RADAR SCANNER DRIVES
USING SERVOS

by Iain Moffatt of EMBC

I am in the process of building a 32" model of the Brave Border class of FPB.
In addition to guns trained a by servo (possibly a Y extension from the steering servo, I decided to have a go at motorising the radar scanner.
The main problem was that of getting a reasonable rotational speed with the minimum of top-hamper. The boat is not really big enough to accommodate traditional motor/gearbox installations. Accordingly I decided to utilise ideas from the robotics world and fit a modified RC servo to drive the scanner.

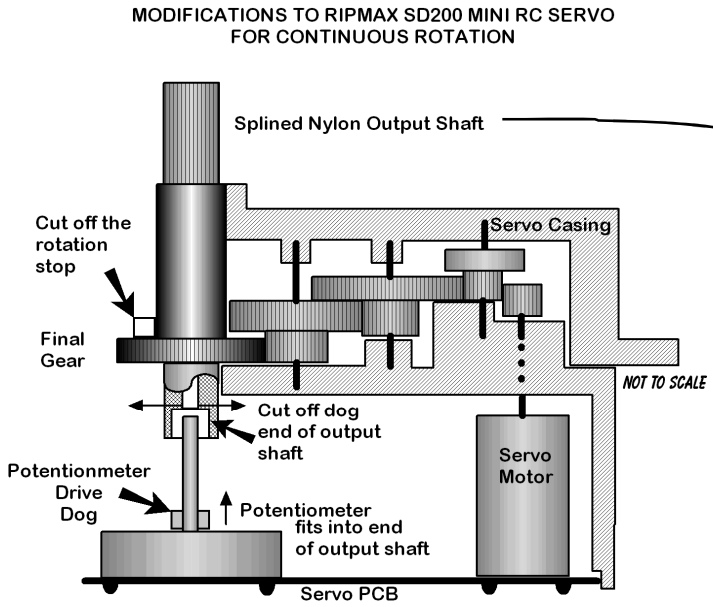
After a some research, I found that the favourite miniature servo for this was the SD200, retailed by Ripmax. Factory modified servos are available, made by GWS, but these are full size. Sizes, costs, torques a RPM are noted later on this page.

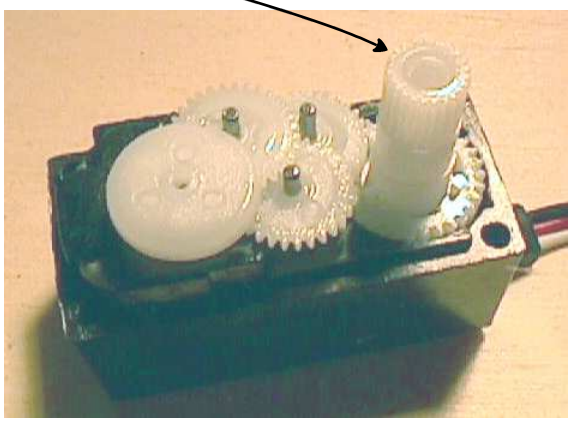
Before you get too excited ..... unless you buy factory modified servos, you have a bit of controlled butchery to do so, if you are not happy with this, go to the bottom right of this page and look for GWS!!

How Servos Work - the basics:
The servo controller receives a pulsed signal from the RC Receiver, the length of each pulse being determined by the degree of movement of the transmitter stick. The servo controller then compares this to its internal reference pulse length and, where there is a difference, it turns the servo motor and hence the control potentiometer, in a direction that reduces the difference to zero (the null point). When the null point is achieved, the servo motor is stopped and rotation ceases. Pulses shorter that the control cause rotation in one direction and longer than control causes rotation in the other direction. (Over simplified I know ..... but this isn't an electronics course!!)

So what is the modification ?
If the control potentiometer does NOT turn when the servo motor runs, the null point can never be reached and hence the servo motor runs continuously (the servo controller keeps trying!!).

OK ..... sounds easy - so what's the catch ?
The main consideration must be just how the gear train in the servo is connected to the potentiometer (the pot). If the pot has, for example, a square shaft that fits into a square socket in the final gear wheel, forget any modification!! It's not easy to turn a square hole into a round one with any accuracy. (I know ..... I've tried!!)
The ideal set-up is where the connection is made through a 'dog clutch' type arrangement - as in the SD200 servo. That's my reason for using it.
Yea right !! So just how am I supposed to do that ?
Have a look at the attached drawing ... read it .... it's got all the instruction you need! Then get a small cross head screw driver, a sharp craft knife and a wee box to put the servo bits into. Take a deep breath and dive in!!





