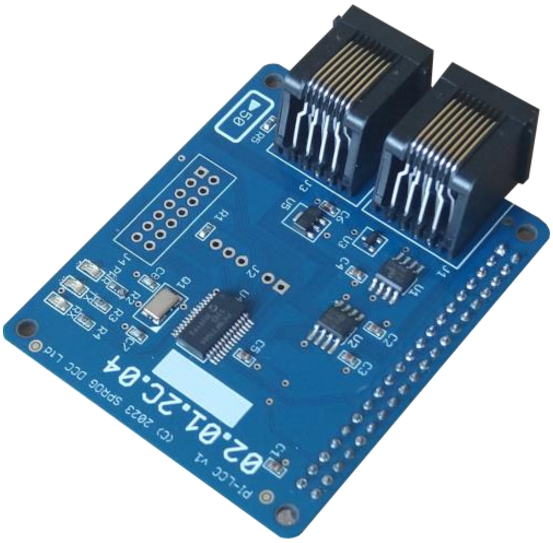
SPROG DCC

Home of the DCC Decoder Programmer

PI-LCC Interface Module
for LCC®/OpenLCB^{TM}
SPROG DCC Ltd



Firmware v1.2

LCC®

OpenLCB

Version 1.2 April 2024

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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

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

Contents

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
  - 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.

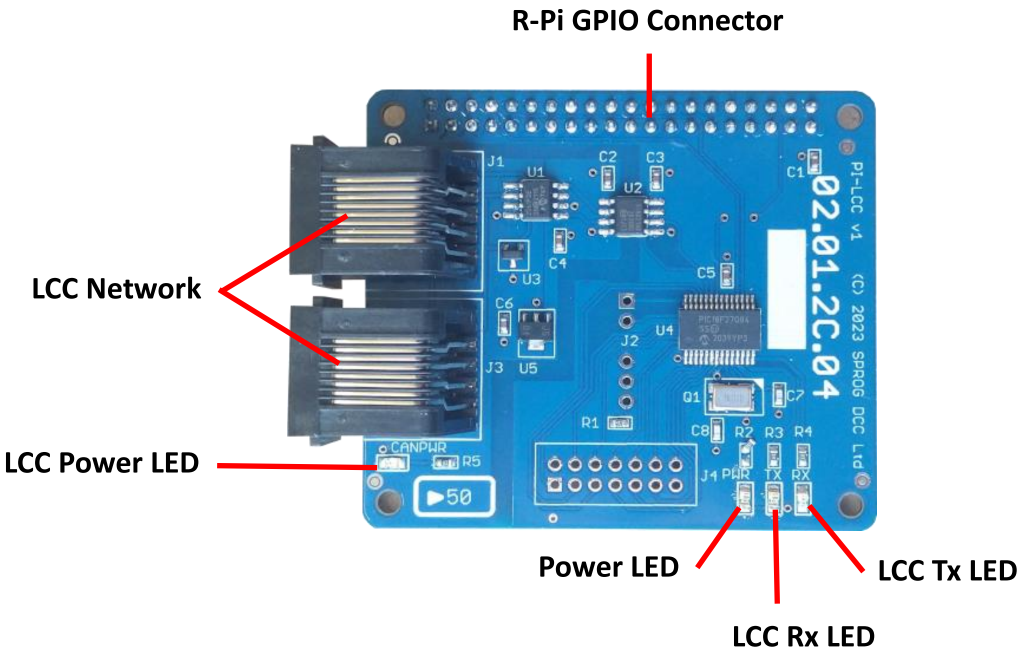
	Minimum (V)	**Nominal (V)**	**Maximum (V)**	
LCC Power	7.5	12	15	
R-Pi		3.3 V		Sourced form R-Pi GPIO connector

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).



