VLCB Versatile Layout Control Bus

VLCB Module User Guide

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0.2 Document History

Date	Changed by	Summary of changes
14th April 2025	Ian Hogg M.5144	Initial document

0.3 Trademarks

Where CBUS is used within the VLCB documents it should be noted that CBUS® is the registered trademark of Dr. Mike Bolton.

1 Introduction

The VLCB is a series of specifications of building blocks that define a layout control bus for the purposes of controlling a model railway. The specifications cover communications protocols and some operational requirements. VLCB builds upon CBUS by adding additional functionality, improved documentation with less ambiguity. VLCB is an open standard that can be used by anyone and managed by a group of enthusiasts.

Hardware modules to provide practical interfaces for a model railway can be provided with firmware to implement the VLCB standards and also provide module specific functionality.

Modules typically have a push button and two LEDs, one green and one yellow. Other LEDs may be present for example to indicate power. VLCB allows other means of user interaction using for example a text based terminal or graphical display.

2 Assigning a Node Number

Modules, or more accurately nodes, must be assigned a user supplied node number so that the module can be identified on the communications bus.

Although some specialised modules may not require a Node Number most modules must be assigned a network wide unique Node Number. Node Numbers are in the range 1~65535 although some are reserved for modules with fixed node numbers.

A factory fresh module does not have a valid node number, it is assigned the invalid number of 0. The module must be assigned a valid number before use. To assign a node number the module must be powered up and connected into the network which has a configuration tool such as FCU or MMC connected too. A module without a valid node number will have the green LED on and the yellow LED off.

The module's push button should be held down for about 4 seconds, at which point the green LED will go off and the yellow LED will start flashing. The configuration tool will then prompt the user for the node number to be assigned and possibly a friendly node name. It is important to assign a node number that is not used elsewhere on the layout's network.

Once a node number has been assigned the module's green LED will be off and the yellow LED will be steady on; this is the module's normal state.

After a module has been assigned a unique Node Number the module may then participate in normal VLCB network operation, respond to VLCB messages addressed to it, and participate in producing and consuming events.

3 Module test support

A module may provide self-test facilities. The exact operation during User Test operation is module specific. Examples of tests would be for the module to cause a sequence of flashing LEDs, to drive outputs to particular states, or by allowing inputs to be tested by reflecting those input states on the outputs.

If a module supports a power up test mode then the test mode can be entered by holding the push button down for between 2 and 6 seconds then released as the module is powered up.

4 Force Module Bootloader

Modules based on PIC microcontrollers typically support “bootloading” which allows new or different versions of firmware to be loaded. Bootloading can be instructed from a configuration tool, specifying a new firmware image. If the user loads an incompatible firmware it may no longer communicate over the network and further bootloading from the configuration tool will not be possible. VLCB modules provide a mechanism to force the module to accept new firmware by holding down the push button at power up for between 0 and 2 seconds then released.

Whilst in bootloader mode both the green and yellow LEDs should be lit.

5 Factory Reset

Occasionally it is desirable to reset a module back to its ‘factory settings’. Although this can be achieved from a configuration tool it may also be done without needing to know the node number of a module through the use of the module’s push button. Since the module will lose any configuration this process is purposely designed to be a little difficult so that it is not done accidentally.

To perform a factory reset the module’s push button needs to be held down at power up for between 10 and 30 seconds then released and then, within 5 seconds, pressed again for between 2 and 4 seconds.

6 Configuration Tool support

VLCB modules must be supported by a configuration tool to allow general users to be able to configure and use their system in a user-friendly way.

VLCB modules are back compatible with CBUS modules and thus there are a number of potential configuration tools:

- MMC (Module Management Console)
- FCU
- LayoutMesh
- FCU lite
- Module based web interface

MMC is able to support the advanced features of VLCB and therefore is the preferred configuration tool.

