

TRIAC
OFF-LINE PROGRAMMING
INSTRUCTION GUIDE

DENFORD

COMPUTERISED MACHINES AND SYSTEMS

TRIAC

OFF-LINE PROGRAMMING

INSTRUCTION GUIDE

SECTION 1

TRIAC SOFTWARE SYSTEM

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1.0 CONTENT OF SOFTWARE PACKAGE

- 3 DISKS
 1. SYSTEM DISK.
 2. EXAMPLES DISK & HELP MESSAGES IN TEXT FORMAT.
 3. DRIVERS DISK.
- PARALLEL DONGLE.
- CABLE FOR COMPUTER-TRIAC CONNECTION.

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1.1 INSTALLATION

Before attempting to run the Triac system you should copy it onto a suitable disk, either hard or floppy and put the originals in a safe place.

If you are copying the system onto floppy disks remember that the system disk will only just fit onto one 360Kb floppy, without DOS. You can use the 'B' drive, with the path set to 'B:', for data if you are using this option. 720Kb drives will run the System with room for program data.

To copy the Triac System onto your hard drive use the following procedure.

- Make a sub-directory in the root directory of your C drive by typing:

```
C: <RETURN>
```

```
CD\ <RETURN>
```

```
MD DENFORD <RETURN>
```

- Insert the first of the supplied disks into the A drive of your computer.

- Change directory to the one you have just created by typing:

```
CD DENFORD <RETURN>
```

- Copy all the files from the A drive by typing:

```
COPY A:.* <RETURN>
```

- Repeat this process for the other disks.

To copy the Triac System onto other floppy disks use the following procedure:

- Insert the first original into the A drive and a blank disk into the B drive.

- Type:

```
COPY A:.* B:.* <RETURN>
```

- Repeat this process for the other disks.

Once you have copied all the files from the supplied disks the Triac System can be installed, to do this type:

```
Triac -c <RETURN>
```

NOTE: This is not required under normal circumstances.

1.2 BATCH FILES, SET COMMANDS

To run the Triac System from a copy on hard drive (C:) :

- Change directory to the one containing the Starmill System, in this case C:\DENFORD by typing:
C: <RETURN>
CD DENFORD <RETURN>
- Run the system by typing:
TRIAC <RETURN>

To run the Triac System from a copy on dual floppy drives:

- Insert the System disk into drive A and the Example disk into drive B
- Run the system by typing:
TRIAC <RETURN>

To run the Triac System from a copy on a single floppy drive:

- Insert the System disk into drive A
- Run the system by typing:
TRIAC <RETURN>
- Replace the System disk with the example disk or a blank formatted disk for program data

NOTE:

Before you run the Triac System make sure that you connect the dongle to the parallel port of your computer.

1.2

SET COMMANDS

Set commands are commands that can be placed in a batch file to customise the system to individual users. The different set commands are as listed below.

set denford_data = pathname

This sets the default path for the storing of CNC programs etc.

set denford_cfg = pathname

This sets the default path for storing the options files.

Set commands can be placed in a batch file and automatically activated by typing the batch file name.

1.2 Example of Batch File

To create a batch file in the root directory to run the Triac System make sure you are in the root directory and type:

```
copy con Triac.bat
cd \denford
Triac
cd \
^Z {Ctrl Z}
```

This will create a batch file in the root directory called Triac. The Triac System is then executed by either by typing Triac or from an individualised batch file as described below.

To create an individualised batch file type:

```
copy con jim.bat
set denford_data=c:\jim
set denford_cfg=c:\jim
Triac
^Z {Ctrl Z}
```

This creates a batch file called jim in the current directory. To run the batch file type jim and press return.

The path for saving the CNC programs and the options files is c:\jim.

Finally the batch file runs the Triac System batch file which you have created.

Note:

If the final line is altered to read

```
Triac %1
```

This will allow the user to load a CNC program at the same time as the system is loaded.

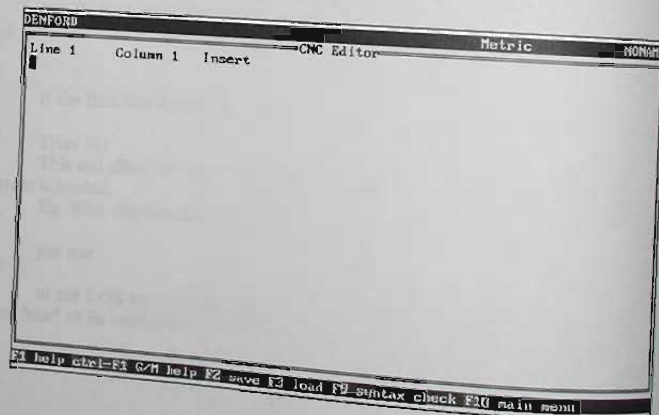
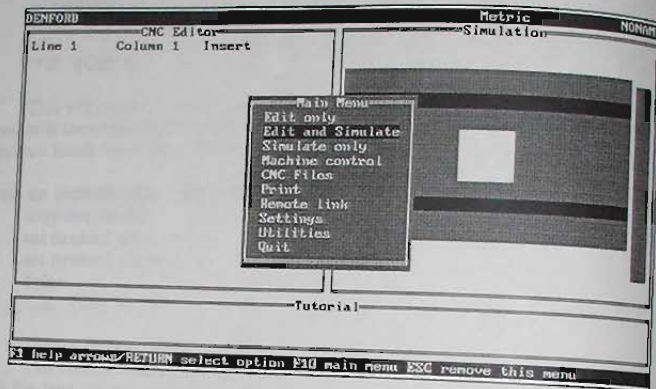
Eg. With this line altered typing:

```
jim star
```

at the DOS prompt will cause the system to be loaded and the CNC program "star" to be loaded into the editor.

1.3 THE

1.3 SCREENS SHOWING SYSTEM IN EDIT AND SIMULATION MODE AND IN EDIT ONLY MODE



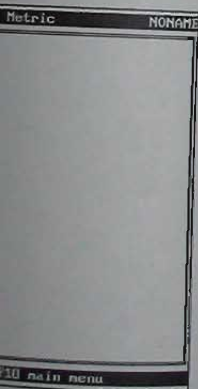
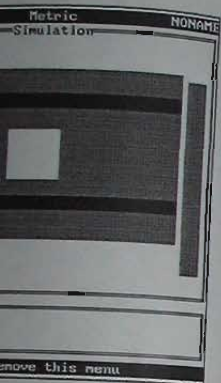
1.3.0 INTRO

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1.3.0 INTRODUCTION

The Triac CNC editor incorporates all the features you would expect to find in any professional editor.

These features include:

Insert, Delete, Move, Copy and Block functions.

These functions are described in more detail on the following pages.

1.3.1 DIFFERENT TYPES OF INPUT

There are different types of input for the various functions of the system. They are as follows:

Comment-

A comment is used to insert information into the program that does not actually affect the running of the CNC program. To insert a comment type a (as the first character of the line.

The text colour will change to RED.

Eg. (Program written by John Smith

G or M Codes-

This is the normal mode for programming in the editor, no special key is used to define this option.

The text colour is CYAN.

Tutorials-

Tutorials are used to display information in the box at the bottom of the screen. There are two types of tutorial:

A. Using ! as the first character of the line. This displays text in the tutorial box as the CNC program is running and scrolls it upwards as it is replaced by the next tutorial.

Eg. ! Moving to start of cycle

B. Using ? as the first character of the line. This has the same effect as using ! as the first character of the line, but when displaying the tutorial it pauses the program and waits for the RETURN key to be pressed.

Eg. ? Check for clearance above work

The text colour for both types of tutorial is GREEN.

1.3.1

Directives-

Directive
program. There are

A. [billet

This is us

Eg.

[billet 118

sets the b

length =

Note:

This must

B. [edgem

This is use
to simulate more accu

Eg.

[edgemove

This states
the program datum in
the -y direction.

Note:

This statem

1.3.1

Directives-

Directives are used to input information that is to be used by the program. There are four types of directive:

A. [billet

This is used to set the size of the billet and the datum position.

Eg.

[billet l180 w60 d20

sets the billet size to:-

length = 180, width = 60, depth = 20

Note:

This must be the first line of any CNC program.

B. [edgemove

This is used to move the billet position on the table. Only required to simulate more accurately the Triac machine.

Eg.

[edgemove x-10 y-20

This states that the bottom left corner of the billet is 10 mm from the program datum in the -x direction and 20 mm from the program datum in the -y direction.

