

Vertical router  
CNC Machine  
User's Manual



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## 1: Notes

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# 1: Warning Notices

## Warranty Disclaimer.

The Warranty on your Vertical Router will be invalidated if any modifications, additional ancillary equipment is 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.

## Maintenance Disclaimer.

Always obtain permission from the person responsible for machinery in your establishment, before accessing the electrical control panel or Vertical Router 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 the machine systems and injury to the maintenance personnel. Denford Limited **cannot accept responsibility** for any damage, injury and/or loss that may occur through incorrect maintenance of your Vertical Router.

## Foreseen Use of Machine.

Your Vertical Router is designed for routing hard and soft woods, certain ceramics and plastics. In each case, the appropriate tooling, speeds and feeds should be used as recommended by the material supplier. Facility is provided for dust extraction. Always use the machine coupled to a vacuum system.

Your Vertical Router is **not** intended for use with any ferrous or metallic materials.

Do **not** attempt to use your Vertical Router for manual operations.

Do **not** remove the router head and attempt to use it independently of the machine.

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 (CO<sub>2</sub> 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 Vertical Router CNC machine, including any operational features of <b>hardware specific to the Vertical Router series</b>.</p> <p>This manual does not provide any information regarding the software packages used to control your Vertical Router - please refer to the help section in the machine control software.</p> <p>Please note that the Electrical Diagrams for your Vertical Router 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 <b>specification, servicing, or features of your Vertical Router, please contact Denford Customer Services</b>. Denford Limited reserves the <b>right to change the specification and/or operating features</b> regarding this CNC machine without notice or documentation.</p>
Disclaimer	<p>Please note that due to the nature of hardware and software developments, <b>the specifications and features of this product can change without notice</b>. 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 <b>may be different for the configuration of the CNC machine control software</b> being used to control your Vertical Router.</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 Vertical Router

Congratulations on your purchase of a Vertical Router series CNC machine. In this manual you will learn how to setup and use your Machine correctly and safely.



Your Vertical Router is a full three axes CNC router with a large work area, allowing machining of materials approaching 1380x1040mm 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 20m/min your Vertical Router is the ideal partner for intensive 3D applications, such as the F1 Team in Schools CAD/CAM Design Challenge ([www.f1inschools.co.uk](http://www.f1inschools.co.uk)) Land Rover4x4 challenge. Your Vertical Router 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 Wood, MDF, Wax, Plastics and Acrylics.
- Links to various CAD/CAM software packages.
- Totally enclosed high visibility interlocked guard.
- Feedrate override control.
- Dust extraction.

# 1: Before Beginning to Setup

Before beginning to set up your Vertical Router, 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 Vertical Router CNC machine.

- Vertical Router CNC Machine. Note that the precise specification of your CNC machine will depend on any options selected at the time of ordering (see below).
- 1 x Set of Workholding Clamps
- 1/4" Collet and 1/2" Collet
- 1 x Allen (hex) keys pack.
- 2 x Router head spanners.
- External USB Cable
- 1/4"Dia. Ball Nose Cutter
- 1 x Vertical Router warranty pack (UK Machines only)
- 1 x CD-ROM containing Denford VR CNC Machine Control Software and manuals, and Machine user's manual.
- 1 x VR CNC Machine Control Software Security Key (dongle) or Flash screen software (supplied on removeable media).
- Swansil Lubricant.

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

- Additional Software: CAD/CAM, Offline CNC Machine Control.
- CNC Machine Control software security keys (dongles) or licence disks.
- PC workstation.
- Dust extraction unit.
- 4th Axis Programmable Rotary Fixture inc. QuickCAM 4D (Site Licence).
- F1 in Schools Car Manufacturing Fixture (for both D and R Type Cars)
- 4th Axis F1 in Schools Car Manufacturing Conversion Kit
- Various tooling packages.
- Courseware, project books and project material packages.
- Video conferencing system.
- Additional and/or on-site training courses.
- On-site CNC machine commissioning.



## 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 guard door with interlock 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.

