

STARMILL

SOFTWARE & MAINTENANCE

MANUAL

BBC VERSION

STARMILL PROGRAMMING SECTION INDEX

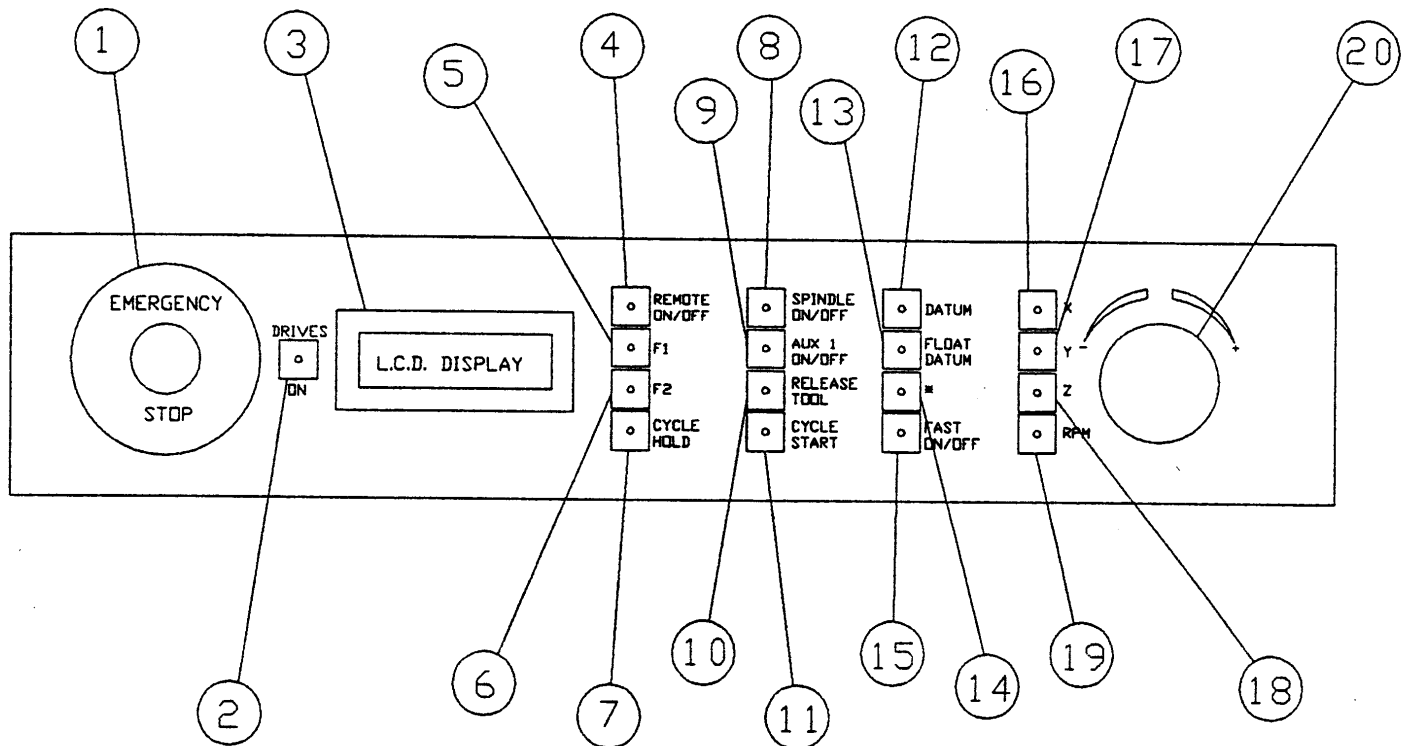
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STARMILL FRONT PANEL



1..... Emergency Stop Button

2..... Drives On

3..... L.C.D. Display Window

4..... Remote On/Off – Toggles between operation from a host computer and the Front Panel

5..... Used when operating the self test program

6..... Used when operating the self test program

7..... Cycle Hold during execute program

8..... Spindle On/Off

9..... Turns Aux 1 On/Off – LED is on when the auxilliary is on

10.... Press to release tool – ATC only

11.... Cycle Start – Re-activates program after Cycle Hold

12.... Datum – Machine must be datumed before any moves can take place

13.... Floating Datum – Resets the datum to the current position

14.... Reserved for future expansion

15.... Fast On/Off – Changes the speed of the axis movement (manual mode)

16.... X – selects movement on X axis

17.... Y – selects movement on Y axis

18.... Z – selects movement on Z axis

19.... RPM – selects spindle speed control

20.... Handwheel – manual control of axis

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## **INTRODUCTION**

Denford Machine Tools have a range of CNC software packages for all of today's popular Micro's. Our off line programming software has been developed to assist in the training of CNC programming and has been developed around a particular Denford controller. CNC programs can be written in the Editor, tested with simulated graphics and finally downloaded to the Machine Tool.

### **Hardware Specification**

- \* BBC B, BBC B+128, MASTER Series, Compact
- \* Single or Dual Disk Drive (40 or 80 Track)
- \* Monitor

### **Software Specification**

- \* Single Floppy Disk 40/80 Track
- \* Security EPROM
- \* Manual
- \* Cable

## **SETTING UP**

### **FIRST TIME BBC USER'S**

If you have received a BBC system with your software be sure to read through the BBC User guide on how to setup your computer before trying to use this Software. Run through the BBC Software supplied with the computer to get a feel for the machine.

**FITTING THE EPROM** (This may have been fitted already by Denford's)

Remove the lid from the BBC computer by means of four screws, on the MASTER Series these are labelled 'FIX'

### **BBC Model B**

Unscrew the keyboard by removing the two screws, one at either end. On the near right of the main circuit board there are five 28 pin ROM sockets and the EPROM can be inserted into any free socket.

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BBC MODEL B

The keyboard section does not need removing. Located at the far left of the main circuit board are 8 ROM sockets. The EPROM can be inserted into any of these.

BBC MASTER Series

The EPROM can be installed in two ways.

1 ROM Cartridge

If a ROM cartridge is available then use it, as the EPROM is simpler to install, and can be transferred easily between separate MASTER computers. The EPROM can be positioned into any socket on the cartridge, which can be fitted into any slot of the computer.

2 Socket inside the Computer

After removing the computer cover you will find a bank of four ROM sockets on the near right of the main circuit board, some of which may be occupied. The EPROM must be located in the socket shown in the diagram below.

ACORN
BASIC ROM

EMPTY
SOCKET

EMPTY
Starturn security EPROM → SOCKET
must be fitted here

EMPTY
SOCKET

ROM CARTRIDGE SLOT

ROM CARTRIDGE SLOT

IMPORTANT

Take Special care when inserting EPROMS and ensure that all the pins on the chip are correctly positioned in the socket and none are bent. The small notch at one end of the chip must lie in the same direction as the other chips on the main circuit board. Try not to touch the pins on the chip.

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SECTION ONE AND SECTION TWO

The Starmill software system is supplied on one or two floppy disks.

Disk 1 is supplied if the software has been purchased without the Starmill machine to be used for Offline Programming.

Disk 2 is supplied with the machine and is used for machine control and execution.

The first section of this manual covers the off line programming and the second section Starmill control and execution.

SECTION ONE

Switch on the computer, monitor and Disk Drive and place the Disk in Drive 0. Hold down the SHIFT and BREAK key, release the BREAK key followed by the SHIFT key. The disk drive light will come on for a few seconds and the STARMILL title page will appear on the screen. Press the space bar to continue.

STARMILL MACHINE SIMULATION

Select one of these operations.

S... Simulation
C... Create
E... Edit
D... Select program Drive
N... Name program
W... Workpeice size
Q... Quit

Key in your choice

Drive 0 holds your CNC program Disc
Cnc program is not yet named

STARMILL SIMULATOR

Setting Up

When running the Starmill Simulator for the first time select the following:-

- a) Press 'D' to select a program DRIVE. If you don't select a Drive number a message will remind you to do so.
- b) Press 'N' to give the CNC program a name. If you don't select a Cnc name a message will remind you to do so.
- c) Press 'W' to select the workpeice size and to set the Datum position.

DATUM AND WORKPEICE SIZE

Press 'W' from the Main Menu to enter this section as shown below.

STARMILL - MACHINE SIMULATION

Select one of these operations

L ... Length of Workpeice

W ... Width of Workpeice

D ... Datum

S ... Save Settings

R ... Read Settings

Q ... Quit

Key in your choice:

Length ? Width ?

X Datum 0 Y Datum 0

LENGTH

Press 'L' key to enter a length between 30 and 200 mm.

WIDTH

Press 'W' key to enter a width between 30 and 100 mm.

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## **DATUM**

Press the 'D' key to set the Datum.

After selecting this option you will see a graphics display of the Starmill table and the workpiece. The default Datum position is the bottom lefthand corner of the workpiece. To change this use the arrow keys to move the cross hairs to the correct position. Note the 'X' and 'Y' positional readout at the bottom of the screen. To assist in the movement of the cross hairs use the Space Bar to toggle between Fast or Slow Mode.

When you have positioned the cross hairs at the correct Datum position press the Return key to confirm.

The 'X and Y' data will display the Datum position from the bottom left hand corner. If you come back to this section at a later date the cross hair will be displayed at it's new position.

## **SAVE SETTINGS**

To save the Datum settings select 'S'. The data is saved automatically under the same filename as the workpiece but using a different letter prefix.

## **READ SETTINGS**

Select this option to load Datum information that has already been saved at an earlier date.

## **QUIT**

Press the Esc key to quit. Any of the information can be changed by returning to this section. Remember if you change anything to Save it to Disk.

## **Entering Cnc programs.**

Once the Disk Drive number, component name, Datum position and component dimensions have been entered a CNC program can be written.

Press the 'C' key to Create a CNC program.

Note

If you are using a Data Disk in Drive 0 you will be prompted when to place it in the Disk Drive.

## HOW TO ENTER PROGRAMS

The Starmill like most CNC milling machines is programmed using G and M codes . Because of the learning problems associated with CNC programming languages we have incorporated single line entry with on screen simulation. This is particularly useful for beginner's to CNC programming.

### TYPING A CNC LINE

All lines are typed at the prompt "=>", with a flashing cursor indicating the computer is waiting for a key to be pressed.

The following keys can be used to edit the current line:-

- Delete to erase previous characters.
- Arrow keys to move cursor to new edit position.
- Esc or Ctrl U to delete the current line.
- Return to confirm.

### Correct Format

All lines can be typed in lower or upper case. Spaces can be used to pad out the lines. G codes can be typed as "G01" or as "G1". Where certain information has been missed off a line you will be told. Information on a line can be in any order.

For example :-

G1 X22.3 Y12.3 F122 or  
g1 y12.3 f122 x22.3

All lines are checked for validity and a related error message will appear on the screen. If the line is valid you will be asked to confirm whether you want to accept the line or not.

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G/M CODE PROGRAMMING

Entering a new program

G00 Fast Traverse

Moves the tool along the 'X' 'Y' and 'Z' axes a programmed distance at a maximum feedrate.

Eg G00 X22.3 Y33.3 Z1.0

G01 Linear interpolation

Moves the tool along the 'X' 'Y' and 'Z' axes a programmed distance at a specified feedrate.

Eg G01 X10.2 Y12.2 Z1.2 F99.0

G02/G03 Circular interpolation

Moves in a Clockwise or Anti-clockwise direction along the 'X' and 'Y' axes a programmed radii and feedrate.

Eg G02 X50 Y50 R10 F122.0

Negative and positive radii.

The Starmill can be programmed to do any length of arc.

The direction is specified by the G code and a positive radii will produce the shorter arc with a negative radius producing the longest arc.

To produce a full circle the finish position will be the same as the start position.

To see the variations in circular interpolation type in the following program.

```
G00 X50 Y50 Z1
G01 Z-2 F100
G02 X60 Y60 R10 F80
G03 X50 Y50 R10
G02 X60 Y60 R-10
G00 Z2
G00 X70 Y30
G01 Z-2
G02 X70 Y30 R10
G03 X70 Y30 R10
G00 Z10
M02
```

G04 Dwell

Halts execution of the program a specified number of seconds.

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## **G AND M CODE PROGRAMMING**

### **G10 Mirror X**

Mirrors all future moves about the 'X' axis until cancelled.

### **G11 Cancel Mirror X**

Cancels mirror image on 'X' axis.

### **G12 Mirror Y**

Mirrors all future moves about the 'Y' axis until cancelled.

### **G13 Cancel Mirror Y**

Cancels mirror image on 'Y' axis

### **G70 Imperial Units**

All tool movements will be Imperial until changed by a G71

### **G71 Metric Units**

All tool movements will be Metric until changed by a G70

### **G79 Activate Cycle**

Activates the last programmed cycle if there has been one.

### **G80 Deactivate Cycle**

Cancels the current cycle until a G79 reactivates it.

### **G82 Circular Cycle**

Produces a circular pocket about the current "X Y" position the programmed radius,depth,cycles and feedrate.

Eg G82 R20 Z4 C2 F88

### **G83 Peck Drilling Cycle**

Moves on 'Z' the programmed depth,cycles and feedrate.

Eg G83 Z4 C2 F122

### **G84 Rectangular Pocket Cycle.**

Produces a rectangular pocket about the current "X Y" position the programmed width,length,depth,cycles and feedrate.

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G AND M CODE PROGRAMMING

Cycles in general

All cycles return to their start position on all three axes after executing the cycle. The 'Z' depth is an incremental distance and any negative 'Z' moves are taken to be positive. The Feedrate is optional.

A programmed cycle stays active until a Tool Change, End of Program another Cycle is programmed or a G80 Deactivate code. Cycles can be activated by a G79 code. If a cycle is active it will be executed after any traverse move.

G90 Absolute

All moves to be from a set datum position. The datum positions are taken from the Set datum section

G91 Incremental

All moves will be programmed distance on 'Z' 'Y' and 'X' axes.

M02 End of program

Ends execution of the program.

M03 Spindle On

Switches the spindle at a programmed speed.

Eg M03 S2000

M05 Spindle Off

Sends a command to the Starmill to switch the Spindle off.

M06 Tool Change

Non Tool Changer Version

Stops the Spindle and moves to 'Z' top position. Puts the Starmill in Manual mode where the machine may be moved to make room for the Tool. After the Toolchange the Starmill will move back to it's original "X Y" position.

Tool Changer Version

Stops the Spindle then moves to the Tool Changer, places the current Tool in it's holder and picks up the programmed Tool. After exchanging Tools the Starmill will return to its original "X Y" position but stays at 'Z' top position.

Command Functions.

To assist in the learning of CNC programming there are several command functions to allow the writing of interactive lessons.

1- Comments Eg (This is a comment

Comments can be typed only after a left bracket has been keyed in as the first character on a new line. This is useful for describing what is happening in the program. The programmer's name, component information and tool sizes can also be typed into the program as comments.

2- Scrolling Messages Eg !This is a message

Scrolling Messages can be typed only after an exclamation mark has been keyed in as the first character on a new line. The message will be displayed at the bottom of the screen. Useful as an instruction to the student. Eg To tell him to write down what type of cycle is to be executed next.

3- Static messages ?This is a static message

These are similar to scrolling messages but wait for a key to be pressed before execution of the program continues. The first character for Static messages is a question mark.

COMMANDS

There are several commands that affect the simulation and aid in the development of CNC lessons.

All commands are entered after a left hand square bracket Eg [TOOLPATHON.

TOOLDIAMETER

Prior to a Toolchange this command is used to tell the Simulation what Tooldiameter is required by the next Tool. Only becomes active after a Toolchange.
Format:- [TOOLDIA 8 will select an 8mm Tool.

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## **TOOLPATH**

There are two modes of simulation

- 1 Full Toolpath
- 2 Quick Toolpath

The full toolpath shows all moves when executing cycles, this takes longer and clutters the screen. The quick Toolpath just shows the pocket generated by a particular cycle. Both modes can be called up anywhere within the program.

### **Note**

The single line simulation always shows the quick Toolpath. It is only when Simulation has been selected from the main menu that all the commands are implemented.

Format :- [TOOLPATHOFF  
          [TOOLPATHON

## **SINGLE STEP SIMULATION.**

This command allows single step or continuous execution of the program. May be selected anywhere within the program and implemented as many times as required.

Format :- [STEP  
          [NOSTEP

## **CLEARING MESSAGES.**

The messages that appear at the bottom of the screen scroll up when new messages are printed but do stay on the screen. This command clears all messages from the message window

Format :- [CLEAR

## **HELP**

Typing "HELP" at the command line will list the G and M codes with a description at the bottom of the screen. Use the arrow keys to scroll up and down and the Esc key to quit.

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PRINT OPTIONS

There are three Help files that can be printed out from the Edit Command Line.

Type Print for a listing and description of all the G and M codes.

Typing Print1 or Print2 to send file Help1 or Help2 to the printer. These files are user definable. Use any word processor to create your own Help. Save the files as "Help1" or "Help2" onto the Disk that is currently used for saving CNC programs.

ESCAPE

During Single Line Simulation mode you must program a M02 to quit. You can then Return to the Main Menu by pressing the Esc key.

SIMULATION

To simulate a CNC program in full select the Simulation option from the Main Menu.

All axis moves are simulated on the screen by a plan view showing the 'X Y' moves and a thermometer showing the 'Z' position.

Fast Traverse is shown in blue as a dotted line with all feed movement in red. Any moves outside the workpiece are clipped and not visible. If the STEP command is used you will have to press a key after each line has been simulated.

After the full CNC program has been simulated you may press the Esc key to Return to the Main Menu.

Starmill Editor

Select option 'E' from the Main Menu to enter the full screen Text Editor.

Once a student is conversant with CNC programming through use of the single line simulation he can move on to a full screen cnc text editor. The whole program can be typed using powerful edit routines like Copy, Move, 6 Delete, Insert, Merge.

The Main functions of the Editor are listed below:-

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## **CNC EDITOR**

### **F0 - Help**

Use the arrow keys to page up or down through the Help Screens. Press the Esc key to quit.

### **F1 - G and M code listing**

Use the arrow keys to page up or down or press the ESC key to Quit.

### **F2 - Info**

Program information on free memory available ,Denford's address and telephone number and information about marked lines.

