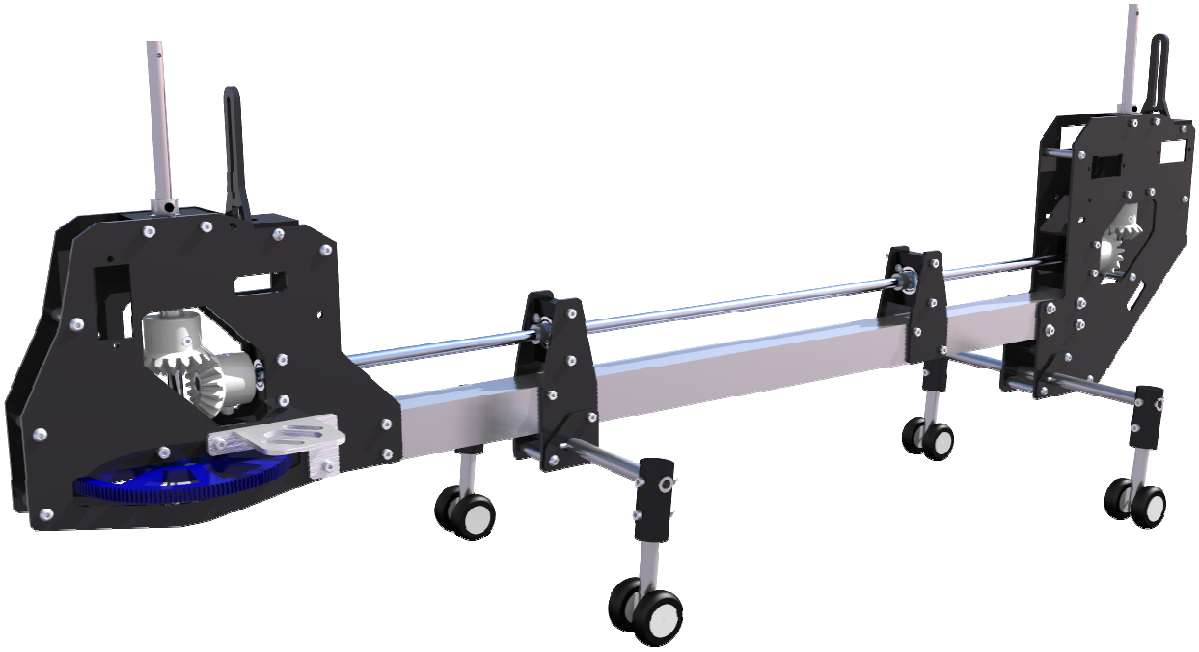
Twinn Rexx V2 Assembly Manual



Introduction

The Twinn Rexx V2 is a third-generation tandem helicopter that incorporates the latest components that current technology can offer. Its flight performance and capabilities far exceed that of any other tandem model available on the market today. Its sturdy construction has been designed to be easily repaired and maintained and uses many common-place 450 class helicopter parts. Welcome to tandem country !

Safety Notice

The Twinn Rexx tandem helicopter is not a toy and can cause severe injury or death if not properly assembled and operated. It is not for beginners and should only be assembled/operated by those experienced and qualified. Eye protection is recommended anytime the rotors are turning.

Always follow the AMA safety code - http://www.modelaircraft.org/files/105.pdf and become an insured member for your protection and others.

Other Documentation

See the Twinn Rexx support section on our website for additional information and documents.

Specifications

Shaft to Shaft Distance	20.25 inches
Weight (no body or battery)	1160 grams (approximate)
Motors	500W - 1000W 3S or 4S (1900KV 11T pinion on 4S)
Servos	6 - 65MG or 5065MG (or equivalent)
Receiver	6 channel
Yaw, roll, pitch gyro	3 axis airplane gyro
DCP gyro	Gy240 - AVCS mode
BEC	5V 3.0 Amp min.
ESC	35 Amp
Tandem controller	Tech TH-2 GP + Extender board
Rotor heads	2 or 3 blade
Rear main shaft	Align HS1280 450 shaft (or equivalent)
Front main shaft	Custom
Blades	315, 325 or 335
Main drive gear	450 class 150T

Assembly Notes:

1. Do not tighten or crack-loose with a ball driver. Instead, use a standard hex wrench. The stainless steel sockets will strip with a ball driver - especially the 1.27mm heads. Ball drivers are for low torque driving only.

