MERG, CBUS and DCC   by Ian Both

(Based on a Paper presented at the Modelling of the Railways of Queensland Convention 2012)

My presentation is about the most dynamic electronic model railway group in the world, Model Electronic Railway Group (MERG) www.merg.org.uk and their modules, kits and software. MERG is an international organisation based in the UK and members are model railway enthusiasts who, in their real jobs, are engineers, programmers, electronic serviceman and not so knowledgeable non-electronic persons. The group members invented CBUS, an advanced model railway layout accessory control system, created by railway modellers *for* railway modellers.

Members of the Group regularly seek assistance from other members on the club web site forum to discuss and resolve their problems. The forum consists of an experienced and knowledgeable support group who are keen to assist with all kinds of model railway electronic issues, especially CBUS and DCC. The Group has over 1,700 members and they are located around the world, including the largest number of non-UK members in Australia.

The CBUS system is a modern and exciting method to control model railway layout accessories. It can co-exist with an existing DC control system but it would be a better layout if it was changed completely to CBUS and its control modules. The MERG system also includes a set of three DCC modules, track power booster, command module and CBUS controller handset.

The DCC system is very cost effective, powerful and compares favourably with commercial systems. Very importantly, it is National Model Railroad Association (NMRA) DCC system compatible and supports all of its standards and functions. You will be acquiring a system that will operate the shiny (or weathered) new DCC sound equipped loco that you purchase or build in a year or two.

The MERG system integrates with the Java Model Railway Interface (JRMI), the free downloadable model railway computer software for Windows.

For JMRI software and more information go to http://jmri.sourceforge.net/

The other free and not so free model railway software packages available that support the MERG system include Rocrail and SSI. For Rocrail software, go to web

page address http://wiki.rocrail.net/doku.php, for the SSI software, the web page is http://www.gppsoftware.com/ProductList.aspx?P=57582C2324222829 .

The MERG Group developed a system that enhanced railway modelling to appeal to the 'iPad generation' by

- Means of modern computer and micro processor based electronics to control locos and layout functions
- Controlling a loco via JMRI with a WiFi console or a mobile 'smart phone' with handset 'app'
- Operating layout accessories using a computer with JMRI and CBUS modules
- Upgrading your layout to the MERG DCC System and its handset controller
- Enjoying accurate scale control and running of a layout
- Connecting all layout accessories with only four wires, positive and negative 12V DC, two CBUS wires and two cables for track power
- Making it easier to fault find the control systems on the layout
- Using a complete computer setup of a layout with free and downloadable software tools.

Currently, there is no interface or connection to YouTube, Facebook, Twitter or SMS but I am sure that it is in development. ☺
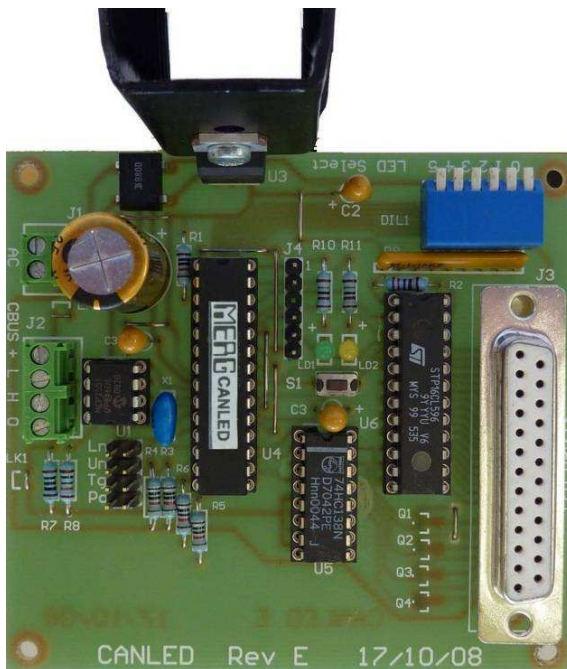
The CBUS system has been developed from the industry CAN bus. CAN is used to control a variety of things such as a modern automobiles computer systems and other electrical functions. It is an industry standard for software and hardware. Because the CBUS system is derived from a robust versatile design and if installed as described and recommended by MERG, it will reliably control a model railway layout. It is a complete, scale and manufacturer independent, system of controlling turnouts, signals, crossing gates, locos and other accessories. All types and brand names of turnout can be controlled by a CBUS module. All CBUS modules are designed to be interconnected with other CBUS modules and to the MERG DCC command module.

