

JTElectronics

Infrared Locomotive Detector

Model: IRLD1



The Infrared Locomotive Detector (IRLD1) device uses an infrared beam sent out and reflected back to detect the presence of a passing locomotive, rolling stock, or other nearby object. You can use this detection signal to possibly operate crossing lights, turnouts, track power, auto-reverse loops, sound an alarm etc.

In the past you may have used reed switches but the locomotive would need modification by adding a magnet to the bottom of it. This attracts unwanted metal or dirt build-up, and can get caught on the track causing a derail.

Using this IRLD1 module for train detection requires no modification to the locomotive or other rolling stock!

There are a lot of simple circuits published, and infrared detector boards available, that use a similar infrared sensor mechanism to detect the proximity of passing objects but most of these are very poor at handling changes in ambient light, and sunlight, and will give false detections making them practically useless.

This IRLD1 module uses advanced circuitry and microcontroller algorithms to ignore changes in ambient light from affecting the infrared sensor detection and sensitivity. The IRLD1 module detects passing objects very reliably, and needs no “sensitivity” or “level” adjustments. It does have an adjustment to extend the output activation time.

The IRLD1 is usually mounted below the track, with the sensor in between the sleepers, but can also be mounted at the side of the track near to where the train will pass by.

The detection range using a very good reflector – the “[Corner Cube Retroreflector](#)” – is about 1.5 meters so you could use this module for other detection purposes like across a doorway to detect people etc.

NOTE: The IRLD1 is supplied wrapped in a protective clear heatshrink sleeve. You can easily see the green and red LED indicators through it, and adjust the output on-delay. Please do NOT remove this heatshrink sleeve as it protects the delicate circuitry inside. Any applicable warranty will be voided by opening the protective heatshrink sleeve, or operating the IRLD1 module outside the specifications detailed in this document.

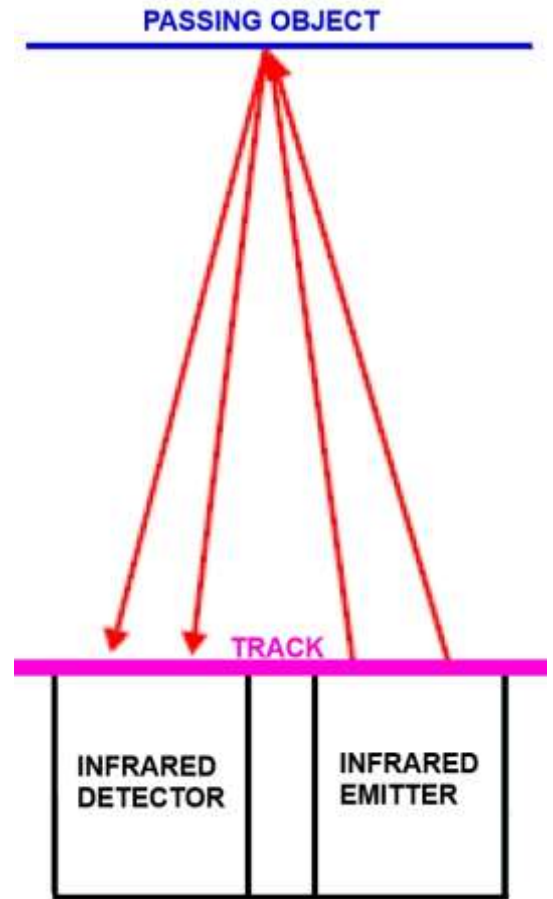
HOW IT WORKS

Infra-Red light (IR) is sent out of the IR emitter part of the sensor and a small amount of IR light is reflected off the passing object in all directions. The sensor's IR detector sees some of this reflected light and passes this signal into a microcontroller for further processing. The microcontroller "looks" for passing objects by sampling the IR detector signal approximately 10 times per second and if it detects an object for more than two consecutive samples the "Detect" output is activated. The green "Detect" LED is also turned on to indicate detection of a nearby object.

