

DENFORD



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FANUC OT  
(Offline Turning)  
Programming  
Manual  
- DOS version

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# INTRODUCTION.

FANUC offline software is a very powerful Educational and Industrial system used for teaching the principles of CNC (Computer Numerically Controlled) Machine Tool operation and G and M code programming techniques.

In Education, students can learn to program CNC Machine Tools at the computer and prove their CNC programs using animated simulations of the cutting path.

In Industry, the ability to prove out CNC part programs away from the actual machine in a clean and quiet environment and store CNC Files on disk media has many obvious advantages.

Additionally, the use of the CNC Desktop Tutor overcomes the problems of group training by offering true MDI (Manual Data Input) programming at a computer rather than a machine.

# USING THIS MANUAL.

This manual covers both the qwerty keyboard and the Desktop Tutor versions of the offline software.

Each section contains combined information on the keys required for both packages - see the next page.

Choose the relevant keys according to the package being operated.

Areas that are included for a specific package are also clearly marked.

# CONVENTIONS USED IN THIS MANUAL.....

Coventions used in this manual follow this format :

For qwerty keyboard operation :

{.....} - Text enclosed by braces show the individual qwerty keyboard keys to press.

For example, {Escape} means press the "Escape" key.

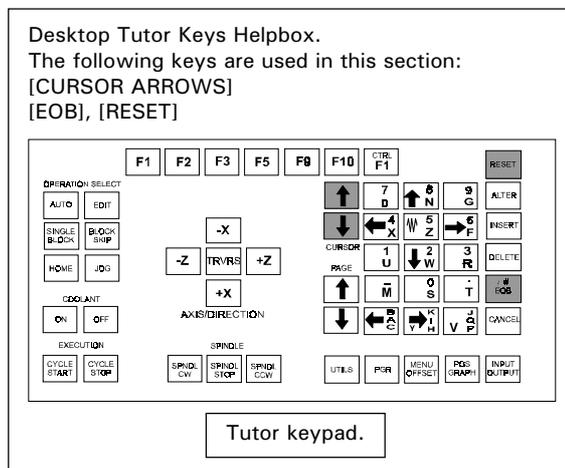
For example, {Ctrl-F1} means press the "Ctrl" key and the "F1" key at the same time.

For example, {F5} {Escape} means press the "F5" key, then press the "Escape" key.

For Desktop Tutor operation :

[.....] - Square brackets with text show the individual Desktop Tutor keys to press, for example, [EDIT] means press the Tutor pad "Edit" key.

Additionally, any section involving use of the Desktop Tutor contains the Desktop Tutor graphic, as shown below. The keys required to complete each particular section are highlighted in grey. For example....



The helpbox above would show that the [CURSOR ARROWS], [EOB] and [RESET] tutor keys are used at some point during that particular section.

Common elements :

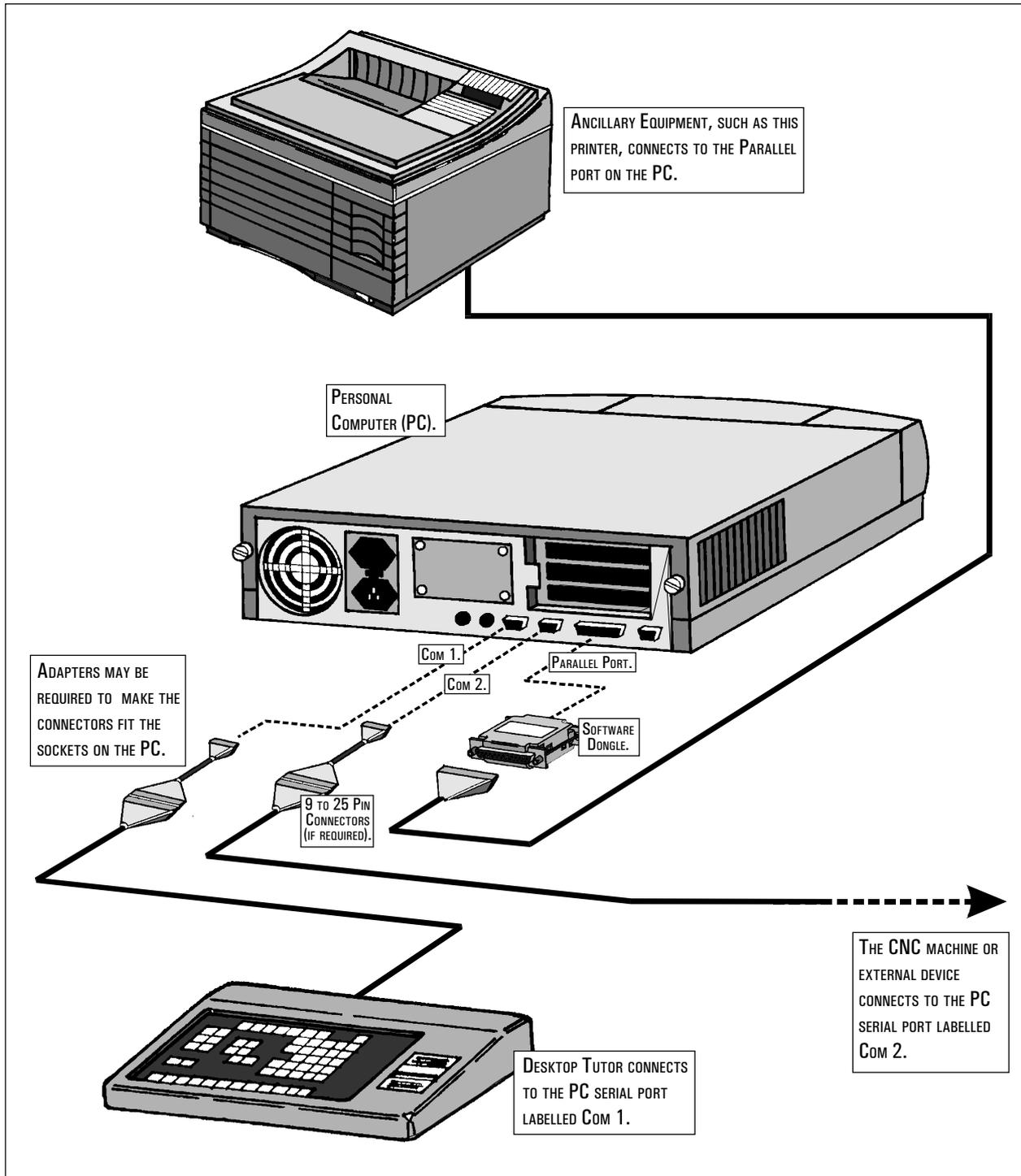
*Italics.* - Italics are used to show menu and text selections within the software.

Sections in the manual can be easily located using the indexing captions in the bottom corner of each page.

# HARDWARE REQUIREMENTS.

- IBM PC, XT, AT and all 100% compatible computers.
- Standard 3.5 inch floppy drive.
- CGA, EGA, VGA graphics.
- Serial port (for Desktop Tutor connection).
- Serial port (for machine or external device connection).
- Parallel port (for security dongle).

# HARDWARE CONNECTIONS.



# SOFTWARE INSTALLATION.

Both the qwerty keyboard and the Desktop Tutor offline software packages are contained on one 3.5 inch floppy disk each.

Note, although the pc keyboard is used to install both software packages, when the Desktop Tutor offline software is run, the pc keyboard will be disabled.

To install from a "DOS" prompt :

- 1) Insert the disk into the floppy drive, this is usually labelled as A:
- 2) Change to that drive letter, ie, type A: and press {Enter}.
- 3) Type *install* and press {Enter}.
- 4) Follow the on-screen instructions.

To install using "Windows 3.x" :

- 1) Insert the disk into the floppy drive, this is usually labelled as A:
- 2) In the "Program Manager", click "File" on the top menu bar, then select "Run" from the drop-down menu.
- 3) Type *A:install* in the dialog box and click "OK".
- 4) Follow the on-screen instructions.

To install using "Windows 95" :

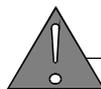
- 1) Insert the disk into the floppy drive, this is usually labelled as A:
- 2) To view the contents of the disk, double-click the left mouse button on, first "My Computer", then "3 1/2 floppy (A:)".
- 3) Double-click the left mouse button on the Install file

:



Install.exe

- 4) Follow the on-screen instructions.



Important -

Make backup copies of your disks and place the master copies in a safe dry location.

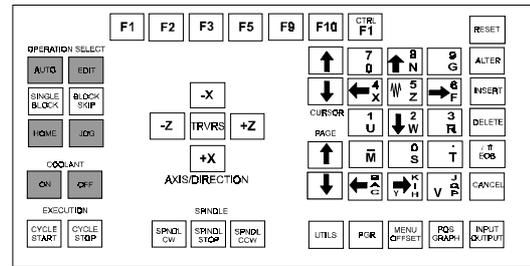




The following keys perform no functions when used with the offline software:

- 1) Operation Select [AUTO]
- 2) Operation Select [HOME]
- 3) Operation Select [JOG]
- 4) Coolant [ON]
- 5) Coolant [OFF]

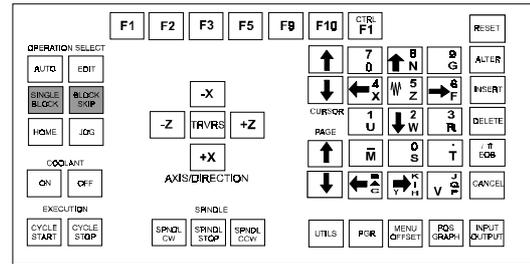
The [EDIT] key can be used to directly access the *Edit and Simulate* screen display.



Tutor keypad.

The [SINGLE BLOCK] key is used to run a program in single blocks (ie, line by line).

The [BLOCK SKIP] key is used select the option to ignore, or include, specific program blocks (activated by a "/" character in front of the block).



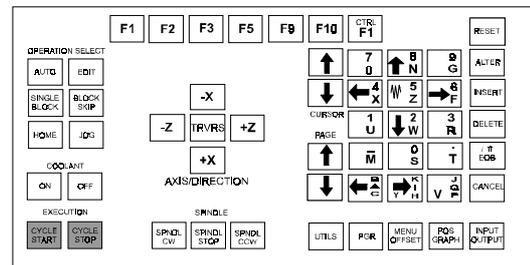
Tutor keypad.

The [CYCLE START] key is used to:

- 1) Simulate any program currently loaded.
- 3) Resume a program which has been paused.

The [CYCLE STOP] key is used to:

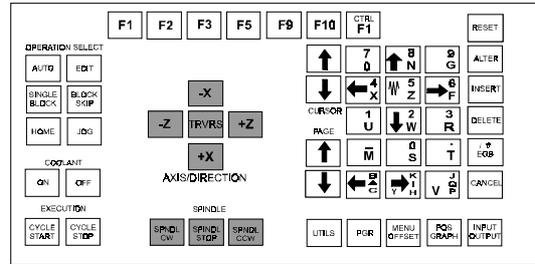
- 1) Stop a program currently running.
- 2) Pause a program currently running.



Tutor keypad.

The following keys perform no functions when used with the offline software:

- 1) Axis/Direction [ + X]
- 2) Axis/Direction [-X]
- 3) Axis/Direction [ + Z]
- 4) Axis/Direction [-Z]
- 5) Axis/Direction [TRVRS]
- 6) Spindle [SPNDL.CW]
- 7) Spindle [SPNDL.STOP]
- 8) Spindle [SPNDL.CCW]



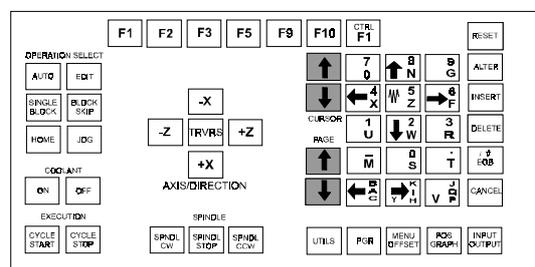
Tutor keypad.

The blue [CURSOR ARROWS] keys are used to:

- 1) Move up or down lines on purple Menu Selection screens.
- 2) Move up or down text lines when editing programs.

The blue [PAGE ARROWS] cursor keys are used to:

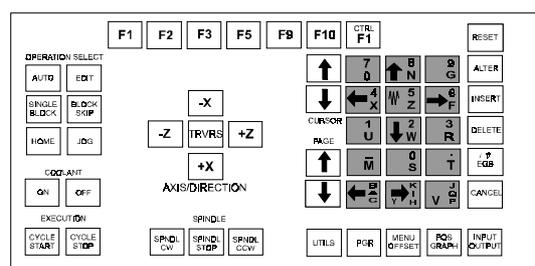
- 1) Move between the top and bottom lines of purple Menu Selection screens.
- 2) Move up or down between the pages of a program.



Tutor keypad.

The [ALPHA/NUMERICAL] keys are used to enter characters and numbers used in program data.

Multi-character keys will toggle between the characters shown according to the number of times the key is pressed.



Tutor keypad.

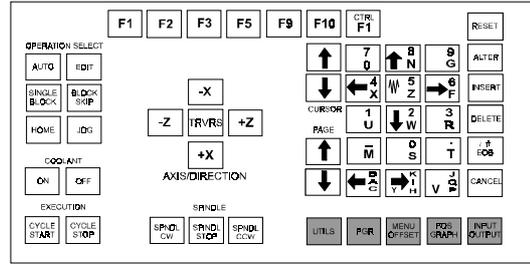
The [UTILS] key is used to display any directives within a program, shown on screen as [YELLOW LINES]. Directives are Denford definitions for tool sizes, billet sizes etc....

The [PGR.] key is used to toggle between these screen modes: *Simulate only, Edit only or Edit and Simulate.*

The [INPUT OUTPUT] key is used to select the *Remote Device Link Menu* (this menu allows data to be sent or received from external devices).

The following keys perform no functions when used with the offline software:

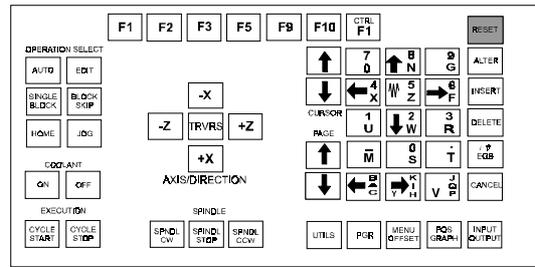
- 1) [MENU OFFSET]
- 2) [POS. GRAPH]



Tutor keypad.

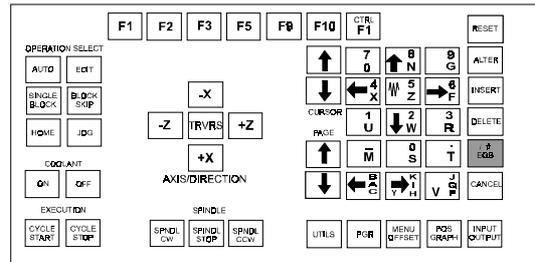
The [RESET] key is used to:

- 1) Move back through any menu screens accessed, one by one, until the highest (start) level is reached.
- 2) Clear any red warning or error messages from the screen.
- 3) Move to the top of a program.



Tutor keypad.

The [EOB] key is the 'End of Block' command, used to signify the end of sequence of events or to confirm choices within the software. It is the equivalent of the {Return} or {Enter} key on a pc.



Tutor keypad.

The [ALTER] key is used to:

- 1) Change any operation words (made from an address letter and a number) in a program line.
- 2) Delete information in a text entry box/window (ie, load/save boxes).

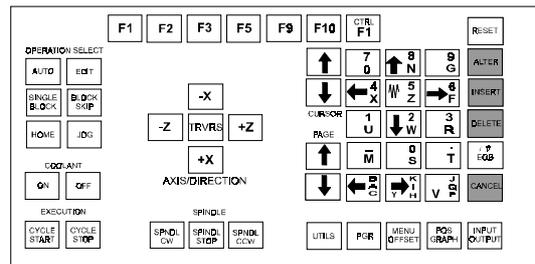
The [INSERT] key is used to place a word into a program line.

The [DELETE] key is used to:

- 1) Remove a word from a program line.
- 2) Remove unwanted characters that have been typed in.

The [CANCEL] key is used to:

- 1) Remove a word from a program data entry line.
- 2) Abort a running program.



Tutor keypad.



# STARTING THE OFFLINE QWERTY SOFTWARE.

To run the qwerty keyboard offline software from a "DOS" prompt :

- 1) Change to the drive and directory where the software has been installed, eg, type *C:\Denford* and press {Enter}.
- 2) Type *fanucl* and press {Enter}.

The software will now load and show the default start-up screen.

To run the qwerty keyboard offline software using "Windows" :

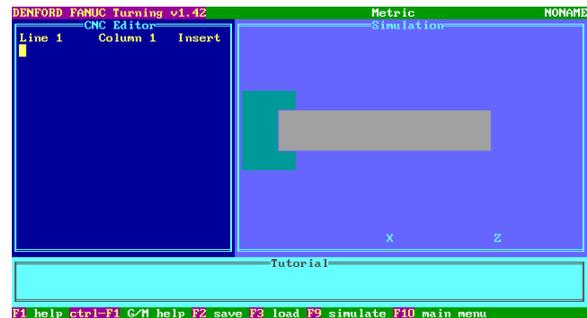
- 1) Open the folder where the software has been installed, eg, C:\Denford
- 2) Double-click the right mouse button on the *fanucl* icon :



The software will now load and show the default start-up screen.

Note, "Windows 95" users can access the software through the *Start Menu*.

The default start-up screen is shown below.



# STARTING THE OFFLINE TUTOR SOFTWARE.

To run the Desktop Tutor offline software from a "DOS" prompt :

- 1) Ensure that the Desktop Tutor is is connected to the pc Com/Serial port (default is Com1).
- 2) Change to the drive and directory where the software has been installed, eg, type *C:\Denford* and press {Enter} on the pc keyboard.
- 3) Type *fanucl*d and press {Enter} on the pc keyboard.

The software will now load and show the default start-up screen.

Note, the pc keyboard will be disabled from controlling the software.

To run the Desktop Tutor offline software using "Windows" :

- 1) Ensure that the Desktop Tutor is is connected to the pc Com/Serial port (default is Com1).
- 2) Open the folder where the software has been installed, eg, C:\Denford
- 3) Double-click the right mouse button on the *fanucl*d icon :

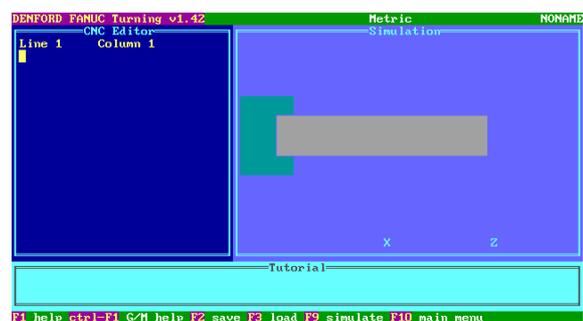


The software will now load and show the default start-up screen.

Note, the pc keyboard will be disabled from controlling the software.

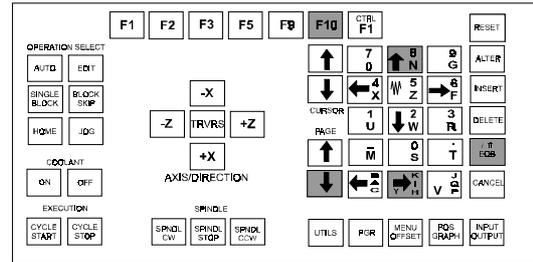
"Windows 95" users can access the software through the *Start Menu*.

The default start-up screen is shown below.



# CLOSING THE OFFLINE SOFTWARE.

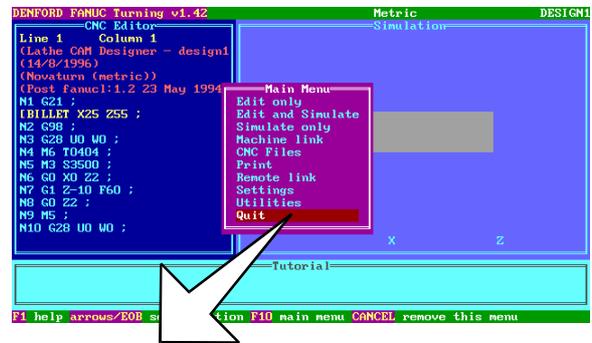
Desktop Tutor Keys Helpbox.  
The following keys are used in this section:  
[F10], [PAGE DOWN], [N], [Y], [EOB]



Tutor keypad.

Select the *Main Menu* by pressing the [F10] / {F10} key.

Press the [PAGE DOWN] / {Page Down} key to highlight 'Quit', then press the [EOB] / {Enter} key to close the software.



When the *Quit* option is selected a message may be displayed, asking whether the current program being used needs to be saved.

If this program does not need to be saved, press the [N] / {N} key.

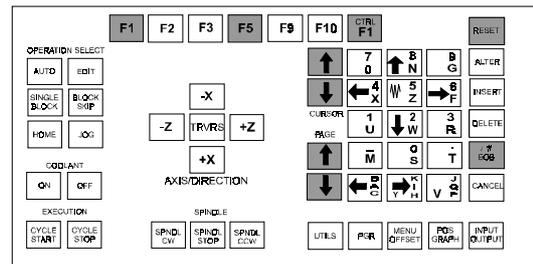
If this program does need to be saved, press the [Y] / {Y} key. Enter the filename (only number characters can be used with the Desktop Tutor) and press [EOB] / {Enter} to save the program on the currently selected drive.

**Question**  
Current program not saved - Save it first?



# HELP SCREENS.

Desktop Tutor Keys Helpbox.  
The following keys are used in this section:  
[F1], [F5], [CTRL F1]  
[CURSOR ARROWS], [PAGE UP], [PAGE DOWN]  
[EOB], [RESET]



Tutor keypad.

The offline software contains a powerful help system, split into 3 main sections :

- 1) General Help (assigned to the [F1] / {F1} key).
- 2) G and M code Help (assigned to the [CTRL F1] / {Ctrl-F1} key).
- 3) Data Information Help (assigned to the [F5] / {F5} key).

Options 1) and 2) are context sensitive. Context sensitive help displays information related to the position of the main screen cursor and is available at all times during the use of the software.

## HELP SCREENS - GENERAL HELP.

### *General Help.*

Use the context sensitive *General Help* to find out anything about the software except G and M code uses and definitions.

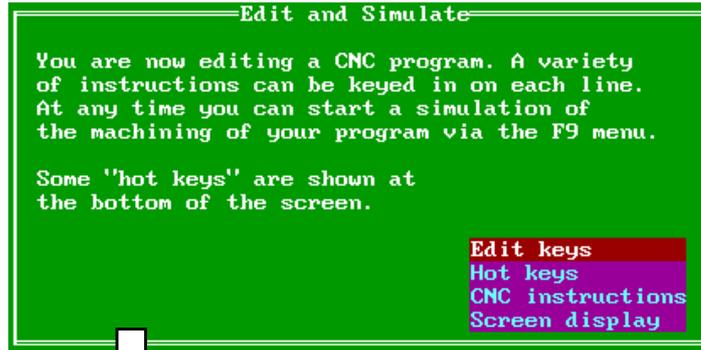
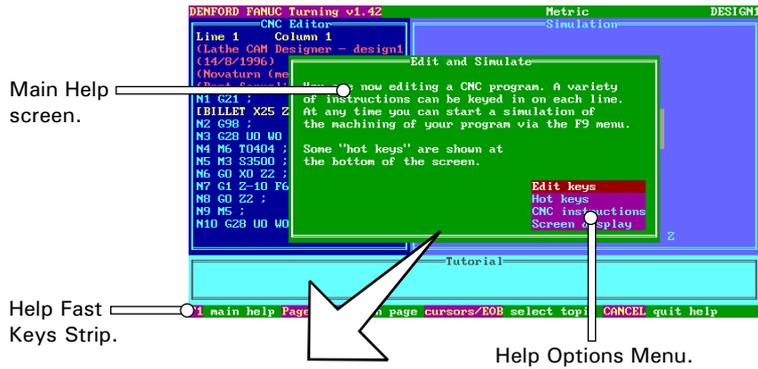
To select the *General Help* screen press the [F1] / {F1} key. The information on the help screen will depend on the position of the cursor when the [F1] / {F1} key was pressed (eg, if the cursor was highlighting an option in the Main Menu, the help screen will display information about options available within the Main Menu). Pressing the [F1] / {F1} key again will display a sub-related topic.

continued....

