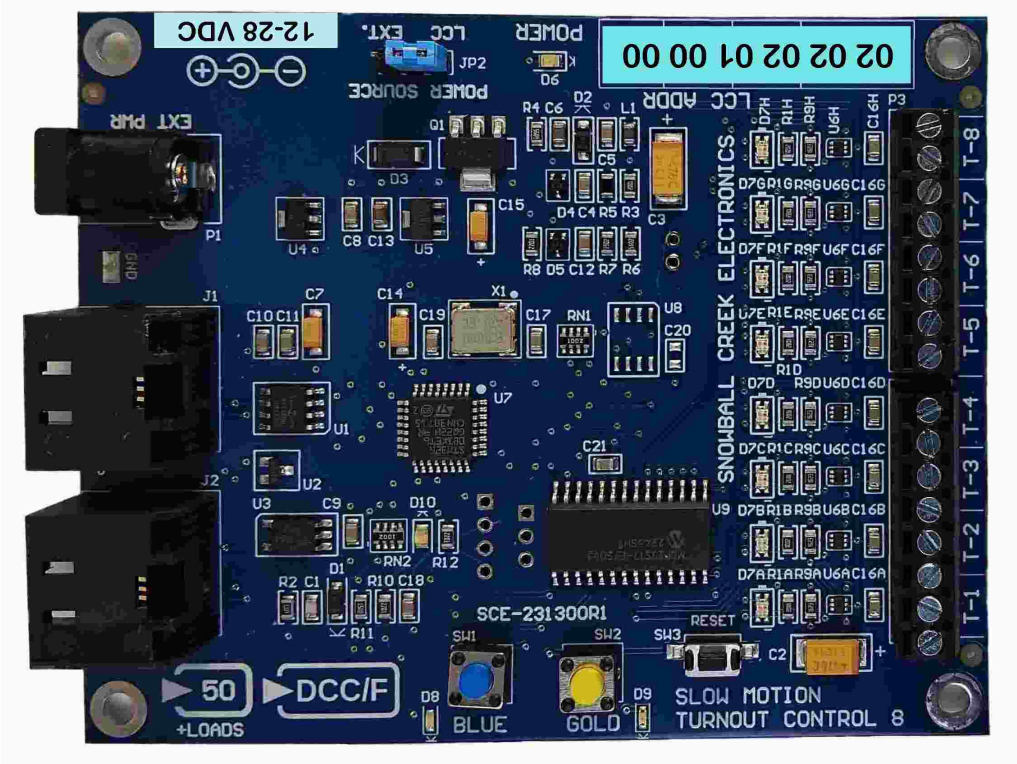
SNOWBALL CREEK
ELECTRONICS

LCC Slow Motion Turnout Control x8

User Guide



Slow-motion turnout control for an LCC or DCC network

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CANADA

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1. Terms & Notations used in this document

The following Icons and terms are used in this document.

	Important information
	Good to know - Tricks

LCC

Layout Command and Control® (or LCC for short) is an NMRA standard for a layout control bus. The standards are created by the OpenLCB group, and then adopted as a standard by the NMRA. This open standard is designed to let all manufacturers connect to the layout control bus and interoperate with each other. For additional information, visit the NMRA website at https://www.nmra.org/lcc

DCC Full Scale Interface

This term is defined in NMRA Specification S-9.1.2 as “the DCC signal with voltages that match the standard track voltage”. For the purpose of this device, you can connect the DCC track power directly to this device on pins 4 & 5 of the RJ45 LCC Port ONLY.

