



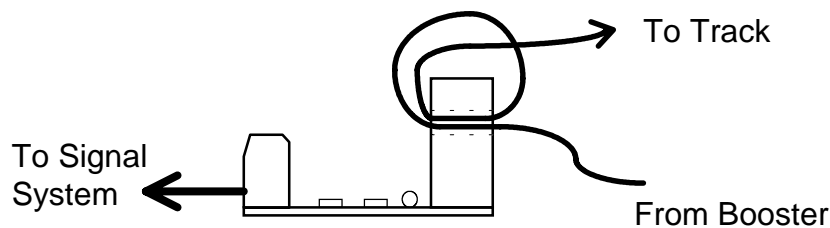
# Power Pro

## BD-20 DCC Block Detector Manual

The BD-20 block detector module is normally used to indicate the presence of a locomotive, caboose or other rolling stock in a track section by sensing electrical current drawn by that rolling stock. Locomotives will naturally trigger the detector because they draw current through their DCC decoder. Unpowered rolling stock will not trigger the detector unless equipped with some means of drawing current from the rails such as lights or resistor wheel sets.

Unlike other detection units the BD-20 requires no direct electrical connection to the track. This block detector can be used with any sized DCC power booster of up to 12 Amps capacity. The track feeder wire for one rail of the block is just passed through the hole in the current transformer on the module (see figure 1) before connecting the feeder to the track. The more times the wire goes through the hole in the current transformer the more sensitive the detector becomes. See the section on Detector Sensitivity for some limits on this matter.

An LED is provided if you wish for simple indication of staging track occupancy, progress through a helix, etc. You can also add an external relay to control heavy or high



voltage loads.

Figure 1

### **False Triggering:**

You may get false triggering of the detector if the block is too long. The capacitance between the rails actually conducts a small amount of the DCC signal and can cause the detector to trigger. If you think you have problems with this see the section on desensitizing the detector.

### **Detector Output:**

The Logic Output of the detector is "open collector" (figure 2). This type of output is compatible with most signal system logic boards on the market today. If you design your own signal logic circuitry, sensitivity rating of the detector is specified with a load of 500uA (10K pullup to 5 volts) on the output transistor. Heavier loads will yield slightly less sensitivity. The maximum rating of the transistor is 10mA at 12 volts. When the detector activates the Logic Output Transistor turns on connecting the LOGIC (terminal 2) output to GND (terminal 1).

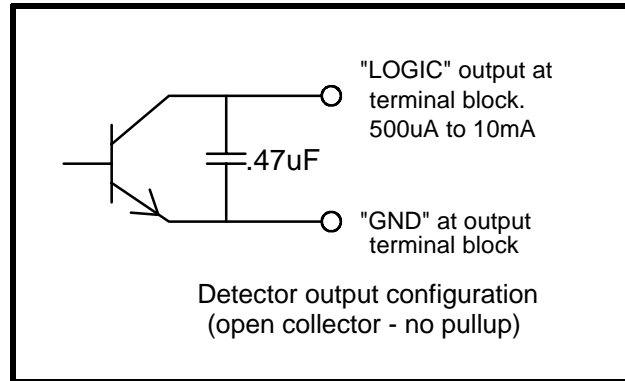


Figure 2

### **Desensitizing the detector:**

If you have problems with false triggering due to humidity, ballast glue, track oil, etc. providing a conduction path for the DCC track current, a resistor or potentiometer may be installed on the PC board to desensitize the detection circuit. Figure 3 shows the location of the desensitizing resistor mounting holes. The resistor or pot should be 1/4 watt or more. The value is determined adjusting the pot. You can use a pot to determine the correct resistance for the block then substitute a fixed resistor of the same value for the pot. The value is typically in the range of 500-10K Ohms. We suggest a 6mm 5K-10K pot. Digikey (1-800-DIGIKEY - [www.digikey.com](http://www.digikey.com)) offers suitable pots. Part number X262R103B-ND is under 50 cents.

