

DENFORD

COMPUTERISED MACHINES AND SYSTEMS

Operating Guide for the Triac PC (ATC) Series of CNC Milling Machines

- Installation
 - Specific Features
 - Routine Maintenance
-

This manual applies only to the machine having the serial number shown below.

Please note that this number will be required should Denford Limited be contacted regarding this machine.

Machine Serial Number : _____

Year of Manufacture : _____



Manufactured by
Denford Limited,
Birds Royd, Brighouse, West Yorkshire, HD6 1NB, England.
Telephone: + 44 (0)1484 712264.
Fax: + 44 (0)1484 722160.
Email: service@denford.co.uk

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INTRODUCTION.

This guide will describe how to transport, site and setup your Denford Triac PC CNC Milling Machine.

Any operational features, specific to the Triac PC range, are also covered in this guide. General operating functions are explained in the separate "Generic CNC Milling Manual" delivered with your machine.

A Routine Maintenance section is also included. Please note, the Electrical Diagrams for your machine are held in a folder fixed inside the electrical control box.

IF YOU HAVE ANY DOUBTS AND/OR QUESTIONS REGARDING THE SPECIFICATION, SERVICING OR FEATURES OF YOUR MACHINE, PLEASE CONTACT CUSTOMER SERVICES AT DENFORD.

WARNING.

The Warranty on this 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.

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

EC DECLARATION OF CONFORMITY.

The responsible person :

Business Name :

Denford Limited.

Address :

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

Declares that the machinery described :

Manufacturer :

Denford Limited.

Model Name :

Triac PC

Serial Number :

conforms to the following directives :

EC Machinery directive 89/392/EEC as amended by directive 91/368 EEC and directive 93/44/EEC, CE marking directive 93/68/EEC and low voltage directive 73/23/EEC

and the following standards :

BS EN 60204 - 1 : 1993

and complies with the relevant health and safety requirements.

Signature :

Position within company :

Signed at :

Denford Limited,
Birds Royd,
Brighouse,
West Yorkshire,
HD6 1NB,
England.

UNPACKING & LIFTING THE MACHINE.

Cut the top of the delivery box open and remove the styrofoam packaging carefully.

To obtain better access to the machine and the power supply box, remove all the sides from the delivery box, leaving the machine standing on its wooden delivery pallet.

Lift the power supply control box from the packaging. If possible, lift the power supply box using a porters trolley.

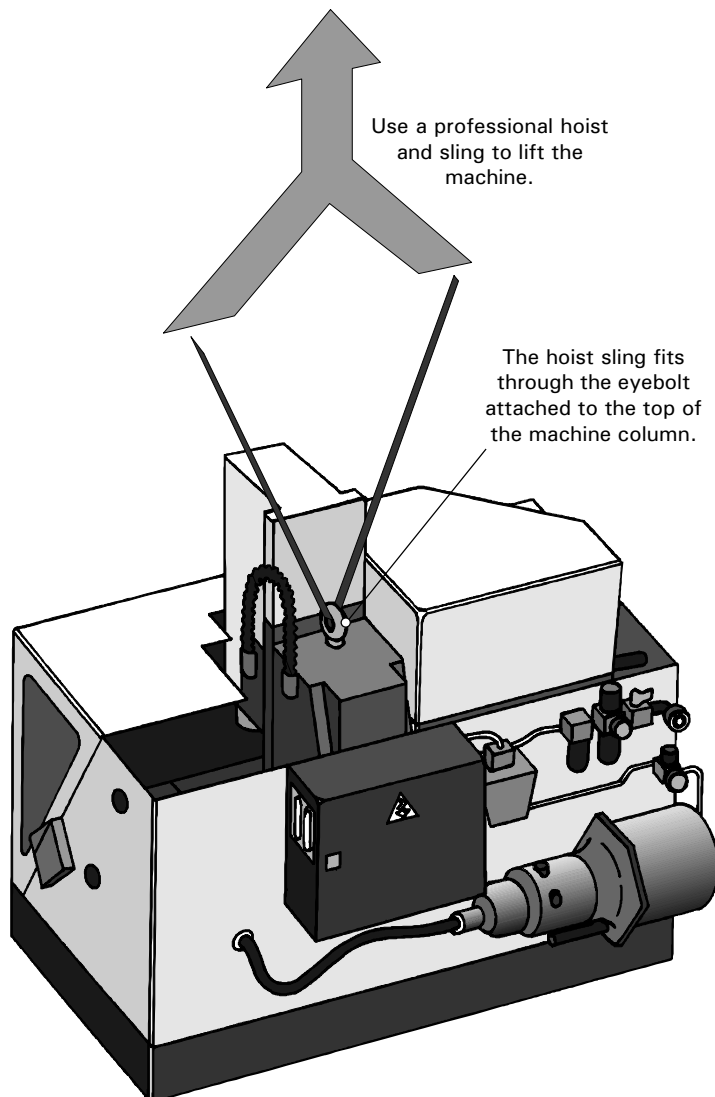
Lift the machine from the packaging. Denford recommends using a professional hoist and sling, arranged as shown in the diagram below. Ensure that the machine is secure before lifting. Always use sensible lifting precautions in accordance with Health and Safety Regulations in your establishment.

Weights (net) :

Triac PC = 240 Kilos (528 lbs)

Triac PC with ATC = 320 Kilos (705 lbs)

Control Box = 70 Kilos (154 lbs)



LEVELLING & POSITIONING THE MACHINE.