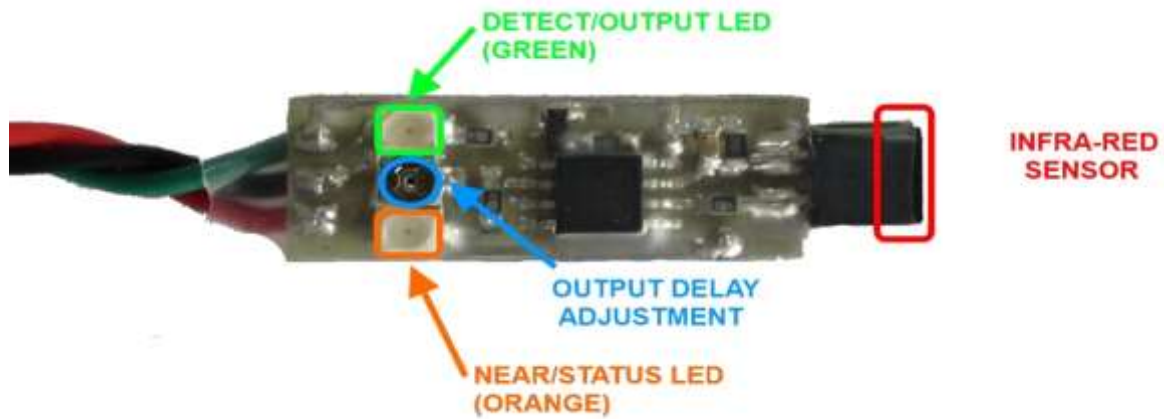
The IRLD1 board would usually be mounted under the track with the IR sensor's emitter and detector visible in the gap between the sleepers. An unmodified locomotive is easily detected as it will only be about 10mm above the end of the IR sensor. If a significantly longer detection range is really needed, you could put something more reflective on the bottom of the locomotive like white paint, tin foil etc.

To assist in correctly positioning the IRLD1 under the track and between the sleepers, the IRLD1 will warn you of an unusual amount of unwanted reflected IR light by flashing the orange "Near" LED very quickly. This means something is near the IRLD1 IR sensor and causing a fair amount of reflected IR light, but not enough to be considered a detected passing object. You will want to realign the sensor so nothing is interfering with it by reflecting back too much unwanted IR light.

NOTE: All Infra-Red sensors are affected by sunlight, and this IRLD1 module is no different. Direct sunlight will cause the IRLD1 to turn on the orange LED to indicate this situation. Fortunately detection of rolling stock will not usually be affected because as your locomotive passes over the IRLD1 sensor, it is most likely to temporarily block the sunlight and the IRLD1 will recover very quickly and detect the passing locomotive as it normally would!



IRLD1 DIAGRAMS



INSTALLATION INSTRUCTIONS

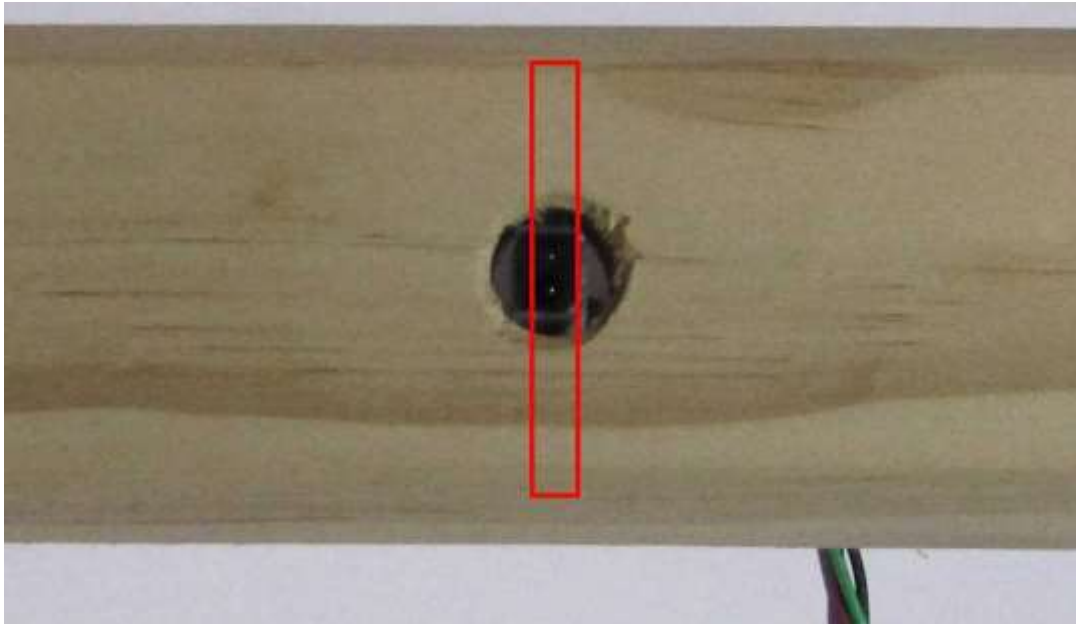
1. If required, adjust the "Output Delay" to the desired setting before mounting the IRLD1 as it will be very difficult to adjust the output delay once the IRLD1 is mounted below your track
2. Temporarily lay your track and mark the centre of the desired sensor position between the sleepers
3. Remove track and drill a 0.5" / 13mm hole through the roadbed using a "spade bit" for a nice clean hole



