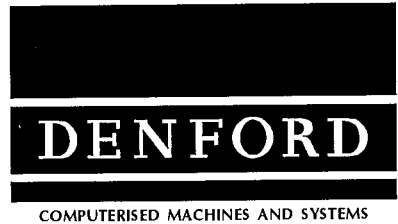


DENFORD

Triac

21i  
FANUC



---

## Operating Guide for the Triac FANUC 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.  
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Email: [service@denford.co.uk](mailto:service@denford.co.uk)

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# INTRODUCTION.

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

Any operational features, specific to the Triac FANUC, are also covered in this guide. Use of the machine control software is covered in the separate FANUC control software 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 cabinet.

**IF YOU HAVE ANY DOUBTS AND/OR QUESTIONS REGARDING THE SPECIFICATION, SERVICING, OR FEATURES OF YOUR MACHINE, PLEASE CONTACT CUSTOMER SERVICES AT DENFORD. DENFORD LIMITED RESERVES THE RIGHT TO CHANGE THE SPECIFICATION AND/OR OPERATING FEATURES REGARDING THIS CNC MACHINE WITHOUT NOTICE OR DOCUMENTATION.**

## 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.*

## WARNING.

*Warning! Obtain permission from the person responsible for the machine in your establishment, before opening the electrical control box 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.*

## FORESEEN USE OF MACHINE.

This machine is designed for milling non-hardened Ferrous metals, Aluminium, hard woods and plastics. In each case the appropriate tooling, speeds and feeds 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 the machine for manual operations. Never attempt to fit an abrasive wheel to the machine spindle.

# 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 FANUC 21i

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 :

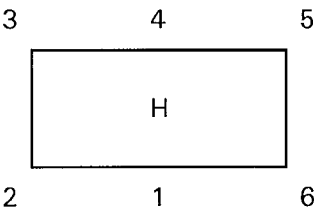
Denford Limited,  
Birds Royd,  
Brighouse,  
West Yorkshire,  
HD6 1NB,  
England.

# NOISE LEVEL TEST.

Test Report No: NL - TR9 - Ø1.  
Machinery Manufacturer: Denford Limited.  
Machinery Type/Model: Triac FANUC  
Test Specification in accordance with BS4813 : 1972.

Instrumentation used: Cirrus CRL 2.35A  
Test Site: Denford Limited, Inspection Dept.

General Machine Test Conditions:  
Spindle on size: Std.  
Splash guard on: N/A.  
Machine mounting: Floor.  
Additional equipment: None.  
Test positions:



Background Noise : 61 dB (A)  
Maximum Spindle Speed : 4000 revs/min  
Spindle Direction : Counter-clockwise

Spindle	Speed	Feed	Sound Levels dB (A)						
RPM	Range	INS/REV	Position						
			1	2	3	4	5	6	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

Background Noise : 61 dB (A)  
Maximum Spindle Speed : 4000 revs/min  
Spindle Direction : Clockwise

Spindle	Speed	Feed	Sound Levels dB (A)							
RPM	Range	INS/REV	Position							
			1	2	3	4	5	6	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	

# UNPACKING & LIFTING THE MACHINE.

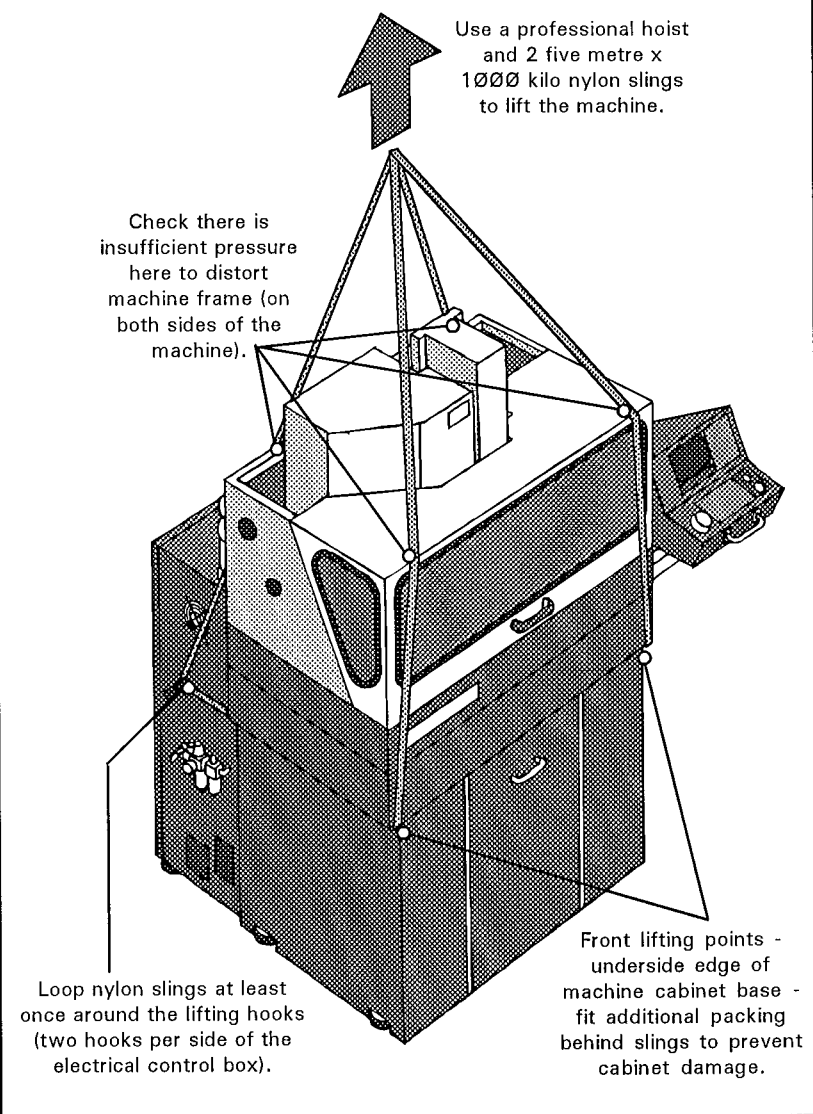
Cut the top of the delivery box open and remove the styrofoam packaging carefully.

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

Lift the machine from the packaging. Denford recommends using a professional hoist and 2 five metre x 1000 kilo nylon slings fitted to the lifting points on the machine, 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.

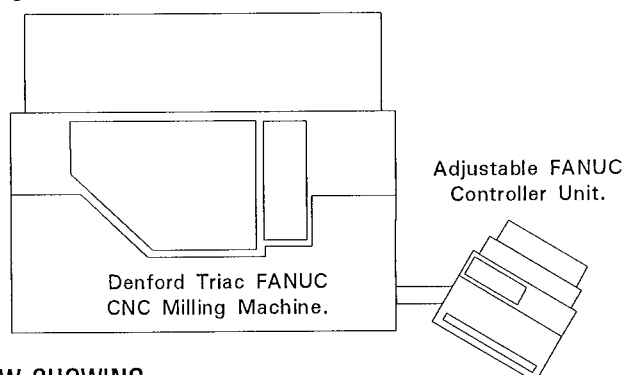
Triac FANUC weight = 340 kilos.



# POSITIONING THE MACHINE.

Remember when positioning the machine in the room, space will be required for opening of the electrical control box door, at the rear of the machine (leave a gap of at least 1000mm). Sufficient room should also be provided for effective maintenance to be carried out around the machine.

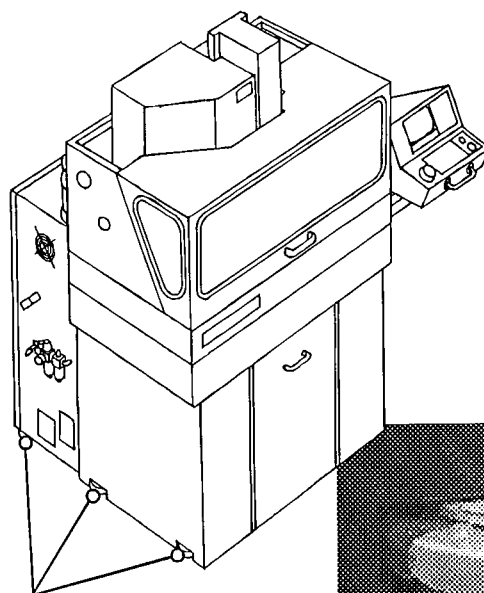
The Triac FANUC is mounted on a machine table incorporating the coolant tank, with the electrical control cabinet attached to the back of this table. It is designed for a height which enables comfortable operating and programming to take place. Ideally, the user will operate the machine when standing at its front, with a clear view of both the machine table (through the front viewing window) and the controller unit (which may be angled towards the user), as shown in the diagram below.



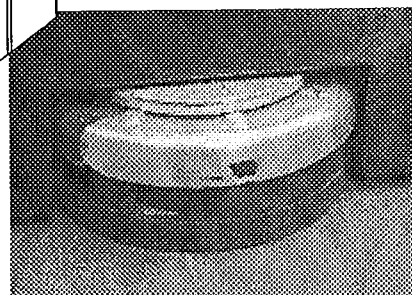
**PLAN VIEW SHOWING  
IDEAL MACHINE  
OPERATING POSITIONS.**



# LEVELLING THE MACHINE.



Anti-vibration levelling pads are located at these locations - three per side of the machine.



# LEVELLING THE MACHINE.

The Triac FANUC stands on six anti-vibration feet. The machine bed is levelled to the cabinet during manufacture, hence it is only necessary to ensure that the cabinet is levelled during installation.

Four feet are situated at the corners of the machine table incorporating the coolant tank - access for adjustment is gained by completely removing the front wheeled coolant tank unit and adjusting each anti-vibration foot from the inside of the table.

Note - The coolant pump cable beneath the machine is attached to the Triac FANUC cabinet by a spring and hook, to prevent entrapment when the coolant tank is pulled forward from the machine table.

Two feet are situated at the rearmost corners of the electrical cabinet - access for adjustment is gained through opening the rear doors and adjusting each anti-vibration foot from the inside of the electrical cabinet.

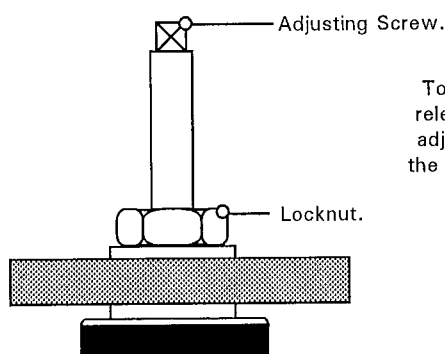
Note - The two feet inside the electrical control cabinet should not be used to level the machine - they should be adjusted last - only to support the electrical control cabinet itself.

Tools required: Spirit level, 10mm and 24mm A/F spanners.

Place the spirit level on the machine table itself, running parallel to the "T" slots. If the bubble is not aligned adjust as follows:

Release the locknut on the levelling screw whilst holding the screw stationary with the 10mm spanner. By turning the screw CW the machine can be raised, whilst turning CCW lowers the machine. When the bubble is aligned, turn the spirit level through 90 degrees and again adjust the feet to align the bubble. Once the machine is level, tighten all the locknuts, taking care to hold the adjusting screw stationary.

**Note:** On delivery the electrical cabinet should be sealed with a yellow tamperproof seal. If this is broken inform the suppliers immediately.



To increase the machine height, release the locknut, then turn the adjusting screw clockwise (when the adjusting screw is viewed from above).



# ELECTRICAL DIAGRAMS, CONTROL CABINET CONNECTION AND SEAL.

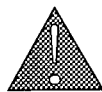
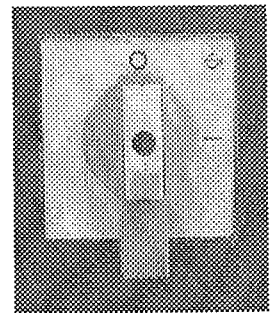
The electrical control cabinet is located directly behind the machine, attached to the machine table incorporating the coolant tank.

The Electrical Diagrams and Inspection Sheets for your machine are held in a folder fixed inside the electrical control cabinet.

Access to the electrical control cabinet is obtained through the pair of doors located at the rear of the machine. Ensure that the isolator switch is in the "OFF" position and the power supply to the machine is unplugged, before opening the electrical control cabinet doors.

**Note:** Depending on the specification of the machine, some electrical cabinet doors may additionally be fitted with locks.

Isolator switch must be in "OFF" position before unlocking and opening the electrical cabinet doors.



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

*The electrical control cabinet 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.*

*All electrical connections must be carried out by a suitably qualified electrical engineer.*

**Warning!** Obtain permission from the person responsible for the machine in your establishment, before opening the electrical control box 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.

# CONNECTING THE MAINS SUPPLY.

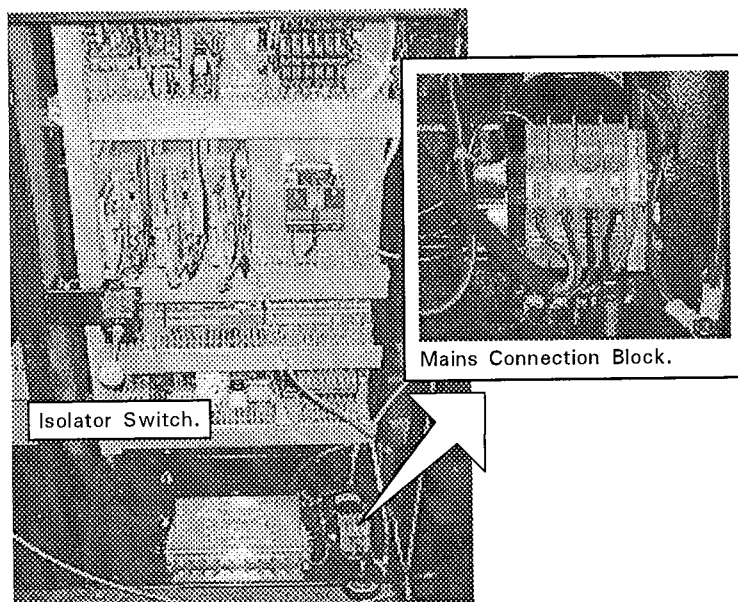
The electrical power supply is fed to the electrical control cabinet, attached to the back of the machine table, which in turn is connected to the milling machine.