## 2: Safety Features - Emergency Stop Button



A circular, red emergency stop button is located on the right hand side of your Vertical Router located below the feed and speed override buttons. When pressed, it has the effect of stopping all axes and spindle movements immediately. The guard interlock switch will also close. When the safety guard door is in its closed position, this will prevent access to the working area of the CNC machine.

To active an emergency stop, press the button in until it clicks. The emergency stop button will continue to cut all power to the machine drives and continue to keep the interlock switch closed, 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.

## 2: Safety Features - Interlock Guard Switch

### Note

A closed safety guard door cannot be opened when:

- The machine is switched off (ie, not in use). To release the interlock guard switch, supply power to the machine.
- The emergency stop button is fully pressed in. To release the lock, push in and turn the emergency stop button counter-clockwise until it springs back out to its ready position.
- Machining is taking place. The interlock guard switch will release when the machining operations have been completed and the machine controlling software is operating in Jog Mode.

### Warning



**Danger of serious injury!**  
Do not let unauthorised personnel use the machine when the guard lock feature is disabled. Ensure the guard lock feature is switched back on as soon as possible. Under no circumstances must the safety switch actuator be removed (or a spare or replacement actuator, or other device be used) to defeat the safety interlocking system.

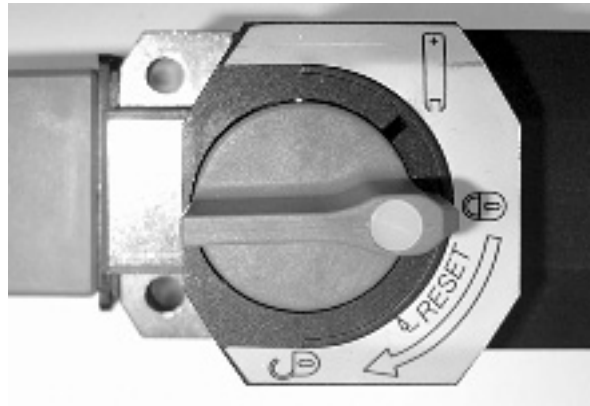
An interlock guard actuator is fitted to the front machine door. The switch unit itself is attached to the bottom of the door frame.

The lock must be manually released to enter the working area when the 24 volt circuit has failed and the door is clamped electrically.

An override facility is provided on the interlock guard switch, allowing **temporary** removal of the guard lock feature.

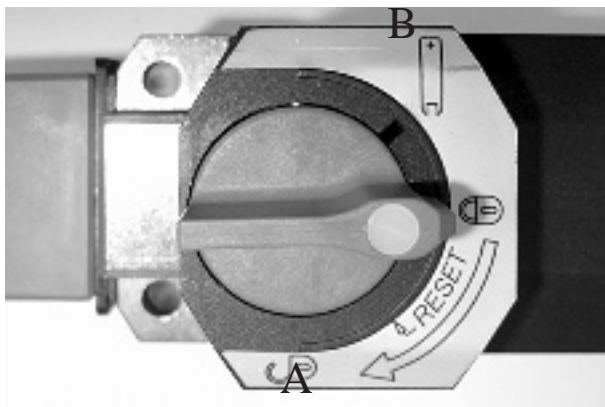
For manual interlock release, the power supply must be switched off.

This work should only be carried out by authorised personnel. If the machine is left unattended before this procedure has been completed, a prominent warning must be posted on the machine informing users that the safety guard door lock is not operating, and that the machine must not be used.



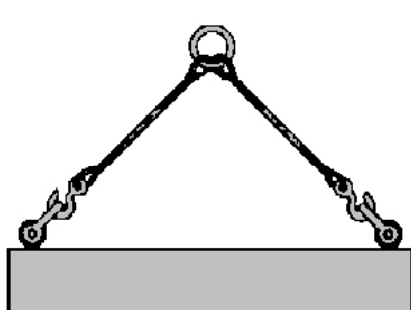
## 2: Safety Features - Interlock Guard Switch cont..

