

Powerhouse™

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 a resistor wheel set.

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 20 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 can easily be added for simple indication of staging track occupancy, progress through a helix, etc. The LED indicator requires a DC power supply of between 5 and 15 Volts to power the LED. You don't need this power if you don't use the LED option.

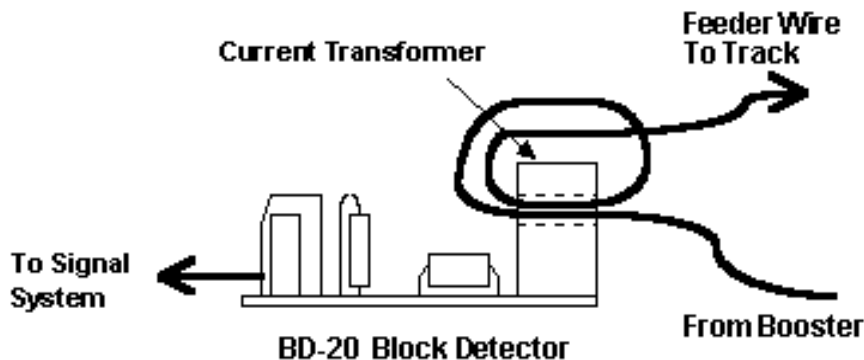


Figure 1

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 output of the detector is "open collector" (figure 2) to be compatible with most signal system logic boards on the market today. Trac-tronics is one manufacturer of signal logic circuitry that is compatible. If you design your own signal logic circuitry the output transistor of the detector specifications apply to a load of 500uA (10K pullup to 5 volts). Max. rating is 10mA at 18 volts. The transistor turns on connecting the "+" output to ground when current is detected.

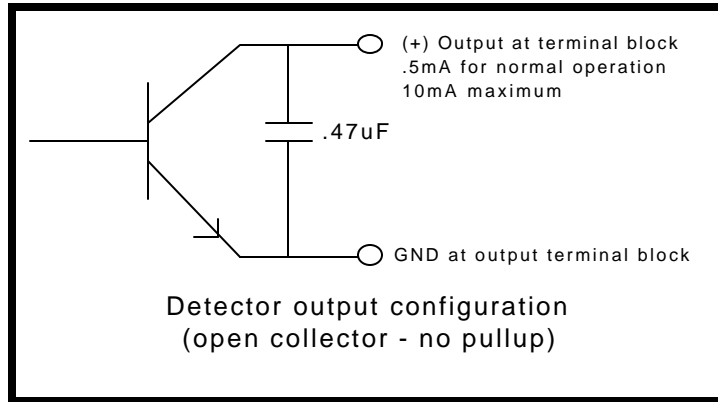


Figure 2

Desensitizing the detector:

If you have problems with false triggering due to humidity, ballast glue, track oil, etc. providing a conduction path for track current, a resistor 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 should be 1/4 watt and mounted vertically. The value is determined by trial and error (a pot could be used). The value is typically less than 500 Ohms.

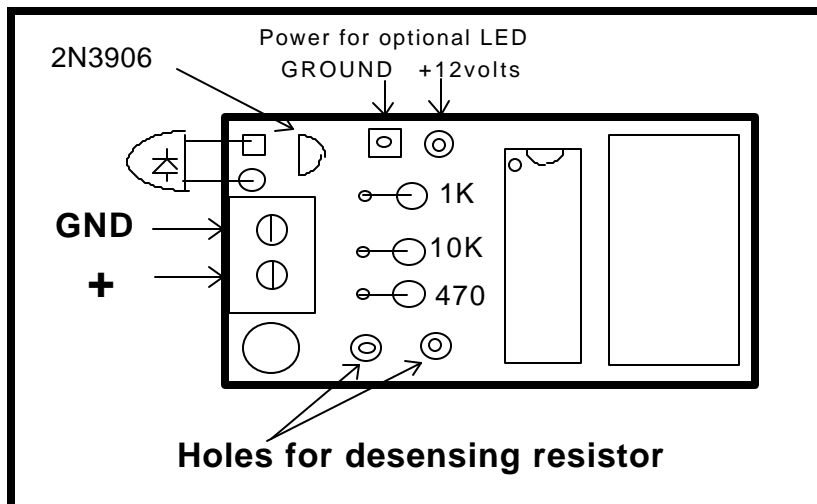


Figure 3 Component layout.
Location of parts for optional LED

Optional LED indicator:

