

CNC3000 Series CNC3460/600

Operators manual

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880901

Numerical control



Industrial &
Electro-acoustic Systems

PHILIPS

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1. SWITCHING ON

After the mains voltage for the control has been switched on, the control checks the system configuration.

If every board is correct, the display will shortly show the picture below. A slight deviation from this picture can occur due to the different configuration the concerned control has.

```
POWER-UP CHECK V697
HARDWARE CHECK
CPU 80286      10MC      PASSED
PROM          6601.697    PASSED
LANGUAGE GER ENG 6601.697    PASSED
RAM          256K      PASSED
MEM.MOD.2    1024K     PASSED
DRIVE 1 2 3  LMS      PASSED
DRIVE 4 5 6  RMS      PASSED
IN/OUT 1     PASSED
CONTROL/TELET PASSED
GRAPHICS     8PL      V697    PASSED
```

Fig. 1.-1

The control switches to manual mode automatically; proceed with chapter 1.1.

If one of the tests indicate: FAILED (see picture below) proceed to chapter 13. for diagnostic procedures.

```
POWER-UP CHECK V697
HARDWARE CHECK
CPU 80286      10MC      PASSED
PROM          6601.697    PASSED
LANGUAGE GER ENG 6601.697    PASSED
RAM          256K      PASSED
MEM.MOD.2    1024K     PASSED
DRIVE 1 2     LMS      PASSED
DRIVE 3       LMS      FAILED
DRIVE 4 5 6   RMS      PASSED
IN/OUT 1     PASSED
CONTROL/TELET PASSED
GRAPHICS     8PL      V697    PASSED
```

----- **MANUAL** **DIAG** -----

Fig. 1.-2

1.1. REFERENCE POINT SEARCH

Except for reference point search, jogging and data input/output, the control does not accept any instructions until the reference points of the axes have been set.

Important : As long as >REF-POINT< is displayed in the machining mode line of the monitor, the software limit switches are not active. Hence care must be taken during jogging. As a precaution measure the display shows error code 05 at the first attempt to jog in an axis. Clear the error and touch the jog button again. When using the Philips Linear Measuring system the area switches function as software limit switches as long as the reference points are not established. (In some applications, however, these switches are only present at one side of the slide!).

```

MANUAL REF. POINT
PM 9001 N

JOG CONTINUE

COMMAND ACTUAL DIST TO GO
X X 0.000 X 0.000
Y Y 0.000 Y 0.000
Z Z 0.000 Z 0.000
A A 0.000 A 0.000
B B 0.000 B 0.000

F 0.000 F 0.000 F-OVR 100 %
S 0 S 0 S-OVR 100 %
T 0 T 0 LIFE 0
G 0 17 25 27 40 51 53 63 70 72 90 94
M 5 9 10 22 41

YZAB

HELP ----- DISPLAY
  
```

Fig. 1.1.-1

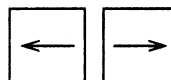
To enable the software limit switches to be established, all axes must be first moved to their reference points. The control enables simultaneous reference point search in all axes.

Attention : All selected axes move *at the same time* to their reference points.

Procedure : (1) Check which axes can be moved to their reference points safely.

(2) Select with the Address Selector buttons

the address of one of the relevant axes.



(3) Touch the Enter button



(4) Select the next address, touch the Enter button, etc.

- (5) When all desired addresses have been selected as shown in the block input line (e.g. >X-RP<), touch the Start button

The axes selected now move to their reference points at the same time.

On the monitor under >COMMAND< the indication >RP< appears for the selected axes. As soon as an axis reaches its reference point, the indication >RP< for this axis disappears.

The position of the reference point of an axis, relative to the machine zero point, is shown under >ACTUAL<.

If necessary, jog the axis at a position which enables the remaining axes to be moved to their reference points (see part 2.1. jogging).

When all axes have reached their reference points, the indication >R-POINT< in the machining mode line of the monitor disappears;

```

MANUAL      MAN. OPER.
PM  9001          N

JOG CONTINUE

COMMAND      ACTUAL      DIST TO GO
X            X 111111.111 X      0.000
Y            Y 222222.222 Y      0.000
Z            Z 333333.333 Z      0.000
A            A 444444.444 A      0.000
B            B 555555.555 B      0.000

F      0.000 F      0.000 F-OVR 100 %
S      0      S      0      S-OVR 100 %
T      0      T      0      LIFE  0
G 0 17 25 27 40 51 53 63 70 72      90 94
M      5  9      10 22 41

```



HELP ----- **DISPLAY**


Fig. 1.1.-2

Remark: The values under >ACTUAL< show the actual position of the axes.



The control is ready for use now.

- During reference point search, axes movements may be

interrupted via the Feed Hold Button  or the Feed/Speed Hold Button 

Touching the start button  causes the axes to be restarted.

- During standstill, an axis reference point search can be cancelled by:

- *Selecting the relevant address with the Address*   *Selector buttons*


- *Touching the Enter button* 


The associated indication in the block input line of the monitor, e.g. >RP-X<, disappears.

1.1.1. How to proceed when hitting a software limit switch

When during machining or jogging a software limit switch is hit, the control shows error code 05 for the relevant axis (e.g. X05) and the execution of the program is interrupted.

In this case proceed as follows:

- Touch Manual button 

- Touch Clear button 

- Jog the axis in the opposite direction away from the software limit switch.
(No harm is done when jogging in the wrong direction; error code 05 is displayed immediately and the axis does not move).

1.2. ZERO POINT SETTING

The program zero point can be found by:

- Executing a G-function for stored zero offset, either by using manual data input MDI (part 10.1.) or via a program.
- Presetting the axis at the current position, see part 2.3.3.

