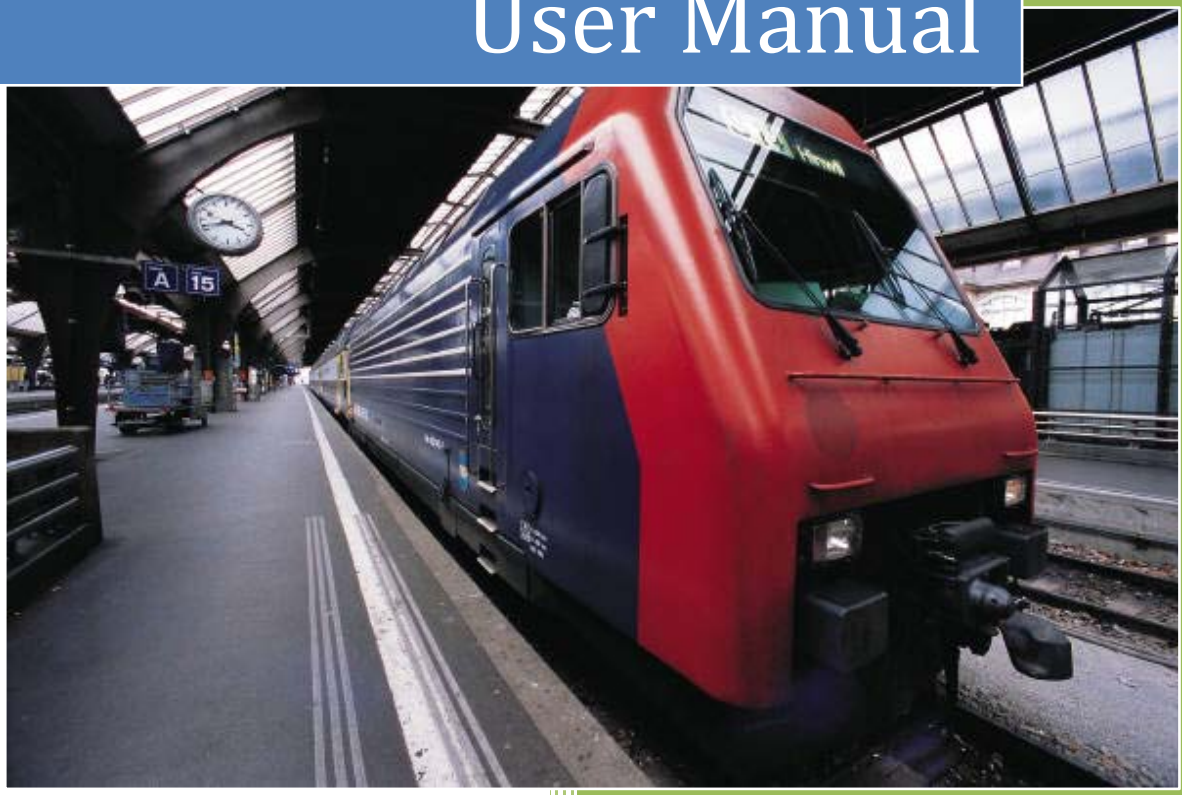
2016

cmOS Engineering LCP1 User Manual



cmOS Engineering

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Thank you for using a cmOS Engineering LCP1 Layout Command and Control (LCC) CAN node. Please ensure you read the sections on setting the jumpers and power requirements as a minimum before installing the LCP1 in your layout

This node is compliant with specifications of the OpenLCB project and offers a number of enhanced features.

Functional Description

The LCP1 as supplied, provides 16 connections that may be configured as inputs or outputs to control model railway accessories. The factory default is 8 inputs and 8 outputs. These connections are designed to provide or receive low power (5 volt) control. See the specification section for maximum load capacity.

The LCP1 has the capability of accepting one or two expansion boards, available separately, which can drive higher power loads such as relays, pulse point motors, stall point motors, and other accessories. These expansion boards allow the LCP1 to control up to 32 individual devices.

