USB-LCC Interface Module for LCC[®]/OpenLCB[™]



PI-LCC Interface Module for LCC®/OpenLCB[™] SPROG DCC Ltd



Firmware v1.3 Hardware v1 and v1.1





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Date	Revision	Comments			
February 2024	1	Created			
February 2024	1.1	Added known issues			
April 2024	1.1.1	Added known issues			
April 2024	1.2	Update for new firmware version			
		Numerous issues fixed			
May 2024	1.3	Maintenance release, no material changes			
May 2024	1.3.1	Update for hardware v1.1			
		Added Firmware Update section			

Unless otherwise notes references in this document to LCC apply equally to OpenLCB, and vice-versa.

LCC[®] is a registered trademark of the NMRA

OpenLCB[™] is a trademark of the OpenLCB Group

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1 Introduction

The PI-LCC allows easy connection between a Raspberry-Pi computer and an LCC/OpenLCB network. The PI-LCC is supported by JMRI (Java model Railroad Interface).

1.1 Features

- Raspberry Pi Interface for NMRA LCC and OpenLCB[™]
- Galvanic isolation between USB and LCC network
- Four status LEDs
- Supported by JMRI
- Implements an LCC node
 - LCC bootloader for firmware upgrades
 - Via host or network
 - \circ $\,$ Configurable functions on two of the status LEDs $\,$
- Dual RJ45 for network pass-through or terminator
- Network side is powered from LCC

Unlike generic USB-CAN interfaces, that may also be used for LCC, the PI-LCC implements a true LCC node with its own CDI (Configuration Description Information). The bootloader allows the node firmware be updated via the USB or LCC network connections.

1.2 Electrical Specification

The Pi-LCC draws a small current (50 mA max.) from the LCC PWR_POS/PWR_NEG conductors in the LCC network cable and will operate properly with a supply voltage of 7.5 V to 15 V.

The R-Pi 3.3 V supply from the GPIO connector is used to power the remaining active circuitry on the PI-LCC.

	Minimum (V)	Nominal (V)	Maximum (V)	
LCC Power	7.5	12	15	
R-Pi		3.3 V		Sourced form R-Pi GPIO
				connector

2 Installation

There are no jumper links or other configuration required to use the PI-LCC.

Power for the LCC interface must be available on the LCC network cable(s).

The Pi-LCC can be connected anywhere along the LCC network, subject to the usual LCC cabling requirements (e.g., daisy chain connections, correctly terminated).

On v1 hardware, a number of discrete LEDs show the status of the node:



On v1.1 hardware, the status IEDs are integrated into the LCC network connectors:



The LCC Power LED indicates the presence of power from the LCC network.

The Power LED indicates the presence of power from the R-Pi GPIO connector.

The remaining two LEDs are configurable via the CDI and default to LCC network activity (see **3.1.1** LED CONFIGURATION).

3 Configuration

3.1 PI-LCC Configuration

The PI-LCC configuration is self-describing via the CDI (Configuration Description Information) and may be configured with suitable software tools such as JMRI.

3.1.1 LED Configuration

Two of the status LEDs are configurable via the CDI. Each LED is controlled by up to four consumer events or internal status.

Segment: LED Configuration							
🕅 Settings							
Configure LEDs to respond to events or indicate network status							
LEDI (Green - CAN Activity) LED2 (Red - CAN Fault)							
LED Name							
Green - CAN Activity Refresh Write							
LED Events							
C1 C2 C3 C4							
Event Name							
Optional - enter a user-friendly event name							
Refresh Write							
Event							
Specify the event that (when consumed) will cause the LED action							
02.01.2C.04.00.00.00 Refresh Write More Copy Paste Search							
Action							
Select the LED action to be performed in response to a consumed event,							
or the network or module status to be displayed by the LED:							
Show packets handled by this node 🔻 Refresh Write							
LED Battara							
Select the LED blink pattern, repeating appx, every 2 s							
Off with Short (64 ms) blink on 💌 Befresh Write							

The CDI Action field controls the LED functions

Action Select the LED action to be performed in response to a consumed event, or the network or module status to be displayed LED:						
Show combined LCC reception/transmission (LED events ignored) 💌	Refresh Write					
No Action						
Turn LED on if event consumed						
STurn LED off if event consumed						
Toggle LED if event consumed						
Show LCC packet reception (LED events ignored)						
Sec Show LCC packet transmission (LED events ignored)						
Show combined LCC reception/transmission (LED events ignored)						
Indicate fault in the module (LED events ignored)						

