Circuitron
Electronics for Model Railroads

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DT-1

GRADE CROSSING DETECTION UNIT

GENERAL DESCRIPTION: The CIRCUITRON **DT-1** is an advanced, integrated circuit design, detection unit for grade crossings. The **DT-1** operates on a photoelectric principle with tiny Opto-Sensors that mount between the ties. No modifications to rolling stock are necessary, and the **DT-1** will detect powered or unpowered equipment. In addition, the **DT-1** incorporates track polarity detection for bi-directional applications and will provide fully automatic operation for all scales utilizing 2 rail DC operation. The **DT-1** utilizes four Opto-Sensors, two for each direction of travel. The **DT-1** can also provide bi-directional operation for AC or carrier control track power, however, the train direction must be manually set from the panel. The **DT-1** will operate off a wide range of supply voltages between 10 and 18 volts AC or DC. The output terminal on the **DT-1** provides a connection to ground (-) when the train is detected. The output can control any DC powered device with a current draw of 250 ma. or less. The **DT-1** does not include crossbuck flashing circuitry. A CIRCUITRON **FL-2** or **FL-3** should be used along with the **DT-1** for a complete installation. *NOTE: The **DT-1** output will be on whenever one of the two Opto-Sensors in the direction of travel are covered. Short trains falling between sensors will not be detected. If you run many short trains or single locomotives, use a Circuitron **DT-2** instead.*

INSTRUCTIONS: Please refer to the diagram for labeling and Opto-Sensor locations. The **DT-1** can be connected with .110" solderless connectors (available from CIRCUITRON) 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. A section of CIRCUITRON'S **PCMT** can be used for simple, snap-in mounting of the circuit board or you may drill holes in the mounting pads in the corners of the board and mount the **DT-1** with screws and standoffs.

CONVENTIONAL WIRING FOR USE WITH DC TRACK POWER

1) Install the Opto-Sensors following the instructions packaged with them. Sensors **B** & **C** should be located just past the crossing on either side. Sensors **A** & **D** should be placed a distance before the crossing where you want the flashing action to start as the train approaches. In HO Scale, 4-6 feet before the crossing works pretty well in most cases.
2) Mount the **DT-1** in a convenient location near the crossing. This may be under the layout or inside a large structure if you prefer. The **FL-2** or **FL-3** flasher should be mounted at this time also.
3) Connect one lead from each of Opto-Sensors A & B together with light gauge (22-24 ga.), preferably stranded wire, and then run that wire to the Sensor Drive **[SD]** terminal on the **DT-1** printed circuit board.
4) Connect a wire to the remaining lead on Opto-Sensor A, and run it to one side of Opto-Sensor C.
5) Connect a wire to the remaining lead on Opto-Sensor B, and run it to one side of Opto-Sensor D.
6) Connect a wire to the remaining lead on Opto-Sensor C, and run it to the **[S1]** terminal on the circuit board.
7) Connect a wire to the remaining lead on Opto-Sensor D, and run it to the **[S2]** terminal on the circuit board.
8) Connect a wire to the right rail of the track in the vicinity of the grade crossing. The right rail is to the right when the track is viewed from the Sensor A position looking toward Sensor D. Run the wire to the Right Track Terminal **[R]** on the **DT-1** printed circuit board.
9) In similar fashion, connect a wire between the left rail and the Left Track Terminal **[L]**.
10) Connect a wire between the Output Terminal **[OUT]** on the **DT-1** printed circuit board and the Control Terminal **[C]** on a CIRCUITRON **FL-2** or **FL-3.** If you are using a different brand of flasher, it ***must*** be DC powered by the same supply that is powering the **DT-1.** In this situation, the positive [+] connection to the flasher board is wired directly to the positive [+] side of the power supply. The negative [-] connection to the flasher is connected to the **[OUT]** terminal on the **DT-1**. This hookup will then switch the entire flasher current through the output transistor on the **DT-1.** *MAKE CERTAIN YOUR TOTAL LAMP LOAD DOES NOT EXCEED 250 MA.*
11) Connect a source of AC or DC, 10 - 18 volts, to the Supply Terminals, [+] and [-] on the **DT-1** printed circuit board. *NOTE: Although the **DT-1** may be powered from an AC or DC source, we suggest that you set up a DEDICATED 12 volt DC power supply for your electronic circuits.*