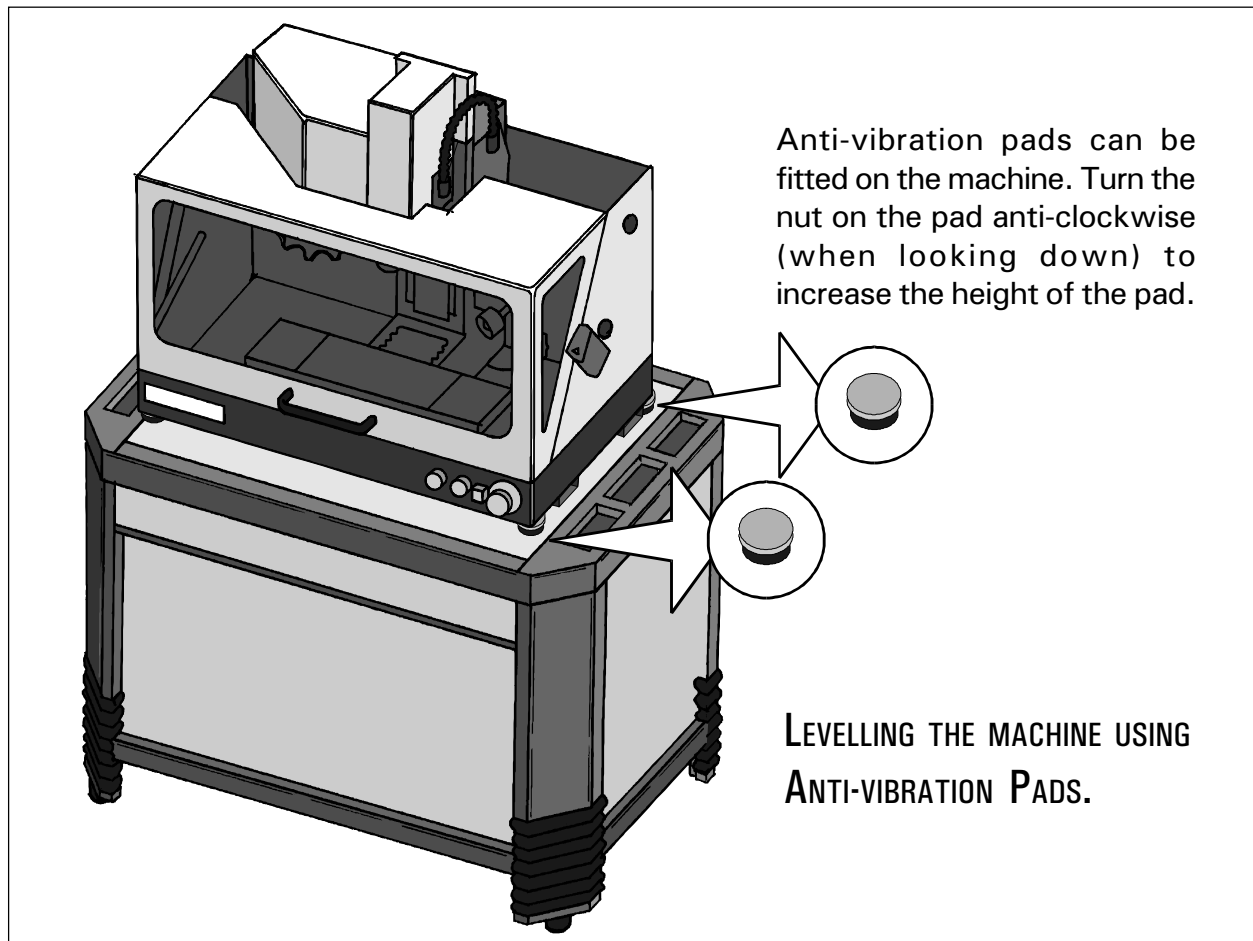
Remember when positioning the machine in the room, space will be required for both the electrical control box and a pc (personal computer) with an attached Desk Top Tutor. Sufficient room should also be provided for effective maintenance to be carried out.

The Triac PC 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.

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

If the machine is not stable resting on these two hollow sections, insert four anti-vibration pads at each corner of the machine. Adjust the pads until the machine is stable and level - as illustrated in the diagram below. The pads will also help to reduce the amount of noise and vibration generated when the machine is operating.

Note - the pads are *ONLY* used to *help* stabilise the machine, the main weight of the machine should still be taken by the hollow sections (ie, these sections should *ALWAYS* be in direct contact with the table surface).



CONNECTING THE PC.



Warning! Do not connect cables between any electrical hardware with the mains power switched on, since this could damage the hardware.

Ideally, the pc (personal computer) should be placed next to the machine and its electrical control box, with access to a mains power supply.

Connect the elements of the pc together as described in the pc manufacturers operating manual.

The pc and the machines electrical control box are physically linked by the RS232 cable (supplied). This cable is fitted with 25 pin connectors at both ends.

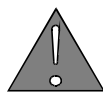
One end connects to the 25 pin port on the electrical control box labelled "RS 232".

The opposite end of this cable connects to the 25 pin port of the pc labelled "COM2". If this port cannot be identified on the back panel of the pc, please refer to the pc manufacturers operating manual.

Note. On some personal computers, this port may have a 9 pin connection. If this is the case, a 25 pin to 9 pin adapter, available from most good computer/ electrical retailers must be fitted to allow the cable to be connected to the pc.

A schematic diagram illustrating these component connections is shown on page 8.

ELECTRICAL DIAGRAMS AND CONTROL BOX SEAL.

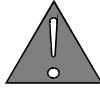


Warning! Do not connect cables between any electrical hardware with the mains power switched on, since this could damage the hardware.

The electrical control box is inspected then sealed with a yellow seal; if this seal is broken on delivery, inform the suppliers immediately. The seal should only be broken for the initial mains power connection.

CONNECTING THE MAINS SUPPLY.

The large flexible machine power cable, leading from the side of the electrical control box is connected to the fixing bracket on the junction box at the back of the milling machine. Check that the connector is inserted into the bracket in the correct orientation (see the diagram on page 9).



Warning! Do not insert the connector into the bracket the wrong way round; this could damage the connector pins. Check that the letters and numbers on the two halves of the connector and bracket match before closing the junction.

Ensure the two roller clips holding the male connector against the female bracket are fully closed. There should be no free movement at the junction.

The mains power supply is fed to the electrical control box, which in turn, is connected to the milling machine.

This electrical control box is delivered with the mains supply cable connected directly into the isolator with approximately 3 metres of cable. The cable should then be fitted with a standard 13 amp. plug suitable for the mains power supply.

The supply is 220/240volt Single Phase 50Hz.