Note:

This statement should follow the [billet statement.

1.3.1

C. [tooldef

This is used to define the tools that you are going to use when machining the program. The number of tools that you can define depends on the machine configuration.

For either a standard machine with manual toolchanger or if using the simulator alone the range is 0 to 9.

Note:

All [tooldef directives should directly follow the [billet directive.

Eg. [tooldef T1 D6 L65

Specifies: the tool No., tool Dia., tool length.

The tool length is the distance from the spindle nose to the bottom face of the cutter. This length, when used will allow the simulation to check for overtravel on the z axis. The default value is 65mm.

D. [clear

This is used in conjunction with the tutorial option and clears the tutorial box when the CNC program reaches that line during execution.

The text colour for directives is YELLOW.

1.3.2 EDITOR KEYS

The main control keys for the editor are as follows:

Cursor keys-	Move cursor in appropriate direction.
DEL-	Deletes one character at the cursor.
Backarrow-	Deletes one character to the left of the cursor.
INS-	Toggles between insert and overwrite.
HOME-	Moves to start of line.
END-	Moves to end of line.
PGUP-	Moves up one page.
PGDN-	Moves down one page.
Ctrl PGUP-	Moves to first line.
Ctrl PGDN-	Moves to last line.
Ctrl Y-	Deletes all of the current line.
Ctrl N-	Inserts a new blank line.
Ctrl R-	Restores line after edits.

(this is only possible if you have not moved the cursor off the line)

1.3.2

These keys relate to block edits:

F7-	Sets the start of a marked area.
F8-	Sets the end of a marked area.
Alt D-	Deletes marked area.
Alt M-	Moves marked area to current cursor position.
Alt C-	Copies marked area to current cursor position.
F2-	Quick saves the current CNC program, if it has been given a name.
F3-	Quick loads of a different program.

Other Function Keys:

F10-	Displays the main menu.
F9-	Simulation menu.
F5-	Information window.
Alt Q-	This will QUIT the Triac System and return to DOS

Note: This option will prompt the user to save any file that has been altered !

1.3.3 MARKING AN AREA

To Define a block:

- Position the cursor in the editor.
- Press F7 to define the start point.
- Moving the cursor up and down highlight a marked area.
- Press F8 to confirm a marked area.

Note:

- The settings option allows two modes for marked areas. Anchor or Drag.

To undefine a block press F8 again.

To Move a marked area:

If you are sure that the correct area has been marked you can:-

- Move the cursor to the new start position for the marked area.
- Press alt M to move the block to its new position.

To Copy a block:

If you are sure that the correct area has been marked you can:-

- Move the cursor to the new start position for the marked area.
- Press alt C to copy the block to its new position.

To Delete a block:

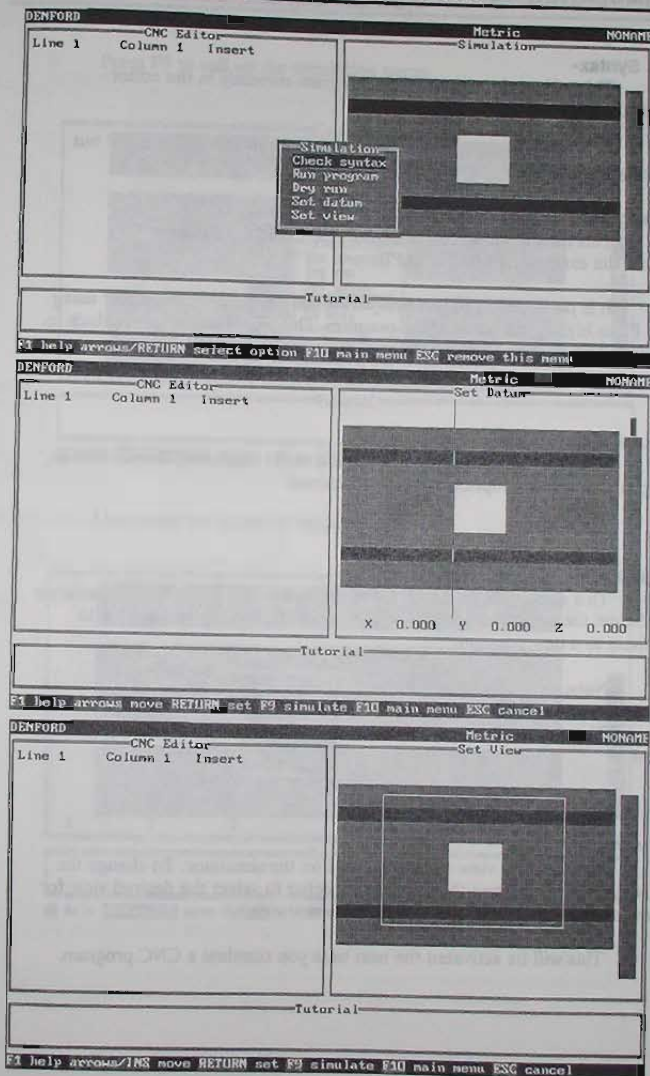
If you are sure that the correct area has been marked you can:-

- Press alt D to delete the marked area.

1.3.4 LIMITATIONS WHEN PROGRAMMING

- 1. Nesting of subroutines should only be attempted to 10 levels.
- 2. Subroutines should always be written one after another, never inside each other.
- 3. Subroutines are limited to 50
- 4. The line length of the editor is 240 characters.
- 5. The editor has a memory limit of 64K.

1.4 SIMULATION MENU, SET DATUM & VIEW



1.4 SIMULATION MENU (F9)

Check Syntax-

This will go through the CNC program currently in the editor checking the syntax.

Note: It is possible for a program to pass this test and still not but still not be machinable

Run Program-

This runs the program currently held in the CNC editor. To terminate the execution press ESCAPE.

It is possible to run just one part of the program on the editor using F7 and F8 to highlight a block of the program. This will cause only this block to be simulated when the program is executed.

Dry Run-

This will run the program without actually displaying the simulation, making sure that the component can be machined.

Set Datum-

This allows you to simulate the tool offset option whilst in simulation mode. Select the option to display the crosshairs and use the cursor keys to move them to a new position.

Note:

This setting is overwritten as soon as the machine control option is selected.

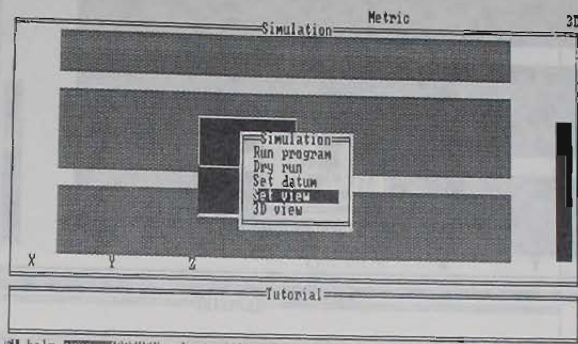
Set View-

This sets the view to be displayed on the simulator. To change the view, select this option and then use the spacebar to select the desired view for the simulator. Press RETURN to accept the new view.

This will be activated the next time you simulate a CNC program.

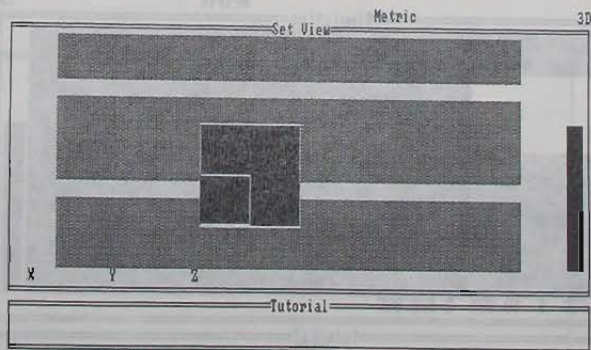
1.4.1 SIMULATION MENU (3D VIEWS)

Press F9 to call up the simulation menu.