2. All screws into metal parts must use medium (blue) thread locker. DO NOT USE THREAD LOCKER ON PLASTIC PARTS. Thin CA should be used for locking screws into or in contact with plastic parts.

3. All of the M2.5x30 frame screws should enter the frame from the left side. The screws heads are on the left and the nuts are on the right side.

Recommended Tools/Materials

Tools Required:

Safety Goggles/Face shield
Drill - small drill bits – 1/16, 2mm etc.
Marking pen (Sharpie etc)
Hobby knife #11 blade
Rulers - caliper etc.
Soldering iron - electronics solder
Wire cutter/stripper
Pitch gauge
Blade balancer
Small flat file
Misc. hand tools

Materials Required:

Acetone or brake cleaner (degreasing agent)
Thread locker (medium - Loctite 242)
Pinion glue (Loctite 609)
Thin CA
Silicone rubber or Goop glue
Double-sided servo tape
Misc. tywraps
26 gage servo wire
Misc. heat shrink tubing
22 gage hookup wire
Electrical tape

1. Front Frame - Assembly

Parts:	***Qty:***	***Description:***
TR-100-L	1	Front left main frame side plate
TR-100-R	1	Front right main frame side plate
TR-108	2	Main shaft bearing blocks
TR-109	1	Driveshaft bearing block w/M2x6 mounting screw
TR-111	1	Anti-rotation bracket w/screws
TR-500	2	Main shaft bearings - 5x11x5mm
TR-501	1	One-way bearing - HFO-612 - *Assembled into main gear*
TR-502	1	Driveshaft block bearing - 5x10x4 flanged
TR-301	1	Miter gear
TR-302	1	Miter gear aluminum sleeve
TR-304	1	Front main shaft
TR-305	1	Main shaft locking collar w/setscrew.
TR-306	1	Main drive gear (150T)
TR-309-1	1	Front main shaft ring
TR-309-2	1	Front one-way shaft
TR-302-1,2	1	M2x20 socket head w/M2 locknut
TR-309-1,2	1	M2x10 socket head w/M2 locknut
TR-200-1	4	M2.5x19mm frame spacer
TR-200-2	8	M2.5x5 button head screw
TR-200-5	6	M2.5x30 socket head screw
TR-200-6	5	M2.5 locknut

1. Attach the four frame spacers to the front right frame side (TR-100-R) with four M2.5x5 screws. Use thread locker. See Figure 1a.

2. Attach the front left frame side (TR-100-L) to the right side assembly with four M2.5x5 screws. Use thread locker. See Figure 1b.

3. Add the two main shaft bearing blocks (TR-108) with four M2.5x30 screws. The bearings face outwards (top bearing faces up and bottom bearing faces down). Use three M2.5 locknuts.
   Be sure the bearing blocks are parallel to the top of the frame sides and to each other. Leave the bottom block rear screw without a nut and washers for now. Insert the two bearings (TR-500). See Figure 1c.

   The top front block screw must be trimmed so approximately 1mm of threads extend past the locknut. This is for clearance with the servo linkage. See Figure 1d.

4. Add the driveshaft bearing block (TR-109) with two M2.5x30 screws. The bearing faces towards the front. Use two M2.5 locknuts.
   Secure the bearing (TR-502) with the M2x6 screw. Apply some thin CA to the threads to lock into place.

5. Slide the miter gear aluminum sleeve (TR-302) into the miter gear (TR-301) so the mounting holes line up. Insert the M2x20 screw to keep them aligned. Keep the M2x20 mounting screw in place without the nut for now.

6. Slide the front main shaft (TR-304) through the top bearing and through miter gear/sleeve assembly. The gear teeth face downward. Continue sliding the shaft through the bottom bearing, through the main shaft ring (TR-309-1), and finally through the main gear/one-way assembly (TR-309-2, TR-307). Attach the main gear to the shaft with the M2x10 screw and locknut. Be sure the inside of the main shaft ring is sitting on the outside of the one-way shaft.
   Leave the miter gear unfastened for now. The screw will be added after the rotors timing is set.

7. Add the main shaft locking collar. Use thread locker.

8. Add the anti-rotation bracket (TR-111) mount with a M2x6 button head screws. Apply some thin CA to the threads to lock into place. Add the anti-rotation bracket with M2x6 phillips head screws. Center it between the frame plates. Apply some thin CA to the threads to lock into place.
See Figures 1e..1k.