### **F3 - Menu**

- L ..... Load Cnc Program
- S ..... Save Cnc Program
- N ..... Begin New Program
- R ..... Renumber/Strip N Prefixes
- P ..... Print Cnc Program
- H ..... Print Help Notes

Select an option

## **Load Cnc Program**

- a) You will be prompted to accept the default filename or type in a new filename. If you type in a new filename the default filename will still be active when you return to the Main Menu.
- b) If the editor has a program resident in memory you will be prompted as to whether you wish to merge the program on Disk with the active program or not.
- c) If you don't want to merge programs and the active program has been changed since the last save to Disk you will be warned and given the chance to Save the program.
- d) If the program being loaded is too large for the Editor you will be told so and the file will be truncated.

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CNC EDITOR

Saving Cnc Program

- a) When saving you will be prompted to accept the current filename or not. Either press Return to accept or type in the new name.
- b) If the filename already exists on Disk you will be warned and prompted to overwrite or not.
- c) If part of the program is currently marked you will be offered the choice of saving just the marked area or all of the program.
- d) If during the save the Disk becomes full you will be told. Either Compact the disc on another computer and then try again or format a Data Disk and select save again.

Begin A New Program

Select this option to wipe the current program from memory. If the current program has been changed since the last save you will be told so and given the chance to save it.

Renumber/Strip N Numbers

The N block numbers are line numbers and quite often you will want to renumber them. If you want to miss them out altogether during editing you can. They can be added at the end of programming prior to a save. If there is a marked area you will be asked whether to change the marked area or to change the whole program.

- a) You will be asked if you want to add N block numbers or strip them off.
- b) If you selected add N block numbers you must select the start value and an increment value.

After one of the above operations control returns to the main edit screen.

Print Cnc Program

You will be prompted for Line feeds (Y/N)?
If there is a marked area you will be asked whether to print the marked area or to print the whole program.

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## **CNC EDITOR**

### **Print Help Notes**

You will be given a choice of two Help files:

#### **Help File Number 1**

This file contains information on the G and M codes and how the Editor works. The name of the file is EDHELP1.

#### **Help File Number 2**

This file can be filled out by the software user with any wordprocessor that saves files in ascii format. The name of the File is EDHELP2.

### **Remember**

This file is empty until you create your own Help Screen and save it to Disk under the name EDHELP2.

## **CNC EDIT COMMANDS**

### **Cursor Position**

The flashing cursor always points to the current edit line.

### **Cursor Keys**

|                  |                               |
|------------------|-------------------------------|
| Left Arrow       | Moves one space to the left.  |
| Right Arrow      | Moves one space to the right. |
| Ctrl/Left Arrow  | Moves to start of the line.   |
| Ctrl/Right Arrow | Moves to the end of the line. |
| Up Arrow         | Moves up one line.            |
| Down Arrow       | Moves down one line.          |
| Shift/Up/Arrow   | Moves up one page.            |
| Shift/Down/Arrow | Moves down one page.          |

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CNC EDITOR

CNC EDIT COMMANDS

Ctrl/Up/Arrow Moves to the first line.

Ctrl/Down/Arrow Moves to the last line.

Delete Keys

Delete Deletes character before cursor position.

Copy Deletes character at cursor position.

Control Keys

Ctrl & N Makes room for new blank line.

Ctrl & U Deletes line at cursor position.

Ctrl & R Restores current line to pre edit status.

Function Keys

F0 Displays help screens

F1 Displays G and M code's.

F2 Displays program information.

F3 Selects utilities menu.

Ctrl & F4 Block Copy

Ctrl & F5 Block Move

Ctrl & F6 Block Delete

F7 Begin marking block.

F8 End marking block.

F9 Toggle between insert and overwrite.

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## **SECTION TWO**

### **CONNECTING THE CABLE**

The 5 pin connector links to the BBC computer and the seven pin connector to the Starmill machine. On the BBC, the cable connects to the port labelled 'RS423' with the screw on the connector facing away from the power ON/OFF switch. On the STARMILL the cable connects to the port labelled 'RS232' with the screw on the connector facing the top.

#### **Please note**

You do not need the cable linked to run the Simulation and Editor, only for sending or receiving information between the computer and the Starmill in MANUAL CONTROL and EXECUTE modes.

#### **IMPORTANT**

Make a backup copy of your STARMILL software before running the program. You will also need to prepare a blank formatted disc to store your CNC programs. Your Disk Drive manual will tell you how to copy and format Disks.

### **CONTROL PANEL FUNCTIONS**

#### **EMERGENCY STOP**

The red emergency stop button is positioned to the far left of the Control Panel. Pressing this button will stop any axis and spindle movement dead. The Drives-light to the right of the Stop button will go off. To continue, rotate and pull the Stop button and switch the drives back on.

#### **DRIVES**

The Drives control button is positioned to the right of the Emergency Stop Button. Before any axis movement can take place, the drives must be active.

#### **DISPLAY WINDOW**

Various data is displayed in the L.C.D. window. You will find it most useful for running the built in test.

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CONTROL PANEL FUNCTIONS

Not used

FAST ON/OFF

Select fast or slow feeds for manual positioning of any axis.

X Y Z

Sets the current axis for Manual Control.

RPM

Manually controls the spindle speed. Used in conjunction with the - + control knob at the far right of the control panel.

BUILT IN SELF TEST

To operate the self test routines switch the starmill on from cold. The L.C.D. display reads:

**DENFORD STARMILL
F2 FOR TEST.**

Note: If you press any other key than **F2**, the self test will no longer work and the machine will have to be switched off and on again.

OPERATION

Use the **F1** key to run a test program.

Use the **F2** to select the next test in the sequence.

To exit the program press the **F2** key until the display reads **EXIT** then press **F1** to return to normal mode.

Note: If any of the tests return a checksum error please contact M.Bishop at Denford Machine Tools.

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## **CONTROL PANEL FUNCTIONS**

### **Manual Version**

For Starmill machines that have not been fitted with an Automatic Tool Changer, the Tool release is mechanical. Use the spanner supplied with the machine to release or secure the Tool Holder.

### **Important**

Before removing any Tool Holder always place a piece of wood under the spindle to stop any damage being done to the machine bed.

### **Automatic Tool Changer**

All Starmill's supplied with an Automatic Tool Changer are pneumatically controlled. Please ensure all tools are in the Tool Changer prior to executing a program.

### **Important**

The Automatic Tool Changer may stop working if the air pressure supplied to the Starmill drops below 90 B.P.I

## **STARMILL CONTROLLER**

The control software for the Starmill machine is supplied on a separate Disk to the Starmill Simulator. This means someone can program and simulate away from the machine while another student can be using the Starmill machine.

Boot the software up in the usual way by pressing the Shift and Break key.

### **Note:-**

The Starmill control and execution software will run on any model of BBC.

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STARMILL CONTROL

The Main Menu is displayed as below:-

STARMILL - MACHINE CONTROL

Select one of these options

M ... Manual control of Starmill
E ... Execute CNC program
D ... Select CNC program drive
N ... Give CNC program a name
Q ... Quit

Key in your choice:

CNC program drive not known
CNC program is not named

Before selecting the Main options set the Drive number and program name.

Manual Control of Starmill

When entering this section for the first time you are forced to datum the Starmill and to select a Tool No.

Non Tool Changer Version

Select a Tool number from 1 to 3. If there is not a Tool in the spindle select Tool number 1.

Tool Changer Version

Select a Tool number from 0 to 3. If there is not a Tool in the spindle select Tool 0. Be sure to select the correct Tool number so the Tool Changer knows where to place the current Tool.

STARMILL CONTROLLER

Once the Starmill has been datumed the operator is prompted with the following options:-

X Y Z	Axis moves
F	Alter Feedrate
S	Alter spindle speed
T	Tool change and Offsets
M	Manual Control
D	Datum machine
U	Change units
E	Execute CNC program

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## **STARMILL CONTROL**

The following facilities will be available in this mode of operation.

### **Move X/Y/Z Axis**

Allows a single axis absolute move in the X/Y/Z axis to be executed, at the current feedrate.

All moves must be within the parameters displayed within brackets.

### **Feed rate**

Changes the current feedrate at which all movements in manual mode take place.

### **Spindle**

Spindle speed can be changed within the stated parameters.

### **Tool change and Offsets**

Displays a the menu below:

|   |                        |
|---|------------------------|
| C | Change tool            |
| X | Sets X offset          |
| Y | Sets Y offset          |
| Z | Sets Z (length) offset |
| E | Edit tool offsets      |
| L | Load offsets from disk |
| S | Save offsets to disk   |

### **Change tool**

Selects a Tool and calls up it's offset if the Offsets are set.

### **Set X offset**

Zeroes the 'X' data position on the screen. All future moves will be from this set Datum position unless changed at a later date.

### **Set Y offset**

Zeroes the 'Y' data position on the screen. All future moves will be from this set Datum position unless changed at a later date.

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STARMILL CONTROL

Set Z (length) offset

Zeroes the 'Z' data position on the screen. All future moves will be from this set Datum position unless changed at a later date.

All programming is from a set Datum position and the Starmill needs to know where this Datum is. By moving the Tool to the bottom left hand edge of the component and touching the top of component with the cutter you are in the correct place to Set the Datum at this position.

Tool offsets

Tool length offsets are described as a measured distance from the machine fixed zero plane at which the part is programmed, usually top of the workpiece.

The ability exists to use several tools with independant lengths in one program. To program the Z axis we must know where the tip of the tool is at all times. This is done by the current tool number and using the tool length offsets stored in the tool library.

If a move Z-3 is programmed using tool 1 the tool moves -3 from Z 0.

Edit

The 8 tool length offsets allowed can be entered or altered simply by selecting the tool number, from 1 to 8 then either entering the amount of length offset that the tool requires.

Load Tool Offsets from disk

Type in the Tool Offset filename and press Return to load information.

Save Tool Offsets to Disk

Type in the Tool Offset filename and press Return to save the current offsets to Disk.

Once the Tool Offsets have been fixed you can execute the program.

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## **PROGRAM EXECUTION**

During program execution the machine uses several commands as documented in the Simulation section.

[STEP [NOSTEP [TOOLDIA [CLEAR

Comments and questions are also used allowing lessons to be produced.

### **Escape Key.**

If during execution you want to restart the program from the beginning or to quit altogether, pressing the Escape key will give you these two options.

### **Emergency Button**

The red emergency button can be used to stop execution at anytime. Using this button will cut off power to the drives and switch the spindle off. You can restart the program from the beginning by releasing the emergency button and resetting the drives.

### **Important**

The Escape key is not to be used in an emergency, it does not stop the spindle or the drives and should only be used under controlled conditions.

After the program has completed execution with a M02 code the spindle switches itself off and the spindle retracts to a safe tool position.

Programs may be repeated any number of times. Remember to load your Tool Offsets before executing an old program.

STARMILL CNC

EXAMPLES

# STARMILL Milling CNC Program Listing

## Listing of program EXAMPLE1

```

      (Starmill Example1 program.....
      (Exercise Slot and Square.....
N001 G90 ABSOLUTE FORMAT
N002 G71 METRIC UNITS
N003 M06 TOOL CHANGE
      TOOL 1
N004 M03 SPINDLE FWD
      2000 RPM
N005 G00 RAPID TRAVERSE
      X 10.000   Y 10.000   Z 1.000
N006 G01 LINEAR
      X           Y           F
      Z-5.000   F 90.00
      (Start of slot
N007 G01 LINEAR
      X 50.000   Y           F 90.00
      Z           F
N008 G00 RAPID TRAVERSE
      X           Y           Z 2.000
N009 G00 RAPID TRAVERSE
      X 30.000   Y 30.000   Z
N010 G01 LINEAR
      X           Y           F
      Z-5.000   F
      (Start of square
N011 G01 LINEAR
      X 50.000   Y           F
      Z           F
N012 G01 LINEAR
      X           Y 50.000   F
      Z           F
N013 G01 LINEAR
      X 30.000   Y           F
      Z           F
N014 G01 LINEAR
      X           Y 30.000   F
      Z           F
N015 G00 RAPID TRAVERSE
      X           Y           Z 2.000
N016 G00 RAPID TRAVERSE
      X-10.000   Y 30.000   Z 20.000
N017 M02 END PROGRAM

```

End of listing

# STARMILL Milling CNC Program Listing

## Listing of program EXAMPLE2

```
(Starmill Example 2 program
(Exercise Repeats Cycle
N001 G90 ABSOLUTE FORMAT
N002 G71 METRIC UNITS
N003 M06 TOOL CHANGE
      TOOL 1
N004 M03 SPINDLE FWD
      1900 RPM
N005 G00 RAPID TRAVERSE
      X 10.000   Y 10.000   Z 2.000
N006 G01 LINEAR
      X          Y          F
      Z-4.000   F 122.00
      (Start of profile shape
N007 G01 LINEAR
      X 20.000   Y 20.000   F 122.00
      Z          F
N008 G01 LINEAR
      X 40.000   Y 20.000   F
      Z          F
N009 G01 LINEAR
      X 40.000   Y 10.000   F
      Z          F
N010 G01 LINEAR
      X 10.000   Y 10.000   F
      Z          F
N011 G00 RAPID TRAVERSE
      X 10.000   Y 10.000   Z 2.000
      (Start repeat cycle
N012 G81 REPEAT
      FROM 5    TO 11  REPEATS 3
      OFFSETS
      X 10.000   Y 15.000   F
      Z          F
N013 G00 RAPID TRAVERSE
      X          Y          Z 20.000
N014 M02 END PROGRAM
```

End of listing

# STARMILL Milling CNC Program Listing

## Listing of program EXAMPLE3

```

      (Starmill Example Program
      (Produced from AutoCAM & AutoCAD
      (Exercise Circular Cycles
N001 G90 ABSOLUTE FORMAT
N002 G71 METRIC UNITS
      (CAM Profile 1 .....
N003 M05 SPINDLE STOP
N004 M06 TOOL CHANGE
      TOOL 1
N005 M03 SPINDLE FWD
      600 RPM
      (Start of roll round cut
      (No tool compensation
N006 G00 RAPID TRAVERSE
      X 23.782   Y 89.963   Z 1.000
N007 G01 LINEAR
      X 23.782   Y 89.963   F 100.00
      Z-1.000    F 100.00
N008 G03 CIRCULAR CCLW
      X 5.000    Y 70.000   F
      Z          F
      CENTRE     X 25.000   Y 70.000
N009 G03 CIRCULAR CCLW
      X 25.000   Y 50.000   F
      Z          F
      CENTRE     X 25.000   Y 70.000
N010 G03 CIRCULAR CCLW
      X 45.000   Y 70.000   F
      Z          F
      CENTRE     X 25.000   Y 70.000
N011 G03 CIRCULAR CCLW
      X 26.224   Y 89.962   F
      Z          F
      CENTRE     X 25.000   Y 70.000
N012 G01 LINEAR
      X 26.224   Y 85.000   F
      Z          F
N013 G02 CIRCULAR CLW
      X 40.000   Y 70.000   F
      Z          F
      CENTRE     X 25.000   Y 70.000
N014 G02 CIRCULAR CLW
      X 25.000   Y 55.000   F
      Z          F
      CENTRE     X 25.000   Y 70.000
N015 G02 CIRCULAR CLW
      X 10.000   Y 70.000   F
      Z          F
      CENTRE     X 25.000   Y 70.000
N016 G02 CIRCULAR CLW
      X 23.786   Y 84.951   F
      Z          F
      CENTRE     X 25.000   Y 70.000
N017 G01 LINEAR
      X 23.786   Y 80.000   F
      Z          F
N018 G03 CIRCULAR CCLW
      X 15.000   Y 70.000   F
      Z          F

