



Compact 1000 Router
CNC Machine
User's Manual



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1: Warning Notices

Warranty Disclaimer.

The Warranty on your Router 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 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 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 router.

Foreseen Use of Machine.

Your 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. Your Router is not intended for use with any ferrous or metallic materials. Facility is provided for dust extraction. Always use the machine coupled to a vacuum system. Do not attempt to use your Router for manual operations.

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

If you have any doubts and/or questions regarding the 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.

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 Router CNC machine, including any operational features of hardware specific to the Denford Router 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 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 specification, servicing, or features of your Router, 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 - November, 2006. 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 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: customerservices@denford.co.uk</p>

1: Introducing your Compact 1000 Router

Congratulations on your purchase of a Compact 1000 series CNC machine. In this manual you will learn how to setup and use your Machine correctly and safely.



Your Router is a full three axes CNC router with a large work area, allowing machining of materials approaching 400 x 240mm 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 Router is the ideal partner for intensive 3D applications, such as the F1 in Schools Formula One Technology Challenge (www.f1inschools.co.uk) and the 4x4 in Schools Technology Challenge (www.4x4inschools.co.uk). Your Compact 1000 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 ready.

1: Before Beginning to Setup

Before beginning to set up your Compact 1000, 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 Router CNC machine :

- Compact 1000 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 Compact 1000 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).

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/or PC & PC workstation.
- Vacuum for dust collection.
- Additional work holding systems.
- Various tooling packages.
- On-screen representation of industrial control systems (FANUC 21i) and optional link to industrial keypad.
- 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 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. 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.

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 Router, as shown above. 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 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 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.

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

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.

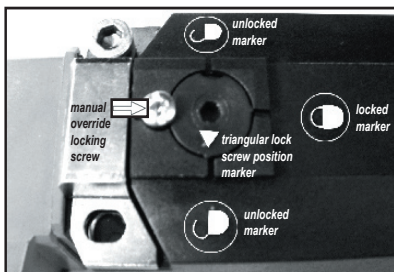
An interlock guard switch is fitted to the front machine door. The switch unit itself is attached behind the lower machine panel, accessible from beneath the front of the machine. The lock must be manually released to enter the working area when the 24 volt circuit has failed and the door is clamped electrically.



Left: The interlock guard switch unit (circled) is located behind the lower front machine panel.

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.

- 1) Working beneath the front edge of the machine, locate the interlock guard switch unit.
- 2) Using a small flat or crosshead screwdriver, loosen the manual override locking screw until the circular black plastic lock screw can be turned (refer to photograph below).
- 3) Using a 3mm allen key, turn the circular black plastic lock screw one quarter turn to switch off the guard lock feature. If in doubt refer to the lock/unlock symbols embossed on the casing surface.
- 4) If necessary, tighten the manual override locking screw slightly. If you need to leave the machine, post a warning note informing



Left: Looking directly at the face of the interlock guard switch unit.

3: Unpacking and Lifting your CNC Machine

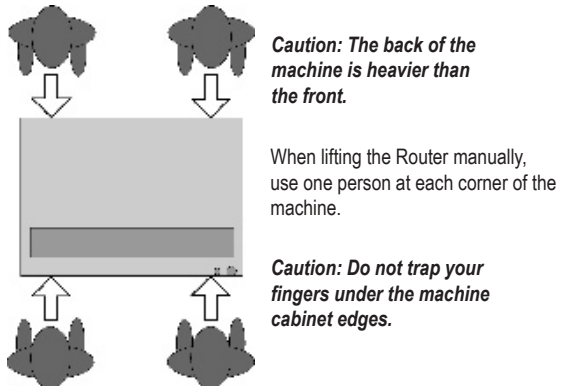
Warning



Caution.
Always use sensible lifting precautions in accordance with Health and Safety Regulations in your establishment.

If your Router 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 Router weighs 90 KG . Take suitable precautions when manually lifting the machine from the packaging (see text below).

Denford recommends that four or more persons should be used to lift the Router, one at each corner of the machine, as illustrated in the diagram below. Always use sensible lifting precautions in accordance with Health and Safety Regulations in your establishment. Ensure that your Router is both secure and balanced before lifting. Do not tip the CNC machine whilst lifting.



Points to Note.

The majority of the weight is situated at the back of the machine.

