UNDERSTANDING LCC

LAYOUT COMMAND CONTROL

A HELPFUL GUIDE

A presentation for NMRA and CRMHA members

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A Few Terms to Know

Node - A NODE is a hardware device which you install to do something.

Think of it like a DCC booster or Decoder. Every node has a globally unique Node ID assigned by the manufacturer. A common convention is that a nodes default Event IDs are based on the node ID, guaranteeing unique events. Event IDs may, however be freely assigned by the user.

Producer - A device which has the ability to *Produce an Event*

Consumer - A device with can respond to, or *Consume an Event*.

It could be a turnout or an indicator lamp.

Event - A message indicating something has happened, or will/should happen.

There can be multiple Producers creating an Event, as well as multiple Consumers reacting to it.

An event could be used to change one turnout, or multiple devices to create a route and properly.

OK… Let's see how an Event works!

Turnout 101
PushButton

Tower LCC +Q
(Node)

When Turnout 101 Button is pressed, an **Event** is **Produced** 40.00.AE.00.07

The **Event** is sent along the CAN Bus for all the **Nodes** to see.

When a **Node** sees an **Event** it has been configured for, that **Event** will be **Consumed** and will control the Turnout.

Turnout 101
40.00.AE.00.07

Node 2

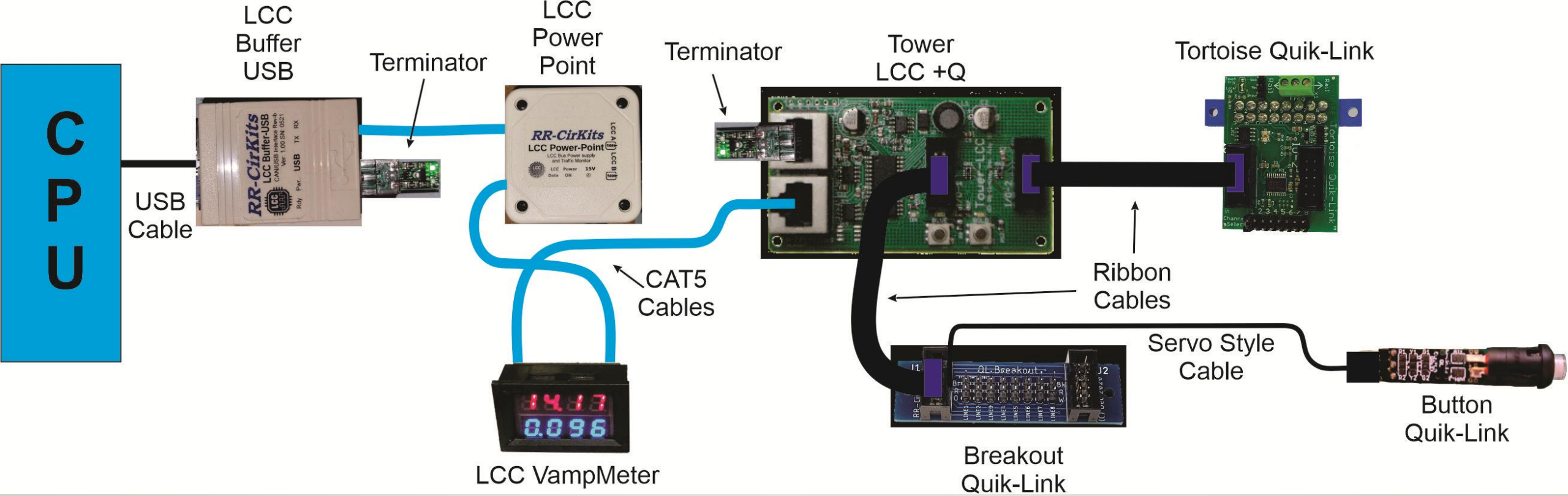
Turnout 102
40.00.AE.00.08

Node 3

Turnout 103
40.00.AE.00.09

Node 4

CAN Bus



Basic Hardware needs:

LCC Buffer-USB – To connect to your computer.
Power Point / Repeater / LCC-LocoNet Gateway – All can provide power to the CAN BUS.
Terminators – To terminate each end of the CAN BUS.
Tower LCC +Q – A node to communicate with other devices.

CAN Bus

Controller Area Network - CAN bus is a robust, decentralized, and cost-effective communication protocol that allows multiple electronic control units (ECUs) in a vehicle or other system to communicate without a central computer.

1986 - Developed by bosch
1991 - Mercedes-Benz used in S class
1993 - Standards established
1996 - ODBC ports mandatory
2008 - Made mandatory for all us cars

For Layout Command Control (LCC), using standard Cat5 cable, you can run a bus for up to 1000 feet (300 meters) per segment, though each node on the bus reduces the overall maximum length. For example, with multiple nodes or stub cables, you may need to subtract length from the 1000-foot maximum. Always use Cat5 cable or similar shielded Ethernet-style cable, not standard flat phone cable, to ensure noise immunity and error correction for your control bus.

LCC Cable Limitations:

- **Maximum Bus Length:** The theoretical maximum length for an LCC bus is 1000 feet (300 meters).
- **Nodes and Stubs:** The 1000-foot limit is reduced by the number of nodes and "stub" cables (short connections from the main bus to a node) attached to the bus.
- **Minimum Cable Length:** Some LCC systems, like the RR-CirKits Tower LCC, require a minimum of 1 foot of cable between LCC connectors.