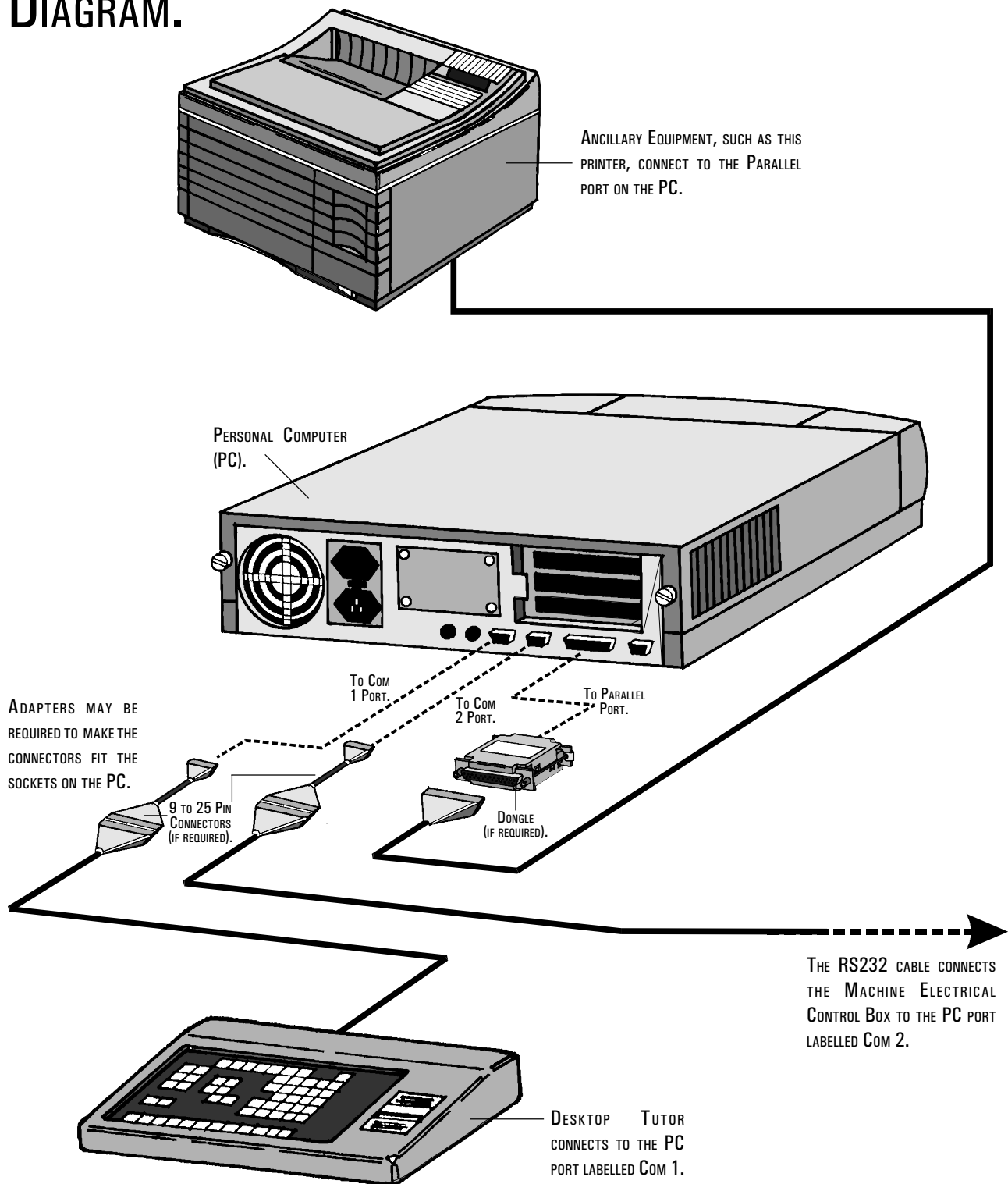
Cable required:- 2 Core + Earth, 1.5mm per core.

Current Taken 11 Amps.

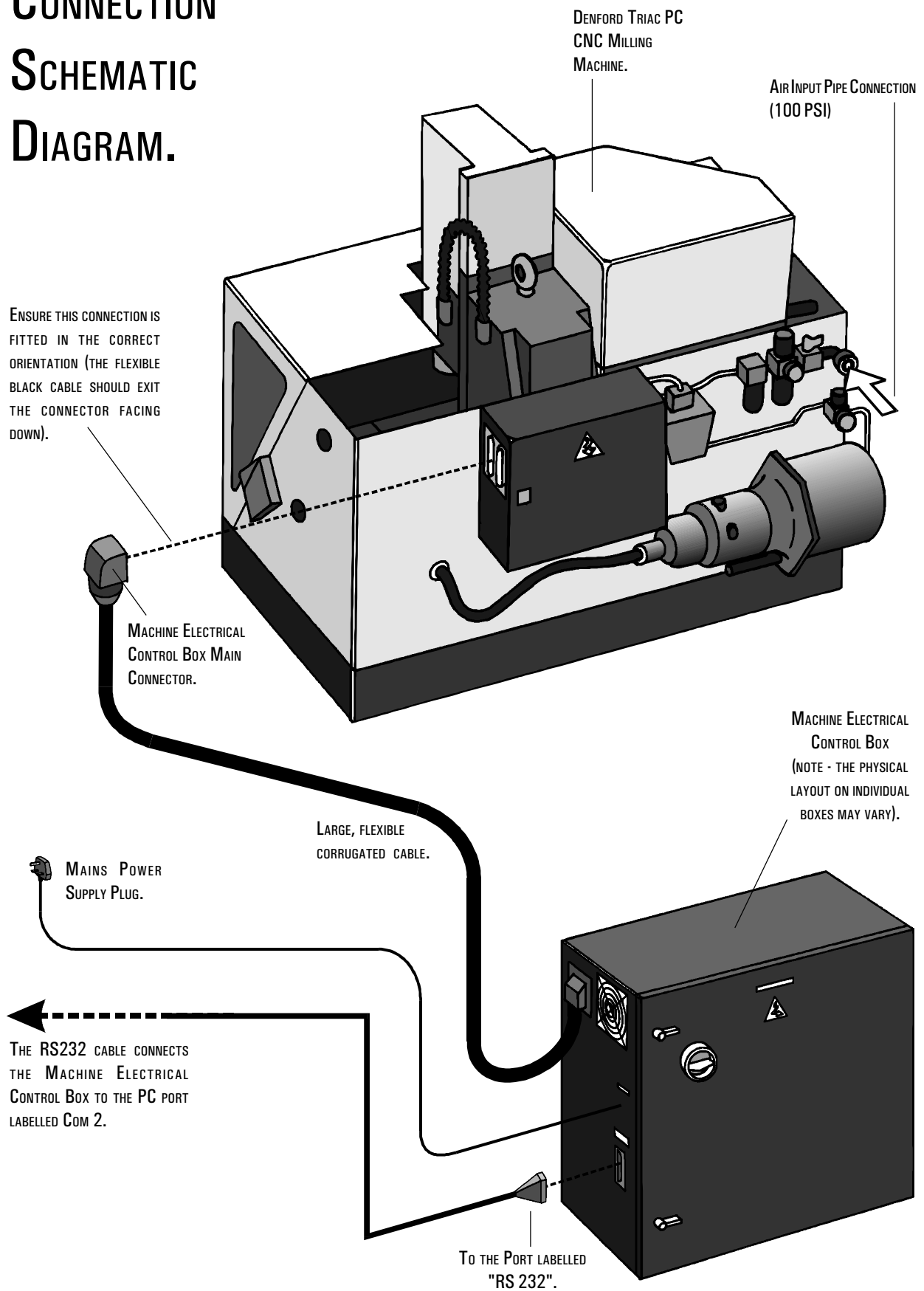
All electrical connections should only be made by a suitably qualified electrical engineer.

A schematic diagram illustrating these component connections is shown on page 8 and 9.

COMPONENT CONNECTION SCHEMATIC DIAGRAM.



COMPONENT CONNECTION SCHEMATIC DIAGRAM.