Due to the small clearance at the base of the machine, take precautions to ensure you do not trap your fingers under the edges of the machine cabinet, when lowering your Router onto a table top.

If necessary use two 100kg (220 lb) rated lifting bars to help raise the machine. Ideally lifting bars should be fed through or placed between the hollow support runners. To transport your Router over longer distances, we recommend the use of a suitably sized wheeled trolley.

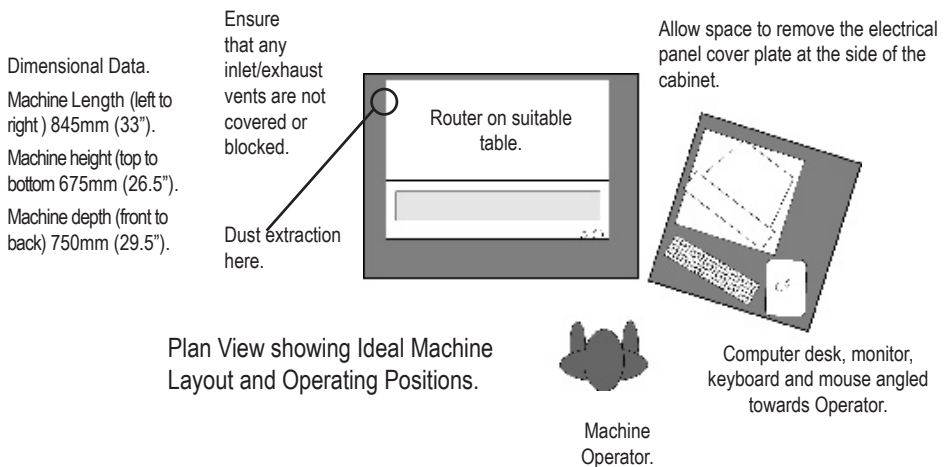
3: Choosing a Site for your CNC Machine

Site your machine in a well ventilated room. The Router is a bench mounted machine, so 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.

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 right hand 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. 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.

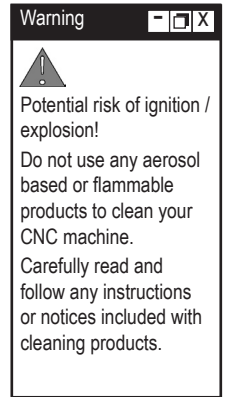


3: Removing Protective Coatings and Packaging

Once your 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 windows must be removed and the glass and perspex 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.
- 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: Dust Extraction & General Wood Precautions

Your Router is designed to run with a dust extraction system, used to remove any potentially harmful airborne wood dust particles from within the working area of the machine.

The dust extraction system used should be independently tested to ensure that dust is kept well below the maximum exposure limits set by law. Denford can supply dust extraction systems for your machine, or you may wish to connect your own system. The machine should only be used with the dust extraction system enabled.

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.

General Wood Dust Safety Precautions.

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

Wood dust particles that remain inside the working area of the Vertical Router after a part has been machined, should be removed using a vacuum.

NEVER USE A PRESSURISED 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.

Wood dust particles on the floor can cause slipping. This should be monitored by the operator and removed before it becomes 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.

The following health problems are among the effects associated with exposure to wood 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 the flexible hose from your separate dust collection vacuum system is securely fitted to the connection hole, located at the top of the left side viewing window.
 - 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 immediately above the power inlet socket. To switch machine on depress the left-hand side of switch. The switch will illuminate when power is being supplied to the machine.
 - 7) Switch on the machine controller PC and start the CNC machine control software.
- If the Router 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 (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.

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 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.
- 4) Shut down and switch off the machine controller personal computer.
- 5) 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 immediately above the power inlet socket. 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.
- 6) 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.

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.

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.

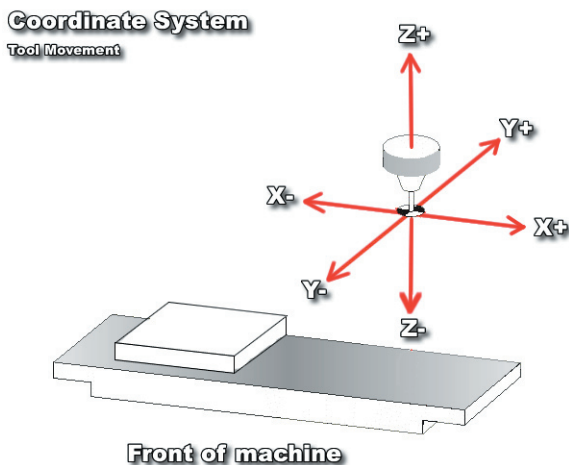
Note

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

Note the Y movements refer to table movement. The Axis notations in the above diagram refer to Tool movement relative to the table.