Physical Description

The LCP1 is a 60mm by 70mm Printed Circuit Board (PCB), with two RJ45 sockets which loop the CAN bus, a 7mm power connector which can power the board, (see the section on power requirements), two 10 way screw connectors for connecting control and power to accessories, two sockets to allow expansion boards to be connected, and five LEDs to provide status indication.

Mounting

The LCP1 has four mounting holes in each corner. It is recommended that at least two of these be used. Small neoprene spacers MUST be used. DO NOT screw any PCB directly to the layout structure as mechanical stress damage may occur.

Power Requirements

The basic power consumption of the LCP1 without any accessories connected is 35mA. This power may be supplied by providing a local power supply with a maximum output of 13.8V via the local power connector with the centre pin positive. The device is protected against reverse polarity connections. This power may be distributed to the CAN bus if desired.

Alternatively, the power may be drawn from the CAN bus. See the section below on setting the jumpers. If you draw power from the CAN bus, the total load including the devices connected to the LCP1 must not exceed 1 amp. It is recommended that devices that draw power from the bus be within 6M of the node suppling power.

It is safe to have the jumpers installed to draw power from the bus and provide local power. The node is designed to arbitrate any power conflict.

Due to the high voltage or current requirements of some expansion boards, the settings for these jumpers are covered in the documentation for those boards.

Setting the Jumpers

The CAN bus operates a very high data rate and certain technical requirements need to be met to accommodate this high data rate.

It is essential that the CAN bus be electrically terminated at each end. The LCP1 is capable of providing this termination rather than requiring separate terminators. IT IS ESSENTIAL THAT THE EACH END OF THE BUS IS TERMINATED. Failure to observe these requirements may introduce difficult intermittent faults in the installation.

If the LCP1 is at either end of the CAN bus, two jumpers must be placed on LK1, otherwise there must be no jumpers on LK1. See the mechanical drawing at the end of this document for locations of the jumpers. If you add a node to the end of the bus, remember to remove the termination jumpers from the node that was last on the bus. We see this as a potential problem in larger layouts if these requirements are not strictly observed.

Link Number	Function	Link Installed	Link Removed	Comment
LK 1	CAN Bus Termination	Bus Terminated	Bus not Terminated	MUST be terminated ONLY on nodes at each end of bus
LK 2	CAN Bus Ground	CAN Bus grounded at node	CAN Bus nit grounded at node	Generally not required - Only in electrically noisy environments - should be left removed
LK 3	Power to left bus segment	Power used or sent to left bus segment	Power not used or sent to left bus segment	
Lk 4	Power to right bus segment	Power used or sent to right bus segment	Power not used or sent to right bus segment	

Table 1 Jumper/Link Settings

Configuration

Note: Configuration involves writing to the configuration memory. This will cause a functional reset which may cause accessories to change state, possibly causing derailments etc. Do not configure when trains are running.

When an input to the node changes state (producer), e.g., a button being pressed, an event id will be sent to the CAN bus. An event on the CAN bus, or generated locally, may be used (consumed) by an

output of the node. There are two event ids associated with every producer or consumer on the node. These are called activation and deactivation event ids. The relationship for example for a button and a light:

Button Press: Activation Event id for that button sent.

Button Release: Deactivation Event id for that button sent.

Activation Event id received that matches an Activation Event for a light on the node, that ;light will turn on.

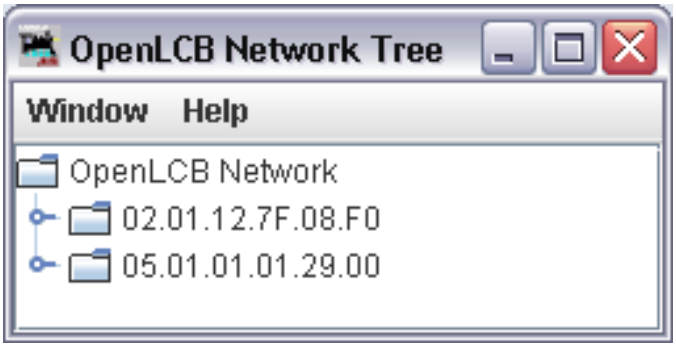
Inactivation Event id received that matches a Inactivation Event for a light on the node, that light will turn off.