Connection procedure:

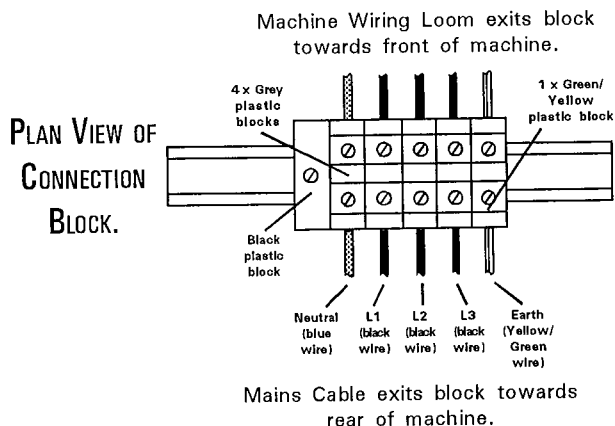
- 1) Switch the isolator to "OFF", then unlock and open the the electrical control cabinet (breaking the delivery seal).
- 2) The isolator is located in the top centre position, the mains connection block is located in the bottom right corner, viewed from the back of the machine.
- 3) Put crimp connectors on all five mains cable wires (three live, one neutral, one earth).
- 4) Connect these mains wires into the contact block, as shown in the diagram below.

Tool required:

Flathead screwdriver and crimping pliers.

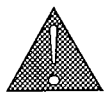


*The electrical diagrams are shown for illustrative purposes only. The location and arrangement of wiring for your machine may differ according to its specification. Note the clear labelling of terminals on your machine before following the connection procedures listed here.*



# CONNECTING THE MAINS SUPPLY.

The supply is 380/415 Volts 3 Phase 50/60 Hz.  
Cable required:- 3 Core + Neutral + Earth, 2.5mm<sup>2</sup> per core.  
Current Taken 12 Amps.



*All electrical connections must be carried out by a suitably qualified electrical engineer.*

*Warning! If the neutral conductor is isolated from earth potential, then the machine(s) must be protected by a Residual Current Device (RCD).*

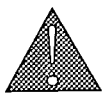
At this stage, it is required to check that the phases on the mains power are connected correctly. The simplest method to check the phases is to view the direction of the coolant pump, switched on using the [COOLANT ON] button and switched off using the [COOLANT OFF] button, located on the FANUC controller.

The coolant pump is located at the back of the removable flood coolant tank unit, the middle unit of the machine table, when viewed from the front. If the pump spindle is rotating in a clockwise direction (when viewed directly from above) then the phases are wired correctly. If the spindle is rotating in an anticlockwise direction, the phases must be switched over. When adjusting phases, only switch between two selected wires from the three available.

# 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.

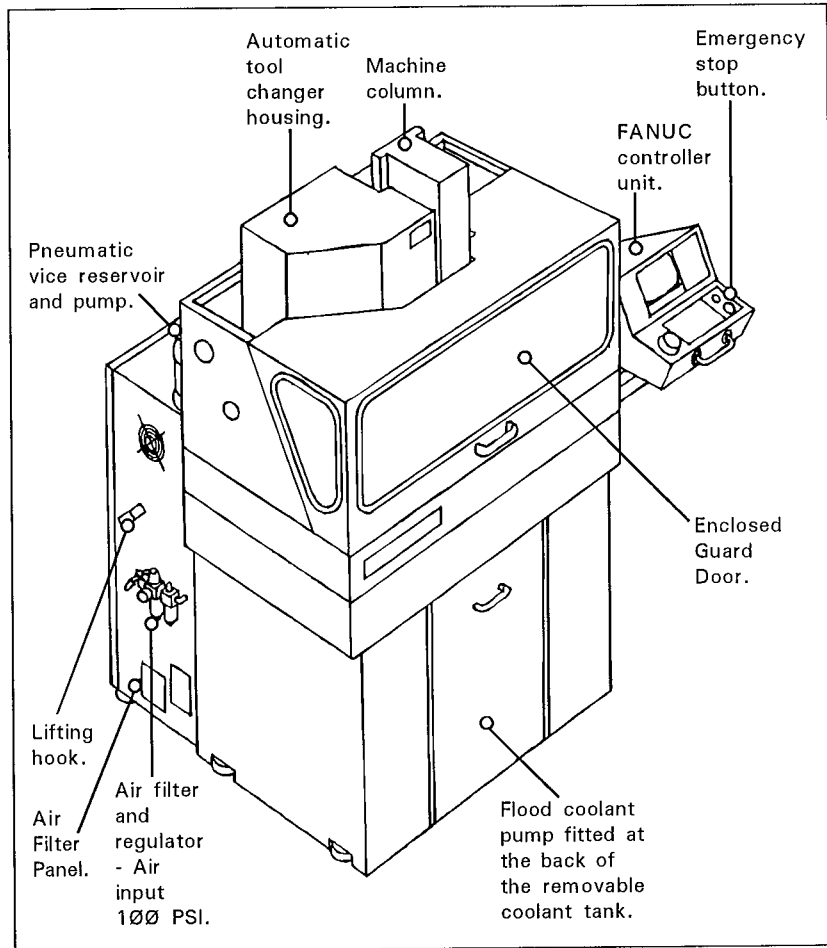
The protective coatings applied to the slideways and bright surfaces can be removed using a kerosene based solvent. The coatings must be removed from the slideways before any attempt to move them is made. Once these protective coatings have been removed, all untreated surfaces should be coated with a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



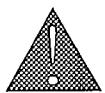
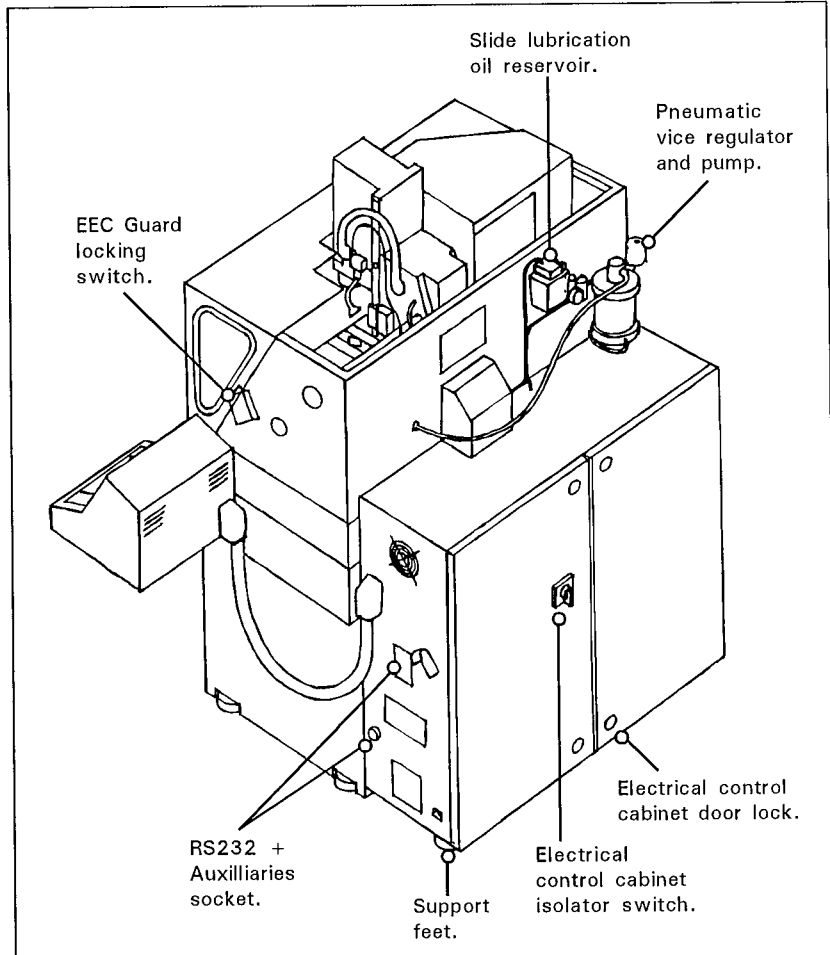
*Warning! Only use kerosene based solvents in accordance with the solvent manufacturers instructions and safety recommendations. Ensure that no naked flames are present.*

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

# TRIAC FANUC - GENERAL LAYOUT - FRONT 3/4 VIEW.



# TRIAC FANUC - GENERAL LAYOUT - BACK 3/4 VIEW.



## IMPORTANT !!

*Please Note - The positions of any ancillary components shown in these diagrams may differ on your machine due to specification and/or engineering component updates.*

# AIR PIPE CONNECTION.

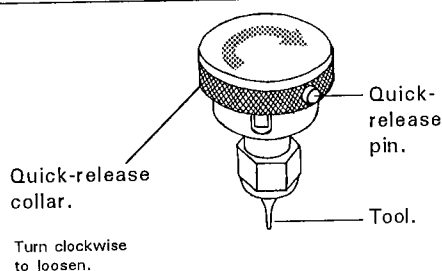
The ATC (Automatic Tool Changer), machine guard door and the Hydro/Pneumatic Vice require an air compressor fitted with a SCHRADER quick release connector.

The connection fitted onto the machine air filter regulator and lubricator is SCHRADER part number SC 8Ø51-11 1/8 BSP MALE (or Denford part number BI Ø1451S).

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 Ø1128S).

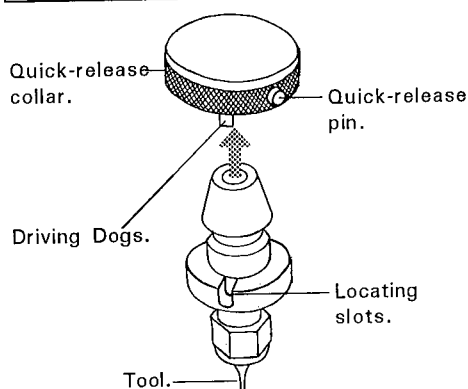
## TOOL CHANGING - MANUAL.

Removing a Tool manually.



To physically remove a tool from the machine, grip the tool holder quick-release collar, so that the quick-release pin in it is fully depressed. Hold the tool itself still and rotate the quick-release collar clockwise until it stops. Remove the tool whilst keeping the quick-release pin still depressed - this prevents the quick-release mechanism from closing.

Refitting a Tool manually.



To refit, align the two locating slots of the tool with the two driving dogs on the quick-release collar. Push the tool up into the holder. The quick-release mechanism should now spring closed and grip the 'new' tool securely.

# TOOL CHANGING

- PNEUMATIC DRAWBAR.
- ATC.

## PNEUMATIC DRAWBAR.

To control the Pneumatic Drawbar:

- 1) Stop the spindle.
- 2) Use the spindle clamp operator button on the FANUC controller panel to unclamp the tool - press and hold to open.
- 3) Replace the old tool with the new tool. Release the spindle clamp operator button to close the spindle clamp, holding the new tool in position.

See your separate FANUC control manual for further details on MDI (manual data input) for tool changing.

## ATC - AUTOMATIC TOOL CHANGER.

The ATC is controlled using M codes:

- 1) Press the [PROG] key on the FANUC data panel until the screen is running in MDI mode - the [PROG] key toggles between MDI and Program modes. Note - check that the [MDI] key on the main FANUC operators panel is also illuminated.
- 2) Use the M06 command followed by the tool number corresponding to the required tool from the tool carousel.

For example,

O 0000 ;

M06 T04 ;

Access the ; character using the [EOB] key FANUC data panel.

After entering each program on the edit line at the base of the screen press the [INSERT] key on the FANUC data panel.

- 3) Cursor to the beginning of the program and press [CYCLE START] on the main FANUC operators panel to start the program.

# HYDRO/ PNEUMATIC VICE OPERATION.

## Hydro/Pneumatic Vice.

The hydro/pneumatic vice jaws are opened and closed using M codes:

1) Press the [PROG] key on the FANUC data panel until the screen is running in MDI mode - the [PROG] key toggles between MDI and Program modes. Note - check that the [MDI] key on the main FANUC operators panel is also illuminated.

2) Use the M10 command to open the vice and the M11 command to close the vice.

For example, to open the vice,

O 0000 ;

M10 ;

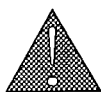
Access the ; character using the [EOB] key FANUC data panel.

After entering each program on the edit line at the base of the screen press the [INSERT] key on the FANUC data panel.

3) Cursor to the beginning of the program and press [CYCLE START] on the main FANUC operators panel to start the program.

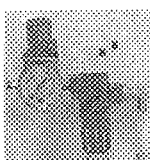
See your separate FANUC control manual for further details on MDI (manual data input) for vice operation. The pressure of the vice jaws can be adjusted using the rotary control on the regulator feeding air into the main cylinder. The regulator is mounted near the pneumatic pump at the back of the machine.

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 later section).