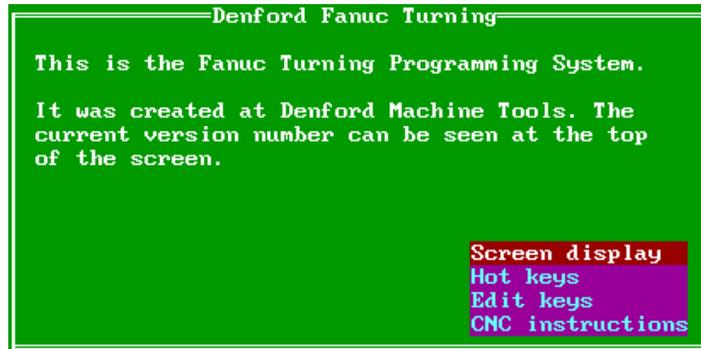
# HELP SCREENS

## - GENERAL HELP.

General Help. continued....



Press [F1] / {F1} key  
for Sub-related topic.



Navigate around the *General Help* screens using the following keys :

[CURSOR ARROWS] / {keyboard arrows} keys - Used to select categories from the pink/red help options menus.

[PAGE UP] / {Page Up} and [PAGE DOWN] / {Page Down} keys - Used to cycle through different help pages, when more than one page is available.

[RESET] / {Escape} key - Used to exit the help screens.

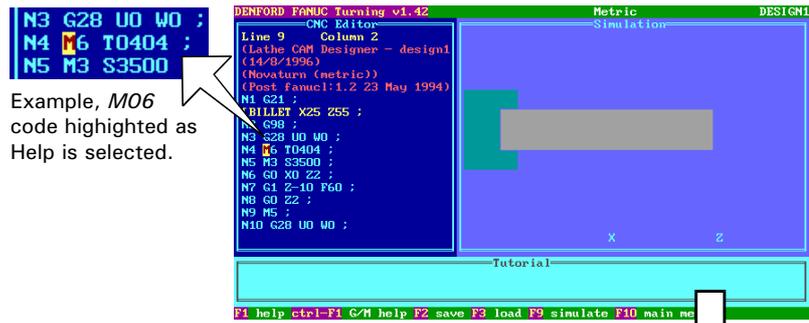
# HELP SCREENS

## - G AND M CODE HELP.

### *G and M code Help.*

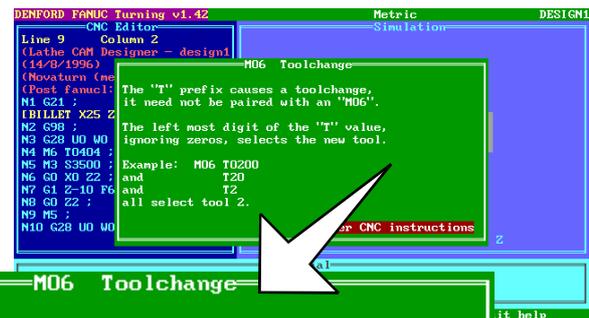
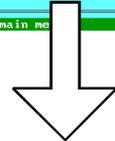
Use the context sensitive *G and M code Help* to find out more about G and M code uses and definitions.

To select the *G and M code Help* screen press the [CTRL F1] / {Ctrl-F1} key. The information on the help screen will depend on the position of the cursor when the [CTRL F1] / {Ctrl-F1} key was pressed (eg, if the cursor was highlighting the code *MO6*, the help screen would display information about that particular code, toolchanging).



Example, *MO6* code highlighted as Help is selected.

Press [CTRL F1] / {Ctrl-F1} key for context sensitive G and M code Help.



Navigate around the *G and M code Help* screens using the following keys :

[CURSOR ARROWS] / {keyboard arrows} keys - Used to select categories from the pink/red help options menus.

[PAGE UP] / {Page Up} and [PAGE DOWN] / {Page Down} keys - Used to cycle through different help pages, when more than one page is available.

[RESET] / {Escape} key - Used to exit the help screens.

# HELP SCREENS

## - DATA INFORMATION.

### Data Information Help.

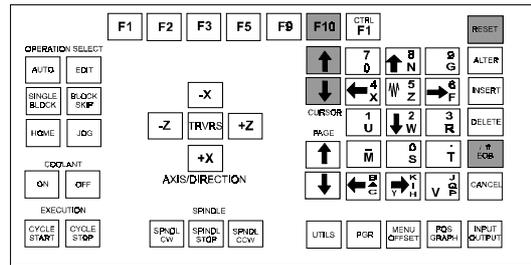
Use *Data Information Help* to find the date, time and current software settings.

To select the *Data Information Help* screen press the [F5] / {F5} key. To exit the help screen, press the {RESET} / {Escape} key.



# MAIN MENU.

Desktop Tutor Keys Helpbox.  
 The following keys are used in this section:  
 [F10]  
 [CURSOR ARROWS]  
 [EOB], [RESET]

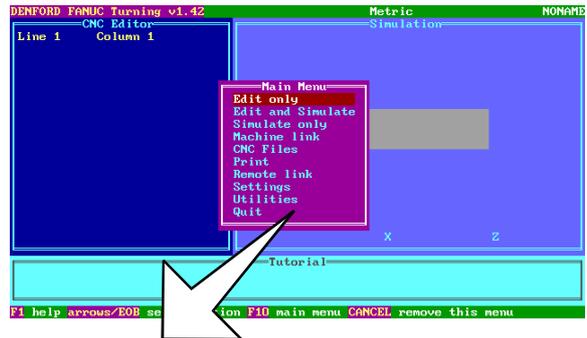


Tutor keypad.

The *Main Menu* navigates around the most commonly used options of the offline software.

Select the *Main Menu* by pressing the [F10] / {F10} key. To select one of the ten options available, highlight the required option using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key to confirm this choice.

Unwanted menus can be removed by pressing the [RESET] / {Escape} key.



# MAIN MENU.

See Section 7.1

See Sections 7.1 & 8.1

See Section 8.1

See Section 5.3

See Section 6.1

See Section 5.4

See Section 5.6

See Section 9.1

See Section 5.8

See Section 3.3

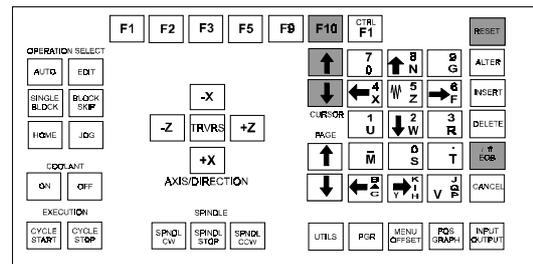
The *Main Menu* contains ten options:

- 1) *Edit Only*. This option will display the full screen CNC File Editor with 241 characters sideways scrolling facility. The CNC File can be altered using this option. Simulation is not available from this section but pressing the [F9] / {F9} key will run a syntax check on the CNC code.
- 2) *Edit and Simulate*. This option will display the CNC File Editor, Simulation graphics and Tutorial windows as a split screen. If the CNC line is longer than the Editor window, a sideways scrolling facility will be offered. During CNC File editing, a graphical Simulation can be started at any time. When this Simulation has been completed, the cursor will return to its last position in the CNC File Editor. The CNC File can be altered using this option.
- 3) *Simulate Only*. This option will display the CNC File in full screen graphical format only. The Tutorial window is still displayed at the bottom of the screen. If an error occurs during a CNC File execution, the *Edit and Simulate Mode* will be automatically selected and the error code highlighted. The CNC File cannot be altered using this option.
- 4) *Machine Link*. This option allows a CNC File to be downfed or loaded from an external FANUC controller via an RS 232 serial connection.
- 5) *CNC Files*. This option gives access to a sub-menu allowing CNC Files to be loaded, saved, deleted and the drive directories changed.
- 6) *Print*. This option will print the currently loaded CNC File in various formats.
- 7) *Remote Link*. This option gives access to a sub-menu allowing the machine controller to be linked to an external device (such as a paper tape punch etc) for CNC File transfer.
- 8) *Settings*. This option gives access to a sub-menu allowing many of the options listed above to be customised and configured.
- 9) *Utilities*. This option will allow access to other software products running through DOS.
- 10) *Quit*. This option will exit the machine controlling software and returns to DOS.

# MAIN MENU

## - MACHINE LINK.

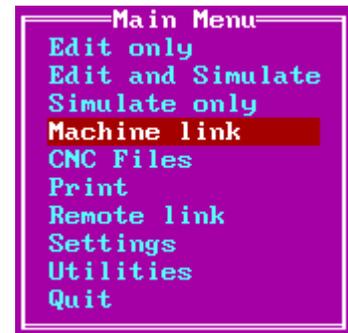
Desktop Tutor Keys Helpbox.  
 The following keys are used in this section:  
 [F10]  
 [CURSOR ARROWS]  
 [EOB], [RESET]



Tutor keypad.

The *Machine Link* option allows a CNC File to be downfd or loaded from an external FANUC controller via an RS 232 serial connection (see page 1.2).

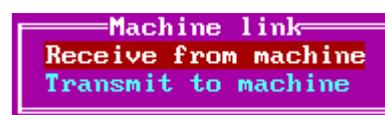
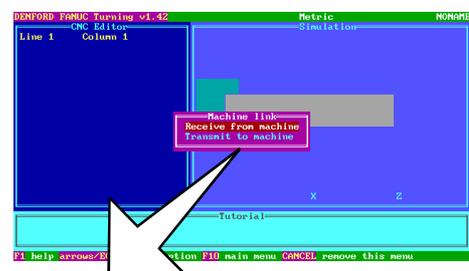
Select the *Main Menu* by pressing the [F10] / {F10} key. Highlight '*Machine Link*' using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key.



The *Machine Link Sub-menu* contains two options :

- 1) *Receive from machine*. This option will allow a CNC File to be accepted from an outside source.
- 2) *Transmit to machine*. This option will allow a CNC File to be transferred to an outside source.

Select the required option using the [CURSOR ARROWS] / {keyboard arrows} keys, then press the [EOB] / {Enter} key.

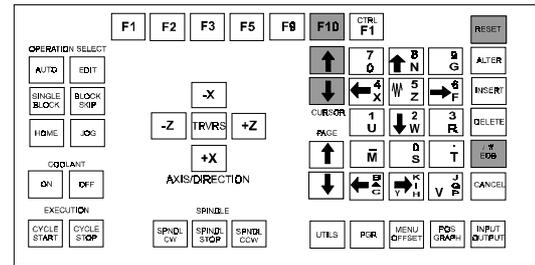


Press the [RESET] / {Escape} key to remove any unwanted menus from the screen.

# MAIN MENU

## - PRINT.

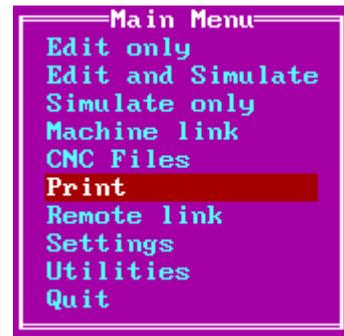
Desktop Tutor Keys Helpbox.  
The following keys are used in this section:  
[F10]  
[CURSOR ARROWS]  
[EOB], [RESET]



Tutor keypad.

The *Print* option allows you to generate a paper copy of the currently loaded CNC File from a connected printer.

Select the *Main Menu* by pressing the [F10] / {F10} key. Highlight '*Print*' using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key.



The *Printing Sub-menu* contains two options :

- 1) *Line format with errors*. This option will print the CNC File as displayed in the Editor window with any errors highlighted.
- 2) *Line format with no errors*. This option will print the CNC File as displayed in the Editor window without highlighting any errors.

continued....

# MAIN MENU

## - PRINT.

continued....

Select the required option using the [CURSOR ARROWS] / {keyboard arrows} keys, then press the [EOB] / {Enter} key.



Press the [RESET] / {Escape} key to remove any unwanted menus from the screen.

## PRINTING ERRORS.

If the printer does not respond, check the following :

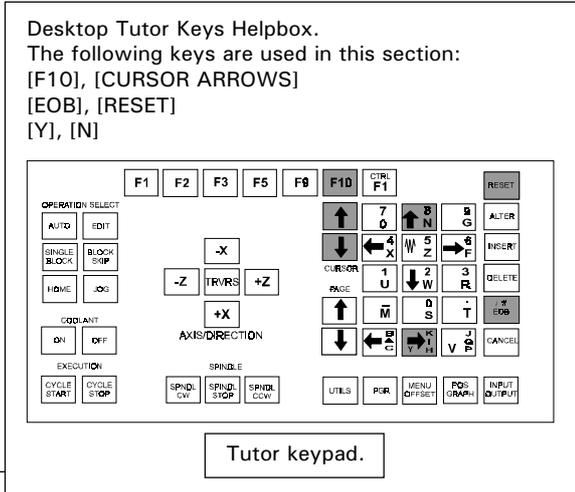
- 1) Is the cabling between the computer and printer secure?
- 2) Is the printer set for Parallel or Serial communications?
- 3) Have the correct parameters been set in the "Settings Menu - Print Device" (see section 9.14) ?
- 4) Is the printer switched 'on' and is there enough paper available for the printout?

## PAGE LAYOUT ERRORS.

If the layout on the printout is incorrect, the page widths and linefeeds can be changed in the "Settings Menu - Print Page Layout" (see section 9.15).

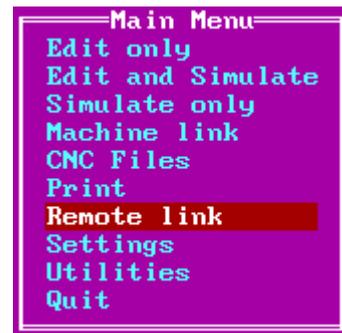
# MAIN MENU

## - REMOTE LINK.



The *Remote Device* option allows a CNC File to be sent or received from a remote device, such as another computer, paper tape punch reader, data carrier etc....

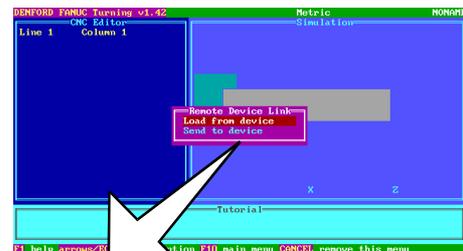
Select the *Main Menu* by pressing the [F10] / {F10} key. Highlight 'Remote Link' using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key.



The *Remote Link Sub-menu* contains two options :

- 1) *Load from device*. This option will load the CNC File from the remote device.
- 2) *Send to device*. This option will send the CNC File to the remote device.

Select the required option using the [CURSOR ARROWS] / {keyboard arrows} keys, then press the [EOB] / {Enter} key.



continued....

# MAIN MENU

## - REMOTE LINK.

continued....

### LOAD FROM DEVICE.

If there is a CNC File currently loaded in the offline software, you will be asked whether to merge the CNC File when loading from the remote device.

Press the [Y] / {Y} key to merge both CNC Files into one and the [N] / {N} key to clear the current CNC File from the offline software.

### SEND TO DEVICE.

You will be prompted with a '*Ready to send?*' message. Press the [Y] / {Y} key to send the CNC File and the [N] / {N} key to abort the operation.

During CNC File transfer, a '*Transmitting to device*' message window will be displayed, showing the number of bytes and lines sent. A '*Transmission completed*' message will be displayed to confirm that the whole CNC File has been sent to the remote device.

Press the [RESET] / {Escape} key to remove any unwanted messages and menus from the screen.

### COMMUNICATION ERRORS.

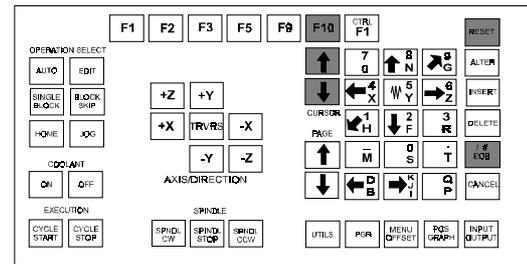
If an error is encountered, check the following :

- 1) Is the cabling between the computer and remote device secure?
- 2) Is the cable connected to the correct ports with the correct pin connections?
- 3) Have the correct parameters been set in the "Settings Menu - Remote Link" (see section 9.17)?
- 4) Is the remote device switched 'on' and ready to send or receive data?

# MAIN MENU

## - UTILITIES.

Desktop Tutor Keys Helpbox.  
 The following keys are used in this section:  
 [F10], [CURSOR ARROWS]  
 [EOB], [RESET]



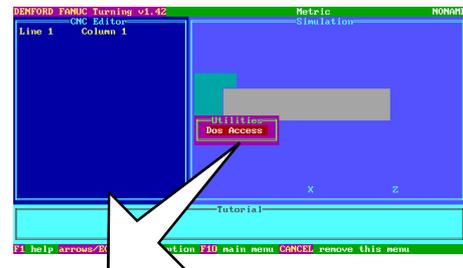
Tutor keypad.

The *Utilities* option allows access to other software packages (if available) and 'DOS'.

Select the *Main Menu* by pressing the [F10] / {F10} key. Highlight '*Utilities*' using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key.

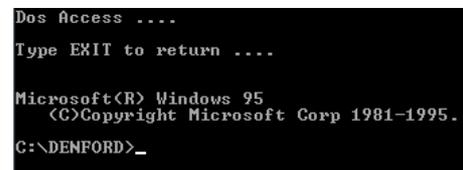


Press the [EOB] / {Enter} key when '*Dos Access*' is highlighted to temporarily exit the offline software.



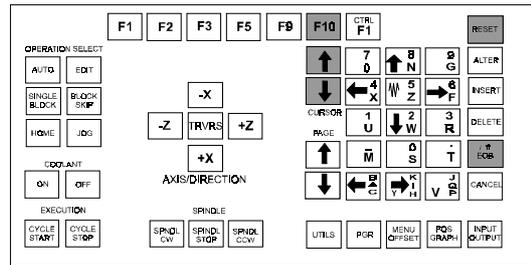
The *Utilities Menu* will give access to other programs and DOS mode. To return to the offline software, type '*EXIT*' at the DOS prompt or close the other program being used. In addition, Desktop Tutor users will also have to press the [EOB] key.

Press the [RESET] / {Escape} key to remove any unwanted menus from the screen.



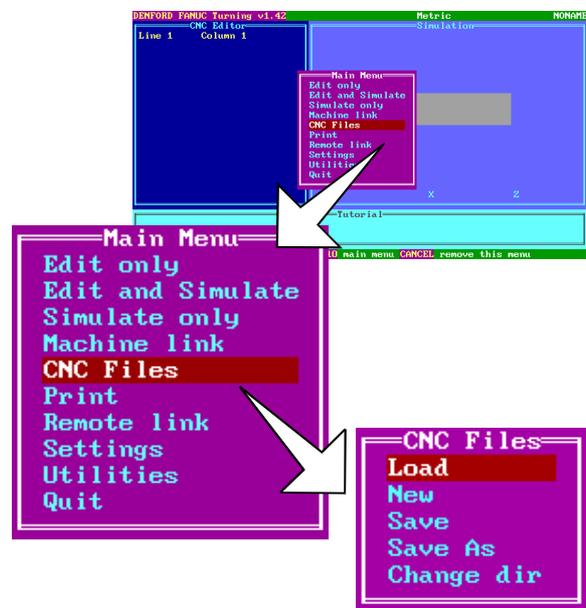
# CNC FILES MENU.

Desktop Tutor Keys Helpbox.  
The following keys are used in this section:  
[F10]  
[CURSOR ARROWS]  
[EOB], [RESET]



Tutor keypad.

Select the *Main Menu* by pressing the [F10] / {F10} key. Highlight 'CNC Files' using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key to confirm this choice.



The *CNC Files Menu* contains 5 options :

- i) *Load* - Load a selected CNC File.
- ii) *New* - Clear a currently loaded CNC File.
- iii) *Save* - Overwrite a CNC File with the same name or save a newly created CNC File.
- iv) *Save as* - Save a CNC File with a specific name.
- v) *Change dir* - Change the drive used to load and save CNC Files.

Press the [RESET] / {Escape} key to clear any menus.

# CNC FILES

## MENU

### - LOAD.

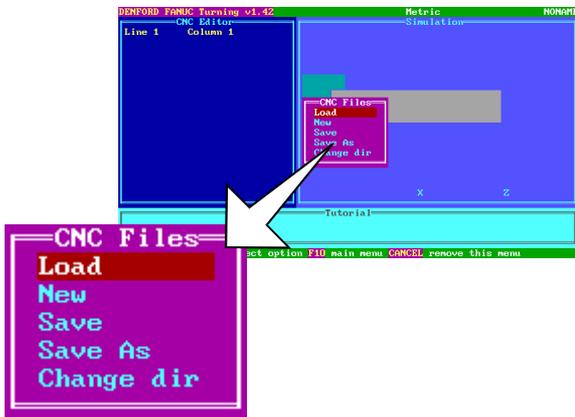
**!** Please Note - the software will be set to read either the computers hard drive (usually C:) or the floppy disk drive (usually A:) by default. If you do not want to load the CNC Files from the default drive, then the drive destination must be changed. See page 6.8 "Changing the Drive Directory - CNC Files".

**!** Please Note - The [F3] / {F3} key can be used as a shortcut to loading from the currently selected drive and directory.

Desktop Tutor Keys Helpbox.  
 The following keys are used in this section:  
 [CURSOR ARROWS], [EOB]  
 [NUMBERS] - not highlighted  
 [DELETE], [N], [RESET], [F3]

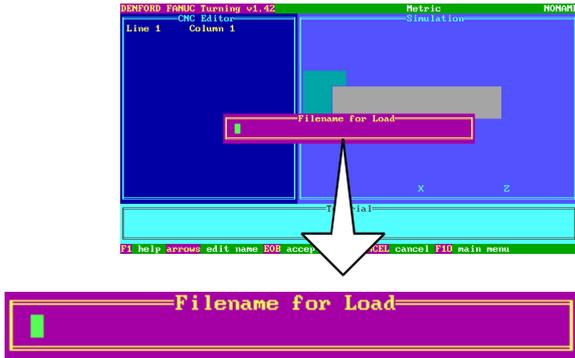
Tutor keypad.

Highlight 'Load' in the *CNC Files Menu* using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {ENTER} key.



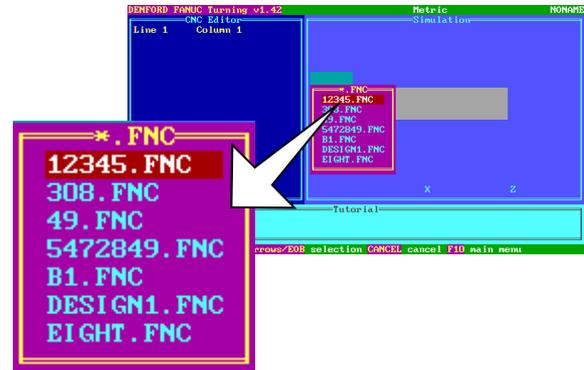
Type in the name of the CNC File you wish to load, using the [NUMBERS] / {Numbers} keys. Incorrect characters can be removed using the [DELETE] / {Backspace} key. Press the [EOB] / {ENTER} key to load the CNC File.

Note that CNC Files can only be saved with alphabet characters when using a Qwerty keyboard. If the filename contains any alphabet characters, it can only be loaded from a directory listing using Desktop Tutors (see the next page).