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2. MANUAL

In the manual mode, machine tool slides can be moved manually, either continuously at a selected speed or over a desired number of increments.
Also the spindle can be turned manually at a predetermined speed.

- Touch the Manual button 

The monitor displays:

```

MANUAL  MAN.OPER.
PM  9001          N

JOG STEP 1


COMMAND      ACTUAL      DIST TO GO
X            X  217.499 X  0.000
Y            Y- 116.999 Y  0.000
Z            Z-  50.000 Z  0.000
A            A   0.000 A  0.000
B            B   0.000 B  0.000

F  0.000 F  0.000 F-OVR 100 %
S  0      S  0      S-OVR 100 %
T  0      T  0      LIFE  0
G 0 17 25 27 40 52 53 63 70 72  90 94
M  5  9  10 22 41
  
```

HELP ----- **DISPLAY**

Fig. 2-1

Remark: Jogging the axes is also possible when the reference points are not yet established.
Take care when doing this; the software end switches are not active !
The display shows error 05 as a precaution measure at the first attempt to jog an axis.

Clear the error  and touch the jog button again.

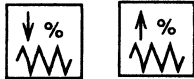
2.1. AXIS JOGGING

A. For continuous jogging with a selected feed, proceed as follows:

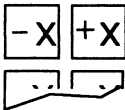
If the programming execution line displays e.g. jogstep 10 (1,

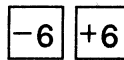
100 or 1000) touch Jog continue button 

In the programming execution line jog continue is displayed.ed.

- Select with the Feedrate Override buttons  the percentage of the jog feed.

(the jog feed is stored in the machine constants memory at 100% feedrate override).

- Touch the relevant Jog Axis button  for moving the axis.



On the monitor under >COMMAND<, the indication >JOG +< or JOG -< appears for the selected axis, according to the required direction.

It is possible to jog two axes simultaneously.

The axes move as long as the buttons remain touched.

No moving occurs when three buttons or the + and - buttons of the same axis are touched.

The monitor displays a picture of axis jogging as shown below. +Y is assumed to be touched.

```

MANUAL   MAN. OPER.
PM  9001           N

JOG CONTINUE

COMMAND      ACTUAL      DIST TO GO
X-          X-  115.490 X  0.000
Y JOG +      Y-   19.208 Y  0.000
Z-          Z-   20.001 Z  0.000
A           A    0.000 A  0.000
B           B    0.000 B  0.000

F  3000.000 F  3000.000 F-OVR 100 %
S    0      S    0      S-OVR 100 %
T    0      T    0      LIFE   0
G 0 17 25 27 40 52 53 63 70 72   90 94
M   5  9   10 22 41
  
```

Fig. 2.1.-1

HELP ----- DISPLAY

B. For jogging over a selected number of increments proceed as follows:

- Select with the Jog step button

| |
|---|
| 1 |
|---|

| |
|----|
| 10 |
|----|

| |
|-----|
| 100 |
|-----|

| |
|------|
| 1000 |
|------|

 , 10, 100 or 1000 increments.

- Touch the relevant Jog Axis button

| |
|----|
| -X |
|----|

| |
|----|
| +X |
|----|

| |
|----|
| -6 |
|----|

| |
|----|
| +6 |
|----|

The axis moves over the selected number of increments every time the button is touched.

On the monitor under >COMMAND<, the indication >JOG +< or JOG -< appears for the selected axis according to the required direction.

When two buttons are touched simultaneously only the axis recognized by the control as touched first, will move.

The monitor displays a picture of axis jogging as shown below. +X is assumed to be touched.

```

MANUAL  MAN. OPER.
PM  9001          N

JOG STEP 100

COMMAND          ACTUAL          DIST TO GO
X JOG +          X           0.100 X
Y                Y           0.851 Y
Z                Z-          13.500 Z
A                A           0.000 A
B                B           0.000 B

F           0.000 F           0.000 F-OVR 100 %
S           0          S           0          S-OVR 100 %
T           0          T           0          LIFE
G 0 17 25 27 40 51 53 63 70 72          90 94
M   5  9   10 22 41
  
```

HELP ----- **DISPLAY**

Fig. 2.1-2

2.2. SPINDLE JOGGING

- Touch the Manual button



Now the spindle can be rotated in the jog mode by means of the spindle-left button



or the spindle-right button



The spindle will turn as long as the button is touched.


The spindle speed is set by a machine constant.

During spindle jogging, the speed override buttons are inoperative. (S.OVR displays 100%).

The spindle can be jogged only when it is at standstill. Even when the spindle is stopped by the machine interface but the display shows in the M-function line M3 or M4, spindle jogging is impossible. Program via Teach-in M5 first (10.1.).

2.3. MANUAL MENU

To display the manual menu:

- Touch the Manual button  .

- Touch the Menu button  .

The monitor displays:

```
MANUAL  MAN. OPER.
PM  9001          N

JOG CONTINUE

MANUAL MENU:

1 BLOCK SEARCH
2 REFERENCE POINT SEARCH
3 RESET AXIS
6 REMOTE PANEL ON
7 DIAGNOSTIC
8 HANDWHEEL
```

HELP -----

Fig. 2.3.-1

The required function is called by touching the number preceding the function.

Note: Handwheel and Remote panel are optional. If not available, the menu does not show them.

2.3.1. Block search

This is described in detail in section 7.

2.3.2. Reference point search

If a search for a reference point is needed during normal operation, select 2 in the Manual menu.

The axis can now be moved to their reference points as described in part 1.1.

The reference point search mode is terminated by selecting an operation mode

MANUAL  , SINGLE  , AUTO  or TEACH IN  .

2.3.3. Preset axis

To preset the axes, select **3** in the Manual menu.