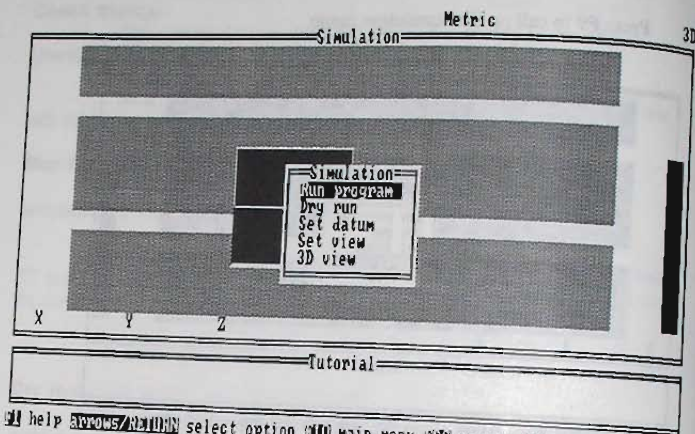
help arrows/INS select option F10 main menu ESC remove this menu

Use space bar to select required view.

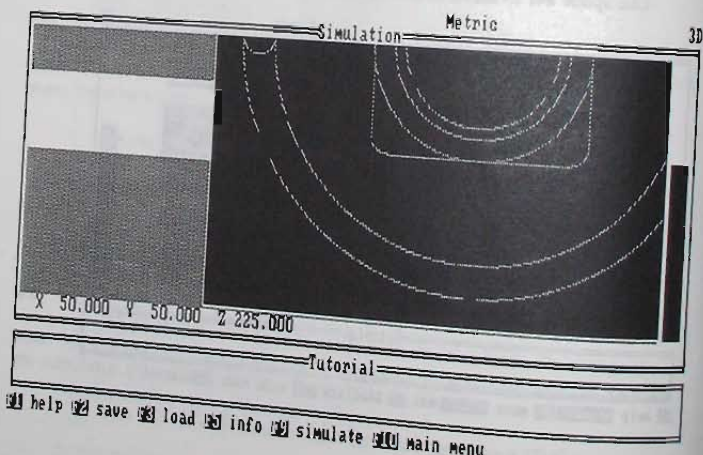


help arrows/INS move RETURN set F9 simulate F10 main menu ESC cancel

SELECT RUN PROGRAM



help arrows/MAIN select option GO main menu ESC remove this menu



help save load info simulate GO main menu

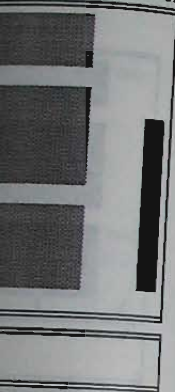
USE CURSOR

help arrows

PRESS HOME

help arrows/

3D

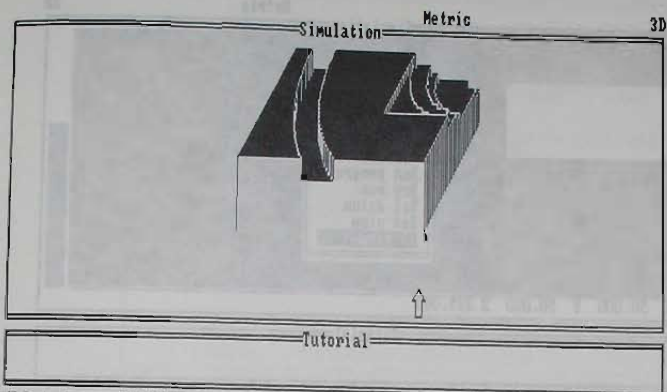


this menu

3D

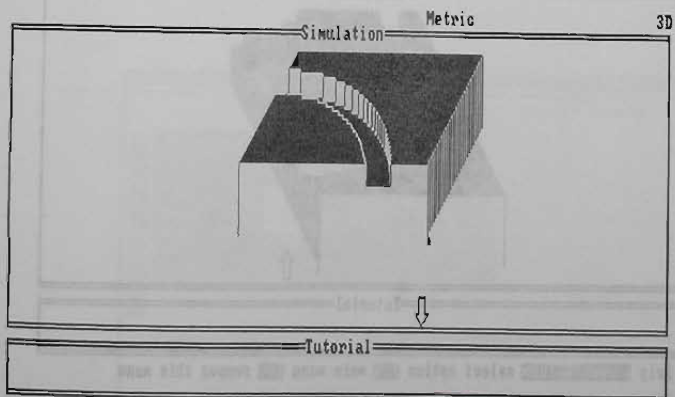


USE CURSER TO MOVE ARROW TO SELECT SECTION VIEW



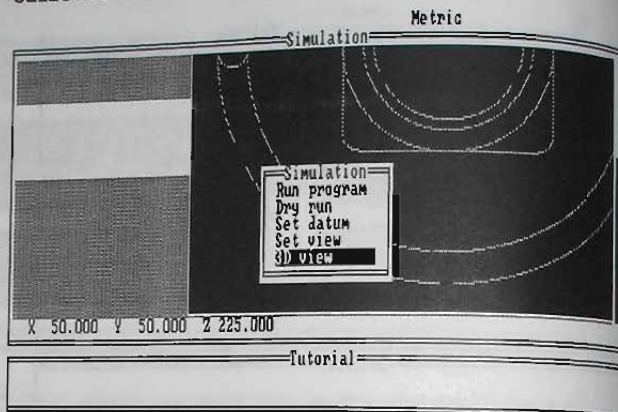
help **arrows/RETURN** select option **F10** main menu **ESC** remove this menu

PRESS HOME BUTTON ON KEYBOARD FOR OTHER VIEW

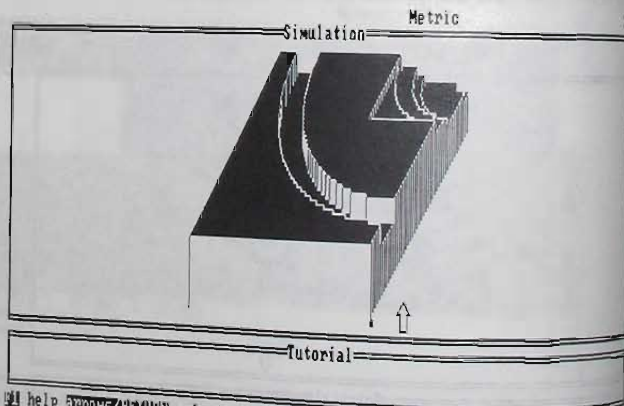


help **arrows/RETURN** select option **F10** main menu **ESC** remove this menu

SELECT 3D VIEW

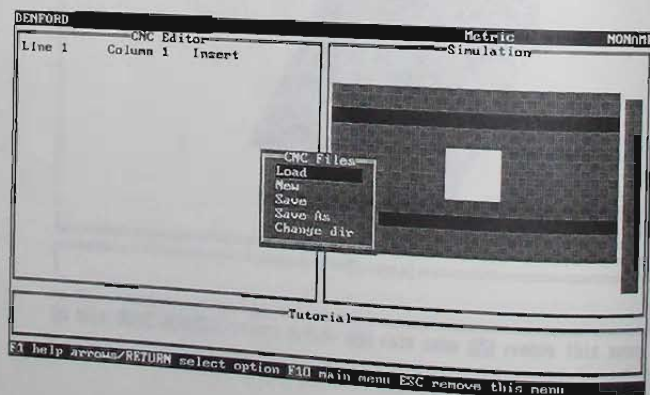
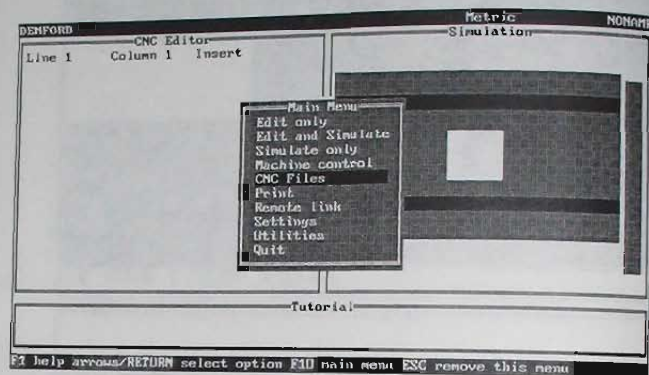


help ARROWS/RETURN select option F10 main menu F30 remove this menu



help ARROWS/RETURN select option F10 main menu F30 remove this menu

1.5.1 SCREENS SHOWING MAIN MENU AND LOAD OPTION



1.5.1 LOA

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If Triac System editor, answer

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1.5.1 LOADING A PROGRAM

To load a program into the CNC editor use the following procedure.

- Press F10 to display the main menu.
- Select CNC Files by using the cursor keys to highlight the option and pressing return.
- Select Load by using the cursor keys to highlight the option and pressing return.
- Either type in the name of the program and press return or just press return for a list of the programs in the current directory. To load one of these programs use the cursor keys to highlight the program name and press return.

