ACEIRMC CNC Shield V3

ACEIRMC CNC Shield V3 and A4988 Driver Module Instruction Manual

Model: CNC Shield V3

Brand: ACEIRMC

1. Introduction

This manual provides detailed instructions for the installation, configuration, and operation of the ACEIRMC CNC Shield V3 Engraver Expansion Board paired with A4988 Stepper Motor Drivers. This kit is designed to facilitate the control of stepper motors for applications such as 3D printers and CNC engraving machines, typically in conjunction with an Arduino board (not included).

Key Features:

- Supports 4 axes (X, Y, Z, A), with the ability to clone X, Y, Z axes or use D12 and D13 pins for a custom 4th axis.
- Integrated PWM spindle and direction pins for spindle control.
- Compatible with A4988 DMOS Micro-stepping Drivers, featuring translator and overcurrent protection.
- A4988 drivers offer low RDS (On) output and automatic current decay mode detection/selection.
- Synchronous rectification for reduced power dissipation.
- Internal UVLO (Under Voltage Lockout) and crossover-current protection.
- 3.3V and 5V compatible logic supply.
- Thermal shutdown circuitry and ground fault protection.
- Load short-circuit protection.
- Five selectable step modes: full, 1/2, 1/4, 1/8, and 1/16.

2. Package Contents

Verify that all components listed below are present in your package:

- 1 x CNC Shield Board (V3.0)

- 4 x A4988 Stepper Motor Driver Modules
- 4 x Aluminum Heatsinks for A4988 Drivers

