Total Commitment to Education and Training WorldWide.

Triton Series
CNC Machine
User's Manual.

approved

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Warning Notices

⚠ Warranty Disclaimer.

The Warranty on your Denford Triton CNC machine will be invalidated if any modifications, additional ancillary equipment is fitted, or any adjustments 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 your Denford Triton CNC machine and/or the electrical panels within the machine casing 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 CNC machine.

⚠ Foreseen Use of Machine.

Your Denford Triton CNC machine is designed for milling non-hardened ferrous metals, aluminium, hard woods, plastics and prototyping materials. In each case, the appropriate tooling, spindle speeds and feedrates should be used as recommended by the material supplier.

Only use water based soluble oil cutting fluids, do not use parafinic or potentially explosive cutting fluid.

Do not attempt to use your CNC machine for manual operations.

Never attempt to fit an abrasive wheel to the machine spindle.

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

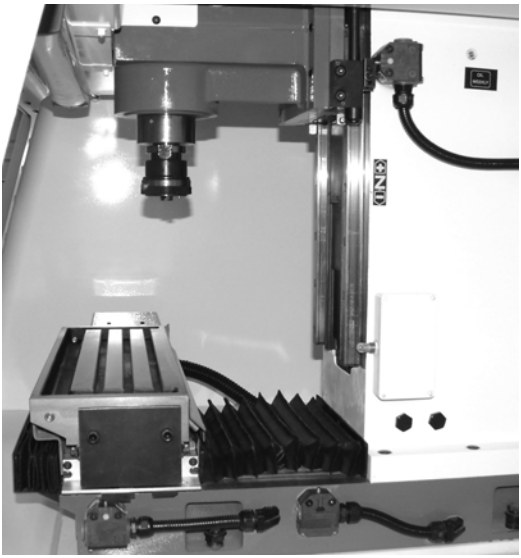
Denford Limited reserves the right to change the specification and/or operating features regarding this CNC machine without notice or documentation.

About this Manual

Using this manual	This manual provides information describing how to transport, site, setup and operate the basic functions of your Denford Triton CNC machine, including any optional equipment associated with the Triton series. Please note that the Electrical Diagrams for your Triton CNC machine are not included in this manual. They are either stored in a folder attached to the inside of the electrical panel cover plate or delivered separately in the standard equipment box supplied with your machine. Further electrical schematics are available on request. Hazard Voltages exist within the machine - when removing the electrical panel cover plate always isolate the power and leave all electronic components untouched for at least 5 minutes. If you have any doubts and/or questions regarding the specification, servicing, or features of your Triton CNC 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.
Disclaimer	We take great pride in the accuracy of information given in this manual, but due to nature of hardware and software developments, be aware that specifications and features of this product can change without notice. The information contained in this manual is correct at the date of printing only - October, 2002. 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.
Screenshots	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 Denford Triton CNC machine.
Language	This manual is written using European English.
Contact	Any comments regarding this manual should be referred to the following e-mail address: customerservices@denford.co.uk

1: Introducing your Triton Series CNC machine

Congratulations on your purchase of a Denford Triton Series CNC machine. In this manual you will learn how to setup and use your CNC machine.



The Triton is a versatile three axes CNC milling machine, with a large working area. This makes it particularly suitable for prototyping complex 3D designs in a wide range of materials.

Main Features:

- Designed specifically for Education, Training and Prototyping.
- Manufactured to industrial standards.
- Capable of cutting resistant materials, such as wax, foams, plastics, acrylics, hard woods, copper, aluminium and steel.
- Links to CAD/CAM software including Pro/DESKTOP, ArtCAM, Techsoft, Mill CAM Designer, AutoCAD and other industrial packages.
- Totally enclosed high visibility interlocked guard.
- Feedrate and spindle speed override controls
- CE approved for safety.
- Programming via International Standards Organisation format.
- Flexible workholding capabilities.
- Optional software allows programming via ISO Format, incorporating controls such as FANUC.
- Option of inclusion in FMC/FMS/CIM systems.

1: Triton Series Model Variants

Triton

The Triton has been developed with stepper motors, offering improved feedrates to meet the increased demands of 3D machining.

System resolution: 0.00500mm (0.000197")
Rapid traverse rates: 2000mm/min (78in./min)
3D Profiling: 900mm/min (35in./min)

Triton Pro

The Triton Pro adds servo motors to allow rapid profiling feedrates when cutting prototype modelling materials, whilst still retaining robust metal cutting facility.

System resolution: 0.00625mm (0.000246")
Rapid traverse rates: 5000mm/min (197in./min)
3D Profiling: 5000mm/min (197in./min)

Main options available across the Triton Series:

- CAD/CAM software and manuals.
- On-screen representation of industrial control systems and optional link to industrial keypad (FANUC 21i).
- Machine work bench.
- Video conferencing system.
- Machine controlling PC and workstation.
- Additional work holding sytems.

1: What is CNC?

CNC (Computer Numerical Control) is the general term used for a system which controls the functions of a machine using coded instructions, processed by a computer. CNC machines are a very important part of the modern manufacturing process. Indeed, many of the different types of products you use everyday have been made using some sort of CNC machine.

The CNC Manufacturing Process - Example.

The sequence shown below defines the main steps involved in producing a component using a CNC system.

1) A part program is written using G and M codes. This describes the sequence of operations that the machine must perform, in order to manufacture the component.
2) The part program is loaded into the machines computer, called the controller. At this stage, the program can still be edited or simulated using the machine controller.
3) The machine controller processes the part program and sends signals to the machine components. These direct the machine through the required sequence of operations necessary to manufacture the component.

What are the advantages of CNC?

CNC systems are automated and very accurate. Once programmed, a CNC machine will perform repeat tasks until instructed to stop. Each component produced will be exactly the same size and shape, saving money on designing any jigs and fixtures that might have otherwise been required.

Using CNC machines can reduce waste material, since a CNC machine is much less likely to make an error than a human operated machine. CNC machines can also run 24 hours a day, if necessary, with no signs of fatigue.

Companies can estimate the manufacturing costs for CNC production much more accurately, compared to a production line with conventional production machines.

Jargon Buster

CNC refers to Computer Numerical Control, the automatic system used to control a machine tool.
A Part Program is 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.
A G and M code is a series of letters and numbers that make up the language used by CNC machinery.

1: Before Beginning to Setup...

Before beginning to setup your Denford Triton CNC machine, take a moment to 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.

Note

The standard equipment listed here is correct at the time of printing - October, 2002 - but is liable to change through continuous development of our products.

Please refer to your invoice for the definitive list of standard equipment shipped with your machine.

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

- Denford Triton or Triton Pro CNC milling machine. Note that the precise specification of your Triton will depend on any options selected at the time of ordering.
- Integrated electrical panels.
- 1 x Denford Machine Link serial cable (25-9 pin connection cable including built-in crossover)*. Note that the CNC machine controller PC not included as standard.
- 1 x Guard door interlock switch.
- 1 x Operators toolkit - metric allen (hex) keys and spare fuse package.
- 1 x Easychange toolholder package.
- 1 x Triton Series CNC machine warranty pack.
- 1 x Triton Series CNC machine inspection certificate.
- 1 x Triton Series CNC machine manual (this book) plus additional OEM product manuals (as required).
- 1 x CNC Machine Control Software manual.
- 1 x CNC Machine Control Software CD-ROM and/or floppy disks.
- Machine commissioning and basic instruction.
- 1 Day training course, for 2 persons, at Denford Limited (UK).

*** Note**

* Short 9-25 pin serial link adaptor cables can be used to convert the Denford Machine Link cable connectors according to the type of COM port fitted to your computer.

2: Safety Features Overview and Precautions

Safety Features Overview.

The following safety features are standard on your Denford Triton CNC machine:

- Emergency stop button.
- Totally enclosed guard door with interlock switch.
- Electronic shear key built into spindle controller.
- Axis limit microswitches; single depth stop switch adjustable on Z axis (Triton and Triton Pro); two switches per axis (Triton Pro only).
- Automatic tool retraction and spindle stop during a tool change operation.
- Option on control software to check CNC programs prior to machining.

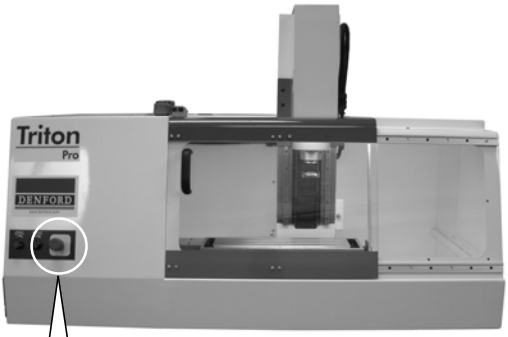
Safety Precautions.

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 Denford Triton CNC machine.

General Safety Precautions :

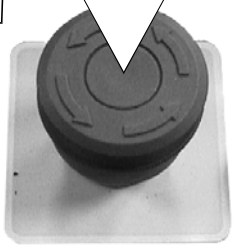
- Wear clothing suitable for machine operation and follow the safe working procedures in place at your establishment.
- Do not place any objects so that they interfere with the guards or the operation of the machine.
- Never try to clean the machine if any part of it is rotating or in motion.
- Always secure the work on the table or in a fixture or vice.
- Ensure that the correct cable for the power source is used.
- If power fails, immediately turn off the red, square on/off switch (mounted on the back panel of the machine cabinet).
- Hazardous voltages can still exist immediately after switching off the machine power. Always wait at least 5 minutes before attempting to access any electronic components.
- Ensure the power is switched off before starting any maintenance work on the machine. Always post a warning informing others that the machine is undergoing essential maintenance.
- Lubricate the required machine areas at the intervals specified in this manual, to prevent the axes from seizing (see the Maintenance section for further details).
- Observe caution when adding or removing machine tooling.
- When an emergency stop is required, press the circular red emergency stop button, located on the front machine operators panel.

2: Safety Features - Emergency Stop Button



Emergency stop button located on the front operators panel.

To active an emergency stop, press the button fully in until it clicks.



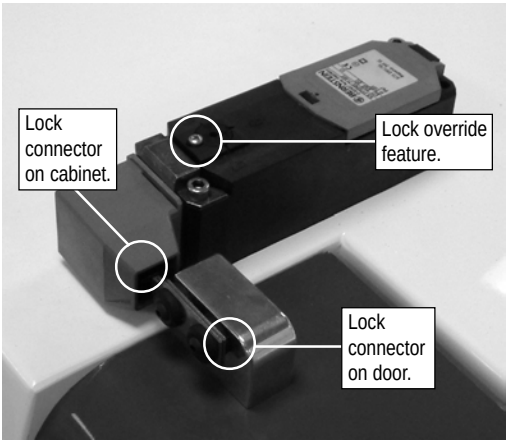
A circular, red emergency stop button is mounted on the front operators panel, situated at the left end of the machine cabinet.

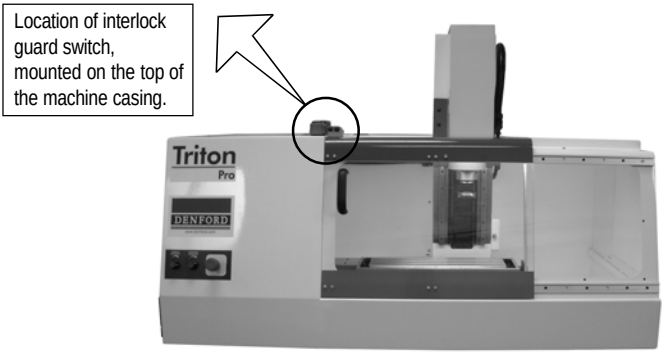
When pressed, it has the effect of stopping all axes, toolchanger and spindle movements immediately. The interlock switch will also close. When the safety guard door is in its closed position, this will prevent access to the working area of the machine.

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.

2: Safety Features - Interlock Guard Switch



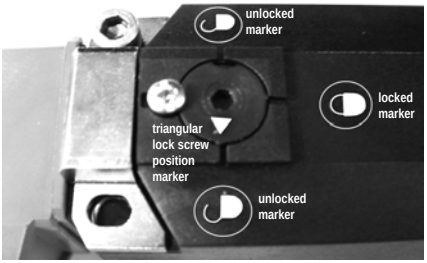


An interlock guard switch is fitted to the front, top of the machine cabinet. A closed machine door will remain locked when:

- The machine is switched off (ie, not in use). To release the lock, power up the machine, using the square red on/off button on the back panel of the cabinet.
- The emergency stop button is fully pressed in. To release the lock, push in and turn the emergency stop button counterclockwise until it spring back out to its ready position.
- Machining is taking place. The lock will release when the machining operations have been completed and the CNC control software switched to operate in jog mode.

2: Safety Features - Interlock Guard Switch

To override the lock:
1) Loosen the manual override locking screw.
2) Turn the circular black plastic lock screw one quarter turn.



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

1) Using a small flat or crosshead screwdriver, loosen the manual override locking screw until the circular black plastic lock screw can be turned.
2) 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.
3) If necessary, tighten the manual override locking screw slightly.
4) If you need to leave the machine, post a warning note on the machine informing users that the safety guard door lock is not operating.

3: Unpacking & Lifting your Triton

Warning

Denford does NOT recommend direct lifting of the Triton.

Under no circumstances should the sling be used across the front and rear panels, since this will place stress on the polycarbonate safety guard door.

Safety First !

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

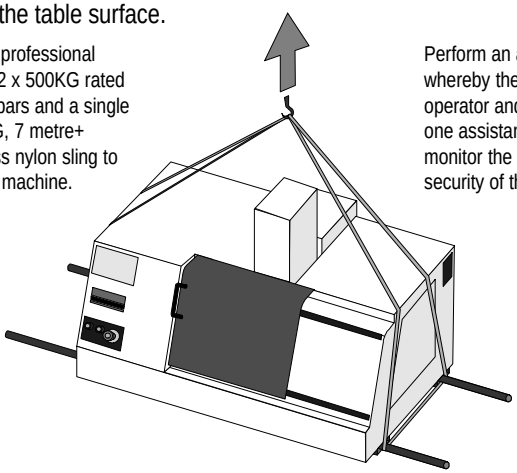
Data Panel

Machine Weight:
235 KG (517 lb).

Cut the top of the delivery box open and carefully remove any packaging, strengtheners and bracing struts, where fitted.

To obtain better access to the Triton, remove all the sides from the delivery box, leaving the machine standing on its timber delivery pallet. If a fork lift is available, transport the machine to the location table, where it can be carefully manoeuvred from the delivery pallet onto the table surface.

Use a professional hoist, 2 x 500KG rated lifting bars and a single 500KG, 7 metre+ endless nylon sling to lift the machine.



Perform an assisted lift, whereby the hoist operator and at least one assistant can monitor the balance and security of the load.

Whenever possible, the following equipment should be used to lift the Triton:

- A professional hoist.
- 2 x 500KG (1120 lb) rated, 2 metre+ (80”+) length lifting bars.
- 1 x 500KG (1120 lb) rated, 7 metre+ (275”+) endless nylon sling.

Working from the end of the machine, feed each lifting bar through the two U-shaped sections used to support the machine cabinet. Leave equal amounts of bar protruding from each end of the machine. Pass the sling around the two protruding sections of bar at the right end of the machine, then over the top edge of the right end panel. Continue passing the sling across the top of the machine, through the lifting hook on the hoist then over to the top edge of the left panel. Finally, wrap the sling around the two protruding sections of bar on the left end of the machine (see diagram above).

Perform an assisted lift, whereby the hoist operator and at least one assistant can manually monitor the balance and security of the load as is it moved. Note that the machine will be heavier at the left-hand end of the cabinet, due the integrated electronic systems situated here.

To transport the Triton over longer distances, use a suitably sized trolley.

3: Deciding on a Site for your Triton

Note

Optional machine tables designed specifically for the Triton CNC machine series, are available from Denford Limited.

Data Panel

Dimensional Data.
Total machine width 1450mm (57").
Total machine height 930mm (36 5/8").
Total machine depth 820mm (32 5/16").

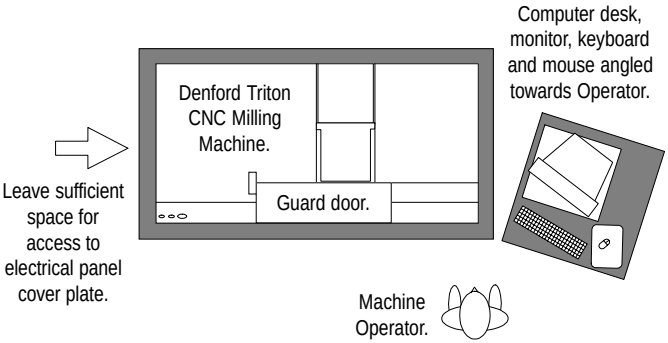
Site your Triton in a well ventilated room. The Triton is a bench mounted machine, so it should be sited on a bench of sturdy construction to take the weight of the machine and of a height which enables comfortable operating and programming to take place.

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. We recommend positioning the pc on a movable workstation, to allow easier access to the various vents and removable panels on the Triton cabinet, when required.

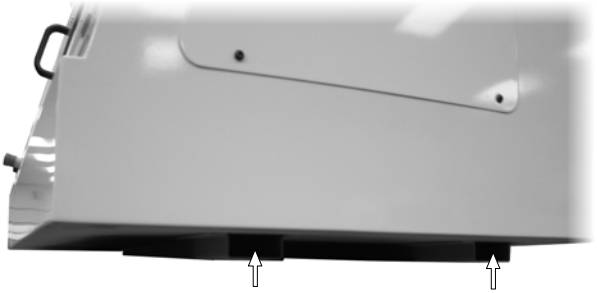
In particular, leave at least 195mm (7 11/16") of space at the right, front end of the machine, for clearance when the safety guard door is opened. Also, leave enough space at the left end of the machine, to allow for removal of the electrical panel cover plate.

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. Sufficient room should also be provided for effective maintenance to be carried out around the CNC machine itself.



Plan View showing Ideal Machine Operating Positions.

3: Levelling your Triton



Your Triton rests level on the two hollow sections which run beneath the machine cabinet. The machine itself has been levelled to the machine cabinet prior to dispatch, so it is only necessary to level the table on which the Triton is to be situated.

3: Accessing the Triton Electrical Panel

Warning

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

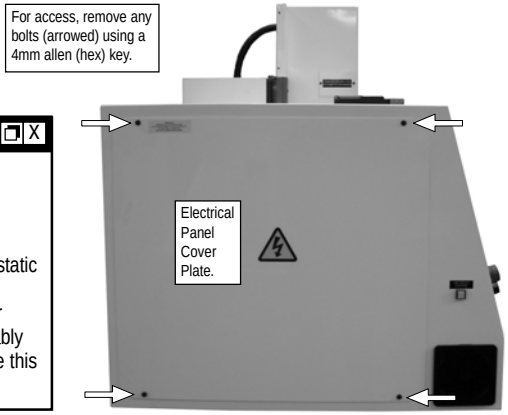
Note that hazardous voltages can still exist immediately after switching off the power.

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

The Triton electronics are located in the left end of the machine cabinet. Using a 4mm allen (hex) key, remove any retaining bolts, then withdraw the cover plate, to gain access to the electrical panel, as shown below.

Warning

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



3: Connecting the Mains Supply

The Triton is delivered with standard mains specification cable connected directly into the isolator. The cable should be fitted with a standard 13 amp plug suitable for the mains power supply. All electrical connections should be completed by suitably qualified electrical engineers.

Mains supply required: 220/240Volts, 50Hz, 8Amps.
110/115Volts, 60Hz, 15Amps.
Cable required: 3 Core, 1.5mm^2 per core.
Spindle motor: 1.1kW, 1.5HP.

3: Electrical Diagrams

Warning

Hazard Voltages exist within the machine - when removing the electrical panel cover plate always isolate the power and leave all electronic components untouched for at least 5 minutes.

The Electrical Diagrams for your Triton are not included in this manual.

They are either delivered separately in the standard equipment box supplied with your machine, or stored in a folder attached to the inside of the electrical panel cover plate.

Further electrical schematics are available on request.

3: Connecting your PC to the Triton

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.

Your Triton CNC machine is controlled using a standard IBM compatible PC (personal computer). In this role, the PC can be referred to as the machine controller computer.
Ideally, the PC you intend to use should be placed next to the Triton, in a position which will not interfere with routine maintenance and machine operation.

Your PC must be equipped with hardware that allows it to:
1) run the CNC Machine Control software.
2) be physically connected to the Triton.

The specification of PC required to control your Triton will depend upon the type of CNC machine controlling software being used. Please refer to your separate CNC machine controlling software manual for details regarding the exact PC specification required.

3: Connecting your PC to the Triton

Warning

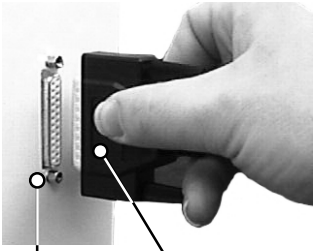
Do not connect cables between any electrical hardware with the mains power switched on, since this could seriously damage components inside your CNC machine.

To connect your PC to the Triton:

1) Connect the elements of your PC together as described in your original PC manufacturers operating manual. At this stage, your PC should not be switched on.
2) The PC must be physically connected to the Triton, using the supplied Denford Machine Link cable. This is the long, thin serial link cable fitted with a 25 pin D male connector at one end and a 9 pin D female connector at the opposite end, as shown below right.
3) Connect the 25 pin D male end of the RS 232 cable to the 25 pin D female port mounted on the back panel of the Triton cabinet. The port is labelled **RS 232**.