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.

4: Machine Operators Panel

Feedrate Override Control.

Note

Feedrate override changes will only be registered when an actual spindle speed or feedrate is being applied by the CNC control software.

The feedrate of the 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%.

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.

Mains Power Switch.

To supply power to the CNC machine, depress left-hand side of red 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. 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.

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 active 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 counter-clockwise until it springs back out, then wait 6 seconds for the machine systems to reset, unlocking the safety guard door.

5: Performing a Tool Change

Standard Tool Change System.

The tool change system, supplied as standard with your 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.



(i) Router Motor.

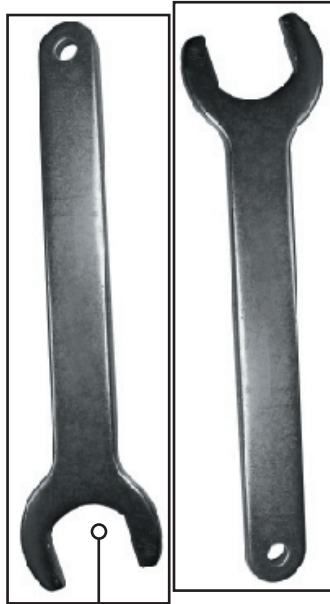
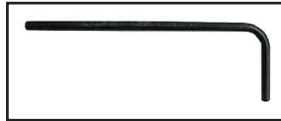


(ii) Collet and Nut Assembly.



(iii) Cutting tool.

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.

5: Performing a Tool Change

Warning [-] [□] [X]



Never open the safety guard door and enter the working area when the spindle or machine axes are moving.

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.

Note [-] [□] [X]

When two or more tools are used in the same CNC file:
Your new tool **MUST** be refitted to router motor and machine head in exactly the same position used when originally configuring its Z tool offset value.

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: Setting Tools in the Router Motor

Warning



Your Router must only be used with standard 1/4" or 1/8" shank routing bits, capable of running safely at speeds of 23,000RPM.

- Tools required:
- 2 x C Spanners (supplied).

Removing a Tool.

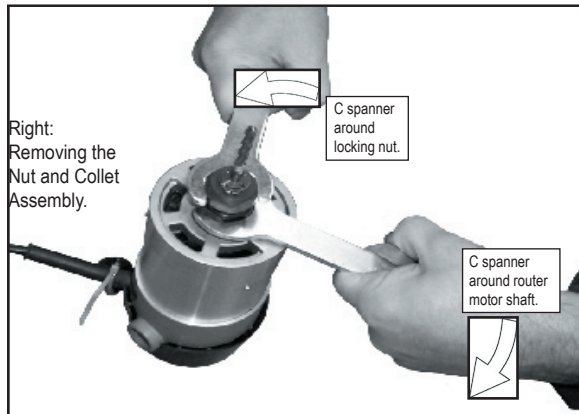
Position the first C spanner around the locking nut on the end of the router motor shaft. Position the second C spanner around the locating fixture on the router motor spindle.

To loosen the locking nut, when directly viewing the end of the router motor shaft, turn the C spanner around the locking nut in a counter-clockwise direction. Turn the C spanner around the router motor shaft in a clockwise direction, as shown in the photograph below.

Warning



Caution.
If the cutting tool has been recently used, it may still be HOT.



continued...

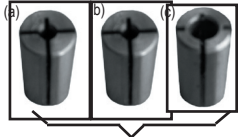
Remove the nut and collet assembly, then remove the cutting tool.

5: Setting Tools in the Router Motor

Note
Metric convertor collets (to allow fitment of metric shank tools) and various tooling packages are available as options.

Refitting a Tool.

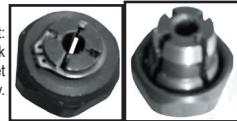
Select the correct nut and collet assembly, according to the shank size of your new cutting tool, as shown in the photograph below.



Right: From left to right, collets to convert from 1/2" to (a) 1/8" shank tools, (b) 3mm shank tools and (c) 6mm shank tools. The convertor collets fit inside the 1/2" nut and collet assembly.



