

WHISTLEBLOWER

The Newsletter of the Farnham & District Model Railway Club

February 2015

Editorial: Welcome to the February edition of Whistleblower. The club seems to have been a hive of activity these past few weeks. Lots of work on layouts and personal projects. This edition includes a report on Wickwar's visit to Wickwar and an article which will unveil the mysteries of the servo.

From the Committee: The Committee met on the 14th of January and reported below are some of the topics discussed. These are only a brief summary as the Committee decided to make a copy of the minutes of each meeting available in the club room for members to read if they so wish. However, it is occasionally necessary for the Committee to discuss an item which may need to remain confidential or is of a personal nature. The minutes of any such discussions will not be included in the club room copy.

1. Constitution: A review and rewrite of the Constitution will be undertaken during 2015.

2. Finance: The Treasurer will investigate the possibility of moving our deposit account to a financial institution offering a better rate of interest. He is also undertaking a review of the club's insurance.

The Committee is undertaking a full review of all aspects of the club's finances. This will include the level of reserves, increasing the income from the Exhibition, increasing membership numbers and other methods of increasing our income. If necessary an EGM will be called before the 1st of November to reverse or modify the decision at the 2014 AGM to increase membership subscriptions.

3. Clearing Up Policy: In response to the motion placed before the AGM by Richard Harris it was agreed that the Clearing Up rota would be based on a 4 week rotating system with each group taking turns. The 4 groups are OO, OO/P4, N and O. The rota would also remind members as to the various responsibilities for cleaning and tidying up.

4. Data Protection: The club will take action to ensure it meets its responsibilities under the Data Protection Act. The new membership application form has been amended to allow new members to give consent for their details to be stored electronically. Existing members will be invited to confirm their agreement. The Constitution will be suitably amended as part of the overall review.

Servo operation of turnouts, signals and other model railway features.

Many members already know that our club has used electromechanical servomechanisms – servos - for turnout control on Wickwar and semaphore signals on Brixcombe. Servos have now become a method worthy of serious consideration as an alternative to longer established methods of control such as solenoids. Not only have the servo devices become excellent value for money, but significant industry support together with a volume of press and internet interest has raised their profile.

In this short article I could not cover every product available, and the editor would not thank me for copying material already published, however I hope to have included something of value to a range of tastes and talents.

So – What is a servo?

A servo achieves the movement of something that is remote, inaccessible or cumbersome over a range of positions in response to a controlling input. This definition validly applies to many things – such as the power steering of a car – but here we will only deal with small devices that are electrically powered and controlled. Where a servo differs from other devices used on model railways is that it can adopt any position over its operating range. This is in contrast to the ‘two end-stops’ mode offered by solenoid, stalled motor, or similar devices.

Many such servos are available. Some were initially developed for the model aircraft hobby, where the precise positioning of control surfaces, throttles etc. is essential. The usual output of these devices is the rotation of a shaft through 90 to 170 degrees, though variants delivering linear movement are also available. Fig. 1 shows an example of both types, together with the selection of ‘horns’ that are supplied to make practical use of the shaft rotation variant.

These servos contain four key elements:

- A small electric motor.
- Reduction gearing between the motor and output shaft.
- A device for detecting the position of the output shaft.
- Electronic circuitry which compares the output shaft position with that requested by the control input and, if they don't match, drives the electric motor, and hence the shaft, in the correct direction to eliminate any difference.



Figure 1

How is the servo controlled?

The control input travels along one of the three wires attached to the servo. The other two wires (0v and +5v) provide the power to the electronic circuitry (and thereby to the motor as and when required). The control input provides information to the electronics by altering its potential between values, 0v and +5v. The information is conveyed as a series of ‘pulses’ where the voltage is raised to +5v and then after a time reset to 0v. The time for which the voltage stays at 5v is called the ‘pulse width’ and, for these servos, should be somewhere between 0.5 and 2.5 milliseconds (ms). The pulses should repeat every 20 ms. Usually pulse widths varying between 1.0 ms and 2.0 ms correspond to 90 degrees rotation of the shaft. Many servo variants can extend to almost 180 degrees rotation by using the full (0.5 to 2.5 ms) range of pulse widths.

If the stream of pulses changes from one pulse width to another then the servo moves as quickly as possible to the new desired position. If a slow movement is required then the pulse widths must be gradually changed over the required time. If the stream of pulses ceases the servo should not change from its last position.

