



PCB Engraver  
CNC Machine  
User's Manual



<http://www.denford.co.uk>



# OPENROB

# 1 : Notes



# 1: Contents

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# 1: Warning Notices

## Warranty Disclaimer.

The Warranty on your Engraver will be invalidated if any modifications are made to the machine or any additional ancillary equipment fitted, or any adjustments are made to the controlling devices without prior notification from Denford Limited. Please refer to the information held in your separate Warranty pack, for specific details.

Do not carry out any portable appliance testing (PAT) on any of the supplied equipment.

## Maintenance Disclaimer.

Always obtain permission from the person responsible for machinery in your establishment, before accessing the electrical control panel or Engraver machine casings to carry out any maintenance work. All work must be carried out by personnel suitably qualified for each maintenance task, to avoid damage to both the machine systems and the maintenance personnel. Denford Limited cannot accept responsibility for any damage and/or loss that may occur through incorrect maintenance of your Engraver.

## Use of Machine.

Your Engraver is designed for cutting common resistant and prototyping materials, including copper circuit board, plastic and acrylic. In each case, the appropriate tooling, speeds and feeds should be used as recommended by the material supplier. Information should also be sought from suppliers regarding the safety specification of the materials to be cut. Facility is provided for connecting a vacuum system for dust extraction. Always use the machine coupled to such a system.

Your Engraver is **not** intended for use with any metals other than copper circuit board. Do **not** remove the Engraver head and attempt to use it independently of the machine. Do **not** use the machine without the floating head feature in place, and a suitable extraction system fitted and enabled. Do **not** machine any toxic, radio-active or volatile materials.

***Use of the machine for any purpose other than those for which it is designed may result in injury, and may also invalidate the warranty.***

The machine should only be used under constant supervision, to help guard against, and respond to, any unforeseen hazard such as fire or explosion. First aid and firefighting equipment (CO2 Extinguisher) should be located nearby in a clearly signed and prominent position.

# 1: Warning Notices



## Sound Level Disclaimer.

The Noise Level test published in this manual is for the machine and any essential equipment such as dust extraction equipment, and complies with the relevant standards. It cannot make provision for noise resulting from the cutting process, since this is a variable, depending on such factors as material, cutting data and tooling.

Any ancillary equipment supplied by Denford will also comply with the relevant standards. However, when used jointly with the machine in a machining environment, the combined sound levels emitted may require that Personal Protection Equipment, such as ear defenders, be used. Other factors, such as high ambient noise levels and nearby machinery and equipment can also increase the sound levels.

It may be possible to reduce the sound levels by changing the machining process and/or repositioning the machine and/or its ancillary equipment.

If, under these circumstances, it is felt that the sound level is still unacceptably high, then independent advice should be sought and complied with.

If you have any doubts and/or questions regarding the use, specification, servicing, or features of your machine, please contact Denford Customer Services.

Denford Limited reserves the right to change the specification and/or operating features regarding this CNC machine without notice or documentation.



## Portable Appliance Testing.

### In-Service Testing

This is the testing carried out as a routine to determine whether the equipment is in a satisfactory condition.

In-Service testing will involve the following:

- Preliminary inspection
- Earth continuity tests (for Class 1 equipment)
- Insulation testing (for Class 1 equipment)

Electrical testing should be performed by a person who is competent in the safe use of the test equipment and who knows how to interpret the test results obtained. This person must be capable of inspecting the equipment and, where necessary, dismantling it to check the cable connections.

If equipment is permanently connected to the fixed installation, e.g. by a flex outlet or other accessory, the accessory will need to be detached from its box or enclosure so that the connections can be inspected. Such work should only be carried out by a competent person.

# 1: Warning Notices

## Portable Appliance Testing (continued).

### **Preliminary inspection**

Formal visual inspections should only be carried out by persons competent to do so.

- Cables located so as to avoid damage
- Means of disconnection/isolation readily accessible
- Equipment positioned to avoid strain on cord
- Equipment is being operated with the covers in place
- Indiscriminate use of multi-way adaptors and trailing sockets is avoided
- Identify signs of overheating
- Identify signs of damage to insulation
- Check the correct size fuse is fitted (13A)
- Check the flexible cable connections and anchorage.

***Before carrying out the following tests ensure the machine is disconnected from any external equipment or supplies.  
Ensure USB and RS232 connections are removed prior to testing.***

### **Earth continuity Test (Class 1 equipment)**

The test should be carried out at 25A for a period of 5 – 10 Seconds  
The reading should be less than  $0.1 + R$  (where R is the resistance of the lead)

### **Insulation Resistance Test (Class 1 equipment)**

The applied test voltage connected between Live/Neutral and Earth should be 500VDC  
The insulation Resistance should be greater than 1M Ohms



# 1: About this Manual

Using this manual	<p>This manual provides information describing how to transport, site, setup and operate the basic functions of your Denford Engraver, including any operational features of hardware specific to the Denford Engraver series.</p> <p>This manual does not provide any information regarding the software packages used please refer to the help section within the appropriate software.</p> <p>Please note that the Electrical Diagrams for your Engraver are not included in this manual - they are delivered separately in the standard equipment box supplied with your CNC machine.</p> <p>If you have any doubts and/or questions regarding the specification, servicing, or features of your Engraver, please contact Denford Customer Services. Denford Limited reserves the right to change the specification and/or operating features regarding this CNC machine without notice or documentation.</p>
Disclaimer	<p>Please note that due to the nature of hardware and software developments, the specifications and features of this product can change without notice. The information contained in this manual is correct at the date of printing only - September 2010. No liability can be accepted by Denford Limited for loss, damage or injury caused by any errors in, or omissions from, the information supplied in this manual.</p>
Screenshots	<p>Please note that any screenshots are used for explanation purposes only. Any numbers, wording, window or button positions may be different for the configuration of the CNC machine control software being used to control your Engraver.</p>
Language	<p>This manual is written using European English.</p>
Contact	<p>Any comments regarding this manual should be marked for the attention of our technical authoring team and referred to the following e-mail address: <a href="mailto:customerservices@denford.co.uk">customerservices@denford.co.uk</a></p>





# 1: Introducing your PCB Engraver

Congratulations on your purchase of a PCB Engraver. In this manual you will learn how to setup and use your Machine correctly and safely.



Your Engraver is a three axis CNC Engraver with a large work area, allowing machining of materials approaching 330 x 210mm in size. Suitable for all levels of education and training, it is manufactured to meet industrial standards. Together with rapid traverse rates of up to 5000 mm/min your Engraver is the ideal partner for the manufacture of Printed Circuit Boards. Your PCB Engraver is designed with you in mind - making the processes involved both safe and easy to use.

## Main Features:

- Designed specifically for Education and Training.
- Manufactured to industrial standards.
- Programming via International Standards Organisation format, incorporating controls such as FANUC.
- CE approved for safety.
- Capable of cutting common resistant and prototyping materials, including copper circuit board, plastic and acrylic.
- Links to various CAD/CAM software packages.
- Totally enclosed high visibility guarding.
- Feedrate override control.
- Dust extraction ready.