```

N019 G03 CIRCULAR CCLW  
      X 25.000     Y 60.000     F  
      Z             F  
      CENTRE       X 25.000     Y 70.000  
 N020 G03 CIRCULAR CCLW  
      X 35.000     Y 70.000     F  
      Z             F  
      CENTRE       X 25.000     Y 70.000  
 N021 G03 CIRCULAR CCLW  
      X 26.211     Y 79.926     F  
      Z             F  
      CENTRE       X 25.000     Y 70.000  
 N022 G01 LINEAR  
      X 26.177     Y 74.859     F  
      Z             F  
 N023 G02 CIRCULAR CLW  
      X 30.000     Y 70.000     F  
      Z             F  
      CENTRE       X 25.000     Y 70.000  
 N024 G02 CIRCULAR CLW  
      X 25.000     Y 65.000     F  
      Z             F  
      CENTRE       X 25.000     Y 70.000  
 N025 G02 CIRCULAR CLW  
      X 20.000     Y 70.000     F  
      Z             F  
      CENTRE       X 25.000     Y 70.000  
 N026 G02 CIRCULAR CLW  
      X 23.828     Y 74.861     F  
      Z             F  
      CENTRE       X 25.000     Y 70.000  
      (End of roll round cut  
      (CAM Profile 2 .....  
 N027 G00 RAPID TRAVERSE  
      X 23.828     Y 74.861     Z 10.000  
 N028 M03 SPINDLE FWD  
      600   RPM  
      (Start of roll round cut  
      (No tool compensation  
 N029 G00 RAPID TRAVERSE  
      X 73.782     Y 89.963     Z 1.000  
 N030 G01 LINEAR  
      X 73.782     Y 89.963     F  
      Z-1.000       F  
 N031 G03 CIRCULAR CCLW  
      X 55.000     Y 70.000     F  
      Z             F  
      CENTRE       X 75.000     Y 70.000  
 N032 G03 CIRCULAR CCLW  
      X 75.000     Y 50.000     F  
      Z             F  
      CENTRE       X 75.000     Y 70.000  
 N033 G03 CIRCULAR CCLW  
      X 95.000     Y 70.000     F  
      Z             F  
      CENTRE       X 75.000     Y 70.000  
 N034 G03 CIRCULAR CCLW  
      X 76.224     Y 89.962     F  
      Z             F  
      CENTRE       X 75.000     Y 70.000  
 N035 G01 LINEAR  
      X 76.224     Y 85.000     F  
      Z             F

|      |                          |          |          |
|------|--------------------------|----------|----------|
|      | X 90.000                 | Y 70.000 | F        |
|      | Z                        | F        |          |
|      | CENTRE                   | X 75.000 | Y 70.000 |
| N037 | G02 CIRCULAR             | CLW      |          |
|      | X 75.000                 | Y 55.000 | F        |
|      | Z                        | F        |          |
|      | CENTRE                   | X 75.000 | Y 70.000 |
| N038 | G02 CIRCULAR             | CLW      |          |
|      | X 60.000                 | Y 70.000 | F        |
|      | Z                        | F        |          |
|      | CENTRE                   | X 75.000 | Y 70.000 |
| N039 | G02 CIRCULAR             | CLW      |          |
|      | X 73.786                 | Y 84.951 | F        |
|      | Z                        | F        |          |
|      | CENTRE                   | X 75.000 | Y 70.000 |
| N040 | G01 LINEAR               |          |          |
|      | X 73.786                 | Y 80.000 | F        |
|      | Z                        | F        |          |
| N041 | G03 CIRCULAR             | CCLW     |          |
|      | X 65.000                 | Y 70.000 | F        |
|      | Z                        | F        |          |
|      | CENTRE                   | X 75.000 | Y 70.000 |
| N042 | G03 CIRCULAR             | CCLW     |          |
|      | X 75.000                 | Y 60.000 | F        |
|      | Z                        | F        |          |
|      | CENTRE                   | X 75.000 | Y 70.000 |
| N043 | G03 CIRCULAR             | CCLW     |          |
|      | X 85.000                 | Y 70.000 | F        |
|      | Z                        | F        |          |
|      | CENTRE                   | X 75.000 | Y 70.000 |
| N044 | G03 CIRCULAR             | CCLW     |          |
|      | X 76.211                 | Y 79.926 | F        |
|      | Z                        | F        |          |
|      | CENTRE                   | X 75.000 | Y 70.000 |
| N045 | G01 LINEAR               |          |          |
|      | X 76.177                 | Y 74.859 | F        |
|      | Z                        | F        |          |
| N046 | G02 CIRCULAR             | CLW      |          |
|      | X 80.000                 | Y 70.000 | F        |
|      | Z                        | F        |          |
|      | CENTRE                   | X 75.000 | Y 70.000 |
| N047 | G02 CIRCULAR             | CLW      |          |
|      | X 75.000                 | Y 65.000 | F        |
|      | Z                        | F        |          |
|      | CENTRE                   | X 75.000 | Y 70.000 |
| N048 | G02 CIRCULAR             | CLW      |          |
|      | X 70.000                 | Y 70.000 | F        |
|      | Z                        | F        |          |
|      | CENTRE                   | X 75.000 | Y 70.000 |
| N049 | G02 CIRCULAR             | CLW      |          |
|      | X 73.828                 | Y 74.861 | F        |
|      | Z                        | F        |          |
|      | CENTRE                   | X 75.000 | Y 70.000 |
|      | (End of roll round cut   |          |          |
|      | (CAM Profile 3 .....     |          |          |
| N050 | G00 RAPID TRAVERSE       |          |          |
|      | X 73.828                 | Y 74.861 | Z 10.000 |
| N051 | M03 SPINDLE FWD          |          |          |
|      | 600 RPM                  |          |          |
|      | (Start of roll round cut |          |          |
|      | (No tool compensation    |          |          |
| N052 | G00 RAPID TRAVERSE       |          |          |
|      | X 48.782                 | Y 49.963 | Z 1.000  |

|      |                   |          |          |
|------|-------------------|----------|----------|
|      | X 48.782          | Y 49.963 | F        |
|      | Z-1.000           | F        |          |
| N054 | G03 CIRCULAR CCLW |          |          |
|      | X 30.000          | Y 30.000 | F        |
|      | Z                 | F        |          |
|      | CENTRE            | X 50.000 | Y 30.000 |
| N055 | G03 CIRCULAR CCLW |          |          |
|      | X 50.000          | Y 10.000 | F        |
|      | Z                 | F        |          |
|      | CENTRE            | X 50.000 | Y 30.000 |
| N056 | G03 CIRCULAR CCLW |          |          |
|      | X 70.000          | Y 30.000 | F        |
|      | Z                 | F        |          |
|      | CENTRE            | X 50.000 | Y 30.000 |
| N057 | G03 CIRCULAR CCLW |          |          |
|      | X 51.224          | Y 49.962 | F        |
|      | Z                 | F        |          |
|      | CENTRE            | X 50.000 | Y 30.000 |
| N058 | G01 LINEAR        |          |          |
|      | X 51.224          | Y 45.000 | F        |
|      | Z                 | F        |          |
| N059 | G02 CIRCULAR CLW  |          |          |
|      | X 65.000          | Y 30.000 | F        |
|      | Z                 | F        |          |
|      | CENTRE            | X 50.000 | Y 30.000 |
| N060 | G02 CIRCULAR CLW  |          |          |
|      | X 50.000          | Y 15.000 | F        |
|      | Z                 | F        |          |
|      | CENTRE            | X 50.000 | Y 30.000 |
| N061 | G02 CIRCULAR CLW  |          |          |
|      | X 35.000          | Y 30.000 | F        |
|      | Z                 | F        |          |
|      | CENTRE            | X 50.000 | Y 30.000 |
| N062 | G02 CIRCULAR CLW  |          |          |
|      | X 48.786          | Y 44.951 | F        |
|      | Z                 | F        |          |
|      | CENTRE            | X 50.000 | Y 30.000 |
| N063 | G01 LINEAR        |          |          |
|      | X 48.786          | Y 40.000 | F        |
|      | Z                 | F        |          |
| N064 | G03 CIRCULAR CCLW |          |          |
|      | X 40.000          | Y 30.000 | F        |
|      | Z                 | F        |          |
|      | CENTRE            | X 50.000 | Y 30.000 |
| N065 | G03 CIRCULAR CCLW |          |          |
|      | X 50.000          | Y 20.000 | F        |
|      | Z                 | F        |          |
|      | CENTRE            | X 50.000 | Y 30.000 |
| N066 | G03 CIRCULAR CCLW |          |          |
|      | X 60.000          | Y 30.000 | F        |
|      | Z                 | F        |          |
|      | CENTRE            | X 50.000 | Y 30.000 |
| N067 | G03 CIRCULAR CCLW |          |          |
|      | X 51.211          | Y 39.926 | F        |
|      | Z                 | F        |          |
|      | CENTRE            | X 50.000 | Y 30.000 |
| N068 | G01 LINEAR        |          |          |
|      | X 51.177          | Y 34.859 | F        |
|      | Z                 | F        |          |
| N069 | G02 CIRCULAR CLW  |          |          |
|      | X 55.000          | Y 30.000 | F        |
|      | Z                 | F        |          |
|      | CENTRE            | X 50.000 | Y 30.000 |

```
      X 50.000    Y 25.000    F
      Z          F
      CENTRE      X 50.000    Y 30.000
N071 G02 CIRCULAR CLW
      X 45.000    Y 30.000    F
      Z          F
      CENTRE      X 50.000    Y 30.000
N072 G02 CIRCULAR CLW
      X 48.828    Y 34.861    F
      Z          F
      CENTRE      X 50.000    Y 30.000
      (End of roll round cut
      (End of program
N073 G00 RAPID TRAVERSE
      X 48.828    Y 34.861    Z 10.000
N074 M05 SPINDLE STOP
N075 M02 END PROGRAM
```

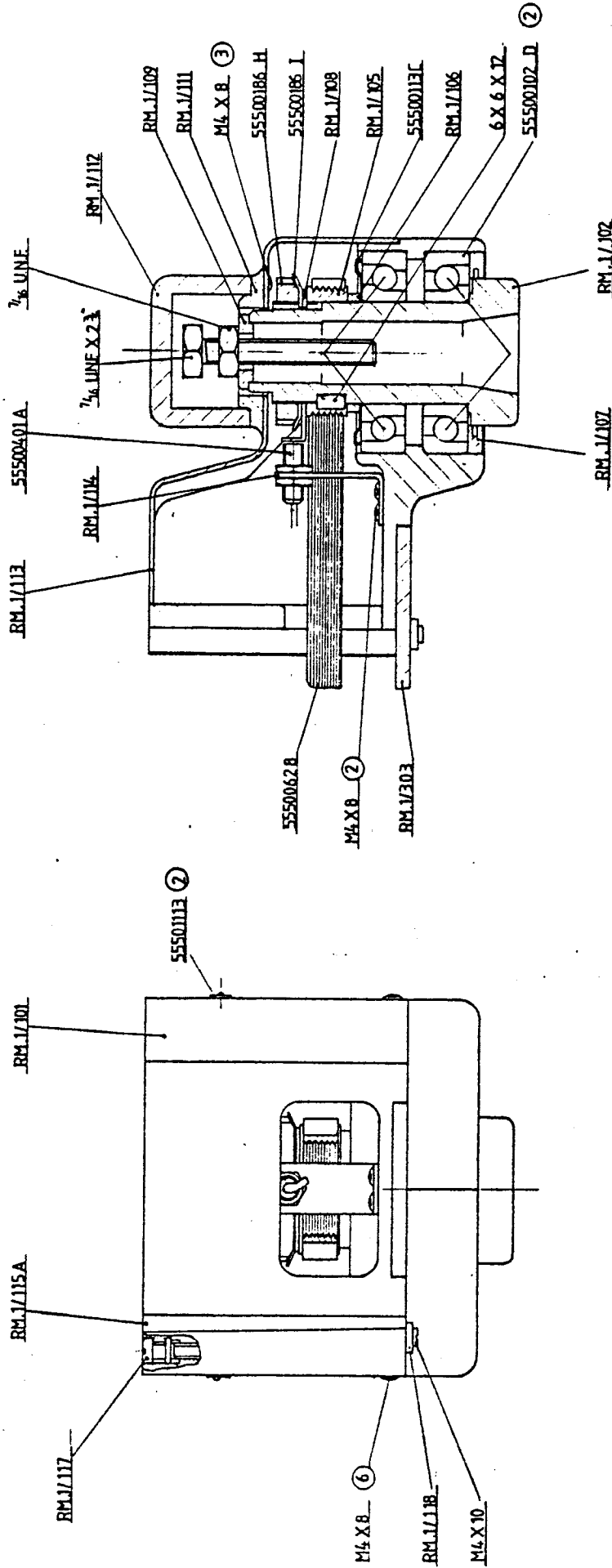
End of listing

# STARMILL

## PART LIST INDEX

|                          |          |
|--------------------------|----------|
| HEAD                     | RM.1/100 |
| BASE & CROSS SLIDE DRIVE | RM.1/200 |
| COLUMN & HEAD DRIVE      | RM.1/300 |
| TABLE & CROSS SLIDE      | RM.1/400 |
| CABINET                  | RM.1/500 |
| A.T.C.                   | RM.1/700 |

IF IN DOUBT ASK



| DESCRIPTION                                     |     | ALTERATIONS |     | DATE |        |
|-------------------------------------------------|-----|-------------|-----|------|--------|
| REV                                             | APP | REV         | APP | DATE | DATE   |
|                                                 |     |             |     |      |        |
| DENFORD MACHINE TOOLS LTD. BRIGHOUSE, YORKSHIRE |     |             |     | DATE | 19 8 8 |
| STARMILL                                        |     |             |     | DATE |        |
| HEAD ASSEMBLY (R8 SPINDLE)                      |     |             |     | DATE |        |
| LIMITS ON DIMENSIONS UNLESS OTHERWISE STATED    |     |             |     | DATE |        |
| ANGULAR ± 1/2° 3 PLACE DECIMAL ± 0.005°         |     |             |     | DATE |        |
| FRACTIONAL ± 0.015" 4 PLACE DECIMAL ± 0.0005"   |     |             |     | DATE |        |
| MATERIAL SIZE                                   |     |             |     | DATE |        |
| MATERIAL                                        |     |             |     | DATE |        |
| MACHINE AT 17°                                  |     |             |     | DATE |        |
| GRIND AT 17°                                    |     |             |     | DATE |        |
| DRAWN A. F. L.                                  |     |             |     | DATE |        |
| CHECKED                                         |     |             |     | DATE |        |
| APPROVED                                        |     |             |     | DATE |        |
| DRAWING No. RM.1/111                            |     |             |     | DATE |        |

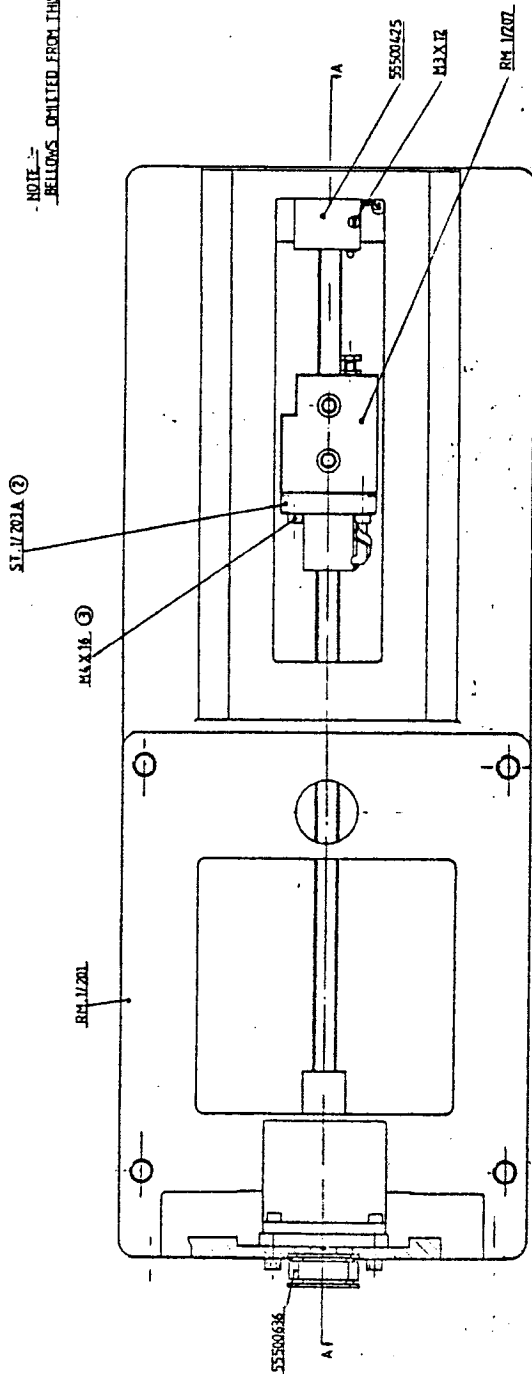
STARMILL PARTS LISTING

| PART No. | DESCRIPTION           | QTY |
|----------|-----------------------|-----|
| RM.1/101 | HEAD                  | 1   |
| 102      | SPINDLE (R8)          | 1   |
| * 103    | SPINDLE (No 2 MT)     | 1   |
| * 104    | SPINDLE (No 30 INT.)  | 1   |
| 105      | SPINDLE PULLEY        | 1   |
| 106      | COLLER                | 1   |
| 107      | GREASE COLLER         | 1   |
| 108      | RPM SENSOR TRIP       | 1   |
| 109      | R8 SPINDLE END CAP    | 1   |
| * 110    | 30 INT. SPINDLE TENON | 2   |
| 111      | DRAW BAR CAP MOUNTING | 1   |
| 112      | DRAW BAR CAP          | 1   |
| 113      | HEAD COVER            | 1   |
| 114      | R.P.M SENSOR BRACKET  | 1   |
| 115A     | HEAD GIB STRIP        | 1   |
| 117      | GIB STRIP SCREW       | 1   |
| 118      | GIB STRIP LOCK        | 1   |

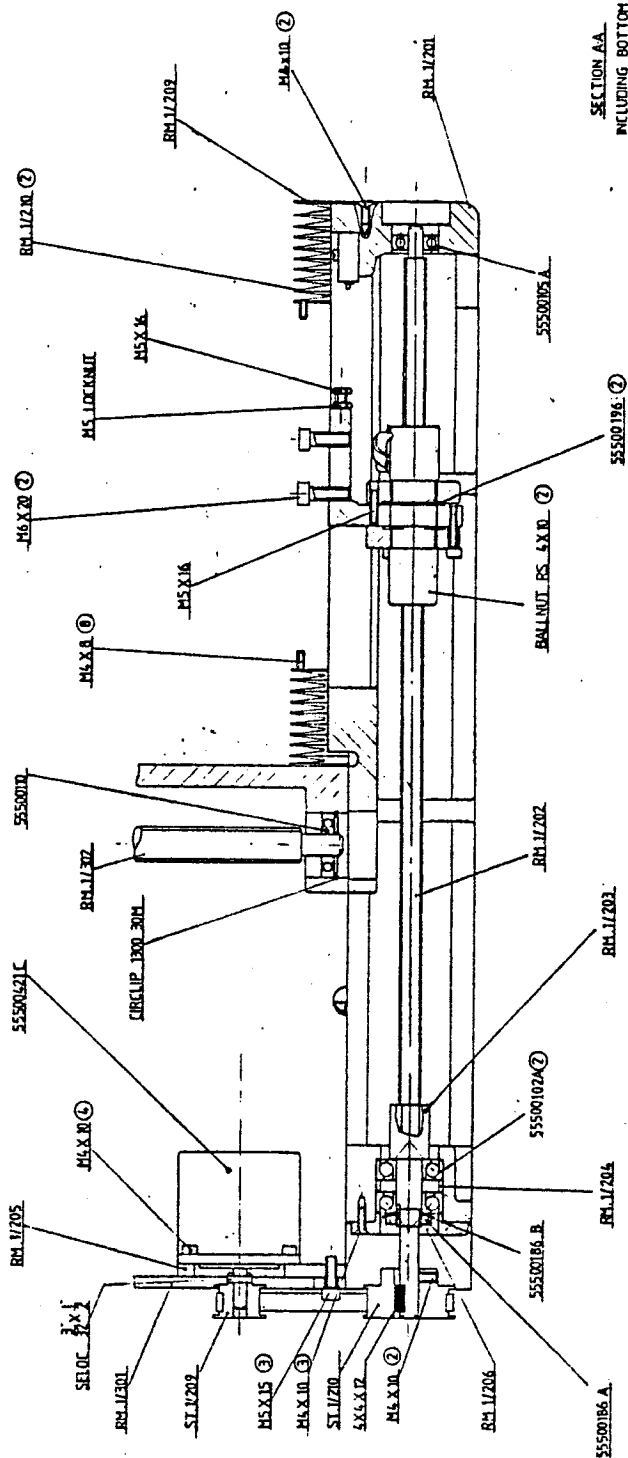
| ITEM       | MANUFACTURER<br>AND REF.No. | COMPUTER No. | QTY |
|------------|-----------------------------|--------------|-----|
| BEARING    | FAG 7208 B                  | 55500102D    | 2   |
| LOCKNUT    | FAG KM 8                    | 55500186H    | 1   |
| TABWASHER  | FAG MB 8                    | 55500186I    | 1   |
| SENSOR     | BALLUFF NJ1 58 GN           | 55500401A    | 1   |
| DRIVE BELT | POLY 'V' 240 J6             | 55501113     | 1   |
| OILER      | LUMATIC BO-4                | 55501113     | 2   |
| NYLOS RING | NYLOS 6208                  | 555001130    | 1   |

\* NOTE : These parts are optional alternatives.

