

Journal of the Model Electronic Railway Group

2 Aspect Signals



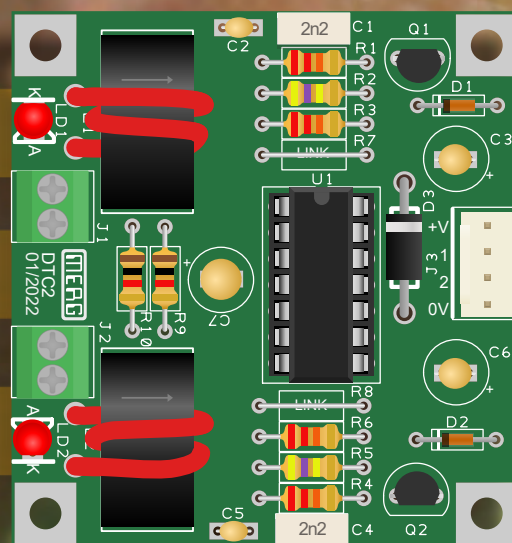
CBUS modules at Croydon Area Group

Graphical Guides

Van Rides

Sounds Right

3D Printing For ATC 2



OXFORD EVENT - SATURDAY 28th OCTOBER

MERG Website - What's Where



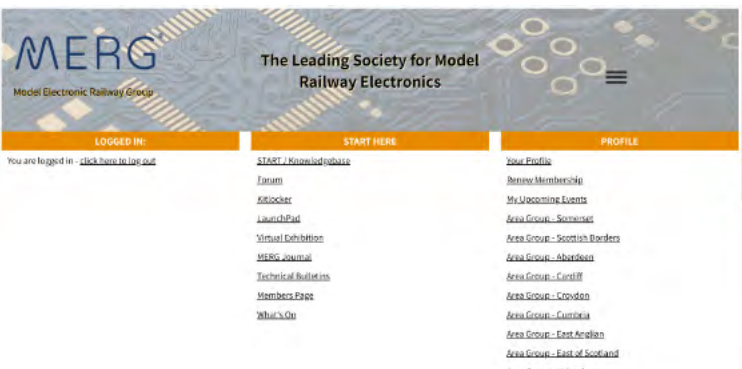
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Login Page



Member Area

Member Resources

MERG's website comprises several discrete parts with a completely different look and menu structure to each one. This is the legacy of how our virtual presence has expanded rapidly over the past decade.

The Home page has information about MERG and a taste of what is available to members. There are links to further details about:

- Quarterly Journal
- Technical Bulletins
- Members Forum
- Knowledgebase

Also Davy Dick's ebook "Electronics for Model Railways" - free for all to download.

Member Area

Login via the link 'Members Area' - see left - which provides access to our resources:

START/Knowledgebase:

The portal to thousands of pages written by our members.

Forum: Want to introduce yourself, ask a question or provide a solution? This is the place.

Kitlocker: MERG's shop window, approximately 250 lines including kits, PCBs, components, PSUs, apparel and other items.

LaunchPad: A quick guide for new members. Virtual Exhibition: Presentations and layout videos.

MERG Journal: An archive of publications from 1997 onwards in PDF format for download.

Technical Bulletins: PDFs on all things relating to model railway electronics including legacy kits.

Members Page: Where to find documents and links to key parts of our website.

What's On: Diary of events and meetings, both face to face and via Zoom.

Your Profile: Your personal data and groups you are subscribed to.

Renew Membership: Sign up here before your membership expires for up to two years.

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https://www.merg.org.uk/merg_wiki/doku.php?id=handbook:start

Charter and Rules:

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Committee members:

https://www.merg.org.uk/merg_pages/committee.php

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The Journal of the Model Electronic Railway Group

The deadline for submitting articles: 16th September 2023, reports 1st October 2023

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MERG Journal September 2023

Editorial

Welcome to the September edition of the Journal. Included with this quarter's mailing are the AGM papers. Please note the dates to nominate members for the 12 Managing Committee places and submit motions – they are different and in the past have led to motions being submitted after the deadline.

The Oxford Event

This year's AGM sees a welcome return to the format established at Thirsk in 2019. A full day event featuring layouts by local Area Groups, demonstrations, talks, kit sales and a cafe. The AGM meeting will be a hybrid event – accessible via Zoom to those who cannot travel to Oxford. Vice Chairman Andrew Hicks explains all in this issue.

Articles

Roger Edwards' Beginners – Where to Start article points to useful resources. Continuing the drive to make the Journal more accessible to members, Peter Wilson demonstrates simplified fiddle yard point control using a modified PMP27 and Servo4 kits whilst Tony Chamberlain answers the question: "How can I play the right sounds at the right time in the right place for the right cost?" Trevor Pocock shows how to build a two-aspect colour light signal with self-contained electronics from scratch.

We publish the next instalment of our series of articles about the Automated Train Control second generation range of modules and a set of 3D printed stands designed by Allan Geekie. Geoff Latham describes in Van Rides his adaption of Davy Dick's range of Pocket Money Kits to create a fully automated model railway and Davy gives an update about changes to the Ezybus Input Module (Kit 23). Julian Coles delves into TOTIs – Train-on-track Indicators and Chris Sharp's Graphical Kit Guides breaks new ground. John Purbrick describes a system for peer-to-peer communication between Arduino processors (KISNet). Finally, we publish seven updates written by Managing Committee members.

Added Value

MERG's subscription pays for the cost of printing and distributing the Journal; purchasing electronic components, PCBs, etc., for kits; exhibition and publicity, software licences and server space plus administrative costs. Income is split between subscriptions, joining fees, the sale of kits and other items.

Where then is the added value? It lies within the tremendous number of hours our volunteers dedicate to keeping MERG going. Without them the organisation would cease to exist. The Magenta Section has been expanded to acknowledge their sizeable contribution and further demonstrate the number of volunteers required to provide our services.

Other matters

Jan Carr has stepped down as Assistant Editor, though continues to edit and proof Journal articles. I owe him a considerable debt of gratitude as my mentor and guide.

At the time of going to press, Martin Da Costa has announced his intention to step down from the role of IT Manager for medical reasons. He will not be seeking re-election at the 2023 AGM for this reason.

Emily Johnston
Journal Editor

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Submission Guidelines – Update

Emily Johnston, Journal Editor

Author Photos

Those submitting technical or other articles destined for the Orange section of the Journal are invited to submit a recent head and shoulders photo to accompany their work. This is entirely optional and not a condition of publication. Photos should be in JPG format, 300dpi please and original – that is straight out of your camera or other device – not Photoshopped. If using a mobile device, ensure it is first set to the highest resolution possible.

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The Editor reserves the right to reject any submission which infringes the intellectual property of another author, publication, body corporate or organisation which risks MERG's reputation being brought into disrepute and/or the threat of legal action. Also, we do not accept submissions that have been generated by Artificial Intelligence (AI) – all work must be yours.

Drawings, schematics and flow charts

All imagery submitted to the Journal must be suitable for print reproduction – we work to 300dpi. A rough way of judging if your image will be legible is to print it out at column width (90mm) or margin width (185mm) and have another party view it at reading distance. Text must be a minimum of 8pt sans serif (eg: Arial, Helvetica) at printed size, avoiding the use of green and light blue.

Please remember that a schematic or drawing that looks satisfactory on a large monitor may be too small to read on the printed page without the aid of a decent magnifying glass.

Schematics must be drawn in mono, not colour - unless for educational purposes - with extraneous detail such as terminal numbers on discrete components (eg: passives, diodes, transistors) removed prior to submission. Also, please ensure that all lines are of sufficient thickness to reproduce clearly in print. Please send SVG or PDF files for such vector work.

Exhibition and Event Notices

It is essential you provide all details when submitting notice of events with a MERG presence: the event title, organisation's name, the venue's full address including postcode, dates and times and the organising club or institute's website, preferably with a link to the event page.

Photographing Minors

Prior to photographing minors – for instance at an exhibition, Area Group or club meeting – you must gain written permission from their parent/guardian. MERG's Photo Policy and relevant forms are here:

https://www.merg.org.uk/merg_wiki/doku.php?id=com_comms:policies_and_procedures

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A Two-Aspect Signal From Scratch

Trevor Pocock M7058

Abstract

Probably, like many MERG members, I beaver away quietly on my own with a host of projects for my model railway and one of those projects was to build a two-aspect colour light signal with self-contained electronics from scratch. To me it was neither novel nor ground-breaking but after showing it to my 3 Counties Area Group (3C AG – for Bucks, Beds and Herts) they encouraged me to submit this article. In this article I describe the journey I took from inception to installation showing how I used the skills I had already picked up from within MERG while acquiring new skills and knowledge on the way. I have tried to include enough detail in this short article for others to build their own or to improve on it.

Background

My 4mm scale OO gauge model railway loft layout is based on a rural village station, Cowden, on the Southern Region ex-LBSCR line from Oxted through to Tunbridge Wells in Kent in the late 1950s. The layout is signalled with working upper quadrant semaphores as per prototype. However for no very good reason other than I fancied it, I wanted to install a few colour light signals in an urban section of the layout leading to my automated traverser. This area is a nod to the approaches to Tunbridge Wells West station and its extensive goods yard and it is not unreasonable to believe that two-aspect signals could have been used in this area (although they never were to my knowledge).

Control for the original layout started off, nearly ten years ago, with a hard-wired physical control panel and solenoid point motors. It progressed to Arduinos and servo motors with even more wiring but, prompted by extensions to the layout, is now based on MERG CBUS modules. These are mainly CANMIOS running Universal firmware driving servos for turnouts, signals and uncouplers. Inputs deal with sensors and feedback events and other outputs drive lighting and accessories – and all with far less wiring. DCC is serviced by MERG CANCEBS and a CANCSB (combined command station and 3 amp booster, not in the Kitlocker but available as a kit of parts [Ref 1]). The physical control panel has now been replaced with a touch screen glass panel running JMRI software on a Raspberry Pi 4 which is very versatile, easily modified and displays a host of additional information.

Design

I had no thought of buying the few colour light signals I wanted and it was inevitable that I'd try to work out how to build them myself from scratch with my own control circuitry. I'm a reasonably competent modeller, can understand a schematic, have successfully built MERG kits and modified simple circuits. I have also designed PCBs, can solder Surface Mount Device (SMD) components, programmed microprocessors and have a 3D-printer so it seemed another good project to tackle to put my existing skills into practice and learn new ones. I roughed out a design with dimensions for the actual signal from photographs and reference material. What could possibly go wrong?

I knew there were several circuits and modules for controlling and automating colour-light signals, both within

and outside of MERG, but they seemed to be more sophisticated than I needed. My criteria for the two-aspect signals were simple:

- Self-contained signals with their own electronics using 5V supply.
- A 0V or 5V logic level input to toggle between red and green aspects (in my case from a CANMIO output channel but it could of course be from any source).
- Option to fit a feather route indicator controlled by a second input (on when at 5V but only illuminated when green aspect is lit as per prototype).
- The signal head and mast to be removable and plug into a small main circuit board through a 13 mm hole in the baseboard.
- Use 1.8 mm LEDs for main aspects otherwise mainly SMD components including SMD LEDs for the feather.

I have no block occupancy detection but do have some spot detectors (based on Judi Rastall's differential LDR circuit described in MERG Journal Vol 53 [Ref 2]) with some laser detectors (MERG Kit PMK22 [Ref 3]). Outputs from these detectors along with feedback events from turnout servos from CANMIO Universal firmware would be adequate in my case for automating these signals.

Project page

There is a project page in the Knowledgebase to accompany this article (Member Projects, Signalling [Ref 4]). It contains notes on construction, KiCad and Gerber files, STL files for 3D-printed components and jigs, JAL code, BOM and more photos.

Circuit

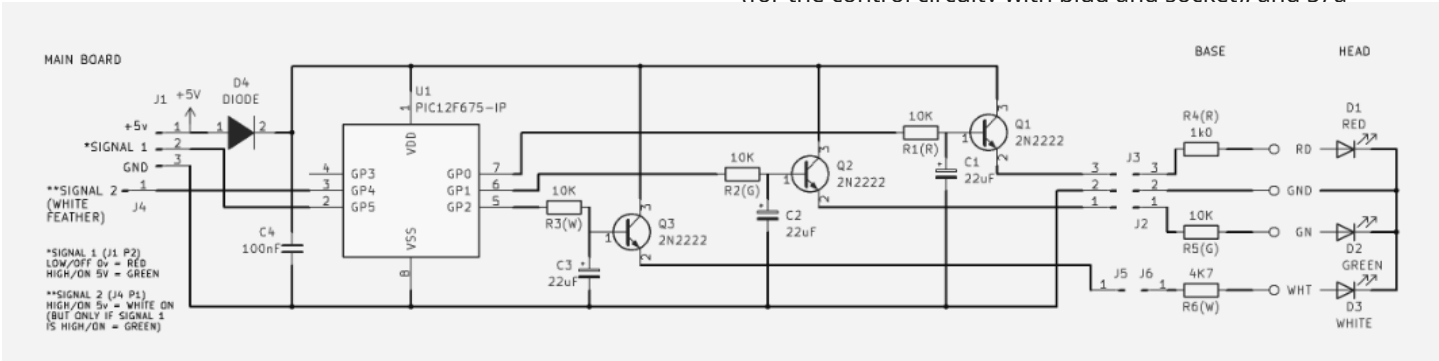
I wanted to keep the circuit simple and use mainly SMD components. My first attempt used the 0V/5V input signal as a sink and source for a pair of optocouplers switching the red and green aspect LEDs, with a third optocoupler for the feather driven by the output to the green LED. This worked well on the breadboard with a 0V or 5V input but failed when tested with the output from a CANMIO channel 1-8; the green LED glowed dimly when it should have been off. I worked out that this was because my CANMIOS have the 1K DIL resistor network fitted at IC3 for servo control and JP3 set to UP (to pull up servos in idle state) which drops the output voltage to only 0.46V, sufficient to allow the optocoupler to trickle enough current to the green LED. Channels 9-16 on the expansion connector worked fine because it was a 0V or 5V signal. I obviously hadn't thought it through enough and an electronics expert would have predicted this outcome at the design stage. My quick fix solution was to set jumper JP3 to pull down (DN) which fortunately had no adverse effects on servo operation or any other functions linked to these channels.

However I was not comfortable with the circuit (hence it's not shown here) nor the required adjustment to the CANMIO configuration so a rethink of the circuit was in order, prompted also by a comment from a colleague in my 3C AG when I demonstrated the original design. He suggested having a prototypical fade on and fade off to

better represent the incandescent lamps used for colour light signals in the 1950s rather than the abrupt on/off of the LEDs.

I researched how I could use a simple circuit with few components to accomplish this and decided to use a PIC12F675 which was cheaper than the two or three optocouplers needed for the first design. Of course using a digital input and output was more robust than relying on an optocoupler's input and output. I had previously dabbled with JAL (Just Another Language) [Ref 5] and used JalEdit to amend the code for a PIC to toggle tail lamps on goods brake vans, based on a journal article describing a DCC Coach Lighting circuit [Ref 6]. It seemed to be a straightforward task to edit some code for the two inputs and three outputs. I decided to use a simple RC (resistor – capacitor) circuit for the fade on/off to drive the base of

Figure 1 – Schematic



2N2222 NPN transistors with the LEDs connected to the emitters (final schematic is shown in Figure 1). The 10k resistor and 22uF tantalum capacitor gave a fade on and off of about 0.5 to 1.0 second (Figure 2). If the fade is not needed for modern signals, then the three resistors and capacitors may be omitted and the resistors bridged.



Figure 2 – Voltage change for fade on and off

PCB design

For this project with SMD components I needed a professionally fabricated PCB rather than the home-produced ones I used on many earlier projects. After investigating various free software I chose KiCad 6 [Ref 7] (now at version 7) because for me it seemed to be the most intuitive and flexible (once I'd overcome the shock of seeing the rat's nest of virtual connections when first generating a PCB layout from the schematic!). I refer you to a recent article by Alan Lomax [Ref 8] which describes very well the design and fabrication of PCBs using KiCad and closely matches my own experience as I got to grips with it. Suffice to say I find using KiCad a really satisfying and rewarding



Figure 3 – PCB panel front and back

activity!

I created five separate PCB components for 1) the signal head (to hold 1.8 mm LEDs), 2) the optional feather (using five 0603 white SMD LEDs), 3) the base of the mast (for the LED current-limiting resistors and plug), 4) the main board (for the control circuitry with plug and socket), and 5) a

baseplate (on the mast to cover the baseboard hole). They fitted neatly onto a 20 x 100 mm board with enough space between each component for separating them manually and I could get five of them panelised onto each single 100 x 100 mm board! (Figure 3).

Construction

If you intend to build your own signals I recommend you use the construction guide in the accompanying Project page [Ref 4] which gives more detail than is included below. The first step was to solder a 50mm length of 2mm brass tube (with baseplate slid on but not yet fixed) to the signal head and signal base. I 3D-printed a jig to hold them and an optional left or right feather in alignment for soldering (Figure 4). The other advantage of using this jig was to check that the PCBs were filed down to the correct size for fitting into the baseboard mount. The two 1.8 mm LEDs were soldered to the signal head and the three current-limiting resistors (or two without the feather) and 2x3 right-angle header pins were soldered to the signal base. Thin enamelled wire was threaded through the tube and connected at either end to the LED anodes on the head and the appropriate solder pads on the base; the brass tube being common 0V (Figure 5). Soldering SMD components is very achievable with a suitable tip (say 1mm chisel) and with everything held securely plus a bit of confidence under your belt. I found a very useful SMD third-hand soldering aid on Thingiverse [Ref 9] which has been adopted enthusiastically by several colleagues in our local 3C AG. It was admittedly more challenging to hold the double-sided main board securely when soldering its second side so I 3D-printed another simple jig to hold it in place (Figure 6).



Figure 4 – Jig with components ready for soldering mast

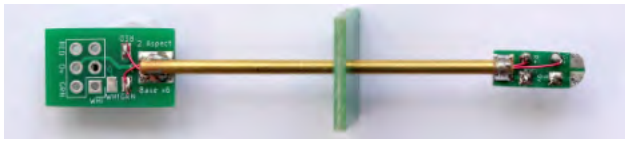


Figure 5 – Assembled signal head, mast, base and plate



Figure 6 – Main board in its jig with third-hand soldering aid

The PICs were programmed before fitting with a PicKit3 clone using a hex file compiled with JALedit. The straightforward code is included on the Project page.

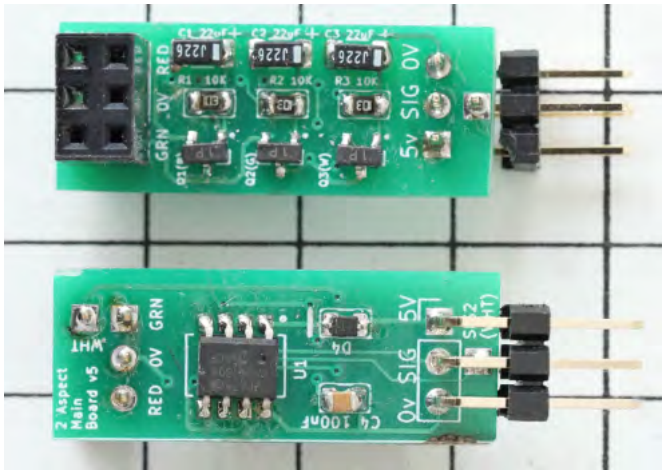


Figure 7 – Assembled main board front and back

I retained the two unused header pins on the 2x3 connector between the signal base and the main board because I found that the six pins gave a more robust fit. Likewise there are two unused pins (or three without feather) on the 2x3 input connector on the main board but in this case it could be helpful to remove them to avoid confusion when connecting the IN1/5V/0V lead (Figure 7). There are left and right versions of the optional feather PCB with silkscreen markings to help file them to size. Each has five 0603 (1 mm x 0.75 mm) white SMD LEDs in parallel soldered upside down flush to the pads in countersunk holes shining through to the front through 0.5 mm holes. Polarity of the SMD LEDs is indicated by a 'T'-shaped symbol on the

reverse: the top of the 'T' is the anode end; the stalk of the 'T' points towards the cathode (visible in Figure 8). Using the first jig, the assembled feather is aligned centrally atop the signal head and attached by bridging the two pairs of solder pads. I found that it did need a small strap soldered across for strength (Figure 8). The final assembly is shown in Figure 9.

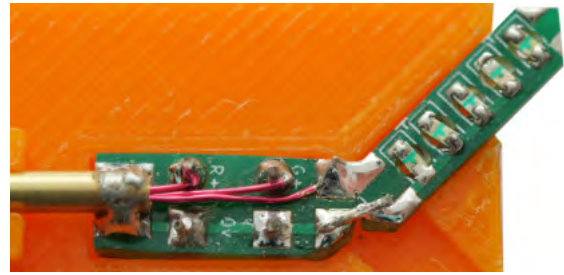


Figure 8 – Attaching feather to signal head



Figure 9 – Completed signal with base plugged in to main board

For my semaphore signals I have used the Removable Servo Mount (Kitlocker Kit 687) and was aware of Kit 689 for a similar plug-in mount for colour light signals. However I needed a mount to hold the main control board so with these in mind I designed my own 3D-printed holder to fit into a 13 mm hole in a 5 mm baseboard. The signal base slots into it and plugs in to the main board which is held horizontally. For thicker baseboards the length of the brass tube may be simply extended as necessary or the mount redesigned using the STL files in the Project page as a basis.



Figure 10 – 3D-printed cover and lens hoods

After successful testing, the signal head PCB had to be enclosed. This was challenging and after a just-about adequate attempt with thin card I finally used a 3D-printed casing with a separate back (Figure 10). For the optional feather, a slot was cut into the casing to accommodate it. Lens hoods were cut from black plastic tubing and glued on. Finally the 3D-printed mount

was fitted into a 13mm hole in the baseboard and once the signal was in its final location the baseplate was aligned, lowered and superglued to the mast (Figure 11). Finishing touches included fitting a ladder, a guard rail fashioned from thin wire (yes, another jig!) and final painting. Images of the signals in situ are shown in Figures 12, 13 and 14. The cost per signal was less than £5 although of course the initial outlay was higher as some components had to be bought in multiples.

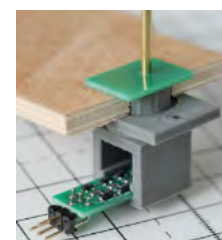


Fig 11 – Mount with signal base and main board slotted together and baseplate fixed in position



Figures 12,13,14 – Completed two-aspect signal, Completed signal with optional feather and another two-aspect in situ

Connecting to CBUS and JMRI

These signals are controlled by a 0V/5V logic input to IN1 for red/green and IN2 for feather off/on. At its simplest, the source of the input could be a switch connected to 5V or it could be the output directly from a Train-On-Track-Indicator, either spot detection or block detection. More likely, especially for MERG folk, is that the 0V/5V is the output from a module connected to a Layout Control Bus with inputs from many sources and where a degree of interaction, logic and interlocking can be applied.

My layout is based on CBUS with mostly CANMIO modules running Universal firmware. To control these signals I currently use a mix of inputs including LDR spot detectors and laser detectors (no block detection yet), feedback from turnouts and changes to sensors in JMRI with Logix conditions. Reading the Journal or browsing the MERG Forum and website shows that there are many other ways to control signals, some very complex and near-prototypical.

A simple example, not claimed to be prototypical, is shown in Figure 15 using just one CANMIO module with an input from a laser train detector (PMK 22 [Ref 3]), a servo output to control a turnout and two outputs to the signal. A train on the track blocks the laser beam and sets the signal to red; when the track clears, the signal goes green after a 5 second delay; the feather is on when the turnout is reverse but only for a green aspect. My personal preference is to use Short Events in the FCU Software Node taught to the CANMIO modules and setting the Event Variables (EVs). The details about the set up, Events and EVs for this simple example are on the Project page [Ref 4]. What might be worth mentioning here is how I used the TWO_ON Happening. It is used in combination with the DISABLE_OFF flag and allows an ON Event to be produced when the INPUT goes OFF so that two different ON Events are generated as an INPUT changes state. I used the second Event when input goes off to generate the delay before changing to green.

Next steps

The final product does fulfil the design criteria. I think it could be improved aesthetically with a shorter signal head by reducing the space below the lower aspect. The electronics work so no need to change them. Hmm. But then I did think that the design could be converted into a 3 or even 4-aspect signal fairly easily by using the spare pins on the PIC with new JAL code and using a 5V pulse to cycle through ... but maybe I should just get on with the next project on my list.

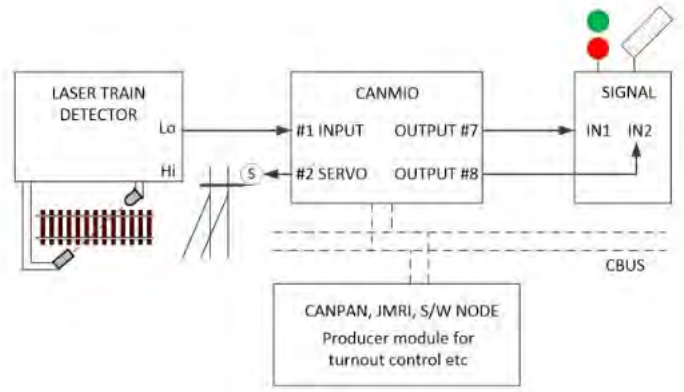


Figure 15 – Simple example connecting to a CANMIO

Summary

I was chivvied and encouraged to submit this article by some of my colleagues in the 3C AG. I am not an electronics expert and what I ended up with is not sophisticated, novel nor ground-breaking but it works, looks the part and is adequate and satisfactory for what I wanted to achieve. The project called on my previous experience within and outside of MERG and introduced me to new skills setting me up for my next project whatever that might be. I'm delighted to acknowledge the support and encouragement that I received from my colleagues in the MERG 3C AG.

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Biography

My interest in railways was kindled as a boy when I spent some time living in the station house of a rural station in Kent in the late 1950s. I had a model railway as a teenager and I remember using simple levers, cotton thread, screw eyes and springs to change the points. After my Ph.D. in plant physiology and researching sugar-beet crops for 15 years I switched careers to manage the business computing needs at the same research institute. After retirement I started a new layout based on my childhood memories and quickly learnt about the many developments in model railways since my teenage years. I discovered MERG and progressed from cotton thread and springs to CBUS and servos! I class myself as an enthusiastic railway modeller and a self-taught electronics hobbyist ready to apply electronics and computing to my model railway and other hobbies and I will explore and use new systems and technologies as much as I can.

Sounds Right!

Tony Chamberlain M2543

Some years ago, I built Davy Dick's Arduino Nano-based DFPlayer system that plays MP3 Audio files stored on a microSD card. [Ref 1]. However, the sounds I wanted to play were not readily available so I needed to find a suitable sound file source. I have no prior experience in sound technology, but I was a volunteer signaller on the Severn Valley Railway where I was bombarded on every shift with all the sounds I could ever want! All I needed to do was capture them! How I did that and how I learned to change them to a useful format is the subject of this article.

My problem boiled down to: "How can I play the right sounds at the right time in the right place for the right cost?"

Davy Dick's Sound-player was ideal. In Davy's system the Arduino Nano controls the sounds. His system is low cost, and he suggests the use of Train on Track Indicators (TOTI) to play the desired sound at the right time. He also suggests the use of Reed relays to direct the sound to speakers at specific locations, which would require his Arduino code to be modified.

Further developments of Davy's sound-player include:

- a PCB available from Alan Turner M2178 [Ref 2]
- David Thomas' A CBUS Sound Player [Ref 3]

Thus, my only requirement was to obtain the right sound files.

Like taste and smell, sounds can be ambiguous – I try to link sounds to visual clues to minimise this. i.e., lineside locations where the sounds may be anticipated.

Sound recordings come in many different file formats, so which is best?

Uncompressed formats – Sound captured and converted to digital format without further processing. e.g., WAV, giving large files requiring large amounts of storage space.

Lossy compression - Data is lost during the compression process reducing sound quality but with the advantage of much smaller file sizes. There are many formats and different algorithms used to produce each compressed file type e.g., MP3 and Ogg Vorbis [Ref 4]. Note that changing a WAV file to MP3 and then back to WAV will result inevitably in a lower quality sound; however, this may not be noticeable.

Our hearing changes for the worst during our lifetime due to various factors, including age and previous exposure to loud environmental noise. In my twenties I could just hear 23kHz frequency sound. Now in my seventies the limit is more like 15kHz. This needs to be taken into consideration when selecting the type of file you want to use.

Audio files are available on the internet, and some are royalty-free, as noted in Davy Dick's article. However, finding the right sounds to play is more problematic.

Recording the actual sound you want, using a microphone and recorder and then converting to MP3 or another file format using a free App, is an excellent low-cost solution. To this end using an iPhone to record a voice memo has the added advantage of being able to record unexpected sounds as they happen. The M4a file produced by the iPhone can be converted later to another file format. Make sure there are no copyright restrictions in your actual recording location. For those who are interested, quick overview of the Apple M4a format can be found here [Ref 5].

A rich source of useful sounds is a heritage railway. Besides the loco/train sounds, seek out less obvious sources, such as station announcements, doors opening and closing, workshops, goods yard workings, guard's whistles and signal boxes. Make sure not to expose yourself to danger in the recording process.

What if the sounds you have obtained don't match your exact requirements? A free app for non-commercial applications called Audacity [Ref 6] is available. It is a multi-track audio editor and recorder for Windows and other operating systems. Other similar free apps are also available.

Audacity allows you to switch easily between WAV, MP3 and other sound file formats. I tend to store and modify my recordings in WAV format.

You can:

- cut, copy, splice and mix sounds
- change speed, pitch or tempo of a recording
- reduce noise

Record your computer playback with Microsoft's free Windows Audio Session Application Programming Interface (WASAPI) app that is available within Audacity. If you can play a sound from any source through your computer, you can record it with this app. For example, the soundtracks of your old video recordings can be obtained easily as files for use in the sound-player using this software. WASAPI is useful to change the M4a file of an iPhone voice memo to MP3. At the time of writing, M4a is not accepted by Audacity unless an additional library is used, but it can be played through Windows Media player and recorded on-the-fly by WASAPI. Once recorded in Audacity the sound can be exported in WAV or MP3 format.

On older versions of Audacity you can find WASAPI in Audacity in a drop-down menu on the upper left side of the Audacity screen. On newer versions the Device Toolbar is NOT displayed by default. To enable it, click on View > Toolbars and check Device Toolbar. A dropdown menu, probably showing MME, appears on the LHS of the display. Open this dropdown and check WASAPI.

Using WASAPI it is easy to convert an M4a file to another file format. Make sure "WASAPI" is visible on the Audacity display and double click the M4a file so that it plays via Windows Media player. Quickly click the Record button, which has the large red dot and is located at the top left of

the Audacity screen. After a few moments you should see the recording taking place on-the-fly. When the recording has completed, click on FILE and export as a WAV or MP3 file. That's it!

Remember always to comply with Copyright and be aware that commercial Internet sounds often have hidden identifying codes added to the file.