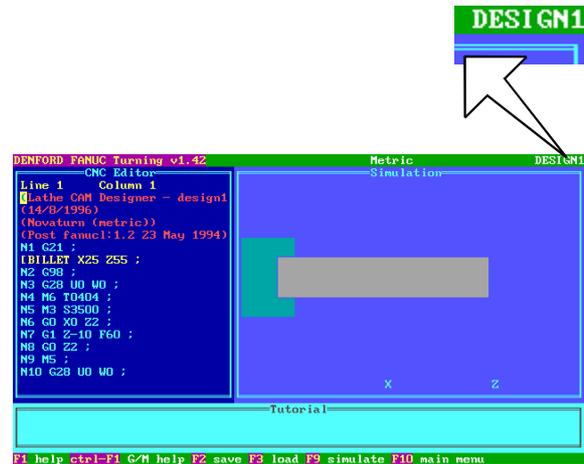


# CNC FILES MENU - LOAD.

If the filename is unknown, press the [EOB] / {Enter} key to list all the CNC Files stored on the currently selected drive. CNC Files within these lists can be loaded by highlighting them using the [CURSOR ARROWS] / {keyboard arrows} keys and pressing the [EOB] / {Enter} key.



The name of the CNC File you have just loaded is displayed in the top right hand corner of the screen.



Note - If there is a CNC File currently in the editor when loading a new CNC File, the screen will display '*Do you want to merge?*' (ie, do you want to combine the program you wish to load with the program already loaded).

To merge CNC Files press the [EOB] / {Enter} key, otherwise, press the [N] / {N} key to clear the current CNC File and load the selected CNC File into the editor.

**Question**  
Do you want to merge?

# CNC FILES MENU

## - LOAD.

If no CNC Files can be found on the selected drive, an error message will be displayed (see example below). To clear this message, press the [RESET] / {Escape} key. In most cases, this message is displayed when the computer is trying to read the CNC Files from the wrong drive or directory - refer to section 6.8 "Changing the Drive Directory - CNC Files".

**Error**  
There are no matching files

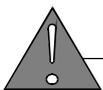
The error message below will be displayed if the CNC File you want to load has been entered incorrectly or does not exist in the directory being read.

**Warning**  
File not found - Starting new program

Press the [RESET] / {Escape} key to clear the screen of any unwanted menus, error messages or information.

# CNC FILES MENU

## - ADVANCED LOAD SETUP.



Please note - Any changes made to these settings should be carried out by either your IT Manager or computer technician.

Please Note - The offline software may be set to read and create any one of three possible file extensions - ".mir", ".fnc" or ".fnl". The offline software (by default) and Denford LatheCAM software will save G-code programs with the file extension ".fnc".

This section explains how to change the file extension that is read and created by the offline software.

To change the file extension read and created by the offline software, open a DOS box and change the pathname to read the directory where the offline software files are stored, for example type....

**CD C:\Denford**

.... and press the {Enter} key on the pc keyboard.

For qwerty keyboard versions of the offline software type.....

**option fanucl filetype file-extension**

or, for Desktop Tutor versions of the offline software type.....

**option fanuclid filetype file-extension**

.... where **file-extension** is replaced by the file extension required (**mir** or **fnl** or **fnc**)

.... and press the {Enter} key on the pc keyboard.

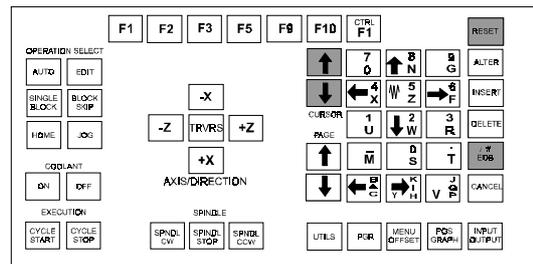
An '*Accepted*' or '*Modified*' message will be shown to indicate the settings have been successfully applied.

# CNC FILES

## MENU

### - NEW.

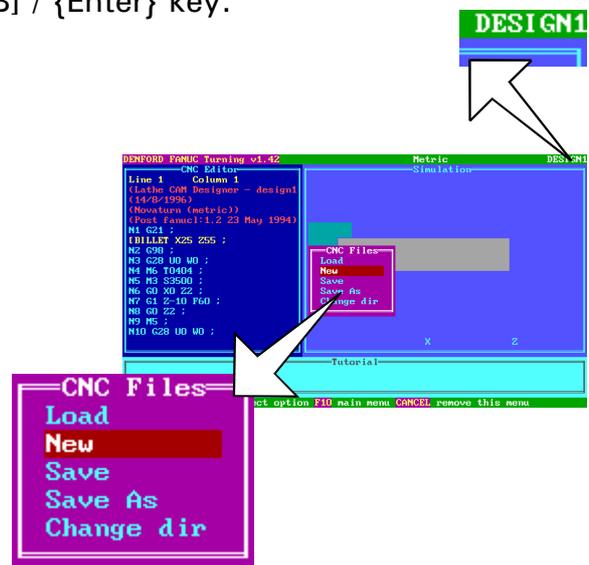
Desktop Tutor Keys Helpbox.  
 The following keys are used in this section:  
 [CURSOR ARROWS]  
 [EOB]  
 [RESET]



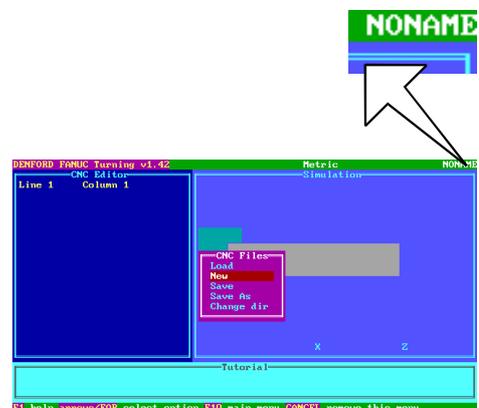
Tutor keypad.

The 'New' command will clear any CNC File currently loaded in the editor.

Highlight 'New' in the *CNC Files Menu* with the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key.



The current CNC File is cleared leaving the editor with no CNC File loaded.



Press the [RESET] / {Escape} key to clear the screen of any unwanted menus or information.

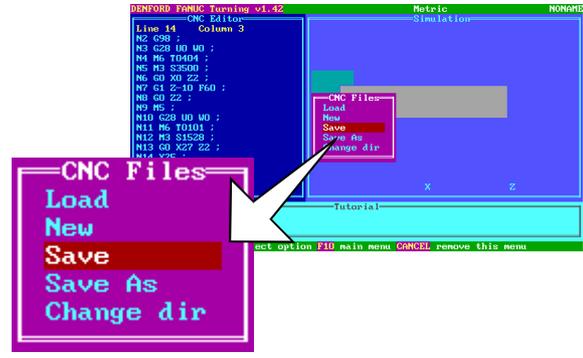
# CNC FILES MENU - SAVE.

Desktop Tutor Keys Helpbox.  
 The following keys are used in this section:  
 [CURSOR ARROWS], [EOB]  
 [NUMBERS] - not highlighted  
 [DELETE], [RESET], [F2]

**!** Please Note - the software will be set to read either the computers hard drive (usually C:) or the floppy disk drive (usually A:) by default. If you do not want to save the CNC Files on the default drive, then the drive destination must be changed. See page 6.8 "Changing the Drive Directory - CNC Files".

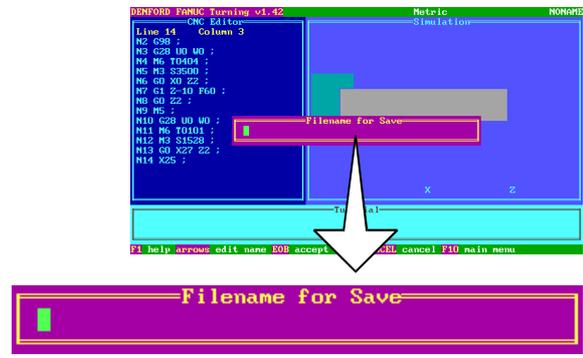
**!** Please Note - The [F2] / {F2} key can be used as a shortcut to saving to the currently selected drive and directory with the same filename.

Highlight 'Save' in the *CNC Files Menu* using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key.



If the CNC File has never been saved, ie, it has just been manually entered, the software will prompt for a filename. Use the [NUMBERS] / {Numbers} keys to write a filename into the dialog box. Incorrect characters can be removed using the [DELETE] / {Backspace} key. Press the [EOB] / {Enter} key to save the CNC File.

Note that CNC Files can only be saved with alphabet characters when using a qwerty keyboard.

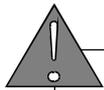


If a CNC File has been previously loaded, then edited, the 'Save' command will overwrite the original CNC File with the new edited version - no filename dialog box will be displayed. Press the [RESET] / {Escape} key to clear the screen of any unwanted menus or information.

# CNC FILES

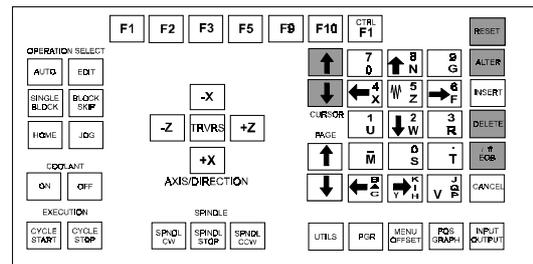
## MENU

### - SAVE AS.



Please Note - the software will be set to read either the computers hard drive (usually C:) or the floppy disk drive (usually A:) by default. If you do not want to save the CNC Files on the default drive, then the drive destination must be changed. See page 6.8 "Changing the Drive Directory - CNC Files".

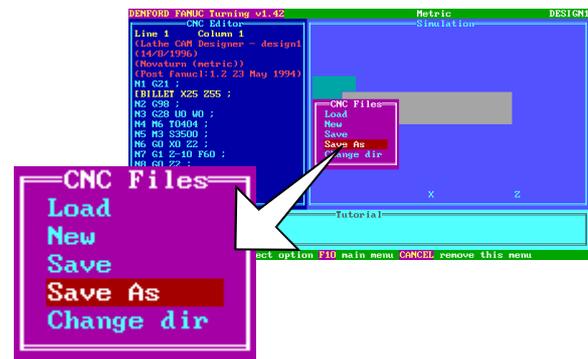
Desktop Tutor Keys Helpbox.  
The following keys are used in this section:  
[CURSOR ARROWS], [EOB]  
[NUMBERS] - not highlighted  
[ALTER], [DELETE], [RESET]



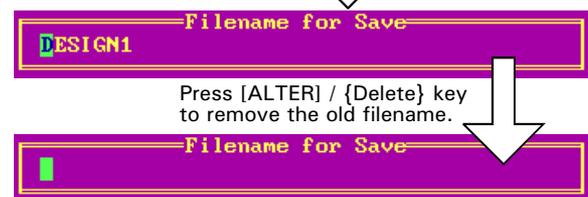
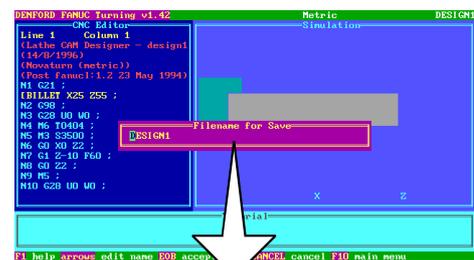
Tutor keypad.

To save a newly edited CNC File with a different name from the original version, the 'Save as' command must be used.

Highlight 'Save as' in the *CNC Files Menu* using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key.



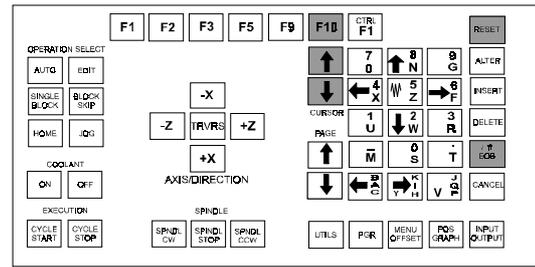
To remove the old filename, press the [ALTER] / {Delete} key, then enter the new filename using the [NUMBERS] / {Numbers} keys. Any characters typed in by mistake can be corrected using the [DELETE] / {Backspace} key.



Press the [EOB] / {Enter} key to Save this new CNC File to the currently selected drive. Press the [RESET] / {Escape} key to clear the screen of any unwanted menus or information.

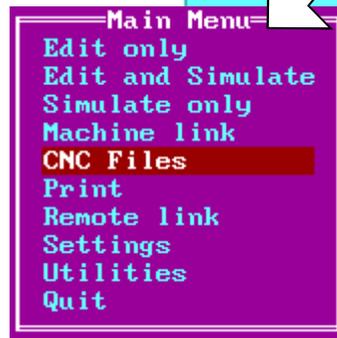
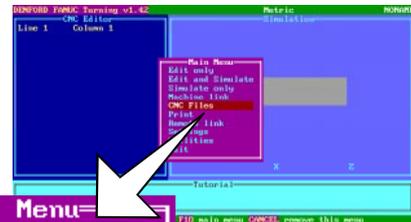
# CHANGING THE DRIVE DIRECTORY - CNC FILES.

Desktop Tutor Keys Helpbox.  
The following keys are used in this section:  
[F10]  
[CURSOR ARROWS]  
[EOB], [RESET]

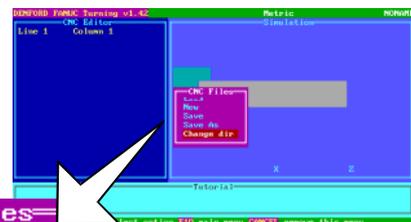


Tutor keypad.

Select the *Main Menu* by pressing the [F10] / {F10} key. Highlight 'CNC Files' using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Escape} key to confirm this choice.



Highlight 'Change dir' with the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Escape} key.

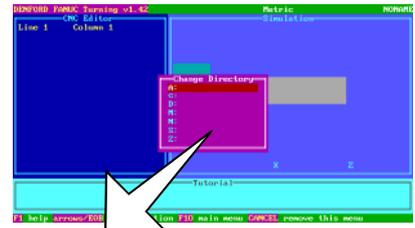


continued....

# CHANGING THE DRIVE DIRECTORY - CNC FILES.

continued....

Highlight the drive required (in this example 'A:' is selected) using the [CURSOR ARROWS] / {keyboard arrows} keys.



Upon pressing the [EOB] / {Enter} key the selected drive will be displayed.



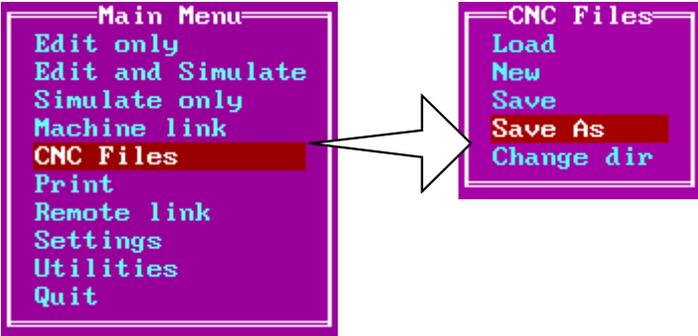
Press the [RESET] / {Escape} key to clear the screen of any unwanted menus or information.

# SAVING CNC FILES ON A CHANGED DRIVE.

Keys Helpbox.  
 The following keys are used in this section:  
 [F10], [CURSOR ARROWS]  
 [NUMBERS] - not highlighted  
 [EOB], [ALTER], [RESET]

Tutor keypad.

Select the *Main Menu* by pressing the [F10] / {F10} key, highlight 'CNC Files' and press [EOB] / {Enter}. Highlight the 'Save as' option and press the [EOB] / {Enter} key.



Note - the screen may display the previous setting for the drive. In the example above, the screen displays the drive as 'C:' , even though it has just been changed to save on 'A:' , as shown in the last section. If this occurs, press the [ALTER] / {Delete} key to reset to the new drive.

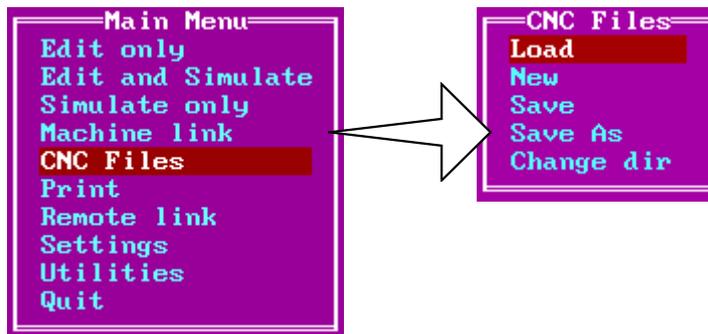


Enter the filename using the [NUMBERS] / {Numbers} keys and press [EOB] / {Enter} to confirm this. The CNC File will now be saved on the new drive.

Note that CNC Files can only be saved with alphabet characters when using a Qwerty keyboard.

# LOADING CNC FILES ON A CHANGED DRIVE.

Select the *Main Menu* by pressing the [F10] / {F10} key, highlight 'CNC Files' and press the [EOB] / {Enter} key. Highlight the 'Load' option and press the [EOB] / {Enter} key.



Note - the screen may display the previous setting for the drive. In the example above, the screen displays the drive as 'C:' , even though it has just been changed to load from 'A:' , as shown in the last section. If this occurs, press the [ALTER] / {Delete} key to reset to the new drive.



Enter the filename using the [NUMBERS] / {Numbers} keys and press [EOB] / {Enter} to confirm this. The CNC File will now be loaded from the new drive.

Note that CNC Files can only be saved with alphabet characters when using a Qwerty keyboard.



If the filename is unknown, the list of CNC Files stored on the drive can be accessed by pressing the [EOB] / {Enter} key.



The screen below will be shown, if there are no matching files on the drive that is being read. To clear this, press the [RESET] / {Escape} key.





# EDITING A CNC FILE - SCREEN VIEW OPTIONS.

Once a CNC File has been loaded, its content can be altered using the Editor windows.

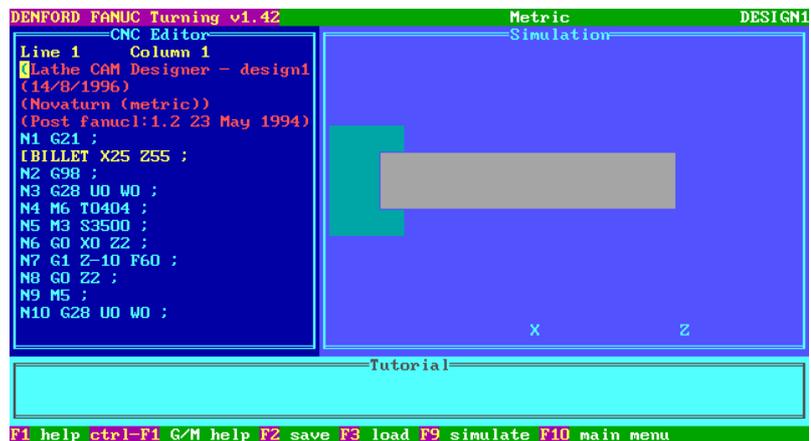
Pages 7.1 - 7.2 apply to editing with both a qwerty keyboard and a Desktop Tutor.

Pages 7.3 - 7.6 apply to editing with a Desktop Tutor only.

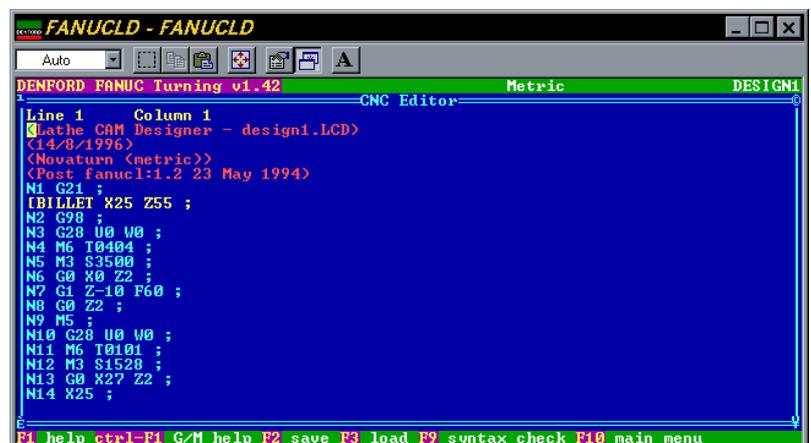
Pages 7.7 - 7.10 apply to editing with a qwerty keyboard only.

CNC Files can be edited in two main screen view options:

*Edit and Simulate.* The CNC File can be altered using the Editor side of the screen and then simulated using the graphical display (side elevation or 3d).

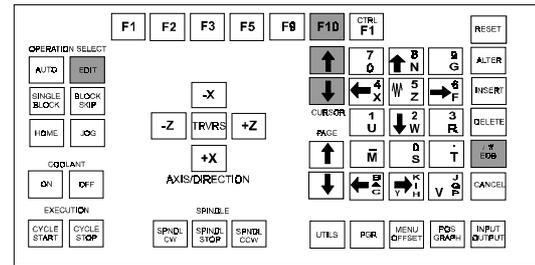


*Edit only.* The CNC File can be altered using a full screen Editor window.



# EDITING A CNC FILE - SCREEN VIEW OPTIONS.

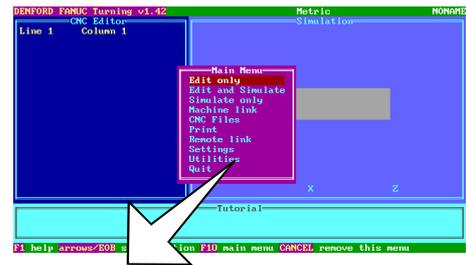
Desktop Tutor Keys Helpbox.  
The following keys are used in this section:  
[F10]  
[CURSOR ARROWS], [EOB]  
[EDIT]



Tutor keypad.

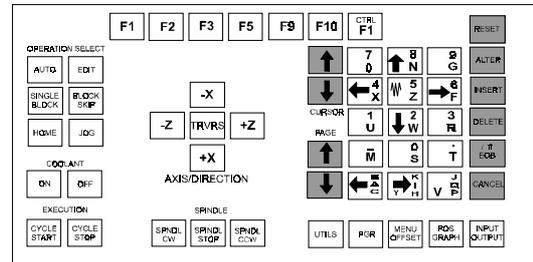
Select the *Main Menu* by pressing the [F10] / {F10} key. Highlight either the 'Edit and Simulate' or 'Edit only' options, using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key to select the highlighted option.

Note - The 'Edit and Simulate' option can be directly accessed on the Desktop Tutor by pressing the [EDIT] key.



# EDITING A CNC FILE - DESKTOP TUTOR KEY FUNCTIONS.

Desktop Tutor Keys Helpbox.  
The following keys are used in this section:  
[CURSOR ARROWS]  
[NUMBERS/LETTERS] - not highlighted  
[ALTER], [CANCEL]  
[DELETE], [INSERT]  
[PAGE UP ARROW], [PAGE DOWN ARROW]  
[EOB]



Tutor keypad.

When editing a CNC File using the Desktop Tutor, the following keys are used:

[CURSOR ARROWS] keys.

These keys will cycle the yellow cursor up or down through each program word/character in the CNC File.

[DELETE] key.

This key will remove the program word/character highlighted by the cursor in the CNC File.

[INSERT] key.

This key will place a 'new' program word/character (from the edit line) directly after the program word/character highlighted by the cursor in the CNC File.

[PAGE UP ARROW] and [PAGE DOWN ARROW] keys.

These keys will move the CNC File text up or down by one full screen page.

[EOB] key.

This key ends the program line, by placing an end of block character (; or /).

[CANCEL] key.

This key will clear any characters from the edit line.

[ALTER] key.

Pressing this key will replace the program word/character highlighted by the cursor in the CNC File with any 'new' text entered on the edit line.