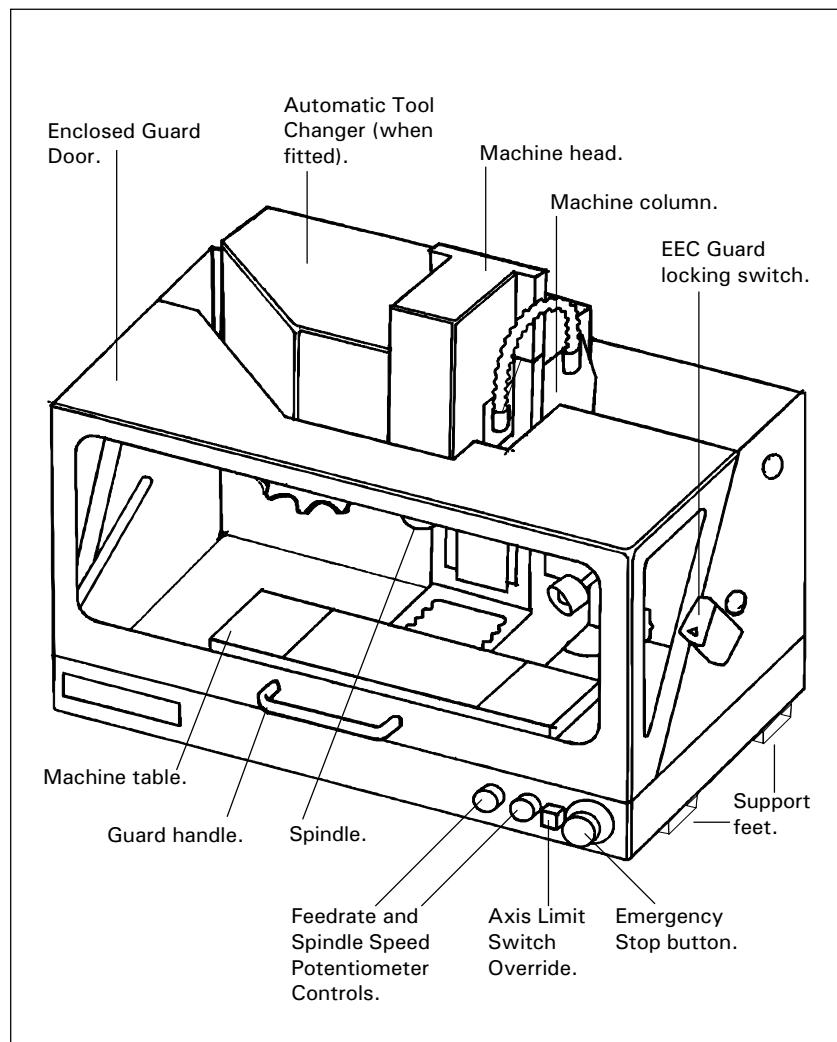
REMOVAL OF PROTECTIVE COATINGS.

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

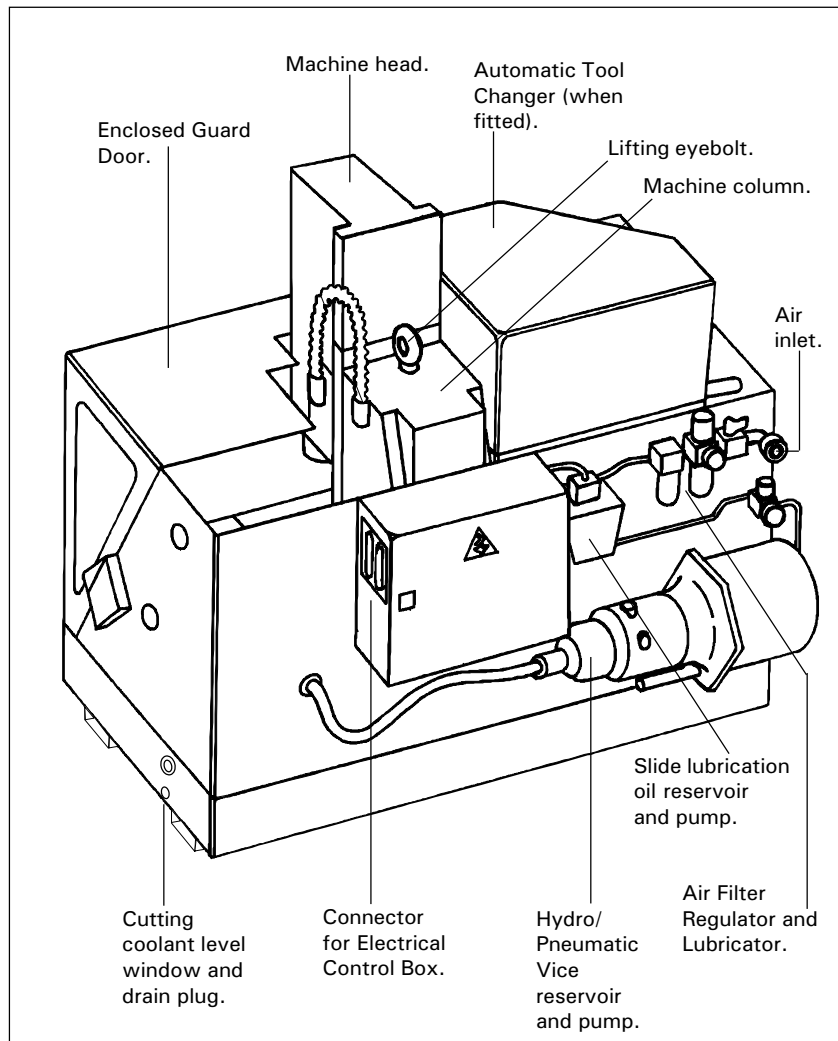
The protective coatings applied to the slideways and bright surfaces can be removed using a kerosene based solvent. The coatings must be removed from the slideways before any attempt to move them is made. Once these protective coatings have been removed, all untreated surfaces should be coated with a light covering of machine oil (eg BP: CS 68).

The protective plastic sheeting on the guard windows should be removed and the perspex cleaned with an anti-static cleaner.

TRIAC PC - GENERAL LAYOUT - FRONT VIEW.



TRIAC PC - GENERAL LAYOUT - BACK VIEW.



AIR PIPE CONNECTION.

The ATC (Automatic Tool Changer) and the Hydro/Pneumatic Vice, when fitted, require an air compressor fitted with a SCHRADER quick release connector.

The connection fitted onto the machine air filter regulator and lubricator is SCHRADER part number SC 8051-11 1/8 BSP MALE (or Denford part number BI 01451S).

The female connector required on the 1/4" pipe leading to the air compressor is SCHRADER part number 9793C-12 1/4" BSP FEMALE (or Denford part number BI 01128S).

ATC OPERATION.

ATC - Automatic Tool Changer (when fitted).
The ATC is controlled using M codes (see the separate "Generic CNC Milling Manual" - section 11.5 for M codes listing and section 4.1 for tool changing).

HYDRO/PNEUMATIC VICE OPERATION.

