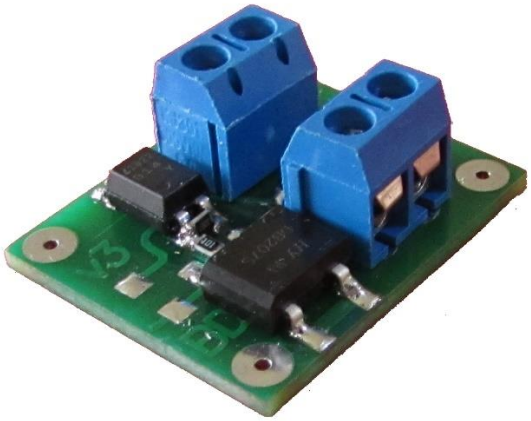
# JTElectronics Block Occupancy Detector Module

# Model: JTEBD1



By following and improving on well published designs of bridge rectifier-based block occupancy detectors, we bring you the JTEBD1 – a cheap and easy to use block occupancy detector. The JTEBD1 is wired in series with ONE track feeder wire to the block of track. It does not matter which feeder wire you use, and the JTEBD1 will detect the presence of a locomotive or rolling stock on that block of track due to the small increase in current drawn from your track controller. You can then use this block detection sensor signal as an input to your lighting control system, as a sensor input to the JMRI Panel Pro system, or many other uses. The JTEBD1 works very well with DCC systems. Any of our JTEDCC series of modules can pass the block occupancy information on to JMRI Panel Pro for further action... Or you can connect it to the JTECFx crossing flasher modules for grade crossing signals.

This block detector will also work with DC track control systems due to the bi-directional optocoupler used but there are a few issues as described here:
http://www.gatewaynmra.org/1997/easy-block-detection-2-color-signals-detection-systems-circuits/
or a PDF snapshot of this web page here:
http://www.jtelectronics.co.nz/products/documents/Easy_Block_Detection_Gateway_NMRA.pdf

The JTEBD1 is cheap and easy to use for a reason – the block occupancy detection is done by sensing a voltage drop across two diodes in a bridge rectifier which means the actual voltage applied to your locomotive may be about 1.4 Volts lower than without the block detector. While some model railroad operators may say “well this voltage drop is just unacceptable” in practical situations we have noticed no great change in locomotive operation. Ideally you will want a block detector connected to ALL track section so the voltage drop will be consistent around your whole track.

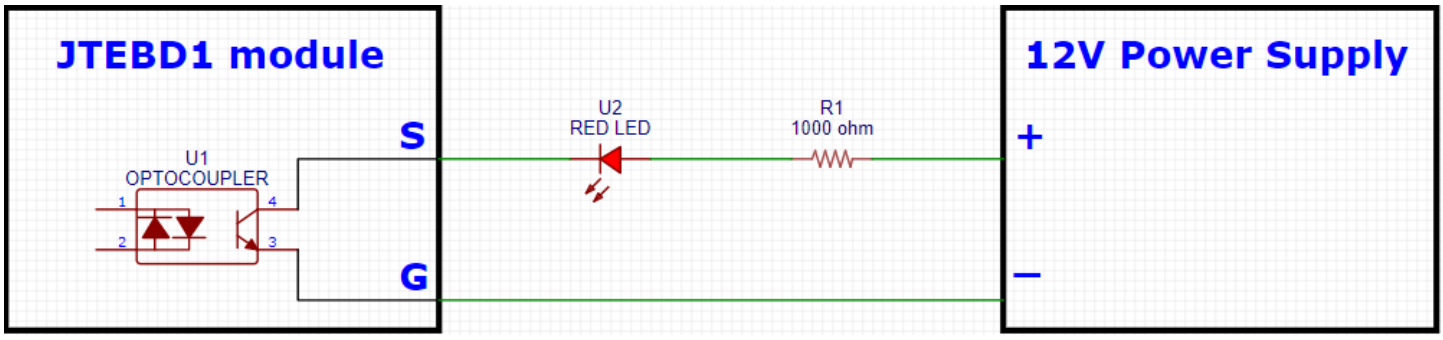
Like with all block detectors, you will need rolling stock with either internal lights or axle resistors so every part of your train will draw current from the track and be detected. The JTEBD1 will detect a 4700 Ohm (or lower) resistor across the track rails and detection current is about 2mA. You will need to do some Google-ing on how to check and/or install "axle resistors" or "wheelset resistors" and measure the resistance as being 4700 ohms Ohm or less to ensure the rolling stock will draw over 2mA track current. DCC locomotives should work fine without modification as their internal DCC decoder will draw over 2mA of track current even when totally idle.