When and where appropriate, modules and software are upgraded and their features enhanced with feedback from interested members. Group members can freely download from the MERG web pages - technical bulletins, circuit diagrams, printed circuit board layouts, component overlays, completed module photos and the latest programs for all modules and computer software.

When module kits are designed, developed and production ready, they are rigorously tested by members on real layouts. The modules are sold to members as a complete kit of parts from the MERG web page Kitlocker for a realistic price. The

Kitlocker provides a fantastic service with parcels normally arriving [in Australia] a week after ordering.

CBUS modules presented here are CANLED, CANACE3, CANACE8C,

CANUSB and CANSERVO8. I have purchased the majority of the parts for these modules from internet sites. Primarily, they are sourced via EBay from China with some specialist items from other web suppliers. The printed circuit boards were purchased from the Kitlocker. This suite of modules provides the high level and sophisticated control of a layout that is a work in progress. [Complete kits for these modules are available from the MERG kitlocker, as well as the PCBs]
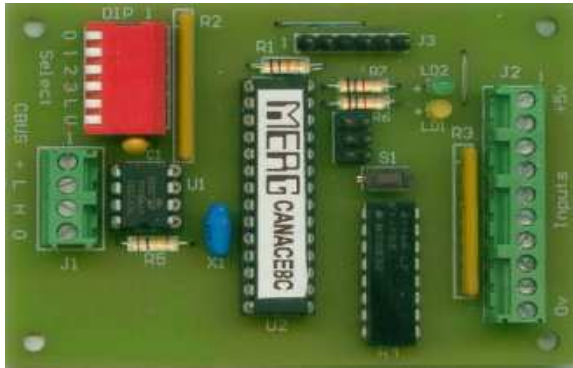

CANLED is a module used to control track indicator LEDs that form a mimic panel or display.

Our layout has two layout mimic panels where identical information will be displayed thus two of these modules will be installed, one located at the front of the layout and one at the rear, adjacent to the 'fiddle yard'.
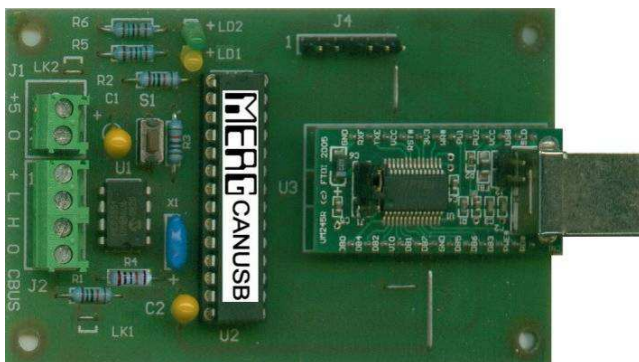
Operators will see the status of all turnouts from any position around the layout.
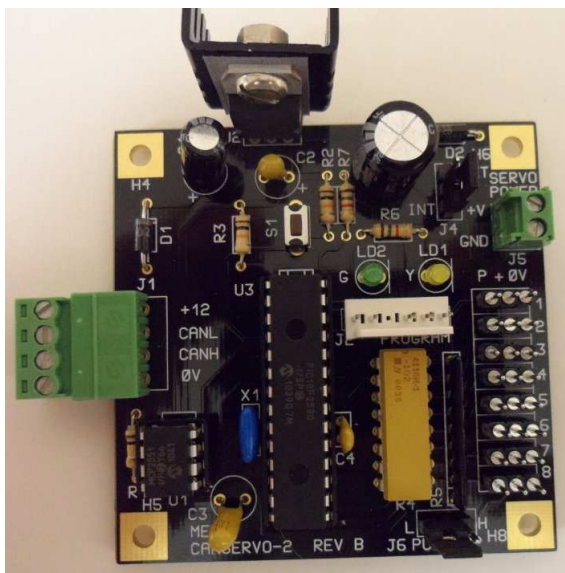