Location

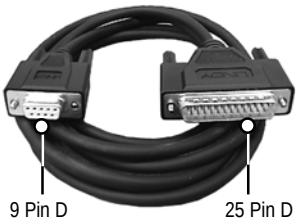
RS232 connector for the Denford Machine Link cable on machine cabinet back panel.



25 pin D female connector fitted to electrical control box side panel.

25 pin D male connector fitted to RS232 cable.

Denford Machine Link Cable.



9 Pin D Female Connector.

25 Pin D Male Connector.

Note

PC Terminology:

The COM ports on your PC may be labelled as Serial ports. Most COM ports have a 9 pin D MALE connector, though some older computers may be fitted with additional PCI COM cards having a 25 pin D MALE connection. In this case, a 9 to 25 pin adaptor cable can be added to the Denford Machine Link cable supplied with your machine. The Denford Machine Link cable supplied with your machine must always be used, since this cable features crossovers on some of the pin connections.

You must also configure the machine control software to recognise which numbered COM port is being used by the Denford Machine Link machine lead. Details on this procedure are outlined in your separate CNC machine control software manual.

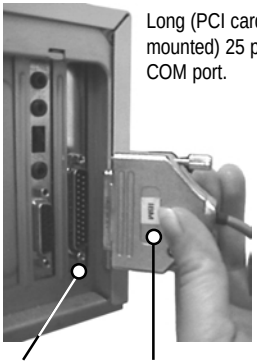
The Parallel port on your PC may be labelled as the Printer port. The printer port has a 25 pin FEMALE connector.

3: Connecting your PC to the Triton

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.

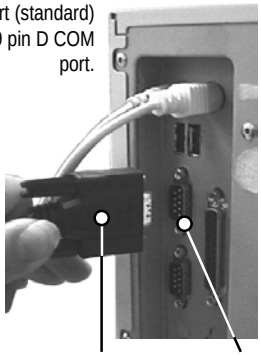
4) Connect the remaining 9 pin D female end of the Denford Machine Link cable to the 9 pin D male **COM** port on your PC, ideally COM 2. Most computers usually have two COM ports situated on the back panel of your PC. If you cannot identify any of the ports on your PC, please refer to your original PC manufacturers operating manual for further guidance. Note that older computers may be fitted with a 25 pin D male COM port, which may require the fitting of an additional 9 to 25 pin adaptor to your Denford Machine Link cable.



Long (PCI card mounted) 25 pin D COM port.

25 pin D male connector fitted to pc (back) panel.

25 pin D female connector fitted to Denford Machine Link cable (using a 9 to 25 pin adaptor).

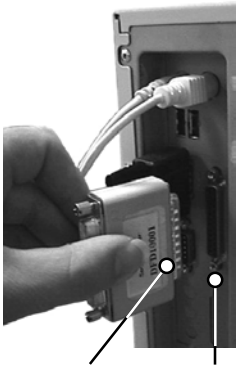


Short (standard) 9 pin D COM port.

9 pin D female connector fitted to Denford Machine Link cable.

9 pin D male connector fitted to pc (back) panel.

5) Do not confuse the 25 pin D female parallel (printer) port on your PC with the 25 or 9 pin male D COM ports. If your CNC machine control software is supplied with a security key, the 25 pin D male connector of this key must be fitted to the 25 pin D female parallel port, as shown right. Security keys are also referred to as dongles.



25 pin D male connector on security key (dongle).

25 pin D female connector fitted to pc (back) panel.

A schematic diagram illustrating these component connections is shown on page 23.

3: Removal of Protective Coatings

Warning

Potential risk of ignition / explosion!

Do not use any aerosol based / flammable products to lubricate your CNC machine.

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

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

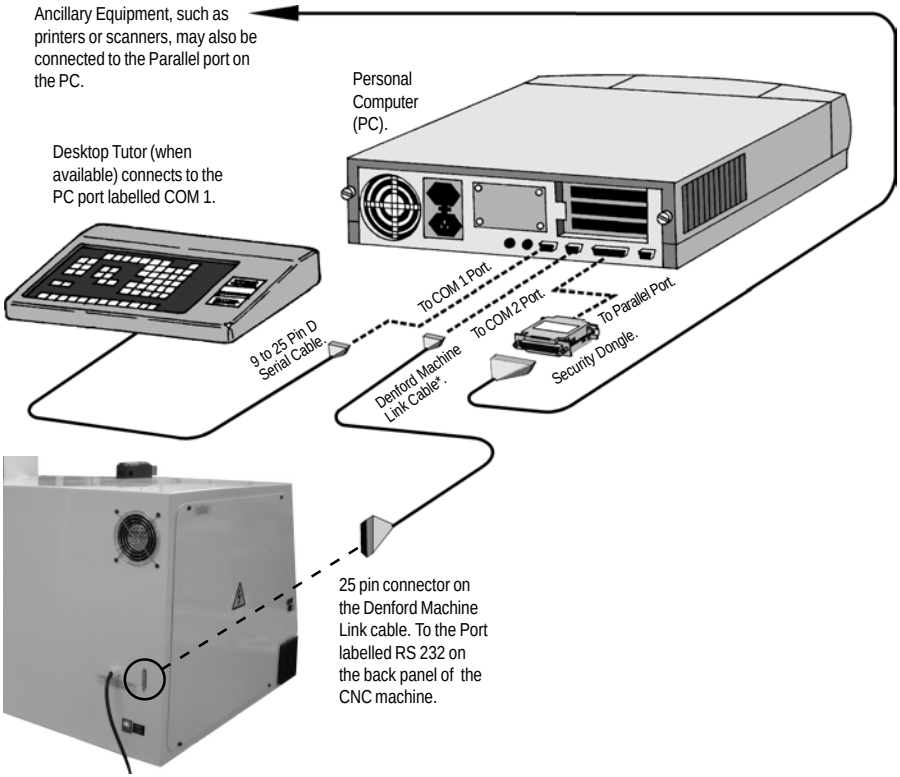
1) The protective plastic sheeting on the guard windows should be removed and the glass and perspex cleaned with an anti-static cleaner.
2) Remove any optional equipment boxes and internal packaging used to prevent movement of components during transit.

   To gain entry to the working area of the machine, power must be supplied to the machine, in order to release the switch that locks the safety guard door.

   Insert the mains supply plug into an available socket, then power up the machine using the square red on/off switch mounted on the back panel of the Triton cabinet. The on/off switch will illuminate when power is being supplied to the machine.
3) Before using the machine, the protective coatings applied to the slideways and bright surfaces must be removed, using a kerosene based solvent. No not attempt to move the machine axes until all protective coatings have been removed. Once all protective coatings have been removed, all untreated surfaces should be coated with a light covering of machine oil grade - BP. CS 68.

   Only use kerosene based solvents in accordance with the solvent manufacturers instructions and safety recommendations. Ensure that no naked flames are present and adequate ventilation is provided. To avoid the potential risk of ignition / explosion, ensure that all 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: Component Connection Schematic Diagram



Note

PC Terminology: The COM ports on your PC may be labelled as Serial ports. Most COM ports have a 9 pin D MALE connector, though some older computers may be fitted with 25 pin D MALE connectors. The Parallel port on your PC may be labelled as the Printer port. The printer port has a 25 pin FEMALE connector.

*** Note**

The Denford Machine Link cable connects the Triton to the PC port labelled COM 2. The Denford Machine Link cable is the long, thin cable fitted with a 9 pin D female connector at one end and a 25 pin D male connector at the opposite end. Connect the 25 pin D male end of the Denford Machine Link cable to the 25 pin D female **RS 232** port on the back panel of the Triton. Connect the remaining 9 pin D female end of the Denford Machine Link cable to the 9 pin D male **COM2** port on your PC. Note - a 9 pin to 25 pin adapter may also be required if your COM port has a 25 pin connection.

The Denford Machine Link cable supplied with your machine must always be used, since this cable features crossovers on some of the pin connections.

4: Using your Triton - Overview

Several steps must be completed before the final manufacture of a part. The flowchart below lists the general steps that should be followed for CNC file creation, simulation and final part manufacture, in the recommended order. However, miscellaneous factors may warrant the user to complete the steps in a different order to that shown.

Note *

For more detailed information regarding these steps please refer to your separate CNC Machine Control Software User's Manual.

Note

Steps F and G are not required when working with a simulated CNC machine (for example, Virtual Reality).

Billet data is taken from Denford directives written in the CNC program - step B.

Tooling data is taken from the configuration of the software tooling - step C.

A: Switch on the Triton, then start the CNC Control Software
(see section 4: page 27 and see Note * left)

B: Load or create the CNC program
(see Note * left)

C: Configure the tooling files in the CNC Control Software
(see Note * left)

D: Simulate the CNC program in 2D or 3D
(see Note * left)

E: Establish communications and home the Triton
(see section 4: page 29 and see Note * left)

F: Prepare any tooling hardware for the Triton
(see section 5 - Preparing Tooling Hardware: pages 40 to 52)

G: Load the billet into the Triton
(see section 6 - Work Holding: pages 53 to 61)

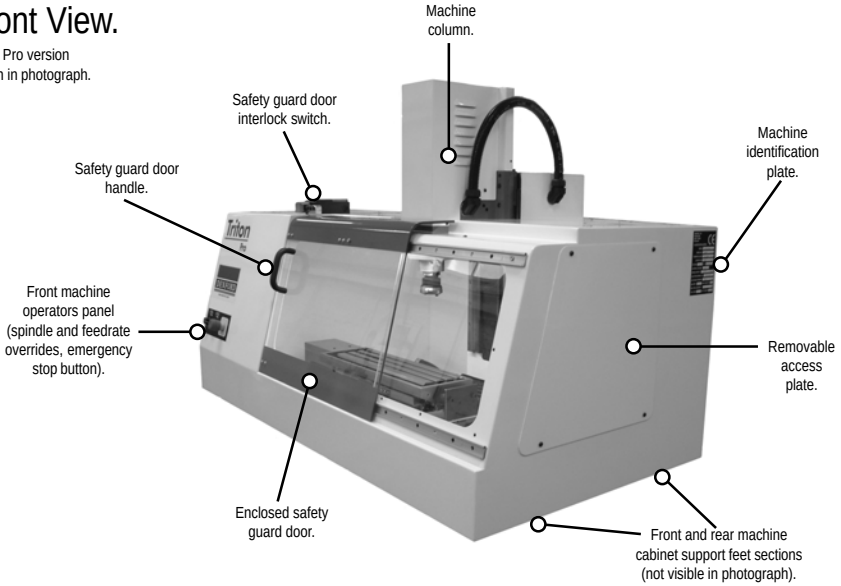
H: Configure the workpiece offset file and tool length offsets
(see section 4: pages 33 to 36 and see Note * left)

I: Manufacture the part
(see section 4: pages 37 to 39 and see Note * left)

4: General Location of Triton Components

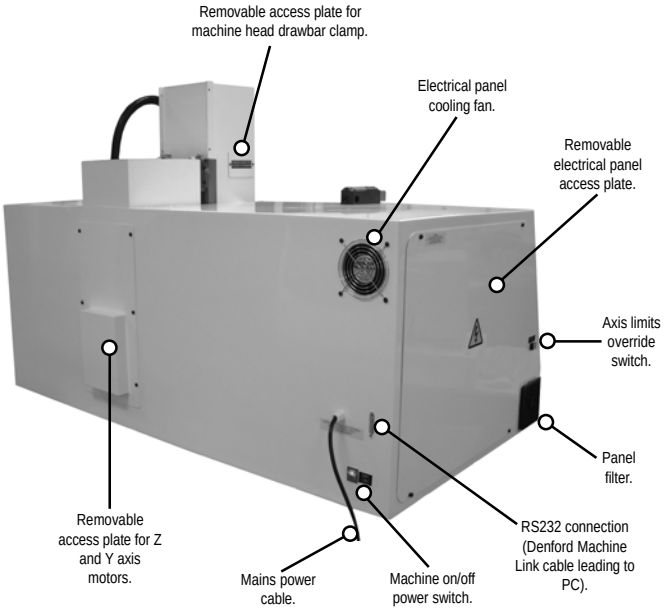
Front View.

Triton Pro version shown in photograph.



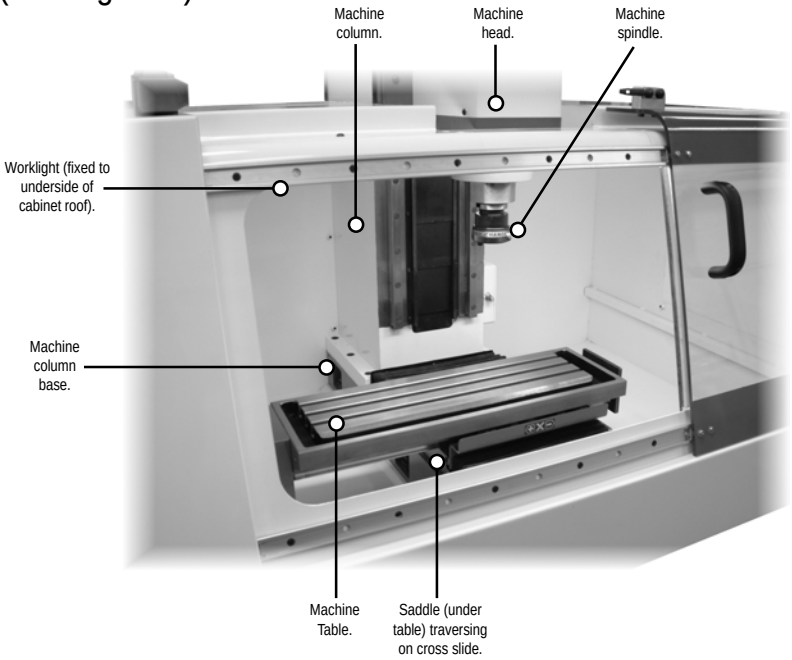
Rear View.

Triton Pro version shown in photograph.



4: General Location of Triton Components

Inside the Triton Cabinet (working area).



4: Switching the Triton On

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 in the CNC machine or electrical control box with the mains power switched ON.

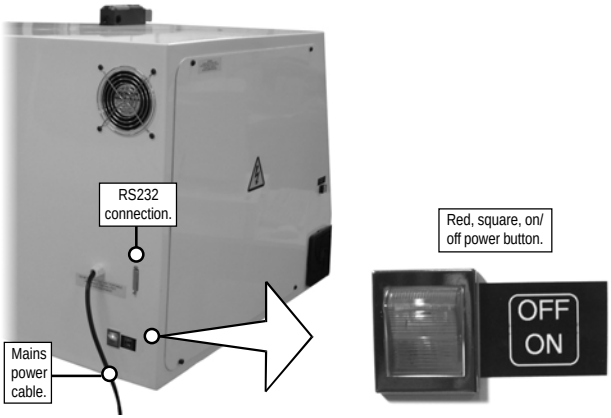
Note that hazardous voltages can still exist immediately after switching off the power.

If the machine has previously been switched on, wait at least 5 minutes before attempting to access any electronic components.

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 Microrouter:

1) Check the Denford Machine Link cable is fitted securely between the serial (COM) port socket on the machine controller PC and the RS232 socket, located on the back panel of the Triton 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) Plug the Triton mains supply cable into an available power socket. Switch the power socket on.
5) Power up the Triton using the square, red, on/off power switch, located on the back panel of the cabinet. Press the switch to the down (on) position. The switch will illuminate when power is being supplied to the electronic components.



If the Triton does not begin its power-up routine, switch off the mains power supply to the CNC machine. Check all connections and fuses, referring to Section 8 - Machine Electronics, if necessary.

6) Switch on the machine controller PC and start the CNC control software. Establish a communication link with the Triton - please refer to your separate CNC Control Software User's Manual for details outlining this procedure.

   If a communication link cannot be established, recheck the connections on the Denford Machine Link cable, followed by the communication settings of your CNC control software, referring to Section 9 - Technical Support, if necessary.

4: Switching the Triton Off

Follow these instructions to switch off your Triton:

1) Wait for the Triton 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 Triton, 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 Triton using the illuminated, square, red, on/off power switch, located on the back panel of the cabinet. Press the switch to the up (off) position. The light inside the switch will turn off when power is cut to the electronic components.

   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 the Triton.

4: Homing the Machine Axes (Home Mode)

Note

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

Immediately after establishing a communication link between the CNC control software and the Triton, all three axes of the CNC machine must be homed.

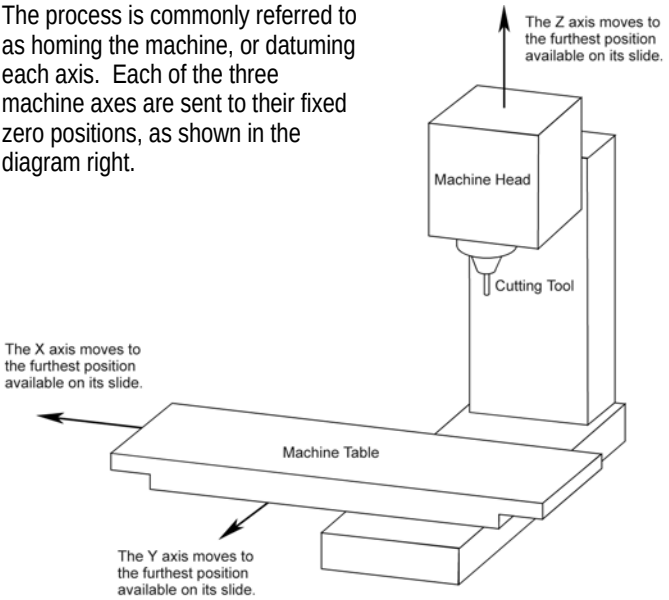
Homing the CNC machine defines:

- The constraints of three dimensional co-ordinate grid system used for plotting any programmed movements - effectively the working envelope of the CNC machine.
- The machine datum - the zero reference point for the CNC machine - so the controlling software can calculate where the tool is positioned in relation to our working envelope.

Note

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

The process is commonly referred to as homing the machine, or datuming each axis. Each of the three machine axes are sent to their fixed zero positions, as shown in the diagram right.



Note

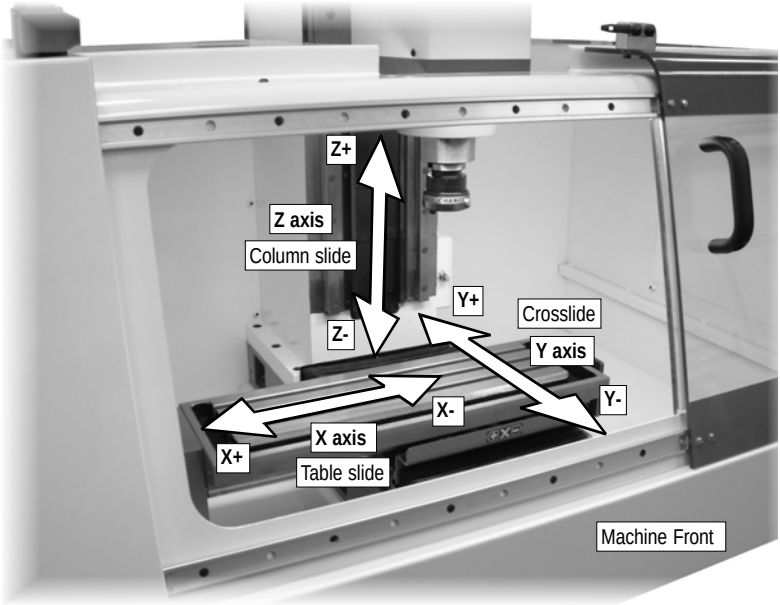
The machine datum position is set by Denford and can never be moved, since it defines the physical movement capability of the CNC machine.

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 (this assumes that no offsets are loaded).

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: Manually Controlling the Triton (Jog Mode)

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.

Note

The keys for manual axis movement will depend on the type of CNC control software being used - please refer to your separate CNC Control Software User's Manual for specific details.

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.

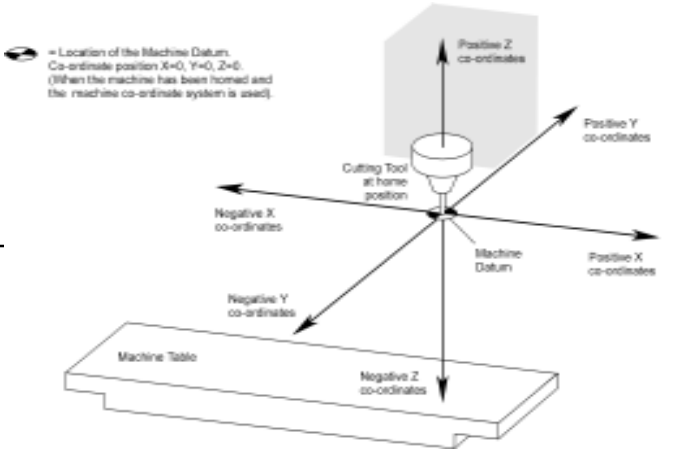
Y Axis - The Y axis slides run at 90 degrees to the X and Z axes, horizontally forwards and backwards, when viewed from the front of the machine.
Minus (-) Y movements run towards the front of the machine and positive (+) Y movements run towards the back of the machine.

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.