2. Rear Frame - Assembly

Parts:	***Qty:***	***Description:***
TR-101-L	1	Rear left main frame side plate
TR-101-R	1	Rear right main frame side plate
TR-104	2	Landing gear locking plates
TR-108	2	Main shaft bearing blocks
TR-109	1	Driveshaft bearing block w/M2x6 mounting screw
TR-111	1	Anti-rotation bracket w/screws
TR-301	1	Miter gear
TR-302	1	Miter gear aluminum sleeve
TR-303	1	Rear main shaft
TR-400	1	LG cross beam
TR-500	2	Main shaft bearings - 5x11x5mm
TR-502	1	Driveshaft block bearing - 5x10x4 flanged
TR-302-1,2	1	M2x20 socket head w/M2 locknut
TR-203-1	6	M2.5x19mm frame spacer
TR-203-2	8	M2.5x5 button head screw
TR-203-5	6	M2.5x30 socket head screw
TR-203-7	6	M2.5 locknut
TR-203-8	4	M2.5x8 button head screw

1. Attach the four frame spacers to the rear right frame side (TR-101-R) with four M2.5x5 screws. Use thread locker. See Figure 2a.

2. Attach the rear left frame side (TR-101-L) to the right side assembly with four M2.5x5 screws. Use thread locker. See Figure 2b.

3. Add the two main shaft bearing blocks (TR-108) with four M2.5x30 screws. The bearings face outwards (top bearing faces up and bottom bearing faces down). Use four M2.5 locknuts.
Be sure the bearing blocks are parallel to the top of the frame sides and to each other. Insert the two bearings (TR-500). See Figure 2c.

   The top front block screw must be trimmed so approximately 1mm of threads extend past the locknut. This is for clearance with the servo linkage. See Figure 2d.

4. Add the driveshaft bearing block (TR-109) with two M2.5x30 screws. The bearing faces towards the rear. Use two M2.5 locknuts.
Secure the bearing (TR-502) with the M2x6 machine screw. Apply some thin CA to the threads to lock into place.

5. Slide the miter gear aluminum sleeve (TR-302) into the miter gear (TR-301) so the mounting holes line up. Insert the M2x20 mounting screw to keep them aligned
Apply a small amount of thin CA to tack the sleeve and gear together. Allow to cure. Remove the M2x20 mounting screw.

6. Slide the rear main shaft (TR-303) through the top bearing, bottom bearing and through the miter gear/sleeve assembly. The miter gear teeth face downward. Secure the miter gear/sleeve to the shaft with a M2x20 screw and locknut. The screw head should be in the recessed side of the gear. Add the main shaft locking collar. Use thread locker.

7. Add the anti-rotation bracket (TR-111) mount with a M2x6 button head screws. Apply some thin CA to the threads to lock into place. Add the anti-rotation bracket with M2x6 phillips head screws. Center it between the frame plates. Apply some thin CA to the threads to lock into place. See Figure 2e.

8. Check the fit of the LG cross beam (TR-400) into the rear frames. It should slide into the hole with mild pressure. If needed, enlarge the hole slightly with the emery paper provided (TR-902). Roll the emery paper into a tapered tube, sand the hole evenly and slowly checking for proper fit often.

9. Insert a M2x12 SS dowel pin (TR-406) into the LG cross beam (TR-400). Center the pin inside the beam shaft. Slide the shaft through both sides of the frame sides. Insert a second M2x12 SS dowel into the LG cross beam. Center the pin inside the beam shaft.

10. Slide a landing gear locking plate (TR-105) onto each side of the frames. Attach the two M2.5x20mm frame spacers with the four M2.5x8 screws. Use thread locker. See Figures 2f.. 2j.

3. Rear DS Support - Assembly

Parts:	***Qty:***	***Description:***
TR-102 (TR-802)	2	(HD) Driveshaft support plates
TR-110	1	Driveshaft support bearing block w/M2x6 mounting screw
TR-105	1	Main frame aluminum tube
TR-503	1	Driveshaft support bearing - 8x12x3.5 flanged
TR-202-1	4	M2.5x30 socket head screw
TR-202-2	4	M2.5 locknut

1. Draw a mark on the main frame aluminum tube (TR-105) with a marking pen 8.5 inches (216 mm) from the front edge. Draw the mark on all four sides of the tube. This is the CG (center of gravity) location for the aircraft.