These event ids are 16 digits long so there is no shortage of ids.

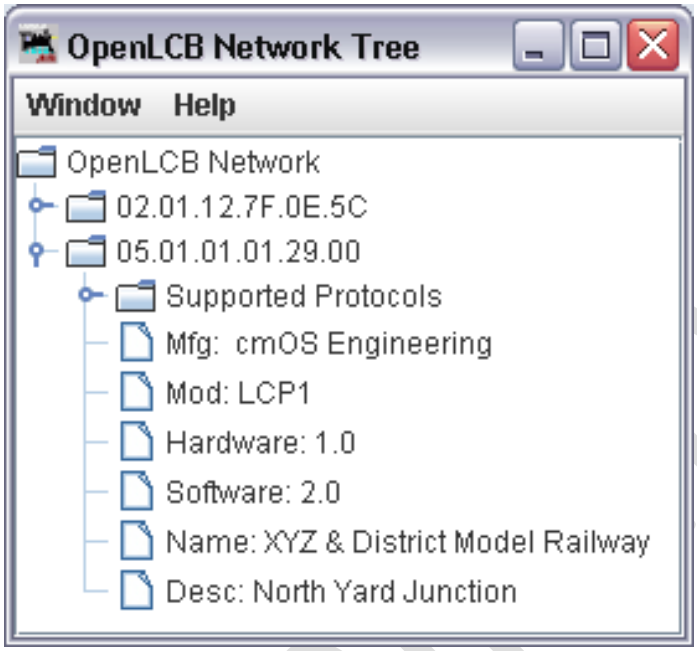
A series of unique ids is loaded into the LCP1 prior to shipping from the factory, but to be of any real use, changes need to be made depending on your layout requirements.

The ubiquitous JMRI software is used to configure the LCP1 node.

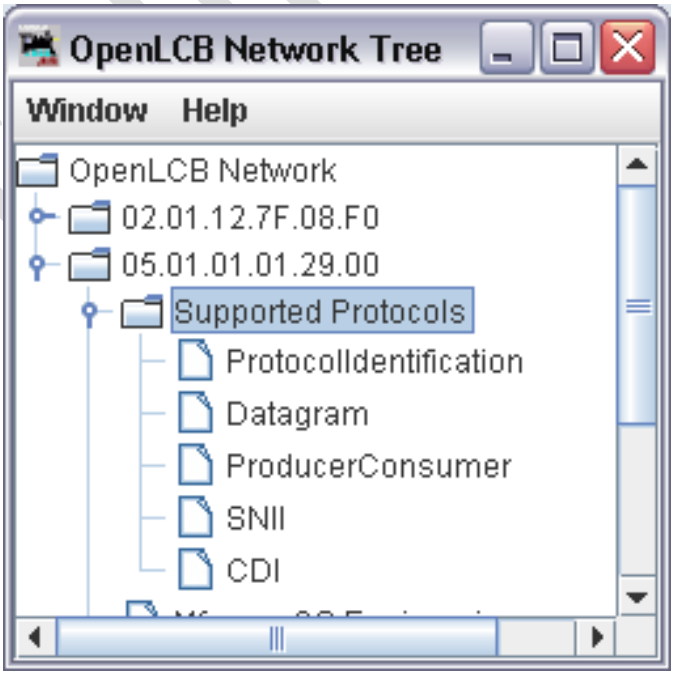
Select OpenLCB and choose Configure Nodes