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

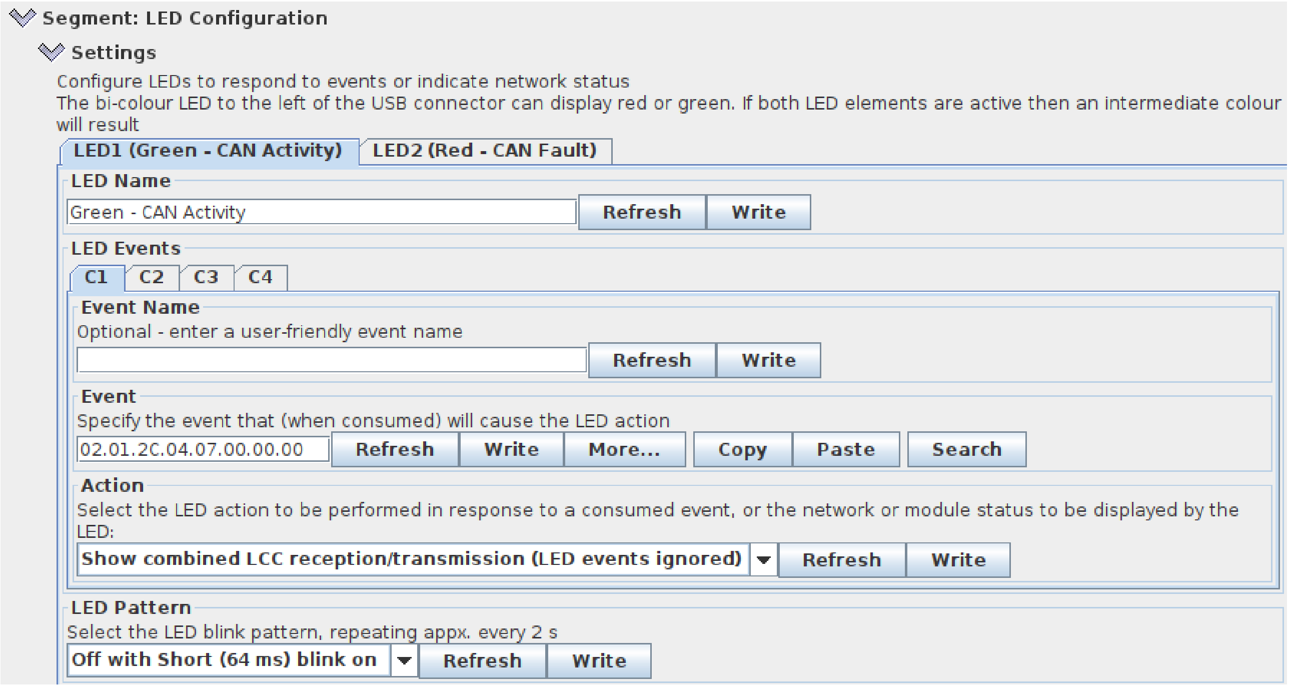
3.1 PI-LCC Configuration

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

See also **4 Known Issues**

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
The bi-colour LED to the left of the USB connector can display red or green. If both LED elements are active then an intermediate colour will result

LED1 (Green - CAN Activity) | LED2 (Red - CAN Fault)

LED Name: Green - CAN Activity

LED Events: C1 | C2 | C3 | C4

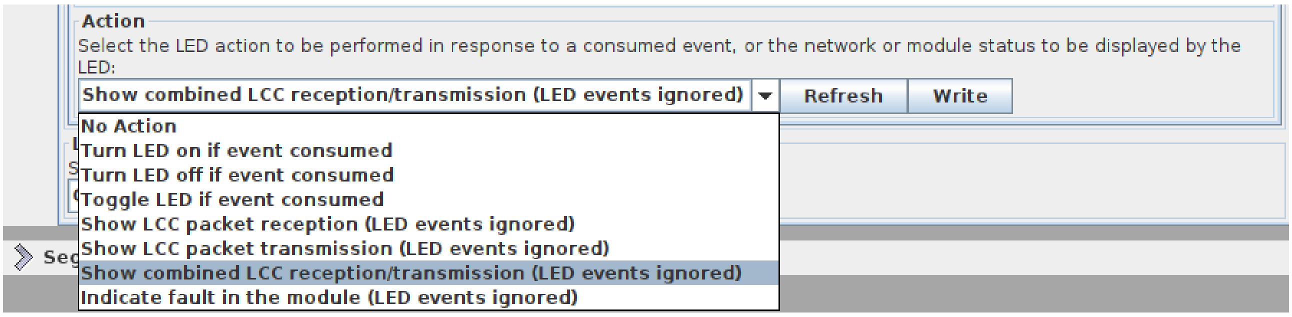
Event Name
Optional - enter a user-friendly event name

