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METAL GIMBAL MANUAL

DEDICATION

After a successful stick rebuild in 1987, another transmitter required stick rebuilding in 1992. Unfortunately, I ended up breaking a new pot because I forgot how to the job correctly. That will never happen again!

This manual is dedicated to those poor slobs who must do everything themselves because they are either too cheap to pay someone else or wouldn't trust any one else to do the job right.

INTRODUCTION

I have 4 sets of metal open gimbal sticks - 2 from Royal Classic transmitters and 2 from Ace transmitters. Each is slightly different.

The early versions had "cube" style main frames, large pots and different size bezel openings. The axis support bolts also vary from a machined bolt to a hardened machine bolt less the hex but with a clip to minimize axial shaft play.

The original sticks were manufactured by the late Bob Dunham. In a 1987 letter to him, he had indicated that the tooling to make the sticks had been sold to DACA.

After years of use, the bearing surfaces develop play in the yokes/bales and also in the stick pot bushings. At this point the stick assemblies should be rebuilt. Rebuilding a metal stick assembly is not expensive, but the job takes a considerable amount of patience. The purpose of the rebuild is to re-establish the bearing surfaces on the axis support bolts, eliminate axial play and if necessary (do not overlook the pot bushings) replace the stick pots.

New stick pots should have a hole in the shaft for adjusting Aileron/Rudder (AIL/RUD) neutrals and a screwdriver slot for adjusting Elevator/Throttle (ELEV/TH) neutrals. Ace has modified pots for this purpose or you can modify your own if care is taken not to damage the pot. During assembly, care must be taken to avoid applying pressure against the solder lugs or pot case. When completed, the Elevator/Aileron stick should be perpendicular to the front side of the main frame and the Rudder/Throttle stick (Rudder direction) should be perpendicular to the front side of the main frame.

SOME OF THE TOOLS REQUIRED

Two ½" open end wrenches, the thinner the better for tightening the ½" hex nuts on the pots. Those cheap punched wrenches work the best. Sorry, the Sears miniature wrenches are too thick for this particular task.

Small wrenches (various) to tighten the axis support bolts.

Large dia. pin or music wire for adjusting the AIL and RUD pot neutrals.

Small screwdrivers.

Small C clamp to hold the main frame stop against the main frame

DISASSEMBLY PROCEDURE:

1. Remove the stick assemblies from the transmitter.
2. Compare the sticks to the schematics and note any changes like location of the nylon and Teflon washers. Note the differences between the AIL/ELEV stick and RUD/TH stick - particularly why the RUD/TH stick won't center but still has the scissors and spring (the TH spring cover lacks a scissors stop but instead holds the TH spring).
3. AIL/ELEV Stick
 - a. Remove the axis support bolt.
 - b. Loosen the AIL clamp screw.
 - c. Slide the AIL/ELEV single square bale assy off the AIL pot.
4. AIL/ELEV Single Square Bale
 - a. Remove the axis support bolt
 - b. Remove the yoke stop.
 - c. Remove the ELEV clamp screw.
 - d. Carefully (If necessary, it can break easily) spread the clamp and slide off the pot shaft.
 - e. Remove scissors, spring and washers.
 - f. Remove the ½" hex nut.

g. Slide ELEV pot out, this will also release the black plastic throttle detent. Note the 2 raised dimples-they serve to align the throttle detent on reassembly

5. Rest of Main Frame

a. Slide off split fiber washer, scissors, spring and washers off the AIL pot shaft.

b. Remove ½' hex nut.

c. Remove Main Frame Stop

d. Slide AIL pot out.

6. RUD/TH Stick

This is essentially a repeat of the above except that the TH is non-centering.

REASSEMBLY PROCEDURE:

This is a reverse of the above, however, before starting study the following notes. Reassembly requires patience so as to obtain the proper alignment.

REBUILDING & ASSEMBLY NOTES:

On the machine bolt and nut axis support versions (per drawing) the fix is simply to super glue a 5/32"od section of brass tubing over the existing 1/8" od machined section of the 4 axis support bolts. Then drill out (using a 5/32" drill) the sloppy 1/8" dia. holes in the :

AIL/ELEV single square bale

AIL/ELEV yoke

RUD/TH square bale

RUD/TH yoke

This completes the rehab (and considerably cheaper than buying new parts!); note that the nuts will slide back over the axis support bolts and will clear the 5/32" dia. brass tubing. Also, note that the assembled stick will work a little stiff at first and may not want to return to neutral. Use a little oil on the axis support bolts and keep working until the new bearing surfaces wear in. A little extra oil on the scissor's will help it along.

