DCC & The Model 97

Diagrams, notes and tips for using older Phoenix Sound Boards with DCC or LGB's MTS.

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Overview

When the Model '97 (and earlier) sound boards were designed, DCC was not common in Garden Scale trains. This manual shows how to connect a model '97 (or '96) sound board to DCC.

There are many reasons to have a sound system that understands the DCC system directly (like our 2K2 or P5 systems) but if you are content to have only the whistle and bell as button sounds and the installation is not cramped for space, then using your model '97 board with DCC will be fine.

Generally if you hook the model '97 board to the decoder motor outputs, it will behave like it normally would in a conventional DC installation.

Some things consider before you begin:

1. Will you run exclusively on DCC or will you run on DC sometimes?
2. How important is eliminating the sound board battery.
3. How many wires are you willing to run between the DCC decoder and the sound board if they are not located in the same piece of rolling stock.

Selecting the options

DCC only or DCC and conventional DC.

If you intend to operate on DC, you will need to preserve the sound board battery in order to get sounds when the train is not moving or moving slowly.

Battery or not.

Aside from allowing you to operate on conventional DC with no loss of sounds, the sound board battery will sustain the sound if you encounter dirty track and it will help deliver full power when the power hungry sounds, like the whistle, are played. Model '96 Sound boards do not operate well without a battery.

Wiring

The sound board will need to be connected to a decoder. This will probably be the main decoder that drives the motor(s) if the sound system and decoder are in the same piece of rolling stock. This is the best configuration since no wires need to go between pieces of rolling stock. If your motor decoder is in a different car from the sound system, you might be better off with a small decoder that rides with the sound system.

Selecting a configuration and the components.

The first very broad option to consider is whether to use conventional DCC or Wireless DCC. In conventional DCC (or MTS) the control signals are sent through the rails along with the power for the motors and lights. There are non-tethered versions of conventional DCC that look like wireless DCC but the transmitter sends to a stationary box which then sends the DCC signal out over the rails. The conventional DCC configuration will require track cleanliness and attention to proper wire size and power distribution capacity to insure reliable operation.

In wireless DCC (Airwire) the DCC signals are transmitted directly to a receiver mounted on the train. The receiver and the entire train are normally powered by an on board rechargeable battery. In a battery set up the track is not normally energized. Constant track power configurations or battery/track power hybrids are possible but not encouraged or supported by Airwire.

So to summarize, your choices at this point are

1. Conventional track powered DCC.
2. Battery powered wireless DCC.
3. Track powered wireless DCC.

The options and components needed for these configurations are as follows.

Conventional DCC

For Conventional DCC, here are the 4 typical configurations based on common installation requirements. There are many more options and you may need to borrow pieces from several diagrams to fit your particular needs. The characteristics of each system are summarized below.

DC and DCC compatible [Diagram 1]

This configuration will preserve the sound system operation when it is used with DC. Some modelers prefer to switch out the DCC components when running on DC. This adds a switch and complicates to the wiring but delivers power more directly to the motors and sound system. The decoder is powering both the audio amplifier and the battery charging circuit so it must be sized appropriately (allow one amp for the sound system).

DCC only, no sound board battery

There are two ways to eliminate the battery from the sound system.

One is to use a battery eliminator circuit (like the big boost) that is powered off the track and feeds into the battery inputs. [Diagram 2]

The second is to hook the DCC track power to the track inputs and derive the speed using an axle magnet. [Diagram 3]

DCC only, dedicated sound decoder [Diagram 4]

When the motor and it's decoder are isolated from the sound system, you may want to use a dedicated decoder. This can be any inexpensive 1 amp decoder with the desired function outputs. NCE D13SR or equivalent.

Wireless DCC (Airwire)

In wireless DCC, the decoder driver output on the receiver is essentially the DCC track. This connection will not have the power capacity or the robustness of the DCC you get from the track in a conventional system.

