Introduction to Laser & CNC Router Machines

Welcome!

Agenda

- Welcome
- Router
  - Video (Router workshop 16:00)
  - Video (Clock making apllication of cnc 15:00)
  - History of my Machine
  - Safety Considerations
  - Components
  - Some Uses
- Laser
  - Short Video (Fibre revolver stock 1:30)
  - History of my Laser
  - Safety Considerations
  - Components
  - Some Uses
  - Some specifications and considerations
  - Basic Functions
  - Lenses

Video

Another video

Introduction to CNC Router

CNC Router Introduction

History of my router:

1)Purchased in January 2008

2)Cost very high at the time (R240K)

3)Chinese Machine (3 problems only)

4)Did not buy for woodworking (Denel & electrical labels)

CNC Router Introduction

Safety considerations:

1)Eye protection

2)Ear protection

3)Don’t wear loose clothing/Jewellery that can get caught up by moving parts.

4)Stay well away while machine in motion, if really have to use a sacrificial stick.

5)Follow all usual moving machinery safety guidelines.

CNC Router Introduction

Components of the machine:

1)Bed

2)Spindle and its speed control.

1)Colette

2)Colette Nut

3)XYZ Stepper/ Server motors

4)XYZ Safety Limits

5)Travel Linear Bearings and guides

6)Electronics (card based)

CNC Router Introduction

1)What does CNC Stand for?

2)Some Uses (not a comprehensive list):

1)Duplication of parts

2)Inlays

3)Moulding Templates

4)Rapid Prototyping

5)Pattern making (Drilling holes in a precise required positions)

6) The list goes on and on

CNC Router Introduction

Some Specifications and machine considerations:

1)Bed Size

2)Type of bed (vacuum / Slotted / magnetic / etc;). Sacrificial Layer

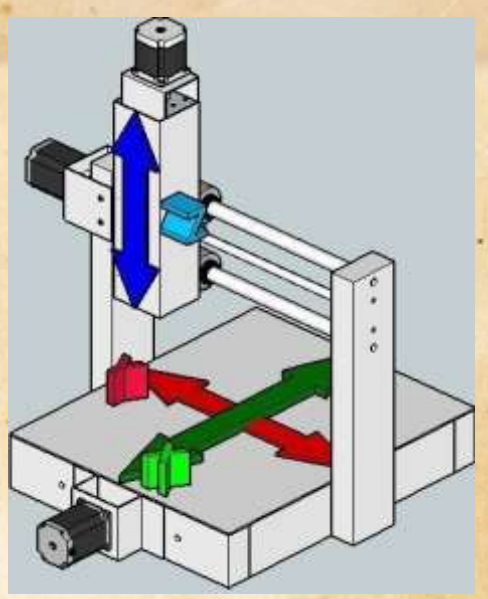
3)Spindle (size in Kw / speed / cooling method)

4)Software Compatibility:

1)Ability to use General cad software eg v-carve, mach3 autocad.

2)Alternatively use custom Software from manufacturer where PC is directly connected to CNC

CNC Router Introduction



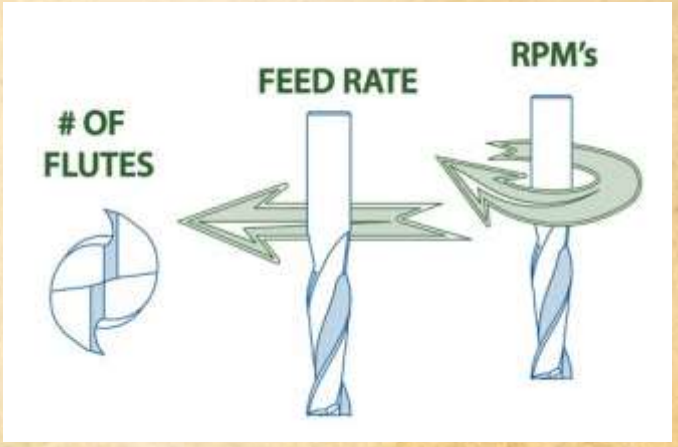
Basic Functions:

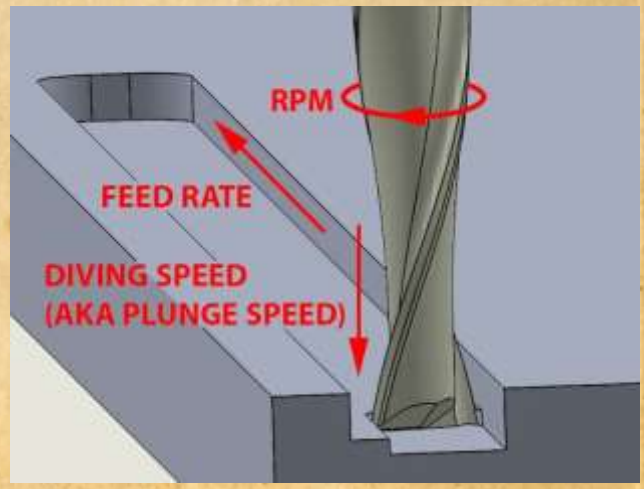
1)XYZ Co-ordinate system (3-axis)

2)Home

3)Origin

4)4,5,6 axis machines available, the more axis the more you can do.





5)Plunge Rate

6)Process Speed / Feed Rate

7) Spindle Speed

CNC Router Introduction

Router Bits:

1)Countless varieties on the market and manufacturers. Unfortunately with CNC router bits goes hand in hand with knowledge and use of them for their applications.

2)Engraving Tip for Rowmark

3)End mills

4)V-tips

CNC Router Introduction

- Maintenance:

–General Cleanliness

–Oiling of guides,Lead screws and bearings

–Regular resurfacing of bed (sacrificial material)

–Fairly standard machining maintenance practices.

CNC Router Introduction

Tips & Tricks:

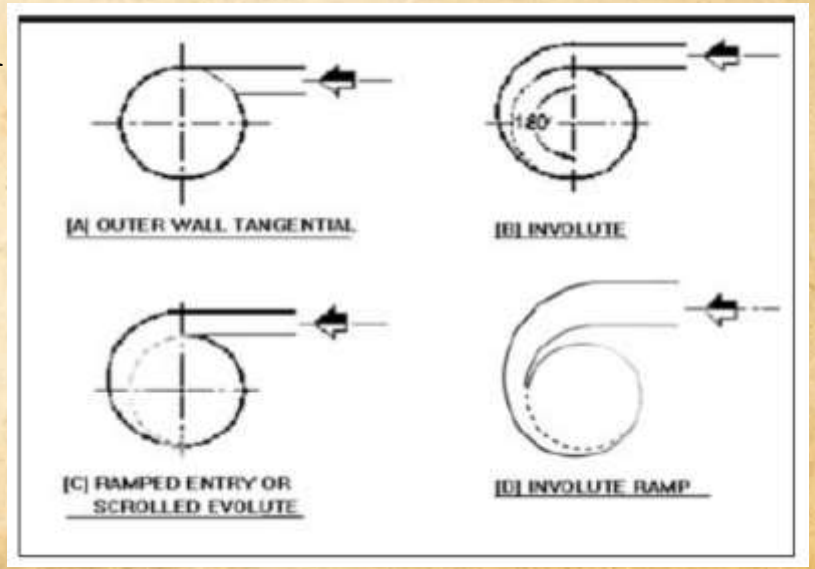
1)Dry Runs

2)Kiss cut

3)Use of tabs

4)Double sided tape for clamping down.