# 1: Before Beginning to Setup

Before beginning to set up your PCB Engraver, please check your separate order documentation, making sure that all items have been delivered to your establishment. Any missing or damaged items should be reported to Denford Customer Services as soon as possible.

The following equipment is supplied as standard with your Engraver CNC machine :

- PCB Engraver CNC machine. Note that the precise specification of your CNC machine will depend on any options selected at the time of ordering (see below).
- Range of Collets from 1mm to 3.2mm.
- Collet Spanner.
- Slot Drill.
- Depth Gauge.
- 1 x Allen (hex) keys pack.
- External USB Cable.
- Mains Cable.
- Spare Fuses.
- Swanslip Lubricant.
- 1 x PCB Engraver warranty pack (UK Machines only)
- 1 x CD-ROM containing Denford CNC Machine Control Software and manuals, and Machine user's manual.
- 1 x CNC Machine Control Software Security Key (dongle) or Flash screen software (supplied on removeable media).

The following optional equipment may also be supplied with, or ordered for, your machine:

- Additional Software: CAD/CAM, Offline CNC Machine Control.
- CNC Machine Control software security keys (dongles) or licence disks.
- Machine work bench and PC workstation.
- Vacuum for dust collection.
- Various tooling packages.
- Courseware, project books and project material packages.
- Video conferencing system.

## 2: Safety Features Overview and Precautions

### Safety Features Overview.

The following safety features are standard on your Router Emergency stop button.

- Manually operated, totally enclosed cabinet, door with guard switch.
- Option on control software to check CNC programs using toolpath graphics, prior to machining.
- Automatic tool retraction and spindle stop for tool changing.

### Safety Precautions.

Safety is very important when working with all forms of machinery but particularly when working with CNC equipment, due to the hazardous voltages, speeds and forces that exist in the hardware. Follow the rules below at all times, when using your Router.

General Safety Precautions :

- Wear clothing suitable for machine operation and follow the safe working procedures in place at your establishment. When cleaning down machine, or handling tooling, consider additional protective clothing such as respiratory masks, eye protection, gloves and overalls.
- Do not place any objects so that they interfere with the guards or the operation of the machine.
- Never try to clean the machine if any part of it is rotating or in motion.
- Always secure the work on the table or in a fixture or vice.
- Ensure that the correct cable for the power source is used.
- Ensure the mains power is switched off (and preferably unplugged) before starting any maintenance work on the machine. Depending on ancillary equipment supplied with machine there may be more than one power supply to the machine. When isolating machine always ensure that **all** power sources have been disconnected. Post a notice informing others not to use the machine since it is undergoing maintenance.
- Hazardous voltages can still exist immediately after switching the machine off. Always wait at least 5 minutes before accessing the CNC machine electronics.
- If power fails turn off the mains power switch immediately and unplug the machine from the mains power socket.
- Service the required areas at the intervals specified in this manual (see the Maintenance section for further details).
- Observe caution when handling machine tooling or cleaning down machine, particularly with regard to hot and/or sharp cutters. Consider wearing protective gloves.
- When an emergency stop is required, press the circular red emergency stop button, located on the right side of the CNC machine front panel.
- If laser scanner fitted do not stare into laser beam. Refer to Scanner instruction manual for all aspects of safe use of laser.
- Visually check door and window for signs of cracks or chips. Any damage should be reported immediately to Denford and a suitable replacement obtained without delay.
- Regularly check door hinges for correct tension and adjust or replace if necessary.

## 2: Safety Features - Emergency Stop Button



The emergency stop button is located on the right front panel of the CNC machine. To activate an emergency stop, press the button fully in until it clicks.

A circular, red emergency stop button is located on the right front panel of your Engraver, as shown above. When pressed, it has the effect of stopping all axes and spindle movements immediately.

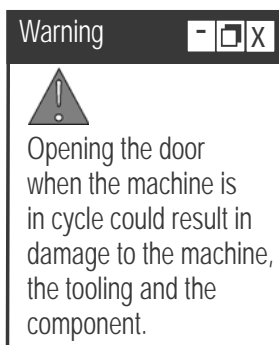
To activate an emergency stop, press the button in until it clicks. The emergency stop button will continue to cut all power to the machine drives until the release sequence is performed.

To release a closed emergency stop button, push in and turn the button clockwise until it springs back out.

After releasing an emergency stop, you may need to reset any CNC control software messages and home the CNC machines axes.

Check the emergency stop button is released before attempting to power up the Engraver

## 2: Safety Features - Guard Switch



A guard switch is used on the door of the machine. The switch itself is fitted to the frame of the cabinet and the sensor is fitted to the door.

When the door is opened with the machine in cycle, the axes and spindle will stop. The axes can then be manually jogged, but the spindle will be inhibited. Closing the door will return the machine to full functionality, but will not cause the axes or spindle to restart.

When the door is opened with the machine powered up, but not in cycle, the axes can be manually jogged, but the spindle will be inhibited. Closing the door will return the machine to full functionality, but will not cause the axes or spindle to start.

If the machine is powered up with the door open, the axes and spindle will be inhibited until the door is closed and the machine has been homed.

## 2: Dust Extraction & General Dust Precautions

***Note the floating head of your Engraver cannot function without a dust extraction system fitted and enabled.***

Your Engraver must be used with a dust extraction system, used to clear dust and swarf from the cutting area, and to remove any potentially harmful airborne dust particles from within the working area of the machine.

Denford can supply dust extraction systems for your machine, or you may wish to connect your own system. Connect the pipe from your dust extraction system to the aperture in the right hand wall of the machine cabinet.

***It is a legal requirement to have the dust extraction system independently tested every 14 months to ensure that dust is kept well below the maximum exposure limits set by law.***

### General Dust Safety Precautions.

Obtain "material safety data sheets" from your material suppliers and enforce the recommended precautions. Be aware that certain hardwood and other material dust particles, such as oak and MDF, could contain known carcinogens. Please consult your materials supplier for further details.

Dust particles that remain inside the working area of the Engraver after a part has been machined, should be removed using a vacuum.

***Never used a compressed airline for this purpose.***

When emptying the dust extraction system base unit or cleaning down the machine, wear suitable respiratory protective equipment that is CE marked. Other personal protective equipment, such as eye protection, overalls and gloves should also be considered.

Dust particles on the floor can cause slipping. This should be monitored by the operator and removed before becoming a hazard.

Launder overalls regularly, provide good washing facilities with hot and cold water, soap and towels and encourage a high standard of personal hygiene.

***Failure to fit and enable a suitable dust extraction system, and failure to adhere to the material safety data sheets could lead to the following health problems which are among the effects associated with exposure to certain dust particles:***

- Skin disorders.
- Obstruction to the nose.
- Rhinitis.
- Asthma.
- Nasal cancer.