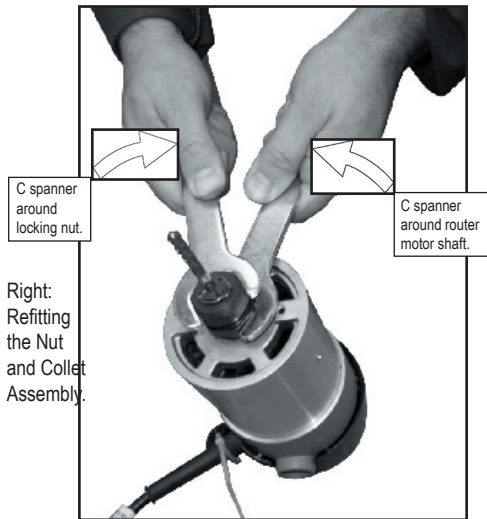
Right: 1/2" shank nut and collet assembly.



Left: 1/4" shank nut and collet assembly.

Hand thread the locking nut back onto the router motor shaft, then insert the cutting tool into the nut and collet assembly. Position the first C spanner around the locking nut on the end of the router motor shaft. Position the second C spanner around the locating fixture on the router motor spindle.

To tighten the locking nut, when directly viewing the end of the router motor shaft, turn the C spanner around the locking nut in a clockwise direction. Turn the C spanner around the router motor shaft in a counter-clockwise direction, as shown in the photograph below.



C spanner around locking nut.

C spanner around router motor shaft.

Right: Refitting the Nut and Collet Assembly.

Check that the cutting tool is secure before putting the machine back in to operation.

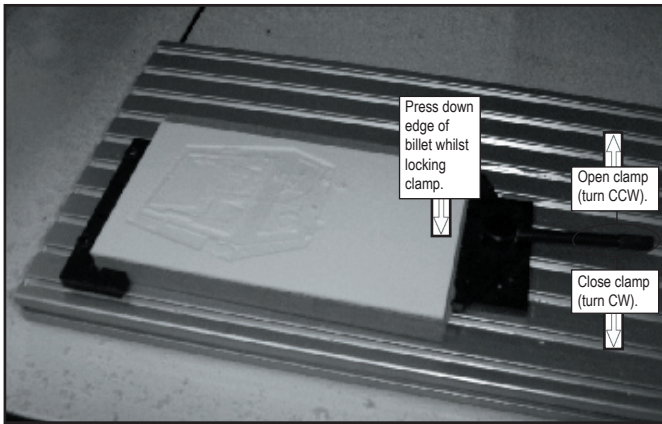
6: Using the Work Clamp

Setting the Position of the Work Clamp.

Place the billet onto the machine table, so it is located correctly against the inside edges of the datum plate. Set the work clamp in the open (unlocked) position. If you have fitted the work clamp to the right end of the machine table, you must push the handle back.

Slide the work clamp assembly along the machine table until the two flats on the clamp plate are just touching the billet. Fully tighten the two hex bolts to firmly fix the work clamp base plate in position on the machine table. At this stage, it should still be possible to remove the billet.

To close (lock) the work clamp, pull the handle forwards. Press the end of the billet down against the machine table, whilst locking the work clamp - this will prevent the end of the billet from lifting. The handle should only need to be turned about one quarter of a revolution before locking the billet firmly in position. If the billet can still be moved, you must loosen the two hex bolts and reposition the work clamp base plate so it is closer to the billet.



Now that the work clamp position has been set, the billet can be continually withdrawn from the machine table, then replaced, always to the same position.

This is an advantage for jobs involving the repeat milling of pieces of work, such as a small production run or a college class/group project.

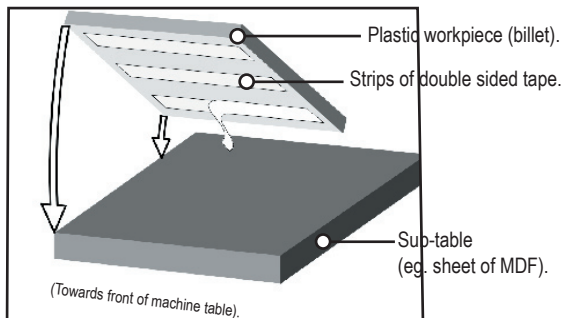
6: Using the Work Clamp

The work clamp, when used in combination with the datum plate, is a quick and versatile method of securing most pieces of work to the machine table.