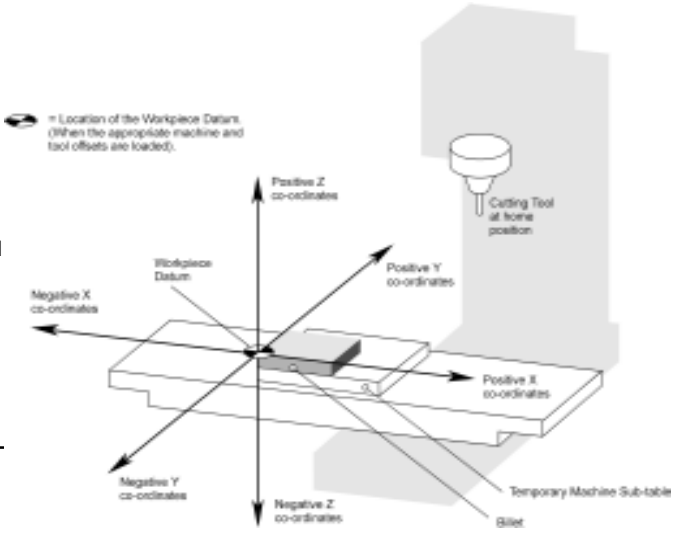
Co-ordinate Display Systems.

The co-ordinate display can be changed, according to datum (zero position) required:

Machine Co-ordinates Display System.
The co-ordinate position values are displayed relative to the fixed machine datum. The co-ordinate display always shows the true position of the machine.



Work Piece Co-ordinates Display System.
The co-ordinate position values are displayed relative to the programmed (moveable) workpiece datum, described through use of the offset facility. Offsets temporarily shift the entire co-ordinate based grid system of the machine. It is common to configure the workpiece datum as the location from which all machining co-ordinates will be taken.



4: Manually Controlling the Triton (Jog Mode)

Note

The sequence of events required to manually enter an M code will depend on the type of CNC control software being used.
In addition, many of these miscellaneous functions may be controlled directly using buttons and commands available in your CNC control software.
Please refer to your separate CNC Control Software User's Manual for specific details.

Manually entering M codes.

M codes can be manually entered for control of miscellaneous functions, such as switching the spindle on and off.

M03 - Spindle forward
M04 - Spindle reverse
M05 - Spindle stop

Requesting a Tool Change.

The Miscellaneous Function M06 is used to program a manual tool change operation.

The M06 code activates the request for a tool change and is followed by the code T_ _ _ _, indicating the new tool number (the first two numerical digits) using the stated tool length offset file number (the last two numerical digits).

For example,
M06 T0305 ;
This command is read request a tool change, from the current tool number to tool number 3, using tool length offset file number 5.

Safety First !

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

Using the Manual Tooling System.

When a manual tool change request is read by the CNC control software, a message window will be displayed. Wait for all machine movements to stop before opening the safety guard door, then change to the new tool number requested. Close the safety guard door and confirm via any CNC control software message windows that machining can be resumed.

Details regarding how to physically change the tool can be found in Section 5 - Preparing Tooling Hardware.

Safety First !

Caution.

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

4: Understanding Offsets

> **Note**
>
> Further information regarding configuration of workpiece and tool length offsets can be found in your separate CNC Machine Control Software User's Manual.

What are offsets?

Offsets are a collection of numerical values used to describe the location of the workpiece datum. The moveable workpiece datum defines the zero point on the billet (the material you want to machine). This is the starting point for any cutting co-ordinates supplied by the machine controller.

Two types of offset file are used, in combination, to describe this location:

i) The workpiece offset file - This file allows global offset values to be set for the X, Y and Z axes. In other words, every tool profile will use the workpiece offset values.

ii) The tool length offset files - Every tool has its own individual tool length offset file, containing a single Z offset value. They are used to compensate for the differences in length between tools.

How is a workpiece datum calculated?

The X position of the workpiece datum is defined by the X value entered into the workpiece offset file.

The Y position of the workpiece datum is defined by the Y value entered into the workpiece offset file.

The Z position of the workpiece datum is defined by the combination of the Z value entered into the workpiece offset file and the value entered into the tool length offset file belonging to the tool profile currently in use.

How is the workpiece datum used?

The software uses the workpiece datum as the starting point (zero reference) for any co-ordinate movements it receives. These co-ordinate movements are read from the loaded CNC file. In other words, the position of the workpiece datum will determine the place on the CNC machine where the part is manufactured.

What actually happens when I program my workpiece datum position?

Configuring the workpiece datum position shifts, or offsets, the entire three dimensional co-ordinate grid system used by the CNC machine. The workpiece datum will now be read by the CNC machine as its zero position, rather than the machine datum. The machine datum is a fixed point, defined when you first switch on and home the CNC machine.

4: Understanding Offsets

Note

Further information regarding configuration of workpiece and tool length offsets can be found in your separate CNC Machine Control Software User's Manual.

Where should I position the workpiece datum on my billet?

This depends on the position of the part datum set in your CNC program. The part datum is the zero reference, or starting point, used when plotting all the co-ordinates that describe the shape of your design.

The part datum could have been set by the programmer, when manually writing the CNC program from a traditional engineering drawing, or automatically set by a CAD/CAM software package.

For example, if you used the CAD/CAM software package, Denford MillCAM Designer, your design would have been drawn within a fixed area, representing the size of the billet you intend to use. The software would then have generated the CNC program, automatically setting the front, left upper corner of this imaginary billet as the part datum. In this case, you would need to position the workpiece datum in the front, left upper corner of the real billet on the machine table.

What happens if I don't use any offsets with my CNC file?

If no offset is programmed, the machine controlling software will use the machine datum as the starting point (zero reference) for any co-ordinate movements it receives. Since it is unlikely that the position of the machine datum is the place where you want any machining to begin, your CNC machine will attempt to manufacture your design in the wrong place in its working area. Offsets are very important because without them, the CNC machine will not know where to begin cutting on your billet. Offsets must always be configured before manufacturing the part.

Are standard offset files supplied?

No, you must set your own. We DO NOT supply any standard offset files with your CNC control software. However, once you have configured and saved your offset files, the same files may be used over and over again, so long as the following holds true:

- The same cutting tools are used.
- The next billet to be machined is the same size as the last billet used.
- The next billet to be machined is placed in the working area in exactly the same position as the last billet used.

4: Configuring a Workpiece Offset

Note

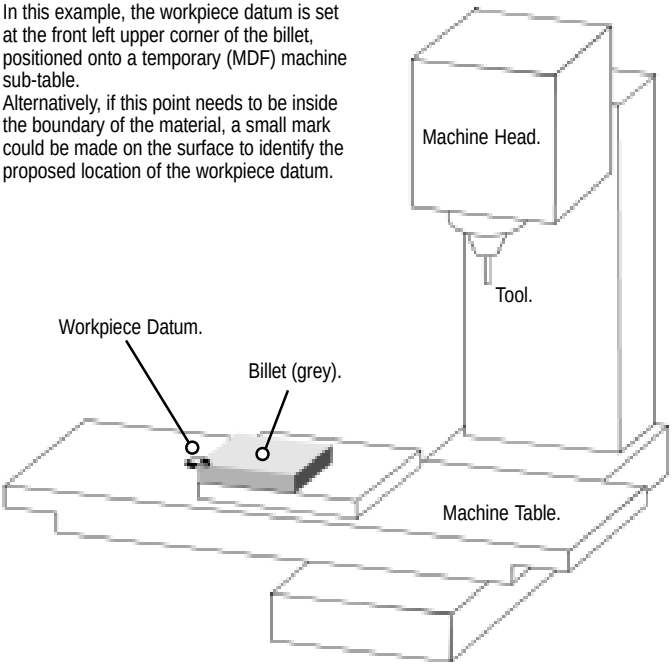
Further information regarding configuration of workpiece and tool length offsets can be found in your separate CNC Machine Control Software User's Manual.

The workpiece offset file contains three values, used to describe the location of your workpiece datum. They determine how much you want to shift the zero reference position of the CNC machine along the X, Y and Z axes.

However, if your CNC file uses two or more tool profiles, the workpiece offset file will not account for the difference in length between the tools. To achieve this, you must also configure a tool offset value for each tool profile you intend to use (see the next page).

Before you can begin entering the workpiece offset values, you must position the tool over your workpiece datum. Move the tool so its cutting tip just touches your chosen workpiece datum position, as shown in the diagram below. Take care not to damage the cutting tip, when manoeuvring the tool.

In this example, the workpiece datum is set at the front left upper corner of the billet, positioned onto a temporary (MDF) machine sub-table.
Alternatively, if this point needs to be inside the boundary of the material, a small mark could be made on the surface to identify the proposed location of the workpiece datum.



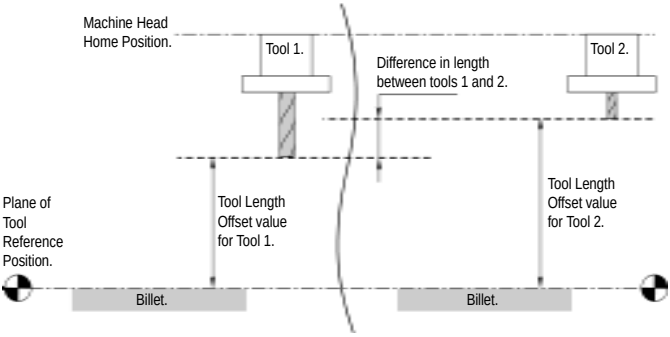
4: Configuring a Tool Length Offset

Note

Further information regarding configuration of workpiece and tool length offsets can be found in your separate CNC Machine Control Software User's Manual.

The tool length offset files each contain a single Z value. A separate tool length offset file must be configured for every tool we want to use. They allow us to establish a common workpiece datum position, no matter what length of tool is used with the CNC file.

Select a point on your billet that can be reached by all the tools you intend to use. All tool length offsets are configured against this common tool offset reference point. When values are entered into each individual Z length tool offset file, each tool will use this reference point as their zero co-ordinate along the Z axis. It is this figure that compensates for the differences in length when various tools are used together on the same job, as shown in the diagram below.



Move the Tool over the chosen Tool Offset Reference Position. Take care not to damage the cutting tip, when manoeuvring the tool.

4: Running a CNC Program (Auto Mode)

Note

The sequence of events required to begin part manufacture on the Triton will depend on the type of CNC control software being used - please refer to your separate CNC Control Software User's Manual for specific details.

Auto mode is used for controlling the CNC machine when running a CNC program.

Part Manufacture Checklist.

Before beginning to manufacture your part, check to see that the following tasks have been completed:

- Billet mounted and secure.
- Tools prepared and numbered ready for use, according to your CNC file.
- Safety guard door closed.
- CNC file loaded and checked via simulation.
- Workpiece and Tool Offset files configured or loaded.
- Machine homed (datumed).
- CNC control software switched to Auto mode.

4: Front Machine Operators Panel

The left side panel contains the following controls:

- Axis Limit Switch Override.

The machine operators panel, mounted directly on the front, left side of the Triton cabinet, contains the following controls:

- Spindle Speed Override.
- Feedrate Override.
- Emergency Stop.

Spindle Speed and Feedrate Override Controls.

Note

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

The spindle speed and feedrate of the Triton can be manually overridden during a machining operation, using the potentiometer controls fitted to the operators panel. On machines where these controls are not fitted, or disabled, the spindle speed and feedrate must be overridden using the CNC control software (please refer to your separate CNC Control Software User's Manual for details regarding this feature).

The spindle speed can be overridden between 50% and 120%.

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

To increase the spindle speed or feedrate, rotate the appropriate control clockwise.

To decrease the spindle speed or feedrate, rotate the appropriate control counterclockwise.

The degree of adjustment applied to each value is displayed in the CNC control software.

Warning

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

Emergency Stop Button.

Note

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

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 until it clicks. The emergency stop button will remain closed (continuing to cut all power to the machine drives) until the button is released. To release, turn the button clockwise until it springs back out.

Axis Limit Switch Override.

The axis limit switch override control is a square push button. If an axis limit switch has been activated, to move the axis in question press and hold the axis limit switch override button and at the same time jog (move) the axis away from the switch using the appropriate axis jog key.

5: The Easychange Tooling System

Easychange Tooling System Components.

The easychange tooling system is supplied as standard with the Triton PC. The system comprises of two elements:

i) The Easychange collar (shown below), which is permanently attached to the spindle under the machine head. Tool holders are held in the collar using a spring closed mechanism.

Easychange
Tool Collar.

ii) The tool holders (shown below), containing the different cutting tool profiles. Each cutting tool must be fitted into a collet (a tubular split metal casing), especially designed to fit securely in the tool holder. Different sized collets are available to accept the various sizes of cutting tool shaft diameters.

Easychange
Tool Holder.

Tool and Collet
Assembly.

5: Removing an Easychange Tool Holder

Removing a Tool Holder from the Collar.

To physically remove a tool from the Easychange collar, grip the knurled collar and fully depress the quick-release pin on its circumference.

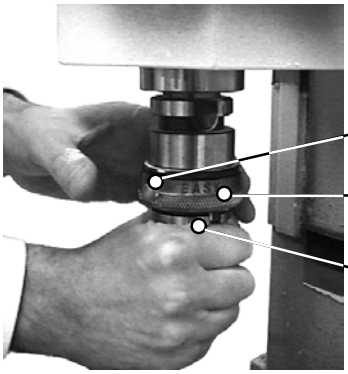
Warning

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

Warning

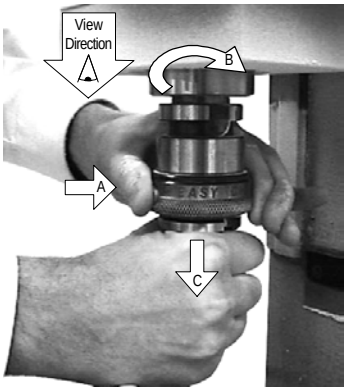
Caution.

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



The mechanism in the Easychange collar is spring loaded. The collar needs to be rotated approximately one third of a turn to fully open the mechanism.

Whilst keeping the quick-release pin fully depressed, hold the tool holder still and the rotate the collar in a clockwise direction (when viewed from above the machine head).



Removing a tool holder from an Easychange collar:

A: Press and hold the quick-release pin.

B: Whilst keeping the quick-release pin depressed, rotate the knurled collar clockwise (when viewed from above machine head).

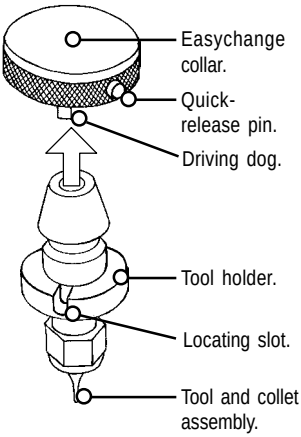
C: Pull the tool holder downwards away from the Easychange spring mechanism.

Remove the tool holder downwards, whilst keeping the quick-release pin still depressed. This prevents the mechanism in the Easychange collar from closing.

5: Fitting an Easychange Tool Holder

Fitting a Tool Holder in the Collar.

To refit a new tool holder into the empty Easychange collar, align the two locating slots on the tool holder with the two driving dogs on the Easychange collar. Ensure the tapered body of the tool holder is clean and free from dust and debris. Push the tool holder up into the Easychange collar. The spring loaded mechanism will close to grip the new tool holder securely.

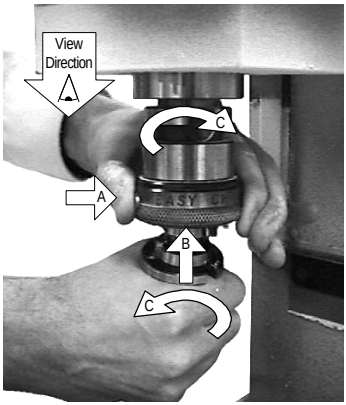


If the spring loaded mechanism in the Easychange collar is closed before the new tool holder is fitted, press and hold the quick-release pin. Push the tapered end of the tool holder into the empty Easychange collar as far as it will travel. Begin to turn the tool holder in an counterclockwise direction (when viewed from above the machine head), whilst continuing to push the tool holder upwards. At the same time, turn the knurled collar in a clockwise direction (when viewed from above the machine head) to reopen the spring mechanism.

When the driving dogs on the Easychange collar and the locating slots on the tool holder align, the tool holder will move up into the collar and the spring mechanism will close.

Warning

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



Fitting a tool holder in a closed Easychange collar:

A: Press and hold the quick-release pin.

B: Push the tool holder upwards and hold it against the closed Easychange spring mechanism.

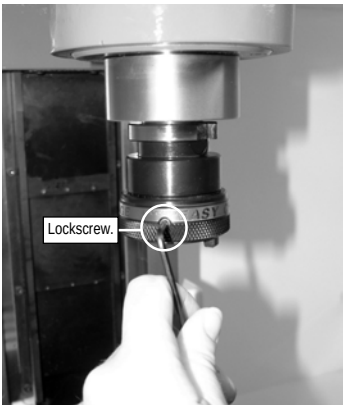
C: Rotate the knurled collar clockwise and the tool holder counterclockwise (both when viewed from above machine head).

5: Locking an Easychange Tool Holder

The Easychange collar contains a locking mechanism, for additional stability. The lockscrew should always be used when:

- Cutting tools of 19mm (3/4") diameter and above are fitted.
- Heavy or intensive milling operations are envisaged.
- Spindle speeds on or above 3000RPM are employed.

The lockscrew can also be used to prevent unauthorised removal of tool holders. This can be particularly useful when the toolchange facility is not required for long periods of time.



Locking a tool holder in an Easychange collar:
A: Insert 2.5mm allen (hex) key into grubscrew.
B: Turn screw clockwise to engage lock, or counterclockwise to release lock.
C: Remove 2.5mm allen (hex) key from the machine working area.

To lock the Easychange collar, insert a 2.5mm allen (hex) key into the grubscrew, positioned in the knurled outer collar ring. Turn the screw clockwise to lock the tool, or counterclockwise to release the lock. Remember to remove the 2.5mm allen (hex) key from the screw, before resuming any machine operations.

5: Setting Tools in the Easychange Tool Holder

Note

Additional Tools:

2.5mm allen (hex) key for spindle drawbar cover plate and Z axis depth stop locking grubscrew.

19mm spanner for spindle drawbar clamping bolt.

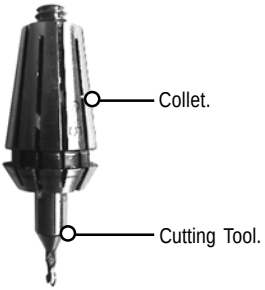
Diagram showing layout of Easychange Tool Holder components and fitting tools.

5: Setting Tools in the Easychange Tool Holder

Fitting Tools to the Collet.

Each cutting tool must be fitted into the appropriate sized collet, before attempting to fit the assembly into the tool holder. The collet is the tubular split metal casing, especially designed to fit securely in the tool holder. Different sized collets are available to accept the various sizes of cutting tool shaft diameters.

A Collet Assembly, ready to fit to the Tool Holder.



Changing the Collet Assembly.

The collet assembly is changed using the nut at the bottom of the Easychange tool holder body.

The easiest method for changing collet assemblies is when the tool holder is fitted to the machine head, since the changing procedure is a two handed operation.

Tools required:

- 25mm Spanner - this fits around the nut used to hold the collet assembly in the tool holder.
- 45-50mm C Spanner - this fits around the locating slot on either the upper part of the Easychange collar or the tool holder body.

continued...

5: Setting Tools in the Easychange Tool Holder

Warning

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

Warning

Caution.

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

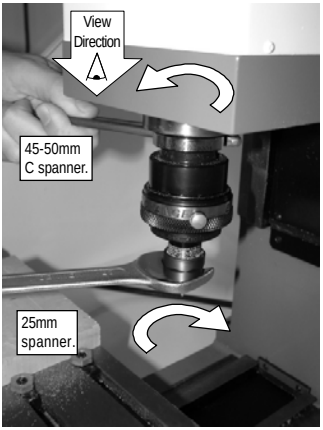
Removing a Collet Assembly.

Place a soft cloth under the tool holder, incase the collet assembly unexpectedly falls out of the tool holder during the operation. Using the 25mm spanner, loosen the nut at the bottom of the Easychange tool holder body, by turning in a clockwise direction (when viewed from above). Position the 45-50mm C spanner on the on the Easychange collar locating slot (as shown below left) to prevent the spindle from rotating as you loosen the nut.

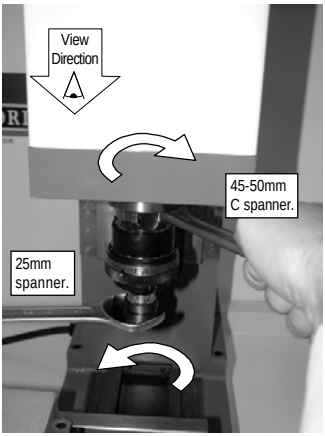
Adding a Collet Assembly.

Insert the collet, containing the new tool profile, as far as it will travel into the bottom of the tool holder. Continue to slide the tool itself up inside the collet until it hits the depth stop screw. The depth stop screw determines how much of the tool will protrude from the bottom of the tool holder - see the next page for details on how to adjust the depth stop screw. Hand turn the nut at the bottom of the Easychange tool holder body counterclockwise (when viewed from above) until it grips the collet assembly. Using the 25mm spanner, continue to tighten the nut, by turning in an counterclockwise direction (when viewed from above). Position the 45-50mm C spanner on the Easychange collar locating slot (as shown below right) to prevent the spindle from rotating as you tighten the nut.

Removing a Collet Assembly.



Adding a Collet Assembly.



Adjusting the Tool Depth Stop Screw.

A tool depth stop grubscrew is fitted to the inside of the Easychange tool holder. Rotating this screw allows the user to define the amount of tool that protrudes from the bottom of the tool holder.