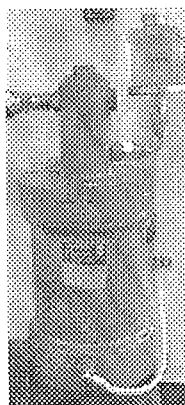


### IMPORTANT !!

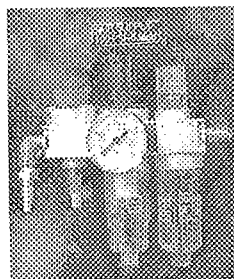
*Please note that auxilliary components may differ from those shown and described, according to the model specified and fitted. If you have any doubts concerning the connection and operating features for the auxilliary components fitted to your machine, please contact Denford Limited, or your local Denford agent, for further details.*



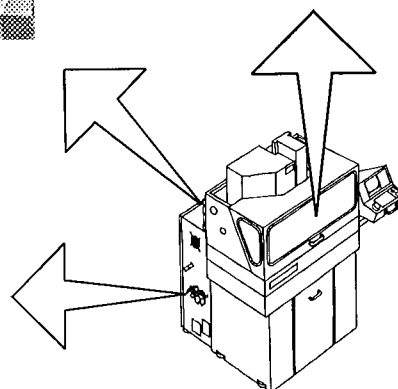
Rotary adjusting Pressure Regulator (above) for Hydro/Pneumatic Vice Pump (right).



Above: Hydro/pneumatic vice clamped to machine table.



Above: Main Air Pressure Regulator.



# GENERAL SAFETY PRECAUTIONS.

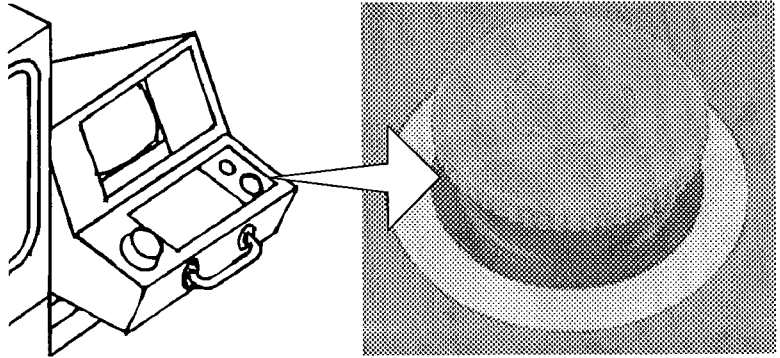
## General Safety Precautions :

- 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 cabinet) immediately.
- Ensure the power is switched off before starting any maintenance work on the machine or opening/working on the electrical control cabinet.
- 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.



# EMERGENCY STOP BUTTON.

The red emergency stop button is fitted on the lower half of the FANUC controller housing (to the left of the main panel). When depressed it has the effect of stopping all axis and spindle movement. To reset, push the button in and turn clockwise.



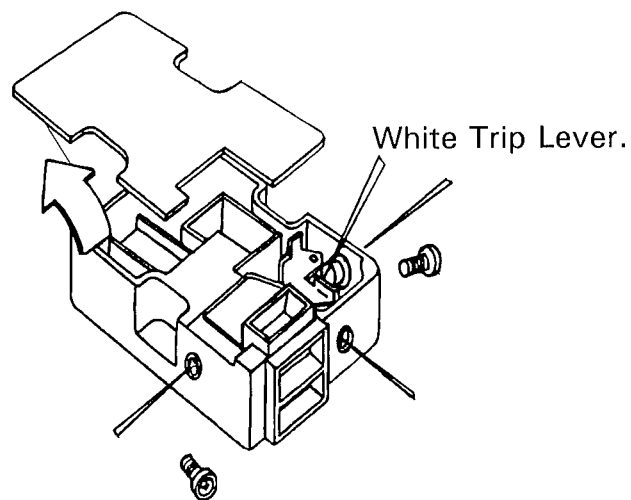
# GUARD DOOR SAFETY SWITCH.

## GUARD DOOR SAFETY SWITCH.

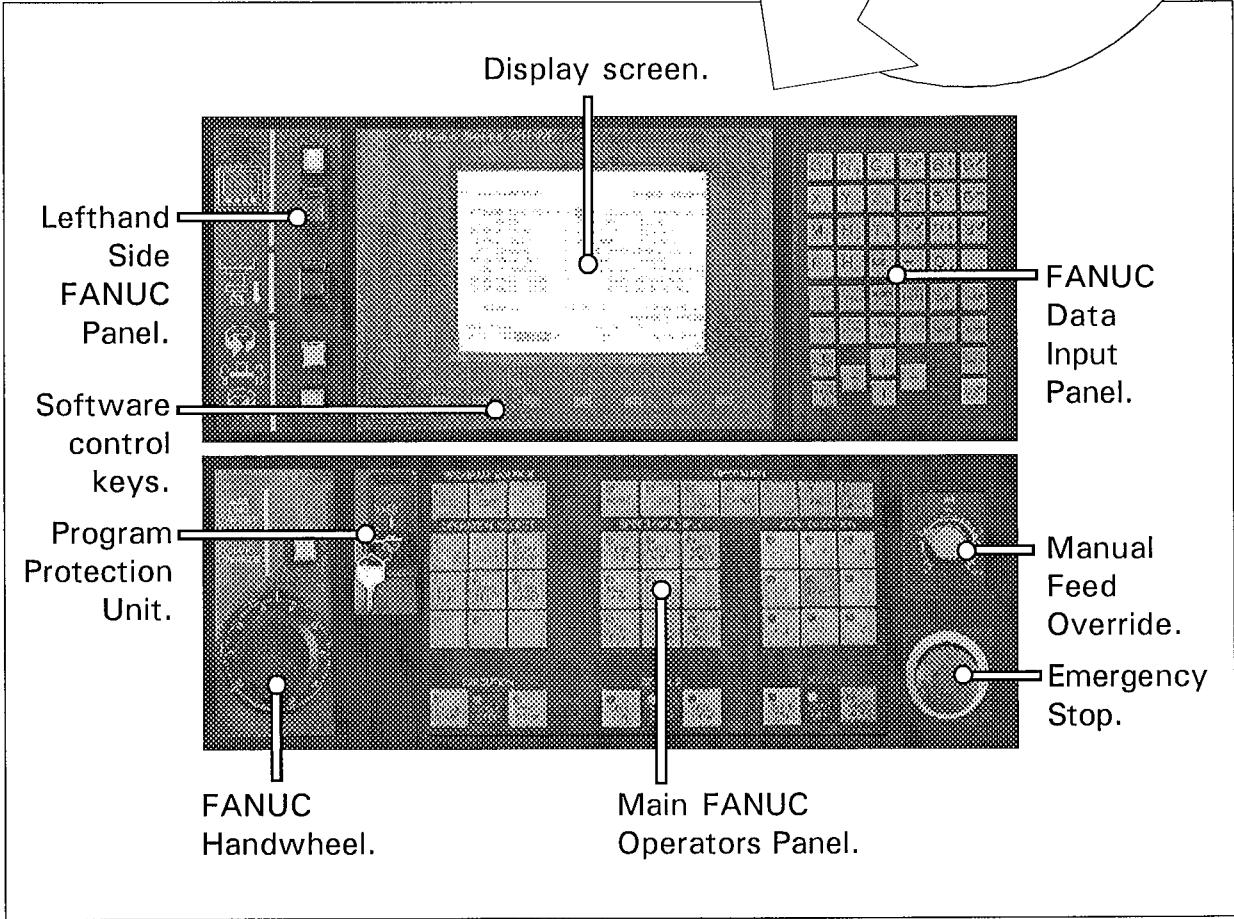
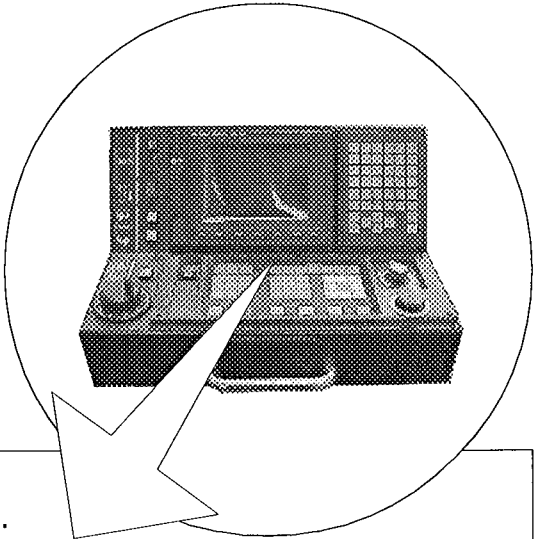
To enter the working area when the 24 volt circuit has failed and the door is clamped electrically. As indicated in the diagram below:

1) The cover of the safety switch can be removed using the special tool (supplied in the toolkit) to remove the special tamper proof screws (6); the internal workings of the switch are now exposed. Alternatively, by removing any of the three screws indicated, the white trip lever may be moved using a 2mm dia. rod through the screw hole.

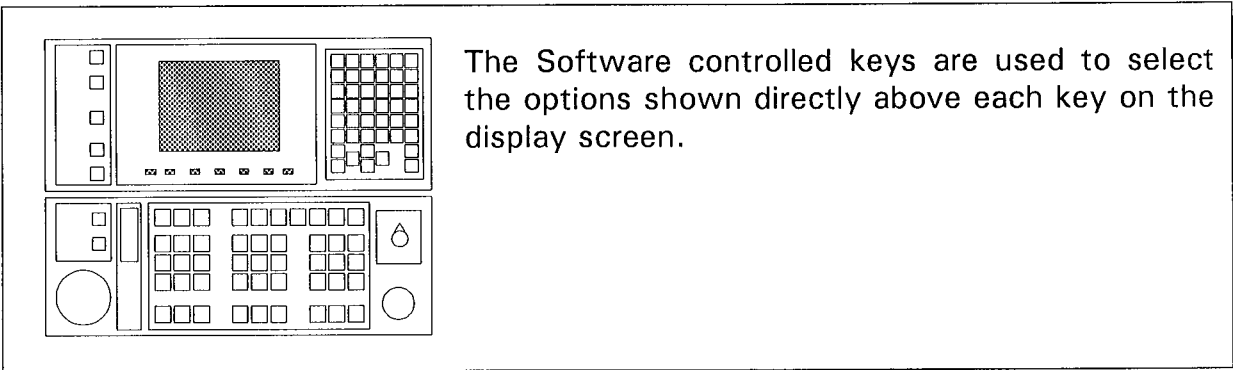
2) Using a screwdriver, or similar tool, move the white trip lever to the right to operate the switch, keeping this depressed the door can now be opened.



# GENERAL LAYOUT OF FANUC OPERATOR CONTROL PANEL.

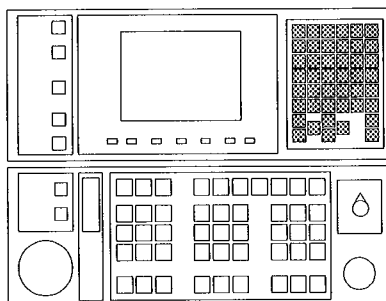
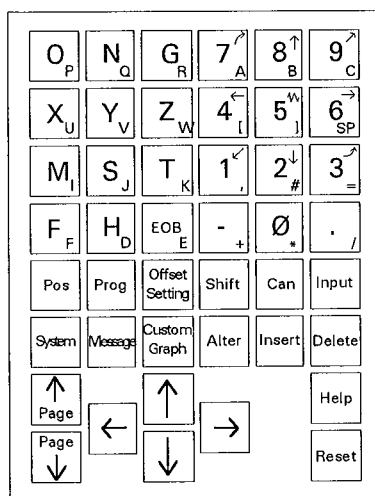


## DISPLAY AREA LAYOUT.



# FANUC DATA

## INPUT PANEL.



[RESET] - Resets any alarm messages.

[HELP] - Obtain help when using MDI keys.

[ADDRESS/NUMERIC] - Used to enter letters and numbers.

[SHIFT] - Pressing [SHIFT] followed by an address key will input the lower-right character on the address key. The character ^ is displayed to indicate that the lower-right character will be displayed.

[INPUT] - Used when data from the key input buffer needs writing to the offset register.

[CAN] - Deletes characters from the key input buffer.

[ALTER] - Edit program - alter character.

[INSERT] - Edit program - insert character.

[DELETE] - Edit program - delete character.

[POS] [PROG] ... - Used to switch screens for each function.

[POS] - Displays current position.

[PROG] - Displays and edits a program stored in memory.

[OFFSET SETTING] - Displays offset values and data.

[SYSTEM] - Displays and sets a parameter and pitch error compensation value and displays self diagnostic data.

[MESSAGE] - Displays an alarm messages and data.

[CUSTOM GRAPH] - Displays graphical data.

[CURSOR RIGHT] - Moves cursor right, or forwards, in small units.

[CURSOR LEFT] - Moves cursor left, or backwards, in small units.

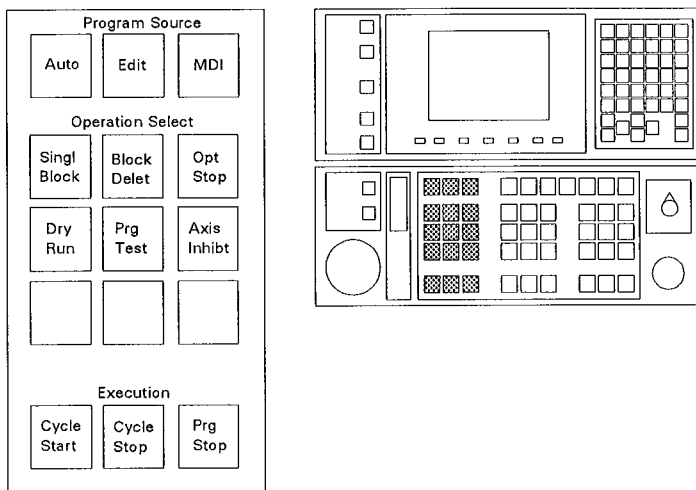
[CURSOR DOWN] - Moves cursor down, or forwards, in large units.