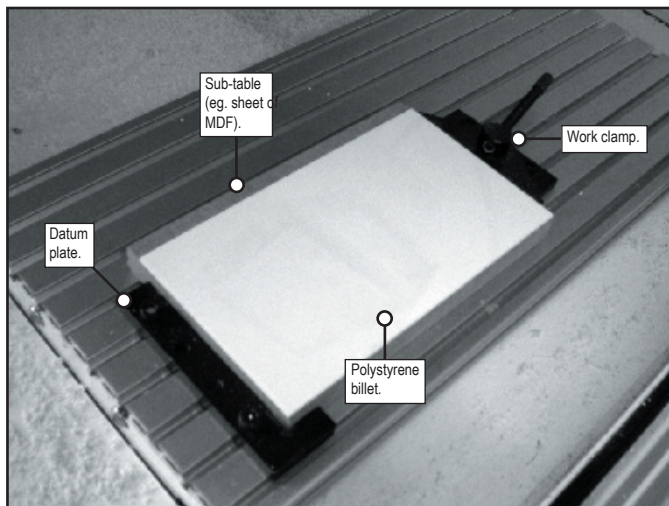
In the example shown below, a polystyrene billet is taped onto a sheet of MDF (medium density fibreboard), with its front and left-hand edges aligned with the front and left-hand edges of the MDF - this front, left upper corner will be configured as the workpiece datum for the machine offsets. The MDF is used as a sub-table - a safety measure to prevent damage occurring to the machine table itself, should a problem occur when milling.

Tape Tip

Use plastic type double sided tape, which can be removed from your billet without tearing. If your billet material comes supplied with a protective film, affix the tape to this film, then simply tear off the film once machining has been completed. Avoid using tissue type double sided tape, which is a strip of tissue with a thin coating of glue each side - this type is very difficult to remove from your billet once it has been machined.



The polystyrene/MDF block can then be added or removed from the machine table without having to reconfigure the machine offsets.



continued...

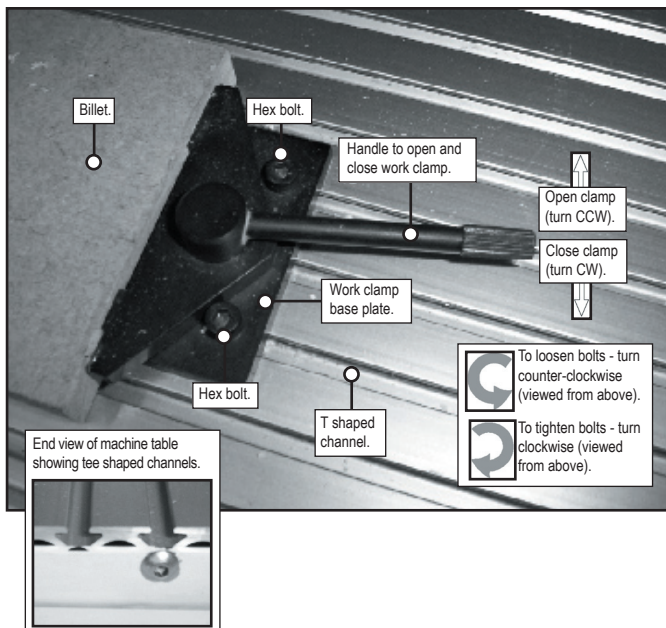
6: Fitting and Removing the Work Clamp

Removing the Work Clamp.

Using a 4mm allen (hex) key, loosen the two hex bolts clamping the work clamp to the machine table. Do not completely remove the bolts at this stage, since this will make removal of the individual tee nuts more difficult. Slide the entire work clamp assembly to a free end of the machine table, release the tee nuts from their respective channels and withdraw the work clamp assembly.

Fitting the Work Clamp.

Fit, align and clamp the datum plate. Loosely assemble the two hex bolts and tee nuts through the two holes in the work clamp base plate. Move the work clamp assembly to a free end of the machine table, then carefully align each tee nut with the respective channels in the machine table and slide the clamp onto the table. Before fully tightening the hex bolts, adjust the position of the clamp against your chosen billet, as described on the next two pages.