CANACE3 is a module used by the system to find the status of mimic panel switches. A single switch can operate a single turnout or multiple turnouts and even a complete route. Conversely, more than one switch can control a single turnout or signal. This is similar control that can be configured on a wired relay panel without its wiring complexity. Toggle switches or push buttons are supported by software.

CANACE8C is a module that is used to input signals that are processed by the system to provide information about layout accessories. E.g. this module can be connected via micro switches to test the position of a turnout.

CANUSB is a module to interface the CBUS to a computer via its USB port for module configuration and JMRI layout and other control functions.

CANSERVO8 is a module to control low cost servos like the Tower Pro SG90. Typically, these units will operate turnouts, semaphore signals, road crossing gates and other moving layout features. The SG90 can be purchased on EBay for less than AUS$5.00 [about £3.00] and when mated with moving accessories, it can be a versatile combination for an economical price.

Currently, a Kitlocker kit is not available for this module, the programmed PIC microprocessor and printed circuit board are available though.

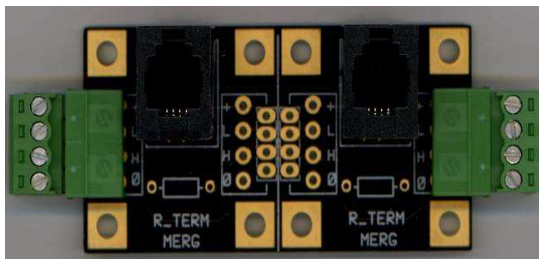 **DCC modules** presented are CANCAB, CAN-RJ22, CANCMD and NB1B.

 CANCAB is a small hand held module that controls a loco's speed and direction; in addition it can also operate turnouts and other moving layout accessories.

Multiple locos can be selected and controlled in a 'consist' by one CANCAB.
Up to 32 separate locos can be controlled on a layout, at any one time.

An innovative feature of the CANCAB handset is the red coloured 'Stop!' button

- Press the button once, the only the loco to stop is the one that you are controlling. On other model train control systems all locos on the layout stop.

- Press it twice and all moving loco's stop. This is a loco and rolling stock saving function in the case of a derailment or other layout failure
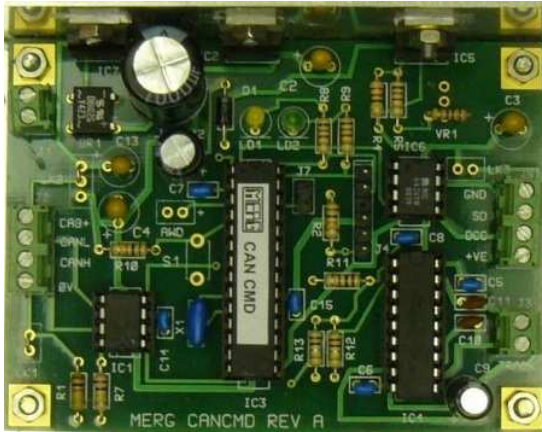
This hand held module is probably the smartest, smallest and most feature packed handset loco controller available.
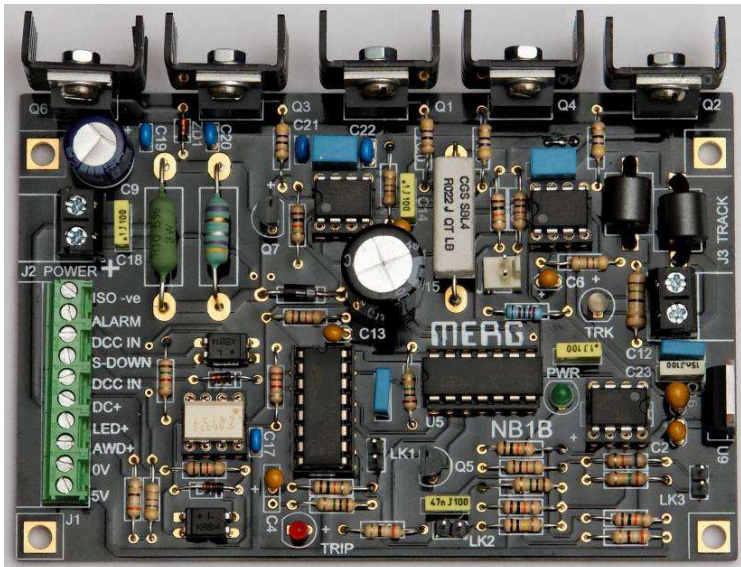
 CAN-RJ22 module is used to interconnect CBUS layout wiring to the CANCAB module. It uses a standard telephone 'curly cord' cable with RJ22 type connectors to connect to the handset controller. Convenience and practicality will determine how many low cost CAN-RJ22 are installed.