# 3: Unpacking and Lifting your CNC Machine



If your CNC machine has been supplied inside a delivery box, cut the top of the box open and remove any packaging carefully. To obtain better access to the machine, remove all the sides from the delivery box. Your PCB Engraver weighs 43 kg. for bench mounting; with floor standing unit it weighs 157 kg.

With the bench mounting unit a suitable method of transportation must be used as the unit is not fitted with wheels: for example secure machine on a pallet and transport using a pallet truck.

The machine only can be lifted by 2 people. Account should be taken of the non-uniform distribution of the weight of the machine. It is generally heavier at the back than at the front of the machine. The use of suitably rated lifting bars through the hollow sections under the machine may assist in lifting the machine.

Always use sensible lifting precautions in accordance with Health and Safety Regulations in your establishment. Particularly in the case of manual lifting be aware of the danger of trapping.

Ensure that your CNC machine is both secure and balanced before lifting. Do not tip the machine whilst lifting.

All lifting equipment must be certified as being suitable for the loads involved.





### 3: Choosing a Site for your CNC Machine

Site your machine in a well ventilated room. If the Engraver is supplied for bench mounting it should be sited on a bench of sturdy construction to take the weight of the machine and of a height which enables comfortable operating and programming to take place.

If the Engraver is supplied with a Universal Machine Bench, the adjustable corner feet should be wound down to contact the floor to help minimise noise and vibration.

Ideally, the user will operate the machine when standing at its front, with a clear view of both the machine working area (through the transparent guard window) and the personal computer being used as the controller unit (which should be angled towards the user), as shown in the diagram below.

Sufficient room should also be provided for effective maintenance to be carried out around the machine itself. In particular, leave enough space for removal of the large plate covering the electronics at the rear side of the cabinet. Positioning the PC on a movable workstation may allow easier access to the various vents, connectors and switches on the machine cabinet, when required.

Position any vacuum pumps used with the dust extraction at the rear, or under, the machine table. The use of a centralised extraction system or, where possible locating the extraction unit in a separate room, will help in noise reduction.

Do not place the machine in a position which allows any of the cabinet vents to be covered. Ensure all cables, pipes and flexes are routed to avoid the possibility of users tripping over them.

#### Dimensional Data.

Machine Length (left to right) 570mm (22.5").

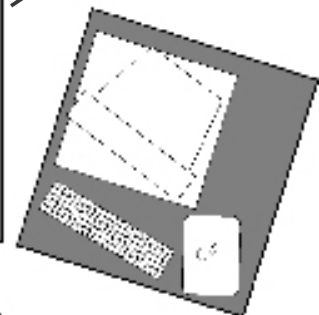
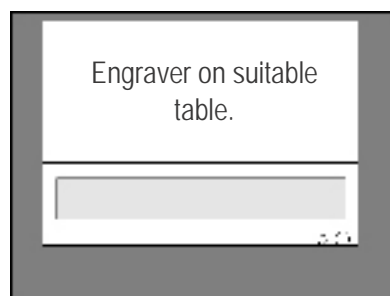
Machine height (top to bottom) 385mm (15.2").

Machine depth (front to back) 585mm (23").

Ensure that any inlet/exhaust vents are not covered or blocked.

Allow space to remove the electrical panel cover plate at the rear of the cabinet.

Dust extraction here.



Plan View showing Ideal Machine Layout and Operating Positions.



Machine Operator.

Computer desk, monitor, keyboard and mouse angled towards Operator.


# 3: Removing Protective Coatings and Packaging

Once your Engraver has been sited, the protective coatings and transit packaging must be removed to prepare the machine for running:

- 1) The protective plastic sheeting on the guard door must be removed and the door cleaned with an antistatic cleaner.
- 2) Tie-wraps may be used in the working area of the machine, to prevent movement of components during transit. Additional items from your order may also be supplied packaged inside the working area.

Warning - Aerosol based or flammable products must not be used to clean your CNC machine. To avoid the potential risk of ignition / explosion, ensure that any trapped solvent vapours can exit fully from any enclosed areas on the CNC machine. Wait at least 1 hour before attempting to operate the CNC machine.

**Warning** - [X]



Potential risk of ignition / explosion!

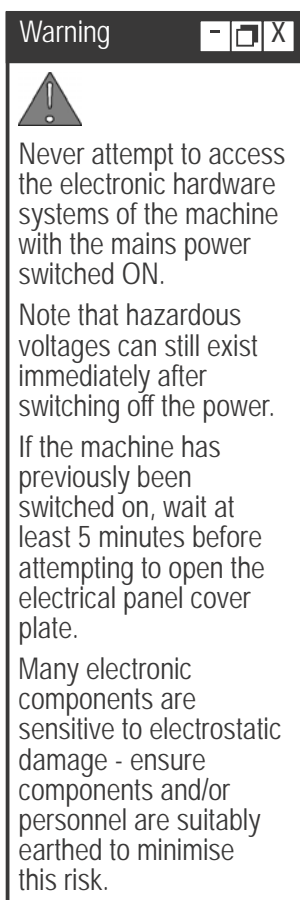
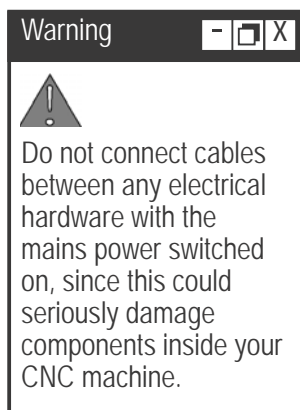
Do not use any aerosol based or flammable products to clean your CNC machine.

Carefully read and follow any instructions or notices included with cleaning products.





## 4: Switching the Engraver On



Follow these instructions to switch on your Engraver:

- 1) Check the Denford machine link cable is fitted securely between the USB port socket on the machine controller PC and the USB socket, located on the right-hand panel of the Engraver cabinet.
- 2) Check that all access panels are in position and securely fastened.
- 3) Check that all inlet/exhaust vents are clear from obstructions.
- 4) Check the flexible hose from your separate dust collection vacuum system is securely fitted to the connection hole, adjacent to the lifting handle on the right-hand panel of the cabinet.
- 5) Check that the guard door is fully closed.
- 6) Plug the Engraver mains supply cable into an available power socket. Switch the power socket on.
- 7) The on/off power switch is located on the right-hand panel of the Engraver cabinet. To switch machine on depress the left-hand side of switch. The switch will illuminate when power is being supplied to the machine.
- 8) Switch on the machine controller PC and start the CNC machine control software.


If the Engraver does not begin its power-up routine, switch off the mains power and check all connections and fuses.

Establish a communication link between your machine controller and PC.

When the 'found new hardware' box appears install the driver for the USB connection (Software CD must be in the CD Drive) - for help please contact technical support 01484 728000.

## 4: Switching the Engraver Off

Warning



Never attempt to access the electronic hardware systems of the machine with the mains power switched ON.

