

Motor control exercise

In this exercise you will make a VI that controls an electric motor by using National Instruments multifunction IO device USB-6008 (or USB-6211). You should be able to control the motor in both directions and prevent too large movements by using limit switches.

Please be extremely careful with electric connections. Wrong connections may permanently damage electronic circuits used in this work. Read this paper entirely before any connections.

Motor control electronics

Motor control electronics have a standard H-bridge as a power stage and some logic to give simple run and direction controls. Motor rotates a shaft through a gearbox. The shaft has a cam which uses the limit switches.

The controller has the following electric connections:

Motor GND

Ground for the motor. This is electrically connected to the logic ground. Connect this to external supply's - terminal.

Motor V_{cc}

4-6 V 0.6 A DC supply for the motor. Connect this to external supply's + terminal.

Logic GND

Ground for logic. This must be connected to IO-device's ground terminal.

Logic V_{cc}

5 V supply for motor controller's logic. Connect this to IO-device's 5V output.

Run

Motor's power. When this input gets logic 1 (+5V), motor runs and when this gets logic 0 (0 V) motor does not run.

Direction

Motor's direction. Logic 1 is counterclockwise (CCW) and logic 0 is clockwise (CW).

CW limit

When the CW limit switch is activated, this output goes to logic 0 state. Otherwise this is in 1 state.

CCW limit

When the CCW limit switch is activated, this output goes to logic 0 state. Otherwise this is in 1 state.

Run and Direction should be connected to IO-device's digital output pins and both limits should be connected to IO-device's input pins.

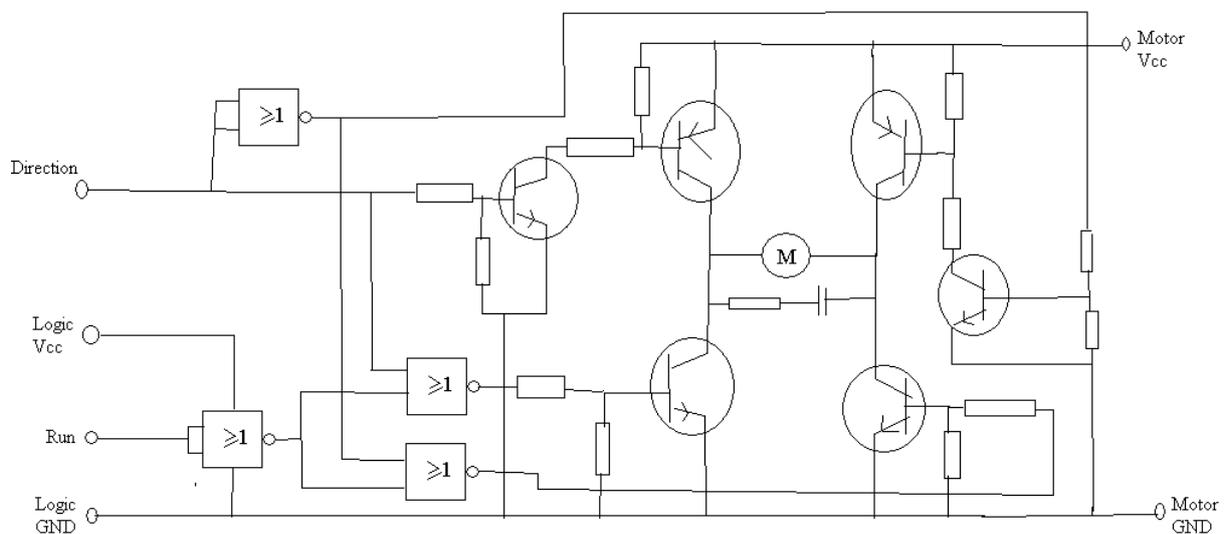


Figure 1. Schematic diagram of motor controller (if you are interested).

IO device

In this work you use National Instrument's NI USB-6008 or NI USB-6211 Multifunction IO devices. Details of these units can be found in manuals, which can be downloaded from the manufacturer's webpages. These versatile IO devices have many interesting functions: AD-

converters, DA-converters, counters etc. but in this work you use only digital input and output lines.

Building the VI

The VI must have controls to move the motor in both directions. It must not allow movements over limit switches and it has to give a warning (for example with a LED) when the limit is reached. You should communicate with IO device by using a NI-DAQ Assistant.

Practical advice

You should first plan a user interface. Then you can plan the electric interface between IO device and motor controller. What kind of signals do you need? You should download the manual for your IO device and select the ports and pins you are going to use. Check also the +5V and GND terminals needed by the controller.

Configure the NI-DAQ Assistants for inputs and outputs. Build a control logic between the user interface and NI-DAQ Assistants. LabView gives many possible ways to do this, feel free to use your creativity. Check the numbered terminals for electric connections and make connections between the motor controller and the IO device. Unplug the IO device from the USB-port when you connect wires to it. Check everything so many times that you are sure. Connect the motor controller to external supply (ask details from assistant, this is extremely critical connection). Then run the VI and test that everything works.

Remember always safety, when you work with electronics. Think everything twice, check everything twice and connect only once, in the right way. Do not hesitate to ask help or confirmation from assistant. There is no risk for personal injuries with these low voltages and currents but unfortunately, it is practically impossible to make the electronics to withstand any possible errors in the connections.