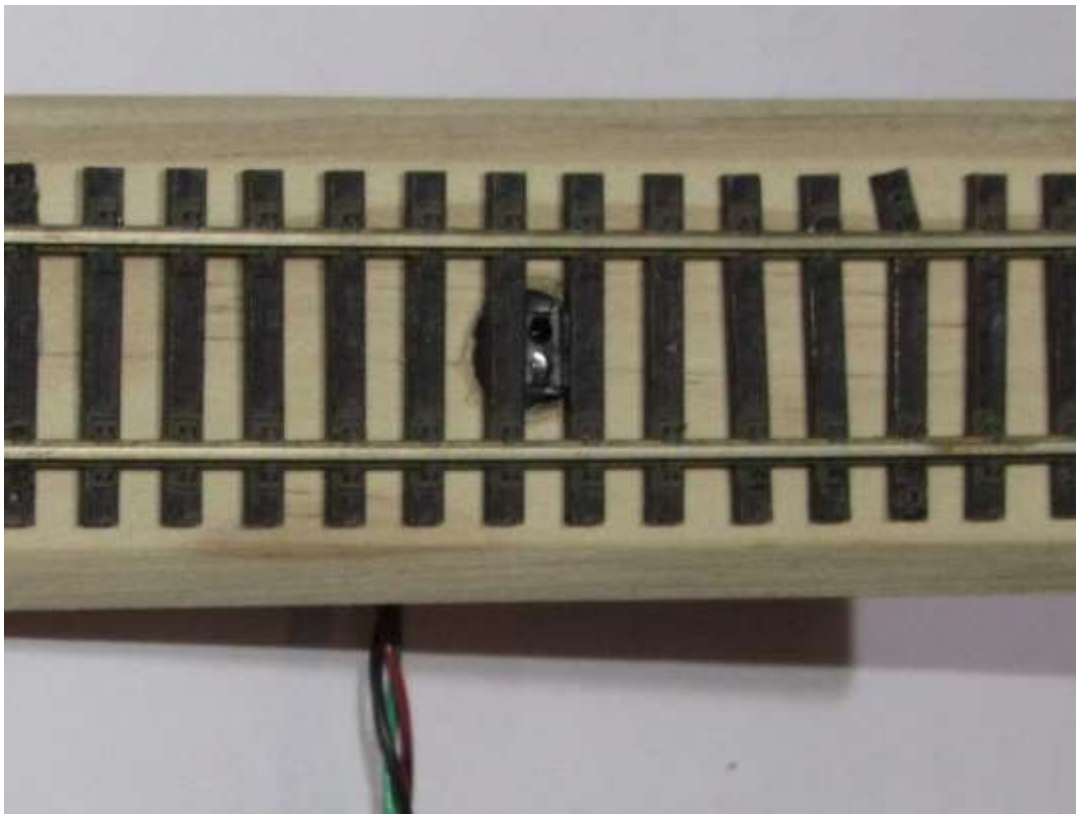
4. Insert the IRLD1 from the underside of the roadbed. It will be a snug fit and you may need to enlarge the hole slightly with a file.
5. The IRLD1 infrared sensor must be flush with the top of the roadbed



6. The two infrared sensor LED's must be perpendicular to the direction of the track so BOTH sensor LED's will end up being visible between the sleepers.