2. Product Description

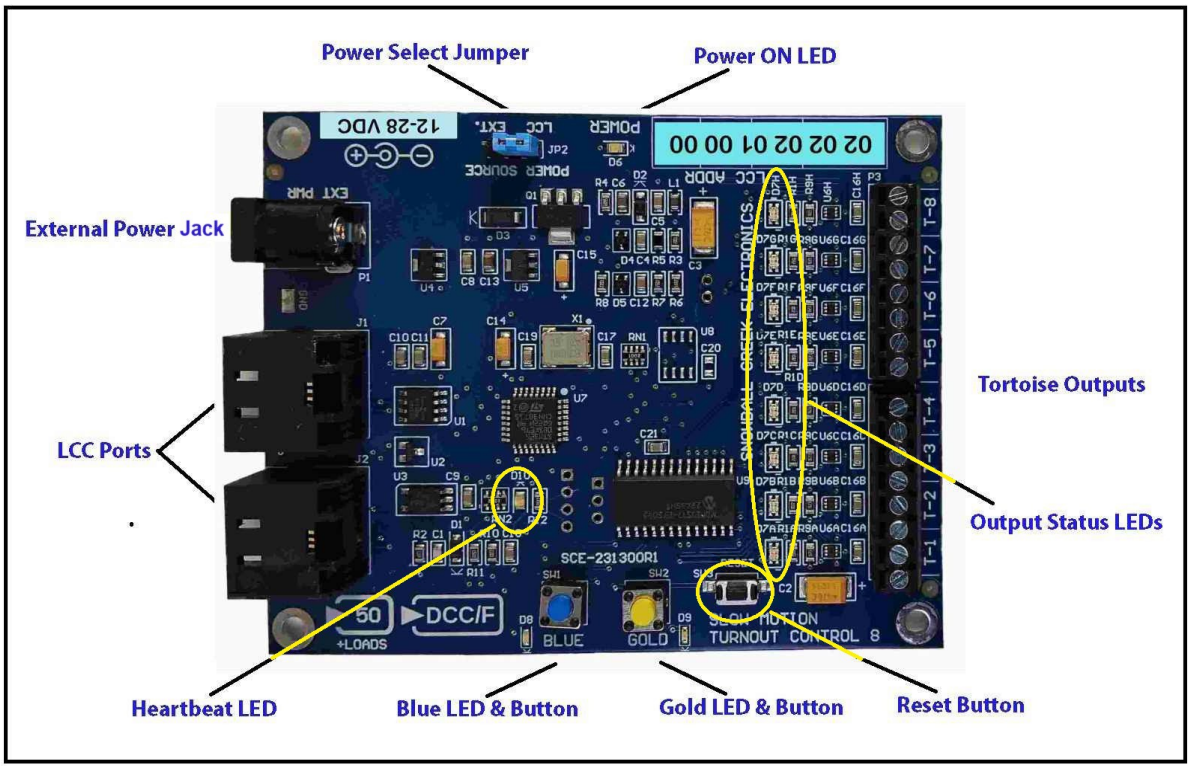
The SMTC8 controls up to eight stall-motor type switch machines(e.g. Circutron Tortoise™). Other turnout control motors such as the MTB MP1v2 and MP4 may also be controlled. Turnouts may be controlled over the LCC network using standard turnout commands, or using custom EventIDs.

If you don't have an LCC network, DCC switch commands may also be decoded.

Turnouts may also be set to a specific position on startup to ensure that they are in a known position. This may be useful so that turnouts on the mainline can all be set to the normal position on startup, ensuring that trains can run normally.

2.1 Hardware Description

The SMTC8 has two RJ45 ports for LCC, as well as a 2.1mm barrel connector for external power. Each turnout also has an LED to indicate the direction that it is currently in, green for normal and red for reverse.



2.2 POWER REQUIREMENTS

The SMTC8 may be powered directly from the LCC bus. A Circutron Tortoise™ is specified to draw 15mA at stall. When 8 are installed, this is approximately 120mA being drawn from the LCC bus in addition to the 50mA specified for the SMTC8 for a total power draw of 170mA.

If all outputs are connected, the total current required will be approximately 170mA!

2.2.1 POWER VIA LCC BUS

Verify you have enough available current on your LCC bus segment to handle the number of turnouts you will be connecting.

Set “POWER SOURCE” jumper to LCC.

2.2.2 POWER VIA EXTERNAL JACK

Plug in a 2.1mm barrel connector with center Positive and outside Negative. Power must be 12 to 28VDC, and must be capable of enough current to power the SMTC8 plus all outputs.

Set “POWER SOURCE” jumper to EXT.

