The Universal Translator

In most situations Touch Toggles manage the position of the each output directly - with one position for green and another for red.

Using Touch Toggles with DCC, network, or other control system is a bit more complicated. Each of these systems has the ability to operate a control remotely without ever touching the Toggle. To be useful, it's important that each Touch Toggle shows the actual switch position no matter what method was used to throw the turnout.

All the control of your turnouts is done by your decoder. Our Universal Translator makes each touch send a brief push-button-press to your DCC decoder or control system, which then moves the turnout. This Translator output is wired like a pushbutton with just a small wire pair.

The Universal Translator is designed to connect to almost any system

The position of the turnout is sent back to the Translator input on a second small pair of wires. The color of the Toggle is controlled by this DC signal: power on for red, off for green. The small bit of power needed can be from an indicator output on the decoder, stall motor power, or turnout contacts. This way the Touch Toggle always shows the true switch position.

It doesn't matter what signal voltage or polarity your decoder uses. Each input and output pair is isolated from all others; Separate systems, voltages, and power supplies can be connected for each Toggle. Connections to individual separately powered decoders that normally can't be wired together will work without any problems. Adjacent Toggles can be connected to entirely different types of decoders: ground-common systems like NCE, or positive-common systems like Digitrax. Each input can be driven with 5 to 28 volts without flinching. Translator outputs can switch up to +/- 28 volts. *Reversed connections won't harm the Universal Translator, but of course, it won't operate properly.*
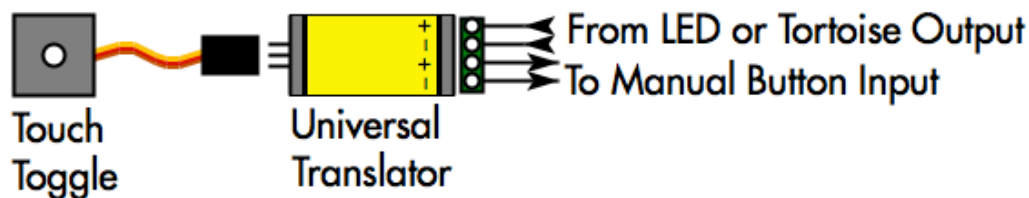
Most users will find that telephone or ethernet cable (untwisted, Cat3, Cat5, or Cat6) are handy sizes for wiring the Universal Translator terminals to the DCC decoder. Connections from the Translator to the decoder can be quite long. Extensions from the Translator to the Touch Toggles must not exceed 10 feet. The Translator's input circuit which connects to indication power or stall motor power is most easily connected by inserting a second wire alongside existing wires running into the terminal outputs of the decoder.

Examples and Guidelines

The Translator's output makes a pushbutton-press closure just like a real pushbutton. It wires to the change-position-pushbutton input available on many DCC decoders. Some DCC decoders need to be setup or have a "CV" register properly set to recognize this single pushbutton type toggling input.
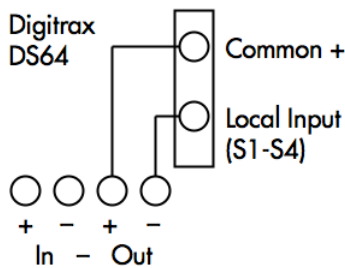
Always make sure your decoder is wired and working properly before adding the connections to the Universal Translator. Use a small jumper wire to touch the two pushbutton terminals as a test to be sure the button input is working properly. *Always test and troubleshoot the decoder first. Use the decoder instructions until the pushbutton jumper works.*