The machining mode line on the monitor indicates >PRESET AXIS< as shown below.

```

MANUAL  RESET-AXIS
PM  9001      N
JOG STEP 1

COMMAND      ACTUAL      DIST TO GO
X-           X- 63.749 X 0
Y-           Y- 45.000 Y 0
Z-           Z- 36.510 Z 0
A-           A- 0.000 A 0
B-           B- 0.000 B 0

F 0.000 F 0.000 F-OVR 100 %
S 0 S 0 S-OVR 100 %
T 0 T 0 LIFE 0
G 0 17 25 27 40 51 53 63 70 72 90 94
M 5 9 10 22 41

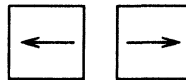
XYZAB
X
HELP ----- DISPLAY
  
```

Fig. 2.3.3.-1

Preset axis:

- Jog the axis to the required point.

- Select the axis with the Address selector



- Enter via the keyboard the



preset value for that axis.

In case of entering a wrong number, the value can be cleared with the CLEAR button



- Touch the Enter button



Repeat these 4 steps for all axes needed.

The block input line on the monitor now indicates the preset values for all required axes. See below.

```

MANUAL  RESET-AXIS
PM 99999 N 99999

JOG CONTINUE

COMMAND      ACTUAL      DIST TO GO
X             X           0.000 X       0
Y             Y           0.000 Y       0
Z             Z           0.000 Z       0
A             A           0.000 A       0
B             B           0.000 B       0

F 0.000 F 0.000 F-OVR 100 %
S 0 S 0 S-OVR 100 %
T 0 T 0 LIFE 0
G 0 17 25 27 40 52 53 63 66 72 90 94
M 5 9 41

XYZZB
A
X100 Y20.25 Z300

HELP ----- DISPLAY
  
```

Fig. 2.3.3.-2

Touch the Store button



The values for the selected axes, displayed under >ACTUAL< are changed for the present values. The resulting zero-offset is stored in the stored zero offset memory under G52, which is activated at the same time:

```

MANUAL  RESET-AXIS
PM 99999 N 99999

JOG CONTINUE

COMMAND      ACTUAL      DIST TO GO
X             X           100.000 X      0
Y             Y            20.250 Y      0
Z             Z           300.000 Z      0
A             A           0.000 A       0
B             B           0.000 B       0

F 0.000 F 0.000 F-OVR 100 %
S 0 S 0 S-OVR 100 %
T 0 T 0 LIFE 0
G 0 17 25 27 40 52 53 63 66 72 90 94
M 5 9 41

XYZZB
A

HELP ----- DISPLAY
  
```

Fig. 2.3.3.-3

Once the zero offset is established it can be activated after powering-on again by executing G52 in MDI. (See part 10.1.).

G52 is cancelled by executing G51 in MDI. (See part 10.1.).

The Preset mode is terminated by selecting an operation mode

MANUAL  , SINGLE  , AUTO  or TEACH IN  .

2.3.3.1. Reset axis

Resetting an axis is equal to presetting that axis with the value 0.

To reset an axis proceed as described in 2.3.3., but enter the value 0 for the relevant axis.

2.3.4. Remote panel (option)

When a remote panel is available proceed to section 16.

2.3.5. Diagnostic

Since the diagnostic features are extensive, they are described in a separate section, see section 13.

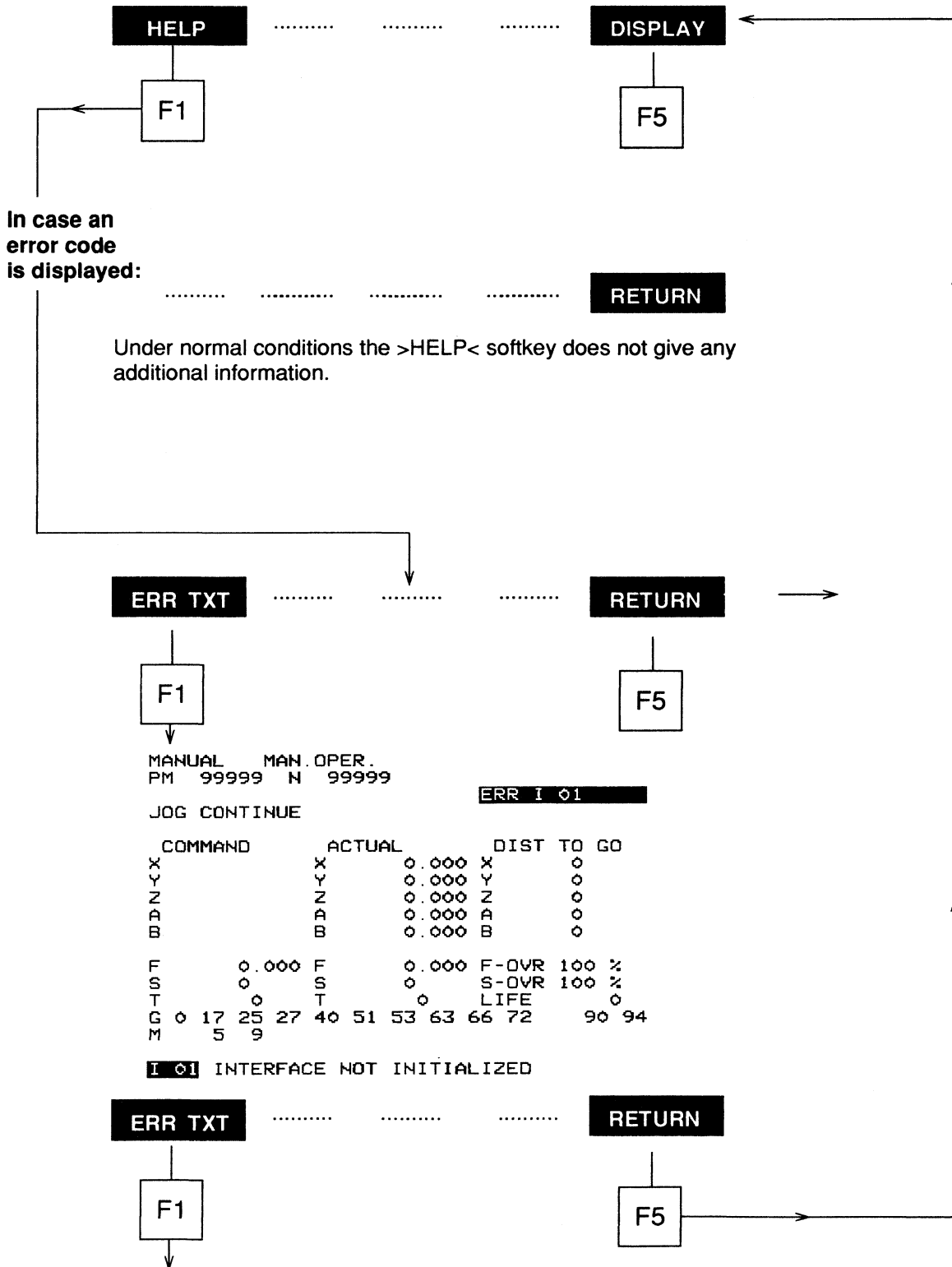
2.3.6. Handwheel (option)