Note:

If you already have a program in the editor the Triac System will ask you if you wish to merge the new program into the one already in the editor.

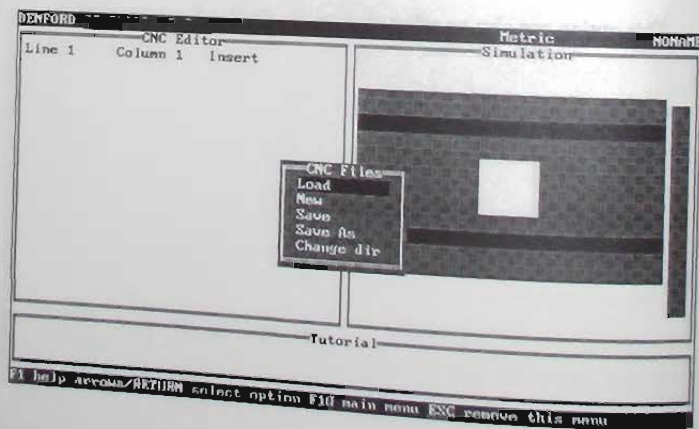
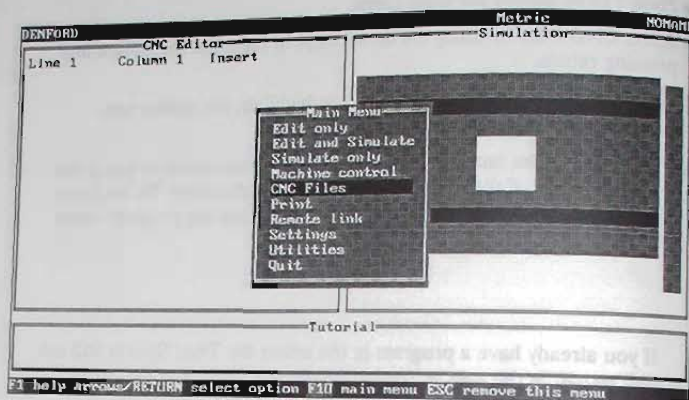
If you do not want to merge the two programs together press N. The Triac System will then ask if you wish to save the program currently in the editor, answer Y for YES, N for NO.

Note:

This option can also be selected using the F3 Hot Key instead of the menus.



1.5.2 SCREENS SHOWING MAIN MENU AND LOAD OPTION



1.5.2 MERGING TWO PROGRAMS

As well as loading a single program it is also possible to merge a number of programs together.

To merge use the following procedure.

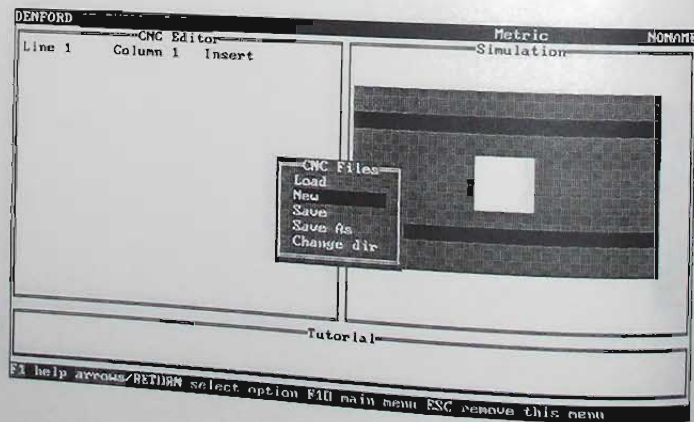
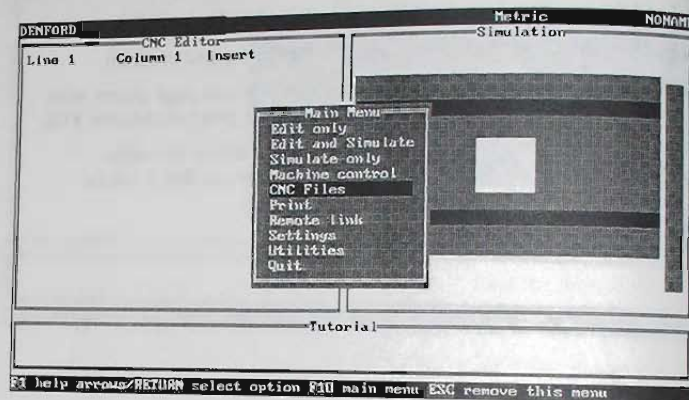
- Load the program into the editor as described on the previous page.
- Position the cursor at the start position for the merged program
- Use the load command as described on the previous page except when the Triac System asks if you wish to merge the programs answer YES.

The second program will be merged into the first at the cursor position. The second program will be highlighted in Green so that it can be easily identified.

- Press F8 to clear the marked area.



1.5.3 SCREENS SHOWING MAIN MENU AND NEW OPTION



1.5.3 STARTING A NEW PROGRAM

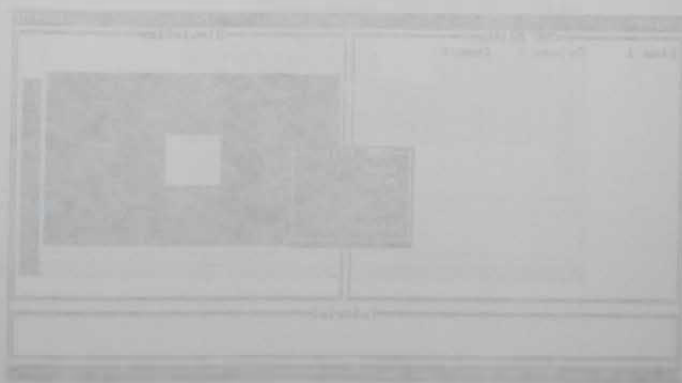
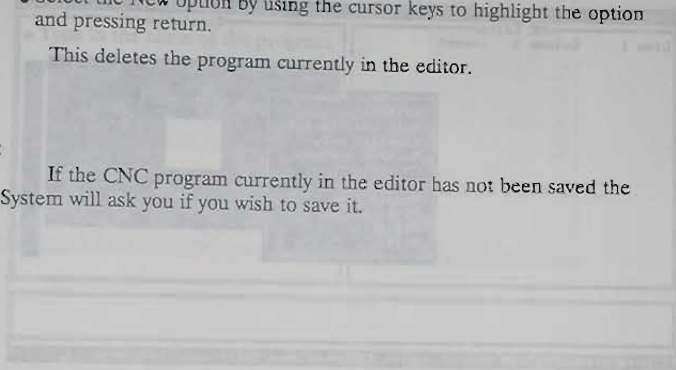
To start a new program use the following procedure.

- Press F10 to display the main menu.
- Select the CNC Files option by using the cursor keys to highlight the option and pressing return.
- Select the New option by using the cursor keys to highlight the option and pressing return.

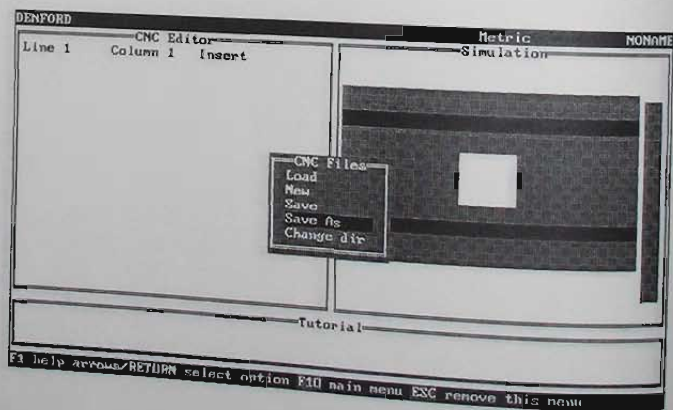
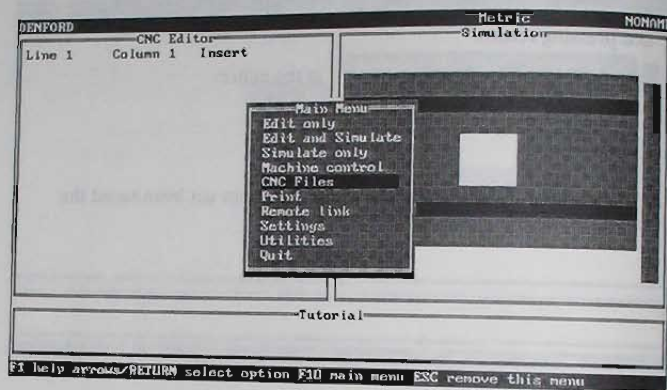
This deletes the program currently in the editor.