NOTE :-  
BELLOWS OMITTED FROM THIS VIEW.



SECTION A-A  
INCLUDING BOTTOM OF COLUMN

[illegible]

**DENFORD MACHINE TOOLS LTD. BIGHOUSE, YORKSHIRE.**

**STARMILL**

## BASE & CROSS SLIDE DRIVE

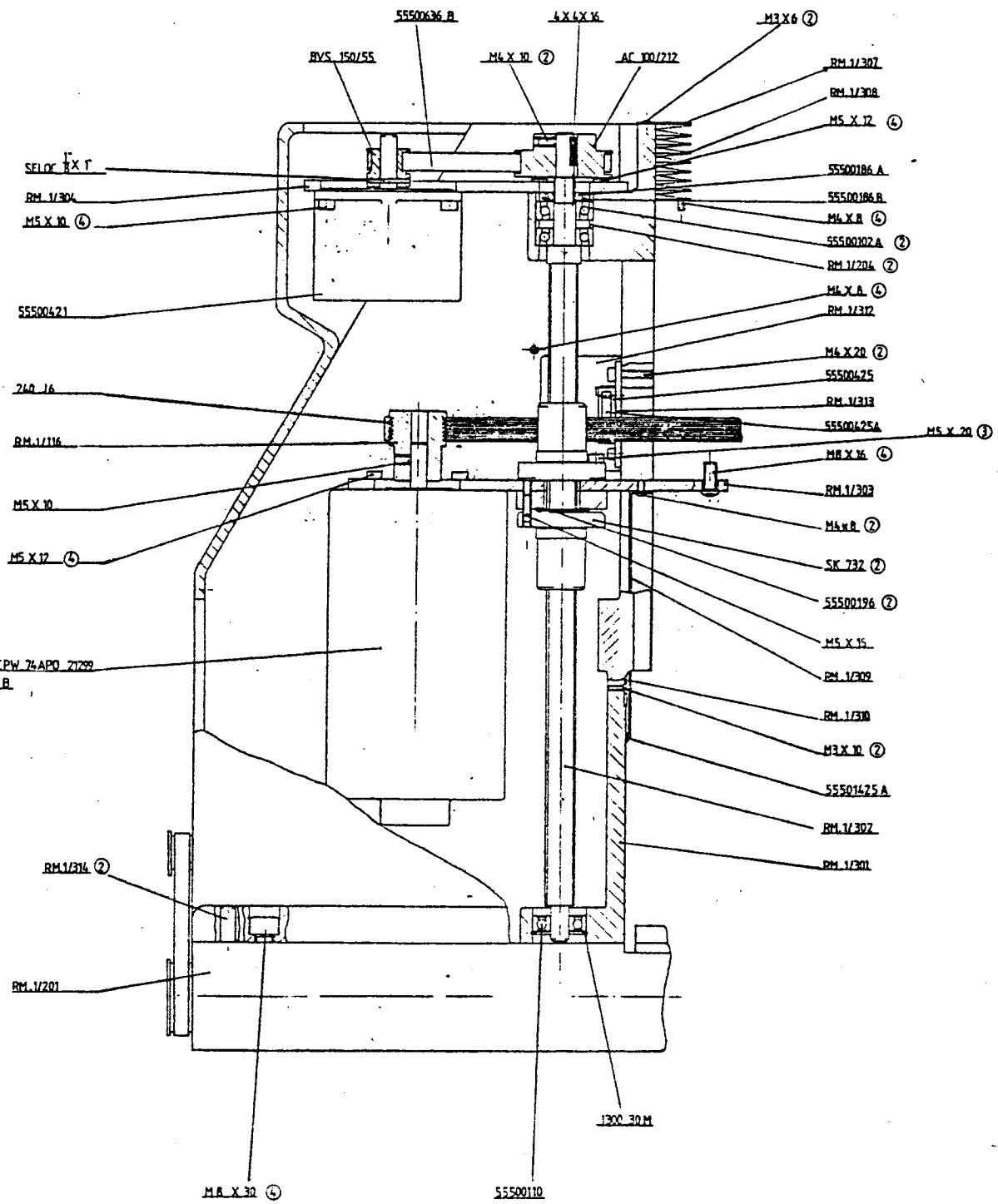
DRAWING No. BM11/3

STARMILL BASE & CROSS SLIDE DRIVE

| PART No.  | DESCRIPTION              | QTY |
|-----------|--------------------------|-----|
| RM.1/201  | BASE                     | 1   |
| 202       | 'Y' AXIS BALLSCREW       | 1   |
| 203       | 'Y' AXIS BALLSCREW       | 1   |
| 204       | BEARING SPACER           | 1   |
| 205       | 'Y' AXIS MOTOR PLANES    | 1   |
| 206       | RETAINING PLATE          | 1   |
| 207       | 'Y' AXIS BALLNUT BRACKET | 1   |
| 208       |                          |     |
| 209       | BASE BELLOW END PLATE    | 1   |
| 210       | BASE BELLOW              | 2   |
| 211       |                          |     |
| 212       |                          |     |
| 213       |                          |     |
| ST.1/203A | BALLNUT HOUSING          | 2   |
| 209       | 12T MOTOR PULLEY         | 1   |
| 210       | 24T PULLEY               | 1   |

| ITEM        | MANUFACTURER<br>AND REF.No.             | COMPUTER No. | QTY |
|-------------|-----------------------------------------|--------------|-----|
| BEARING     | FAG 7201 B                              | 55500102A    | 2   |
| BEARING     | FAG 627 2RS                             | 55500105A    | 1   |
| LOCKNUT     | FAG KM1                                 | 55500186A    | 1   |
| TABWASHER   | FAG MB1                                 | 5500196      | 1   |
| DISC SPRING | 29.7 x 17.4 x 0.40                      | 55500421C    | 2   |
| STEP MOTOR  | CENRONIC DYNAMICS<br>HY-200-2220-210-A8 | 55500421C    | 1   |
| MICROSWITCH | BURGRSS V3S                             | 55500425     | 1   |
| TIMING BELT | FENNER 100 XL 037                       | 55500636     | 1   |
| TIMING      |                                         |              |     |
|             | PULLEY FENNER 24 XL 037<br>(ST.1/210)   | 55500638A    | 1   |
| TIMING      |                                         |              |     |
|             | PULLEY FENNER 12 XL 037<br>(ST.1/209)   | 55500640     | 1   |
| BALLNUT     | HO FONG RS 4 x 10                       |              | 2   |

IF IN DOUBT ASK.



|                                                  |          |
|--------------------------------------------------|----------|
| DRAWING No. RM.1/                                |          |
| DATE                                             | 23/7/8   |
| BY                                               | AM       |
| CHECKED                                          | ATPROVED |
| LIMITS ON DIMENSIONS UNLESS OTHERWISE STATED     |          |
| FRACTIONS 1/16" 3/32" DECIMALS 0.001"            |          |
| TOLERANCES 1/16" 3/32" DECIMALS 0.001"           |          |
| DIN FORD MACHINE TOOLS LTD. BIGHOUSE, YORKSHIRE. |          |
| COLUMN & HEAD DRIVE                              |          |
| STARMILL                                         |          |
| ALTERATIONS                                      |          |

STARMILL COLUMN & HEAD DRIVE RM.1/300

| PART No. | DESCRIPTION                    | QTY |
|----------|--------------------------------|-----|
| RM.1/301 | COLUMN                         | 1   |
| 302      | COLUMN BALLSCREW               | 1   |
| 303      | SPINDLE MOTOR PLATE            | 1   |
| 304      | 'Z' AXIS MOTOR PLATE           | 1   |
| 305      |                                |     |
| 306      |                                |     |
| 307      | COLUMN BELLOW TOP COVER        | 1   |
| 308      | COLUMN BELLOW                  | 1   |
| 309      | COLUMN COVER PLATE             | 1   |
| 310      | COLUMN COVER PLATE(STATIONARY) | 1   |
| 312      | COLUMN SWITCH COVER            | 1   |
| 313      | COLUMN SWITCH PLATE            | 1   |
| 314      | DOWEL PIN                      | 2   |
| 116      | MOTOR PULLEY                   | 1   |
| 204      | BEARING SPACER                 | 2   |

|            |                       |   |
|------------|-----------------------|---|
| BVS.150/55 | 12T PULLEY            | 1 |
| AC.100/212 | 30T PULLEY            | 1 |
| SK.732     | BALLNUT FLANGED 16x5P | 2 |

| ITEM             | MANUFACTURER<br>AND REF.No.              | COMPUTER No. | QTY |
|------------------|------------------------------------------|--------------|-----|
| BEARING          | FAG 7201 B                               | 55500102A    | 2   |
| BEARING          | FAG 6200 2RS                             | 55500110     | 1   |
| LOCKNUT          | FAG KM1                                  | 55500186A    | 1   |
| TABWASHER        | FAG MB1                                  | 55500186B    | 1   |
| DC. MOTOR        | BALDOR DCPM<br>74AH021299                | 55500308B    | 1   |
| STEP MOTOR       | CETRONICS DYNAMICS<br>HY-200-3424-310-A8 | 55500421     | 1   |
| MICROSWITCH      | BURGESS V3S                              | 55500425     | 1   |
| MICROSWITCH      | BURGESS VLR1                             | 55500425A    | 1   |
| ACTUATOR         |                                          |              |     |
| TIMING BELT      | FENNER 120 XL 037                        | 55500636B    | 1   |
| TIMING<br>PULLEY | FENNER 30 XL 037<br>(AC.100/212)         | 55500639     | 1   |
| TIMING<br>PULLEY | FENNER 12 XL 037<br>(BVS.150/55)         | 55500640     | 1   |
| WIPER            | A-6 x 72mm long                          | 55501425A    | 1   |
| DISC SPRING      | 29.7 x 17.4 x 0.40                       | 55500196     | 2   |

DRG. No.

NOTE --  
BASE BELLOWS RM. 1/209 &  
TABLE GUARD RM. 1/616  
ARE OMITTED FROM THIS ARRANGEMENT



|       |        |         |          |         |       |
|-------|--------|---------|----------|---------|-------|
| DRAWN | ISSUED | CHECKED | APPROVED | DATE    | SCALE |
| A.M.  |        |         |          | 21/7/85 |       |

DRAWING No. RM.1/4000

# STARMILL TABLE & CROSS SLIDE

| PART No. | DESCRIPTION              | QTY |
|----------|--------------------------|-----|
| RM.1/401 | CROSS SLIDE              | 1   |
| 402      | TABLE                    | 1   |
| 403      | TABLE BALLSCREW          | 1   |
| 404      | TABLE BALLSCREW ADAPTER  | 1   |
| 405      | TABLE BALLNUT HOUSING    | 2   |
| 406      | TABLE DRIVE HOUSING      | 1   |
| 407      | TABLE BEARING HOUSING    | 1   |
| 408      | CROSS SLIDE GIB STRIP    | 1   |
| 409A     | TABLE GIB STRIP          | 1   |
| 410      | TABLE MOTOR BRACKET      | 1   |
| 411      | TABLE SWITCH COVER PLATE | 1   |
| 412      | TABLE SWITCH BRACKET     | 1   |
| 413      | TABLE BALLNUT MOUNTING   | 1   |
| 414      |                          |     |
| 415      | CLAMP WASHER             | 1   |
| 416      | TABLE GUARD              | 1   |
| 417      | DATUM AND LIMIT TRIP     | 1   |
| 117      | GIB STRIP SCREW          | 1   |
| TR.1/414 | SWITCH PLATE             | 1   |
| 417      | X MOTOR CONNECTION BOX   | 1   |
| ST.1/209 | 12T MOTOR PULLEY         | 1   |
| ST.1/210 | 24T PULLEY               | 1   |

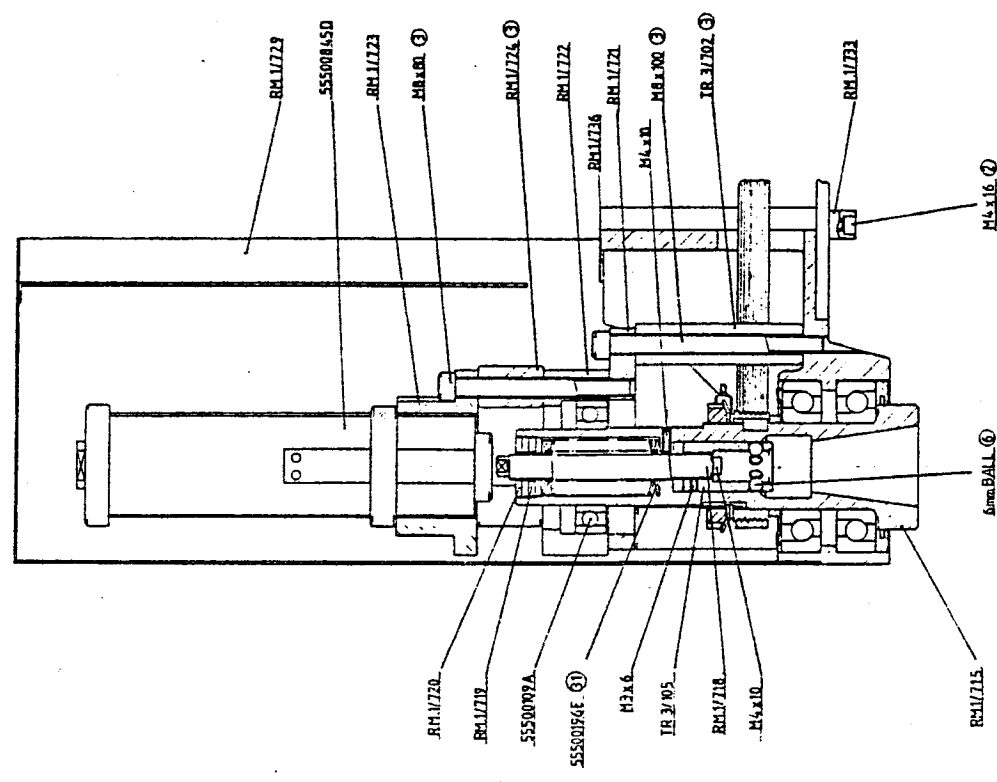
| ITEM        | MANUFACTURER<br>AND REF.No.              | COMPUTER No. | QTY |
|-------------|------------------------------------------|--------------|-----|
| BEARING     | FAG 7201 B                               | 55500102A    | 2   |
| BEARING     | FAG 627 2RS                              | 55500105A    | 1   |
| LOCKNUT     | FAG KM1                                  | 55500186A    | 1   |
| TABWASHER   | FAG MB1                                  | 55500186B    | 1   |
| STEP MOTOR  | CETRONICS DYNAMICS<br>HY-200-2220-210-A8 | 55500421C    | 1   |
| MICROSWITCH | BURGES V3S                               | 55500425     | 1   |
| MICROSWITCH | BURGES VLR1                              | 55500425A    | 1   |
| ACTUATOR    |                                          |              |     |
| TIMING BELT | FENNER 70 XL 037                         | 55500631     | 1   |
| TIMING      |                                          |              |     |
| PULLEY      | FENNER 24 XL 037<br>(ST.1/210)           | 55500638A    | 1   |
| TIMING      |                                          |              |     |
| PULLEY      | FENNER 12 XL 037<br>(ST.1/209)           | 55500640     | 1   |
| OILER       | LUMATIC BO-4                             | 55501113     | 2   |
| BALLNUT     | HO FONG RS 4 x 10                        |              | 2   |
| HOLE PLUG   | HARMSWORTH TOWNSLEY<br>211-E1062-01      |              | 1   |