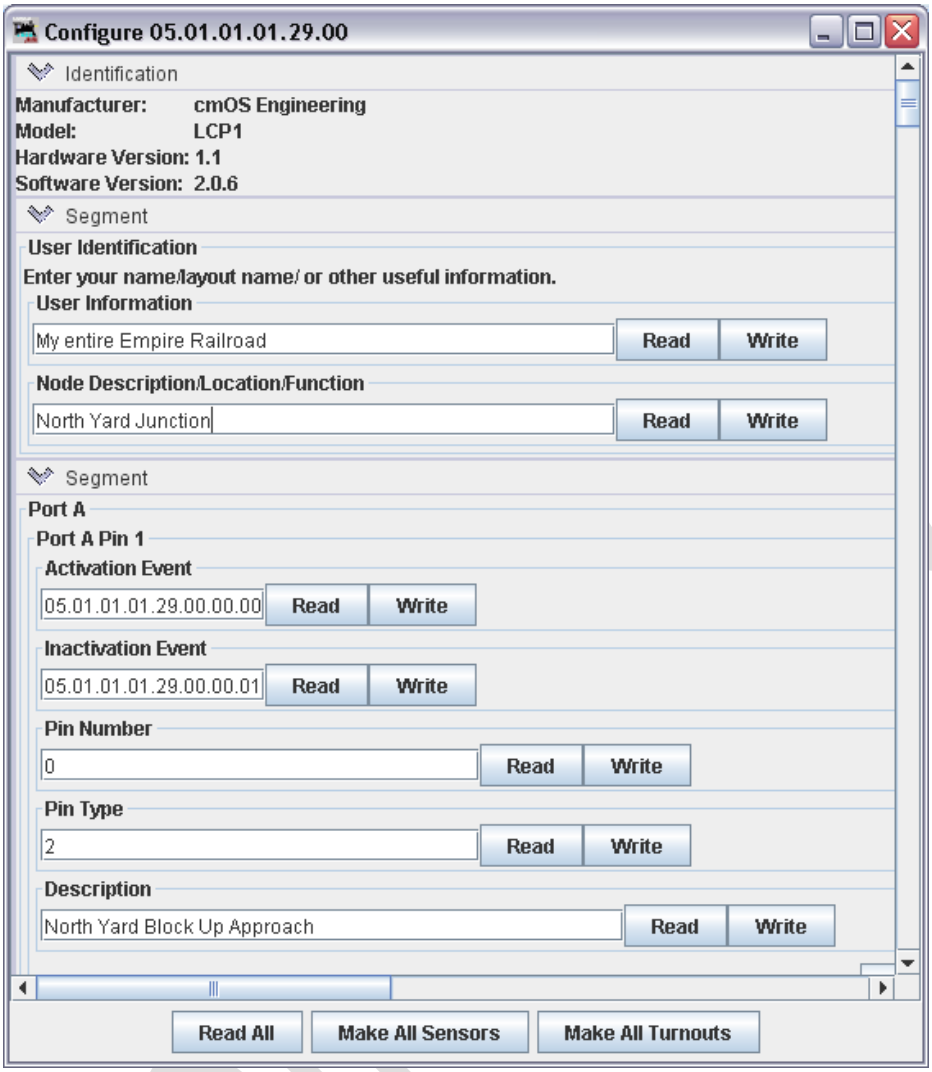
Each node has a unique address assigned at manufacture time. The LCP1 node address is the serial number printed on the board near the top. In this example we will configure the node with address 05.01.01.01.29.00. Open the node and it will reveal various information and a folder of supported protocols.



Open the supported protocol folder. If you have obtained a block of personal node ids, these can be programmed during manufacture at no additional charge. The OpenLCB group allocate ids to clubs, groups, and individuals at no charge. See the reference section for details.



cmOS Engineering nodes use the CDI protocol. Select CDI. The resulting window will take several seconds to load.



The identification and user identification segments section at the top of the screen appear only once The next section appears once for each producer or consumer on the node. The LCP1 has 32 available, but unless there is an expansion board plugged in, only the first sixteen are relevant.

The Activation and Inactivation event ids should be changed as required. Changes to the pin number have no effect. The pin type defines a consumer (output) or producer (input) or not present.