All this may sound complex, but a number of electronic circuits are available to achieve this, some are ready built and available off the shelf, others are self-assembly kits. It may be of interest to note that these circuits are typically based on Programmable Interface Controller (PIC) chips. These tiny devices are capable of running quite complex computer programs which can be locked in to the chip for life. Other user defined parameters needed by the program, such as speed of movement, can be saved in the chip as part of a setup process.

Those circuits intended to move the servo between two pre-set positions, for example to operate a turnout or signal, are designed to be operated from a simple, single pole on/off switch. They can alternatively be operated from DCC or CBUS steady state decoders, but that is beyond the scope of this article.

All this may sound complex, but a number of electronic circuits are available to achieve this, some are ready built and available off the shelf, others are self-assembly kits. It may be of interest to note that these circuits are typically based on Programmable Interface Controller (PIC) chips. These tiny devices are capable of running quite complex computer programs which can be locked in to the chip for life. Other user defined parameters needed by the program, such as speed of movement, can be saved in the chip as part of a setup process.



Figure 2

Those circuits intended to move the servo between two pre-set positions, for example to operate a turnout or signal, are designed to be operated from a simple, single pole on/off switch. They can alternatively be operated from DCC or CBUS steady state decoders, but that is beyond the scope of this article.



Figure 3

Some servo control circuit products

This selection is to illustrate the range. Copious further information is available on their websites and – Other products are available!

- **EzyPoints from MERG.** This 'Pocket Money Project' No.18 is a self-assembly kit to control one servo. It consists of eleven components, including a PIC, to be mounted on stripboard. Presets of the two endpoints and speed are set by onboard trimpots. Operation is from a single pole on/off switch. Probably the cheapest and simplest available, this is supported by

excellent instructions for construction and test. This simple project is quite suitable for the novice electronics constructor. Fig 2 shows the EzyPoints kit components.

- **Single and Dual Servo Motor Controllers from Heathcote Electronics.** These ready-assembled circuit boards operate one or two servos as stated. Presets are programmed by onboard push-buttons. Links are provided to make two servos operate one after the other in response to a single switch operation – possibly useful for crossing gates or similar.
- **Servo-4 Driver from MERG.** This kit No.75 is self-assembly and is based on a printed-circuit board on which some 30 components are to be mounted. It drives up to four servos. Setup of endpoints and speeds can be from an IBM PC running software downloaded from MERG or from a Setup Control Box - MERG kit No.76. Fig 3 shows an assembled Servo-4 control board.
- **Sema-4 Driver from MERG.** This is the same kit No.75 as above, but ordered with the PIC containing the alternative Sema4 software. This software allows each of 4 servos to drive a semaphore signal with realistic 'bounce' at the end of travel. The bounce parameters have to be set up from appropriate (free) software running on a PC. This is further described later in the section Brixcombe Signals.
- **Bouncing semaphore controller from Heathcote Electronics** This ready-assembled circuit board operates a single servo driving a semaphore signal. Onboard push-buttons set the endpoints and bounce characteristics.
- **SmartSwitch from PECO.** The SmartSwitch board comes as part of a set containing everything needed to operate four devices. The set includes the servos, mountings, control and setup boards, switches, nuts, bolts, screws and operating wire. PECO have done their best to make this a mass-market plug and play product. Soldering is hardly required and the documentation is excellent. The control board and setup board are initially plugged together to pre-set the endpoints and speed for each servo. In addition to driving the servos, outputs are provided to light indicator LEDs showing turnout etc. settings on a panel. Alternatively the control board can operate their SmartFrog product which correctly energises turnout crossings. Further components of the set can be purchased separately. One does not need more setup boards. This very user-friendly and well documented product set does not come cheap, but it will undoubtedly be the right solution for a good number of modellers.
- **Servo controller/tester from MERG.** This 'Pocket Money Project' No.3 is a self-assembly kit to control one servo. It differs from all of the previous examples in that it has a fully variable manual input. Turning the input device, a variable resistance, through its full range drives the servo similarly though its operating range. As its name implies it could have application where manual control is appropriate and could also be very useful when testing servos and their connection to modelled items. This kit is another well within the capability of a novice constructor.

Mounting and connecting up the servo

Some ingenuity is needed to mount the servo and connect its output to the device that is to be moved. Some helpful products are noted below, but if none fit the bill then modellers may have to revert to their traditional methods of crafting a solution with aluminium angle, stiff wire etc.!