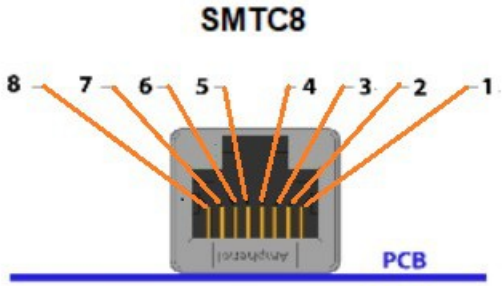
2.3 Power loss

When the SMTC8 detects a loss of power, it will automatically save certain information to internal memory, assuming it is configured to do so. This information includes the current state of the turnouts, and the current state of the DCC decoded turnouts. If the SMTC8 is not configured to save the state of the turnouts on power-down, or the DCC to LCC translation is not enabled, no data will be saved. This low power detection is activated once the supply voltage drops to approximately 7v.

2.4 LCC Port Connections

The SMTC8 uses the standard LCC RJ45 connections as shown below.

Note: *In order to utilize the DCC decoding feature, the Full Scale DCC Interface Signal (as defined in NMRA S-9.1.2) must be present on pins 4 & 5 of the LCC cable. This can be the track DCC signal. See section 5. for more information on this feature.*



BOTH CONNECTORS ARE WIRED THE SAME

PIN #	SIGNAL
8	+ POWER POSITIVE
7	- POWER GROUND
6	GROUND
5	DCC SIGNAL
4	DCC SIGNAL
3	GROUND
2	CANL – LCC SIGNAL
1	CANH – LCC SIGNAL

Power Requirements: 12-28VDC

DCC Requirements: 8-28V

DCC signal can be connected to track!

2.5 Output Connections

Connect a Tortoise™ turnout driver to any one of the output pairs labeled T-1 through T-8. If the associated LED is either green or red, the output is active and will have 11.3VDC. Shorting the outputs will not affect the device.

Each turnout output has two screw terminals. Make sure that your turnout is connected to the correct terminals, and not cross connected to another output.

If the turnout is behaving opposite of what you expect, simply reverse the output connections.

3. Basic Operation

By default, the SMTC8 will decode addresses 1-8 over the LCC bus. You may therefore plug the STMTC-8 into an LCC network and immediately throw switches from an LCC throttle, or from JMRI.

3.1 LED Indicators

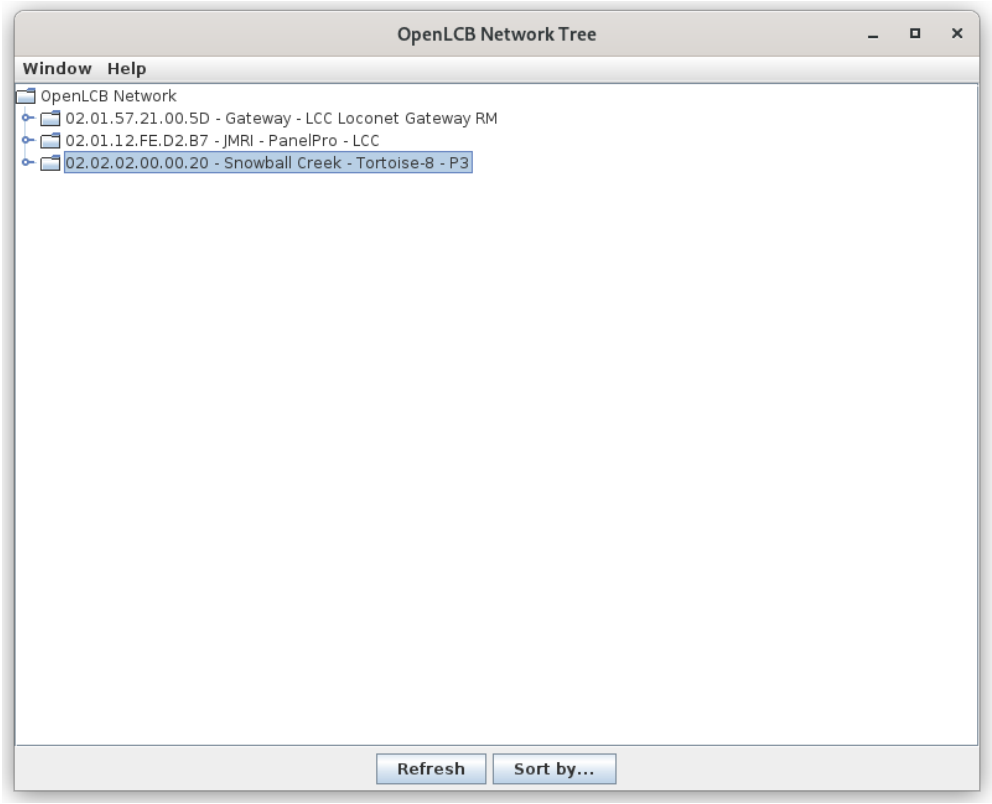
There are four LED indicators on the SMTC8. The indications shown by these LEDs is summarized in the following table:

