



Electronics for Model Railroads

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## BD-1, BD-1HD

### BLOCK OCCUPANCY DETECTOR

**GENERAL DESCRIPTION:** The CIRCUITRON **BD-1** is an advanced, integrated circuit design Block Occupancy Detector operating on a photo-electronic principle that provides positive indication whenever a section of a layout is occupied by any piece of rolling stock. CIRCUITRON Opto-Sensors are mounted between the ties at the end points of the block to be protected. Any piece of rolling stock entering the block shades the Opto-Sensors from ambient room light which then activates the logic circuitry on the **BD-1** circuit board. There are no modifications to the rolling stock necessary. The **BD-1** is completely bi-directional and will give proper indications even if a train leaves a block by reversing direction and backing out. The CIRCUITRON **BD-1** also contains all the driver circuitry necessary to power two-color LED or incandescent lamp block signals at each end of the protected block. The **BD-1** has a 250 ma. output driving capacity. The **BD-1HD** can handle 500 ma. on each output. For 3 color signaling, additional signal drivers will be necessary. The **BD-1** requires a 10-18 volt DC input for proper operation. The power supply *must* be filtered. If you do not have a filtered power supply, the CIRCUITRON **PS-1** filtered AC to DC Converter is ideal for this application.

**INSTRUCTIONS:** Please refer to the diagram for labeling and Opto-Sensor locations. The **BD-1** can be connected with .110" solderless connectors or by soldering leads directly to the terminals on the printed circuit board. If soldering, use a small pencil-type iron and electronics-grade rosin core 60/40 solder (available at Radio Shack). Use only as much heat as necessary to obtain a good joint and do not wiggle the terminal until the solder has cooled completely.

- 1) Mount the circuit board in a convenient location. A section of CIRCUITRON's **PCMT** makes this a simple task, or the mounting pads in the corners of the board may be drilled out and the circuit mounted with screws. If more than one **BD-1** is going to be used, they can be mounted in rows for convenient bussing of the power supply connections between circuit boards. With a 12 volt DC power supply, a maximum of 6 **BD-1**'s can be bussed together. The reason for this is that there is a 0.7 volt drop per board. Exceeding 6 boards connected together may result in insufficient voltage for proper operation of all units.
- 2) Following the installation instructions packaged with the Opto-Sensors, install two Opto-Sensors at each end of the block you wish to protect. The actual length of the block does not matter, but it is important that the room lighting be the same at each end of the block. We recommend that you locate these Opto-Sensors 2 ties apart in HO Scale. Maintain a 1/2" separation in other scales.
- 3) Connect one lead from Opto-Sensor **SSa** to one lead of Opto-Sensor **SSb** using a light gauge (22-24) wire.
- 4) Connect one lead from Opto-Sensor **SRa** to one lead of Opto-Sensor **SRb** using light gauge wire.
- 5) Connect the remaining lead of Opto-Sensor **SRa** to the remaining lead of Opto-Sensor **SSa** and run a wire from this connection to the Sensor Drive terminal [**SD**] on the printed circuit board.
- 6) Run a wire from the remaining lead of Opto-Sensor **SSb** to the Sensor Set terminal [**SS**] on the printed circuit board.
- 7) Run a wire from the remaining lead of Opto-Sensor **SRb** to the Sensor Reset terminal [**SR**] on the printed circuit board.
- 8) Connect a source of filtered DC between 10 and 18 volts to the [+] and [-] Power Supply Terminals.
- 9) Connect the loads you wish to drive (lamps, LEDs, relays, etc.) between a positive DC source (this may be the same source that is powering the **BD-1** or a separate DC supply) and the [**OCCUPIED**] and [**CLEAR**] terminals as shown. If you are using LEDs, you must include resistors as shown. Please note that the outputs of the **BD-1** provide a ground or common connection and that all loads are connected to the positive supply.

**NOTE:** If you are utilizing a separate DC power source for your lamps, the negative (-) side of this power source *must* be connected to the negative (-) side of the **BD-1** power source for proper operation.