5)Tangential dia



Practical Interaction with machine

Yet Another Video

Tea & Refreshments

Introduction to Laser Machine

Laser Machine Introduction

History of my Laser:

1)Purchased September 2017 (second laser – upgrade)

2)Cost of this kind of machine (1.2mil)

3)I wanted to buy a laser that was fairly all round

Laser Machine Introduction

Safety:

1)Very safe if you follow manufacturer guidelines

2)Closed lid design – safest

1)Physical Barrier

2)Tinted lid (eye protection)

3)Opticals (laser tube) cant be operated,under normal circumstances, with lid open

Laser Machine Introduction

Components

1)Laser Tube (CO2 DC, CO2 RF, Fibre, MOPA, GALVO)

2)Light from tube bounces off **Mirrors**

3)Into **Lense** that is attached to a **nozzle**

4)Bed (Lamellae, Honeycomb, flat, Vacuum)

5)Cross and height Travel mechanisms

6)Electronics

7)Air assist

8)Extraction

Laser Machine Introduction

Some Uses (not a comprehensive list):

1)Fine Artwork Cutting

2)Fine Engraving for decoration/ embellishments

3)Name and serial plates

4)Inlays

5)Engraving onto jeans, Hessian sacks, stones

6)Art

7)The list goes on

Laser Machine Introduction

Some Specification and machine considerations:

1)Best is to choose a machine for the purpose you intend to use it for.

2)Best practice is to buy the best machine that you can afford.

3)Bed Size

4)Calibration Techniques

5)Pass through facilities

6)Closed Gantry

7)Tube type

Laser Machine Introduction

Basic Functions:

1)XYZ Controls

2)Origin/snapping point (Setting on PC is the F8 key)

3)Home

4)Settings to allow you to work from bottom up or top down.

5)Lots of advanced settings we are not going to go into.

Laser Machine Introduction

- Lenses
(the router bits of laser):

–1.5 inch

–2 inch

–2.5 inch

–3.75 inch

–4 inch

–5 inch

–7.5 inch

Laser Machine Introduction

- Maintenance:

–Basic cleaning of mirrors, lenses and nozzle

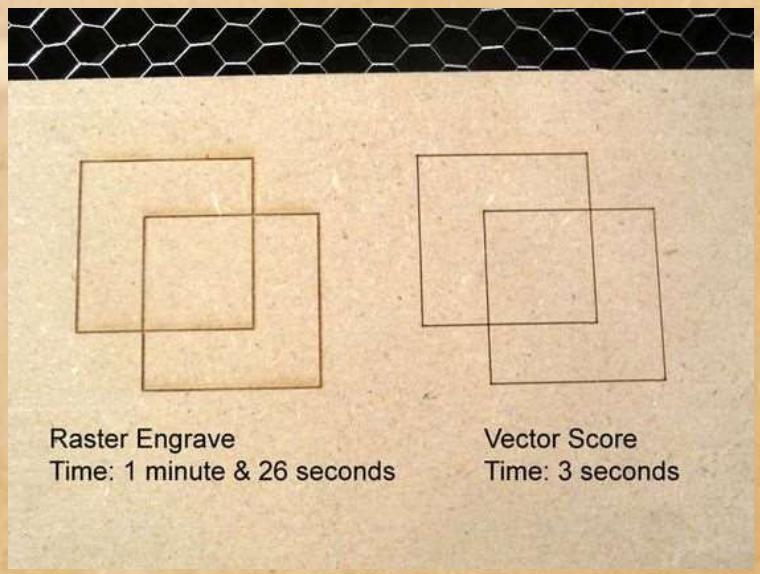
–Cleaning of bed and bed catchment area

–Cleaning Extraction fan vanes

–Emptying Compressor and water traps.

–Cleaning of Gantry (mine is sealed therefore minimal)

Laser Machine Introduction



Tips & Tricks

1)Kiss Cut

2)Application Tape

3)Bottom Up vs Top down

4)Yellow vs Brown MDF

5) Speeding up - vector cut borders & Outlines (cutting is faster than engraving)

6)Speed up job by placing longest engraving length left to right as the machine is faster in that direction due to the gantry not moving.