Other differences are that you will probably want a separate decoder if you intend to use any of the functions. The Airwire system has two function outputs which are normally used for smoke [F6] and lights [F0]. These could alternately be used to trigger sounds if not being used as intended.

It is a good idea to connect to the on board battery. This will reduce the load on the receiver DCC driver output and insure solid power to the sound system. If your battery pack exceeds 20 volts, you will need to regulate the battery voltage - 12 volts is a good choice.

Diagram 5 would be the conventional wiring for Wireless DCC. If you want to use constant track power and eliminate the on board battery use Diagram 6 which substitutes a battery elimination circuit for the battery.

The battery elimination circuit would consist of at least one full wave bridge rectifier (2 if using two trucks to pick up power), a voltage regulator if there is any chance that the output of the rectifiers will exceed the input rating of the Airwire battery (18 volts or 24 volts depending on the receiver) or the Phoenix Sound board (20 volts). Include as much filtering as you can manage. If your track power is unregulated/unfiltered the elimination circuit should limit the voltage to some reasonable level below the maximums for the receiver and the sound board. The elimination circuit will dissipate heat in proportional to the voltage difference across the eliminator and the current through it. It could get hot.

Additional helper circuits

Here are three useful circuits that may be needed for some DCC installations.

Motor interface. [Diagram 7]

If you discover that the sound system thinks the train is going full tilt when the motor is off you need to insert this circuit between the sound board and the DCC motor drive. Measure the voltage from each of our track inputs to ground on the sound board when the motor is off. If you find that both are at a high level (the motor will see no volts) then you need this circuit.

Trigger input Isolation. [Diagram 8]

The function output voltage levels relative to our ground may vary with the motor voltage. This is not generally a problem when using the programmed whistle and bell. However for the manual whistle, you may get somewhat random triggering because the ground on the sound board is different from the ground on the decoder. Do not try to fix this situation by hooking the grounds together - this will only cause unhappiness, use the isolation circuit instead.

Speed trigger isolation. [Diagram 9]

Use this circuit if you have a speed contact that uses the chassis as one side of the switch closure. Any wires that go to the track inputs on the sound board must be kept isolated from the board ground. It is quite common in O-scale brass to find the chassis is connected to one of the rails and can become connected to our ground through the speed contact wiring.