Wire Type:

Recommended that you choose AWG 24 CAT-5 wiring or AWG 23 CAT6 wiring. The use of AWG 26 wiring reduces the maximum length of your network to approximately 40% of its specified length. Especially avoid using copper clad aluminum wire or AWG 28 low profile wiring as they have even higher than normal resistance at the relatively low frequencies used by the LCC. This higher resistance shortens the maximum distance for reliable communications even more than using AWG 26 wiring does.

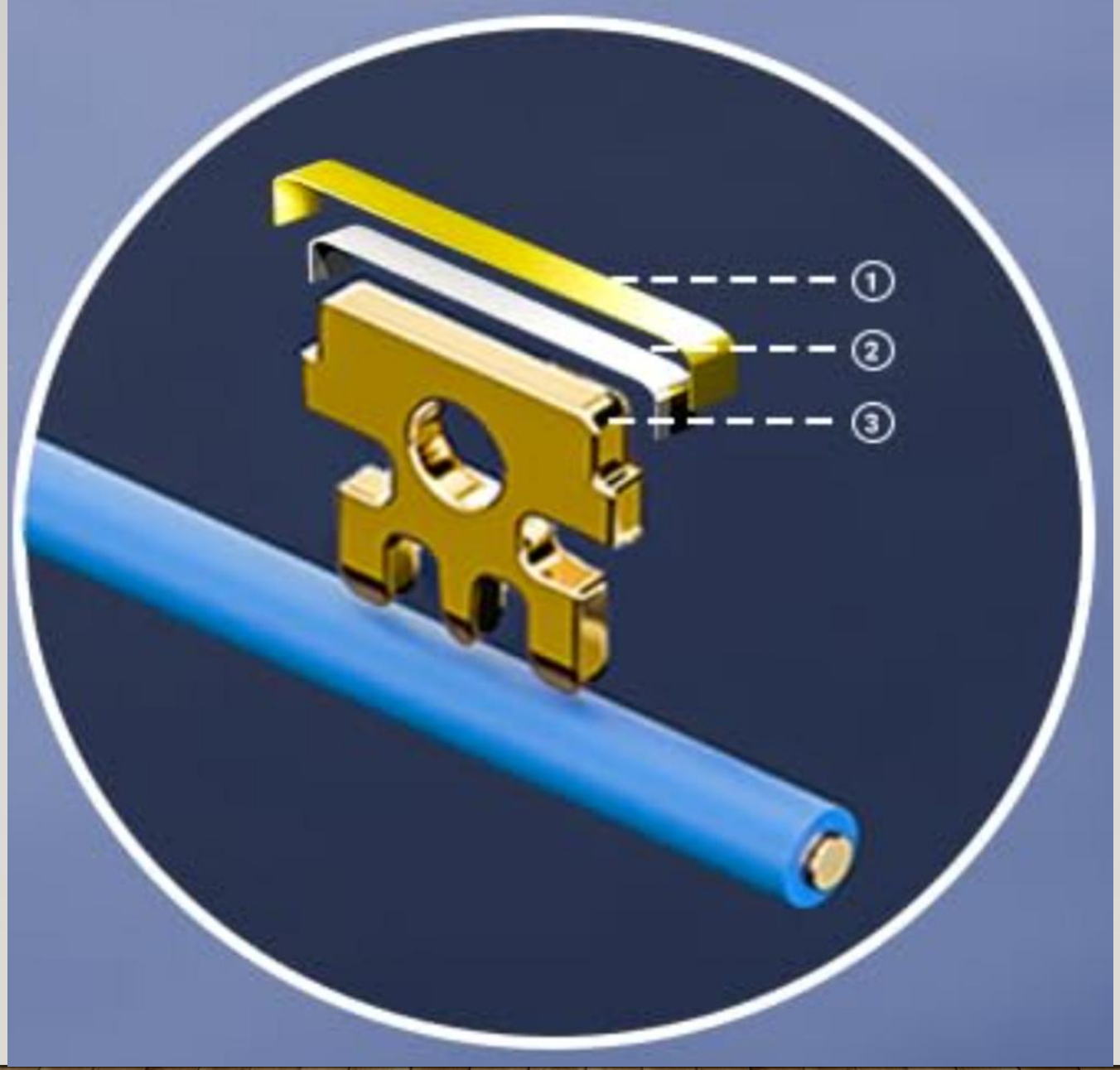
RJ45 Connectors:

RJ-45 crimp connectors are made with three blade styles. (the end of the contact that crimps into/onto the wire) Single 'U', double 'UU', and triple 'VVV' points. Stranded cables may be made with any of the three blade styles because the points crimp into and between the individual wire strands. However, if you are using solid wire, then you must only use the Three Point Style of blade. ('VVV') It is designed to trap the solid wire between the three points, two on one side, and the center one on the other side, for a corrosion tight connection.