[CURSOR UP] - Moves cursor up, or backwards, in large units.

[PAGE UP] - Display the previous page.

[PAGE DOWN] - Display the next page.

# MAIN FANUC OPERATORS PANEL.



## AUTOMATIC OPERATION PANEL KEYS.

### Program Source:

[AUTO] - - Select to run program (Auto mode).

[EDIT] - - Select to edit program (Edit mode).

[MDI] - - Select to manually key in G & M Codes out of program mode.

### Operation Select:

[SINGL BLOCK] - - Allows single step execution of program.

[BLOCK DELETE] - - Select in edit mode to ignore block when running program (Activates / in front of block)

[OPT STOP] - - Used in conjunction with MO1 to optionally stop program.

[DRY RUN] - - Runs program through at jog feed rate.

[PRG TEST] - - Runs program through ignoring all M codes.

[AXIS INHIBT] - - Runs program through with axes locked.

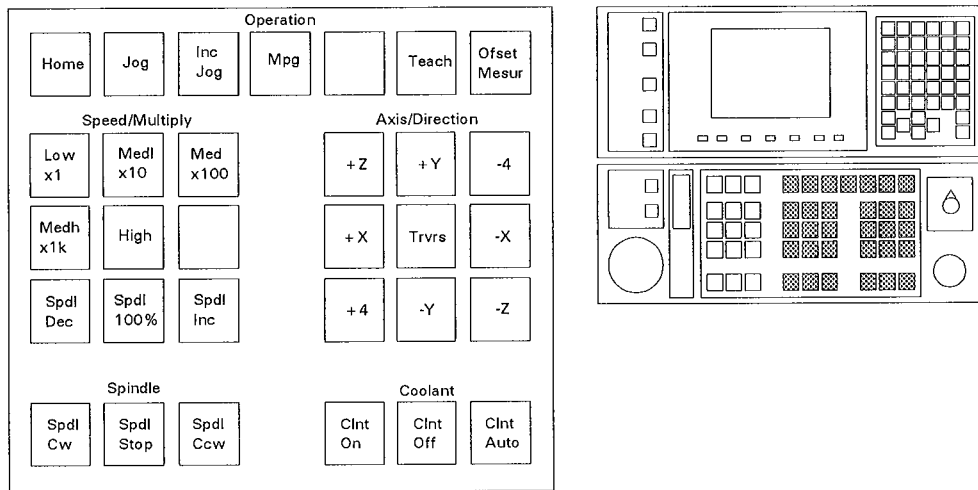
### Execution:

[CYCLE START] - - Starts program.

[CYCLE STOP] - - Stops program.

[PRG STOP] - - Stops program at end of current block.

# MAIN FANUC OPERATORS PANEL.



## FANUC MANUAL OPERATION PANEL KEYS.

### Operation:

- [HOME] - - Zeros machine around its own reference points.
- [JOG] - - Moves axes around at feeds as set on override.
- [INC JOG] - - Moves axes at 0.001, 0.01, 0.1, 1 Increments.
- [MPG] - - Manual Pulse Generator (Electronic Handwheel Control).
- [TEACH] - - Inputs actual machine position into program.
- [OFFSET MESUR] - - Tool offset setting mode.

### Speed/Multiply:

- [X 1] - - Multiplier selection for handwheel control MPG or INC JOG mode - x1.
  - [X 10] - - Multiplier selection for handwheel control MPG or INC JOG mode - x10.
  - [X 100] - - Multiplier selection for handwheel control MPG or INC JOG mode - x100.
  - [X 1K] - - Multiplier selection for handwheel control MPG or INC JOG mode - x1k.
  - [HIGH] - - Multiplier selection for handwheel control MPG or INC JOG mode - High.
  - [SPDL DEC] - - Spindle Decrease (Override of SPDL 100%), -10 %.
  - [SPDL 100%] - - Reverts spindle speed back to programmed value.
  - [SPDL INC] - - Spindle increase (Override of SPDL 100%), +10%.
- continued on next page....

# MAIN FANUC

## OPERATORS PANEL.

....continued from previous page.

*Axis/Direction - Press either [JOG] or [MPG] to operate:*

[-X] - Movement in -X direction.

[+ X] - Movement in + X direction.

[-Y] - Movement in -Y direction.

[+ Y] - Movement in + Y direction.

[-Z] - Movement in -Z direction.


[+ Z] - Movement in + Z direction.


[-4th] - Movement in -4th direction.


[+ 4th] - Movement in +4th direction.

[TRVRS] -  - Rapid Traverse (toggle switch).


*Spindle:*

[CW] -  - Spindle movement clockwise.


[STOP] -  - Spindle Stop.

[CCW] -  - Spindle movement counter clockwise.

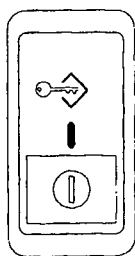
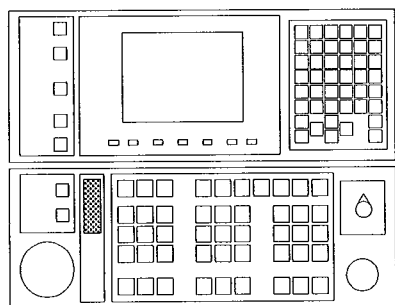
*Coolant:*

[CLNT ON] -  - Coolant on.

[CLNT OFF] -  - Coolant off.

[CLNT AUTO] -  - Coolant operated by program.

# PROGRAM PROTECTION UNIT.

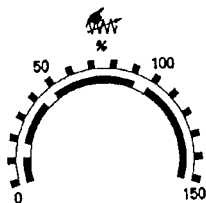
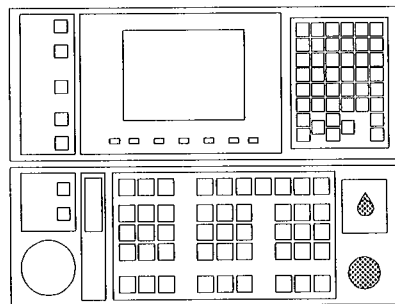


Key operated protection switch.

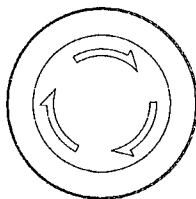
[SWITCHED ON] - Protects programs from tampering or accidental erasure.

[SWITCHED OFF] - Allows full program editing.

# EMERGENCY STOP & MANUAL FEED OVERRIDE.



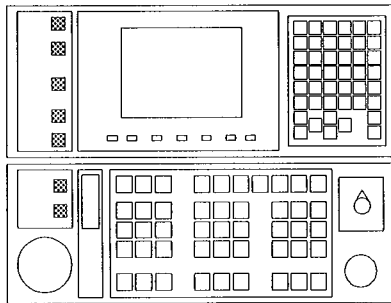
The manual feed override dial provides manual override of the program feed and rapid traverse rates and override of axis direction feed rates.



When pressed, the emergency stop button will cut all power to the drives.



# LEFTHAND SIDE FANUC OPERATORS PANEL.



The lefthand side of the upper and lower Fanuc Operators panel contains a row of 5 + 2 switches, listed below from top to bottom:

## *Control:*

[START CONTROL] - Green button to start the control system.

[CLOSE CONTROL] - Red button to close down the control system.

## *Automatic Tool Changer:*

[SPINDLE CLAMP] - Spindle clamp operator, push to open, release to close.

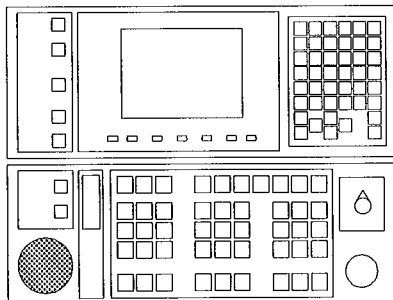
[ATC CCW] - Carousel index counter clockwise by one position.

[ATC CW] - Carousel index clockwise by one position.

## *Override:*

[AXIS LIMIT OVERRIDE] - Manual limit switch override.

[GUARD OVERRIDE] - Manual guard switch override.



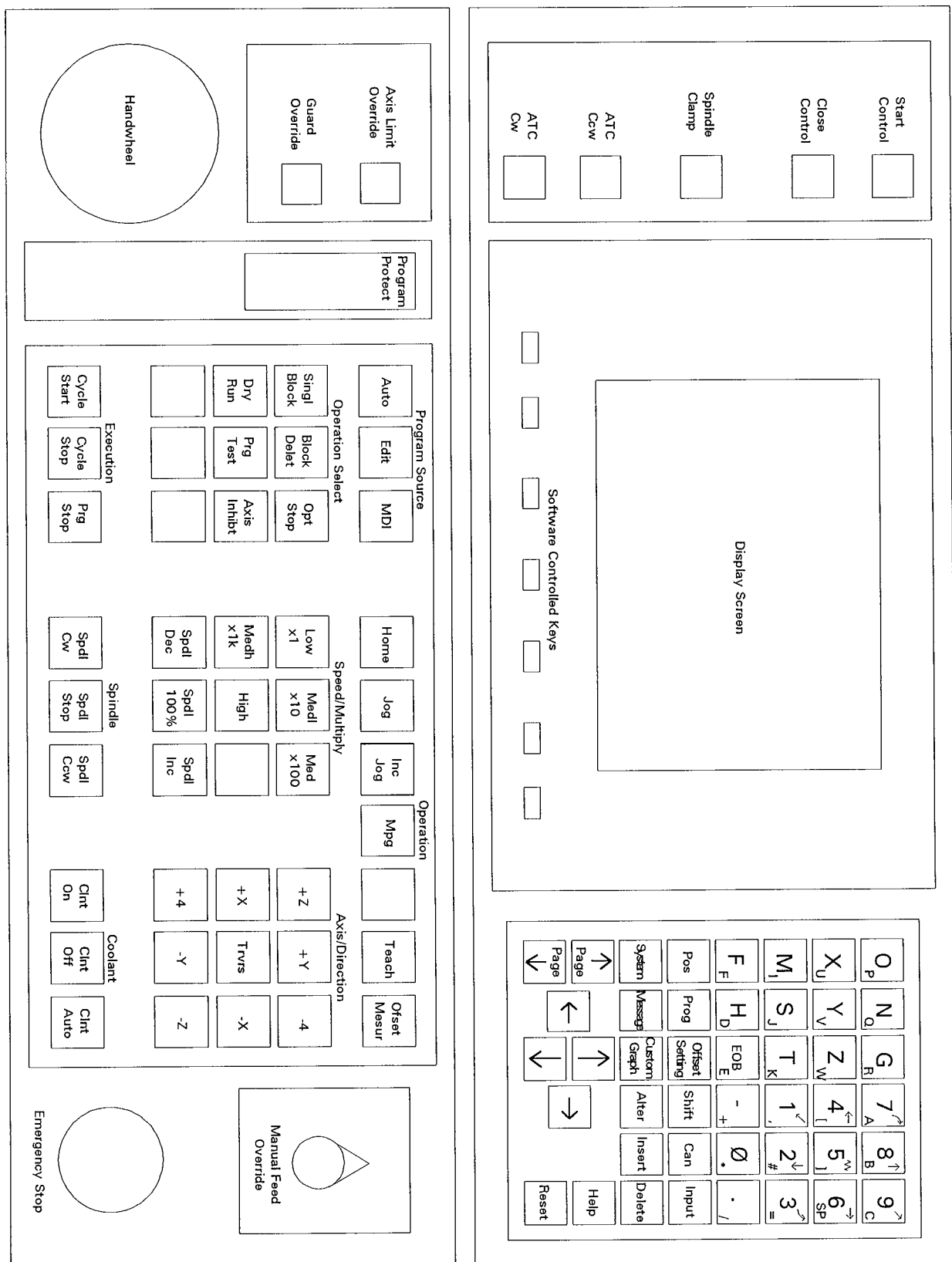
The FANUC Handwheel, MPG (Manual Pulse Generator). Manual movements of X, Y and Z axes when operating in handwheel mode.

Clockwise = Positive direction.

Counter clockwise = Negative direction.

# CONTROL PANEL -

## QUICK REFERENCE DIAGRAM.



# SWITCHING THE MACHINE On/ Off.

## SWITCHING THE MACHINE 'ON'.

Power up the machine by turning the yellow rotary isolator switch on the electrical control box door to the 'on' position.

Press the green 'control on' button once (on the righthand side of the lower FANUC control panel) to initialise power to the FANUC controller.

When the first display screens have loaded, press the flashing green 'control on' button again to fully power up the controller.

## SWITCHING THE MACHINE 'OFF'.

Press the red 'control off' button (on the righthand side of the lower FANUC control panel) to power down the FANUC controller.

Power down the machine by turning the yellow rotary isolator switch on the electrical control box door to the 'off' position.

The machine must not be turned off if a milling program is running, or the machine is cutting work....

# DATUMING THE MACHINE AXES.

Use the following procedure to datum (home) the machine axes:

1) Press the [PROG] key on the FANUC data panel until the screen is running in MDI mode - the [PROG] key toggles between MDI and Program modes. Note - check that the [MDI] key on the main FANUC operators panel is also illuminated.

2) Press the [EOB] key (to access the ; character) followed by the [INSERT] key, both found on the FANUC data panel. The first program line should read **O 0000 ;**

Type the second program line **G91 G28 X0 Y0 Z0** ; and press the [INSERT] key on the FANUC data panel.