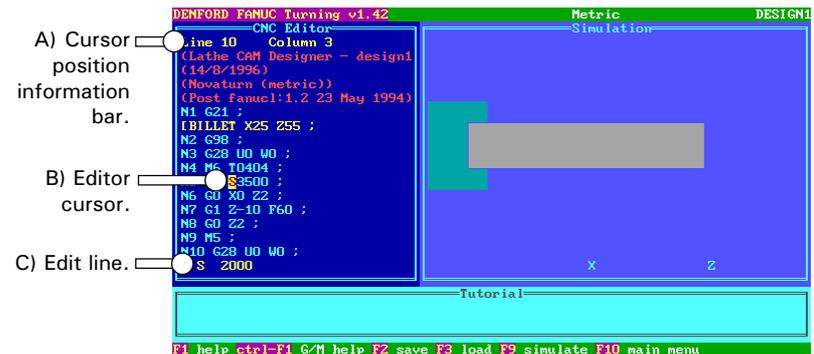
# DESKTOP TUTOR

## - EDITOR WINDOW LAYOUT.

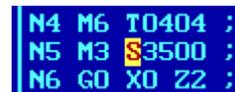
All example screenshots are shown using the *'Edit and Simulate'* option.

The CNC File Editor window, in the *'Edit and Simulate'* option, is displayed by default on the left side of the screen. To alter the screen display properties, see section 9.3 "Change Settings - Editor" and section 9.18 "Change Settings - Miscellaneous".

The general layout of the CNC File Editor window is shown below:



A) The Cursor position information bar displays the exact location of the cursor by program line and column.



B) The yellow Editor cursor highlights the program word or character that can be edited. In this example it highlights the program word 'S3500', referring to the spindle speed.

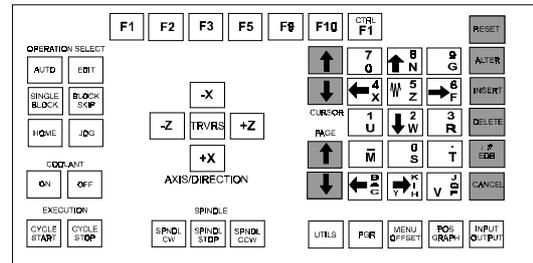


C) The Edit line (at the bottom of the Editor window) is the area of the display where 'new' program words/lines can be written, then inserted into the CNC File. In this example, a 'new' spindle speed of 'S2000' has been entered on the edit line, using the tutor keypad.

# DESKTOP TUTOR

## - EDITING A CNC FILE.

Desktop Tutor Keys Helpbox.  
 The following keys are used in this section:  
 [CURSOR ARROWS]  
 [NUMBERS/LETTERS] - not highlighted  
 [ALTER], [CANCEL]  
 [DELETE], [INSERT]  
 [PAGE UP ARROW], [PAGE DOWN ARROW]  
 [EOB]



Tutor keypad.

Using the 'Edit and Simulate' screen shown on the previous page as an example, the CNC File could be edited in a variety of different ways.

### SELECTING PROGRAM TEXT.

```
N4 M6 T0404 ;
N5 M3 S3500 ;
N6 G0 X0 Z2 ;
```

Using the main screen displayed on the previous page as an example, the program word 'S3500' is highlighted in the CNC File by using the [CURSOR ARROWS] keys. As the [CURSOR ARROWS] keys are pressed, the corresponding program word is highlighted. Note that the Editor window can only display a certain number of lines on the screen. To move through a larger CNC File quickly use the [PAGE UP ARROW] and [PAGE DOWN ARROW] keys.

```
S 2000
```

The 'new' program word 'S2000' is entered on the edit line using the tutor keypad.

Any 'new' program word, or set of words, is always entered from the edit line.

The [CANCEL] key is used to clear unwanted text from the edit line.

The [EOB] key will enter any text entered on the edit line as a 'new' program line in the CNC File.

# DESKTOP TUTOR

## - EDITING A CNC FILE.

### INSERTING AND DELETING PROGRAM TEXT.

```
N4 M6 T0404 ;  
N5 M3 S3500 ;  
N6 G0 X0 Z2 ;
```

Edit line text.  
S 2000



```
N4 M6 T0404 ;  
N5 M3 S3500 S2000 ;  
N6 G0 X0 Z2 ;
```

If the [INSERT] key is pressed, any 'new' program word entered on the edit line is placed at the position of the cursor. The 'new' program line reads 'N5 M3 S3500 S2000 ;' as shown above.

Any 'new' text is placed directly after the last program word/character highlighted by the cursor.

To remove the highlighted program word 'S2000', the [DELETE] key would be pressed whilst it is still highlighted.

### ALTERING A PROGRAM LINE.

```
N4 M6 T0404 ;  
N5 M3 S3500 ;  
N6 G0 X0 Z2 ;
```

Edit line text.  
S 2000



```
N4 M6 T0404 ;  
N5 M3 S2000 ;  
N6 G0 X0 Z2 ;
```

If the [ALTER] key is pressed when 'S2000' is entered on the edit line and 'S3500' is highlighted by the cursor, 'S3500' is replaced by 'S2000'.

If [ALTER] is pressed when the edit line contains a number of program words, they will all be placed over the program word/character last highlighted by the cursor.

# EDITING A CNC FILE - QWERTY KEYBOARD FUNCTIONS.

When editing a CNC File using the qwerty keyboard, the following keys are used:

{keyboard arrows} keys.

Moves the cursor up, down, left and right.

{Delete} key.

Deletes the one character highlighted by the cursor.

{Back arrow} key.

Deletes one character to the left of the cursor.

{Insert} key.

Toggles between the two settings '*insert*' and '*overwrite*'.

{Home} key.

Moves the cursor to the start of the current line.

{End} key.

Moves the cursor to the end of the current line.

{Page up} key.

Moves up a page.

{Page down} key.

Moves down a page.

{Ctrl-Page up} keys.

Moves to first program line.

{Ctrl-Page down} keys.

Moves to last program line.

{Ctrl-Y} keys.

Deletes all of the current line.

{Ctrl-N} keys.

Inserts a new blank line.

{Ctrl-R} keys.

Restores an edited line (only possible if you do not move off the line).

These keys relate to marking in *Anchor Mode*:

{F7} key.

Sets start of marked area.

{F8} key.

Sets end of marked area.

These keys relate to marking in *Drag Mode*:

{F7} key.

Starts making (use {keyboard arrows} to drag out the marked area).

{F8} key.

Stops marking. If pressed again cancels marked area.

These keys relate to program line group editing:

{Alt-D} keys.

Deletes marked area.

{Alt-M} keys.

Moves marked area to current cursor position.

{Alt-C} keys.

Copies marked area to current cursor position.

# QWERTY KEYBOARD - EDITOR WINDOW LAYOUT.

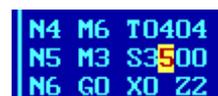
All example screenshots are shown using the 'Edit and Simulate' option.

The CNC File Editor window, in the 'Edit and Simulate' option, is displayed by default on the left side of the screen. To alter the screen display properties, see section 9.3 "Change Settings - Editor" and section 9.18 "Change Settings - Miscellaneous".

The general layout of the CNC File Editor window is shown below:



A) The Cursor position information bar displays the exact location of the cursor by program line and column. The current setting of the *Insert/Overwrite* feature is also highlighted at the right of this information bar.



B) The yellow Editor cursor highlights the program word or character that can be edited. In this example the cursor highlights the text character '5' in the program word 'S3500', referring to the spindle speed.

Note - the qwerty version of the software does not require an "Edit Line", since the qwerty keyboard is much more flexible than the Desktop Tutor when manipulating text characters.

Note - End of block characters are not displayed on the qwerty keyboard software Editor.

# QWERTY KEYBOARD - EDITING A CNC FILE.

Using the '*Edit and Simulate*' screen shown on the previous page as an example, the CNC File could be edited in a variety of different ways.

## SELECTING PROGRAM TEXT.

```
N4 M6 T0404  
N5 M3 S3500  
N6 G0 X0 Z2
```

Using the main screen displayed on the previous page as an example, the program word 'S3500' is highlighted in the CNC File by using the {keyboard arrows} keys. The yellow cursor can be moved up, down, left and right through the text in a similar way to many pc based word processor packages.

```
N5 M3 S3500
```

Pressing the {Home} key will quickly select the start of the current program line.

```
N5 M3 S3500
```

Similarly, pressing the {End} key will move the cursor to the end of the current program line.

Note that the Editor window can only display a certain number of lines on the screen. To move through a larger CNC File quickly use the {Page up} and {Page down} keys to cycle through the lines of the program.

```
Line 1      Column 1      Insert  
[L]athe CAM Designer - design1  
(14/8/1996)  
(Novaturn (metric))  
(Post fanuc1:1.2 23 May 1994)  
N1 G21
```

Pressing the {Ctrl-Page up} keys will quickly select the first line of the program.

```
N258 M5  
N259 G28 U0 W0  
N260 M30
```

Similarly, pressing the {Ctrl-Page down} keys will select the last line of the program.

# QWERTY KEYBOARD - EDITING A CNC FILE.

## DELETING PROGRAM TEXT.

```
N4 M6 T0404  
N5 M3 S3500  
N6 G0 X0 Z2
```



```
N4 M6 T0404  
N5 M3 S300  
N6 G0 X0 Z2
```

Pressing the {Delete} key will remove the character highlighted by the cursor.

```
N4 M6 T0404  
N5 M3 S3500  
N6 G0 X0 Z2
```



```
N4 M6 T0404  
N5 M3 S500  
N6 G0 X0 Z2
```

Pressing the {Backspace} key will remove one character to the left of the cursor.

```
N4 M6 T0404  
N5 M3 S3500  
N6 G0 X0 Z2
```

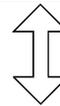


```
N4 M6 T0404  
N6 G0 X0 Z2  
N7 G1 Z-10 F60
```

Pressing the {Ctrl-Y} key will remove all of the current program line.

## SELECTING INSERT AND OVERWRITE EDIT MODES.

```
-----CNC Editor-----  
Line 10 Column 9 Insert
```



```
-----CNC Editor-----  
Line 10 Column 9 Overwri
```

New program text can be entered in two modes, 'Insert' and 'Overwrite'. Pressing the {Insert} key will cycle between these two modes. The current setting of the mode is displayed in the top right-hand corner of the Editor window.

# QWERTY KEYBOARD - EDITING A CNC FILE.

## ENTERING PROGRAM TEXT USING INSERT MODE.

*Insert Mode* should be used to manually enter completely new programs.

When editing an existing program, *Insert Mode* is useful for adding new program words into the line.

```
CNC Editor  
Line 10 Column 9 Insert
```

Check that the Editor window is set to *Insert Mode*, selected by pressing the {Insert} key.

```
N4 M6 T0404  
N5 M3 S3500  
N6 G0 X0 Z2
```



```
N4 M6 T0404  
N5 M3 S31234500  
N6 G0 X0 Z2
```

New characters / program words can be inserted at the cursor position by using the {alphabet} and {numbers} keys. Any characters typed in are placed to the left of the cursor position. In the example above, the characters '1234' have been entered.

## ENTERING PROGRAM TEXT USING OVERWRITE MODE.

When editing an existing program, *Overwrite Mode* is useful for altering program words.

```
CNC Editor  
Line 10 Column 9 Overwri
```

Check that the Editor window is set to *Overwrite Mode*, selected by pressing the {Insert} key.

```
N4 M6 T0404  
N5 M3 S3500  
N6 G0 X0 Z2
```



```
N4 M6 T0404  
N5 M3 S31234  
N6 G0 X0 Z2
```

Any characters highlighted by the cursor, or to the right of the cursor, are replaced as new text is entered.

In the example above, the characters '1234' have been entered.

# QWERTY KEYBOARD - EDITING A CNC FILE.

## CREATING A NEW BLANK PROGRAM LINE.

```
N4 M6 T0404  
N5 M3 S3500  
N6 G0 X0 Z2
```



```
N4 M6 T0404  
N5 M3 S3500  
N6 G0 X0 Z2
```

Pressing the {Ctrl-N} keys will create a new blank program line directly before the program line on which the cursor is currently placed.

In the example shown above, the cursor is highlighting program line 'N5', so the new program line is inserted between program line numbers 'N4' and 'N5'.

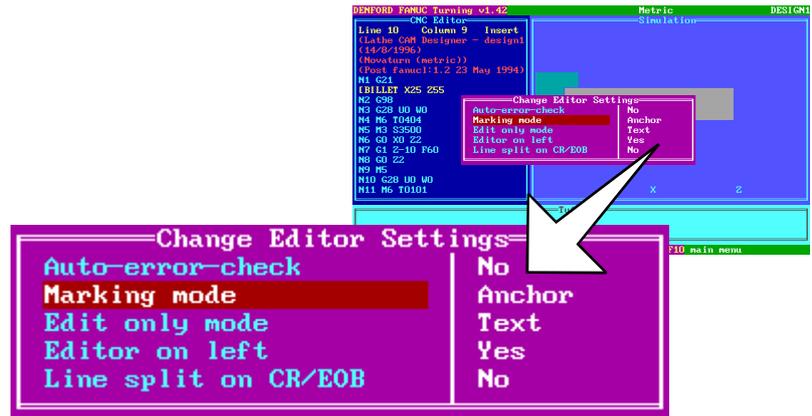
## UNDO / RESTORE A PROGRAM LINE.

Pressing the {Ctrl-R} keys will undo any editing of a program line.

Note - this feature will only operate if the cursor has not been moved off the program line before pressing the {Ctrl-R} keys.

# QWERTY KEYBOARD - EDITING A CNC FILE USING ANCHOR MODE.

## CONFIGURING ANCHOR MODE.



*Anchor Mode* is used to select a group of program lines that can be copied, moved or deleted. Using *Anchor Mode* will not highlight program lines as they are selected.

To configure the Editor for *Anchor Mode* follow this procedure:

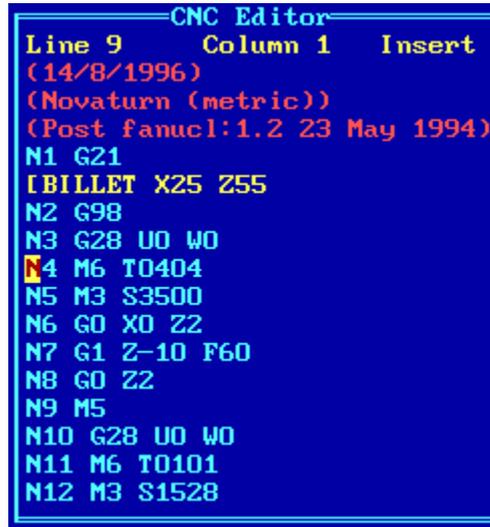
- 1) Press {F10}, highlight '*Settings*' and press {Enter}.
- 2) Highlight '*Editor*' and press {Enter}.
- 3) Highlight '*Marking Mode*' and press {Enter} until '*Anchor*' is shown.
- 4) Press {Escape} to clear the menus from the screen.

# QWERTY KEYBOARD

## - EDITING A CNC FILE USING ANCHOR MODE.

### SELECTING A GROUP OF PROGRAM LINES.

To select a group of program lines, follow this procedure:

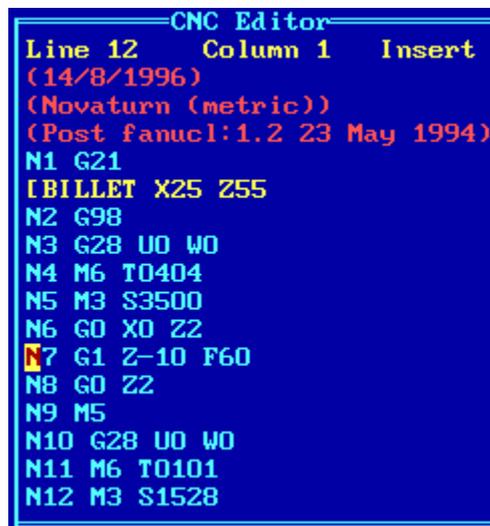


```
CNC Editor
Line 9      Column 1  Insert
(14/8/1996)
(Novaturn (metric))
(Post fanucl:1.2 23 May 1994)
N1 G21
[BILLET X25 Z55
N2 G98
N3 G28 U0 W0
N4 M6 T0404
N5 M3 S3500
N6 G0 X0 Z2
N7 G1 Z-10 F60
N8 G0 Z2
N9 M5
N10 G28 U0 W0
N11 M6 T0101
N12 M3 S1528
```

1) Position the cursor anywhere on the first program line of the group you wish to select and press the {F7} key.

This marks the start point of the grouping.

In the example above, program line 'N4' has been chosen as the start of the grouping.



```
CNC Editor
Line 12     Column 1  Insert
(14/8/1996)
(Novaturn (metric))
(Post fanucl:1.2 23 May 1994)
N1 G21
[BILLET X25 Z55
N2 G98
N3 G28 U0 W0
N4 M6 T0404
N5 M3 S3500
N6 G0 X0 Z2
N7 G1 Z-10 F60
N8 G0 Z2
N9 M5
N10 G28 U0 W0
N11 M6 T0101
N12 M3 S1528
```

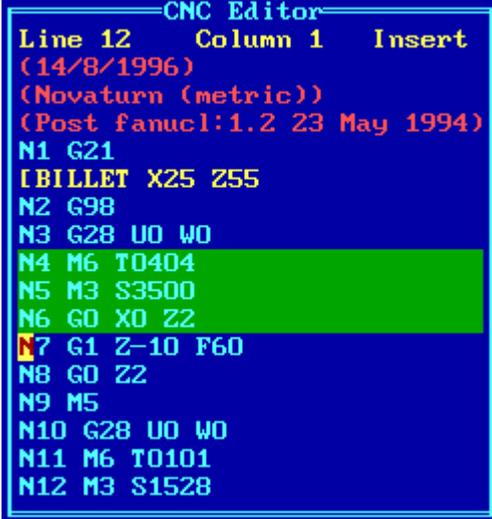
2) Move the cursor down to the program line directly after the last program line of your grouping and press the {F8} key.

This marks the end point of the grouping.

In the example above, a grouping of program lines 'N4 to N6' was required, so the cursor was positioned on program line 'N7' to mark the end of this grouping.

# QWERTY KEYBOARD - EDITING A CNC FILE USING ANCHOR MODE.

## SELECTING A GROUP OF PROGRAM LINES.



```
CNC Editor
Line 12   Column 1   Insert
(14/8/1996)
(Novaturn (metric))
(Post fanuc1:1.2 23 May 1994)
N1 G21
[BILLET X25 Z55
N2 G98
N3 G28 U0 W0
N4 M6 T0404
N5 M3 S3500
N6 G0 X0 Z2
N7 G1 Z-10 F60
N8 G0 Z2
N9 M5
N10 G28 U0 W0
N11 M6 T0101
N12 M3 S1528
```

3) When the {F8} key is pressed the group of program lines will be highlighted in a green box.

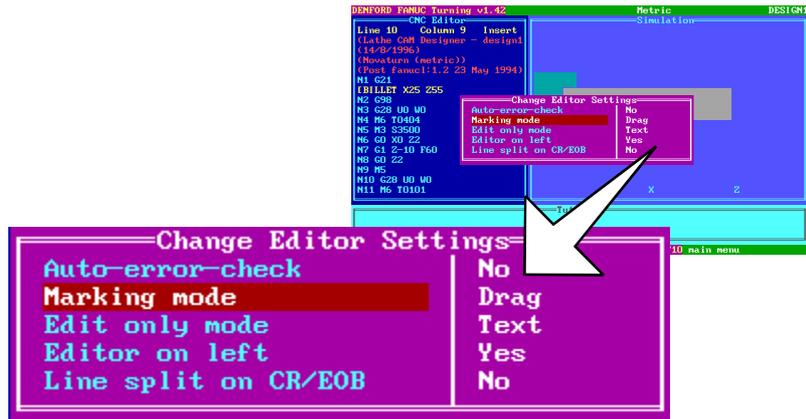
If the cursor is moved to other parts of the program, the grouping will still be retained in memory.

## DESELECTING A GROUP OF PROGRAM LINES.

To undo/clear a grouping of program lines, press the {F8} key on the program line that started the grouping.

# QWERTY KEYBOARD - EDITING A CNC FILE USING DRAG MODE.

## CONFIGURING DRAG MODE.



*Drag Mode* is used to select a group of program lines that can be copied, moved or deleted. Using *Drag Mode* will highlight program lines as they are selected, in a similar way to dragging around objects to select them in "Windows" packages.

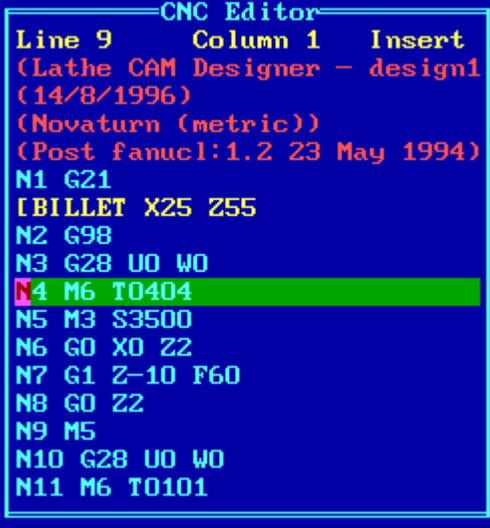
To configure the Editor for *Drag Mode* follow this procedure:

- 1) Press {F10}, highlight '*Settings*' and press {Enter}.
- 2) Highlight '*Editor*' and press {Enter}.
- 3) Highlight '*Marking Mode*' and press {Enter} until '*Drag*' is shown.
- 4) Press {Escape} to clear the menus from the screen.

# QWERTY KEYBOARD - EDITING A CNC FILE USING DRAG MODE.

## SELECTING A GROUP OF PROGRAM LINES.

To select a group of program lines, follow this procedure:

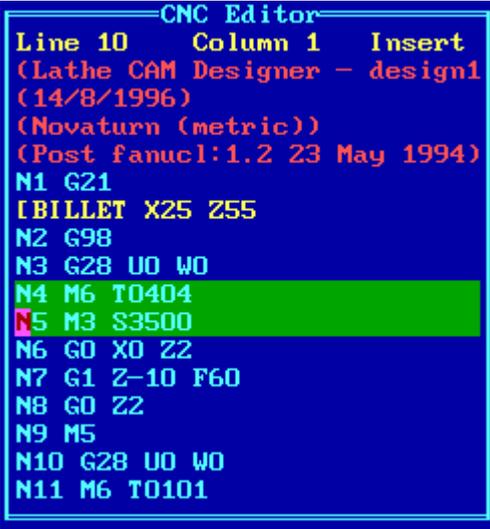


```
CNC Editor
Line 9      Column 1      Insert
(Lathe CAM Designer - design1
(14/8/1996)
(Novaturn (metric))
(Post fanuc1:1.2 23 May 1994)
N1 G21
[BILLET X25 Z55
N2 G98
N3 G28 U0 W0
N4 M6 T0404
N5 M3 S3500
N6 G0 X0 Z2
N7 G1 Z-10 F60
N8 G0 Z2
N9 M5
N10 G28 U0 W0
N11 M6 T0101
```

- 1) Position the cursor anywhere on the first program line of the group you wish to select and press the {F7} key. The selected program line will be highlighted in a green box.

This marks the start point of the grouping.

In the example above, program line 'N4' has been chosen as the start of the grouping.



```
CNC Editor
Line 10     Column 1     Insert
(Lathe CAM Designer - design1
(14/8/1996)
(Novaturn (metric))
(Post fanuc1:1.2 23 May 1994)
N1 G21
[BILLET X25 Z55
N2 G98
N3 G28 U0 W0
N4 M6 T0404
N5 M3 S3500
N6 G0 X0 Z2
N7 G1 Z-10 F60
N8 G0 Z2
N9 M5
N10 G28 U0 W0
N11 M6 T0101
```

- 2) To group a number of program lines, press the {Down keyboard arrow}. As the cursor moves down, through the program, each program line included in the grouping is highlighted in the green box.

