PCR Club Car Convention 2015
'Duino Demo Board

The PCR board is intended to be a foundation for experimentation and learning about 'duino programming and model railroad applications. It provides

- An Arduino-compatible "DFR-pro-mini" module
- A regulated 5v power supply
- 9v battery (good for only 6-8 hours runtime…) and adapter
- 3x pushbuttons
- 5x LEDs, arranged as a grade crossing and a signal head
- A servo, and
- A 2x16 LCD display
- I2C connector for access to expanded IO devices

The EagleCAD design files and an example Arduino Sketch for this board are available online:

http://www.spcoast.com/wiki/index.php/PCR-Badge-2015
https://codebender.cc/sketch:112378

Brought to you by SPCoast, a source for DIY model railroad electronics ideas

Assembly instructions

1. Assemble the Pro-Mini

a. find two rows of 12x pins, one row of 3x pins and one row of 2x pins

b. using a breadboard to align the 12x rows, solder them to the bottom of the Pro-Mini

c. (Optional)
   - The 3-pin row exposes the A6 and A7 Analog Input-Only pins which are not used on the demo board - it is OK to not install them. Installing them on the bottom makes the Pro-Mini not work in a breadboard. Align the 3x row, solder it to the Pro-Mini
   - The 2-pin row exposes the I2C signals from A4 and A5. I2C isn't used by the demo board, though it does connect them (if present) to a 4-pin connector for your own use. As above, installing these pins on the bottom makes the Pro-Mini not fit into a breadboard, which is the reason this step is optional. Insert the 2x row - holding it in place with a short piece of blue tape - and solder it carefully to the Pro-Mini

d. find the 6x row if "right angle" pins, solder it to the TOP of the Pro-Mini.

e. Set the completed Pro-Mini aside for now

2. Assemble the Demo Board

    a. Working through the parts list, install

        i. The capacitors (C1 & C4 are polarized - the long lead goes into the "+" hole)

        ii. The resistors - skip R6 & R8 (1K and 1M). Note that the 2K0 R12 (next to the top pushbutton) and the 620R R6 (near the bottom pushbutton) have different color bands than the rest (which are 330R):
           330R: Orange Orange Brown
           620R: Blue Red Brown
           2K0:   Red Black Red
           The potentiometer mounts under the "P"; it needs its pins gently straightened/aligned with a needlenose pliers

        iii. The servo connector. Use either the 3-pin right-angle or make a 3-pin straight from the extra Pro-Mini pins.

        iv. The voltage regulator VR1 - carefully bend the leads 90 degrees where they change shape.

        v. The power connector - careful - the large pins/holes get hot when soldering; be sure not to burn your fingers!

        vi. Sw1, Sw2, Sw3 - you may need to clip off an unused 5th pin (the one connected to the top of the button) before you can insert them into the 4-hole footprints.

        vii. (The PhotoDetector feature doesn't work, and is left unpopulated) Leave the 1M, photodiode/IRLED and 2N2222 device spots empty.

        viii. The female connectors (12x, 12x, 3x, 2x) for the Pro-Mini are easily aligned by plugging the actual Pro-Mini into them as they are sitting on the board; a strip of blue tape will hold everything onto the board as you turn it over to solder the pins. Solder one pin, then use your finger to push everything tight onto the board as you solder a second pin in the other corner. Once the connectors are flush and square, solder the rest of the pins. If you didn't install the 3x and 2x pins to the Pro-Mini, you don't need to install the mating 3x and 2x sockets either.

        ix. The 16 pin LCD connector. Start with one pin, ensure flush and flat, solder a second one, then the rest…

        x. The LEDs - 2x Red for the crossbucks and 1x each Red, Yellow and Green for the Signal mast. Flat = short lead = "-", long lead = "+"

        xi. The Servo. You can screw it directly to the demo board with the provided screws if desired. You can choose which "horn" to attach to the servo to match the application you will use it for. In this situation, I used the long, single ended arm to represent a crossing gate that goes up and down… Don't attach a horn to the servo until you run the demo sketch - it centers the servo so you can align the horn in a pleasing orientation.

3. Assemble the LCD
    a. Solder the 16x pin strip to the LCD, making sure it is flat and flush.

4. Assemble the USB Programmer
    a. Find the 4-wire harness
    b. Connect one end to 5.0v, TxD, RxD and GND. Make note of the colors...

5. Connect the pieces
    a. Plug the Pro-Mini into the demo board if you haven't already
    b. Plug the servo into the 3-pin servo connector (alignment color code is printed on back of the board)
    c. Plug in the LCD display
    d. Connect the USB programmer to the Pro-Mini
        i. 5.0v goes to VCC
        ii. Gnd goes to Gnd
        iii. TxD goes to RxD, and
        iv. RxD goes to TxD
    e. Attach the 9v battery to the battery cable (but don't yet plug it into the board)
    f. Install (if needed) the Prolific PL2303HX drivers for your OS
       Windows: http://www.prolific.com.tw/US/ShowProduct.aspx?p_id=225&pcid=41
       Mac: http://www.prolific.com.tw/US/ShowProduct.aspx?p_id=229&pcid=41
       Linux Kernel 2.4.31 and above already includes built-in drivers for PL-2303 (VID_067B&PID_2303)

6. Try it out
    a. Load the demo sketch in your Browser and set the properties correctly
        i. https://codebender.cc/sketch:112378
        ii. select Pro Mini (5v, 16MHz, ATmega '328)
        iii. select /dev/cu.usbserial (or whatever the Prolific 2303 enumerates as…)
    b. Modify the GREETING to include your name (you may want to clone the sketch)
    c. select "Run on Arduino". When the blue bar gets more than ½ way across, press the RESET button on the Pro-Mini to tell it to run the bootloader
    d. If you don't get any errors,
        i. you should see your name on the LCD,
        ii. The top button raises the "crossing gate"
        iii. The middle button turns on and off the crossing flashers
        iv. The bottom button lowers the gate.
           You can attach a horn to the servo if you want - lower the gate by pressing the bottom button, then attach the horn so it extends horizontally, using the remaining tiny screw that came with the servo.