Tools required:

- 2mm allen (hex) key.

To adjust the position of the depth stop grubscrew, remove the nut on the bottom of the Easychange tool holder, together with the collet and the tool.

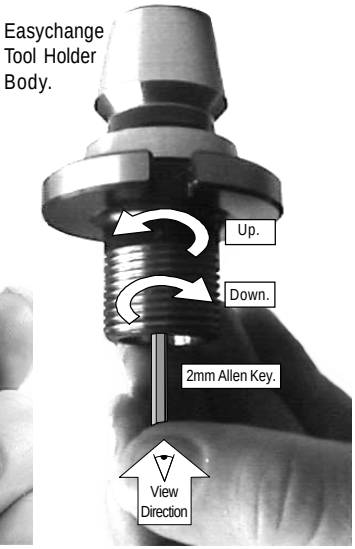
Note that the tool depth stop screw runs along a lefthand thread. Insert the 2mm allen (hex) key into the depth stop grubscrew and turn the allen key counterclockwise to move the depth stop up, or clockwise to move the depth stop down, when looking at the tool holder from the bottom (ie. imagining the toolholder is fitted to the machine spindle).

Refit the collet and tool, to check if the desired tool position has been obtained. Always ensure that the collet is fully seated in the tool holder and the tool itself is touching the depth stop grubscrew. Readjust the depth stop grubscrew again if necessary. Finally, refit the nut on the bottom of the Easychange tool holder.

Warning

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

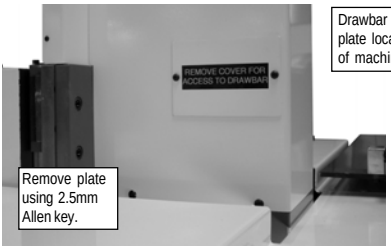
View looking into the bottom of the Easychange tool holder.



Adjusting the tool depth stop screw.

5: Fitting Tools directly to the Spindle

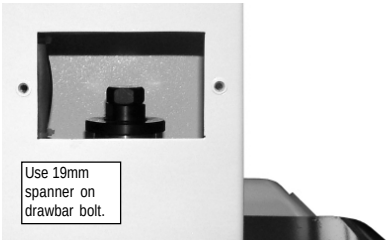
If required, the Easychange collar can be removed from the machine head, allowing long taper length tool holders to be directly fitted to the spindle. The Easychange collar is held onto the spindle using a drawbar bolt.



Drawbar bolt access plate located on left side of machine head.

Remove plate using 2.5mm Allen key.

View looking at the left, upper side of the machine head.



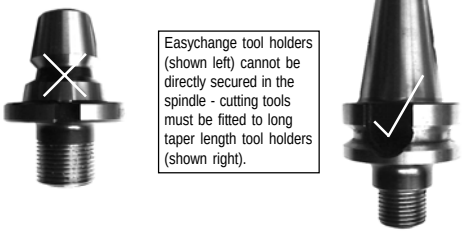
Use 19mm spanner on drawbar bolt.

View looking at the left, upper side of the machine head.

The drawbar bolt can be reached from the left side of the machine head, when viewed from the front of the machine. Using a 2.5mm allen (hex) key, unscrew the two allen headed bolts securing the drawbar access plate onto the machine head casing, then remove the plate.

Place a number of soft cloths under the machine table / Y axis slide, incase the Easychange collar assembly unexpectedly falls from the spindle during the operation.

Using a 19mm spanner, loosen the drawbar by turning the bolt in an counterclockwise direction (when viewed from above). Position a 45-50mm C spanner around the locating slots in the Easychange collar to prevent the spindle from rotating. Withdraw the Easychange collar assembly.



Easychange tool holders (shown left) cannot be directly secured in the spindle - cutting tools must be fitted to long taper length tool holders (shown right).

continued...

5: Fitting Tools directly to the Spindle

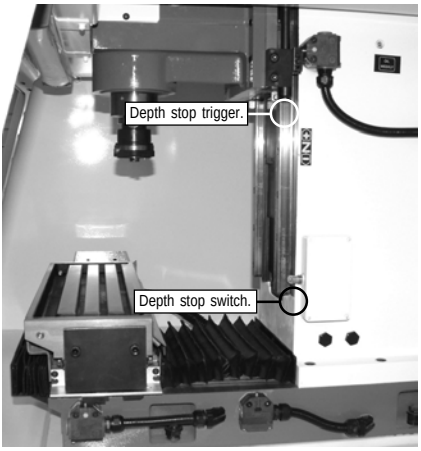
Push the body of the new long taper length tool holder fully into the machine head. Tighten the drawbar bolt by hand until it grips the thread at the top of the tool holder taper. Finish tightening the drawbar bolt using the 19mm spanner. Use the 45-50mm C spanner on the locating slots in the tool holder body to prevent the spindle from rotating as the bolt is tightened.

Replace the drawbar access plate. Check all components in the tool assembly are secure before machining.

5: Z Axis Depth Stop System

The depth stop system fitted to the Z axis cuts drive to the Z axis motor, when hit by a trigger.

The trigger position can be adjusted according to the length of the cutting tool used in the machine head, so power is cut to the Z axis drive motor, before the tool hits specified parts of your work or the machine table.



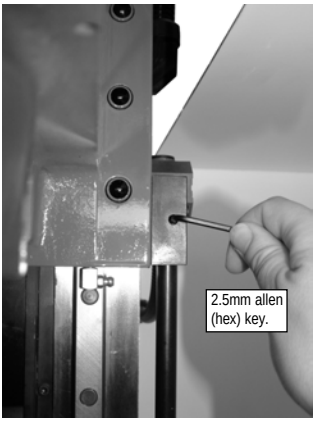
View looking at the right side of the machine head and column (Pro model shown).

The switch is mounted on the lower, right side of the machine column, whilst the depth stop trigger is mounted on the right, lower side of the machine head.

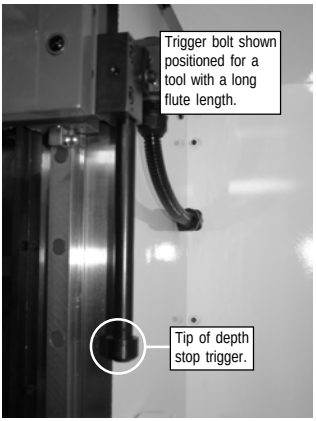
continued...

5: Z Axis Depth Stop System

To adjust the position of the depth stop, use a 2.5mm allen (hex) key to release the grubscrew, locking the trigger bolt in position. The grubscrew is accessible from the front of the trigger mounting block (as shown below left). Turn the hex key in an counterclockwise direction, to loosen the grubscrew.



View looking at the front of the machine head (Pro model shown).



View looking at the front of the machine head (Pro model shown).

Move the bolt so the trigger aligns just below the tip of the cutting tool fitted in the machine spindle. Retighten the grubscrew, by turning the hex key in a clockwise direction, then test the function of the depth stop system.

5: Manually Writing a Tool Change into a Program

The Miscellaneous Function M06 is used to program a manual tool change operation.

The M06 code activates the request for a tool change and is followed by the code T_ _ _ _, indicating the new tool number (the first two numerical digits) using the stated tool length offset file number (the last two numerical digits).

For example,
M06 T0305 ;
This command is read request a tool change, from the current tool number to tool number 3, using tool length offset file number 5.

5: Calling a Tool Change

Warning

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

Warning

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

Manual Calling of a Tool Change.

Before calling the tool change, we recommend you home all three machine axes. When all three machine axes are at their home positions, the maximum amount of free space will be available in the working area, allowing easier access to the tool holder and Easychange collar.

There are two methods used to manually call an Easychange tool change:

1) Switch your CNC control software to Jog mode and use the manual tool change function commands.
2) Write and execute a small “M06” tool change program in your CNC control software editor (see the section on the next page).

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

On calling a tool change, the CNC control software will pause and a message window will be displayed, prompting you to manually change tools. Ensure the new tool profile that is placed in the machine head matches the tool profile expected by your CNC control software.

After changing to the new tool number/profile requested, close the safety guard door, then confirm via any CNC control software message windows that machine control can be resumed.

5: Calling a Tool Change

Warning

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

Warning

Caution.

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

Automatic Calling of an Easychange Tool Change (during the running of a CNC program).

Before starting to run your CNC program, we recommend that you number each easychange tool holder, then fit the appropriate tool profile to each holder, according to the number/profile combinations used in your CNC program. The tool profiles allocated to each tool number are listed at the beginning of your CNC program and may also be programmed into your CNC control software. This will reduce the possibility of the incorrect tool number/profile being placed into the machine head, when the first tool change operation is called.

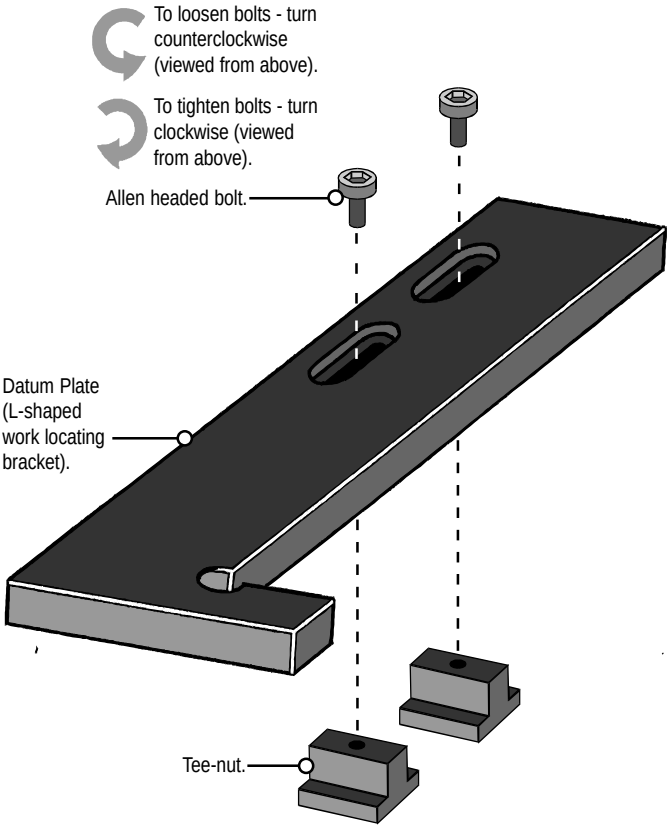
On reading a tool change request in your CNC program, all three machine axes will move to their home positions, via an intermediate point, if programmed. At this point, the CNC control software will pause the CNC program and a message window will be displayed, prompting you to manually change tools.

Wait for all machine movements to stop before opening the safety guard door, then change to the new tool number/profile requested. Close the safety guard door and confirm via any CNC control software message windows that machining can be resumed.

6: Option - The Datum Plate

The datum plate is an L shaped bracket, used for helping to remove and replace work in identical positions on the machine table. This allows projects to be configured using the same workpiece and tool offsets, since the billet can always be placed accurately in position on the machine table - hence the name “datum” plate.

It is fixed against the machine table using two tee nut assemblies which can be moved to the required position for the datum plate. The tee nuts slide along T shaped channels that run horizontally along the machine bed - these trap the datum plate in position when the allen headed bolts are tightened.



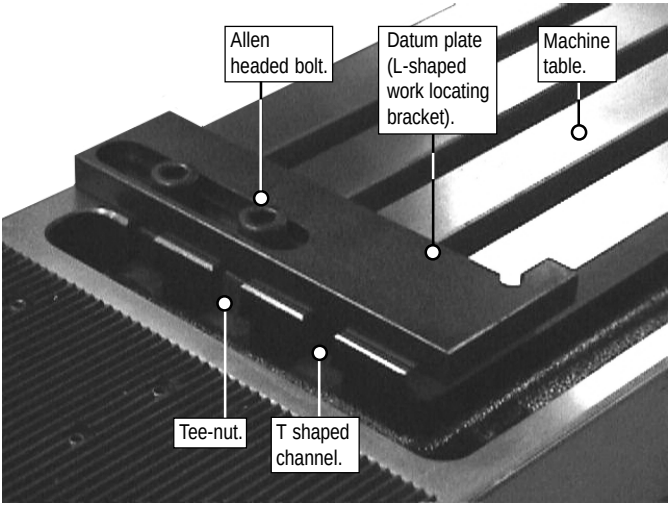
6: Fitting and Removing the Datum Plate

Removal of Datum Plate.

To remove the datum plate, loosen the 2 allen headed bolts, by turning them in an counterclockwise direction. Slide the datum plate along the machine table, until the Tee-nuts are released from their channels, then withdraw the datum plate from the machine table.

Fitting of Datum Plate.

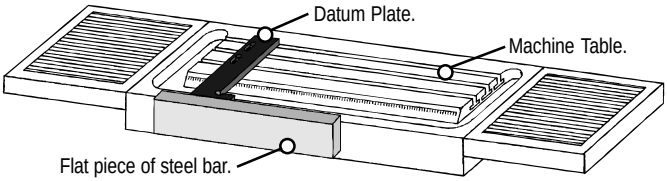
To fit the datum plate in position on the machine table, place it at the end of the T shaped channels. Align each Tee-nut with its respective channel and slide it into position. Slide the datum plate along the machine table to the required position. Note that the datum plate can be slightly adjusted forwards and backwards (ie. parallel to the Y axis), if required, according to whether the front or back two T shaped channels are used. Once the datum plate has been approximately positioned in the correct place, tighten each of the allen headed bolts, by turning them in a clockwise direction until they just begin to grip the plate to the table surface. It must still be possible to move the datum plate, since it may require final adjustments if it needs to be lined up square with respect to the machine axes.



6: Setting the Datum Plate

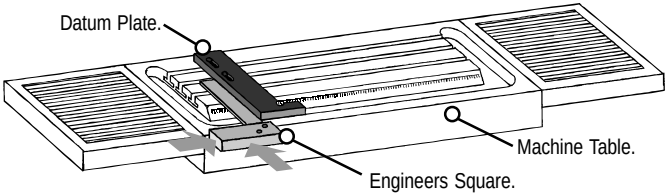
The following diagrams illustrate the various methods that can be used when positioning the datum plate square with respect to the machine table (ie. the edges of the datum plate run exactly parallel with the X and Y machine axes). Each method varies according to the level of position accuracy required.

Datum Plate Setting Method 1.



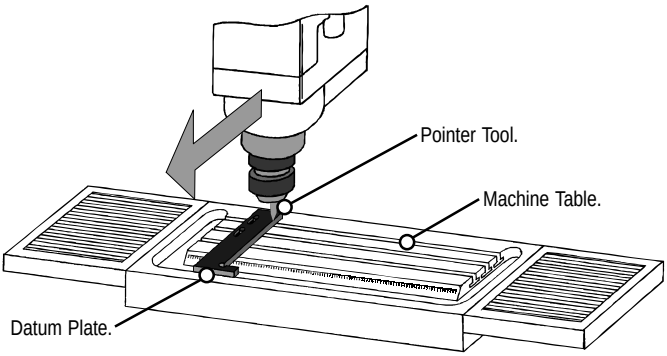
This method is useful if the front face of the datum plate can be positioned exactly level with the front edge of the machine table. Use the true flat face of a section of material, such as a piece of flat steel bar. Press the steel bar firmly against the front edge of the table and adjust the datum plate so its front face also touches the surface of the steel bar. Tighten the allen headed bolts. Note that although this method is quick, it is also fairly inaccurate.

Datum Plate Setting Method 2.



To obtain a better degree of accuracy, use an engineers square lined up against the front edge of the machine table. Adjust the datum plate so it touches the engineers square and tighten the allen headed bolts. This method has the added advantage of allowing the datum plate to be fixed further into the middle of the machine table.

Datum Plate Setting Method 3.

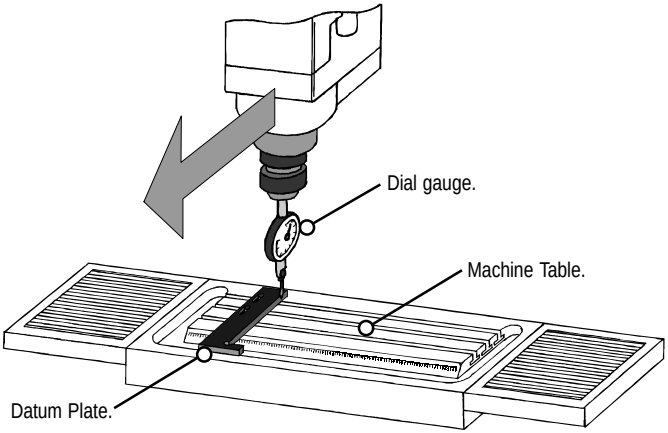


Set up the machine so a pointer is held in place of the cutting tool. Align the pointing tool so it is positioned slightly above one of the 2 edges of the datum plate, which run parallel with the Y axis.

Start with the pointer near the back of the datum plate edge you have chosen. Move the pointer towards the front of the datum plate, checking that the tip of the pointer is still lined up exactly over the edge you have chosen. If the pointer does not align, readjust the position of the datum plate. Keep repeating these steps, moving the pointer forwards and backwards along the datum plate edge, until a suitable degree of accuracy has been obtained.

For a final check, the pointer can be moved above and along one of the datum plate edges which run parallel to the X axis. Finally, tighten the allen headed bolts to fix the datum plate firmly in place.

Datum Plate Setting Method 4.

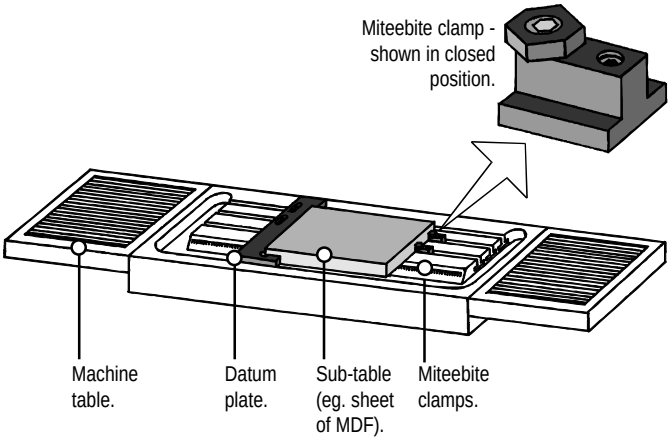


Set up the machine so a dial gauge is held in place of the cutting tool. Align the dial gauge so it is positioned along one of the 2 sides of the datum plate, which run parallel with the Y axis.

Start with the dial gauge near the back of the datum plate edge you have chosen. Move the dial gauge towards the front of the datum plate, checking that the values indicated on the dial gauge do not alter. If the values do alter, readjust the position of the datum plate until the values are constant. Keep repeating these steps, moving the dial gauge forwards and backwards along the datum plate edge, until a suitable degree of accuracy has been obtained. Finally, tighten the allen headed bolts to fix the datum plate firmly in place.

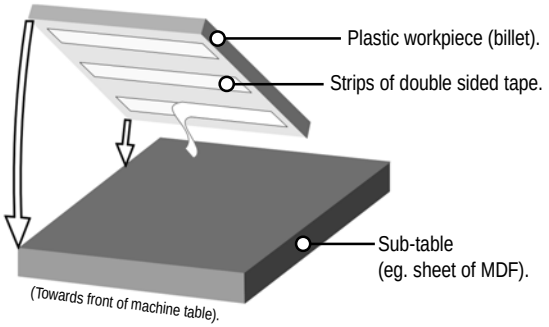
6: Option - Miteebite Clamps

Miteebite clamps are a quick and versatile method of securing most pieces of work to the machine table. In the example shown below, two miteebite clamps are used with a datum plate to clamp a sheet of MDF. This 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.



Loading the Billet.

The actual workpiece, such as a sheet of plastic, would be held in place on the sub-table using double sided tape. The billet is usually positioned with its front and lefthand edges aligned with the front and lefthand edges of the sub-table, as shown below.



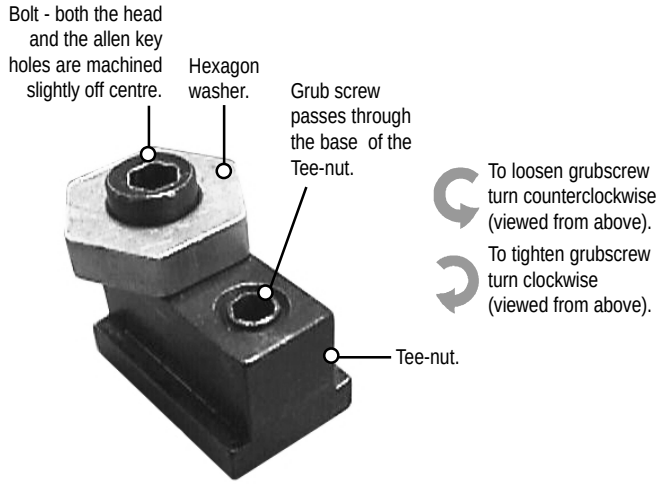
6: How does a Miteebite Clamp work?

The base of the Miteebite clamp consists of a Tee-nut, with 2 threaded holes passing right through its section from top to bottom.

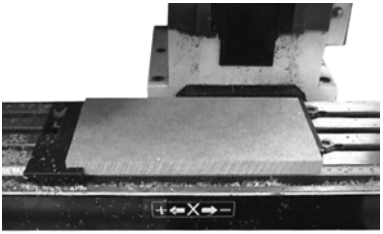
One of these threaded holes contains a grubscrew. When this is tightened, the base of the grubscrew pushes against the surface of the T channel in which it has been placed, securing the Tee-nut in position.