Audacity has the disadvantage of looking intricate and complex, but tutorials are available on the Internet that are useful to get started. A good tutorial can be found here [Ref 7].

Using Audacity, I have been able to remove unwanted sounds such as regular clicks and scratches in a recording. Coughs, sneezes, people talking, dogs barking, phones ringing, etc. can be removed completely by highlighting the unwanted sound and then deleting or replacing with a noise free section of the recording. Regular noise can be minimised using the Audacity Noise app. Wind noise can be difficult to remove so select your recording location carefully. Changing location slightly can often markedly affect your recording and a microphone sleeve can also help.

Enhancing sounds can be added to your layout, such as factory clangs and clanks or farmyard moos and bleats, road traffic, chiming clocks or church bells all playing from loud-speakers positioned in lineside model scenes and actuated by reed relays controlled by the Arduino Nano software, as pointed out by Davy Dick. The only limitation is your imagination!

'New' sounds can also be produced. I wanted a triple whistle that was used in GWR days for the train driver to indicate to the signaller that his train was "In siding clear

of running lines" when it was not possible for the signaller to get an unobstructed view. Even on heritage railways these whistles are only given very occasionally. I have recorded just one such authentic file but using this as a guide I was able to create an effective triple whistle from a single short whistle recording I had made previously, by simply copying the whistle sound and pasting in two copies after the original sound. This took less than 5 minutes to do.

Similarly, if you want a full set of clock chimes, record two or three chimes so that you know the interval between the chimes for that particular clock and then produce a full set of files by copying and pasting an appropriate number of times.

Audacity is powerful. It is worthwhile spending some time getting to know and use its features, especially if you want your model railway to be full of vibrant sounds just like the real thing!

Happy recording!

References:

1. Davy Dick, A Multi-sound Player, MERG Journal, March 2017, 4
2. No longer available at the time of going to press
3. David Thomas, A CBUS Sound Player, MERG Journal, Jun 2019, 33
4. <https://xiph.org/vorbis/>
5. <https://docs.fileformat.com/audio/m4a/>
6. <https://www.audacityteam.org/>
7. <https://www.youtube.com/watch?v=yzJ2VyYkmaA>

Tony Chamberlain's biography is given in MERG Journal, June 2019, Vol53, No2, page 13.

Audacity Mac or Linux

Mac OS

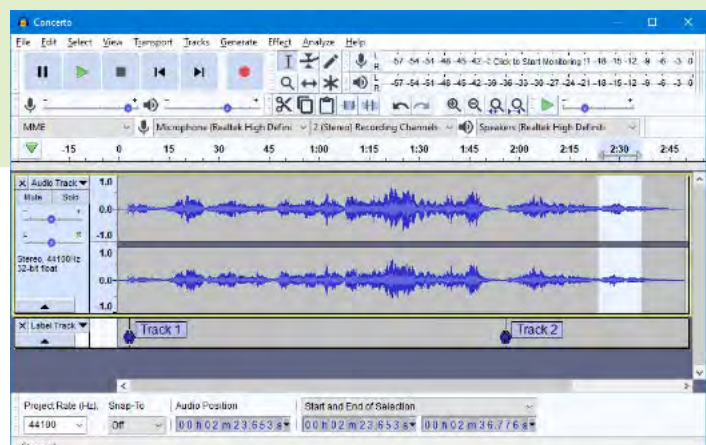
Audacity is available for the Mac OS, but in order to be able to make internal PC recordings, you will need to download some additional software. For those users with the older Mac (Pre M1 Chip), you will need to download a piece of software called Soundflower [Ref 1]. Those users with the more recent Mac (M1 Chip) will need to download a piece of software called Blackhole [Ref 2]. A good how-to video showing how to use Soundflower and Blackhole with Audacity on the Mac can be found here. [Ref 3].

Linux

Linux users of Audacity will need to download a piece of software called Jack [Ref 4]. A how-to video showing the use of Jack, with Audacity, on Linux, can be found here. [Ref 5]

References:

1. <https://www.youtube.com/watch?v=ORLJo2d7IcQ&t=214s>
2. <https://existential.audio/blackhole/>
3. <https://github.com/mattgalls/Soundflower>
4. <https://jackaudio.org/downloads/>
5. <https://www.youtube.com/watch?v=ITVTdH1bKl0>



Automatic Train Controller Kits – Part 2: ATC2-ENDS

Michael Collins M2563, Barry Mason M3426, Paul Howes M1925 and Allan Geekie M5173

Abstract

The Automatic Train Controller consists of a suite of four kits to automate a DC layout. They will be available in MERG's Kit Locker. At the time of writing production has commenced [Ref 1]:

- ATC2-CORE (Kit 145)
- ATC2-ENDS (Kit 146)
- ATC2-PROFILES-PANEL (Kit 147)
- ATC2-MPS (Kit 148).

This article provides a description of the ATC2-ENDS module and the in-built configurations that can be used to control up to three locomotives over five different configurations.

Introduction

In the previous article in this series [Ref 2] the central control module, ATC2-CORE, was described. The addition of an ATC2-ENDS module extends the number of configurations that can be controlled.



Figure 1 - ATC2-CORE (Kit 145) and ATC2-ENDS (Kit 146)

The ATC2-CORE module, also discussed in Reference 1, could be used with a single length of track with two ENDS.

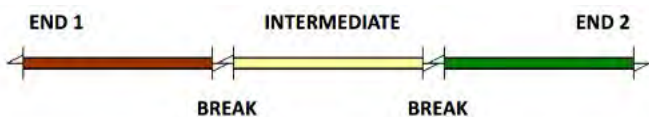


Figure 2 - Configuration A - Simple End-to-End Track Layout

The simple end to end configuration A (Figure 2) is also supported by connecting the track to the INT, END 1 and END 2 connected in parallel and powering up the modules with the configuration switch set to (ON-OFF-OFF-OFF-ON)

It is strongly recommended to have buffers at each end of the track.

The addition of an ATC2-ENDS module allows the combined modules to control up to four track ENDS, accessed through the deployment of one or two points. This enables an additional four configurations to be used as shown in Figure 3 below.

Some configurations can run up to three locomotives. Only one locomotive will run at any one time. The precise configuration is set on the red DIP switch on the ATC2-CORE module and is selected before power is connected to the modules.

In Configuration E, END sections are used as station stops in the passing loop. There are also two INTERMEDIATE sections connected in parallel.

The ATC2-ENDS Module

The ATC2-CORE and ATC2-ENDS modules are linked by a single Cascade ribbon cable as shown in Figure 1. This Cascade cable provides the on-board supply, traction power and control signals.

The ATC2-ENDS board provides the following connectors:

- PL1a - Cascade cable from previous module (in this case ATC2-CORE).
- PL1b - Cascade cable to following module - not used in this case.
- PL2 - open collector output for point and accessory control.
- PL3 - 5V logic (not digital) output for point and accessory control.
- PL4 is used in place of SKT 1 to 5 when used with an ATC2-PROFILES-PANEL
- PL5 - can be used to power LEDs on a remote panel; in which case the jumper on LK11 must be changed.
- SKT6 - used to connect to an alternative build of ATC2-ENDS back to ATC2-CORE-PANEL; this will be described in a future article.
- SKT 1 to 5 – provide track power to the INTERMEDIATE and four ENDS sections.

A further three ATC2-ENDS modules may be added to allow the control of up to 16 ENDS and 15 locomotives.

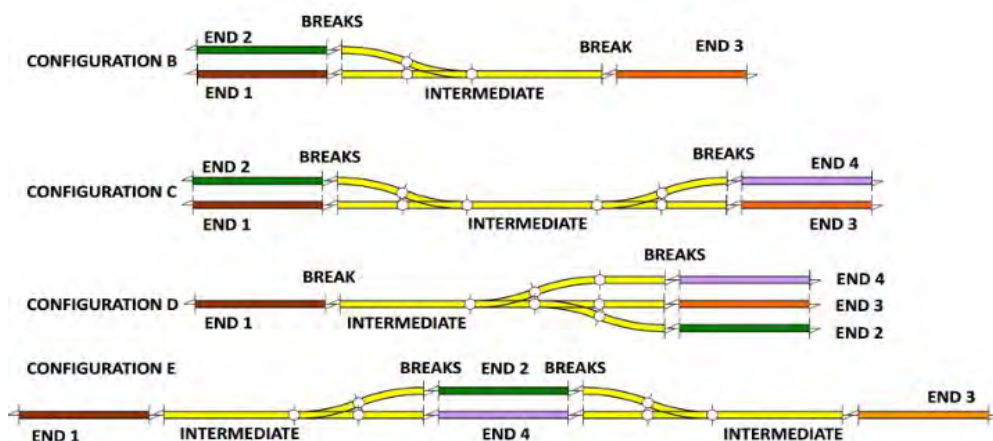


Figure 3 - Configurations B to E.



Figure 4 - Cascading ATC2-ENDS Modules.

To make use of these additional modules, individual train movements must be defined using an Excel spreadsheet. The way that this is achieved will be described in a future article.

Track Connections

With a standalone ATC2-CORE module there were two pairs of track connections, INTERMEDIATE and ENDS, with both track ENDS linked together in parallel. When both modules are used, all connections are made to the ATC2-ENDS module, again in pairs. Each pair of connections to the track are labelled A and B. It is important that all the A connections are made to one side of the track and all the B connections to the other. Failure to make the connections in this way will result in a short circuit as a locomotive travels between two sections.

Traction power is provided from the ATC2-CORE module to the ATC2-ENDS module through the ribbon cable. The Polyfuse limits the track power to 0.5 amps, which is sufficient for Z to OO Gauges. O Gauge trains will run using the standard components. Longer trains, taking more than 0.5 amps, will require Polyfuses with a larger current capacity to be fitted. Two cores are used for each connection in the ribbon cable, enabling the modules to support the higher current requirements for larger gauges (up to two amps).

How it works

The precise configuration to be selected is set by the red DIP switch before power on. This is described in more detail in the next section.

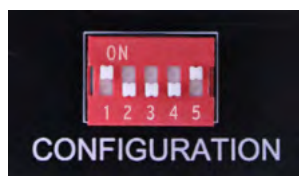


Figure 5 - Configuration (ON-OFF-OFF-OFF-ON)

When power is first applied to the module from ATC2-CORE, all relays and the on-board LEDs are energised, then through PL2 or PL3, are set to their initial position.

The ATC2-CORE module sends a stream of instructions over the Cascade cable. The ATC2-ENDS module moves the first eight bits (byte) of information into the shift register chip. A further byte of transmitted data will result in the first byte being forwarded to the next module through the Cascade cable if further ATC2-ENDS are attached. The eight bits of data, retained in the shift register (IC1) are used to control the eight relays; three are set for each train movement. The control signals are also made available as 5V logic signals or 12V open-collector signals for point and accessory control.

The shift register (CD4093BE) provides the 5V logic (not digital) signals at PL3 and using an open collector driver chip (ULN2803) also provides the same signals through open collector outputs at PL2.

The red/white bi-colour LEDs provide information about the track movement currently enabled. A white LED indicates the originating END, and a pink (red and white on together) LED indicates the destination (think of the locomotive stopping at the destination).

The signals at PL2 and PL3 are used to change the points so that the correct END is selected. For the built-in configurations, the pin number used to energise the points is shown in the detailed version of Table 1, available in ATC CENTRAL [Ref 3].

Using the Module

Taking Configuration B as an example and using a servo motor to change the points, the modules are connected as shown in Figure 6.

Using the Table 1 version from ATC-CENTRAL choose the setting you require, based on the configuration and number of locomotives that you intend to run. If your layout is a mirror image of one of the settings, wiring changes will be needed. The fourth column (Starting Positions) shows the END numbers where the locomotives need to be positioned. The fifth column shows the PL2/PL3 pin numbers used to change the points (not forgetting the common 0V!).

For Configuration B, the two trains must be placed in END1 and END2. Set the configuration switch for Configuration B, two trains as shown in Figure 7.

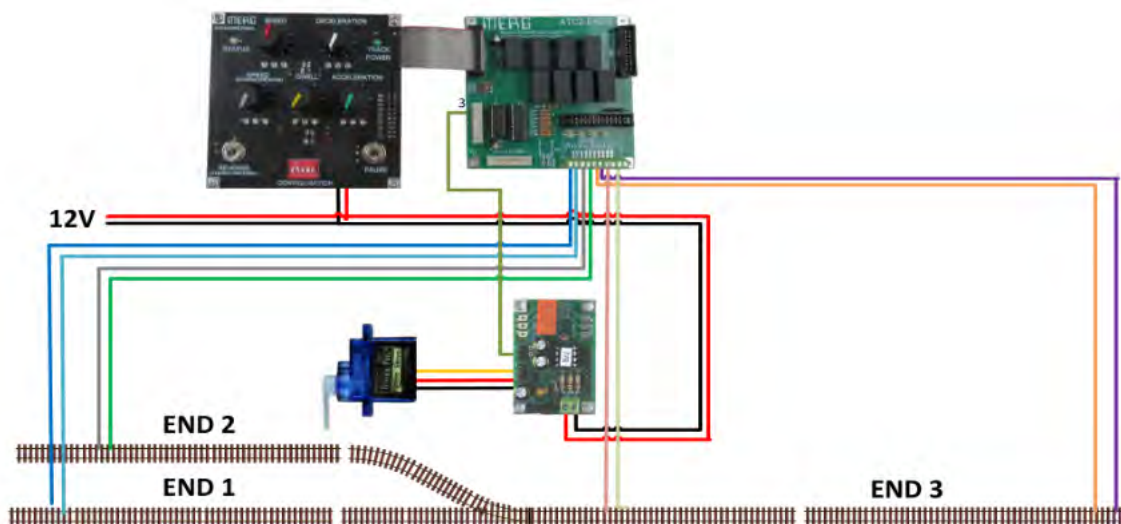
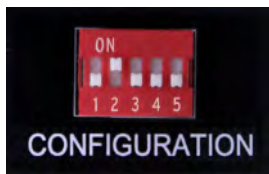


Figure 6 - Configuration B Wiring Diagram

Configuration	Number of Locos	Configuration Switch	Starting Positions (END)	PL2/PL3 point Pin(s)
A	1	ON-OFF-OFF-OFF-ON	1	NA
B	1	ON-ON-OFF-OFF-OFF	1	3
B	2	OFF-ON-OFF-OFF-OFF	1, 2	3
C	1	OFF-ON-ON-OFF-OFF	1	3, 7
C	2	ON-OFF-ON-OFF-OFF	1, 2	3, 7
C	3	OFF-OFF-ON-OFF-OFF	1, 2, 3	3, 7
D	1	OFF-ON-OFF-ON-OFF	2	5, 7
D	2	ON-OFF-OFF-ON-OFF	2, 3	5, 7
D	3	OFF-OFF-OFF-ON-OFF	2, 3, 4	5, 7
E	1	OFF-ON-ON-ON-OFF	1	7, 3
E	2	ON-OFF-ON-ON-OFF	1, 3	7, 3
E	3	OFF-OFF-ON-ON-OFF	1, 3, 4	7, 3

Table 1 - Configuration Settings



The trains will start moving in the sequence shown in Table 2 which will repeat until power is removed from the ATC2-CORE module.

Figure 7 - Configuration B (OFF-ON-OFF-OFF-OFF)

Move	Start	Finish
1	1	3
2	3	1
3	2	3
4	3	2

Table 2 - Configuration B Train Movements

All train movements, for all configurations, are defined in the Information Centre at ATC CENTRAL [Ref 3].

ATC2-Profiles

The third module in the suite is ATC2-PROFILES. However, to deploy this module, track movements must be defined using an Excel spreadsheet, rather than using the built-in train movements defined in the ATC2-CORE module.

The next article in this series will describe:

- the ATC2-PROFILES module, with its dedicated panel.
- the alternative build of the ATC2-ENDS module to produce the ATC2-PROFILES module.
- how simple train movements can be defined and downloaded.
- the way in which a finer degree of control on these automated layouts is applied.

References

1. https://merg.org.uk/merg_wiki/doku.php?id=kits:atc_replacement:start
2. Collins, Michael, et al, MERG's Automatic Train Controller Kits, MERG Journal, 57 No 2, page 5
3. https://www.merg.org.uk/merg_wiki/doku.php?id=projects:atc2:atc_central:atc_central

Michael Collins and Barry Mason's biographies are given in MERG Journal, 57 No 2, page 8
Paul Howes' biography is given in MERG Journal, 54 No 3, page 28
Allan Geekie's biography is given in MERG Journal, 55 No 2, page 21

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ATC Controller Kits – Part 3: 3D Printed Components

Allan Geekie M5173

Abstract

Several 3D printed components have been created to support the ATC2 suite of kits. A modular chassis has been produced to mount the main modules and a bezel that can be added with side supports to position the control panels at an angle.

Introduction

My own interest in 3D printing has been more in support of electronic projects rather than the high quality and detailed modelling produced by members of the 3D SIG.

Some years ago, while building a CANCMDDC, I realised that it would be better to try and design a chassis for the modules rather than attempt to drill many holes in the base of the enclosure. Subsequently I have produced over 100 different chassis designs. I have an IT background and find the programming approach of OpenSCAD to be preferable to the drawing approach used by SketchUp and Fusion 360. The easy reuse of code, describing 3D components means that new designs can be quickly realised by reusing the 'code' from previous designs.

Each ATC2 module has a fixed footprint for the printed circuit board, and this has meant that a modular approach was easy to implement. As the design of the two control panels stabilised in late 2022, a modular approach was also adopted to allow flexibility in the deployment of control panels.

ATC Chassis

Chassis were produced for the original ATC and CSR4 modules back in 2019. Originally M3 brass inserts were used to secure the board to the chassis but later designs just allowed the M3 screws to tap into the plastic material. Originally PLA was used but recent designs use stronger PETG filament. A dual chassis is also provided.

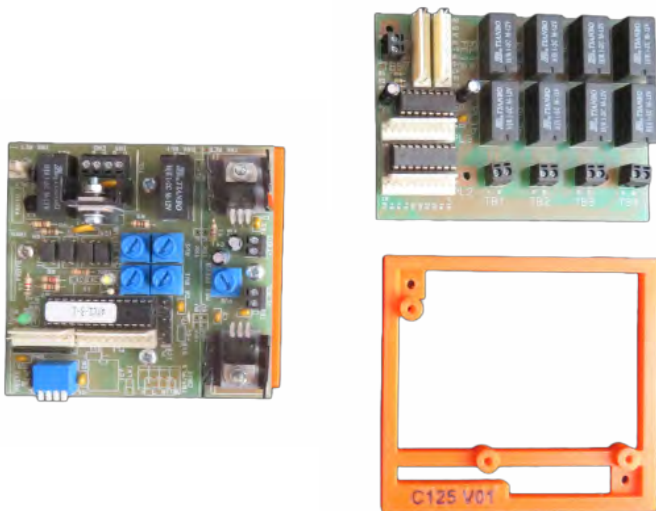


Figure 1 - ATC and CSR4 Chassis

ATC2 Chassis

One of the advantages of the ATC2 range of modules is a consistent set of fixing centres for all three modules. This enabled one chassis to be used for all modules. Figure 2 shows an ATC2-CORE module using the basic chassis.



Figure 2 - ATC2-CORE module and Chassis

The use of a chassis on previous projects had demonstrated the advantage of having an under-chassis that could be used to securely mount more than one module and enable connecting cables to be run under the chassis. This idea then developed into the concept of a basic module that could be linked to extension modules using connecting bars as shown in Figure 3.

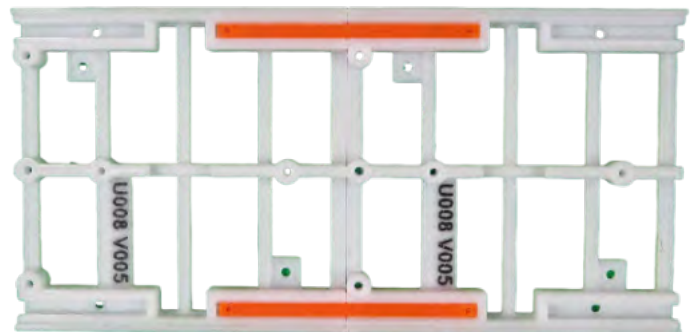


Figure 3 - Two Modules with Connecting Bars

The bars are a push fit as shown in Figure 4 and this is sufficient to build the modules in place in some cases. However, there is provision for M3 countersunk screws to be used to hold the units securely in place.

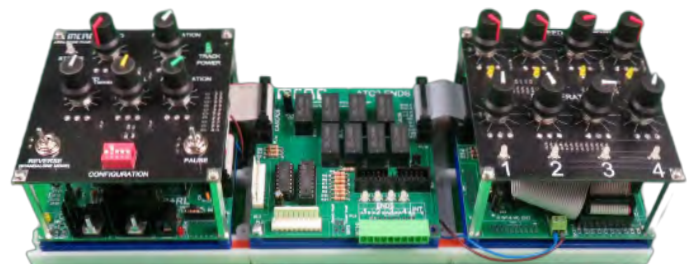


Figure 4 - ATC2-CORE, ATC2-ENDS x 2, ATC2-PROFILES-PANEL

Control Panels

The ATC2 suite of modules also uses control panels that can be secured to the modules using standoffs. A further development of the chassis was the addition of side supports that would provide an angled control panel (Figure 5) and again would support the addition of multiple panels (Figure 6).



Figure 5 - ATC2-CORE with Angled Panel



Figure 6 - ATC2 Twin Panel

Accessories

There is one variant of the ATC2-PROFILES-PANEL that utilises four of the eight potentiometers on the panel. Of course, the other pots could be put in place, but this might be confusing. An alternative is to omit the pots and use a simple hole cap to improve the appearance of the panel (Figure 7).

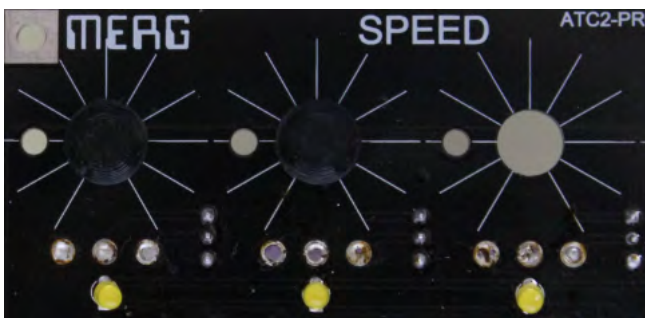


Figure 7 - ATC2 Panel with Hole Caps

Although a chassis can be used to secure the screw end of the standoff, an alternative approach is to use a small boot (Figure 8).

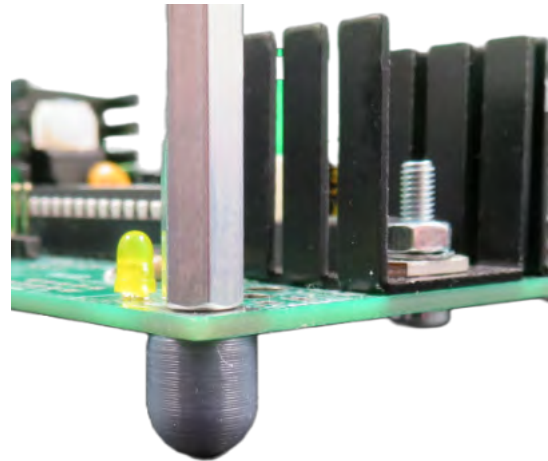


Figure 8 - Standoff Boot

The ATC2-CORE module can be linked to a USB port on a PC using a FDTI board. Figure 9 shows an enclosure that can be built to protect the module and to secure the cables. The toggle switch is used to isolate the RX and TX wires when the module is in use.

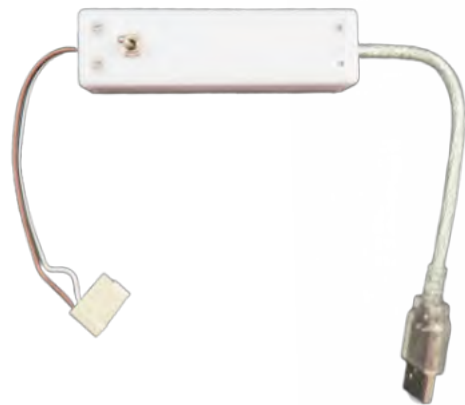


Figure 9 - FTDI enclosure.

Library

All the designs above have been made available as portable .STL files in the ATC STL Library available on ATC CENTRAL.

https://merg.org.uk/merg_wiki/doku.php?id=projects:atc2:atc_central:atc_central

https://merg.org.uk/merg_wiki/doku.php?id=projects:atc2:atc_stl_library:atc_stl_library_start

Prusa filament printers were used to create the examples shown in the photographs above. However, the .STL files should be usable on any 3D filament printer.

Modifications to the PMP27 – Button-Operated Servos

Peter Wilson M5230

Background

Meyrick Road is a OO layout, based on the PECO “Country Station” track plan, which is being developed by Stafford Railway Circle. The initial design of the fiddle yard and its point control was found to have several problems and so it was decided to do a complete re-design and re-wiring of those boards. Since three members of the Meyrick Road team – Terry Neale, Doug Mobley and I – are members of MERG we volunteered to tackle the job. Terry offered to design and build the control panel, whilst Doug and I were tasked with all of the wiring on (and under) the baseboards.

We decided to simplify the control of the fiddle yard by using push-button route selection, via a diode matrix, to MERG Servo4 boards which would drive servos to operate the points.

For those not familiar with the Servo4 board it can control up to 4 servos, with an input line for each. In operation, if the input line is taken LOW the servo moves in one direction; if it goes HIGH the servo moves back. The range of movement and the speed for each servo can be programmed very simply and quickly using the “ServoSet2” plug-in control box.

The Servo4 is designed for use with on/off switches. If connected directly to a push button the servo will move one way when the button is pressed, but move **back** when it is released. Not ideal for our route selection method! This is where the PMP27 “Button Operated Servos” board comes in. This board has 4 pairs of input lines – A1, A2, B1, B2, etc. – which are connected to the push buttons and 4 outputs A, B, etc., which can be connected directly to the Servo4’s inputs.

- Briefly taking input A1 to LOW will cause output A to give a steady “LOW”
- Briefly taking input A2 to LOW will cause output A to give a steady “HIGH”.

This changes short button pushes into steady signals to the SERVO 4. The fiddle yard has 4 boards with over 20 points and uses 9 pairs of PMP27 and Servo4 boards. Figure 1 below, shows how a set of 4 sidings could be controlled.

Modification 1: Eliminate false signals

Once the control panel and wiring were completed we tested the fiddle yard using both Analogue and DCC locos and all seemed well. We invited club members to use the layout and soon got reports of a strange problem. When one particular loco entered the fiddle yard the points would start changing, apparently randomly, anywhere along the fiddle yard. The loco was found to be an old Hornby model with the open frame motor and we suspected that the brushes were sparking and causing spurious signals on the PMP27 input lines.

Luckily, the code for the PMP27 is available on the Knowledge base, so we downloaded and examined it. The code for processing a signal on the A2 input line was as follows:

```
if (buttonA2 == low) then
  while (buttonA2 == low) loop
    delay_1ms(200)
  end loop
  A2_pressed
end if
```

Code fragment 1 – This code was repeated for each of the 8 input lines

Once an apparent “button pressed” signal is received on input A2, the program enters a “while” loop, pauses for 200 ms, before rechecking if the button is still pushed. Once the button is released the A2_pressed function is performed. Unfortunately, if a “spike” causes a very brief signal on the line, the code will loop once then process A2_pressed. It is unable to distinguish between a true button press and a spurious “spike”. To overcome this problem we modified the code to implement a “de-bounce” check on the input, which would require that the button be held down for at least 200 ms to register as a true button press.

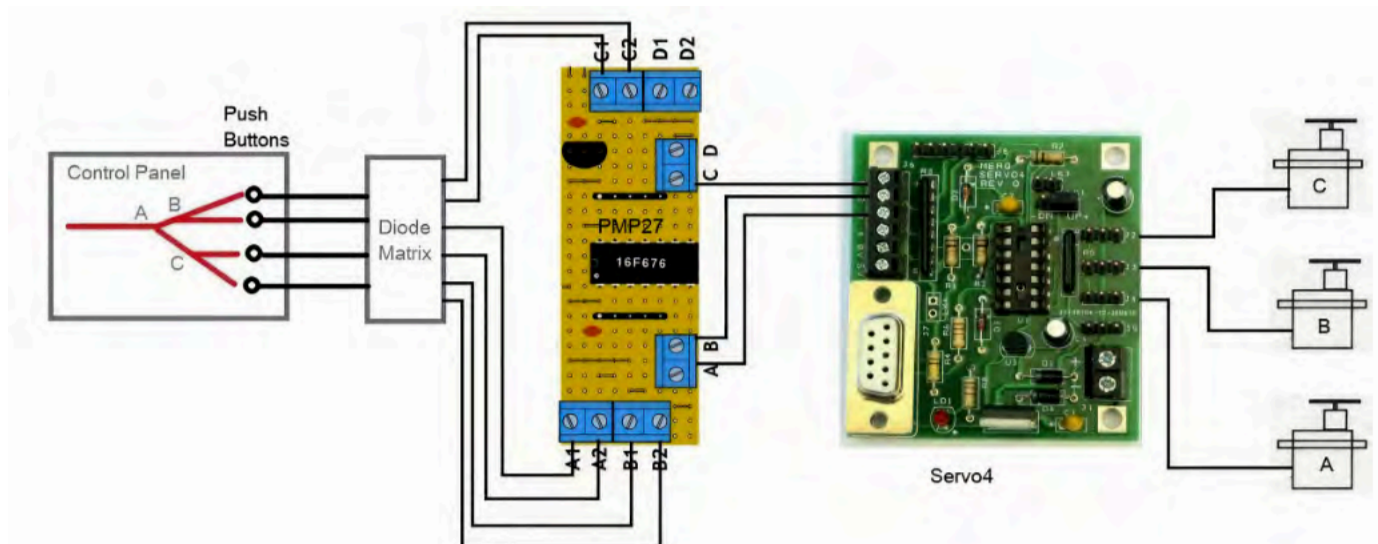


Figure 1 - From Control Panel push buttons to Servos

The revised code is as follows:

```
if (buttonA2 == low) then          -- If button A2 is pressed (or spike) then...
delay_count = 0                    -- initialise loop counter
while (buttonA2 == low) loop      -- keep looping whilst button is pressed
    delay_1ms(20)                  -- Note the shorter delay time
    delay_count = delay_count + 1  -- increment the loop counter
end loop
if (delay_count >=10) then        -- If at least 10 loops (i.e. 200ms) then...
    A2_pressed                      -- this was a real button press, so process it
end if
end if
if (buttonB1 == low) then
    -- etc....
```

Above: Code fragment 2

When the button is first pressed the code starts a counter (delay_count) and the loop pauses for just 20 ms each time around and increments the counter before re-checking. When the button is released the value of the counter is checked.

- If the counter is 10 or more then it is assumed to be a true button press and the appropriate function is called
- If the counter is less than 10 (i.e. button has been held down for less than 200 ms) then it is treated as a “spike” and ignored.