Since the pots have likely seen a lot of use it is probably a good idea to also replace them too. The pot bushings are likely worn and sloppy. Ace R/C has replacement pots (5/8" dia.) that have been modified for assembly into the assemblies but if you have other pots of equal or better quality it is a simple matter to modify them by shortening the shafts to the proper length, adding a screw driver slot and drilling small adjusting holes in the shafts. The Royal Omega transmitter used this stick design and one of the options was instrument quality pots which cost about \$10.00 each. Over the years both 5 k ohm and 10 k ohm pots have been used in these sticks. It makes no difference which is used as the Micro Pro 8000 and Silver Seven encoders will accommodate both.

DISASSEMBLY / REASSEMBLY NOTES:

When removing the pot from the clamped portion of the AIL/ELEV yoke and RUD/TH yoke be very careful when spreading the clamp as it will break.

When assembling the AIL and RUD pots to the main frame use thin 1/2' wrenches and use a small C clamp to hold the main frame stop to the main frame. This is probably the most miserable part of the rebuilding job because unless the main frame stop is correctly positioned, the stick will not be perpendicular to the main frame or transmitter face. Be careful to avoid any pressure on the pot lugs or pot body as they will break. It would be a good idea to buy an extra pot or two just in case!

The AIL and RUD pots have the minimum amount of the pot shaft protruding out of the AIL/ELEV single square bale and RUD/TH square bale. Not only will this make the assembly of the bales easier it will reduce chances of interference of the axis support bolt and the plastic detent.

After the AIL and RUD pots have been properly aligned, carefully push the AIL/ELEV single square bale toward the AIL pot and RUD/TH square bale toward the RUD pot before tightening the clamp screw. This will reduce the axial play. Do the same when tightening the shaft clamp for the ELEV and TH pots.

I see no useful purpose to fill the space between the 1/2" nut and AIL/RUD pots with washers.

The nylon and Teflon washers shown on the schematics were missing on some assemblies. Also, one assembly had double split fiber washers.

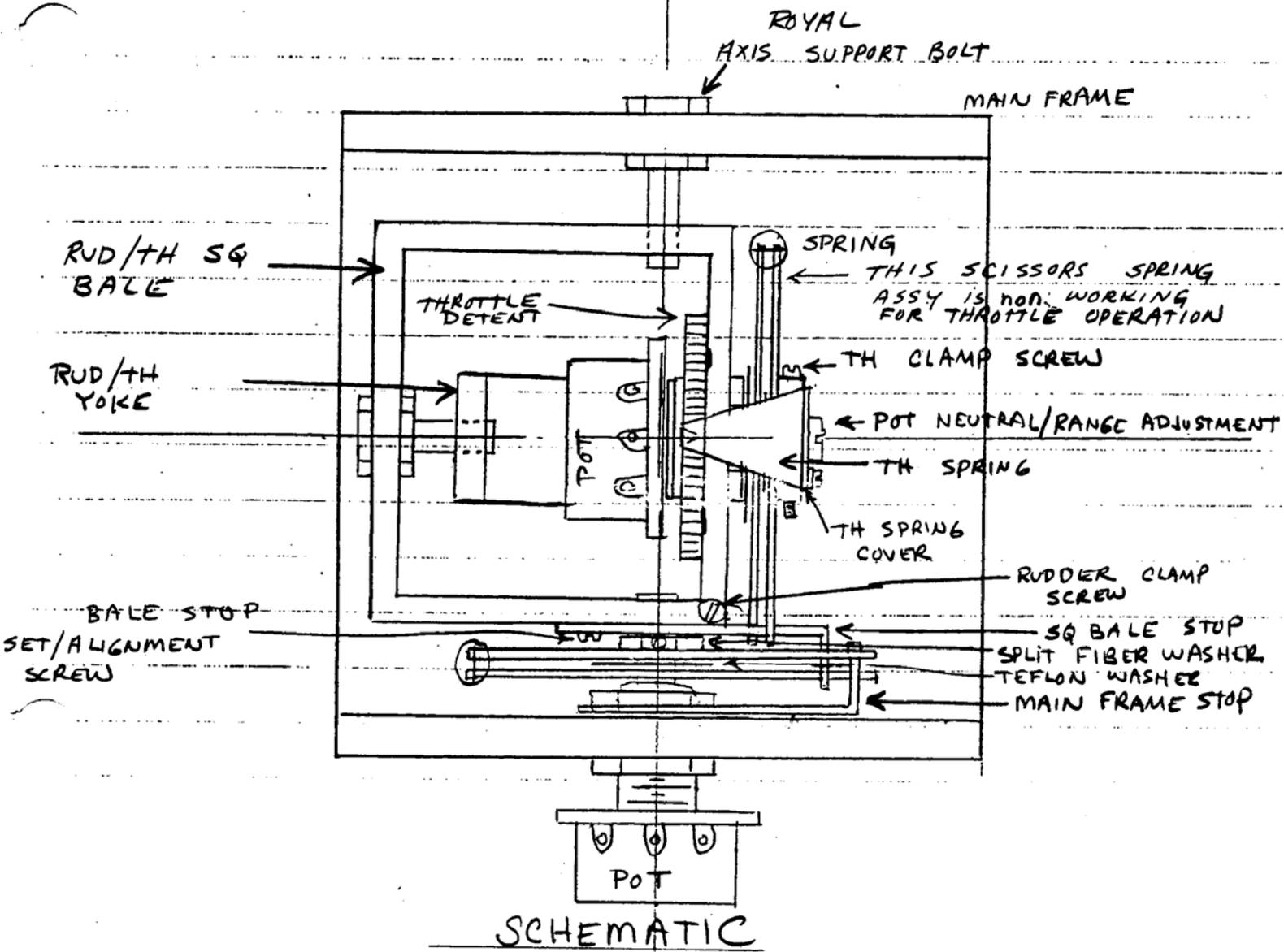
When reassembling the stick units remember to not overly tighten the pot clamp screws because final adjustment will be made after the sticks are wired. Transmitters with servo reversing switches require that the sticks be placed at their exact electronic neutral in order for the reversing switch to reverse without neutral shift. The MicroPro 8000 transmitter is different. The analog to digital converters must be set something inside a 0-255 range of readout on the display.