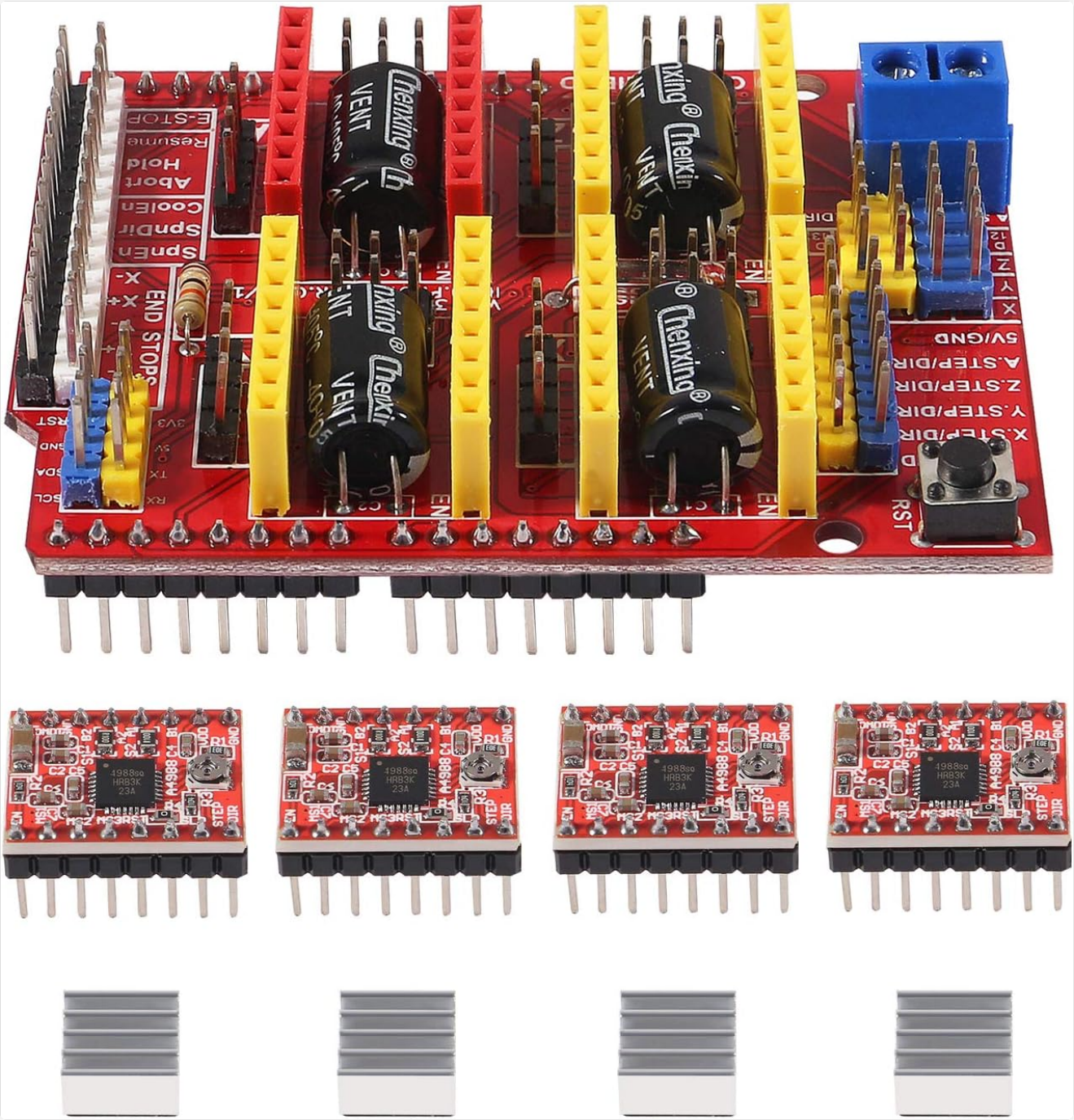


Figure 2.1: Complete ACEIRMC CNC Shield V3 kit showing the main board, four A4988 drivers, and four heatsinks.

3. Specifications

CNC Shield Board:

- Operating Voltage: 5V (logic)
- Digital I/O Pins: 14 (6 with PWM capability)
- I/O Pin Output Current: 40mA max
- 3.3V Output Current: 150mA max
- Clock Speed: 16MHz (when used with typical Arduino Uno)
- Power Input: 12-36V DC (for motor power)

A4988 Stepper Motor Driver:

- Low RDS (On) Output
- Automatic current decay mode detection / selection
- Mix with slow current decay modes
- Synchronous rectification for low power dissipation
- Internal UVLO
- Crossover-current protection
- 3.3 and 5 V compatible logic supply
- Thermal shutdown circuitry
- Ground fault protection
- Load short-circuit protection
- Five selectable step modes: full, 1/2, 1/4, 1/8 and 1/16

4. Setup Guide

4.1 Component Identification

Familiarize yourself with the layout of the CNC Shield V3 board. Key areas include motor driver slots, end stop connections, spindle control pins, and power input terminals.