## STARMILL CABINET

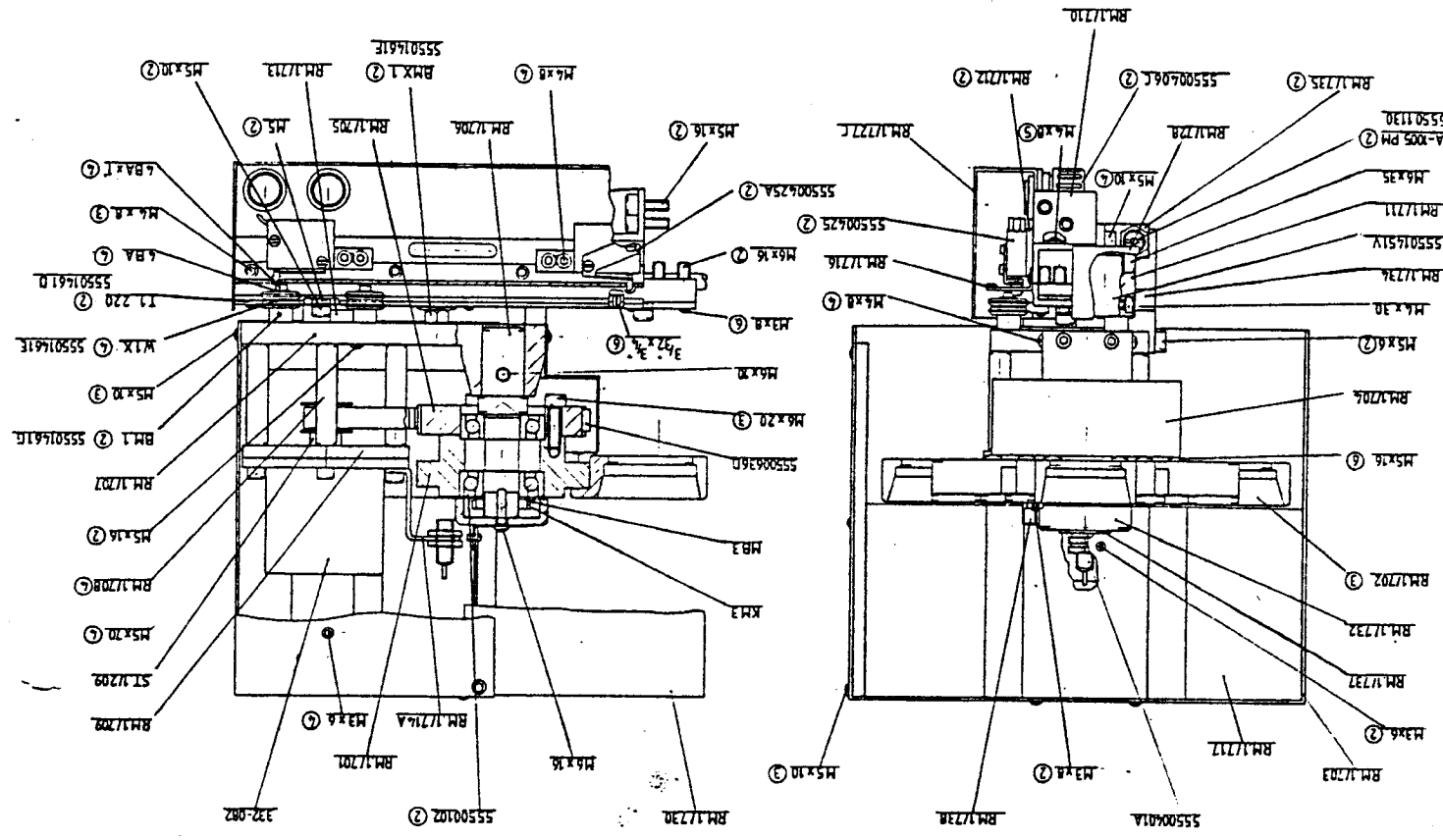
RM.1/500

| PART No.   | DESCRIPTION             | QTY |
|------------|-------------------------|-----|
| RM.1/501 A | CABINET                 | 1   |
| 502        | CABINET TOP             | 1   |
| 503        | CONTROL PANEL BACKPLATE | 1   |
| 504        |                         |     |
| 505        | CABINET PANEL R.H.      | 1   |
| 506        | CABINET PANEL L.H.      | 1   |
| 507        |                         |     |
| 508        |                         |     |
| 509        |                         |     |
| 510        |                         |     |
| 511        | CABINET PANEL ANGLE     | 2   |
| CH.267D    | SPECIFICATION PLATE     | 1   |
| CH.439A    | FRONT PANEL CONTROL     | 1   |

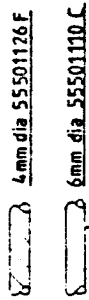
| ITEM               | MANUFACTURER<br>AND REF.No. | COMPUTER No. | QTY |
|--------------------|-----------------------------|--------------|-----|
| ENCLOSURE          | SAREL 8026                  | 55500420D    | 1   |
| ENCLOSURE<br>PLATE | SAREL 5226                  | 55500420E    | 1   |



For parts not numbered see DRG No RM 1/100



**IF IN DOUBT ASK.**

[illegible]

**DRAWING No.** RM 1/ 700 A

STARMILL A.T.C

| PART No.   | DESCRIPTION              | QTY |
|------------|--------------------------|-----|
| RM.1/701   | TURRET                   | 1   |
| 702        | TOOL HOLDER              | 3   |
| 703A       | MOTOR COVER              | 1   |
| 704        | PULLEY COVER             | 1   |
| 705        | TURRET PULLEY            | 1   |
| 706        | BEARING SHAFT            | 1   |
| 707        | CARRIAGE                 | 1   |
| 708        | SUPPORT PILLAR           | 4   |
| 709        | MOTOR PLATE              | 1   |
| 710        | TRACK SUPPORT            | 1   |
| 711        | CYLINDER SUPPORT         | 1   |
| 712        | MICRO SWITCH PLATE       | 2   |
| 713        | STOP                     | 1   |
| 714A       | SENSOR PLATE             | 1   |
| * 715      | SPINDLE (No.35 INT)      | 1   |
| 716        | SWITCH GUARD             | 1   |
| 717        | SENSOR GUARD             | 1   |
| * 718      | DRAW BAR                 | 1   |
| * 719      | PRE LOAD NUT             | 1   |
| * 720      | LIMIT NUT                | 1   |
| * 721      | MOUNTING PLATE           | 1   |
| * 722      | BEARING FLANGE           | 1   |
| * 723      | PISTON FLANGE            | 1   |
| * 724      | SUPPORT PILLARS          | 3   |
| 725        |                          |     |
| 726A       | PNEUMATIC MOUNTING PLATE | 1   |
| 727C       | TRACK GUARD              | 1   |
| 728        | CYLINDER COVER           | 1   |
| * 729      | HEAD COVER               | 1   |
| 730        | TOOL GUARD               | 1   |
| 731        | TABLE GUARD              | 1   |
| 732        | BEARING CAP              | 1   |
| * 733      | HEAD LIMIT TRIP          | 1   |
| 734        | SHOCK ABSORBER BLOCK     | 1   |
| 735        | SHOCK ABSORBER BRACKET   | 2   |
| 736        | BELLOW SUPPORT PLATE     | 1   |
| 737        | SENSOR GUARD LUG         | 1   |
| 738        | SENSOR TRIP              | 1   |
| 739        | FLOW VALVE BRACKET       | 1   |
| * TR.1/119 | HEAD KNOCK OFF           |     |
|            | MICRO SWITCH BOX         | 1   |
| * TR.3/105 | DRAW BAR COLLET          | 1   |
| * 702      | MOUNTING PILLAR          | 3   |
| ST.1/209   | MOTOR PULLEY 12T         | 1   |

\* These parts are added to HEAD ASSEMBLY RM.1/100

# STARMILL A.T.C. Cont.

The following RM.1/100 parts are OMITTED

|          |                       |
|----------|-----------------------|
| RM.1/102 | SPINDLE               |
| 109      | END CAP               |
| 111      | DRAW BAR CAP MOUNTING |
| 112      | DRAW BAR CAP          |
| 113      | HEAD COVER            |

| DESCRIPTION      | MANUFACTURER & REF.      | COMPUTER<br>No. | QTY |
|------------------|--------------------------|-----------------|-----|
| BEARING          | FAG 7203B                | 55500102        | 2   |
| BEARING          | FAG 6007 2RS             | 55500109A       | 1   |
| LOCKNUT          | FAG KM 3                 | 55500184E       | 1   |
| TABWASHER        | FAG MB 3                 | 55500184F       | 1   |
| DISC SPRING      | 28 x 14.1 x 1.25         | 55500196E       | 31  |
| MICRO SWITCH     | BURGES 4CR QR            | 55500381C       | 1   |
| SENSOR           | BALLUFF NJ 58 GN         | 55500401A       | 2   |
| MICRO SWITCH     | BURGES V3S               | 55500425        | 2   |
| ACTUATOR         | BURGES VLR 1             | 55500425A       | 2   |
| TIMING BELT      | FENNER 130XL037          | 55500636D       | 1   |
| TIMING PULLEY    | FENNER 48XL050(RM.1/705) | 55500637        | 1   |
| TIMING PULLEY    | FENNER 12XL037(ST.1/209) | 55500640        | 1   |
| SLIDE TRACK      | HEPCO T1 x 220mm         | 55501461D       | 2   |
| SLIDE WHEEL      | HEPCO W1X                | 55501461E       | 4   |
| ADJUSTABLE BUSH  | HEPCO BMX1               | 55501461F       | 2   |
| STATIONARY BUSH  | HEPCO BM1                | 55501461G       | 2   |
| STEP MOTOR       | R.S. 332-082             | 332-082         | 1   |
| STEEL BALL       | 6mm DIA.                 |                 | 6   |
| NYLON 'P' CLIP   | R.S.543-377              | 543-377         | 1   |
| SHOCK ABSORBER   | ACE FA-1005 PM           | 55501130        | 2   |
| CLAMP UNIT       | BRAUER 489               | 55500845D       | 1   |
| NYLON TUBE       | 6mm DIA.                 | 55501110C       |     |
| NYLON TUBE       | 4mm DIA.                 | 55501126F       |     |
| LUBRICATOR       | ENOTS L04-200-M2KN       | 55501127A       | 1   |
| PUSH IN ELBOW    | ENOTS 97-1005-02         | 55501128B       | 2   |
| SOLENOID VALVE   | ENOTS 14-1135-50-240     | 55501128G       | 1   |
| REDUCER          | .125" x .25" M.B145148   | 55501128M       | 1   |
| PUSH IN ADAPTER  | ENOTS 97-1505-02         | 55501128N       | 7   |
| PLASTIC SILENCER | .125" BSP. S/S 1x10      | 55501128T       | 3   |
| SOLENOID VALVE   | ENOTS X4-1155-50-240     | 55501128V       | 1   |
| NON RETURN VALVE | ENOTS 04-0355-00-000     | 55501128W       | 1   |
| FLOW VAALVES     | ENOTS 04-0351-00-000     | 55501128X       | 2   |
| PUSH IN ELBOW    | ENOTS 97-1114-04         | 55501129H       | 3   |
| REDUCING CON.    | ENOTS 97-1517-27         | 55501129I       | 1   |
| FILTER REGULATOR | ENOTS B06-101-AZKS       | 55501451        | 1   |
| PRESSURE GUAGE   | ENOTS 07-0131-16         | 55501451A       | 1   |
| BRACKET          | ENOTS 18-001-053         | 55501451B       | 1   |
| PUSH IN ADAPTER  | ENOTS 97-1505-04         | 55501451C       | 2   |
| PUSH IN ELBOW    | ENOTS 97-1005-10         | 55501451D       | 1   |
| CON. TEE         | ENOTS 97-1514-04         | 55501451L       | 1   |
| HOSE ADAPTER     | .125" BSP.SCHRADER805    | 55501451S       | 1   |
| CYLINDER         | ENOTS 60-152-01-0160     | 55501451V       | 1   |

STARMILL  
MAINTENANCE  
SECTION

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GIB STRIP ADJUSTMENT

TOOLS REQUIRED

Screw driver, 7mm A/F Spanner, 2mm A/F Allenkey

GENERAL

Over a substantial period of time wear will occur on the GIB STRIPS and so it will be necessary to adjust them.

HEAD GIB STRIP ADJUSTMENT (FIG.1)

1. Release Gib Strip lock underneath head with screw driver.
2. Turn Gib Strip adjustment screw clockwise until tight - DO NOT OVER TIGHTEN !
3. Lock Gib Strip lock.
4. Run head column up and down several times to ensure movement is continuously smooth. If it is not, untighten Gib Strip by repeating 1-3 but turning the Gib Strip adjusting screw counter-clockwise in 2.
Repeat 4.
5. Repeat 1-3 to ensure Gib Strip is still tight.
6. Repeat 4-5 if Gib Strip requires adjustment at 5.

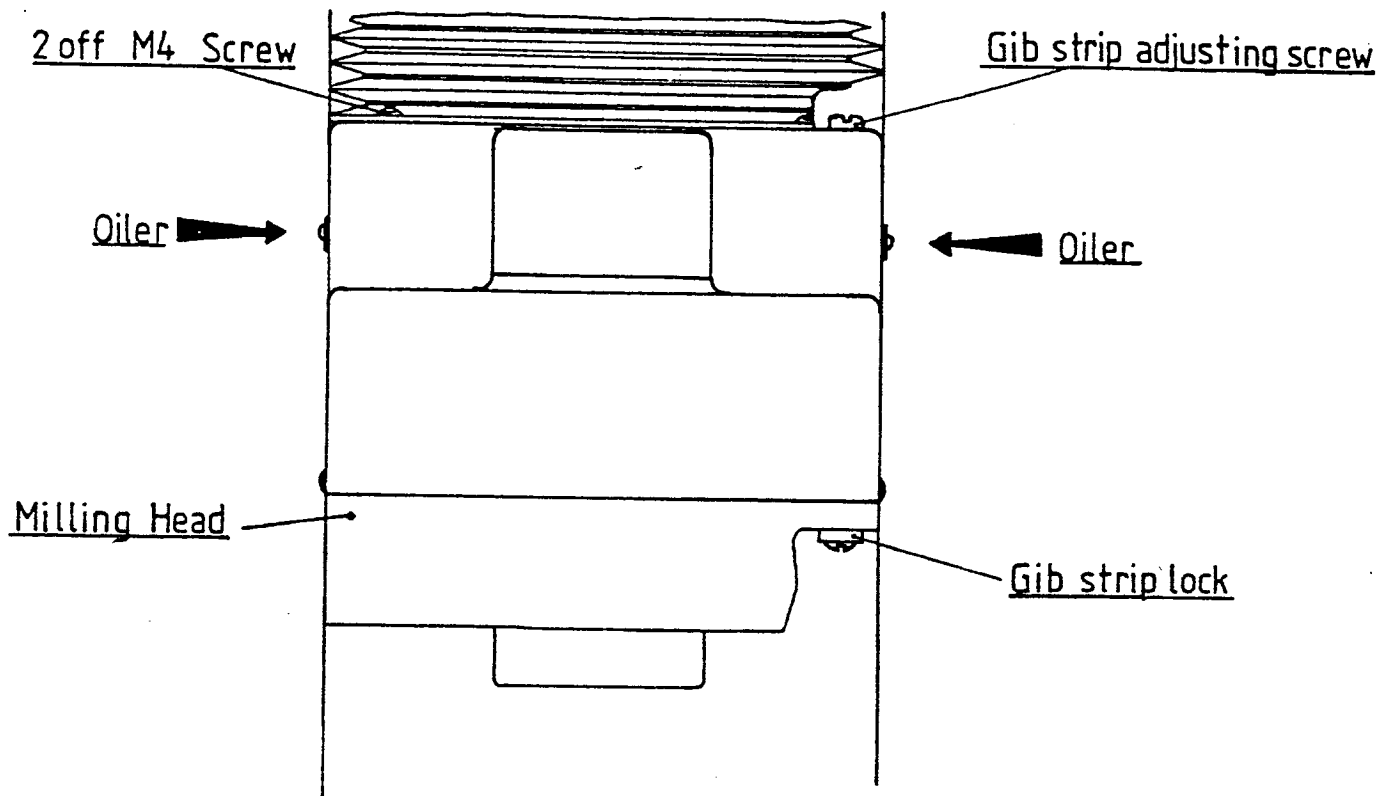
TABLE GIB STRIP ADJUSTMENT (FIG.2)

1. Turn Gib Strip adjustment screw clockwise until tight - DO NOT OVER TIGHTEN !
 2. Run table back and forth several times to ensure movement is continuously smooth. If it is not, untighten Gib Strip by repeating 1 but turning the adjusting screw counter-clockwise.
Repeat 2.
 3. Repeat 1 to ensure Gib Strip is still tight.
 4. Repeat 2-3 if Gib Strip requires adjustment at 3.
- ~~~~~

~~~~~  
**GIB STRIP ADJUSTMENT cont.. fig 2**

- 1 Place 2mm A/F Allen Key into M4 Gib Strip adjusting screw.
- 2 Repeat 1 for the other M4 Gib Strip Adjusting screw and locknut.
- 3 Tighten Gib Strip adjusting screws by turning them both clockwise. Do not over tighten.
- 4 Lock grub screws by turning locknuts clockwise until they lock against the crossslide.
- 5 Run cross slide back and forth several times to ensure movement is continuous and smooth. If it is not then repeat 1-4 but turn Gib Strip adjusting screw counter clockwise as 3. Then repeat 5.
- 6 Repeat 1-4 to ensure Gib Strip is still tight.
- 7 Repeat 5-6 if Gib Strip requires adjustment at 6.

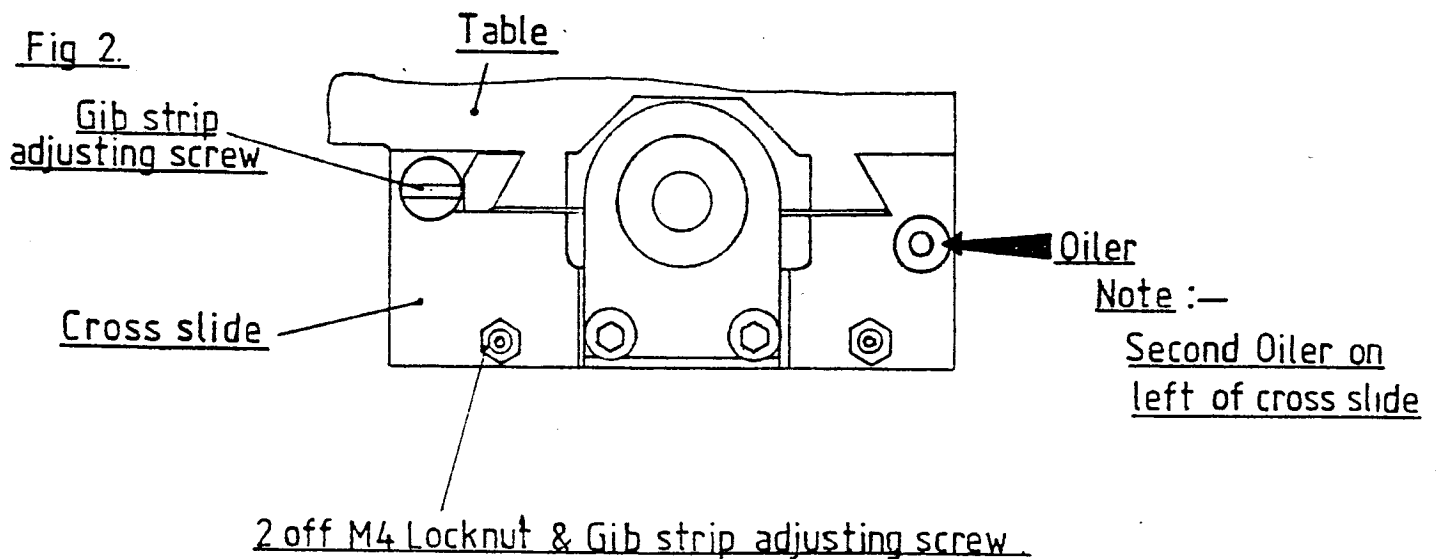
Fig 1.