LED Action	LED function
No Action	LED remains off
Turn LED on if event consumed	The LED displays the selected pattern
Turn LED off if event consumed	The LED turns off
Toggle LED if event consumed	The LED toggles between off and displaying the
	selected pattern
Show LCC packet	The LED blinks briefly on each LCC message
	received
Show LCC packet	The LED blinks briefly on each LCC message
	sent by the PI-LCC
Show combined LCC reception/transmission	The LED blinks briefly for each LCC message
	sent or received
Show packets handled by this node	The LED blinks briefly for a received message
	that is processed by the node (e.g. an event is
	consumed)
Indicate fault in the module (LED events	The LED indicates an error in the module
ignored)	(more details TBD)

The LED Pattern CDI field controls the way the LED is illuminated

There is one pattern setting available per LED. The LED displays the selected patter when turned on (or toggled from off to on) by a consumed event.

	LED Pattern Select the LED blink pattern, repeati Off with Short (64 ms) blink on	ng T	appx. every 2 Refresh	s Write]
	LED on	٠			1
> se	LED off				
	Off with Short (64 ms) blink on		_	_	
	Off with Long (512 ms) blink on	=			
	Equal on/off				
	Equal on/off, faster				
	On with Short (64 ms) blink off				
	On with Long (512 ms) blink off	•			

(One additional selection not shown - Use custom pattern)

3.2 Raspberry Pi Configuration

3.2.1 R-Pi 4 and earlier

When setting up your Raspberry Pi to use JMRI and the PI-LCC we strongly recommend you follow the procedure for setting up the R-Pi UART in our Pi-SPROG family documentation. This can be found in the downloads section of our website, specifically <u>https://www.sprog-</u>

<u>dcc.co.uk/downloads/linux/pi-sprog-pi4-wifi/pi-sprog-wifi-2023-05-03-5.4.pdf</u> in the two sections "Get UART Overlays" and "UART Setup".

This will swap the UARTs so that the full featured UART is used for communicating with the Pi-LCC

3.2.2 R-Pi 5

The R-Pi 5 with the Bookworm release of Raspberry Pi OS is much easier to configure and just needs the Serial port to be enabled in the R-Pi configuration tool. Full instruction are on the document linked from the LCC Info section of our website, specifically <u>https://www.sprog-dcc.co.uk/downloads/linux/pi5/pi-lcc-wifi-2023-12-05-arm64-5.7.1.pdf</u>.

4 Firmware Updates

The PI-LCC supports firmware updates using the JMRI LCC Firmware Update tool.

Firmware updates will be announced on the SPROG DCC Ltd website and the new firmware file will be available for download.

Select the .hex file, select the target node ID and clisk the load butto	on.
--	-----

	LCC Firmware Downloader			×				
Window Help								
	Input file: pi-lcc-1.3.hex							
Select								
	File format: 🔿 16 bit 🔿 24 bit							
Target Node ID:			-]				
	02.01.12.FE.04.87 - JMRI PanelPro - 5.7.7+R5cf2ea9d7f							
02.01.2C.04.00.00 - SPROG DCC Ltd PI-LCC - 1.3								
Lock Node								
	Load Abort							
	0%							
	Click [Download] to download new firmware							

The PI-LCC will reboot when the firmware update is complete.

NOTE: It is recommended that you create a backup of the PI-LCC configuration using the node configuration tool. Occasionally it may be necessary to release firmware updates that "break" the configuration. If this is the case, it will be noted on the firmware download page. The old configuration can be restored, from the backup, after the firmware update is completed

5 Links to Further Information

SPROG DCC Ltd website <u>https://www.sprog-dcc.co.uk</u> For all our products and support.

SPROG DCC Ltd Official YouTube Channel <u>https://www.youtube.com/@sprogdcc</u>

OpenLCB group <u>https://openlcb.org</u> The group behind the OpenLCB/LCC standards.

NMRA LCC standards page <u>https://www.nmra.org/lcc</u> The LCC standards adopted by the NMRA.

OpenLCB discussion group <u>https://groups.io/g/openlcb/topics</u> Discussion of OpenLCB topics, more developer focussed.

The NMRA's LCC user group <u>https://groups.io/g/layoutcommandcontrol/topics</u> a good starting point for asking questions of other LCC users.

JMRI users <u>https://groups.io/g/imriusers/topics</u> JMRI software topics.

JMRI website <u>https://www.jmri.org</u> Download the latest JMRI releases and access support pages.

Book: Introduction to Layout Command Control <u>https://www.amazon.co.uk/Introduction-Layout-</u> <u>Command-Control-Practical/dp/0988825902</u> focussed on RR-Cirkits products but the concepts are applicable to any LCC hardware.