2. Attach the driveshaft support plates (TR-102) or (TR-802 for HD option) to the frame tube with two M2.5x30 screws. Use two M2.5 locknuts

3. Add the driveshaft support bearing block (TR-110) with two M2.5x30 screws. Use two M2.5 locknuts. Insert the bearing (TR-503) so it faces towards the front. Secure the bearing with the M2x6 machine screw. Apply some thin CA to the threads to lock into place. See Figures 3a..3d.

4. Front DS/LG Support - Assembly

Parts:	***Qty:***	***Description:***
-	1	Main frame tube assembly from step 3
TR-103 (TR-803)	2	(HD) Front LG/DS mounting plates
TR-104	2	Landing gear locking plates
TR-110	1	Driveshaft support bearing block w/M2x6 mounting screw
TR-400	1	LG cross beam
TR-404-4	2	M2x12 dowel pin
TR-503	1	Driveshaft support bearing - 8x12x3.5 flanged

TR-201-1	1	M2.5x19mm frame spacer
TR-201-2	2	M2.5x8 button head screw
TR-201-3	4	M2.5x30 socket head screw
TR-201-4	4	M2.5 locknut

1. Attach the two LG/DS plates (TR-103) or (TR-803 for HD option) to the main frame tube assembly using a M2.5x30 screw. The screw goes into the top front section of the mounting plates. Use a M2.5 locknut. Leave the nut loose for now. See Figure 4a.

2. Check the fit of the LG cross beam (TR-400) into the LG/DS plates. It should slide into the hole with mild pressure. If needed, enlarge the hole slightly with the emery paper provided (TR-902). Roll the emery paper into a tapered tube, sand the hole evenly and slowly checking for proper fit often.

3. Insert a M2x12 dowel pin (TR-404-4) into the LG cross beam (TR-400). Center the pin inside the beam shaft. Slide the shaft through both sides of the mounting plates. Insert a second M2x12 dowel pin into the LG cross beam. Center the pin inside the beam shaft. See Figure 4b..4c.

4. Slide a landing gear locking plate (TR-104) onto each side of the mounting plates. Attach them with a M2.5x30 screw and M2.5 locknut. Attach the M2.5x19mm frame spacer with the two M2.5x8 screws. Use thread locker. Tighten both M2.5x30screws. See Figure 4d.

5. Add the driveshaft support bearing block (TR-110) with two M2.5x30 screws. Use two M2.5 locknuts. Insert the bearing (TR-503) so it faces towards the front. Secure the bearing with the M2x6 machine screw. Apply some thin CA to the threads to lock into place. See Figures 4e..4f.

5. Completing the frame - Assembly

Parts:	***Qty:***	***Description:***
-	3	Assemblies from steps 1 - 4
Optional TR-800	1	HD frame tube
TR-300	1	Hollow SS driveshaft w/support sleeves
TR-301	2	Miter gear
TR-302	2	Miter gear aluminum sleeve
TR-308	1	Motor mount
TR-302-1	2	M2x20 socket head screw w/M2 locknut
TR-200-5	4	M2.5x30 socket head screw
TR-200-6	1	M2.5 locknut
TR-203-6	4	M2.5x30 socket head screw
TR-203-7	8	M2.5 washer
TR-203-8	8	M2.5 locknut
Optional TR-800-2	2	M2.5 washer
Optional TR-800-3	4	M2.5x30 socket head screw
Optional TR-800-4	4	M2.5 locknut

1. Attach the front frame assembly and motor mount to the main frame assembly with four M2.5x30 screws. Use four M2.5 locknuts nuts. The top rear section of the frame sides should be square with the frame tube. Note: Depending on the motor used, one or more washers (not included in kit) may be needed to shim the motor mount away from the frame side. The washers stack between the frame side and the motor mount. See Figures 5a..5b.

2. For the remaining two miter gears, slide the miter gear aluminum sleeves (TR-302) into the miter gears (TR-301) so the mounting holes line up. Insert the M2x20 mounting screws to keep them aligned. Apply a small amount of thin CA to tack them together. Allow to cure. Remove the M2x20 mounting screws.