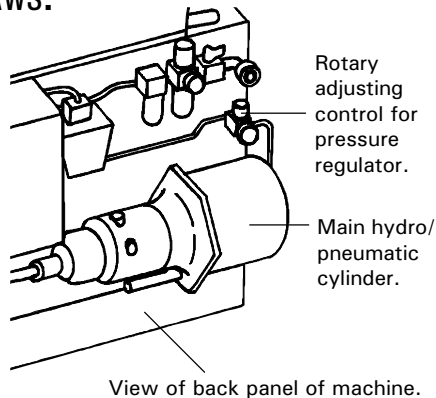
Hydro/Pneumatic Vice (when fitted).

The hydro/pneumatic vice jaws are opened and closed using M codes, M10 (Work Clamp Open) and M11 (work Clamp Close).

To enter an M code, the machine must be running in *Jog Mode*, selected by pressing the [JOG] key. The M code is entered by pressing the [M] key, followed by the two digit number. When the [EOB] key is pressed, the M code will be performed.

The pressure of the vice jaws can be adjusted using the rotary control on the regulator feeding air into the main cylinder. To adjust the pressure, pull up the rotary control to unlock it from its current position. Turn the control clockwise to increase pressure, or anticlockwise to decrease pressure. Push the rotary control down to relock it in its new position. The pressure cannot be adjusted higher than the operating pressure of the main air filter regulator (see page 20).

LOCATION OF PRESSURE ADJUSTING CONTROL FOR HYDRO/PNEUMATIC JAWS.



GENERAL SAFETY PRECAUTIONS.

General Safety Precautions :

- Wear clothing suitable for operating the machine 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 turn off the yellow isolator (found on the electrical control box) immediately.
- Ensure the power is switched off before starting any maintenance work on the machine or opening/working on the electrical control box.
- Check the state of the slideway lubrication daily, to prevent the axes from becoming jammed. The machine is fitted with an auto-lubrication system, ensure the reservoir is topped up regularly.
- Further operational safety precautions are outlined in the separate "Generic CNC Milling Manual".

SAFETY FEATURES.

The following safety features apply to Triac PC (ATC) machines :

KEY OPERATED EMERGENCY STOP BUTTON.

The red emergency stop button is fitted on the righthand front panel of the machine. When depressed it has the effect of stopping all axis and spindle movement. To reset, push the button in and turn clockwise (a key may be required). The axes will then require homing individually. Further information can be found in the separate "Generic CNC Milling Manual" - section 7.9.

AXIS LIMIT SWITCHES.

Limit switches are fitted to all three axes to prevent overtravel. The X and Y limit switches are fixed, but the Z limit switch is adjustable using the sliding bar (see diagram below).

An axis limit switch override button is fitted on the righthand front panel of the machine. It should be used when the table or head has overtravelled and activated the limit switch. To reset, depress the button and simultaneously press the appropriate axis key to move away from the limit switch, then home each axis individually.

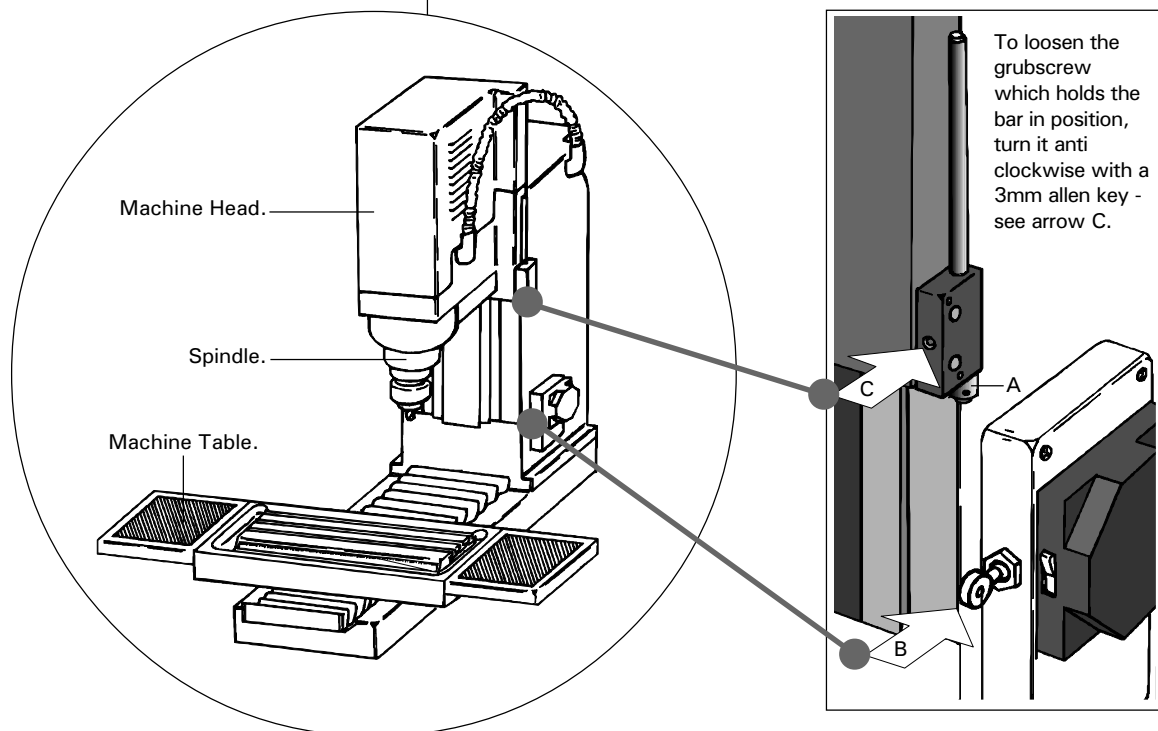


Diagram above - The Z axis limit switch is triggered when the base of the bar, A, fitted to the righthand side of the machine head, hits the switch, B.

INSTALLING & RUNNING THE MACHINE CONTROL SOFTWARE.



To install the machine control software onto your pc hard disk, switch on your pc and run/type the following:

A:\Install.exe

....where **A:** is the label for the floppy (3.5 inch) disk drive.

Press the [ENTER] / [RETURN] key on the pc qwerty keyboard to confirm this command.

The install routine will ask you for a drive destination (the label assigned to your pc hard disk - the default is set as **C:**) and a directory destination (the name of the area/folder you would like the software to be stored - the default is set as **\TRIACPC**).

The machine control software is an MS-DOS application.



Each time you wish to run the machine control software from your pc hard disk, exit,if necessary, to the 'DOS' prompt and type the following:

C:

....where **C:** is the label for the drive where the software is installed, then press the [ENTER] / [RETURN] key on the pc qwerty keyboard. Next, type:

CD\TRIACPC

....where **TRIACPC** is the directory where the software is stored and press the [ENTER] / [RETURN] key on the pc qwerty keyboard. Then type:

FANUCMD

Press the [ENTER] / [RETURN] key on the pc qwerty keyboard and the software will start.

Alternatively, the software can be run directly off one floppy (3.5 inch) disk.



To load the machine controlling software from a floppy (3.5 inch) disk, switch on your pc and exit, if necessary, to the 'DOS' prompt.