Note:

If the CNC program currently in the editor has not been saved the Triac System will ask you if you wish to save it.



1.5.4 SCREENS SHOWING MAIN MENU AND SAVE AS OPTION



1.5.4 SAVING A PROGRAM USING SAVE AS

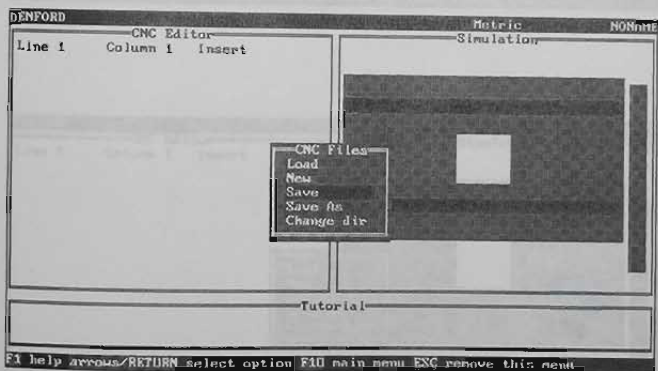
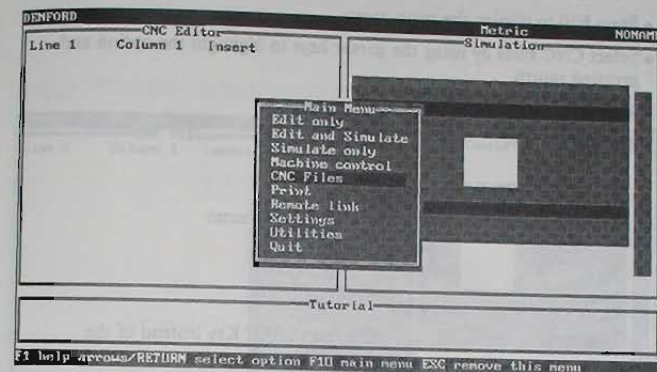
To save a program using Save As use the following procedure.

- Press F10 to display the main menu.
- Select CNC Files by using the cursor keys to highlight the option and pressing return.
- Select the SAVE AS option in the same manner.
- Type in the name of the program.
- Press RETURN.

Note:

This is used to give a new design a name or to save a new CNC program under a new name.

1.5.5 SCREENS SHOWING MAIN MENU AND SAVE OPTION



1.5.5 SAVING A PROGRAM USING SAVE

To save a program under its current name use the following procedure.

- Press F10 to display the main menu.
- Select CNC Files by using the cursor keys to highlight the option and pressing return.
- Select the SAVE option in the same manner.
- Press RETURN.

This saves the program under its current filename

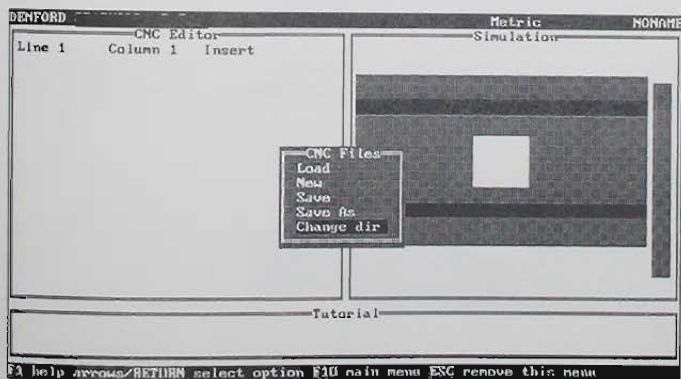
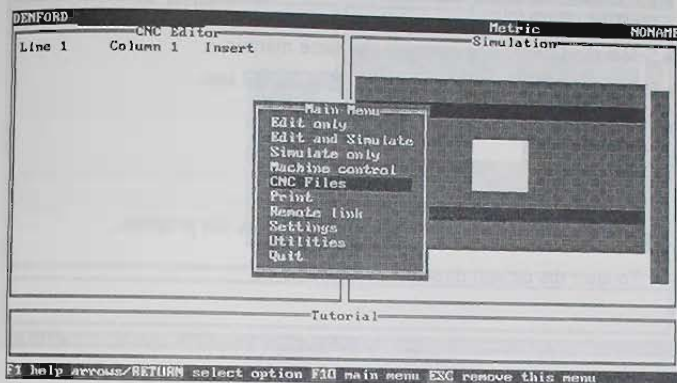
Note:

This option can be selected using the F2 Hot Key instead of the menus.

1.5.6 SCREEN OPTION



1.5.6 SCREENS SHOWING MAIN MENU AND CHANGE DIR OPTION



1.5.6 CHANGING THE DIRECTORY FOR SAVING/LOADING CNC PROGRAMS

To change directory use the following procedure.

- Press F10 to display the main menu.
- Select CNC Files by using the cursor keys to highlight the option and pressing return.
- Select the Change Dir option in the same manner.
- Delete the existing directory name using the del key.
- Type in the new directory name.

Note:

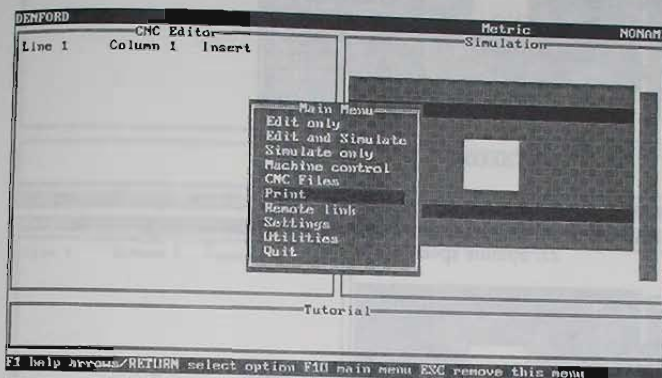
This directory name is lost when you quit from the program.

To alter the default directory see Section 4.1

1.5.7 SCREEN HIGHLIGHTED

[illegible]

1.5.7 SCREEN SHOWING MAIN MENU WITH PRINT OPTION HIGHLIGHTED



1.5.7 PRINTING

When printing there are two options that can be selected, they are as follows:

A. Listing with Errors.

This lists the CNC program highlighting any errors.

Eg.

```
g0 x40 z5
```

```
m3 s2000000
```

```
21: Spindle speed invalid
```

B. No Errors.

This lists the CNC program in the same manner as listing with errors but does not display any error messages.

Note:

Both of these options insert page breaks, page numbers, etc.

These can all be altered, see Section 4.6

1.5.8 SCREEN

DENFORD

Line 1

F1 help screen

DENFORD

Line 1

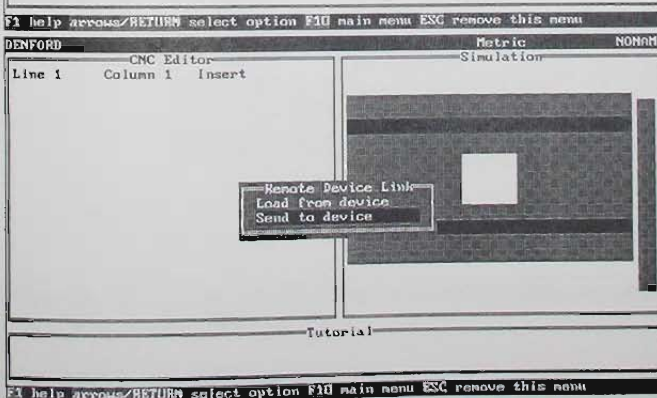
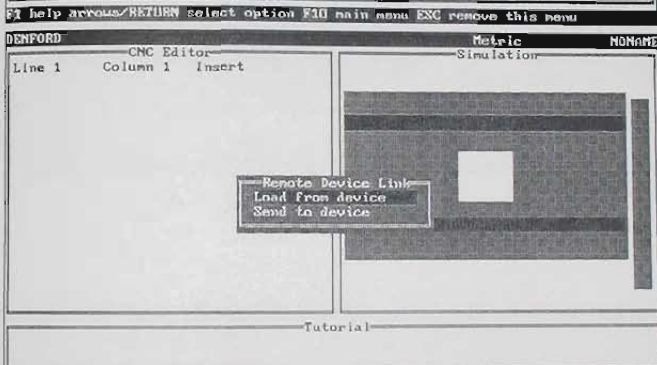
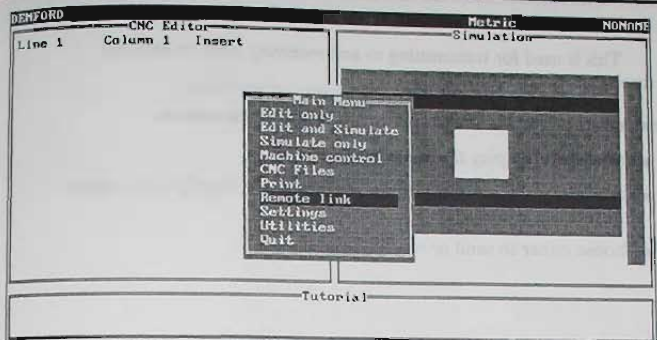
F1 help screen

DENFORD

Line 1

Co

1.5.8 SCREENS OF REMOTE LINK, SENDING & RECEIVING



1.5.8 REMOTE LINK

This is used for transmitting to and receiving from an external source through the serial port.