3. Degrease the entire DS and inside the DS sleeves with a suitable cleaner such as Acetone. Insert the driveshaft (DS) through the rear DS support bearing. Next, slip the two support sleeves on. Continue sliding the DS forward through the front support bearing. While holding the front miter gear assembly in place, slide the DS into it and insert a M2x20 mounting screw to keep them together.

   Slide each support sleeve such that they are centered within the race of each DS support bearing. Mark the locations of the sleeves on the DS. Remove the DS and sleeves. See Figures 5c..5d.

   Re-install the DS as described above. Secure the miter gear/sleeve to the DS with a M2x20 screw and locknut. The screw head should be in the recessed side of the gear. Glue the sleeves into place using a suitable compound (Loctite 609 recommended). Allow to cure. CA glue is not recommended.

4. While holding the rear miter gear assembly in place, slide the rear frame assembly into place on the frame tube. Loosely attach the assembly with four M2.5x30 screws. Use four M2.5 locknut and eight M2.5 washers. Secure the miter gear/sleeve to the DS with a M2x20 screw and locknut. The screw head should be in the recessed side of the gear.

5. Snug either of the two diagonal M2.5x30 screws so that the rear frames can be adjusted but stay in place as well. Adjust the rear frames so that they are square to the main tube and the **DS has a maximum end to end play of 0.5mm (0.02 inches)**. The miter gear teeth should mesh completely. Tighten the four M2.5x30 screws. See figures 5e..5f.

6. Optionally - add the HD frame tube (TR-800). It will only fit one way. Use four M2.5x30 screws. Use four M2.5 locknuts and two washers on the rear frame slotted holes.

6. Setting the timing of the rotors - Assembly

Parts:	***Qty:***	***Description:***
TR-302-1	1	M2x20 socket head screw
TR-302-2	1	M2 locknut

1. **The front and rear rotor heads must be phased to prevent the blades from colliding.** This is done by setting the holes on top of the two main shafts **N** degrees to each other.

   For 2-blade heads, N= 90 degrees.
   For 3-blade heads, N= 0 degrees.

   Remove the mounting screw from the front vertical miter gear. While holding the front main shaft in place, lift the front vertical miter gear (disengage from the other gear) and rotate the rear shaft so the hole is **N** degrees to the front shaft. The trick is to keep the front shaft and miter gear mounting holes aligned while this is done.

   Secure the front miter gear/sleeve to the DS with a M2x20 screw and locknut. The screw head should be in the recessed side of the gear. See figures 6a..6b.

7. Landing gear - Assembly

Parts:	*Qty:*	*Description:*
TR-401	4	LG strut
TR-402	4	LG strut mount
TR-403	8	LG 1" wheel
TR-404-1	4	LG axel
TR-404-2	8	M2x16 socket head screw
TR-404-3	8	M2 locknut

1. The two rear landing gear (LG) strut mounts (TR-402) need to be trimmed slightly for clearance with the CH47 body. The bottom is trimmed so that it tapers upwards around 5mm front to back. This step can be done later when adding the body. See figures 7a..7b.

2. Attach two LG strut mounts (TR-402) to each of the LG cross beams (TR-400) with four M2x16 screws and M2 locknuts.

3. Attach the four LG struts (TR-401) to the LG strut mounts with four M2x16 screws and M2 locknuts.

4. Add the wheels to the LG struts. The solid side of the wheel hubs face outward. The wheels are pressed onto axels. Do one side at a time. Leave some play between the wheel and the strut to allow the wheels to spin freely. See figures 7c..7d.

5. Adjust the LG struts/LG cross beams so that the struts are square with the ground. Use a small amount of silicone rubber or Goop type glue to lock the dowel pins into place. CA is not recommended for this application since it is not easily removed. Apply the glue such that it fills the spaces between the pin and the locking plates. Allow to cure.

8. Servos - Assembly

Parts:	*Qty:*	*Description:*
Servos	6	Hitec HS-65MG or HS-5065MG recommended
TR-200-3	6	M2x10 button head screw
TR-200-4	6	M2 locknut
TR-114	1	Servo ball/link set w/M2 nuts

1. Use the single servo arm that has the second hole 13mm from center. Tap the holes for 2mm in the second hole (from center) on the arm. De-grease the servo arms, balls and 2mm nuts.
   Mount the six balls (TR-114) to the servo arms. Apply some thin CA to the threads to lock into place. Five of the balls are mounted downward (toward the servo) and one is mounted upward. Add a 2mm nut to each ball and tighten. Apply some thin CA to the threads to lock into place. **Do not use thread locker here !** See figures 8a.