7. Lay your track over the IRLD1 sensor making sure the sensor is just touching the bottom of the sleepers and the IRLD1 sensor LED's are both visible between the sleepers



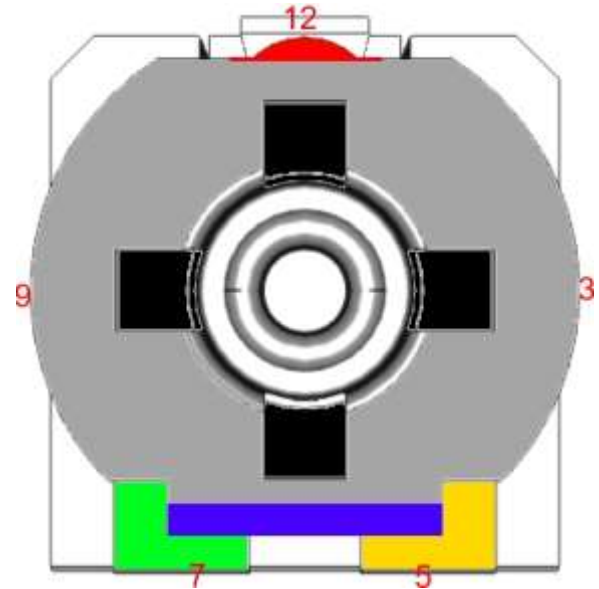
8. The IRLD1 should be a tight fit into the 0.5" hole but, if required, use a small amount of silicone sealant or "blu-tack" on the underside of the roadbed to hold the IRLD1 sensor board in the desired position
9. Power up and test operation of the IRLD1. The orange "NEAR/STATUS" LED should be flashing slowly and the green "DETECT" LED should turn on when you roll a locomotive over the sensor

OUTPUT ON-DELAY FUNCTION

The “Detect” output signal activates soon after an object is detected and normally turns off very soon after the object moves away from the sensor. You have the option of enabling an output on-delay where the output is activated normally, but will be held on (for up to the maximum of approximately 30 seconds) after the object moves away from the sensor. This can assist when the output pulses on/off/on/off/on/off in-between carriages, but with crossing lights you may want the Detect output to stay on for a few seconds, even when the train has passed by...

To the right is a diagram of the delay adjustment potentiometer. It is very small and **rough or careless adjustment will certainly damage it**. To turn it the adjustment wheel, you will need a flat screwdriver with 2.0mm x 0.4mm blade, or a cross screwdriver of similar size. The actual delay adjuster on your IRLD1 will not look exactly like this diagram but will be close. The adjustment wheel is a silver/grey colour. In this diagram, I have coloured some of the areas of interest and they are as follows:

- GREY** The almost-circular adjustment wheel
- BLACK** The adjustment screwdriver slots
- RED** The rounded “pointer” of the adjustment wheel
- BLUE** The “flat” side of the adjustment wheel. The red “pointer” of the adjustment wheel is directly opposite this flat side.
- YELLOW** The “zero” delay setting position (as when supplied to you)
- GREEN** The “maximum” delay setting position



This diagram shows the red adjustment pointer set to the 12 o'clock position at the top, which is midway between the green “maximum” delay setting and the yellow “zero” delay setting. This would give approximately 10 seconds of on-delay.

The IRLD1 is supplied to you with the output on-delay set to zero so the red “pointer” side of the adjustment wheel will be turned clockwise so it’s facing the yellow “zero” delay setting position. As you move the red “pointer” anti-clockwise toward the green “maximum” delay setting, the output on-delay will increase according to the table below:

5 o'clock position (Yellow)	Zero delay
3 o'clock position	Approx. 1 second on-delay
12 o'clock position	Approx. 10 seconds on-delay
9 o'clock position	Approx. 20 seconds on-delay
7 o'clock position (Green)	Approx. 30 seconds on-delay

LED INDICATORS

GREEN	Off	Locomotive not detected
GREEN	On	Locomotive Detected
ORANGE	Slow Flash	Idle heartbeat ON/OFF once per second, no problemo...
ORANGE	Fast Flash	Object is "near" detection, something is too near to sensor
ORANGE	Always On	Sensor flooded by sunlight
ORANGE	Always Off	Very unusual, the IRLD1 is likely to be not working. Check your power wiring...

