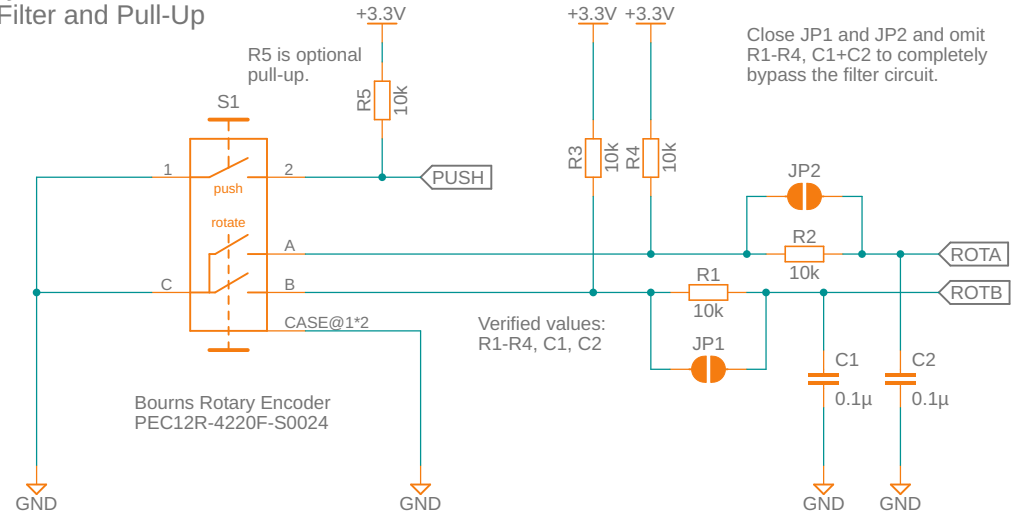
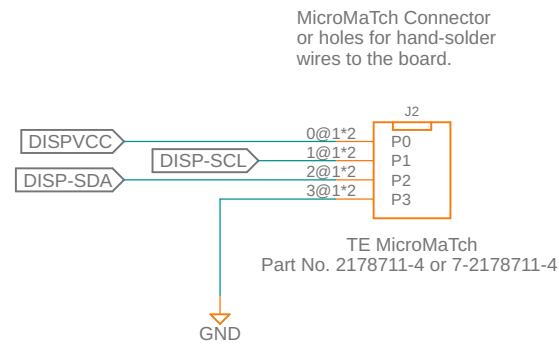


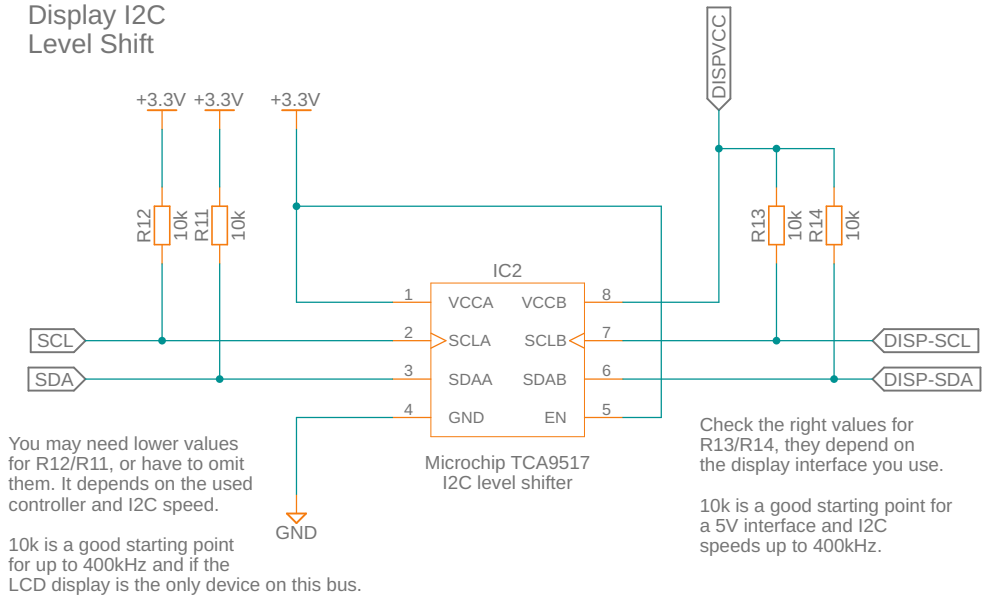
### Rotary Encoder with Filter and Pull-Up