Appendix A. Module User Interface

A.1 Options for displaying mode and errors

Mode	Display			
	Recommendation for 1 LED	**Mandatory for 2 LEDs**	**Recommendation for Terminal**	**Recommendation for Screen**
Uninitialised Mode	Flash 50% 0.5Hz	Green ON, Yellow OFF	Uninitialised Mode	UNT
Setup Mode	Flash 50% 1Hz	Green OFF, Yellow Flash 50% 1Hz	Setup Mode	SET
Normal Mode	ON	Green OFF, Yellow ON	Normal Mode	NOR
Warning for final acknowledgement for factory reset	Flash 50% 2Hz	Both LEDs flash 50% 2Hz alternately	Reset Warning	FRT
Learn Mode	ON	Green OFF, Yellow ON	Learn Mode	LRN
Bootloader Mode	ON	Green ON, Yellow ON	Bootloading	BOT
Message received	Off for 0.25s then ON	Uninitialised mode: Yellow 0.25s flash & Green ON Normal mode: Green 0.25s flash & yellow ON Setup mode: no change	Message received	*** RX Shown for 0.5s
Message acted upon	Off for 0.5s then ON	Uninitialised mode: Yellow 0.5s flash & Green ON Normal mode: Green 0.5s flash & yellow ON	Message processed	*** RXA Shown for 0.5s

		Setup mode: no change		
Transmit error	Off for 1s then ON	Green OFF, Yellow ON	TX error	*** ETX Shown for 5s
Receive error	Off for 1s then ON	Green OFF, Yellow ON	RX error	*** ERX Shown for 5s
Memory fault	flash 50% 2Hz	Both LEDs flash 50% 2Hz	MEMORY FAULT	*** EMM Shown continuously
Fatal error	flash 50% 2Hz	Both LEDs flash 50% 2Hz synchronised	FATAL ERROR!	*** F!! Shown continuously

Where *** continues to show mode

A.2 User Interface Options for requesting action

A facility to request that a module leaves Uninitialised mode and enters Setup mode so that it can request a node number must be provided. This is provided by a physical input device such as a push button.

Other alternate user interface options are permitted such as ASCII terminal input or touch screen. The exact handling of these alternate input methods is left to the module designer but it is recommended that there is consistency with other modules with similar input devices. It is possible that the standard will be more prescriptive in future versions.

Recommended user interface actions are listed below.

Mode	**Push button**	**Software/ Service**	**Terminal**	**On screen**
Change mode from Uninitialised to Setup.	The push button is held down for at least 4 seconds	MNS	Enter ‘s’ and RETURN	
Change mode from Normal to Setup	The push button is held down for between 1 and 2 seconds	MNS	Enter ‘s’ and RETURN	
Change mode from Normal to Uninitialised	The push button is held down for at least 4 seconds	MNS	Enter ‘u’ and RETURN	

Test Mode	If the application supports a test mode. The push button is held down at power up for between 2 and 6 seconds then released.(*) If held down for more than 30 seconds then the module shall continue normal operation.	Application	Enter ‘t’ and RETURN	
Factory reset	The push button is held down at power up for between 10 and 30 seconds then released and then, within 5 seconds, pressed again for between 2 and 4 seconds.(*)	MNS		
Force bootloader	If the module supports bootloading. The push button is held down at power up for between 0 and 2 seconds then released.(*)	Bootloader		
Reboot module	Press reset button on board.		Enter ‘*’ and RETURN.	

* The exact timings may depend upon whether a bootloader is used with the application firmware and the behaviour of the bootloader when the push button is held down.

Appendix B. Glossary

Bootloader	A part of the program running on a VLCB/CBUS module that is used to download new firmware to the module.
CAN	Controller Area Network. A standard communications bus originally defined by Bosch. Widely used in cars, industry and other electrically noisy environments.
CBUS	A set of messages for model railway control. The CBUS system was developed over 4 years by Mike Bolton and Gil Fuchs and introduced with specifications and an initial range of kits in 2007. Since then the system

	has been further developed by many MERG members into a very comprehensive Layout Control Bus.
FCU	FLiM Configuration Unit used to manage CBUS networks.
LED	Light Emitting Diode used for indicator lights.
MMC	Module Management Console used for configuring and managing the VLCB or CBUS network. A multiplatform alternative to FCU.
NN	Node Number