LED	Indication
POWER LED (green)	• Always ON when sufficient power has been applied
Green LED	• Slow blink(once every 1.5 seconds): general heartbeat • Double blink every 1.5 seconds: Heartbeat OK, DCC signal detected
Blue LED	• Blink when LCC message is received
Gold LED	• Blink when LCC message is transmitted

The Blue and Gold LEDs do not blink on every message received or transmitted, they are for a general indication only.

4. CONFIGURATION OVER LCC

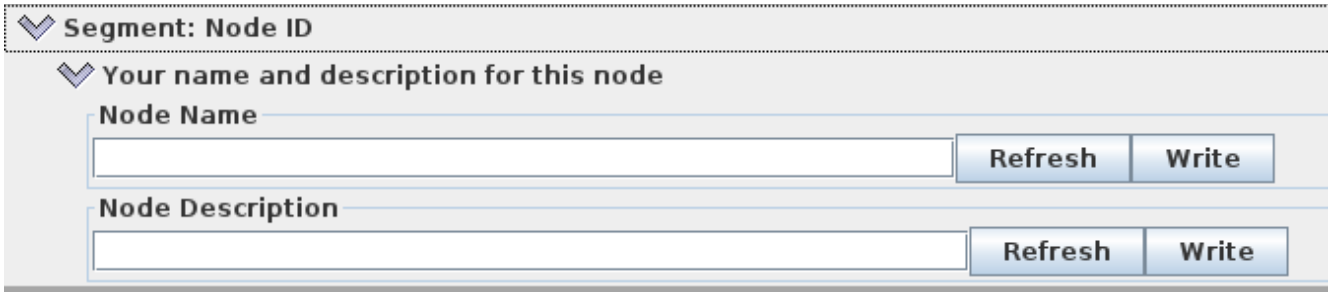
In order to configure this device, an LCC Configuration Tool(such as JMRI) may be used to get and set the options. Once you have an LCC connection on JMRI, you may then go to the OpenLCB→Configure Nodes page in order to see the nodes on your network. The SMTC8 should show up similar to the following:



Open up this tree, and select “Open Configuration Dialog” in order to configure the device.