2. Center each servo with the radio (one at a time) and mount the servo arms to the servos. Mount the servos to the frame using the M2x10 screws and locknuts. Note: The rear "E" servo can be mounted two ways. It can be mounted up top for use without the body, the stock link can be used (same as front link). For use with the body, mount the servo in the lower section, the long "E" link must be used. See figures 8b..8f.

   Note: All servos should be centered to the same transmitter channel for now. Final adjustments will be made later using the TH-2 controller centering.

9. Links - Assembly

Parts:	*Qty:*	*Description:*
TR-112	1	Front link rod set
TR-113	1	Rear link rod set
TR-114	1	Servo ball/link set

Front rods	A - Left	P - Right	E - Rear
	28mm	55mm	32mm
Rear rods	A - Left	P - Right	E - Rear
	32mm	19mm	28mm or 110mm

1. Assemble the front links using the rods from the table above. Each rod should be threaded onto the link a minimum of 3mm (0.12 inches). With the servos centered, the swashplate should be level. Adjust the link lengths as needed.

2. The rear "E" link can be long or short depending on where the servo was mounted. For the long version, see the "E link" specification for adding the proper bend to it. Note, the bend may not be needed for some installations.
   Assemble the rear links using the rods from the table above. Each rod should be threaded onto the link a minimum of 3mm (0.12 inches). With the servos centered, the swashplate should be level. Adjust the link lengths as needed.

10. Rotor heads - Assembly

The kit comes with the one-way bearing installed so that the front rotor will rotate clockwise (CW) and rear rotor CCW. This can be easily changed by re-installing the one-way bearing the opposite way.

1. Assemble the rotor heads per the instructions provided by the manufacturer.

2. Note that blade grips and possibly mixing arms may need to be flipped over on one of the rotor heads.

3. 2-blade or 3-blade heads can be used. Be sure to set the rotors timing as outlined in section 6.

4. The main rotor shafts in this kit are 5mm. For heads designed for a 6mm shaft, an adaptor sleeve can be purchased from our website.

5. Balance the main blades using a blade balancer. Try to get them as perfect as possible since this will reduce vibration.

12. Electronics/Electrical - Assembly

Parts:	*Qty:*	*Description:*
-	1	Motor with mounting screws
-	1	ESC
-	1	BEC (5V 3.5amp minimum)
-	1	3-axis gyro – yaw, pitch, roll
-	1	DCP gyro – heading hold type

-	1	Receiver
-	1	TH-2GP controller + extender
-	1	Deans micro connector set M/F
-	1	Deans Ultra connector set M/F
-	1	36" Servo extension Male
-	4	12" Servo extension Male
-	-	26 gage servo wire
-	-	22 gage stranded hookup wire
-	2	Ferrite ring

Note: Refer to the Twinn Rexx V2 wiring diagram for the instructions below.

- **ESC** / **motor** - The ESC outputs connect to the motor with bullet connectors covered with heat shrink tubing. Mount the ESC up front close to the motor with its heat sink against the main frame tube. The motor attaches to the motor mount with two screws and washers. Verify the mesh with the main drive gear is smooth all around its circumference.

- **ESC to receiver** - The ESC control input connects to the receivers throttle channel. The red power lead must be removed from the connector housing and covered with heat shrink tubing or tape. This is because an external BEC supplies power to all of the onboard electronics. Add a ferrite ring the control lead if needed.

- **ESC to battery** - The ESC power inputs connect to the battery with Deans ultra connectors. The male end is on the ESC side.

- **BEC to battery** - The BEC power inputs connect to the battery with Deans micro connectors. The male end is on the BEC side. This is so the electronics can be powered without the ESC and motor. This is convenient during set up. Mount the BEC up front near the ESC. The output of the BEC should have a ferrite ring installed.

- **BEC to PDB** - The BEC outputs are soldered directly to the power distribution board (PDB).

- **Receiver -** Mount the receiver onto the rear of the frame away from the ESC, BEC etc. For safety, a redundant power connection is made to the PDB output (5v). Use a spare channel if available or a "Y" cable if not. A male servo lead is connected to the PDC output (5V) to supply the power.