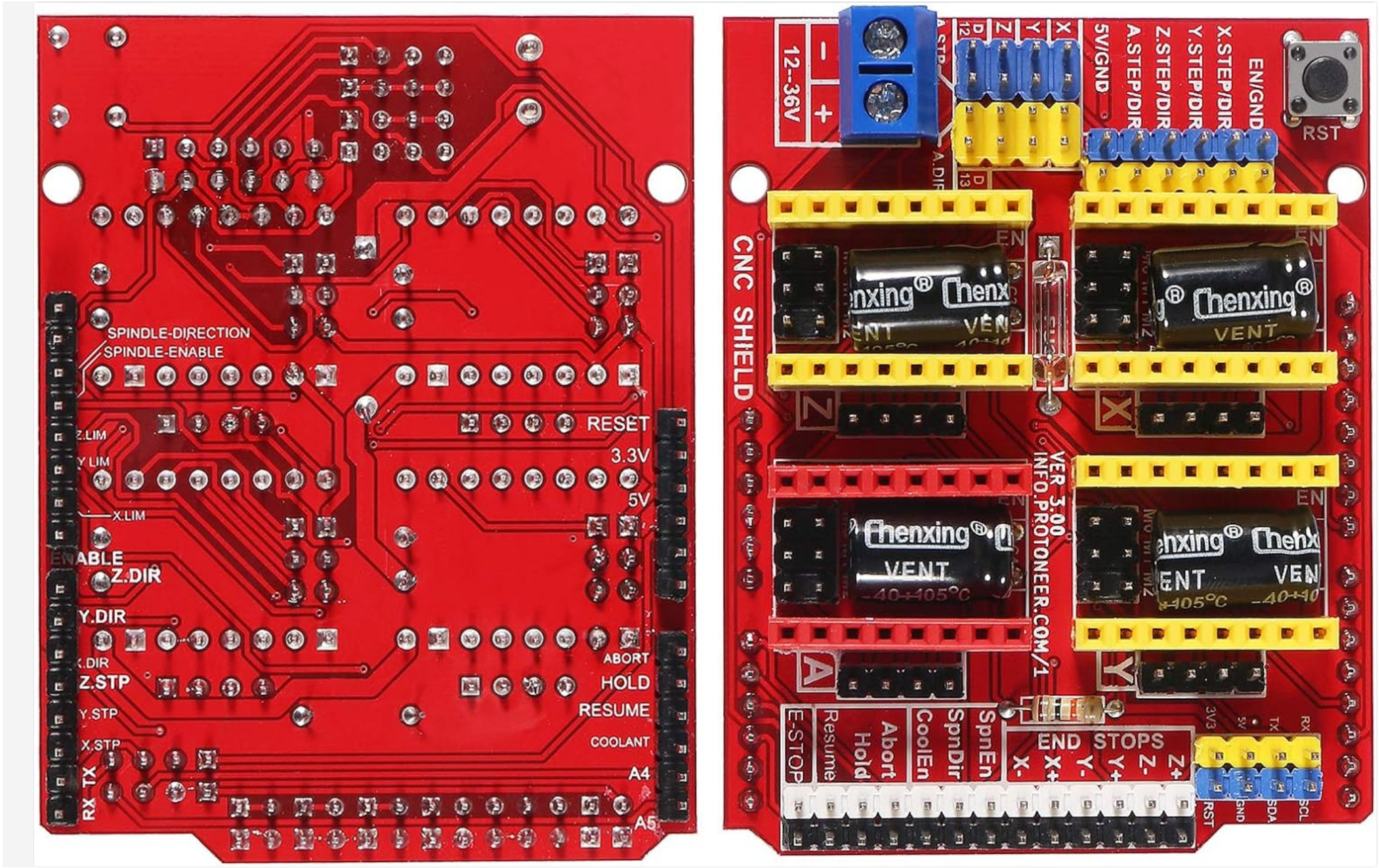

SPINDLE-DIRECTION
SPINDLE-ENABLE
RESET
3.3V
5V
ABORT
HOLD
RESUME
COOLANT
A4
A5
Z.DIR
Y.DIR
Z.STP
Y.STP
X.STP
RX TX
12--36V
CNC SHIELD
VER 3.00
INFO.PROTONEER.COM/1
RST
END STOPS
X-
X+
Y-
Y+
Z-
Z+
SpnEn
SpnDir
CoolEn
Abort
Hold
Resume
E-STOP
EN/GND
X.STEP/DIR
Y.STEP/DIR
Z.STEP/DIR
A.STEP/DIR
5V/GND

Figure 4.1: Top view of the CNC Shield V3 with various pin labels.

4.2 A4988 Driver Installation

1. Carefully insert each A4988 stepper motor driver module into its designated slot on the CNC Shield. Ensure the orientation is correct; typically, the potentiometer on the driver faces away from the power input terminals.
2. Peel the protective backing from the heatsinks and firmly attach one heatsink to the top of each A4988 driver chip. This is crucial for heat dissipation during operation.

