UNIVERSAL SERVO USING A STANDARD DC MOTOR – MGE100

By Matt Goodman

MMGG MIDLANDS MECCANO GUILD GAZETTE
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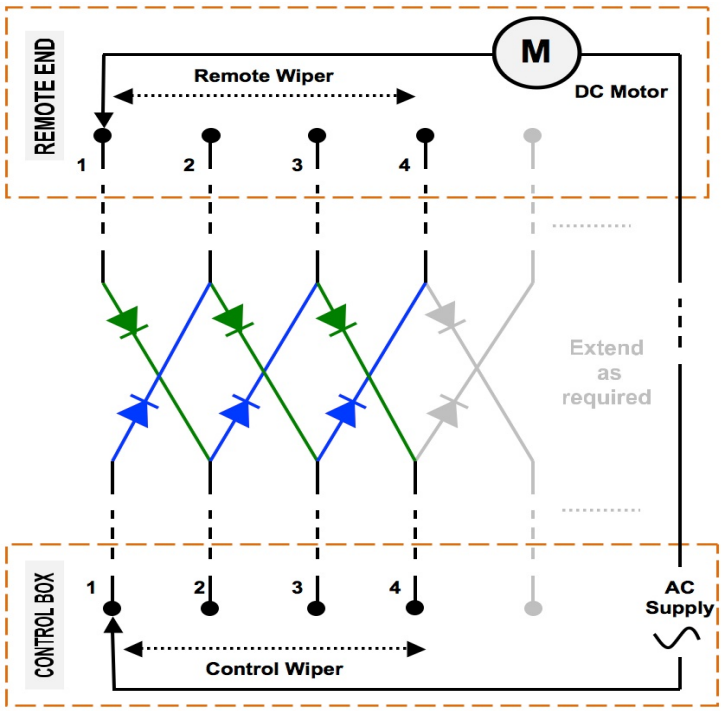
Many times per year I get asked for a copy of my Universal Servo circuit which was first published in the good ol' M²G² when I was a teenager. The reason being is that it is unreasonably simple for the complicated job it does.

What It Is

If you have ever wanted to control a model remotely then you will have wanted to control some parts of it in a continuous way – for instance the drive to the running wheels of a vehicle. Other parts of it you will have wanted to control precisely like the selection of the gear that it is in or the direction that the steering wheels face.



The latter operations require a servo system of some kind. Most people then resort to a full blown digital radio control system with a price tag to match its complexity. Or an inbetween solution like Peter Harwood's excellent Arduino Computer System (see WLMS Newsletter114).

However back in the 1970's all this was unreliable high tech or didn't even exist. Not to be put off and necessity being the mother of invention I came up with a cheap closed loop control system for my models. A very good Engineer's adage is that if it looks good it probably is good. Everyone knows that a plug in power supply steps down the mains voltage and then has to rectify the Alternating Current to feed one's bog standard DC motor. But what if that rectification process is part of the control to the motor !

How It Works

Looking at the diagram above: At the remote end a motor is geared to move the part of the model that needs to be precisely positioned. That part of the model also moves a remote position sensor -which is simply a wiper that can move between discrete contacts. Let's assume four discrete positions are need as in the circuit above. Let's switch on the AC supply. Nothing will happen ! A) If we move the Control Wiper to Position 2 the first green diode will half wave rectify the AC causing the motor to turn in one direction only. If the polarity of the motor is chosen so that the Remote Wiper is moved sympathetically in the direction of Position 2 bingo you've achieved some of your goal. In fact the motor will continue to turn until it leaves Position 1. The same is true for each further position of the Control Wiper. B) If one moves the Control Wiper back then this time one of the blue diodes will cause the motor to turn back.

An Example

Before I devised this circuit I had built a Meccano *Bentley* car which required a gearbox to enable it to get around *Royal Show Ground*. However the severe roughness of the terrain would often knock it partially out of gear and the motor would rev its little guts out whilst the model would roll uncontrollably backwards until I grabbed it (but not just the gear stick otherwise there'd have been severe shredding of teeth with the motor revving one way while the model rolled back the other) I installed this circuit. C) The beauty was that as soon as the wiper put a foot wrong either a green or blue diode would send current in the correct direction to rectify the problem. This is a simple and effective closed loop.

Tips

- It is infinitely extendable. Obviously use diodes capable of carrying the current of your chosen motor.
- Remote contacts should be make-before-break ie the wiper should 'bridge' two contacts as it moves.
- Whilst it doesn't matter how much gearing is used, nor how long the movement takes, it is wise to reduce the 'run on' when power is removed from the motor. Just widening the contacts so that the motor runs on until it stops in the middle of a contact actually isn't a good idea because in case C) above only a short pulse of current may be required to nudge the model back to where it should be. Keep it precise, chaps.
- If used for steering I found 11 steps more than adequate. Mechanically make the centre steps small and more extreme towards the ends. Have a way of precisely centering the mid-point.
- There's no advantage to having the diodes at one or other end so you can choose where the set of long wires (shown dotted either side of the diodes) comes.

Keeping It Simple Isn't Stupid !