If the stick pot is changed from 10 k ohm to 5 k ohm it probably will be necessary to place a pad resistor (try 2K ohm) on the center pot wire to avoid dead spots in the stick travel. Also remember to do the "Set Joysticks Routine" in the calibration section of the Retrofit Manual or you may not be able to access Initializing the EPROM, etc.

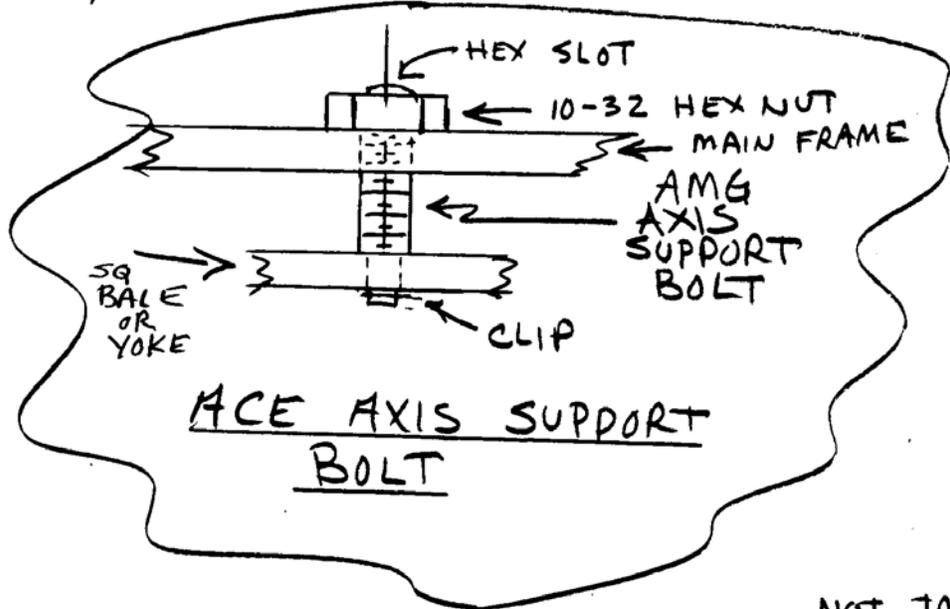
CLOSING

It is my opinion that this stick design could have gone through at least one more design iteration to improve the method of perpendicular alignment of the sticks to the main frame. Also, the bearing surfaces should have had brass bushings. Because of this one flaw, it almost takes the skill of a craftsman to assemble the sticks right. I propose that the accuracy of assembly could be improved by drilling alignment holes through the mainframe stops and drill and tap the main frame for a set screw.