  Apply a layer electrical tape over the receiver connectors to prevent them from coming loose. Wrap the receiver with foam rubber sheet and attach to the frame with tywraps

- **TH-2** - Mount the TH-2 onto the rear of the frame away from the ESC, BEC etc.
  For safety, two power connections are made to the PDB output (5v). Use any two of the spare header connectors (on the TH-2) or a Y-cable. Male servo leads plug into the headers and are connected to the PDB output (5V) to supply the power.

  The rear servos (micro only) plug directly into the TH-2 rear A, E, P outputs.

  An extender board is mounted to the front frame and the front servos plug into the extender board A, E, P outputs. The extender board is connected to the TH-2 with a dual male servo extension to the TH-2s front A, E, P servo outputs. The extender board power inputs are connected directly to the PDB output (5V) with 22 gage stranded wire.

  The TH-2 A, E, P inputs are connected directly to the receivers aileron, elevator and pitch outputs.

- **3-Axis gyro** - Mount the gyro onto the bottom side of the frame tube with double-sided servo tape. Mount it as close a possible to the CG (center of gravity). The gyro inputs connects to the receivers rudder, elevator and aileron outputs. The gyro outputs connects to the TH-2s rudder, elevator and

aileron inputs. Extensions will probably be needed. Apply tape or heat shrink tubing over the connections to prevent them from coming apart.

- **DCP gyro** - Mount the DCP gyro onto the right side of the frame tube with double-sided servo tape. Mount it as close a possible to the CG (center of gravity). The gyro input connects to the receivers CH5 output. The gyro output connects to the TH-2s CH5 input. An extension will probably be needed. Apply tape or heat shrink tubing over the connections to prevent them from coming apart. See figures 12a..12f.
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13. Radio/Electronics - Setup

- **ESC** - Program the ESC for helicopter use. Set the cut-off voltage feature off or to the lowest setting.

- **Yaw gyro** - Set the gyro gain to 50% for now and the mode to "rate mode". The direction setting will be set and verified in a later step.

- **DCP gyro** - Set the gyro gain to 50% for now and the mode to "rate mode". The direction setting will be set and verified in a later step. Also, the mode will be switched to "heading hold" later after the helicopter is lift balanced.

- **Transmitter** - Turn all mixing features off in the transmitter. Set swashplate type is for mechanical mixing (like an airplane).

    a. Set all channels ATV (end point) to 100/100 except for CH5. Set the CH5 ATV (end point) to 50/50.

    b. Setup a PMIX (programmable mix) between the elevator channel and CH5. The elevator is the master and CH5 is the slave. Set the mixing gain to 70/70. This will allow changes to the DCP gain at the flying site by just changing the gain in the transmitter. The external gain sources on the TH-2 could be used as an alternative.

    c. Setup expo of 30% for the aileron, elevator and rudder channels. Set it to reduce sensitivity at center. Some radios will have a positive value and others will be negative (Futaba).

    d. Set the throttle curve (normal mode) to 0, 25, 50, 75, 100.

    e. Set the pitch curve (normal mode) to 0, 25, 50, 75, 100.

- **TH-2** - load the Twinn Rexx settings (constants) into the TH-2. The settings file can be downloaded from the Twinn V2 Rexx support page.

    a. Set all input gains to 50% except DCP is 25% to 30%.

    b. DCP source is CH5.

- **Final calibration -** Turn on the transmitter (TX) and power-up the helicopter without the ESC/motor powered. Set the TX throttle stick to half way. Note: TX reversing switches may need adjusting.

    a. Adjust the TH-2 centering constants so the servo arms are at right angles to the swashplate. This a back and forth try and see procedure. It only needs to be done once.

    b. Adjust the length of the lowest links so each swashplate is level.

    c. Install both sets of main blades. Adjust links so that there is zero degrees of pitch in the main blades. Use a pitch gauge.

d. Set the overall up/down swashplate travel in the TX using the swashplate menu. Adjust the pitch gain setting such that there is no binding of the swashplate at full low stick and full high stick.

e. Set the top end pitch using the pitch curve (normal mode) to about eight (8) degrees.

f. Set the low end pitch using the pitch curve (normal mode) to about minus four (-4) degrees.

g. Verify both rotors and both sets of blades have zero pitch at half stick using a pitch gauge. Do this same test at full low stick and full high stick.