Material	Laser source		Machinability	Process
	CO_2	Fiber		
Laminates	✓	✓*	✓✓✓	Engraving, cutting, marking * Color change on black base material
Acrylic	✓	✓*	✓✓✓	Engraving, cutting *soak-dyed acrylic
Natural rubber	✓		✓✓	Engraving, cutting
PVC	**NO!**	**NO!**	✘	Must not be processed! Laser processing produces dioxin!
Thermoplastics (PC, PI)	✓	✓	✓✓✓	Cutting, marking
Thermoplastics (PMMA, ABS, PP, PE, POM, PA, PES)	✓	✓	✓✓✓	Cutting, engraving, marking
Thermoplastics (PS, PETG)	✓			Engraving, cutting
Thermoplastics (PI)	✓		✓✓✓	Cutting
Thermoplastics (PBT, PPS)		✓	✓✓✓	Marking
Ceramics	✓	✓	✓	CO2 engraving, color change with fiber laser
Paper	✓		✓✓✓	Engraving, cutting
Foamed plastics	✓		✓✓✓	Engraving, cutting
Textiles	✓		✓✓	Engraving, cutting
Leather(ette)	✓		✓✓✓	Engraving, cutting
Glass	✓		✓✓✓	Engraving
Wood	✓		✓✓	Engraving, cutting
MDF	✓		✓✓✓	Engraving, cutting

Material	Laser source		Machinability	Process
	CO_2	Fiber		
Veneer	✓		✓✓✓	Engraving, cutting
Plywood	✓		✓✓✓	Engraving, cutting
Fiberglass	✓		✓✓	Engraving, cutting
Stein	✓		✓✓	Engraving
Aluminium		✓	✓	Engraving
Anodized aluminum	✓	✓	✓✓✓	Engraving
Polished / unpolished brass		✓	✓✓✓	Engraving
Hartmetall		✓	✓✓	Polishing
Chrom		✓	✓✓	Engraving
Polished / unpolished copper		✓	✓✓	Engraving
Gold		✓	✓✓✓	Engraving
Silver		✓	✓✓✓	Engraving
Platinum		✓	✓✓	Engraving
High-speed steel (HSS)		✓	✓✓✓	Annealing / engraving
Brushed / polished stainless steel		✓	✓✓✓	Annealing / engraving
Carbon	**NO!**	**NO!**	✘	Must not be processed!
Titanium		✓	✓✓✓	Annealing / engraving

Some Differences between Laser & Router

Laser	CNC Router	Hand-Held/ Table-Top Router
Depth control is inconsistent and difficult. One needs to rely on intensity and often results in a poor finish	Excellent Depth Control	One depth setting at a time (manual)
Very small spot size (0.07mm) thus can get very sharp corners.	Can't get sharp crisp corners (Relevant to bit radius)	Same as CNC Router
Very fine work can be done (0.07mm)	0.5mm tip is the smallest I have ever used.	
Very little wastage due to spot size	Thickness of tip causes more wastage (example puzzles cut inside and outside of the line)	
Very little forces acting on part	Lots of forces acting on part	Same as CNC Router
Less clamping needed usually masking tape is sufficient	Clamps and/or double sided tape needed.	
Burn on wood is indicative result of lasering	Minimal burn if settings are optimised.	Slight more burn than CNC as its difficult to feed by hand at a constant speed.
Fairly safe	More dangerous due to moving parts at high speed and human error	
Substrate fixed unless rotary attachment is used	Same as laser	Substrate is fixed (Hand Held) or substrate fed into the table top router
Some substrates can't be cut like PVC	Can cut PVC	Same as CNC
Can cut PC but very diffcult to get good result	Much better result than laser (Water jet provides the best result)	Same as CNC
Cutting & Engraving usually faster than CNC Router	Slower than Laser	Generally Slower than both due to manual control.
No bits but Laser tube /lenses are expensive	Need lots of different bits for different materials and applications	Same as CNC
Not portable (big variants)	Same as Laser	Portable

Last Video (I promise)