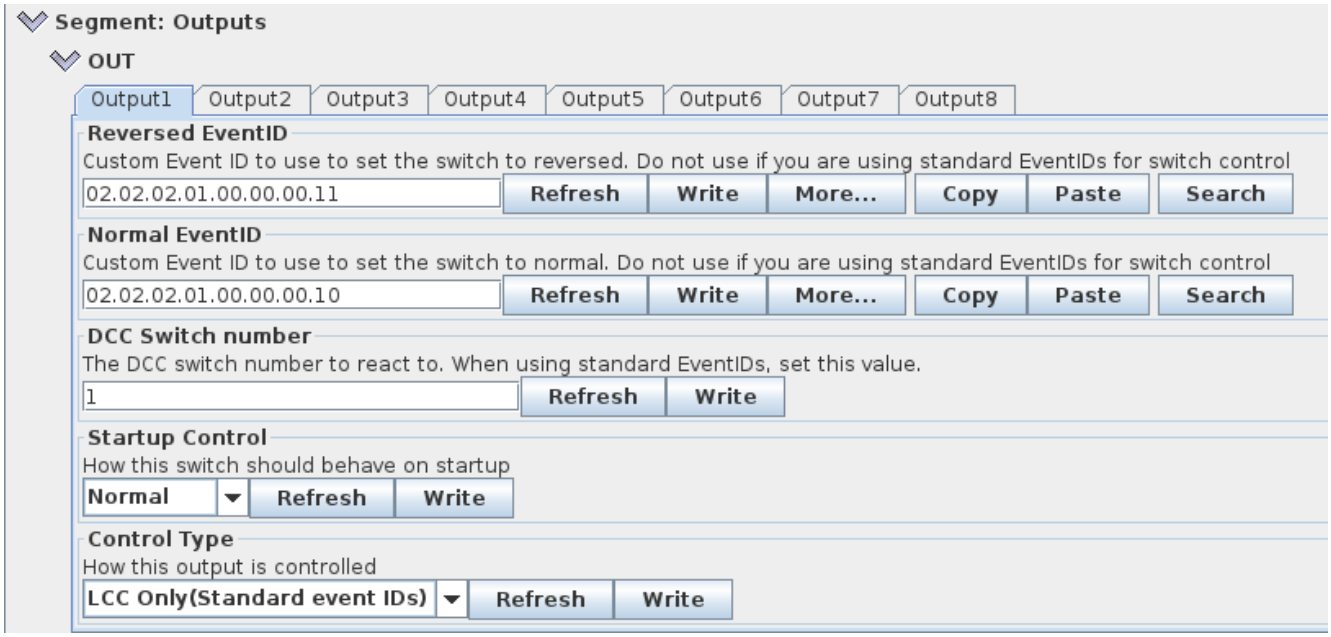
4.1 NODE ID SECTION

This section allows you to put a node name and description for this node. This may be useful in order to put in some information as to where the node is on your layout, or what turnouts it controls.



4.2 OUTPUTS SECTION

This section displays the 8 outputs of the device, and lets you configure the outputs.



For most use cases, you may simply set the 'DCC Switch number' setting. For example, when the 'DCC Switch number' is set to '1' as shown in the picture above AND the 'Control Type' is set to 'LCC Only(Standard event IDs),' the SMTC-8 will automatically respond to the well-known event IDs 01.01.02.00.00.FF.00.09 and 01.01.02.00.00.FF.00.08.

Upon startup, there are three options for how the switches should behave:

1. The switch should come up and go into the normal position.
2. The switch should come up and go into the reversed position.
3. The switch should go into the state that it was in when it was powered down.

When configuring an output to come up in the last state that it was in, the current state of the turnouts will be saved once the voltage to the SMTC8 falls to approximately 7 volts. Long runs of 12v DC power can cause a voltage drop large enough to trigger this low voltage detection.

The default setting for Startup Control is "LAST STATE".

4.3 Custom Event IDs

By default, the SMTC8 will use standard event IDs corresponding to the DCC Switch Number. These standard Event IDs are documented on the TCS wiki[1]. If you do not want to use these standard Event IDs, do the following:

1. Pick two EventIDs for the turnout, one for 'Reversed' and one for 'Normal.' You may use the automatically created ones for this unit, or pick your own. Put these EventIDs in the 'Reversed EventID' and 'Normal EventID' boxes.
2. Under 'Control Type,' select 'LCC (Custom Event IDs)'
3. The switches will now change according to these new events.

4.4 Global Config Section

This section controls the global configuration for the node.

4.5 DCC To LCC Switch Translation

This feature allows the SMTC-8 to decode DCC switch messages, and send the equivalent LCC messages over the LCC network. The current state of the switches as decoded from DCC may also be optionally saved upon shutdown. This allows other LCC devices that may need the current state of a switch to query for the specific event from the SMTC-8.

4.6 Max number of outputs to change at once

Because multiple turnouts can be changed at once, it can be desirable to limit the number of turnouts that change at once in order to reduce the current draw. This is most important when using MTB switch machines. See section 8.1 for more information as to the recommended max value.

This setting defaults to 4.

If the output voltage drops too low, the outputs will automatically be disabled for several moments. This may cause the switch machines to pulse their outputs, where they come on for a brief period of time before shutting back down. The switch machines will eventually travel to their set position.