Event
Specify the event that (when consumed) will cause the LED action
02.01.2C.04.07.00.00.00

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 combined LCC reception/transmission (LED events ignored)

LED Pattern
Select the LED blink pattern, repeating appx. every 2 s
Off with Short (64 ms) blink on

The CDI Action field controls the LED functions



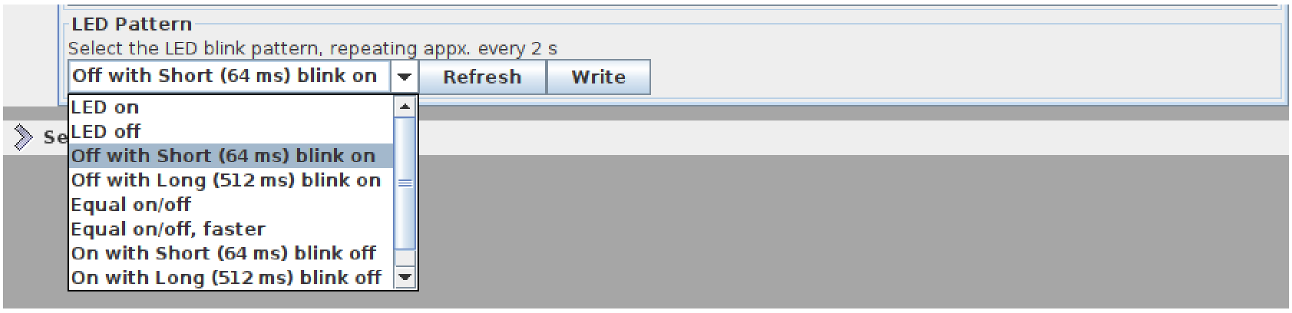
Action
Select the LED action to be performed in response to a consumed event, or the network or module status to be displayed by the LED:
Show combined LCC reception/transmission (LED events ignored)

- No Action
- Turn LED on if event consumed
- Turn LED off if event consumed
- Toggle LED if event consumed
- Show LCC packet reception (LED events ignored)
- 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 reception (LED events ignored)	The LED blinks briefly on each LCC message received
Show LCC packet transmission (LED events ignored)	The LED blinks briefly on each LCC message sent by the PI-LCC
Show combined LCC reception/transmission (LED events ignored)	The LED blinks briefly for each LCC message sent or received
Indicate fault in the module (LED events ignored)	The LED indicates an error in the module (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, repeating appx. every 2 s

Off with Short (64 ms) blink on

- LED on
- 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 https://www.sprog-dcc.co.uk/downloads/linux/pi-sprog-pi4-wifi/pi-sprog-wifi-2023-05-03-5.4.pdf 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 https://www.sprog-dcc.co.uk/downloads/linux/pi5/pi-lcc-wifi-2023-12-05-arm64-5.7.1.pdf.

4 Known Issues

4.1 Issue 1 PCB LED Legend and LED colours do not match description in CDI

The red LEDs labelled as TX and RX LEDs labelled on the PCB are describes as “LED1 (Green – CAN Activity)” and “LED2 (Red – CAN Fault)”, respectively, in the CDI.

The CDI incorrectly refers to bicolour LEDs and a USB connector.

On initial production, both LEDs are red.

LED colours will be addressed in a future hardware batch. The PCB legend will not be changed.

The CDI will be updated in a future firmware release.

4.2 No CDI Field For Setting the Custom LED Pattern

There is no CDI field to enter the data to be used with the LED Pattern – Use custom pattern selection.

Will be fixed in a future firmware upgrade.

5 Issues fixed in This Release

5.1 SNII response if buffer full uses wrong error code

Fixed.

5.2 CDI XML fails with strict parser

Fixed.

5.3 Accessing Configuration Memory

Memory space specified in the optional byte 6 of the memory read/write datagram is handled correctly.

5.4 Button Event Identification

Button events are identified as producer events.

5.5 ACDI Memory Space Layout

Format of the 251 (0xFB) and 252 (0xFC) memory spaces for ACDI are correct.

5.6 Memory Read Requests Flags

The Datagram Received OK message includes the reply pending flag.

6 Links to Further Information

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

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

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

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

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

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

JMRI users https://groups.io/g/jmriusers/topics JMRI software topics.

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

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