# QWERTY

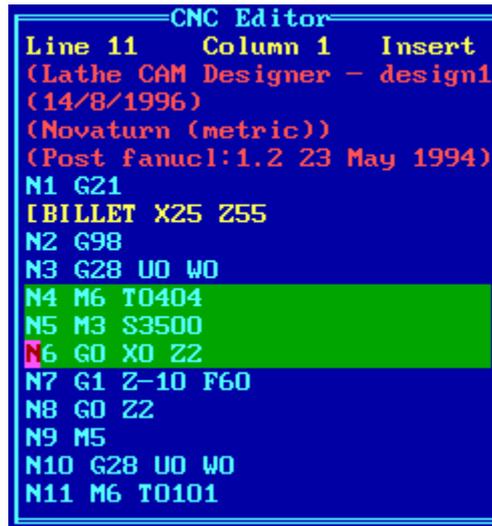
# KEYBOARD

## - EDITING A

# CNC FILE USING

# DRAG MODE.

## SELECTING A GROUP OF PROGRAM LINES.

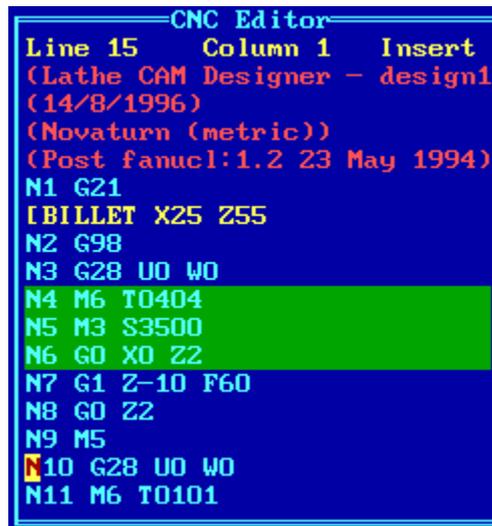


```
CNC Editor
Line 11   Column 1   Insert
(Lathe CAM Designer - design1
(14/8/1996)
(Novaturn (metric))
(Post fanucl:1.2 23 May 1994)
N1 G21
[BILLET X25 Z55
N2 G98
N3 G28 U0 W0
N4 M6 T0404
N5 M3 S3500
N6 G0 X0 Z2
N7 G1 Z-10 F60
N8 G0 Z2
N9 M5
N10 G28 U0 W0
N11 M6 T0101
```

3) When all the required program lines are highlighted in the green box, press the {F8} key.

This marks the end point of the grouping.

In the example above, program lines 'N4 to N6' have been chosen as the grouping.



```
CNC Editor
Line 15   Column 1   Insert
(Lathe CAM Designer - design1
(14/8/1996)
(Novaturn (metric))
(Post fanucl:1.2 23 May 1994)
N1 G21
[BILLET X25 Z55
N2 G98
N3 G28 U0 W0
N4 M6 T0404
N5 M3 S3500
N6 G0 X0 Z2
N7 G1 Z-10 F60
N8 G0 Z2
N9 M5
N10 G28 U0 W0
N11 M6 T0101
```

4) If the cursor is now moved to other parts of the program, the grouping will still be retained in memory.

## DESELECTING A GROUP OF PROGRAM LINES.

To undo/clear a grouping of program lines that have just been selected, press the {F8} key.

(ie, pressing the {F8} key once will end a grouping, pressing it again will clear the grouping).

# QWERTY KEYBOARD - EDITING A CNC FILE USING ANCHOR OR DRAG MODE.

## COPYING A GROUP OF PROGRAM LINES.

```
CNC Editor
Line 15      Column 1      Insert
(14/8/1996)
(Novaturn (metric))
(Post fanuc1:1.2 23 May 1994)
N1 G21
[BILLET X25 Z55
N2 G98
N3 G28 U0 W0
N4 M6 T0404
N5 M3 S3500
N6 G0 X0 Z2
N7 G1 Z-10 F60
N8 G0 Z2
N9 M5
N10 G28 U0 W0
N11 M6 T0101
N12 M3 S1528
```

Pressing the {Alt-C} keys will place a copy of the grouping directly before the program line that the cursor is currently highlighting.

In the above example, the program lines 'N4 to N6' have been grouped and the cursor has been moved to highlight program line 'N10'.

**Question**  
Copy marked block?

When the {Alt-C} keys are pressed, a confirmation window will be displayed. Press the {Y} key to copy the grouping or the {N} key to clear the command.

```
CNC Editor
Line 15      Column 1      Insert
N1 G21
[BILLET X25 Z55
N2 G98
N3 G28 U0 W0
N4 M6 T0404
N5 M3 S3500
N6 G0 X0 Z2
N7 G1 Z-10 F60
N8 G0 Z2
N9 M5
N4 M6 T0404
N5 M3 S3500
N6 G0 X0 Z2
N10 G28 U0 W0
N11 M6 T0101
N12 M3 S1528
```

In the above example, the grouping (program lines 'N4 to N6') has been successfully copied so it fits between program lines 'N9' and 'N10'.

# QWERTY KEYBOARD - EDITING A CNC FILE USING ANCHOR OR DRAG MODE.

## MOVING A GROUP OF PROGRAM LINES.

```
CNC Editor
Line 15   Column 1   Insert
(14/8/1996)
(Novaturn (metric))
(Post fanucl:1.2 23 May 1994)
N1 G21
[BILLET X25 Z55
N2 G98
N3 G28 U0 W0
N4 M6 T0404
N5 M3 S3500
N6 G0 X0 Z2
N7 G1 Z-10 F60
N8 G0 Z2
N9 M5
N10 G28 U0 W0
N11 M6 T0101
N12 M3 S1528
```

Pressing the {Alt-M} keys will move the grouping to a position directly before the program line that the cursor is currently highlighting.

In the above example, the program lines 'N4 to N6' have been grouped and the cursor has been moved to highlight program line 'N10'.

**Question**  
Move marked block?

When the {Alt-M} keys are pressed, a confirmation window will be displayed. Press the {Y} key to move the grouping or the {N} key to clear the command.

```
CNC Editor
Line 12   Column 1   Insert
(Lathe CAM Designer - design1
(14/8/1996)
(Novaturn (metric))
(Post fanucl:1.2 23 May 1994)
N1 G21
[BILLET X25 Z55
N2 G98
N3 G28 U0 W0
N7 G1 Z-10 F60
N8 G0 Z2
N9 M5
N4 M6 T0404
N5 M3 S3500
N6 G0 X0 Z2
N10 G28 U0 W0
N11 M6 T0101
```

In the above example, the grouping (program lines 'N4 to N6') has been successfully moved from its original location so it now fits between program lines 'N9' and 'N10'.

# QWERTY KEYBOARD - EDITING A CNC FILE USING ANCHOR OR DRAG MODE.

## DELETING A GROUP OF PROGRAM LINES.

```
CNC Editor
Line 12 Column 1 Insert
(Lathe CAM Designer - design1
(14/8/1996)
(Novaturn (metric))
(Post fanuc1:1.2 23 May 1994)
N1 G21
[BILLET X25 Z55
N2 G98
N3 G28 U0 W0
N4 M6 T0404
N5 M3 S3500
N6 G0 X0 Z2
N7 G1 Z-10 F60
N8 G0 Z2
N9 M5
N10 G28 U0 W0
N11 M6 T0101
```

Pressing the {Alt-D} keys will delete the current grouping of program lines..

In the above example, the program lines 'N4 to N6' have been grouped.

Question  
Delete marked block?

When the {Alt-D} keys are pressed, a confirmation window will be displayed. Press the {Y} key to delete the grouping or the {N} key to clear the command.

```
CNC Editor
Line 9 Column 1 Insert
(Lathe CAM Designer - design1
(14/8/1996)
(Novaturn (metric))
(Post fanuc1:1.2 23 May 1994)
N1 G21
[BILLET X25 Z55
N2 G98
N3 G28 U0 W0
N7 G1 Z-10 F60
N8 G0 Z2
N9 M5
N10 G28 U0 W0
N11 M6 T0101
N12 M3 S1528
N13 G0 X27 Z2
N14 X25
```

In the above example, the grouping (program lines 'N4 to N6') has been successfully deleted.



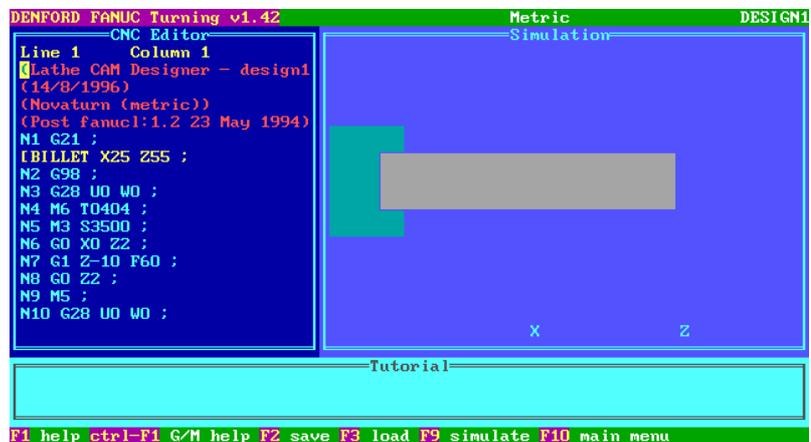
# SIMULATE - SCREEN VIEW OPTIONS.

Once a CNC File has been loaded, its action can be simulated on-screen. Remember that the name of the CNC File is displayed in the top right-hand corner of the display. In the example screenshots, a program called '*DESIGN1*' has been loaded.

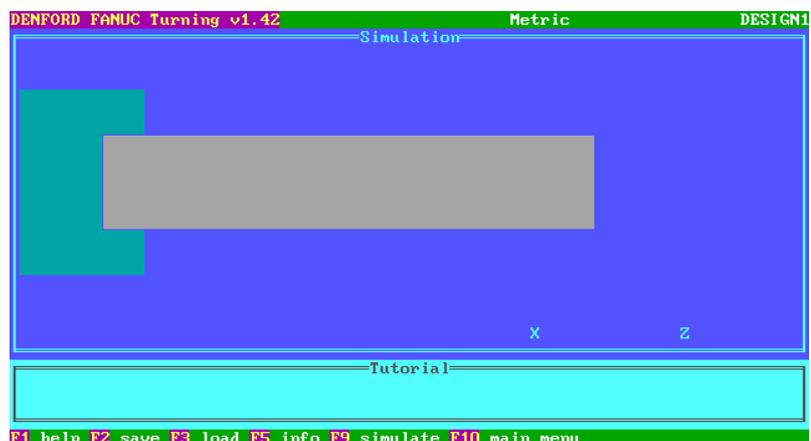
Simulating a program is useful for checking the order of cutting commands, the appearance of the end result and whether the program contains any mistakes.

CNC Files can be simulated in two main screen view options:

*Edit and Simulate.* The CNC File can be altered using the editor side of the screen and then simulated using the graphical display (side elevation or 3d).



*Simulate only.* The CNC File can be simulated using a full screen graphical display (side elevation or 3d).

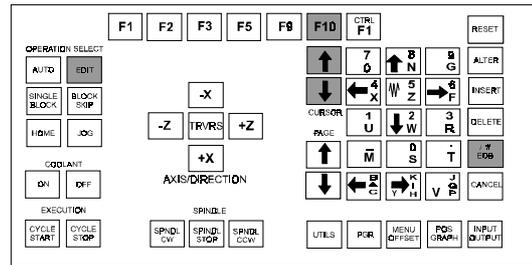


# SIMULATE

## - SELECT

# SCREEN VIEW.

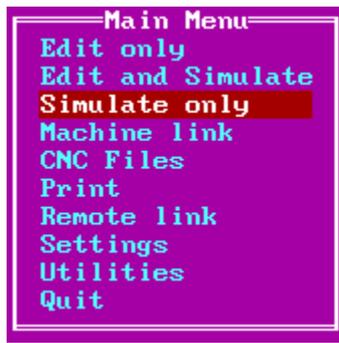
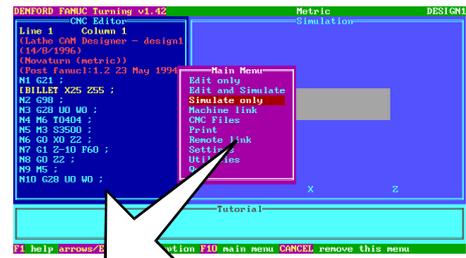
Desktop Tutor Keys Helpbox.  
 The following keys are used in this section:  
 [F10]  
 [CURSOR ARROWS], [EOB]  
 [EDIT]



Tutor keypad.

The required screen view can be accessed by selecting the *Main Menu* by pressing the [F10] / {F10} key. Highlight either the 'Edit and Simulate' or 'Simulate only' options, using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key to select the highlighted option.

Note - The 'Edit and Simulate' option can be directly accessed on the Desktop Tutor by pressing the [EDIT] key.

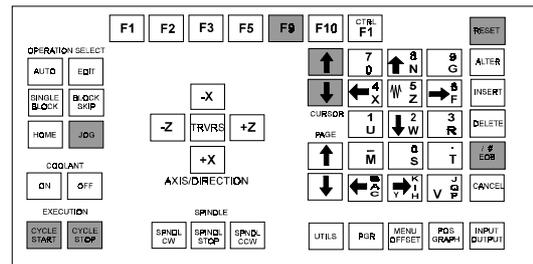


# SIMULATION

# MENU

- CHECK SYNTAX.

Desktop Tutor Keys Helpbox.  
The following keys are used in this section:  
[F9], [CURSOR ARROWS]  
[EOB], [JOG]  
[CYCLE START], [CYCLE STOP], [RESET]



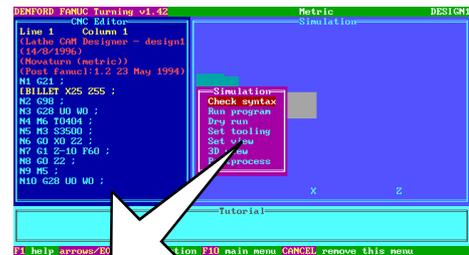
Tutor keypad.

To start simulating the CNC File (program) in the chosen screen view, select the *Simulation Menu* by pressing the [F9] / {F9} key. All example screenshots are shown using the 'Edit and Simulate' option.

1) *Check Syntax*. This checks for illegal G-codes without running the program.

To run this option, highlight 'Check Syntax' using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key.

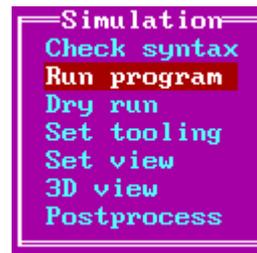
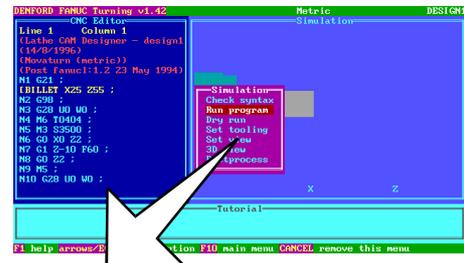
The message indicating the results of this exercise is cleared by pressing the [RESET] / {Escape} key.



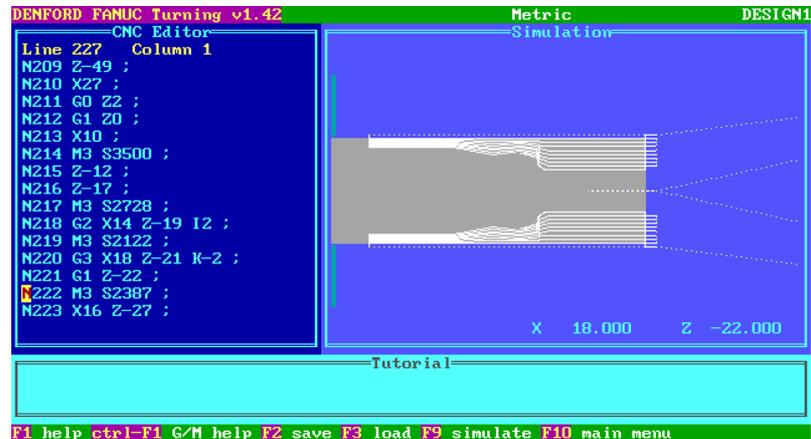
# SIMULATION MENU - RUN PROGRAM.

2) *Run Program*. This instructs the computer to run through the program.

To start this option, highlight *Run Program* using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key.



The *Run Program* option is set to run through the entire program cycle, from start to finish. Whilst the program is running, the written text will scroll down the screen and the pictorial view will be simultaneously updated.



Pressing the [CYCLE STOP] / {Escape} key at any time will abort the run. To reset back to the start of the program, press the [RESET] key twice on Desktop Tutors, or the {Page up} key continuously until the first lines of the program are visible on qwerty keyboards.

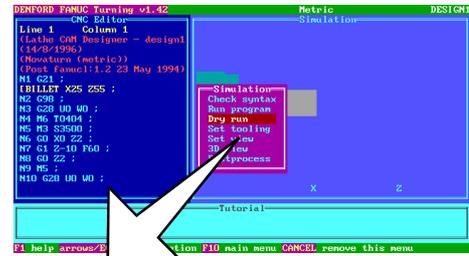


On Desktop Tutors, the [CYCLE STOP] key can also be used to pause a run. The remainder of the program will be run as a seperate cycle by pressing the [CYCLE START] key. Once this smaller cycle has finished press the [RESET] key to return to the start of the program.

# SIMULATION MENU - DRY RUN.

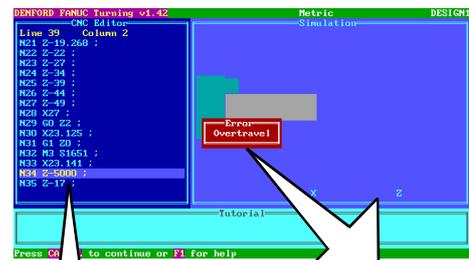
3) *Dry Run*. This option performs a *Check Syntax* and also checks the validity of the machining requirements (for example, any axis overtravel limits programmed into the offline software) by running the program in the computer memory.

To run this option, highlight *Dry Run* using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key.



On short programs it may appear that nothing has happened, since the *Dry Run* operation may take less than a second to complete.

*Dry Run* will display any errors in your program, so if none are shown after pressing [EOB] / {Enter}, your CNC program has run correctly. Error messages are displayed with the appropriate incorrect line in your program highlighted. Any error messages which are displayed can be cleared by pressing the [RESET] / {Escape} key.



# SIMULATION MENU

## - SET TOOLING.

4) *Set Tooling*. This allows the on-screen graphics for simulations to be configured. *Set Tooling* is used to ensure that the correct tool profiles are drawn and used on the display screen at the right time.

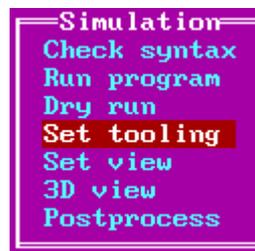
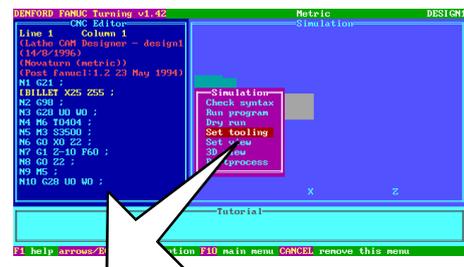
The *Set Tooling* option must be completed, if either the *Edit and Simulate* or *Simulate only* options are to be used, ie, on-screen graphics will be used by the offline software.

Each tool profile is assigned a number, in the CNC program. It is these tool profile/number combinations that must be exactly copied into the *Set Tooling* options.

If the CNC program being used has been generated using Denford's LatheCAM Designer software, the tool profile/number combinations are selected from their own menu screen (see the side panel on the next page).

(Note - If the CNC program will also to be used on a Denford CNC Lathe at a later date, the *Set Tooling* option also needs to be configured on the machine controlling software so it matches the tool profile/number combinations used on both the CNC program and the machine toolpost.)

To select this option, highlight *Set Tooling* using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key.



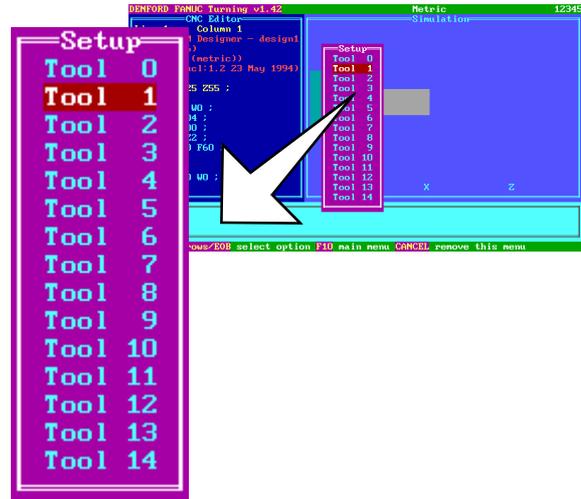
continued....

# SIMULATION

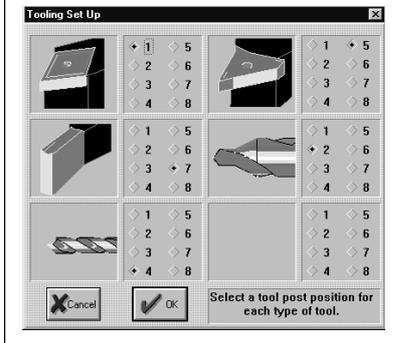
# MENU

## - SET TOOLING.

Select the number of one of the tools from the list, using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key. In this example, tool number 1 is highlighted.



The tool numbers in the LatheCAM Designer software example (ie, the CNC program used) were matched to the tool profiles as follows:  
 Roughing tool - 1.  
 Undercutting tool - 7.  
 Drill - 4.  
 Threading tool - 5.  
 Centre drill - 2.

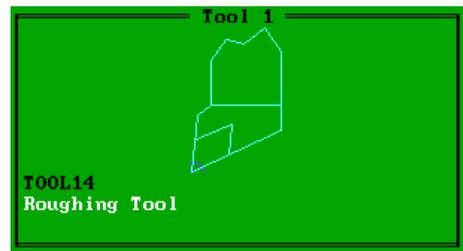


Cycle through the green coloured tool screens available, using the [CURSOR ARROWS] / {keyboard arrows} keys.

The tool profile shown on this screen for the tool number selected, needs to match the tool profile/number combination used in the CNC program (and also on the actual machine toolpost, if used).

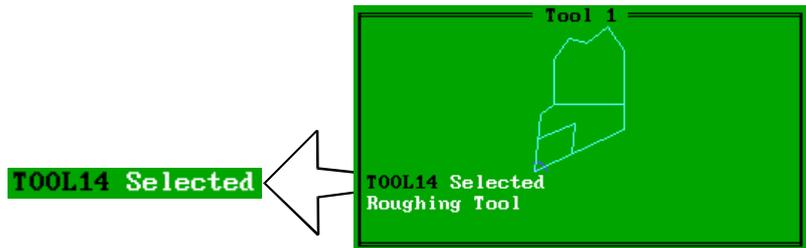
In this example, tool number 1 in the CNC program (from LatheCAM) was a "roughing" tool (see panel, left). The tool profiles available on-screen are cycled through until the same "roughing" tool profile is found for tool number 1 in the offline software.

When the correct tool profile is found for each tool number, press the [EOB] / {Enter} key.



Tool 1 - Roughing tool.

Notice that if 'Tool 1' is selected again, the screen will indicate the profile chosen is now 'selected' as Tool 1.



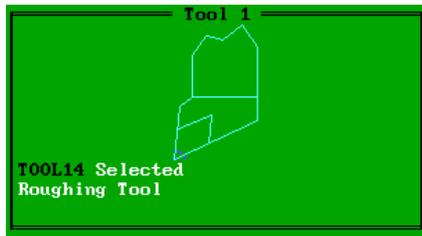
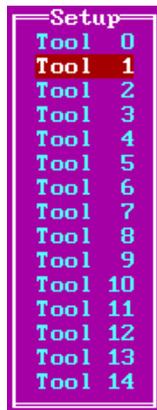
# SIMULATION

## MENU

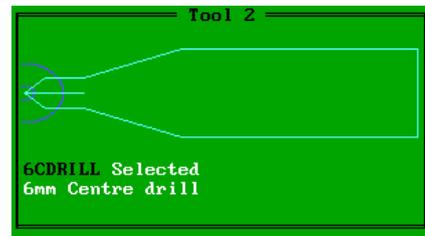
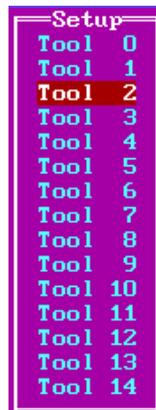
### - SET TOOLING.