- PECO provide a metal mounting bracket as part of their SmartSwitch solution. It consists of a shaped and bent piece of metal sheet designed to grip the servo with a single bolt and has holes for two fixing screws for above or below baseboard mounting. Its use is covered briefly in the SmartSwitch instructions but PECO are to be congratulated on the comprehensive, well-illustrated article, "Using the PECO Smart Switch. An installation guide", in the September 2014 issue of their house publication Railway Modeller. This clearly shows the bracket's applicability to proprietary (PECO) turnouts and (Ratio) signals.

Figs 4 shows the bracket and Fig 5 its use above baseboard operating a turnout. Unfortunately PECO do not seem to offer the bracket on its own. It is available packaged with a servo and fixing screws etc. but, as I have mentioned, items in this range do not come cheap. One sad omission is any simple facility for adding one or more microswitches to be actuated by the servo, but presumably PECO are happy that their overall product set makes other provision for indicator LEDs and crossing (frog) polarity witching.

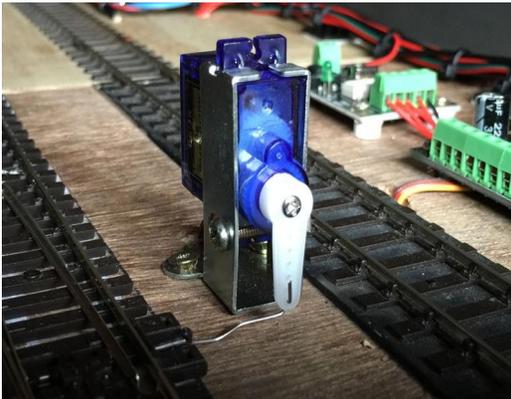


Figure 4

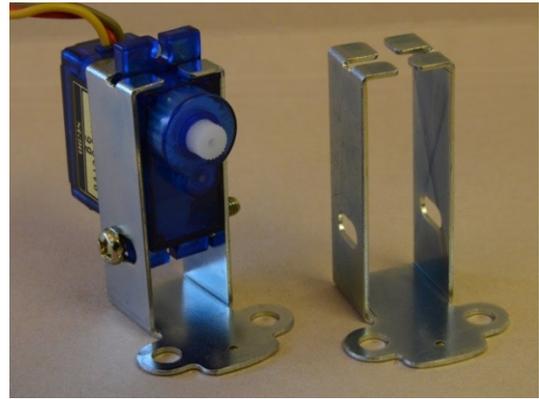


Figure 5

MERG Offer a plastic Micro Servo Mount in kit form, they are tailored for turnout operation. As well as supporting the servo there is provision to mount up to 4 microswitches. The microswitch positions are adjustable so as to obtain any required break before make condition over the full servo travel. These kits come in a pack of 6 suitable for below baseboard mounting. A pack of 6 conversion pieces for above baseboard use is available . These servo mounts have been used in some number on the club layout Wickwar.

- A recent development from MERG is a set of servo mounts tailored for signal operation. They are made of plastic by the 3D printing process and are available in variants for one, two or four signal arms. The documentation does not specify any particular signal or kit manufacturer so I think with these mounts experimentation and pragmatism are order of the day.

Whether using one of the above mountings or a 'home-brew' approach, there are a few golden rules to consider:

- A) Servos are quite strong so, especially if the target device is a delicate signal or suchlike, consider including an omega loop to take the strain during the inevitable setting up mishap!
- B) Keep 'slop' to a minimum, for example by using operating wires only a fraction smaller than the holes they engage with. Every sloppy link between servo and the piece to be moved adds to inaccuracies of positioning.
- C) Design linkages so that a good proportion of the servo's range of travel is used to move the target between desired positions.