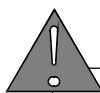
Type the following line at the 'DOS' prompt:

A:\FANUCMD

....where **A:** is the label for the floppy (3.5 inch) disk drive.

Press the [ENTER] / [RETURN] key on the pc qwerty keyboard to confirm this command.

The machine control software will now start.



Note - The default configuration in the software is for the desk-top tutor to connect to COM 1 and the CNC machine to COM 2.

MACHINE START-UP

- AUTOMATIC

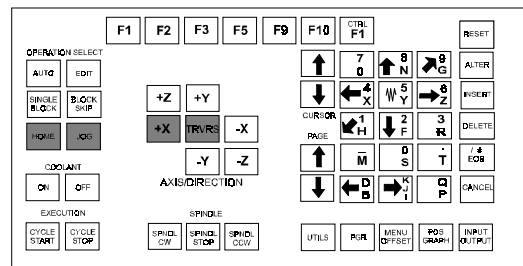
SEARCH FOR DATUM POINT .

Keys Helpbox.

The following keys are used in this section:

[HOME], [TRVRS]

[JOG], [+ X]

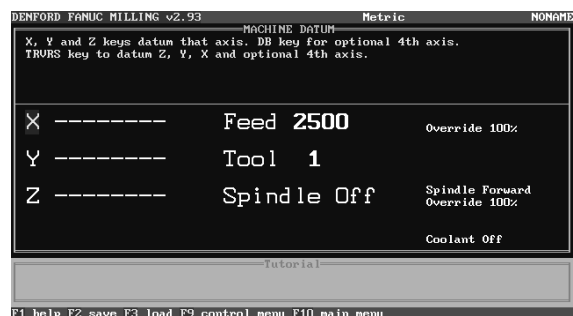


On loading up the DENFORD FANUC MILLING software, the start-up screen will be displayed.



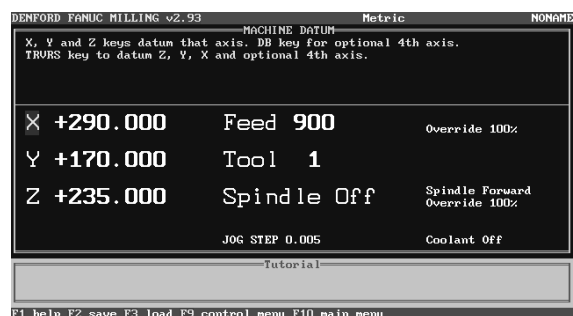
It is necessary to home the machine whenever it is switched on, to find the machine datum point - this is used as a zero reference for describing other co-ordinates on the machine.

To set the machine datum point automatically, first press the [HOME] key.



Next press the [TRVRS.] key. On a Triac PC the table will move to the extreme lefthand front corner of the machine (when looking directly from the front).

The screen will display a set of co-ordinates, relating to the maximum limits of travel for each axis. In the example shown right, the Triac PC has a maximum working area of 290mm in the X axis, 170mm in the Y axis and 235mm in the Z axis.



MAINTENANCE SCHEDULE.

| | |
|-------------------|---|
| <i>Daily</i> | <ul style="list-style-type: none"> - Clean and remove swarf. - Check/top-up slide lubrication oil level in reservoir. |
| <i>Weekly</i> | <ul style="list-style-type: none"> - Clean machine thoroughly. - Check exposed screws and nuts for tightness. - ATC models only - Check pull studs on the top of the tool shanks are tight and ATC slides are lubricated. - Check/top-up Cutting Coolant level. |
| <i>Monthly</i> | <ul style="list-style-type: none"> - ATC/Hydro Pneumatic Vice models - Check/top-up Air Lubricator oil level. - ATC/Hydro Pneumatic Vice models - Check condition of filter and drain any build-up of water in the filter bottle. |
| <i>Biannually</i> | <ul style="list-style-type: none"> - Check condition of electrical connections. - Check and clean collet. - Check all cables for kinks and breaks. - Clean sensors and microswitches. - Hydro Pneumatic Vice models - Check/top-up fluid level. |
| <i>Annually</i> | <ul style="list-style-type: none"> - Check slides for wear. |

LUBRICATION CHART.

| Lubrication Point | Lubricating System | Frequency | Recommended Oil/Grease | Quantity |
|---------------------------|--------------------|--------------------------------|--|--------------|
| Slide ways and Ballscrews | Auto Pump Unit | Alarm Message on Control VDU | BP : CS 68 Shell : Vitrea 68 Castrol : Perfecto NN | 0.5 litre |
| Milling Head | Grease Seal | On Maintenance of Milling 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 |
| Coolant | Electric Pump | As required | Cincinnati Millacron Simcool C 60 | 14.75 litres |

TRIAC PC (ATC)

MAINTENANCE.

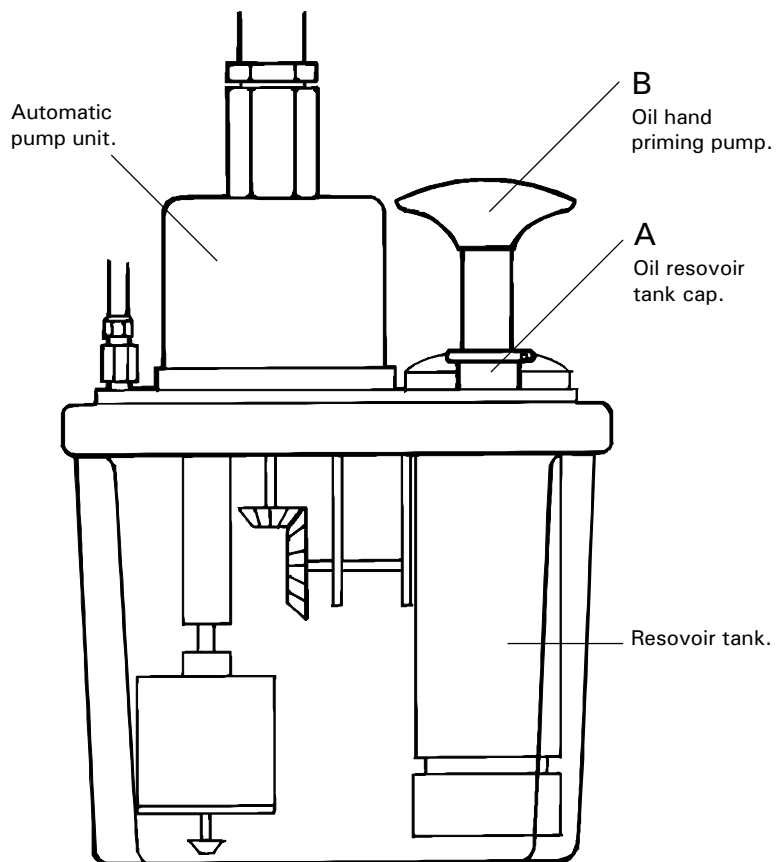
SLIDE LUBRICATION SYSTEM (SEE DIAGRAM BELOW).