Diagram 1: DCC and DCC Compatible

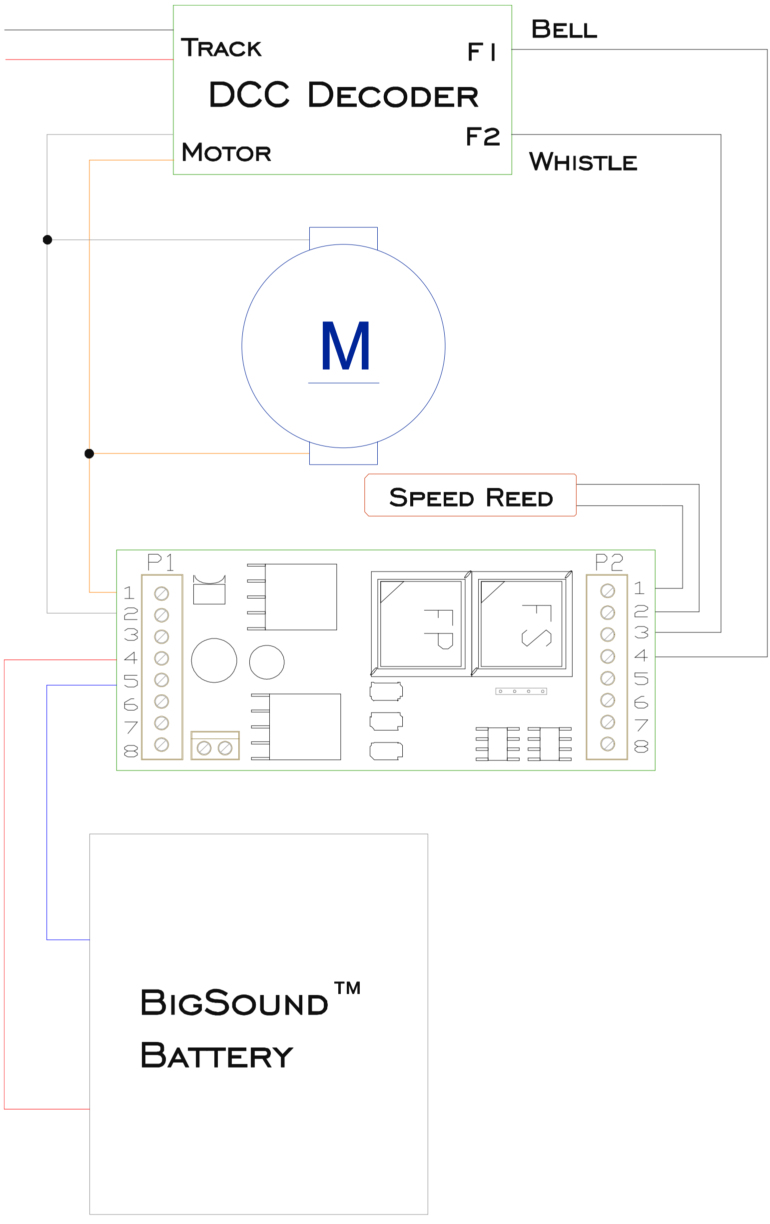


Diagram 2: DCC Only, Battery Eliminator Circuit

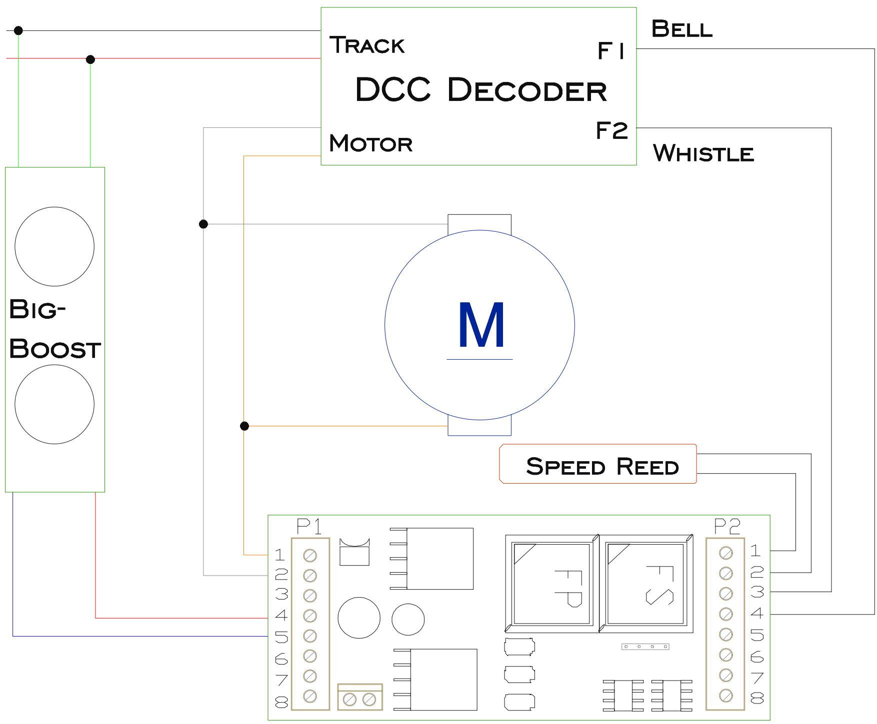
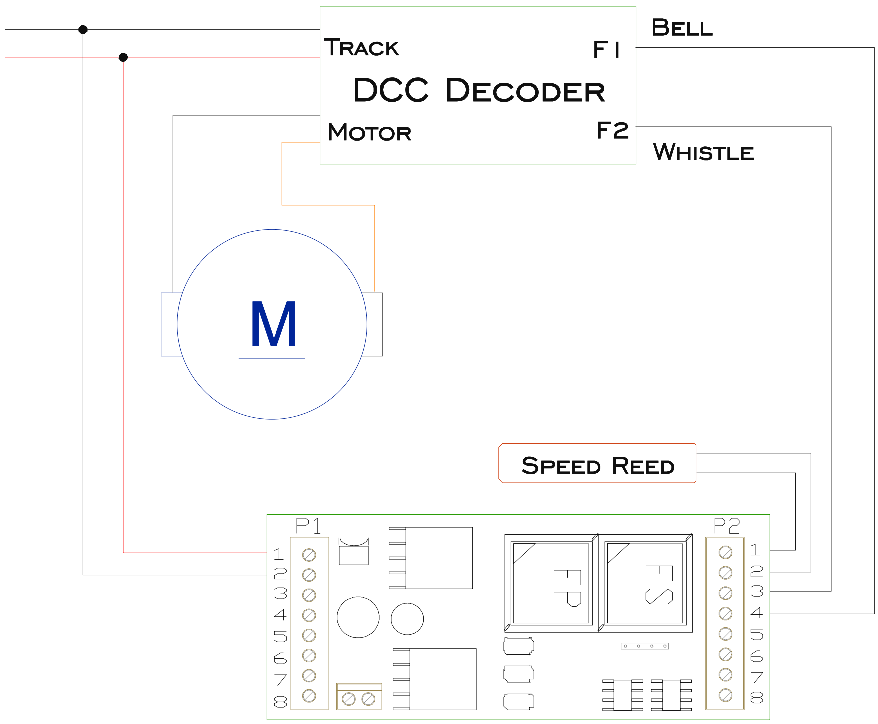