USING THE DT-1 WITH AC TRACK POWER OR COMMAND CONTROL SYSTEMS

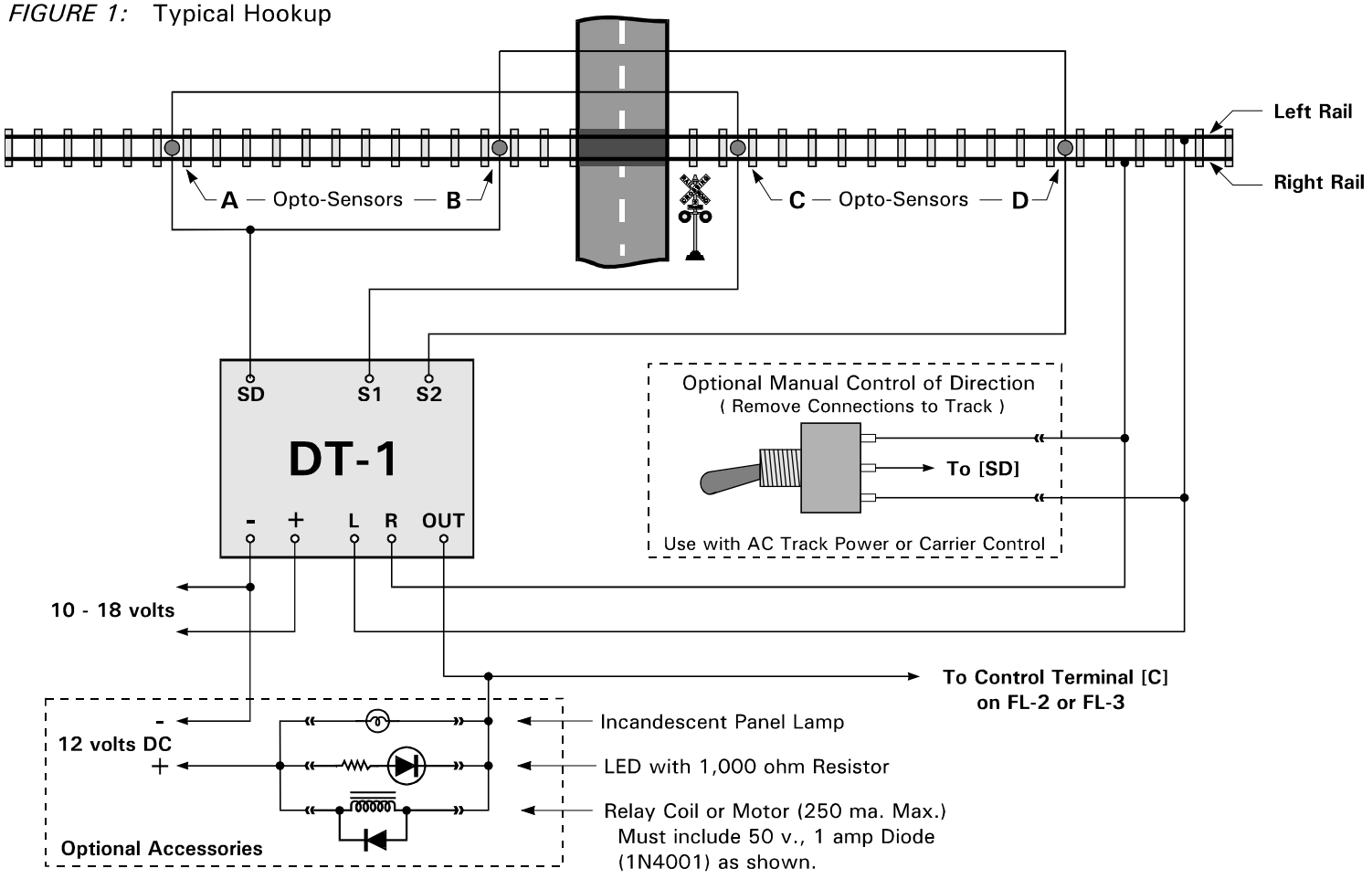
The bi-directional capabilities of the **DT-1** may be preserved when using the circuit with AC track power or Command Control (DCC) Systems. In these cases, the Track Terminals **[L]** and **[R]** are not connected to the track. Instead, a SPDT panel switch is used to "force" the **DT-1** into one direction or the other. In this way, the direction of travel *must* be established by the "dispatcher" prior to a train arriving at the crossing, in much the same way as the prototype. Connect the **[L]** and **[R]** terminals to the outside connections on the switch. The center (wiper) connection of the switch connects to the **[SD]** terminal. Refer to Figure 1.

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 require readjustment of the sensitivity controls.

1) With *no train on the track,* apply throttle voltage to the section of track where the **DT-1** is connected so that a train *would* move from Opto-Sensor A toward Opto-Sensor D.
2) Adjust Sensitivity Control **P1** so that the flashers are operating. Then back the control (P1) off so that the flashing action just stops. Shading Opto-Sensor **A** or **C** with your hand or a piece of rolling stock should bring the flashers on. Shading Opto-Sensor **B** or **D** should have no effect.
3) Reverse the direction control on the throttle or power pack and adjust Sensitivity Control **P2** in the same manner. Now shading Opto-Sensor **B** or **D** should bring the flashers back on and shading Opto-Sensor **A** or **C** should have no effect.

This completes the adjustment of the **DT-1**. Run a train past the crossing from each direction and note that the flashing action begins when the train passes over Sensor A or Sensor D (depending on the direction of travel) and continues only until the last car clears the crossing. If the unit does not operate properly, check your track connections to make sure they are not reversed and then repeat steps 1 - 3 above.

FIGURE 1: Typical Hookup



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 MERCHAN-TABILITY, ON THE PART OF THE UNDERSIGNED OR ANY OTHER PERSON, FIRM OR CORPORATION, APPLIES TO THIS DEVICE.

CIRCUITRON, INC.