When a handwheel is available proceed to section 15.

2.3.7. Operator/Programmer assistance facility

2.3.7.1. >HELP< key

The softkey line displays:



In case a second error code is displayed, it is explained by touching softkey >ERR TXT< again.

The explanation remains until the error has been cleared.

2.3.7.2. >DISPLAY< KEY - AXES monitor

The softkey line displays:

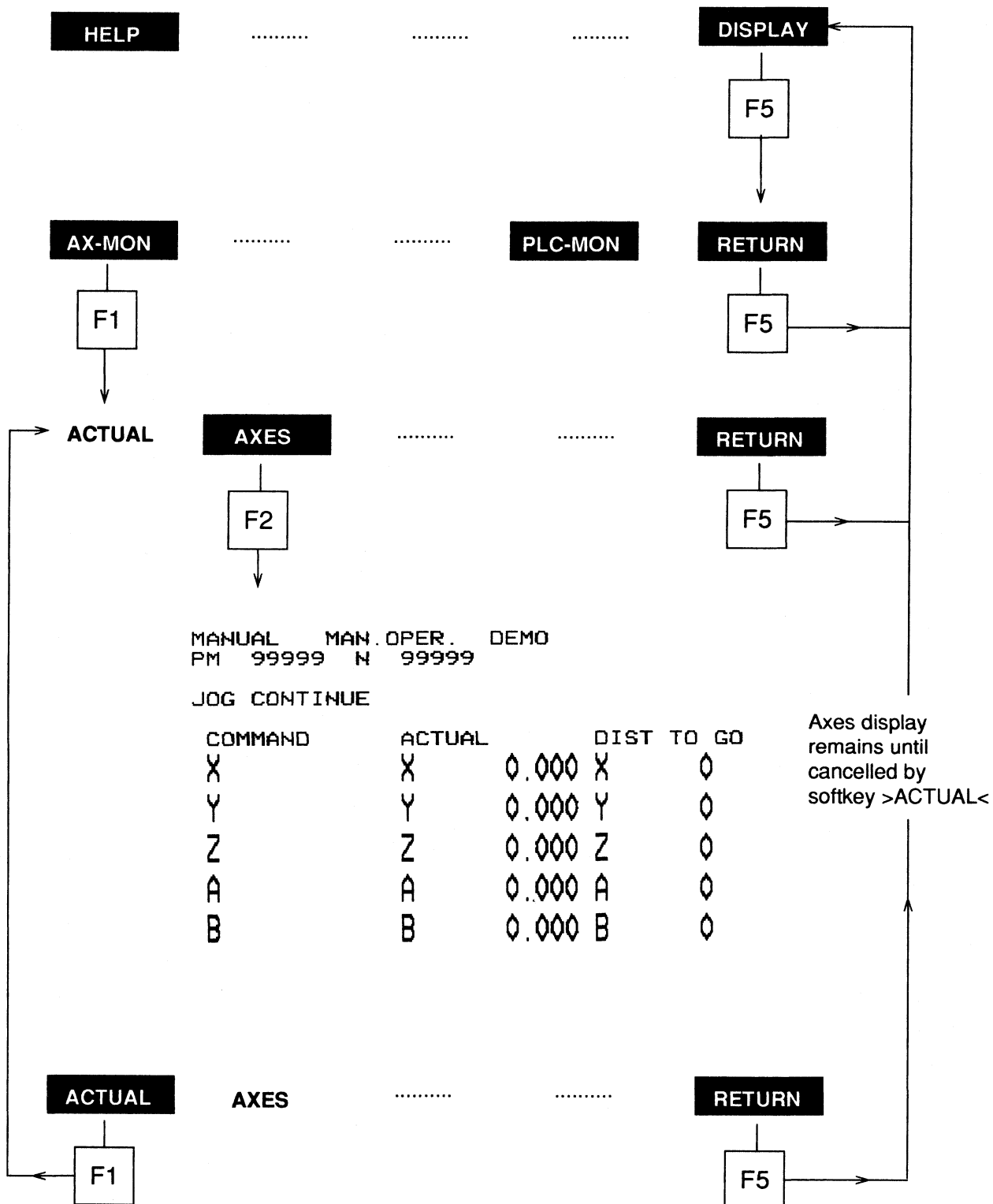
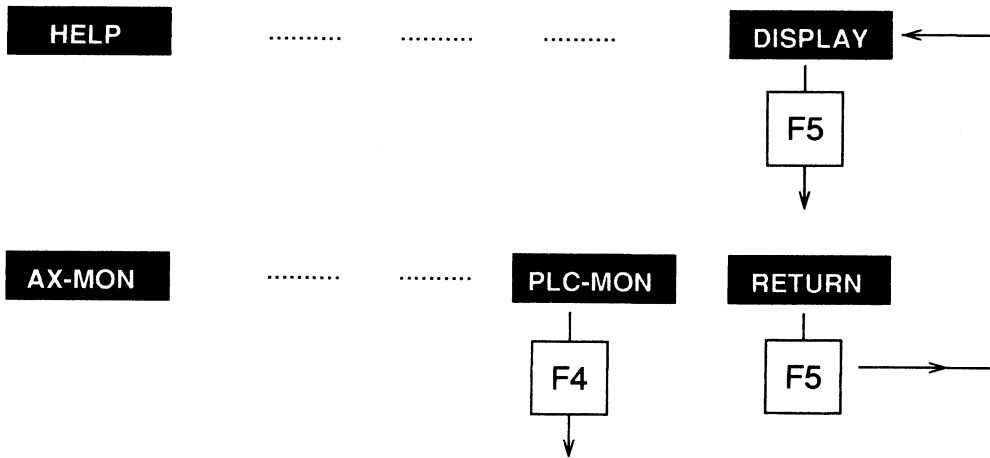