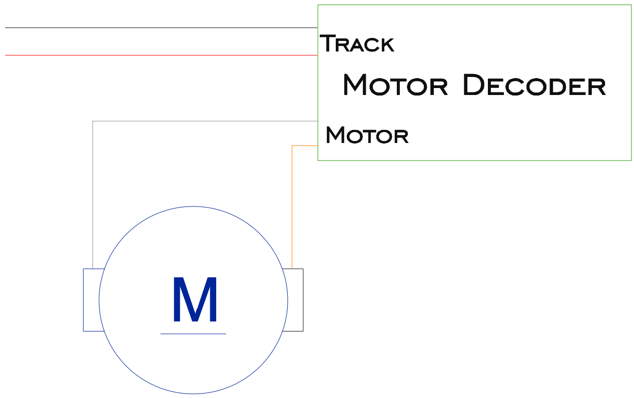
Diagram 3: DCC Only, No Sound Board Battery



Notes: This is a minimum components configuration.

- Model ‘96 systems will probably require a battery.
- Model ‘97 systems may work better with a battery.
- Volume settings are not remembered if there is no battery.
- You must use trigger mode since the DCC power is constant and does not contain DC speed information.
- You will probably want to do your own manual signaling, for which you will need real time chips. The start toots will not be consistently forward or reverse but random, due to the DCC power.