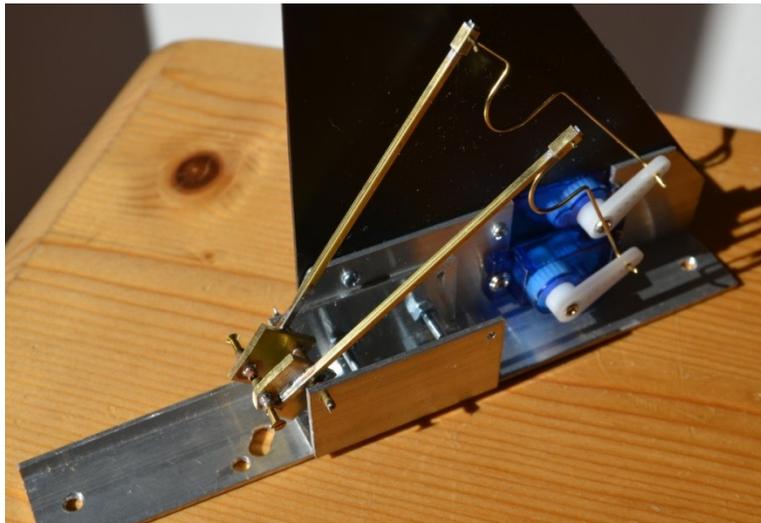


Figure 6

Brixcombe's 'bouncing' semaphores

Transforming Brixcombe's signals to servo operation presented some challenges and an opportunity. The signals are scale models and hence the 3 to 4 inches of control movement required on the prototype is represented by little more than one millimetre movement of the 0.3 mm steel wires that protrude vertically through the baseboard. Our solution was to use 6:1 ratio levers so that a more appropriate proportion of the servo's full travel corresponded to the required 1 mm or so of movement. The solution is not pretty, but effective.

The opportunity was taken to introduce realistic motion of the signal arms where settling at the end positions includes movement described as 'bounce'. We chose the Sema-4 variant of MERG's control board for 4 servos. With the corresponding setup software on a PC we can set not only the endpoint positions for the signal but also up to three positions which the signal 'visits' before settling. By careful choice of these settings the signalman's final tug on pulling the signal off, and the bounce on return under gravity can be depicted.

What does it all cost?

The servos are now relatively inexpensive. The preferred model, Tower Pro SG90 is available for between £3 and £4. Better prices can be found on ebay and the suchlike but, as with everything from the Far East, copies abound and if the price looks too attractive quality might be an issue! Approximate 'street' prices for the components discussed are tabulated below. All solutions require in addition a 12v DC power source. Prices from MERG are for Members who pay an annual fee of £16.

Maker	Product	Price	Servos	Setup requirement	Web
		£1.86	1	Small screwdriver	www.merg.org.uk
Heathcote Electronics	Servo 1 Motor controller	£8.40	1	Onboard push buttons	www.heathcote-electronics.co.uk
Heathcote Electronics	Servo 2 Motor controller	£13.90	2	Onboard push buttons	www.heathcote-electronics.co.uk
MERG	Servo-4 (kit 75)	£6.30	4	PC or ServoSet Kit £20	www.merg.org.uk
MERG	Servo-4 (kit 75)+ Sema-4 PIC	£6.30 + £2.20	4	PC	www.merg.org.uk
Heathcote Electronics	Bouncing controller	£12.80	1	Onboard push buttons	www.heathcote-electronics.co.uk
PECO	SmartSwitch Set	£59.00	4	Setup board included	www.peco-uk.com
MERG	Servo controller 803	£1.86	1	N/A	www.merg.org.uk

Above article by Richard Harris

Didn't we have a luvverly time

Everywhere in Wickwar is uphill. That also goes for the four flights of narrow stairs to the area provided by the brewery for our display. By the time the show was opened to the public we – with the probable exemption of Big Eric - were knackered.

We had been planning the trip for at least a couple of years as part of the development and building of the layout. The invitation came from the Neil, the brewery manager, during one of our several trips to take pictures and worry the residents by measuring their front doors and pavements. A literal highspot was when Neil invited me onto the roof, necessitating a torchlight scramble up rickety stairs, through cobwebbed passages in the dark roof space and wriggling through a metre-square hatch that was thoughtfully



positioned three feet above floor level. I'm not built for that sort of stuff. But it was then that Neil invited us to bring Wickwar to Wickwar and we've never looked back.

Four cars set off from Farnham as a gloomy dawn seeped over the Surrey hills – two full of kit and two with expectant hopefuls, agog with excitement and chattering like sparrows on a line-side telephone wire. It's only 90 minutes to Wickwar, although most of that is a dreary run on the M4 – even allowing for Greg's car, which won't go any slower than 90mph+. We were, of course, very early and so some of us – Greg, Keith and I - diverted en route for a cup of Tesco's finest brew while Andrew plus crew diverted to collect Noel from Bristol Parkway. He was, of course, on a train that was half an hour late, thus providing a watertight excuse for arriving at the brewery just in time to avoid having to carry anything too heavy up the aforesaid stairs.

