Universal Motor Control Board

User Manual

Introduction:

The Universal Motor Control Board is an advanced and versatile solution for managing a wide range of motors, including stepper motors, standard servos, and serial servos. Designed for precision and flexibility, the board supports the simultaneous control of up to 4 stepper motors, leveraging TMC2208/09 drivers for ultra-smooth and silent operation. Each stepper motor is accompanied by dual limit switch inputs (a total of 8), enabling precise positional feedback and improved safety during operation.

The board incorporates a PCA9685, a 16-channel, 12-bit PWM controller, which allows simultaneous control of up to 16 LEDs or servos, making it ideal for applications requiring synchronized motor and lighting control. For more complex setups, it supports interfacing with serial servos, enabling the management of up to 256 servos (such as Waveshare ST3215/SC15) via UART, offering unparalleled scalability for robotics and automation projects.

To enhance usability and monitoring, the board features an onboard Neopixel LED for real-time status indication. Additionally, it includes an external Neopixel interface, enabling easy integration with Neopixel LED strips for customizable lighting effects.

The Universal Motor Control Board is designed for compatibility with any microcontroller development board, such as Arduino, Raspberry Pi, or ESP32, ensuring seamless integration into diverse systems. This flexibility makes it an excellent choice for a variety of applications, including robotics, CNC machines, animatronics, and other mechatronic systems.

By prioritizing expandability, ease of use, and robust performance, this board provides a comprehensive toolkit for efficient motor control and dynamic lighting management, catering to both hobbyists and professional developers alike.

Specifications :

Motor Control:

- Supports control of up to **4 stepper motors** simultaneously.
- Stepper motor drivers: **TMC2208/09** for smooth and silent operation.
- **8 limit switches** (2 per stepper motor) for precise positional feedback.

PWM Control:

- **PCA9685**: 16-channel, 12-bit PWM controller.
- Capable of driving up to **16 LEDs** or standard servos simultaneously.

Serial Servo Support:

- UART interface for controlling up to **256 serial servos** (e.g., Waveshare ST3215/SC15).

LED and Lighting:

- **Onboard Neopixel LED** for real-time status monitoring.
- External Neopixel interface for connecting **Neopixel LED strips**.

Compatibility:

- Can interface with any microcontroller development board, such as **Arduino**, **Raspberry Pi**, **ESP32**, and others.

Power:

- Supports a wide range of input voltages for motors and servos (Voltage range to be added if specific values are known).
- Separate power inputs for motor drivers, servos, and LEDs for optimal performance.

Expansion and Integration:

- Modular design for easy integration into larger systems.
- Compact and robust PCB layout for space-constrained applications.

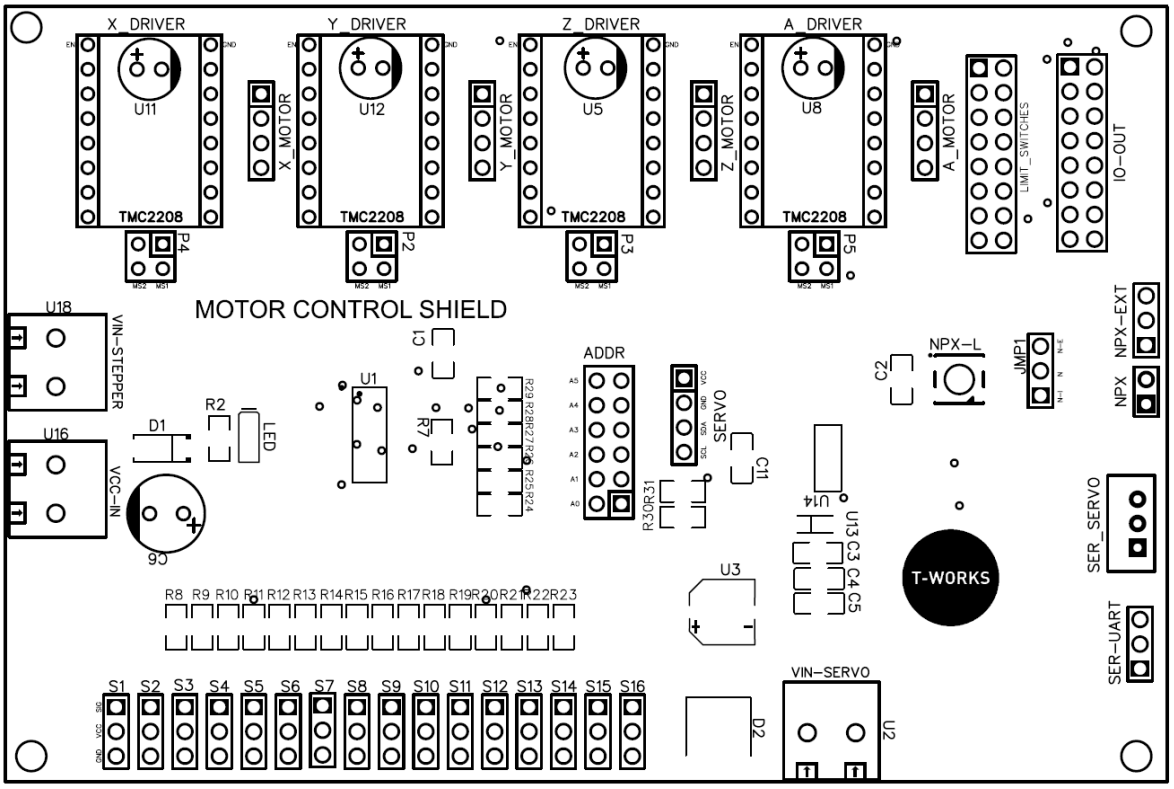
Applications:

- Robotics, CNC machines, animatronics, mechatronic systems, and lighting projects.

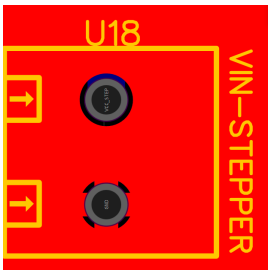
Board Dimensions:

- Length: **100 mm**
- Width: **80 mm**
- Height: **15 mm** (excluding connectors)

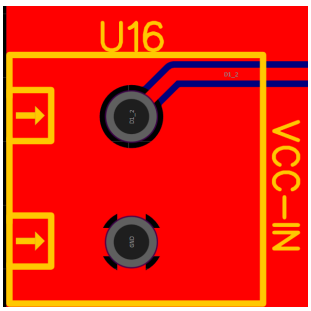
Board Layout :

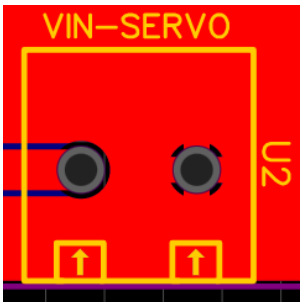


Connector Details :



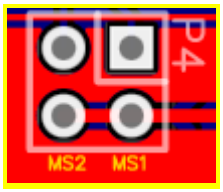
U18: Voltage Input for Stepper - Max 28 Volts





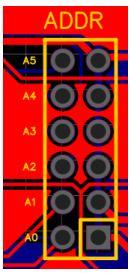
U16: Voltage Input for Board (Max 5V)

U2: Voltage Input for Servo's.



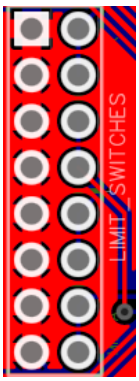
P2, P3, P4, P5: Microstepping for Steppers.

Stepper Motor Inputs : X_MOTOR, Y_MOTOR, Z_MOTOR, A_MOTOR

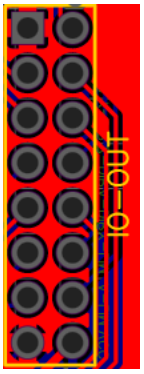


ADDR: Addressing Jumper Connector for the PCA9685

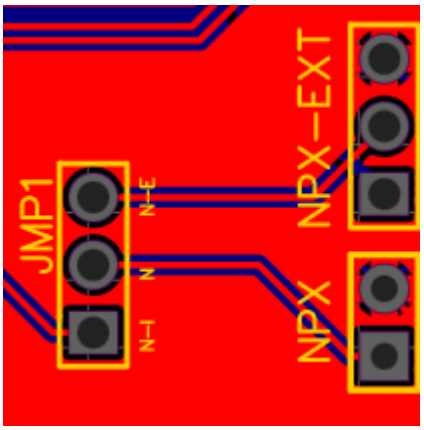
SERVO: I2C Interface for PCA9685



LIMIT_SWITCHES: Limit Switch Interface



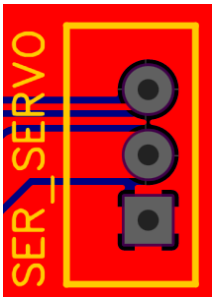
IO-OUT: Microcontroller interface for Steppers and Limit Switches.



JMP1: Jumper for Switching between Internal Neopixel and External Neopixel.

NPX-EXT: External Neopixel interfacing.

NPX: Microcontroller Interface for Neopixel.



SER_SERVO: Serial Servo Interface.

SER_UART: UART Interface for Serial Servo.