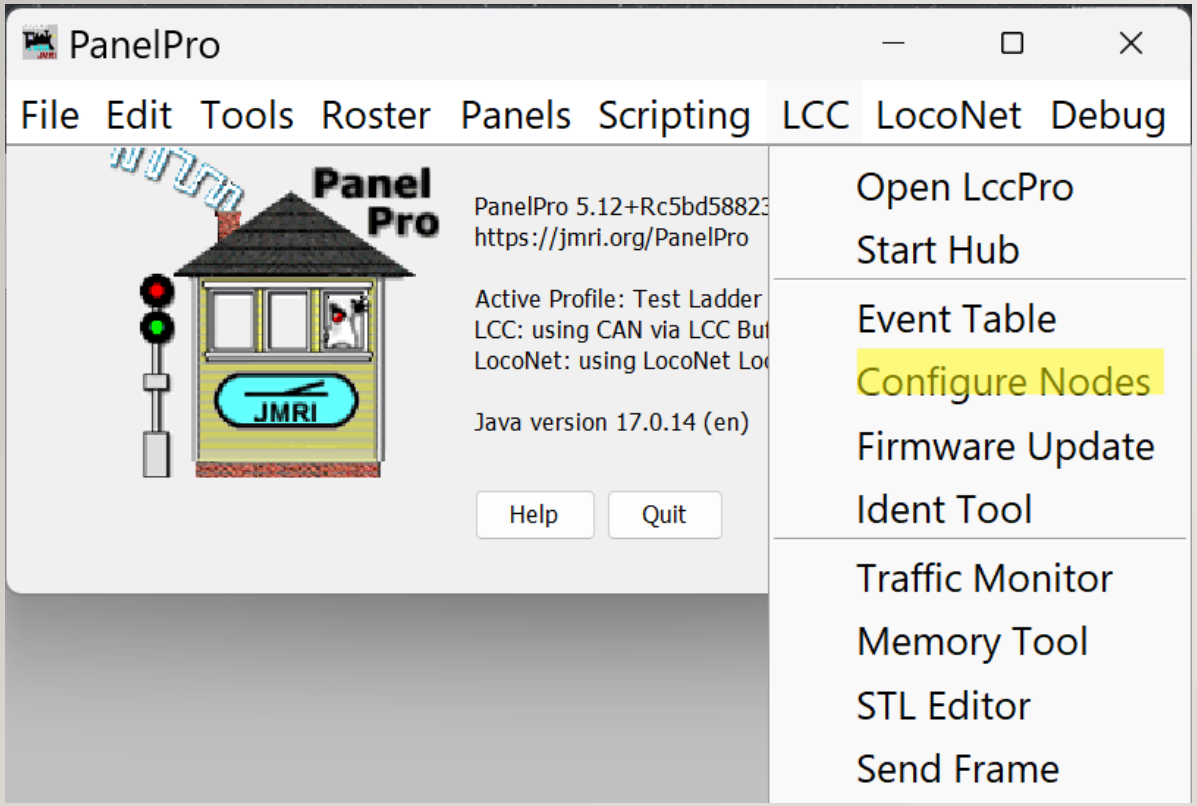
The single or double pointed blades will simply press against the side of the solid wire, and will fail in time. (usually, the morning of your open house)

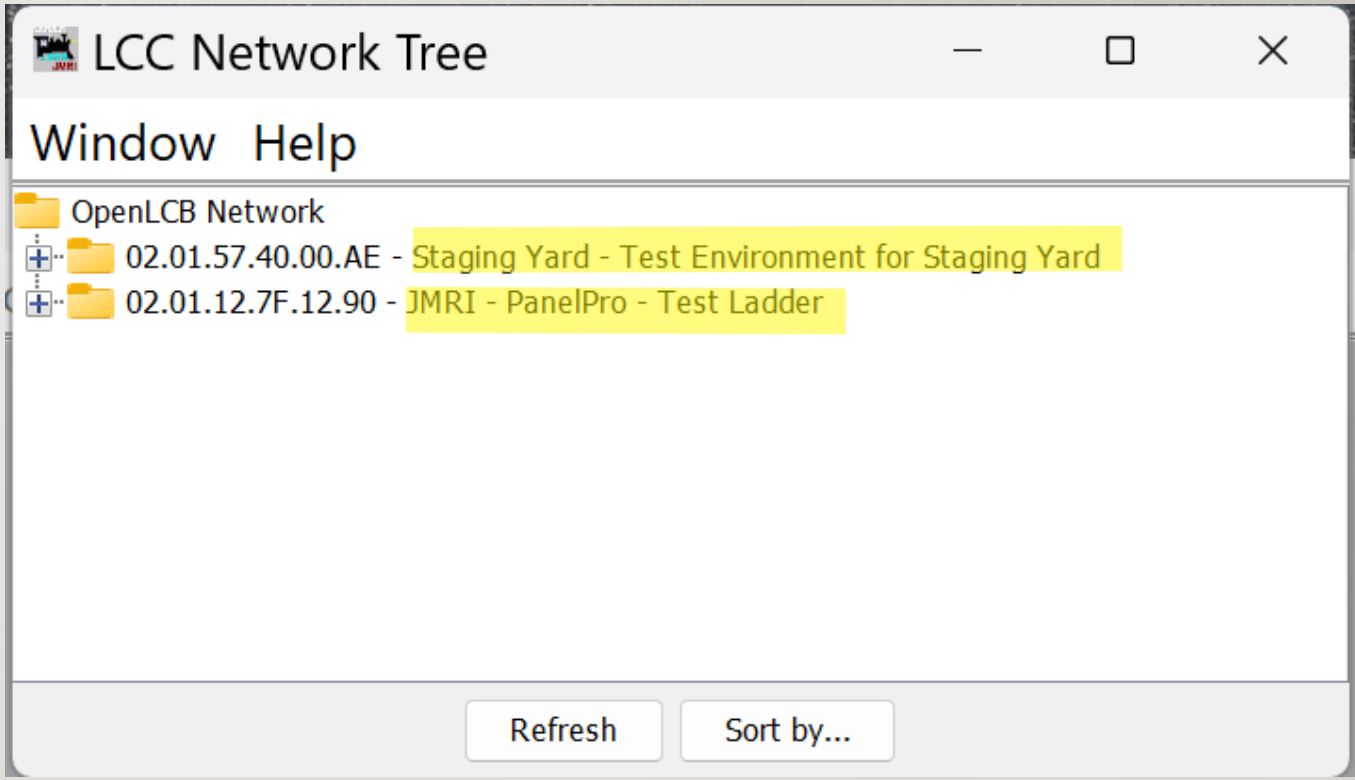
Amazon.com:VCE 100-Pack Cat6 RJ45 Pass Through Connectors, UL Listed Cat 6/Cat 5e RJ45 Ethernet Modular Plugs Ends Gold Plated for Solid or Stranded UTP Network Cable Support PoE : Electronics