The other threaded hole contains a bolt which has its head and allen key hole machined slightly off centre. A hexagon washer spins freely around this bolt head. The bolt behaves in a similar way to a cam when rotated. If the allen key hole is facing away from the grubscrew, then the hexagon washer is slack against the work (ie. the miteebite is open). If the bolt is then turned through 180 degrees so that the allen key hole is now facing towards the grubscrew, then the hexagon washer will be tight against the work (ie. the miteebite is closed).

Continual turning of the bolt is unnecessary, since the full range of movement for the hexagon washer is covered in a single 360 degree rotation of the bolt. In this respect, the hexagon washer will not tighten further if the bolt is continually turned clockwise.



6: Using Miteebite Clamps



The example used in the description below explains the fitting procedure for a temporary MDF sub-table, onto which a plastic sheet can be attached using double sided tape.

Set the Datum Plate into position, then place the temporary MDF sub-table onto the machine table, so it is located correctly against the edges of the datum plate.

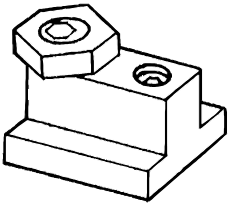
Next, position the miteebites into their respective T channels and slide them along until they touch the sub-table. Ensure that one of the six flat sides of the hexagon washers press against the sub-table, not one of the hexagon points. The hexagon washers should be positioned at this stage so they are open (ie. the off-centre allen key holes on the bolts should be facing away from the grubscrews).

Now tighten the grubscrews in each miteebite to lock them firmly in position. At this stage, it should still be possible to remove the sub-table. Remember, the grubscrews only lock the miteebites in position on the machine table - it is the hexagon washers which actually lock the sub-table in position.

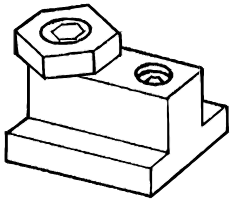
To lock the temporary MDF bed firmly in place, turn the bolts with the off-centre allen key holes 180 degrees so the hexagon washers are in the closed position (ie. the off-centre allen key holes on the bolts should now be facing towards the grubscrews).

Now that the miteebites have been set, the sub-table 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.

Hexagon washer set in open position.

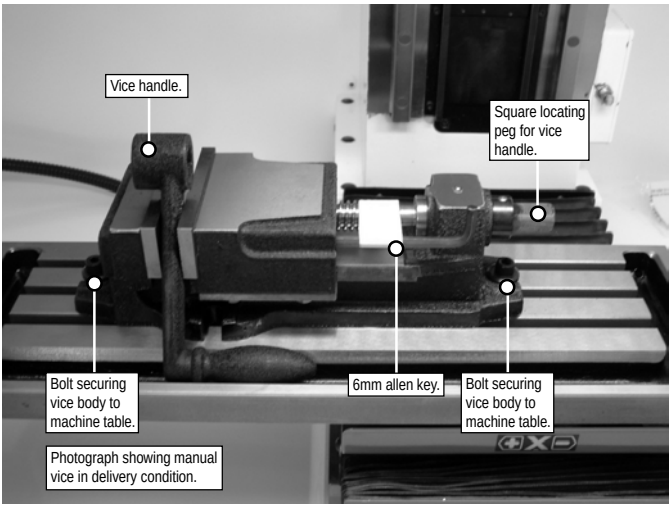


Hexagon washer set in closed position.



6: Option - Table mounted Manual Vice

The table mounted manual vice is designed to clamp a billet securely during the running of a CNC program. The vice body itself is secured to the machine table using a series of allen headed bolts and tee nuts.



Photograph showing manual vice in delivery condition.

To open and close the vice jaws, slide the separate handle onto the square locating peg and turn in the required direction.

Always remove the handle from the vice body and the working area of the machine before starting any machining operations.

To reposition the vice in a different location on the machine table, use the two allen headed bolts at the extreme left and right ends of the vice body. Using a 6mm allen (hex) key, loosen the bolts by turning them in an counterclockwise direction (when viewed from above). If necessary, use additional tools such as an engineers square, to help relocate the vice exactly “square” with respect to the edges of the machine table, then retighten the bolts.

7: 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.
- 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.

Safety First !

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

Safety First !

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

Safety First !

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

7: Maintenance Log

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

7: Maintenance Log

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

7: Maintenance Log

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

7: Maintenance Schedule

Every Day	• Clean and remove any swarf. • Clean tooling system and tool holders.
Every Week	• Clean the machine thoroughly. • Check all exposed screws and nuts for tightness.
Every Month	• Lubricate the machine ballscrews (see note below).
Every Two Months	• Check the condition of any electrical connections. • Check and thoroughly clean all components of the tooling system. • Check all cables for kinks and breaks. • Clean any exposed microswitches.
Every Four Months	• Lubricate the machine slideways.
Every Year	• Check machine alignments and accuracy. • On units not “sealed for life” check spindle bearing adjustment and regrease. • On units not “sealed for life” check and regrease axis bearings. • Check spindle drive belt for wear. • Check axis drive belts for wear.

Note

If your CNC machine is used intensively, we recommend that the maintenance tasks listed in the above schedule are performed on a more regular basis. In particular, the Z axis ballscrew on Triton Pro models used for intensive 3D machining work, should be lubricated on a weekly, not monthly basis.
If you have any doubts concerning any of the above checks, please contact Denford Customer Services for clarification and/or assistance.

7: Lubrication Chart

Lubrication Point	Lubricating System	Frequency	Recommended Oil/Grease	Quantity
Machine Slideways	Pump action oilcan	Every four months	BP : CS 68 Shell : Vitrea 68 Castrol : Perfecto NN	As required
Machine Ballscrews	Pump action oilcan	Monthly (normal use); weekly (intensive use)	BP : CS 68 Shell : Vitrea 68 Castrol : Perfecto NN	As required
Headstock	Grease Seal	On maintenance of machine head	Kluber Isoflex NBU 15	4 cc/Bearing
Axis Bearings	Grease Seal	Once a year	BP : LS 3 Shell : Alvania No. 3	2 cc/Bearing

Warning

Risk of Ignition or Explosion!

Denford recommends that aerosol based lubrication products should NOT be used directly on machine parts, since these products may cause potentially explosive vapours to build-up in enclosed areas of the working area.

Note

If BP : CS 68, Shell : Vitrea 68 or Castrol : Perfecto NN lubricants are unavailable, use a light machine oil, such as “3 in 1”.

7: General Work Area Cleaning

Safety First !

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

Safety First !

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

Thoroughly clean and lubricate the CNC machine, paying special attention to the working area, according to the Maintenance Schedule listed on page 62. In particular, ensure the build up of swarf and debris in the following areas is prevented:

Triton and Triton Pro models:

- The X axis ballscrew, running under the machine table.
- The two X axis slides, running underneath the machine table.
- The X axis datum microswitch, mounted behind the plate on the front of the machine table.
- The two Z axis slides, running right and left down the front of the machine column.
- The Z axis depth stop limit switch, mounted on the front, right side of the machine column and the Z axis depth stop trigger, mounted on the front, right side of the machine head.
- The front and rear sections of the flexible cover on the Y axis crosslide. Also, check underneath the flexible cover.
- The upper surface and T shaped channels on the machine table.
- The machine head and spindle.
- The components of the tooling system.
- The (optional) datum plate and miteebite clamps on the machine table.
- The (optional) table mounted manual vice.

Triton Pro models only:

- The two X axis limit switches, mounted behind the plate on the front of the machine table.
- The Y axis datum switch, mounted on the front, right side of the crosslide base. Note that this switch is mounted in the same casing as the front Y axis limit switch.
- The Y axis limit switches, mounted on the front and back, right side of the crosslide base.

7: Cleaning and Inspecting the X Axis Ballscrew and Slideways

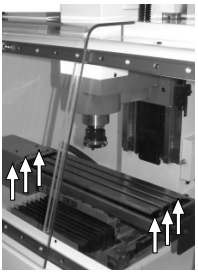
Note

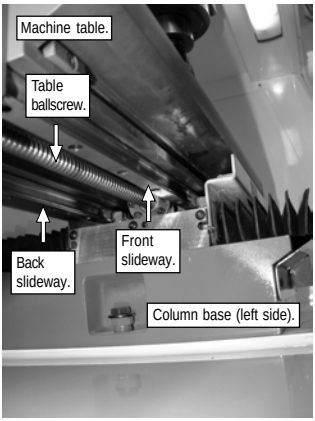
If necessary, use a mirror to help inspect parts of the machine that are hard to reach.

Two X axis slideways are located under the machine table. Run the machine table fully to the left, exposing the left portion of the slides (as shown below left). Using a soft bristled brush, carefully clean any swarf and debris away from both sides of each slideway, to a location where it can be removed from the working area. Inspect each slide for damage or wear. Run the machine table fully to the right, to expose the remaining portion of the slides (as shown below right) and repeat the process.

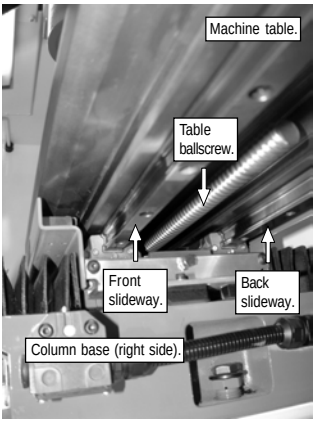
Location

Look under the machine table.





View from the left underside of the machine (Pro model shown).



View from the right underside of the machine (Pro model shown).

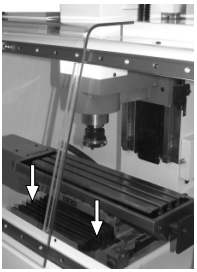
The X axis ballscrew runs centrally along the underside of the machine table. Run the machine table fully to the left, exposing the left portion of the ballscrew (as shown above left), then carefully clean any swarf and debris away, using a soft bristled brush. Inspect the ballscrew for damage or wear. Run the machine table fully to the right, to expose the remaining portion of the ballscrew (as shown above right) and repeat the process.

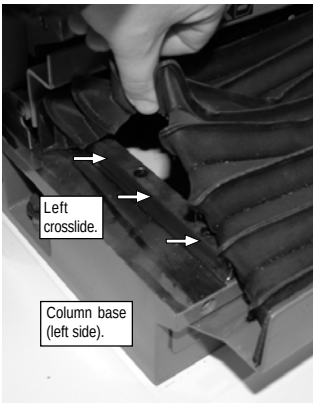
7: Cleaning and Inspecting the Y Axis Ballscrew and Slideways

Two Y axis slideways are located under the sides of the flexible cover at the base of the machine column. Run the machine table and saddle fully back against the machine column. Lift the cover sides (as shown below), then using a soft bristled brush, carefully clean any swarf and debris away from both sides of each slideway, to a location where it can be removed from the working area. Inspect each slide for damage or wear.

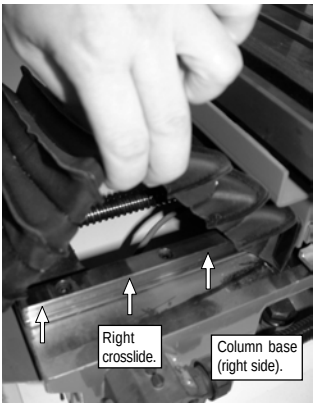
Location

Lift the flexible cover on the machine column base.





View from the left side of the machine column (Pro model shown).

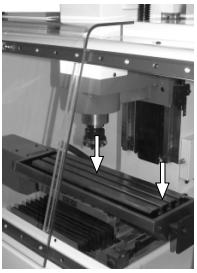


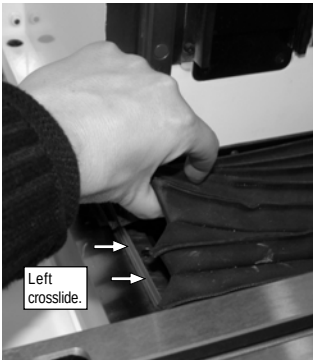
View from the right side of the machine column (Pro model shown).

Run the machine table and saddle fully forwards and repeat the process for the remaining back portions of the slides (as shown below).

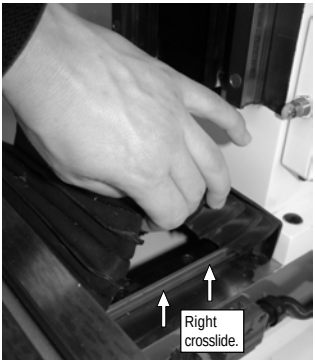
Location

Lift the flexible cover on the machine column base.





View from the left side of the machine column (Pro model shown).



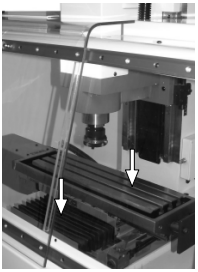
View from the right side of the machine column (Pro model shown).

7: Cleaning and Inspecting the Y Axis Ballscrew and Slideways

The Y axis ballscrew is fully enclosed by the flexible cover, so it is not subject to swarf build-up. Run the machine table and saddle fully back against the machine column, then lift and move the cover to one side (as shown below). Take care not to overstretch or tear the flexible cover. Inspect the ballscrew for damage or wear.

Location

Lift the flexible cover on the machine column base.



View from the right side of the machine column (Pro model shown).

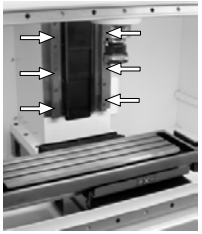
Run the machine table and saddle fully forwards and repeat the process for the remaining part of the ballscrew.

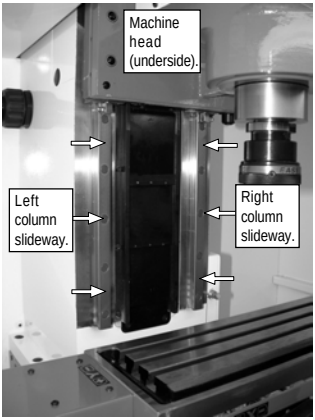
7: Cleaning and Inspecting the Z Axis Ballscrew and Slideways

Two Z axis slideways are fitted to the front right and left sides of the machine column (shown below). Using a soft bristled brush, carefully clean any swarf and debris away from both sides of each slideway, to a location where it can be removed from the working area. Inspect each slide for damage or wear.

Location

Look at the front of the machine column.



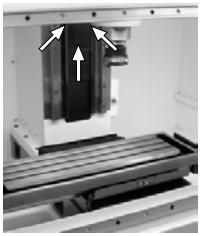


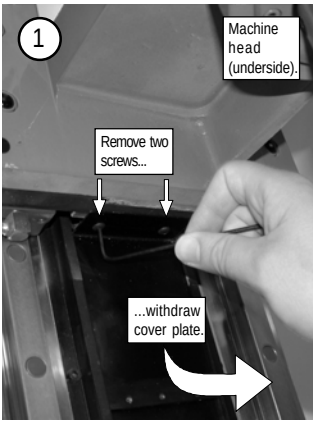
View looking at the front of the machine column (Pro model shown).

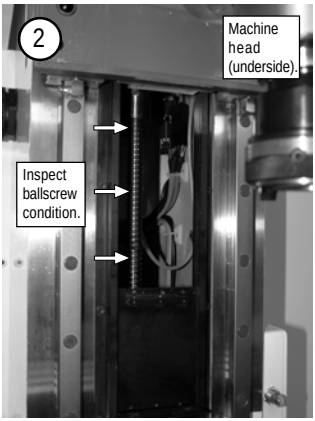
The Z axis ballscrew is fully enclosed by the machine column metalwork, so it is not subject to swarf build-up. The ballscrew can be inspected for damage or wear by removing the cover plate attached to the front of the machine column (as shown below). The cover plate is held in position using two screws, accessible from the underside of the machine head, using a 2.5mm allen (hex) key.

Location

Look at the front of the machine column.







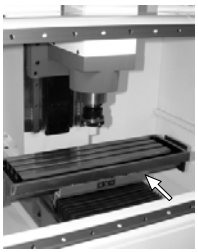
7: Cleaning and Inspecting the X Axis Switches

X Datum Sensorswitch (Triton and Triton Pro models).

The sensorswitch defining the X axis datum is maintenance free and mounted in a small alcove, on the right front upper corner of the saddle, when viewed from the front of the machine. The cover plate fitted to the front face of the machine table usually prevents swarf and debris from building up around the sensor fitted to the switch. However, the switch may require cleaning when the machine has been used in extreme operating conditions.

Location

Look at the front, right side of the machine saddle and under the right side of the machine table.



View looking at the front of the machine table with the cover plate removed (Pro model shown).

Drive the machine table fully to the right. This will make is easier to gain access to the right side of the saddle, where the condition of the sensorswitch can be checked. If necessary, remove the front machine table cover plate. Using a soft bristled brush, carefully clean any swarf and debris away from the sensorswitch, to a location where it can be removed from the working area. Take care not to disturb any wires or sensors. Inspect the sensorswitch for damage or wear.

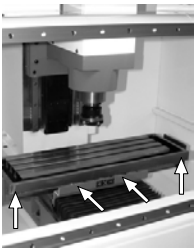
7: Cleaning and Inspecting the X Axis Switches

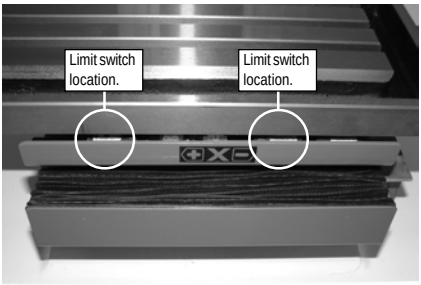
X Overtravel Limit Switches (Triton Pro model only).

The two limit switches, used to control overtravel of the Triton Pro X axis, are mounted in the small channel section, fitted to the front upper part of the saddle. Under normal operating conditions, the cover plate fitted to the front face of the machine table prevents swarf and debris from building up around these switches.

Location

Look at the front of the machine saddle and under the ends of the machine table.





View looking at the front of the machine table with the cover plate removed.

To check the condition of the switches, remove the front machine table cover plate. Using a soft bristled brush, carefully clean any swarf and debris away from the switches, to a location where it can be removed from the working area. Inspect each switch for damage or wear.

Note

The moveable limit switch trigger positions are set at the time of machine manufacture and should not require adjustment.

Note

If necessary, use a mirror to help inspect parts of the machine that are hard to reach.

View looking under the left end of the machine table.

View looking under the left end of the machine table.

The triggers for the limit switches are mounted under the front right and left ends of the machine table. Using a soft bristled brush, carefully clean dust and debris away from each trigger, to a location where it can be removed from the working area. Inspect each trigger for damage or wear.

7: Cleaning and Inspecting the Y Axis Switches

Y Datum Sensorswitch (Triton model only).

The sensorswitch defining the Y axis datum is maintenance free and mounted at the front of the crosslide. The switch is not subject to swarf build-up, since it is fully enclosed by the flexible cover and column base metalwork.

Y Datum Microswitch (Triton Pro model only).

Note

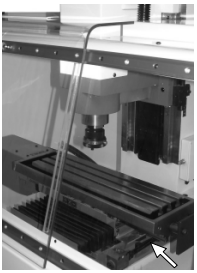
The moveable microswitch trigger position is set at the time of machine manufacture and should not require adjustment.

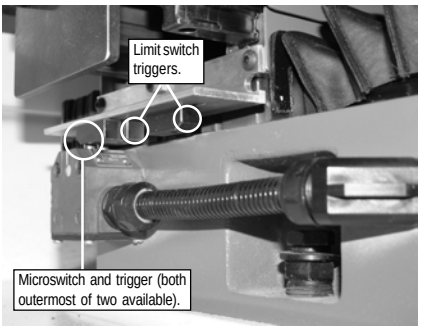
The microswitch defining the Y axis datum is mounted in the two switch unit, fitted to the right side of the machine column base. The datum microswitch is the outer of the two available switches in this unit.

To check the condition of the microswitch, drive the machine table and saddle fully back against the machine column. This will completely expose the switch unit. Using a soft bristled brush, carefully clean any swarf and debris away from the microswitch, to a location where it can be removed from the working area. Inspect the microswitch for damage or wear.

Location

Look at the right side of the machine saddle and the column base.





View looking at the right side of the machine column, towards the front of the machine.

The trigger for the Y axis microswitch is the outer of the two triggers mounted under the bracket secured to the right side of the machine saddle. Using a soft bristled brush, carefully clean dust and debris away from the trigger, to a location where it can be removed from the working area. Inspect the trigger for damage or wear.

7: Cleaning and Inspecting the Y Axis Switches

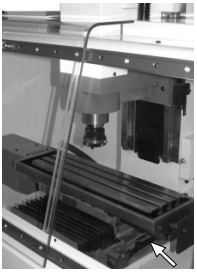
Y Overtravel Limit Switches (Triton Pro model only).

The two limit switches, used to control overtravel of the Triton Pro Y axis, are mounted in sealed units on the right side of the machine column base. The back overtravel is a single switch, whilst the front overtravel is mounted in a two switch unit. The front overtravel limit switch is the inner of the two available switches in this unit.

To check the condition of the front limit switch, drive the machine table and saddle fully back against the machine column. This will completely expose the two switch unit. Using a soft bristled brush, carefully clean any swarf and debris away from the switch, to a location where it can be removed from the working area. Inspect the switch for damage or wear. Drive the machine table and saddle fully forwards to completely expose the back single limit switch unit and repeat the cleaning and inspection process.