The slide lubrication system comprises of an oil reservoir tank and an automatic pump unit. Oil is automatically pumped to the required areas of the machine.

The slide lubrication system is located at back of the machine (see diagram on page 11).

The oil level can be topped-up by adding the required grade of lubrication oil into the reservoir through cap A.

The hand priming pump, B, should only be used if there is no oil in the reservoir, ie, the pump has run dry or the oil is being renewed.



FRONT ELEVATION OF SLIDE LUBRICATION SYSTEM.

TRIAC PC (ATC)

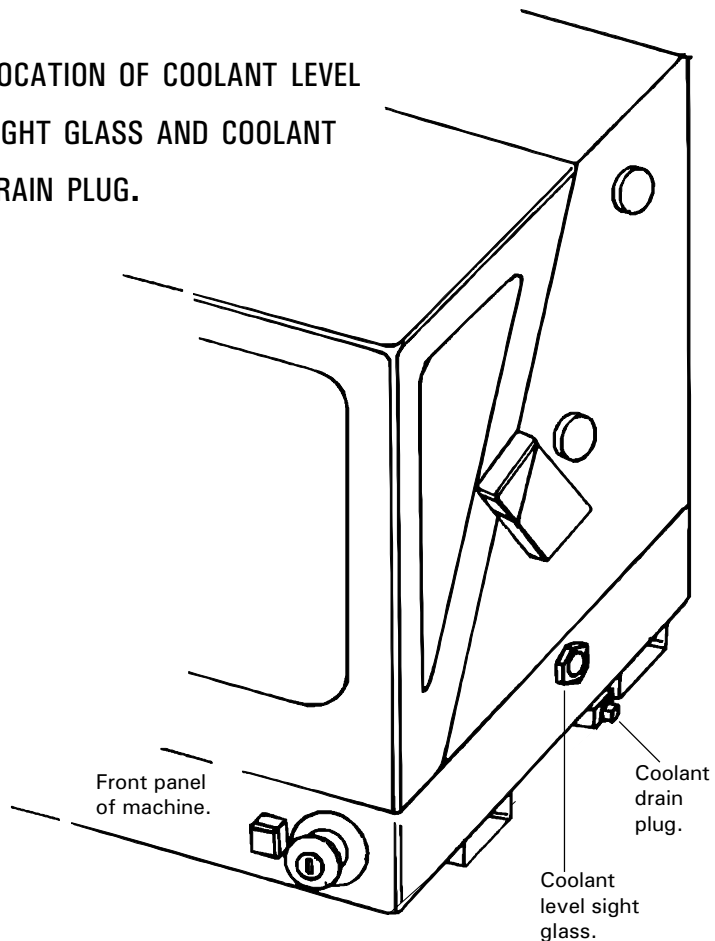
MAINTENANCE.

CUTTING COOLANT SYSTEM (SEE DIAGRAM BELOW).

The coolant tank is positioned in the base of the machine.

The level sight glass and drain tap are located on the righthand side of the cabinet base, when the machine is viewed from the front.

LOCATION OF COOLANT LEVEL SIGHT GLASS AND COOLANT DRAIN PLUG.



TRIAC PC (ATC) MAINTENANCE.

ATC - WHEN FITTED.

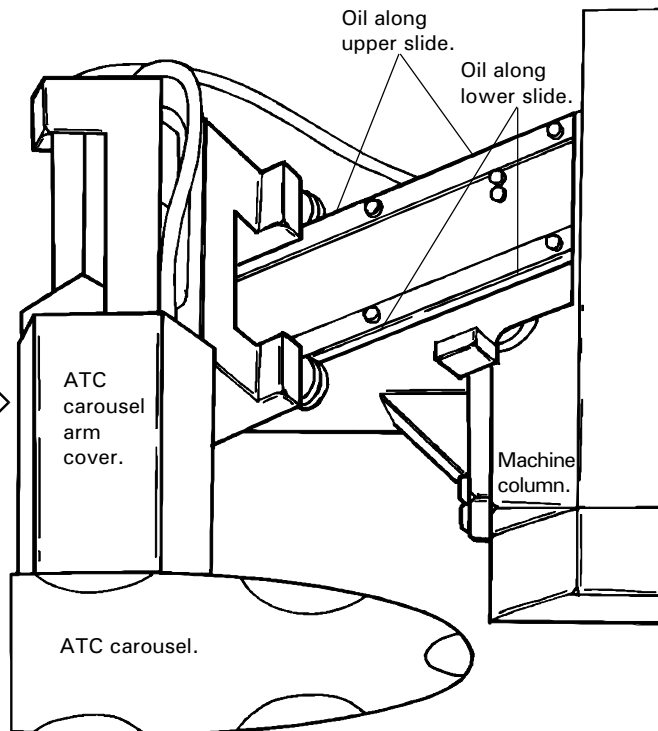
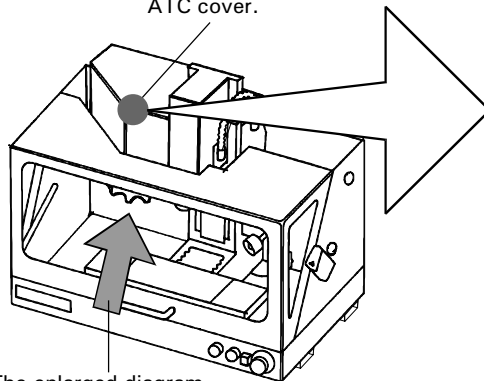
1 - SLIDES LUBRICATION (SEE DIAGRAM BELOW).

The slides on the Automatic Tool Changer are not supplied with lubricating oil automatically.

As part of the weekly maintenance schedule, the condition of the slides should be checked. Lubricating oil should be applied, when necessary, along the length of these slides using an oil can.

RIGHT : SIMPLIFIED VIEW OF ATC SLIDES (WHEN LOOKING FROM FRONT OF MACHINE UP INTO ATC COVER).

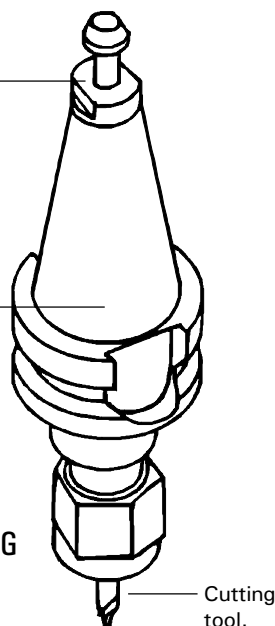
The upper and lower slides of the ATC are located under the ATC cover.



Pull Stud - tighten by turning clockwise.

Tool holder.

VIEW OF TOOL HOLDER SHOWING PULL STUD.



ATC - WHEN FITTED.

2 - MAINTENANCE OF PULL STUDS (SEE DIAGRAM LEFT).