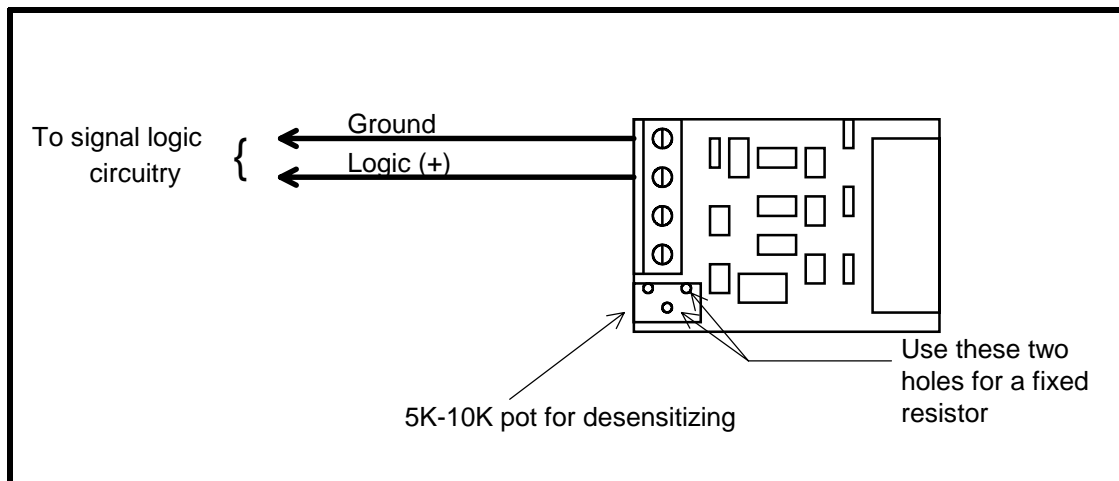


Figure 3 Component layout.

**Optional LED indicator:**

If you decide to use the optional LED indicator connect a DC power supply of between 5 and 12 Volts to terminal 1 (ground) and terminal 4 (+ voltage). When the detector activates the onboard LED will light.

**Optional relay driver output:**

If you decide to use the optional relay (or external lamp, etc.) driver connect a DC power supply of between 5 and 12 Volts, as appropriate for the relay or other device, to terminal 1 (ground) and terminal 4 (+ voltage). The relay coil connects to terminals 3 and 4. The maximum current that can be controlled by the terminal 3 is 150mA.

**Sensitivity and other technical stuff:**

Detector sensitivity may increased by putting more "turns" through the hole in the current transformer. There is a limit to the number of turns based on the output current of the system booster (sometimes called 'power station'). If you put too many turns through the hole for the capacity of the booster you may damage the detector module. Table 1 lists various popular booster sizes. Areas where the detector limits will be OK have an "X" in the table.

For example: putting 3 turns through the transformer is not allowed with a 10 Amp booster.

Booster Current Output				
Number of turns	3 Amp	4 Amp	5 Amp	10 Amp
1	X	X	X	X
2	X	X	X	X
3	X	X	X	
4	X	X	X	
5	X	X		

Table 1: allowable number of turns through current transformer based on capacity of booster

Table 2 lists the number of milliamps through the track feeder wire required to bring the logic output of the detector down to 0.7 volts (a 5 volt supply with a 10K pullup resistor is assumed). This is low enough to give a reliable indication on the TTL logic chips used in most signal systems.

Number of turns	Sensitivity
1	8mA
2	4mA
3	2.5mA
4	1.9mA
5	1.5mA

Table 2: Typical sensitivity in mA (.7 volt output) based on number of turns

## Making resistor wheel sets

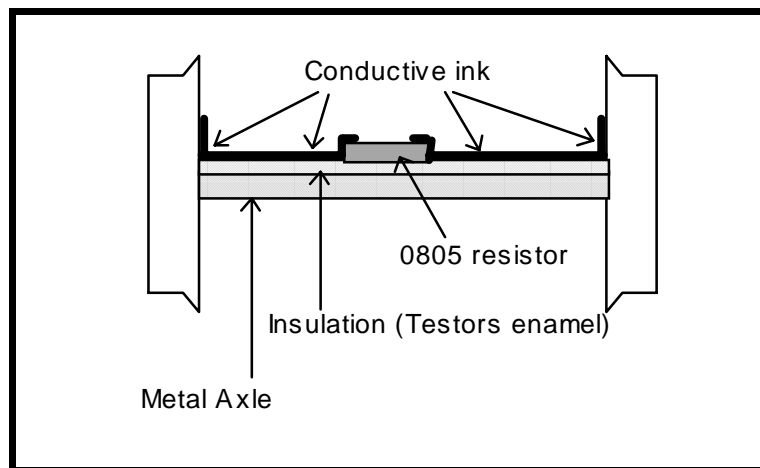
Metal wheel sets such as those available from LifeLike, North West Shortline, Jaybee, Kadee, and others can easily be converted to draw current from the rails for block detection and other current sensing purposes. Our method makes it easy connect a resistor from one wheel to the other without drilling or soldering. The suggested parts list includes 4.7K ohm resistors which will draw about 3 milliamps per wheel set. A 10K resistor can be used but you will probably need two wheel sets with resistors per car. Use a larger value resistor to decrease the current.