Using the same method, set the tool screens for all the other tool numbers used by the CNC program.

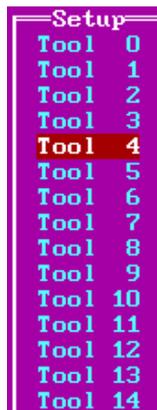
(These screenshots show how the graphics would be set to match the tool profile/number combinations used in the LatheCAM example, shown in the panel below).



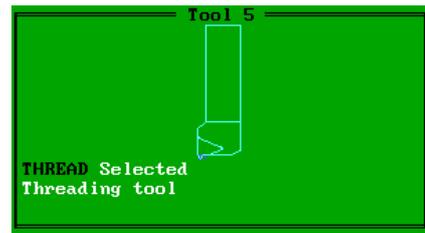
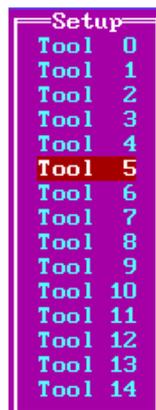
Tool 1 - Roughing tool.



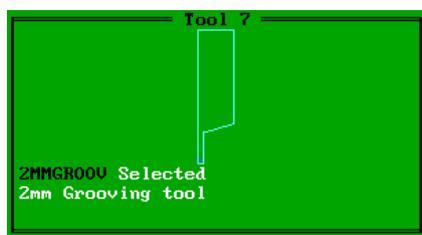
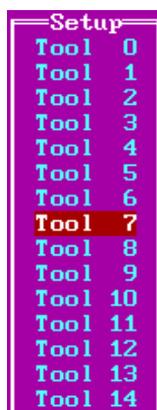
Tool 2 - Centre drill.



Tool 4 - 6mm drill.



Tool 5 - Threading tool.



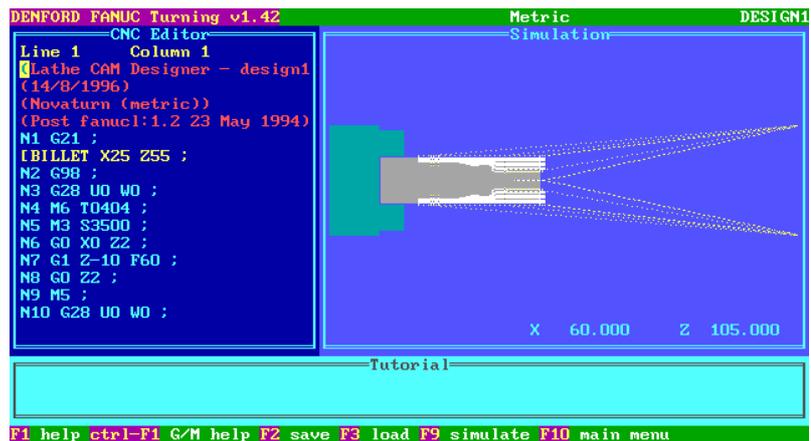
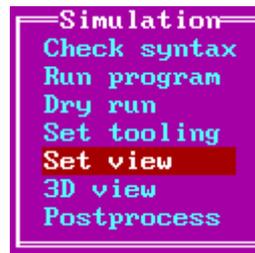
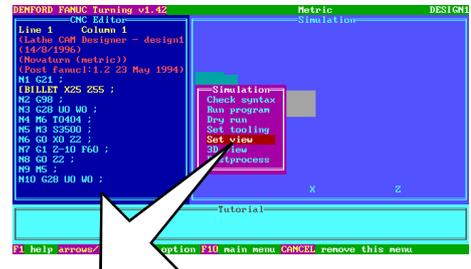
Tool 7 - Undercutting tool.

The tool numbers in the LatheCAM Designer software example (ie, the CNC program used) were set as follows:  
Roughing tool - 1.  
Undercutting tool - 7.  
Drill - 4.  
Threading tool - 5.  
Centre drill - 2.

# SIMULATION MENU - SET VIEW.

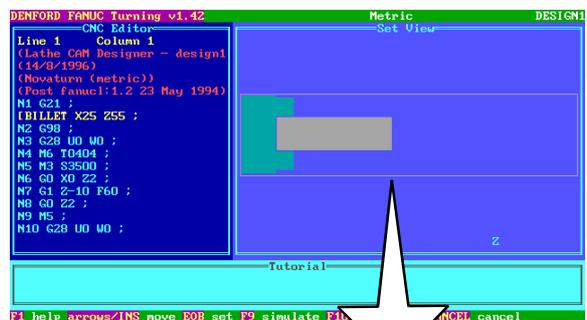
5) *Set View* (not applicable to the *Edit only* option). This allows the detail/magnification level of the pictorial view to be selected.

To select this option, highlight *Set View* using the [CURSOR ARROWS] / {keyboard arrows} keys and press [EOB] / {Enter}.



Simulation window shows 'small' billet.

Set View option selected from Simulation Menu.

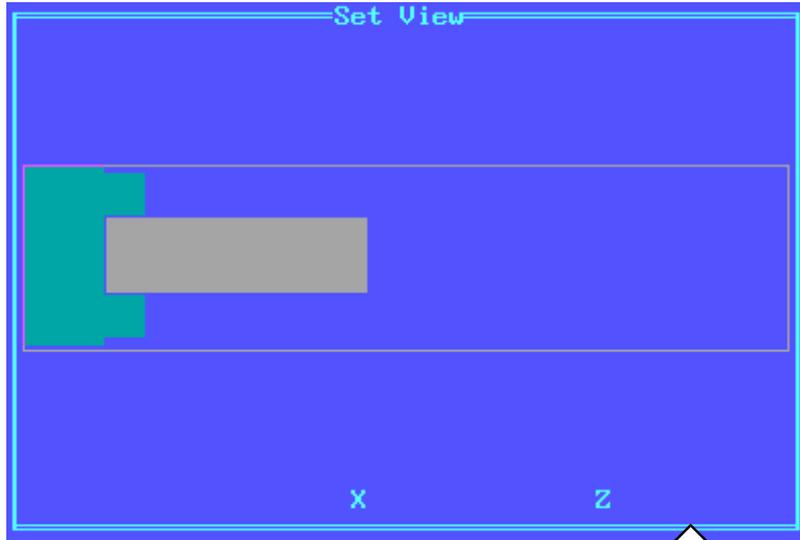


Enlarged area of screen shown on next page....

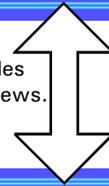
# SIMULATION MENU - SET VIEW.

Press the [JOG] / {Space} key to cycle through the different views. To select the view highlighted press the [EOB] / {Enter} key.

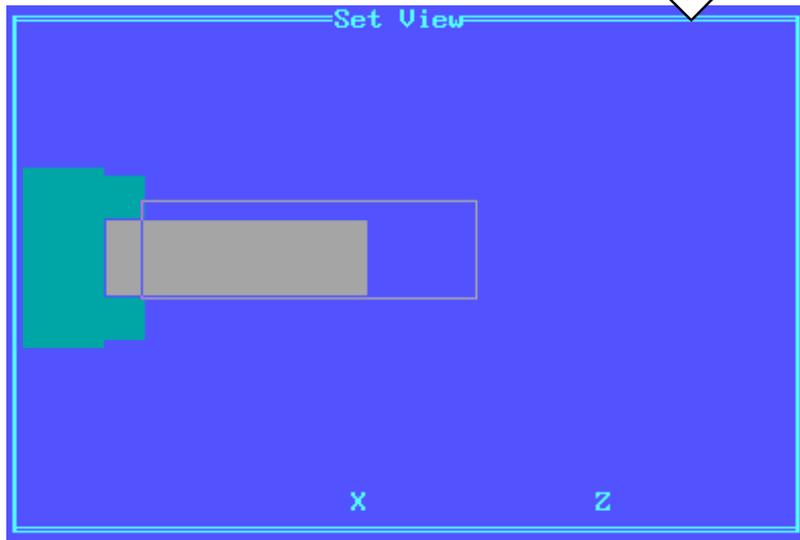
Default view shows smallest billet size.



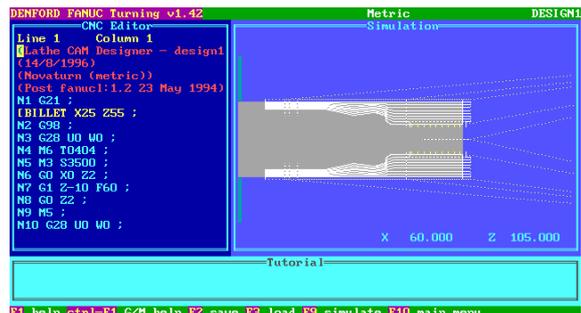
[JOG] / {Space} key toggles around the different sized views.



Magnified view shown by 'new' box outline around billet.



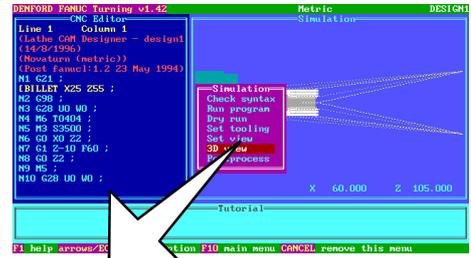
Now, when *Run Program* is selected, the plan pictorial view shown will be the one previously chosen in the *Set View* option.



# SIMULATION MENU - 3D VIEW.

6) *3D View*. This allows a three dimensional model of the work to be displayed in place of the side elevational view.

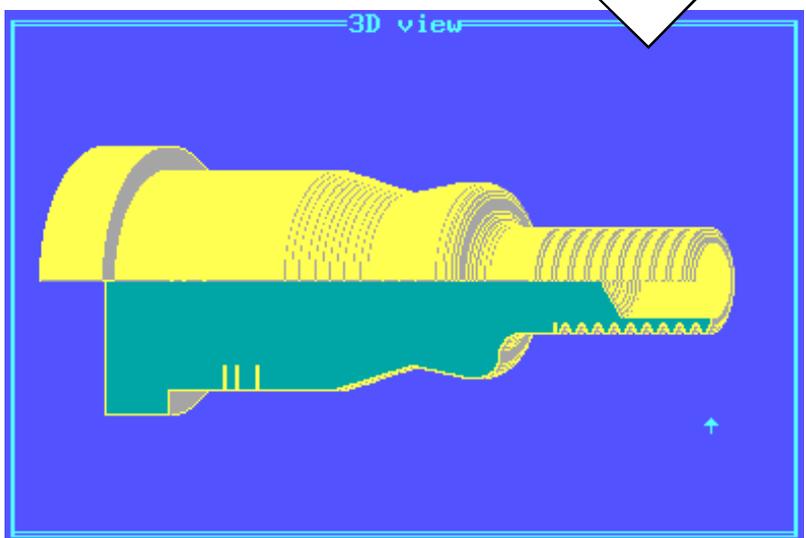
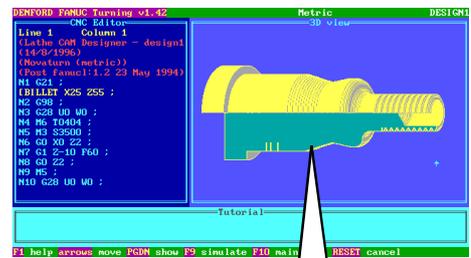
To select this option, highlight *3D View* using the [CURSOR ARROWS] / {keyboard arrows} and press the [EOB] / {Enter} key.



The *3D View* option will only display a static 3d view of the current stage of the work.

To return to the 2d side view, select the *Run Program* option.

If a 3d view is permanently required during the *Run Program* operation, the 3d view must be set from the *Change Settings (Simulation) Menu* (see section 9.9).



# SIMULATION MENU

## - POSTPROCESS.

6) *Postprocess*. This simulates the program in the computer's memory, then writes a new file to disk, describing co-ordinate positioning and movements for that program.

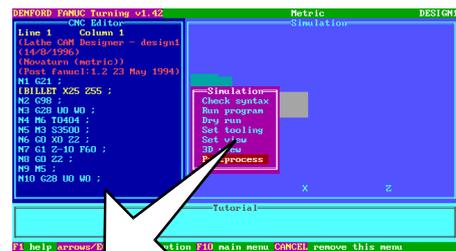
The new file has the extension ".tnc" and will be saved in the last drive and directory set by the offline software (usually C:\Denford or C:\Denford\Data).

These new files can be used by the separate Denford Postprocessor software package to generate new CNC programs understood by other machine controllers (eg, Heidenhain).

The post process option will not alter the original ".fnc" file used to generate the new ".tnc" file.

To select this option, highlight *Postprocess* using the [CURSOR ARROWS] / {keyboard arrows} and press the [EOB] / {Enter} key.

Note - no message window will be displayed to indicate the program has been postprocessed.

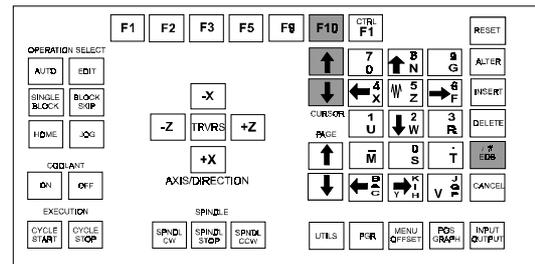


# CHANGE SETTINGS - MENU.

The *Change Settings Menu* allows the offline software to be customised to suit the requirements of the end user.

When all the options have been fully configured, the settings should be saved to disk. Each time the software is started it will load these customised settings.

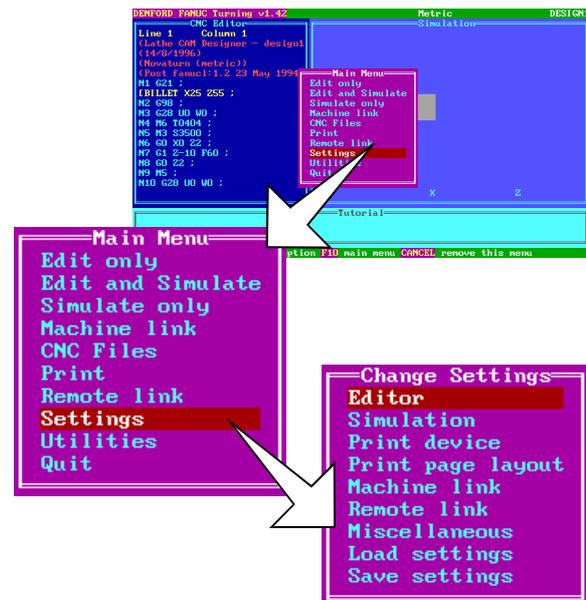
Desktop Tutor Keys Helpbox.  
The following keys are used in this section:  
[F10]  
[CURSOR ARROWS]  
[EOB]



Tutor keypad.

The *Change Settings Menu* is used to switch on and off the various options available within the machine controlling software.

Select the *Main Menu* by pressing the [F10] / {F10} key. Highlight 'Settings' using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key to confirm this choice.



At the *Change Settings Menu*, select the required option and press the [EOB] / {Enter} key.

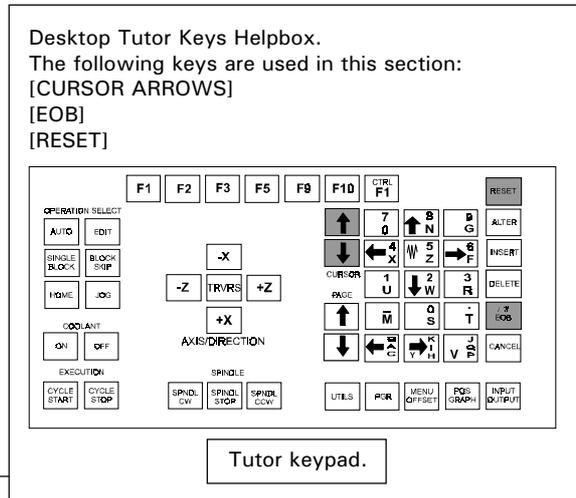
# CHANGE SETTINGS - MENU.



The *Change Settings Menu* contains nine options:

- 1) *Editor*. This option allows the CNC File Editor window to be customised.
- 2) *Simulation*. This option allows the graphics and views in the Simulation window to be customised.
- 3) *Print Device*. This option allows any printers attached to the pc to be configured.
- 4) *Print Page Layout*. This option allows the layouts of any printouts to be customised.
- 5) *Machine Link*. This option allows the communication protocols between the pc on which the offline software is running and an external FANUC controller to be configured.
- 6) *Remote Link*. This option allows the communication protocols between the pc on which the offline software is running and an external device to be configured.
- 7) *Miscellaneous*. This option allows the units of measurement, user's name and screen text size to be customised.
- 8) *Load Settings*. This option allows a collection of settings to be loaded from a disk.
- 9) *Save Settings*. This option allows the current collection of settings to be saved to a disk.

# CHANGE SETTINGS - EDITOR.



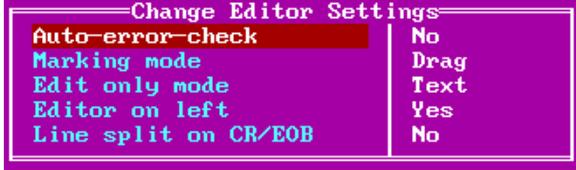
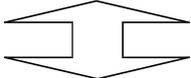
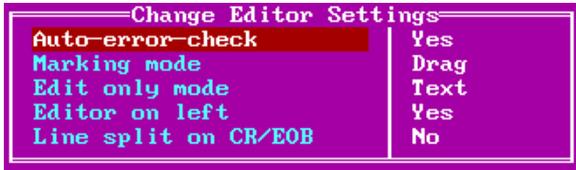
The *Change Settings (Editor) Menu* contains the following options:

1) *Auto-error Check*. This option, when set to 'Yes', will check the validity of CNC program lines as they are manually entered. When the [EOB] / {Enter} key is pressed (to signify the end of a program line) an error description box will be displayed if an error is encountered. Press the [RESET] / {Escape} key to clear the error description box. The cursor will highlight where on the program line the error occurred.

To select this option, highlight 'Auto-error Check' using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key.

The screen will indicate the current setting of the option. Continual pressing of the [EOB] / {Enter} key will toggle the option between 'Yes' and 'No'.

When the setting is correct, press the [RESET] / {Escape} key until all the menus have been removed from the screen.



# CHANGE SETTINGS - EDITOR.

## 2) *Marking Mode*.

The *Marking Mode* feature will only operate on qwerty keyboard versions of the offline software.

This option, will select between the '*Drag*' or '*Anchor*' methods of copying, moving and deleting parts of CNC Files.

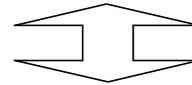
In *Anchor Mode*, program lines are not highlighted on-screen, as they are selected. In *Drag Mode*, program lines are highlighted on-screen, as they are selected.

To select this option, highlight '*Marking Mode*' using the {keyboard arrows} keys and press the {Enter} key.

The screen will indicate the current setting of the option. Continual pressing of the {Enter} key will toggle the option between '*Anchor*' and '*Drag*'.

When the setting is correct, press the {Escape} key until all the menus have been removed from the screen.

Change Editor Settings	
Auto-error-check	No
Marking mode	Anchor
Edit only mode	Text
Editor on left	Yes
Line split on CR/EOB	No



Change Editor Settings	
Auto-error-check	No
Marking mode	Drag
Edit only mode	Text
Editor on left	Yes
Line split on CR/EOB	No

# CHANGE SETTINGS - EDITOR.

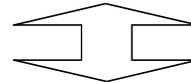
3) *Edit Only Mode*. This option toggles the preference of the *Edit Only* display between 'Text' or 'Graphics'. In *Graphics Mode* preference is given to the appearance of the alphabet characters used by the offline software (ie, the software drivers). In *Text Mode* preference is given to the computer video card, giving a slight speed increase when scrolling the text and direct access to specific character maps controlled by the video card (ie, the computer drivers).

To select this option, highlight '*Edit Only Mode*' using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key.

The screen will indicate the current setting of the option. Continual pressing of the [EOB] / {Enter} key will toggle the option between 'Text' and 'Graphics'.

When the setting is correct, press the [RESET] / {Escape} key until all the menus have been removed from the screen.

Change Editor Settings	
Auto-error-check	No
Marking mode	Drag
<b>Edit only mode</b>	Text
Editor on left	Yes
Line split on CR/EOB	No



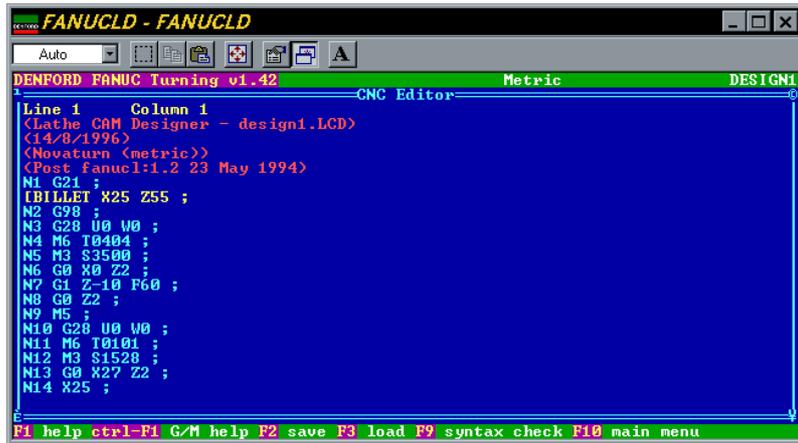
Change Editor Settings	
Auto-error-check	No
Marking mode	Drag
<b>Edit only mode</b>	Graphics
Editor on left	Yes
Line split on CR/EOB	No

continued.....

# CHANGE SETTINGS - EDITOR.

3) *Edit Only Mode*. continued.....

'*Edit Only Mode*' set to '*Text*'.

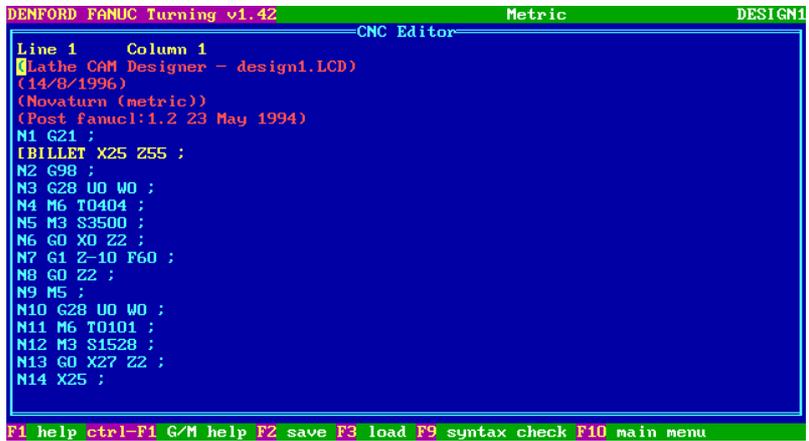


The screenshot shows a window titled 'FANUCCLD - FANUCCLD' with a standard Windows-style title bar. Below the title bar is a menu bar with 'Auto' and several icons. The main area is a green header bar with 'DENFORD FANUC Turning v1.42' on the left, 'CNC Editor' in the center, 'Metric' on the right, and 'DESIGN1' on the far right. The main text area has a blue background and displays the following text:

```
Line 1      Column 1
(Lathe CAM Designer - design1.LCD)
(14/8/1996)
(Novaturn (metric))
(Post fanuc1:1.2 23 May 1994)
N1 G21 ;
I BILLET X25 Z55 ;
N2 G98 ;
N3 G28 U0 W0 ;
N4 M6 T0404 ;
N5 M3 S3500 ;
N6 G0 X0 Z2 ;
N7 G1 Z-10 F60 ;
N8 G0 Z2 ;
N9 M5 ;
N10 G28 U0 W0 ;
N11 M6 T0101 ;
N12 M3 S1528 ;
N13 G0 X27 Z2 ;
N14 X25 ;
```

At the bottom, a green status bar contains the text: 'F1 help ctrl-F1 G/M help F2 save F3 load F9 syntax check F10 main menu'.