## JTEBD1 OUTPUT

The output of the JTEBD1 is an optocoupler device meaning the "S" and "G" output terminals are (optically, physically, and therefore electrically) isolated from the track "T" terminals. The JTEBD1 output is primarily designed to provide a low current ground signal to an external control device. Due to the response of the optocoupler, and the simplicity of the JTEBD1 design, the output current does not snap on and snap off at an exact track current – the output current varies depending on track current through the T1 and T2 terminals. Usually this is not a problem as your external control circuitry will have an on/off voltage threshold which will sort this out.

The JTEBD1 output will easily drive an LED to give you visual indication of block occupancy. You must always limit the current through the output S and G terminals to less than 40 milliamps to prevent damage to the JTEBD1. In the diagram below resistor R1 limits the current through the LED, and the JTEBD1 module output terminals, to a safe level of about 10 milliamps. The resistor R1 is suitable for a 12-volt power supply and a small red LED. Resistor values for another power supply voltage, LED colour, or LED current are easily calculated by searching online for "led resistor calculator".

DigiKey have a useful LED current limiting resistor calculator on their website:
https://www.digikey.co.nz/en/resources/conversion-calculators/conversion-calculator-led-series-resistor




The JTEBD1 output can be directly connected to a microcontroller input pin. Don't forget to use a pullup resistor so the microcontroller sees a "HIGH" level when the JTEBD1 has not detected your train and sees a "LOW" level when your train is detected on the block of track and the optocoupler gets turned on.


JTEBD1 module
S
U4
OPTOCOUPLER
1
2
4
3
G
PULLUP
RESISTOR
Arduino
Microcontroller
Input Pin
Ground

## WHAT YOU DON'T GET…

I can only provide basic help on getting the JTEBD1 module wired up and working. I am no expert on track layouts or operating the JMRI software so if you are having issues try some google searches and you will find the solution.

**Like any electronic device the JTEBD1 module may be damaged by incorrectly connecting wires to the wrong terminals. Make sure you connect the JTEBD1 in SERIES with only ONE track feeder wire and connect the track feeder wiring to ONLY the track (T) terminals on the JTEBD1 board.**

**PLEASE REFER TO THE WIRING DIAGRAMS IN THIS DATASHEET FOR CORRECT WIRING INFORMATION**

**The maximum current allowed through the track feeder terminals in either a DCC or DC system is 2 Amps. Exceeding this current (like when there is a short on this block of track) for any length of time is likely to destroy the JTEBD1 module. Ensure your DCC controller system will either turn off track power, or limit the track current to under 2 amps, under shorted track conditions.**

This document is updated from time to time as new information becomes available – usually due to people asking relevant questions regarding usage or configuration. The "Document Updated" date in the bottom-right corner of each page shows what document date you have. The latest version of this datasheet document can be downloaded from http://www.jtelectronics.co.nz/products/documents/ or Google "JTEBD1"…