This code is repeated for each of the 8 input lines. The revised code has removed the problem caused by the old locos.

Modification 2:

Allow multiple inputs to be processed at the same time

Another problem identified when first installing the PMP27 boards was that if all of the servos for a route were connected to the same PMP27 board only one servo moved when the button was pressed. Since we had several PMP27/ Servo 4 boards under each baseboard we had simply ensured that no more than one servo for each route was on each PMP27. This meant that some servos had to have extension cables made up to connect them to a more distant Servo4 board, long servo cables are not recommended, but needs must.

However, having embarked on the first modification we took another look at the code to see if we could resolve this restriction as well. Looking at Code fragment 2 we can see

that if a button press is linked to both inputs A2 and B1 the code will detect A2 first and loop there until the button is released. So input B1 will not be processed.

The solution was to remove the 20 ms delay loop from each of the 8 sets of code and instead to have a 20 ms delay at the end of the main program loop. This means having a separate counter variable for each input line. The appropriate fragments from the modified code are shown below.

Code fragment 3 (see next page for code)

All of the loop counters were initialised to zero at the start of the program. Inside the main program loop, the code continuously checks each input line in turn:

- If the signal is LOW then it increments the appropriate loop counter
- If the signal is HIGH then it checks the loop counter value and:
 - If counter is greater than 10 it calls the appropriate “button pressed” function
- The loop counter is reset to zero.

This resolved the problem and has allowed us to connect servos to the closest PMP27/Servo4 boards and remove all servo extension cables.

Summary

We are grateful to the designers of the Servo4 and PMP27 boards and I would like to personally thank Davy Dick for his encouragement when consulted about these modifications to his PMP27 code.

The revised code is being passed to the Kitlocker team for consideration as a possible future upgrade of the PMP27 software and a version will be made available on the Knowledgebase.

Code fragment 3 (Modifications to the PMP27 – Button-Operated Servos)

```
-- startup - Performed once at start of program.
-- Initialise all button "loop counter" variables to 0.
  A2_loop_count = 0
  B1_loop_count = 0
-- etc..
-----
--                M A I N   P R O G R A M
-----

forever loop
  if (buttonA2 == low) then          -- If Button A2 is "pressed" (or spike)
    A2_loop_count = A2_loop_count+1  -- increment A2's loop counter
  else                                -- else (button is released or not pressed)
    if (A2_loop_count >=10) then     -- if button was held for at least 200ms
      A2_pressed                     -- then call the function
    end if
    A2_loop_count = 0                -- must reset loop counter
                                     -- ready for next button press

  end if
  if (buttonB1 == low) then
    B1_loop_count = B1_loop_count+1
                                     -- .....etc.....

  delay_1ms(20)                      -- delay for 20ms before repeating main
                                     -- program loop.

end loop
```

EzyBus Input Module Kit 23 Change

Davy Dick M1853

The EzyBus Input Module uses a MCP23017 chip, a 16-bit I2C GPIO expander. The Input Module used all 16 Input/Output pins as inputs. However, for some reason – Microchip say it is “To improve productivity” – they have changed the specification of the chip in their current release. Instead of allowing all 16 pins to be configured as inputs, only 14 are now available for use as inputs. The other two pins, GPA7 (pin 28) and GPB7 (pin 8), can now only be used as output pins.

Where does this leave the EzyBus Input Module? The Input Module has two banks of input pins. One is marked from 1 to 8 and the other from 9 to 16. Input 8 and 16 connect to the pins that are now output only. Consequently, you can only connect 14 switches, pushbuttons, etc., to the module.

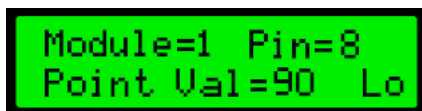


Figure 1 – Controller Module Screen.

It then follows that the Output Modules can now only handle servos 1 to 7 and not 1 to 8 as before. This is a new limitation, although many users often do not use all eight outputs of every module.

How do you know which you have?

- Connect a wire to 0V and touch the other end on Input 8 on the module
- If it is the new version, it will do no harm to the module but the screen on the Controller Module will not register any change
- If it is the older chip version, the Controller screen will display the change
- For example, if the Input Module address is set to 1, Figure 1 shows the output that will be seen on the Controller screen
- When the wire is taken off the input pin, the display at the bottom right will change from Lo to Hi
- If these messages are displayed, you can use all eight inputs and the Controller can configure all eight outputs on the Output module for servos and/or logic outputs.

Auto-adjusting Ambient Light Train-on-track Indicators

Julian Coles M5245

Abstract

Readers of my Articles and Forum posts will know that I am enthusiastic about auto-adjusting Ambient Light Train-on-track Indicators (TOTIs). In this article I gather together my recent designs and explain the features and benefits of each version. They all use a light dependent resistor (LDR) as the sensing element. I first described this type of TOTI in an article in the Journal of March 2021 [Ref 1] and since then I have improved the design and added several variants. These are all described along with some examples of how they can be used.

Optical TOTIs

An optical TOTI tells you if a train is on the track at a particular spot on the layout. This is different to a current-sensing block detector which tells you if a loco - or other current-drawing vehicle - is in the block section which must be electrically isolated by gaps in the track at each end. While some of these gaps exist for other reasons such as when a layout is divided into separately powered districts, for the most part, creating block sections requires purposely cutting rail gaps. The optical TOTI has a clear advantage in that it needs no track cuts. It also detects the presence of stock whether or not it draws current which means that the very first or very last wagon or carriage on a train will be detected regardless of whether it is a loco or where in the train a loco is situated.

MERG has several optical TOTIs in the Kitlocker:

- PMK22 - Laser Train Detector,
- PMP2 - LDR Train Detector,
- Kit 75A - Dual Hector, Infra-red train detector (see General Kits), and
- PMP17 - Automatic Signals.

Of these only the PMP2 and PMP17 use ambient light which is my focus here. Ambient light TOTIs avoid the need to align a light source and light detector but have inherent disadvantages of their own, the main one being dealing with variations in ambient light levels. Overcoming these disadvantages is the subject of the various developments and improvements outlined in this article.

In addition to these Kitlocker offerings, MERG Technical Bulletin T33/25 (a low cost optical detector) describes an ambient light TOTI design using a reference LDR for tracking ambient level along with the track LDR for the actual detection. While this scheme compensates for different ambient light levels, it is a more complex circuit and requires set-up calibration with an adjustment potentiometer. The Technical Bulletin proposes it as a way of detecting that the end of a long train has left a shorter block - which in any case can be done with one of the simpler generic designs described later in this article.

Ambient Light TOTIs

Ambient Light Train-on-track Indicators (TOTIs) have the simplest optics of all TOTIs. As I have said, with only a single optical element, no alignment is needed. They work by detecting the shadow of a train as it passes over an optical detector placed in the trackbed. The MERG PMP2 is such a TOTI [Ref 2] and involves an LDR placed in the trackbed and a panel-LED that lights when a train is over the LDR. It has

just seven components. One of those components is a potentiometer to adjust the trip point of the circuit for the layout ambient light level. This is practical if a layout is in a room that is dominated by artificial light so that ambient light level does not vary with time of day, for example. The automatic threshold adjustment system described below removes the need for any potentiometer so the TOTI becomes 'fit and forget'.

In addition to variations in natural lighting, another of the problems with ambient light TOTIs is that a sudden reduction in room lighting can look just like the arrival of a loco over the LDR, causing the TOTI to trip. For most ambient light TOTIs this is an inescapable fact of life but, again, designs described later in this article can cope.

MERG PMP2 TOTI

As shown in Figure 1, the MERG PMP2 is a nice simple circuit - the sort of circuit I approve of. The LED is switched on when a train is over the LDR placed in the track-bed. This circuit has the same main features as the TOTI circuits described below.

- The light sensitive element is an LDR whose resistance increases with light intensity and decreases as a train shades it.
- The LDR is in a voltage divider circuit with another resistor. In the case of PMP2, the other resistor is a variable resistor to adjust the trip threshold but in the auto-adjusting TOTIs described below the other resistor in the voltage divider is fixed.
- A detection threshold (V_{TH} - the voltage required to trip) is determined by the sum of the 'on' voltages of the LED and transistor V_{be} - in this case $1.4 + 0.6 = 2.0$ V. With a 12v power supply the transistor base voltage must therefore go down to 10 V to switch the transistor and LED 'on'. (The designs described below have the voltage divider reversed with the LDR in the bottom leg so the voltage increases when the train arrives.)
- With no train over the LDR its resistance is low (high illumination) and so the voltage at the junction of the LDR and the resistor (the base of the transistor) is high and above V_{TH} (i.e. > 10 V), so the transistor is switched off and the LED is unlit.

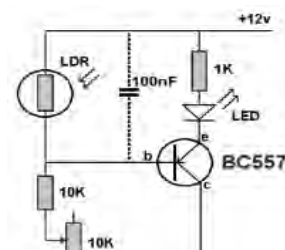


Figure 1 – MERG PMP2 Ambient Light LDR TOTI

Auto-adjusting TOTI

A significant benefit of automatic threshold adjustment for an ambient light TOTI is avoiding a trimming potentiometer. Not only might the potentiometer not always be easily accessible but the need to adjust it for changing layout conditions could be quite frequent.

The design of an auto-adjustment system needs to accommodate two variables which cannot be predicted:

- ambient light intensity which can vary over a wide range
- LDR manufacturing tolerances result in a 5:1 range of "normal" LDR resistance - 20 kΩ to 100 kΩ at 10 Lux illumination level [Ref 3].

Figure 2 shows my simplest auto-adjusting LDR TOTI design which was mentioned earlier [Ref 1]. It provides an output from a 12F683 PIC pin which could be used to directly drive an LED as in the PMP2. In fact, you can probably see the similarities to the PMP2 circuit in Figure 1 in that the LDR is in a voltage divider, in this case with a 100 kΩ fixed resistor. The change in voltage at the voltage divider node is applied to pin GP0 of the PIC instead of the transistor-LED combination of the PMP2 in Figure 1. Pin GP0 is the input to the analogue-to-digital converter (ADC) in the PIC so the light level is translated to a digital value in the PIC. Of course, this can be compared to another digital value which represents the detection threshold. Importantly though, being a digital value, the value of the detection threshold can be easily adjusted by the PIC to suit the ambient light in the layout room. One important difference between the two circuits, however, is that the voltage divider in Figure 2 is the other way up to the PMP2 one in Figure 1. This means that in the auto-adjusting TOTI, a train arriving over the LDR increases its resistance so the node voltage goes up rather than down as for PMP2.

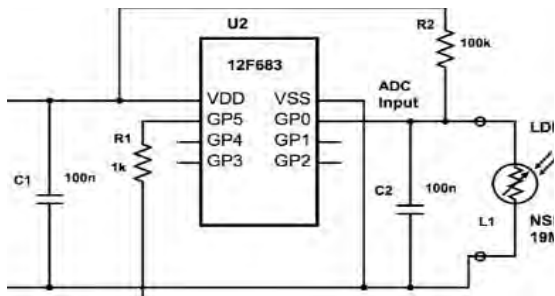


Figure 2 – Simplest Auto-adjusting LDR Ambient Light TOTI

Figures 3a and 3b show the oscilloscope photos when a train arrives under bright and dim ambient light, respectively. The scope is running at 100 ms per (major) division. The analogue-to-digital converter (ADC) range is 0 to 5 V as shown by the red arrow, at 1 V per (major) division.

Looking first at Figure 3a where the ambient light is bright, the top Yellow trace is the ADC input (LDR output) which runs from the ambient level near zero (120 mV) to a level of 1.8 V when the LDR is shaded by the train overhead. A quick calculation, knowing the fixed resistor in the voltage divider, indicates that the LDR resistance is 2.5 kΩ.



Figure 3a – Trip with Bright Light

The Dotted White line at 920 mV is the trip threshold which is automatically set 800 mV above the ambient level.

The Blue trace is the Trip output and occurs as the ADC voltage crosses the threshold voltage at 920 mV.

Now we turn the room lighting right down low as shown in Figure 3b. It uses the same 800 mV differential from ambient for the trip threshold but the lower lighting has increased the ambient voltage to 3 V so the threshold voltage has been automatically adjusted to 3.8 V.



Figure 3b – Trip with Dim Light

A single fixed threshold setting would simply not work across such a wide range of ambient light levels. Of course, it has limits to the range but I found that it works from dimly lit indoor rooms to outdoors under a cloudy sky - but not bright sunlight. This auto-adjusting arrangement works impeccably for both my N-gauge and OO-gauge layouts in different rooms and these TOTIs are integral to automated operation of both layouts.

Regular TOTI - Moving Trains

Alan Turner has designed a through-hole PCB to test this 'Regular TOTI' design as shown in Figure 7 [Ref 1]. The MERG Virtual Areas Group (VAG) has also proposed a Surface-mount Device (SMD) PCB to help members get to grips with SMD construction. This is still a work in progress, but the basic circuit design and software has been thoroughly tested, and some revisions have been made, as I will now describe.

Revisiting the design after a gap of two years gave me a new perspective (as so often happens). The original design used two different trip thresholds: one for tripping and the other for untripping. I thought I was being clever but in fact I had 'overthought' things and there is now a new design which works under a wider range of conditions. The original design effectively had two separate trip levels since the auto-adjust algorithm recognized the LDR shaded by a train as being a new ambient. The revised algorithm, recognizes the light level before a trip as the one and only ambient so it has just one trip threshold. After a trip the same threshold applies. I have also increased the time between increments of the threshold from 25 ms to 38 ms as I found there was a tendency for the threshold to 'track' the voltage changes caused by gaps between wagons for slow-moving trains.

The overall algorithm is shown as a flow diagram in Figure 4. The code loops continuously at a rate of 800 μs per loop. There are two states: 'Untripped' when there is no train shading the LDR, and 'Tripped' when a train is over the LDR. The state is stored in EEPROM so that at switch-on the code can go to 'Untripped' or 'Tripped', depending on the state when the power went off.

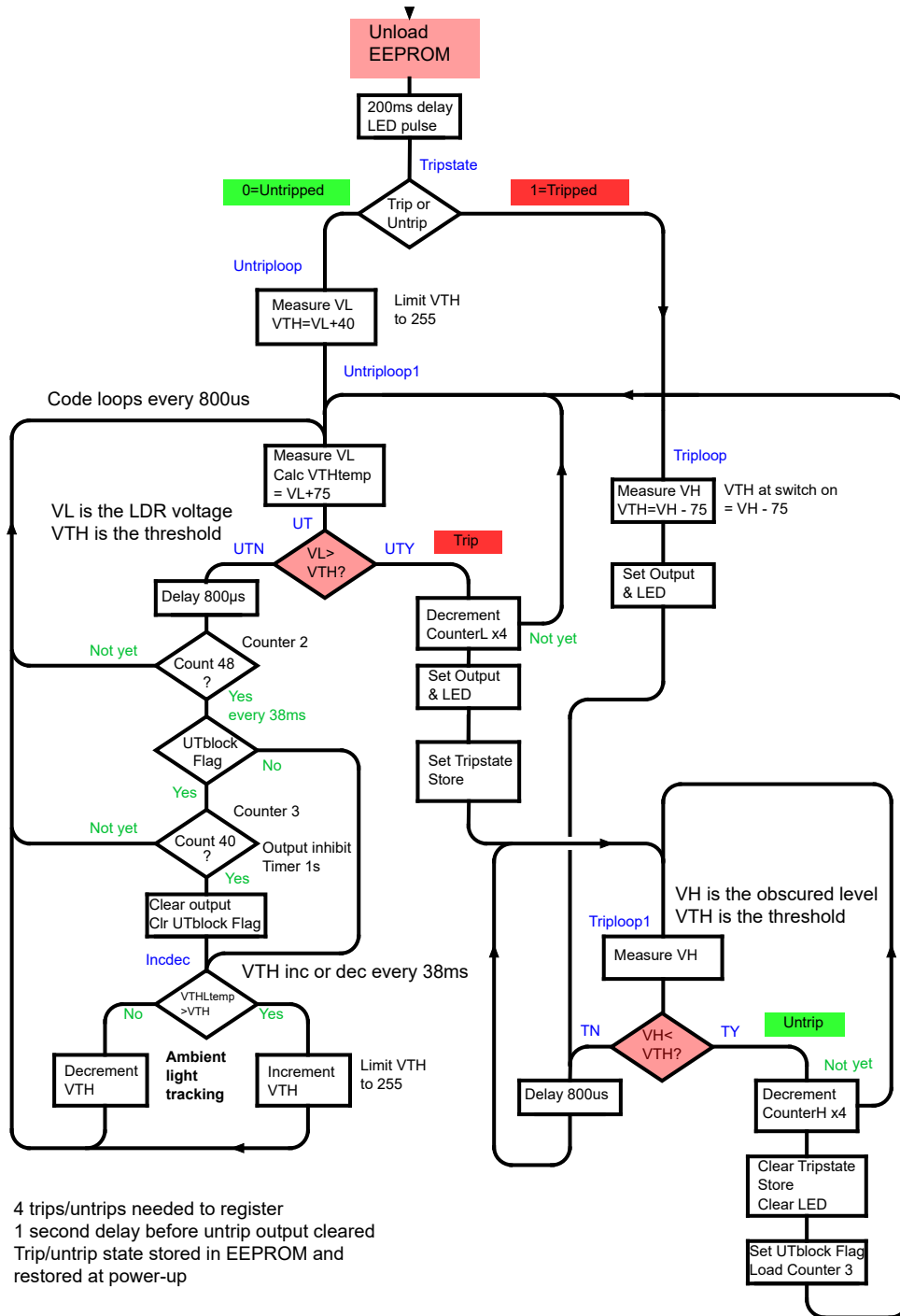


Figure 4 - Auto-adjusting LDR TOTI Code Flow Diagram

If the 'Tripped' state is read from EEPROM when the TOTI is switched on, the threshold (VTH) is temporarily set to the measured ADC/LDR voltage less 75 counts (1.5 V in a range of 0-5 V). When the train moves off the TOTI, the ADC voltage drops below this threshold and the state becomes 'Untripped'. After the return to the 'Untripped' state the output is inhibited from changing for one second to guard against spurious re-trips from wagon gaps. As will be described later, gaps between wagons can also be handled by using two LDRs instead of one.

Figure 5 shows the re-trip inhibiting in action. Note that the 'Untrip' output is delayed past the last wagon in a train by the inhibit time - here 1 second is used.

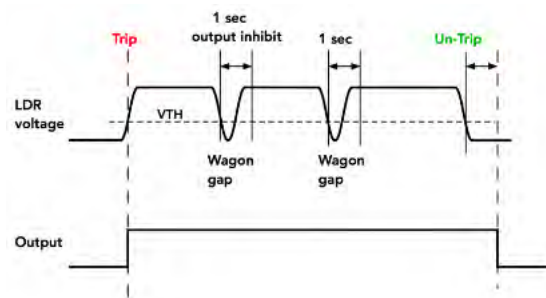


Figure 5 - Re-trip Inhibit in Action

If, on the other hand, the state read from EEPROM at start-up is 'Untripped', the trip threshold (VTH) is immediately set to the ADC measured voltage (VL) plus 40 counts (800 mV in a range of 0-5 V). Every 48 code loops - 38 ms - the voltage threshold is either incremented or decremented by one count, depending on which way the ambient light has moved. If it hasn't moved then the threshold simply toggles between two threshold values so is essentially fixed.

One problem with this design is that you cannot take a train off a covered TOTI while the power is off. The TOTI is in the 'Tripped' state at switch-off so the EEPROM state will put it in 'Tripped' state at switch-on. If the train no longer covers the TOTI, then it is in normal ambient light, but is expecting a higher light level to 'Untrip'. This cannot happen. Later, a 'Trip-only' TOTI is described which only has an 'Untripped' state at power up, regardless of the trip state at power down. So the circuit and algorithm are useful bases for describing it.

The circuit shown in Figure 6 is basically that of Figure 2 with a few additions:

- a power-on LED,
- an opto-coupled output,
- the LDR connected by a plug and socket instead of being on the PCB.

Also, an In-Circuit Serial Programming (ICSP) connector has been included in the VAG's SMD PCB design.

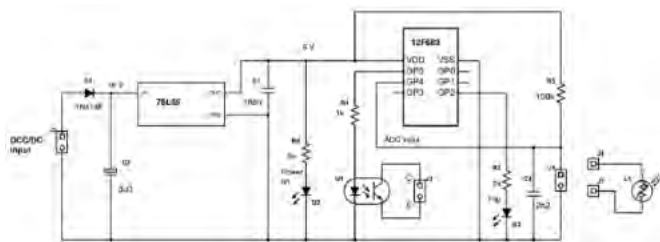


Figure 6 - Auto-adjusting LDR TOTI Circuit Diagram

TOTI Variants

There are a few variations on this Regular TOTI each of which overcomes a challenge or meets a special condition. They are described below:

- stationary trains,
- ambient light change protection,
- Trip-only TOTI,
- Untrip-only TOTI.

Stationary Trains

The Regular TOTI is designed for moving trains. It inhibits a re-trip for 1 second to stop 'Untrips' due to flashes of ambient light reaching the LDR through gaps between passing wagons. But this does not work for trains which could stop with a wagon gap over the LDR - this would cause an 'Untrip'. The solution to this is to use two LDRs wired in series and placed about a half-wagon's length apart (about 40 mm for 00-gauge, 25 mm for N-gauge). One of the LDRs is always covered which is enough to maintain the 'Trip' state.

With the two LDRs wired in series the circuit works the same, just as if there were only one LDR, and the PIC code is unchanged. The 'Untripped' total LDR resistance will be nominally twice the value when using a single LDR, but of course the automatic adjustment system accommodates

this by setting a slightly higher threshold value. To understand why the threshold change is only 'slight', consider if just one LDR is covered by the train, then its resistance increases considerably and the other LDR - still illuminated - will not contribute much to the over-all resistance of the pair in series. When the second LDR is also covered, then the resistance is even higher and the trip is even clearer.

Figure 7 shows two LDRs spaced at 25 mm in N-gauge track. The two N-gauge wagons show that when one of the LDRs is in the gap between the wagons, the other is still covered. The PCB is for the circuit in Figure 6.

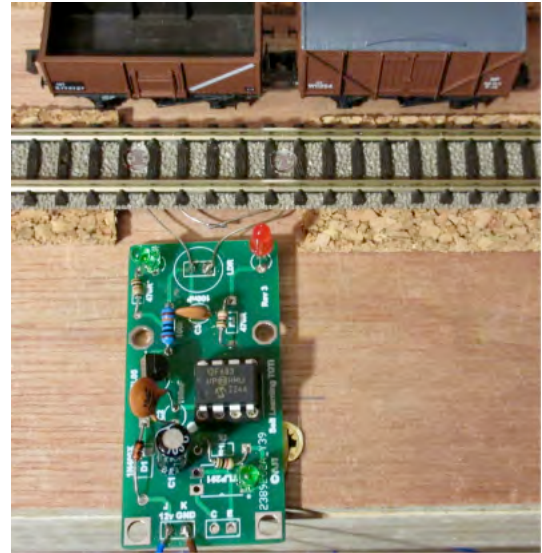


Figure 7 - PCB TOTI with Two LDRs in N-gauge Track

Ambient Light Change Protection

As mentioned above, a sudden reduction in the ambient room light can cause a TOTI to trip. A cunning solution is to use two LDRs placed half a wagon's length apart in the track-bed - as above - but connect them to separate PIC input pins and also modify the PIC program.

The two LDRs each have their own separate trip thresholds which are automatically adjusted as before. I simply connected the second LDR into GP0 (Figure 6). The PIC's ADC is switched between the two inputs (GP0 and GP4) when a measurement is made of the LDR voltages.

Figure 8 explains how we can distinguish a room light reduction from a real loco trip. A train travelling at scale speed of 80 mph arrives at the first LDR and trips it. 42 ms later it reaches the second LDR and trips it. Compare that with a room light reduction where both LDRs trip at nearly the same instant. The PIC can easily separate these two situations by checking the time delay between the two trips. When a very short time delay is detected, a room-induced trip is indicated and can be ignored. Obviously the 1 second 'Untrip' inhibit is no longer needed. The algorithm is thus:

- 1 LDR 1 trips
- 2 Wait 25 ms
- 3 Check if LDR 2 has tripped
- 4a LDR 2 has tripped - hence a room-induced trip - ignore
- 4b LDR 2 has not tripped - a genuine train trip

The reason for the wait at step 2 is because the LDRs will have slightly different characteristics and will not trip at exactly the same instant.

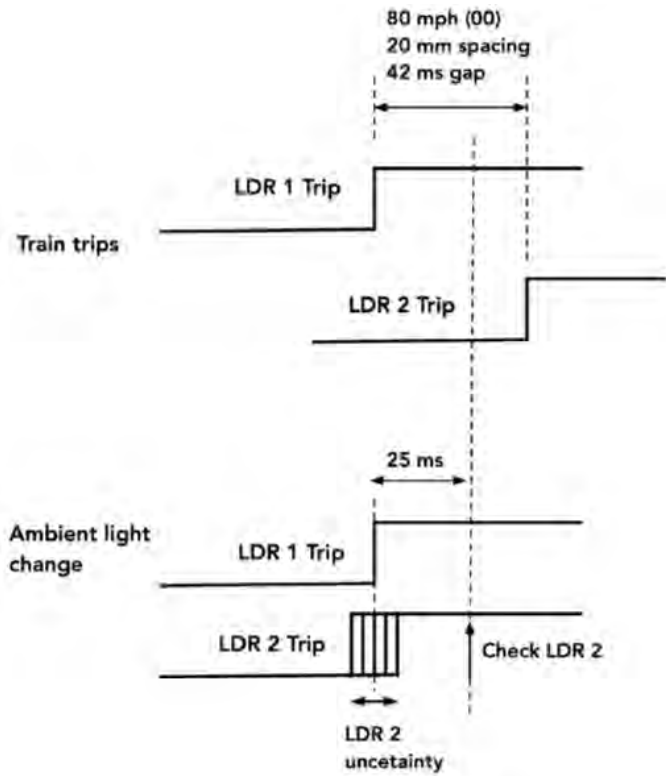


Figure 8 – Two-LDR Ambient Light-Change Protection

This is a 'proof of principle' experiment and only works in one direction of train travel. However, a bi-directional version could be made relatively easily.

Trip-only TOTI

Some applications may require only an indication of an arriving train while others only a departing train. The Regular TOTI needs only software changes to become a Trip-only function or Untrip-only TOTI for these types of applications. Of course, the Regular TOTI would cover both of these applications, but I prefer to optimise a module for the actual intended use because, for example, the Trip-only TOTI is more robust as it doesn't matter if a train is moved off the LDR when the power is off.

I use the circuit of Figure 2 for a Trip-only TOTI. The circuit of Figure 6 can also be used, with the 78L05 voltage regulator removed when connected to other modules that have 5 V power supplies, such as a speedometer as described later.

The action of the Trip-only TOTI is that it outputs a pulse whenever a train arrives over the LDR. Unlike the regular TOTI which outputs a continuous 'Untripped' or 'Tripped' signal, there is no permanent indication that the train is over the LDR. Such a TOTI is useful, for example, to change a signal or point, step through an automation program such as EzyAutomation [Ref 4], or provide the two trips for a speedometer (see below), when we do not need to indicate the presence of a train but just its arrival. In fact, there is no need to indicate the tripped state or indeed to have a tripped state at all. This means that the code can be simplified. It also means that it can provide an extremely robust and reliable indication.

The TOTI is always in the 'Untripped' state, waiting for a train to arrive when it triggers. To prevent multiple triggers due to gaps between wagons of a passing train, a time delay of 10 seconds is used to inhibit successive triggers. Obviously different delays could be used but this is the maximum time a train on my layout takes to pass. With a train over the LDR, either the LDR is uncovered 10 seconds later or it is not. In either case the trip threshold VTH is always reset to the measured voltage plus a count of 40. If the LDR is uncovered after 10 seconds, then the threshold becomes the normal ambient light level and the whole TOTI and detection arrangement has reverted to its normal 'Untripped' state. If the LDR is still covered after 10 seconds, then the threshold will be above the LDR covered value ($V_L + 40$) and no more trips will occur as the shadow over the LDR would need to get much darker, which it won't. When the train moves so the LDR is illuminated again, the threshold VTH is slowly adjusted to the ambient light level, back to normal 'Untripped' state and ready for the arrival of the next train. This takes a few seconds.

Figure 9 is a simplified flow diagram which shows the extreme simplicity of the idea. The code loops round the Quiescent Loop every 800 μ s, updating the Trip Threshold VTH every 25 ms and checking to see if it has been exceeded due to the arrival of a train over the LDR. A pulse is then generated. In my case for 1 ms but obviously this can be of any desired duration. Then the code waits for 10 seconds before it starts looking for another train.

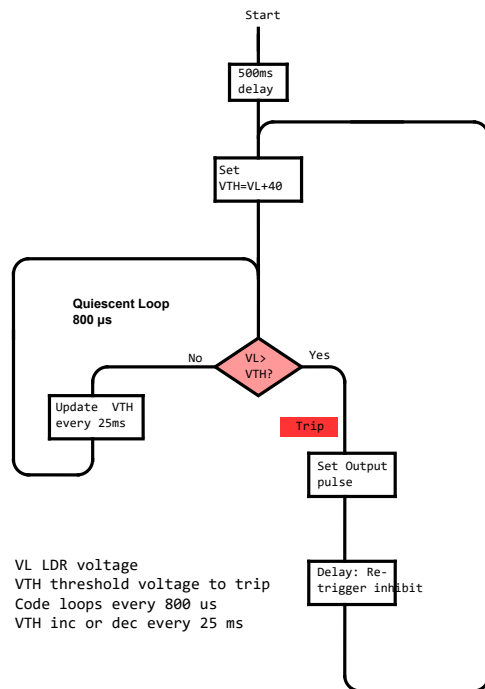


Figure 9 – Trip-only TOTI Code Flow Diagram

Untrip-only TOTI

Figure 10 shows how an Untrip-only TOTI outputs a pulse when a train has cleared the LDR. It can be placed at the end of a track block to confirm that a train has left the block. The LDR is shaded during the passage of the train and when it becomes fully lit after the train has cleared the block the TOTI issues an 'Untrip' indication pulse.

As mentioned previously MERG Technical Bulletin T33/25 (dated 2010) describes a self adjusting ambient light TOTI that has this same functionality but it is not microprocessor-based so is considerably more complex than the circuits described here. As before, a delay is included which prevents wagon gaps prematurely causing an output pulse. The circuits from Figure 2 or Figure 6 would be suitable for this version, the difference from the Regular TOTI being only software coding.

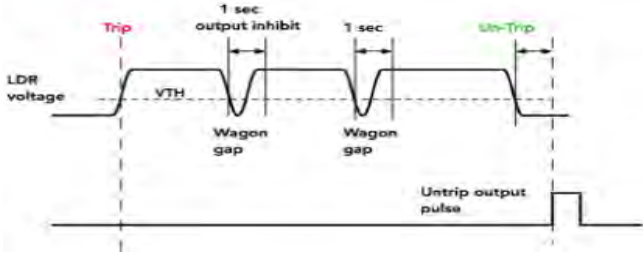


Figure 10 – Untrip-only System

TOTIs In Use

A few examples of how TOTIs can be used will be helpful in understanding the features of the different variants of auto-adjusting LDR designs.