Fig. 2.3.7.2-1

2.3.7.3 >DISPLAY< KEY - PLC monitor

The softkey line displays:



```

MANUAL   MAN. OPER.
PM 99100 N 99100

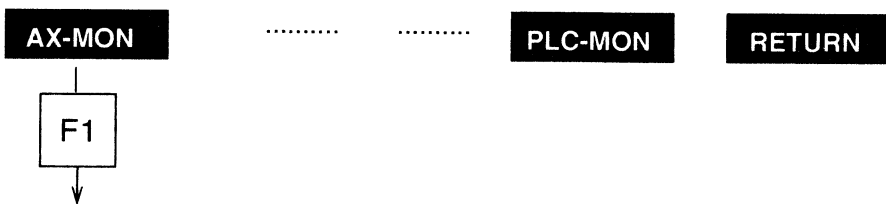
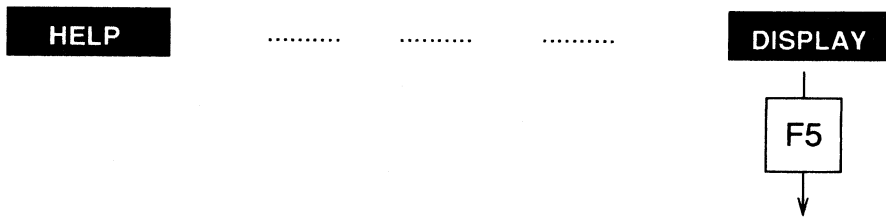
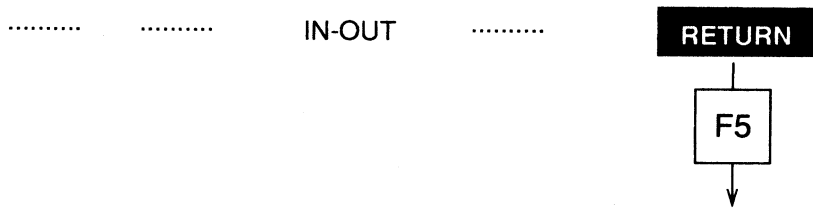
JOG CONTINUE

          1           2           3
          12345678901234567890123456789012

IN  1  .....
IN  2  .....

OUT 1  ..... 1 ..... 1 .....
OUT 2  .....

AREA  .....
    
```




Normal display

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3. MACHINE CONSTANTS

The parameters which dedicate the control to the machine tool are stored in the machine constant memory.

Displaying the contents of this memory is possible in all operation modes.

- Touch the Constant memory button 

The control now displays the beginning of the machine constant list:

```

MANUAL   MAN. OPER.
PM      9001          N

MACHINE CONSTANTS




█ N   0 C           1
  N   1 C           6
  N   2 C          1280
  N   4 C           1
  N   5 C           1
  N   9 C           2
  N  10 C           5
  N  11 C           0
  N  13 C           0
  N  14 C           70
  N  16 C           1




NUMBER OF IO-CARDS (0=1, 1=2, 2=3)
█ N

HELP ----- OPER-MC -----
  
```

Fig. 3.-1

The search for a certain machine constant can be done in two ways:

- 1. - Select the MC number with the Block selector buttons  
- 2. - Enter the MC number via the keyboard 

- When the cursor comes on the bottom line of the list, the next part of the list of MC's is displayed automatically
- In case of entering the wrong number, the value can be cleared with the CLEAR button 
- Touch the Enter button 
- Touch the Search  button

The selected machine constant is shown on top of the list in the display.



In this mode **no** MC can be altered.

3.1. EDITING OPERATOR'S MACHINE CONSTANTS

Most machine constants directly influence the machine tool (Movement direction etc.). These constants can only be altered when a special switch is closed.

Other machine constants (operator's machine constants) set the values e.g. for data I/O or the measuring devices and may be edited by the machine tool operator.

To edit the operator's machine constants:

- Touch Constant memory button 
- Touch softkey  (below >OPER-MC<).

The display shows those Machine constants which may be edited by the operator.