Note that hazardous voltages can still exist immediately after switching off the power.


If the machine has previously been switched on, wait at least 5 minutes before attempting to open the electrical panel cover plate.

Many electronic components are sensitive to electrostatic damage - ensure components and/or personnel are suitably earthed to minimise this risk.

Follow these instructions to switch off your Denford Engraver off:

- 1) Wait for the Engraver to fully complete any machining or processing of any operational instructions.
- 2) Open the safety guard door and remove any finished parts from the working area.
- 3) Close the safety guard door.
- 4) Close down the communication link between the CNC control software and the Engraver, then exit the CNC control software, as described in your separate CNC Control Software User's Manual.
- 5) Shut down and switch off the machine controller personal computer.
- 6) Power down the Engraver by depressing the right-hand side of the red on/off mains power switch. The on/off switch is mounted on the right-hand cabinet panel.
- 7) Switch off the mains power socket.

Warning



Depending on ancillary equipment supplied with machine there may be more than one power supply to the machine.

When isolating machine always ensure that **all** power sources have been disconnected.

## 4: Homing the Machine Axes (Home Mode)

### Note

The sequence of events required to home the Engraver will depend on the type of CNC machine control software being used - please refer to your separate CNC Machine Control Software User's Manual for specific details.

Immediately after establishing a communication link between the CNC control software and the Engraver, all three axes of the CNC machine must be homed. The process is commonly referred to as homing the machine, or datuming each of the three machine axes.

When a communication link is first established between the Engraver and the CNC machine control software, or when the CNC machine "loses" position, the software will not know the true position of the machine head in relation to the three machine axes.

Homing the CNC machine defines:

- The machine datum, by physically driving the machine head to a fixed zero reference point.
- The constraints of three dimensional co-ordinate grid system used for plotting any programmed movements, effectively the working envelope of the CNC machine.

### Note

The CNC machine control software Jog and Auto Modes will not become available until the machine has been configured by homing all three machine axes.

After homing the machine, the zero position of the three dimensional co-ordinate grid system is referred to as the machine datum. You can find the position of the machine datum by switching the co-ordinate display in your CNC control software to read Machine Co-ordinates. The position of the machine datum is achieved when the X, Y and Z panels of the co-ordinate display all read zero.

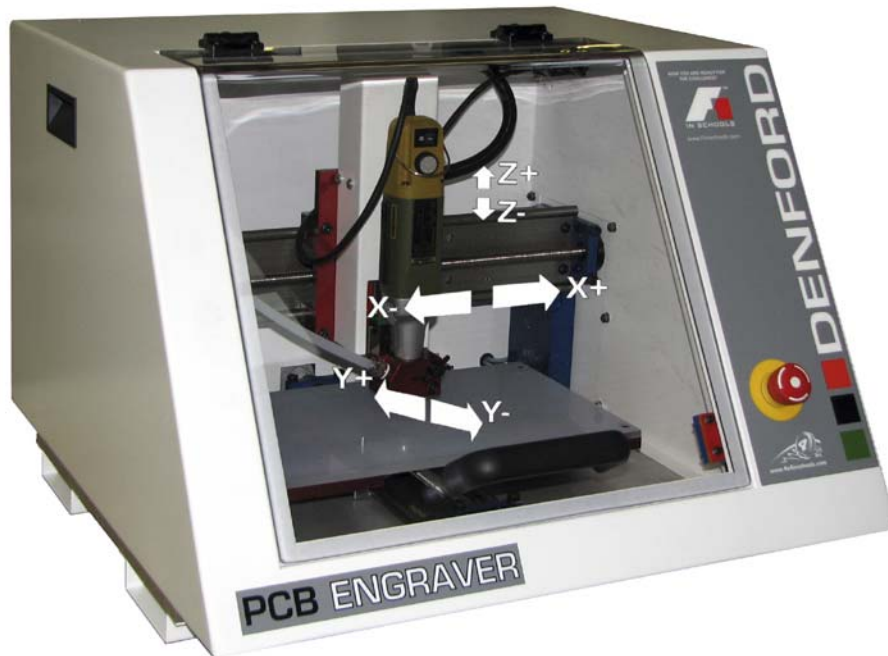
### Note

The machine datum position is set by Denford and can never be moved, since it defines the physical movement capability of the CNC machine.

In addition to homing the CNC machine after it has first been switched on, we also recommend homing the CNC machine after loading or configuring any offsets.

## 4: Manual Control - Axis Definitions (Jog)

Jog mode is used for manually controlling the CNC machine, moving the three machine axes, changing tools, operating optional equipment and configuring any offsets.



### Axis Definitions.

**X Axis** - The X axis slides run at 90 degrees to the Y and Z axes, horizontally left and right, when viewed from the front of the machine.

Minus (-) X movements run towards the left end of the machine and positive (+) X movements run towards the right end of the machine.

Jog Keys to move axis - arrow keys left and right

**Y Axis** - The Y axis slides run at 90 degrees to the X and Z axes, horizontally forwards and backwards, when viewed from the front of the machine.

Minus (-) Y movements run towards the front of the machine and positive (+) Y movements run towards the back of the machine.

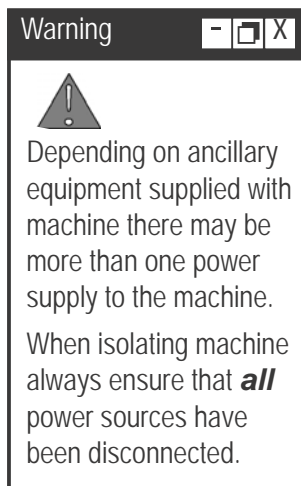
Jog Keys to move axis - arrow keys up and down

**Z Axis** - The Z axis slides runs at 90 degrees to the X and Y axes, vertically up and down, when viewed from the front of the machine.

Minus (-) Z movements run down, towards the floor of the machine and positive (+) Z movements run up, away from the floor of the machine.

Jog Keys to move axis -Page up and Page down

## 4: Machine Operators Panels



### Mains Power Switch.

To supply power to the CNC machine, depress left-hand side of the switch immediately above the power inlet socket. To cut power to the CNC machine, depress right-hand side of switch.

Do not cut the mains power when machining or processing of any operational instructions is taking place.

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### Emergency Stop Button.

The emergency stop button is a circular red push button. Pressing the emergency stop button has the effect of stopping all axes and spindle movements immediately. To activate an emergency stop, press the button in fully until it clicks. The emergency stop button will remain closed (continuing to cut all power to the machine drives) until the release sequence is performed. To release a closed emergency stop button, push and turn the button clockwise until it springs back out.



## 5: Spindle Motor Controls and Features

The spindle motor has an intermittent duty cycle - 100W S3-50 40min.