1. Timing Gates for a Speedometer

I described a speedometer design in the June 2021 Journal [Ref 5] which works by measuring the elapsed time as a loco or train passes two gates 100 mm apart. A Trip-only TOTI can be used for each of the two gates.

2. Automatic Signal

Both Trip-only and Untrip-only TOTIs can be used for automatic signalling as described in my March 2023 Journal article [Ref 6] and depicted in Figure 11. The Trip-only TOTI is most simply integrated with the Signal Controller module while the Untrip-only TOTI located at the end of the signalled block needs to communicate remotely to the Signal Controller. I use my Ezycom system [Ref 7] which transmits the information via the DCC bus similarly to Railcom. However, a wired connection or the proposed MERG Bluetooth (BLE) system [Ref 8] could also be used.

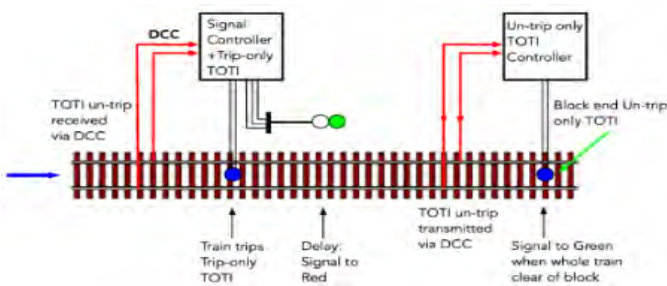


Figure 11 – Automatic Signal with Trip-only and Untrip-only TOTIs

3. Block Status without Track Cuts

TOTIs can be used to provide indication of block occupancy without using track cuts to define the block. In fact using TOTIs to define the block rather than insulating gaps and current detection more closely models prototype behaviour because it indicates 'absolute occupancy'. That is, it indicates whether a block is partially occupied, fully occupied or completely unoccupied.

An 'Untrip-only' and a 'Trip-only' TOTI could be used for an isolated block section. But in a general situation you would use a 'Regular' TOTI at each block entrance to provide a 'Trip' indication for the following block, and an 'Untrip' indication for the preceding block.

Figure 12 shows using two TOTIs, one Untrip-only and one Trip-only on a unidirectional track. The TOTI at the start of the block is tripped as soon as any wagon or loco goes over the LDR. This indicates the block is occupied and this indication remains until the last wagon has cleared the TOTI at the exit to indicate that the block is clear.

TOTIs with two LDRs are needed for bidirectional tracks.

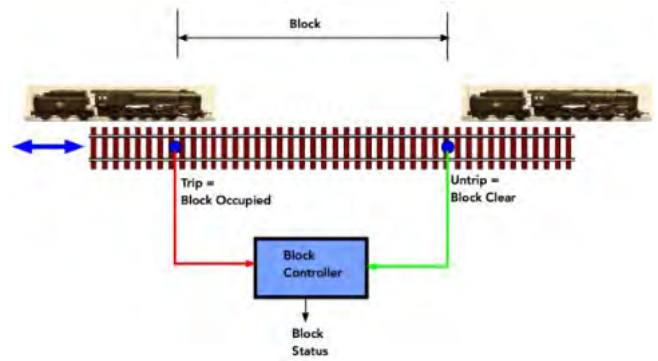


Figure 12 – Uni-directional Block Status without Track Cuts

The sequence of trips in a double LDR enables the direction of train travel to be established and that can be reflected in the logic of the block controller.

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Van Rides

Geoff Latham M4964

Abstract

This article describes using and adapting MERG Pocket Money Projects to create a fully automated model railway based on operations at Highley station on a Gala weekend.

Introduction

The salient features of the kits will be described for context but the kit instructions, Journal articles and relevant Forum topics tabulated at Figure 1 should be referred to for full information and build details. There are further references to the MERG forum in the following text which are covered by those given here. The methods reflect my limited knowledge of electronics and the purpose of the article is to demonstrate how cheap beginner kits can be used and modified to create an interesting automated model.

Kit	Instructions	Forum	Journal
PMP 10 – speed controller (810)	https://www.merg.org.uk/merg_kitlocker/downloadit.php?fileid=350	https://merg.org.uk/forum/viewforum.php?f=167	Volume 47.2 June 2013
PMP 4 – a simple shuttle (804)	https://www.merg.org.uk/merg_kitlocker/downloadit.php?fileid=599	https://www.merg.org.uk/forum/viewforum.php?f=161	Volume 47.1 February 2013
PMP 4a – shuttle add-on (804a)	https://www.merg.org.uk/merg_kitlocker/downloadit.php?fileid=474	https://www.merg.org.uk/forum/viewforum.php?f=161	Volume 53.3 September 2019
PMP 18 – EzyPoints v3 (818)	https://www.merg.org.uk/merg_kitlocker/downloadit.php?fileid=372	https://www.merg.org.uk/forum/viewforum.php?f=174	Volume 48.4 December 2014
PMP 15 – train auto stop (815)	https://www.merg.org.uk/merg_kitlocker/downloadit.php?fileid=487	https://www.merg.org.uk/forum/viewforum.php?f=284	Volume 54.2 June 2020

Figure 1 – list of kits used with references

Background

For the serial builder of compact layouts it was inspirational: a short train, God's Wonderful architecture and a usually nondescript tree resplendent in white Spring blossom. Furthermore, there was a frequent service of unusual stock.

The location was the Severn Valley Railway (SVR), the occasion was the Spring Gala in May 2018 and the setting was a sunny day at Highley station. There for the weekend with my Severn Valley volunteer brother-in-law, we rode the trains together on the Sunday and took advantage of the added attraction of the advertised short van ride from the cattle dock on the adjacent sidings in a Shark brake van propelled by a Ruston and Hornsby 0-4-0 diesel shunter, (Figures 2 and 3)



Figure 2 – loco and van at Highley



Figure 3 – van ride at Highley

The memory was rekindled when the 2mm Fine Scale Association announced its Diamond Jubilee Challenge: to build a working layout with at least one turnout to the Association's fine scale track and wheel standards within a scenic area 60cm long by 9.42 inches wide – a combination of standards to justify 60 for the number of years of existence and 9.42, for the number of mm of the standard track gauge. A layout based on the van ride experience could meet the minimum requirement and could also make use of a wooden (ex saw) box 800mm x 210mm x 135mm for storage and display with width to spare but would require short trains.

Highley is an interesting station. It has a single platform face to a single line with a passing loop and sidings that were important when they served a nearby colliery, the access to which is now the rail link to the Engine House visitor centre and cafe. A right of way to an adjoining property precludes a platform on the loop. The 1905 station layout is shown at Figure 4 [Ref 1] and the proposed track plan for the model at Figure 5, the extra width being used to include the main line and passing loop and the configuration slightly modified for better operation.

Operation

Having established a feasible scenario attention turned to operation. At the Autumn Gala in the previous September we had travelled on another short train – a pannier tank and autotrailer operating a local service on part of the line,

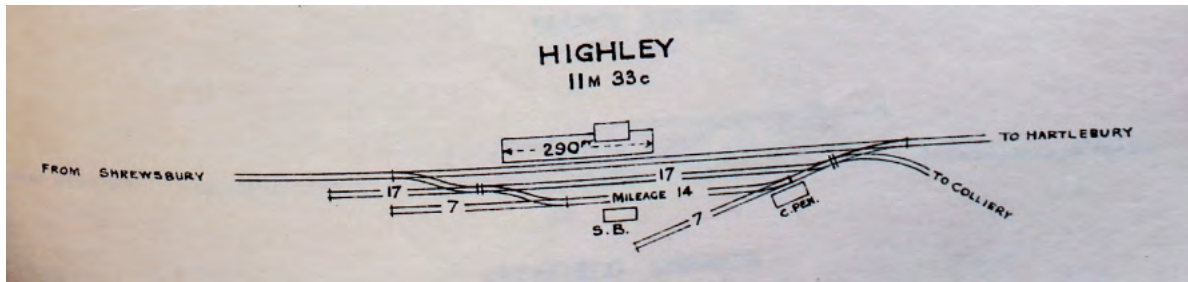


Figure 4 - Highley station layout 1905

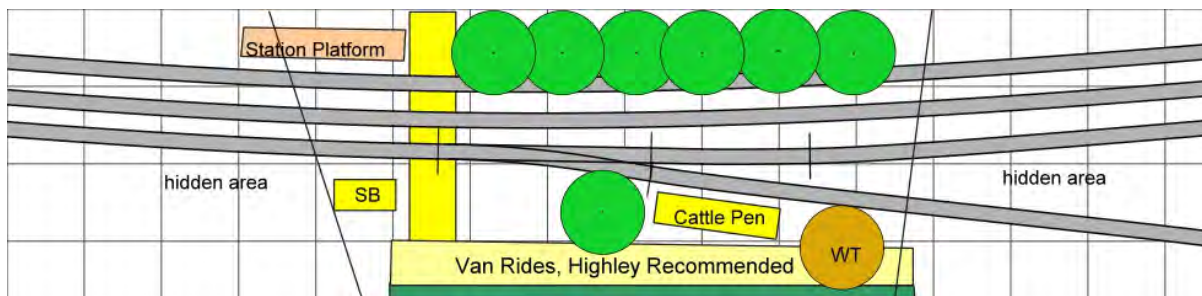


Figure 5 - track plan for model based on Highley, SVR

shown in the sidings at Highley (Figure 6) but probably forming a service terminating in the platform road. A plausible short train for the passing loop could be a loco and chartered inspection saloon (Figure 7) conveying a small party. Thus, frequent van rides with a less frequent local service and a passing train whilst the local is held in the platform.

Pocket Money Projects (some now containing PCBs and reclassified as Pocket Money Kits) for a simple and economic solution.

The single turnout in the sidings creates a fork layout and the operational requirements were for the van train to shuttle both prongs alternately with a single stop at the intermediate cattle dock in each sequence and for the other two trains in turn to shuttle along their respective parallel tracks.



Figure 6 - 0-4-2 and autococh at Highley



Figure 7 - loco and inspection saloon SVR

The accurate control and timing of three trains in a repetitive manner in such a small space on the model would be extremely difficult and thoughts had naturally turned to automation and to consideration of the MERG

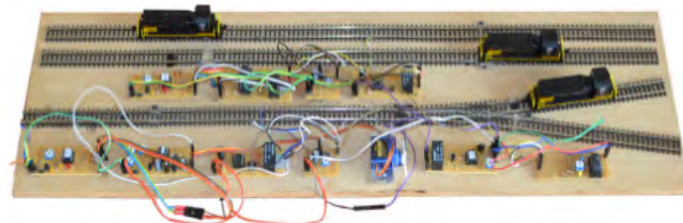


Figure 8 - Peco N gauge test track

The kit instructions on the Kitlocker pages were studied, the relevant sections of the Forum consulted for possible tweaks, further information and help, and the small N gauge test track at Figure 8 was gradually developed on a piece of ply to evaluate the feasibility.

The kits

The component count excludes the stripboard and wire links and some of the board layouts were altered to place the 12V and 0V inputs on adjacent corresponding tracks for neater linking of the boards.

Kit configuration for the fork

The speed controller is a simple kit of 6 components, the main one being an LM317 device that can provide a constant output voltage relative to its input set by a potentiometer. As suggested in the instructions the linear potentiometer in the kit has been replaced by a preset resistor that can be adjusted to suit the particular locomotive being used.

The simple shuttle has 9 components, the main one being a 555 timer chip used in astable mode, i.e. constantly switching between high and low, the output causing a double pole, double throw (DPDT) relay to switch on and off at regular intervals to reverse the track voltage. It is used in conjunction with two diodes bridging gaps cut at each end of one rail in a length of track to provide dead sections to hold the train until the track polarity changes and the train reverses. The board has been modified to incorporate a transistor switch to the output as recommended by Christopher Stanforth on the forum to reduce possible interference from the relay if the same power supply is used for the board and the track (Figure 9).

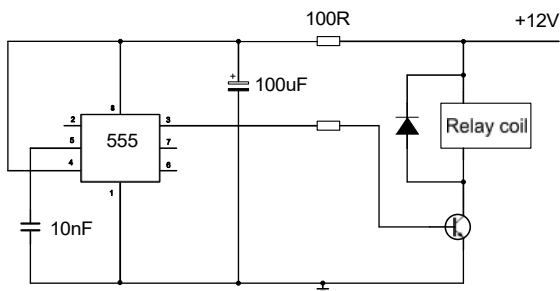


Figure 9 – transistor switch modification

Figure 10 shows in red how the modifications could be made as a retrofit but moving the components on the right-hand side of the board further to the right will give more room for the additional components.

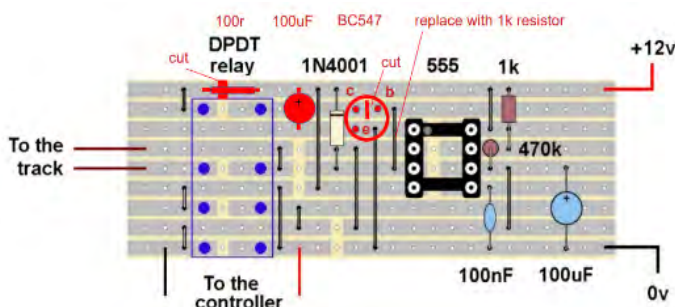


Figure 10 – modification of simple shuttle board for transistor switch

The shuttle add-on has 17 components, the main ones being a ready programmed 12F675 PIC (programmable integrated circuit) to control the circuit and two TCRT5000 infrared sensors. By inserting a turnout and siding into the shuttle track and adding another diode to bridge a gap cut in the new extension the kit is designed to shuttle two trains alternately. The sensors are located at suitable points in each diverging track and each time the program senses both are covered, the output is switched between 0V and 5V and can be connected to a controller to change the turnout.

The intended use is therefore different to that required on the model. However, by locating a single sensor at the handle end of the fork and wiring it to both sensor inputs the PIC triggers the output each time the sensor is covered changing the turnout for the return journey.

The EzyPoints board has 16 components, the main ones being another ready programmed 12F675 PIC and three preset resistors. The PIC translates the settings of the three

presets into signals sent to a servo attached to the turnout to rotate it to the required endpoint at the desired speed.

The train auto-stop has 14 components, the main ones being yet another ready programmed 12F675 PIC and another DPDT relay, but no detectors. The PIC uses signals from one or two detectors to operate the relay to feed or cut the supply to an isolated section of rail in the track. It can be used in one of two modes by inserting a wire link, either to stop a train anywhere, for example at a station on a circle of track, or, in shuttle mode, at two different places as at either end of a station on a single back and forth line.

Neither option was suitable for the proposed model where the train was wanted to stop at an intermediate point on alternate journeys. Following various suggestions on the Forum, it was found that this could be achieved by having a single detector positioned in one prong immediately before its dead section, so it was activated on alternate journeys. The isolated intermediate section is dead at the same time as the train is stopped at the end of that journey, and when the train exits that prong the isolated section is dead when the train arrives.

Before that, however, some work was required for the detector. It had been planned to use the spare TCRT5000 from PMP 4a. The suggested alternatives for PMP 4a are Neodymium magnets and reed switches, laser TOTI (PMP 22) or Hector. The suggested detectors for PMP 15 are laser detector, Hector or reed switch, but no TCRT5000. A subtle but not explicit difference. The TCRT5000 has insufficient output to trigger the PMP 15.

There may be a number of ways of achieving a suitable output but, because the components were to hand, a small IR sensor module (Figure 11) was made using one channel of an LM 324N quad op-amp as a comparator to provide a 5V or 0V output and a 10k preset pot set to a threshold to produce 0V when the sensor is just triggered by the train.

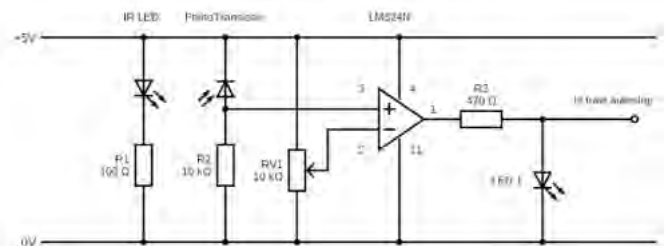


Figure 11 – infrared sensor module

A schematic of the boards and connections is shown at Figure 12.

Kit configuration for the parallel tracks

Operation on the parallel tracks uses the speed controller, simple shuttle and shuttle add-on as above. Initially it was thought that switching between the two tracks should be no more difficult than switching a turnout, and possibly is not using a suitable DPDT relay, however, some available solid state relays (opto-isolators) could be used and a track switcher module was made.

Figure 12 - schematic of boards for the fork track

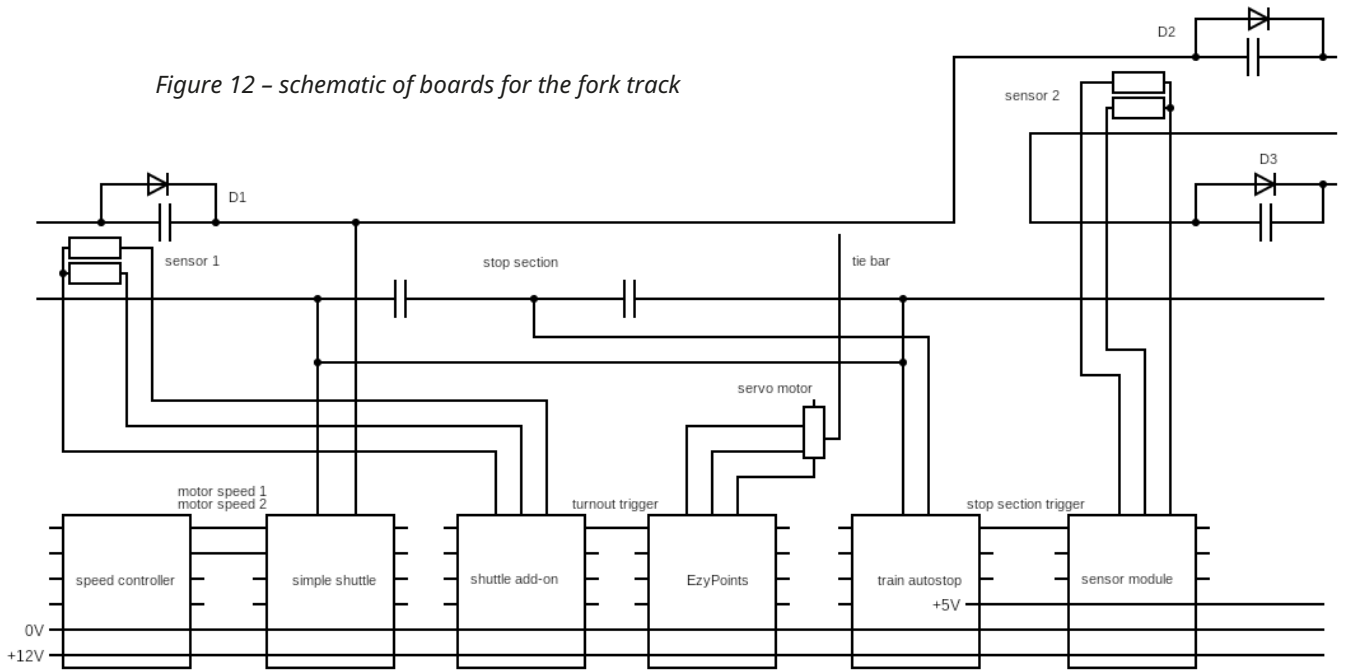
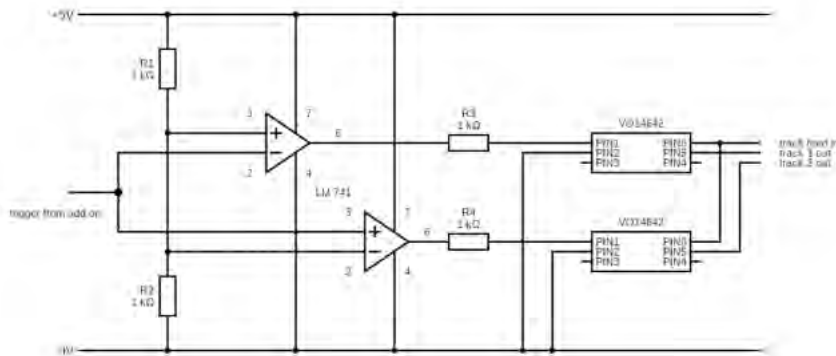


Figure 13 (left) - track switcher module



The shuttle add-on is used with two sensors positioned at the station end of each track. The board has two op-amps wired as positive and negative voltage comparators with the outputs connected to two opto-isolators controlling the current in one rail of each track (Figure 12). One track feed from the simple shuttle unit feeds one rail in each track, the other is the input to the opto-isolators, the outputs of which are connected to the other two rails. Two equal resistors form a voltage divider to provide a 2.5V

reference for the op-amps so that when the shuttle add-on outputs 5V the positive comparator has a positive output and its opto-isolator enables the current to its attached rail, and when it outputs 0V the negative comparator has a positive output and its opto-isolator enables the current to its attached rail. Thus one or other of the op-amps will be conducting and the train on the appropriate track will run. When the add-on output changes the other train will run thus alternating the running. A schematic of the parallel track boards and connections is shown below in Figure 14.

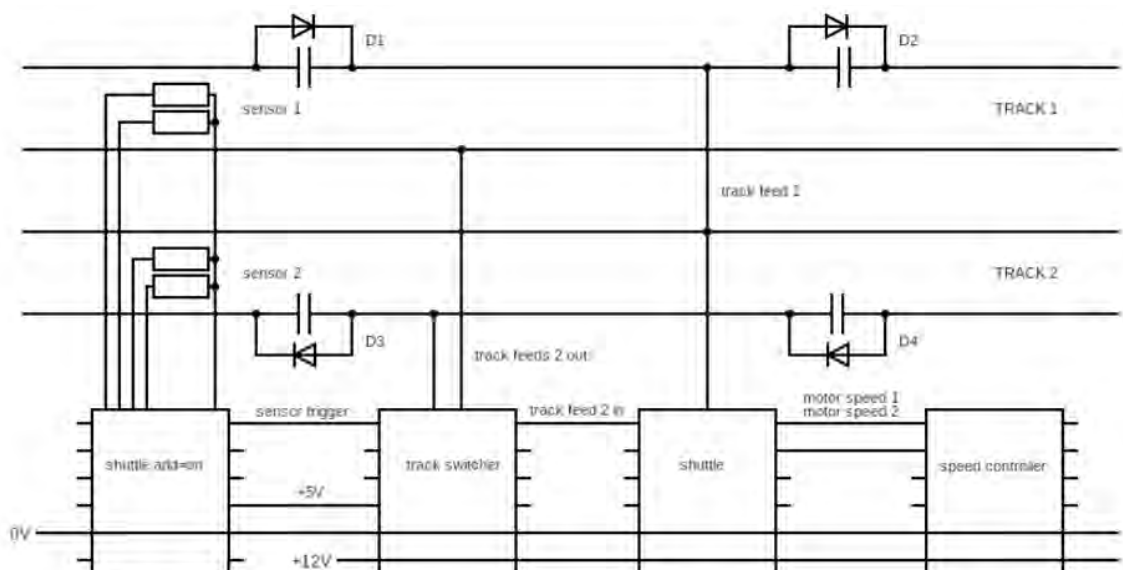


Figure 14 - A schematic of the parallel track boards and connections

Conclusion

The automation works on the test track, which differs slightly from the proposed model in the position of the intermediate dead section, and for this application due to the short distances involved. For a larger model further attention might be needed to adjust the delay times in accordance with the various kit instructions.

Some problems were encountered with very bright sunlight and possibly connectivity issues with the breadboard nature of the set up falsely triggering the infrared sensors.

It will pay to study the kit instructions, diagrams and photographs and read the appropriate Forum posts because there are unfortunate discrepancies or ambiguities that can mean a problem may not necessarily be what is thought.

A MERG 12V PSU provides the power but an alternative would be, as originally used, a 16Vac accessory supply and two PMP 6 – 12V supply kits.

The development of the Van Rides automation was prior to the experience of using Arduinos for controlling Glacier (Vol 56 No 3 June 2022) and starting over they would be considered for having fewer components and a smaller footprint, as well as being more flexible to use in the absence of any experience programming PICs. Nevertheless, the PMPs can offer almost off the shelf economic automation.

Being a sucker for challenges, the attempts are usually completed, but not always by the deadline, this being no exception despite a long extension due to Covid. However,.....

Pendward Gap

Another challenge was that for the 2023 Wealden Group show at Steyning to create a Book Nook (bookshelf insert diorama) for any railway related subject not to exceed the dimensions of a 9 inch cube.



Figure 15 – Pendward Gap

From the experience gained on Van Rides it was realised that animation was possible, that a loco and van in N measures 4½ inches and that with a line on the diagonal of about 12 inches a train could

move from A to B with a run between, and if there were two tracks? A turnout is not possible but a sector plate is, and the train is very light.

Using the same kits as for Van Rides, the setup is two tracks converging on a two-position sector plate, rail cuts at the far ends and on the sector plate and a single sensor on the sector plate under the outward end of the stationary train. For operation an SG90 servo is mounted on an axial line from the sector plate pivot to a mount below the front of the sector plate. The mount is a short length of brass tube

with a vertical slot filed in the bottom and the operating wire from the servo engages in the slot thus giving it some flexibility. The sector plate of 2mm card, the same as the surrounding surface, is concealed beneath an overbridge. The theme is similar to Van Rides but uses N gauge models that were to hand (Figure 15).

The components for a speed controller, simple shuttle, shuttle add-on and EzyPoints were assembled on a single piece of perforated board, as was originally envisaged for Van Rides, that is attached to the underside of the framing for the 2mm card. There is a saving in wiring but little saving of space. Keeping to separate modules is advised as a better idea for more flexible location and easier troubleshooting. The modelled scene is lit off the common power supply by three 12V LEDs left with longish leads to allow (careful) manual adjustment.

The layout was left running for the afternoon of the show, the speed adjusted to the loco in use, the train running back and forth, the sensor operating without interference and the sector plate moving from side to side with the train on it.

At a recent 'show and tell' using a LiPo 11.1V battery it was running on the pub table – a satisfactory end to an interesting exercise (Figures 16 and 17).



Figure 16 – Pendward Gap laid bare



Figure 17 – the inspiration

References

1. *Severn Valley Railway wiki*. Track plan image subject to license conditions at: https://www.svrwiki.com/File:Highley_plan_1905.png

Geoff Latham's biography is given in MERG Journal, June 2022, Vol 56, No 2 page 36.

KISnet: An Arduino-optimized Communication Scheme

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Abstract

This article describes a system for peer-to-peer communication between Arduino processors, using the built-in serial ports and minimal additional components. The paramount design goals were simplicity, minimal resource usage, and an easy interaction with a user's own software. The system allows real-time viewing of network traffic via the Arduino monitor function.

Introduction

Model railway enthusiasts who want to work on their own control systems frequently find one of the Arduino processors to be an economical and easily-applied device, advantages which are far too well known to be worth describing here. But one characteristic is particularly important, for a situation involving a club even more than a solo designer at home. The simplicity of the Arduino means that it offers the best chance of avoiding the "electronic guru" syndrome, where a system is installed by one person, who remains the only one who understands it. Quite rightly, clubs are often hesitant to get into this situation. While working on this design, I attempted to keep in mind the "KISS principle" - "Keep It Simple", with the thought that it should be reassuring to potential users if the system contains as few mysteries as possible. Continuing with the ethos of the Arduino system generally, I wanted to design something for the user who isn't an expert programmer. Hence "KISnet", and of course - every data bit must find its destiny.

The Arduino environment was created to allow a user, of any skill level, to get projects working easily. If an individual is working with a single Arduino, something quite satisfying can be achieved without much difficulty. In the model railway field, a user might want to set up a mimic panel to operate an area of a layout, perhaps a goods yard or a mainline junction with numerous turnouts and indicator lights on the panel. A single Arduino can do this fairly readily. However, the situation becomes much more difficult if there are multiple panels controlling the same area, or if the panel is remote from the layout. To avoid a large bundle of wires connecting the various parts, it might be desirable to have one processor operating the turnouts and one, or others, operating the panel(s). Such a scenario creates a need for connecting processors together. This is a major increase in complication and beyond the ability of many users. The KISnet project is intended to give the user a set of library routines to pass data between multiple Arduinos, routines which are easy to interact with and do not make high demands on the user's programming skills. Another objective was to allow easy inspection of the data passing over the network within the Arduino programming environment. This eliminates the situation where it is unclear whether a "sending" unit is failing to put the right data on the line, or the "receiving" unit is failing to deal with it properly.

Differential transmission, as with CAN Bus or RS485, is the most robust connection method for reliable data transfer when any significant distance is involved. Systems based on the CAN Bus do fill this need, but

connecting Arduinos to CAN is not a trivial procedure; hence it has been a slow process to get the Arduino linked to MERG's CBUS. Martin da Costa wrote about his work to achieve this in the December 2022 edition of this Journal [Ref 1], although I understand that he has now transferred his efforts to the Raspberry Pi Pico platform.

Both CAN Bus and RS485 are party-line systems, where all units receive and transmit data over the same wires. With such a system it is necessary to ensure that only one unit transmits at a time. CAN deals with this by an elaborate process of assigning priority, normally performed by an interface chip or by a special section of a microcontroller. These methods relieve the processor and the user's software of a lot of the computation. If RS485 is used instead, the determination of which unit will transmit has to be done by software, with an inherent loss of efficiency. A further draw on the processor's time is that CAN messages may cause interrupts, but individual characters do not, whereas with a system using a serial port characters must be handled one by one. Nevertheless, I felt that an RS485 system could still be useful for a lot of projects in the model railway field. With an Arduino's processing rate of 16 million instructions per second, it seemed as if there could be a reasonable trade of computational efficiency to achieve a simple design. This should work because generally model railway projects are simple and not limited by processor time.

One possible problem concerning the use of serial communication with Arduinos is that there is only one serial port, which must be used for both inter-processor function and communication via the USB port. At first sight this presents a problem, but with some consideration I concluded that it actually offers an opportunity. It turns out to be a major advantage of KISnet that any traffic that passes over the network can be transmitted to a computer in real time. If the data can be sent in a form that is simultaneously usable by the processors and intelligible to a human it becomes possible to check the activities in the processors on a constant basis. The same USB port can still be used to reprogram the Arduino when necessary.

It is a feature of the Arduino's serial port that each of the incoming (RX) and outgoing (TX) lines has an LED attached to it. These turn out to be quite useful in the KISnet design because they provide a quick visual verification that data is actually being received and transmitted by each unit. If both lights are flickering rapidly, it indicates that the unit is connected and operating.