Parts to obtain from Mouser Electronics (1-800-346-6873):

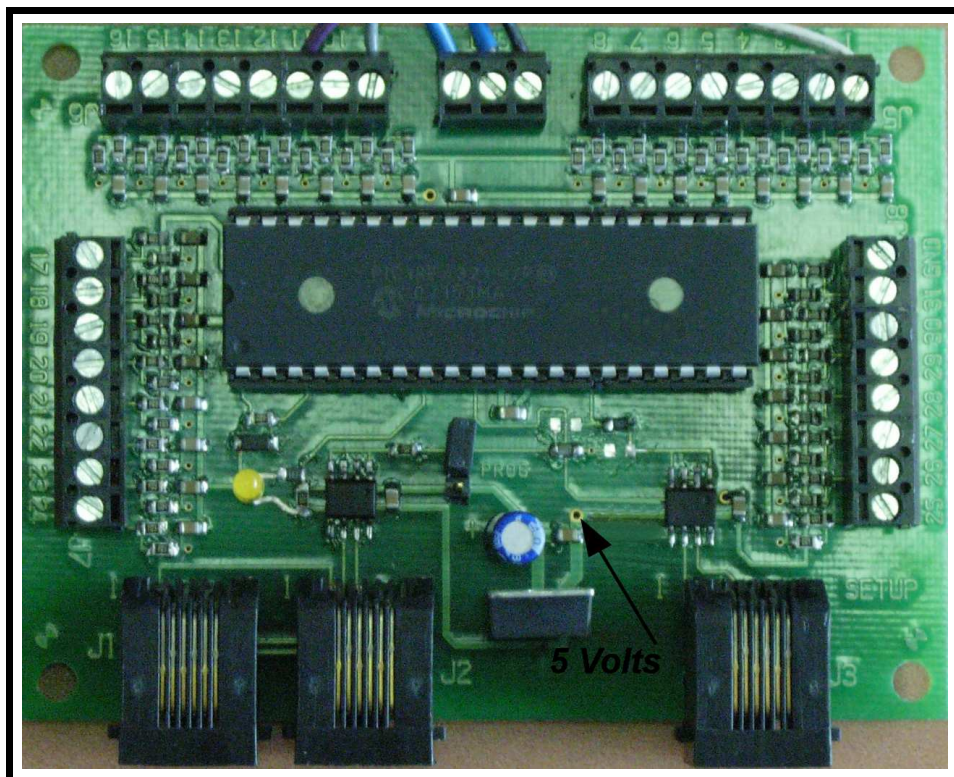
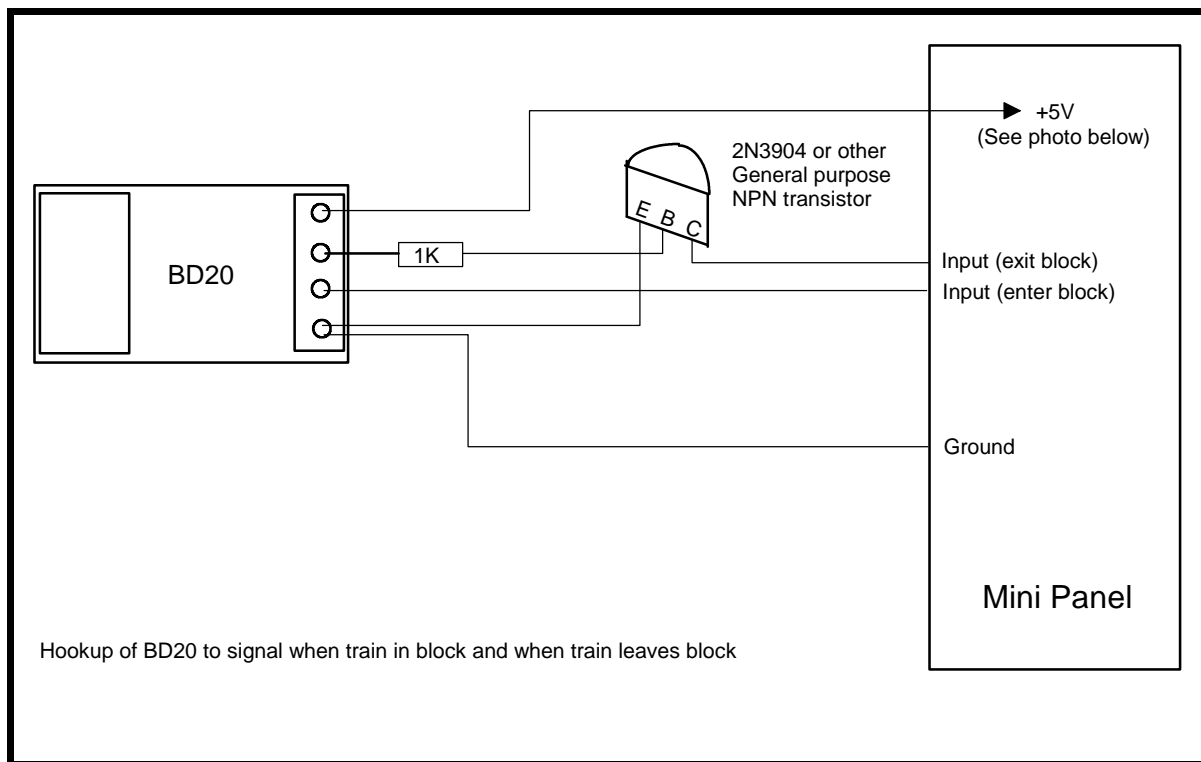
Circuit Works Conductive Ink Pen	- part number 5168-2200ST	\$11.95
Circuit Works Overcoat Pen	- part number 5168-3300G	\$ 9.95
Surface mount resistors		
(size:0805 1/10 watt 4.7K ohms)	- part number 260-4.7K	\$2.40 per 100