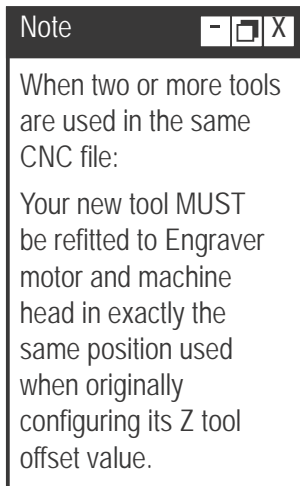
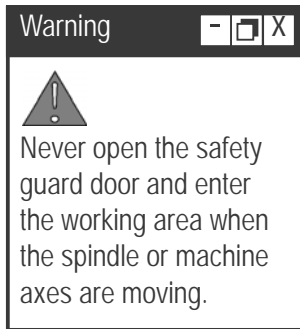
i.e. the motor can be run continuously at 100W for a maximum of 20 minutes in any 40 minute cycle. For the remainder of the cycle it must be allowed to cool before being used again.

If this duty cycle is likely to be exceeded, then it is highly recommended that a spare motor be purchased to alternate with the original motor.

A second motor also improves tool change times in that the tool change on one motor can be done in parallel with cutting on the other motor.



## 5: Performing a Tool Change



### Performing a Manually Requested Tool Change.

Before beginning a manual tool change operation, we recommend you home the Y and Z machine axes and drive the X axis to roughly the mid point on its axis. When the axes are in this position, the maximum amount of free space will be available in the working area, allowing easier access to the tooling.

### Performing an Automatically Requested Tool Change during the running of a CNC program.

On reading a tool change operation line in your CNC program, all three machine axes will move to their home positions, via an intermediate point, if programmed.

At this point, the software will pause the CNC program and a message window will be displayed, prompting you to manually change tools.

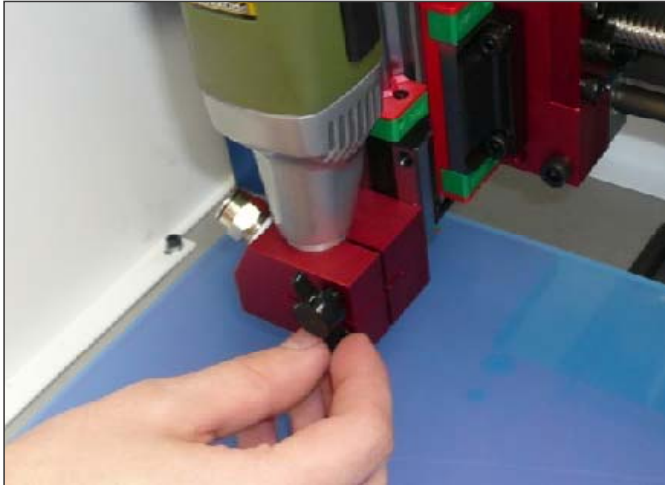
Always wait for the spindle and machine axes to stop moving, before attempting to open the safety guard door.

Replace the current tool number with the tool number specified in the software message window (the tool profiles allocated to each tool number may be listed at the beginning of your CNC program).

Close the safety guard door and clear the software message window to resume your machining.



## 5: Performing a Tool Change



Remove the Spindle Motor from the machine using the thumbscrew as shown.



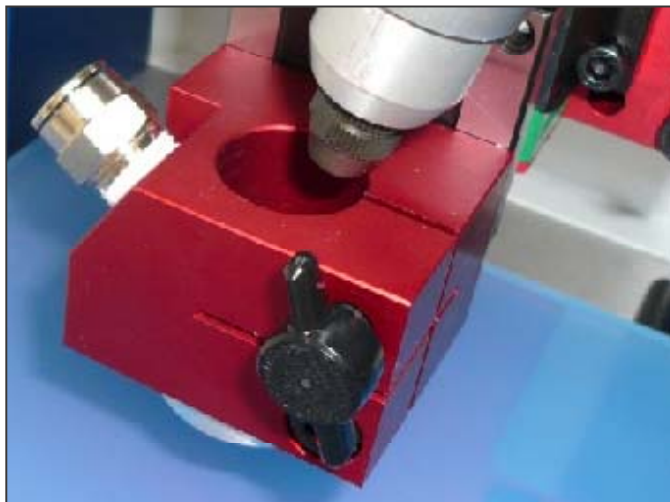
Release tool collet by pressing on the button and turning the spanner supplied. Insert engraving tool and very lightly tighten the collet.



Using the tool setting gauge, push the tool into the spindle on the Z=0 setting. Now fully tighten the collet.



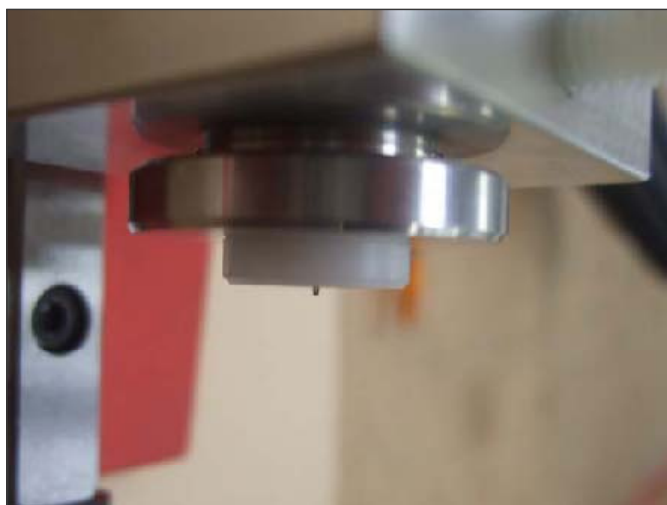
## 5: Performing a Tool Change



Place the spindle motor back into the floating assembly. Make sure the clamp is clean and free from debris. Retighten the thumb screw.



Loosen the cap screw and adjust the floating ring by turning until the tool tip protrudes...

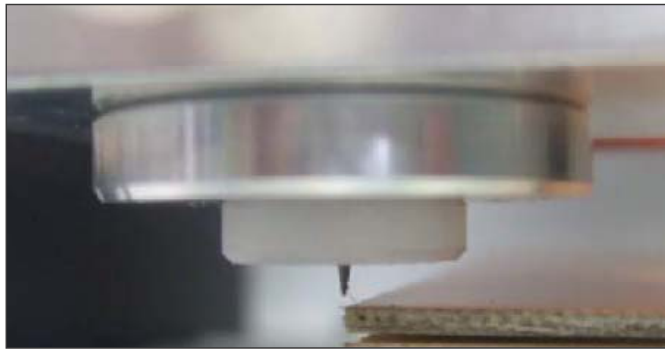


The tool should protrude just enough to break the surface of the engraving material or PCB. Now tighten the cap screw.