Diagram 4: DCC Only, Sound and Motor Separate



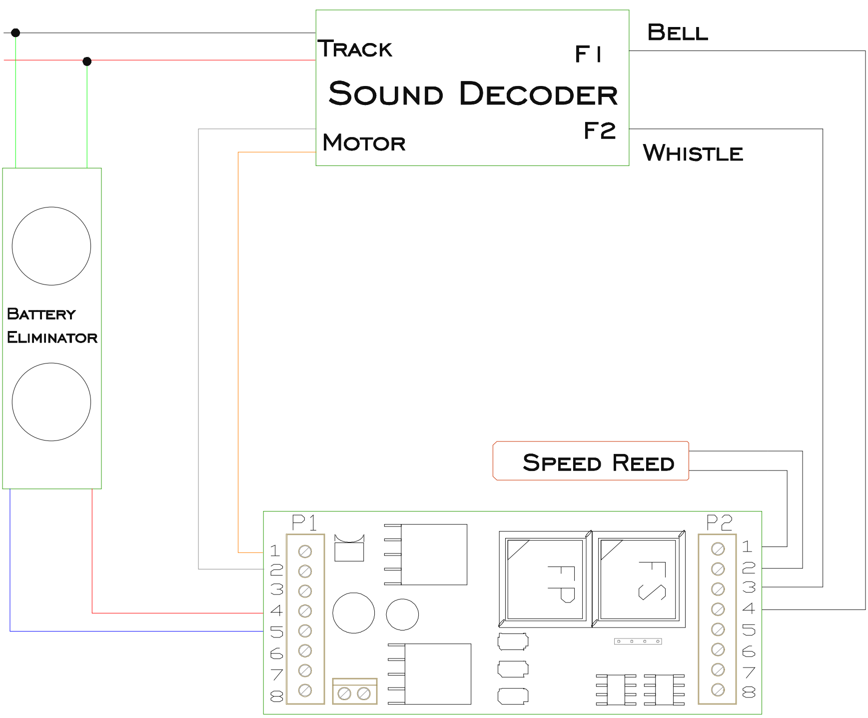


Diagram 5: Battery Powered Wireless DCC – Airwire

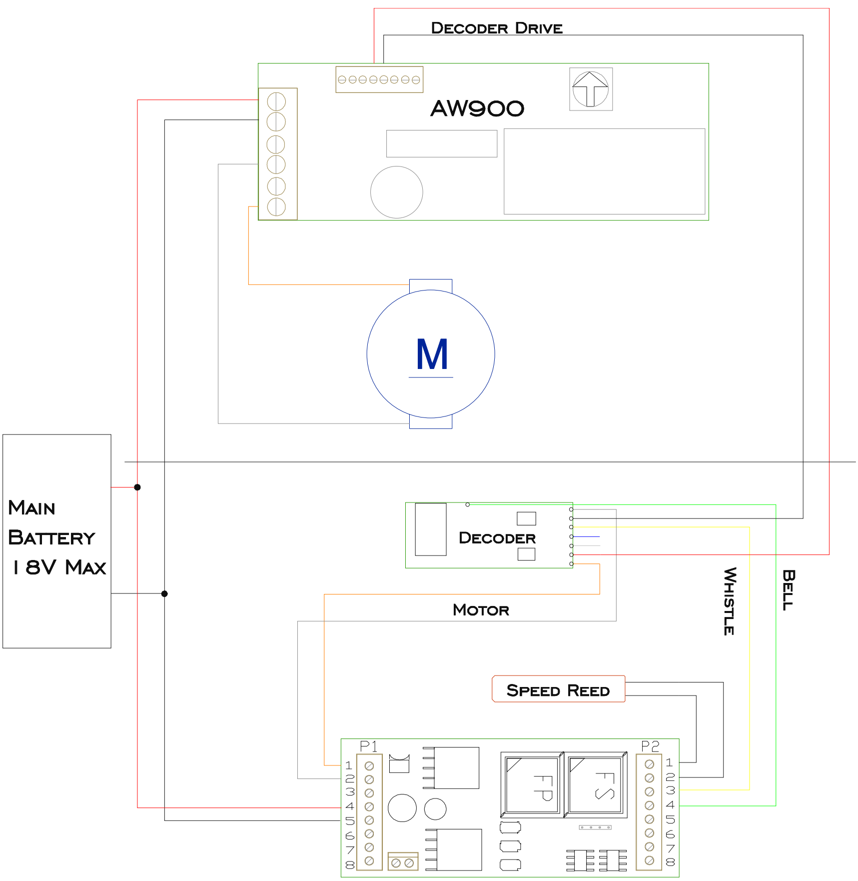


Diagram 6: Track Powered Wireless DCC (Airwire)