Gold-Plated 3-Prong Contacts


1
2
3

Before Configuring or Changing
Backup your File



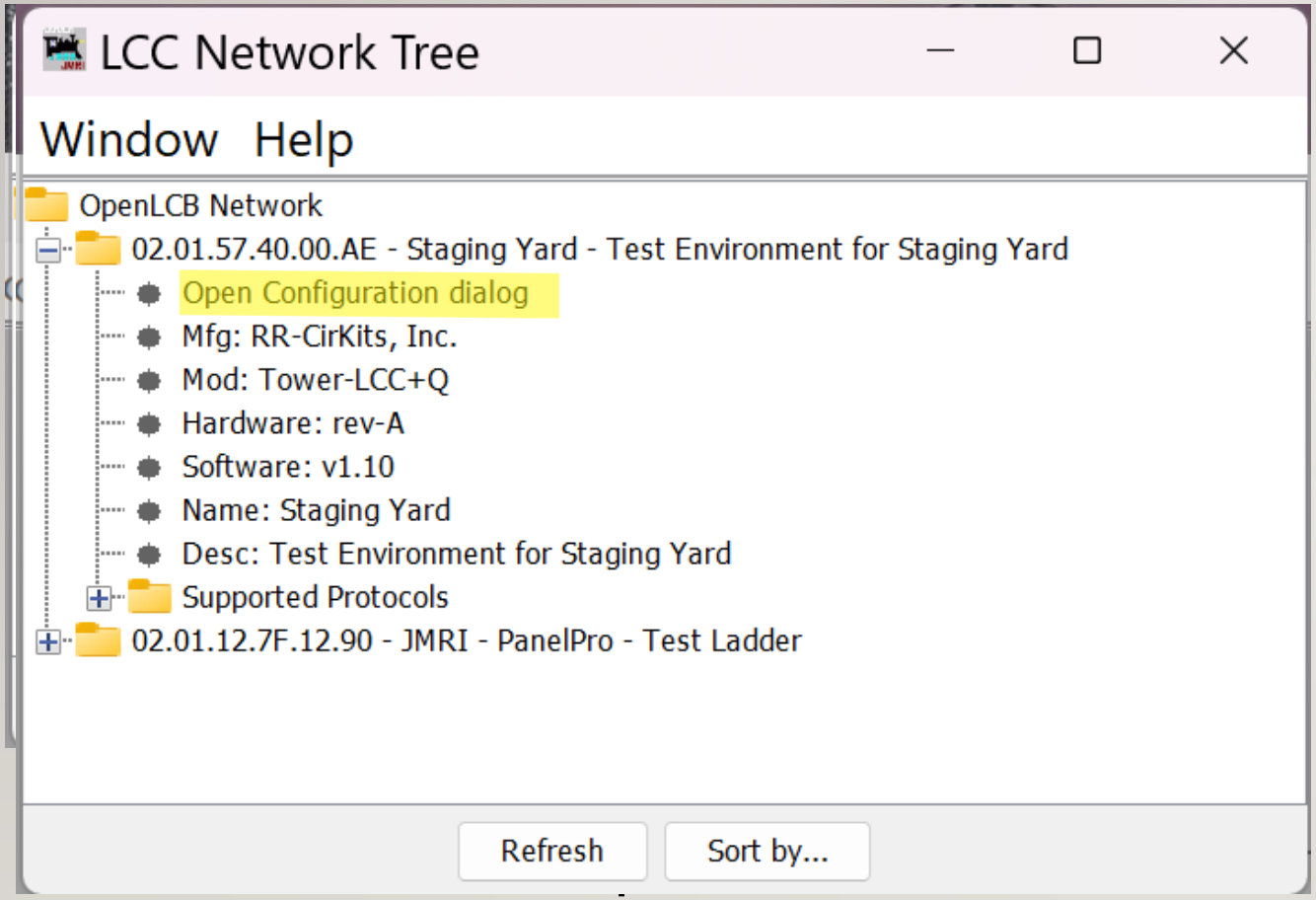


JMRI PanelPro with LCC Configured

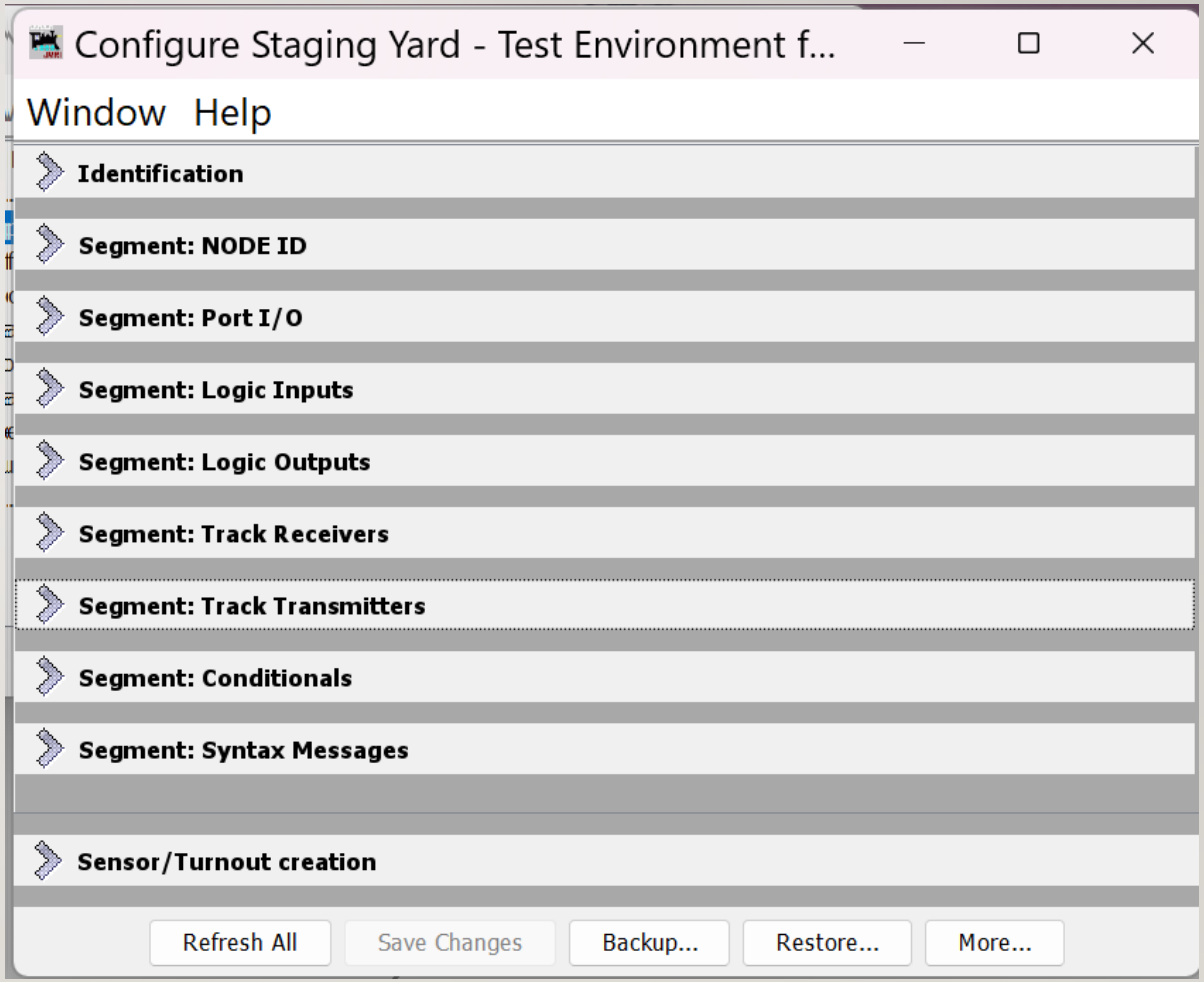
LCC Network Tree Showing Nodes

Before Configuring or Changing

Backup your File



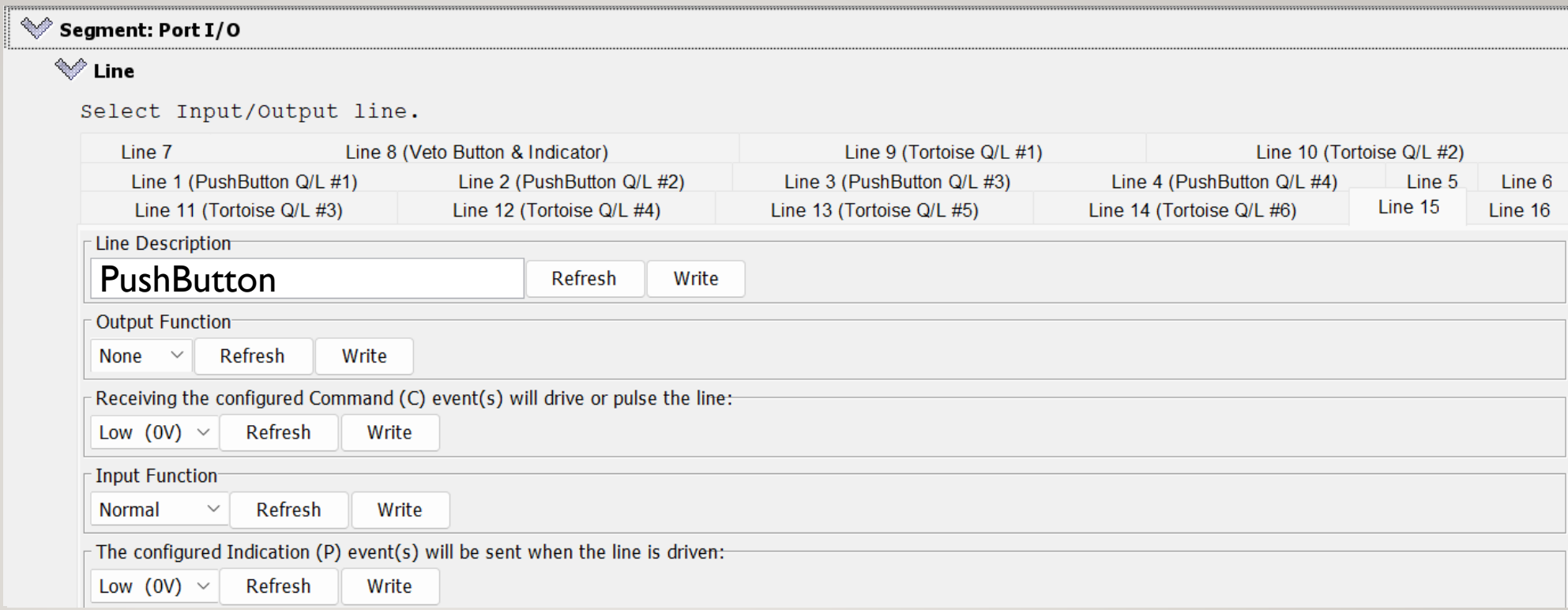
Click on Open Configuration dialog



Click on Backup and name file Blank

Configuration:

* Lines (I/O, Pins, Tabs)
  Commands/Consumers
  Actions/Producers