## 5: Performing a Tool Change

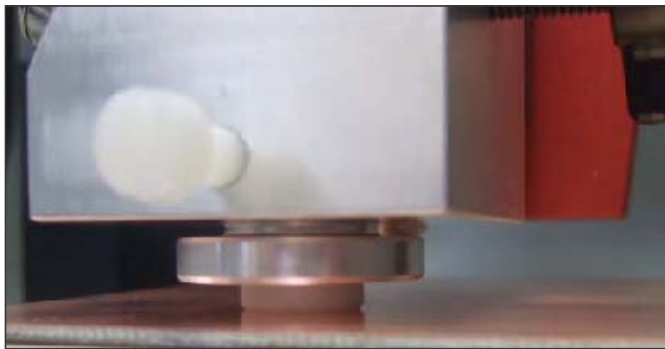



Now that the floating ring has been set, there should be no need to change this again. Simply use the tool depth gauge whenever changing tools in future.



Now fasten the material to the table (usually with quality double-sided tape) and JOG the machine to the corner of the material.

Set the X and Y DATUM positions here by clicking  for X and Y.

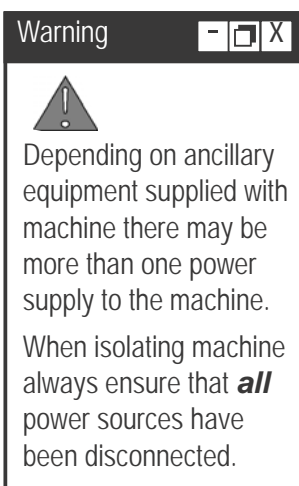
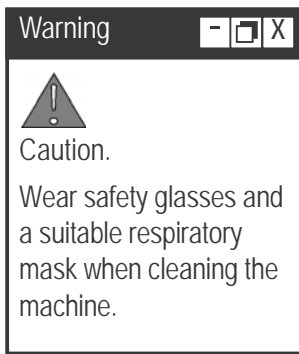


Now turn the spindle motor ON and jog down until the tool goes into the surface and the floating head lifts by a few mm. Now set DATUM for Z. 



Setting up different tools is now simple-just set the tool with the gauge. If you want to use a drilling tool, then use the gauge to set how far the tool will protrude and thus travel into the material.

# 6: Planning Procedure for Maintenance Work



When carrying out any maintenance, pay special attention to the following items, ensuring safe and correct working procedures in accordance with Health and Safety Regulations in your establishment:

- Before starting any maintenance work, define the task and obtain the information relevant to carry out the maintenance. Also, define the time period needed to complete the task, to obtain the correct tools and order any spare parts, if required.
- During the maintenance work period, display a suitable notice stating that the machine is under maintenance and should not be used until the notice is removed.
- Safety must be a priority when carrying out any maintenance work. Covers and safety guards that are removed during the maintenance work must be replaced after the task is completed.
- All work must be carried out by suitably qualified personnel.
- Never attempt to access the electronic hardware systems of the machine with the mains power switched ON.
- Hazardous voltages can still exist immediately after switching off the power. If the machine has previously been switched on, wait at least 5 minutes before attempting to open the electrical panel access plate.
- When replacing electrical components, ensure the new parts are of suitable replacement specification.
- All work completed on the machine, whether progressive, or preventative, should be logged to ensure a complete service record is available for future referral. We recommend the following two pages are used to log any maintenance tasks undertaken.
- When maintenance work has been completed, check that the replaced or serviced parts work correctly, before allowing general operation of the machine.

## 7: Maintenance Schedule

Every Day (and, if necessary between components)

- Clear dust from working area of machine and ensure that the surfaces of the spindle, tool housing and tool are clean - **do not use compressed air.**

Every Week

- Clean the machine thoroughly.
- Clean dust from Engraver motor - see p28.
- Lubricate the slideways and leadscrews - see p29
- Check all exposed screws and nuts for tightness.
- Visually check door for signs of cracks or chips.  
**Any damage should be reported immediately to Denford and a suitable replacement obtained without delay.**  
**Door Part Number PCB/0401D**

Every Two Months

- Check the condition of any electrical connections.
- Check and thoroughly clean all components of the tooling system.
- Check all cables for kinks and breaks.
- Check door hinges for correct tension and adjust if necessary  
The centre screw of each hinge should be tightened, with an appropriate tool, sufficiently to hold the door open with the top section of the door perpendicular to the cabinet top.  
**If this condition cannot be achieved, new hinges should be obtained and fitted without delay.**  
**Denford part Number BI01229/A**

Every Three Months

- Clean microswitches - see p28

## 7: Cleaning the Engraver Motor

Carefully remove any dust and debris from all air passages and vents using a vacuum cleaner or soft brush. DO NOT use compressed air for this purpose. Pay particular attention to any dust or debris that may have been drawn into the motor.

## 7: Cleaning the Microswitches

The X,Y Z axis all have microswitches

Using a soft bristled brush, carefully clean dust and debris away from the microswitch, to an area where it can be removed using a vacuum cleaner.



The Y axis switch is mounted in front of the rear wall of the cabinet adjacent to the R.H. column.

The X axis switch is mounted on the rear face of the crossbeam and is located immediately above the Y axis switch.



The Z axis switch is located at the top R.H. corner of the head slide and is accessed by removing the the white head cover.

# 7: Lubrication of the slideways and leadscrews

## Use of Swansil Lubricant on Denford Machines

1. Clean down machine with brush and vacuum - do not use compressed air.
2. Position the Machine in mid-travel.
3. Open the guard.
4. Isolate machine from power supply.
5. Spray each lead screw and guide rail with a 2-3 second burst.
6. Leave 2-3 minutes for silicone to dry before operating the machine.

Item 1 to carried out daily or between components.

Items 2 – 6 to be carried out weekly.

***Always adhere to general instructions and warnings on Swansil can.***

For full health and safety information visit <http://www.swantek.com/html/msds/136.htm>

Do not spray into confined areas.

Any excessive over spray to be dried off with a dry, clean, lint-free cloth before operating the machine.

## 8: Maintenance Log

Date of maintenance work.	Name of personnel carrying out the maintenance.	Details of maintenance work completed.

## 8: Maintenance Log

Date of maintenance work.	Name of personnel carrying out the maintenance.	Details of maintenance work completed.



## 9: Technical Support

Denford Limited provides unlimited telephone and e-mail Technical Support on this CNC machine to registered users. On-site visits by our engineers may be chargeable. Please refer to the information held in your separate Warranty pack, for specific details.

Before contacting Denford for support, please read your hardware and software manuals and check the Denford websites for support.

Internet (access technical support and FAQ sections):

[www.denfordata.com/bb](http://www.denfordata.com/bb)

When you request support, please be at your CNC machine, with your hardware and software documentation to hand. To minimise delay, please be prepared to provide the following information:

- CNC Machine Serial Number (from the machine ID panel).
- Registered user's name / company name.
- The CNC machine control software name and version number (from the "Help/About" menu option).
- The wording of any error messages that appear on your computer screen, if applicable.
- A list of the steps that were taken to lead up to the problem.
- A list of any maintenance work that has been carried out on the CNC machine.