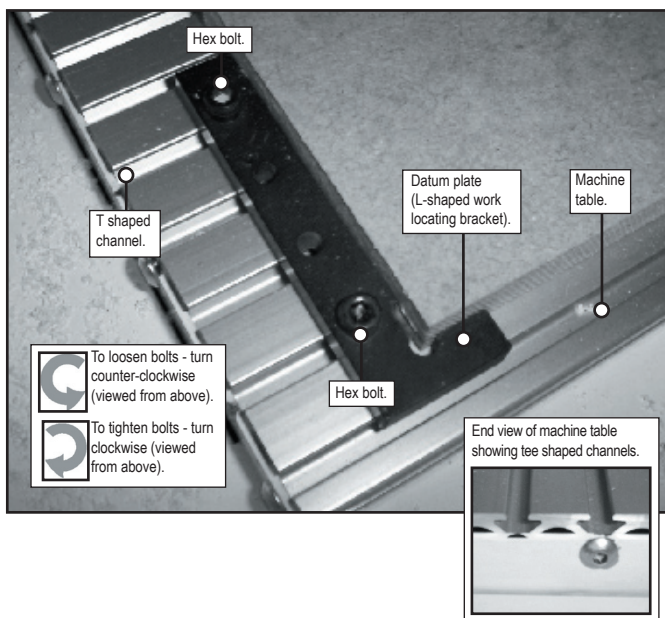
6: Fitting and Removing the Datum Plate

Removing the Datum Plate.

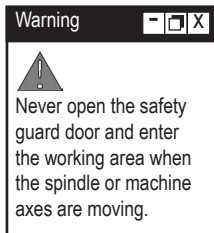
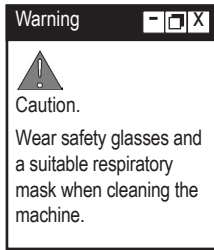
Using a 4mm allen (hex) key, loosen the two hex bolts clamping the datum plate to the machine table. Do not completely remove the bolts at this stage, since this will make removal of the individual tee nuts more difficult. Slide the entire datum plate assembly to a free end of the machine table, release the tee nuts from their respective channels and withdraw the datum plate assembly.

Fitting the Datum Plate.

Loosely assemble the two hex bolts and tee nuts on the datum plate. Four holes are provided on the plate for the tee nut assemblies - we recommend using the two outermost holes, as shown in the photograph below. Move the datum plate assembly to a free end of the machine table, then carefully align each tee nut with the respective channels in the machine table. Slide the assembly to the approximate position required. Using a 4mm allen (hex) key, tighten each of the hex bolts, by turning each bolt in a clockwise direction until they just begin to grip the datum plate to the table surface. It must still be possible to move the datum plate, since final adjustments will be required to align the plate exactly "square" with respect to the edges of the machine table - exactly parallel to the direction of the X and Y machine axes. After adjusting the position of the datum plate, fully tighten the two hex bolts.



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: Cleaning the Router Motor

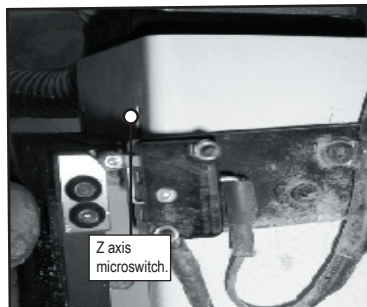
Using a vacuum or a soft brush, clean and dust and debris away from the top and bottom of the machine head plate.

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.





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.



7: Maintenance of the Router Motor

Warning    

Caution.

Wear safety glasses and a suitable respiratory mask when cleaning the machine.

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.

Warning    

Never open the safety guard door and enter the working area when the spindle or machine axes are moving.

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.

Warning    

Caution.

If the cutting tool has been recently used, it may still be HOT.

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.

7: Lubrication

Notes on use of Swansil Lubricant on Denford Routing 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 be 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):

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

Denford USA: <http://www.denford.com>

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,

Birds Royd, Brighouse, West Yorkshire, HD6 1NB, UK.

Telephone: 01484 728000

Fax: 01484 728100

ISDN: 01484401157:01484401161

E-mail: 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.

9: Troubleshooting - Cutting Problems

The part is being cut at an incorrect depth :

Check the validity of the following:

- 1) The Z value entered in the tool length offset.
- 2) The Z value entered in the workpiece offset file.
- 3) The number (size) used for defining the depth of cut used in your CNC program.
- 4) The sign (+ or -) used for defining the depth of cut used in your CNC program. If your workpiece datum is aligned with the upper surface of your billet, any Z values cutting into this billet will have a minus sign.