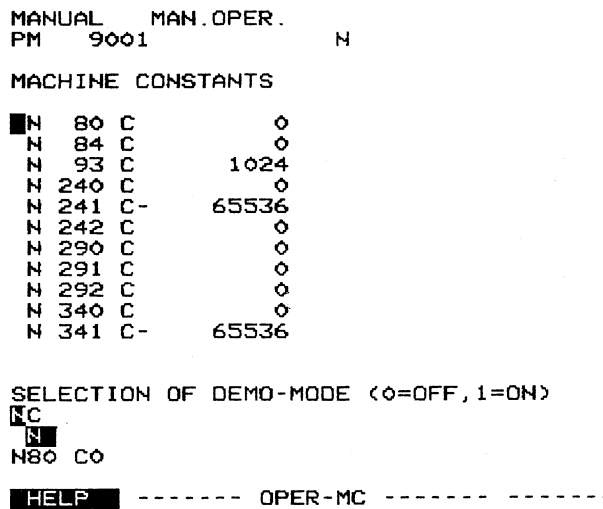






Fig. 3.1.-1


- Select the MC number (see chapter 3.)

- Select C with the Address selector button  

- Enter the MC value with the keyboard 

- Touch Enter button 

The new entered value appears in the block input line

- Touch Store button 

The new value appears in the MC list, the cursor moves to the next MC.

The machine constant mode is terminated by selecting an operation mode.



The new value of the MC is valid only after selecting an operation mode.

3.2. EDITING MACHINE CONSTANTS

This is done in the same way as described in part 3.1, except that the MC enable switch must be made and the control must be in manual mode:

- Make MC enable switch

- Touch manual



The display shows the first machine constants now:

```
MANUAL    MAN. OPER.
PM 9001   N
VERSION NUMBER 6601.697
MACHINE CONSTANTS

N 0 C      1
N 1 C      6
N 2 C     1280
N 4 C      1
N 5 C      1
N 9 C      2
N 10 C     5
N 11 C     0
N 13 C     0
N 14 C     70
N 16 C      1

NUMBER OF IO-CARDS (0=1,1=2,2=3)
N C
N
NO C1

HELP EDIT-MC -----
```


Fig. 3.2.-1

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4. PART PROGRAM MEMORY

4.1 FAMILIARIZATION

Part-programs can be viewed, edited and new ones completely entered in the part-program memory. Non-active part-programs can be edited in any mode provided they are not protected (locked or invisible refer to 4.1.1). An active program however, can only be edited in the manual mode; if partly or completely run, the clear control button must be pressed before editing can take place.

Reference should be made to section 7 for activating a part-program. To access the part-program memory, press the PROG. MEM.  button on the front panel.

The first ten blocks (max) of the active program will be displayed, an example is shown below. If there is not an active program, the directory (ID-DIR) is immediately displayed (see section 4.1.1.).

```
AUTO
PM 99999 N 99999

PARTPROGRAM N 99999

■N99999 <PHILIPS SHIELD SYMBOL>
N1 G54
N2 G98 X-80 Y-80 Z-5 I160 J220 K10
N3 G99 X-75 Y-75 Z-2 I150 J210 K5
N4 T1 M67
N5 G0 X-70 Y0 Z10 <THE FRAME>
N6 G1 Z0 F500
N7 Y120
N8 X70
N9 Y0
N10 G2 X-70 Y0 R70

■NXYZABCDEFGHIJKLPRFSTHME
■G
N99999 <PHILIPS SHIELD SYMBOL>

■HELP ■MENU-G ----- ■ID-DIR
```

Fig. 4.1-1

Viewing part program in automatic mode; editing not possible

```
MANUAL MAN.OPER.
PM 99999 N 99999

PARTPROGRAM N 99999

■N99999 <PHILIPS SHIELD SYMBOL>
N1 G54
N2 G98 X-80 Y-80 Z-5 I160 J220 K10
N3 G99 X-75 Y-75 Z-2 I150 J210 K5
N4 T1 M67
N5 G0 X-70 Y0 Z10 <THE FRAME>
N6 G1 Z0 F500
N7 Y120
N8 X70
N9 Y0
N10 G2 X-70 Y0 R70

■NXYZABCDEFGHIJKLPRFSTHME
■G
N99999 <PHILIPS SHIELD SYMBOL>

■HELP ■MENU-G ----- ■EDITFUNK ■ID-DIR
```

Fig. 4.1-2

Manual mode, program not active; editing is allowed.

The task of preparing or editing programs is aided by the features provided by the softkeys. Descriptions, pictures and the address-string associated with G-functions can be displayed to give comprehensive if not conclusive programming guidance. These softkeys are also displayed after searching a program or entering a new one.



- HELP - For selecting the G-LIST (section 4.1.2) and the PICTURES (4.1.2 and 4.1.3) softkeys.
Also error explanation can be activated with this softkey.
- MENU G - For displaying G-modal groups along with a G-function and its associated address-string (section 4.1.3).
- EDITFUN - To activate the block editing functions i.e.; delete, copy, renumber, line edit. (see section 4.1.4.)
- ID-DIR - To enter into the directory (section 4.1.1)

The part-program memory also has a menu which is designated - PROGRAM MENU - and via option 1, it is possible to view and edit macros (sub-programs) and completely enter new ones in the same way as part-programs (section 4.5.).

4.1.1 Directory and softkeys

The directory is a listing of all the part-programs, where depending on machine constant 84, a description (TITLE) of the part-program or the program length (BYTES) and the program status (read/write) is indicated alongside the part-program number.

To access the part-program directory:

- select the PROG.MEM. button 
- select the >ID.DIR.< softkey. 