- 1) Locate 2 cap head screws in the Tee slot in the bottom section of the L.H. door frame.
  - 2) Remove cap screws. This will allow the door to open, leaving the switch actuator engaged in the interlock switch.
  - 3) To release actuator from switch, turn lever on top of switch clockwise to the unlocked position (position A).
  - 4) To reset switch, turn lever anti-clockwise to reset position and insert release tool. (Position B)
- Turn lever anti-clockwise to locked position.
- 5) Ensure that 24v supply is restored and that switch is in the locked position before checking functioning of interlock switch.
  - 6) With machine powered up and E Stop button depressed, engage actuator in switch. The actuator should be retained in the switch. Releasing the E Stop button should release the actuator.
  - 7) Refit actuator to door and close door, before returning machine to users.



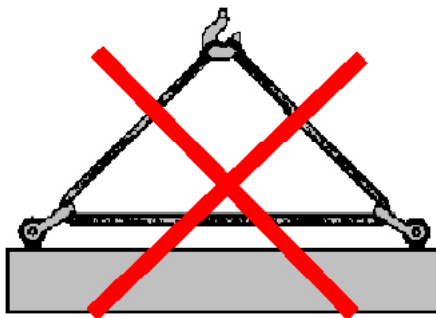
### 3: Lifting and moving your CNC Machine

# SAFE LIFTING



#### Correct method

of fitting pairs of collar eyebolts, eyebolts with link, and Swivel Hoist Rings



#### Incorrect method

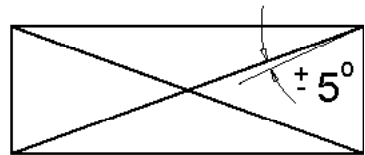
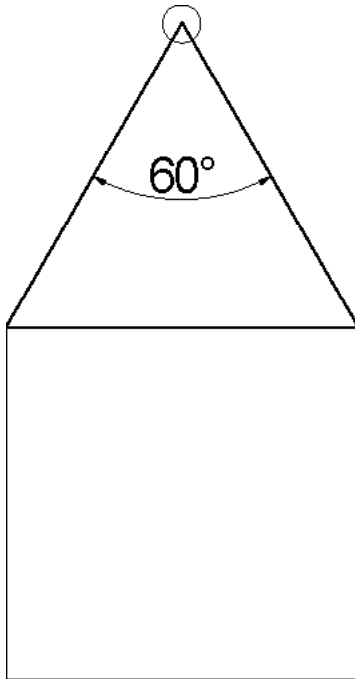
of fitting pairs of collar eyebolts, eyebolts with link, and Swivel Hoist Rings

Fitting pairs of collar eyebolts.

The plane of the eye of each of a pair of collar eyebolts should ideally be within  $\pm 5^\circ$  of the plane containing the axes of the two eyebolts. This may be achieved by the insertion of shims, which should not exceed in thickness half the pitch of the relevant screw thread, or by machining the contacting surface, but **not the underside of the eyebolt collar**. Under no circumstances should the eyebolt be over-tightened in an attempt to achieve correct alignment. Care should also be taken to avoid an alignment whereby the application of the angular load tends to unscrew the eyebolt from its seating.

### 3: Lifting and moving your CNC Machine

All 4 lifting points must be used, and slings adjusted to ensure equal loading on all 4 lifting points. The included angle between any pair of chains must not exceed  $60^\circ$ , requiring sling lengths of 2100mm each. Safe working load for each sling to be no less than 0.26 tonnes.



***ALL EYEBOLTS AND SHACKLES REMAIN THE PROPERTY OF DENFORD LTD., AND SHOULD BE RETURNED WITH SHIPPER.***



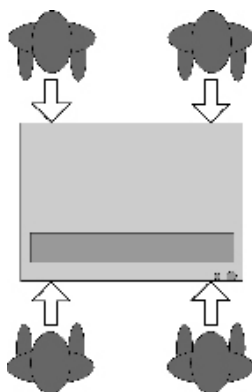
### 3: Lifting & moving your CNC Machine

Denford cannot advise manual lifting for this machine as your Vertical Router weighs 458 KG (1007 lbs). Take suitable precautions when moving the router (see text below).

When your Vertical router has been delivered you must make sure the stabilising feet are in the raised position prior to moving.