'*Edit Only Mode*' set to '*Graphics*'.



The screenshot shows a window titled 'DENFORD FANUC Turning v1.42' with a standard Windows-style title bar. Below the title bar is a menu bar with 'Auto' and several icons. The main area is a green header bar with 'DENFORD FANUC Turning v1.42' on the left, 'CNC Editor' in the center, 'Metric' on the right, and 'DESIGN1' on the far right. The main text area has a blue background and displays the following text:

```
Line 1      Column 1
(Lathe CAM Designer - design1.LCD)
(14/8/1996)
(Novaturn (metric))
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I BILLET X25 Z55 ;
N2 G98 ;
N3 G28 U0 W0 ;
N4 M6 T0404 ;
N5 M3 S3500 ;
N6 G0 X0 Z2 ;
N7 G1 Z-10 F60 ;
N8 G0 Z2 ;
N9 M5 ;
N10 G28 U0 W0 ;
N11 M6 T0101 ;
N12 M3 S1528 ;
N13 G0 X27 Z2 ;
N14 X25 ;
```

At the bottom, a green status bar contains the text: 'F1 help ctrl-F1 G/M help F2 save F3 load F9 syntax check F10 main menu'.

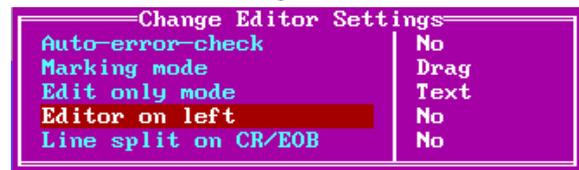
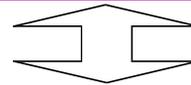
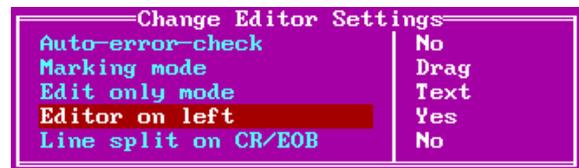
# CHANGE SETTINGS - EDITOR.

4) *Editor On Left*. This option, when set to 'Yes', will display the CNC Editor window on the left side of the screen (when the control is set in 'Edit and Simulate' Mode). Selecting 'No' will display the CNC Editor window on the right side of the screen (when the control is set in 'Edit and Simulate' Mode).

To select this option, highlight 'Editor On Left' using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key.

The screen will indicate the current setting of the option. Continual pressing of the [EOB] / {Enter} key will toggle the option between 'Yes' and 'No'.

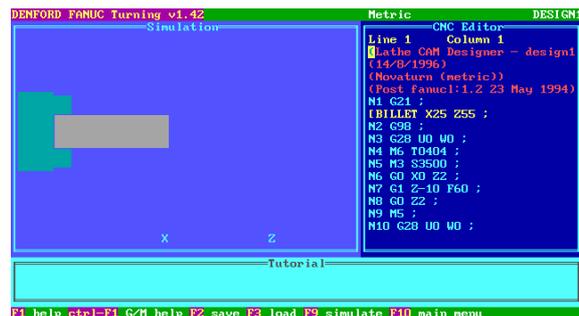
When the setting is correct, press the [RESET] / {Escape} key until all the menus have been removed from the screen.



'Editor On Left' set to 'Yes'.



'Editor On Left' set to 'No'.



# CHANGE SETTINGS - EDITOR.

## 4) *Line Split On CR/EOB.*

The *Line Split On CR/EOB* feature will only operate on qwerty keyboard versions of the offline software.

When this option is set to 'Yes', the cursor can be used to split a program line apart. For example, when the cursor is positioned in the middle of a long program line, pressing the {Enter} key will create a new program line. Any program words which originally appeared after the cursor are now transferred to this new program line.

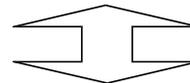
When this option is set to 'No', pressing the {Enter} key will insert a new (blank) program line, after the program line on which the cursor is currently positioned. The original program line will be unaffected by this procedure.

To select this option, highlight '*Line Split On CR/EOB*' using the {keyboard arrows} keys and press the {Enter} key.

The screen will indicate the current setting of the option. Continual pressing of the {Enter} key will toggle the option between 'Yes' and 'No'.

When the setting is correct, press the {Escape} key until all the menus have been removed from the screen.

Change Editor Settings	
Auto-error-check	No
Marking mode	Drag
Edit only mode	Text
Editor on left	Yes
Line split on CR/EOB	Yes



Change Editor Settings	
Auto-error-check	No
Marking mode	Drag
Edit only mode	Text
Editor on left	Yes
Line split on CR/EOB	No

# CHANGE SETTINGS - SIMULATION.

Desktop Tutor Keys Helpbox.  
The following keys are used in this section:  
[CURSOR ARROWS]  
[EOB]  
[RESET]

Tutor keypad.

The *Change Settings (Simulation) Menu* contains the following options:

1) *Simulation Window*. This option will switch the size of the graphical simulation window between wide and normal.

Normal splits the display screen to 50% editor window and 50% graphical simulation window. Wide increases the graphical simulation window, at the expense of the Editor window size.

To select this option, highlight '*Simulation Window*' using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key.

The screen will indicate the current setting of the option. Continual pressing of the [EOB] / {Enter} key will toggle the option between '*normal*' and '*wide*'.

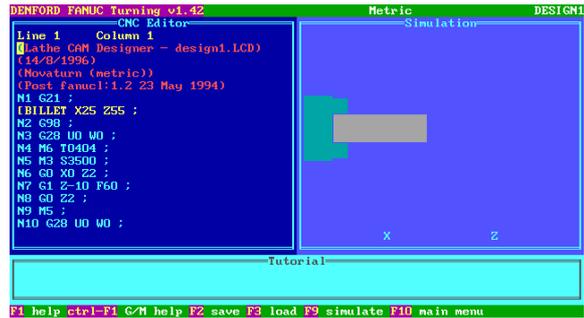
When the setting is correct, press the [RESET] / {Escape} key until all the menus have been removed from the screen.

continued....

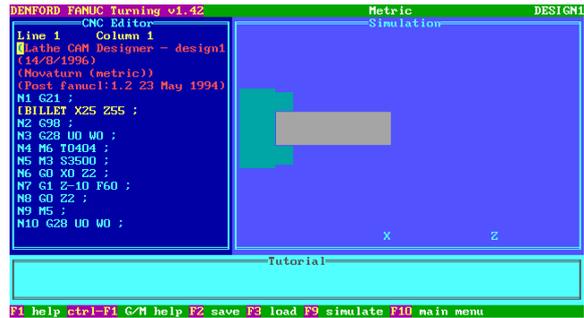
# CHANGE SETTINGS - SIMULATION.

## 1) Simulation Window. continued....

Simulation Window set to 'Normal'.



Simulation Window set to 'Wide'.

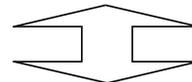


2) *Show 3d*. This option, when set to 'Yes', will display the work as a three dimensional object.

To select this option, highlight '*Show 3d*' using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key.

The screen will indicate the current setting of the option. Continual pressing of the [EOB] / {Enter} key will toggle the option between 'On' and 'Off'.

When the setting is correct, press the [RESET] / {Escape} key until all the menus have been removed from the screen.

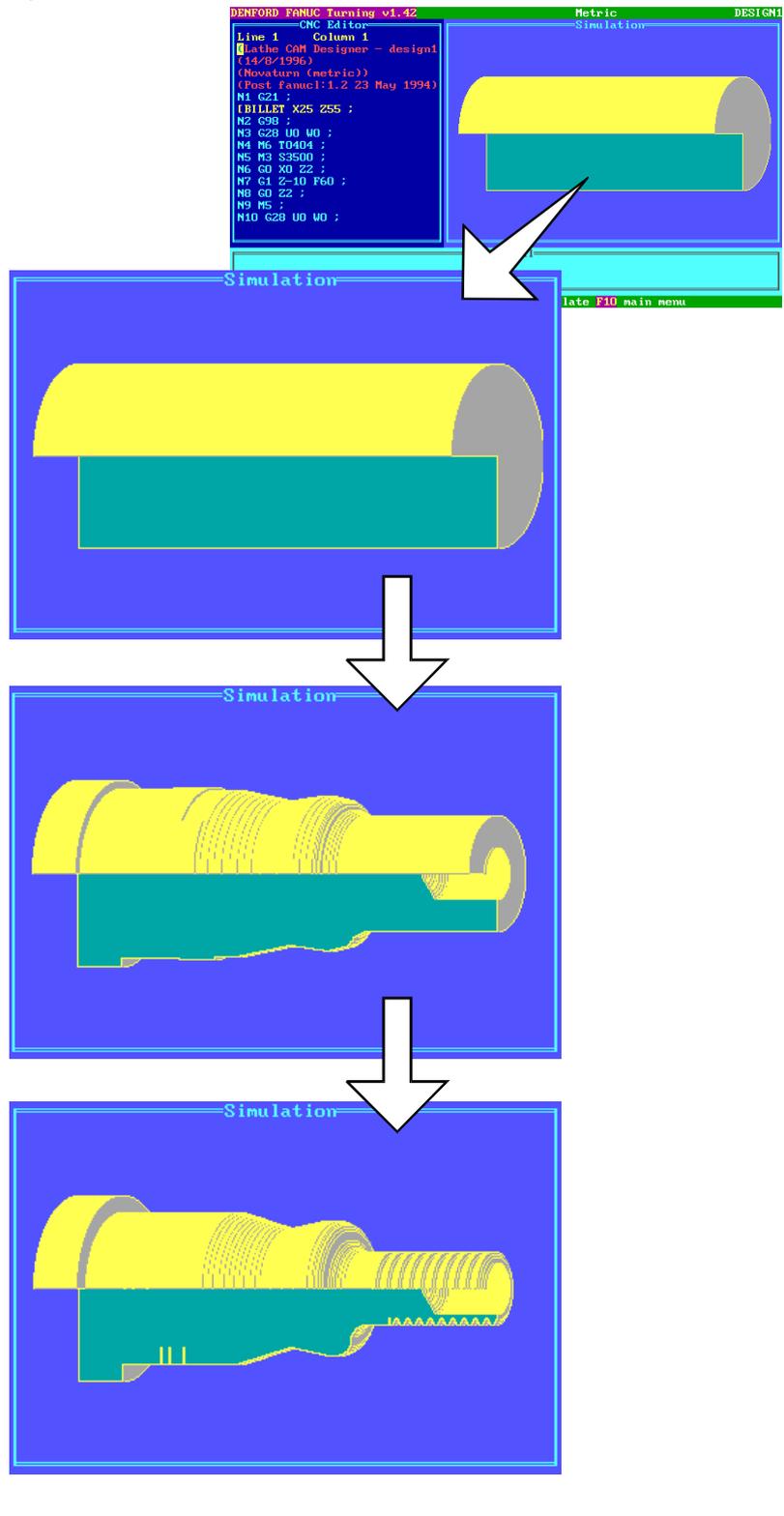


continued.....

# CHANGE SETTINGS - SIMULATION.

2) Show 3d. continued.....

When 'Run Program' is selected, the work will be displayed in 3d, throughout the running of the program cycle.



# CHANGE SETTINGS - SIMULATION.

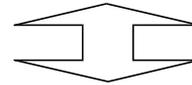
3) *Display Fast Traverses*. This option is active when set to 'Yes' (not available for 3d views).

*Display Fast Traverses*, when set to 'Yes', will show all fast traverse movements as yellow dotted lines. Lines cut into the billet are shown in white.

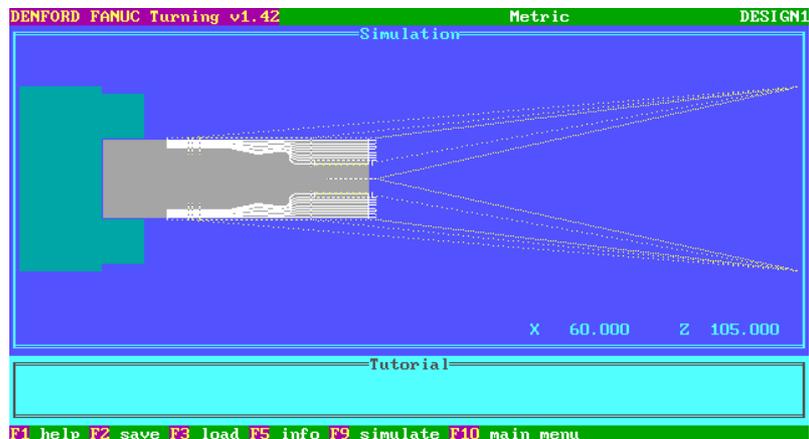
To select this option, highlight '*Short Cuts*' using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key.

The screen will indicate the current setting of the option. Continual pressing of the [EOB] / {Enter} key will toggle the option between 'Yes' and 'No'.

When the setting is correct, press the [RESET] / {Escape} key until all the menus have been removed from the screen.



*Display Fast Traverses* set to 'Yes'.



*Display Fast Traverses* set to 'No'.



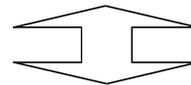
# CHANGE SETTINGS - SIMULATION.

4) *Tool Motion*. This option, when set to 'Yes' will display a graphic of the tool profile being used, showing the movement and path as it cuts the material. In order for the correct tool profiles to be shown, the tool graphics must be correctly set - see section 8.6 "Simulation Menu - Set Tooling".

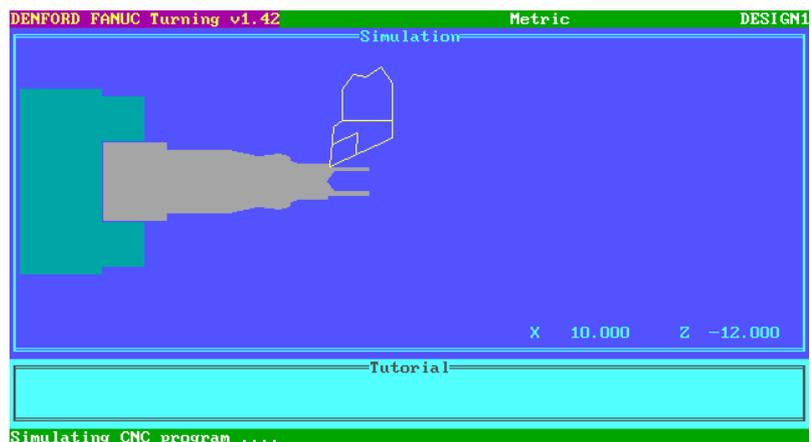
To select this option, highlight '*Tool Motion*' using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key.

The screen will indicate the current setting of the option. Continual pressing of the [EOB] / {Enter} key will toggle the option between 'Yes' and 'No'.

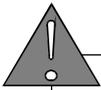
When the setting is correct, press the [RESET] / {Escape} key until all the menus have been removed from the screen.



When '*Run Program*' is selected, the tool motion will be shown , throughout the running of the program cycle. The program cycle may run slower with this option switched 'on'.

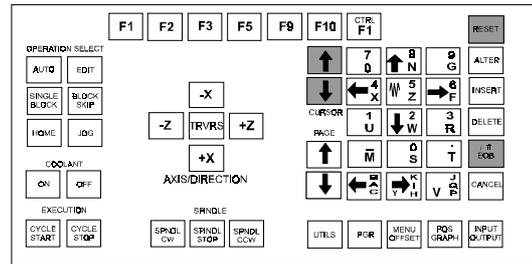


# CHANGE SETTINGS - PRINT DEVICE.



Please note - Any changes made to these settings should be carried out by either your IT Manager or computer technician.

Desktop Tutor Keys Helpbox.  
The following keys are used in this section:  
[CURSOR ARROWS]  
[EOB]  
[RESET]



Tutor keypad.

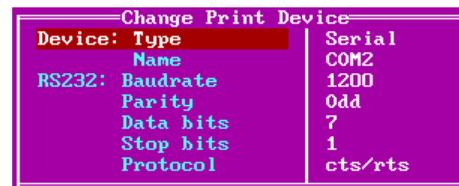
The *Print Device* option is used to configure the settings for any printers attached to the pc.

There are three different printer options, selected by pressing the [EOB] / {Enter} key when the cursor is highlighting the 'Device : Type' :

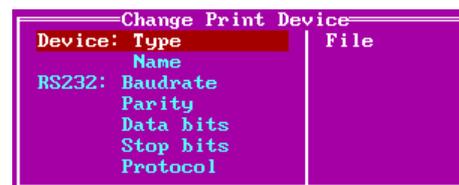
- 1) *DOS Device* - A DOS Device is normally the parallel port which can be set to LPT1. LPT2. or PRN. Select this option if your printer has a parallel port.



- 2) *Serial Device* - Select the individual settings using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key to toggle between the different values.

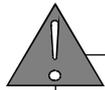


- 3) *File* - This option is used to save the CNC File on disk, for printing off at a later date. The currently loaded CNC File will be saved with an extension ".LST".



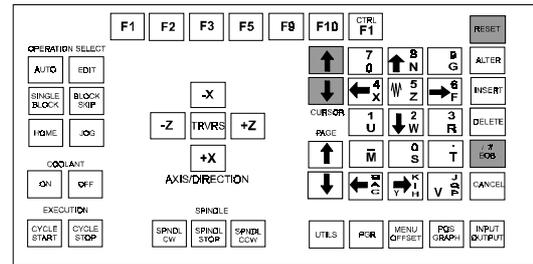
When the setting is correct, press the [RESET] / {Escape} key until all the menus have been removed from the screen.

# CHANGE SETTINGS - PRINT PAGE LAYOUT.



Please note -  
Any changes made to these settings should be carried out by either your IT Manager or computer technician.

Desktop Tutor Keys Helpbox.  
The following keys are used in this section:  
[CURSOR ARROWS]  
[EOB]  
[RESET]



Tutor keypad.

The *Print Page Layout* option is used to customise any printouts taken from the control software.

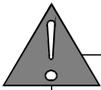
If several printers are available, save each individual setting with a different filename (see page 9.22).

Select the individual settings on the *Change Print Page Layout Menu* using the [CURSOR ARROWS] / {keyboard arrows}. Press the [EOB] / {Enter} key to move the cursor across, type in the required values, then press the [EOB] / {Enter} key to confirm the new value.

When the setting is correct, press the [RESET] / {Escape} key until all the menus have been removed from the screen.

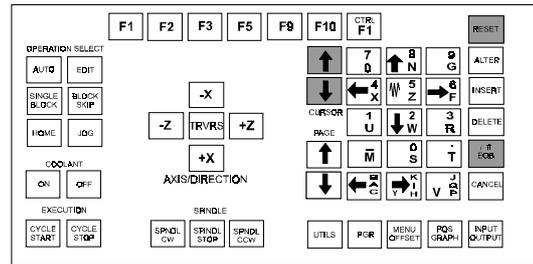
Change Print Page Layout	
Page width	80
Page depth	60
Left margin	0
Top margin	0
Bottom margin	0
Column width	80
Carriage return nulls	0
Line feed nulls	0
Form feed nulls	0
Print line feeds	Yes

# CHANGE SETTINGS - MACHINE LINK.



Please note - Any changes made to these settings should be carried out by either your IT Manager or computer technician.

Desktop Tutor Keys Helpbox.  
The following keys are used in this section:  
[CURSOR ARROWS]  
[EOB]  
[RESET]



Tutor keypad.

The *Machine Link* option is used to configure the communication protocols between the pc and an external FANUC controller.

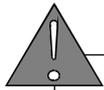
The unused serial port (usually COM2) on the pc should be used (if available) to link to the external FANUC controller.

To select the individual settings use the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key to toggle between the different values.

When the settings are correct, press the [RESET] / {Escape} key until all the menus have been removed from the screen.

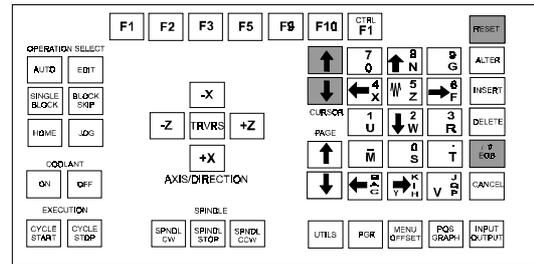


# CHANGE SETTINGS - REMOTE LINK.



Please note -  
Any changes made to these settings should be carried out by either your IT Manager or computer technician.

Desktop Tutor Keys Helpbox.  
The following keys are used in this section:  
[CURSOR ARROWS]  
[EOB]  
[RESET]



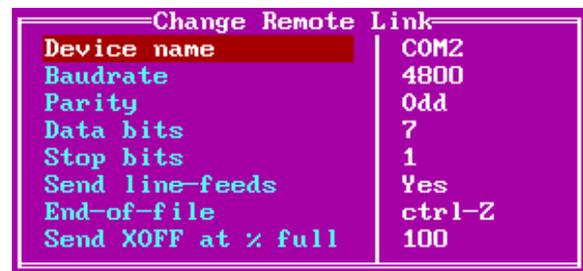
Tutor keypad.

The *Remote Link* option is used to configure the communication protocols between the pc and an external device (such as a remote computer, paper tape punch, or printer).

The unused serial port (usually COM2) on the pc should be used (if available) to link to the external device.

To select the individual settings use the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key to toggle between the different values.

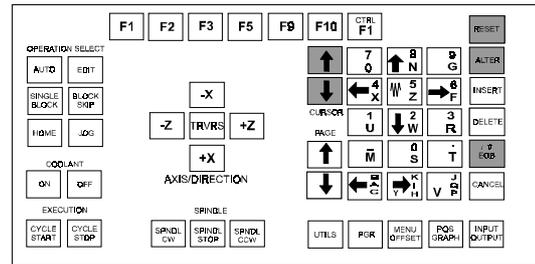
When the settings are correct, press the [RESET] / {Escape} key until all the menus have been removed from the screen.



# CHANGE SETTINGS

## - MISCELLANEOUS.

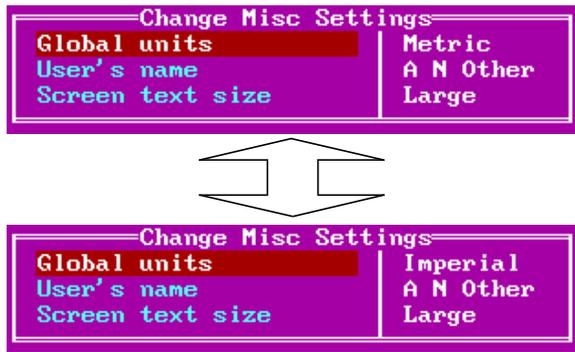
Desktop Tutor Keys Helpbox.  
 The following keys are used in this section:  
 [CURSOR ARROWS]  
 [EOB], [RESET], [ALTER]  
 [NUMBERS] - not highlighted



Tutor keypad.

The *Change Settings (Miscellaneous) Menu* contains the following options:

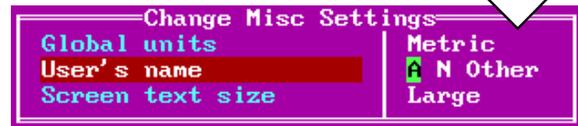
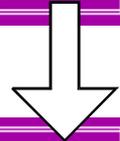
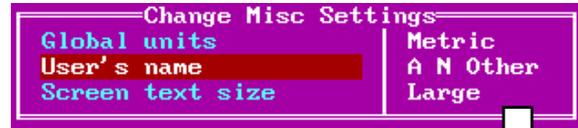
1) *Global Units*. This option, when set to 'Metric', will set the programming units of measurement as metric (millimetres). When set to 'Imperial', the programming units of measurement are set as imperial (inches).  
 To select this option, highlight 'Global Units' using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key. Continual pressing of the [EOB] / {Enter} key will toggle the option between the two settings.  
 When the setting is correct, press the [RESET] / {Escape} key until all the menus have been removed from the screen.