If there is not an active program the directory is immediately displayed.

```

MANUAL   MAN.OPER.
PM 99999 N 99999

PARTPROGRAM N 99999

ALL MEMORY 91392 BYTES FREE
■ N 9900
N 99999 <PHILIPS SHIELD SYMBOL>
N 99100
  
```

```

■ N
■ N
N9900

HELP ----- FILE RETURN
  
```

Fig. 4.1.1-1

Program directory with description (MC84 = 0).

```

MANUAL   MAN.OPER.
PM 99999 N 99999

PARTPROGRAM N 99999

ALL MEMORY 91392 BYTES FREE
N 9900 < 512 BYTES )
N 99999 < 2560 BYTES READING)
N 99100 < 2432 BYTES )
  
```

```

N
N
N9900 < 512 BYTES )
HELP ----- FILE RETURN
  
```

Fig. 4.1.1.-2.

Program directory with status (MC84 = 1).

The bottom line indicates to the cursor position and the input line allows a new program to be entered or another existing program to be searched (refer to sections 4.3.1 and 4.3.2).

Explanation of the status words:

- LOCK : Indicates that a part-program is protected against unauthorised or unintentional editing/deleting (section 4.3.6).
- READING : Indicates the active program and the one being edited. Also indicates that a program is output that via DATA I/O or DNC.
- WRITING : Indicates that a program is input via DATA I/O or DNC.

SOFTKEYS

- RETURN - Enter into the active program or when applicable, another program (including a new program) for editing or viewing.
- FILE - To activate the following softkeys

```

HELP COPYFUN RENAME ATTRIB RETURN
  
```

Fig. 4.1.1.-3.

- ATTRIB - To lock and/or unlock programs. (A program can be protected against unauthorised or unintentional editing - section 4.3.6).
- RENAME - To change the part-program number (4.3.7)
- COPY FUN - To copy an existing part-program (4.3.3)

Note: The RETURN softkey will now activate the previous softkey level

4.1.2 G-List

A G-list is available which separates the G-functions into nine functional groups. When a particular group is selected all the G-functions belonging to it will be displayed along with the corresponding description. It is also possible to display most G-functions graphically (in a picture). The G-list is acquired by softkeys while editing a program or entering in a new one as described in section 4.1.

- Select softkey >HELP< **F1** (section 4.1)

The following softkeys are activated:

----- **PICTURE G-LIST** ----- **RETURN**

Fig. 4.1.2-1.

- Select softkey >G-LIST< **F3** to display the G-List as shown below.

```
MANUAL  MAN.OPER.
PM 99999  N 99999

PARTPROGRAM N 99999

G FUNCTIONS:

1 ELEMENTARY MOTION
2 GEOMETRY
3 COORDINATE SYSTEM, PLANE SELECTION
4 ZERO POINT SHIFT, DIMENSION
5 PROGRAM CONTROL
6 FEED
7 TOOL CORRECTION
8 CYCLES
9 GRAPHIC
```

----- G-LIST ----- **RETURN**

Fig. 4.1.2-2

In the following example it can be seen that option 1 - ELEMENTARY MOTION - was chosen (by pressing key 1 of the keypad).

```
MANUAL  MAN.OPER.
PM 99999  N 99999

PARTPROGRAM N 99999



ELEMENTARY MOTION


G 0 RAPID TRAVERSE
G 1 LINEAR INTERPOLATION
G 2 CIRCULAR (CW)
G 3 CIRCULAR (CCW)
G 27 RESET POSITIONING FUNCTIONS
G 28 POSITIONING FUNCTIONS
G 74 PROGRAMMABLE HOME POSITION
```

```
NGXYZABIJKLPRFSTHME
N
N99999 (PHILIPS SHIELD SYMBOL)
```

----- **PICTURE G-LIST** ----- **RETURN**

Fig. 4.1.2-3

- Enter the number (via the keypad) corresponding to the function desired. If necessary select the G-address using the Address-selector buttons.  

- Press the Enter button 

The address-string will now relate to the G-function as shown below; a description of each address is also available.

```

MANUAL MAN.OPER.
PM 99999 N 99999

PARTPROGRAM N 99999

ELEMENTARY MOTION

G00 00 RAPID TRAVERSE
G01 01 LINEAR INTERPOLATION
G02 02 CIRCULAR <CW>
G03 03 CIRCULAR <CCW>
G27 27 RESET POSITIONING FUNCTIONS
G28 28 POSITIONING FUNCTIONS
G74 74 PROGRAMMABLE HOME POSITION
  
```

```

NCXYZABIIJKLPRFSTHME
N14 G2 I0 J0
----- PICTURE G-LIST ----- RETURN
  
```

Fig. 4.1.2.-4

Most G-functions can be displayed graphically (in a picture).

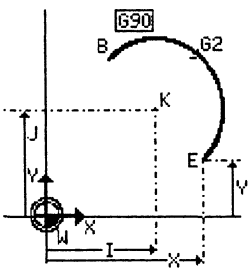
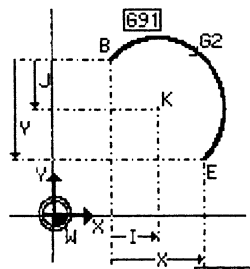
- Select softkey PICTURE 

An example of the display:

```

MANUAL MAN.OPER.
PM 99999 N 99999


PARTPROGRAM N 99999
  
```

```

----- PICT G
NCXYZABIIJKLPRFSTHME
N14 G2 I0 J0
----- PICTURE G-LIST ----- RETURN
  
```

Fig. 4.1.2-5

In some cases (as in the example) more than one picture display is available (>PICT 0<). More picture displays relating to the G-function can be viewed by selecting the PICTURE softkey. 

- After the required G-function has been entered and the address-string completed as necessary.

- Press the STORE button



The part-program is displayed indicating that the new (or edited) block is now entered into the program. The next block can now be edited (or compiled).