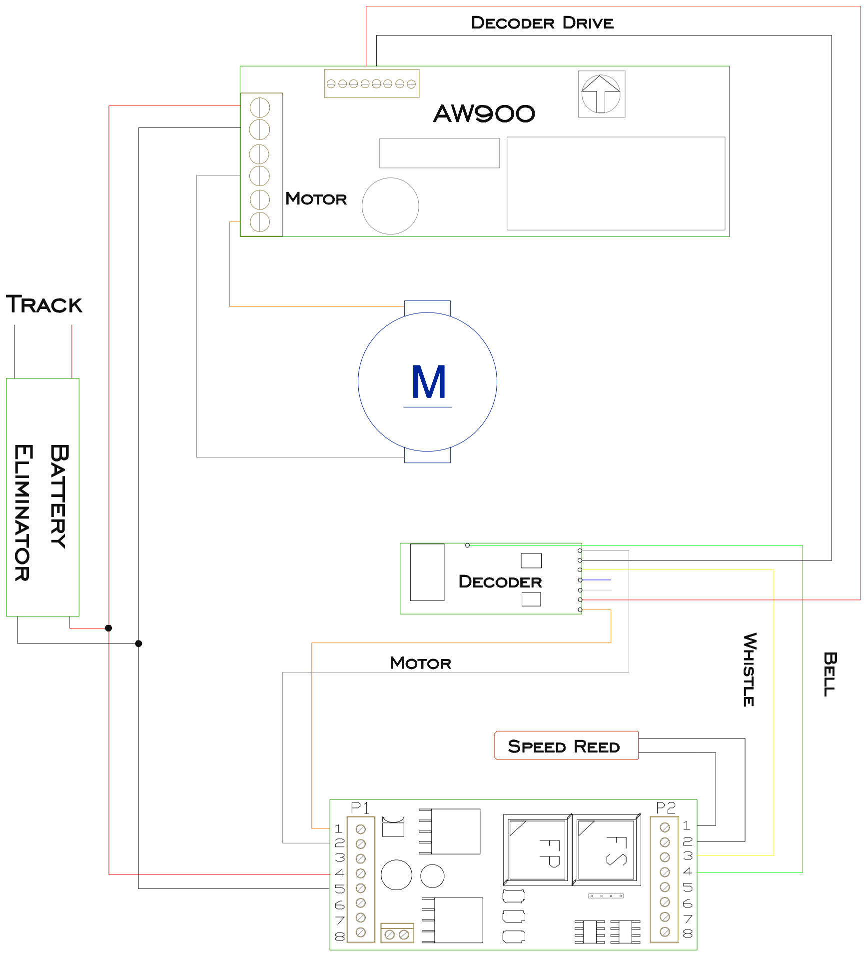


Diagram 7: Motor Interface Circuit

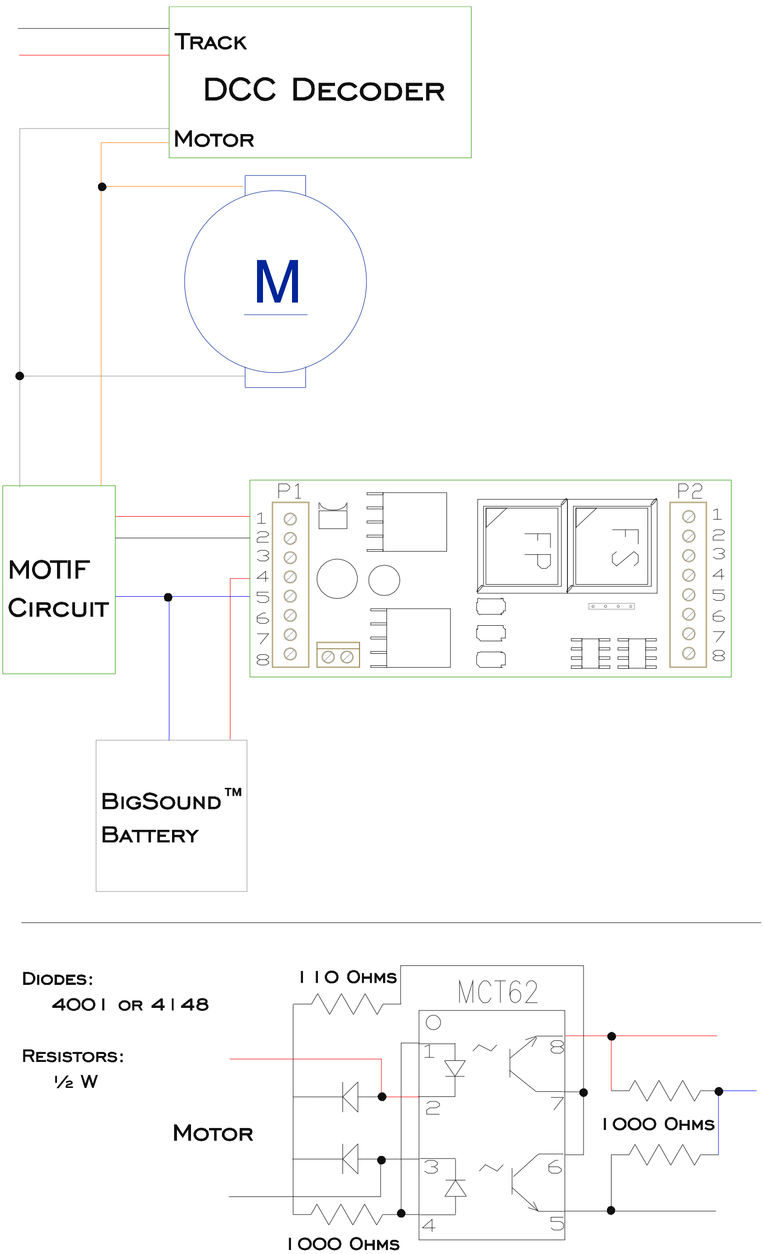