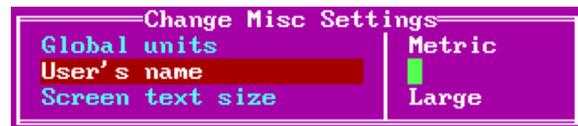
# CHANGE SETTINGS - MISCELLANEOUS.

2) *User's Name*. This option allows the user's name to be printed out on any subsequent CNC File printouts.

To select this option, highlight '*User's Name*' using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key to move the cursor across to the text '*A N Other*'.



To delete the text '*A N Other*' press the [ALTER] / {Delete} key.



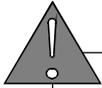
Enter the new text and press the [EOB] / {Enter} key to confirm (note - Desktop Tutor users can only enter numerical names).



When the setting is correct, press the [RESET] / {Escape} key until all the menus have been removed from the screen.

# CHANGE SETTINGS

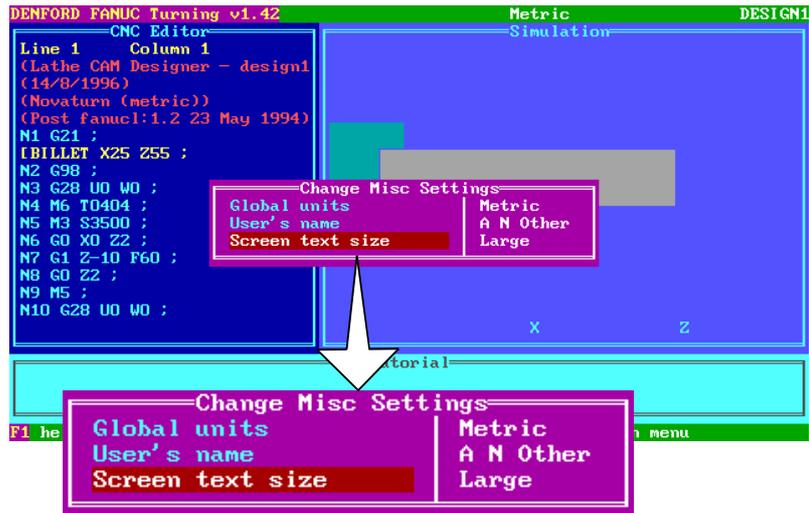
## - MISCELLANEOUS.



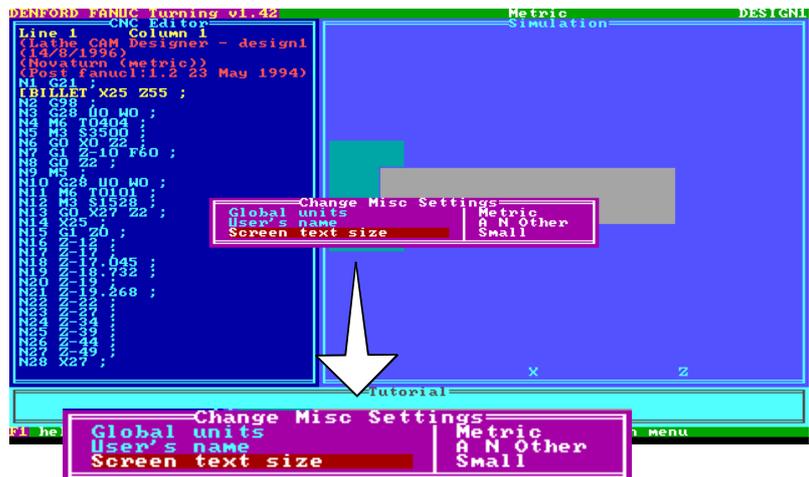
Please note -

The screen text size option will operate when the main screen display is set to "EGA" mode but will NOT operate when set to "VGA" mode. The screen mode can be altered by opening a DOS window and editing the "fanuc.go" file, found in the root of the software directory. The screenshots in section 3) are taken from "EGA" displays.

3) *Screen Text Size*. This option, when set to 'Large', will set the text size to 25 lines on screen :



When set to 'Small', the text size is set to 43 lines on screen :

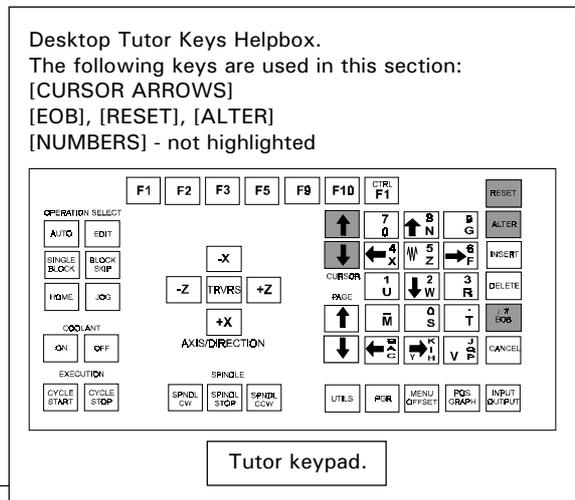


To select this option, highlight '*Screen Text Size*' using the [CURSOR ARROWS] / {keyboard arrows} keys and press the EOB] / {Enter} key. Continual pressing of the [EOB] / {Enter} key will toggle the option between the two settings.

When the setting is correct, press the [RESET] / {Escape} key until all the menus have been removed from the screen.

# CHANGE SETTINGS

## - LOAD SETTINGS.



The *Load Settings* option is used to load any previously saved offline software settings.

When the *Load Settings* option is selected, the default settings filename will appear in the edit window. The default filename is:

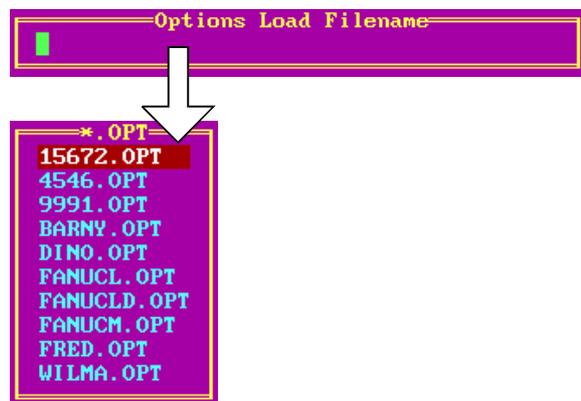
- 1) 'FANUCLD' for Desktop Tutor controlled software.



- 2) 'FANUCL' for qwerty keyboard controlled software.

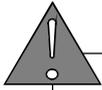


To list all of the available Settings Files, clear the edit window by pressing the [ALTER] / {Delete} key and press the [EOB] / {Enter} key. Select the required settings file from the list using the [CURSOR ARROWS] / {keyboard arrows} keys and press the [EOB] / {Enter} key to load the highlighted file.



When the Setting File has been loaded, press the [RESET] / {Escape} key until all the menus have been removed from the screen.

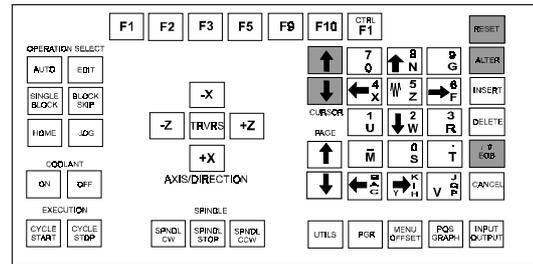
# CHANGE SETTINGS - SAVE SETTINGS.



Please note -

If the current settings file is to become the 'new' default settings file, save the file with the name 'FANUCLD' on Desktop Tutors, or 'FANUCL' on qwerty keyboards and ensure it is saved on the machines hard drive.

Desktop Tutor Keys Helpbox.  
The following keys are used in this section:  
[CURSOR ARROWS]  
[EOB], [RESET], [ALTER]  
[NUMBERS] - not highlighted



Tutor keypad.

The *Save Settings* option is used to save the currently loaded software settings.

When the *Save Settings* option is selected, the default settings filename will appear in the edit window. The default filename is:

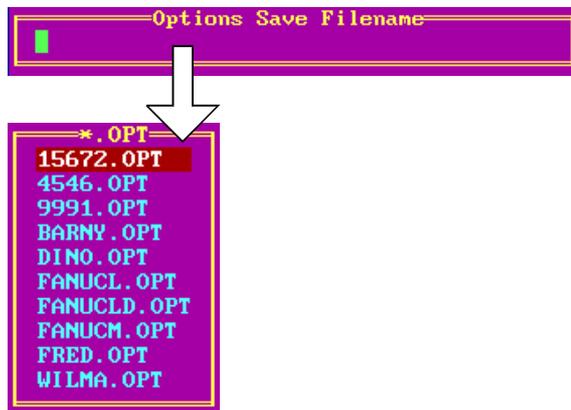
- 1) 'FANUCLD' for Desktop Tutor controlled software.



- 2) 'FANUCL' for qwerty keyboard controlled software.



If the settings are saved with this default filename, they will be reloaded as the default settings whenever the offline software is restarted. To save the settings with a different name, press the [ALTER] / {Delete} key to clear the window. Type in the 'new' filename and press the [EOB] / {Enter} key. The 'new' Settings File will be saved on the currently selected drive.



When the Settings File has been saved, press the [RESET] / {Escape} key until all the menus have been removed from the screen.

# PROGRAMMING TERMS AND CONVENTIONS.

This section describes the composition of a basic CNC part program, listing the following terms used:

- 1) Program Address characters.
- 2) G Codes used on Denford CNC Lathes.
- 3) M Codes used on Denford CNC Lathes.
- 4) Denford Directives (program codes specific to Denford CNC Machines).

# WHAT IS A PART PROGRAM ?

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

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

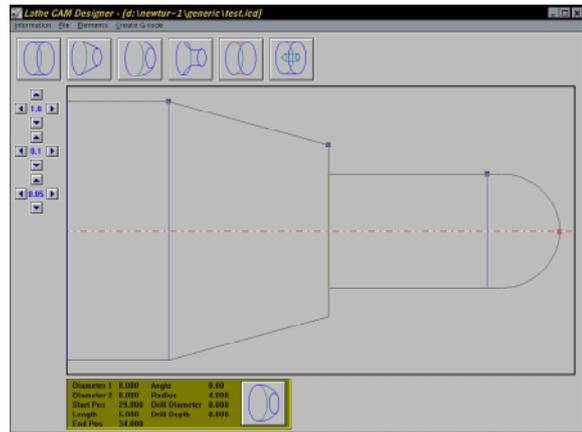
The part program can be further broken down into separate lines of data, each line describing a particular set of machining operations. These lines, which run in sequence, are called *blocks*.

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

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

These terms are illustrated on the next page....

# COMPOSITION OF A PART PROGRAM.



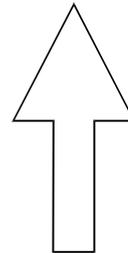
The component is designed "on-screen" using Denford's LatheCAM Designer software.

This CAD/CAM software package automatically generates a G-code part program suitable for Denford CNC machines, listed on the bottom left of this page....

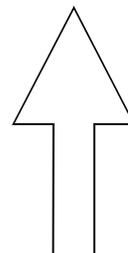
## PART PROGRAM EXAMPLE -

```
(Lathe CAM Designer - test.LCD)
(20/5/1997)
(Novaturn (metric))
(Post fanuc:1.2 23 May 1994)
N1G21
[BILLET X20 Z40]
N2G98
N3G28U0W0
N4M6T0101
N5M3S1910
N6G0X20Z2
N7X22
N8X20
N9G1Z-33.5F60
N10X22
N11G0Z2
N12X15
N13M3S2546
N14G1Z-20.8
N15X17
N16G0Z2
N17X10
N18M3S3500
N19G1Z-15.3
N20X12
N21G0Z2
N22X5
N23G1Z-0.15
N24X7
N25X22
N26G0Z2
N27G1Z0
N28X0
N29G3X8Z-4K-4
N30G1Z-5
N31Z-16
N32X12
N33M3S2122
N34X18Z-27
N35Z-34
N36X22
N37G0Z2
N38M5
N39G28U0W0
N40M30
```

## ADDRESS EXAMPLE - G



## WORD EXAMPLE - G1



## BLOCK EXAMPLE - N23G1Z-0.15;

## DENFORD DIRECTIVE EXAMPLE - [BILLET

# LISTING OF ADDRESS CHARACTERS.

- N - Defines the program line (sequence) number.
- X - Defines a position movement perpendicular to the spindle centreline (along the X axis), programmed as a diameter value. Minus (-) movements of the tool are towards the centreline of rotation, whilst positive (+) movements are away from this centreline.
- Z - Defines a position movement parallel to the spindle centreline (along the Z axis), programmed as an absolute value. Minus (-) movements of the tool are away from the headstock, whilst positive (+) movements are towards the headstock..
- G - Defines preparatory functions.
- U - Defines an incremental distance (diameter value) for a position movement parallel to the X axis.
- W - Defines an incremental distance for a position movement parallel to the Z axis.
- R - Defines an arc radius as an absolute distance.
- I - Defines an arc radius as an incremental distance (with sign) parallel to the X axis, between the start of the arc and the arc centre (arc limited to quadrant).
- K - Defines an arc radius as an incremental distance (with sign) parallel to the Z axis, between the start of the arc and the arc centre (arc limited to quadrant).
- M - Defines miscellaneous or auxiliary functions.
- T - Defines tool numbers.
- S - Defines spindle speeds, speed constraints or constant surface speeds.
- F - Defines feed rates.
- Q - Defines final contour block in automatic cycles.
- P - Defines first contour block in automatic cycles or subprogram number.

# G CODES LISTING FOR DENFORD CNC FANUC LATHES.

NOTE: NOT ALL G CODES APPLY TO EACH MACHINE.

*Grp. Code and Description.*

1	G00 Positioning (Rapid Traverse)
1	G01 Linear Interpolation (Cutting Feed)
1	G02 Circular Interpolation CW
1	G03 Circular Interpolation CCW
Ø	G04 Dwell
Ø	G10 Offset Value Setting by Program
6	G20 Imperial Data Input (Inches)
6	G21 Metric Data Input (Millimetres)
9	G22 Stored Stroke Check On
9	G23 Stored Stroke Check Off
Ø	G27 Reference Point Return Check
Ø	G28 Reference Point Return
Ø	G29 Return from Reference Point
Ø	G30 Return to 2nd Reference Point
Ø	G31 Skip Function
1	G32 Thread Cutting
1	G34 Variable Lead Thread Cutting
Ø	G36 Automatic Tool Compensation X
Ø	G37 Automatic Tool Compensation Z
7	G40 Tool Nose Radius Compensation Cancel
7	G41 Tool Nose Radius Compensation Left
7	G42 Tool Nose Radius Compensation Right
Ø	G50 Work Co-ord. Change/Max. Spindle Speed Setting
Ø	G65 Macro Call
12	G66 Macro Modal Call
12	G67 Macro Modal Call Cancel
4	G70 Finishing Cycle
4	G71 Stock Removal in Turning
Ø	G72 Stock Removal in Facing
Ø	G73 Pattern Repeating
Ø	G74 Peck Drilling in Z Axis
Ø	G75 Grooving in X Axis
Ø	G76 Thread Cutting Cycle

# G CODES LISTING FOR DENFORD CNC FANUC LATHES.

- 1 G90 Cutting Cycle A
- 1 G92 Thread Cutting Cycle
- 1 G94 Cutting Cycle B
- 2 G96 Constant Surface Speed Control
- 2 G97 Constant Surface Speed Control Cancel
- 11 G98 Feed Per Minute
- 11 G99 Feed Per Revolution

## NOTES.

G codes from group 0 are non-modal (they must be programmed into every program block when required).

All other G codes are modal (they remain active through subsequent program blocks, until replaced or cancelled by a G code from their particular group).

# M CODES LISTING FOR DENFORD CNC FANUC LATHES.

NOTE: NOT ALL M CODES APPLY TO EACH MACHINE.

*Code. Description.*

M00*	Program Stop
M01*	Optional Stop
M02*	Program Reset
M03	Spindle Forward
M04	Spindle Reverse
M05*	Spindle Stop
M06	Auto Tool Change
M07	Coolant "B" ON
M08	Coolant "A" ON
M09*	Coolant OFF
M10	Chuck Open
M11	Chuck Close
M13	Spindle Forward and Coolant On
M14	Spindle Reverse and Coolant On
M15	Program Input Using "MIN P" (Special Function)
M16	Special Tool Call (Tool Call ignores Turret)
M19	Spindle Orientate
M20	Spindle Index A
M21	Spindle Index 2A
M22	Spindle Index 3A
M23	Spindle Index 4A
M25	Quill Extend
M26	Quill Retract
M29	Select "DNC" Mode
M30	Program Reset and Rewind
M31	Increment Parts Counter
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

# M CODES LISTING FOR DENFORD CNC FANUC LATHES.

M48	Lock % Feed and % Speed at 100%
M49	Cancel M48 (Default)
M50	Wait for Axis in Position Signal (cancels Continuous Path)
M51	Cancel M50 (Default)
M52	Pull-out in Threading = 90 Degrees (Default)
M53	Cancel M52
M54	Disable Spindle Fluctuation Testing (Default)
M56	Select Internal Chucking (from PLC Edition "F")
M57	Select External Chucking (from PLC Edition "F")
M62	Aux. 1. On
M63	Aux. 2. On
M64	Aux. 1. Off
M65	Aux. 2. Off
M66*	Wait for Input 1
M67*	Wait for Input 2
M68	Only Index with all Axes at Home Position
M69	Index Turret Anywhere
M7Ø	Mirror in X On
M76	Wait for Input 1 to go Low (from Revision C)
M77	Wait for Input 2 to go Low (from Revision C)
M8Ø	Mirror in X Off
M98	Sub-Program Call
M99	Sub-Program End

## NOTES.

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

# DENFORD DIRECTIVES.

Directives are program terms defined by Denford Limited.

They are used to help generate the graphics used in *Edit and Simulate Mode* and *Simulate only Mode*.

## [BILLET

This directive allows a billet that appears in a simulation window to be given a size. The billet definition should be placed at the start of a program, after the units of measurement have been set.

Example:

```
G21
```

```
[BILLET X5Ø.Ø Z1ØØ.Ø
```

This sets the measure to metric (Note - if set to Imperial the units would be inches) and defines the billet as 1ØØmm long with a diameter of 5Ømm. Note that the length does not include the "extra" material required by the headstock chuck jaws.

## [SUBPROGRAM

This directive allows a program with a non-numeric name to be called as a subprogram.

Example:

```
[SUBPROGRAM Ø2ØØ FRED
```

```
M98 PØ2ØØ
```

This example assigns a subprogram number of Ø2ØØ to the program named FRED, then calls the subprogram Ø2ØØ.

## [STEP

This directive runs an on-screen program in single steps. This means the program will run one program line, then wait for the operator to prompt it to move to the next line; this continues until the program is instructed to stop this function.

The directive applies to both simulation and actual machining with a program.

# DENFORD DIRECTIVES.

## **[NO STEP**

This directive runs an on-screen program without single steps. This means the program will run as originally intended with no pausing, unless a pause is requested from within the program itself.

The directive applies to both simulation and actual machining with a program.

## **[SHOW**

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

## **[NOSHOW**

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

## **! (Qwerty keyboard offline software only)**

An exclamation mark is used to display a message in the tutorial messages window (shown in the lower part of the screen). The message will be shown until it is either cleared or replaced by another message.

Tutorial messages are shown coloured green, within the program, on-screen.

Example:

## **! NOW CUTTING THREAD**

This example would print the line "NOW CUTTING THREAD" in the tutorial messages window in the lower part of the screen.

# DENFORD DIRECTIVES.

**?** (Qwerty keyboard offline software only)

A question mark is used to display a message in the tutorial messages window (shown in the lower part of the screen). When the message is displayed the program will stop. A keypress is required to set the program running again. Any messages will be shown until they are either cleared or replaced by another message.

Tutorial messages are shown coloured green within the program, on-screen.

Example:

**? CHECK SURFACE FINISH OF TAPER**

This example would print the line "CHECK SURFACE FINISH OF TAPER" in the tutorial messages window and stop the program. A key would need to be pressed to allow the program to continue.

**[CLEAR** (Qwerty keyboard offline software only)

This clears any messages currently displayed in the tutorial messages window.

# GLOSSARY.

ABSOLUTE	In absolute programming, zero is the point from which all other dimensions are described.
ARC	A portion of a circle.
AUTOMATIC CYCLE	A mode of control operation that continuously runs a cycle or stored program until a program stop or end of program word is read by the controller.
AUXILIARY FUNCTION	The function of the CNC machine (ie, F, S, T, M codes etc.), other than co-ordinate based commands.
AXIS (AXES)	The planes of movement for the cutting tool, usually referred to as X (running at 90 degrees to the spindle centreline) and Z (running parallel to the spindle centreline).
BILLET	The actual material being machined, sometimes referred to as the "workpiece".
BLOCK	A collection of program words that collectively describe a machining operation.
CHARACTER	A number, letter or symbol as entered into a CNC program.
CIRCULAR INTERPOLATION	G-code term for a programmed arc movement.
COMMAND	A signal (or group of signals) instructing one step/operation to be carried out.
CNC	Computer Numerical Control.
CYCLE	A sequence of events or commands.
DATUM	The point (co-ordinate) from which a series of measurements are taken.

DESKTOP TUTOR	The input control keypad for the machine. Keypad overlays are interchangeable according to the type of controller required.
DIRECTORY	An area of a disk containing the names and locations of the files it currently holds.
DISK	A computer information storage device, examples, C: (drive) is usually the computers hard (internal) disk and A: (drive) is usually the floppy (portable 3.5" diskette) disk.
DRIVE	The controller unit for a disk system.
DRY RUN	An operation used to test how a CNC program will function without driving the machine itself.
DWELL	A programmed time delay.
EDIT	The mode used for altering the content of a CNC program via the Desktop Tutor or qwerty keyboard.
END OF BLOCK SIGNAL	A symbol or indicator that defines the end of a block of data. The 'pc' equivalent of the 'return' key.
ERROR	The deviation of an attained value from a desired value.
G-CODE	The programming language understood by the machine controller.
FILE	An arrangement of instructions or information, usually referring to work or control settings.
FORMAT	The pattern or way that data is organised.
G CODE	A preparatory code function in a CNC program that determines the control mode.
HARDWARE	Equipment such as the machine tool, the controller, or the computer.

INCREMENTAL	Incremental programming uses co-ordinate movements that are related from the previous programmed position. Signs are used to indicate the direction of movement.
INPUT	The transfer of external information (data) into a control system.
INTERFACE	The medium through which the control/computer directs the machine tool.
M CODE	A miscellaneous code function in a CNC program used to indicate an auxiliary function (ie, coolant on, tool change etc.).
MACHINE CODE	The code obeyed by a computer or microprocessor system with no need for further translation.
MDI	MDI - Manual Data Input is the method used for inserting data into the control system (ie, Desktop Tutor, qwerty keyboard etc.).
MODAL	Modal codes entered into the controller by a CNC program are retained until changed by a code from the same modal group or cancelled.
NC	Numerical control.
PC	Personal computer.
PROGRAM	A systematic arrangements of instructions or information to suit a piece of equipment.
SOFTWARE	Programs, tool lists, sequence of instructions etc.....
TOOLPOST	The holder for the various cutting tools. ATCs (Automatic Tool Changers) are mounted above the spindle centreline, whilst manual toolposts are mounted below it.
WORD	A combination of a letter address and digits, used in a CNC program (ie, G42, M04 etc.).

