Layout Control Bus

You are planning to build your layout, you may well have decided how to control the trains, DCC or traditional DC. But how do you control the rest of your layout, points, signals, uncouplers possibly, isolating sections if you are using DC, layout lights and potentially many other things as well?

A significant part of this choice is how you plan to implement a control panel. You don't have to have a control panel, individual switches along the front or back edge of the layout can work but this is usually restricted to small layouts and, even then, not that common. Your main choice lies between a traditional control panel with switches, lights and a track diagram or a computer implemented version using a touch screen or a tablet, or possibly some combination of the two.

Wiring - The "Not a Layout Control Bus" Solution

You don't have to have a Layout Control Bus (LCB), historically no one had a LCB so what is this alternative. Simply put switches, indicator lights, point motors, signals, etc., with dedicated wires between them for each function. It's a perfectly reasonable solution and one which has served the hobby well from the earliest days. So why change?

If you have a permanent layout that will not be moved then the wiring required for control panels to directly connect to each item on the layout might be acceptable. Except on the smallest layout it will be a lot of wire and a lot of soldered or other joints. Accurate record keeping is essential. And even permanent layouts may need to be moved if moving house.

If you are planning a portable or exhibition layout then you have the added problem of plugs and sockets between boards and between the boards and the control panel. These can be problematic to make, costly and a definite fault liability.

The biggest single failing of this approach is the lack of flexibility. Any change to the layout probably requires changes to the wiring and changes to the control panel; are there enough connectors on the plug and socket?, drilling new holes, covering up old ones. Adding new features to your layout or replacing items no longer available can cause significant issues and make maintenance a lot more difficult.

If you choose not to go down the path of multiple dedicated wires you will need a Layout Control Bus.

Layout Control Bus - Benefits

If traditional point to point wiring that has served the hobby so well for many years has such drawbacks whet, exactly, is an LCB going to do for us. There are probably three main benefits.

An LCB significantly reduces wiring and, by definition, connections, soldered, screwed or any other type of connector. Connections are always a fault point so anything that reduces these is a benefit to reliability. This reduction in wiring is particularly important in cross baseboard wiring and wiring to a control panel. In most cases these require a significant number of wires, meaning multiway plugs and sockets with large numbers of pins. This can be reduced to a handful, usually six or less pins, allowing the use of much more reliable and robust plugs and sockets than would otherwise be needed.

The nature of an LCB is that modules can be added or subtracted relatively easily. Adding features or functionality or changing the topography of the layout is not a major task. In addition the flexibility inherent in LCBs means that you can, if you wish, control your layout from several types of interface. You could, for example, change points from a handset, a traditional control panel or a computer touch screen, all on the same layout, and each would know the real state of the point once it had been changed.

If you want to use a computer screen, either to control the layout or just to show status of points, signals and trains, etc., the an LCB is really a requirement.

Now let's look at some of the options.

DCC

If you have chosen to implement DCC to control the trains then that might be your first obvious choice to control the other aspects. Although the obvious choice, using DCC might not be a good choice. There are three main issues with using DCC to control the points and other ancillary features of your layout.

On the upside you can control the points, and other features such as signals, from your DCC handset, via accessory or stationary decoders, and thus it is possible to have a layout without a control panel. However, the size of layout where this practical tends to be small and it has other limitations as well.

The first of the drawbacks is an operational one. If a train fouls a point and causes DCC to shut down due to a short circuit then you can't change the point to remove it, it needs to be fixed manually. This may be mitigated by the use of District Cut Outs and Frog Juicers but nevertheless remains an issue.

On many systems DCC is, relatively, long winded to set a point. Like all DCC devices your point will be attached to an accessory decoder with a 2 or 4 figure address. Releasing your train, entering the point address and selecting it, operating the point, releasing the point decoder and re-selecting the train can be a slow process. This is only compounded if you also want to set a signal or other layout feature. Certainly this is much better on some systems ~~rather~~ than others. Allied to this is the fact that the operator will need to remember, or have a list, of what points are what address. You can have those written on a track plan but this problem is compounded by the next, and most fundamental, issue.

DCC is a one-way system, you can send commands to mobile and stationary decoders but there is no way for the stationary decoders that are controlling your points and other accessories to send back information. Thus your point or signal cannot tell you what state it is in and the point will need to be set every time, even if it was actually in the right place already.

These issue can, and are, overcome but only by implementing something similar to one of the solutions noted here so you end up effectively running two separate layout control systems.

Proprietary Systems

Layout control buses are not standardised in the same way as DCC. With DCC you can expect any DCC decoder to work on any DCC system the same is most definitely not true of LCBs.

