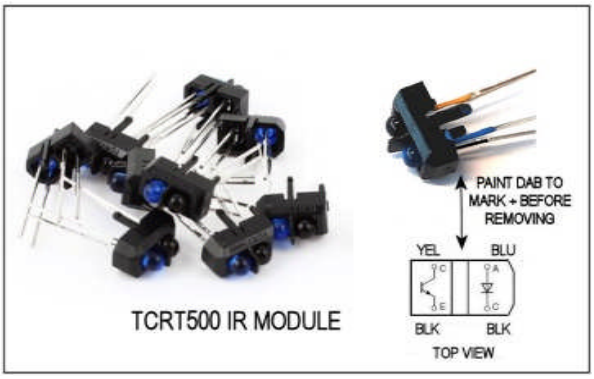
IR DIFFERENTIAL DETECTION CIRCUIT

By F. Miller, MMR

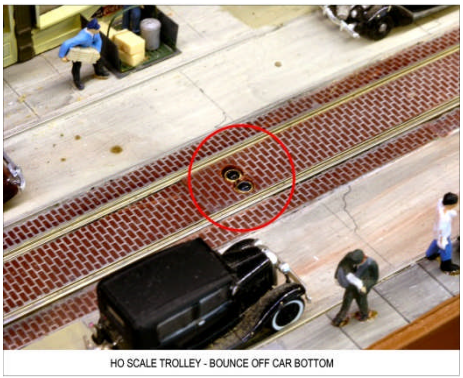
The custom IR detection circuit used on several of my layouts is built around either:

(1) the TCRT5000 (IR LED and IR Detector pair). This set is sold in a plastic holder. I remove the LED and Detector from the plastic mounting <u>after</u> marking the polarity on the leads.

(2) A smaller IR LED Emitter (LTE-302) and the IR transistor Receiver (LTR-301). These units are very small and easily hidden in the scenery or buildings surrounding the detection site. A paint dab helps in identifying the units when mounting. The bodies can be painted black to better hide the unit

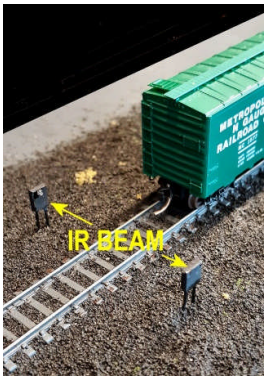


I have mounted the IR LED and IR Detector pairs in various ways: one is between the tracks to bounce the signal off the bottom of a streetcar; and the other is placing the pair in a trackside structure or truck to bounce the signal off the side of a streetcar. Another is simply mounting the LED and IR Detrector on their own leads, across an N-Scale track (to be hidden behind buildings or trees. All approaches work quite well.



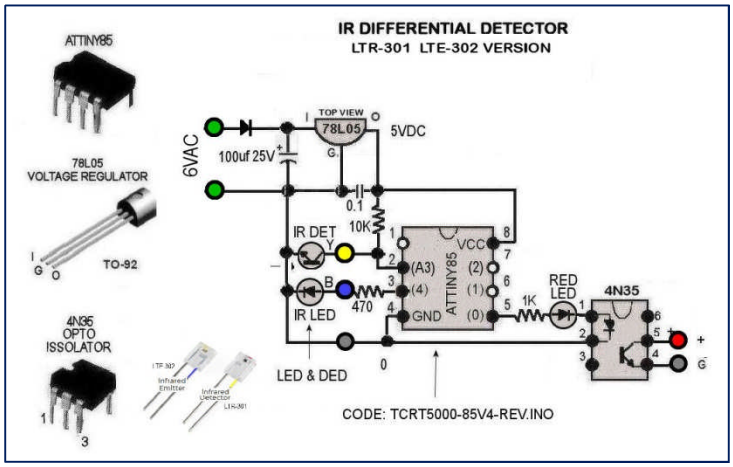
HO SCALE TROLLEY - BOUNCE OFF CAR BOTTOM

HO SCALE TROLLEY - BOUNCE OFF CAR SIDE

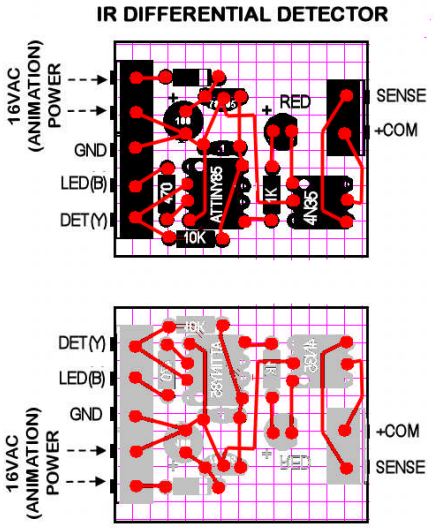


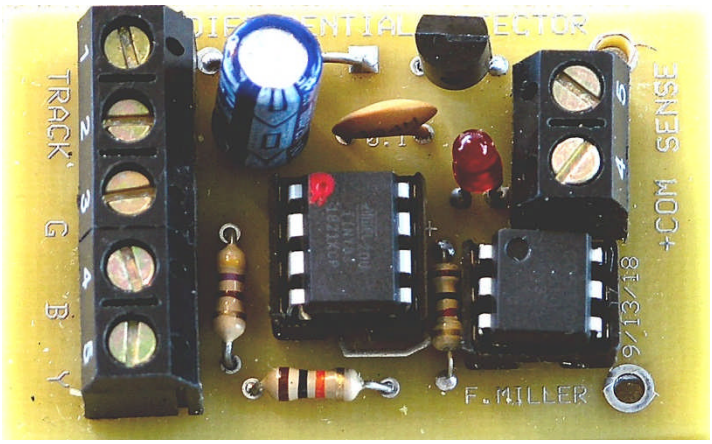
N Scale Cross-track

The code running in the micro-controller removes ambience noise from sensor data by comparing received IR with and without the IR LED on, making the circuit insensitive to high ambient light, sun, etc. and of course works in the dark. My circuit uses a 4N35 Optical Coupler to isolate the circuit from any logic level inputs (e.g.the Digitrax DS64 stationary decoder, or other Arduino circuits.) Note that the code is slightly different to accommodate 'beam bounce' or 'beam break'.

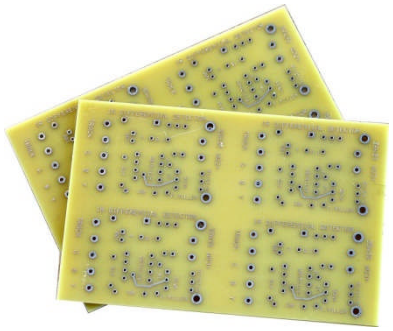


As is my usual process, I develop the circuit and program (sketch) on an Arduino UNO with Breadboard Shield. When the circuit and program work satisfactorily I move the code over to a smaller micro-controller, in this case an ATTINY85. I then recheck the operation with the ATTINY85 on a breadboard instead of the ARDUINO UNO.
When that is operating correctly I graphically lay out the components on a perf board template and "wire" the components graphically in a top view. The drawing is also flipped to represent the bottom of the circuit and is used to do actual wiring on the perf board.





The components can be acquired for something less than $5 bringing a perf-board hand wired unit to $5.



Since this circuit could be used at a number of locations on a layout, committing the circuit to a printed circuit board might be useful to reduce the effort in soldering individual boards. Combining circuits on a board can reduce the price per PCB to around $5.