  Events (ID numbers)
  Commands



Once you enter a Line Description, the field will change colors. After you click on Write, the new value is written and the field color is returned to normal.

The Output Line

The hardware has an internal function generator that may be configured in 5 ways to create different types of actual outputs:. The two you will use most often are:

None (the output line is disabled)
Steady (output line follows the output state),

Drive Polarity

Low (0V) The output line is low when true. (default)
High (5V) The output line is high when true.

Producer (Input Function)

An input line may be configured in 3 ways:

None is no response to the input.
Normal response is used when an input change directly controls the sending of events.
Alternating action is used when a single line needs to produce alternating control events. (e.g. turnout normal, reverse)

Configuration:

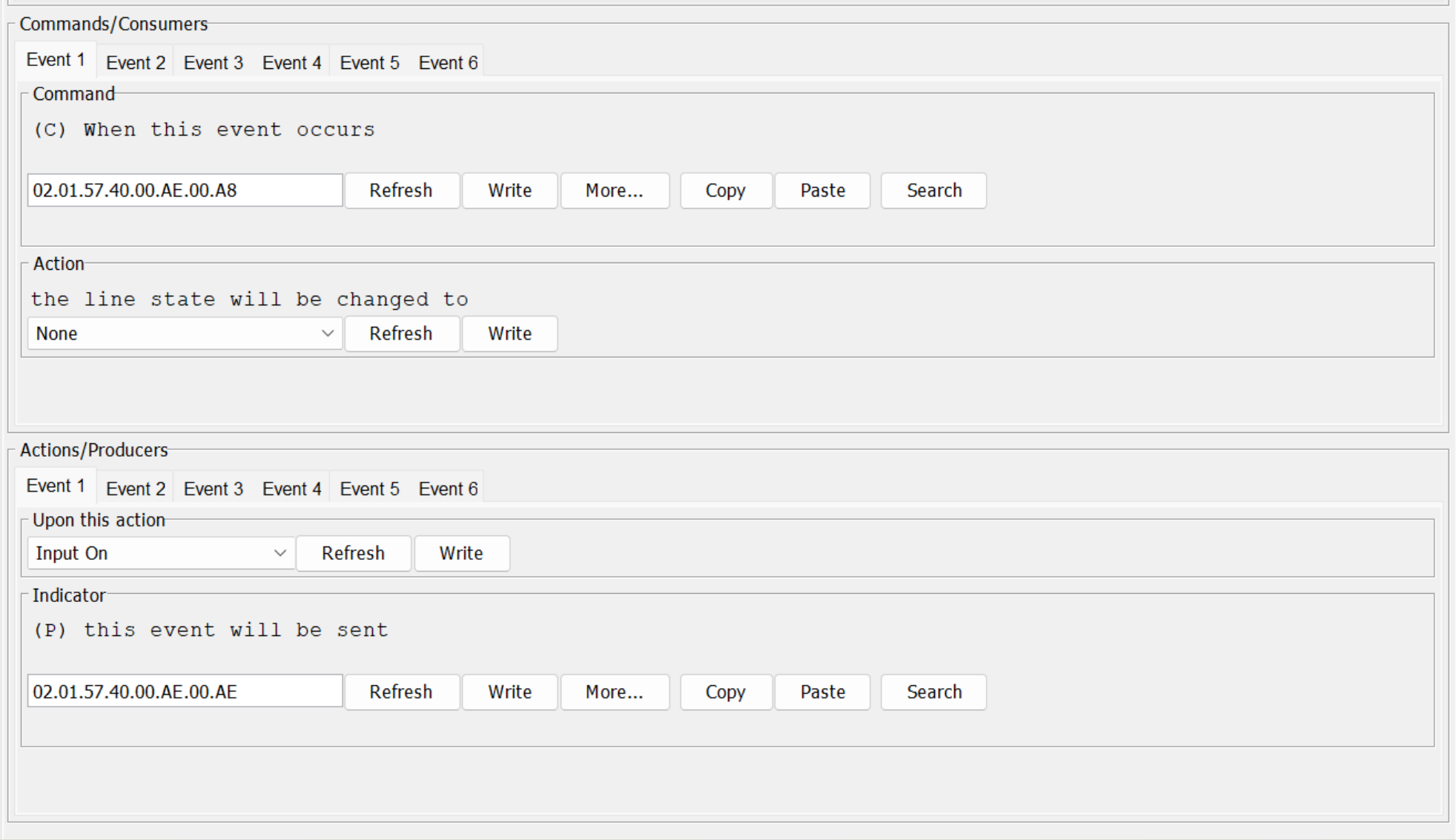
Lines (I/O, Pins, Tabs)