Most DCC systems implement a control bus of some sort, an essential part of the system to allow the handset or throttle to communicate with the Command Station, which manages the DCC system.

The two main commercial ones are XpressNet from Lenz and LocoNet from Digitrax. XpressNet is a proprietary protocol that has always been published by Lenz and a number of other manufacturers have implemented this system. Digitrax's LocoNet is fully proprietary and has been licensed to a number of other companies but only recently has it been available to all.

The two are not compatible.

Licencees of LocoNet are probably very compatible with DigiTrax products, and each other, but other implementations of LocoNet, as with XpressNet implementations, are not necessarily

completely compatible with seemingly similar systems or may not implement all features. If you do intend to mix manufacturers you will need to check this out first.

As stated at the start, an LCB is suitable and complimentary for both DCC and DC layouts. However, the solutions covered until now are inherently DCC layout focused. For a DC layout you probably want something that is independent of of DCC and DCC systems.

MERG CBUS

MERG is a group of like minded hobbyists who got together to form a ‘club’ promoting the use of electronics in railway modelling, you can find them at https://www.merg.org.uk.

MERG have defined a protocol known as CBUS for use as an LCB. As with proprietary systems it interworks with the MERG DCC offering but is also intended to be independent of MERG DCC or, indeed, any DCC system and is therefore well suited to DC based layouts. MERG do not own the specification but it is managed and updated, in practice, via the MERG group which is open to anyone to join, expert or novice.

There are a wide range of modules for outputs, such as points, signals, control panel lights, and inputs such as switches, block detectors and sensors of all types. These are “build it yourself” modules but MERG instructions are very good and a lot of help is available through the forum and local area groups.

There are other manufacturers that do proprietary systems, but the main ones are covered here. MERG also do alternative bus systems for, mainly, simpler layouts (MERG is not a CBUS organisation but covers a range of model railway electronics, not just LCBs).

OpenLCB

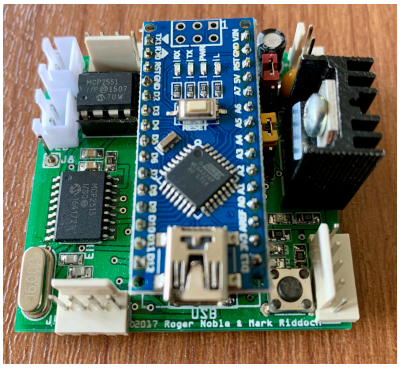
The NMRA (National Model Railroad Association) is the USA based group that led and mages the standardisation of DCC. It has also now produced a ‘standard’ for LCB called OpenLCB. OpenLCB is based on the same underlying CAN bus protocol that CBUS uses but the two are not interoperable. The standard is available, published and accessible by all.

Being initially published only 5 years ago the proprietary systems, and CBUS in the UK, are already well established. The major manufacturers are using, and have heavily invested in, either LocoNet or XpressNet and have shown no public desire to adopt OpenLCB. There doesn’t seem to be the same overarching reason for standardisation that DCC had, with the requirement that any DCC system could drive any DCC decoder.

A number of companies, primarily in the USA, produce OpenLCB systems, often with gateways to ‘legacy’ systems, including XpressNet and LocoNet allowing the use of OpenLCB in conjunction with DCC manufacturers from either the LocoNet or XpressNet camps.

Software Implementations

All the implementations mentioned here have software available for an Arduino, and often other platforms as well. This allows those interested to make their own modules that can perform functions an existing commercial product does, but often a lot more cheaply, or provide capabilities that are not available on any commercial product.



As an example here is a board designed to drive two stepper motors and two input/output pins for ancillary functions on MERG CBUS but it would take only minor hardware changes and LocoNet or Xpressnet based software to make something similar for those systems.

Computer Interface

Finally a word about the interfacing of these LCBs to a computer. These all have the ability to support a physical panel in one form or another. They all also have the ability to interface with a computer based control panel. This will also support the DCC system employed if it is a DCC based layout but it is equally applicable on DC based layouts.

There are a range of commercial and proprietary systems available, especially in the USA but the Open Source, and free, JMRI (Java Model Railroad Interface) is the most common and has modules for setting up DCC decoders as well as managing the operation of your layout.

Summary

An LCB is not necessary to operate your layout, but it is likely to significantly increase the flexibility for any changes you may make and will, in the long run, likely to be easier to install and maintain and less susceptible to faults. You do not have to have computer control or a screen based control panel, but it's available if you want it, it can support a traditional panel just as well.

Even if electronics is not "your thing" give the idea some consideration, speak to others, often at your local club, discuss the pros and cons and then decide what you want to do. You can do anything, its your layout.

Roger