

# Circuit Documentation

## Summary

This circuit is designed to control multiple bipolar stepper motors using TMC2208 stepper motor drivers, a Teensy 4.0 microcontroller, and a resistive touch screen interface. The circuit is powered by a 48V power supply, which is stepped down to 5V for the Teensy and other components. The TMC2208 drivers are used to control the stepper motors, and the Teensy microcontroller is responsible for sending control signals to the drivers and interfacing with the touch screen.

## Component List

1. **TMC2208 Stepper Motor Driver**
  - Description: A stepper motor driver used to control bipolar stepper motors.
  - Pins: GND, VIO, M2B, M2A, M1A, M1B, VM, DIR, STEP, CLK, PDN, NC, MS2, MS1, EN
2. **Power Supply**
  - Description: Provides power to the circuit.
  - Pins: +, -
3. **Bipolar Stepper Motor (NEMA 17)**
  - Description: A type of stepper motor used for precise control of motion.
  - Pins: A-, A+, B+, B-
4. **Electrolytic Capacitor**
  - Description: Used for filtering and stabilizing voltage.
  - Pins: -, +
  - Properties: Capacitance: 0.0001 Farads
5. **Teensy 4.0 Microcontroller**
  - Description: A microcontroller used for processing and control tasks.
  - Pins: 5V, GND, 3V, 23, 22, 21, 20, 19, 18, 17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, 0
6. **48V to 5V Converter**
  - Description: Steps down voltage from 48V to 5V.
  - Pins: out+, out--, in+, in--
7. **Rocker Switch**
  - Description: A switch used to control the power supply.
  - Pins: 1, 2
8. **Resistive Touch Screen**
  - Description: A touch screen interface for user input.
  - Pins: 1, 2, 3, 4

# Wiring Details

## TMC2208 Stepper Motor Driver

- **VM Pin:** Connected to the positive terminal of the electrolytic capacitors and the 48V to 5V converter's in+ pin.
- **GND Pin:** Connected to the negative terminal of the electrolytic capacitors, the 48V to 5V converter's in-- pin, and the Teensy 4.0's GND pin.
- **VIO, MS2, MS1 Pins:** Connected to the Teensy 4.0's 3V pin.
- **EN Pin:** Connected to the Teensy 4.0's pin 0.
- **STEP Pin:** Connected to the Teensy 4.0's pins 1, 3, and 5 for different instances.
- **DIR Pin:** Connected to the Teensy 4.0's pins 2, 4, and 6 for different instances.

## Power Supply

- **+ Pin:** Connected to the Rocker Switch's pin 2.
- **- Pin:** Connected to the 48V to 5V converter's in-- pin.

## Bipolar Stepper Motor (NEMA 17)

- **A+, A-, B+, B- Pins:** Connected to the corresponding M1A, M1B, M2A, M2B pins on the TMC2208 drivers.

## Electrolytic Capacitor

- **+ Pin:** Connected to the VM pin of the TMC2208 drivers and the 48V to 5V converter's in+ pin.
- **- Pin:** Connected to the GND pin of the TMC2208 drivers and the 48V to 5V converter's in-- pin.

## Teensy 4.0 Microcontroller

- **5V Pin:** Connected to the 48V to 5V converter's out+ pin.
- **GND Pin:** Connected to the 48V to 5V converter's out-- pin and the GND pin of the TMC2208 drivers.
- **3V Pin:** Connected to the VIO, MS2, and MS1 pins of the TMC2208 drivers.
- **Pins 0-6:** Used for control signals to the TMC2208 drivers.

## 48V to 5V Converter

- **in+ Pin:** Connected to the Rocker Switch's pin 1.
- **in-- Pin:** Connected to the GND pin of the TMC2208 drivers and the Power Supply's - pin.
- **out+ Pin:** Connected to the Teensy 4.0's 5V pin.

- **out-- Pin:** Connected to the Teensy 4.0's GND pin.

## **Rocker Switch**

- **Pin 1:** Connected to the 48V to 5V converter's in+ pin.
- **Pin 2:** Connected to the Power Supply's + pin.

## **Resistive Touch Screen**

- **Pins 1-4:** Connected to the Teensy 4.0's pins 14-17 for touch input.

## **Code Documentation**

Refer to <https://github.com/skulkarni3000/ball-balancing-bot>