* Commands/Consumers

* Actions/Producers

Events (ID numbers)

Commands



Configuration:

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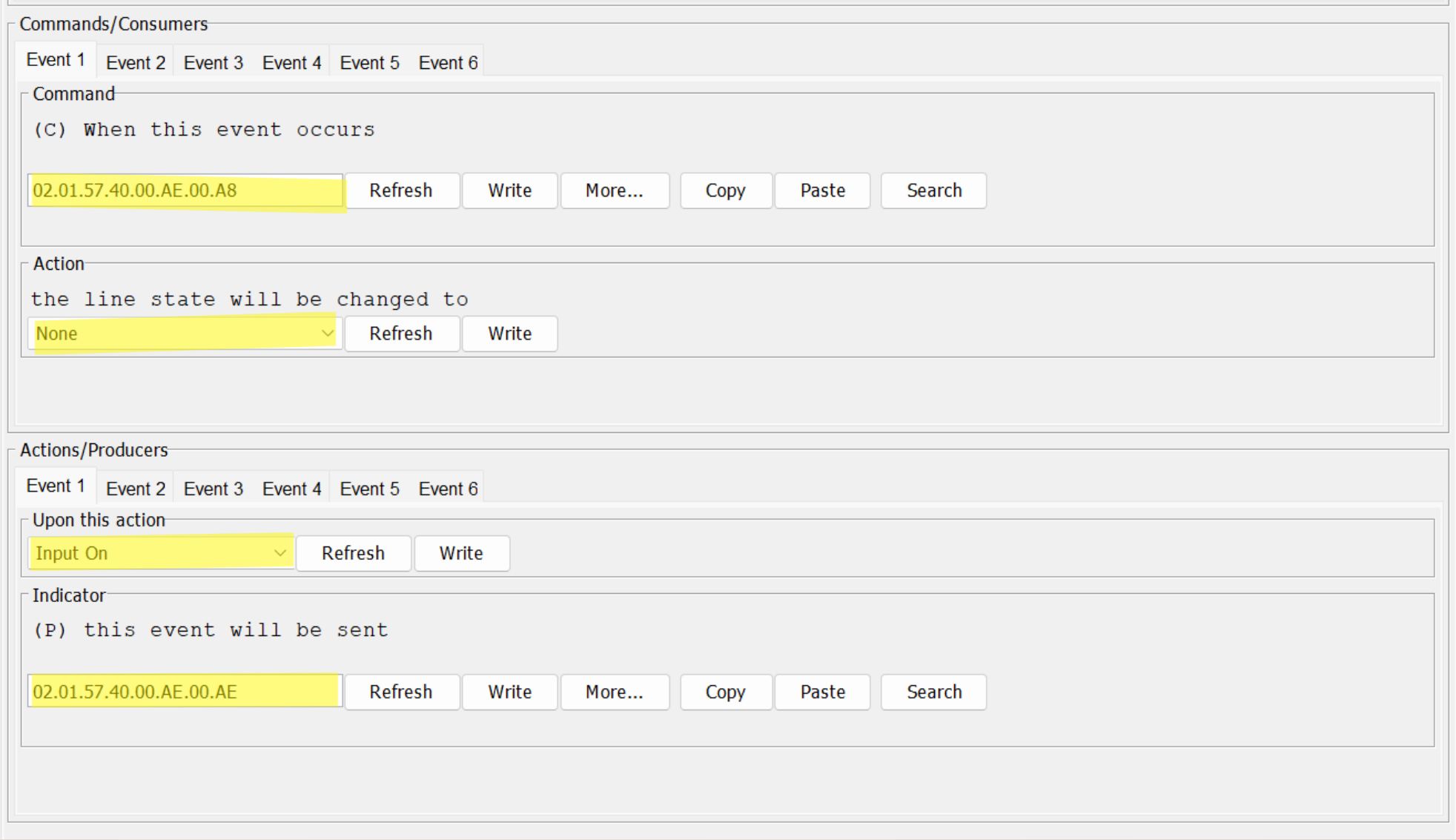
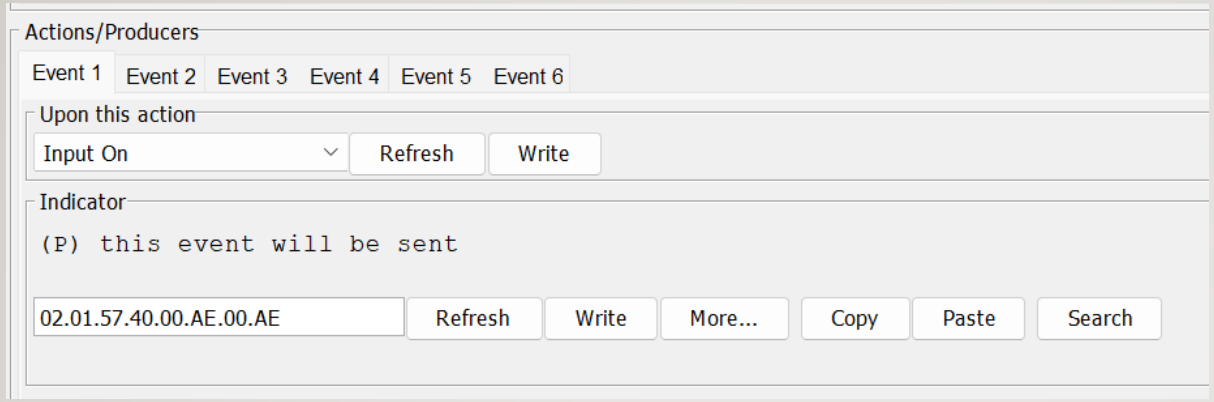