OIL WEEKLY

| Recommended Oil |             |
|-----------------|-------------|
| B.P.            | C S,68      |
| CASTROL         | Perfecto,NN |
| SHELL           | Vitrea,68   |

Fig 2.



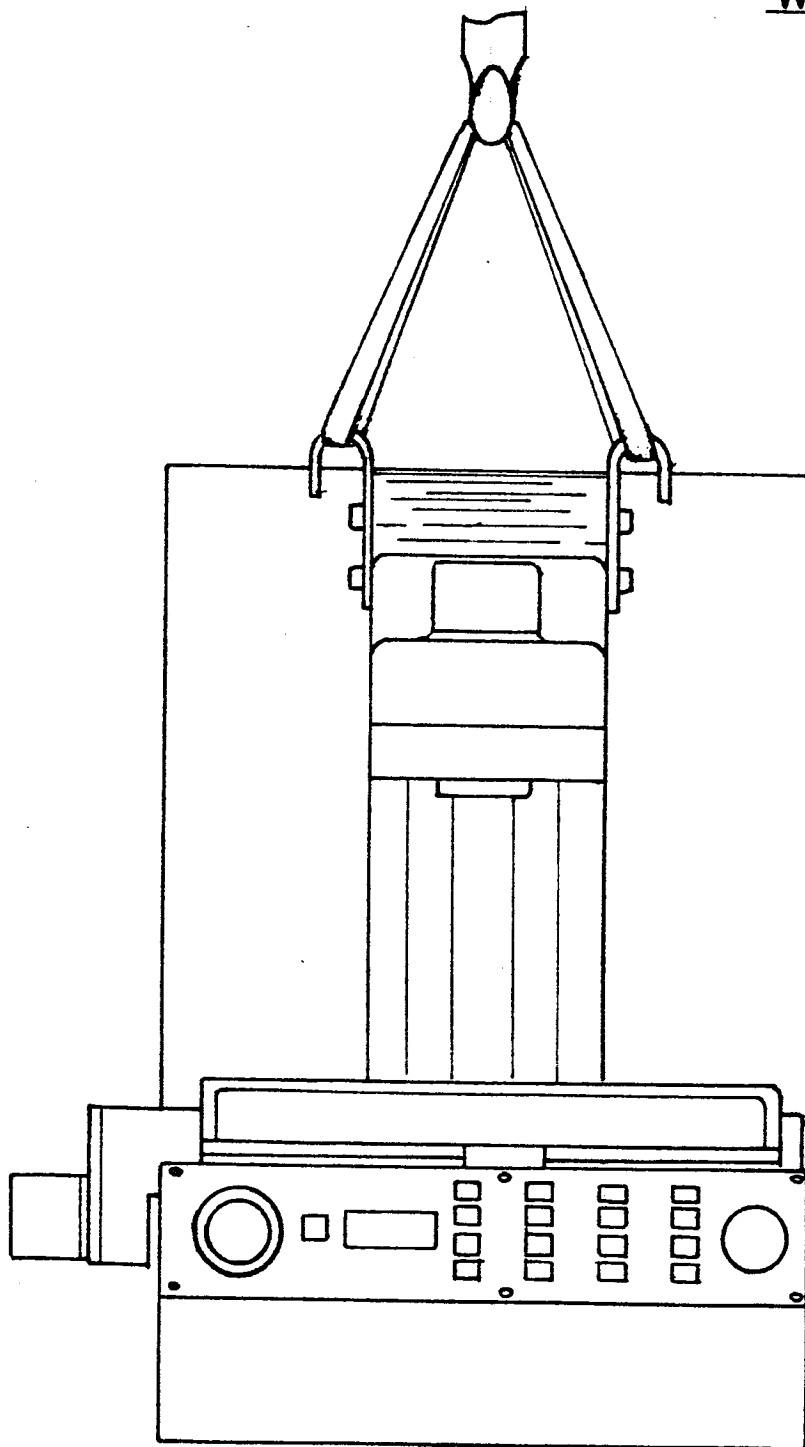
# STARMILL

## LIFTING DIAGRAM

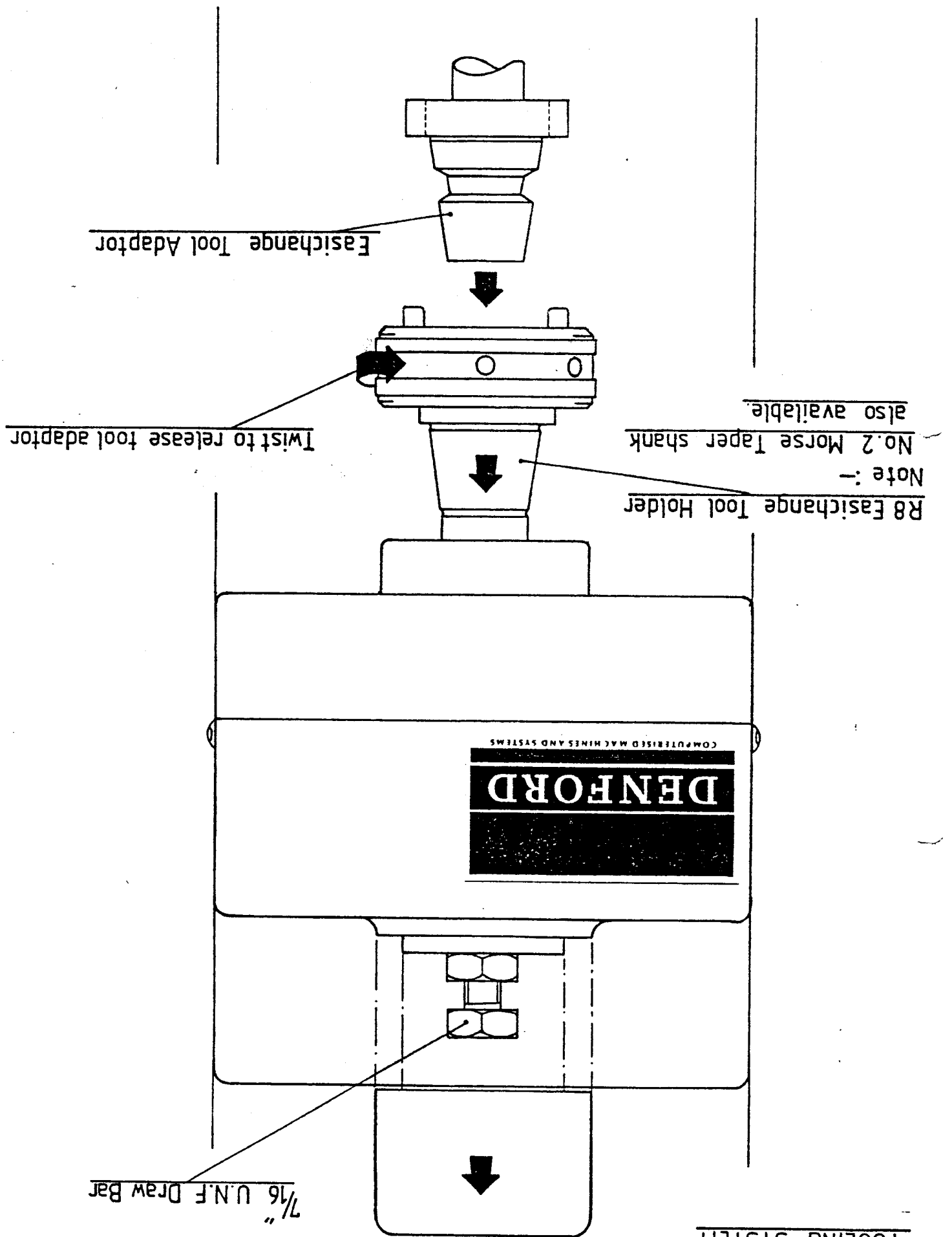
Weight :-

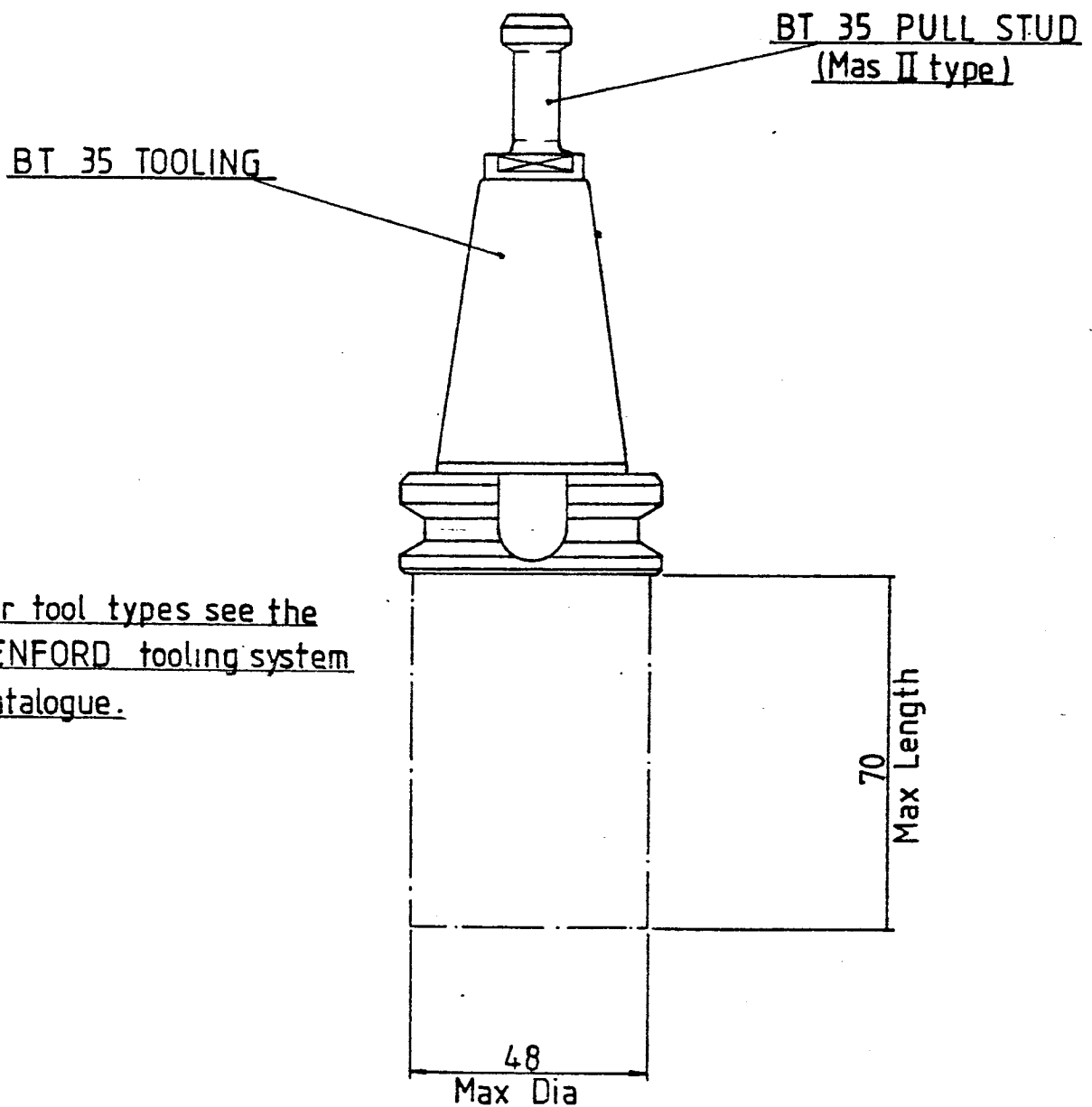
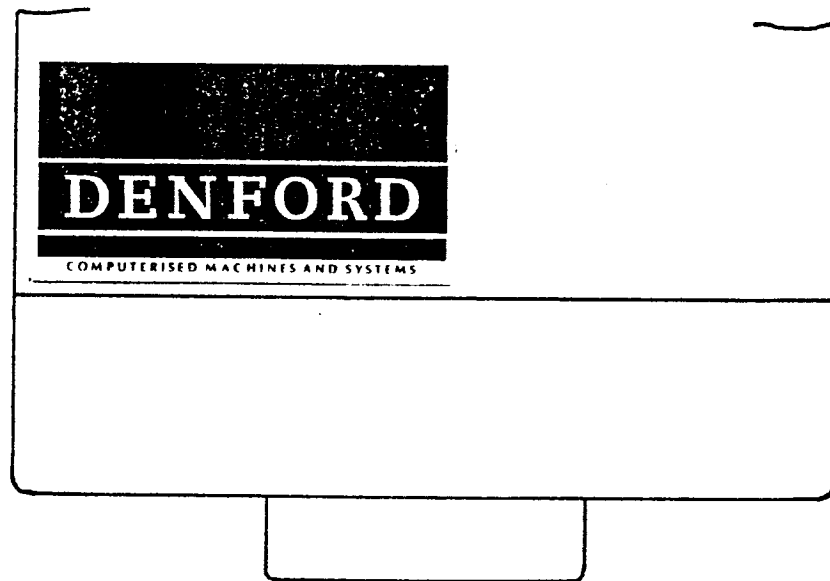
With A.T.C. 110 kg

Without A.T.C. 100 kg



# STAR MILL TOOLING SYSTEM





For tool types see the  
DENFORD tooling system  
catalogue.

# Air Conditioning Unit

PRESSURE INCREASE

OIL FEED INCREASE

LOCK RING (RED)  
Press down to lock

LOCK RING (RED)  
Press down to lock

Schrader  
Connector

AIR IN

80-100 P.S.I.  
(5.5-6.5 BAR)

Recommended  
Air line lubricant  
SAE 10 (Thomas  
Wrights)