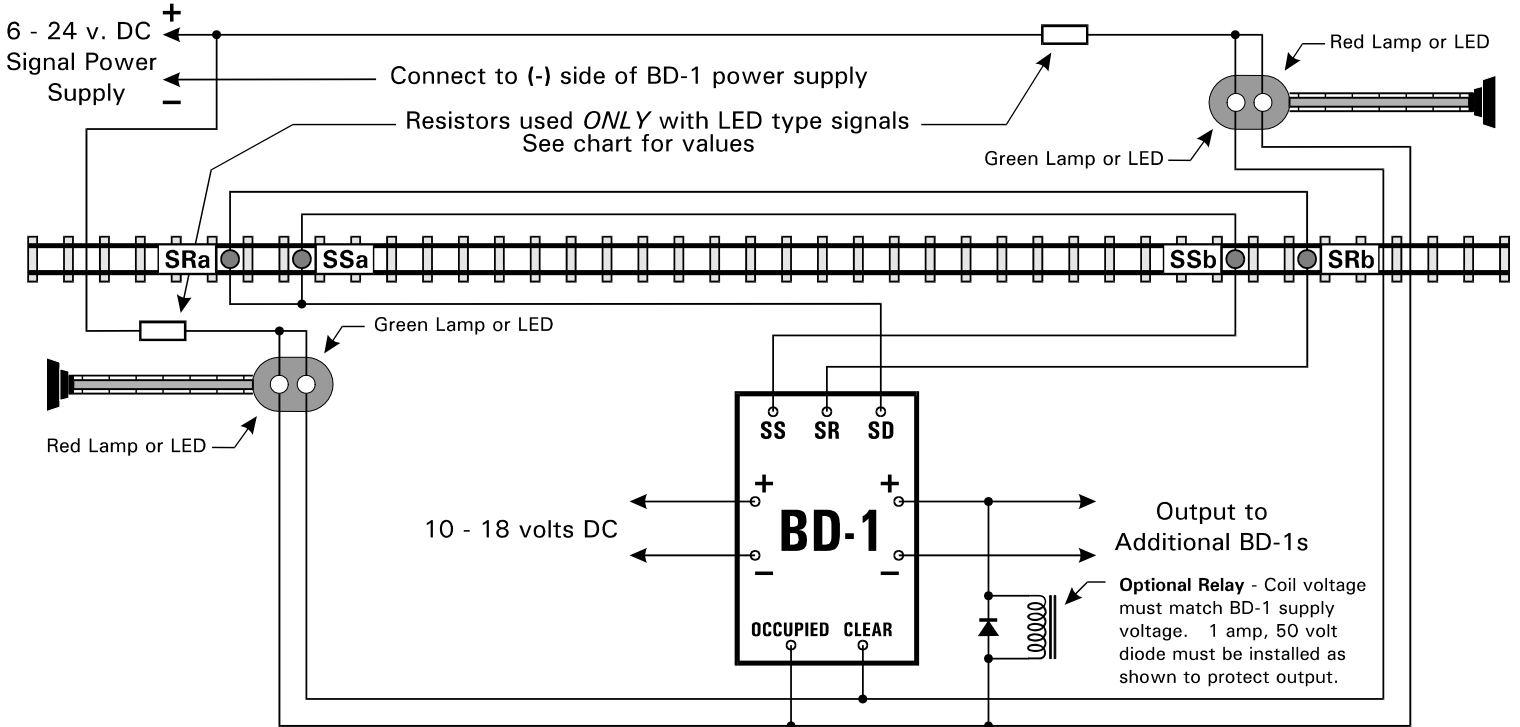
***DO NOT EXCEED 250 ma LOAD (500 ma for the BD-1HD) ON EITHER OUTPUT UNDER ANY CONDITIONS.***

**ADJUSTMENTS:** All adjustments should be made with the room lighting at the level it will be at during operating sessions of the layout. Changes of room lighting may necessitate readjustment of the sensitivity controls.