h. **Yaw gyro direction** - Verify the direction setting on the yaw gyro is correct. This is done by rotating the model along its yaw axis and observing if the motion is being corrected by the gyro. Forcing a right yaw should cause the gyro to apply left yaw and visa versa.

i. **DCP gyro direction** - Verify the direction setting on the DCP gyro is correct. This is done by rotating the model along its DCP axis and observing if the motion is being corrected by the gyro. Forcing the nose down should cause the gyro to apply aft DCP (front swashplate up and rear swashplate down). Temporarily setting the gyro gain higher will make it easier to see the motion of the servos etc. Be sure the DCP gyro is set to "rate" mode for now and until the front/rear lift balancing is completed.

j. **Other gyros direction** - If equipped with a roll axis gyro and/or pitch axis gyro, then verify the direction settings are correct as mentioned above.

14. Initial Run-up

Remove the rotor blades. Wear eye protection and power-up the radio and helicopter in a suitable location. Advance the throttle slowly to about 1/4 stick. Notice the following.

- There should be no vibration. If vibration is present, find the source and correct it before going further.
- The drive-train should be running smoothly and quietly. Correct if not.
- The flybars (if equipped) should be flying level. Correct if not.
- The cyclic controls should be operating properly. 3-blade heads need to have the swashplate follower set to the correct angle so that the rotor disk tilts in the proper direction when commanded. Correct if not.
- Install the front rotor blades. Wear eye protection, run it up slowly and track the blades. Check for vibration and correct as needed. Do not over-speed the rotor (1000 RPM max). Remove the front rotor blades.
- Install the rear rotor blades. Wear eye protection, run it up slowly and track the blades. Check for vibration and correct as needed. Do not over-speed the rotor (1000 RPM max).
- Re-install the front rotor blades. Verify the front and rear rotors are phased properly and won't collide. Correct as needed.
- **Verify the driveshaft end to end play is no more than 0.5mm (0.020 inches).**
- **Check that all fasteners we properly tightened.**

15. First flight

Wear eye protection and power-up the radio and helicopter at the flying site. A hard clean surface is recommend.

- **Lift balancing** - Lift off the helicopter about six inches. It should have equal lift in each rotor. If so, both rotor discs will be flying in the same plane. Correct if needed by adding pitch the low rotor or by reducing pitch in the high rotor. This is done by adjusting the uppermost links a half turn at a time.

- **DCP gyro HH mode** - With the helicopter properly lift balanced, switch the DCP gyro into "heading hold" mode. This will make the helicopter fly much smoother and be more enjoyable. Be sure to maintain a DCP gain of 25% to 30% (in the TH-2). This will provide the gyro with enough control power to overcome most disturbances.

16. General Flying Notes

- Tandems are inherently stable helicopters. When setup properly it will fly hands off for quite some time. Unlike single rotor helicopters, a tandem won't drift off in some direction and head for the ground. It will just happily float around.

- Keep the rotor head speed lower than that of a single rotor helicopter. The maximum recommended RPM is about 2000. An RPM of 1800 to 1900 is good. The two rotors offer plenty of gyroscopic stability. Higher head speed will generate higher levels of vibration due to the overlapped rotors. This can reach levels that may produce positive feedback into the yaw gyro. This condition can make the helicopter uncontrollable.

- All tandems experience Front Rotor Vortex Interference (FRVI). It occurs at low flying speeds and at high angles of attack. From a stationary hover gaining forward speed, at some speed the front rotor vortex will begin to extend back and interfere with the lift generated by the rear rotor. This will cause the tail of the aircraft to drop. To correct, apply forward stick and some power. The sooner you apply the correction the smaller the effect of FRVI will be.

  The DCP gyro will handle this condition for most flight conditions. It will stay ahead and compensate automatically up to a point. Understand that there are many flight conditions and attitudes beyond the control power of the gyro to compensate. It is recommended that you practice with the DCP gyro in "rate" mode to develop a "feel" for when these conditions occur and the reflexes to compensate. Practice will allow you to recognize the onset of FRVI and allow you to recover or even prevent an occurrence.

- Tandems require more forward stick to be held during forward flight. This will induce a steady state yaw to the left due to the DCP. Yaw compensation can be used to counter this effect. This can be done by the TH-2 controller or by a programmable mix in your transmitter (elevator to rudder).