Denford recommends that four or more persons should be used to move the Vertical Router, one at each corner of the machine, as illustrated in the diagram below. Always take precautions in accordance with Health and Safety Regulations in your establishment.

Do not tip the CNC machine whilst moving.



#### Points to Note.

Do not use a forklift to move this machine.

To transport your Vertical Router over long distances a lorry fitted with a tail lift must be used.

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

Site your machine in a well ventilated room. The Vertical Router is a floor mounted machine, so it should be sited on flooring suitable to with stand the weight of the machine plus operator and computer equipment.

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).

Sufficient room should also be provided for effective maintenance to be carried out around the machine itself. In particular, leave enough space for opening the electrical panel door at the L. H. 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.

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.

The use of a centralised extraction system or, where possible locating the extraction unit in a separate room, will help in noise reduction. Again, if a vacuum pump is being used in conjunction with a vacuum work holding feature, remote location would

#### Dimensional Data

Machine Width A = 2795mm (110")  
(electrical cabinet open)

Machine Width B = 2280mm (89")

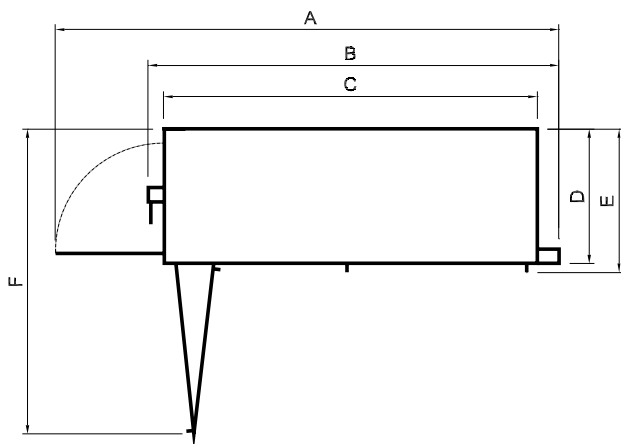
Machine Height = 1920mm (76")

Machine Depth

D= 750mm (30") without door handles

E= 800mm (32") with door handles

F= 1750mm (69") cabinet door open

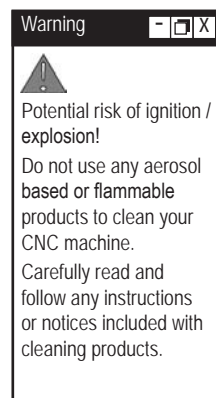


### 3: Removing Protective Coatings and Packaging

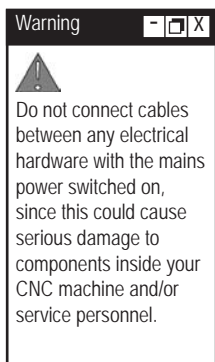
Once your Vertical Router has been sited and connected electrically, the protective coatings and transit packaging must be removed to prepare the machine for running:

- 1) The protective plastic sheeting on the guard doors and windows must be removed prior to cleaning them 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.
- 3) To gain entry to the working area of the machine, power must be supplied to the machine, in order to release the switch unit that locks the safety guard door. Note that the switch unit will also remain locked when the emergency stop button is fully pressed in.

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.



# 3: Connecting to the machine



## Mains Supply

Your Vertical Router is delivered with 3 core mains cable (1.5mm<sup>2</sup> per core) and a standard 13 Amp plug.

Mains supply required: 220/240 Volts, 50 Hz, 13 Amps

Note: Machine must NOT be connected through an RCD. The supply should be fitted with a 16Amp motor circuit breaker Type'D'.

Spindle motor: 1.68 kW, 2.25 HP, 21000 RPM.

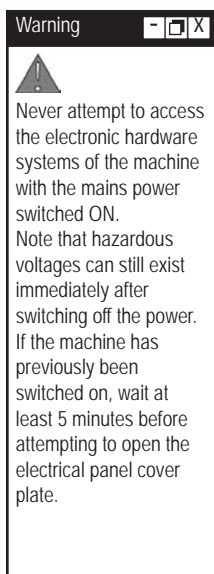
## Communications

For guidance and diagrams on connecting the communication cables to you computer please install VR milling software and refer to the 'How to connect to the machine' located in the help section.