The machine begins cutting the part at the wrong location :

Check the following:

- 1) The workpiece and tool offset files have been configured and applied successfully. If no offsets have been configured, the CNC machine will use the machine datum as the starting point for any machining co-ordinates read.
- 2) The X and Y values entered in the workpiece offset file are correct.

Poor surface finishes are obtained :

Check the following:

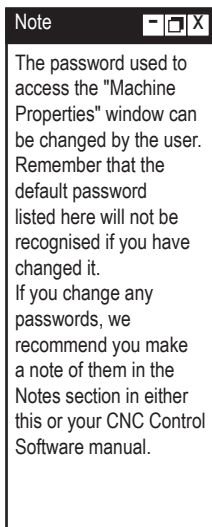
- 1) The correct feedrates and spindle speeds are being used, appropriate for the cutting tool profile and type of material being machined. Recommended feed and speed values should be available from your tool and material supplier. Note that running incorrect feeds and speeds can severely shorten the life expectancy of your tools.
- 2) The billet being machined is securely clamped.
- 3) The correct tool profile, appropriate to the finish required, is being used. Check that the cutting edges are sharp and undamaged.
- 4) Any machine drive belts are correctly tensioned and not slipping.
- 5) The tool profile is held securely in the tool holder or collet, which in turn is held securely in the machine spindle.

When using double sided tape, the billet keeps lifting from the sub-table (sheet of MDF) :

Check the surface of the sub-table is clean and smooth before attempting to add the billet. Routinely clean tape adhesive residue from the sub-table. Check tape adequately covers all parts of the billet. Check the sequence in which the various parts of your design are machined. For example, machine any small or etched surfaces before cutting pieces completely out from the billet. If you keep the largest solid area of the billet attached to the sub-table for as long as possible, you reduce the likelihood of the billet moving during machining.

9: Troubleshooting - VR CNC Milling Software

- 1) Your computer communicates with your Router using the Denford Machine Link cable. Check the Denford Machine Link cable (RS232 or USB) is securely plugged into a valid COM/USB port on the computer. Note that COM ports are sometimes labelled as serial ports. Identify whether the COM port being used is labelled as COM1 or COM2. The opposite end of this cable is securely plugged into the RS232/USB port, located on the right end panel of the machine cabinet.
- 2) Check all mains power connections are correctly fitted and secure. Power up the Router, using the red on/off switch, If no power is present, switch off the mains supply, then wait at least 5 minutes before attempting to access the Router electronics. The Router electrical panel is mounted on the left side of the machine cabinet. Check the condition of the on/off switch and any fuses. For more information.
- 3) Start the VR CNC Milling software (from the default installation, click "Start | Programs | Denford | VR Milling"). The name of CNC machine that can be directly controlled by the VR CNC Milling software is displayed on the main program titlebar. From the main menubar at the top of the VR CNC Milling software screen, click "Setup | Setup Machine Parameters". You may be required to enter a password. The default password is "denny". Type the password and click [OK]. The "Machine Properties" window will open. You can configure the type (name) of CNC machine attached to your pc and any COM port settings from this window.
- 4) The "Machine Properties" window will open with the name of the current (active) machine highlighted and its listing expanded. The name of the active machine in the software must match the name and version of your real CNC machine - this information is printed on the CE identification panel, usually applied to one of the machine cabinet end panels. If the correct machine name is NOT listed as the active machine, right click over the required machine name title to display a pop-up menu. Click "Make Active", then click [OK] and restart the VR CNC Milling software. Reopen the "Machine Properties" window to check that the changes have been applied.



9: Troubleshooting - VR CNC Milling Software



- 5) Check the LED display status on the NextStep Motion Control Board, referring to the descriptive list to determine the condition of the board. A problem with this card can cause problems with communications. The board is located in the top, left corner of the electrical panel. Call Denford Customer Services for assistance.

Warning - Risk of electric shock. Note that in order to check the readout, the CNC machine must be powered up with the electrical panel exposed. Exercise extreme caution - do not touch any live electrical components since damage may occur to the hardware or technician inspecting the equipment. Remember to shutdown the CNC machine, then replace the electrical panel cover plate, on completion of this step.