To either send or receive data use the following procedure.

- Press F10 to display the main menu.
- Select Remote Link by using the cursor keys to highlight the option and pressing return.
- Choose either to send or receive data.

Note:

The parameters for the remote link can be set in the settings menu see Section 4.6

1.6 THE SETTINGS MENU

INTRODUCTION

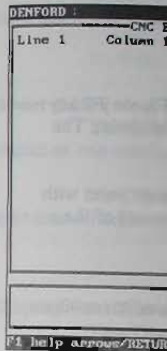
The Settings menu is used to control the settings for the Triac System.

The settings can be saved and loaded therefore allowing the Triac System to be customised to a number of users.

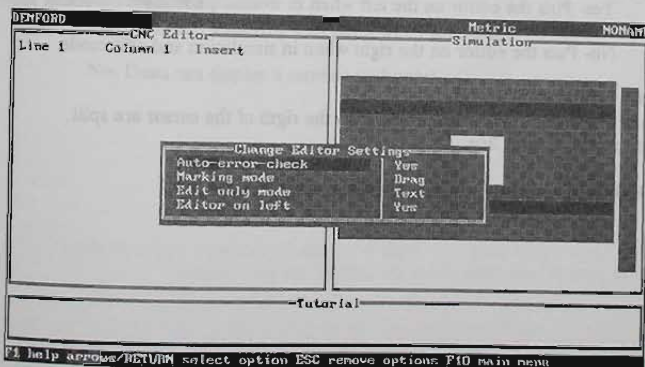
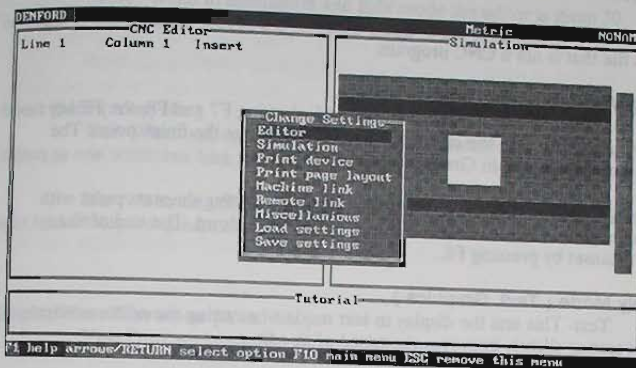
Note:

The settings are there to be changed, so the user can optimise to operation of the system to his/hers own preference.

1.6.1 SCREENS & SETTINGS HIGH



1.6.1 SCREENS SHOWING SETTINGS MENU WITH EDITOR SETTINGS HIGHLIGHTED AND EDITOR SETTINGS MENU



1.6.1 EDITOR SETTINGS

Auto-Error-Check (Yes, No)

Yes- When set, each time the cursor is moved from one line to another the line is syntax checked. If any error is found then an error message is displayed.

No- When set, no error checking is done. Use this setting when editing a file that is not a CNC program.

Marking Mode (Anchor, Drag)

Anchor- When defining a marked block using F7 and F8, the F7 key sets the start point, move the cursor and the F8 key marks the finish point. The block is then highlighted in Green.

Drag- This is the same as anchor but after setting the start point with F7 the highlighted block follows the cursor either up or down. The end of the block is again set by pressing F8.

Edit Only Mode (Text, Graphics)

Text- This sets the display to text mode when using the editor on its own, this setting slightly improves the speed of the editor.

Graphics- This sets the display to graphics mode when using the editor on its own.

Editor On Left (Yes, No)

Yes- Puts the editor on the left when in simulation and edit mode.

No- Puts the editor on the right when in simulation and edit mode.

Line split on CR/EOB (yes,no)

When set to yes any characters to the right of the cursor are split and inserted on the next line.

Straight edit

Not yet available.

1.6.2 SIMULATION

Simulation Window

Normal
of the screen.

Wide-
columns to work in

Short Cuts (Yes)

Yes- W
shown as one cont

No- WH
split into 90 degree

Display Fast Travel

Yes- Di

No- Do

Tool Motion (Yes)

Yes- Di

No- Do

1.6.2 SIMULATION SETTINGS

Simulation Window (Normal, Wide)

Normal- When in Simulation and Edit mode both areas take up half of the screen.

Wide- When in Simulation and Edit mode the editor is given 30 columns to work in, the rest of the screen is given to the simulator.

Short Cuts (Yes, No)

Yes- When set, cycles are shown by on boundary line and arcs are shown as one continuous line.

No- When set, all line associated with cycles are shown and arcs are split into 90 degree quadrants.

Display Fast Traverses (Yes, No)

Yes- Displays fast traverses on simulation.

No- Does not display fast traverses on simulation.

Tool Motion (Yes, No)

Yes- Displays a moving tool point when simulating.

No- Does not display a moving tool point.

4.6.3 PRINT DEVICE SETTINGS

Device Type (File, DOS Device, Serial)

This toggles the print device between those listed. The other menu option will change accordingly.

File- No other options can be set. The Triac System will prompt for a filename to print to when you select the print option from the main menu.

DOS Device- Use this device to print a file to a DOS Device

eg. LPT1, LPT2.

Press return to display a cursor and then type in the name of the device.

Serial- Sets the print option to print to the serial port, use the cursor keys to highlight an option and then use the return key to toggle between the available values.

NOTE :-

The RS232 : Baudrate

Parity

Data bits

Stop bits

Protocol

These operations only apply when the Device type is sent to serial. Check with your printer manual for the settings for your printer.

1.6.4 PAGE LAYO

To change
option and press the n

Page Width

Page Length
footers, any value from

Left Margin
with page width to set

Bottom Ma
those printers without
form feed capability.

Column Wi
column format, usually

Nulls- Used

Print Line F
inserts a line feed after

1.6.4 PAGE LAYOUT SETTINGS

To change the page layout settings use the cursor to highlight the option and press the return key to display a cursor. Type in the new value.

Page Width- Sets the number of columns on a page, 40 to 80.

Page Length- Sets the length of the page, including headers and footers, any value from 1 upwards.

Left Margin- Used to set the left margin, also used in conjunction with page width to set the right margin, 0 to 50.

Bottom Margin- Used to set the number of line feeds to output, for those printers without a form feed capability. Set to 0 for those printers with a form feed capability.

Column Width- Sets the width of the columns if you wish to print in column format, usually set to the same as the page width.

Nulls- Used to insert time delays for slow printers.

Print Line Feed- Set to NO when using a printer that automatically inserts a line feed after a carriage return.

1.6.5 MACHINE LINK SETTINGS

Used to set the values for:

Device Name

Baud Rate (9600)

Parity (ODD)

Data Bits (7)

Stop Bits (2)

Use the cursor keys to select any option and return to toggle between the available values. The values in brackets give the best results.

1.6.6 REMO

These
computer and b

To se
press return to t

Used

Devi

Baud

Parity

Data

Stop

Send

End

Send

The e
and pressing retu
you wish to be at
values are the ch
of carriage return.

Send X
Triac System will
sending data, an X
is ready to receive

1.6.6 REMOTE LINK SETTINGS

These options are used for communication between computer and computer and between computer and punch tape machine.

