

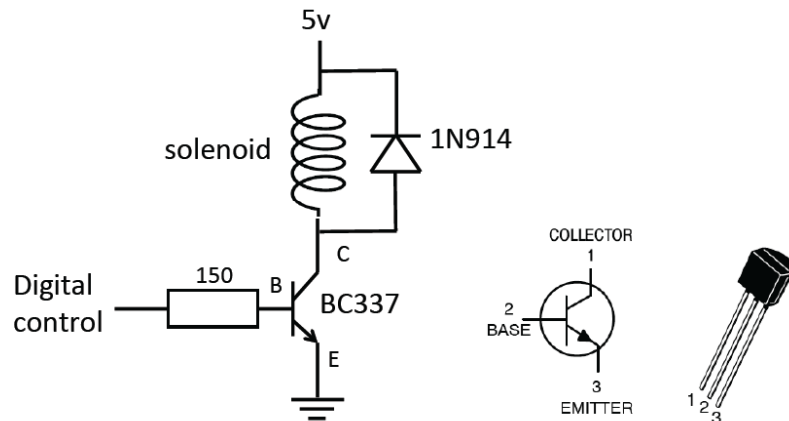
How to drive a solenoid?

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The Pyboard digital output cannot deliver sufficient current to drive a solenoid, even when the solenoid is small and operates at 5V (as the one we have in the DE1 stores).

For that you need some how “amplify” the digital signal (it is in fact current that you are amplifying) using a small bipolar transistor.

Here is a circuit that works:



The digital output from the Pyboard delivers is about 20mA at 3.3V when it outputs a ‘1’. The voltage across the base-emitter of the NPN bipolar transistor is around 0.7V when the transistor is ON. Therefore the current flowing into the transistor’s base terminal is around 17mA.

The solenoid coil resistance is around 4.5Ω . Therefore when the transistor is ON, the current through the transistor (collector current) is around 1A. The transistor has a current gain of at least 100 (current gain = collector current/base current). Therefore the 17mA base current is more than enough to drive the transistor in order to deliver 1A to the solenoid.

The 1N914 diode is there to provide a path for the current to flow when the transistor is switch OFF. This is because the current through the inductor cannot change instantly. Without the diode, the voltage at the collector will shoot up as the transistor tries to turn OFF (i.e. increasing its collector to emitter resistance).

You don’t need to fully understand the working of this circuit because we have not covered bipolar transistors in the lecture. However, this circuit should allow you to drive the relay.