4.7 Firmware Versions Section

This section displays the current firmware versions in the firmware slots on the SMTC8. The values in this section are read-only and can be safely ignored.

1 https://docs.tcsdcc.com/wiki/DCC_Turnout_Creation_in_JMRI_With_TCS_Command_Stations#LCC_Event_ID_Reference_Table

5. CONFIGURATION OVER DCC

The SMTC8 can decode switch messages as sent by the DCC command station and act appropriately. In order to enable this feature, follow the procedure in section 5.1.

Operating the SMTC8 in DCC mode can only be done if the unit is successfully decoding DCC packets. The heartbeat LED will be double-blinking to indicate that it is decoding DCC packets.

5.1 DCC ACCESSORY CONFIGURATION

To set an output to be controlled by a DCC accessory address, the following procedure may be used:

1. Activate configuration mode by holding down the Blue button for at least 5 seconds.
2. Verify that the Blue LED is blinking once every two seconds
3. Select the output to program by pressing the Gold button. The LED indicating the direction of the output currently being programmed will go dark.
4. Using your throttle, send an accessory command. The output will blink on briefly indicating that it received the accessory command. *Note that the output will not blink if the address is the same as what is already programmed.*
5. Repeat steps 2-4 as necessary.
6. When finished, exit configuration mode by holding down the Blue button for at least two seconds.

5.2 RELAY DCC SWITCH MESSAGES TO LCC

In addition to responding to DCC switch messages, the SMTC8 can also translate DCC switch commands and send them as well-known events over the LCC network. In order to enable this feature, configure the SMTC8 over LCC. The SMTC8 must be restarted for this feature to work.

When switch messages are relayed to the LCC network, the last known state of the switch will be tracked. This allows devices to query the current state of the switches on the layout.

The DCC signal is decoded using pins 4 and 5 on the LCC cable. If you do not have an LCC command station, connect pins 4 and 5 of the RJ45 LCC port to track power from a commercial command station.

6. Configuration Mode

A limited amount of configuration is able to be done using the Blue/Gold buttons on the SMTC8. Configuration mode may be activated by holding down the Blue button for at least 5 seconds. Configuration mode may be exited by holding down the Blue button for at least two seconds.

When configuration mode is entered, the main heartbeat LED will be mostly on, winking off every three seconds.

The current mode of configuration may be changed by pressing the Blue button. This mode is indicated on the Blue LED, which will blink a number of times every two seconds showing the configuration mode that is currently active. The modes are summarized in the following table:

Blue LED blink times(every two seconds)	Configuration Mode
1	DCC accessory address programming
2	Factory reset

6.1 DCC Accessory Programming

Refer to section 5 for DCC operation details.

6.2 Factory Reset

If you cannot access the SMTC8 over an LCC connection, it may be reset to factory defaults using the following procedure:

1. Power on SMTC8
2. Go to configuration mode by holding down the Blue button for at least 5 seconds
3. Press the Blue button once. The Blue LED should be blinking twice every two seconds.
4. Hold down the Gold button for at least two seconds. When the factory reset is done, the Blue and Gold LEDs will begin alternating On/Off quickly.
5. Release the Gold button

The SMTC8 does not need to be rebooted for the new settings to take effect.

Note that resetting to factory defaults does not reset the firmware version to the factory default, just the settings.

7. Firmware Updates

The firmware may be updated using the standard LCC firmware upgrade protocol. New firmware files will be posted on snowballcreek.com

To upload the new firmware from JMRI:

1. Go to OpenLCB→Firmware Update
2. Select the Snowball Creek SMTC x8, using the standard address space of 0xEF (239).
3. Open the firmware update file
4. Press the ‘Load’ button
5. Wait for the firmware to be uploaded

The node will automatically reboot once the firmware update is done.

While the SMTC8 is protected against invalid firmware updates(e.g. loading an invalid firmware file or loading a firmware file for a different product) other devices on the network may not be as robust.

Due to technical limitations in how the firmware upgrade is processed at the moment, this means that firmware intended for a different node may appear to be loaded onto the device. Firmware that is too large will correctly report a failure while flashing, but firmware intended for a different node will not trigger a failure until the node reboots. This failure is currently not reported over LCC.