*A "Common" is the pushbutton wire that all buttons connections share.*

Positive common systems like Digitrax should be wired with the decoder button input terminal connecting to the Translator "–" output. The Translator "+" outputs all connect to the common or "A" terminal on a Digitrax DS64 or V+ Common on a Digitrax SE8C decoder. *(see application notes below)*
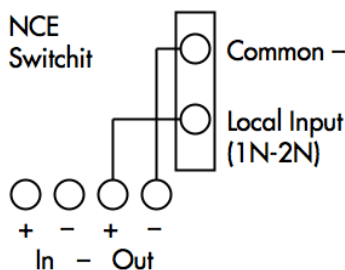
Ground or negative-common systems like NCE, DCC Specialties, and most other decoders should be wired with the decoder button input terminal connected to the "+" output of the Translator. The Translator "–" output wires all connect to the "COM" or "GND" terminal(s) on the decoder. *(See application notes below)*

Feel free to experiment to see which polarity works with your system. If the wires are incorrect, the decoder will simply stop operating until the wires are reversed. *Reversed wires acts like the button not connected.*

If your decoder is not responding, test it as described at the top of page 5 *before* any further frustration.
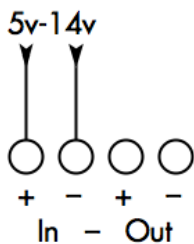
When positive voltage is run to the Translator's "+" "In" terminal, the connected Touch Toggle will show Red. When the power is reversed or disconnected the Touch Toggle will show Green.

Usually the input should be wired to the stall-motor output or the LED signal output of the decoder. Usually it's easiest to slide a small wire into the output terminal alongside existing connections at the decoder.

Typical input power from 5 volts to 14 volts should be attached directly to the input terminals. With stall-motor power, if the Touch Toggle indication turns out to be reversed, just reverse the input wires.
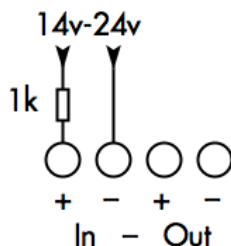
If the Translator input is connected to higher voltages of 15 to 24 volts, a 1k resistor is recommended to reduce the current through the circuit. Add the resistor as shown here *(It can be installed in either wire)*. No more than a 1/8 watt sized resistor is needed.

> *For the tech folks, this adds to the 1k resistor already inside. The added resistance keeps the current down to about 5-10ma.*
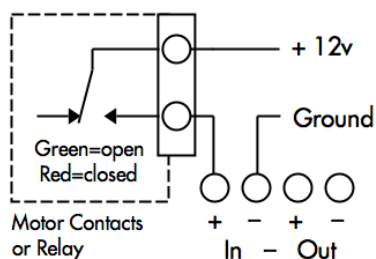
If there is no output for a stall-motor or indication from the DCC control system, contacts in a switch machine or relay may be needed. This circuit just needs to turn power to the input on and off. This power can be whatever's handy, from 5 to 12 volts (or more) DC. *The input just needs the same kind of power used to light an LED.*

The Atlas Snap-Relay wired in parallel to the switch machine is an easy way to add contacts to twin-coil machines like Atlas and Peco that don't come with power switching contacts.
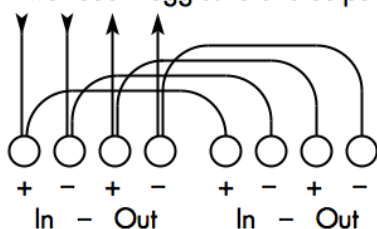
More than one Touch Toggle can be operated in a "3-way" type circuit:

It's easy to have two or more Touch Toggles work together, each operating the same pushbutton output. A circuit with jumpers as shown will respond when either Toggle is touched, and will display the same indication on every connected Toggle. Many Toggles may work together this way by just jumpering one set of terminals to the next.

If you have many inputs connected this way each input will draw about 10ma.

Digitrax decoders SE8C or DS64, set to operate Tortoise type machines, work right away when wired to the Universal Translator. NCE SwitchIt, Switch8MK2 with Button Board, and Switch Kat will work out of the box too. DCC specialties Hare and Wabbit also work well.

Obviously, decoders that only take DCC commands and don't have connections for local control can't be directly controlled by the Universal Translator either. Some of these are the original NCE Switch8, Switch8-Mk2 without button board, AuxBox, LEDcoder, and Digitrax DS52, DS44, and DS51K1.