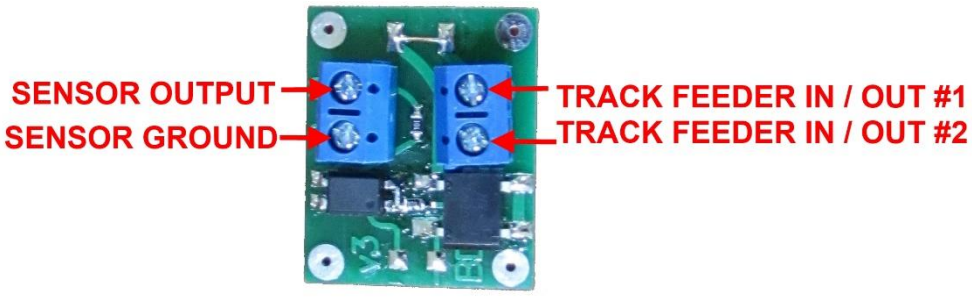
## SOFTWARE and INFORMATION LINKS

| | |
|---|---|
| Model Railroad Hobbyist | https://model-railroad-hobbyist.com/node/31270 |
| GatewayNMRA.org | http://www.gatewaynmra.org/1997/easy-block-detection-2-color-signals-detection-systems-circuits/ |
| DccWiki "Block Detection" | https://dccwiki.com/Block_Detection |
| JMRI Computer Control Software | http://jmri.org |

## JTEBD1 MODULE SPECIFICATIONS

| | |
|---|---|
| Board Length: | 31mm |
| Board Width: | 25mm |
| Board Height: | 12mm |
| Track Controller Type: | DC or DCC |
| Max Track Current: | 2 Amps |
| Track Trigger Current: | About 2 milliamps track current which corresponds to about 4700 Ohm resistor across the track |
| Max Output Current | 40 milliamps (from optocoupler output) |
| Max Output Voltage | 30V DC max. between the S ang G terminals but ALWAYS limit current to less than 40 milliamps |

## JTEBD1 MODULE - TOP VIEW

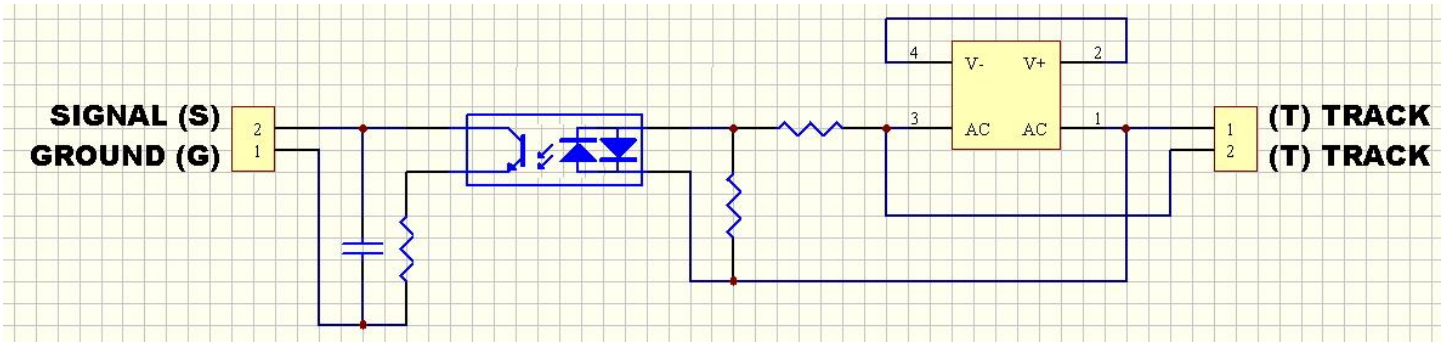



## WIRING CONNECTIONS

- **TRACK FEEDER IN/OUT #1 & #2**
  **Wire in series with ONE of the track power bus wires for the block of track** – it does not matter which bus wire you connect in series with just keep it the same around your track layout to avoid confusion. It also does not matter which terminal is the power Input or Output, you can wire it either way around.
  **Do NOT connect the JTEBD1 board to both track wires or you will destroy it!**
- **SENSOR GROUND**
  Wire to the Ground connection of your control system
- **SENSOR OUTPUT**
  Wire to the Sensor Input of your control system

**NOTE: The maximum current allowed through the track feeder terminals in either a DCC or DC system is 2 Amps. Exceeding this current (like when there is a short on this block of track) for any length of time is likely to destroy the JTEBD1 module. Ensure your DCC controller system will either turn off track power, or limit the track current to less than 2 amps under shorted track conditions.**

