Timpdon Electronics

Technical Note - No. 16

How to Convert a Standard RC Servo to a Bi-directional RC Controlled Low Speed Motor Gearbox

Introduction

All RC Servos include a bi-directional speed controlled motor, driving an output shaft via a high reduction gearbox.

Coupled to the output shaft is a feedback potentiometer, measuring the position of the shaft, which is used within the servo to control the motor speed and direction, such that the position of the potentiometer, and hence the shaft, always matches a reference position determined by the joystick setting of the transmitter channel in use.

If the coupling between the output shaft and potentiometer is removed, the motor will attempt to rotate continuously either clockwise or anti-clockwise depending on whether the transmitter joystick setting is greater or less than the fixed position of the uncoupled potentiometer.

If the transmitter setting is equal to the position of the potentiometer, the motor will stop.

On most servos, there are mechanical end stops which prevent the output shaft from rotating more than approximately 180 degrees, but these can easily be removed, permitting continuous rotation of the shaft and, in conjunction with a centre neutral transmitter joystick channel, bi-direction speed control of the servo as a motor gearbox.

The resulting maximum rotation speed of the output shaft can be easily determined from the published maximum rotation rate of the servo. For example, if the servo is quoted with a slew time of 0.2 seconds for 60 degrees rotation, this corresponds to 1.2 seconds per revolution, or 50 rev/min, maximum.

This speed is almost ideal for direct drive of anchor and similar winches.

Conversion Procedure

This conversion procedure involves mechanical modifications only. All of the original electronic control circuits are retained, and used to provide bi-directional motor power in the converted version.

The description below uses an ACOMS AS17 servo, but most standard servos will be similar in construction.

Please note, however, that you embark on these modifications at your own risk. No warranty is given that this procedure will work on all servos. Also some dexterity is required. Do not attempt this modification unless you are confident in your ability to achieve success.

Also, carefully read and understand all of the procedures outlined below before starting.

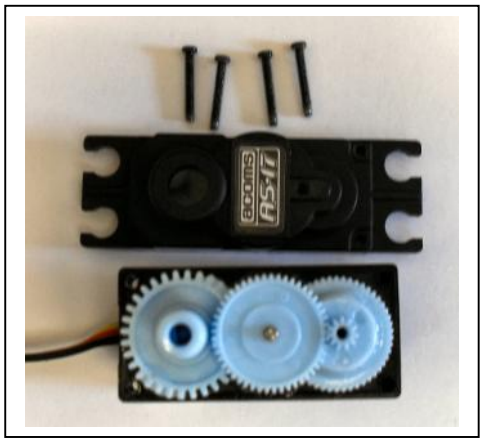
Step 1

First, locate the fixing screws holding the servo body parts together.

There are normally four, two on the top on one end, and two on the underside at the other.

Carefully remove and retain these screws.

Step 2

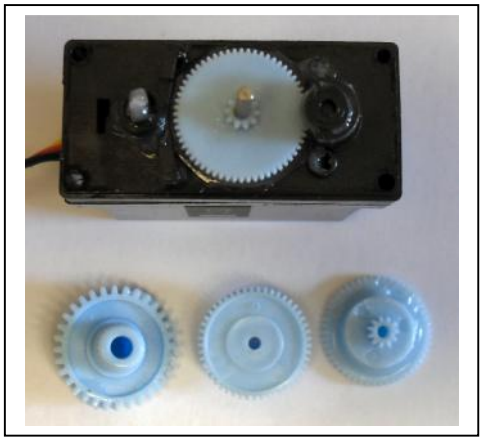


Carefully remove the top case moulding from the top mounting plate by pulling upwards.

Take care not to disturb the lower moulding.

Take careful note of the positions of all gear wheels so that you can be sure to replace them in the correct positions later.

Step 3



Remove the centre gear only from its bearing. Rotate the output shaft and note that it will only rotate as far as the end stops.

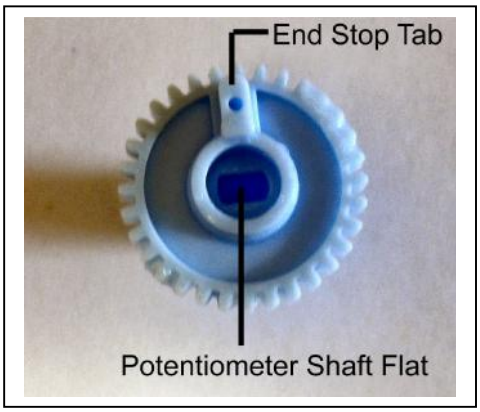
Now, remove the output shaft and motor gears from their bearings.