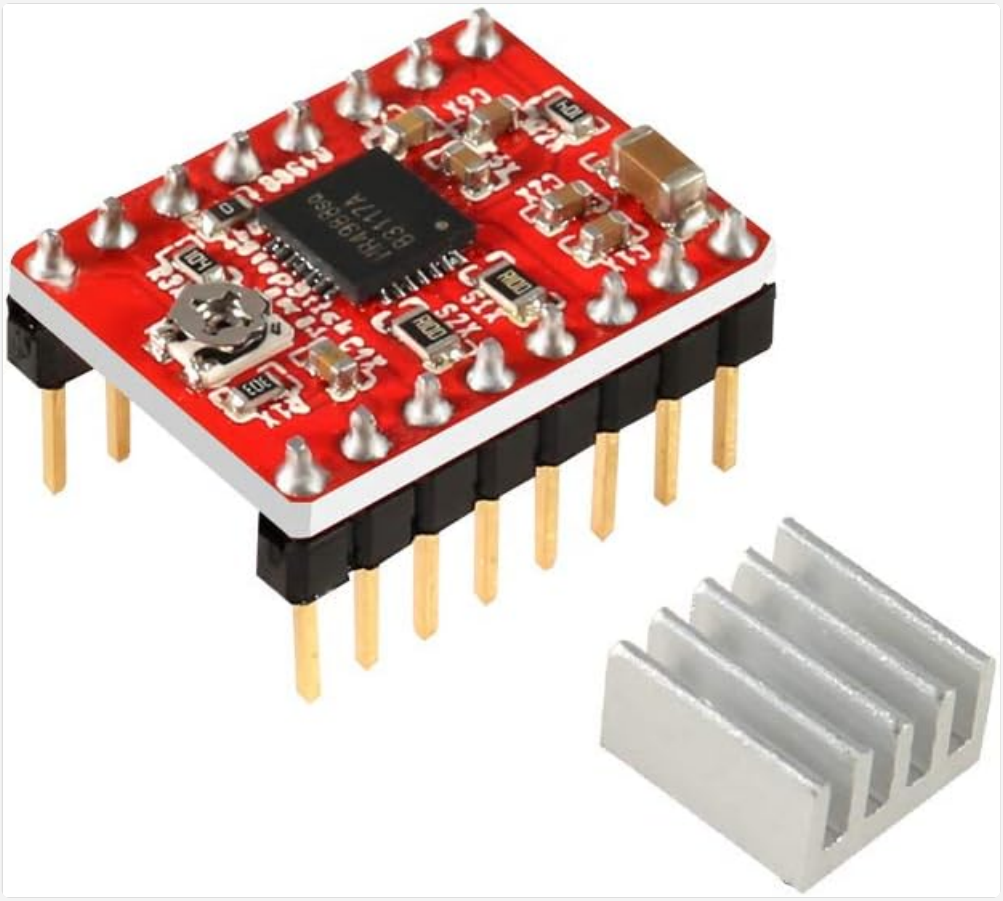


Figure 4.2: An A4988 driver module and its accompanying heatsink.

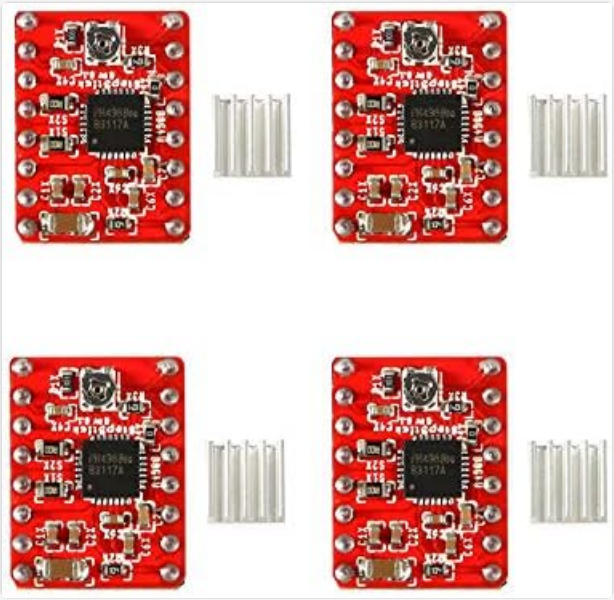


Figure 4.3: Four A4988 drivers with heatsinks.

4.3 Jumper Configuration for Micro-stepping

The A4988 drivers support various micro-stepping modes (full, 1/2, 1/4, 1/8, 1/16). These modes are typically configured using jumpers on the CNC Shield board, located beneath each driver slot. Refer to the specific documentation for your chosen firmware (e.g., GRBL) for recommended jumper settings to achieve desired micro-stepping resolution.

4.4 Driver Enablement

For the A4988 drivers to function, a jumper must be placed between the EN (Enable) pin and the GROUND pin for each axis you intend to use. These pins are typically located above the STEP/DIR pins for the X, Y, and Z axes on the CNC Shield.

4.5 Power Supply Connection

Connect your external DC power supply (12-36V) to the power input terminals on the CNC Shield. Ensure correct polarity. If you are using an Arduino Uno or similar board, it is essential to power the Arduino with an external power source in addition to the CNC Shield's motor power. The CNC Shield does not typically power the Arduino through its 12V input.

Figure 4.4: Assembled CNC Shield V3 board.

5. Operating Instructions

5.1 Connecting Stepper Motors

Connect your stepper motors to the corresponding X, Y, Z, and A axis terminals on the CNC Shield. Ensure the motor wiring matches the driver's pinout (typically 4-wire bipolar stepper motors). Incorrect wiring can damage the drivers or motors.

5.2 Software Configuration (GRBL)

The CNC Shield V3 is commonly used with GRBL firmware flashed onto an Arduino Uno. You will need to:

1. Flash the GRBL firmware to your Arduino board.
2. Configure GRBL settings (e.g., steps per millimeter, maximum feed rates, acceleration) to match your specific machine and stepper motors.
3. Use a GRBL-compatible G-code sender software on your computer to control the CNC machine or 3D printer.

Refer to the official GRBL documentation and community resources for detailed software setup and configuration guides.