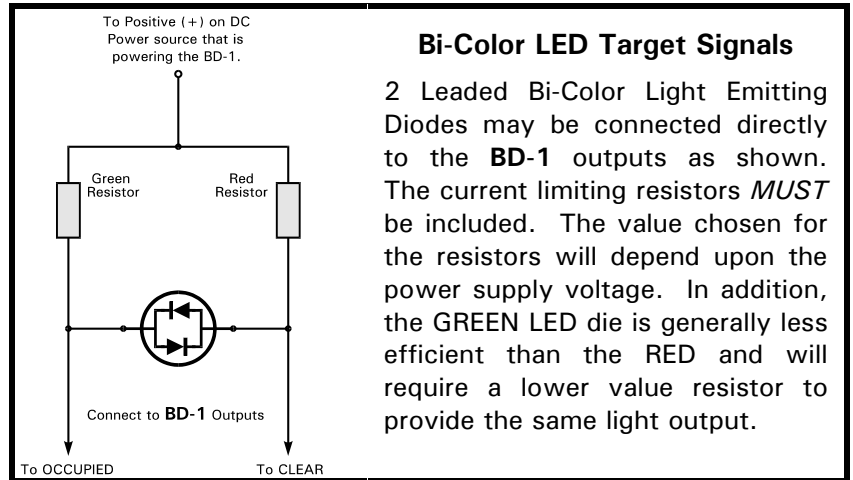
- 1) Making certain that no piece of rolling stock is shading any of the Opto-Sensors, rotate the Set Sensitivity Adjuster (**PS**) until the Set Indicator (**LS**) comes on. Rotate **PS** back until **LS** just turns off.
- 2) Repeat Step 1 for the Reset Sensitivity Adjuster (**PR**) and Reset indicator (**LR**).
- 3) The **BD-1** should now be properly adjusted. Run a train through the block and observe the signals. If they do not indicate red (occupied) whenever a piece of rolling stock is within the block, repeat steps 1 and 2 above. If you notice any flickering of the indications, you do not have the adjustments quite sensitive enough. Again, repeat steps 1 and 2 above.

**NOTES:** The **BD-1** has no memory to retain occupancy information when power is removed from the circuit. We have designed it to always indicate occupied upon first application of power. This will necessitate a “dummy” run through the blocks to initially set the proper indications when the layout is first turned on. Additionally, if a train attempts to enter an occupied block, a Green-Red flicker will be noticed upon first entry into the occupied block. This is normal.

If your block has a turnout (siding) within it, it is possible to add an additional pair of Opto-Sensors on the siding wired in series with the other two pair. With 3 sensors wired in series to each input on the **BD-1**, however, the sensitivity of the circuit is reduced to 1/3 of maximum, and it may be quite difficult or impossible to properly adjust the circuit, especially under uneven lighting conditions. It is possible to use a **DT-4** Rolling Stock Detector along with the **BD-1** to restore the sensitivity. Consult **CIRCUITRON’s** engineering department for additional information.



LED Current Limiting Resistor Values for Maximum Light Output (Higher values will yield less light output)	
SUPPLY VOLTAGE	MINIMUM VALUE
6	220 ohms
8	330 ohms
10	430 ohms
12	560 ohms
14	680 ohms
16	750 ohms
20	1,000 ohms
24	1,200 ohms



### WARRANTY

*CIRCUITRON warrants this device against defects in materials and workmanship for a period of one year from the date of purchase. This warranty covers all defects incurred in normal use of the device and does not apply in the following cases:*

- a) damage to the device resulting from abuse, mishandling, accident or failure to follow operating instructions.*
- b) if the device has been serviced or modified by other than the CIRCUITRON factory.*

*EXCEPT AS MENTIONED ABOVE, NO OTHER WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED INCLUDING MERCHANTABILITY, ON THE PART OF THE UNDERSIGNED OR ANY OTHER PERSON, FIRM OR CORPORATION, APPLIES TO THIS DEVICE.*