Contact Details:

Denford Limited,

Armytage Road, Brighouse, West Yorkshire, HD6 1QF, UK.

Telephone: 01484 728000

Fax: 01484 728100

E-mail: [customerservices@denford.co.uk](mailto:customerservices@denford.co.uk)

Technical Support: Monday to Friday 8.30am - 4.30pm GMT

For international dialling: +44 and remove first 0 in each city code.



# 10: Specification of the PCB Engraver

## Safety Features:

- Manual operation, totally enclosed cabinet with safety guard door.
- Emergency stop button.
- Toolpath graphics to verify part programs prior to machining.

## Mechanical Details:

- Travel X axis 330mm (13").
- Travel Y axis 210mm (8.3").
- Travel Z axis 40mm (1.6").
- Float Z axis 5mm (0.2").

## Dimensions:

- Machine width 570mm (22.5").
- Machine height 385mm (15.2").
- Machine depth - door closed 585mm (23").

## Weights:

- Machine weight 43 kg (95 lb).

## Electrical Details:

- Mains supply required:  
220/240Volts, 50Hz, 5 Amps.
- Spindle motor: 100W S3-50 40min.
- Spindle Speeds: 5000 - 20,000 RPM.
- Axis stepper motors

## Performance:

- Rapid traverse rate up to 5000 mm/min (197 in./min)
- Max Feed traverse rate up to 5000 mm/min (197 in./min)



# 10 : EC Declaration of Conformity for Machines Prior to 29.12.09

## EC Declaration of Conformity

The responsible person	Mr P T Harkness
Business Name	Denford Limited
Address	Brighouse West Yorkshire United Kingdom

Declares that the machinery described:

1. Make	Denford Limited
2. Model	PCB Engraver
3. Serial Number	

Conforms to the following Directives	The Machinery Directive 98/37/EC The EMC Directive 89/336/EEC The LVD Directive 73/23/EEC
--------------------------------------	---

Also the following standards (where applicable)	.....
---	-------

And complies with the relevant health and safety requirements	.....
---	-------

Signature of responsible person	.....
---------------------------------	-------

Position	Senior Design Engineer
Signed at	Denford Limited Brighouse West Yorkshire United Kingdom

# 10 : EC Declaration of Conformity for Machines After 29.12.09

## EC Declaration of Conformity

The responsible person and  
person authorised to compile the  
Technical File

Mr P T Harkness

Business Name

Denford Limited

Address

Armytage Road  
Brighouse  
West Yorkshire  
HD6 1QF  
United Kingdom

Declares that the machinery described:

1. Make

Denford Limited

2. Model

PCB Engraver Standard Engraver

3. Serial Number

Fulfils the relevant provisions of  
the following Directives

Machinery Directive 2006/42/EC  
Low Voltage Directive (LVD) 2006/95/EC  
EMC Directive (2004/108/EC).

Also the following standards  
(where applicable)

EN 953 1997 + A1 2009: Safety of machinery – Guards. General requirements for the design and construction of fixed and movable guards.  
EN 954-1 1997: Safety of machinery - Control systems - Part 1 General principles for design.  
EN 60204-1 2006: Safety of Machinery - Electrical-equipment of machines Part 1 General requirements.  
EN ISO 12100-1 2003: Safety of machinery. Basic concepts, general principles for design - Part 1 Basic terminology, methodology.  
EN ISO 12100-2 : Safety of machinery. Basic concepts, general principles for design - Part 2: Technical principles.  
EN ISO 13732-1 2006: Ergonomics of the thermal environment. Methods for the assessment of human responses to contact with surfaces - Part 1: Hot surfaces.  
EN ISO 13850 2008: Safety of machinery - Emergency stop -Principles for design.  
BS EN ISO 14121-1 2007: Safety of machinery - Risk assessment Part 1 Principles.  
EN 55011 2007: Limits and methods of radio interference characteristics of industrial, scientific and medical equipment. Conducted Emissions.  
EN 55011 2007: Limits and methods of radio interference characteristics of industrial, scientific and medical equipment. Radiated Emissions.  
EN 61000-4-2: 1995 +A1 +A2 2001: Testing and Measurement Techniques; Electrostatic Discharge immunity test.  
EN 61000-4-3: 2002 +A1 + A2 2005: Electromagnetic Compatibility – Basic Immunity Standard. Radiated radio frequency electromagnetic field immunity test.  
EN 61000-4-4 2004: Testing and measurement techniques. Electrical fast burst/transient immunity test.

Signature of responsible person

.....

Position

Senior Design Engineer

Signed at

Denford Ltd., Armytage Road, Brighouse

Date

.....



# 10 : PCB Engraver Series Noise Level Test

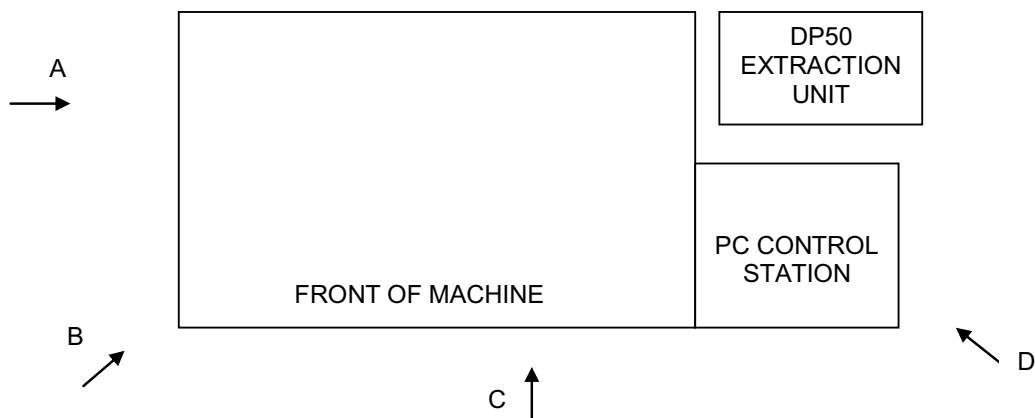
## Noise Level test

Test Report No: NL-PCB-01S  
Machinery Manufacturer: Denford Limited.  
Machinery Type/Model: PCB Engraver

Equipment:  
Meter Ref. Standard ST-805  
Denford PCB Engraver  
DP50 Extraction Unit

### Test Conditions:

Spindle speed: 0 - 20000 RPM.  
Axis speed: 0 - 5000 mm/min  
Ambient background noise: <50 dB(A).



A, B, C, & D are measurement positions 1 metre from the machine and at height of 1.6 metres above floor level.

### Results;

All values are measured in dB(A)

Condition	A	B	C	D
Test Program	72	72	73	74

### Test Program

Spindle speed varying between 0 and 20000 RPM  
Machine axes in combination 0 to 5000mm/min.  
Extraction unit ran continuously during test.

The entire test cycle was run at each of the positions shown and the maximum figures registered at each position were recorded in the above table.