FULL

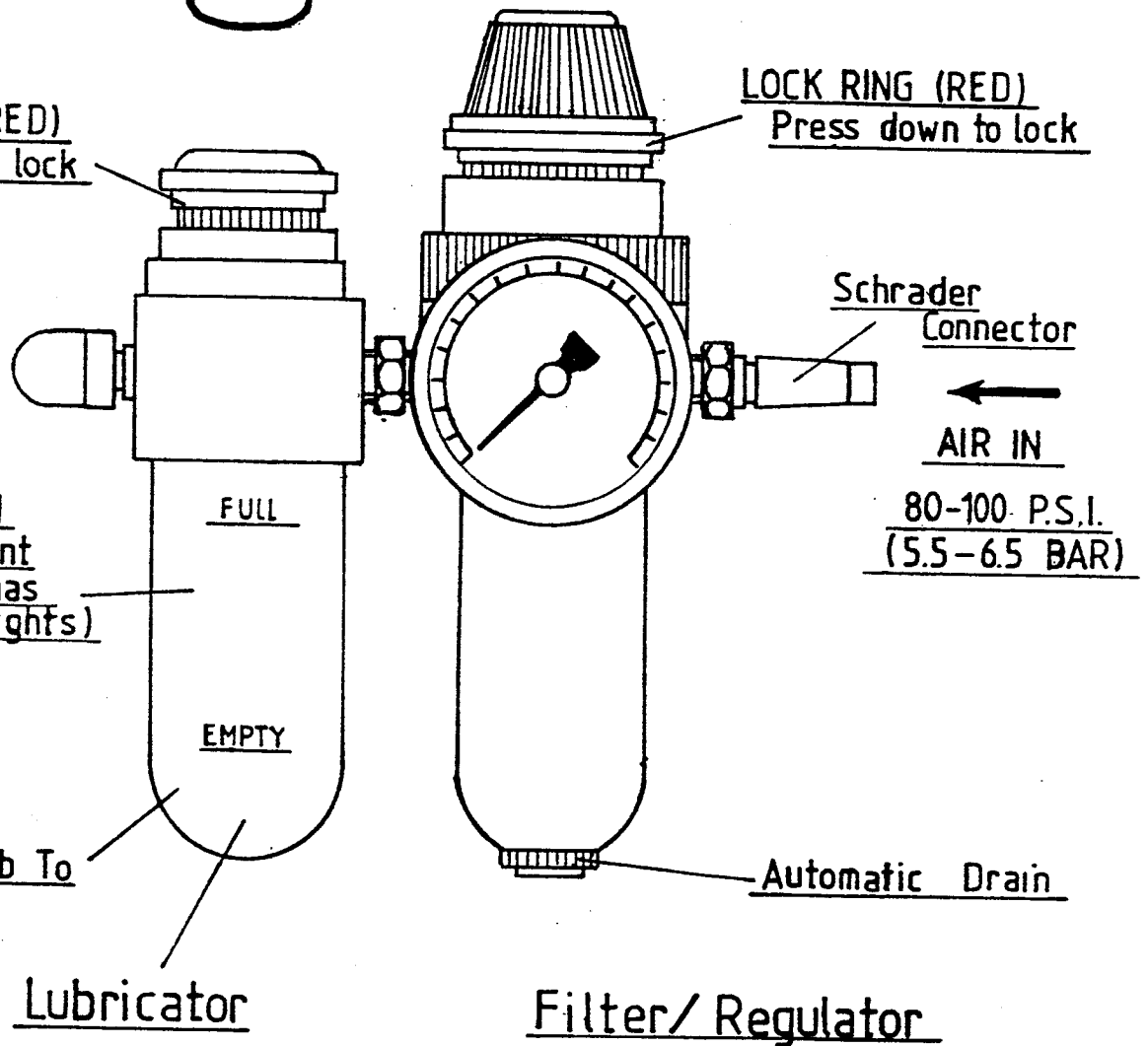
EMPTY

Unscrew Bulb To  
Refill

Lubricator

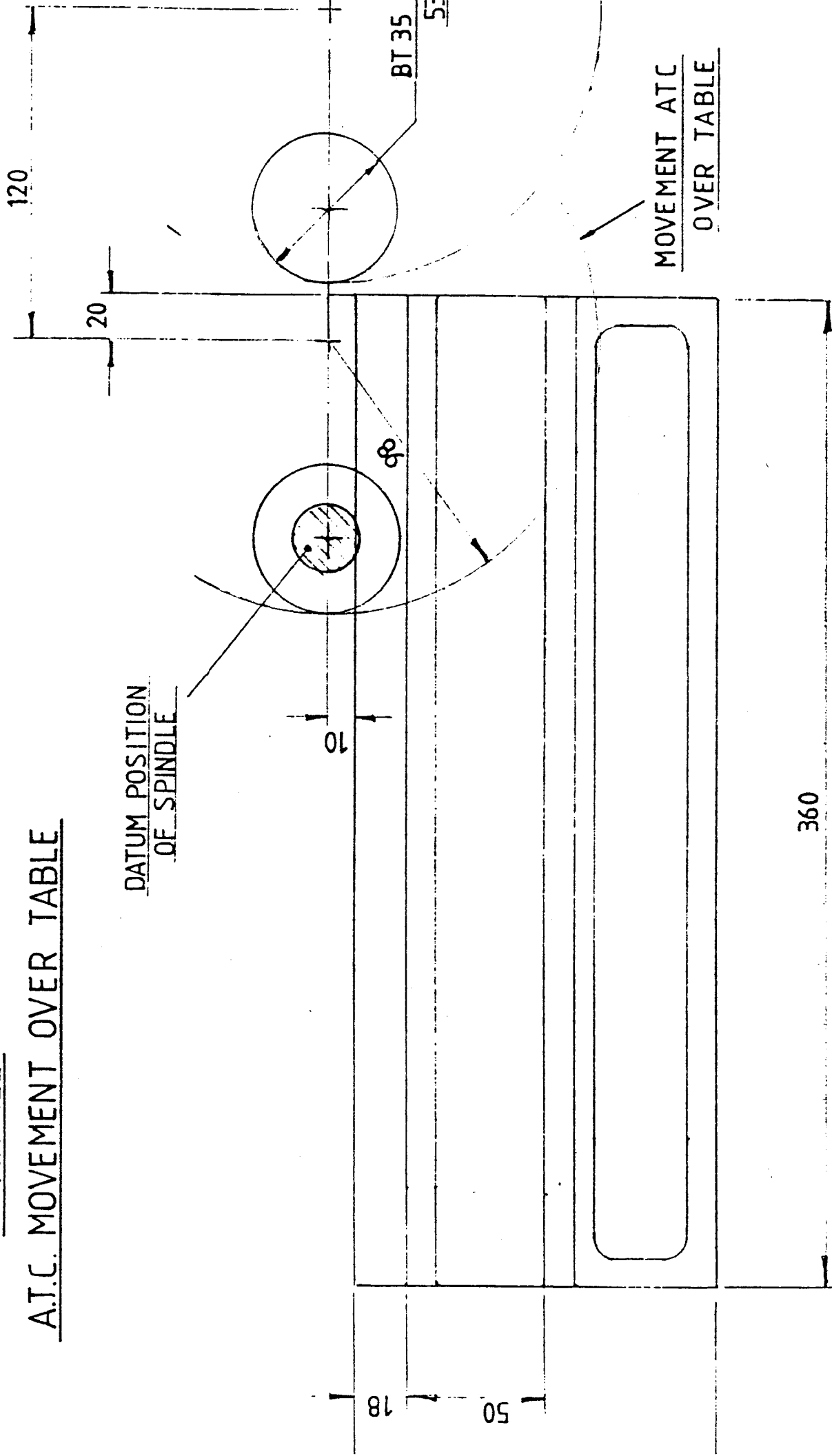
Automatic Drain

Filter/Regulator



STARMILL

A.T.C. MOVEMENT OVER TABLE



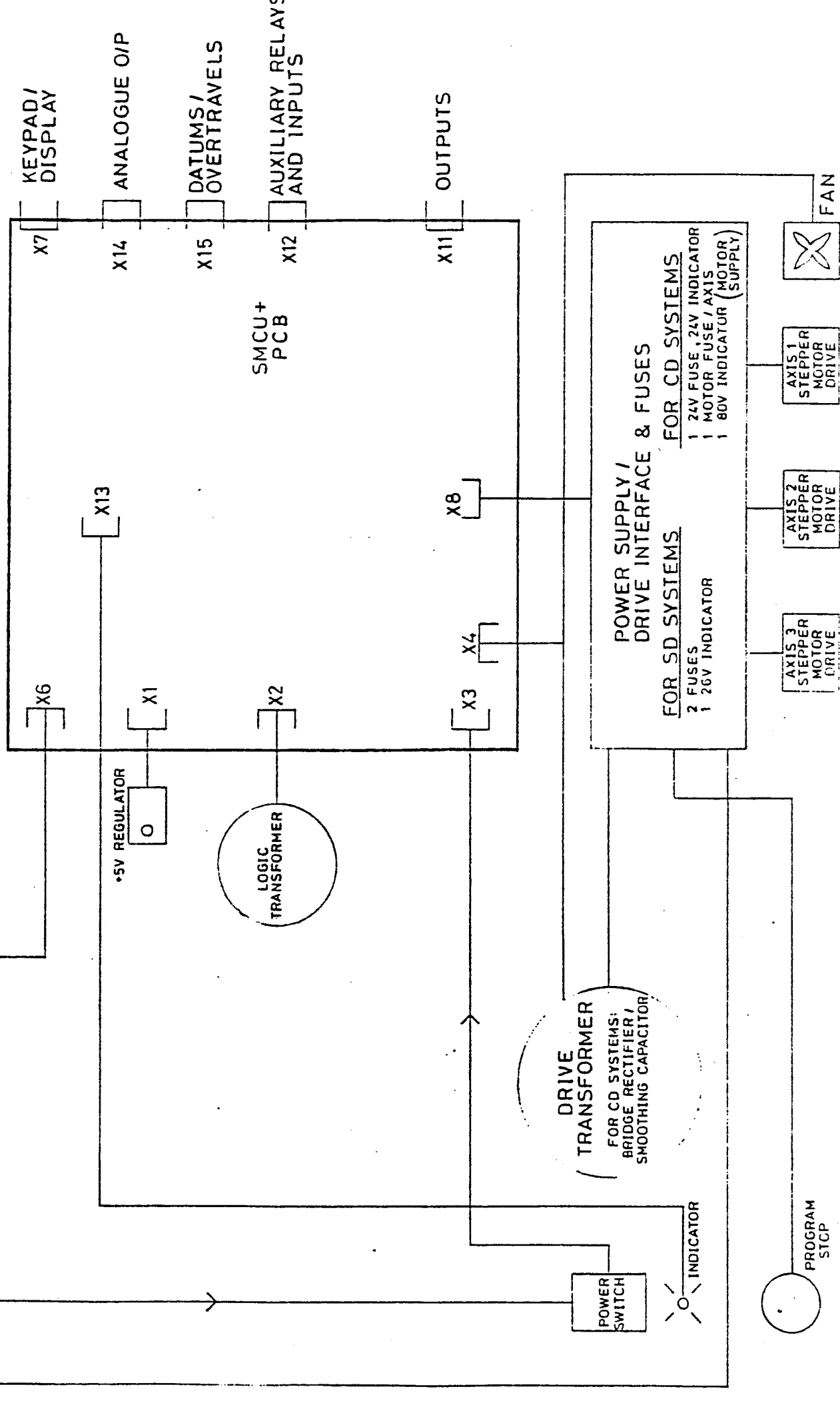
10TORS

POWER

RS232

# SMCU+ BLOCK DIAGRAM 24/8/87

ISSUE 1  
REV 1

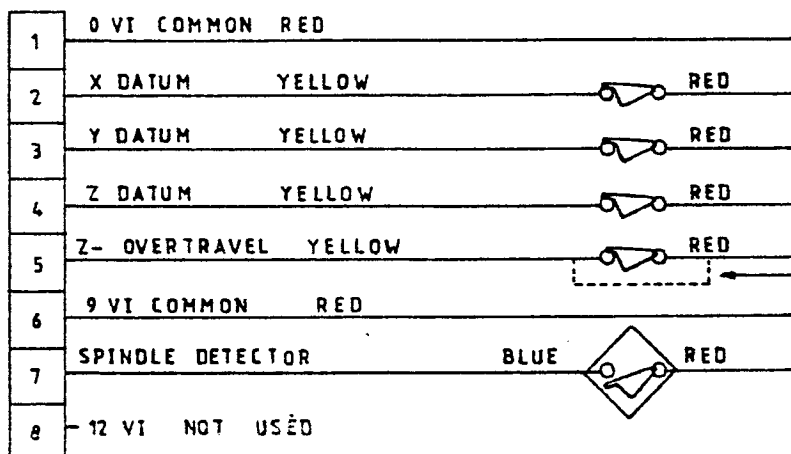
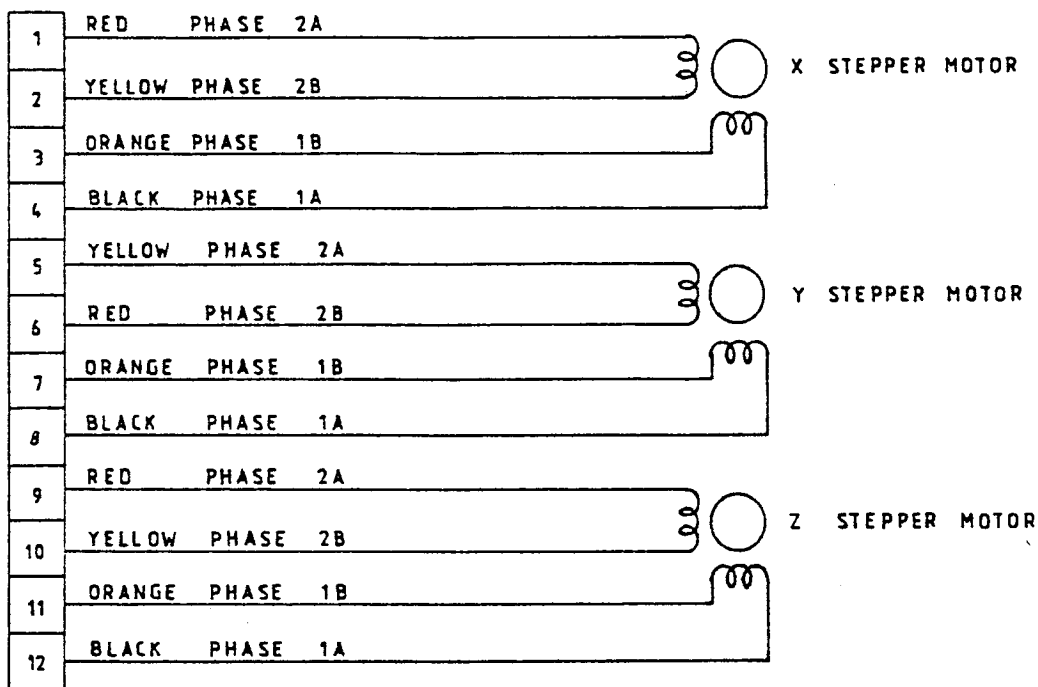


STARMILL STEPPER &  
DATUM WIRING

OF

CONT ON  
SHEET No.

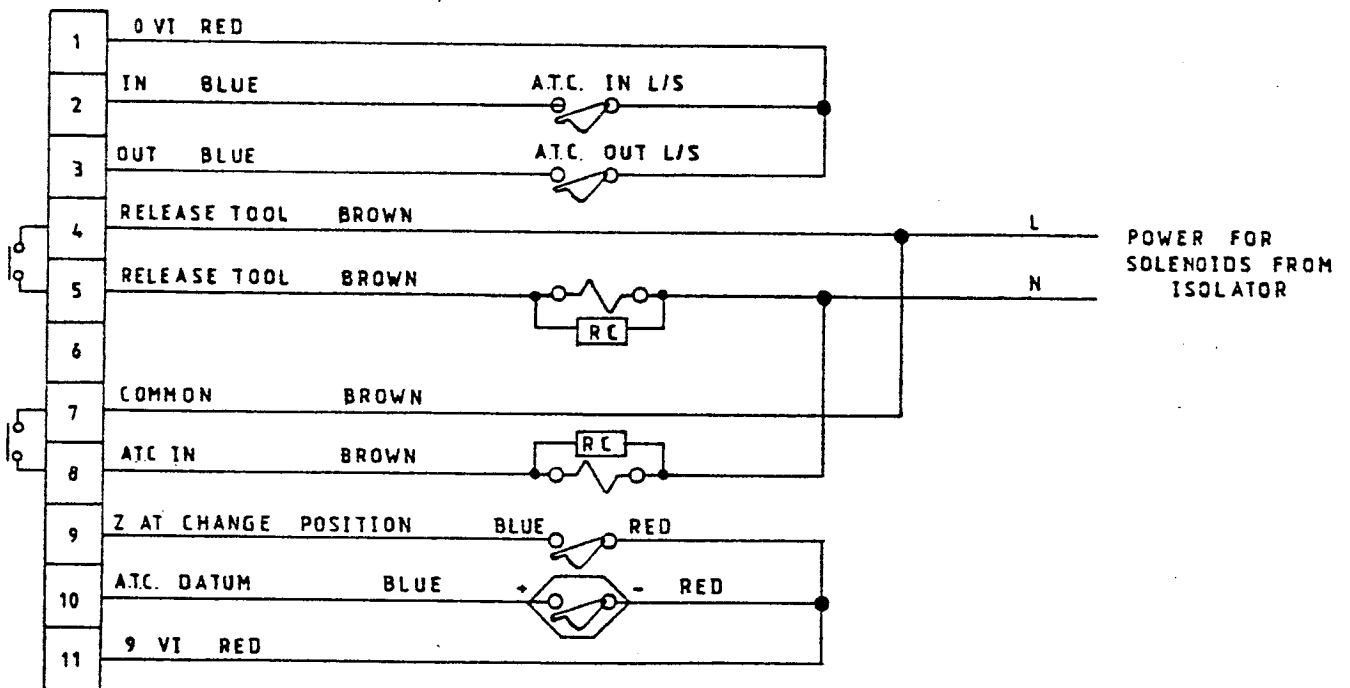
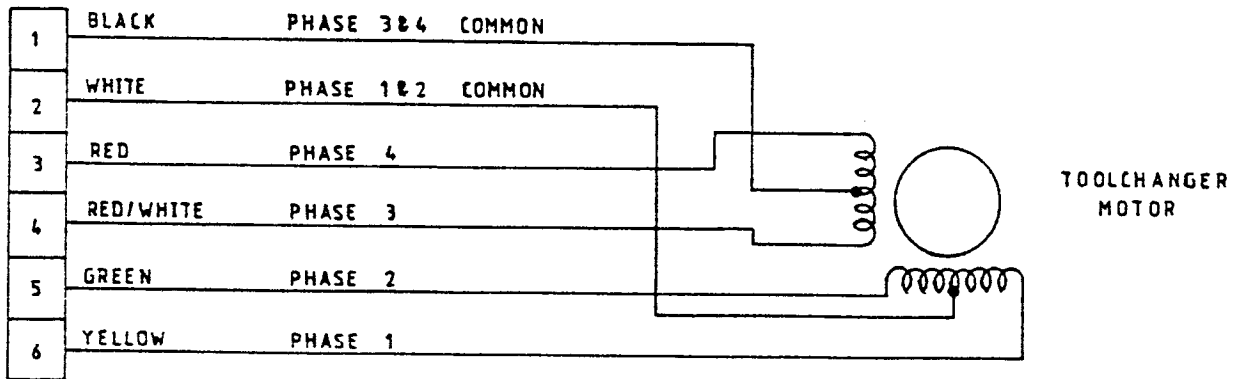
SHEET No.



L/S NOT FITTED ON STANDARD  
STARMILLS (LINK AS SHOWN)

STARHILL A.T.C.  
TOOLCHANGER WIRING

SHEET No.  
OF  
CONT. ON  
SHEET No.



