UK1125
VERSION 1.0

Digital 7A Bidirectional DC Motor Speed Controller

Cana Kit
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Manufacturer of High Quality Electronic Kits & Modules

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This unique bidirectional DC motor speed controller is based around using a Microchip PIC Microcontroller at the heart of the circuit controlling a Full H-Bridge Power stage using four high-power efficient MOSFETs.

The controller allows controlling both the **Speed** and **Direction** of a DC motor using a Pulse-Width-Modulated (PWM) DC voltage with a Duty Cycle fully adjustable from 0 to 100% (both Positive and Negative DC output). It can can provide up to a maximum continuous current of about 7A out of the box, and up to 10A to 15A with the addition of an optional fan (Model No. FAN-12VDC) and reinforcement of PCB tracks.

Traditionally, switches are used to reverse the polarity of the voltage applied to a DC motor in order to change the rotation direction. However, this method requires use of DPDT switches and causes the voltage applied to the motor to suddenly change from full positive to full negative. The sudden change while the motor is spinning leads to a high level of mechanical stress on the motor as well as high current surges that can cause damage to any electronics in the path.

Using a Full H-Bridge circuit, the solid-state design of this motor speed controller does not use any mechanical switches and allows the control of both speed and direction through a single potentiometer. At its center position, the motor will be forced to stop **(i.e. it brakes)**. Turning the potentiometer clockwise will cause the motor to start spinning slowly in the positive direction, with increasing speed up to the maximum supply voltage at it's maximum position. Turning the potentiometer in the counter-clockwise direction will cause the motor to spin in the reverse direction, again starting slowly up to a maximum negative supply voltage. Note that in it's center position, the motor will actually brake (motor terminals will be grounded) forcing the motor to stop rather than be in a "floating" or coasting position.

As an added option, the controller allows for selection of two operating PWM frequencies: **100 Hz** or **200 Hz** .

Recommended Generic Case: BX-1591LF

Note: Cana Kit offers custom design and modification services to the firmware of any of our Microcontroller based products. Please contact us at support@canakit.com if you require any specific changes to the operating logic or specifications of this product for your particular application (e.g. different operating frequencies, "Coasting" as opposed to "Braking" in the center position, digital control of speed, etc.).

Operating Instructions

1. Connect your motor (or DC load) to the motor terminals as indicated on the wiring diagram.
2. Making sure you add an **appropriately rated fuse** inline with your supply (rated a little higher than the maximum current you expect to draw), connect a voltage of 6 to 24V DC to the circuit making sure of the correct polarity of the connection. Note that the voltage applied to the motor will be supply voltage applied to the circuit.
3. You can now control both the speed and direction using potentiometer "P1". The center position will cause the motor to brake and stop, and turning in either direction from the center will slowly start the motor all the way up to the maximum speed in either direction when at the maximum or minimum position.
4. The controller offers two operating PWM frequency options: 100 Hz and 200 Hz. The operating frequency is selected through the position of Jumper "J1".

If you require a different operating frequency, a custom firmware can be developed for you. Please contact support@canakit.com with your specific requirements for more information.

The controller can handle currents of up to approximately 7A out of the box. However, the MOSFETs used can handle a much higher current with proper cooling. The IRFZ44 MOSFETs used can handle up to 49A and the IRF4905 MOSFETs can handle up to 74A as Absolute Maximums under ideal conditions. In reality however, you are limited to how much cooling you can provide to the MOSFETs, as well as how much current the PCB tracks and terminals can handle.

With the addition of an optional **fan of appropriate voltage** (e.g. Model # FAN-12VDC) and **reinforcement of the high-current PCB tracks** underneath the PCB with solder or copper wires, you can go up to 10 to 15A. Three PCB tracks have been unmasked on the bottom side of the PCB which you can reinforce if you need to handle higher currents. A fourth connection also needs to be reinforced between the Drain of the Q3 MOSFET (Center Pin) and the M+ terminal. This final connection will need to be reinforced using a short piece of high-gauge wire.

Important Notes

An appropriately rated fuse (rated a little higher than the maximum current you expect to draw) is required to ensure safe operation.

The controller is NOT reverse-polarity protected and will be damaged if you connect the supply voltage with wrong polarity. Double check all connections before applying power and always turn off the power supply before making any wiring changes.

It is recommended to add a fan with a voltage that is the same as your supply voltage (available from Cana Kit) to cool the heat sinks if the MOSFETs get too hot for a long period of time. Two pins have been provided on the board for connection of an fan with an appropriate voltage.

The MOSFET heat sinks are electrically live. Make sure no wires touch the heat sinks and that the two heat sinks are not connected together in anyway.

Always use the shortest possible length for all wiring carrying high current to ensure minimal loss. The longer the wire, the higher the voltage drop across it which leads to a less efficient overall system.

To avoid mechanical stress on your motor and also avoid creating a very high voltage surge across the motor terminals (which in extreme cases can cause damage to the controller), do not suddenly change direction of the motor in the opposite direction before waiting for the motor to slow down and stop.

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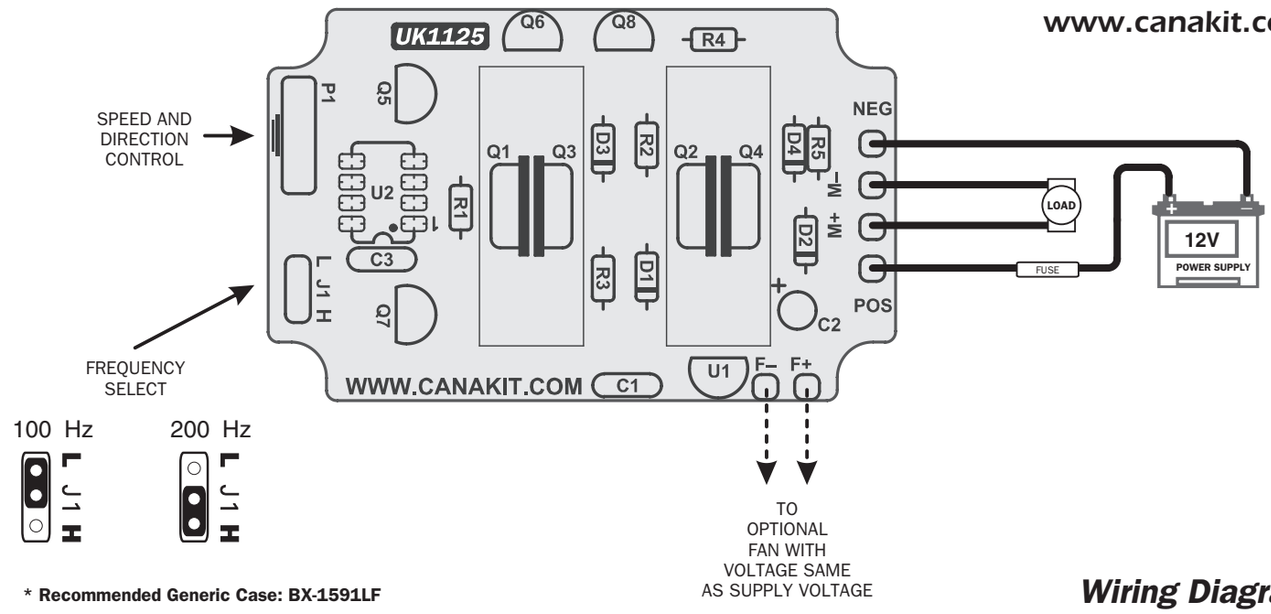

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Wiring Diagram

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Schematic Diagram

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