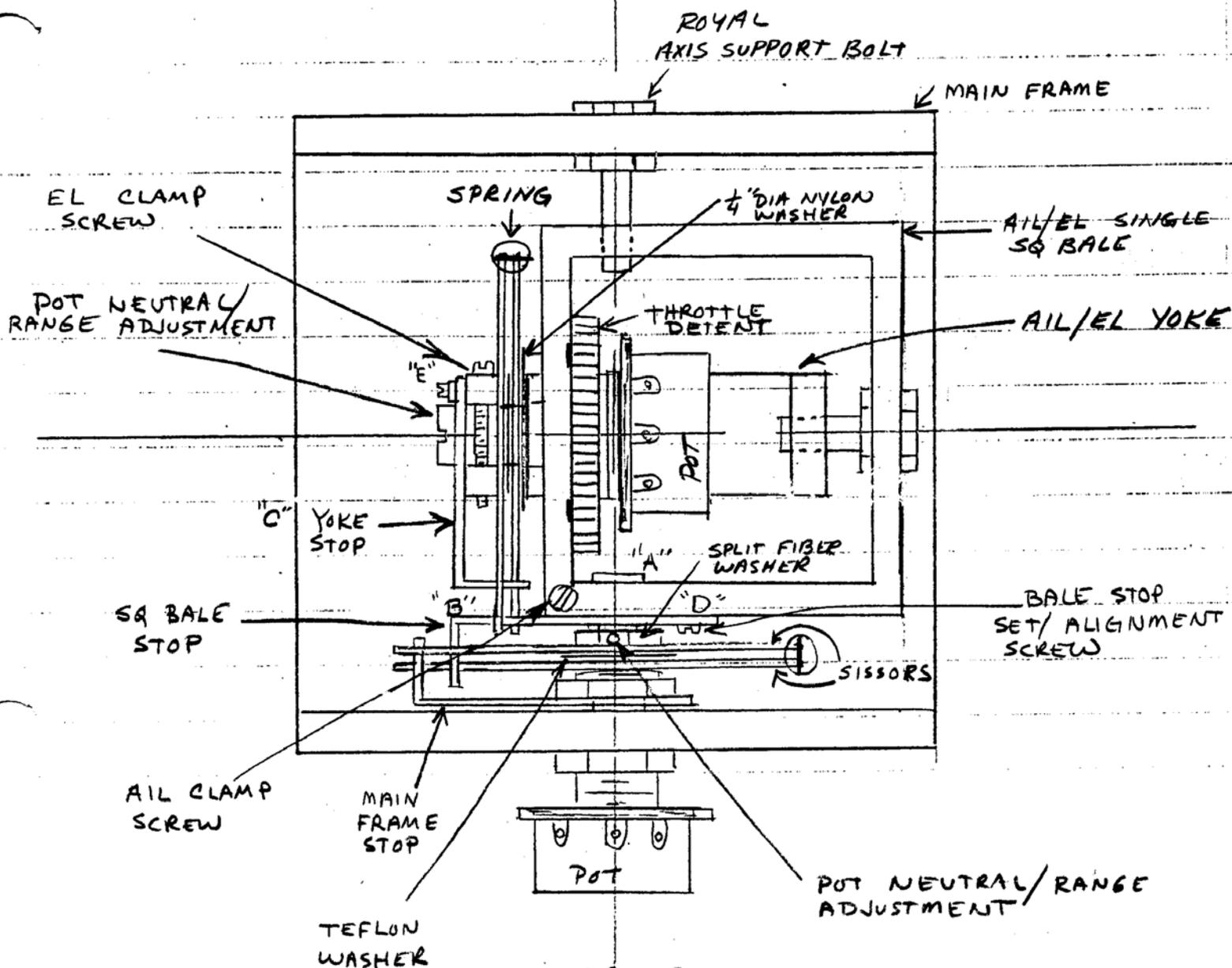
An observation made by Sid Kauffman in the RC Sportsman series on the Omega Transmitter (Oct-Dec 1977) was that these sticks cost more than some complete radio systems. This is still true today. I'm still using the same sticks (in a Silver Seven transmitter) from a 1976 Royal Classic transmitter. The only change is that the pots were replaced and the axis support bolts were bushed with 5/32; dia. brass tubing. So while the stick assemblies may be expensive they have the capability to last a lifetime!



RUD/TH METAL OPEN GIMBLE



NOT TO SCALE



SCHMATIC

AIL/EL METAL OPEN GIMBLE

NOTES:

- "A" - HAVE MIN AMOUNT OF POT SHAFT STICKING THRU HERE, THIS WILL MAKE PLACING THE AIL/EL SINGLE SQ BALE ASSY ON POSITION EASIER.
- "B" - ADJUST SUCH THAT AIL/EL SINGLE SQ BALE IS \perp TO MAIN FRAME THEN TIGHTEN SET SCREW AT "D"
- "C" - ADJUST YOKE STOP SUCH THAT EL IS \perp TO MAIN FRAME THEN TIGHTEN SET SCREW AT "E"