To select an option use the cursor keys to move to the option and press return to toggle between the available options.

Used to set the values of:

Device Name

Baud Rate

Parity

Data Bits

Stop Bits

Send-Line-Feeds

End Of File

Send XOFF at % Full

The end of file character can be changed by highlighting the option and pressing return. This displays the cursor, you can then type in the character you wish to be at the end of the file for sending and receiving. The allowed values are the characters with ascii values between 0 and 31 with the exception of carriage return, line feed and escape.

Send XOFF at % Full sets the percentage full value at which the Triac System will send a XOFF value to the remote device to tell it to stop sending data, an XON value is sent to the remote device when the Triac System is ready to receive data again

1.6.7 MISCELLANEOUS SETTINGS

Global Settings (Metric, Imperial)

Used to set the units to be used in the Triac System.

User's name

Press return to display the cursor. Type in the user's name to be displayed on the information page (F5) and on printouts. Maximum of 30 characters.

Text size (Large, Small)

Toggles between large and small characters on the display.

1.6.8 LOADING

All the
soft, for use the

To Save Settings
Select
cursor keys to hi

The m
Either
the name using t
and save the sett

To Load Settings
Follow
settings option fr

1.6.8 LOADING AND SAVING SETTINGS

All the options that can be altered can be saved to a disk, hard or soft, for use the next time the same person uses the Triac System.

To Save Settings:

Select the Save Settings option from the settings menu by using the cursor keys to highlight the option and pressing return.

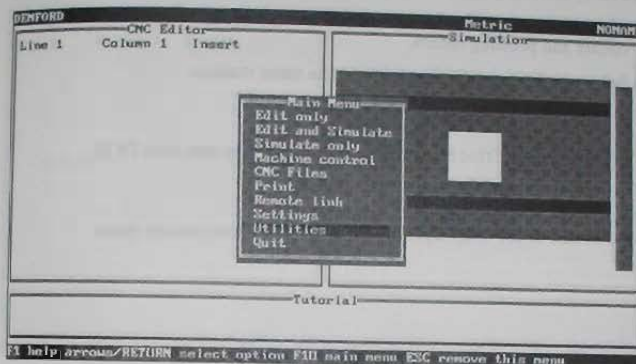
The name of last settings file to be loaded will be displayed.

Either press return to save these settings under this name, or clear the name using the del key and press return for a list of filenames already saved and save the settings under one of these, or type in a new filename.

To Load Settings:

Follow the same procedure as for saving settings but choose the load settings option from the settings menu.

1.7 SCREEN SHOWING MAIN MENU WITH UTILITIES HIGHLIGHTED



1.7 UTILITIES, DOS ACCESS

To use DOS Commands from within the Triac System use the following procedure.

- Press F10 to display the main menu.
- Select the Utilities option by using the cursor keys to highlight the option and pressing return.
- Select the DOS ACCESS option in the same manner.

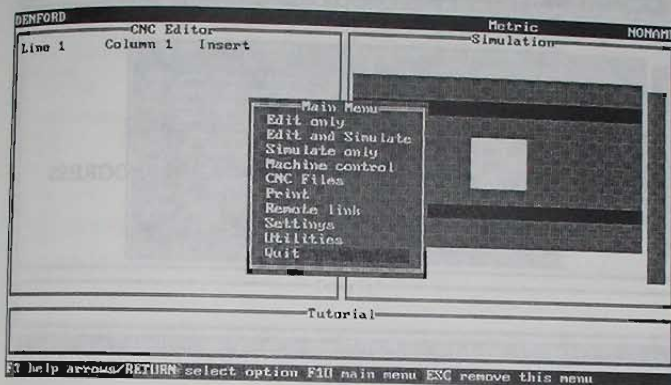
This puts the Triac System into the background and runs DOS

- To return to the Triac System type EXIT and press return twice.

1.8 SCREEN HIGHLIGHT



1.8 SCREEN SHOWING MAIN MENU WITH QUIT HIGHLIGHTED



1.8 QUITTING FROM THE SOFTWARE

To quit from the Triac System use the following procedure.

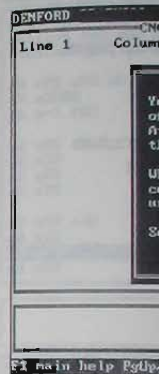
- Press F10 to display the main menu.
- Select QUIT by using the cursor keys to highlight the option and pressing return.

Note:

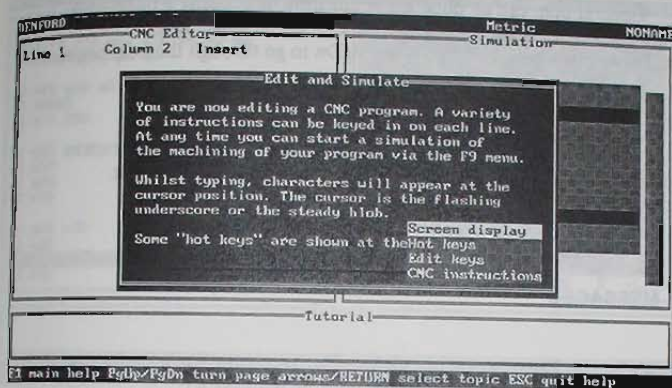
You can quit the Triac System at any time by pressing Alt Q

WARNING THIS WILL NOT SAVE ANY WORK IN PROGRESS

1.9 SCREEN S



1.9 SCREEN SHOWING EXAMPLES HELP PAGE



1.9 HELP AND ERROR MESSAGES

HELP

General help can be obtained at any time by pressing F1. The help file is context sensitive and gives help on the area of the Triac System currently highlighted or in operation. Use PgUp and PgDn to go through the help pages.

Press F1 for sub menu help options.

To get help on specific G and M codes whilst writing a program in the editor, place the cursor at the beginning of the G or M code you want information on and press Ctrl and F1 together.

ERROR MESSAGES

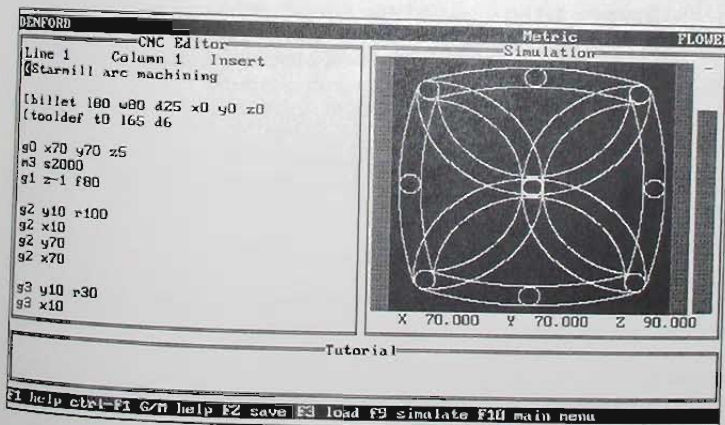
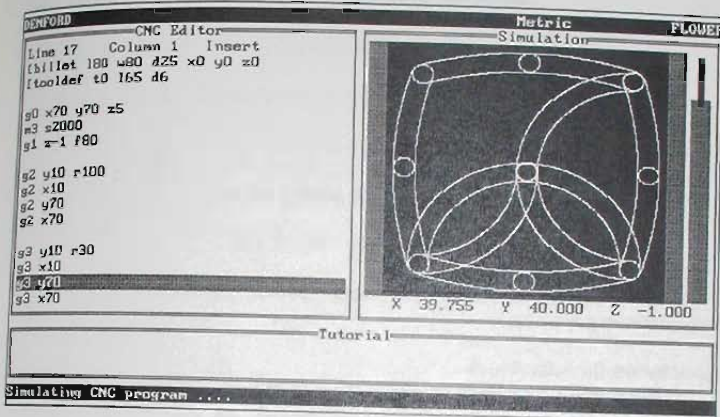
When an Error Message comes up on the screen a more detailed explanation of the cause of the error is available by pressing F1.

4.10 SCREEN AND WITH T

DENFORD	
Line 17	Colu
[billet 180 w80	
[tooldef t0 165	
g0 x70 y70 z5	
m3 s2000	
g1 z-1 f80	
g2 y10 r100	
g2 x10	
g2 y70	
g2 x70	
g3 y10 r30	
g3 x10	
g3 y0	
g3 x70	
Simulating CNC p	

DENFORD	
Line 1	Colu
[Starnill arc m	
[billet 180 w80	
[tooldef t0 165	
g0 x70 y70 z5	
m3 s2000	
g1 z-1 f80	
g2 y10 r100	
g2 x10	
g2 y70	
g2 x70	
g3 y10 r30	
g3 x10	
F1 help ctrl-F1	

4.10 SCREENS SHOWING A PROGRAM PART SIMULATED AND WITH THE SIMULATION COMPLETED



4.10.1 G codes

G00 Fast Traverse

A G00 causes linear motion to the given position at the maximum feedrate.