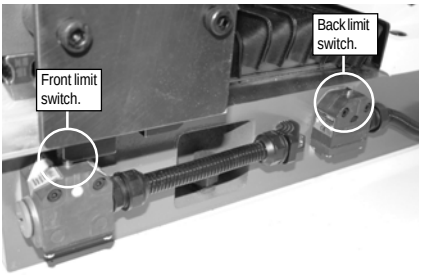
Location

Look at the right side of the machine saddle and the column base.

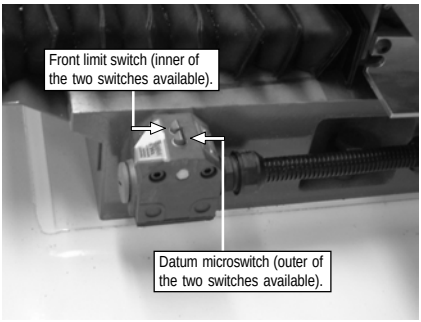


Note

The moveable limit switch trigger positions are set at the time of machine manufacture and should not require adjustment.



View looking at the right side of the machine column, towards the back of the machine.



View looking at the right side of the machine column.

The triggers for the limit switches (shown in the photo on the previous page) are mounted under the bracket secured to the right side of the machine saddle. The trigger for the front limit switch is the inner of the two triggers mounted together at the front of the bracket. Using a soft bristled brush, carefully clean dust and debris away from each trigger, to a location where it can be removed from the working area. Inspect each trigger for damage or wear.

7: Cleaning and Inspecting the Z Axis Switches

Z Datum Sensorswitch (Triton model only).

The sensorswitch defining the Z axis datum is maintenance free and mounted at the top of the machine column. The switch is not subject to swarf build-up, since it is fully enclosed by the machine column casing.

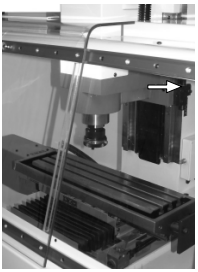
Z Datum Microswitch (Triton Pro model only).

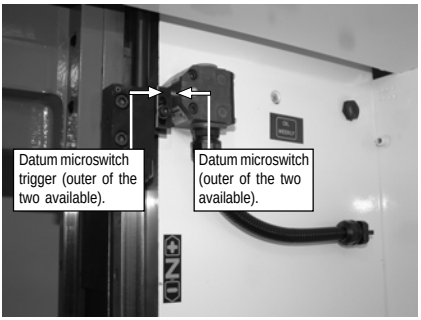
The microswitch defining the Z axis datum is mounted in the two switch unit, fitted to the right, upper side of the machine column. The datum microswitch is the outer of the two available switches in this unit.

To check the condition of the microswitch, drive the machine head down so the two switch unit is completely exposed. Using a soft bristled brush, carefully clean any swarf and debris away from the outer microswitch, to a location where it can be removed from the working area. Inspect the microswitch for damage or wear.

Location

Look at the right upper side of the column and the right lower side of the head.





View looking at the right side of the machine head and column.

The trigger for the Z axis microswitch is the outer of the two triggers mounted on the bracket, attached to the right, lower side of the machine head. Using a soft bristled brush, carefully clean dust and debris away from the trigger, to a location where it can be removed from the working area. Inspect the trigger for damage or wear.

Note

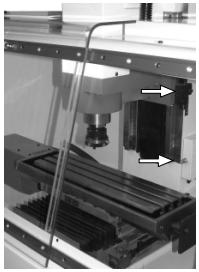
The moveable microswitch trigger position is set at the time of machine manufacture and should not require adjustment.

7: Cleaning and Inspecting the Z Axis Switches

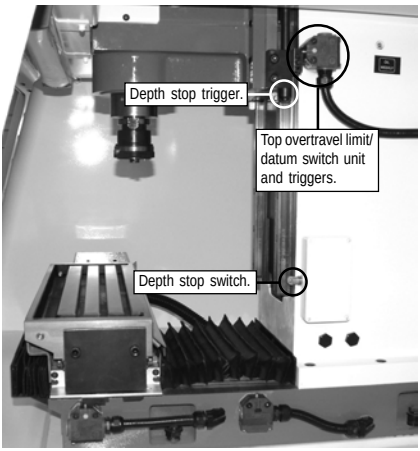
Depth Stop Switch (Triton and Triton Pro models).

Location

Look at the right lower side of the column base and the right lower side of the head.



The switch mounted on the lower, right side of the machine column cuts drive to the Z axis motor, when hit by the adjustable depth stop trigger, mounted on the right side of the machine head. The trigger position can be set according to the longest cutting tool used in the machine head, so power is cut to the Z axis drive motor before the tool hits specified parts of your work or the machine table.



View looking at the right side of the machine head and column (Pro model shown).

Using a soft bristled brush, carefully clean any swarf and debris away from both the switch and the trigger, to a location where it can be removed from the working area. Inspect the switch and trigger for damage or wear.

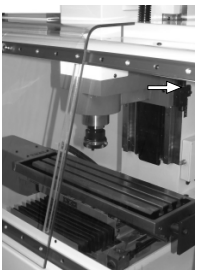
7: Cleaning and Inspecting the Z Axis Switches

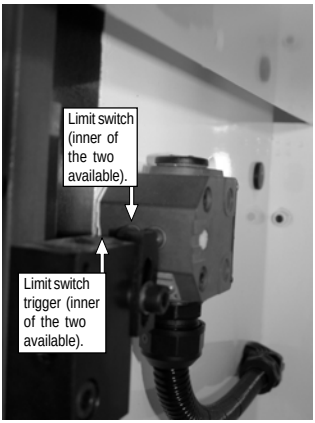
Overtravel Limit Switch (Triton Pro model only).

The limit switch, used to control overtravel at the top of the Triton Pro Z axis, is mounted in a two switch unit attached to the right, upper side of the machine column.. The limit switch is the inner of the two available switches in this unit.

Location

Look at the right upper side of the column and the right lower side of the head.





View looking at the right side of the machine head and column.

To check the condition of the limit switch, drive the machine head down so the two switch unit is completely exposed. Using a soft bristled brush, carefully clean any swarf and debris away from the inner switch, to a location where it can be removed from the working area. Inspect the switch for damage or wear.

Note

The moveable limit switch trigger position is set at the time of machine manufacture and should not require adjustment.

The trigger for the limit switch is the inner of the two triggers mounted on the bracket, attached to the right, lower side of the machine head. Using a soft bristled brush, carefully clean dust and debris away from the trigger, to a location where it can be removed from the working area. Inspect the trigger for damage or wear.

7: X Axis Ballscrew Lubrication

Note

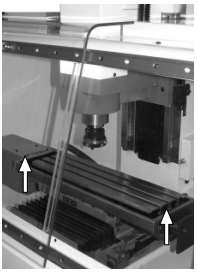
If necessary, use a mirror to help locate parts of the machine that are hard to reach.

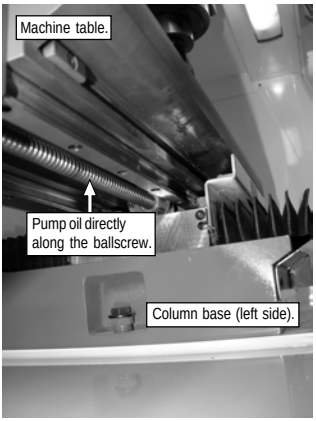
The X axis ballscrew is located under the machine table. Run the machine table fully to the left, exposing the left portion of the ballscrew (as shown below left). Using a pump action oilcan, reach under the left side of the machine table and pump oil directly onto the uncovered parts of the ballscrew.

Run the machine table fully to the right, to expose the remaining portion of the ballscrew (as shown below right). Using a pump action oilcan, reach under the right side of the machine table and pump oil directly onto the remaining parts of the ballscrew.

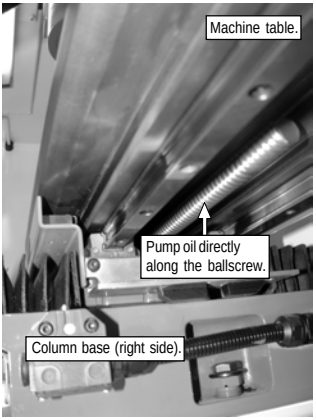
Location

Look under the machine table.





View from the left underside of the machine (Pro model shown).



View from the right underside of the machine (Pro model shown).

Finally, run the table left and right along the X axis, to distribute the oil along the full length of the ballscrew.

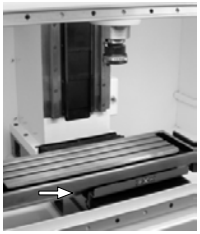
7: Y Axis Ballscrew Lubrication

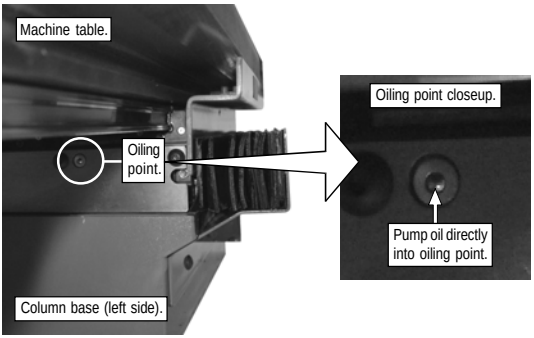
The Y axis ballscrew is located under the flexible cover at the base of the machine column. To lubricate the ballscrew, use the single oiling point mounted on the left side of the machine saddle*.

Run the machine saddle to approximately the mid-point of the Y axis. Using a pump action oilcan, reach under the left side of the machine table and pump oil directly into the oiling point (as shown below).

Location

Look at the left side of the machine saddle.





View from the left underside of the machine (Pro model shown).

Run the machine saddle forwards and backwards along the Y axis, to distribute the oil along the full length of the ballscrew.

Note *

On some machines, the Y axis ballscrew oiling point is positioned next to the Z axis ballscrew oiling point, on the right side of the machine column, above the roof of the machine cabinet.

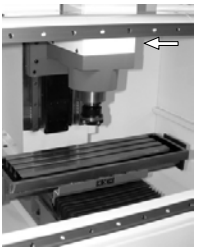
7: Z Axis Ballscrew Lubrication

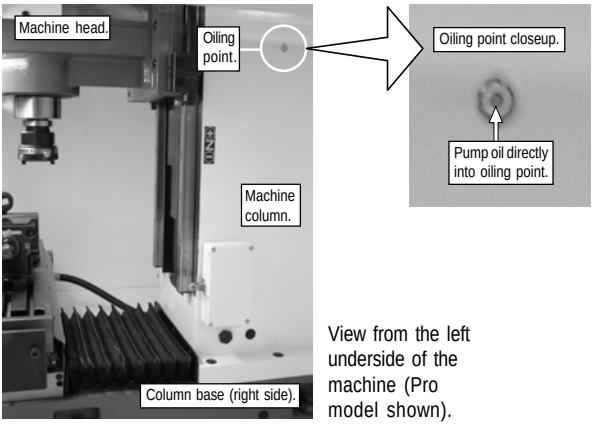
The Z axis ballscrew is located behind the cover plate, on the front of the machine column. To lubricate the ballscrew, use the single oiling point mounted on the right side of the machine column, below the roof of the machine cabinet.*.

Run the machine head to approximately the midpoint of the Z axis. Using a pump action oilcan, reach inside the working area towards the right side of the machine column and pump oil directly into the oiling point (as shown below).

Location

Look at the right side of the machine column.





View from the left underside of the machine (Pro model shown).

Run the machine head up and down along the Z axis, to distribute the oil along the full length of the ballscrew.

Note *

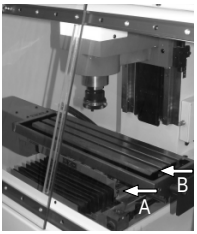
On some machines, the Z axis ballscrew oiling point is positioned next to the Y axis ballscrew oiling point, on the right side of the machine column, above the roof of the machine cabinet.

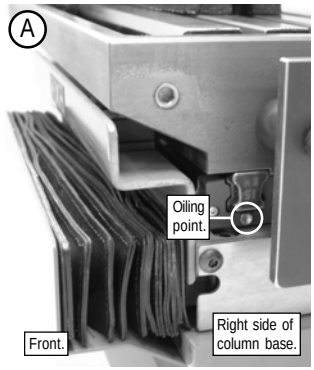
7: X Axis Slideways Lubrication

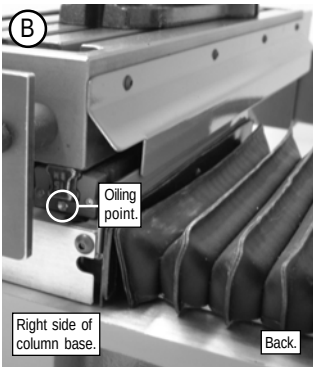
Four oiling points for the X axis are located in the sides of the machine saddle. Each oiling point is positioned under the appropriate X axis slideway, at the four locations where the slideways pass over the edge of the machine saddle.

Location

Look at the right side of the machine saddle.





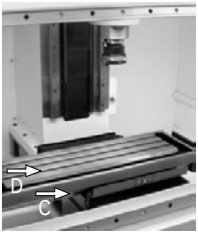


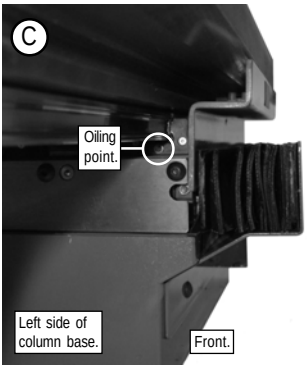
Run the machine table fully to the right, to obtain the best possible access to the two oiling points located under the front and rear right slideways. Using a pump action oilcan, reach under the right side of the machine table and pump oil into the two oiling points (as shown above).

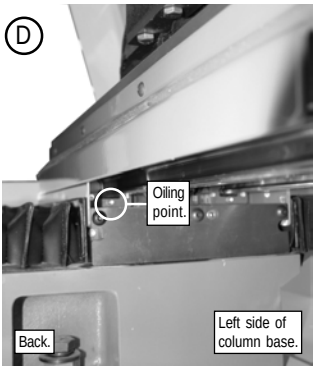
Run the machine table fully to the left, to obtain the best possible access to the remaining two oiling points, located under the front and rear left slideways. Using a pump action oilcan, reach under the left side of the machine table and pump oil into the two oiling points (as shown below).

Location

Look at the left side of the machine saddle.







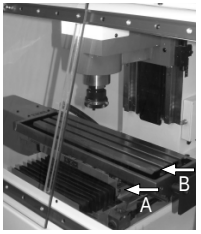
Finally, run the table left and right along the X axis, to distribute the oil along the full length of the slideways.

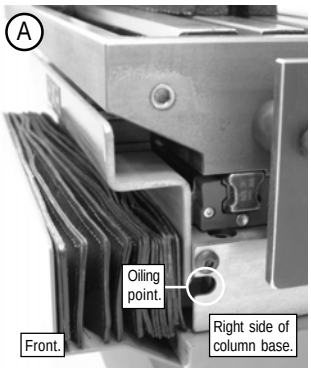
7: Y Axis Slideways Lubrication

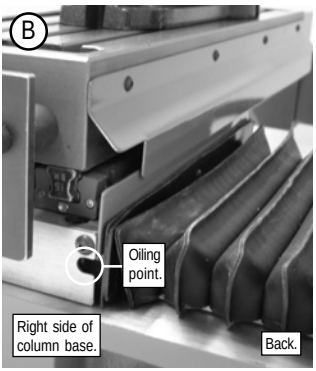
Four oiling points for the Y axis are located in the sides of the machine saddle. Each oiling point is positioned in a cutaway slot, directly under the points where the X axis slideways pass over the side edges of the machine saddle.

Location

Look at the right side of the machine saddle.





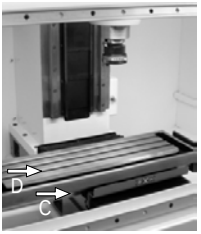


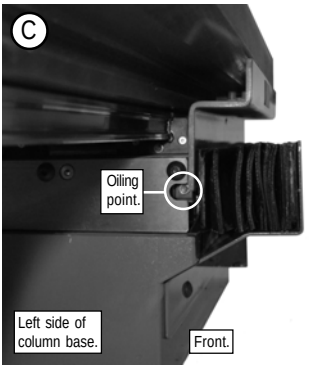
Run the saddle to approximately the midpoint of the Y axis. Run the machine table fully to the right, to obtain the best possible access to the two oiling points located under the front and rear right table slideways. Using a pump action oilcan, reach under the right side of the machine table and pump oil into the two oiling points (as shown above).

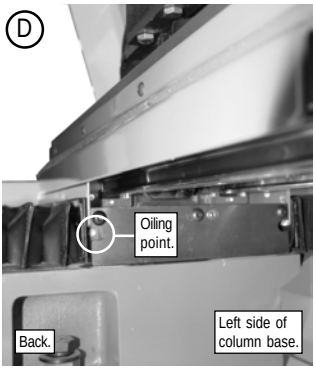
Run the machine table fully to the left, to obtain the best possible access to the remaining two oiling points, located under the front and rear left table slideways. Using a pump action oilcan, reach under the left side of the machine table and pump oil into the two oiling points (as shown below).

Location

Look at the left side of the machine saddle.







Finally, run the saddle forwards and backwards along the Y axis, to distribute the oil along the full length of the slideways.

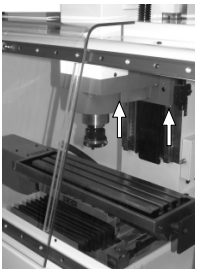
7: Z Axis Slideways Lubrication

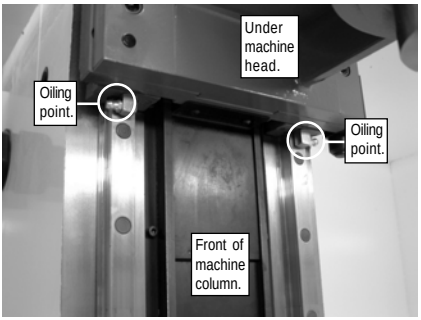
Four oiling points are provided for the Z axis. Two are located at the top of the machine column, in line with the slideways. The remaining two are located under the machine head, in line with the slideways.

Run the machine head fully up, to obtain the best possible access to the two oiling points located under the front of the machine head. Using a pump action oilcan, reach into the working area of the machine and pump oil into the two oiling points (as shown below).

Location

Look under the machine head.



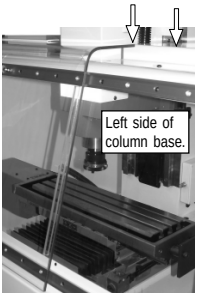


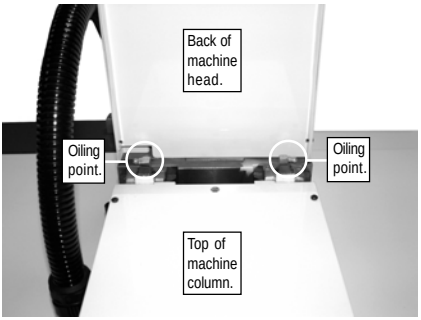
View from the left underside of the machine head.

The remaining two oiling points are located at the top of the machine column, just behind the back face of the machine head. They are best accessed from the back of the machine, using a small stepladder to help gain comfortable access. Using a pump action oilcan, pump oil into the two oiling points (as shown below).

Location

Look at the top of the machine column.





View from the back of the machine, looking down onto the machine column.

Finally, run the machine head up and down along the Z axis, to distribute the oil along the full length of the slideways.

7: Maintenance of the Easychange Tooling System

Safety First !

Use compressed air with caution, following safe and correct working procedures in accordance with Health and Safety Regulations in your establishment.

Warning

Risk of Ignition or Explosion!
Denford recommends that aerosol based lubrication products should NOT be used on any other parts of the CNC machine, since these products may cause potentially explosive vapours to build-up in enclosed areas of the working area.

Every Day.

Before each use of the Easychange tooling system, check that the tapered bores of the Easychange collar and the tool holder are clean.

Every Two Months.

Bimonthly thorough cleaning and lubrication of the Easychange collar and tool holders is recommended. Under more intensive use, check and service the components on a weekly basis:

- Easychange collar - When the collar is set in the open (empty) position, check the condition of any exposed internal surfaces, particularly the tapered bore. Direct a compressed air jet onto the steel balls inside the tapered bore of the collar. WD40 or a similar aerosol light machine oil may also be used to lubricate the collar components, then check the operation of the mechanism components.
- Tool holders - Check the condition of any exposed external surfaces, particularly the tapered bore. Clean any dust and debris by wiping the surfaces with a soft cloth, then lubricate the tapered bore with a thin coating of light machine oil. Remove the nut securing the tool and collet assembly. Strip down the components, check their condition, clean, lubricate, then reassemble.

When cleaning the machine table, ensure that no dust or debris particles enter the Easychange collar, when the mechanism is set in the open (empty) position.

7: Maintenance of the Manual Vice

Every Two Months.

Bimonthly thorough cleaning and lubrication of the table mounted (optional) manual vice is recommended. Using a light machine oil (or similar) in a pump action oilcan, lubricate all moving parts and screws on the vice. Under more intensive use, check and service the components on a weekly basis. When cleaning a vice mounted on the machine table, ensure that no dust or debris particles can enter the Easychange collar, when the mechanism is set in the open (empty) position.