3) Cursor to the beginning of the program and press [CYCLE START] on the main FANUC operators panel to start the program.

# Run In PROCEDURES.

Before working on the Triac FANUC for the first time, it is important that the spindle is "run in" for a set period:

Speed.	Time.
500 rpm	15 min
1000 rpm	10 min
2000 rpm	10 min

Use the following procedure to "run in" the spindle:

- 1) Press the [PROG] key on the FANUC data panel until the screen is running in MDI mode - the [PROG] key toggles between MDI and Program modes. Note - check that the [MDI] key on the main FANUC operators panel is also illuminated.

- 2) Press the [EOB] key (to access the ; character) followed by the [INSERT] key, both found on the FANUC data panel. The first program line should read **O 0000 ;**

Type the second program line **M 03 S 500 ;** and press the [INSERT] key on the FANUC data panel.

- 3) Cursor to the beginning of the program and press [CYCLE START] on the main FANUC operators panel to start the program.

Note - Ensure that SPDL 100% is activated on the main FANUC operators panel.

- 4) After the correct time period for this spindle speed stated in the table above, press the [SPDL STOP] key on the main FANUC operators panel, to stop the spindle.

- 5) To change the spindle speed, re-enter the program but change the **S** value in the second program line to read the next spindle speed stated in the running-in table above.

- 6) Cursor to the beginning of the program and press [CYCLE START] on the main FANUC operators panel to start the program.

- 7) After the correct time period for this spindle speed stated in the table above, press the [SPDL STOP] key on the main FANUC operators panel, to stop the spindle.

- 8) Run through this procedure until all spindle speeds have been run for their stated time periods.

# SETTING OF WORK DATUM.

## SETTING OF WORK DATUM.

A working datum is essential in all work done on a CNC Milling Machine, so that the machine knows the position of the work piece in relation to its own machine datum.

When entering a program these offset values are inputted via the G92 code. The offsets are usually incorporated at the beginning of a program.

For example,

O 0000 ;

G91 G28 X0 Y0 Z0 ;

**G92 X.... Y.... Z.... ;**

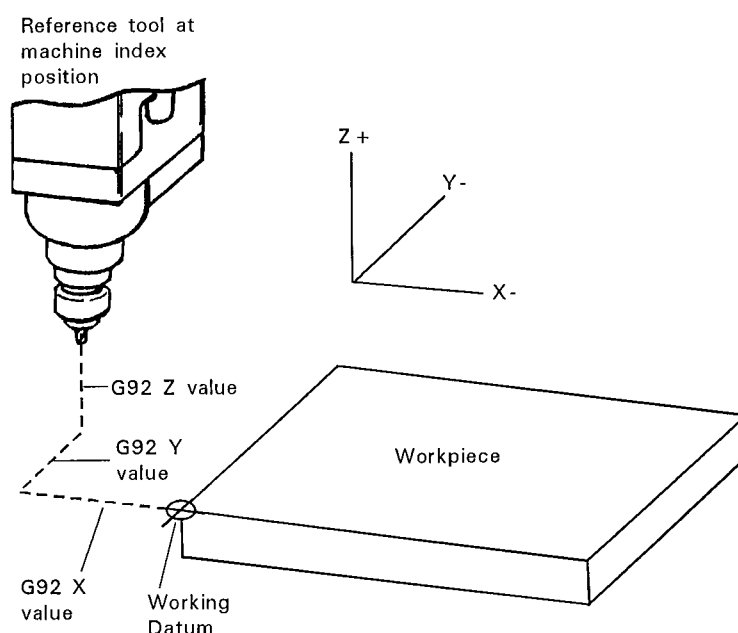
G90 G43 X00 Y00 Z2 H01 ;

When programing, these values are usually set to zero and then determined during setting up.

### Note:

If details concerning the dimensions of the workpiece, the precise location of its fixtures and the precise lengths of tools are available, the actual axis offset values maybe put in at this stage.

Once the program is entered/loaded, the offset values are usually inputted by the operator driving the reference tool (usually either the longest or the most frequently used tool) to a known position relative to the workpiece. Comparison of the position readout at machine reference point and at known position relative to the workpiece will reveal the appropriate G92 values. See diagram below....



# TOOL SETTING PROCEDURE.

This section uses the following terminology:

softkey = Software option displayed at the base of screen controlled by the appropriate key below its title.

softkey: [LEFT ARROW] will view previous menus and commands.

softkey: [RIGHT ARROW] will view next menus and commands.

On initial power up of the controller, the machine will be running in Absolute mode, viewed from the [POS] screen. Secure the billet on the machine table.

The Tool Setting procedure can be carried out using a number of different methods. One of these methods is listed below:

- 1) *Datum (home) the machine and change to the reference tool.*

Datum the machine using MDI mode, as described in the section on page 27.

Change tools using MDI mode, as described in the section on page 14. For the purposes of this section, the reference tool will be referred to as tool number 1.

- 2) *Clear any registered tool compensation (offset) values.*

To clear any values present in the offsets file, press the [OFFSET SETTING] key on the FANUC data panel. From the displayed menu at the base of the screen, press softkey: [OPRT]. Use softkey: [RIGHT ARROW] to toggle through options and press softkey: [CLEAR], softkey: [ALL]. This will zero all the values registered in the offsets table.

- 3) *G92 Tool Setting procedure.*

Check the machine is running in JOG mode - the [JOG] key on the main FANUC operators panel will be illuminated. Use the [AXES] keys on the main FANUC operators panel to drive the reference tool to a known position on the billet. For rapid movement press the [TRVRS] key at the same time as one of the [AXES] keys. For precise adjustments, switch to handwheel mode by pressing the [MPG] key on the main FANUC operators panel. Press the appropriate [AXIS] direction key before turning the handwheel. Adjust the rate of movement using the [SPEED/MULTIPLY] keys on the main FANUC operators panel.

# TOOL SETTING PROCEDURE.

To set the position of the reference tool to 'zero', press the [POS] key on the FANUC data panel. Note that the co-ordinates are read as Absolute values. Press softkey: [RELATIVE], softkey: [OPRT], softkey: [ORIGIN], softkey: [ALL] - this will set X, Y and Z values to all read zero. Note that the co-ordinates are now read as Relative values.

To set individual X, Y or Z values, instead of pressing softkey: [ALL], press either [X], [Y] or [Z]. The appropriate axis letter will flash on the screen. Input the required value, including the correct sign (+/-) and press softkey: [PRESET].

Datum the machine using MDI mode, as described in the section on page 27, to find the G92 values. The co-ordinate values now read from the [POS] screen, including any signs (+/-) are the values entered into the G92 X.... Y.... Z.... ; at the start of your program.

#### 4) *Enter Tool Compensation (Offset) values.*

After setting up the G92 command the reference tool will drive to XØ YØ ZØ (ie, component datum) if given the command:

GØØ XØ YØ ZØ

If tool number 2 is given the same command it will drive to

XØ YØ Z ?

The value ? is equal to the difference in length between the reference tool and tool number 2. This discrepancy can be compensated for by having a tool length offset associated with the tool number 2. In this case a value of ? would be stored in the tool offset file. The tool offset file may be addressed and modified by the machine operator.

Any movement called for by a tool is modified by the tool offset value currently held on file for that tool, ie, Ø (zero) for the reference tool and, if tool number 2 is shorter than the reference tool, +? for the second tool.

Change to tool number 2 using MDI mode, as described in the section on page 14.

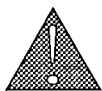
Drive tool number 2 to the known position (ie, the component datum) on the billet.

Press the [OFFSET SETTING] key on the FANUC data panel. [CURSOR] to offset number TØ2 and enter the displayed relative Z co-ordinate value onto the edit line, including any signs (+/-). Press softkey: [INPUT] to register this value in the tool offsets table.

Repeat the procedure for all tools used in the program.



# NOTE FOR FMS SYSTEMS.



*Note: If the machine is part of an FMS system, but you require to run the machine as an independent unit, ensure that the dummy plug is placed in the socket marked auxiliary, on the side panel of the electrical control cabinet.*

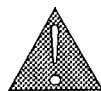
## PLANNING PROCEDURE FOR MAINTENANCE WORK.

When carrying out maintenance work, pay special attention to the following items to ensure safe and correct procedures.

- 1) Before starting any maintenance work, define the task and obtain the information relevant to carry out the maintenance to a successful conclusion.
- 2) Prior to commencing any maintenance task, define the work period to do the necessary work, obtain the correct tools, order the spare parts needed to complete the task.
- 3) During the maintenance work period put up a notice in a place easily seen, to the effect that the machine is under maintenance and should not be used until the notice is removed.
- 4) Safety should be a priority when carrying out any maintenance, covers and safety guards that are removed during the maintenance period should be replaced after the work is completed and all interlocks and micro-switches reset.
- 5) All maintenance work should be carried out by suitably qualified personnel.
- 6) When replacing electrical components ensure that they are the ones specified. When carrying out maintenance work with the power turned off, put up a notice "DO NOT TURN ON POWER" on the isolator switch.
- 7) All maintenance work done on the machine whether progressive or preventative should be logged so that a complete service record can be kept for future referral.
- 8) When the maintenance is completed, check that the replaced and serviced parts are working correctly, and that the machine runs efficiently.

# MAINTENANCE SCHEDULE.

<i>Daily</i>	<ul style="list-style-type: none"> <li>- Clean and remove swarf.</li> <li>- Check/top-up slide lubrication oil level in reservoir.</li> </ul>
<i>Weekly</i>	<ul style="list-style-type: none"> <li>- Clean machine thoroughly.</li> <li>- Check exposed screws and nuts for tightness.</li> <li>- ATC models only - Check pull studs on the top of the tool shanks are tight and ATC slides are lubricated.</li> <li>- Check/top-up Cutting Coolant level.</li> </ul>
<i>Monthly</i>	<ul style="list-style-type: none"> <li>- ATC/Hydro Pneumatic Vice models - Check/top-up Air Lubricator oil level.</li> <li>- ATC/Hydro Pneumatic Vice models - Check condition of filter and drain any build-up of water in the filter bottle.</li> </ul>
<i>Biannually</i>	<ul style="list-style-type: none"> <li>- Check condition of electrical connections.</li> <li>- Check and clean collet.</li> <li>- Check all cables for kinks and breaks.</li> <li>- Hydro Pneumatic Vice models - Check/top-up fluid level.</li> </ul>
<i>Annually</i>	<ul style="list-style-type: none"> <li>- Check slides for wear.</li> <li>- Check adjustment of head, cross slide and table strips.</li> <li>- Grease axis bearings.</li> <li>- Check machine alignments and accuracy.</li> <li>- Check spindle bearing adjustment.</li> <li>- Check spindle drive belt.</li> <li>- Check axis drive belt for wear.</li> <li>- Change air filters.</li> </ul>



*If in doubt about any of the above, please contact Denford Limited, or your local Denford Agent for 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".

# ATC (AUTOMATIC TOOL CHANGER).

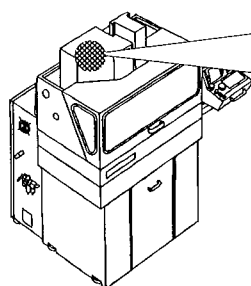
## 1 - SLIDES LUBRICATION (SEE DIAGRAM BELOW).

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

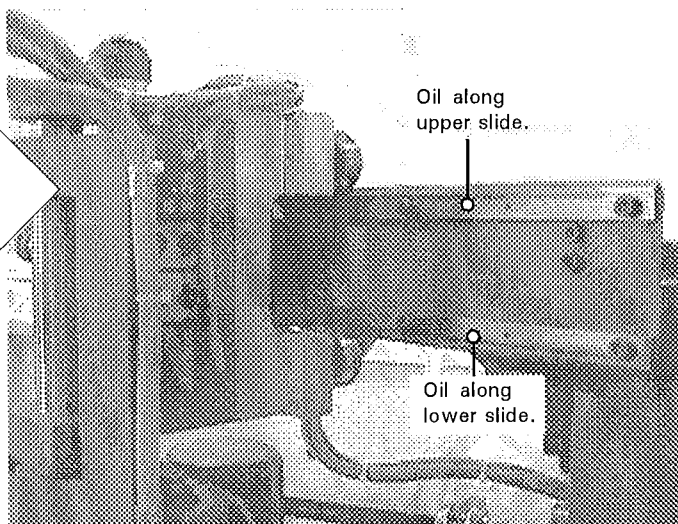
As part of the weekly maintenance schedule, the condition of the slides should be checked. Lubricating oil should be applied, when necessary, along the length of these slides using an oil can.

Use oil specification BP CS 68 / Shell Vitrea 68 / Castrol Perfecto NN or equivalent.

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



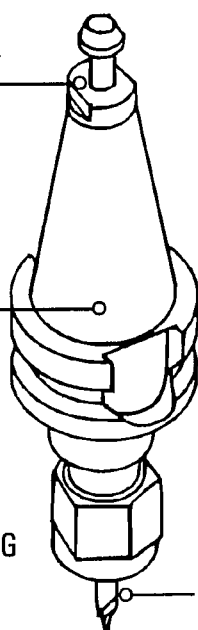
The photo (right) shows the mechanism of the ATC.



Pull Stud - tighten by turning clockwise.

Tool holder.

VIEW OF TOOL  
HOLDER SHOWING  
PULL STUD.



Cutting tool.