With an RS485 system, the most common way to achieve the all-important function of ensuring that only a single unit will transmit is to use a "master-slave" (MS) mode. The best-known protocol for doing this is Modbus, originally a commercial design but now in the public domain. It is clumsy and restrictive but any kind of MS system requires a "master" which initiates every operation. Transfer of data from one node to another ("peer to peer") is basically impossible, so the "master" processor needs to be programmed with the details of

where data needs to come from, and where it needs to go. Unfortunately, in the model railway environment, peer-to-peer data transfer is what is commonly needed as with a mimic panel. Also the MS scheme is slow, because every interaction between nodes needs to be individually commanded.

I created the following list of desirable features for KISnet:

- Run on a basic Arduino processor (Uno or Nano)
- Use a minimum of processor resources, to allow maximum space for user code. This would include both ROM and RAM, and peripherals like interrupts and timers
- Use a minimum of external components
- Be flexible in how much data is sent from any unit at a time
- Provide a user with a framework for communication in the form of a library, as commonly used with the Arduino, but expect the user to write code for each processor
- Allow for a computer interface, but not require it.

Design Description

Early on in the design process, I decided that the classic MS format was unsuitable for the project. I wanted another way to control use of the bus, and the scheme I came up with is one that I've always called a "cascade read". The principle is that each unit on a network has a unique assigned address, as virtually all systems require, but each one is also primed with the address of one of the other units, which I call a "C_address". If data packets are designed so that when a unit transmits, its address is included in that packet, then that address can be recognized by a second unit as its C_address. Then, when transmission by the first unit finishes, the second unit makes its own transmission. This is then recognized by a third unit, which transmits next, and the process continues until all the units have transmitted. There is still a master unit, but its functions are limited to setting up the network initially, determining the order of the cascade, and starting each cascade, but it does not handle data on behalf of the other units. Instead, each one is programmed to listen to transmissions on the bus, and process whatever information it needs. Likewise, each unit contains software to send out the data which other units need.

KISnet is intended for users who can program their own systems or persuade someone else to do it for them. It does not function as a set of fully-programmed devices which have fixed tasks, requiring the user only to set up tables listing the data to be processed. The RS485 communication system uses only a single data channel, so each unit in a KISnet system has access to data generated by any of the others. What gets sent, and how it is handled after it is received, are up to the user. KISnet is intended to provide a protocol for the sending and receiving data in a form which is easy for users to build into their own software and which will help get projects working without the need to give much thought to the communication subsystem. I believe this philosophy matches the kind of working environment that the Arduino provides.

KISnet requires each node in the network to have a unique address loaded into the top byte of EEPROM. This can be done by an EEPROM.update command in the

setup() section of an Arduino sketch - see demonstration sketch [Ref 2].

One, and only one, unit on a KISnet network must have the address 0: this will be the master unit during operation. Other addresses can have any value between 1 and 254, so long as they are all unique. When the system starts up the master unit will send a series of "ping" messages to all possible addresses. These messages trigger a response from any unit whose address matches, allowing the master to create a list of valid addresses. At the same time, each unit is monitoring responses from any other unit which responds, and it stores the number of the highest responding unit which is lower than its own address. That would mean that if the addresses in use in a network were 15, 20 and 25, unit 25 would store address 20, unit 20 would store 15, and unit 15 would store 0. These values become the C_addresses. A cascade is initiated when the master sends out a data packet with its own address, 0. The cascade proceeds with each unit responding in numerical order. Note that the master unit can send, receive and process data on the same basis as all other units; it is not dedicated to the "master" functions alone. Figure 1 shows a screen capture from the Arduino monitor, with successive cascades involving units 0, 10 and 11 operating. Note that the pushbutton on unit 10 was pressed between the first and second cascades (see circled items).

```

COM6

:00 < 03 30 05 CF 87
:0A > 02 00 0C 0C
:0B > 02 01 0F E7

:00 < 03 30 05 D0 5B
:0A > 02 01 0D 96
:0B > 02 01 0F E7

:00 < 03 30 05 D1 05
:0A > 02 01 0D 96
:0B > 02 01 0F E7

```

cascades (see circled items). While this is a very simple network having only three nodes, the master with address 0, and two other nodes with addresses 10 and 11, it serves to illustrate the principle. (See below for a fuller description of how data packets are constructed)

Figure 1 – Successive Cascades on KISnet

It is an important feature of KISnet that bytes within data packets are not transmitted as binary data. Instead I made the decision to write out each byte as a two-character hexadecimal number and separate them with spaces. In fact, the entire packet is in printable ASCII form and each packet additionally begins with a carriage return. Every unit receives all the data sent over the network; one additional task for the master unit is to re-transmit each arriving data byte via its USB port. If the user connects a terminal program, or the monitor that comes with the Arduino programming environment, traffic on the network will be displayed as scrolling lines of text, with each line representing a packet from one unit on the bus, beginning with an extra return character to insert a blank line, as seen in Figure 1. This arrangement allows the user to monitor network activity in real time and to verify that every unit is delivering the expected data.

A KISnet packet begins with a colon ":". Any time one appears all recipients must treat it as the start of a new packet and any data received in an incomplete packet up to that point are discarded. The next byte is the address of the unit transmitting, then an opcode, which is a

single alphabetic character corresponding to the type of packet being sent, then the number of data bytes in the packet (up to 32, where a “null packet” with zero bytes is also possible), then the actual data, and then a CRC, or cyclic redundancy code, for verification [Ref 3]. As demonstrated in Figure 1, the first packet comes from address 0 (the master) and uses an opcode of '<'. There is no requirement to use letters of the alphabet for opcodes so I decided that cascade operations would use '<' and '>' as opcodes to represent “out” and “back”. In this case there are two other units in sequence, and their addresses are 10 and 11, showing up as 0A and 0B in hexadecimal, and then the '>' opcode. Then each unit other than the master sends 02 to say the packet holds 2 bytes of data, and the master sends 03 because it delivers 3 bytes. A baud rate of 250000 is used, which means that each of these packets takes about 1.5 ms to transmit. 250 kB/s may seem like a fast transmission speed, but it still allows 40 µs between characters, which corresponds to 640 instructions at the Arduino's 16 MHz processing rate. With a twisted-pair communication line, this speed of transmission should be reliable over a range of several hundred metres [Ref 4].

Considering the type of operations typical for model railways, such as monitoring control panels, setting turnouts and signals, and checking train-on-track sensors, it seemed reasonable to run cascade operations at a rate of 10 times per second. This means that packets which respond to user inputs will occur with very brief delays, usually not noticeable, but still allowing time within each cycle for a reasonable number of units to send their data before the next cascade becomes due. If a typical packet has 4 data bytes then the maximum number of units in a network will be about 50. This is an approximate match to the electrical limit of how many nodes can function on an RS485 network [Ref 5]. This creates compromises in that cascades need to be repeated rapidly in order to avoid delays, but there must also be time for all units to contribute. A fast baud rate makes this easier, but going too fast means that processors may be swamped by incoming data. I have checked KISnet operation with an oscilloscope and never seen it fail because of timing problems. The key to this is that although characters come in at a rapid rate, each one can be processed quickly.

KISnet does not work by sending commands to selected units, or by having units “bid” to control the bus asynchronously, in the way that CAN bus does. The cascade read process means that each unit gets a turn to transmit frequently enough for model railway purposes and during its turn that unit can send whatever data it needs to. All of these transmissions are visible to all other units on the bus and it is up to the programmer to decide what gets sent and what gets listened to.

Library Interfacing

The KISnet software resides in a library, which must be linked into the user's program with the command `#include <kisnet.h>`, and then invoked with the command `kisnet.begin()`. KISnet handles the serial port, and there is no use of the familiar calls to `Serial.begin()` and `Serial.write()` etc. The `kisnet.begin()` call takes three arguments. The first argument is a number telling the software how many data bytes to send in each cascade

packet. The other two arguments give the names of functions which must appear in the user's sketch and they tell KISnet what to do at two points during operation. Although these functions must exist, or be replaced with “NULL” as will be explained, they should not be called by the user's code. Instead, they will be called automatically by KISnet itself.

In the Arduino sketch shown the two functions which handle KISnet packets are `new_packet()` and `load_outgoing()` although the user has the option of choosing names for them. `new_packet()` or its equivalent will be called any time that a valid packet, sent by any unit, is received. A test is made on the parameter `kisnet.address` when an incoming packet arrives to determine whether its data are useful. The other parameters that might be checked in this way are `kisnet.opcode` and `kisnet.nbytes`. `kisnet.address` identifies the sender of the packet, `kisnet.opcode` identifies the action being performed or expected and `kisnet.nbytes` tells the number of bytes that can be read from the array `kisnet.in_data[]`. Readers who are familiar with C coding may recognise the use of a structure at this point. Any of these parameters could be useful for a processor to determine whether incoming data is relevant to its needs, although in the example, only the address is being tested.

The sketch is intended to illustrate the principles of a KISnet program. Its purpose is to operate the circuits shown in Figures 2 and 3. There is a pushbutton attached to each Arduino and when one of these is pressed it causes the on-board LED on another particular unit to change state. The unit addresses 0, 10 and 11 are as shown in Figure 1. When the button attached to unit 0 is pressed the on-board LED on unit 10 will change state; if the button on unit 10 is pressed, the LED on unit 11 changes state and if the button on unit 11 is pressed the LED on unit 0 changes state. This demonstrates that data can be sent and received by any unit on the network and operation can be verified by the monitor of a computer connected to the master unit. The second byte in each packet shows the number of times the button has been pressed and in the master unit's transmissions a third byte increments once per cycle. Note that for the purpose of this article I wrote a sketch which is identical for the three Arduinos in the system. Since the software is the same, there needs to be some other method for allowing a unit to know its own address and my KISNet library lets the user to do this via a call to `get_address()`. Reading EEPROM location 1023 would have given the same result and is in fact what `get_address()` does. If I had written an individual sketch for each Arduino, the test for the unit's own address would not have been needed.

The second function, `load_outgoing()`, is also called automatically but the call happens immediately before the unit makes its transmission as part of a cascade operation. Its purpose is to gather together any information that needs to go out in that unit's cascade packet. This data should be placed in the array `kisnet.out_data[]`, which has a maximum size of 32, although the number of bytes actually sent is determined by the first parameter used in `kisnet_begin()`. If the user wishes to change the number of bytes sent, this can be done by changing `kisnet.out_nbytes`. However, in most cases, the size of an outgoing packet won't need to change.

Note that both `new_packet()` and `load_outgoing()` are void as far as input parameters and a returned value are concerned. This has to be true, because the user's sketch has no control over when they are called; however, the two functions can read and write variables which are globally declared. Also, neither of these functions absolutely has to exist. If a user's sketch has no need to send anything, or no need for input from any other unit, either or both can be replaced by NULL in the `kisnet_begin()` call. For instance, a user might prefer to put all data into the `kisnet.out_data[]` array elsewhere in the sketch and dispense with the `load_outgoing()` function. This would work, but the user should be aware that it could involve data being sent out in an unsynchronized manner because the user's sketch has no control of the moment when a unit makes its cascade transmission. This could occur when some data has been loaded, but not all. This may or may not be acceptable. For the `new_packet()` function there cannot be an equivalent because data in the `kisnet.in_data[]` array is only valid for the most recently received packet. This also means that incoming data must be read from `kisnet.in_data[]` promptly, before the next packet arrives. There should be no difficulty in reading the data from the `kisnet.in_data[]` array within the `new_packet()` function.

An item to note in connection with the cascade read operation is that once a unit has matched its `C_address` with the address of a previous packet, it is temporarily the "bus master". A unit's turn ends only when it sends a packet with an opcode of '>' (response to packet) and, before doing that, it has the ability to send packets for whatever purpose the user has devised, using any opcode. This adds extra time to the cascade, but it may be useful under some conditions. For example, a "Start of Day" problem has been identified in connection with data-transfer networks, where at the time the network starts up, each unit attempts to report its initial conditions: this has caused overloading under some circumstances. With KISnet, a unit could send special packets to report this data with, as an example, an opcode of 'S' for Startup and any unit needing this information from any other unit(s) could be programmed to look out for it. If there are many of the startup packets and there is a concern that the network is running out of time between cascades, units could monitor the startup packets and let cascades go by without contributing, then make their own transmissions later. At 10 cascades per second this is unlikely to lead to long delays. Perhaps special opcodes are unnecessary; it is always possible to use markers within a normal cascade packet to identify particular types of data.

Resources Used

It was a goal of the KISnet design to produce a working system with minimal use of the Arduino's resources, leaving the maximum for the user. When the example sketch is compiled for an ATmega328P the computer reports:

Sketch uses 5304 bytes (17%) of program storage space. Maximum is 30720 bytes.

Global variables use 150 bytes (7%) of dynamic memory, leaving 1898 bytes for local variables. Maximum is 2048 bytes.

Clearly, there is plenty of memory, both ROM and RAM,

available for user programs. KISnet also functions well on ATmega168 processors, but memory usage is proportionately higher.

Each unit stores its network address in location 1023 of the EEPROM on an ATmega328, or in location 511 on an ATmega168. User code can write to all other locations.

As should be expected, KISnet takes over the Arduino's UART and it is not available to the user. Pins D0-D3 are used for the RX and TX functions and also to control the RS485 transceiver (D2 and D3 can be changed in the `kisnet.h` library file). One other processor function used by KISnet is only required by the master unit and it is the timer comparator A for Timer 0, accessed by register OCR0A. Timer 0 has the default function on Arduinos of generating the 1 ms clock, and this function must be left to operate normally on the master unit. There are no restrictions on the other timers, or on Timer 0 on units other than the master.

There will be interrupts from RX and TX at approximately 40 microsecond intervals during the time that data is being transferred, which occurs in bursts at a 10-per-second rate. I have measured these interrupts at about 10 microseconds each, increasing to 25 μ s at the end of each received packet. Additionally, the master unit has a timer interrupt every 0.5 μ s. KISnet does rely on interrupt-driven reception and transmission of data bytes, so if user code absolutely must suspend interrupts, such pauses should be brief.

Electrical Design

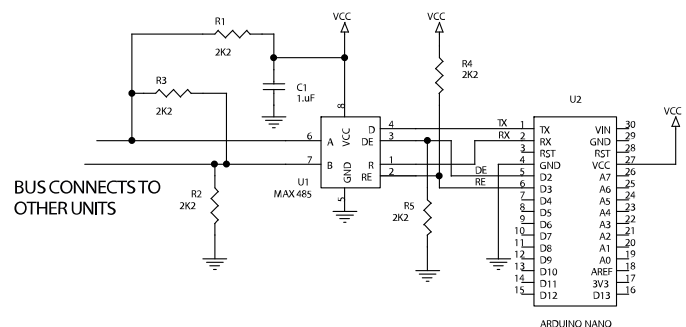


Figure 2 - Schematic for Single KISnet Node

Figure 2 shows the electrical wiring for a single unit on a KISnet network. All units, including the master, use the same circuit. It is a standard RS485 node and it can be implemented with commercially available circuit boards, perhaps in the form of a shield. It is important, however, to ensure that the circuit includes the pullup and pulldown resistors R1 and R2. These have an effect during programming of the Arduino, when they disable the MAX485 transceiver's sending and receiving functions while the pins of the processor are in their high-impedance state. If the pins were both high, the unit would be making uncontrolled transmissions on the network while being programmed. If both were low, the MAX485 would overpower the output of the USB interface and programming would fail. Note that pins D2 and D3 should control the transceiver; if other pins must be used, the relevant lines in `kisnet.h` must be changed. There are also three resistors R3-R5 installed at only one place on the network, to ensure that the lines are in a valid idle state if no unit is transmitting. If the network is very long, then transmission-line effects would have to be considered, and these resistors would need to be replaced, most likely with smaller values.

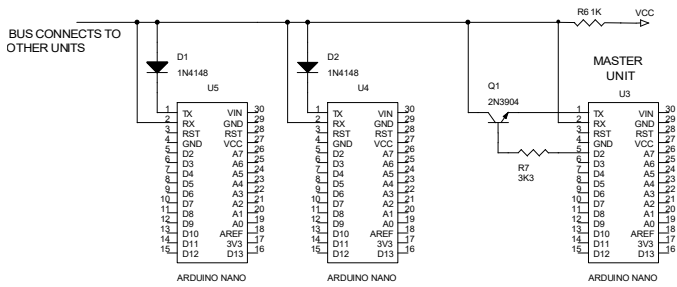


Figure 3 – Simplified KISnet Node for Short Distances

Figure 3 shows a simplified circuit which uses a single wire rather than RS485, with just a diode per unit replacing the transceiver chips. In this case, the master unit differs from the others, using a single transistor (any small-signal NPN would work) to implement some very simple logic. With this wiring scheme the Arduinos would have to be disconnected from the network while being programmed. A single-wire network would be functional over a short distance, as in a benchtop demonstration, but it is not recommended for serious use. It would be a good start for anyone wanting to try out KISnet without the need for much hardware.

It should be clear that the “SW pushbutton” component in the diagrams is to be used in conjunction with the demonstration sketch herein. It is not normally required for KISnet.

For those interested in such things I have written a version of KISnet for PIC processors (the PIC16F series) and made them inter-operate with Arduinos. I’m willing to discuss this via email or on the forum.

Computer Interface

The USB port on each Arduino running KISnet is active. If a computer is plugged in KISnet will always be sending data. If the connection is made to the USB port on the master unit, then all traffic on the network will be repeated, as shown in Figure 1. If the computer is connected to the USB port on any unit other than the master only that particular unit’s outgoing data will be seen. Any unit can be re-programmed via USB at any time without disconnecting the network, but the user should expect temporary disruption to occur.

KISnet was designed to be an autonomous network of Arduino processors. If the user chooses to attach a computer, it allows inspection of traffic via the Arduino environment’s monitor or any other terminal program, but there is no way to send commands controlling the activity of any unit(s). This is where the shared serial port becomes a limitation, because input from the computer would likely conflict with KISnet’s operation unless there could be some way to control network timing. Input from a computer nevertheless seemed like a useful feature to have, so I have done a certain amount of work to design it. It seemed impossible to use the Arduino monitor for this purpose, so I wrote an extra program for the computer, functioning like the Arduino monitor but adding the opportunity to send input to KISnet.

This works where the Arduino monitor fails, because it interacts with KISnet’s operation. The computer continuously monitors the cascade packets and is able to determine when cascades terminate, which occurs when the highest-numbered unit has contributed. At this point the network can be assumed to be quiet for some period and then the computer can add its input.

This comes in the form of a regular KISnet packet, using the address 255 (0xFF) which is disallowed for any normal unit on the network. The opcode and packet size sent by the computer are at the user’s discretion. The computer does not need to be present and if present, it does not need to send a packet in every cascade cycle. This software is not included in the material I will place on the MERG website, but I am willing to discuss it with anyone who wants to contact me, either by email or on the forum.

If the reader has understood how KISnet functions, it may be apparent that there is a certain vulnerability in its operation which doesn’t affect CAN-based systems. That is the fact that the units initially present on the network, which are evaluated by the master to create the C_addresses that will be used in the cascade read process, must remain present and active. If a unit fails to respond, perhaps because the user has re-programmed it during operation, when its turn comes around cascades will end prematurely. This problem appeared obvious enough that I felt that KISnet wouldn’t be complete unless I could find a way around it. So I added some code to the master routines, having the effect of storing the address of the last unit to respond when the network is initially checked. If a cascade ends with some other unit making the last transmission the master is required to go back to the beginning and re-scan the network. If the errant unit can respond during this process it joins the network: if not, it will be left out. This leads to another problem, which is that a processor which fails once gets left off the network and never gets a chance to rejoin, unless the system is reset by some mechanism. The cure-all is to reset the master unit, but this may not always be convenient. It seems as if the solution may be to cause the units to evaluate the network status when they start up and if they find themselves connected to a functioning system send a message at some time when no other packet is being transmitted. This would have the effect of calling for a restart of the network. Perhaps by the time this article appears in print, I shall have dealt with this item!

Additional Material

The software is available via the MERG website in the Knowledgebase: Member Projects—Arduino Projects:

merg.org.uk/merg_wiki/doku.php?id=projects:start#arduino_projects

There is a video which describes and demonstrates KISnet located at:

youtube.com/watch?v=1zHLS2F1Chk

I welcome discussion of the KISnet project on the Forum. Some time ago I started a thread with the same title as this article on Software/Firmware and Micro-Arduino. Any questions can be dealt with there.

References

1. Martin Da Costa, *An Arduino CAB Bus Shield*, MERG Journal, Vol 56, No 4, December 2022, pages 10-13
2. https://www.merg.org.uk/merg_wiki/doku.php?id=journal_software:start
3. sunshine2k.de/articles/coding/crc/understanding_crc.html
4. analog.com/media/en/technical-documentation/product-selector-card/rs485fe.pdf
5. analog.com/en/technical-articles/calculating-the-maximum-number-of-nodes-on-an-rs485-bus.html

Introduction

On becoming a MERG member I joined the Arduino SIG and it wasn't long before I mustered up the courage to ask questions at the fortnightly zoom calls. Soon after I was giving a series of presentations sharing my beginners journey into coding these extremely useful micro-controllers. A previous career as a software trainer left me with a knowledge of how to pitch a presentation and the skills to design an engaging PowerPoint presentation.

Knowing my way around graphic design software meant that I could draw vector graphic images of the Arduino and modules I was working with, for example see Figure 1. These added to the slick visual style of my slides. People may not have found my talks of, but at least they had some lovely graphics to watch.

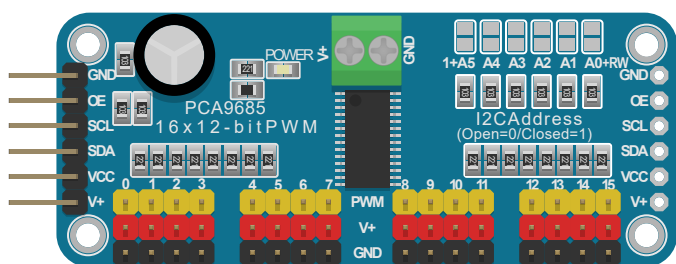


Figure 1 - A vector graphic of a PCA9685 module

Andrew Hicks set up the E101 group and I was involved from the start. He was keen to use my graphical presentation style in the content we would be developing and I soon gave a presentation on how to develop and deliver a presentation. E101 focused on creating video content for YouTube. My style of high quality graphics would be one area where MERG content could set itself apart from the other electronic and model railway channels. I have identified another area within MERG that could benefit from these graphics - Kit Locker instructions. The instructions for the limited number of kits that I have built were clear and logical to follow. However, they are a product of the 20th century. We make them available in paper and download, but they are designed for the medium of print rather than the screen. I felt there was an opportunity to develop complementary instructions which would not be limited by the medium of A4 paper. We could embrace the advantages that the screen provides.

I propose two additional styles of build guides, available for all our kits, both made available alongside the current kit instructions.

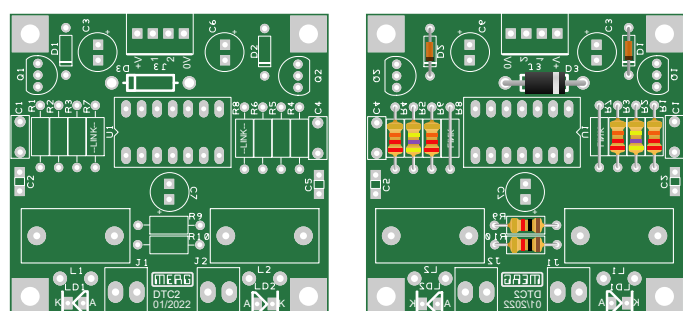


Figure 2 - Kit 50 DTC2 shown at steps 1, 7, 13 and completed

Step by Step Guides

The first is a Step-by-Step guide in a similar style to those provided by Lego or Ikea. A downloadable PDF with clear and detailed graphics showing every stage of the build. The text instructions from the current guide will form the basis of the guide, with each stage having images of the components that need to be fitted along with an image of it in place on the PCB or stripboard. Step by step, page by page the graphics will show the progress of the kit build (Figure 2) providing the maker with visual confirmation that their build is as per the instructions.

Interactive Guides

My second idea for complementary instructions are interactive guides on the MERG website. The text content from the current instructions will be included alongside the graphics created for the step by step PDFs. The website version will provide interaction. The maker will progress through the guide by clicking on "Next" and "Previous" buttons. The components will be animated so that the maker will see the component move into position on the PCB, highlighting exactly where they need to place it. Further interaction can be provided if supplementary or conditional instructions are available. DTC2 (Kit 50) can be constructed with a link wire in place of 1K resistors. The instructions could explain why you would choose one or the other and then graphics would reflect the makers choice.

Proof of Concept

I have worked up some proof of concept designs and demonstrated these to the Kit Locker team as well as to several SIGs and AGs. There is a significant amount of support for the project. Members have recognised the potential to improve upon our excellent instructions by adding images of every stage of the build.

I have drawn designs for several kits, creating demos of both PDF and interactive versions. Through this process I have built up an asset library of electronic components, which is easily accessible when designing future projects. Each kit guide that is designed will include components that may not have been used in previous kits. These will need to be designed and then added to the assets database. The need to do this will reduce as the number of component assets grow.

The Kit Locker team have been very helpful. They have interrogated their PCB design software and found the feature that enables them to export the board design as a

PDF which is editable in a graphic design app, see Figure 3. It removes the laborious process of trying to draw the PCB layout, which is unique for each kit. The export also ensures that everything is exactly to scale and in the correct location. They also provide the position for aligning the components on the board.

Graphic design apps feature “layers” whose visibility can be switched off an on. Components can be grouped together in a layer. This can then be set to visible or hidden for each of the build stages and then exported as a PDF for use in the Step by Step guide.

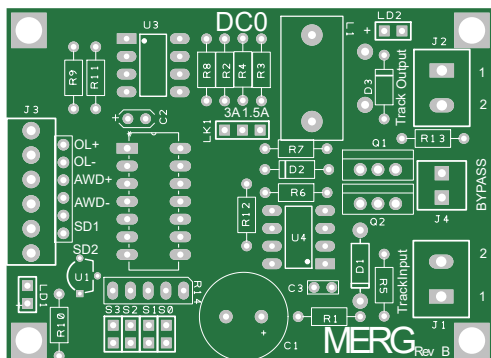


Figure 3 - PCB of Kit 57 exported from Design Spark

The build layers are also included when the design is exported as a Scalable Vector Graphic (SVG) file for use on the web. The SVG file format describes the image as a text file. It is of little use for pixels of a photograph, but graphics made up of lines, polygons, colours etc are ideal for this format. When you open an SVG in a text editor you can read x and y co-ordinates, heights and widths, lengths and radii, depths and colour codes. A web browser reads the file and draws the image. The code of the SVG file to generate the diode in Figure 4 is available here [Ref1]. The three shapes are “drawn” first. Then their colour gradients, which give a more 3D effect, are defined.



Figure 4 - Diode drawn in Scalable Vector Graphics

The descriptive format of the image means it can be manipulated within the browser. At a basic level the build layers created in the graphic design can be switched between hidden and visible to provide a basic build functionality of an interactive guide. “Next” and “Previous” buttons will enable the maker to move through the stages to see the build. More complex animation can be achieved through Javascript libraries such as JQuery or SnapSVG. Animation could move a component into position on the board, showing very clearly what the maker needs to do at this stage.

I have designed products with this kind of functionality. That was a couple of decades ago. JavaScript has evolved while my knowledge of it has faded. I know what can be done and I could relearn JavaScript or a suitable library. But my current job as a bicycle mechanic doesn't require this particular skill, my railway modelling coding is in C++ and Python. I don't have the enthusiasm to reskill in JavaScript.

I'm looking for members who are already proficient in JavaScript – or looking for a new challenge – and would like to contribute to this leap forward in how we present our guides. There will be plenty of interesting challenges and

lots of room for creativity. The interactivity of the web takes us beyond the binary choice of hide/visible. At the start of the guide components could be displayed as they appear in the kit bag, stuck to a card or in a jumbled mess. Animation could then be used to move these into a position ready to be installed. Then moved into position on the PCB or strip board, emphasising their location. There could be buttons which enabled the maker to flip the board over to see it from the soldering side, or rotate the board through 90, 180 or 270 degrees. Components could be drawn from multiple perspectives, giving top-view, side-view and end-view options to help with identification. It may be possible to create 3D views of components, see Figure 5. Members who use KiCad may want to explore its 3D imaging capabilities, see Figure 6.

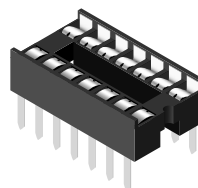


Figure 5 - A 14 pin DIL socket drawn on an isometric grid

We have many kits in our locker and I have no intention of doing the graphic design for all of them. I need people to work with me on this aspect. Some design knowledge would be useful. However, this is a skill that can be learnt and one you may find useful in other areas of our hobby.

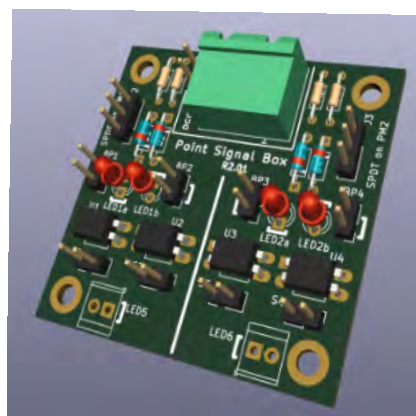


Figure 6 - KiCad 3D export created by Alan Lomax

To ensure that there is consistency across the new instructions a Style Guide and templates will have to be drawn up and signed off. We will have to figure out how to best implement the interactive guides. Is there a suitable SVG JavaScript library we could use, or will we write our own? Where will the content we create be stored, who will have access to it? The skills and experience required for this project are very different to those required for designing electronics circuits and thus kits. This project creates an opportunity for many of us to get involved in contributing to the success of MERG, an opportunity that we may not have felt open to us. If you think that you may be able to take on one of the many roles in this project then please get in contact with me via chris@copmanthorpe.org.uk.

Chris Sharp's biography is given in *MERG Journal*, 56 No 2, Page 31

Reference:
1. https://www.merg.org.uk/merg_wiki/doku.php?id=journal_software:start

Beginners – Where to Start

Roger Edwards M2176

It can be difficult for a complete newcomer to MERG to find the information required on the MERG website and this is especially true for beginners or people without technical knowledge of the electronics industry. There is an enormous amount of information on the MERG website and Knowledgebase for beginners, but it is not always easy to find, partly due to the acronyms and other terms frequently used. Consequently, a good starting point is the Glossary, found here: <http://www.merg.org.uk/s/glossary> Technical Bulletins also give more technical information and are better suited to members with some prior knowledge and can be found here: https://www.merg.org.uk/merg_wiki/doku.php?id=glossary:start

Over the years a number of articles have been written especially for beginners and these are summarised in Table 1 below.