The brewery at Wickwar was built at a time when clearly the government was fearful of Napoleonic invasion and therefore required all new buildings to withstand cannon shot, earthquake and the occasional tsunami. It has turrets and battlements. From the outside its darkling walls of huge grey limestone blocks are daunting: from the inside a maze of corridors connects polished woodwork, concrete floors, bronze-age toilets and mysterious flights of metal stairs which connect at least 5, maybe more, floors. Overall lies the powerful smell of yeasty malt. Why it was necessary to create Fort Knox in a tiny

Cotswold village to facilitate the brewing of beer is a question that will occupy historians for generations to come.

So there we were, allotted a wide open space alongside stainless-steel vats three or four floors up and by a handy counter selling the brewery's tawny brown output to the punters while giving as much as could be drunk to anyone wearing the Farnham Green. It was at this point that the dreadful truth sank in – that those of us who were driving were denied the major benefit of the occasion. But we all buckled to and in a trice the layout was up and levelled and our splendid new lighting switched on. Greg took the lid off his box of Mysterious Electronics Relevant to Locomotives and other Ingenious Novelties and scurried about plugging in cables, mostly to the right sockets. I withdrew to the relative safety and comfort of glue, paint and flock, repairing bits that had fallen off during our hair-raising dash down the motorway. Everyone else potted about, trying to look useful.

Then Alan turned up and Greg disappeared under the layout, so normality was restored and the first punters arrived. Naturally, the first trains we put on the layout refused to obey the commands issuing from MERLIN and there was a lot of earnest muttering involving technical terms such as “ghosting” and “resistive axles”, as well as quite a lot of inventive language. But by lunchtime the ghosts were exorcised, axles became properly resistive, and the bus and lorries trundled up and down until their batteries expired. Even the flow of novel language abated. Trains ran pretty much as they were asked to do and an admiring and appreciative crowd around the layout was at times three-deep.

Now that all seemed well, some of us snuck out for a trip to the village sarnie shop – all uphill of course – while others chose to stay close to MERLIN in case he threw some sort of occult wobbly.

Terry, the Chairman of the Parish Council and Pat, his clerk, turned up, as did Julie, the editor of the Parish mag, and the Vicar (MERLIN never misbehaved after that). Most of the visitors seemed to be from the village and surrounding area, all keen to see what the village was like 50 years ago – the last stopping passenger train, a Class 46 Peak “Grenadier Guardsman” with four maroon Mark 1s, went through on 2 January 1965. We met a man whose father was an odd-job-man and gardener at the brewery back then. We also met no fewer than two ladies whose fathers were station masters at Wickwar. One lady told us in no uncertain terms that her house had no rear extension 50 years ago (John Scambler please note!) but our trees were OK because one of them fell on her father's car. Several visitors were from Bristol or Gloucester and had come principally to “see the trains”. In fact, the brewery manager said that around 70% of the visitors seemed to be more interested in the layouts than in the brewery's open day.

I should admit that although Wickwar was both originator and highlight of the day, we were pleased to share the event with our friends from Sodbury Vale MRC, who turned up with a small but delightful panorama and the mixed-scale “End of the Line”, which had just been bought, post Warley, by Tim Crockford. It was Sodbury Vale's show on the

following day, which prompted their observation that life is strange – a Saturday show in a brewery followed by their annual exhibition on Sunday in the Church and Church Hall in nearby Yate. But, together, we put on an event that brought a lot of nostalgic pleasure to over 250 people, smiles to the faces of the brewery salesmen and much quiet satisfaction to the N-Gauge element of Farnham MRC.

Will we do it again? Certainly; when the time is ripe. The mixture of model trains and open day at a brewery seems to be a marriage made in heaven (sorry, Vicar!)

Stop Press

The O Gauge Group took Weydon Road to the Stafford Show last weekend. They were both surprised and delighted to be awarded ‘Best Layout in Show’ especially as there were many fine and well known layouts present. Mike le Marie was also at the show with his layout ‘Garsdale Head’ which was highly commended by the organizers. A good weekend for F&D MRC.

And Finally – A Riddle

Picture a heavily laden Luton van being driven into an exhibition hall. The roof only just clears the door and some of the lights. The layout is unloaded and then it is suddenly realised that the roof of the van is steadily rising! What happened next? When you get a chance ask your friendly member from the O gauge Group!