Actions/Producers

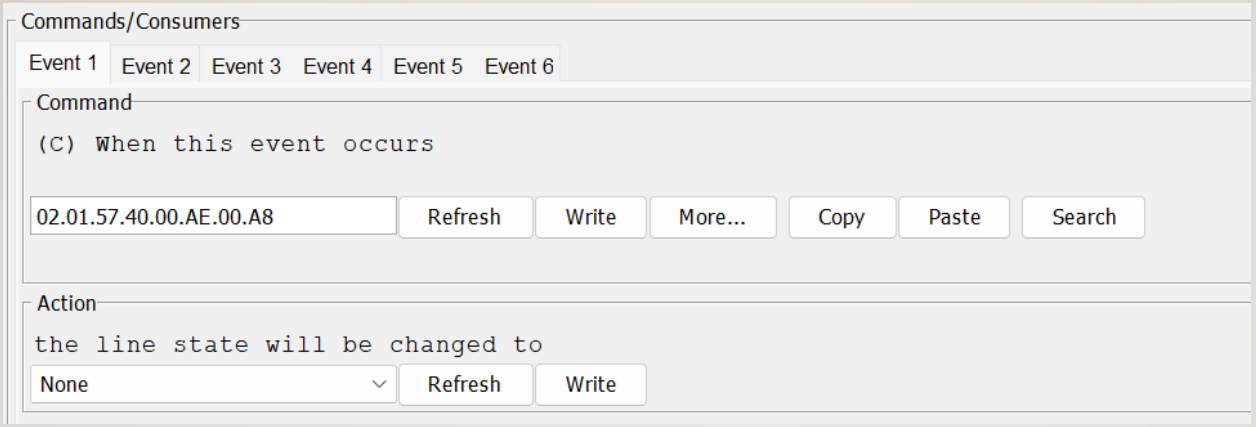
Producer are events that are sent to the bus. Each line has 6 producer events associated with it.



- **None** – This event is not created in response to anything.
- **Input On** – Responds to an input level change to ‘true’
- **Input Off** – Responds to an input level change to ‘false’
- **Gated On (Not Veto Input)** – Gated response to an input level change to ‘true’
- **Gated Off (Not Veto Input)** – Gated response to an input level change to ‘false’
- **Cascade command** – Responds to any output state change
- **Output State On command** – Responds to an output state change to ‘true’
- **Output State Off command** – Responds to an output state change to ‘false’
- **Output On (Function hi)** – Responds to an output level change to ‘high’
- **Output Off (Function lo)** – Responds to an output level change to ‘low’

Commands/Consumers

Commands are consumer events that are sent to the line. Each line has 6 consumer events associated with it.



- **None** –
- **On (Line Active)** – Sets the output state to ‘true’
- **Off (Line Inactive)** – Sets the output state to ‘false’
- **Change (Toggle)** – Changes the output state to its opposite state
- **Veto On (Active)** – Sets the veto state to ‘true’
- **Veto Off (Inactive)** – Sets the veto state to ‘false’
- **Gated On (Non Veto Output)** – Sets the output state to ‘true’ if veto is ‘false’
- **Gated Off (Non Veto Output)** – Sets the output state to ‘false’ if veto is ‘false’
- **Gated Change (Non Veto Output)** – Inverts the output state if veto is ‘false’

Two Very Important Registers

Everything is Line driven, meaning that all of the configuration for one device (i.e. Button Q/L or Tortoise Q/L) connected to a Line is to be configured under that Line in the Configuration Tool.

Also, each Line has two registers associated with it!

The first register is used to store the Last State.

Whatever the state of a Line was when power was removed, will be returned to that same state, once the power has been restored. So, if a Button Q/L was displaying Red when you powered everything down, when you bring your system back up, that Button Q/L should be displaying Red, just as it was before the power was removed. This is true of any device connected to a Line, including the Turnouts!

The second register is used to store the Veto state.

When the Veto register is turned on, using the **Veto On (Active)** command, then the register will be set to True. To reset the Veto register to False, you will use the **Veto Off (Inactive)** command. The Veto register is configured for each line independently. Also, instead of using the command **Input On,** we will use the command **Gated On (Non Veto Input)**. Now, if the Veto register (for that line) is True, the Input will be blocked. This is how you lock out a Push Button from little hands…

A Few (Statement List) STL Commands

(these will not be covered right now!)

- **A - And**
- **AN - And Not**
- **O - Or**
- **ON - Or Not**
- **X - Exclusive Or**
- **XN - Exclusive Or Not**

You can terminate a Boolean bit logic string by using one of the following instructions:

- **= - Assign**
- **R - Reset**
- **S - Set**

Links to obtain more information:

LCC Components:

RR CirKits.com

Logic Rail Tech.com

SPROG DCC Ltd

LCC Documents:

Ken's Documents

YouTube Videos:

The LCC Channel Welcome and Intro

Introduction to Layout Command Control (LCC)

Layout Command Control 1 - Push Button Route Control with LCC (1)