Note that in Tables 1 and 2, page numbers prefixed “n” are in the Newsletter section, and those prefixed “j” are in the Journal/Articles section. Before 2013-3, Vol 47-3, the pages did not have a prefix identifying their section. Back issues of the Journal as far as December 2013 can also be downloaded from the MERG website at:

https://www.merg.org.uk/merg_journal/

Older articles can be found at:

https://www.merg.org.uk/merg_wiki/doku.php?id=journal:index_page

The MERG website has grown a bit like topsy and the MERG Managing Committee is well aware of this problem. It is in the process of making it easier to use, especially for new members, so by the time you read this article some of the links mentioned may have been changed. Also, a completely new website is being designed.

Learning about electronics

A good starting point for learning about electric circuits and the components used in MERG kits is reference RDE1 in Table 1 above or the book by Davy Dick "Electronics for Model Railways" available from the MERG website at: <https://www.merg.org.uk/content/ebook>

The reference RDE1 describes basic electrical theory and the units used. It then describes the common components used in MERG kits, and a brief description of resistors, capacitors, inductors, diodes and transistors. Article reference HW4 makes a few corrections to the first article and looks at various type of diodes and how they are used to solve common problems, ranging from logic to control panels. The next article, reference RDE2, shows how transistors can be used as amplifiers or switches and RDE3 discusses the various integrated circuit “families” and how they can be used for various logic functions. It then discusses how integrated circuits can be used to make linear and switched mode power regulators, which are required in most kits. Other articles in this series discuss microcontrollers, software and communication.

Table 1 - Resources for beginners

Ref	Title	Journal	Page	Subject
JJ1	Electric Circuits Basics 1	Autumn 2004	18	Models for Electricity Part 1
JJ2	Electric Circuits Basics 2	Winter 2004	6	Models for Electricity Part 2
JJ3	Electric Circuits Basics 3	Spring 2005	28	DC Circuits
JJ4	Electric Circuits Basics 4	Summer 2005	28	Pulse Circuits, Waveforms and Logic.
JJ5	Electric Circuits Basics 5	Autumn 2005	6	Inductance
JJ6	Electric Circuits Basics 6	Winter 2005	28	Semiconductors and Transistors
JJ7	Electric Circuits Basics 7	Spring 2006	14	Integrated Circuits
JJ8	Electric Circuits Basics 8	Summer 2006	12	Transformers
JJ9	Electric Circuits Basics 9	Autumn 2006	8	Design
JJ10	Electric Circuits Basics 10	Winter 2006	22	Oscilloscopes
HW1	Beginners Corner	Spring 2011 Vol 45-1	44	Resistors & Resources
HW2	Beginners Corner	Summer 2011 Vol 45-2	21	Capacitors & Software Downloads
JL1	Beginners Corner	Autumn 2011 Vol 45-3	41	Understanding the Electric Motor
IM1	Beginners Corner	Winter 2011 Vol 45-4	2	Assembling Molex Connectors
HW3	Beginners Corner	Spring 2012 Vol 46-1	40	Connectors & Terminal Blocks
RDE1	Beginners - The Starting Point	Summer 2014 Vol 48-2	j7	Summary & description of common components
HW4	Beginners Corner	Autumn 2014 Vol 48-3	j5	Diodes
RDE2	Beginners Corner	December 2014 Vol 48-4	j6	Transistors
RDE3	Beginners Corner	March 2015 Vol 49-1	j6	Integrated Circuits
RDE4	Beginners Corner	June 2015 Vol 49-2	j8	Microcomputers and Microcontrollers
RDE5	Beginners Corner	September 2015 Vol 49-3	j10	Software
RDE6	Beginners Corner	December 2015 Vol 49-4	j12	Software, A Level Crossing Project
RDE7	Beginners Corner	March 2016 Vol 50-1	j16	Software - Coding
RDE8	Beginners Corner	September 2016 Vol 50-3	j8	Communications

Launchpad

As mentioned previously the MERG website has grown a bit like topsy and it is sometimes difficult for a beginner to find his/her way round and the information required.

To help with this the Launchpad section was introduced accessed via:

https://www.merg.org.uk/merg_wiki/doku.php?id=launchpad:start

This takes you to the LaunchPad introduction page which explains what the LaunchPad is and how to use it. Half way down the page there is a "Let's Get Started" box with links to a Beginners Portal and Signposts. The Beginners Portal lists subjects under seven main headings:

- Getting Started
- Demystifying Components
- Video Materials
- Kitlocker
- Technology Platforms
- Resources
- Online Tools

The Signpost tab lists subjects of interest in an alphabetical order, but you may need to check with the Glossary for the meaning of some of the acronyms used.

Knowledgebase

The Knowledgebase contains an enormous amount of information for members. This page has a set of tabs at the top to take you to specific topics on the MERG web site such as the Area Groups or Forum. The main part of the page has a number of columns, each with links to a specific point of interest. For beginners, the top left column "BEGIN HERE" shows the topics likely to be most useful for beginners.

See: https://www.merg.org.uk/merg_wiki/doku.php

Pocket Money Projects

The above articles in Table 1 explain how things work; however, that is not much help to beginners trying to build kits. For this MERG has a range of very low cost Pocket Money Projects (PMPs), these are very simple kits that do something useful on the layout, such as controlling a servo motor for operating a point, but allow the user to become familiar with the components and practice their soldering skills without breaking the bank.

Table 2 - Pocket Money Projects described Kits

	PMP Resources Checklist	MERG Journal article			
		Year	Volume	Page	kit locker
PMP (0)	Stripboard	2012-3	46-3	15	
PMP 1	A Track Tester	2012-3	46-3	16	801
PMP 2	Train Detector with LDR	2012-4	46-4	8	802
	Further information	2013-1	47-1	n10	
PMP 3	A Simple Servo Exerciser	2012-4	46-4	11	803
	Further information	2013-1	47-1	n10	
PMP 4	A Simple Shuttle	2013-1	47-1	24	804
PMP 4a	Shuttle Kit Add-on	2019-3	53-3	6	804A
	Further information	2020-1	53-1	8	
PMP 5	A Logic Probe	2013-1	47-1	30	805
PMP 6	A 12V output from a 15V AC supply	2013-2	47-2	4	806
	Further information	2013-3	47-3	15	
PMP 7	A DCC train detector	2013-2	47-2	6	807
PMP 8	Welding/Arcing etc Simulator	2013-3	47-3	14	808
	Further information	2014-4	48-4	j3	
PMP 9	4-way Traffic Lights	2014-1	48-1	j3	809
	Further information	2016-1	50-1	j12	
PMP 10	A speed controller	2013-2	47-2	11	810
PMP 11	LED Dimmer	2013-2	47-2	15	811
PMP 12	Ten x Lit Buildings with random on/off times	2013-4	47-4	j3	812
PMP 13	Lighthouse/Beacon, selectable light colours+patterns	2014-3	48-3	j3	813
PMP 14	DCC decoder setup/testing rig	2013-3	47-3	18	814
PMP 15	Train Auto Stop	2020-2	54-2	6	815
PMP 16	A simple point position sensor (DCC)	2013-3	47-3	22	816
PMP 17	Automatic Signals	2014-2	48-2	j3	817
	Further information	2014-4	48-4	j6	
PMP 18	EzyPoints	2014-4	48-4	j4	818
PMP 19	Automatic Coach Lighting	2015-2	49-2	j3	819
PMP 20	A Versatile Timer	2015-4	49-4	j3	820
PMP 21	Twin Flasher	2016-2	50-2	j3	821
PMP 22	A Laser TOTI	2017-2	51-2	16	822
PMP 23	DCC Return Loop Controller	2018-1	52-1	6	823
	Further information	2020-1	53-1	8	
PMP 24	Arc Flash Generator	2018-2	52-2	6	824
PMP 25	Steam Sound Emulator	2018-4	52-4	6	825
PMP 26	Event Sequencer	2019-1	53-1	6	826
PMP 27	Button Operated Servos	2019-2	53-2	6	827
PMP 99	Hall Effect Sensor Pack				

The kit cost is so low, from less than 50p to no greater than a fiver, that it doesn't matter too much if mistakes are made, but experience is gained. A list of the PMPs is shown in Table 2, the ones shown in red in the first column were described in the relevant Journal article, but no longer appear in the kit locker. They can be found at: https://www.merg.org.uk/merg_kitlocker/section.php?id=31

MERG TV

MERG members have recorded a number of interesting projects. Some are from the various Area Groups, MERG courses or members projects and several show how to build some of the MERG kits. They are available via: https://www.merg.org.uk/merg_wiki/doku.php?id=subjects:videolinks

Kitlocker

MERG produces a large range of kits for its members which have been explained by Judi Rastall in the MERG Journal - Vol 55 - No 1 March 2021 Page 8. This article about the Kitlocker discusses kits available for traction control, both DC and DCC. It also covers the kits available for accessory control and the feedback of information for display on a control panel, either physical or glass screen (computer). This also covers the use of various Layout Control Busses, such as CBUS, PTP-Lite and EzyBus to reduce layout wiring. See: https://www.merg.org.uk/merg_wiki/doku.php?id=kits:range_outline

More detail on specific kits can be found by going to the Kitlocker. It shows a list of kit categories from which you can then select the kit of interest. For each kit there is a panel with the kit name and number and a picture. In the top left hand corner there is also an icon (🔍) which points you to the full details about the kit including the components, circuit diagram and links to any other relevant information such as the building instructions and technical bulletins.

See:

https://www.merg.org.uk/merg_kitlocker/

Biography

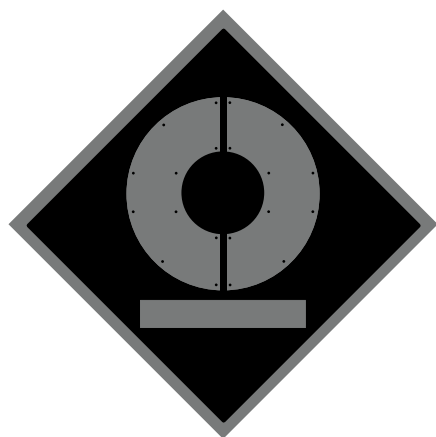
I left QMC London with a Masters degree in Electrical Engineering in 1963 and started work with The English Electric Co (EE) as a Systems engineer, that is putting "black boxes" together to solve customer's problems. Often the "black boxes" didn't exist, so I also had a desk in the development department to design them, including the design of the small computers used at the time. Much of this work involved telemetry, SCADA (Supervisory, Control And Data Acquisition), data logging and computer control systems.

I also spent time in sales and in 1969 helped win an order from Kiruna, Sweden, for a system to control a standard gauge underground mineral railway consisting of some 100 points and 200 track sections - spread over an area of 7km by 5km - and using up to 20 trains that were completely driverless and controlled from the computers. In late 1969 EE was taken over by GEC and I spent a few years with them as a section head in a department handling telemetry and SCADA systems.

I then moved to an instrumentation company in Birmingham and in 1979 started my own company, Advantec Systems Ltd to advise clients on computer control, instrumentation, telemetry, SCADA and similar communication and computer control systems.

I retired early in 1999 when my wife became terminally ill with the big C and later decided to build a model railway as a hobby to experiment with routing, control and interlocking. I joined MERG sometime about 2007 and was elected to the Committee in 2008. For many years I looked after or helped with the Journal production and started, very slowly due to pressure of other commitments, on the design of my own Layout Control Bus, At-Bus.

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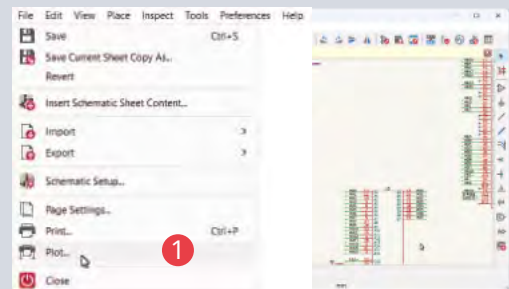
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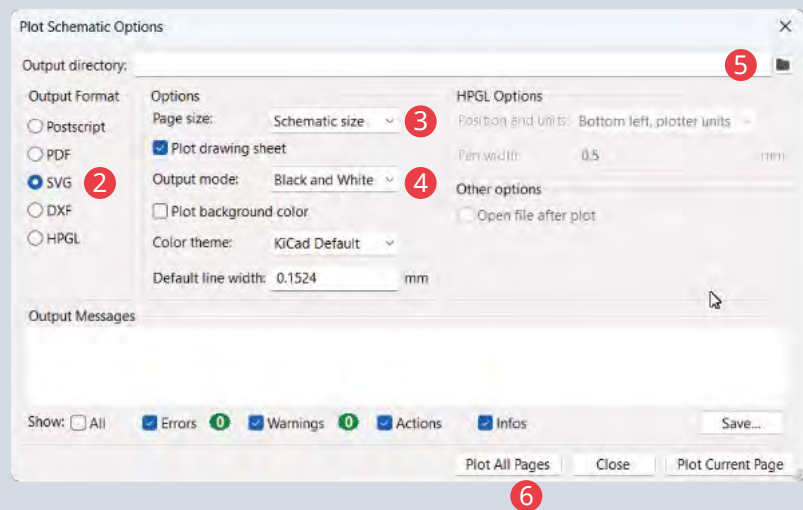
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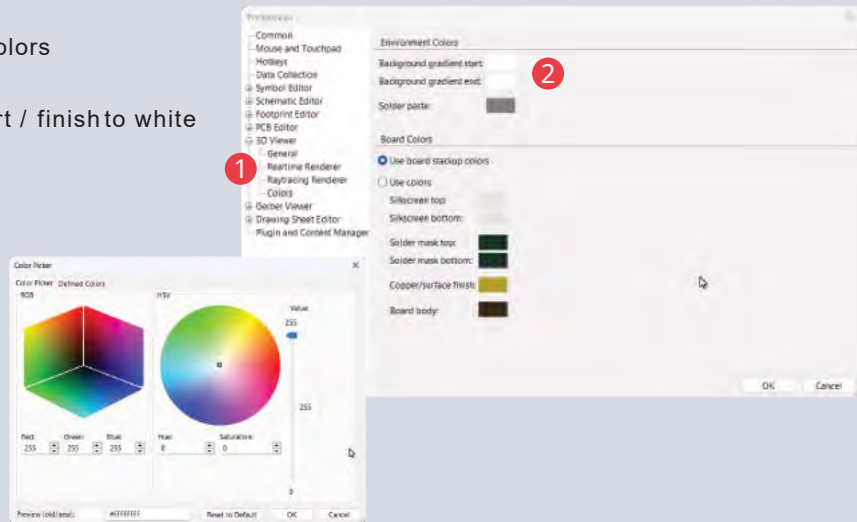


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Area Group Reports

3 Counties Area Group

We continue with the format of one club night, one Zoom meeting and one Saturday workshop every quarter. This has proved a successful compromise to allow members to participate and keep in touch with the group.

We have started working on building a new MERG Demonstration Shuttle Display; we need this to demonstrate a system designed by Jim Douglas. This is based on two very sturdy laser cut base boards from Tim Horn donated by Christopher Langdon.

At one of our Zoom meetings, we discussed the problem of layouts with more than one operator needing to communicate with each other in order to send and receive trains between them. The outcome was the desire for a block instrument offering/accepting trains by sending/receiving data over CBUS. Subsequently, Duncan Greenwood gave a fascinating presentation on his work on this subject and we will be having working prototypes soon.

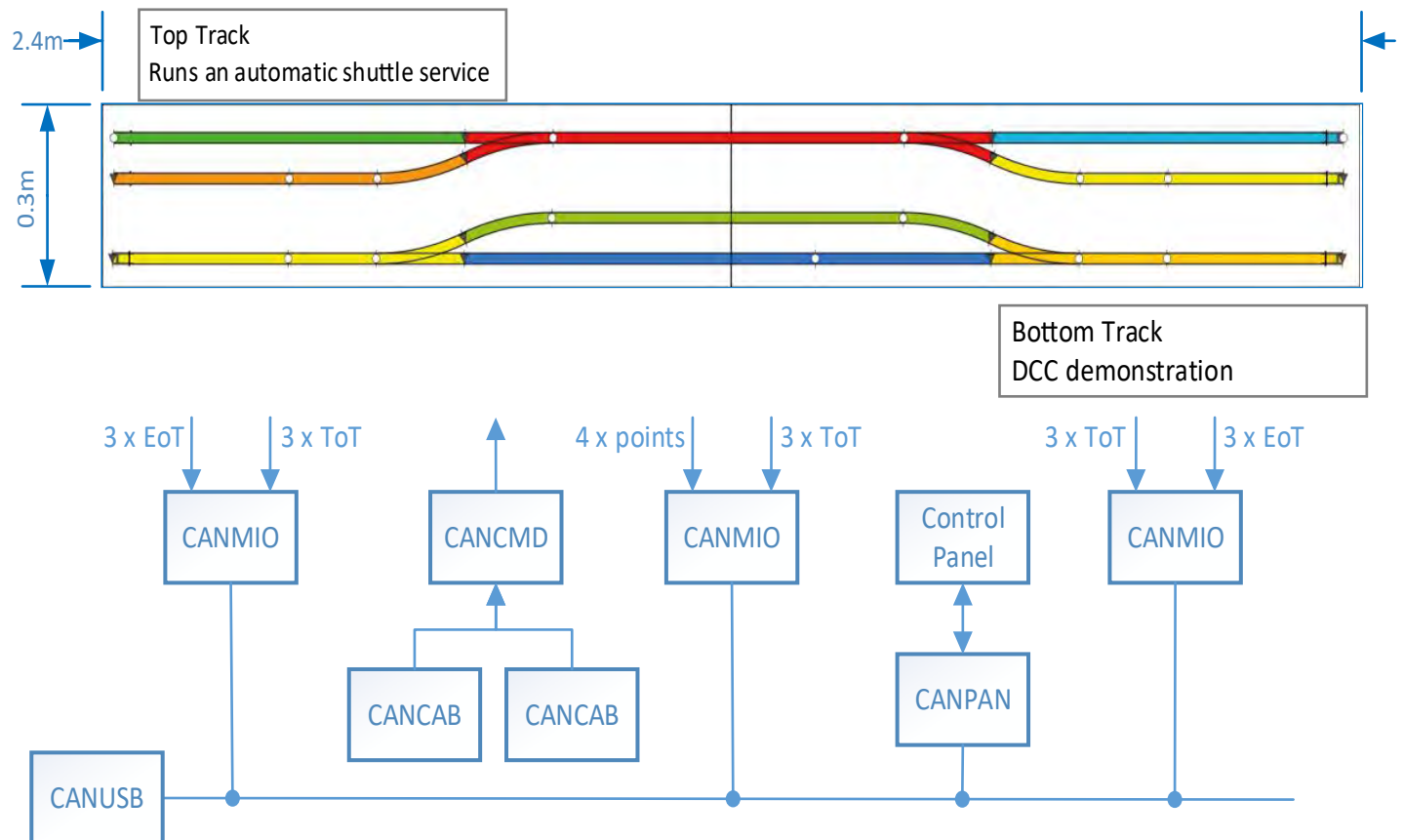
At our last Saturday workshop, we had a discussion on how to proceed with the MERG demonstration shuttles that we can take to local exhibitions to promote MERG and attract new members. It was agreed that the module will consist of two separate end to end displays on two different levels, one at the front on the lower level and another at the back sitting approximately 150mm above the front one.

Christopher Langdon has very kindly supplied two 1200mm x 300mm Tim Horn laser cut baseboards and foam underlay. He is also supplying several lengths of fine scale track to go on the upper level section which will be configured with two ends and two fine scale hand built points. Christopher has also offered to supply a half width baseboard for the upper level fine scale track. The upper level will use servos and 3D printed mounts for the points.

Jim Douglas and Barry Cossins have offered to make a start on the lower section which will use Peco 'Setrack' and be configured to have two ends with a passing loop in the middle. The lower section will use small commercially manufactured point motors to operate the points. The idea is to also have a low profile mimic panel sitting in front of the layout to show block occupancy and contain several switches and a train controller so users can operate the points and loco. We plan to make the motive power operate in both DC & DCC and use CBUS (2 x CANMIOS) for the block and spot detectors to communicate between the baseboards and controllers.

Christopher Langdon

Figure 1



Warwickshire & North Area Group

There were a good range of talks and our largest attendance since Covid at our meeting on the 20th May. We started with "Sounds Right" by Tony Chamberlain featuring some of the techniques to add background sound effects to a layout. It gave rise to a good discussion and lots of ideas. The second talk was on "Train on Track indication" by Simon West providing an overview of the different, primarily MERG, types available for both block and spot detection. Options for both DC and DCC operation were explained and helped at least one member find a solution for DC block detection - which are quite rare beasts compared to DCC options.

The talks concluded with an update on FCU (FLIM Configuration Utility for CBUS) development and background given by Jon Denham, part of the team that have taken on the FCU software after the sad loss of Dave Radcliffe. The rest of the meeting provided for some more detailed discussion of the talks and trouble shooting of MERG modules, PIC re-programming and access to the area kit locker.

The slides from the talks are available from the Area Groups presentations area: https://www.merg.org.uk/merg_wiki/doku.php?id=helpsystem:presentations

The WNO Area Group meet at the clubrooms of the Leamington and Warwick Model Railway Society where many of the layouts make use of MERG electronics and can be used to illustrate how to implement various techniques. Excellent refreshments and signature bacon butties were provided with thanks to Mike Collins and team of helpers. The group now has a co-leader after Andy Cumming kindly volunteered to help with some of the group organisation and provides some resilience.

The WNO meetings for the remainder of 2023 are planned for the 30th September and the 18th November - keep an eye on the area group pages for details:

https://www.merg.org.uk/merg_wiki/doku.php?id=areagroups:general:area_groups_start

Simon West

Somerset Area Group

Work continues on our Group Demonstration Layout Project; with several baseboards now made it was time to get some track down. In the photo below you can see Tony Braithwaite demonstrating his excellent track laying skills to Peter Olnier, who is about to embark on a large layout for himself at home.



Our plan for the June meeting was to connect all our boards together and see if we could get a train running. Whilst only half the boards were present, you can see in



the second photo Olivia Howes enjoying a rare moment of relaxation after catering for everyone during the day.

After a long sabbatical Ron Pluck has returned to the group online meetings and demonstrated his basic DCC Controller. He has promised to look at expanding this to include block control similar to Superbloc for DC, but controlled by a processor. If you would like to get involved, then please contact us, we would love to see you at one of these events.

Both photographs by Paul Howes

Malcolm Asker

Tayside Area Group

We continue to meet via Zoom on the first Wednesday of each month and face to face at The Friary, Tullideph Road, Dundee on the third Saturday of the month - exhibitions permitting. As usual, the Zoom sessions have covered a wide range of topics.

Preparations of our EzyBus demo board did not quite go to plan for completion by the Perth show where we displayed it as a work in progress. Despite the setback completing the wiring of inputs to and outputs from the EzyBus modules, other work now allows this board to be displayed as intended mounted above my CBUS layout so that a direct comparison can be made between the two layout control buses (LCB). We now have a rolling PowerPoint presentation that explains what LCBs are and describes the modules on the two layouts. Another display shows the JMRI shuttle script running on the CBUS layout and its output showing

the speed steps etc. as the loco accelerates, coasts and decelerates and the interaction of the loco with the ToTis used to detect the loco's position.

The Glenrothes show in Kirkcaldy in May and the Perth show in June were well attended and our stand was quite busy at both. Potential members took away flyers and a copy of a Journal, commonly after engaging in conversation for quite an extended period. It is frustrating that group leaders are not able to see the reports of where members heard about MERG and/or their reason for joining.

We will be representing MERG at shows in Cupar in July, St Andrews in August, Aberdeen in October and Falkirk in November and hope that they will be as successful as Kirkcaldy and Perth.

Fraser Smith

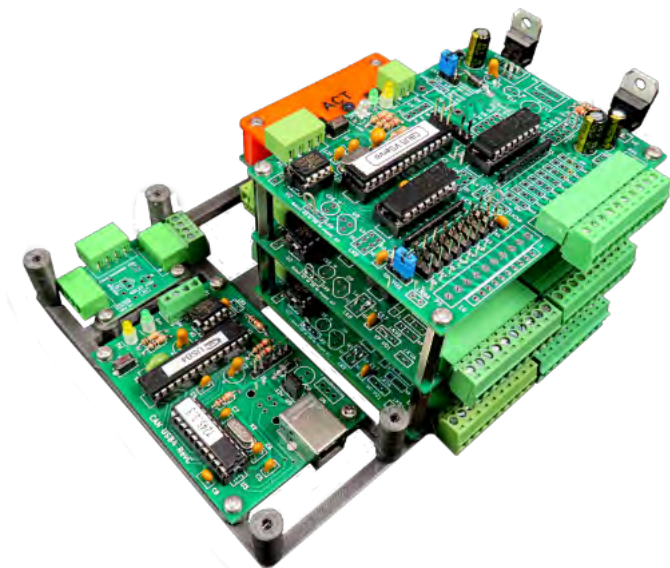
Croydon Area Group

Our monthly meetings continue on the second Friday of each month at the Croydon Model Railway Society clubhouse in South Croydon.

The focus of the group in the last quarter has mainly been around automation.

Work continues on the O-Gauge Dockland project. The prototype coal tippler module has led to a complete rethink of the harbour area and in particular a rethink of harbour coal operations to result in a set of realistic coal movements. The extra space in the harbour has allowed the passenger shuttle line to be extended and this will be controlled by the new Automatic Train Controller.

Richard presented a second JMRI session to the group where he focussed on the basic steps needed to get JMRI working on a layout. An N-gauge test track has been built based on the O gauge layout and work has now started on connecting a 'CBUS stack' that will control the accessories and traction.



The 'stack' consists of:

- CANCSB – DCC traction
- CANVServo – point control
- CANVOUT x 2 – current sensor input
- CANACTOUT – monitoring and handset sockets
- CANUSB4 – PC connection.

Discussions earlier in the month highlighted that many of the members wanted to learn more about AnyRail and this resulted in Allan presenting a beginner's demonstration to encourage members to download the software and get started.

We plan to ask members to let us know what topics we want to present / discuss at meetings in the Autumn. Currently our schedule is as follows:

14th July – Workshop: - coal tippler project / JMRI on mini-Dockland / module repair shop.

11th August – The Automatic Train Controller – exploring how DC analogue control can be used for automated operations of part or all of a layout.

8th September - Workshop: - coal tippler project / JMRI on mini-Dockland / Automatic Train Controller / module repair shop.



Left to right, David Hill M1982, John Martin M621, Ray Baker M6138, Richard Wallis M6689.

Photos by Allan Geekie 5173

Allan Geekie

North West Area Group

NWAG had its first exhibition stand since Covid at the Manchester Model Railway Exhibition on 10/11th December 2022. Ian Macdonald brought his demo layout, rolling road and other items to fill the absence of our usual items. MERG kits were displayed and on sale to members as usual, with Chris Morgan showing some of his enclosures for PCBs.

The venue was in the Sugden Centre which was a change from the previous shows and it seemed to work quite well despite the usual teething problems. Many thanks to all who assisted, primarily Ian Macdonald, but also at various times: Chris Morgan, Malcolm Balls, Anthony Johnson and Mike Bolton. Basil Stephens and James Jordan also attended for brief periods. Everyone enjoyed the two days despite the freezing weather and it is hoped to have a MERG stand again at the 2023 exhibition in December.

Geoff Holland



MERG at the Manchester Exhibition Dec. 2022 - on the left is Ian Macdonald (MERG's Events & Exhibitions Manager), Geoff Holland in the centre, and Chris Morgan on the right. Photo supplied by Geoff Holland

4th April 2023 : Grazeley Memorial Hall (10 Thames Valley AG members, 2 South Hants AG members)

Nick Murphy gave a practical demonstration of Martin Snashall's StaRFishrail RFID system and of the latest MERG 2nd Gen RFID system.

StaRFishrail Hub (max 32 readers) cost £120, Single reader £25 (readers are matched to aerials).

Two aerial sizes are available, one with 30mm range, the other with 40mm range.

Tags are 6mm X 9mm (ideal for N gauge), 13.56Hz with aerials and a protocol that allows a 30mm vertical range (through baseboard). Currently read only tags (5 byte). JMRI ID Tag table is updated as each tag passes over a reader.

The latest MERG 2nd Gen RFID development has hardware and firmware by Mike Bolton and RF testing and development by Nick. The MERG reader/writer (inc aerial) £ Miller1.50, 6mm X 15mm tags £0.30, ~£20 to £25 for RFID module. Write function writes/overwrites ID tag info.

2nd May 2023 : Online (6 Thames Valley AG members, 12 MERG members)

Howard Watkins introduced Duncan Greenwood. Duncan described the scope of the presentation as 'Arduino for DCC'. Duncan described the DCC signal as transmit only for both control and power. The main DCC components are the Command Station, Throttle/cab, Decoder, Booster, Cut-out, and Throttle/cab/feedback bus (possibly wireless).

Arduino Command Station. The original DCC++ project needed only an Uno, a motor shield and power supply. The command interface was text strings to/from the serial port. Recently a DCC-EX team is taking the project forward with portable code, new functionality, simpler installation, and improved web site.

Arduino Decoders: there are two types of decoders, multi-function (loco) decoders and accessory decoders. There is an NMRA DCC decoder library which supports any Arduino board.

Throttles for DCC++. The requirements are an Arduino, a display, a rotary encoder and buttons. The throttle sends and receives text strings from the Command Station serial port. WiFi linking is possible. A MERG CANCAB can 'talk' to a throttle.

Boosters and Cut-outs. Not strictly Arduino, but an Arduino can allow intelligent control of various 'events'. Train detection. Any train on track detector can interface to an Arduino.

Duncan answered a number of questions about WiFi, C+ coding, Colour Touch-Screen communications for layout operators/signallers, and other Arduino related questions.

6th June 2023 : Grazeley Memorial Hall (10 Thames Valley AG members, 2 South Hants AG members)

Andrew Hicks shared the background to the significant personnel changes in the MERG Managing Committee (MMC) that had taken place in autumn 2022. Andrew commented that MERG had recently passed two major milestones; over its life 10,000 members have joined MERG and currently there are 4,000 active members. The MMC has committed to enlarging the number of officers/ members supporting the various formal activities of the organisation to cope with the growth seen over the last few years and to support anticipated future growth.

Andrew talked about the forthcoming AGM. The current outline agenda is for an Exhibition from 10.00 to 15.30, to be followed by the AGM at 16.00. There are a number of layouts already booked for the exhibition. The Kitlocker will have a room and there will be a tutorial room for members needing help.

Andrew shared a simple smoke generator (Figure 1) that he had developed and a scent generator (steam train, oil, coal, cattle dung, etc).

Andrew described his Block and Bell approach to signalling. The bell is a bicycle bell 'dinged' by a solenoid. The Block is a 3-way rotary switch and a centre-off adapted ammeter driven by an H-bridge (Figure 2).

The loco number is sent and received using CANPAN (Figure 3). There is some complexity in mapping the inputs to the various outputs.

Photos of Andrew Hicks' equipment by Paul Miller

Paul Miller



Figure 1 - Smoke Generator



Figure 2 - Block Bell Indicator



Figure 3 - Loco Descriptor Dial

Aberdeen Area Group

Monthly meetings continue with three to four members in attendance. Discussions have covered the usual wide range of topics, with a focus on how to make our demonstration layout do what we want.