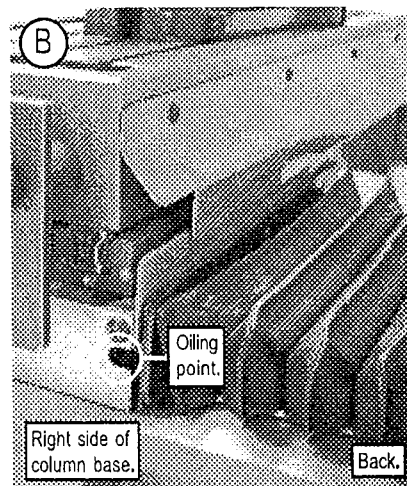
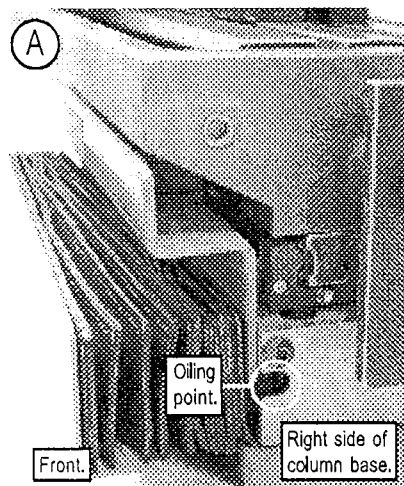
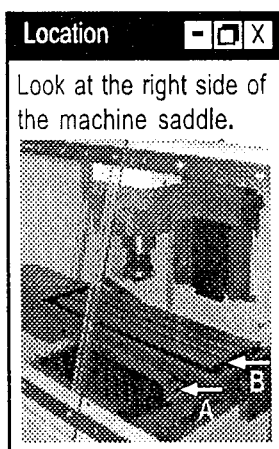
## 2 - MAINTENANCE OF PULL STUDS (SEE DIAGRAM LEFT).

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.

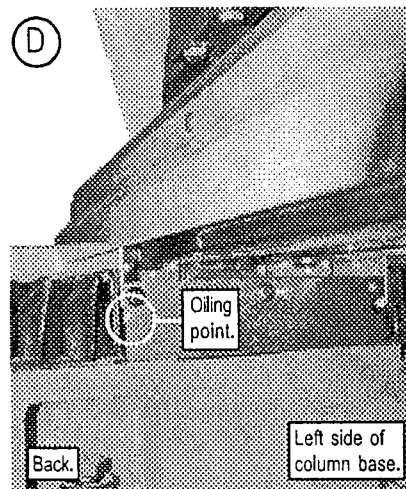
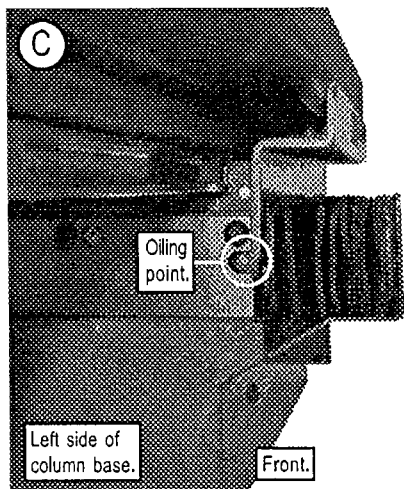
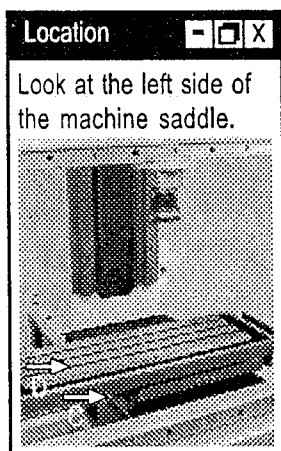
## 7: Y Axis Slideways Lubrication

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.



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).

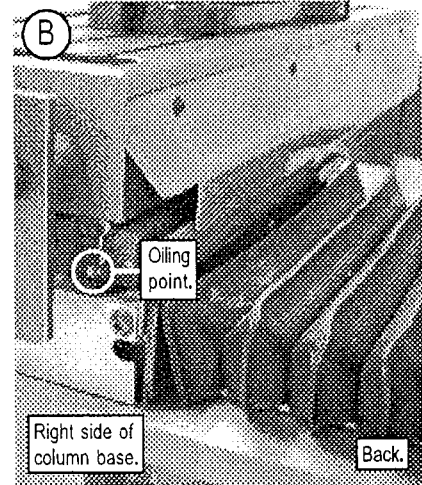
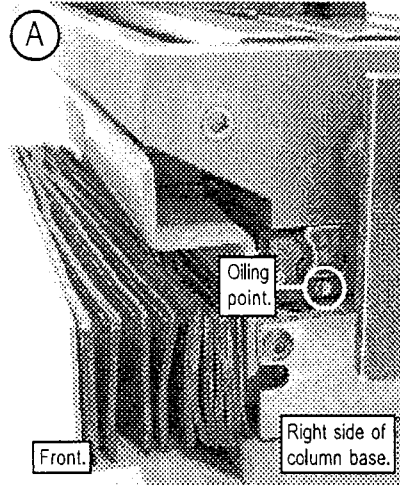
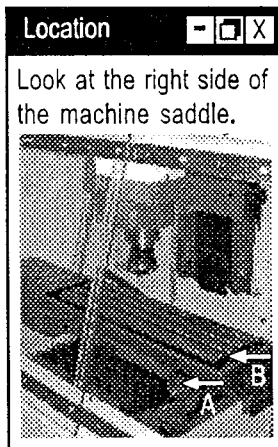
Run the machine table fully to the left, to obtain the best possible access to the remaining two oiling points, located under the front and rear left table slideways. Using a pump action oilcan, reach under the left side of the machine table and pump oil into the two oiling points (as shown below).



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

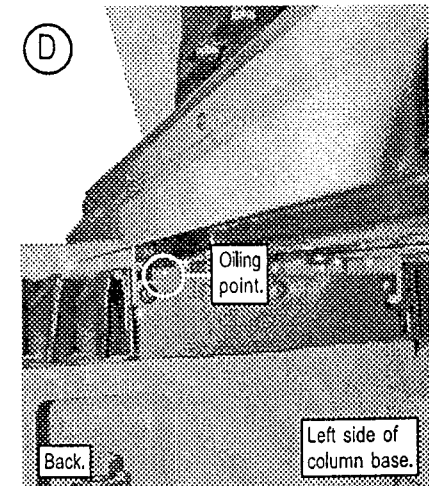
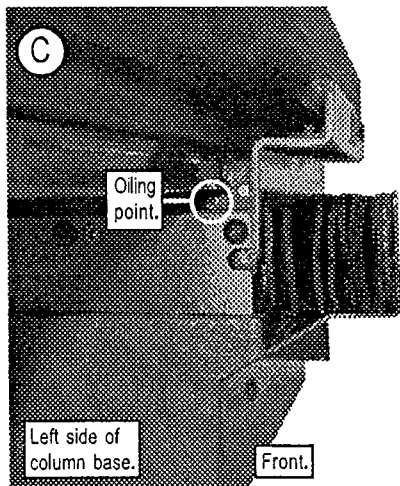
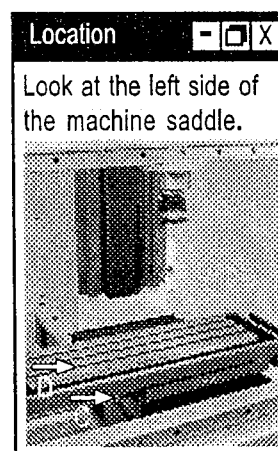
## 7: X Axis Slideways Lubrication

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.



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).



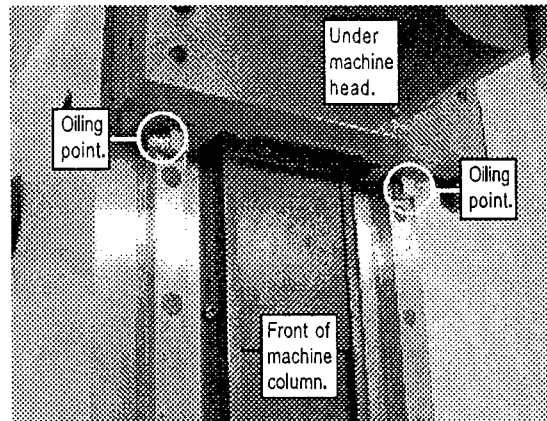
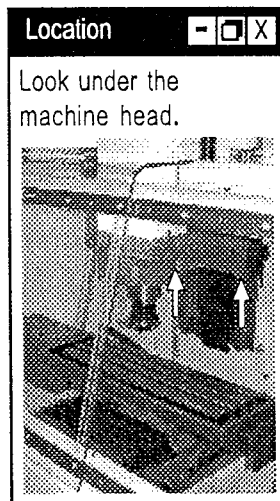
Finally, run the table left and right along the X axis, to distribute the oil along the full length of the slideways.

## 7: Z Axis Slideways Lubrication

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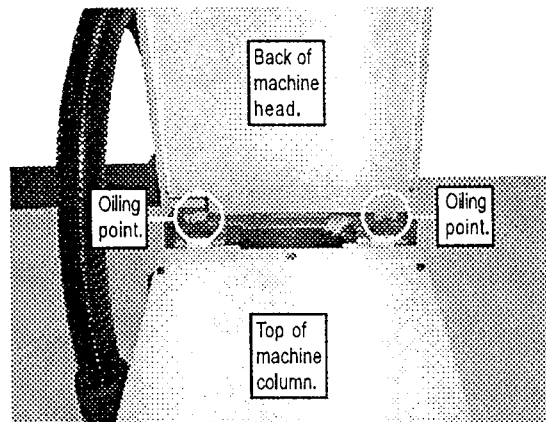
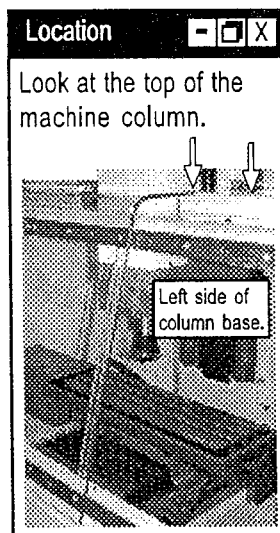
Four oiling points are provided for the Z axis. Two are located at the top of the machine column, in line with the slideways. The remaining two are located under the machine head, in line with the slideways.

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).



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).



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.

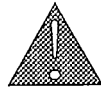
# COOLANT FILLING.

Capacity: 25 Litres

Recommended Type: Cincinnati Millacron Simcool C6Ø

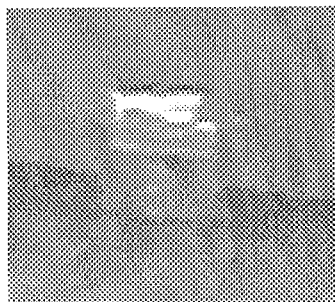
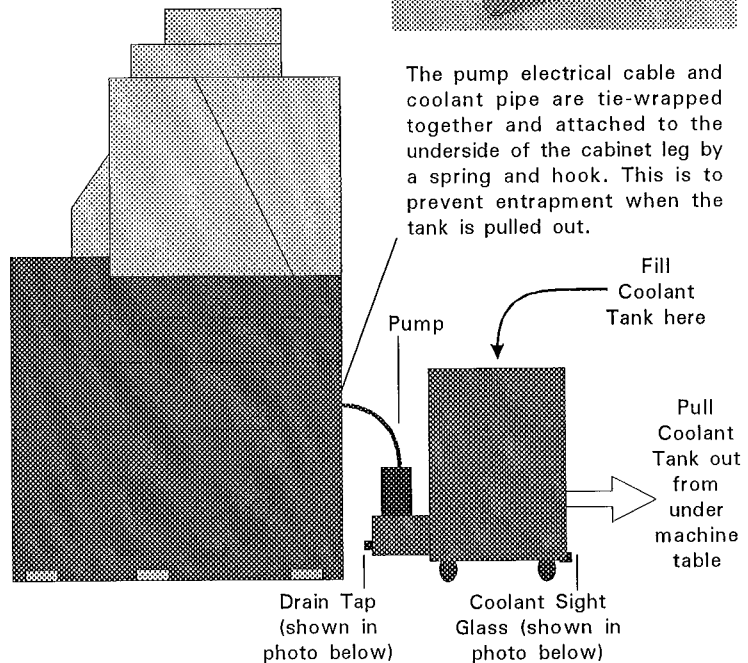
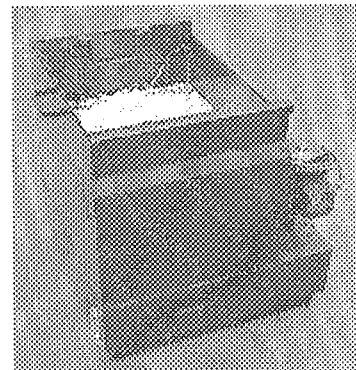
Filling:

- 1) Mix the coolant as prescribed by the manufacturer.
- 2) Pull out the tank from beneath the machine and clean out swarf.
- 3) Pour in the coolant from the top of the tank (see diagram below).
- 4) Watch the sight level on the front of the coolant tank.
- 5) Stop filling when the coolant level is reached.



