

FTC Team Number/Timer Displays

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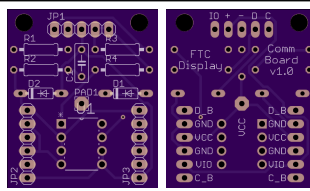
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v0.3


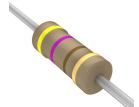
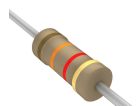
1 Electronics

Parts

You will need to acquire the components listed in the following table. (Depending on interest, I may do a group order/kit-style order to bring down the price of these components. See <http://maths22.com/ftc/display/ordering.html> for more information.)

ARD-1	1	Arduino Uno		http://www.adafruit.com/product/50
CABLE-1	1	USB cable		http://www.monoprice.com/Search?keyword=5438
CABLE-2	4	6p6c cable		http://www.monoprice.com/Search?keyword=940
CABLE-3	1	USB Panel mount B(female) to B(male)		http://www.adafruit.com/product/907
CAP-1	5	0.1 μ F ceramic capacitor		http://www.digikey.com/short/75qpd3

CONN-1	5	8pin DIP socket		http://www.digikey.com/short/75qp19
CONN-2	4	5pin female header		http://www.digikey.com/short/75qp10
CONN-3	10	6p6c jack		http://www.monoprice.com/Search?keyword=7296
DIODE-1	10	BAT85 Schottky Diode		http://www.digikey.com/short/75qzcf
DISP-1	4	I2C 1.2" yellow 4-digit seven segment display		http://www.adafruit.com/product/1269
IC-1	5	P82B96P I2C Buffer		http://www.digikey.com/short/75qztz
PCB-1	5	Custom PCB		https://oshpark.com/shared_projects/Dd9Y0B0i (If you want to order them from another supplier, you can find the original Eagle board and schematic here: FTCDispNew.zip)
PWR-1	1	Barrel adapter terminal block		http://www.adafruit.com/product/368

PWR-2	1	5 V 2 A switching power supply		http://www.adafruit.com/product/276
RES-1	10	470 Ω resistor		http://www.digikey.com/short/75qz39
RES-2	10	1.3 k Ω resistor		http://www.digikey.com/short/75qzqc

You will also need a soldering iron and solder, and should know how to solder through-hole components (or be willing to learn).

Assembly

1.1 6p6c Jacks

First, assemble the 6p6c modular connectors (CONN-3). For each connector, cut 6 4-5" pieces of 22 gauge solid core wire. Then, punch these wires into the punchdown connectors on the jack. (Do not strip the wires—you should be able to attach them using your hands and the caps the connectors come with, or you can use slip-joint pliers.) Finally, strip the end of each wire.

1.2 PCB

Next, assemble the pcb. (See Figure 1 for the schematic.) All components should be placed on the "top" of the board, which is the side with part numbers/names on the silkscreen.

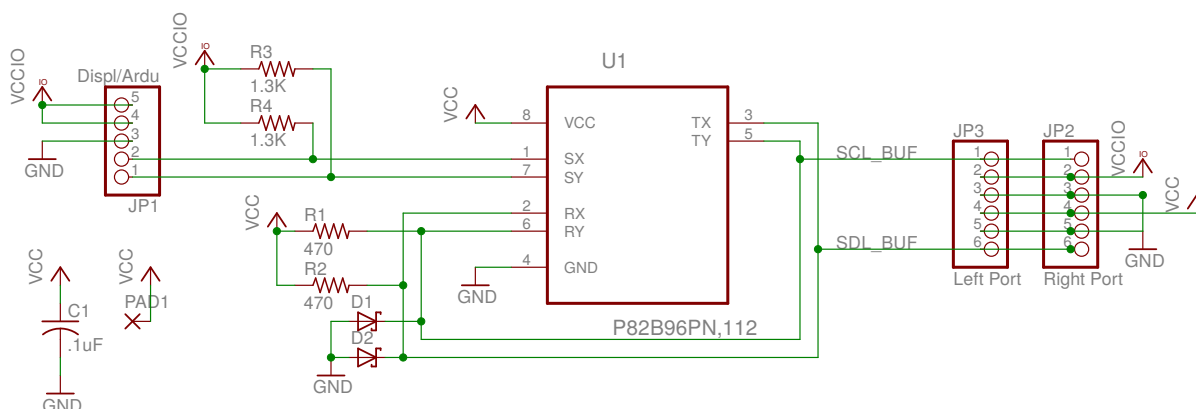


Figure 1: Schematic of PCB

1. Place CAP-1 in the C1 holes
2. Place DIODE-1 in the D1 and D2 holes, ensuring that the polarity is correct.
3. Place RES-1 (470Ω) in the R1 and R2 holes
4. Place RES-2 ($1.3k\Omega$) in the R3 and R4 holes
5. Solder these components in place and clip the leads
6. Solder CONN-1 to the U1 position on the board
7. Solder CONN-2 to JP1 position on the board
8. Solder the CONN-3 + wire assemblies to the JP2 and JP3 positions. Wire 1 should be closest to the edge of the board, and wire 6 should be closest to the diodes.
9. On one of the 5 pcbs, solder a short piece of 22 gauge wire to pad 1 and plug the other end of it into the IO position on the header (consult the back silkscreen for the labels). This pcb will be used to connect to the Arduino.
10. Insert IC-1 into the IC socket-the dot on the IC should align with the asterisk on the PCB.

1.3 Displays

Next, assemble the LED displays (DISP-1). Solder the display onto the backpack (PCB) it came with, making sure to align it with the silkscreen underneath. Attach the header pins that it came with as well. Then, connect the PCB assembly from above to the displays: the silkscreen on the bottom of the pcbs should align with the one on the top of the displays, so the pcb should be sticking out the back of the display.

1.4 Arduino and power

On the Arduino side, connect the SDA and SCL to the D and C header positions with 22 gauge solid wire. Connect the + on the PCB to the + side of PWR-1, the terminal block, and connect another wire from the + terminal block to the 5v header position on the Arduino (not Vin). Connect - on the PCB and GND on the Arduino to the - terminal block position.

1.5 USB cable

Finally, we need to modify the USB panel mount cable (CABLE-3) to make it a data-only cable. Strip off a 1-2 cm region of the outer insulation to reveal the shielded braid. Cut through the braid and foil to get to the wires inside, and cut the red (5v) wire. Tape off the ends of the cut wire, align the foil and braid so that the two sides are in contact with each other, and wrap the exposed insulation in electrical tape or heat shrink tubing.

2 Hardware

Case designs are still being finalized and will be released in a later revision of this document. A full set will probably require 5 square feet of black acrylic and 1 square foot of translucent bronze acrylic. M3 and M2 screws and nuts, along with M2 spacers/washers will also be necessary.

3 Software

Software for 2015-16 will be created after the new control system for the 2015-16 season is announced. For the 2014-15 season, there was a program that read the current teams and game state from the FCS and used it to display the appropriate team numbers/current time remaining on the displays.

The Arduino sketch will be updated to support teams with 5-digit numbers, but otherwise should remain the same for next season. 5 digit numbers will be represented through the initial colon, which will be used to represent the digit '1'.

Software can be found at <http://maths22.com/ftc/display/software.html>.