DIY CNC Machine

This open-source initiative has been developed solely for educational purposes and to inspire others to get involved with CNC technology. This CNC project targets individuals seeking a competitively priced, larger-scale CNC machine for their DIY needs. Many hobbyists and novice machinists find industrial machines prohibitively expensive. However, the reality is that, with a few minor trade-offs, you can construct your own CNC machine for a fraction of the cost. I meticulously designed this machine from the ground up using CAD, with the entire assembly process achievable using basic workshop tools, eliminating the need for welding. This approach empowers the project to have a more significant impact within the community, enabling others to follow suit. Below, you'll find detailed information about the project, how to get started, and safety considerations.

Project Author: thehardwareguy
YouTube: https://www.youtube.com/@thehardwareguy
Website: https://www.thehardwareguy.co.uk/diy-cnc-machine
X: https://x.com/hardwareguy
Community Discord Server: https://discord.gg/QsC6AE8
Donate: https://www.thehardwareguy.co.uk/membership

The entire build process has been documented online over on my YouTube channel. The entire collection of videos has been provided below, which you can also find over on my website.

Video	Link
DIY CNC 001 - Introduction	https://youtu.be/V6vN64v3qZI
DIY CNC 002 – Specification & Hardware	https://youtu.be/cbj6O_6vPtw
DIY CNC 003 – Tools for Machining Aluminium	https://youtu.be/2csS5e6N4TE
DIY CNC 004 – Drilling, Counterboring & Tapping	https://youtu.be/S0u6eHL628k
DIY CNC 005 – Y- Axis Frame Assembly	https://youtu.be/lG_drvXXd4g
DIY CNC 006 – Gantry Assembly & Bracket Installation	https://youtu.be/dQoVTa4hZwc
DIY CNC 007 – Z-Axis Assembly	https://youtu.be/CxpiYYbfL-E
DIY CNC 008 – Linear Rail Installation	https://youtu.be/Ci8BTSeqi48
DIY CNC 009 - Spindle Installation & Electronics Overview	https://youtu.be/dFtL7i9NhX8
DIY CNC 010 – Closed Loop NEMA Wiring and Mach3 Setup	https://youtu.be/Og-nvmThAJE
DIY CNC 011 – VFD and Spindle Test	https://youtu.be/lW8G5LwveII
DIY CNC 012 – Electrical Control Box	https://youtu.be/XsyS7X16zCg
DIY CNC 013 – Configuration & Basic Testing	https://youtu.be/ol4UvCvNaeo
DIY CNC 014 – Motor Tuning, Squareness and Spoilboard Surfacing	https://youtu.be/p3a4PpV8HGY
DIY CNC 015 – Carveco 3D Relief	https://youtu.be/JNyvcQU3StA

Open-Source License

This project is open source and must remain free and accessible to everyone. The files provided should not be sold in any way and are intended for community use and educational purposes.

To get started with your own DIY CNC machine build, follow the videos provided. First, ensure you have all the necessary components and tools before beginning the assembly process. You can find all this in the Bill of Materials.

I welcome contributions to improve this project. If you have suggestions, improvements, or have built your own version, please share your experience and feedback in the Community Discord Server.

For any questions or further information, please contact me: gareth@thehardwareguy.co.uk

DISCLAIMER

This project is provided solely for educational, hobby and personal non-commercial use. The designs, documentation and guidance are shared to help individuals learn about CNC technology and build machines for their own private use. They are not intended for, and must not be relied upon for, commercial, workplace or professional use.

No Liability

The creator (thehardwareguy / Gareth) provides these materials “as is”, free of charge, for educational purposes only. The creator accepts no responsibility or liability whatsoever for any injury, damage, loss, or claim arising from the use, construction, modification or operation of any machine built using this information. Everyone who builds, modifies or operates a machine based on these designs does so entirely at their own risk and is solely responsible for the entire process, including design decisions, component selection, assembly, electrical work, compliance with all applicable laws, and safe operation.

The designs have not been certified, type-approved, or formally assessed against any machinery safety standard or regulation. They are not guaranteed to meet the Essential Health and Safety Requirements of the Supply of Machinery (Safety) Regulations 2008 (or any equivalent legislation), nor any other regulatory requirement.