Instructions (all steps refer to the wheelset drawing below):

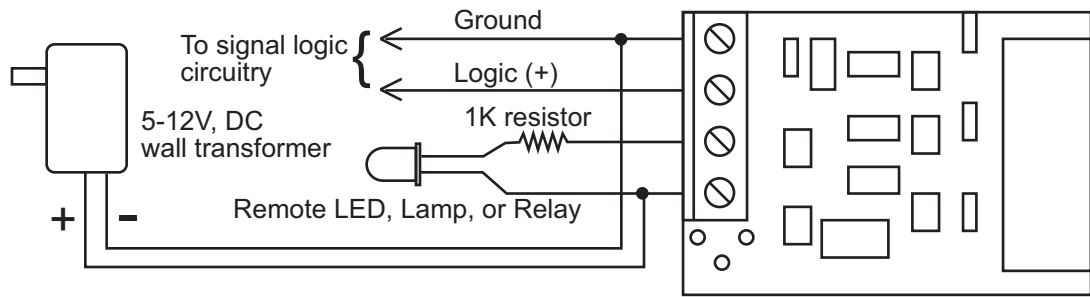
Paint an insulating stripe down the metal axle with either the overcoat pen or some good old Testors enamel paint. The enamel costs less but takes take 1-2 days to dry. Glue a resistor to the axle taking care to keep the glue off the metal ends of the resistor as we will need to make connections here later. Use the conductive ink pen to connect one metal end of the resistor to its corresponding wheel. Connect the remaining end of the resistor to the other wheel. Voila! You now have a resistor wheel set.

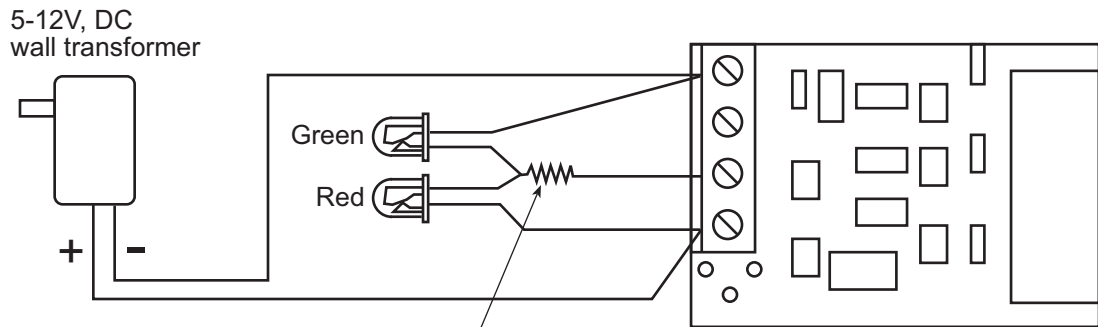


Resistor Wheel Set Figure



Five volts is available on the mini panel by soldering a wire to the indicated hole (above). To avoid potential damage to the mini panel or BD20 use only the 5 volts from the mini panel. There are no specific voltage or current requirements for the transistor as long as it is an NPN transistor. The 1 K resistor can be any wattage, 1/4 Watt is the most common.





If the wall transformer is 5 VDC, then use a 470 Ohm resistor.  
If the wall transformer is 12 VDC, then use a 1K resistor

You will need:

- One 5 VDC or 12 VDC wall transformer  
(this transformer will power several LED signals)
- One Red LED
- One Green LED
- One 470 Ohm, 1/4 Watt or one 1K Ohm, 1/4 Watt resistor