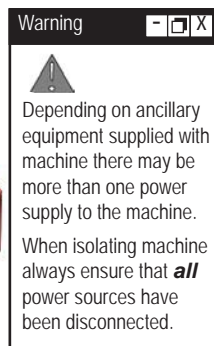
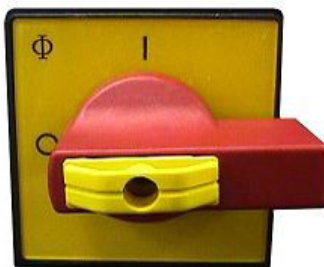
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## 3: Vertical Router Electrical Panel

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Your Vertical Router electronics are located at the left hand side of the machine. Should you need to access the electrical panel, turn the isolator to O (off), and wait at least 5 minutes before opening the cabinet door using the key provided.



### 3: Dust Extraction & General Dust Precautions

***If cutting known hazardous materials, the machine must be used with a suitable dust extraction system fitted and enabled.***

Your Router is designed to run with a dust extraction system, used 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 through hole in the left hand cabinet wall to the hole on the left hand side of the spindle motor adaptor plate.

***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 Router 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.

Laundry 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 when machining known hazardous materials, and failure to adhere to the material safety data sheets, could lead to the following health problems which are among the potential effects associated with exposure to certain dust particles:***

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

## 4: Switching the Router On

### Note

The safety guard cannot be opened until the Router is powered up to release the interlock guard switch.

### Warning



Do not connect cables between any electrical hardware with the mains power switched on, since this could seriously damage components inside your CNC machine.

### 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 on your Router:

- 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 router 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 that the guard door is fully closed.
- 5) Plug the router mains supply cable into an available power socket. Switch the power socket on.
- 6) The on/off power switch is located on the right-hand panel of the Router cabinet. To switch machine on depress the left-hand side of switch. The switch will illuminate when power is being supplied to the machine.

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

- 7) Switch on the machine controller PC and start the CNC machine control software.

Establish a communication link between your machine controller and PC.

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

## 4: Switching the Router 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.

### 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.


Follow these instructions to switch off your Denford Router off:

- 1) Wait for the Router 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 Router, 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 Router 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, Note that cutting the machine power will trigger the closing of the interlock guard switch. This will lock a closed safety guard door in position, preventing access to the machine working area. The interlock guard switch will automatically reopen when power is next supplied to your Router.
- 7) Switch off the mains power socket.


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

**Note** 

The sequence of events required to home the router 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.

**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.

**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.

Immediately after establishing a communication link between the CNC control software and the Router, 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 router 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.

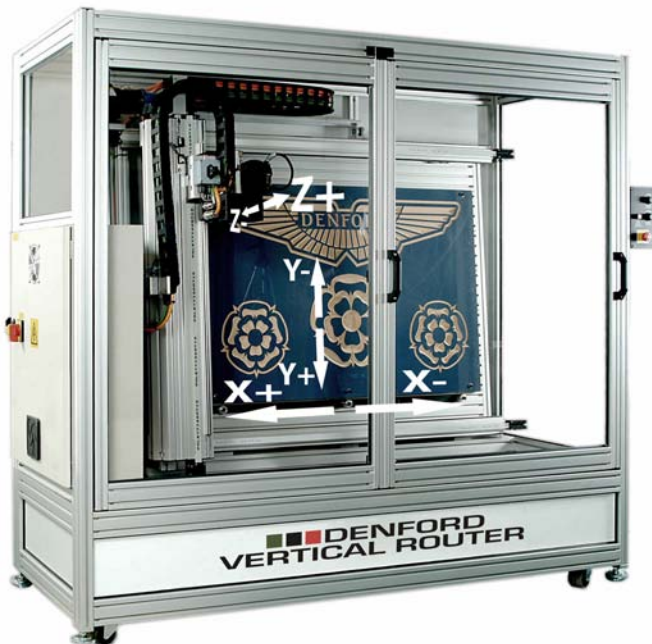
After homing the machine, the zero position of the three dimensional co-ordinate grid system is referred to as the machine datum. You can find the position of the machine datum by switching the co-ordinate display in your CNC control software to read Machine Co-ordinates. The position of the machine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

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 right and left, when viewed from the front of the machine.