Your browser does not support the video tag.

Video 5.1: An overview of the ACEIRMC CNC Shield V3 and A4988 driver kit, demonstrating its components and potential applications in 3D printing and CNC engraving.

6. Maintenance

6.1 Heatsink Application and Monitoring

Ensure that the heatsinks are securely attached to the A4988 driver chips. During extended operation, especially with higher motor currents, monitor the temperature of the drivers. If they become excessively hot, consider improving ventilation or using higher-quality heatsink compound if necessary. Overheating can lead to thermal shutdown or permanent damage.

6.2 General Care

Keep the board clean and free from dust and debris. Avoid exposing the board to moisture or extreme temperatures. Handle the board by its edges to prevent damage to components or static discharge.

7. Troubleshooting

- **Motors Not Moving:**
  - Verify that the A4988 drivers are correctly installed and oriented.
  - Ensure the EN (Enable) pin for each active axis has a jumper to GROUND.
  - Check that the Arduino board is powered by an external source, not solely relying on the CNC Shield's motor power input.
  - Confirm that the motor power supply (12-36V) is connected and providing adequate voltage.
  - Inspect motor wiring for correct connections and continuity.
  - Review GRBL or other firmware settings for correct steps per millimeter and motor current limits.

- **Drivers Overheating:**
  - Ensure heatsinks are properly attached to each A4988 chip.
  - Verify that the motor current is set correctly via the potentiometer on the A4988 driver. Excessive current will cause overheating.
  - Improve ventilation around the board.
- **Erratic Motor Movement:**
  - Check for loose motor connections.
  - Ensure micro-stepping jumpers are correctly configured.
  - Verify the integrity of the G-code or control signals.

8. Safety Information

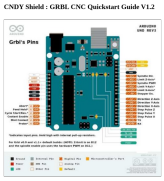
- **Power Disconnection:** Always disconnect power to the CNC Shield and any connected components (Arduino, stepper motors) before making or changing any wiring connections. Connecting or disconnecting a stepper motor while the driver is powered can cause permanent damage to the driver module.
- **Voltage Compatibility:** Ensure that your power supply voltage is within the specified range (12-36V DC) for the CNC Shield. Using an incorrect voltage can damage the board and connected components.
- **Static Discharge:** Electronic components are sensitive to static electricity. Handle the board by its edges and consider using anti-static precautions when working with it.
- **Heat:** Stepper motor drivers and motors can generate significant heat during operation. Ensure adequate ventilation and do not touch components that may be hot.

9. Warranty and Support

This product is covered by the standard manufacturer's warranty. For technical support, troubleshooting assistance, or warranty claims, please contact ACEIRMC customer service through your purchase platform. Please have your purchase details and product model number ready when contacting support.

Related Documents - CNC Shield V3

	JOY-IT ARD-CNC-Kit2: Arduino CNC Controller Board with 4x DRV8825 Drivers - Technical Guide Detailed technical guide for the JOY-IT ARD-CNC-Kit2, an Arduino Uno compatible CNC controller board featuring four DRV8825 motor drivers. Learn about pin assignments, microstep settings, motor driver adjustment, GRBL integration, and safety instructions.

	[CNDY Shield GRBL CNC Quickstart Guide V1.2] A quickstart guide for the CNDY Shield, a GRBL CNC breakout board, detailing pinouts, configuration for dual-axis features, and setting up diagnostic LEDs with an Arduino Uno.
	[BIGTREETECH S42C Stepper Motor Driver User Manual] Comprehensive user manual for the BIGTREETECH S42C closed-loop stepper motor driver board. Details features, parameters, installation, UART protocol, and operation for 3D printers and CNC machines.
	[ZK-SMC02 CNC Stepper Motor Driver: Features, Parameters, and Operation Guide] Detailed technical specification and operational guide for the ZK-SMC02 CNC Stepper Motor Driver. Learn about its features, parameters, setting methods, work modes, applications, and wiring.
	[ZK-SMC02 CNC Stepper Motor Driver User Manual] Detailed guide for the ZK-SMC02 CNC Stepper Motor Driver, covering its description, features, parameters, setting methods, work modes, applications, and package contents. This document provides comprehensive information for operating and integrating the ZK-SMC02 with stepper motors.
	[CNC Stepper Motor Driver - Operation, Parameters, and Control] Detailed guide for the CNC Stepper Motor Driver, covering its description, parameters, various setting methods, work modes, and MODBUS control. Includes parameter tables and application examples.