Bruce Davidson kindly showed us his construction of "MERC DCC in a box", including the relevant power supplies, and how use of specific plugs and sockets has eliminated the possibility of making wrong connections. He also showed us how he corrected a screen problem with one of his DCC handsets.

Other discussions have covered CBUS, detectors, loco conversions to DCC, an idea for a drive-in movie theatre in HO using a mobile phone screen, and the solution implemented on the Aberdeen Model Railway Club O gauge layout to achieve simultaneous operation of crossover pairs of points which use Cobalt Digital iP motors.

We intend more hands on activities over the next few months, so please come along and join us on the third Thursday evening of the month – all members welcome.

Colin Stevenson

South Hampshire Area Group

Just a short update on our activities. We continue with our weekly Zoom meetings on Thursdays at 7:30pm. The discussions are wide ranging covering many railway topics, not just electronics. We have international members, so these Zoom meetings are not restricted to those in our geographical area, all are welcome.

We meet regularly at the Southampton Model Railway Society Clubrooms on the second Thursday and third Saturday of each month. The Saturday workshops continue to be popular. We build kits, develop software, give topical presentations and continue building our narrow gauge exhibition layout.

Since the last Journal we have represented MERC at Expo EM (Bracknell), Lymington and should be attending exhibitions at New Milton and Tolworth. Please see the MERC diary for full details of our meetings and the exhibitions we will be attending. If you want to join us contact Chris Barker. His details are on the Area Group Leaders page in this Journal.

Ian Hart

Irish Area Group

Our monthly Zoom meetings are continuing with discussions about subjects members have problems with or want to learn more about.

Our physical meeting in June at Wexford covered everything you want to know about servos from how the servos are controlled by a sequence of pulses of variable length, what servo controllers are available in the Kitlocker and elsewhere, and how you best use servos on layouts. This included using an oscilloscope to visualise the pulses. Eve and Tim worked on a new shuttle layout based on PMP kits and featuring a semaphore signal operated by a PMP18.

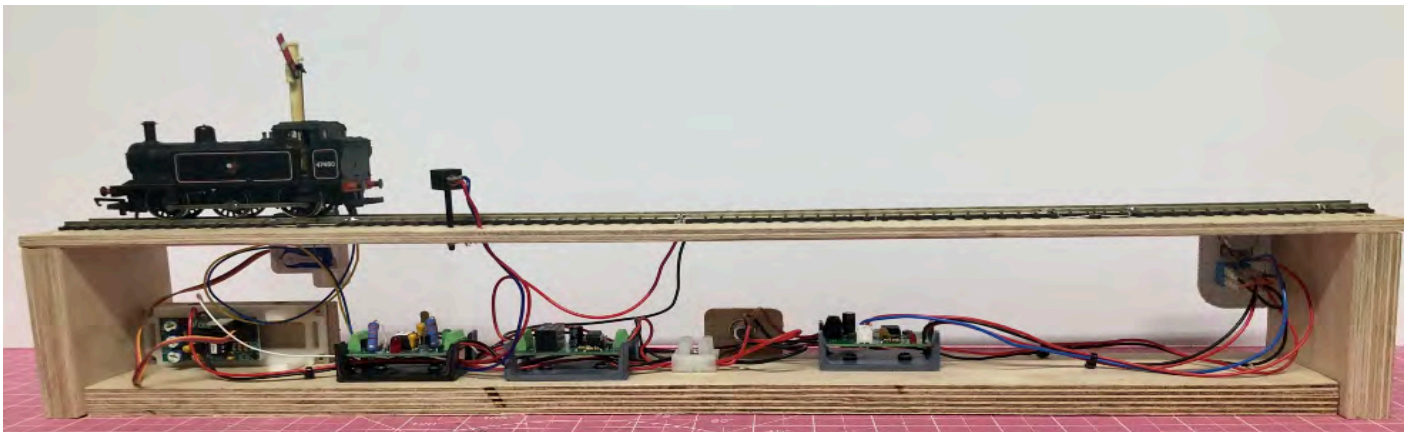
we have got feedback at shows that people think that our shuttles have too many wires. This new shuttle hides all the electronics and wiring on a lower level. Hopefully this will be more appealing to the viewers while still demonstrating the electronic side.

We also had a lot of chats and questions about everything including a demonstration of CBUS using the MERC beginner's kits and the original ATC kit. Thanks Eve for hosting this meeting.

We had a stand at the Wexford MRC Exhibition in April. Thanks Eve, Pat and Tim for helping out with the stand together with me and to all the members that introduced themselves. We are now preparing for the next exhibitions in October. We will attend the Wexford MRC exhibition on the 9th of October and the South Dublin MRC exhibition on the October bank holiday (28-30). If you attend any of these shows please say hello to us, or even better volunteer to help us with the stand.

Some of us have lost Kitlocker orders in the post. The Kit Sales manager Paul Tomkins kindly resent these via courier. One of these orders was urgent as it was going to be used in the June meeting. Thanks Paul for this help. As a result the Kitlocker team decided that orders to Ireland and other non-UK destinations will be sent as tracked mail which will mean additional postage cost for our orders. It is sad that this is necessary. Personally I am happy with this as the extra cost is worth the certainty of delivery.

Sven Rosvall



Eve's new shuttle layout. Photo by Eve Wallis

West of Scotland Area Group

We continue with our weekly activities. We are still not holding the large Glasgow-based meetings. Instead, we have started a monthly meet-up hosted by the Renfrewshire MRC. This is in addition to the fortnightly sessions in Prestwick. 19 attended the first Renfrewshire meeting and over 70 members have come to the two locations this year.

At our online AGM, we elected our Convenor, 2 deputies, a 6-member committee, and an 8-member exhibition team. Since my last report, we have displayed at three exhibitions, with 15 members volunteering to operate the stand.

The photograph below shows our stand comprising two demo layouts, a showcase for PMPs and a promotion area. The showcase demonstrates the use of 15 kits, along with Nanos controlling an OLED and a DFPlayer. A successful strategy is showing how they work, then pointing to their use on the demo layouts. In all, the stand has 67 MERG kits, 6 Arduinos, 10 PICs, along with a range of servos, motors, relays, DFPlayers and OLEDs. This gives us plenty to talk about to the adults while the kids love watching the automated trains and animations.



Yorkshire Area Group

In the Spring the Yorkshire Area Group met on three occasions, twice on Zoom, and a face to face meeting at The Middleton Railway in Leeds with 20 in attendance. We welcomed a couple of new members to the group. Peter Denton gave a presentation on the 555 timer, one of the cornerstones of electronics. He used PMP11 - LED Dimmer to demonstrate its practical use on a model railway.

Bob Shanks introduced us to the concept of colour temperature, explaining why the different temperatures of white lights at Model Railway shows make photography difficult. Then Bob talked about how neo-pixel LEDs can be used to control the colour temperature of light to create the effect of moving from daytime to dusk and then night.

Chris Sharp re-hashed a talk he'd given to the Arduino SIG in November 2022. He covered non-addressable and addressable LED strips and how to control them with an Arduino. With no coordination or planning the three talks dovetailed into each other to create a surprisingly coherent session. After pack-lunches had been consumed, we enjoyed our usual informal time of chatting and members helping each other with their projects. This was accompanied by intermittent flashing lights as a few of us

We have continued our series of presentations to members.

Modelling issues included:

- Modernising and lighting Sheildinch Mansions
- Converting a 00 Bachmann SECR C Class 0-6-0 into a Caledonian 294 Class Jumbo
- A fault-finding experience
- Track laying, ballasting and much more
- 3D printing

Electronic issues included:

- Recovering and using vape batteries
- A Nano-based DCC servo decoder
- Accessory Bus Options
- A DC PWM controller
- Optocouplers and photo-interrupters

Programming issues included:

- Saving to Memory, covering PICs, Arduinos and Pi Picos.
- The design, construction and operation of an automated mine.
- Modular design in PICs and JAL
- Designing a Nano development board

These were, in addition to the many 'show and tell' at meetings, fault-finding on kits, advising on issues, etc. Despite the reluctance to hold large meetings, the Area Group maintains a busy programme with many members participating and contributing.

Left: West of Scotland Exhibition Stand

Davy Dick

played with an Arduino controlling a couple of metres of neo-pixels.

Our June Zoom meeting followed the 'What's On My Workbench' format. Adrian Nockles showed us how he had added sound to his tramway auto shuttle using the DF Media Player. Peter Denton gave an overview of the Hornby HMDC control system which he is using on a railway for his grandchildren. Chris Sharp explained his Arduino controlled Balloon Loop. We noticed that we couldn't hear the sound effects from either Adrian or Peter's demos. A group interrogation of Zoom's audio settings led to a discovery: the App has some very clever features that filter out background noises. A tweak to the settings and we could then hear their various bells, whistles, chuffs and whooshes.

Our modular baseboard project continues to grow. Our July meet up will give members the opportunity to bring their boards and we will attempt to join them all up and run some trains. We have a full calendar for 2023 and into 2024. If the Yorkshire Area Group is your nearest, we encourage you to join and get involved.

Chris Sharp

East Midlands Area Group

This was our first area group meeting since September last year. As the East Midlands is a large area, we like to have our meetings at different venues throughout the area, ideally with some railway or model railway connection. This meeting took place at the Kingsway Centre in Wellingborough, home of the Kingsway Model Railway Society (KMRS). Thanks to KMRS for hosting this meeting for us, and providing refreshments.

There was plenty of model railway activity to see, which included the KMRS 00 gauge layout which uses MERG DCC and CBUS, together with their analogue N gauge layout. Pete Brownlow brought the Missenden St Mary's layout, which he looks after for Chris Langdon. This uses MERG DCC, CBUS and JMRI as well as other MERG kits such as Hectors and DTC train detectors.

Roger Barker gave a welcome and introduction to KMRS. James Cunningham gave a talk on his new role as MERG Treasurer. Then Pete Brownlow gave his CBUS & DCC update, covering the new MERG CANCAB kits and new features now and coming in the CANCMD command station. One of the new encoder cabs was available for members to try.

After the coffee break Mike Collins gave a detailed talk about the updated ATC kits, being developed for the Kit Locker, with a comprehensive demonstration. Judi Rastall gave an update, via Zoom, on changes in the running of the

Kit Locker and the team structure, necessary to keep up with continuing growth of what is now a massive operation.

The afternoon session had plenty of activity with the three layouts in operation, Mike's ATC demo working, together with Colin Head's DCC demo, with which he was giving instruction on loco DCC settings. Whilst this was all going on, members were getting help with their kit problems and Pete Brownlow demonstrated building a CANMIO in one hour. In fact, the build was complete in about 40 minutes, then a few more minutes to do static voltage tests and fit the ICs.

We had about 25 people attending in the room, with another eight joining via Zoom. Our next face to face meeting will be in July, kindly hosted by Judi Rastall in Sutton on Sea, then in September we will be visiting the Lincoln and District Model Railway Club at Aisthorpe Village Hall near Lincoln. Keep an eye on the diary page on the MERG website for more details. Thanks to John Wood for taking the photos.

Pete Brownlow

Editor's note: Due to an oversight on my part, this report and a selection of photos from the East Midland Area Group were not published in the June 2023 edition. My apologies to Pete Brownlow, John Wood and members of EMAG.

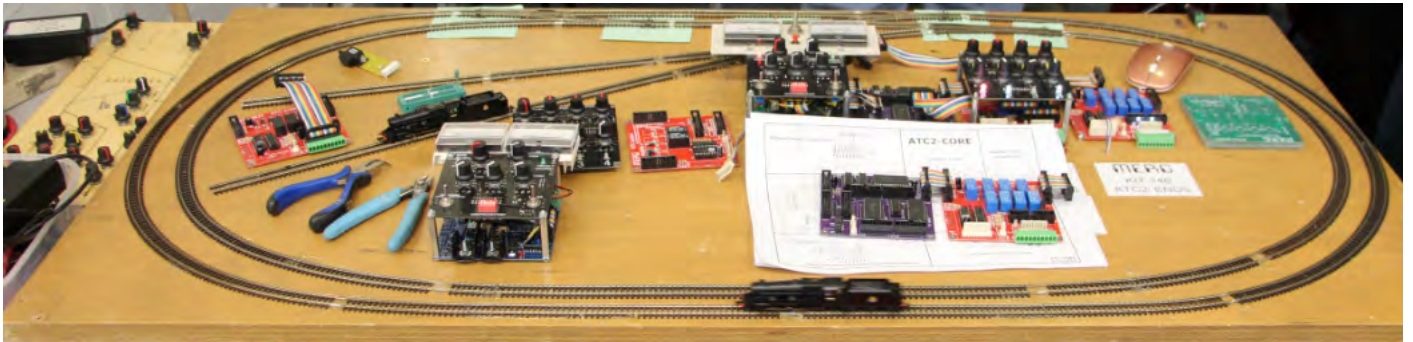


Figure 1 - Mike Collins' ATC demo layout, with the new ATC kits on show.



Figure 2 - Mike Collins gave a talk and demo of the new ATC analogue shuttle kits.



Figure 4 - Pete Brownlow demonstrating a CANMIO build in less than one hour.



Figure 3 - Our Motley group.

Special Interest Groups

3D Special Interest Group September Update

The 3D Sig has been quiet the last few months due to John Holmes taking a long vacation and having limited internet access for holding Zoom meetings. He has been working on the Knowledgebase to try and make that more user friendly. Eddy has decided to step down from his role within the SIG which is a great shame as he has made a lot of great information available on many topics for the group to learn from. I would like to thank him for the work he has put into making the 3D SIG what it is today.

So What Has The Group Been Up To?

The first item I would like to bring to your attention is the creation of this page on the Knowledgebase:

'How To Create an AA Telephone Box In Fusion 360'



Picture of Russ Davies' AA box on his layout

MERG Knowledgebase link:
https://merg.org.uk/merg_wiki/doku.php?id=sig:3dsigtv:russ_aa_box

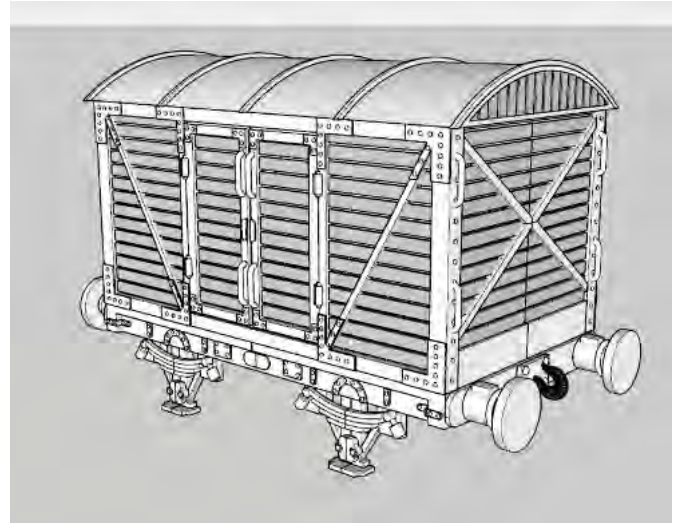
This Knowledgebase page shows you how to create a 3D printable AA telephone box in Fusion 360. There are two videos that walk you through the various stages of designing it. This has been made possible thanks to Russ Davies who gave the presentations to the SIG.

The STL file is available via the Cardiff AG website:
<https://cardiffag.org.uk/>

	
Part 1: https://youtu.be/X_AZQXHhUbk	Part 2: https://youtu.be/1vaMqkOI5Ms

You will need to create an account to log in and here you will find a number of 3D Files and other items of interest.

The second item I would like to present is: 'How To Create A Wagon In SketchUp'.



Eddy's wagon created in SketchUp

MERG Knowledgebase link:
https://merg.org.uk/merg_wiki/doku.php?id=sig:3dsigtv:wagon_demo_sketchup

This Knowledgebase page pulls together a series of 14 videos that Eddy gave to the SIG about how he designs his wagons for his Essex Brick layout. He demonstrates many great techniques using Sketchup Plugins which are free, except for one which is a paid Plugin.



Part 1: <https://youtu.be/3Ay4pUWlJvg>

After the first video they are broken down into short sections, which make it easy to follow his workflow when designing his models.



Signal Box designed in Fusion 360 - Russ Davies
<https://a360.co/3tiPxPf>

Future Meetings

In the next few months we will start to look at laser cutting with talks planned by Andrew Hick showing how he used it to create a sliding fiddle yard. We will also carry on with the Fusion 360 talks given by Russ Davies and Jon Mynott.

We have a number of other people waiting to show what they have been working on.

John Holmes 8528

Returning to the MERG committee, what has changed?

Paul Howes

I previously served on the committee as Membership Secretary for many years. During my time on the MERG Management Committee (MMC) I held a good working relationship with all other members. One of my major inputs was to put through major changes to the way MERG membership was handled and thus provided a base specification for MOMS (MERG Online Membership System) which has proved pivotal to many other areas of administration since its launch.

What then has changed? Well of the people on the Committee, I think only Keith Norgrove remains. But despite the change in personnel there is still an underlying desire to help MERG change and develop as membership increases and workload for individuals increase. Meetings have changed from a morning to all day and yearly strategy meetings are now tagged onto a normal meeting and scheduled over a weekend.

Given that the membership is ever increasing and now tops 4000 worldwide it seems to me the steps being taken to ensure MERG copes with a larger membership pool are now much greater. Significant changes are being implemented that help us all share the burden and key areas are now being viewed as teams of members rather than individuals.

Large steps means we as a Committee have to make larger decisions which will impact on MERG for the foreseeable future, hopefully in a positive way.



Looking back on my first tenure, most decisions appeared less radical and the potential of MOMS was not completely foreseen. One thing has remained constant throughout and that is the desire of all Committee members to act in the best interests of MERG as an organisation. Do not be misled that we always agree on everything! Sometimes a member of the Committee will disagree and their view either is changed by discussion or modifies the proposal. This is why we have 12 diverse members serving so that we can consider all views and get behind the best solution. Knowing that other members of the Committee back the idea helps it progress with confidence.

This is my second period on the MMC, I feel that my views are valued by others and that I value their views. It requires commitment but I recommend a period on the Committee to any member who wishes to work with others to benefit MERG.

The MERG IT System - Update

Martin Da Costa, IT Manager

In March of this year, I wrote about the problems of having an IT system that was difficult to support and relied upon one person. Andrew Woollass has been working hard to get to grips with our systems and make sure that everything keeps running. This has been a very steep learning curve for him as he has had little support from his predecessor. The result is that whilst he now has a reasonable grasp of things, he is the new single point of failure. I am, therefore, delighted to advise that Jon Denham has come on board as Deputy Webmaster.

Jon has just the skills required to work with Andrew. Having two people able to maintain and support the website has already shown benefit, although this will have passed most members by. This is, of course, exactly how it should be.

Once I have finished writing this, I will be looking at the list of mailboxes with an @merg.org.uk address. I was staggered to find that there are over 60 mailboxes and over 200 forwarding addresses. The list does not seem to have been reviewed in a long time – if ever! This is just another example of the problems that have arisen as a result of having just one, overworked individual running the show.

Last time I wrote, I mentioned that I was completing a review of the IT system that had been started by the defunct IT System Steering Group. That review was completed with the help of various MERG members, presented to your Managing Committee at our January meeting and discussed in more detail at the Strategy Review at the beginning of April. As a result, budget was

agreed to develop a new website around the Joomla Content Management System (CMS). Our Vice-Chair, Andrew Hicks, has recent experience of developing a Joomla based CMS website and has taken the lead on laying the foundations for our new website. One of Jon Denham's first tasks as Deputy Webmaster was to produce a clone of our site to allow experimentation and testing of the migration to Joomla, without impacting upon the day to day running of the active site. Jon will be heavily involved with website migration when the time comes.



Andrew Hicks already has a heavy portfolio and cannot be allowed to become another single point of failure. In addition, it is necessary to ensure that we have good documentation to secure our systems for the future. We are thus looking for volunteers with experience of CMS systems, preferably Joomla but that is not essential. We also need to start building a team of technical authors as it is never too early to start documentation. By building teams, the overall task can be shared and thus not be too onerous. If you have experience in any of these areas, please email me at: itmanager@merg.org.uk

The very existence of MERG is dependent upon members being prepared to volunteer a bit of time for the common good. Building teams to address the various tasks ensures that the load is not onerous. Contributing can be a very rewarding aspect of the hobby that we all enjoy.

Membership Feedback

Emily Johnston, Journal Editor

Upon renewing membership, members are afforded the opportunity to tell the Managing Committee what they think about MERG. There are nine questions: three are free-form and six require a response to specific options. More of those results anon. This summary covers all aspects – not merely those responses relating to the Journal – from mid November 2022 to mid June 2023 from 453 respondents.

MERG Journal

Overall members appeared to be satisfied with the Journal recognising that, as a member-led organisation, we can only publish what authors submit. The new look design is welcomed. Members would like to see more of whatever interests them – it's a long list – and less of other subjects. One respondent highlighted that PC users are well catered for, though little thought has been given to those with Apple Macs. There is a clear desire for articles which explain the practical application of MERG kits on layouts, such as accessory control – not merely how a kit's electronics works – and more content aimed at beginners. Davy Dick's free e-book "Electronics for Model Railways" is an excellent primer for electronics neophytes, praised for its clear explanations and broad content. [1]

It is apparent that CBUS articles are a turn-off – a primer would be welcomed – with real world examples of how to use the somewhat extensive and bewildering range of modules. One respondent commented that MERG should change its name to "Model Electronic Software Group", another that articles "... may as well have been written in ancient Sumerian for all the sense they make ..." and a third that the Journal was "... becoming close to a programming journal." Fair comment – the popularity and economy of Arduino and Raspberry Pi modules is the driver behind so many articles including code listings. The solution is for members to send submissions about electronics and the practical application of their design or MERG kits used on their layouts. Several articles about Area Group demonstration layouts currently under construction have been commissioned.

Looking at past Editorials and summaries of renewal responses by my predecessors there is a familiar pattern: members appreciate what is published, beginner's and explanatory articles are a perennial request, lengthy and complex articles have little appeal except to experts. The nature of MERG is changing, it is no longer the province of those skilled in electronic design – though the organisation could not exist without them. An opt-out of the printed Journal or digital-only subscription is another reoccurring topic. It goes back over a decade since the download of Journal PDFs was introduced. Current policy is unequivocally that the Managing Committee considers distribution of the printed Journal as a fundamental part of the membership offer.

Area Groups and Special Interest Groups

There is a 50:50 split between those who are members of AGs and SIGs and those who are not. There are a number of reasons stated for the latter: distance, timing or infrequency of meetings, the lack of AG Zoom meetings, also no response to queries about the Group or simply that a particular AG or SIG is inactive or non-existent. On the

whole, those subscribing to an AG or SIG expressed satisfaction and praised those leading them.



Have you watched any of the recorded sessions from AG or SIG meetings via MERG TV?

Yes	147
No	173
Keep meaning to look	86
Never heard of MERG TV	15
No answer	32
Total number of responses	453

If you have encountered a particular electronics problem recently did you find help from the Forum?

Provided an answer to my problem	77
Gave me some clues which enabled me to sort the problem myself	97
Too many disparate suggestions	21
No help whatever	25
No answer	233
Total number of responses	453

When building MERG kits have you found the documentation:

Just what was needed to get the module working	298
Difficult to follow and understand	9
Could be more explanatory as to how the kit works	43
Superfluous as I can build to the schematic	8
No answer	95
Total number of responses	453

When starting out in MERG and its website would you have found a personal guidance mentor?

Not necessary	183
Good to exchange ideas with	71
Essential for finding my way around the website	21
Handy for early education in electronics	83
No answer	95
Total number of responses	453

Do you use a Layout Control BUS (LCB)?

PTP-Lite	5
EzyBus	20
CBUS	132
DCC - Accessory Control	67
Other	59
None	112
No answer	58
Total number of responses	453

What system do you use to control your trains?

Analogue DC	73
MERG DCC	103
Commercial DCC	176
Radio	5
Other	51
No answer	45
Total number of responses	453

How the Managing Committee could improve MERG.

Members acknowledge that the current Managing Committee are doing a good job with a few caveats about:

- The Forum: rules have recently been revised and greater moderation introduced. Keith Norgrove explains these changes elsewhere in this edition
- Greater transparency over decisions and responsibilities: see the Journal's regular position pieces by Committee members explaining key issues and timely publication of minutes on the Knowledgebase
- The website being difficult to navigate: a new one is being designed from the ground up. Martin Da Costa has an update in this issue.

Finally one respondent – to be clear I have no access to the identity of those providing comments – requested “free biscuits”. Alas we cannot include them with the Journal as they will suffer in transit or be seized by customs.

References

[1] <https://www.merg.org.uk/content/ebook>

New Forum Rules

Keith Norgrove, Web Content Editor

Although we, your Committee, get compliments on the friendliness of the Forum from those who use it – including from new joiners introducing themselves – there is also a background of complaint from others who feel unwelcome or patronised. As we don't like any of our members having such feelings we established a small subgroup to look at the forum rules and the moderation process to see what improvements might be possible.

This subgroup comprising: John Fletcher, Andrew Hicks, Keith Norgrove and Francis Pritchard took the view that the rules should be made clearer, both in the standards

expected of forum contributors and in the moderation procedures required when the rules are not followed.

All members contributing to the forum are required to follow these rules so that all will feel welcome on the forum and that, as a result, the moderation provisions for serious rule breaches will never be needed.

The rules and the identities of the moderators are published on the forum.



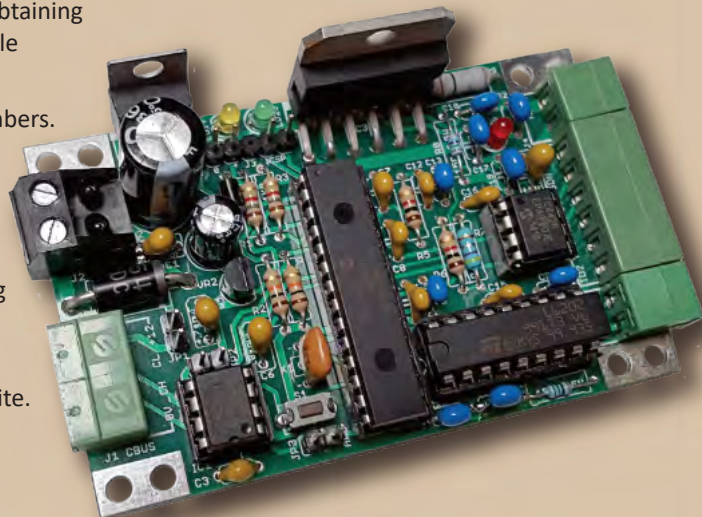
DCC COMMAND STATION AND BOOSTER

Railway Modelling Experts Ltd. (RME) was formed to facilitate MERG members obtaining PCB's, kits and other items not available through the MERG Kit Locker.

The three Directors are all MERG members.

This photo shows a completed CAN Command Station and Booster [CANCSB] offering a 3 amp digital output for the track, Programming track output and communication using CBUS. This kit is sold as a bag of bits with the instructions available on line.

There's lots more to see on our Web site.



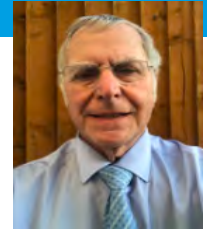
All items on our website are supplied by RME, not by MERG. There is no intention to duplicate any item in the Kit Locker. RME is responsible for after sales support and MERG itself has no liability for any of the items listed.



www.rmeuk.com

Getting New Kits into the Kit Locker

Paul Tompkins, Kit Sales Manager



General Principles

From time to time, there will arise an idea or proposal for a new MERG kit. This usually originates from a member who has developed an idea for their own use. Such a proposal may seem like a good idea to a group of members and may have been discussed by them on the forum. There is a specific subforum for such proposals, We have a defined procedure for kit introduction into the Kit Locker which assesses the technicality, desirability, difficulty and cost of what is suggested and is summarised below. see: <https://www.merg.org.uk/forum/viewforum.php?f=48>.

The process of kit introduction is coordinated by the Product Manager and since this task, in itself can be onerous, other members may be invited to assist where possible. This will also allow the Kit Sales Manager, Inventory Manager and the Treasurer to manage the resultant finances and stock arrangements with the minimum of confusion.

With those principles in mind consideration is given to need, assessment of likely sales volume, design, documentation and prototyping.

MERG has a comprehensive range of kits, many proposals will be for simplification or other improvements to existing designs. Some design changes are brought about by the poor availability of components where a partial or complete redesign may be required.

For any new design proposal, the Product Manager and the Technical Support Manager shall review with the proposer the merits of the new design. This may include liaison with the Kit Sales Manager to benefit from their experience in reviewing the quantity and type of any queries received on existing kits and estimating the likely volume of sales of the proposed kit. Due consideration shall be made of how a new kit will fit into MERG's existing range and which other kits might be displaced or become redundant as a result.

The objective of this stage is to estimate possible quantities, establish financial outlay and consider production security with respect to sourcing required components. A supporting role could be played by the production of a prototype kit complete with documents so that the Kit Management team and if needed the MERG Managing Committee can view the proposal in its entirety. In addition, planning for ongoing kit production shall take place which could involve canvassing the membership for a Kit Producer aka 'Elf'.

On completion, the Product Manager presents a case to the Kit Management Team for approval. They discuss the

case, decide whether it is valid and consider the production of the first batch of kits, subject to the availability of funds. They may agree to defer if it is impracticable at that specific time.

Once production of a kit has been approved the Kit Sales Manager allocates a kit number for accountancy and identification purposes and to allow the Product Manager to prepare the documentation including a Bill of Quantities (B of Q).

Documentation

At this stage, design and proposed documentation must be finalised and kit production resources and processes established. A willing Kit Producer will be located and apprised of the principles of kit production if necessary and method of purchasing/funding kit parts. Since the Inventory Manager will have ultimate responsibility for inventory and the Kit Sales Manager for sales and any resultant kit content queries/problems, it is important that they are fully involved.

Prototyping

Prior to the initial batch production, it is advisable that one or more prototype kits are test built by 'guinea pig' members whose feedback will help to refine and tune the design and documentation. The Product Manager, Kit Sales Manager and Kit Producer confer on the production process and ensure all sales/purchases are accountable. The Inventory Manager then finalises and prices the B of Q and advises on the suggested selling price.

The Kit Sales Manager will add the new kit and its PCB, where separately available, to the Kit Locker along with supporting documentation and make these visible when ready. The availability of new kits will be announced via email to Area Group leaders, via the forum (kit announcements subforum) and in the next Journal.

Resultant sales will be monitored by the Inventory Manager and the Kit Sales Manager as part of routine management to identify take-up rate and predict follow-on production volumes.

The Kit Management Team, principally the Product Manager once appointed will ensure that this development and production process is fully detailed in the Kit Development Progress Index which is part of our website knowledgebase. See: https://merg.org.uk/merg_wiki/doku.php?id=kits:kit_progress_start. By this means the members will be kept informed.