# 11: Glossary

BILLET .....	A small, usually rectangular, bar of wood or metal in an intermediate stage of manufacture.
CAD .....	Computer Aided Design - the use of a wide range of computer based tools that assist engineers, architects and other design professionals in their design of "real world" objects.
CAM.....	Computer Aided Manufacture - software that is capable of creating tool cutter paths in a number of different axes for different CNC systems. Usually taking the design input from CAD system.
CNC.....	Computer Numerical Control - a computerised system of hardware and software, which controls the movement of a machine tool.
DRIVE .....	The controller unit for a disk system.
DRY RUN .....	An operation used to test how a CNC program will function without driving the machine itself.
DWELL .....	A programmed time delay.
EDIT .....	The mode used for altering the content of a CNC program via the Desktop Tutor or qwerty keyboard.
END OF BLOCK SIGNAL ...	The symbol or indicator ( ; ) that defines the end of a block of data. The equivalent of the pc [return] key.
ERROR.....	The deviation of an attained value from a desired value.
G-CODE .....	The programming language understood by the machine controller.
FEEDRATE .....	The rate, in mm/min or in/min at which the cutting tool is advanced into the workpiece. For milling and drilling, the feedrate applies to the reference point on the end of the axis of the tool.
FILE .....	An arrangement of instructions or information, usually referring to work or control settings.
FORMAT .....	The pattern or way that data is organised.
FNC .....	FANUC Miller file, extension ".fnc". Contains G and M codes describing the machine and cutting operations.
G CODE .....	A preparatory code function in a CNC program that determines the control mode.
HARDWARE .....	Equipment such as the machine tool, the controller, or the computer.
HOME .....	Operation to send the axes of the CNC machine to their extreme limits of movement. Defines the co-ordinate based grid system of the CNC machine. Commonly referred to as homing the machine, or sending the machine to its home position.
INCREMENTAL .....	Incremental programming uses co-ordinate movements that are related from the previous programmed position. Signs are used to indicate the direction of movement.
INPUT .....	The transfer of external information (data) into a control system.
INTERFACE .....	The medium through which the control/computer directs the machine tool.



# 11: Glossary

JOG CONTROL.....	Manual movement mode for the machine axes, using very small pre-defined movements, called jog steps. One stepped movement is applied per movement using the machine offset facility. key/button press.
M CODE .....	A miscellaneous code function in a CNC program used to indicate an auxiliary function (ie, coolant on, tool change etc.).
MACHINE DATUM .....	A fixed zero reference point set by the machine manufacturer. The machine datum is used to define the co-ordinate based grid system of the CNC machine. All machining co-ordinates originate from this point. However, this point can be temporarily moved
MACHINE OFFSET .....	The workpiece offset file used with VR and real CNC machines.
MDI .....	Manual Data Input - A method used for manually inserting data into the control system (ie, Desktop Tutor, qwerty keyboard etc.).
MODAL .....	Modal codes entered into the controller by a CNC program are retained until changed by a code from the same modal group or cancelled.
NC .....	Numerical control.
OFFSET .....	Combination of two types of file, the workpiece offset and the tool offset. Used to describe the workpiece datum, a zero reference used on the CNC machine to ensure machining occurs in the correct place on the billet. Offsets are used to shift parts of the three dimensional co-ordinate based grid system, used by the CNC machine.
PART DATUM .....	Used as a zero reference point in a CNC file. All machining co-ordinates originate from this point.
PART PROGRAM.....	A list of coded instructions which describes how the designed part, or component, will be manufactured. The part program is also referred to as the CNC file, program, or G and M code program.
PC .....	Personal computer.
POST PROCESSOR.....	A file or setting that contains instructions for a CAM system, detailing how to create CNC code that can be understood by a particular CNC system (e.g. VR CNC Milling).
PROGRAM .....	A systematic arrangements of instructions or information to suit a piece of equipment.
RAPID TRAVERSE .....	Fast movement of the cutting tool through the 3 machine axes between cutting settings.
REFERENCE POINTS.....	The machine has 3 reference points used in setting the limits of movement for its slides (axes).
REMOVEABLE MEDIA.....	A computerised storage medium that is not permanently attached to the system, e.g. Floppy Disk, Flash Memory Card, USB Memory Key, CD/DVD disc.
Engraver MOTOR.....	The removable cutting head (motor). Also referred to as the machine head.
RPM.....	Revolutions per minute (rev/min) - a measure of spindle speed.
SLIDES.....	The 3 machine axes - see axis.
SPINDLE SPEED .....	The rate of rotation (velocity) of the machine head / cutting tool, measured in RPM.
SOFTWARE .....	Programs, tool lists, sequence of instructions etc...



# 11: Glossary

TOOL OFFSET .....	When machining, allowances must be made for the size of tools being used, since they all differ in length. The tool offset is the amount the Z value must be moved (or offset), so that all the different cutting tool tips used line up with each other, so they can all be used by one CNC file. See OFFSET.
TRAVERSE .....	Movement of the cutting tool through the 3 machine axes between cutting settings.
TXT .....	Standard Windows text only file, extension ".txt".
WORK (WORKPIECE) .....	The actual material being machined. The work is sometimes referred to as the billet or stock.
WORKPIECE DATUM .....	Used as a zero reference point on the real billet. All machining co-ordinates originate from this point, when offset files are used.
WORKPIECE OFFSET .....	A file containing X, Y and Z values that can shift the entire three dimensional co-ordinate based grid system, used by the CNC machine. See OFFSET.
WORD .....	A combination of a letter address and digits, used in a CNC program (ie, G42, M04 etc.).
VIRTUAL REALITY.....	A fully interactive, three dimensional, computer based simulation of a real world object or event.
Z TOOL OFFSET .....	See Tool Offset





## 12: Notes

Use this page to make a note of any parts of the software you have changed or configured, for example, common tooling set-ups, machine parameters, changes to installation paths or passwords etc.

[illegible]

## Contact Details :

Denford Limited,  
Armytage Road, Brighouse,  
West Yorkshire, HD6 1QF,  
UK.

## For General Enquiries :

Telephone: 01484 728000  
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## For Customer Services and Technical Support :

For Free Online Technical Support visit Denford's Technical Forum at :

[www.denfordata.com/bb](http://www.denfordata.com/bb)

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E-mail: [customerservices@denford.co.uk](mailto:customerservices@denford.co.uk)  
Technical Support: Monday to Friday 8.30am - 4.30pm GMT  
For international dialling from outside the UK: Add "44" to the number and remove the first "0" from each city code.

## Disclaimer :

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## Language :

This manual is written using European English.

## Questions and Comments :

Any questions and comments regarding this guide should be referred to the following e-mail address: [customerservices@denford.co.uk](mailto:customerservices@denford.co.uk). Alternatively, telephone Denford Customer Services on 01484 728000 and ask to speak to a member of our Technical Authoring Team.

