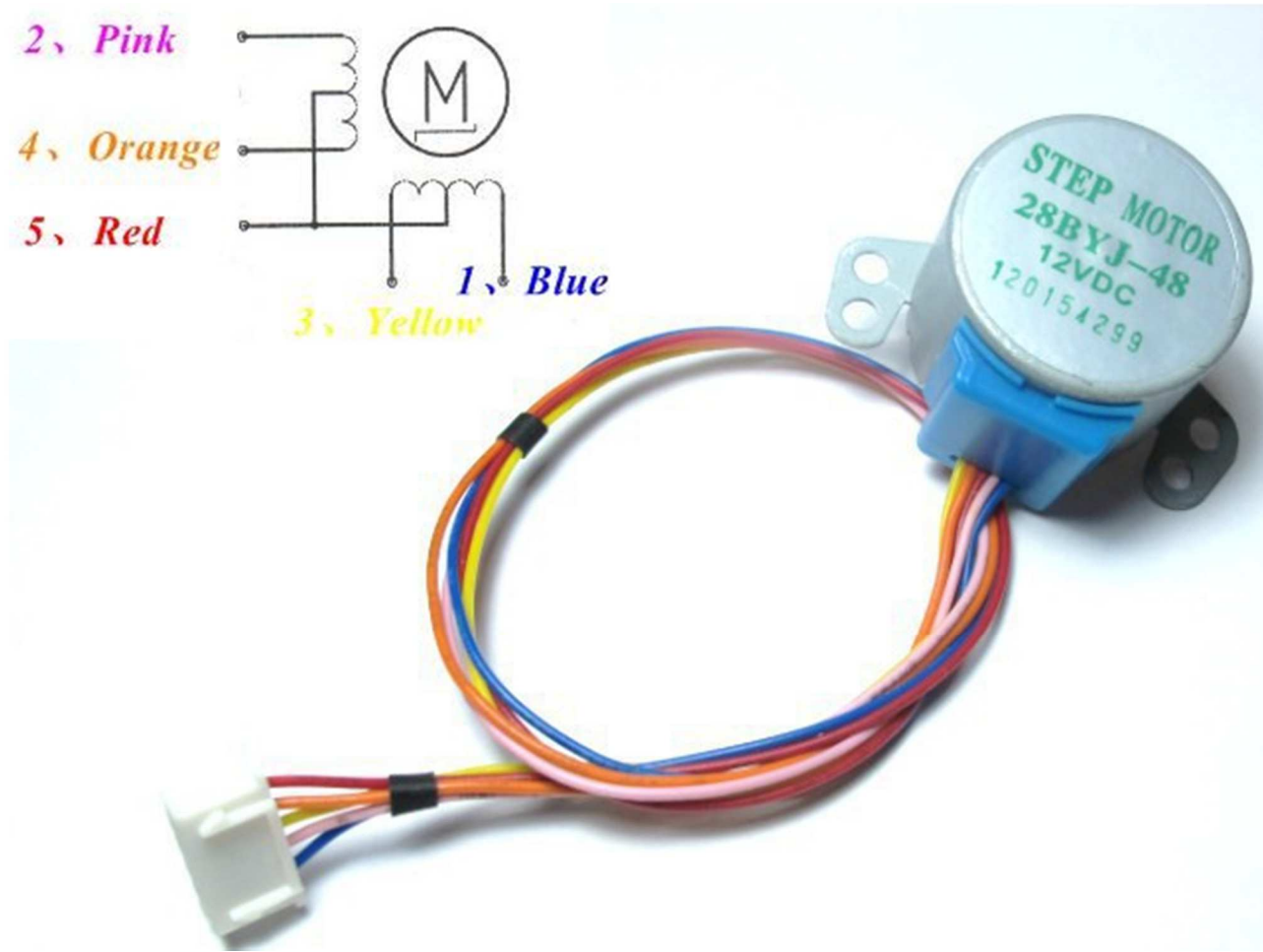


# Modifying a 28BYJ-48 step motor from unipolar to bipolar

I have always liked the 28BYJ-48 motor because of its power and price, it also supposed to very reliable since it is used in different types of air conditioners. This step motor comes in 5V and 12V flavours.