MERG AGM & Exhibition - The Oxford Event

Andrew Hicks, Vice Chairman



The MERG Management Committee (MMC) decided at its Thirsk meeting, held in April, that the 2023 AGM would restart as a physical as well as online event. It would include an exhibition as a celebration of all that is good about MERG and a gathering opportunity for as many members as possible. We aim to make this as enjoyable as possible and to end this year on a high note.

Following the successful Northern event in 2019, it was subsequently decided to hold this event in Oxford, on the basis of Oxford being in reasonable proximity to the largest cluster of south-eastern MERG members, having excellent rail links throughout Britain and a good number of MERG Area Groups able to support the running of the event.

The venue will be the West Oxford Community Association (WOCA) Hall on Botley Road, Oxford, OX2 0BT. This has the advantages of being in close proximity to Oxford Railway Station – closer than the length of the platforms from the station – easy road access from the A34 Oxford Ring Road, lots of nearby parking and hotels as well as several rooms with ample space for an exhibition, presentations, workshop, vendors plus an on-site café.



Venue floor plan (created by Phil Silver)

The Oxford Event will open at 10.30am on Saturday 28th October. Admission is open to all MERG members and free of charge. There will be a small exhibition of model railway layouts in the main hall, an hourly programme of presentations and demonstrations in the largest room, space for the Kitlocker and other MERG vendors in one of the side rooms and a workshop with soldering stations and experienced members able to give tuition to new and less experienced members in the other side room. At 3.30pm the Chairman, John Gowers, will judge the Cakebox Challenge entries in the Presentation Room. The exhibition will have closed at 3.15pm to allow the hall space to be cleared for the AGM which will start at 4pm. The AGM will also be available online via Zoom for members who cannot get to Oxford.

The AGM will include only the Annual Reports by the MERG Officers, followed by the announcement of the results of the various ballots for officers, committee and motions and then an opportunity for questions and discussion. This will

be primarily an online Zoom meeting in accordance with MERG rules and the moderation rules will apply equally to all attendees. Voting will be entirely online over the previous week, to allow maximum participation for all MERG Members equally, so there will be no further motions or voting at the AGM itself.

In a departure from previous practice and to build trust in the democratic process by which MERG is governed, the announcement of results this year will be managed entirely by a team of two independent Returning Officers – Nigel Phillips and Fraser Smith. They have been appointed by the MMC under existing rules covering the Independent Invigilator plus additional delegated authority from other Officers. Once this process has been seen to work in practice it will later be formalized within MERG's Rules. Having made many changes last year, the MMC felt it best to hold fire on further changes this year.

Details of how to submit motions and nomination forms for members standing for election will be posted in advance on the MERG Forum.

Timetable

16th September: final date by which all draft motions should have been submitted. There will then be opportunity for open discussion in the MERG Forum, during which time proposers may revise or withdraw their motions.

- 13th October: closing date for finalised motions and nominations to the MERG Managing Committee.
- 14th October: motions and nominations to be posted on the Forum with election statements from candidates.
- 15th October: 2pm online Zoom meeting – see below.
- 19th October: voting opens, exclusively online.
- 26th October: voting closes at 4pm, 48hrs before the AGM.

In a departure from previous practice and to address concerns due to online voting having closed two days prior to the AGM, an additional online Zoom meeting will be held on the 15th October after submissions have closed and before voting opens. This is to allow all MERG members to have the opportunity to question the candidates and proposers of motions and to express their views to the membership. Additional Zoom meetings will be arranged if extra capacity or time is needed. There should be no question of any MERG member feeling they have not had a fair chance to have their say.

We hope the Oxford Event in 2023 will be an enjoyable experience and an opportunity to remind ourselves just how special MERG is. It offers a chance to celebrate the work done by so many volunteers and for other members to contribute to the running of MERG by participating in the AGM. We hope as many members as possible will submit entries to the Chairman's Cakebox Challenge – the rules were summarised in the June 2023 MERG Journal (pages 50-51) and in the MERG Forum. We look forward to seeing you there and enjoying a really fun day together.

Notes from the MERG Chairman

John Gowers

It won't be long, by the time you read this, before we have our Annual General Meeting (AGM). So what have we achieved since our last AGM?

The MERG Managing Committee (MMC) had realised fairly early on in our term of office that many of our official posts needed to be run by a team. This would allow for the excessive work load to be spread more evenly, guard against having one point of failure, enhance MERG's resilience in the future, be able to cope with an increase in membership numbers and would permit a new member of the MMC to gain an understanding of what is needed should they decided to take on more responsibility within MERG.

Our Treasurer, James Cunningham, now has two further helpers, John Davy and Terry Lawson.

Our Webmaster, Andrew Woolass, has help from Web Team Manager Martin Da Costa and Jon Denham, Deputy Webmaster.

Our Journal Editor, Emily Johnston, is helped by Graphics Editor Phil Silver and Production Russ Davies.

Our Kit Production Team headed by Judi Rastall is assisted by Paul Tompkins, James Cunningham, Martin Perry, Andrew Hicks, Phil Wheeler, Simon West and Tim Callun-Pratt.

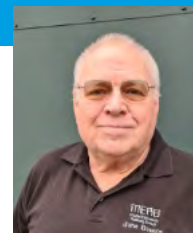
We have tackled some difficult areas in MERG's financial situation which has led us to increase the Membership fee this year. This was not something we undertook lightly, nor with any pleasure, but we believe will set us up to be financial secure in the future.

We are continually striving to be open with our communication and ensure that members are kept informed about all our decision making process, which I hope you will have picked up from the Forum and Journal reports.

The MMC realised at the beginning of our term how critical the MERG Website was to the running of MERG. After some months of investigation and decision making we have decided on a course of action which is being implemented by Andrew Hicks, with assistance from Andrew Woolass, using the Joomla Content Management System aka CMS.

Under the editorship of Emily Johnston we have revamped the look and content of the Journal. We have also been able to radically reduce the cost of printing it.

Under the leadership of Publicity Officer, Phil Silvers, we have introduced a new logo and look to our adverts which appear in mainstream and niche model railway publications. The fruits of his work will gradually filter through other media including exhibition flyers and the new website, presenting a more up-to-date image of MERG.



Young MERG has gradually increased the number of its members, currently four (in July 2023) ranging from ages 12 to 17. MERG will continue to encourage growth in this area of our membership.

John Fletcher, Area Group Liaison, has been hard at work promoting the benefits of Education and Training in MERG through interaction with Area Groups and outside organisations such as Missenden Railway Modellers. This is an area your Committee feel is very important for the continued health of MERG in a rapidly changing electronic environment.

We have been present at a number of Model Railway exhibitions both national and local. These are led by Ian Macdonald with the assistance of Area Groups at the local exhibitions. Our aim is to grow our membership and keep MERG in the forefront of railway modellers' minds.

Moderation of the Forum has been high on the MMC agenda and we have now established a team under the leadership of Web Content Editor, Keith Norgrove. This team with a clear set of rules and processes will curb the excesses that some time appear on the Forum.

The Committee have endeavoured to eliminate shortcomings in the AGM, in the light of past frustrations within the membership and in a desire to facilitate as many member's attendance as possible. Whilst it has been accepted that a face to face meeting would be the best option it is recognised that this would prevent many members attending due to geographic location. We have therefore concluded that we should run the AGM online. Andrew Hicks and Ian Macdonald have been tasked with running an event in Oxford – see Andrew's article in this edition for details.

Whilst I have highlighted some of the work carried out by your Committee over the last 12 months on your behalf, I should also mention and thank the many members who have also contributed to a successful MERG, be they kit packers aka Elves, electrical engineers, Area Group leaders, long suffering partners or indeed tea providers.

New subscription rates from 1st July 2023

UK - £24, EU - £26, Rest of the World - £30.
All per annum plus a one-off joining fee of £5.

The option to subscribe for multiple years has been withdrawn.

Committee News

Membership Report

Here is the distribution of MERG's 4040 members by country as at 03/07/2023. The figures in brackets are changes in membership since the beginning of 2022.

UK/Islands - 3321 members

Isle of Man 6 (8); Jersey 2 (3); United Kingdom 3313 (3193)

Europe - 204 members

Belarus 0 (1); Belgium 7 (7); Cyprus 2 (4); Denmark 12 (10); Finland 6 (6); France 29 (30); Germany 9 (11); Greece 2 (1); Hungary 1 (1); Ireland 41 (29); Italy 8 (11); Latvia 1 (1); Malta 1 (1); Netherlands 27 (17); Norway 7 (7); Poland 0 (1); Portugal 5 (5); Romania 1 (1); Slovakia 1 (0); Slovenia 2 (1); Spain 15 (18); Sweden 18 (22); Switzerland 9 (9)

Rest of the World - 515 members

Australia 232 (181); Brazil 1 (1); Canada 50 (44); China 5 (4); Hong Kong 2 (2); India 1 (2); Israel 2 (2); Mexico 1 (0); New Zealand 43 (38); Singapore 1 (2); South Africa 2 (2); Taiwan 0 (1); Thailand 1 (1); United States of America 174 (143)

Francis Pritchard
Membership Secretary

Groups, Education and Training Report

Area Groups and SIGs

The Virtual Area Group has held some Zoom meetings. I see this as a way to hold meetings which bridge between the interests of different SIGs and also provide for members who do not have an Area Group they can join. There are a number of members in France although they are very scattered in location. I have explored with some of them how they can be supported.

Missenden Courses

I visited Missenden recently with Andrew Hicks to discuss with Mark Riddoch and Chris Langdon how MERG can work with the Missenden Model Railway group. I now understand much better how they work. The number of residential places available to them for the November weekend is limited. They advertise the courses for 2023 in May and the places are now nearly all taken. I sent details to the Area Groups in the UK. This means that we need to work with them already to plan for 2024.

Missenden is a very attractive location. The limitations on numbers mean that it can only be available to a small number of MERG members in any one year. I would like to explore how the sort of courses which run there could be replicated elsewhere. I know that some Area Groups have run courses. I attended one run for the Somerset group.

Guidance for Area Groups

There are set of action points for me which I have not progressed. I will work on these in the next period.

Education Resources

I have continued to work to improve the accessibility of the Knowledgebase, particularly by improving the indexing of areas where new content has been made.

Group Membership

Group	Current
Aberdeen	42
ANZ Virtual	45
Australia Capital Territory	14
Canterbury	11
Cardiff	91
Croydon	33
Cumbria	70
East Anglian	185
East Midlands	485
East of Scotland	122
Ireland	59
North America	67
North West	317
Northern Ireland	37
Scottish Borders	51
SE Queensland	85
Somerset	256
South Hants (Southampton)	185
Tayside	79
Thames Valley	338
Three Counties	118
Victoria	16
Virtual	786
Wales North	67
Warwickshire / North Oxfordshire	327
West Midlands	238
West of Scotland	288
Yorkshire	156
Total excluding Virtual	3782
3D	185
Arduino	563
Automation	342
CBUS ANZ	60
CBUS Development	80
DC	93
E101	40
Education	77
EGG	34
JAL	84
PI	134
RFID	57
Total	1749

John Fletcher
Area & Group Liaison, Education & Training Manager

Summary of Committee meeting 18th May 2023

Introduction

The Managing Committee met via Zoom, as previously agreed at Thirsk, with 11 members present. Apologies were offered by Ian Macdonald who was unable to attend due to work commitments. Chairman John Gowers welcomed everyone.

Action Points

Department heads responded to the list of action points, previously circulated. Kit Locker Manager Paul Tompkins reported that four new Kit Producers (aka Elves) have been appointed.

Subscriptions

The notice of revised subscription rates was published on the Forum and distributed via e-mail to every member. In addition it is reproduced on the June Journal's cover sheet, Emily Johnston, Journal Editor, reported that this issue was being printed and would be mailed within a fortnight. Member's reactions to the rise in subscriptions were mostly positive, appreciating the need for this increase, the first in ten years. Secretary Francis Pritchard received 22 e-mails, three quarters of which were supportive. Web Content Editor Keith Norgrove gave a historical perspective, stating that the subject was discussed by previous Managing Committees every year. During that period, reserves were adequate, costs were stable and there was minimal need for investment.

Forum moderation

Keith Norgrove circulated a draft of Forum Rules for comment. He has set up the means to moderate user's content within the phpBB system which the Forum uses. It was agreed that Keith, Francis and John Fletcher would meet to progress this item.

AGM 2023

The possibility of holding the AGM and an exhibition at Taunton was investigated by Paul Howes, Francis Pritchard and Vice Chairman Andrew Hicks. It was deemed to be impractical due to the lack of suitable venues, hotels, railway connections and only one nearby Area Group to provide support for the event. Other locations with a larger cluster of Area Groups were examined. Oxford was suggested, there are five AGs nearby, hotels and a potential venue – the West Oxford Community Centre – available for hire on our chosen date. It is conveniently situated next to the railway station which has good connections to the rest of the mainline network.

Andrew Hicks gave an illustrated report on the facilities available, including the on-site cafe and parking. The possibility of admitting the public for a fee to cover hall hire costs was debated, it was felt that the event should be open to members only. Three layouts from local clubs are available, there is space for small vendors and potential presenters are being approached to give talks and demonstrations.

It was agreed to confirm the provisional booking of the hall, a notice will be circulated via e-mail and the September Journal. An AGM sub-Committee comprising Andrew Hicks, Francis Pritchard and Paul Howes will coordinate event planning.

The need to appoint a Returning Officer for the AGM was discussed.

Other business

Francis Pritchard confirmed that minutes of the Managing Committee had been added to the Knowledgebase.

Emily Johnston

Summary of Committee meeting 17th June 2023

Introduction

The Managing Committee met at Keen House, London with 11 members present and Emily Johnston joining via Zoom. Chairman John Gowers welcomed everyone, noted the extensive agenda and stated that ad hoc interim meetings via Zoom would be required. The minutes of the April and May meetings were approved.

Content Editor's Report

The draft rules for Forum moderation were approved. Web Content Editor, Keith Norgrove, will write an explanatory article for publication in the September issue of the Journal.

Membership Report

The Secretary Francis Pritchard highlighted problems with out of date Standing Order payments as the amount paid to MERG is fixed – unlike a Direct Debit. Options were discussed to make payment easier and up to date in the future.

IT Manager's Report

Martin Da Costa reported on progress that Andy Woollass and Jon Denham were making with the current IT system and testing of its replacement using the Joomla Contents Management System. Emily Johnston advised that Technical Authors be recruited early to document the new system, rather than relying on system developers. Two volunteers have been approached. The recently introduced PDF flipbook for back issues of the Journal was reviewed and issues requiring resolution noted.

Events and Exhibitions Manager's Report

The Events & Exhibition Manager, Ian Macdonald, expressed considerable and understandable disquiet at the lack of consultation with him about the planned exhibition at the 2023 AGM. This was discussed during the May Zoom meeting when Ian was absent due to work commitments. John Gowers and Andrew Hicks apologised profusely for the omission. Ian suggested that Managing Committee members should attend other shows where ever practical which received the Committee's support.

Kit Sales Manager's Report

Paul Tompkins reported that UK sales were slowing whilst those elsewhere accelerated. Loss of parcels in transit have risen from one per year to four per month. International tracking will be introduced and factored into dispatch charges. At present the Kit Locker Team (KLT) is overworked, understaffed and relies on key volunteers who may step down. Clearly extra volunteers are required to take over retiring member's duties and to augment the KLT. Also, a review the KLT's management structure is required.

Treasurer James Cunningham expressed concerns about stock levels, sales, inventory and spikes in purchases depleting MERG's reserves. Historically six month's reserve stock is held to cover wholesaler's shortages. Paul Howes felt that a intelligent stock control system was required. Andrew Hicks noted that the bulk of the funds set aside for IT are earmarked for (1) Accounting and (2) Inventory systems, rather than for the website itself. Joomla (and likewise other comparable CMS systems) does not cover this complexity of requirement. These will need to be distinct systems from the website, though potentially integrated via bridging software.

There was discussion as to whether the CBUS range should continue to be branded as exclusively CBUS, given alternatives such as VLCB and OpenLCB that would equally run on the same hardware. It was decided to leave such decisions to the discretion of the Kitlocker Management Team.

Journal Editor's Report

Due to technical problems with the Zoom link throughout the day Publicity Officer, Phil Silver, delivered Emily Johnston's report. He stated that their recent meeting in Cardiff with Production Manager Russ Davies had been successful, covering workflow, technical issues, design and the use of Dropbox to replace the Journal's FTP server – a demonstration will be organised and procedures tested. A sample of the June Journal in 'Polywrap' – a compostable alternative to using paper envelopes – was passed around. Since a one year trial four years ago Polywrap has become cheaper than paper envelopes and the Committee endorsed Emily's decision to use it for the September mailing. Andrew Hicks stated that he had visited a number of Area Groups and all were delighted with the new-look Journal's design and direction.

Publicity Manager's Report

Phil Silver displayed samples of artwork featuring a Pocket Money Kit, to be used for advertising MERG in mainstream Model Railway magazines. John Gowers felt that a balance was required as providing PMP kits is only part of what MERG offers. Andrew Hicks added that having a range of advertisements would be beneficial, focusing on other benefits of membership rather than merely promoting kits.

Contingency Planning

James Cunningham highlighted the risks of MERG continuing as an unincorporated body with unlimited liability for MERG's four Officers and the eight Committee members, a situation which cannot continue. Andrew Hicks has examined other risk factors such as child protection which is in hand and certification for MERG kits. Francis Pritchard reminded the Committee that he had suggested MERG seek charitable status a few years ago.

Communications and PR

Phil Silver's designs and work on the new logo, exhibition flyer and Journal covers was praised. Emily Johnston suggested MERG uses a standard letterhead for both internal and external communication.

Event and Exhibition Planning and External Relationships

Andrew Hicks reported progress in organising the 2023 AGM and exhibition including the Area Groups who are likely to attend and those offering to bring layouts. A subcommittee already exists to manage preparations for the AGM. A further subcommittee including Andrew Hicks and Ian MacDonald, plus representatives of the Area Groups supporting the Oxford Event, will manage preparation for the exhibition. A lengthy discussion covered logistics and video streaming the event. Andrew proposed appointing two returning officers – Nigel Philips and Fraser Smith – to oversee voting. Phil Silver described his draft advertisement for the event, designed to be used as a template for subsequent events.

Treasurer's Report

Treasurer James Cunningham's report focused on year end accounts, highlighting that gross stock had been reduced to a net realisable value and that the level of gross stock was one year of sales and in his view, too high. The Committee were requested to examine the accounts and confirm that they progress to examiner review – this was agreed. Post Meeting: Accounts were presented to our Examiner and responses made to her requests for information. James has asked that she completes her review by end of July.

James stated that MERG needs to rely less on spreadsheets for Treasury activities and more on accounting software. Post Meeting: John Davy is starting an exercise to prototype a solution in Xero (cloud-based accounting software). We are working towards a switch to Xero in April 2024. As part of this, we need to offer alternative methods of payment.

Date and venue of next Strategy Meeting

Suggestions for a new venue to hold next year's Strategy Meeting were requested so that a decision may be made at September's meeting.

Any Other Business

John Davy joined the meeting to be interviewed for the post of Deputy Treasurer. Due to lack of time the decision to appoint was deferred and agreed via e-mail. Post meeting: Terry Lawson, John Davy and James Cunningham are holding regular Zoom calls to plan our responsibilities and ways of working. It is anticipated that Terry can commence Accounts Payable early in July.

Paul Howes stated that MERG's media had a far more professional look than in the past.

Dates of Meetings

Committee: 23rd September and 11th November at Keen House, London.

AGM: 28th October at West Oxford Community Centre.

Emily Johnston

Vacancies

Journal Proof Readers

The Journal Team requires additional Proof Readers check edited articles, reports, notices then sections of the Journal prior to its release for printing.

Articles submitted to the Journal often include small grammatical, typographical or spelling errors and it is very difficult for the authors to proof read their own articles to eliminate these. It would be very helpful if these errors were spotted and corrected before the articles were set for publication. Although our editors do their best to spot these errors, some evade their scrutiny.

Prior experience of proof reading is essential. Items will be allocated by the Editor as befits an individual's area of expertise or interest.

Journal Technical Editors

The Journal Team requires additional Technical Editors to handle an increase in workload and cover for those who are temporarily unavailable.

If you have the skills and experience would you be interested in such a post? Ideally you should be familiar with the peer reviewed system of working.

Technical Editors:

- Work with authors to ensure article content is accurate, understandable and informative
- Conforms to the Style Guidelines (currently under review) to facilitate final layout and formatting by Production Editor
- Rewrites and edits as necessary to achieve the above without submerging author's personal style
- Works through diplomacy and consensus in preference to direction
- May act a proof reader for some articles of other editors and overall issue.

Articles will be allocated by the Editor as befits an individual's area of expertise or interest.

The Graphics Editor ensures photographs, schematics and other imagery are of suitable quality for publication prior to articles being edited.

British Railways Amateur Radio Society **RAILS and RADIO**

April 2023



GM6HGW: 60163, Tornado at Ladybank, Fife

In this issue:

- Editorial - President's Viewpoint - Chairman's Chat
- Secretary's Report - AGM 2023 - Membership Secretary's Topics
- My Interest in Radio, Buses, Trolleybuses and Trams
- Model Railway Exhibitions - The Loco Remembered
- Model Railway Exhibition at Mansfield
- Model Railway Exhibition at Belper - George Boole
- Storm Proof VHF Slim Jim Aerial - Amateur Radio Rallies
- Society Information - Who to Contact - Members' Photos

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Connect Create Contribute

CANPAN kit shown - Mimic Panel Interface allowing up to 32 LEDs and 32 Switches / Pushbuttons

Additional Volunteers

Journal Technical Editors

Reg Bundock M3380
Jan Carr M7381
Andrew Donald M9261
Marty Hillier M9610
Keith Moore M5199
Paul Redhead M3685
Tony Shaw M9032
Fraser Smith M5154

Journal Proof Readers

Michael Cox M1777
Alistair Donaldson M332
Jeff Dukes M9206
Andrew Longdon M5802
Ian Macdonald M6216
Wayne McKenzie M4484
Keith Norgrove M764
Simon West M2542

Kit Developers (for current kits)

Pete Brownlow M1741
Martin Da Costa M6223
Davey Dick M1853
Dave Fenton M9969
Bob Gledhill M2309
Gordon Hopkins M328
Dave Harris M2740
Ian Hart M546
Ian Hogg M5144
John Matthews M976
David McCabe M4933
Judi Rastall M3086

Martin Perry M1481
Fraser Smith M5154
Howard Watkins M615
Simon West M2542

Kit Management Team (KMT)

Andrew Hicks M6962 -
New Shop Development
James Cunningham M5733 -
Financial Support
Judi Rastall M3086 -
KMT Chair plus New Kit Production
Martin Perry M1481 -
Document Control & Admin
Paul Tompkins M5231 -
Kit Sales Manager
Phil Wheeler M3645 -
Inventory Manager
Simon West M2542 -
Tech Support

Kit Producers - aka Elves

Malcolm Asker M6456
John Ball M7098
Anthony Braithwaite M4418
Timothy Calnun-Pratt M7133
Chris Cotterill M4818
Rob Cottrell M2924
Mike Collins M2563
Mike Cox M1777
Michael Cullen M3048
Robin Eccles M5485
Bob Farish M4468

Harry Fielding M3812
Allan Geekie M5173
Alan Goss M3051
Barry Grafham M5263
Andrew Hicks M6962
Bob Hull M2551
Charley Johnston M2453
Chris Noble M3237
Keith Norgrove M764
Brian Norris M2616
Graham Overton M7746
Alan Pearmain M1755
Robert Pickford M4287
Judi Rastall M3086
Andrew Robb M4360
David Sawyer M4451
Fraser Smith M5154
Mark Thornber M3748
Paul Tompkins M5231
Dick Venn M6758
Howard Watkins M615
Simon West M2542
Phil Wheeler M3645
Dave Woods M3869



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Exhibitions with a MERG presence

September

Guildex 2023

Bingley Hall on Stafford County Showground.
Weston Road. Stafford
2nd-3rd September

The International N Gauge Show

Warwickshire Event Centre, The Fosse, Fosse Way,
Leamington Spa, Warwickshire CV31 1XN
9th-10th September

Ayr MRC

Walker Hall, Troon Town Hall, South Beach,
Troon, KA10 6EF
16th-17th September
<https://ayrmrg.co.uk/>

October

Wexford MRC Exhibition

St Joseph's Community Centre, Wexford, Y35 A66C
8th October
Opening Times: 11am-5pm
<https://www.facebook.com/events/st-josephs-community-centre/wexford-model-railway-club-annual-exhibition-2023/746731636793572/>

Greenock MRC

Kyle Kirk, 31 Union St, Greenock, PA16 8DD
21th - 22nd October
(Saturday: 10:00-17:00 Sunday: 12:00-17:00)
<https://www.greenockmrc.co.uk/>

Aberdeen Model Railway Club Exhibition

Curl Aberdeen, Eday Walk, Aberdeen AB15 6LN.
28th-29th October 2023
Opening times: Saturday 10:00-17:00 Sunday 10:00-16:00
<https://www.facebook.com/AberdeenModelRailwayClub>

South Dublin MRC Exhibition

Blackrock College, Dublin, A94FK84
28th-30th October (Bank Holiday)
Opening Times: 11am-5pm daily
Website: <http://sdmrc.ie/2023/05/11/sdmrc-model-railway-and-hobbies-exhibition-2023/>

November

Falkirk Model Railway Exhibition

Grangemouth Athletic Stadium
Kersiebank Avenue, Grangemouth, FK3 0EE
18th-19th November 2023
(Saturday: 10:00-17:00 Sunday: 10:00-16:30)
<https://falkirkmrc.com/falkirk-model-railway-exhibition-2023/>

Newcastle & District Model Railway Society

Tyneside 2023 Model Railway Exhibition
Jesmond Park Academy, Newton Road,
Newcastle Upon Tyne, NE7 7DP
11th-12th November
(Saturday: 10:00-17:00 Sunday: 10:00-16:00)
<https://www.newcastlemodelrailway.org.uk/exhibition>

Warley National Model Railway Exhibition

Birmingham NEC
25th-26th November
<http://www.thewarleyshow.co.uk/index.html>

December

Renfrewshire MRC

The Paisley Centre, Causeyside St, Paisley, PA1 1UQ
2nd-3rd December 2023
(Saturday: 10:00-17:00 Sunday: 11:00-16:00)
<https://www.renfrewshiremrc.co.uk/paisleyshow.html>

Manchester Model Railway Show

Sugden Sports Centre, 114 Grosvenor Street, Manchester,
M1 7HL
9th-10th December
<https://www.mmrs.co.uk/exhibition/>

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6mm x 9mm tag on N-gauge loco

Article in September 2021 MERG Journal. Discounts available for MERG members

www.starfishrail.co.uk



MERG at Missenden Manor

3rd - 5th November 2023

Autumn Weekend

The full course line up is:

- 4mm and smaller Loco & Kit Construction with Tony Gee and Jerry Clifford
- 7mm Locomotive & kit Construction with Kevin Wilson
- Weathering with Chris Hopper
- Track Building and Laying with Norman Solomon*
- Semaphore Signals with Karl Crowther
- Radio Control with Giles Favell (new)
- Electronics for Beginners with Chris Langdon (new).

* This will be Norman's last course before emigrating to Australia.

Prices are unchanged for the sixth year: £335 Residential, £215 Non-residential. For details please see: <https://www.missendenrailwaymodellers.org.uk/index.php/autumn-weekend/>

Radio Control for Model Railways

A new tutor, Giles Favell, joins the Missenden Railway Modellers tutors to offer a course on the use of Radio Control within the hobby. Giles will be focusing on the techniques he has used to produce scale radio controlled road vehicles in both 7mm and 4mm scale. Adding a new level of automation and interest to any model railway layout. During the weekend, you will build a working chassis for a road vehicle. The chassis is ideal for fitting to off-the-shelf die cast models that are available in various scales. Giles will guide you through building and motorising and testing your chassis from a kit of parts and advise how to continue with your own automation projects in this fascinating aspect of the hobby.

Model Railway Electronics for Beginners

Are you bewildered by electronics? Do you feel uncomfortable in this digital age? Are you looking for better ways of controlling your layout? Are you returning to the hobby and bemused by the variety of electronic products readily available to the railway modeller? Then this course is for you. It is aimed at those modellers with little or any knowledge or experience of electronics. Chris Langdon will take you through a weekend of theory and practical work which will provide a foundation for using modern electronics to enhance the realistic working of your model railway. All the components for this course are included in MERG Beginners Kits which are described here and available to purchase on the course.

Future courses

Spring Weekend: 8th to 10th March 2024.
Summer School: 28th July to 3rd August 2024.

Christopher Langdon



Meetings - Zoom and Face to Face

Please see the Events page at merg.org.uk/content/events for details of any face to face AG meetings or Zoom based AG or SIG meetings being held. Remember that you can join any AG or SIG: especially useful if they are presenting something that is of interest to you. You do need to sign up to that group via merg.org.uk/membership to get their Zoom joining details.

Details of Zoom meetings for AGs or SIGs that you are signed up to can be seen by clicking the "My Upcoming Events" link on the Start page or at merg.org.uk/s/myevents. Planned video calls for the next 10 days can be accessed from the Upcoming Video Calls link at the top of the Start page under NEWS.

The following groups hold regular Zoom only meetings

(Times are UK time unless noted otherwise)

Australia and New Zealand VAG

3rd Saturday of the month from 12:30 to 14:00 AEST.

Cumbria AG

every other Friday at 14:00 and

North Wales AG

the alternate Friday at 14:00

Ireland AG

3rd Sunday of the month at 19:00.

North America AG

4th Monday of the month at 19:30 central time

Three Counties AG

1st Wednesday of the month at 19:30.

Virtual AG

2nd Tuesday of the month at 09:30 GMT, 08:30 UTC

West of Scotland AG

1st and 3rd Sunday of the month at 14:00

Special Interest Groups via Zoom

Arduino SIG

2nd and 4th Tuesdays of the month (except Dec.) at 19:30

CBUS ANZ SIG

2nd and 4th Sunday of the month from 12:15 AEST [GMT+10]

Electronic Guidance Group SIG

last Tuesday of the month at 19:30

Electronics 101 SIG

1st and 3rd Mondays of the month at 19:30

Just Another Language (JAL) SIG

2nd (technical) and 4th (beginners) Mondays at 19:30

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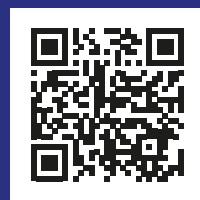
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the Oxford event

West Oxford Community Centre
Botley Road, Oxford OX2 0BT

Saturday 28th October 2023

Exhibition 10.30am - 3.30pm

AGM starts 4pm

Members only

- Model Railway Layouts
- Lectures and Presentations
(10.30, 11.30, 12.30, 1.30 & 2.30)
- Electronics Workshop
(tutorials and troubleshooting)
- Cakebox Challenge Results
(judging by John Gowers 3.30)
- Kit Sales
- Free Admission
- Live Streaming
- Keynote Speakers
- AGM

The AGM will be online (Zoom) and physical attendance

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