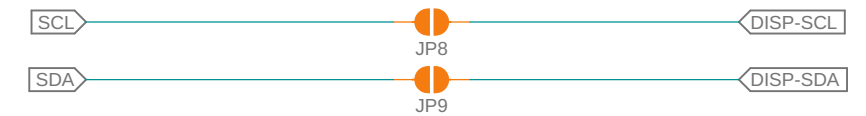
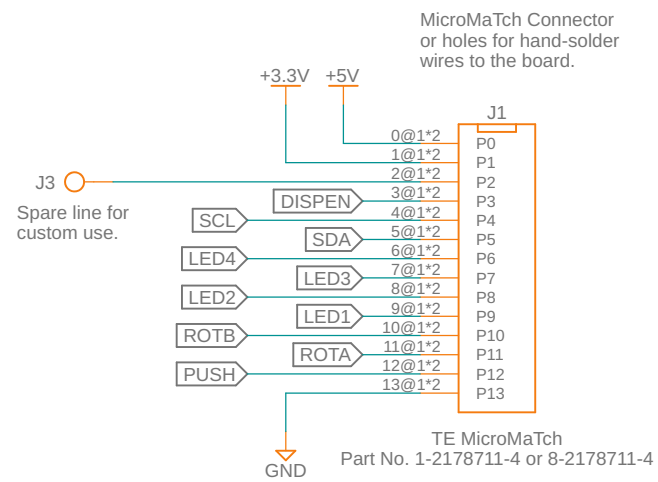
### Display Connector



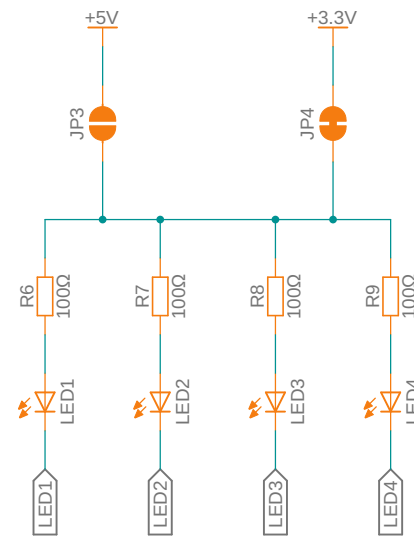
### Display I2C Level Shift



### Connector to Controller



### LEDs



Use JP3 and JP4 to select LED voltage. If you select 5V and use a 3.3V microcontroller, make sure it can handle the voltage!

Choose R6-R9 values to match the LEDs forward voltage (Vf), chosen current (If) and supply voltage.

Use a LED tester or constant current supply to find good uniform brightness for all four LEDs and. You can use the tables on the right to find a matching resistor value.

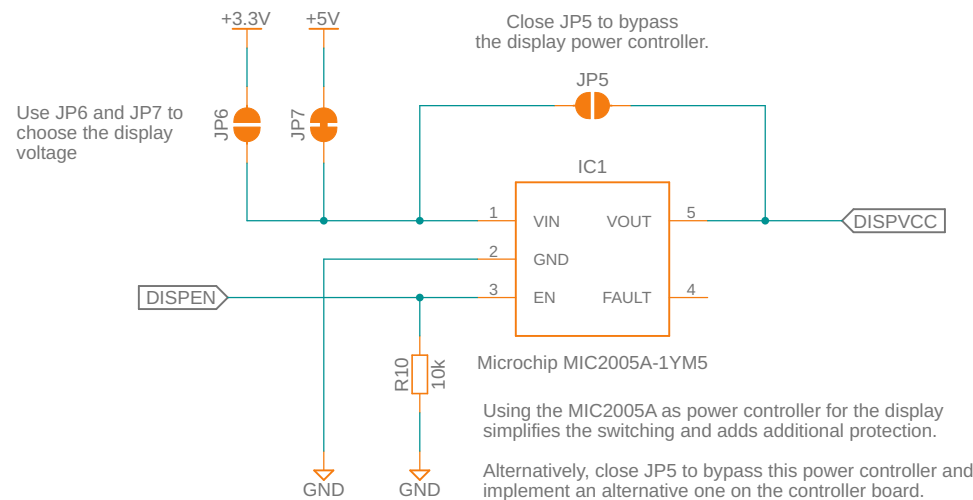
### E12 Resistor values for supply voltage 5.0V