Pin Type Value	Meaning
1	Output (Consumer)
2	Input (Producer)
255	Not present

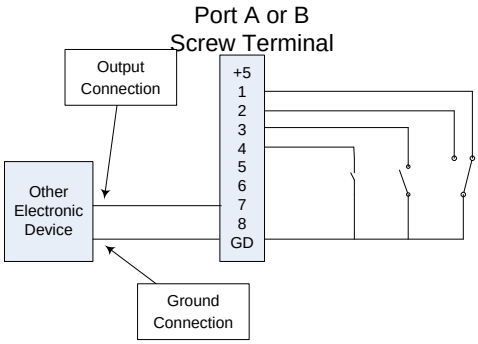
Table 2 Pin Type Values

Once the desired information is set for a line, press the Write button and the information will be written to the LCP1. Each write takes several seconds as the node resets after each write.

The Identification, Location, and Description fields should be used to give meaningful names to the node and the functions controlled.

Input Wiring

It is essential that inputs and outputs from the basic LCP1 node are not subjected to voltages greater than +5 volts or less than 0 volts. Ire repairable damage will result. Some expansion boards are designed for higher voltages. See the appropriate documentation.



Switches, relay contacts, etc are simply wired between Ground and the relevant input screw terminal. There is a Ground screw terminals on the end of each of the Port A and Port B screw terminals marked GD shown on the right above.

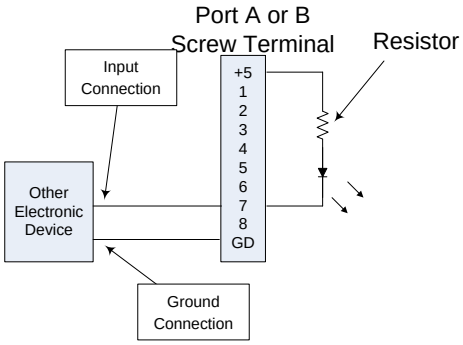
Similarly, as shown to the left above, outputs from other electronic devices as long as the output voltage swing is between 0 and +5 volts. The ground of such devices must be connected to the LCP1 ground.

Output Wiring

The general form is shown below.

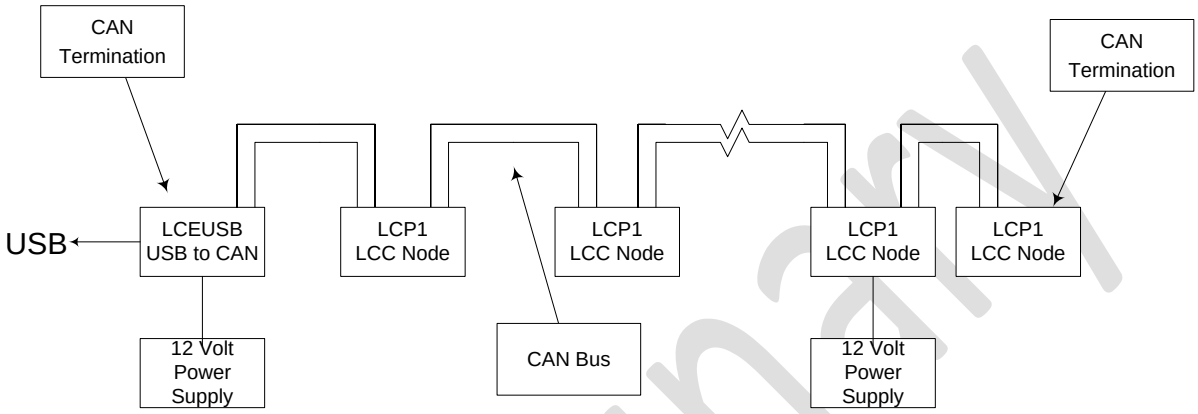
The ground of another electronic device must be connected to the LCP1 ground. The unconnected input to the 'Other Electronic Device' must not float above +5v and should be tested prior to connection to the LCP1.

The resistor must be present for each of the devices shown on the right. The example is a LED. The resistor must limit the current flowing to 10mA per output. For a LED this is usually about 560 ohms for very bright to 820 ohms for low brightness. Grain of wheat bulbs draw in excess of the maximum. Use an LCE08 expansion board for that application.