Minus (-) X movements run towards the right end of the machine and positive (+) X movements run towards the left 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, vertically up and down, when viewed from the front of the machine.

Minus (-) Y movements run towards the top of the machine and positive (+) Y movements run towards the bottom 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, horizontally backwards and forwards, when viewed from the front of the machine.

Minus (-) Z movements run backward towards the bed of the machine and positive (+) Z movements run forwards away from the bed of the machine.

Jog Keys to move axis -Page up and Page down

## 4: Front Machine Operators Panel

### Note

The spindle speed must be overridden using the CNC machine control software (please refer to your separate CNC Machine Control Software User's Manual for details regarding this feature). The spindle speed can be overridden between 50% and 120%.

### Feedrate/Spindle speed Override Control.

The feedrate of the Vertical Router can be manually overridden during a machining operation, using the potentiometer control dial fitted to the right end of the machine.

The feedrate can be overridden between 0% and 150%.

The Spindle speed can be overridden between 0% and 150%

To increase rotate the control dial clockwise.

To decrease rotate the control dial counter-clockwise.

The degree of adjustment applied is displayed in the CNC machine control software.

### 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.

### Mains Power Switch.

To supply power to the CNC machine, Turn the red switch on the electrical panel to 1.

To cut power to the CNC machine, turn the switch to the 0 position (off)

Do not cut the mains power when machining or processing of any operational instructions is taking place. Note that cutting the machine power will trigger the closing of the interlock guard switch. This will lock a closed safety guard door in position, preventing access to the machine working area. The interlock guard switch will automatically reopen when power is next supplied to your Microrouter Compact.

### Note

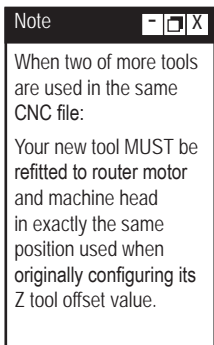
Activating an emergency stop will also trigger the interlock guard switch. This will prevent a closed safety guard door from being opened.

### 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, then wait 10 seconds for the machine systems to reset, unlocking the safety guard door.



## 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.

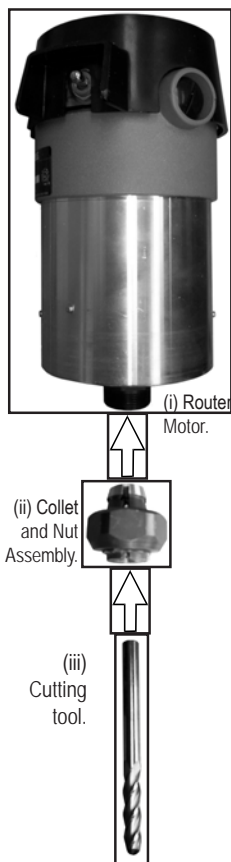
Replace the current tool number with the tool number specified in the software message window (the tool profiles allocated to each tool number may be listed at the beginning of your CNC

# 5: Performing a Tool Change

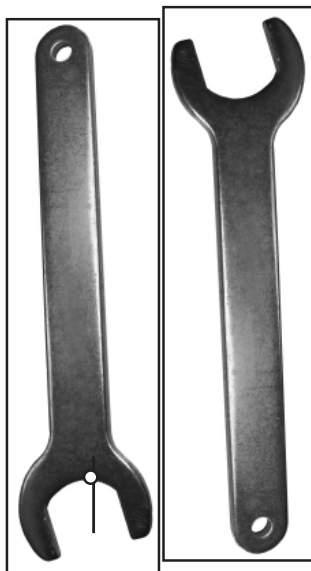
## Standard Tool Change System.