- 6) Check the COM port on your computer is functioning correctly. Consult your IT person or Computer Support Centre for help with these issues. Check the COM port settings in Windows by accessing the Device Manager. Check the com ports enabled and labelled properly in the computer BIOS. Check the physical COM port itself functional. For example, Windows and the BIOS may show that the COM ports are fine, but the port is not seen by any external devices.
- 7) When all else fails...

Thoroughly check the condition of the Denford Machine Link cable. If the cable is bad, communication will not occur. Try using a different computer to connect to the machine. Check for help on the technical support, FAQ and download sections of the Denford websites and/or contact Denford Customer Services for further assistance.

9: Troubleshooting - Mechanical Problems

The safety guard door cannot be opened :

In most cases, this is because the interlock guard switch has locked the door in the closed position. The interlock guard switch is mounted behind the front, lower machine panel, accessible from beneath the front of the machine.

Check the following:

- 1) Mains power is reaching the CNC machine. Check the mains plug is fitted to an available power socket and the socket is switched on. Check the Router on/off keyswitch, mounted on the right end panel of the machine cabinet, has been turned to the on "I" position.
- 2) The emergency stop button is not pressed in. To release, push and turn the button clockwise until it springs back out to its ready position.
- 3) No CNC program is running. Wait for all machining operations to finish, then switch the software to operate in jog mode.

10: Specification of the Compact 1000

Safety Features:

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

Mechanical Details:

- Travel X axis 400mm (15.7").
- Travel Y axis 240mm (9.05").
- Travel Z axis 110mm (4.3").

Dimensions:

- Machine Length 845mm (33").
- Machine height 675mm (26.5").
- Machine depth - door closed 750mm (29.5").

Weights:

- Machine weight 90 KG (198 lb).

Electrical Details:

- Mains supply required:
220/240Volts, 50Hz, 8 Amps.
- Spindle motor: 1.3 kW
- Spindle Speeds: 0 - 23,000RPM.
- 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

The responsible personMr P T Harkness

Business NameDenford Limited.

AddressBirds Royd,
Brighouse,
West Yorkshire,
HD6 1NB,
United Kingdom.

Declares that the machinery described:

ManufacturerDenford Limited.

Model NameCompact 1000 Series CNC Machine.

Serial Number.....(please refer to warranty card and/or machine casing).

conforms to the following directives:.....The Machinery directive 98/37/EC
The LVD Directive 73/23/EEC
The EMC directive 89/336/EEC

and the following standards.....
(where applicable)

and complies with the relevant
health and safety requirements

Signature

Position within companySenior Design Engineer.

Signed atDenford Limited,
Birds Royd,
Brighouse,
West Yorkshire,

Document: DC-RC 1-01. HD6 1NB,

10 : Compact 1000 Series Noise Level Test Results

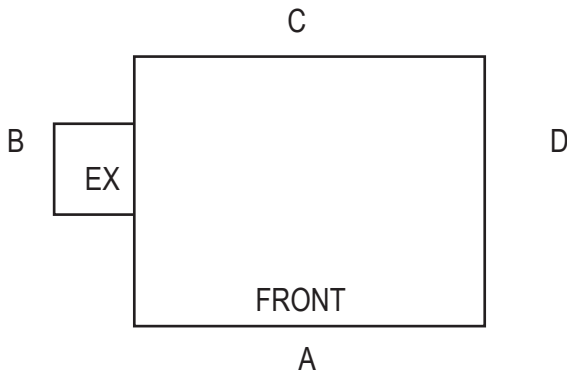
Test Report No.: NL-FR1-01

Machinery Manufacturer: Denford Limited

Machinery Type/ Model: Compact 1000 Router

The Compact 1000 can be supplied with a dust extraction system.
 The test was carried out with and without this option, using a
 ‘Yorkleen Woodvac’ WY1 for this purpose.

Equipment
 Meter ref; ‘Realistic’ 42-3019
 Compact 1000 Router
 Yorkleen Woodvac WY1



A, B, C & D are measurement positions 1 metre from the machine
 Ex: Vacuum for dust extraction.

Test Conditions:

Spindle speed 23,000rpm.
 Axis speed 900mm/min.
 Ambient background noise <60 dB(A)

Test Results				
Condition	A	B	C	D
Spindle + Drives + Extractor	78	76	78	76
Spindle + Drives + NO Extractor	76	75	77	75
Extractor Only	68	70	73	76

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.
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

Contact Details (UK):

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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.

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

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
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