Disconnecting the potentiometer from the drive train means that the servo can never achieve the 'null point' balance it normally looks for and so it will keep rotating.
You MUST remember to cut off the rotation stop on top of the final drive gear !!

WARNING - THE MINUTE YOU TAKE A KNIFE TO THE SERVO, YOU HAVE INVALIDATED ANY MANUFACTURERS WARRANTY!!

Using the Servo .....

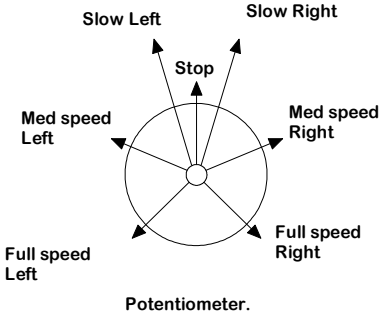
The servo will only operate if [a] it is plugged into a channel on the receiver and [b] if both receiver AND transmitter are switched on.
Plug the servo into any un-used channel - you don't need to have any stick control over it, but you do need a control signal.

But it goes too fast, and in the wrong direction

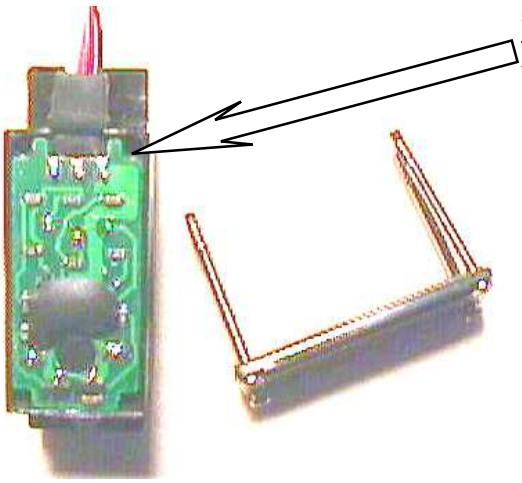
The speed of a servo modified in the way described here is set by using the potentiometer (on the servo PCB, inside the case) as though it were a speed control.

The pot Null Point is in the centre of its available travel. The closer the pot 'wiper' is to the null point, the slower will be the speed of rotation of the servo motor, right down to full stop.

Secondly, the DIRECTION of rotation can be controller by setting the pot wiper either on the left or the right of the null point (see sketch).



Potentiometer.



To get at the pot shaft on an SD200 servo, remove the 4 long screws and, with a small screwdriver blade, gently lever the PCB free of the bottom edge of the case.
You should then be able to pull it out together with the pot and motor as shown above.

SD200 Servo (**you must modify**)
29 x 14 x 25 mm
4.5 to 6 volt
2.5 Kg-cm torque
71 r.p.m maximum on 4.5 volt
Cost : £13 from local model shop

GWS Std. Servo (**Factory modified for continuous rotation**)
Active Robots cat. no. - SO3 -CRS
39.5 x 20 x 39.5 mm
4.5 to 6 volt
2.4 Kg-cm torque
43 r.p.m. on 4.5 volt
Cost : £18 (inc postage) from Active Robots

Points to Watch .....

If you are using a Hitec RC receiver, the connector plug on the SD200 servo is a little over size for the receiver slot.
The plug is 2.63 mm thick whereas the slot is 2.48 mm.
The plug is 7.76 mm wide and the slot is 7.46 mm.
If you shove real hard .... it'll go in - only try getting it out!!

A little bit of careful work with a bit of emery cloth will resolve the problem.

When (if) you strip the servo gear box - PLEASE, please make note of which spindle & gearset goes where!!!
Its a helluva lot easier that trying to work it all out after you've got a pile of disconnected components.
Believe me ..... !!

WARNING:
Servos are NOT designed for continuous operation and, even when the applied load is minimised, you may eventually burn out the servo control electronics. If this happens .. lobotomy may be required !!
Full recovery is possible but -
See another article .....