Note that the feedback potentiometer is coupled directly to the output shaft by a flat shaft.

Note also, the end stops on the output shaft, and servo body which prevent the output shaft rotating more than about 180 degrees.

Step 4

Before



First

Carefully file away the tab on the underside of the output shaft gear which provides the end stops. You may also need to file away part of the fixed stops on the top mounting plate of the servo to ensure that there is no chance of the shaft hitting the end stops as it rotates.

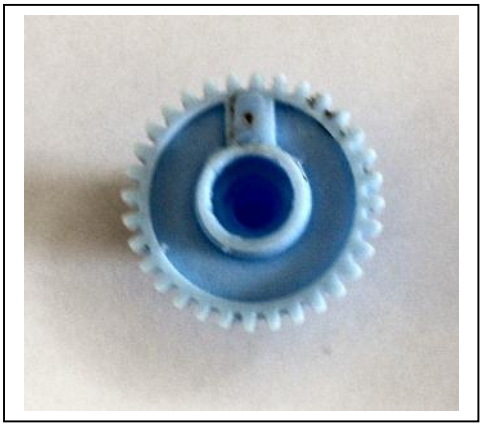
Second

Carefully drill out the flat down the centre of the output shaft to a diameter sufficient to ensure that the feedback potentiometer shaft is clear and can not rotate with the output shaft.

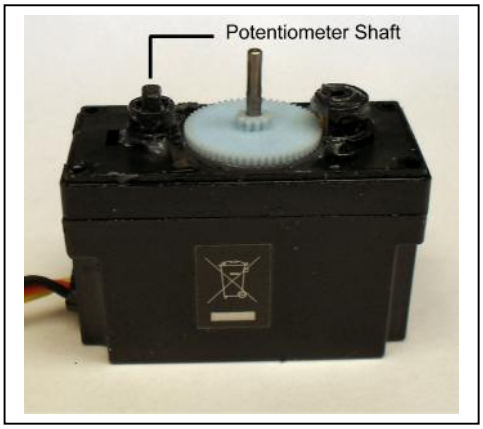
Use the smallest drill which will clear the potentiometer shaft to avoid weakening the output shaft moulding.

Temporarily refit the output shaft and check that it will rotate freely without binding.

After



Step 5



If you have your transmitter available, connect the servo to the channel you will be using to control it, and power up the servo with the output shaft disconnected.

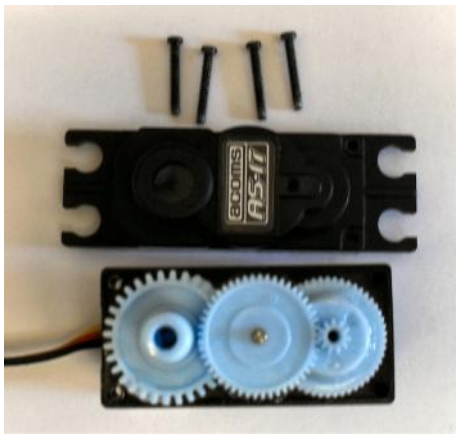
Set the transmitter joystick to the centre neutral [stop] position. Then using a small pair of pliers, manually adjust the position of the potentiometer shaft until the motor is stationary.

Once the correct position has been found, you may wish to lock the potentiometer shaft with a small dab of glue. Ensure that you do not get glue on the output shaft bearing surfaces.

If a transmitter is not available, set the potentiometer shaft as closely as possible to the half way position between its end stops.

This procedure should ensure that you will be able to calibrate the motor stop position with your transmitter joystick in the centre neutral position when in use, within the range of the channel trim adjustment.

Step 6



Finally, re-assemble all of the gears on the top plate, refit the top cover and tighten all fixing screws.

Your converted servo is now ready to use as a slow speed motor gearbox.

Simply plug it into the required RC receiver channel.

Set the transmitter joystick to the centre neutral position and, if necessary, adjust the joystick trim until the output shaft is stationary.

Then check that, as the joystick is moved in one direction, the output shaft rotates, and that it rotates in the opposite direction if the joystick direction is reversed.

Final Comments

Because of the nature of the original servo control system, you will not be able to achieve much speed control of the motor, except for very small movements of the transmitter joystick. Over most of the joystick range, the motor will run at its maximum speed.

This will not usually be a problem, however, as the main application for low speed motors is likely to be for winches, or similar, which normally run at a fixed speed.

A bigger problem may be maintaining zero speed with the transmitter joystick in the neutral position, as any slight variation of transmitted pulse width will cause the motor to jitter or creep.

If this is a problem, *Timpdon Electronics* manufactures a range of servo adaptors which can overcome this, for a number of specific applications. Please ask for details.