The node will take several seconds to boot into the new firmware once a new load is sent to the device. Do not power off the device while the firmware upgrade is in progress.

8. Electrical Specifications

Electrical Specifications				
Input Power	**Min**	**Nominal**	**Max**	**Units**
Source: LCC BUS	9[1]	12	15	VDC
Source: EXTERNAL	12	15	28	VDC
Input Current	45	50[2]	200[3]	mA
Output Voltage ea. Channel +/-	7.5	11.3	11.5	VDC
Output Current ea. channel	0	12-16[4]	20[5]	mA

1 If supply is less than 12VDC, turnouts will move at a slower rate.

2 Nominal input current with NO LOADS attached.

3 Maximum input current with 8 LOADS attached.

4 Normal current draw for a Circutron Tortoise™ at stall is 16mA.

5 Total output current of all channels combined can not exceed 160mA.

8.1 Recommended settings for maximum number of turnouts to change

The number of turnouts that can be safely switched at once is dependent on two factors:

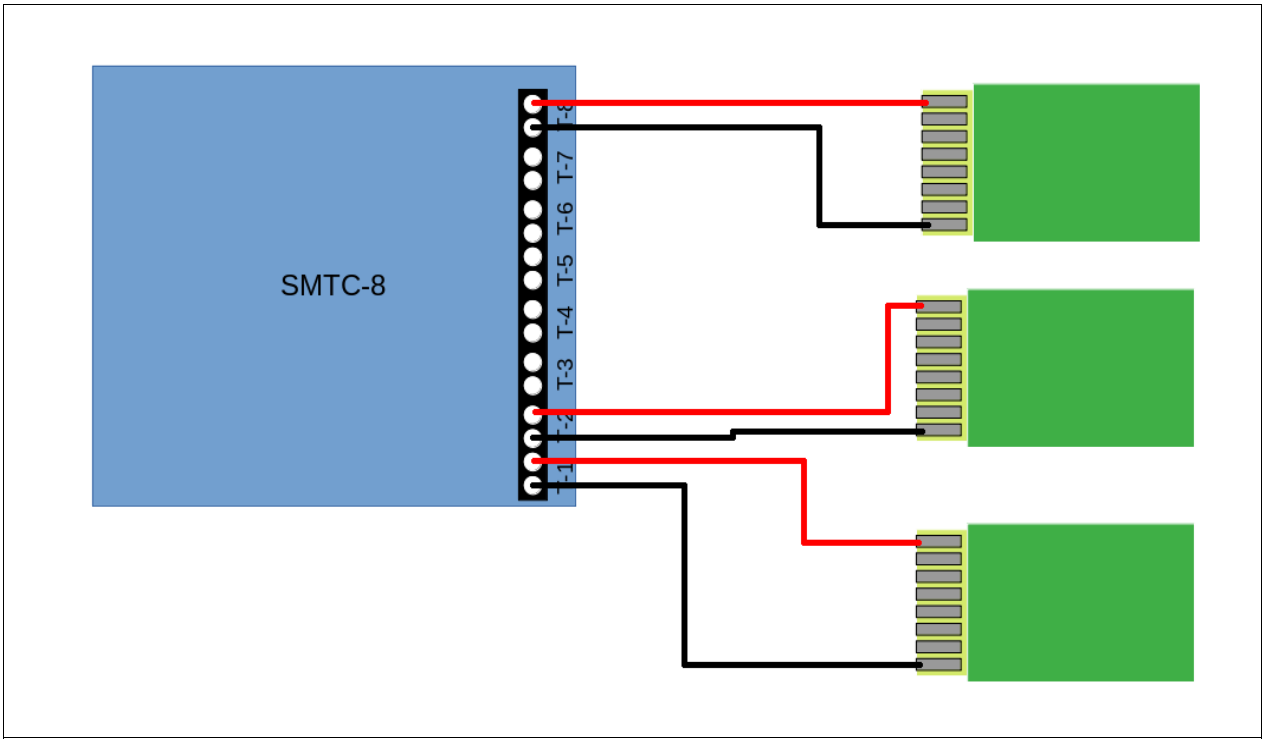
- The type of turnout motor that is installed
- The voltage input into the SMTC-8

When utilizing an MTB turnout motor, we recommend that the SMTC-8 be powered through the barrel connector so as to not draw too much current over the LCC bus. If the input voltage is below 15v, we recommend that the SMTC-8 be configured to no more than two turnouts at once. The input voltage may be queried from the SMTC-8 over LCC.