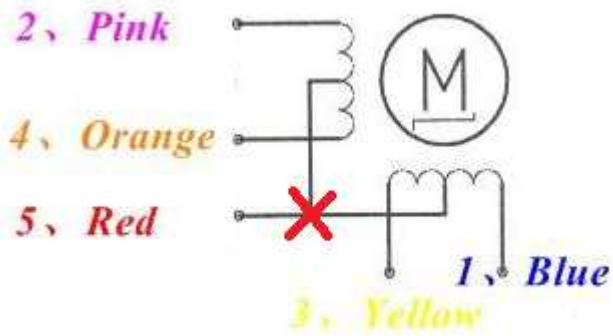


Some information about the motor:

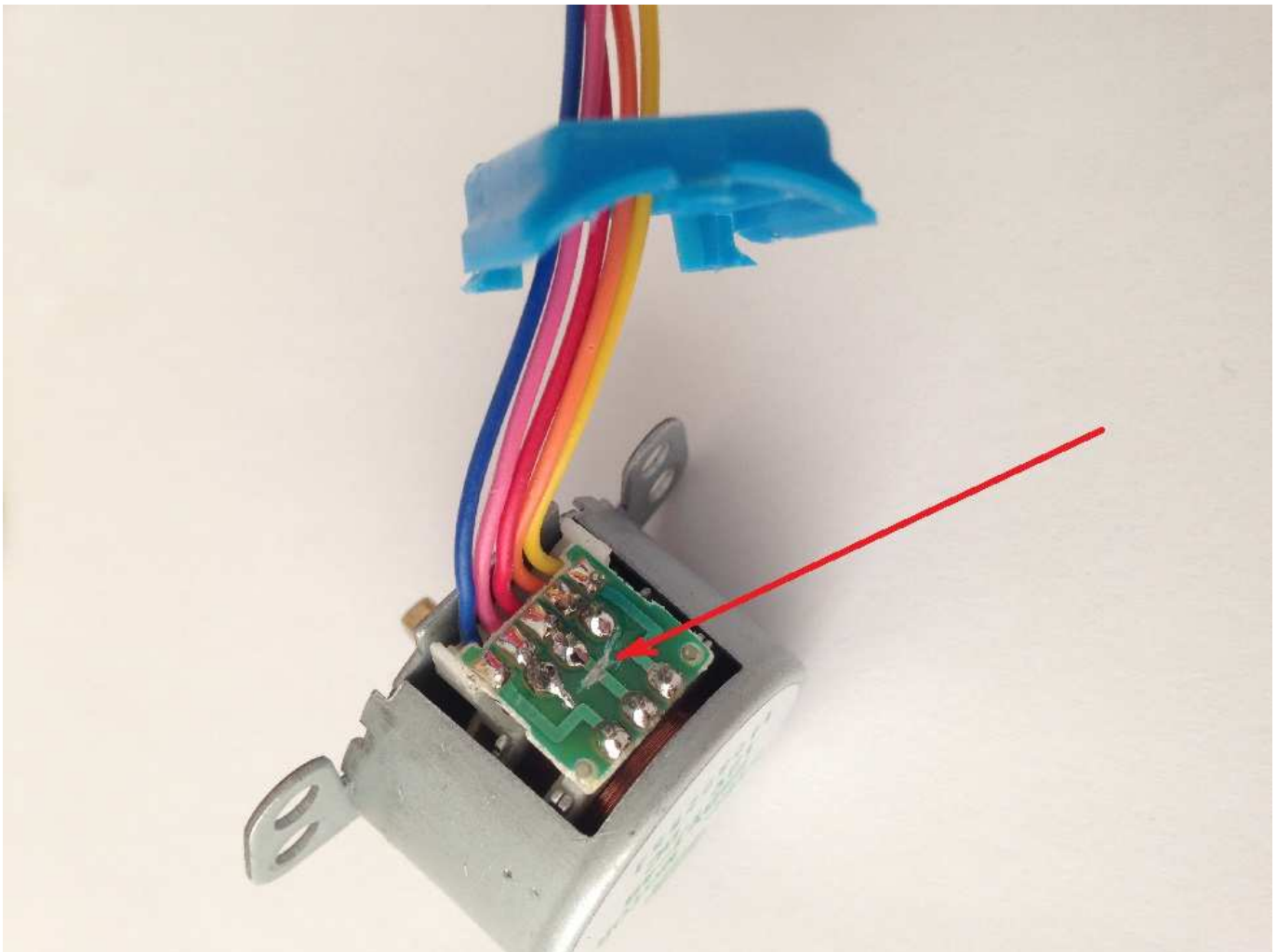
This motor is very small but has enough power for most of the projects because it has a built-in 1/64 reduction gear. The result is a very small step of the motor which is 0,087890625 degrees per step. The reduction gear of course has its downside which is the speed – you can typically drive this motor with maximum frequency of 100Hz which result in 100 steps per second which is 8.7890625 degrees per second. That is 41 seconds per revolution – Not very speedy but for the price of under 2\$ it still is a very good motor. Needless to say they are two versions of the motor (in fact 7 or even more), one is 12 volt and the other is a 5 volt version. They are pretty much the same except for the resistance. In this example I will be using the 12 volt version because of the higher resistance.