The tool change system, supplied as standard with your Vertical router, comprises four elements:

- i) The router motor with attached threaded shaft, bored to allow fitment of the cutting tool and collet assembly.
- ii) The collet and nut assembly - a tapered, tubular, split metal collet held inside the locking nut, which threads directly onto the router motor threaded shaft. Different sized collets and collet adaptors are available to allow use of cutting tools with varying shank sizes.
- iii) The cutting tool.
- iv) Special Tooling - 2 off C spanners and a 4mm allen key are supplied with the machine.

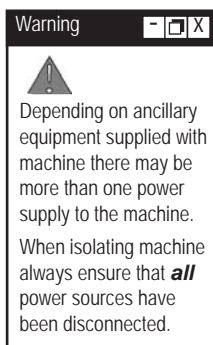
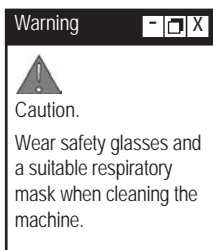


Use a 4mm allen key to release the bracket, used to secure the router motor on the machine head plate.



Use the two C spanners to tighten the locking nut onto the threaded shaft - one around the nut, the other around the shaft.

# 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 maintenance logs at the end of the maintenance section 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.

## 6: Maintenance Schedule

- At one weekly intervals the bellows covers on the bottom Z axis rail should be withdrawn to allow any dust which has ingressed to be removed by vacuum cleaner. Any dust which has settled around the top Z axis rail should be similarly removed.
- At one monthly intervals grease (Lithium based such as Shell Alvania 2 or equivalent) should be applied to the nipples on both the top and bottom Z axis bearings until grease is seen to exude from the bearings and the Z axis ball nut. A further 3 shots of grease should then be applied to purge the bearings of any dust which may have ingressed.

Between shots of grease the Z axis should be manually moved back and forth.

Remove any excess grease and dust with a clean cloth.

***Note: on later machines the Z Axis recirculating ball bearings and ballscrew have been replaced by dry liner bearings and leadscrew. See page 31 for lubrication instructions.***

- At 3 monthly intervals the X and Y rails should be examined for signs of compacted dust build up along the line of contact. If dust build up is apparent the end wipers on the X axis carriages and the top wiper on the Y axis carriage should be removed and any dust vacuumed out of the bearing housings. In extreme cases to ensure effective removal of the dust it may be necessary to cycle the machine back and forth several times along the full length of the axes. Any residual dust in the bearings will be transferred on to the rails, from where it can be removed using a clean dry cloth after ensuring that the machine is stationary. The wiper assemblies should then be replaced before the machine is put back into service.

- At 12 monthly intervals the full procedure for cleaning the X and Y bearing housings should be carried out irrespective of any apparent build up of dust on the rails.

Note Compressed air must never be used for any purpose on your Vertical Router, and no lubricant of any type should be used on the X and Y axes bearings and rails.

## 7: Lubrication of Z axis slideways and leadscrew

### Use of Swansil Lubricant on Denford Routing Machines

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

Item 4 to carried out daily or between components.

Items 4 – 6 to be carried out weekly.

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

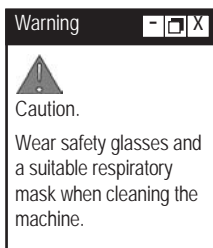
For full health and safety information visit <http://www.swantek.com/html/msds/136.htm>

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.

***When 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.***

## 7: Maintenance of the Router Motor



### Failure to Start.

Should the motor fail to start, check that the prongs on the mains power cord plug are making good contact inside the machine back panel socket. Check the on/off switch on the router motor is set to the “on” position. Check for any blown fuses (referring to the electrical diagrams delivered separately with your machine), replace them and rectify the cause.

### Lubrication.

The router motor has been lubricated with a sufficient amount of high grade lubricant for the life of the unit under normal operating conditions. No further lubrication is necessary.

### Brush Inspection.

At approximately 100 hours of use, Denford recommends you take or send your motor to your nearest authorised router motor service station or Denford agent to be thoroughly cleaned and inspected; worn parts replaced, where necessary; recharged with fresh lubricant, if required; reassembled with new brushes; and performance tested.