WIRING DETAILS

RED Supply Voltage 7V to 24V DC

BLACK Ground

GREEN Detect Output

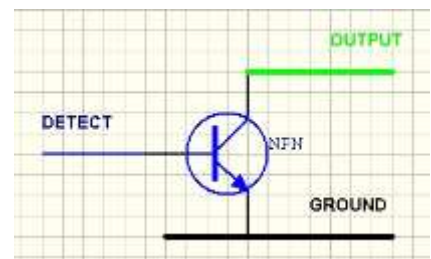
IR LOCOMOTIVE DETECTOR (IRLD1) SPECIFICATIONS:

Supply Voltage	7V to 24V DC	
Supply Current	35mA maximum	
DETECT Output	Switches to Ground (open collector)	
DETECT Output Current	500mA	
Object Detection Range	White 80GSM Paper	approx. 80mm
Locomotive Detection Range	Unmodified locomotive	approx. 15 to 25mm
Doorway Beam Detection	Using Corner Retroreflector	approx. 1.5 meters!!
Adjustable Output Delay	Zero to approx. 30 seconds	
Mounting hole size	Approx. 13mm / 0.5 inch	
Board Dimensions	Approx. 38mm x 13mm	
Wire Length	The IRLD1 will be supplied with 1.5 meters of wire like in the picture below:	



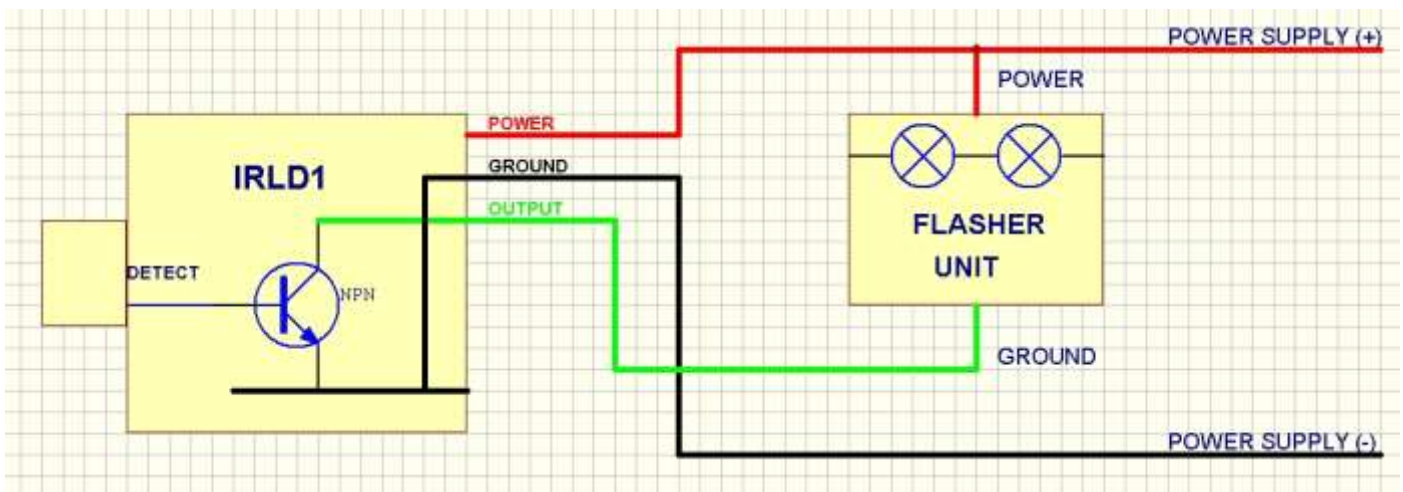
HOW TO WIRE UP THE IRLD1

The IRLD1 has an “open collector” output, using an NPN transistor, as shown in the simplified diagram to the right. The green “Output” wire will switch to ground when an object is detected, and be basically open-circuit when no object is detected. You would use the Output signal to provide a ground connection to the required circuitry.



For example when connecting a flasher unit you could use wiring like in the picture below:

1. Connect the IRLD1 Power and Ground wires to your power supply + and -
2. Connect the flasher unit Power wire to your power supply +
3. Connect the flasher unit Ground wire to the IRLD1 Output wire
4. When the IRLD1 detects an object, the IRLD1's output will connect the flasher unit Ground wire to the power supply (-) ground and the flasher unit will turn on (and start flashing) as it is now powered correctly