The main issue about driving this motor with a pololu a4988 driver is that this is an unipolar motor and the pololu driver is designed to work with bipolar motors. The best driver for our motor is the ULN2003 or similar but the point is to make it work with pololu drivers. What is the point? you may ask...well, the point is to be able to create different type of high precision machines which usually use the pololu driver. Such machines would be a mini CNC router, a 3D printer and especially a laser engraver because of the high precision. Another point is the cost, this motor costs less than 2 bucks a piece compared to a 15+ dollars for a Nema17 stepper motor

Ok, so straight to the point. How can we solve the issue? The answer is simple, we modify the motor to be bipolar. How? Just cut the red wire:



This is however not that simple. We definitely don't need the red wire so we can cut it but we also need to cut the path which is connecting the two sets of coils. The picture above shows what should be done. This is accomplished by removing the blue plastic cover of the motor and cutting one of the paths. Do not try to disassemble the motor itself because it will be too hard to assemble, just grab a knife or a sharp flat screwdriver and carefully pull out the blue plastic cover. Do not worry if it breaks, it will be pretty easy to get back in even if it does. Just try to not pull the wires too much when doing this.



After you remove the blue plastic you will have access to the path we need to remove. Can you see the cut in the picture above? That is best cut with the tip of a sharp knife. We only need to cut the path in the middle just like shown in the picture. Make sure that the cut is deep enough and there is no contact between its two sides – otherwise the motor will not work as a bipolar one. At this point we are pretty much done. We just need to put back the blue plastic cap to its place and we are done. The thing you might want to do is to cut the red wire before closing the cap since we will no longer need it.

Congratulations! You now have a bipolar 28BYJ-48 motor

Last but not least the two pair of wires are orange/pink and blue/yellow. Between each pair there should be a resistance doubled in value of the original – In my case it was 210 Ohms but this really depends on the motor type. From what I can see in the spec there are 7 types of motors each with different resistance ranging from 60 Ohms for the 5v version to 380 for the 12v versions

At this point you can connect the motor to the a4988 driver. The good news is if you are using RAMPS you can rearrange the wires in the motor connector and cut out the fifth pin and it can be directly plugged in to the RAMPS X, Y or Z ports.

**Don't forget to adjust your A4988/DRV8825 driver current to the minimum!** These motors cannot take more than about 100mA per phase. Forgetting to do that will burn or even melt the motor. You can also decrease the resolution of the driver to 1/2 step