

A simple DCC block occupancy detector (BOD1)

This design is a simple block occupancy detector for use on DCC systems only. It is based on the resonant transformer circuit by Wayne Roderick of Teton Short Line to whom full acknowledgement is given. See

<http://www.tslrr.com/detector.htm>

The MERG schematic is BOD1_sch.pdf.

The DCC track feed is passed through a current transformer T1. This is a CS1200 type by Coilcraft. The same transformer is used in other MERG designs. The primary is simply a wire passed through the coil centre so there is no voltage drop incurred. The transformer secondary is tuned with C1 to resonate at approximately the frequency of a DCC 'one' bit sequence which occurs as the preamble to all DCC packets. (8621 Hz). Using this resonance principle both greatly increases the sensitivity of the detector and helps to reject noise and other signals which lie outside the resonant region. The secondary inductance of the CS1200 is 100 mH. The exact value for C1 should be 3.4 nF but 3.3nF (3300 pF) is the nearest standard value. (The extra 100 pF could be added in parallel if wanted). Other current transformers could be used, including 'home made' ones using available toroids provided their frequency response is adequate and C1 is chosen to be resonant with the secondary inductance.

If there is a short in the block, the primary current may be very high so the transformer output is clamped by R1 along with the diodes D1 and D2 to protect the following comparator U1 input. U1 is a low cost dual comparator type LM393. The transformer output voltage is compared with an adjustable reference using VR1. The reference is derived from the zener diode D3 so the sensitivity is independent of the DCC track voltage. The BOD1 is powered off the track. If the voltage from the transformer exceeds the threshold set by VR1, comparator U1a will switch and charge C2 through the diode D4. The now positive voltage on C4 will activate the comparator U1b and switch the indicator LED LD1 (if fitted) and the opto isolator. The opto isolator output can be used to indicate block occupancy by any suitable means. It can be connected directly to the input of a CBUS module such as the CANACE8C to give occupancy information to any other CBUS module. When occupancy ceases, C2 will discharge slowly through R5 to give a slight delay. Along with the hysteresis of the comparator U1b, this gives a good degree of immunity to short artefacts or unwanted triggering on noise.

BOD1 is intended to be placed close to the block in question so eliminating the need for long track feeders as is the case where there are multiple BODs on one PCB. There is a PCB layout available as BOD1_pcb.pdf.

From testing, the BOD1 can easily detect rolling stock with axle resistors as large as 10K. While greater sensitivity can be achieved, there is a limit with DCC as it is an 'AC' signal. The capacitance of the track in the block will cause some small flow of current even when not occupied. Hence the sensitivity should be adjusted so it reliably detects a single axle but not any higher.