The CAN-RJ22 has an easy to operate cable connector and supports the 'walk around feature' of the CANCAB handset controller. The handset controller can be disconnected from one CAN-RJ22 point and reconnected to another point, if it is reconnected in less than twenty seconds, the handset will still control the same loco.

CANCMD is a module connected to CBUS and is controlled by the CANCAB handset or the JMRI throttle screen. It creates and sends the DCC signals to the track via the NB1B booster. If less than 1 amp DC track power is required, it can power the track directly without the need of a booster.
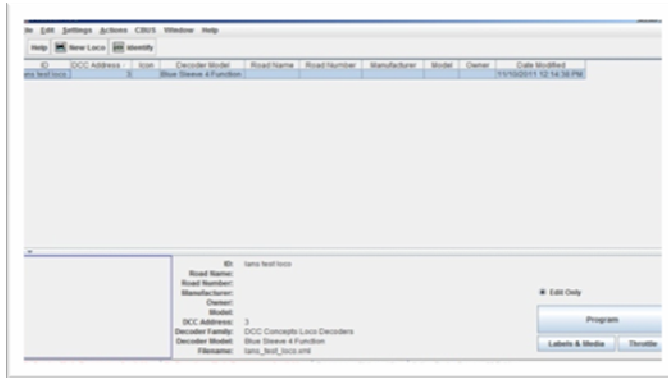

NB1B is a DCC track power booster and is directly connected to the CANCMD module and also supplies the DCC track power.

It can be configured to power a small home layout or a very large club layout via the component choices that are installed on the module. It is suited to modern model railway layouts because of its power overload limiting design and its low heat dissipation.
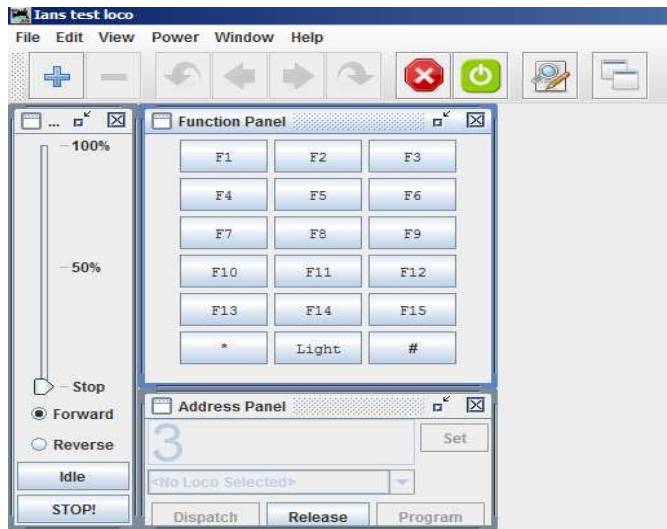
Other MERG kits and modules available for purchase from the