Because a Circutron Tortoise™ draws less current when it is moving, it should always be safe to switch all outputs at once.

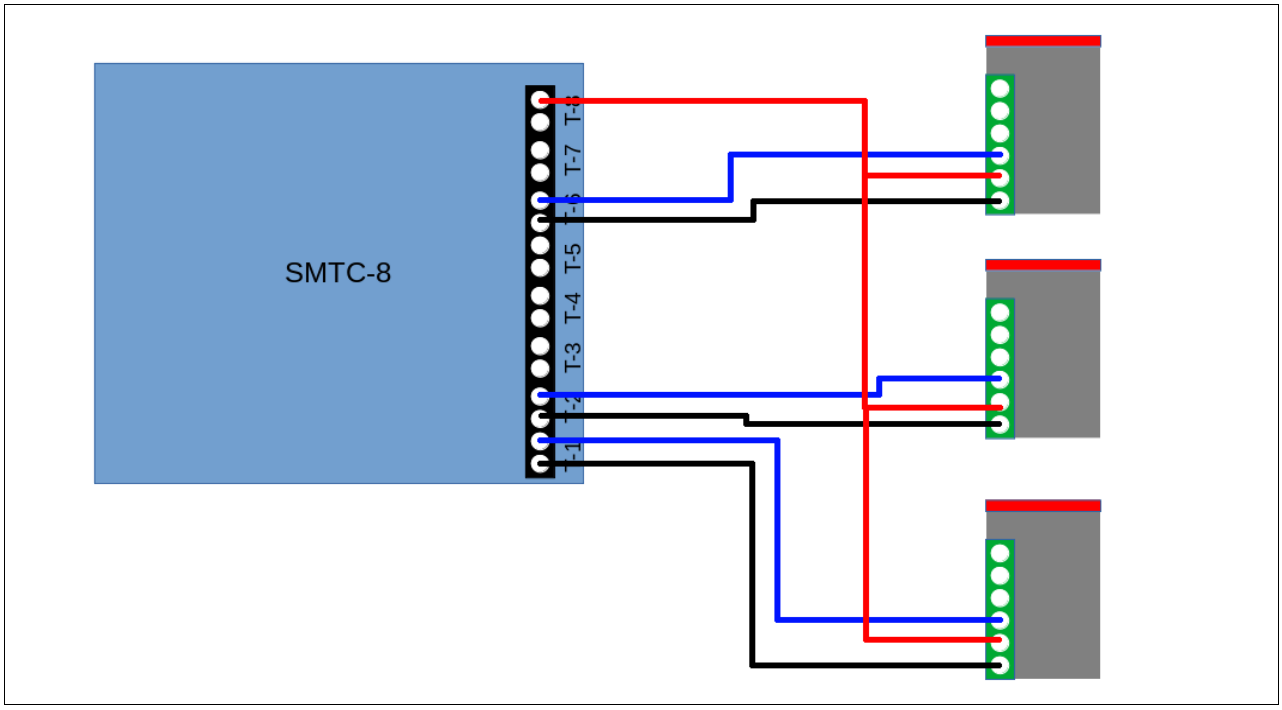
9. Wiring Diagrams

9.1 Circutron Tortoise™



9.2 MTB MP1v2

When using the MP1v2, we recommend setting one of the outputs to be ‘Always on’ and using the positive output as the positive input to the MP1. Because the MP1 requires three wires, at least one output must be dedicated to providing the positive voltage.



9.3 MTB MP4

This diagram shows a sample of how to plug in an MTB MP4 into an SMTC-8. Because the MP4 can be controlled with only two wires, it is possible to connect the wires the same as a Circutron Tortoise™.