NCE offers an interesting workaround for decoders that don't have pushbutton inputs. The NCE Mini-Panel offers 31 input pushbutton terminals, each that can send up to 4 DCC commands. This would give our Universal Translators a great way to connect, and control turnouts all over the layout.

Many snap/twin-coil only decoders have no indicator or DC output, like the Digitrax DS64 set for twin-coil operation, NCE QSnap, and SnapIt. These will need switch machine contacts or the addition of an Atlas Snap Relay to sense switch position and correctly show the turnout position on the Toggle.

Special Note About Installing:

Setting up DCC decoders or other control systems can be complicated, with both wiring and software issues. We've done what we can to make installing the Universal Translator as simple and direct as possible. Please test your decoder installation first, before adding complications by adding our system. Please get help from an experienced friend, your dealer, or the decoder manufacturer for decoder problems. We cannot stress enough that a Translator connected to a non-functional decoder can never improve that situation.

We happily offer direct support for Touch Toggles and the Universal Translator at Berrett Hill Trains: 443 527 6320 or kevin@berretthill.com. Please call during business hours Eastern Time.

Revision 1.3.3 and 1.3.4 of this document include new examples and clarify some language in revision 1.3.2 of April 2017

Application Notes

Circutron

The **Smail** installation requires a small amount of DC to provide indication power to sense the turnout position.

Smail:		**Universal Translator:**	**Notes:**
Input	C1	to Output +	
Common	Gnd	to Output –	
Terminal	6 or 7	to Input +	[reverse terminals 6 & 7 to reverse display color]
Terminal	5		to +5v to +12v DC Supply
		Input -	to -5v to -12v DC Supply

DCC Specialties

Wabbit:		**Universal Translator:**	**Notes:**
Input	4(A) or 1(B)	to Output +	
Common	5(A) or 2(B)	to Output –	
Output	5(A) or 7(B)	to Input	[reverse Wabbit outputs to
Output	6(A) or 8(B)	to Input	reverse display color]

Hare revB (current):		**Universal Translator:**	**Notes:**
Input	12	to Output +	
Common	11	to Output –	
Output	8 or 6	to Input +	[reverse Hare 6 or 8 to
Output	6 or 8	to Input –	correct display color]

Hare revA (earlier):		**Universal Translator:**	**Notes:**
Input	10	to Output +	
Common	9	to Output –	
Output	8 or 6	to Input +	[reverse Hare 6 or 8 to
Output	6 or 8	to Input –	correct display color]

NCE

Switchit-MK2		**Universal Translator:**	**Notes:**
Input	1N, 2N (R not used)	to Output +	Set Switchit CV 548 to "1"
Common	C	to Output –	or button will not work in both directions
Output	A or B of 1 or 2	to Input +	[reverse Switchit A & B to
Output	B or A of 1 or 2	to Input –	reverse display colors]

Switch8-MK2 w/ Button Board		**Universal Translator:**	**Notes:**
Input	BB: 1N-8N (R not used)	to Output +	Set Switch-8 CV 548 to "1"
Ground	BB: Ground or Gnd	to Output –	or button will not work in both directions
Output	Sw8: A or B of 1 - 8	to Input +	[reverse Switch-8 A & B to
Output	Sw8: B or A of 1 - 8	to Input –	reverse display colors]

Application notes continue – next page…

Digitrax

DS64 - Tortoise operation		**Universal Translator:**	**Notes:**
Input	1S, 2S, 3S, 4S	to Output –	Set for stall motor operation Op 1
Common	Com+	to Output +	as described in DS64 manual Pg 10 & 11
Output	1R, 2R, 3R, 4R	to Input + or –	[reverse DS64 R & G to
Output	1G, 2G, 3G, 4G	to Input – or +	reverse display colors]

DS64 - Twin-Coil operation		**Universal Translator:**	**Notes:**
Input	1S, 2S, 3S, 4S	to Output –	Set for twin coil operation Op 1 (default)
Common	Com+	to Output +	as described in DS64 manual Pg 10 & 11
Contacts	Contacts should close	pair to Input +	Connect switch motor contacts or Snap
for "red" position	and Input -	Relay as described on page 3.	