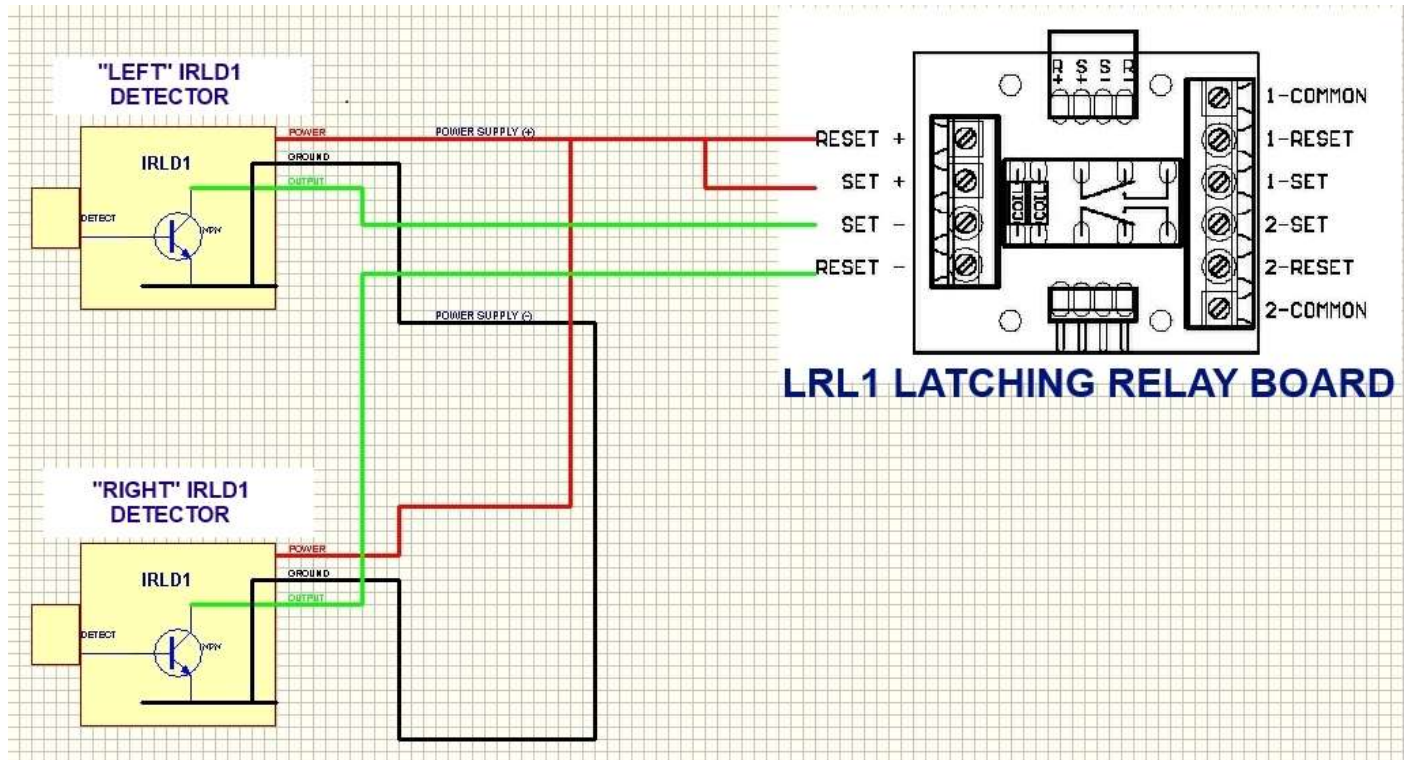


NOTE: Check out my [LRL1 Latching Relay Board](http://www.jtelectronics.co.nz/products) for how to make a simple lamp flasher unit using the LRL1 relay board, two resistors and two capacitors

WIRE UP THE IRLD1 TO A RELAY LIKE THE “LRL1” LATCHING RELAY

You can easily connect two IRLD1 detectors to a latching relay as shown in the diagram below. This will allow you to use the relay board to switch higher currents and a wide variety of signals.

When an object passes by the top IRLD1 sensor, the relay is energised into its “SET” position. When an object passes by the bottom IRLD1 sensor, the relay is energised into its “RESET” position.



You then can use the six relay connections on the right side of the LRL1 board for your required purpose.

For a Left/Right auto-reverse straight track (like shown in [the LRL1 datasheet](#)) you would wire the relay contacts as follows:

Controller Power #1	->	1-COMMON
Controller Power #2	->	2-COMMON
Track #1	->	1-RESET and 2-SET
Track #2	->	2-RESET and 1-SET