Diagram 8: Function Trigger Isolation

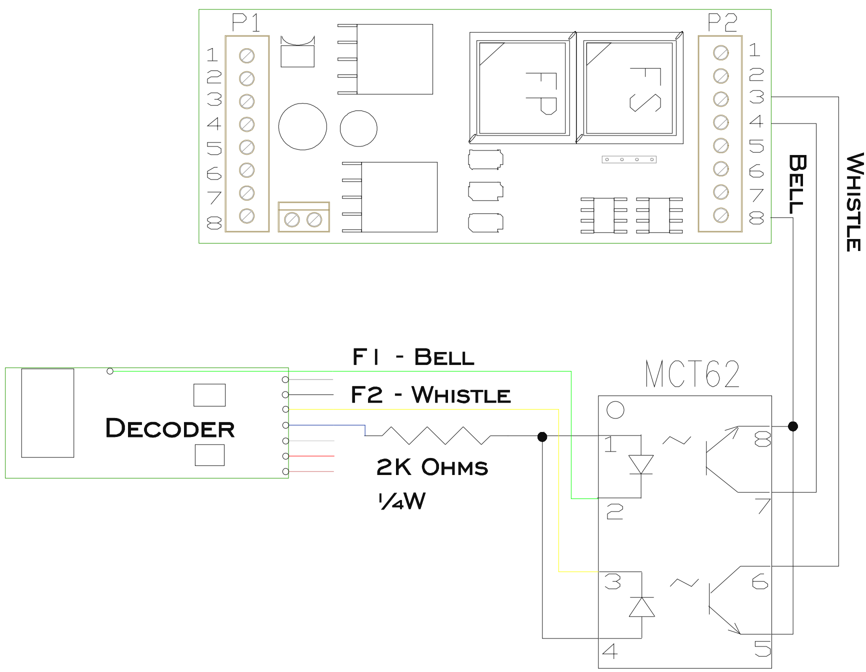


Diagram 9: Chuff Contact Isolation