8: Accessing the Triton Electrical Panel

Warning

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

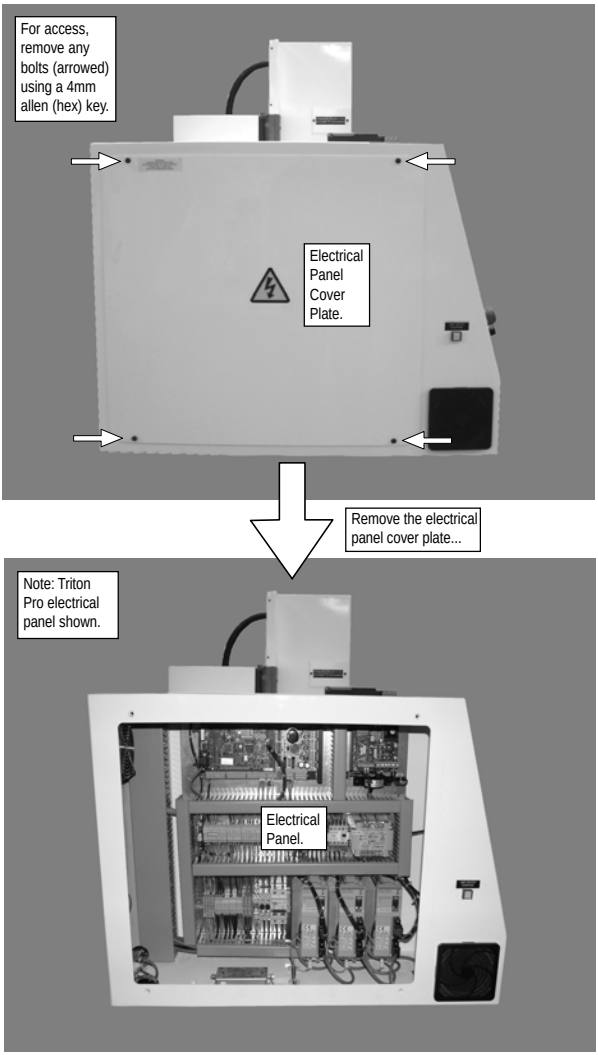
Note that hazardous voltages can still exist immediately after switching off the power.

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

Warning

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

The Triton electronics are located in the left end of the machine. Using a 4mm allen (hex) key, remove any retaining bolts, then withdraw the cover plate, to gain access to the electrical panel, as shown below.



8: Electrical Panel Layout - Triton Models

Note

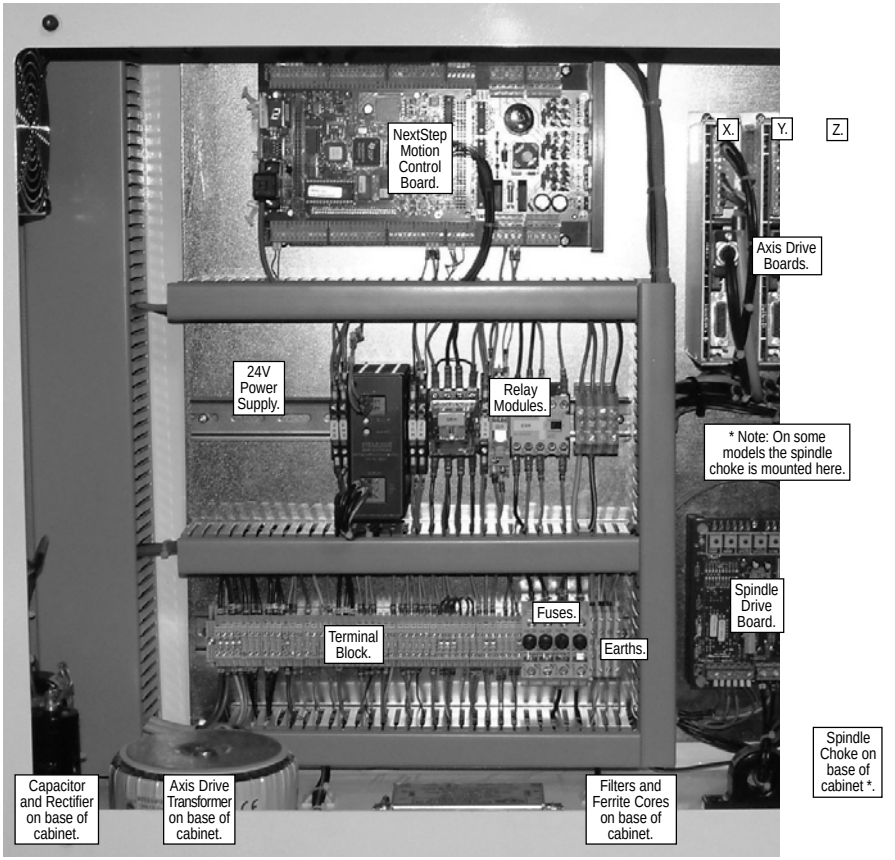
The electrical diagrams for your Triton are not included in this manual. They are either stored in a folder attached to the inside of the cover plate or delivered separately in the standard equipment box supplied with your machine.

The photo below labels all important areas on the Triton electrical panel.

Please note that the layout of your electrical panel may differ from the photo, depending on components and options fitted to your Triton.

Before commencing any work, refer to the schematic diagram of the electrical panel and components. Further electrical schematics are available on request.

Triton Electrical Panel Layout.



8: Electrical Panel Layout - Triton Pro Models

Note

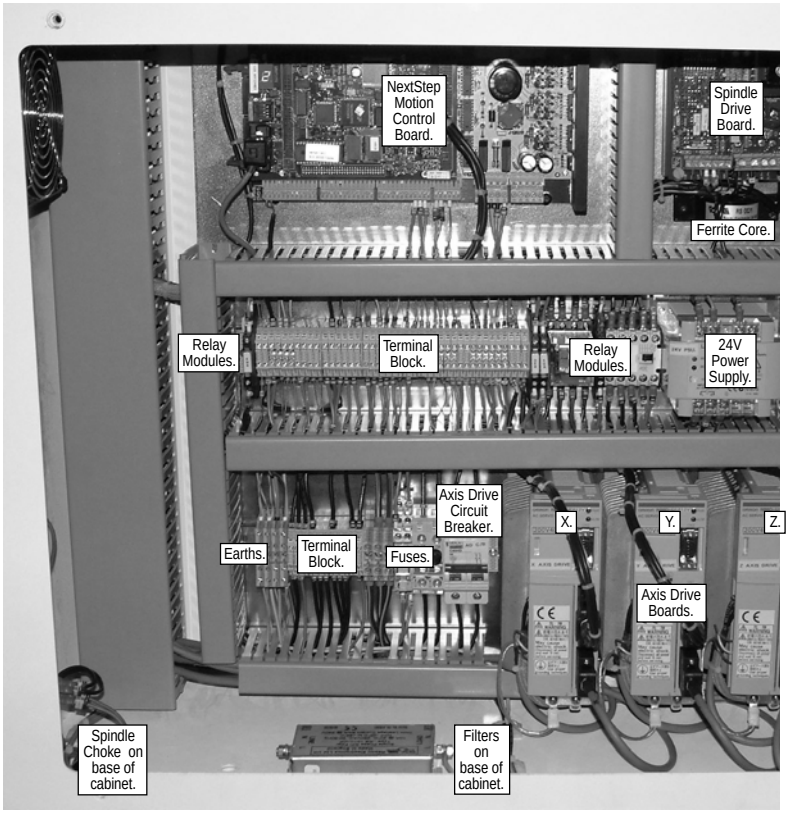
The electrical diagrams for your Triton Pro are not included in this manual. They are either stored in a folder attached to the inside of the cover plate or delivered separately in the standard equipment box supplied with your machine.

The photo below labels all important areas on the Triton Pro electrical panel.

Please note that the layout of your electrical panel may differ from the photo, depending on components and options fitted to your Triton Pro.

Before commencing any work, refer to the schematic diagram of the electrical panel and components. Further electrical schematics are available on request.

Triton Pro Electrical Panel Layout.

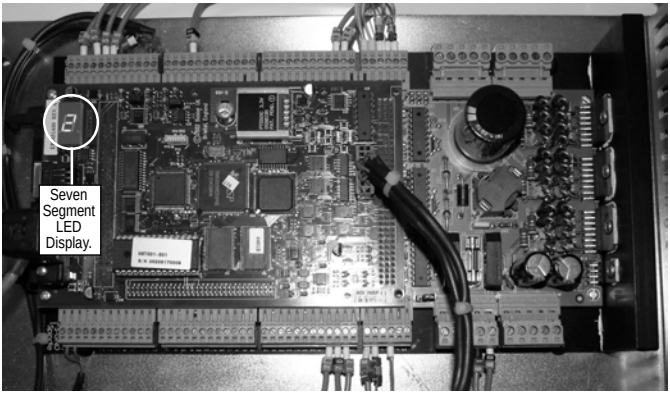


8: The NextStep Motion Control Board - All Models

Warning

Hazard Voltages exist within the machine - when removing the electrical panel cover plate always isolate the power and leave all electronic components untouched for at least 5 minutes.

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



The NextStep motion control board processes the step and direction signals, which are then passed to the separately fitted axis drive units used to control the three machine axes.

The NextStep motion control board is mounted in the top left corner of the electrical panel on both Triton and Triton Pro models (shown in the panel layout on pages 63 and 64).

Motion Control / Axis Drive Troubleshooting.

Check the validity of the following:
Triton models ONLY:

1) Check the emergency stop button is not depressed.
2) Check the machine has not triggered the Z- overtravel limit switch.
3) Check the axis drive transformer input fuse - labelled F2, the axis drive control fuse - labelled F3 and the axis drive transformer output fuse - labelled F4. All fuses are mounted on the main fuse rack (shown in the panel layout on page 63). In addition, refer to the electrical schematic diagrams for specific fuse details and labelling.

Triton Pro models ONLY:

1) Check the emergency stop button is not depressed.
2) Check the machine has not triggered any of the six overtravel limit switches.
3) Check the two pole axis drive circuit breaker switch. The switch is mounted to the right of the main fuse rack (shown in the panel layout on page 64). The switch should be in the “up” position under normal running conditions.
4) Check the control fuse - labelled F2. All fuses are mounted on the main fuse rack (shown in the panel layout on page 64). In addition, refer to the electrical schematic diagrams for specific fuse details and labelling.

8: The NextStep Motion Control Board - All Models

Warning

Hazard Voltages exist within the machine - when removing the electrical panel cover plate always isolate the power and leave all electronic components untouched for at least 5 minutes.

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

LED Status and Fault Display Codes.

The status of the motion control can be determined from the LED display, mounted on the left side of the NextStep board.
Errors are all shown with a flashing dot in the bottom right corner of the LED display.

Whilst NextStep is powering up:

 ..... Indicates FPGA has booted successfully.

 ..... Indicates FPGA 'walking ones' test on FPGA scratchpad has failed. HALT.

 ..... Indicates pseudo random number test on all of RAM has failed. HALT.

 ..... Indicates CAN controller reset has failed. HALT.

 ..... Indicates 'walking ones test' on the CAN controller has failed. HALT.

 ..... Indicates that power up test did not find any valid Firmware in Flash device.

 Indicates that new firmware is being loaded into the NextStep control.

When NextStep has powered up:

 ..... Normal indication that card is powered up. Figure '2' is the default card NODE number.

 ..... Axes disabled, normally after downloading Mint (MEX file) for the first time, before starting Denford S/W.

 ..... Flashing E whilst Flash memory is being erased and mint (MEX) file is being downloaded.

When Mint is running and Denford Software is connected:

Note that these figures relate to axis 0 specifically (ie, the X axis).

 ..... Axis is enabled.

 ..... Flashing E. A general error has occurred (possible Mint failure).

 ..... A SPLINE move is being executed.

 ..... A circular move is being executed.

 ..... A Flying shear (used in lathe threading moves) is being executed.

 ..... Axis is in homing sequence.

 ..... Axis is performing a positional linear move.

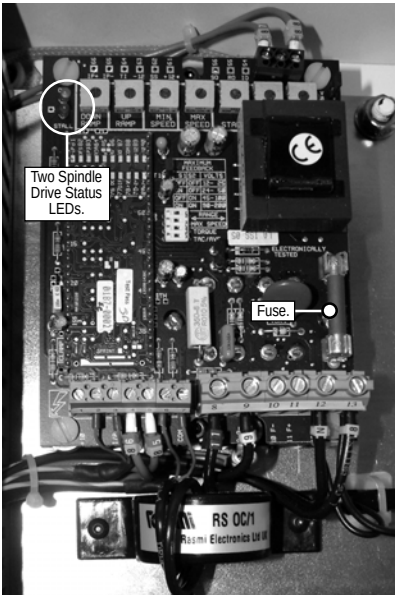
 . Flashing sequence. Emergency Stop has been pressed. On Denford S/W this is a solid S symbol.

8: The Spindle Drive Board - All Models

Warning

Hazard Voltages exist within the machine - when removing the electrical panel cover plate always isolate the power and leave all electronic components untouched for at least 5 minutes.

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



The spindle drive board controls the motor for the programmable spindle. On Triton models, the board is mounted in the bottom right-hand corner of the electrical panel. On Triton Pro models, the board is mounted in the top right-hand corner of the electrical panel.

Spindle Drive LED Status.

The two spindle drive status LEDs are mounted in the top left-hand corner of the spindle drive board.

Display.	**Meaning.**
ON LED	Spindle drive board operational. If this is not lit, check the spindle drive board fuse (shown in the diagram above) then the fuse labelled F1 on the main fuse rack (shown in the panel layout on pages 63 and 64).
STALL LED	Motor stall. This indicates a faulty motor or component on the spindle drive board.

Spindle Drive Troubleshooting.

Check the validity of the following:

1) Check the spindle drive fuse, labelled F1, on the main fuse rack.
2) Check the control circuit fuse, labelled F3 on a Triton model or F2 on a Triton Pro model.

   In addition, refer to the electrical schematic diagrams.

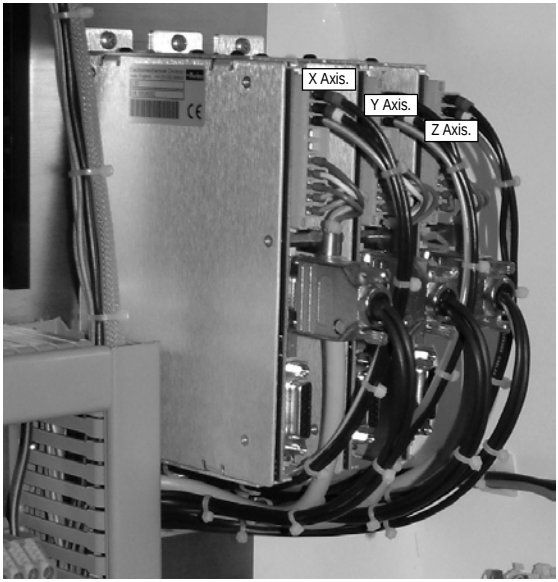
8: Axis Drive Boards - Triton Models Only

Warning

Hazard Voltages exist within the machine - when removing the electrical panel cover plate always isolate the power and leave all electronic components untouched for at least 5 minutes.

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

A block of shielded axis drive boards are fitted in the right top corner of the electrical panel. They control the three machine axes, receiving step and direction signals from the NextStep controller card. From left to right, the three boards correspond to the X, Y and Z axes, as shown below.



Motion Control / Axis Drive Troubleshooting.

Check the validity of the following:

1) Check the emergency stop button is not depressed.
2) Check the machine has not triggered the Z- overtravel limit switch.
3) Check the axis drive transformer input fuse - labelled F2, the axis drive control fuse - labelled F3 and the axis drive transformer output fuse - labelled F4. All fuses are mounted on the main fuse rack (shown in the panel layout on page 63). In addition, refer to the electrical schematic diagrams for specific fuse details and labelling.

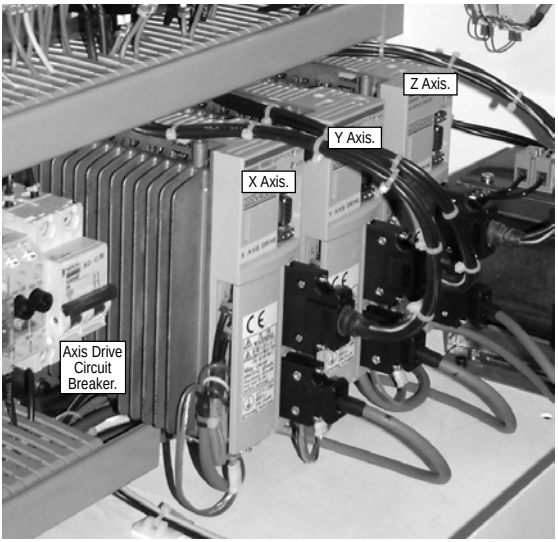
8: Axis Drive Boards - Triton Pro Models Only

Warning

Hazard Voltages exist within the machine - when removing the electrical panel cover plate always isolate the power and leave all electronic components untouched for at least 5 minutes.

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

A block of shielded axis drive boards are fitted in the right top corner of the electrical panel. They control the three machine axes, receiving step and direction signals from the NextStep controller card. From left to right, the three boards correspond to the X, Y and Z axes, as shown below.



Motion Control / Axis Drive Troubleshooting.

Check the validity of the following:

1) Check the emergency stop button is not depressed.
2) Check the machine has not triggered any of the six overtravel limit switches.
3) Check the two pole axis drive circuit breaker switch. The switch is mounted to the right of the main fuse rack (shown in the photograph above). The switch should be in the “up” position under normal running conditions.
4) Check the control fuse - labelled F2. All fuses are mounted on the main fuse rack (shown in the panel layout on page 64). In addition, refer to the electrical schematic diagrams for specific fuse details and labelling.

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.
- 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 722733
Fax: 01484 722160
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 - VR CNC Milling Software

Note

Your screen may display the message "Error 50 Mint 3.28 Disconnect" (or similar, depending on the hardware fitted).

1) Your computer communicates with your Triton using the Denford Machine Link cable. Check the Denford Machine Link cable is securely plugged into a valid COM 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 port located on the back panel of the Triton cabinet.

2) Check all mains power connections are correctly fitted and secure. Power up the Triton, using the red on/off switch, mounted on the back panel of the Triton cabinet. If no power is present, switch off the mains supply, then wait at least 5 minutes before attempting to access the Triton electronics. The Triton electrical panel is mounted in the left end of the Triton cabinet, behind the removable cover plate. Check the condition of the on/off switch and fuses. For more information, refer to Section 8 - Machine Electronics.

Note

The password used to access the "Machine Properties" window can be changed by the user. Remember that the default password listed here will not be recognised if you have changed it.
If you change any passwords, we recommend you make a note of them in the Notes section in this manual.

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. Note that there are a number of Triton versions to choose from, depending on the specific CNC machine model you are using. The active machine name in the software must match the name and version of your CNC machine - this information is printed on the CE identification panel, usually applied to the end panel of the Triton cabinet. For example, if “Triton Pro NS” is printed on your CE identification panel, the VR CNC Milling software must have “Triton Pro NS” set as the active machine. 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.

Note

Any optional equipment fitted to your Triton can be configured using the options available in the "Machine Properties" window.

5) In the "Machine Properties" window, click the "Communications" property title. Change the "COM Port" setting to match the number of the COM port being used by your pc. Note that the hardware resources (IRQ. etc.) are those specified in the Windows Control Panel. The "Baudrate" must be set to read "19200". Baudrate is the speed at which data can be transferred through your COM ports. The "Stop Bits" must be set to read "2". Stop Bits are the data signals sent after each data character has been transferred. Click the [OK] button to save and apply any changes made to the property listings.

6) 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. For more information, refer to Section 8 - Machine Electronics. If no display is shown, 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.

7) 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.

8) 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 Triton. 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 - VR CNC Milling Software

Incorrect registration of tool offsets, when using multiple tools of the same diameter :

All tool offset data is saved in the tooling library according to the tool diameter, rather than the tool number used with the machine. This can present problems when you wish to use two or more tools of different lengths but identical tool diameters, for example, a 4mm roughing tool and a 4mm finishing tool. Only one tool offset can be registered, since the standard tooling library only contains one 4mm tool. In this example, separate entries must be created in the tooling library for both the 4mm roughing and finishing tools, then each tool added to the machine tooling window, to allow separate tool offset values to be registered.

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 on the roof of the Triton cabinet and connects to the top, left edge of the polycarbonate guard door.

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 on/off button on the back panel of the Triton cabinet is switched on.
2) The emergency stop button is not pressed in. To release, push and turn the button counterclockwise 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.

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, which in turn is held securely in the machine spindle.

9: Troubleshooting - Electrical Problems

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.

Warning

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

Note

Always refer to your electrical schematic diagrams for the definitive labelling and placement of components and fuses. Information contained on this page is correct at the time of printing - October 2002 - but is liable to change through continuous development of our products.

The spindle drive is not working :

Check the validity of the following:

1) Check the spindle drive fuse, labelled F1, on the main fuse rack.
2) Check the control circuit fuse, labelled F3 on a Triton model or F2 on a Triton Pro model. In addition, refer to the electrical schematic diagrams.

The axis drives do not respond :

Check the validity of the following:

Triton models ONLY:

1) Check the emergency stop button is not depressed.
2) Check the machine has not triggered the Z- overtravel limit switch.
3) Check the axis drive transformer input fuse - labelled F2, the axis drive control fuse - labelled F3 and the axis drive transformer output fuse - labelled F4. All fuses are mounted on the main fuse rack (shown in the panel layout on page 63). In addition, refer to the electrical schematic diagrams for specific fuse details and labelling.