SE8C - Tortoise operation		**Universal Translator:**	**Notes:**
Input	SW01 - SW08	to Output –	Set for stall motor operation
Common	+VE sensor common	to Output +	as described in SE8C manual
Output	SMTM1A - SMTM8A	to Input + or –	[reverse SE8C A & B to
Output	SMTM1B - SMTM8B	to Input – or +	reverse display colors]

Installing Your Translator

Setting up any DCC decoder can be tricky, especially if you aren't familiar with the equipment. In order to simplify the Translator installation ***be sure that the decoder is properly installed*** and operates the turnout from DCC. ₁ₙNext use a short length of wire to momentarily connect the pushbutton terminals on the decoder; The machine should cycle properly. *If these do not perform as expected they **will not improve** after the Translator is connected.*

When installing or fixing a Translator it is best to work with *only one* Toggle channel at a time. Once you've figured out what the right arrangement is it should be easy to duplicate for other Toggles.

Plug the Touch Toggles into the Universal Translator with wire colors shown on the small square legend on the label, with the *yellow wire to the left*. Plug a **5v power supply** into the Translator. Toggles should light up green, and "twinkle" briefly each time they are touched. They will only display the green position until the input terminals are properly connected.

Disconnect power and add wires as described in the Guidelines and Application Notes above. *You should not need to remove any decoder wiring to add the Touch Toggles and Universal Translator to your system.*

Don't worry about making a mistake: Often if you find any of the previous recommendations confusing or unclear, it will be simplest just to try hooking up one channel to see if it works.

If things don't work as expected follow the simple troubleshooting steps on the next page.

Testing and Troubleshooting the Universal Translator

If some aspect of the installation doesn't operate as expected follow these quick troubleshooting steps:

First, think of each Toggle channel as having three isolated circuits: (Read the details for each issue below)

1. *Toggle doesn't "twinkle" when touched.* This is **always** related to the Touch Toggle's connection to the Translator.
2. *The turnout won't throw.* This is **always** related to the decoder, the decoder settings, or the Translator's output connection to the input connections of the decoder. *Be sure the decoder and turnout are working **first**!*
3. *The indicating LEDs don't work properly.* This is **always** related to the input terminals connection from Tortoise or indication power.

Read the details for troubleshooting each issue below:

1. Toggle Connection to Translator

The Toggle should be connected to the Translator, with the yellow wire to the left, and a wire length of **no more than ten feet (3m)**. When powered the Toggle should light up green and "twinkle" (flickering red and green) when touched. This brief rapid flash is designed to acknowledge a touch, and to confirm proper connection to the Translator. If you can see this flash you can be certain that the Toggle and the Translator are both working properly. If not, check the cables and connections, especially for reversed 3-pin plugs. If the Toggle responds to touch by changing color back and forth (without feedback from your decoder) you have a damaged Translator *(Did you plug it into 12v?)* Please contact Berrett Hill.

2. Translator Output to Decoder Pushbutton Input

The Translator's output pair is intended to ask a decoder to change position. This pair needs to be connected to the momentary pushbutton input of your decoder. The Translator output simulates a push button press whenever the Toggle is touched.

If your decoder doesn't respond to the Translator output, make sure the decoder can operate the turnout by sending it a DCC command. If it does not respond check the decoder power indicator, and the wiring from the decoder to the DCC buss and the switch motor. As a second test, try briefly touching both local control input terminals on your decoder to the ends of a jumper wire. If the turnout operates the issue is in the wiring to the Translator; If not, the issue is in the decoder settings or wiring. Many decoders have separate terminals or CV settings for a single pushbutton operation, as opposed to two button operation, so double check those. If the Toggle can only make the turnout move in one direction and not the other you will need to change the CV settings.