## INPUTS AND AUXILIARIES

15 WAY  
D PLUGCONNECTOR  
X 12PINS 4 & 6 ARE  
NOT WIRED ON  
A.T.C. MACHINES

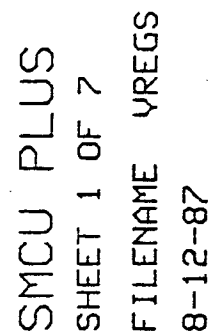
| PIN<br>No. |        |              | PIN<br>No. |
|------------|--------|--------------|------------|
| 1          | ORANGE | AUX 1 N/O    | 3          |
| 3          | BROWN  | AUX 1 COMMON | 1          |
| 4          | VIOLET | AUX 2 N/O    | 6          |
| 6          | GREY   | AUX 2 COMMON | 4          |
| 10         | BROWN  | 0 VI         | 13         |
| 11         | ORANGE | I/P 1        | 14         |
| 12         | BLUE   | I/P 2        | 15         |

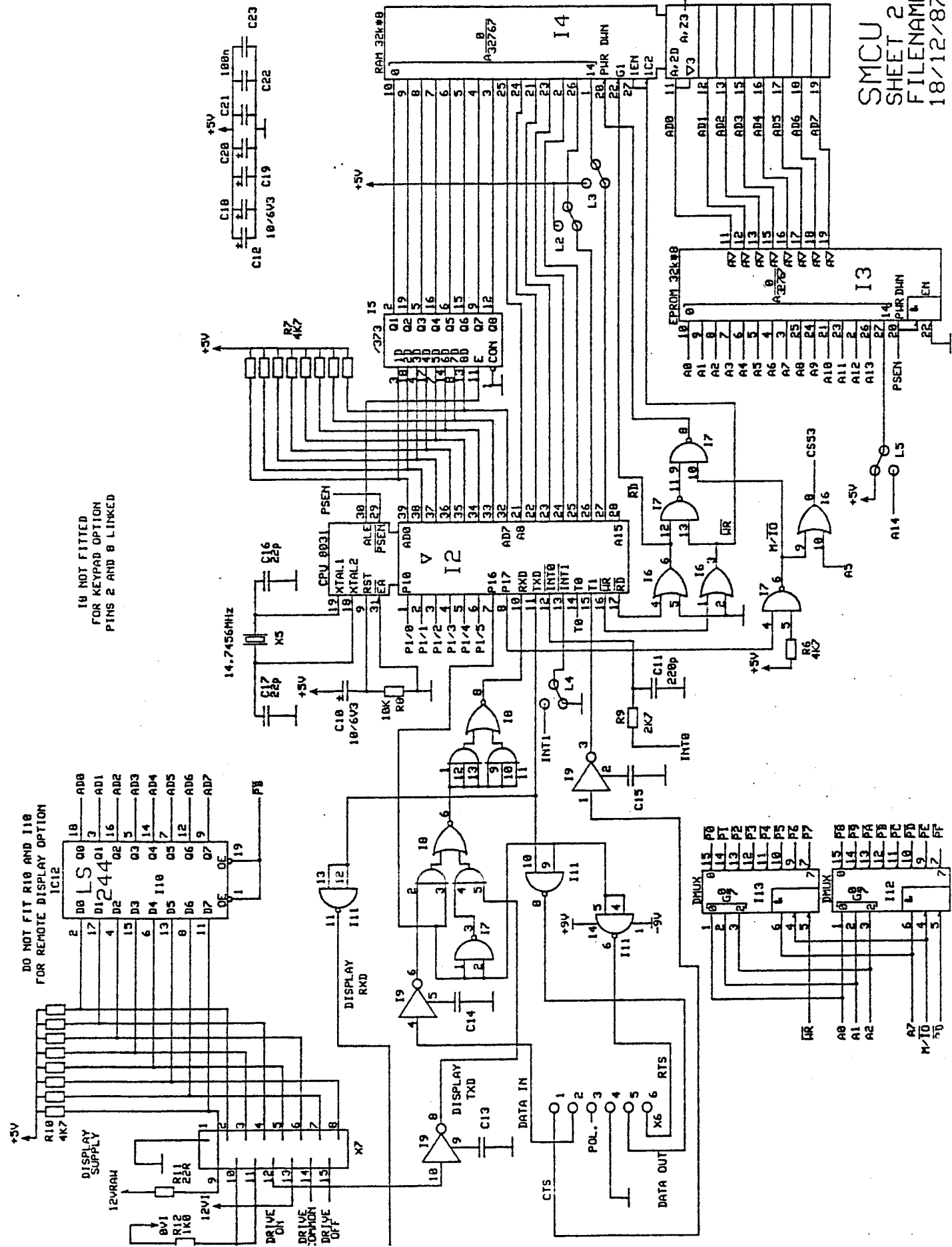
## RS 232 CONNECTIONS

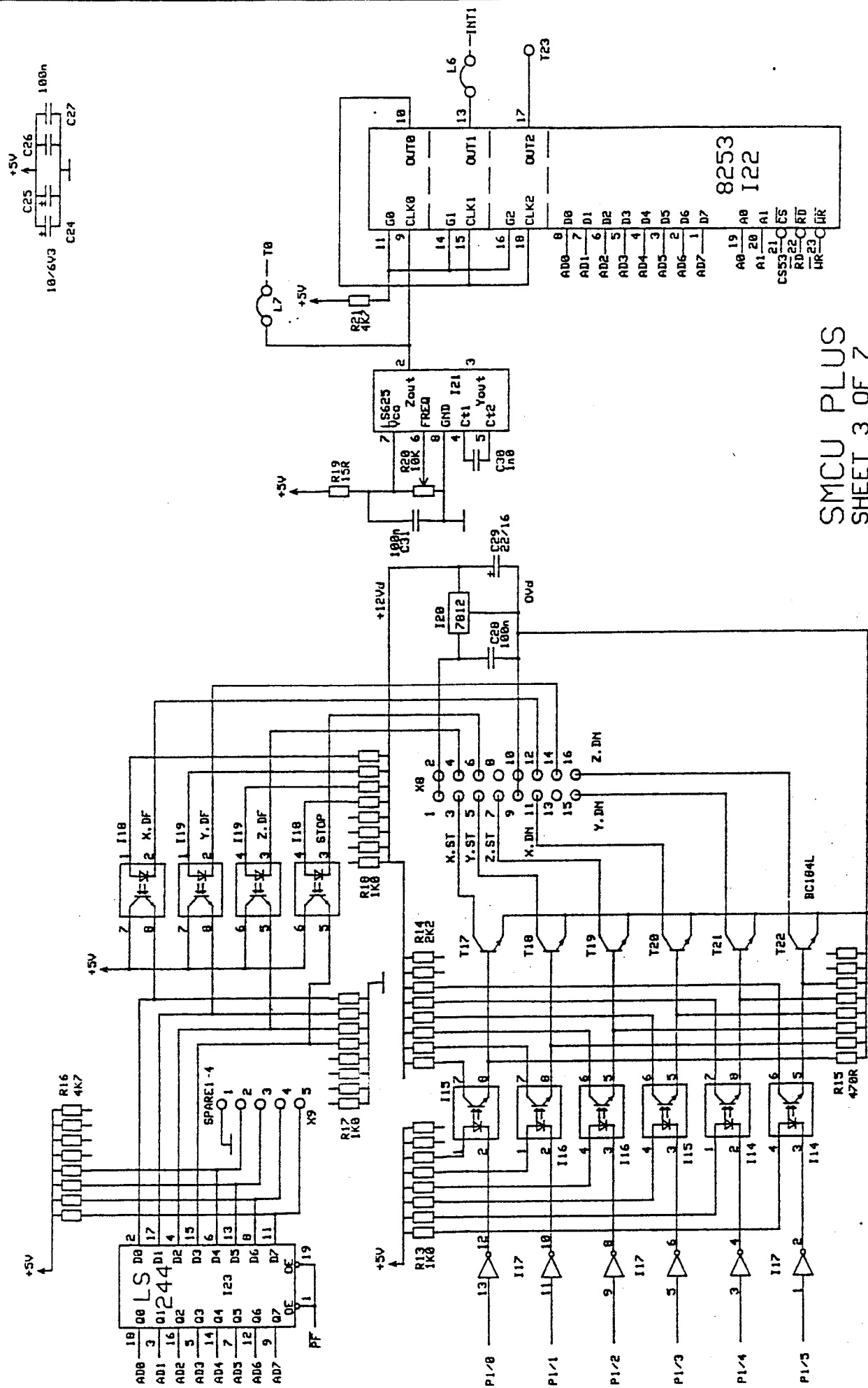
7 PIN  
DIN SOCKETCONNECTOR  
X 6

| PIN<br>No. |       |                    | PIN<br>No. |
|------------|-------|--------------------|------------|
| 2          | GREEN | 0 VI               | 4          |
| 6          | RED   | DATA TO STARMILL   | 2          |
| 7          | BLUE  | DATA FROM STARMILL | 5          |

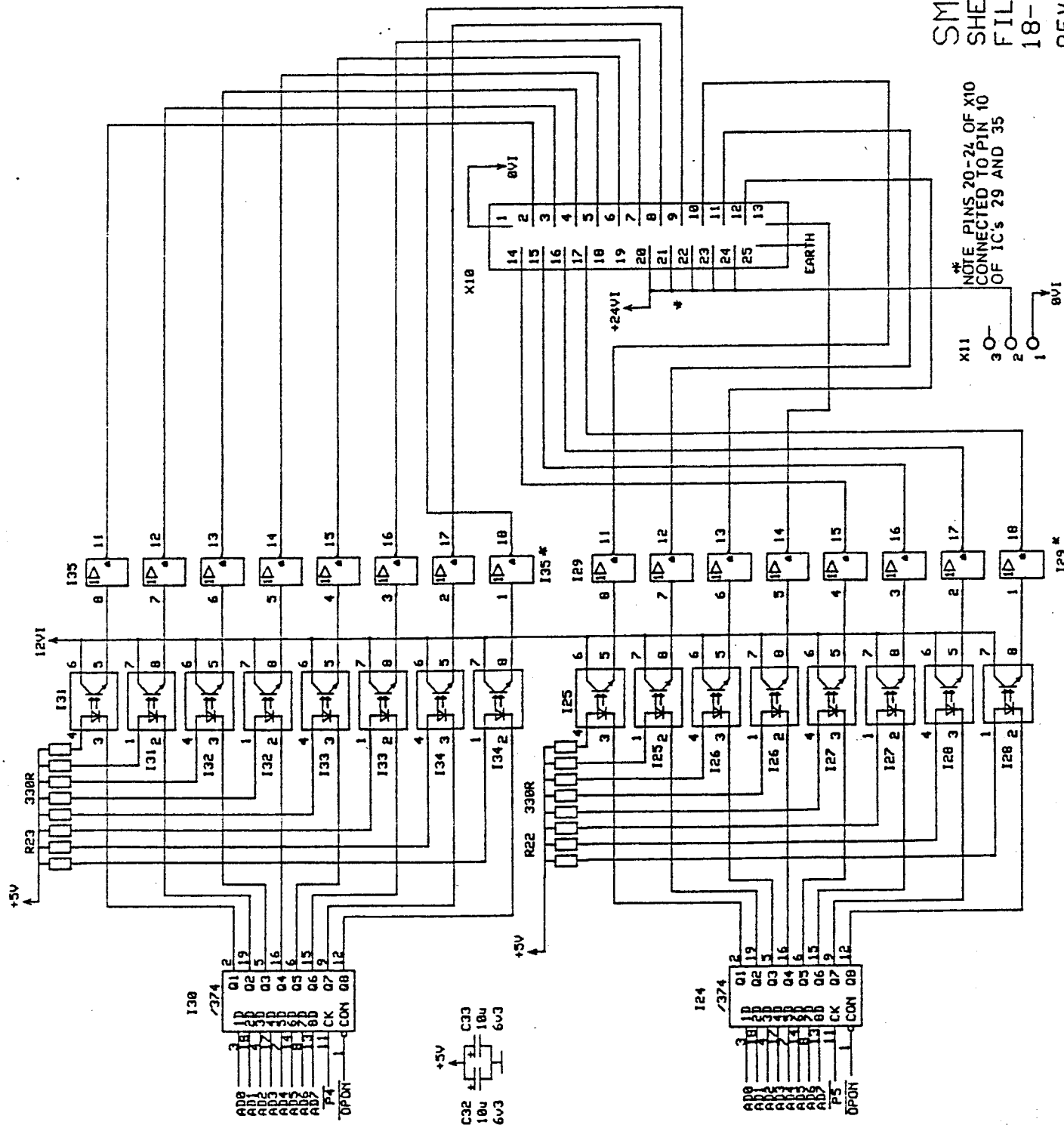
STARMILL INPUTS  
AUXILIARIES & RS 232SHEET No.  
OF  
CONT. ON  
SHEET No.

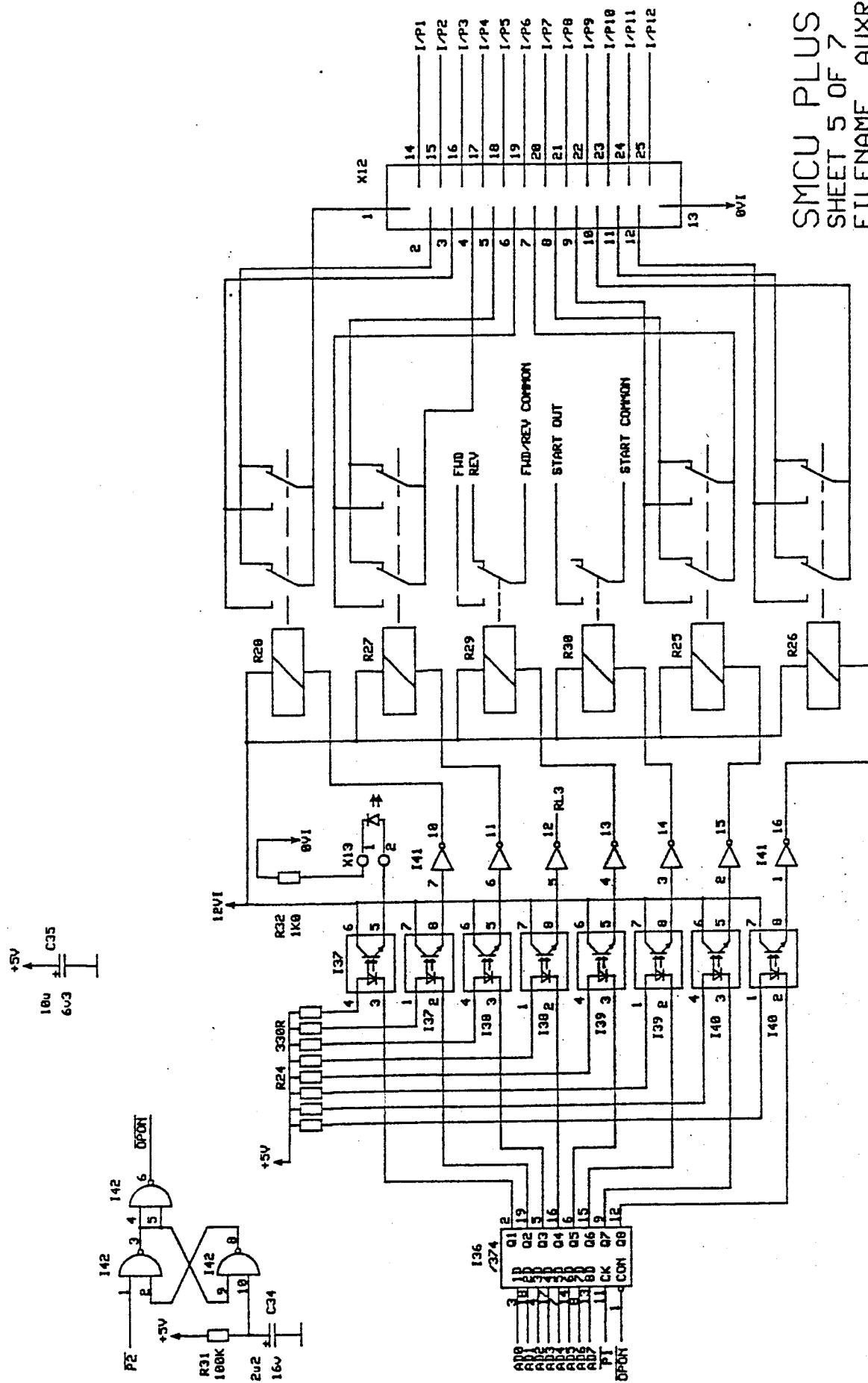




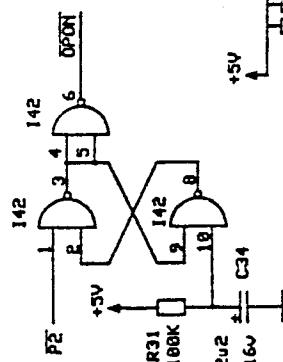
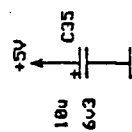


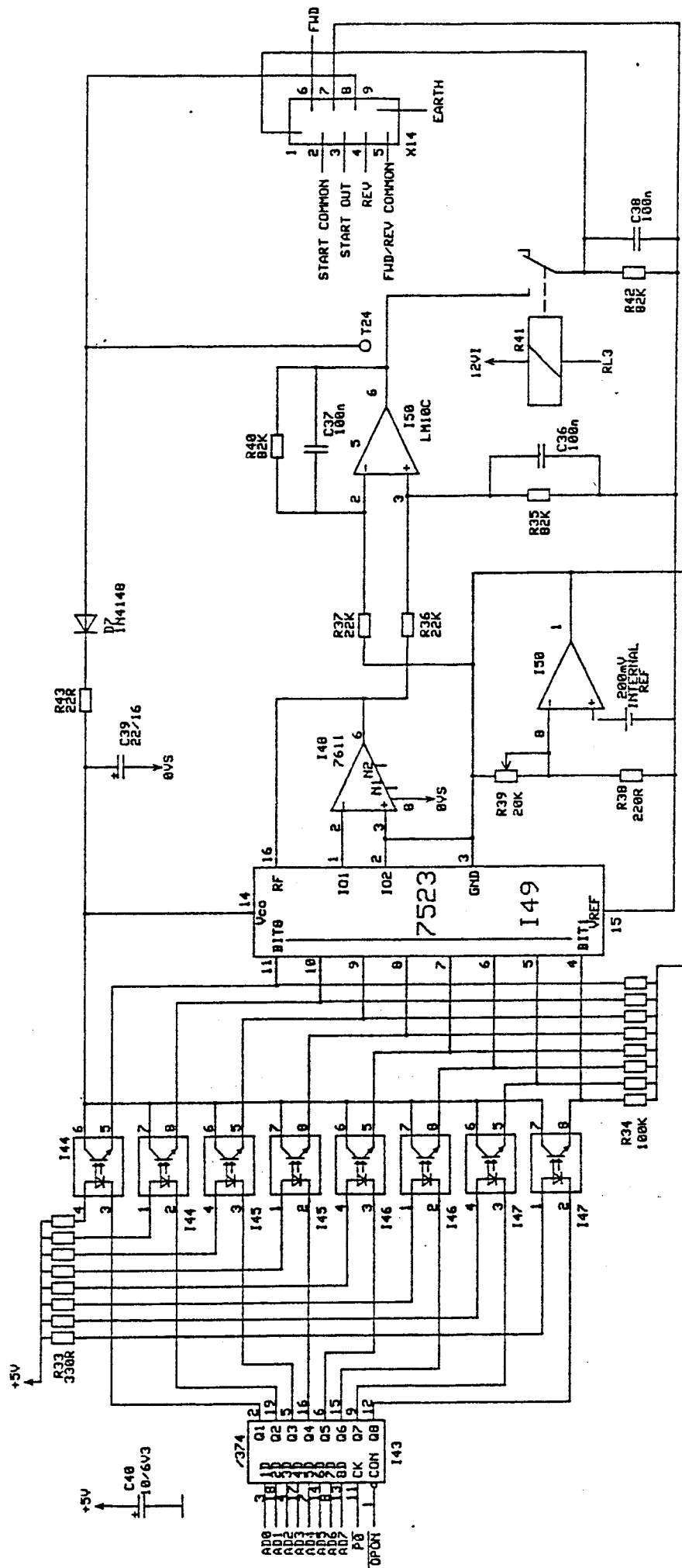
SMCU PLUS  
SHEET 3 OF 7  
FILENAME CONTROL  
18-12-87





SMCU PLUS  
SHEET 5 OF 7  
FILENAME AUXRLY  
18-12-87





SMCU PLUS  
SHEET 6 OF 7  
FILENAME SPINDL  
18-12-87