CAN Bus Wiring

For LCC installations in model railway systems, it is strongly recommended that the bus be cabled using normal Ethernet cable. While not all conductors are used, it simplifies installation. All cmOS Engineering LCC products connect using two RJ45 connectors. This facilitates looping the bus from node to node. It also allows for simple accessory power distribution and generally neater installation. Although the standard allows stub connections, cmOS Engineering strongly recommends stub connections be avoided. The maximum length of a CAN segment is about 300 meters. This length should be reduced by 6 meters for every node installed.



The diagram above shows several nodes connected by a daisy chain CAN segment. The power supplies can be connected in any convenient location. For small current loads, only one supply may be necessary.

Normal Operation

Upon powering up the node, LED 5 will light until all internal housekeeping is complete and detects the prescience of at least one other node. LED 2 will blink for 5 seconds for factory testing purposes. LED 3 will blink at about a one second rate indicating normal operation, and LED 4 will flash when activity on the CAN bus is detected.

cmOS Engineering products

cmOS Engineering Part Number	Description	Comments
LCP1	Primary LCC bus node	LCC node with 16 ports each capable of being producer or consumer. 2 sockets to allow any combination of LCExx cards being connected allowing up to 32 producers or consumers.
LCE08	8 input/output high current	Provides 8 channels individually programmable as producer or consumer. Consumer mode allows current of up to 500mA per channel - although total limit of 1 amp per board. Plugs directly into

		LCP1
LCE14	4 channel stall motor driver	Provides 4 channels of stall motor drive with status feedback to indicate actual turnout position. Each port can drive 2 parallel turnout motors. Plugs directly into LCP1
LCE24	4 channel block detector	Provide 4 channels of block detection. Plugs directly into LCP1. DCC systems only
LCE34	4 channel pulse point driver	Provides 4 channels of pulse motor drive with status feedback to indicate actual turnout position. Each port can drive 2 parallel turnout motors. Plugs directly into LCP1
LCEUSB	USB to CAN adaptor	Provides USB interface to computer system for configuration or enhanced layout automation.
LCEGA1*	Combinational Logic array	Provides virtual programmable logic gates for complex control without the need for a computer system. Connects to the LCC bus.
SMD2	Stand alone dual stall motor driver	Small standalone control for single wire control of stall motor turnouts
BD4	Stand alone quad block detector	Provides 4 independent channels of block detection. Open collector output for control loads of 100mA. DCC systems only.

* Product currently in design

Specifications

Mechanical		
	Dimensions	Width: 70mm Height: 60mm
	Mounting	4 x 3.5mm holes
	Weight	
Environmental		
	Operating	-40°C to 85°C; Humidity <90%
	Storage	-60 °C to 150 °C; Humidity <90%
Electrical		
	Absolute	Supply voltage 13.8 v

	Maximums	Voltage on any input/output pin: Max +5.2V Min -0.2V DC current per input/output pin: 35mA total per device 300mA
	Supply voltage	Min 7 Volts; Max 12.8 Volts Reverse voltage protected
	Supply Current (All input/output off)	35mA
	Connectors	1 x 7mm Input power centre pin positive 2 x RJ45 Ethernet Looping (Power and CAN ground Jumper option) 2 x 10 Screw Terminal for input output connection with +5 & GND 2 x 20 pin Enhancement/Expansion Ports
	CAN termination	Passive bypassed split resistors (Jumper option)
Standards		
	OPENLCB	At least minimum requirements compliant
	NMRA	At least minimum requirements S 9.7 compliant