Vf	If	0.5mA	1mA	2.5mA	5mA	10mA	15mA	20mA
1.6V	6.8kΩ	3.3kΩ	1.5kΩ	680Ω	330Ω	220Ω	180Ω	150Ω
1.7V	6.8kΩ	3.3kΩ	1.2kΩ	680Ω	330Ω	220Ω	150Ω	150Ω
1.8V	6.8kΩ	3.3kΩ	1.2kΩ	680Ω	330Ω	220Ω	150Ω	150Ω
1.9V	5.6kΩ	3.3kΩ	1.2kΩ	560Ω	330Ω	220Ω	150Ω	150Ω
2.0V	5.6kΩ	2.7kΩ	1.2kΩ	560Ω	270Ω	180Ω	150Ω	150Ω
2.1V	5.6kΩ	2.7kΩ	1.2kΩ	560Ω	270Ω	180Ω	150Ω	150Ω
2.2V	5.6kΩ	2.7kΩ	1.2kΩ	560Ω	270Ω	180Ω	150Ω	150Ω
2.3V	5.6kΩ	2.7kΩ	1.0kΩ	560Ω	270Ω	180Ω	120Ω	120Ω
2.4V	5.6kΩ	2.7kΩ	1.0kΩ	560Ω	270Ω	180Ω	120Ω	120Ω
2.5V	4.7kΩ	2.7kΩ	1.0kΩ	470Ω	270Ω	180Ω	120Ω	120Ω
2.6V	4.7kΩ	2.2kΩ	1.0kΩ	470Ω	220Ω	150Ω	120Ω	120Ω
2.7V	4.7kΩ	2.2kΩ	1.0kΩ	470Ω	220Ω	150Ω	120Ω	120Ω
2.8V	4.7kΩ	2.2kΩ	820Ω	470Ω	220Ω	150Ω	100Ω	100Ω
2.9V	3.9kΩ	2.2kΩ	820Ω	390Ω	220Ω	150Ω	100Ω	100Ω
3.0V	3.9kΩ	1.8kΩ	820Ω	390Ω	180Ω	120Ω	100Ω	100Ω

### E12 Resistor values for supply voltage 3.3V

Vf	If	0.5mA	1mA	2.5mA	5mA	10mA	15mA	20mA
1.6V	3.3kΩ	1.8kΩ	680Ω	330Ω	180Ω	120Ω	82Ω	82Ω
1.7V	3.3kΩ	1.5kΩ	680Ω	330Ω	150Ω	100Ω	82Ω	82Ω
1.8V	2.7kΩ	1.5kΩ	560Ω	270Ω	150Ω	100Ω	68Ω	68Ω
1.9V	2.7kΩ	1.5kΩ	560Ω	270Ω	150Ω	100Ω	68Ω	68Ω
2.0V	2.7kΩ	1.2kΩ	560Ω	270Ω	120Ω	82Ω	68Ω	68Ω
2.1V	2.2kΩ	1.2kΩ	470Ω	220Ω	120Ω	82Ω	56Ω	56Ω
2.2V	2.2kΩ	1.0kΩ	470Ω	220Ω	100Ω	68Ω	56Ω	56Ω
2.3V	1.8kΩ	1.0kΩ	390Ω	180Ω	100Ω	68Ω	47Ω	47Ω
2.4V	1.8kΩ	820Ω	330Ω	180Ω	82Ω	56Ω	47Ω	47Ω
2.5V	1.5kΩ	820Ω	330Ω	150Ω	82Ω	56Ω	39Ω	39Ω
2.6V	1.5kΩ	680Ω	270Ω	150Ω	68Ω	47Ω	33Ω	33Ω
2.7V	1.2kΩ	560Ω	220Ω	120Ω	56Ω	39Ω	27Ω	27Ω
2.8V	1.0kΩ	470Ω	180Ω	100Ω	47Ω	33Ω	27Ω	27Ω
2.9V	820Ω	390Ω	150Ω	82Ω	39Ω	27Ω	18Ω	18Ω
3.0V	560Ω	270Ω	120Ω	56Ω	27Ω	18Ω	15Ω	15Ω

### Display Power Control



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