Triton Pro models ONLY:

1) Check the emergency stop button is not depressed.
2) Check the machine has not triggered any of the six overtravel limit switches.
3) Check the two pole axis drive circuit breaker switch. The switch is mounted to the right of the main fuse rack (shown in the panel layout on page 64). The switch should be in the “up” position under normal running conditions.
4) Check the control fuse - labelled F2. All fuses are mounted on the main fuse rack (shown in the panel layout on page 64). In addition, refer to the electrical schematic diagrams for specific fuse details and labelling.

The worklight is not working :

Check the validity of the following:

1) Check the bulb.
2) Check the worklight fuse, referring to the electrical schematic diagrams for specific fuse details and labelling.

10: Specification of Triton Series

Triton Models:

Standard Equipment:
- Triton CNC milling machine.
- Easychange tooling system.
- CNC machine control software.
- Installation, maintenance and instruction manuals.
- Set of maintenance tools and spare parts list.
- Machine commissioning and basic instruction.
- Training (UK Only).

Optional Extra Equipment:
- IBM or 100% compatible PC, keyboard, mouse and monitor.
- Desk top tutor.
- Workholding: datum plate and miteebite clamping system.
- Workholding: manual vice system.
- Upgrade pack for integration into Denford FMC, FMS or CIM systems.
- Courseware and project books.
- Various tooling packages.
- Additional training packages.
- Additional CNC machine control software licences.
- Machine work bench.
- Video conferencing system.

Safety Features:
- Manual operation, totally enclosed, interlocked, safety guard door.
- Emergency stop button.
- Adjustable Z axis depth stop switch.
- 2D/3D toolpath graphics to verify part programs prior to machining.
- Automatic tool retraction & spindle stop for tool changing.

CAD/CAM/CNC Software options:
- MillCAM Designer.
- Techsoft 2D Design Tools.
- MiniCAM.
- AutoCAD and additional Autodesk products.
- MasterCAM.
- Pro/DESKTOP.
- CNC Tutor.
- ArtCAM.

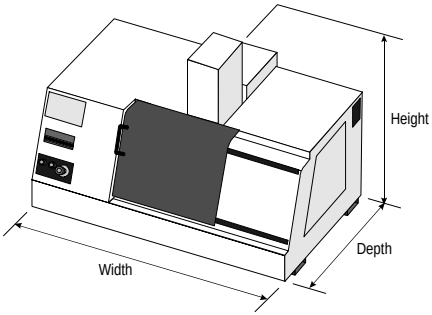
10: Specification of Triton Series

Dimensions:
- Total machine width 1450mm (57 1/16”).
- Total machine height 930mm (36 5/8”).
- Total machine depth 820mm (32 5/16”).

Weights:
- Machine weight 235KG (517 lb) .

Mechanical Details:
- Longitudinal travel (X axis) 280mm (11”).
- Cross travel (Y axis) 150mm (5 15/16”).
- Vertical travel (Z axis) 235mm (9 1/4”).
- Working table surface 500mm x 160mm (19 11/16” x 6 5/16”).
- Spindle to table 275mm (10 13/16“).
- Spindle to column 194mm (7 5/8“).
- Spindle taper ISO30.
- Tooling BT30.
- 3 Tee Slots, 10mm (3/8“) width, 31.5mm (1 1/4“) centres.
- X, Y and Z Axis Ballscrews, 16mm dia. x 5mm (5/8“ x 3/16“) pitch.
- Spindle speed override potentiometer from 50 to 120%.
- Spindle speed programable between 250 - 4000 RPM.
- Feedrate override potentiometer from 0 to 150%.
- Rapid traverse rate 2000mm/min (78 in/min).
- 3D profiling rate 900mm/min (35 in/min).
- System resolution 0.005mm (0.000197”).

Electrical Details:
- Mains supply required: 220/240 Volts, 50 Hz, 8 Amps. 110/115 Volts, 60 Hz, 15 Amps.
- Spindle motor - 1.1 kW, 1.5 HP.
- Axis motors - Stepper.



Triton Pro Models:

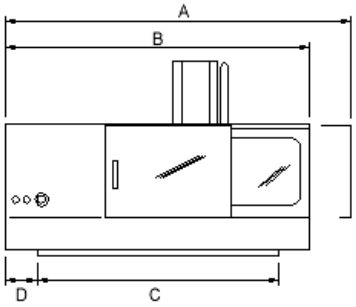
As Triton model specification plus:

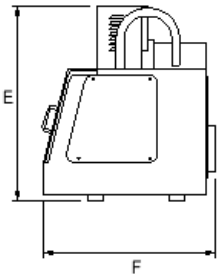
Safety Features:
- Overtravel limit switches on X, Y, Z axes. Two switches per axis, adjustable on Z for depth stop.

Mechanical Details:
- Rapid traverse rate 5000mm/min (197 in/min).
- 3D profiling rate 5000mm/min (197 in/min).
- System resolution 0.00625mm (0.000246”).

Electrical Details:
- Axis motors - Servo.

10: Triton Series Dimensions





A 1645mm (64 3/4“).
B 1450mm (57 1/16“).
C 1150mm (45 1/4“).
D 150mm (5 15/16“).
E 930mm (36 5/8“).
F 820mm (32 5/16“).

10: What is a Part Program?

A Part Program is a list of coded instructions which describes how the designed part, or component, will be manufactured. The part program is also called the CNC File.

These coded instructions are called data - a series of letters and numbers. The part program includes all the geometrical and technological data to perform the required machine functions and movements to manufacture the part.

The part program can be further broken down into separate lines of data, each line describing a particular set of machining operations. These lines, which run in sequence, are called blocks.

A block of data contains words, sometimes called codes. Each word refers to a specific cutting/movement command or machine function. The programming language recognised by the CNC, the machine controller, is an International Standards Organisation code, which includes the G and M code groups.

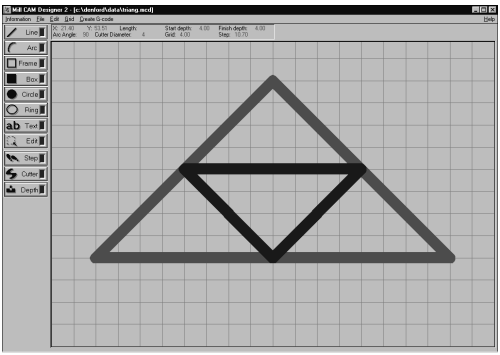
Each program word is composed from a letter, called the address, along with a number.

These terms are illustrated on the following pages.

10: Composition of a Part Program

A component is designed using a CAD/CAM software package, such as Mill CAM Designer.

The CAD/CAM software package automatically generates the part program, including all the G and M codes required to manufacture the component.



Part Program example -

(Mill CAM Designer - triang.MCD)
(3/3/1997)
(metric)
(Post fanucm:1.2Ø 24 June 1994)
G21
[BILLET X8Ø Y55 Z1Ø
[EDGEMOVE XØ YØ
[TOOLDEF T1 D2
NØØ1Ø G91G28XØYØZØ;
NØØ2Ø M6T1;
NØØ3Ø G43H1;
NØØ4Ø M3S15ØØ;
NØØ5Ø G9ØGØX4ØY48;
NØØ6Ø Z2;
NØØ7Ø G1Z-Ø.5F1ØØ;
NØØ8Ø X72Y16F15Ø;
NØØ9Ø X8;
NØ1ØØ X4ØY48;
NØ11Ø GØZ2;
NØ12Ø X24Y32;
NØ13Ø G1Z-1F1ØØ;
NØ14Ø X56F15Ø;
NØ15Ø X4ØY16;
NØ16Ø X24Y32;
NØ17Ø GØZ2;
NØ18Ø M5;
NØ19Ø G91G28XØYØZØ;
NØ2ØØ M3Ø;

Denford Directive Example - [BILLET

Address example - G

Word example - G1

Block example - NØ13Ø G1Z-1F1ØØ;

10: G Codes List

Note - Not all G codes may apply to your CNC machine.

G Code.	Group.	Function.
GØØ	1	Positioning (Rapid Traverse)
GØ1	1	Linear Interpolation (Cutting Feed)
GØ2	1	Circular Interpolation CW
GØ3	1	Circular Interpolation CCW
GØ4	Ø	Dwell, Exact Stop
G2Ø	6	Imperial Data Input (Inches)
G21	6	Metric Data Input (Millimetres)
G28	Ø	Reference Point Return
G4Ø	7	Cutter Compensation Cancel
G41	7	Cutter Compensation Left
G42	7	Cutter Compensation Right
G73	9	Peck Drilling Cycle
G74	9	Counter Tapping
G76	9	Fine Boring
G8Ø*	9	Canned Cycle Cancel
G81	9	Drilling Cycle, Spot Boring
G82	9	Drilling Cycle, Counter Boring
G83	9	Peck Drilling Cycle
G84	9	Tapping
G85	9	Boring Cycle
G86	9	Boring Cycle
G87	9	Back Boring Cycle
G89	9	Boring Cycle
G9Ø*	3	Absolute Zero
G91	3	Incremental Command
G94*	5	Feed per Minute
G95	5	Feed per Revolution
G98*	1Ø	Return to Initial Point in Canned Cycle
G99	1Ø	Return to R in Canned Cycle
G17Ø	Ø	Circular Pocket
G171	Ø	Circular Pocket
G172	Ø	Rectangular Pocket
G173	Ø	Rectangular Pocket

Code listing full and correct at the time of printing - October, 2002.

Note

G codes from group Ø are non-modal (they must be programmed into every program block when required). All other G codes are modal (they remain active through subsequent program blocks, until replaced or cancelled by a G code from their particular group).
The G codes indicated by an asterisk (*) are reactivated as defaults when the machine started.

10: M Codes List

Note - Not all M codes may apply to your CNC machine.

M code.	Function.
MØØ*	Program Stop
MØ1*	Optional Stop
MØ2*	Program Reset
MØ3	Spindle Forward (clockwise)
MØ4	Spindle Reverse (counter clockwise)
MØ5*	Spindle Stop
MØ6	Automatic Tool Change
MØ8	Coolant On
MØ9*	Coolant Off
M1Ø	Vice/Work Clamp Open
M11	Vice/Work Clamp Close
M13	Spindle Forward and Coolant On
M14	Spindle Reverse and Coolant On
M19	Spindle Orientation
M2Ø	ATC Arm In
M21	ATC Arm Out
M22	ATC Arm Down
M23	ATC Arm Up
M24	ATC Drawbar Unclamp
M25	ATC Drawbar Clamp
M27	Reset Carousel to Pocket One
M3Ø	Program Reset and Rewind
M32	Carousel CW
M33	Carousel CCW
M38	Guard Door Open
M39	Guard Door Close
M62	Auxiliary Output 1 On
M63	Auxiliary Output 2 On
M64	Auxiliary Output 1 Off
M65	Auxiliary Output 2 Off
M66*	Wait for Auxiliary Output 1 On
M67*	Wait for Auxiliary Output 2 On
M7Ø	Mirror in X On
M71	Mirror in Y On
M76	Wait for Auxiliary Output 1 Off
M77	Wait for Auxiliary Output 2 Off
M8Ø	Mirror in X Off
M81	Mirror in Y Off
M98	Sub Program Call
M99	Sub Program End and Return

Code listing full and correct at the time of printing - October, 2002.

Note

Not all M codes listed are available, all M codes marked with an asterisk (*) will be performed at the end of a program block (ie, after any axis movement).

10: List of Program Address Characters

N - Program Sequence (line) number.

X - Primary motion in X axis.

Y - Primary motion in Y axis.

Z - Primary motion in Z axis.

G - Preparatory functions.

I - Incremental distance parallel to X axis.

J - Incremental distance parallel to Y axis.

K - Incremental distance parallel to Z axis.

R - Radius.

M - Miscellaneous functions.

T - Tool numbers.

S - Spindle speeds.

F - Feed rates.

10: Denford Directives

Directives are program terms defined by Denford Limited. They are used to help generate the 2D and 3D graphics used by the machine controlling software.

[BILLET - This directive allows a billet that appears in a simulation window to be given a size. The billet definition should be placed at the start of a program, after the units of measurement have been set. Example:
G21
[BILLET X1ØØ.Ø Y9Ø.Ø Z2Ø.Ø
This sets the measure to metric (Note - if set to Imperial the units would be inches) and defines the billet as1ØØmm long by 9Ømm wide, with a depth of 2Ømm.

[SUBPROGRAM - This directive allows a program with a non-numeric name to be called as a subprogram. Example:
[SUBPROGRAM Ø2ØØ FRED
M98 PØ2ØØ
This example assigns a subprogram number of Ø2ØØ to the program named FRED, then calls the subprogram Ø2ØØ.

[TOOLDEF - This directive sets the length and diameter of a cutting tool. The length of a tool is the distance from the spindle nose to the bottom of the cutter. Example:
G21
[TOOLDEF T1 D8 Z65
This example defines tool number 1 as being 8mm in diameter, and 65mm long.

[STEP - This directive runs an on-screen program in single steps. This means the program will run one program line, then wait for the operator to prompt it to move to the next line; this continues until the program is instructed to stop this function. The directive applies to both simulation and actual machining with a program.

[NO STEP - This directive runs an on-screen program without single steps. This means the program will run as originally intended with no pausing, unless a pause is requested from within the program itself. The directive applies to both simulation and actual machining with a program.

[SHOW - This directive allows the machining operations to be graphically simulated on-screen.

[NOSHOW - This directive stops the machining operations from being graphically simulated on-screen.

EC Declaration of Conformity

The responsible person ..... Mr J.M. Boyle.

Business Name ..... Denford Limited.

Address ..... Birds Royd,
Brighouse,
West Yorkshire,
HD6 1NB,
United Kingdom.

Declares that the machinery described:

Manufacturer ..... Denford Limited.

Model Name ..... Triac * Series CNC Milling Machine.

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

conforms to the following directives: .... The EC machinery directive 89/392/EEC as ammended by directive 91/368 EEC and directive 93/44/EEC and CE marking directive 93/68/EEC

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

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

Signature .....

Position within company ..... Senior Design Engineer.

Signed at ..... Denford Limited,
Birds Royd,
Brighouse,
West Yorkshire,
HD6 1NB,
United Kingdom.

* Note - Triac series mechanicals identical to Triton series.

Back of the EC Declaration of Conformity Certificate.

Triac * Series Noise Level Test Results

Test Report No:	NL - TR5 - 01.
Machinery Manufacturer:	Denford Limited.
Machinery Type/Model:	Triac Series CNC Milling Machine.
Date compiled:	14-12-94.
Test site:	Inspection Dept.
Test specification:	In accordance with BS4813 : 1972.

Equipment.

Meter ref: Cirrus CRL 2.35A - 1 off.

Denford Triton Series CNC machine: 1 off.

General Machine Test Conditions.

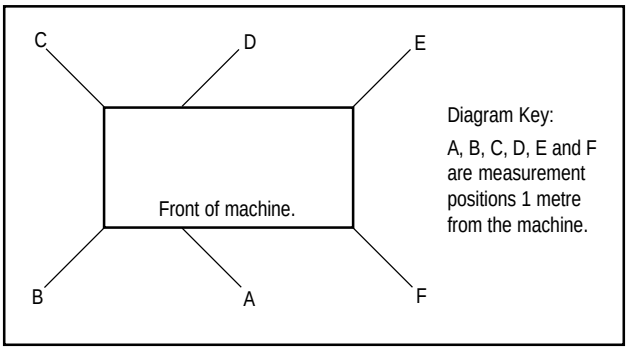
Chuck on size: Standard.

Splash on guard: Standard.

Machine mounting: Floor.

Additional equipment: None.

Test Positions.



* Note - Triac series mechanicals identical to Triton series.

continued on reverse...

Triac * Series Noise Level Test Results

Test Conditions:
Spindle speed: 4,000 RPM.
Spindle Direction: Counter-clockwise.
Ambient background noise: <61 dB (A).

Spindle Speed			Sound Levels dB (A)						
RPM	Range	Ins/rev	Position						
			A	B	C	D	E	F	Mean
100	N/A	N/A	61	62	61	61	61	62	61
1000	N/A	N/A	62	62	62	61	62	62	62
2000	N/A	N/A	63	62	62	61	62	63	62
3000	N/A	N/A	62	62	62	62	63	63	62
4000	N/A	N/A	63	62	62	62	64	63	62

Test Conditions:
Spindle speed: 4,000 RPM.
Spindle Direction: Clockwise.
Ambient background noise: <61 dB (A).

Spindle Speed			Sound Levels dB (A)						
RPM	Range	Ins/rev	Position						
			A	B	C	D	E	F	Mean
100	N/A	N/A	61	61	61	61	62	62	61
1000	N/A	N/A	62	62	62	61	62	62	62
2000	N/A	N/A	61	63	62	62	61	61	62
3000	N/A	N/A	62	62	62	62	63	61	62
4000	N/A	N/A	63	63	63	63	64	62	63

* Note - Triac series mechanicals identical to Triton series.

11: Glossary

ABSOLUTE ..... In absolute programming, zero is the point from which all other dimensions are described.

ALLEN HEAD ..... A hexagon shaped hole on the head (top) of a set screw. These are tightened and loosened using allen keys/wrenches.

ARC ..... A portion of a circle.

AUTOMATIC CYCLE ..... A mode of control operation that continuously runs a cycle or stored program until a program stop or end of program word is read by the controller.

AUXILIARY FUNCTION ..... The function of the CNC machine (ie, F, S, T, M codes etc.), other than co-ordinate based commands.

AXIS (AXES) ..... The planes of movement for the cutting tool, usually referred to as X (horizontal left and right, parallel to the front of the machine), Y (horizontal forward and backwards, parallel to the side of the machine) and Z (directly vertical). Combinations of all 3 allow precise co-ordinates to be described. Axes are also referred to as slides or slideways.

BILLET ..... The actual material being machined, sometimes referred to as the "workpiece" or "stock".

BLOCK ..... A collection of program words that collectively describe a machining operation. A single program line in the CNC file.

CHARACTER ..... A number, letter or symbol as entered into a CNC program.

CIM ..... Computer Integrated Manufacturing (System).

CIRCULAR INTERPOLATION G-code term for a programmed arc movement.

COMMAND ..... A signal (or group of signals) instructing one step / operation to be carried out.

CONTEXT SENSITIVE ..... When the type of input signal of an event automatically changes the output signal.

CO-ORDINATES ..... Positions or relationships of points or planes. Co-ordinates are usually described using three numbers referring to the (X,Y,Z) axes, e.g. the co-ordinate (23,35,45) means X axis = +23 units, Y axis = +35 units and Z axis = +45 units.

CNC ..... Computer Numerical Control.

CNC FILE ..... The sequence of commands describing the manufacture of a part on a CNC machine, written using G and M codes, also called the CNC program.

CUTTER SPEED ..... The velocity of the cutting edge of the tool relative to the workpiece. With circular tools, the cutting speed is related to the tool when new (maximum cutting diameter). Usually the effect of feedrate is ignored.

CYCLE ..... A sequence of events or commands.

DATUM ..... The zero point (co-ordinate) from which a series of measurements are taken.

DATUM PLATE ..... The L-shaped bracket used to help locate pieces of work in position on the machine table.

DESKTOP TUTOR ..... The input control keypad for the machine. Keypad overlays are interchangeable according to the type of controller required.

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DIRECTORY ..... An area of a disk containing the names and locations of the files it currently holds.

DISK ..... A computer information storage device, examples, C: (drive) is usually the computers hard (internal) disk and A: (drive) is usually the floppy (portable 3.5" diskette) disk.

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.

FMC ..... Flexible Manufacturing Cell.

FMS ..... Flexible Manufacturing System.

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.

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.

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M CODE ..... A miscellaneous code function in a CNC program used to indicate an auxiliary function (ie, coolant on, tool change etc.).

MACHINE CODE ..... The code obeyed by a computer or microprocessor system with no need for further translation.

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 using the machine offset facility.

MDI ..... Manual Data Input - A method used for manually inserting data into the control system (ie, Desktop Tutor, qwerty keyboard etc.).

MITEEBITE CLAMP ..... Method of securing work to the machine table, using the series of machine table T channels.

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.

PRJ ..... Denford CNC Project file, extension ".prj". Project files contain global information about user defined settings in the VR CNC Milling software, such as tooling setup, tooling library, offsets, toolbar and window positions etc.

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).

RPM ..... Revolutions per minute (rev/min) - a measure of spindle speed.

SIMULATION OFFSET ..... The workpiece offset file only used with VR CNC Milling software 2D and 3D graphics.

SLIDEWAYS ..... The 3 machine axes - see axis.

SPINDLE SPEED ..... The rate of rotation (velocity) of the machine head / cutting tool, measured in RPM.

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SOFTWARE ..... Programs, tool lists, sequence of instructions etc...

SUB-TABLE ..... A secondary table that is clamped to the actual machine table. The work is then fastened to this secondary table. Used as a safety feature to prevent damage occurring to the actual machine table, should a problem occur when milling. For example, a sheet of MDF. Sometimes referred to as a temporary table or platen.

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. Sometimes referred to as the tool length offset. 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 milled. 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.

XNC ..... Denford Compiled CNC file, extension ".xnc". A compiled file is a FANUC Miller file that is formatted to allow 3D elements such as the 3D Viewer to run as quickly as possible. XNC files can also be used to drive an attached CNC machine when run through the VR CNC Milling software.

Z TOOL OFFSET ..... See Tool Offset

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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.