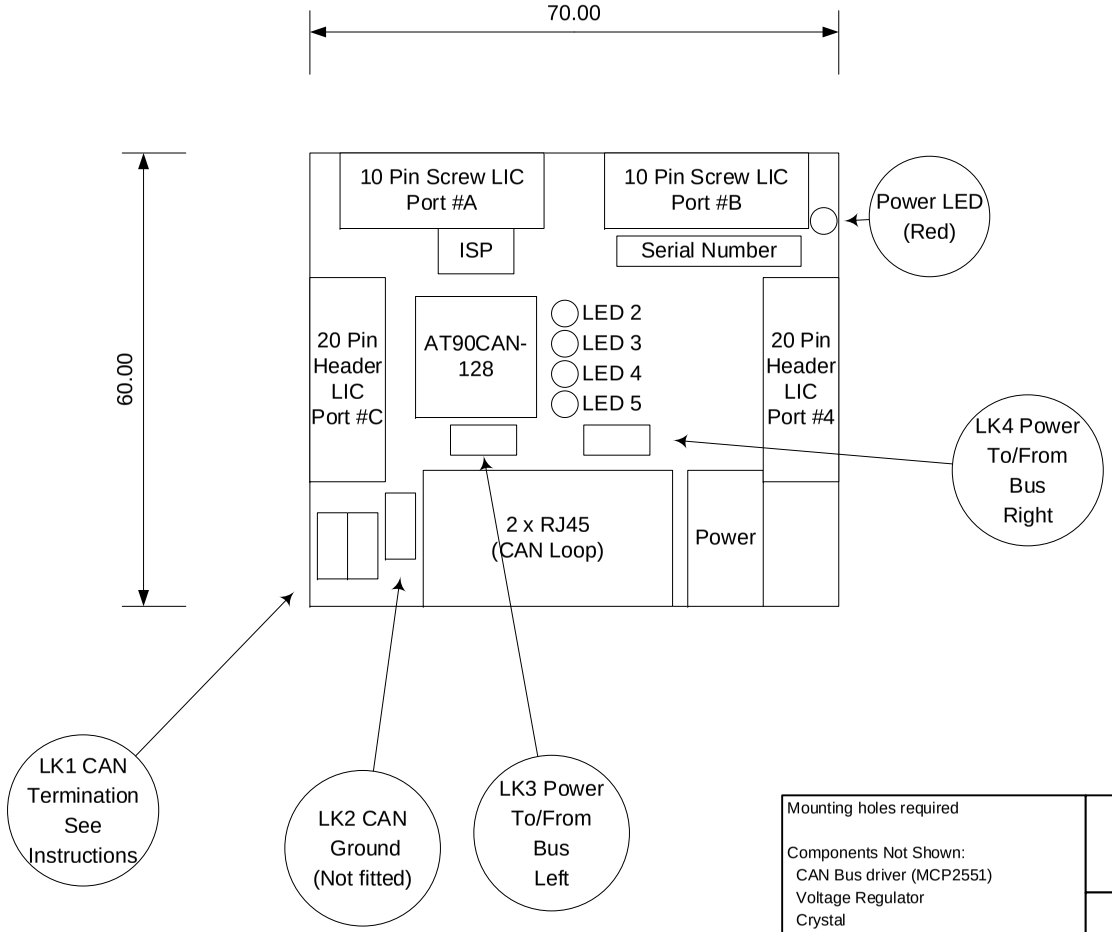
Copyright and Attribution

In alphabetical order:

DGoodman
Digital Graphics P/L
Fabian Greif, Roboterclub Aachen e.V.
OpenLCB group
Peter Fleury

References

cmOS Engineering: CMOSEng.com.au
Apply for node id range: http://registry.openlcb.org/uniqueidranges
General OLCB information: http://openlcb.org/
CAN documentation: https://en.wikipedia.org/wiki/CAN_bus
JMRI
Users: https://groups.yahoo.com/neo/groups/jmriusers/conversations/messages
Project: http://jmri.sourceforge.net/
NMRA Standards: http://nmra.org/index-nmra-standards-and-recommended-practices



Mounting holes required

Components Not Shown:
- CAN Bus driver (MCP2551)
- Voltage Regulator
- Crystal
- Power Jumper
- Termination Jumper

Ports Resized & Renumbered

Dimensions in mm

Drawn: Chris Minahan

cmOS Engineering

LCC Primary Board
LCP1

SIZE	FSCM NO	DWG NO	REV
A4	None	150626	4

SCALE 1:1 SHEET 1 OF 1