The Translator output uses a transistor to simulate the pushbutton, so it will only work in one electrical direction; If the wiring pair is reversed the decoder will not see any change. No harm will be done with a reversed connection, but it just won't work, so the simplest test is to just **reverse the wires** to try both polarities.

3. Turnout Indication to Translator Input Terminals

The connected Touch Toggles will show green when there is no connection to the input terminals. When power (5v to 24v) is applied to the input terminals the Toggle indication will show red. This input drives a small LED, so the input only works in one polarity. Reversed power is seen the same as no connection so try connecting the wires both ways to check polarity. If the indication stays green there is likely no power reaching the input.

To test the Translator apply DC power directly to the Translator input. If the Toggle does not change when power is applied in either direction your Translator is damaged. Please contact Berrett Hill.

What's Going On Inside
or *More than most folks want to know...*

When connected to Touch Toggles and powered up each Toggle should "twinkle" with a bright quick flash when touched. The twinkle acknowledges the touch and confirms that the Translator is working properly.
Other than this acknowledging flash, all connected Touch Toggles will show green until power is applied in correct polarity to the Input terminals opposite that Toggle's input plug. When power is applied that Toggle will always show red. The connected Touch Toggle LEDs are like little puppets, doing whatever they're told.
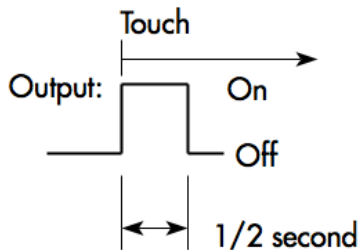
When any Toggle is touched and made to "twinkle", the associated output control will send a 1/2 second "on" pulse to the output transistor, connecting any circuit across the Output terminals. This push-button like pulse is the same no matter which color is showing on the Touch Toggle.

Each input and output are isolated by an Opto-Isolator. This is an encased LED and phototransistor pair that carries the on/off signal from the input to the output as a beam of light. The two sides of this pair are consequentially highly insulated from each other, up to about 3000 volts.

All this isolation protects the Universal Translator and Touch Toggles from all connected equipment, and each piece of connected equipment from all others.
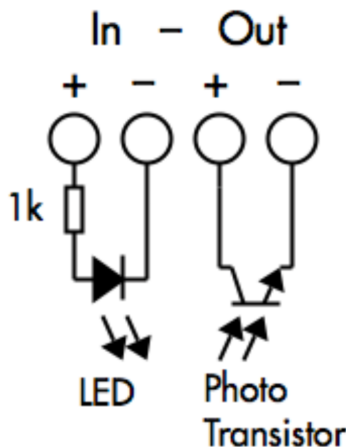
This circuit shows what's just behind the input and output terminals. The LED and Photo Transistor shown are inside *separate* opto-isolators, so the input might be connected to 12v and the output to 5v, or vice versa.

The maximum voltage for input or output is 28 volts. Current should be limited to 20ma on the input side, and 60ma on the output side (well within most DCC limitations).

The LED will ignore any reverse polarity sent to the input.

The transistor will not connect any reverse polarity wired to the output. This will always appear as an open switch to a reversed DCC or computer input.

Inputs to the Translator that are not connected to a Touch Toggle may randomly trigger or oscillate. This random operation is not harmful, but may give confusing results if outputs are connected while the associated Toggle is not.

The circuitry in the Translator runs on 5v DC. Regulated or switching power supplies are required for dependable operation. Older non regulated supplies may give unexpected results. **Connection to a power supply greater than 5.5v will instantly destroy the Translator**.

The power sharing pins on the right and left of each Translator allow one Base to share power with the next just by plugging them together. Our 5v DC 2 amp supplies should power up to 48 Touch Toggles and their Bases.

Berrett Hill – 6005 Old Washington Road – Sykesville MD 21784
443 527 6320