If you decide to use the optional LED indicator you must also provide a DC power supply of between 5 and 15 Volts. This is connected to the holes indicated in Figure 3 (hooking it up backwards would probably blow up the PNP transistor so be careful). NOTE: is you wish to use the detector transistor as input to your signal system the DC supply for the LED must be limited to 5 volts

Steps to installing the optional LED

Install a 1K (1/4 Watt) resistor at the indicated location in Figure 3

Install a PNP small signal transistor (2N3906, 2N2907 or 2N4403 or similar are OK)

Install an LED with the cathode in the square hole. The cathode is usually the short lead of the LED. You can "remote" the LED to a control panel instead of soldering it directly to the detector if you want.

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 power output capability of the booster. 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 and has an "x" in areas where the detector limits will be exceeded. There are 2 sensitivity tables. Table 1 lists the number of milliamps through the track feeder wire required to bring the collector of the detector output transistor down to 0.7 volts (5 volt supply with a 10K pullup) which is enough to give a reliable indication on TTL logic chips. Table 2 is the same table but with the collector drawn down to 1.0 volts for "HC" logic compatibility.

| | | Booster | Current | Output | |
|-----------------|-------|---------|---------|--------|--------|
| Number of turns | 3 Amp | 4 Amp | 5 Amp | 10 Amp | 20 Amp |
| 1.00 | 8mA | 8mA | 8mA | 8mA | 8mA |
| 2.00 | 4mA | 4mA | 4mA | 4mA | x |
| 3.00 | 2.5mA | 2.5mA | 2.5mA | x | x |
| 4.00 | 1.9mA | 1.9mA | 1.9mA | x | x |
| 5.00 | 1.5mA | 1.5mA | x | x | x |

Table 1: Typical sensitivity in mA (.7 volt output) based on number of turns

| | | Booster | Current | Output | |
|-----------------|-------|---------|---------|--------|--------|
| Number of turns | 3 Amp | 4 Amp | 5 Amp | 10 Amp | 20 Amp |
| 1.00 | 7.6mA | 7.6mA | 7.6mA | 7.6mA | 7.6mA |
| 2.00 | 3.8mA | 3.8mA | 3.8mA | 3.8mA | x |
| 3.00 | 2.5mA | 2.5mA | 2.5mA | x | x |
| 4.00 | 1.8mA | 1.8mA | 1.8mA | x | x |
| 5.00 | 1.5mA | 1.5mA | x | x | x |

Table 2: Typical sensitivity in mA (1.0 volt output) based on number of turns

Making resistor wheel sets

Metal wheel sets such as those available from 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 3.3K ohm resistors which will draw about 5 milliamps per wheel set. Use a larger value resistor to decrease the current. If you want to increase the current you will have to use a physically larger resistor such as a 1206 or 1812 size in order to dissipate heat generated in the resistor by the current flow.

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 3.3K ohms) | - part number 260-3.3K | \$2.40 per 100 |

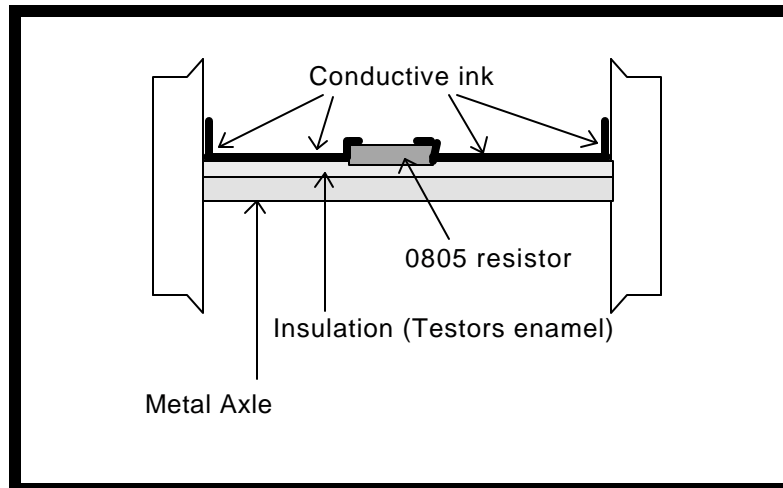
Instructions (all steps refer to the wheelset drawing below):

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