Any loss of power before the above maintenance check may indicate the need for immediate servicing of your router motor. Do not continue to operate the motor under these conditions.

### Cleaning the Router 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. Remove any buildup of grime resulting from working with green or sappy timber. This practice will extend the life of your motor and its brushes. Maintenance procedures for the router motor are outlined on the next page.





# 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 Vertical Router

## Safety Features:

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

## Mechanical Details:

- Table size: 1380mm x 1040mm (54" x 50").
- Travel X axis 1200mm (47").
- Travel Y axis 800mm (32").
- Travel Z axis 150mm (6").

## Dimensions:

- Machine width 2200mm (87").
- Machine height 1920mm (76").
- Machine depth - door open 1780mm (70").
- Machine depth - door closed 800mm (32").

## Weights:

- Machine weight 458 KG (1007 lb).

## Electrical Details:

- Mains supply required:
  - 220/240Volts, 50Hz, 13Amps.
  - 110/120Volts, 60Hz, 15Amps.
- Spindle motor: 1.68 kW, 2.25HP.
- Spindle Speeds: 0 - 21,000RPM.
- Axis servo motors

## Performance:

- Rapid traverse rate up to 20 m/min (780 in./min).



# 11: 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	Vertical Router
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	Brighouse West Yorkshire United Kingdom

# 11: 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	Vertical Router
3. Serial Number	
Fulfuls 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)	<p>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.</p>
Signature of responsible person	.....
Position	Senior Design Engineer
Signed at	Denford Ltd., Armytage Road, Brighouse
Date	.....



# 11: Vertical Router Series Noise Level Test

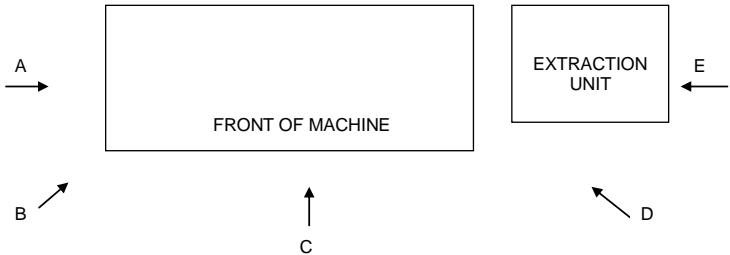
## Noise Level test

Test Report No: NL-VR1-02  
Machinery Manufacturer: Denford Limited.  
Machinery Type/Model: Vertical Router

Equipment:  
Meter Ref. Standard ST-805  
Denford Vertical Router

### Test Conditions:

Spindle speed: 0 - 21000 RPM.  
Axis speed: 0 - 20000 mm/min  
Ambient background noise: <50 dB(A).



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

### Results;

All values are measured in dB(A)

Condition	A	B	C	D	E
Test Program - Machine Only	75	77	76	75	77
Test Program - Machine and Extraction Unit	76	78	78	76	78

### Test Program

Spindle speed varying between 0 and 21000 RPM  
Machine axes in combination 0 to 20000 mm/min.

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 <b>[return]</b> 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 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.
ROUTER 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.

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on the right side, suggesting it's resting on a surface. There is no handwriting or other markings on the paper.

## Contact Details :

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

## For General Enquiries :

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

## For Sales Enquiries :

Telephone: 01484 728000  
Fax: 01484 728100  
E-mail: [sales@denford.co.uk](mailto:sales@denford.co.uk)

## 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)

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 from outside the UK: Add "44" to the number and remove the first "0" from each city code.

## Disclaimer :

Please note that due to nature of hardware and software developments, the specifications and features of this product can change without notice. The information contained in this guide is correct at the date of printing only - September 2010. If in doubt, please refer to your order and delivery invoices. 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. Denford Limited reserves the right to alter any specifications and documentation without prior notice. No part of this manual or its accompanying documents may be reproduced or transmitted in any form or by any means, electronic or mechanical, for any purpose, without the express written permission of Denford Limited. All brands and products are trademarks or registered trademarks of their respective companies. Copyright Denford Limited - Version 08.09.10. All rights reserved.

## 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.