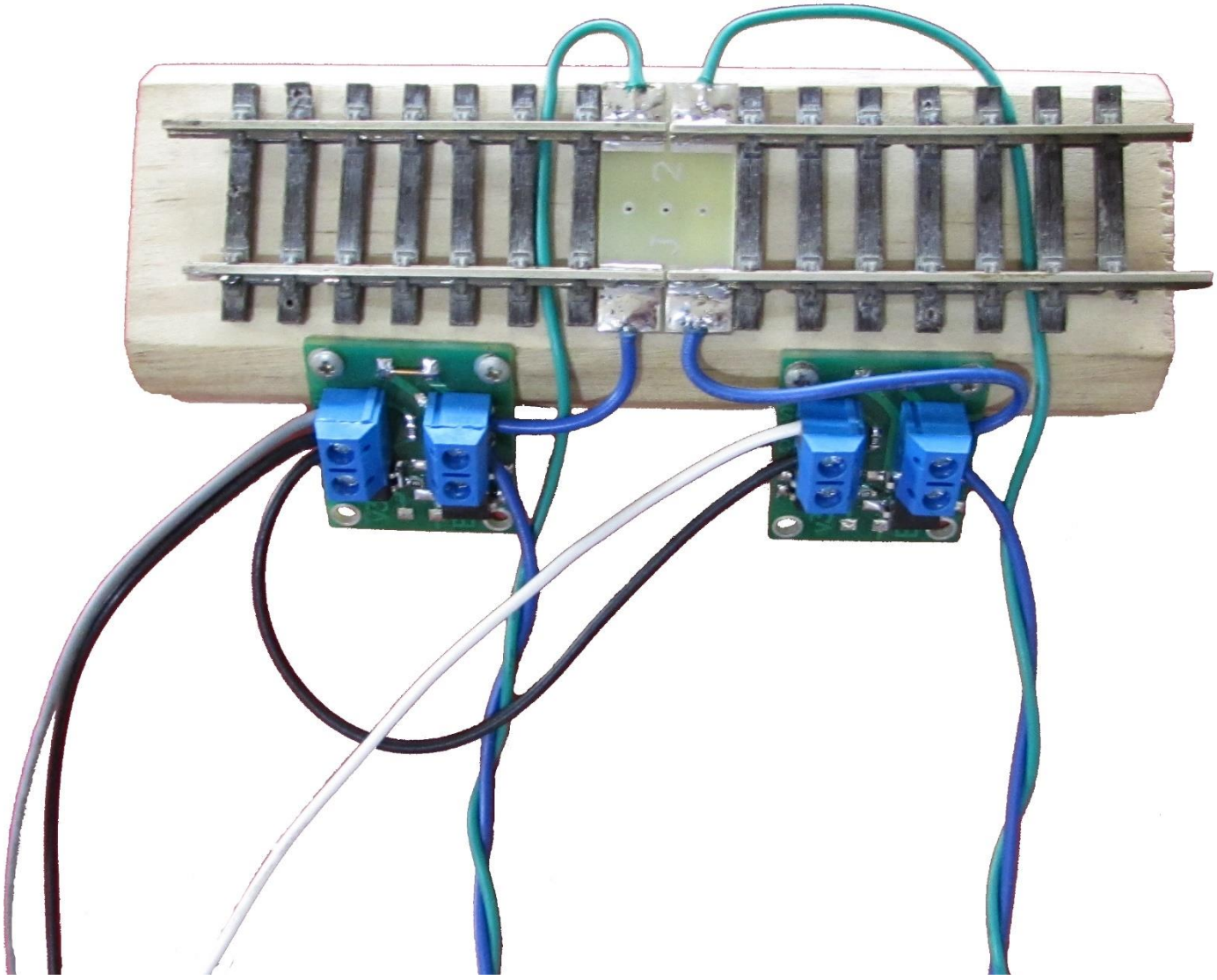
## SCHEMATIC DIAGRAM



# WIRING EXAMPLE #1

This wiring example shows the simplified wiring layout of two blocks with all wiring visible. On your layout you will hide the block detectors and all wiring below the track! In this example, the top track rail is common to both blocks.