*The % mix for Simcool 6Ø is 2 - 5% , if the mixture exceeds this percentage it may have a detrimental effect on the paintwork and seals.*

Right:  
General  
view of  
coolant  
tank and  
motor



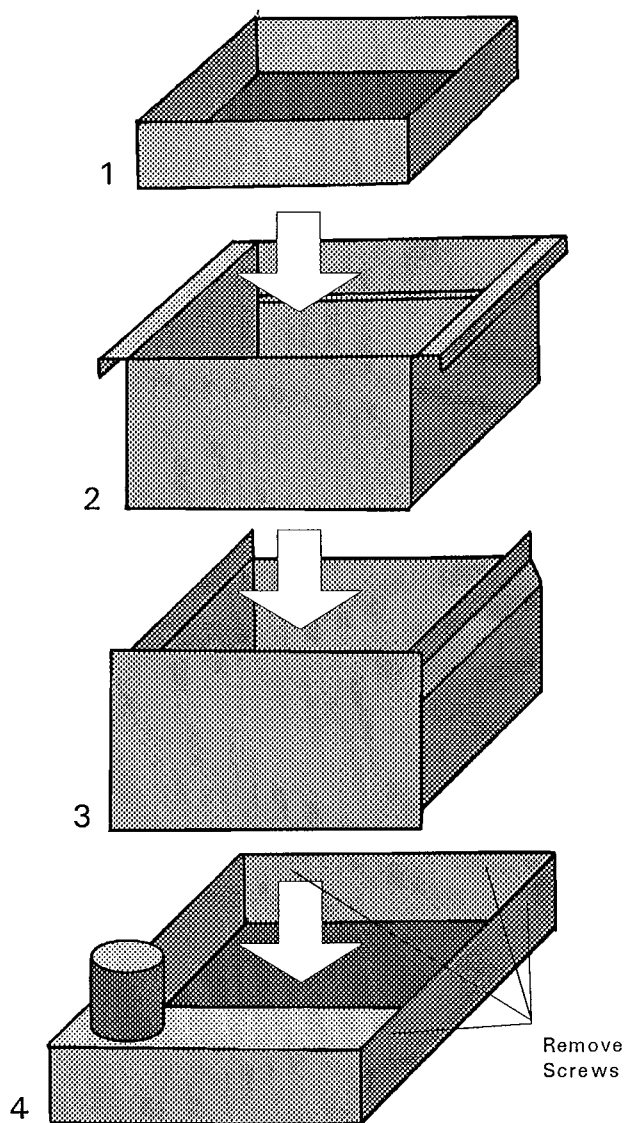


# COOLANT TANK.

The coolant tank breaks down into four component parts:

- 1) The Ferrous filter tray
- 2) The Non - Ferrous filter tray
- 3) The Main Body tank
- 4) The Pump Filter Tank Base.

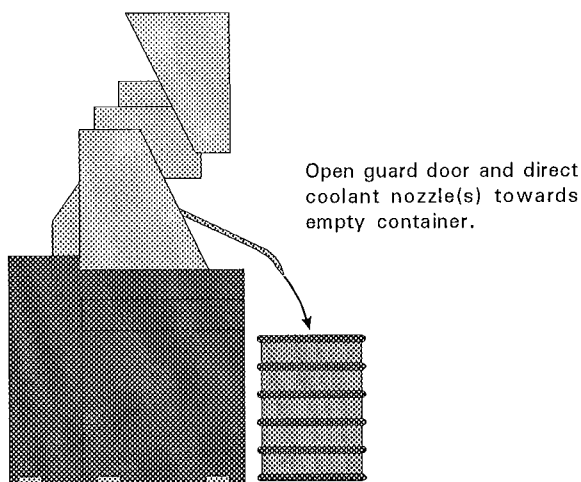
Trays 1 and 2 lift clear (separately) of the main body tank, the main body tank can then be separated from the base by removing the screws.



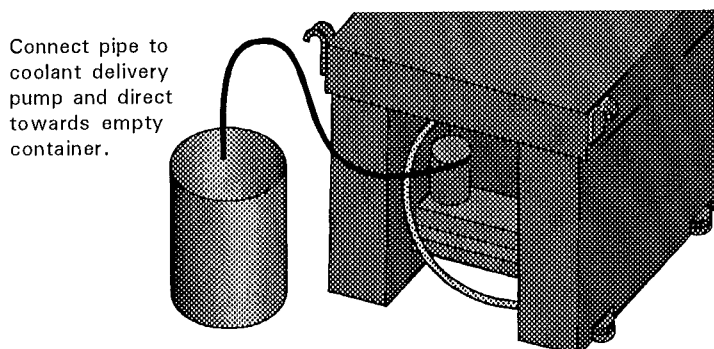
# COOLANT DRAINING.

There are basically two methods of draining the coolant tank:

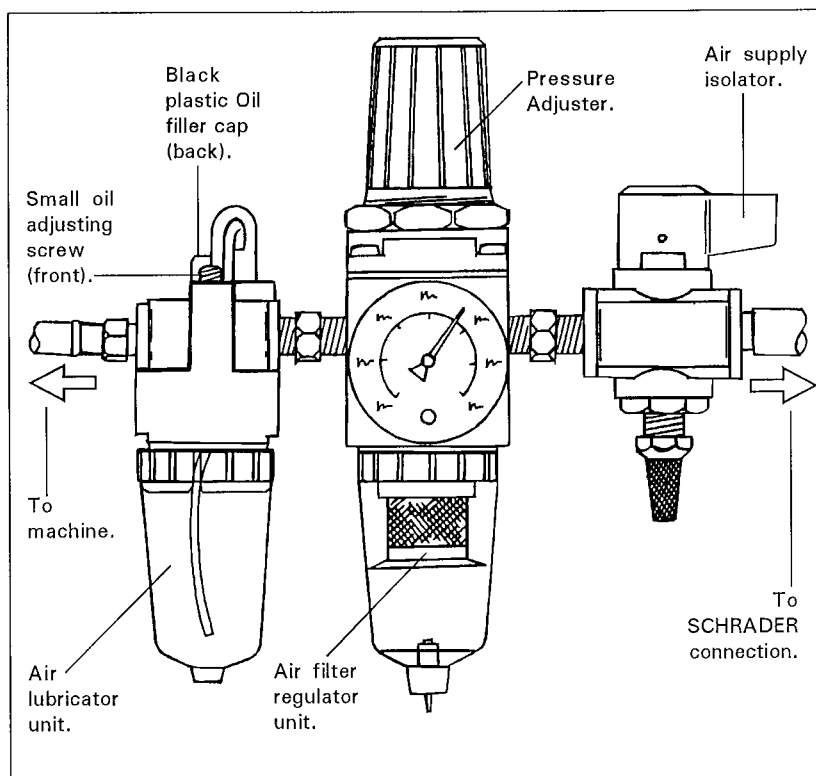
1) With the coolant tank still in place beneath the cabinet base, place a 30 litre drum or container which is to hold the drained off coolant as near to the machine cabinet as possible. Angle the coolant nozzle(s) into the drum and switch on the coolant flow. When the coolant ceases to flow, switch off the coolant and pull out the tank from beneath the cabinet (pull towards the front). The tank can then be separated as in the diagram on the previous page and the remainder of the coolant removed from the base.



2) With the coolant tank still in place beneath the cabinet and with the coolant switched off, remove the coolant delivery pipe from the pump by removing the clip. Place a pipe of the same size over the pump nozzle which you have just removed the delivery pipe from, clamp with the same clip and place the other end in a drum or container, then switch on the coolant pump to drain the coolant into the drum. When the coolant ceases to flow, switch off the coolant pump, pull out the coolant tank from beneath the cabinet. The tank can then be separated as in (1) above. Ensure delivery pipe is reconnected to pump after the draining operation is completed.



# AIR FILTER REGULATOR AND LUBRICATOR.



## AIR FILTER REGULATOR AND LUBRICATOR (SEE DIAGRAM ABOVE).

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

### AIR SUPPLY ISOLATOR.

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

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).

Operating pressure is 100 lbs sq".

Air consumed: ATC: 0.87 dm<sup>3</sup>/cycle. Power Vice: +0.092 dm<sup>3</sup>/cycle.

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.

# TROUBLESHOOTING.

## INTRODUCTION.

This section is concerned with small problems which may occur on the machine due to normal wear and tear over an extensive period of time. The problems listed here can easily be rectified and do not require a service engineer to carry them out.

Should any other problem arise, or if difficulty is experienced following the procedures, then please contact Denford Limited or your local Denford Agent for further assistance.

When working in the Triac FANUC cabinet, or the electrical control cabinet, great care must be taken to ensure that only the items listed are touched or moved. Ensure that no liquid enters the electrical control cabinet.

**ALWAYS SWITCH OFF POWER AT THE ISOLATOR BEFORE ATTEMPTING TO CARRY OUT ANY MAINTENANCE WORK.**

# TROUBLESHOOTING.

## **PROBLEM: POOR SURFACE FINISH IS OBTAINED.**

### **Corrective Action:**

- Ensure axis gib strips are correctly adjusted (see Procedure 1 on next page).

## **PROBLEM: COOLANT IS NOT FLOWING.**

### **Corrective Action:**

- Ensure MØ8 is programmed.
- Check all pipes for leakages, replace where necessary.
- Ensure that the coolant pump is working. Observe the flow in the delivery pipe.
- If no flow is present, contact Denford Limited.

## **PROBLEM: "NOT READY" MESSAGE DISPLAYED ON SCREEN.**

### **Corrective Action:**

- Ensure that no alarm messages are on the screen.
- Ensure Emergency Stop is not engaged.

# TROUBLESHOOTING.

## MECHANICAL CORRECTIVE ACTION PROCEDURES.

**ISOLATE THE MACHINE BEFORE WORKING ON IT.**

### PROCEDURE 1: ADJUSTMENT OF GIB STRIPS.

Tools required:

- Flat blade screwdriver.
- 2.5mm A/F allen key.

Procedure:

X Axis:

- Gib strip screw can be found under the righthand side of the table.
- Turn gib strip screw clockwise to tighten gib strip.
- Move table in + (plus) and - (minus) X directions to ensure smooth continuous movement.

Y Axis:

- Remove bellows unit at the front of the table using a 2.5mm allen key.
- The gib strip screw can be found to the right of the bed.
- Turn the gib strip screw clockwise to tighten the gib strip.
- Replace the bellows unit.
- Move the table in the + (plus) and - (minus) directions to ensure smooth continuous movement.

Z Axis.

- Remove the head cover using a 2.5mm allen key.
- Release the gib strip lock screw at the base of the head.
- Adjust the gib strip by turning the lock screw which is accessible from the top of the head.
- Turn the screw clockwise to tighten the strip. Do not over tighten.
- Replace the head cover.
- Move the head up and down the column to ensure smooth continuous movement.

# FAULT FINDING TABLE.

PROBLEM	CORRECTIVE ACTION.
1) Control will not come on	Check fuse F1
2) Control is on Cabinet fan not running Workilight not on	Check control transformer circuit breaker CT C/B
3) Axis motors will not run Various axis alarms on screen	Check axis drive circuit breakers ADT C/B, AD C/B
4) Spindle motor will not run Alarm on screen: Spindle drive fault	Check spindle drive fuse F2 and fuse on spindle drive
5) Working light not on but everthing else is O.K.	Check fuse F4
6) Coolant pump does not run	Check coolant pump motor starter MMS CP
7) ATC does not rotate	Check fuse F5
If the problem still persists after corrective action has been taken, contact Denford Limited for further assistance.	

# ELECTRICAL

## TROUBLESHOOTING.

Where to find fuses and circuit breakers etc....

The following items are fitted inside the electrical control cabinet:

- The electrical diagrams for the Triac FANUC are held in a folder inside the electrical control cabinet.

- F1 3.15 Amp semi delay fuse
- F2 1Ø Amp semi delay fuse
- F3 3.15 Amp semi delay fuse
- F4 3.15 Amp semi delay fuse
- F5 3.15 Amp semi delay fuse

- ADT C/B 1Ø Amp 3 pole circuit-breaker for axis drive transformer

- AD C/B 1Ø Amp 3 pole circuit-breaker for axis drives

- CT C/B 1Ø Amp 2 pole circuit breaker for control transformer

- MMS CP Ø.6 - 1 Amp motor starter for coolant pump



# LIST OF G CODES.

G Code.	Group.	Function.
G00	1	Positioning (Rapid Traverse)
G01	1	Linear Interpolation (Cutting Feed)
G02	1	Circular Interpolation/Helical CW
G03	1	Circular Interpolation/Helical CCW
G04	Ø	Dwell, Exact Stop
G09	Ø	Exact Stop
G10	Ø	Data Setting
G11	Ø	Data Setting Mode Cancel
G17	2*	XY Plane Selection
G18	2	ZX Plane Selection
G19	2	YZ Plane Selection
G20	6	Imperial Data Input (Inches)
G21	6	Metric Data Input (Millimetres)
G27	Ø	Reference Point Return Check
G28	Ø	Return to Reference Point
G29	Ø	Return from Reference Point
G30	Ø	Second Reference Point Return
G31	Ø	Skip Function
G33	1	Thread Cutting
G39	Ø	Corner Offset Circular Interpolation
G40	7	Cutter Compensation Cancel
G41	7	Cutter Compensation Left
G42	7	Cutter Compensation Right
G43	8	Tool Length Compensation + Direction
G44	8	Tool Length Compensation + Direction
G49	8*	Tool Length Compensation Cancel
G50	11*	Scaling Cancel
G51	11	Scaling
G54	14*	Work Co-ordinate System 1 Selection
G55	14	Work Co-ordinate System 2 Selection
G56	14	Work Co-ordinate System 3 Selection
G57	14	Work Co-ordinate System 4 Selection
G58	14	Work Co-ordinate System 5 Selection
G59	14	Work Co-ordinate System 6 Selection

# LIST OF G CODES.

G Code.	Group.	Function.
G60	0	Single Direction Positioning
G61	15	Exact Mode Stop
G62	15	Automatic Corner Override
G63	15	Tapping Mode
G64	15*	Cutting Mode
G65	0	Macro Call, Macro Command
G66	12	Macro Modal Call
G67	0*	Macro Modal Call Cancel
G68	16	Co-ordinate Rotation
G69	16*	Co-ordinate Rotation Cancel
G73	9	High Speed Peck Drilling Cycle
G74	9	Counter Tapping Cycle
G76	9	Fine Boring Cycle
G80	9*	Canned Cycle Cancel
G81	9	Drilling Cycle, Spot Boring
G82	9	Drilling Cycle, Counter Boring
G83	9	Deep Hole Peck Drilling Cycle
G84	9	Tapping Cycle
G85	9	Boring Cycle
G86	9	Boring Cycle
G87	9	Back Boring Cycle
G88	9	Boring Cycle
G89	9	Boring Cycle
G90	3*	Absolute Command
G91	3	Incremental Command
G92	0	Programming of Absolute Zero Point
G94	5*	Feed per Minute
G95	5	Feed per Revolution
G98	10*	Return to Initial Level in Canned Cycle
G99	10	Return to R Point Level in Canned Cycle

Code listing full and correct at the time of printing.