Commercial and Workplace Use

If a machine built from these designs is used in a commercial context, by a company, or as work equipment (even for the builder’s own use), it becomes subject to the Supply of Machinery (Safety) Regulations 2008 (SMSR) in Great Britain (and the equivalent requirements in the EU / Northern Ireland). In that case the builder is treated as the manufacturer and is legally responsible for:

- Carrying out a full risk assessment
- Ensuring the machine meets all relevant Essential Health and Safety Requirements
- Compiling a technical file
- Issuing a Declaration of Conformity
- Affixing the appropriate conformity marking (UKCA or CE, as applicable)
- Validating safety-related control systems
- Completing all required electrical and other safety tests

before the machine is put into service. Failure to do so can result in enforcement action, invalidation of insurance, and personal or corporate liability in the event of an accident. The creator of these open-source designs is not the manufacturer of any machine built by a third party and accepts no responsibility for commercial or workplace use.

Electrical Safety

All electrical work is the sole responsibility of the builder. Before the machine is powered on, all electrical work must be designed, installed, inspected and tested by a competent person and, where required, signed off by a qualified electrician. Faulty electrical equipment can cause electric shock, burns, fire and other serious harm. Uncertified or incorrectly installed equipment can invalidate insurance and create legal liability.

Machinery electrical equipment should be designed and installed in accordance with BS EN 60204-1 (Safety of machinery – Electrical equipment of machines). BS 7671 (IET Wiring Regulations) applies to fixed electrical installations (the building supply side), not to the electrical equipment of the machine itself. The Electricity at

Work Regulations 1989 also apply to the use of electrical systems at work. The Low Voltage Directive / Electrical Equipment (Safety) Regulations do not independently replace the machinery requirements for a complete machine in scope of the SMSR.

Operator Safety

CNC machines are inherently dangerous and capable of causing serious injury or death. Anyone who operates a machine built from these designs must be trained and experienced in the safe use of dangerous machinery. Essential knowledge includes software and G-code operation, machine-specific hazards, emergency stop and lockout/tagout procedures, and basic maintenance. Operators must wear appropriate PPE (safety glasses, hearing protection, sturdy footwear), maintain clear signage, and conduct regular risk assessments.

Jurisdiction

This project originated in the United Kingdom. The creator makes no representations about the legal or regulatory requirements that may apply outside the UK. It is the builder’s responsibility to determine and comply with all applicable laws in their own jurisdiction.

Professional Advice

Builders are strongly advised to consult a qualified electrician and, for any commercial or workplace use, a competent machinery safety specialist before construction or first use. Regulations and standards change; always verify the current requirements.

By using these designs, documentation or videos you acknowledge that you have read, understood and accepted this disclaimer in full.

Operator Safety

CNC machines are inherently dangerous and capable of causing serious injury or even death. It is essential that individuals who replicate and operate this machine are trained and experienced in operating dangerous machinery.

Essential Training and Knowledge

Anyone intending to operate this CNC machine must receive comprehensive training, including:

- Software Operation: Understanding the software used to control the machine, including G-code, toolpaths, and machine settings.
- Machine-Specific Hazards: Awareness of danger zones and potential hazards associated with the machine's moving parts, cutting tools, and work holding mechanisms.
- Emergency Procedures: Familiarity with emergency stop procedures, lockout/tagout protocols, and safe responses to malfunctions.
- Maintenance Practices: Basic maintenance tasks to ensure safe and reliable operation, and knowing when to seek professional assistance.

CNC Training Resources

- Mills CNC Training Academy: Offers CNC training courses covering machine operation, programming, and maintenance.
- The Manufacturing Technologies Association (MTA): Provides CNC training courses and apprenticeships.

Additional Safety Considerations

- Personal Protective Equipment (PPE): Operators should wear safety glasses, hearing protection, and sturdy footwear.
- Clear Signage: Display safety signage around the machine to remind operators of potential hazards.
- Risk Assessments: Conduct regular risk assessments to identify and mitigate potential hazards.

Note: This project was born out of the United Kingdom. The creator cannot make any comments on any regulation outside of the United Kingdom as he has no experience. This is your responsibility.