Example: G71 G00 X20 Y30 Z-1

Here the tool is moved to X 20mm, Y 30mm, and Z -1mm at a feedrate of 400mm per minute.

G01 Linear Traverse

A G01 causes linear motion to the given position.

Example: G71 G01 X20 Y30 Z-1 F80

Here the tool is moved to X 20mm, Y 30mm, and Z -1mm at a feedrate of 80mm per minute.

G02 Clockwise Circular Move

G02 causes clockwise circular motion. If a positive radius is specified then the shortest arc is cut. If it is negative then the longest possible arc is cut.

Example: G71 G02 X30 Y20 R15 F80

In this example the tool is moved to X 30mm and Y 20mm. The arc described has a radius of 15mm.

G03 Counter-clockwise Circular Move

G03 causes counter-clockwise circular motion. If a positive radius is specified then the shortest arc is cut. If it is negative then the longest possible arc is cut.

Example: G71 G03 X30 Y20 R15 F80

In this example the tool is moved to X 30mm and Y 20mm. The arc described has a radius of 15mm.

G04 Dwell

A Dwell of up to 500 seconds can be programmed.

Example: G04 D10

This causes a delay in machining of 10 seconds.

4.10.1

G05 End Of Subroutine

A G05 defines the end of a subroutine begun with a prior G28.

G06 End Of Loop

A G06 defines the end of a loop begun with a prior G73.

G10 Mirror About X

G10 will cause all further movement to be mirrored about the current X axis position.

A G11 instruction will cancel this action.

Tool changes cancel both X and Y mirroring. Mirroring instructions
MIRROR A

G11 Cancel Mirror About X

G11 cancels the effect of a prior G10 mirror instruction.

Tool changes cancel both X and Y mirroring. Mirroring instructions
MIRROR A

G12 Mirror About Y

G12 will cause all further movement to be mirrored about the current Y axis position.

A G13 instruction will cancel this action.

Tool changes cancel both X and Y mirroring. Mirroring instructions
MIRROR A

G13 Cancel Mirror About Y

G13 cancels the effect of a prior G12 mirror instruction.

Tool changes cancel both X and Y mirroring. Mirroring instructions
MIRROR A

G28 Start Of Subroutine

The G28 instruction defines the start of a subroutine. All CNC blocks from here up to the matching G05 will be executed when invoked by a G65 instruction.

Example: G28 L2

This example defines a subroutine labelled "2".

4.10.1

G40 Cance

or G42.

G41 Righ

programm

G42 Left

programm

G65 Call

G70 Imp

That is, th
as metric

G73 Rep

repeatedly
number o

C4

from each

G79 Re-

each suc

compens

4.10.1

G40 Cancel Tool Radius Compensation

G40 switches off any tool radius compensation activated by a G41 or G42.

G41 Right Hand Radius Compensation

G41 causes future movement to take place to the right of the programmed path. The offset used is equal to the radius of the current tool.

G42 Left Hand Radius Compensation

G42 causes future movement to take place to the left of the programmed path. The offset used is equal to the radius of the current tool.

G65 Call Subroutine

Use this instruction to call a subroutine.

Example: G65 L2 C5

In this example the subroutine labelled "2" is executed 5 times.

G70 Imperial Units

All future instruction parameters will be taken as imperial values. That is, they will specify inches. If future instruction parameters will be taken as metric values, that is, they will specify millimetres.

G73 Repeat Loop

The G73 instruction defines the start of a block to be executed repeatedly. All CNC blocks up to the matching G06 will be executed the given number of times. Loops can be nested.

Example: G71 G91 G83 Z6 C2 F80 G73
C4 G01 X5 G06 G80

In this example five 6mm holes are drilled with centres 5mm away from each other.

G79 Re-Enable Cycle

A G79 will re-enable the last programmed cycle.

The cycle will immediately be executed, and then re-executed after each successive G00, G01, G02, or G03.

Cycles are de-activated by G80, tool changes, and tool compensation instructions.

4.10.1

G80 De-Activate Cycle

A G80 will cancel any active cycle.

To re-enable a cycle use a G79 instruction.

G82 Circular Pocket Milling Cycle

Used to machine a circular pocket of a given radius and depth.

Example: G71 G82 R10.5 Z6 C2 F80

Here a circular pocket of 10.5mm radius is milled to a depth of 6mm. 2 cycles are used to mill the complete pocket.

G83 Peck Drilling Cycle

Used to drill down to the programmed depth.

Example: G71 G83 Z6 C2 F80

In this example two drilling cycles take place, each to a further depth of 3mm.

G84 Rectangular Pocket Milling Cycle

Used to machine a rectangular pocket of a given width, length, and depth.

Example: G71 G84 X20 Y30 Z6 C3 F80

This example mills out a rectangular pocket of length (X) 20mm, width (Y) 30mm, and to a depth of 6mm. Because 3 cycles are specified the rectangle is milled 3 times to a further depth of 2mm each time.

G90 Absolute Movement

All future movement will be absolute until over-ridden by a G91 instruction. This is the default at the start of a program.

Example: G71 G90 G01 X30

Upon completion of this example the X axis position will be 30mm.

4.10.1

G91 Incremental Movement

instruction

G01 X2

Help for C

G01 instr

400mm pe
feedrates
1000mm p

4.10.1

G91 Incremental Movement

All future movement will be incremental until over-ridden by a G90 instruction.

Example: G71 G90 G01 X15 G91
G01 X2

Upon completion of this example the X axis position will be 17mm.
Help for G code groupings Linear Motion

Linear (straight line) motion can be programmed with a G00 or G01 instruction.

If movement takes place on the Z axis then feedrates are limited to 400mm per minute. If both the X and Y axes are moved together then feedrates are limited to 500mm per minute. Otherwise there is a top limit of 1000mm per minute.

4.10.1 G CODE GROUPINGS

Circular Motion

Circular motion can be programmed with a G02 or a G03 instruction. Motion takes place on the X and Y axes whilst the Z axis remains motionless.

There is a maximum feedrate of 400mm per minute imposed on circular movement.

Canned Cycles

A canned cycle cause a pre-defined shape to be cut to depth in stages.

Select a cycle from the menu for more information. Mirroring instructions

G10 and G12 switch on the axis mirror facility. If both are switched on at the same time then mirroring will be about both axes.

G11 and G13 switch mirroring off.

Example: G71 G01 X20 Y20 G10 G01 X15

This example will cause the tool to be moved to a final position of X 25mm and Y 20mm.

Tool Radius Compensation

Tool radius compensation causes the cutter to travel along a path immediately to the left or right of that programmed.

G41 causes movement to the right, and G42 to the left. G40, tool changes, and cycles cause tool radius compensation to be switched off.

4.10.2

M02 End

returned

M03 Start

speed with

componen

M05 Stop

change, should you

M06 Change

tool.

using the

Aux Out

or off. No changer.

4.10.2 M codes

M02 End Of Program

M02 halts program execution. The spindle is turned off and the tool returned to the most positive position on the Z axis.

M03 Start Spindle

An M03 instruction starts forward spindle motion. It requires a speed within the range 100 to 3000 rpm.

Example: M03 S2200

The spindle should be switched on before any movement below the component surface.

M05 Stop Spindle

An M05 instruction stops spindle rotation.

It is good programming practice to issue an M05 before a tool change, and at the end of a program. However this will be done automatically should you omit this instruction.

M06 Change Tool

The M06 instruction causes the Spindle to change to a different tool.

Example: M06 T1

You can set tool lengths and diameters at the start of the program using the TOOLDEF directive.

Aux Output

M20 causes one or both of the auxiliary outputs to be switched on or off. Note that there is only one output (A) when you have an automatic tool changer.

Example: M20 A1 B0

This example switches switch A to high on and switch B to low.

4.10.2

Aux Input

An M21 instruction causes execution to halt until the specified inputs are switched to the required state.

Example: M21 A0 B1

This instruction waits for switch A to be switched low, and B to be high.