G codes marked with an \* are set/reactivated as default values at machine power up and when the machine is reset or the emergency stop button is activated.

# LIST OF M CODES.

M code.	Function.
M00*	Program Stop
M01*	Optional Stop
M02*	Program Reset
M03	Spindle Forward (clockwise)
M04	Spindle Reverse (counter clockwise)
M05*	Spindle Stop
M06	Automatic Tool Change
M07	Coolant "B" On
M08	Coolant "A" On
M09*	Coolant Off
M10	Vice/Work Clamp Open
M11	Vice/Work Clamp Close
M13	Spindle Forward and Coolant On
M14	Spindle Reverse and Coolant On
M15	Program Input using MIN P (special function)
M19	Spindle Orientation
M20	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
M28	Reset carousel to pocket position
M29	Select DNC mode
M30	Program Reset and Rewind
M31	Increment parts counter

# LIST OF M CODES.

M37	Door open to stop
M38	Door Open
M39	Door Close
M40	Parts catcher extend
M41	Parts catcher retract
M43	Swarf conveyor forward
M44	Swarf conveyor reverse
M45*	Swarf conveyor stop
M48	Lock % feed and % speed at 100%
M49	Cancel M48 (default)
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 Input
M67	Wait for Auxiliary Output 2 On Input
M68	Only index with all axes at home position
M69	Index turret anywhere
M70	Mirror in X On
M71	Mirror in Y On
M73	Mirror in IV on
M76	Wait for Auxiliary Output 1 Off
M77	Wait for Auxiliary Output 2 Off
M80	Mirror in X Off
M81	Mirror in Y Off
M83	Mirror in IV off.
M98	Sub Program Call
M99	Sub Program End and Return

Code listing full and correct at the time of printing.

M codes marked with an \* are executed at the end of a block, ie, after axis movement.

## This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

# DENFORD CONTACTS, PRODUCTS 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](mailto: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.

# SLIDE LUBRICATION SYSTEM - MLZ AUTOMATIC PISTON PUMP.

## MLZ AUTOMATIC PISTON PUMP (SEE PHOTO BELOW).

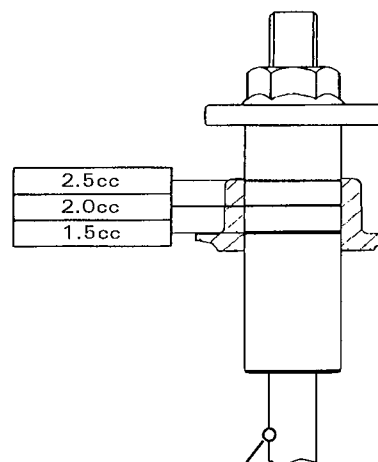
The MLZ slide lubrication system comprises of an oil reservoir tank and an automatic pump unit. Oil is automatically pumped to the required areas of the machine.

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

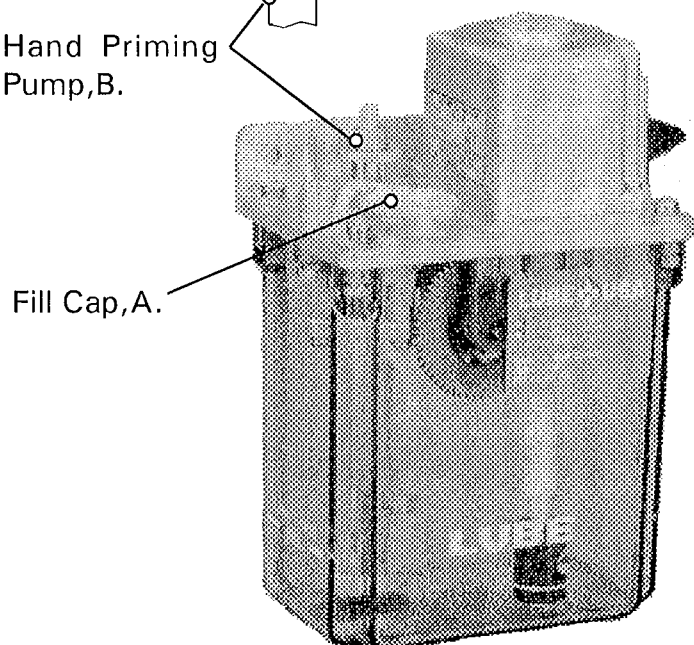
The hand priming pump, B, should only be used if there is no oil in the reservoir, ie, the pump has run dry or the oil is being renewed.

To adjust the discharge of oil, loosen the locknut. Turn the hand priming pump counterclockwise to decrease the discharge, or clockwise to increase the discharge. Tighten the locknut.

Only adjust the oil discharge when the piston is fully relaxed.



Hand Priming Pump, B.



Fill Cap, A.

# SLIDE LUBRICATION SYSTEM - MLZ AUTOMATIC PISTON PUMP.

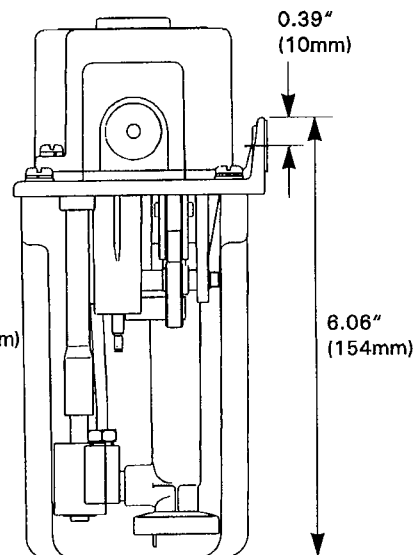
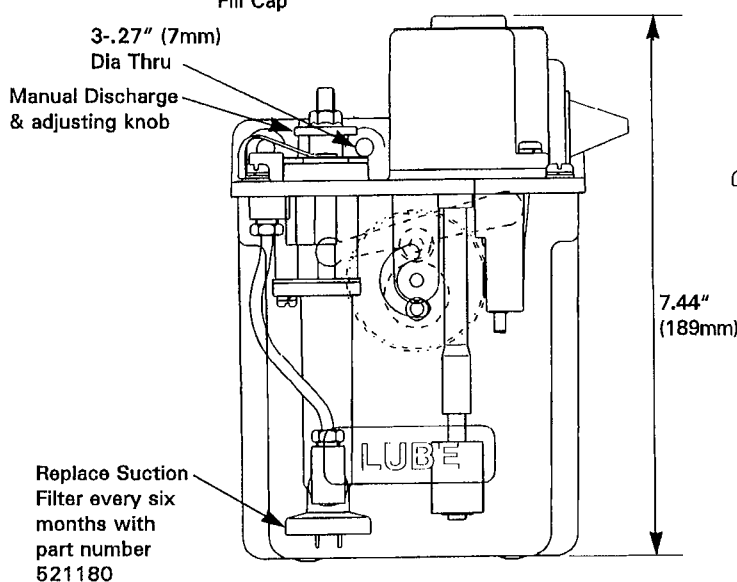
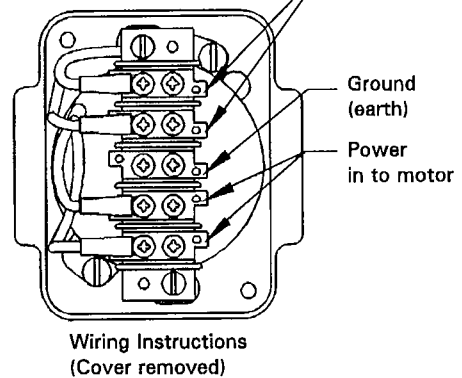
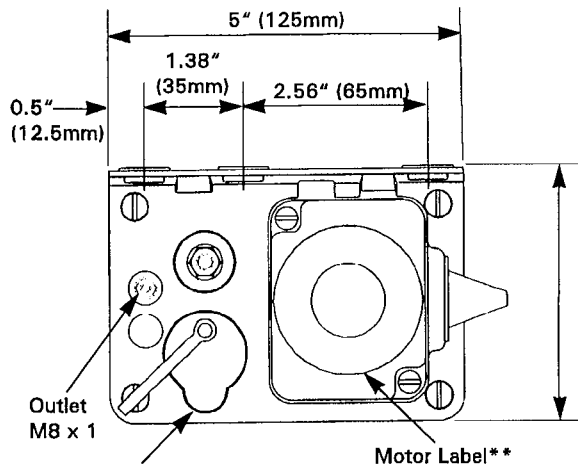


781 Congaree Rd., Greenville, SC 29607  
1-800-326-3765 • TEL 864-297-3950 • FAX 864-242-1652

Interval: 15 min  
Motor: Synchronous Motor  
Motor Voltage: 110V (50/60Hz)  
Motor RPM: 4 RPM  
Oil Level Switch (Without): Part No. 162802  
Oil Level Switch (With): Part No. 162807  
Discharge Pressure: 43 PSI (3 kg/cm<sup>2</sup>)  
Discharge Volume: 1.5cc-2.5cc/shot (0.09 in<sup>3</sup>-0.15 in<sup>3</sup>/shot)  
Working Oil Viscosity: 150-6000 SSU (32-1300 Cst)

Reservoir Capacity 0.8 liters (27 oz.)  
\*\*Note - Check label for motor voltage  
before wiring, interval depends on  
motor (see label on motor cover)

Optional Oil Level Switch  
Max. Volt 200 VAC/DC  
Contact Point Rating  
30W (Resistance Load)  
aux. Relay required





# 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	Ø.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
Cutting Coolant	Electric Pump	As required	Cincinnati Millacron Simcool C 6Ø	25 litres

## AIR FILTERS.

Air filters fitted to the Triac FANUC should be changed annually, or when they are visibly dirty, blocked or damaged.

Air Input Filter: 12Ømm Ref: RS 5Ø7-876.

# SLIDE LUBRICATION SYSTEM.

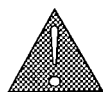
## SLIDE LUBRICATION SYSTEM (SEE DIAGRAM BELOW).

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 on the back panel of machine cabinet.

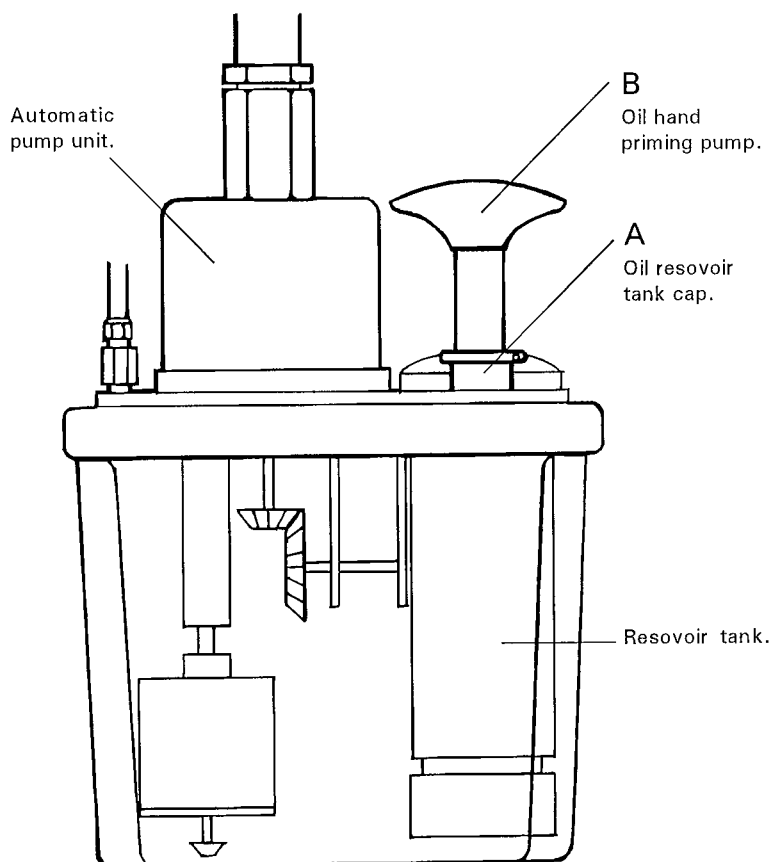
The oil level can be topped-up by adding the required grade of lubrication oil into the reservoir through cap A.

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.



### IMPORTANT !!

*Please note that auxiliary components may differ from those shown and described, according to the model specified and fitted. If you have any doubts concerning the connection and operating features for the auxiliary components fitted to your machine, please contact Denford Limited, or your local Denford agent, for further details.*



FRONT ELEVATION OF SLIDE LUBRICATION SYSTEM.