The cutting tools, used with an ATC, are fitted in separate tool holders. Each tool holder shank has a pull stud which is used to clamp the tool holder firmly in the machine head.

These pull studs should be checked weekly and retightened if they are loose.

TRIAC PC (ATC)

MAINTENANCE.

AIR FILTER REGULATOR AND LUBRICATOR (SEE DIAGRAM BELOW).

The ATC and hydro/pneumatic vice are supplied with compressed air, passing through an air filter regulator and lubricator, situated on the back panel of the machine.

AIR SUPPLY ISOLATOR.

Turn anticlockwise to allow air to flow (as shown in the diagram below).

Turn clockwise to cut air supply and drain air pressure from the system.

AIR FILTER REGULATOR.

Normal operating pressure (as supplied, preset on the machine) is 100 PSI (6.6 Bar).

Maximum pressure for the air regulator is 150 PSI (9.9 Bar).

Always check the main supply pressure before adjusting pressure at the regulator. To adjust the pressure, pull up the rotary control to unlock it from its current position. Turn the control clockwise to increase pressure, or anticlockwise to decrease pressure. Push the rotary control down to relock it in its new position.

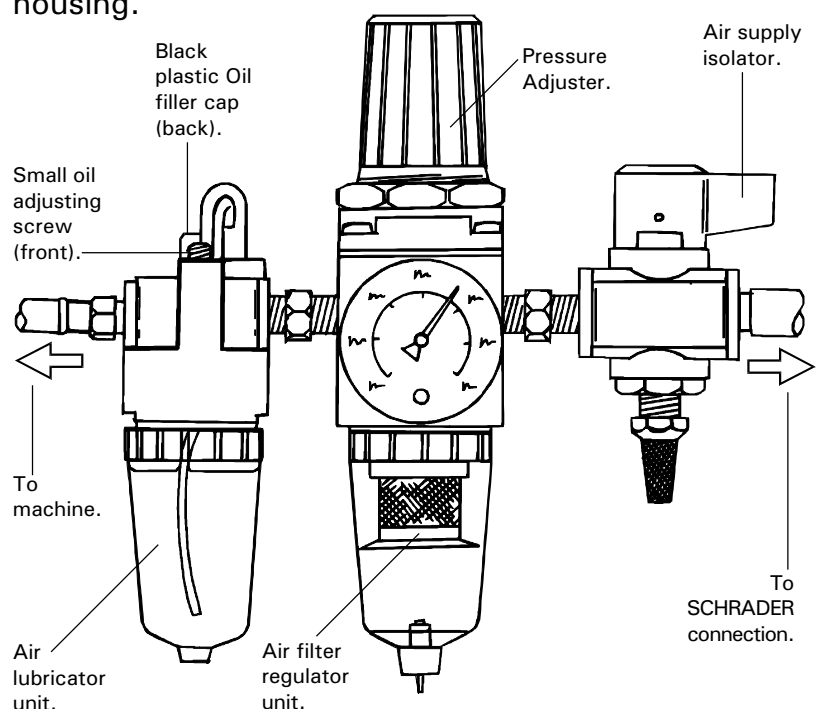
Regularly drain any water collected in the filter bottle using the cap in the base of the bottle. The interval at which this operation is required will depend on the type and condition of the air compressor being used.

AIR LUBRICATOR.

The air lubricator uses oil - ISOVG32.

Turn the front small adjusting screw clockwise to decrease the oil flow, or anticlockwise to increase the oil flow.

Oil can be added to the reservoir bottle by removing the black cap positioned behind the glass bell housing.



TRIAC PC (ATC)

SPECIFICATION.

MECHANICAL.

| | |
|--|--------------------------------|
| Working Table Surface | 500mm x 160mm (19.5" x 6.25") |
| Longitudinal Travel | 290mm (11.5") |
| Cross Travel | 170mm (7") |
| Head Travel | ATC 200mm (8") 235mm (9.25") |
| Spindle to Table | 275mm (11") |
| Spindle to Column | 170mm (6.75") |
| Spindle Taper (+ Quick Change Holder) | ISO30 |
| Spindle Taper for ATC | BT30 |
| 3 Tee Slots | 10mm width 31.5mm centres |
| Z Axis Ballscrew | 16mm dia. x 5mm Pitch |
| X Axis Ballscrew | 16mm dia. x 5mm Pitch |
| Y Axis Ballscrew | 16mm dia. x 5mm Pitch |
| Max. Machine Length | 1285mm (50.625") |
| Max. Machine Width | 890mm (35") |
| Max. Machine Height / guard up | 720mm (28.375") / 1170mm (46") |
| Control Box Length | 600mm (23.625") |
| Max. Control Box Width | 360mm (14.125") |
| Control Box Height | 780mm (30.75") |
| Machine Weight (net) | 240 Kilos (528 lbs) |
| Machine with ATC Weight (net) | 320 Kilos (705 lbs) |
| Control Box Weight (net) | 70 Kilos (154 lbs) |
| Machine Resolution | 0.01mm (0.0004") |
| System Resolution | 0.005mm |
| Spindle Speed Range | Programmable 0-4000 rpm |

ELECTRICAL.

Mains Supply

50/60 Hz - 1 phase 220/240 Volts 11 Amp

Spindle Motor:

Vari Speed 1 HP DC

Axes Motor:

Stepper Motors - 200 steps/rev DC

DENFORD PRODUCTS, CONTACTS AND SERVICES.

If you require specific help regarding the specification, operation or maintenance of this machine, contact Denford on the phone/fax number below. Please have the machine serial number and year of manufacture (printed on the front of this guide) to hand, when you call.

Telephone: +44 (0)1484 712264.

Fax: (01484) 722160.

Denford Limited,

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

Email: education@denford.co.uk

Stuck for projects and ideas?

Denford produces a range of project based courseware material, especially designed for use with our range of CNC Milling Machines and software products. Denford Courseware is developed to encourage the use of CNC machines and software within Keystages 3 and 4 of the Design and Technology National Curriculum.

Products available include:

- Milling Courseware Introductory (a brief introduction to the milling machine and Denfords "MillCAM Designer" software).
- Keystage 3 Projects for Milling.
- Milling Courseware Intermediate (exploring how the machine works, basic G-code program writing and the use of CNC machines in Industry).
- Keystage 4 Projects for Milling.

Need further training?

The Denford PTDC (Professional Training and Development Centre) is a purpose built centre specialising in project guidance, CNC machine training and software development skills for Denford customers. Training packages can be tailored to suit your needs, with the help of our experienced Education Support team. The centre can cater for training sessions from the very basics of CNC machine operation, upto the complexities of G-code programming, then further into 'new' Technology areas such as video conferencing.

Denford Limited is committed to the development of its training guides and manuals. If you have found certain sections in this setup guide useful, or feel that particular sections could be further developed, or new sections added in future, we would welcome your suggestions and comments.