Kitlocker include those for turntable control, loco detection and many others. Some special module component parts like printed circuit boards, programmed PICs and specialist Integrated circuits are available, not all though.
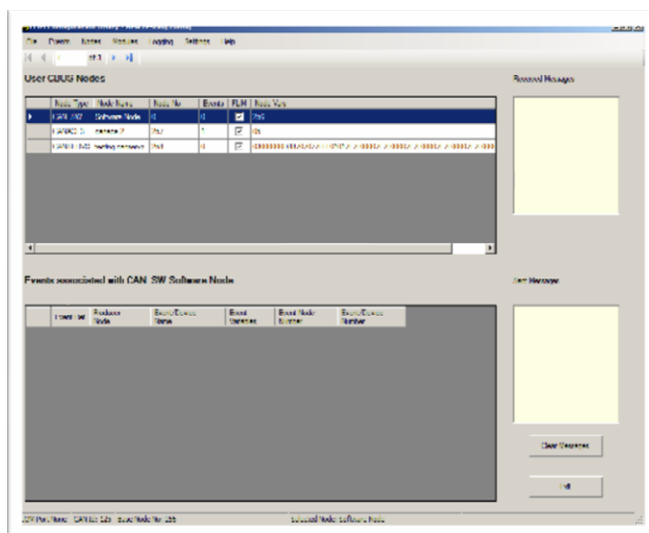
JMRI software.

Main Screen My knowledge of JMRI is limited but will increase as I setup the software and hardware for the completed layout.

Throttle Screen This screen is used to control a loco by using a computer mouse; it has similar functions to a handset throttle like CANCAB.

FLiM mode Configuration Utility (FCU)

The FCU downloads PIC software, configures all CBUS modules and their input or output functions.

When modules are configured in FLiM mode and the layout is fully functional, a computer does not have to be connected to a layout. Modules use CBUS signals to control a layout.

The FCU 'User CBUS Node' screen will demonstrate

CANSERVO and track turnout control.

SLiM Mode

All CBUS modules, except for CANSERVO8, can be configured via onboard switches without using a computer and FCU, it is called SLiM mode. When CBUS modules are configured in SLiM mode, the CBUS system has the same functionality as if modules were configured in FLiM mode. The SLiM mode of configuration is documented in module Technical Bulletins.

CBUS module control signalling, a brief overview

1. Toggle a mimic panel switch connected to an input of a CANACE3, a signal is transmitted via CBUS and received by a CANSERVO8
2. The CANSERVO8 responds and its output, connected to a SG90 servo, changes a semaphore signal
3. Simultaneously, a CBUS signal is received by another CANSERVO8 which operates another servo to shift a turnout moving arm
4. Meanwhile a micro switch, coupled to the arm of the turnout, changes state. This switch is connected to the input of a CANACE8C
5. The CANACE8C sends a CBUS signal to the CANLED to illuminate a led on a mimic panel
6. The led indicator displays the position of the turnout

Operate one switch and three different layout functions are changed.

The MERG system could be used to accurately model conventional railway functionality for example

- The correct operation of signals after a detected loco passes a signal could be automatically changed from go to danger state
- Loco speed and operating characteristics can be 'scaled' for different locos
- Loco 'consisting' is an easy function to join two dissimilar or similar locos in a set. This is designed into JMRI and built into the CANCAB handset.

The system is designed to be 'hands off' the layout and with some imagination and configuration, can be completely automatic in its application. This level of control can be achieved with accurate scale speed and operation, making the layout pleasing to the eye.

Future Developments

MERG members are always looking at ways to improve the CBUS and DCC system and enhance their features. For example, a DCC Block Cut-out module has been developed and currently is in the testing stage. It is compatible with the current range of modules and will enhance their functionality.

I think that you will appreciate the cost effectiveness, robustness, versatility, control, features and functionality of CBUS with its matched DCC system and with MERG as a forward thinking organization with a cutting-edge product.

My email tibothie@yahoo.com

The MERG web pages www.merg.org.uk

The Membership Secretary email memsec@merg.org.uk

Thank you for your interest.