- The GREEN and BLUE wires are for the track power bus feeders and come from your DCC (or DC) controller bus wires.
- The GREEN track power feeder wires are connected to the top track rail. This picture shows the top track rail cut, but it does not necessarily have to be cut.
- The BLUE track power feeder wires are wired in series with the relevant JTEBD1 board. The track MUST be cut between every block to electrically separate the blocks of track.
- The BLACK wire is connected to the "G" terminal on all JTEBD1 boards and is the common "Ground" sensor output connection. This will likely be wired to the Ground terminal of a JTEDCC controller module or wired to the ground of your own block occupancy detection control system.
- The GREY and WHITE wires are each connected to one of the JTEBD1 "S" terminals and are the block detection sensor output. These will likely be wired to the sensor input terminals of a JTEDCC controller module or wired to your own block occupancy detection control system sensor inputs.

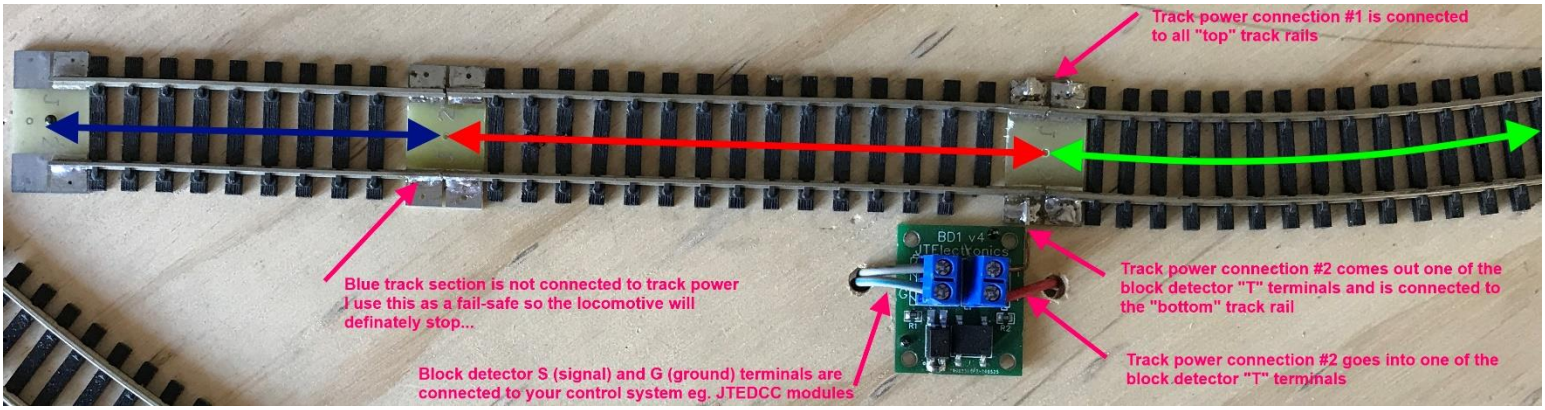


# WIRING EXAMPLE #2

This wiring example is from one of my test tracks where a locomotive on the red block of track would be detected and the block occupancy signal gets sent back to a JTEDCC-BF module which causes the locomotive to reverse direction back onto the green section of track.

- One track power wire is connected to all top track rails
- The other track power wire is connected to a block detector “T” terminal
- The bottom track rail gets track power from the other block detector “T” terminal
- The bottom track rail on ALL live track sections is connected via a block detector

The blue section of track has no power connections and if a locomotive gets here it will stop – before landing on the floor…



# WIRING MULTIPLE FEEDERS TO A BLOCK OF TRACK

If you have a few power feeders to a block of track, the block detection units will need to be connected at the "main" power feed to the block just before the power feed gets split to the individual feeders. This ensures all power to that block of track must go through the block detector for that block of track.

The picture below shows four electrically isolated blocks of track and how you would connect four JTEBD1 modules in series with the blue power feed wire.