THE G-LIST OPTIONS

1. ELEMENTARY MOTION

-:G0 → G3, G27, G28, G74.

2. GEOMETRY

-:G11, G63, G64

3. COORDINATE SYSTEM, PLANE SELECTION

-:G17, G18, G19, G180, G182

4. ZERO POINT SHIFT, DIMENSION

1 RESET-AXIS ZERO POINT SHIFT

-:G51, G52

2 STORED ZERO POINT SHIFT

-:G53 → G59

3 PROGR. NPV, ROTATION

-:G92, G93

4 PROGRAM DIMENSION

-:G70 → G73

5. PROGRAM CONTROL

-:G4, G14, G22, G23, G29, G78

6. FEED

-:G25 → G28, G94, G95

7. TOOL CORRECTION

-:G40 → G44, G141

8. CYCLES

1 ACTIVATE FIXED CYCLES

-:G77, G79

2 DEFINITION FIXED CYCLES

-:G81, G83 → G89

3 MEASURING CYCLES

-:G45, G46, G49, G50

9. GRAPHIC

-:G98, G99

4.1.3 Menu-G

All part-programs are assigned with default G-functions as they are valid after clear control. These G-functions are normally active in the program until a block containing another G-function (from the same group) is executed. With MENU G these modal G-functions are displayed above the input line. During programming of another G-function (belonging to one of these modal groups) the modal group line will give conformation of this by displaying the newly entered G-function. A description of the G-function and its associated address-string (as in the G-list) is also shown. MENU-G can be activated while editing a program or entering a new one as described in section 4.1.

- Select the MENU-G softkey F1 (section 4.1)

The address-string will now relate to the G-function as shown below; a description of each address is also available.

```

MANUAL   MAN. OPER.
PM 99999 N 99999

PARTPROGRAM N 99999

■M99999 <PHILIPS SHIELD SYMBOL>
N1 G54
N2 G98 X-80 Y-80 Z-5 I160 J220 K10
N3 G99 X-75 Y-75 Z-2 I150 J210 K5
N4 T1 M67
N5 G0 X-70 Y0 Z10 <THE FRAME>
N6 G1 Z0 F500
N7 Y120
N8 X70
N9 Y0
N10 G2 X-70 Y0 R70

MODAL G G 17 63 40 180
RAPID TRAVERSE
NGXYZABCSTHMB1B2L1L2T1P1E
G
M99999 <PHILIPS SHIELD SYMBOL>

HELP FREE-G ----- ED-EXPR ID-DIR

```

Fig. 4.1.3-1

If the block in question does not have a G-function entered, the address-string will relate to the default G-function G0.

Most G-function can be displayed graphically (in a picture). Pictures will only be displayed however if a G-function is either entered in the input line or programmed in the block.

- Select the >HELP< softkey F1

The following softkeys will be activated

----- PICTURE G-LIST ----- RETURN

Fig. 4.1.3.-2

- Select the >PICTURE< softkey F2

An example of the display

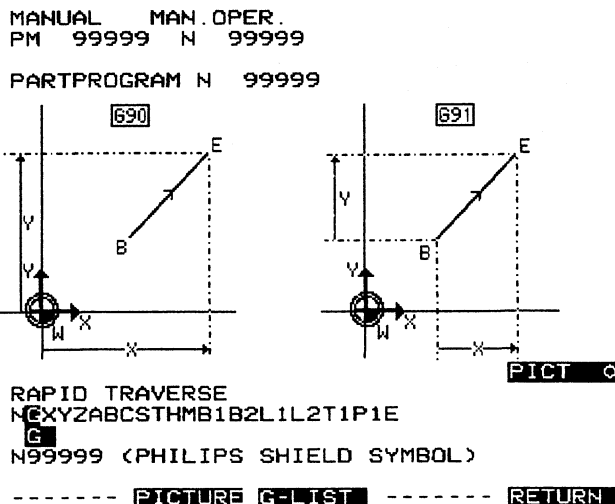


Fig. 4.1.3.-3

In some cases (as in the example) more than one picture display is available (>PICT 0<). More picture displays relating to the G-function can be viewed by selecting the PICTURE softkey. F2

- After the required G-function has been entered and the address-string completed as necessary

- Press the STORE button STORE

The part-program is now displayed indicating that the new (or edited) block is now entered into the program. The next block can now be edited or compiled

4.1.4 Editing or compiling blocks using text and mathematical functions

This section introduces the use of softkeys which enable text and mathematical functions to be entered into the program. An example of text writing could be the title of the part-program itself. Other facilities include copy and delete functions which enable blocks as well as individual ones to be edited along with the useful re-numbering feature.

- Select the EDITFUN softkey F4 shown in section 4.1

The following softkeys are activated.

DELFUN COPYFUN RENUM-N ED-LINE RETURN

Fig. 4.1.4.-1

The functions of the first three softkeys (from left) are self-explanatory and the procedures can be found in other sections. The RETURN softkey will give the previous softkey level.

- Select EDLINE softkey F4

Three pages are now available and selectable using the PAGE softkey. F3 The first page (PAGE 0) will be displayed automatically as shown below.

```

MANUAL  MAN. OPER.
PM 99999 N 99999

PARTPROGRAM N 99999

PAGE 1 > Text Functions
00= Q      10= R      20= S      30= T      40= U
01= V      11= W      21= X      31= Y      41= Z
02= [      12= \      22= ]      32= ^      42= _
03= `      13= a      23= b      33= c      43= d
04= e      14= f      24= g      34= h      44= i
05= j      15= k      25= l      35= m      45= n
06= o      16= p      26= q      36= r      46= s
07= t      17= u      27= v      37= w      47= x
08= y      18= z      28= [      38= \      48= ]
09= `      19= a      29= b      39= c      49= d

```

```

N99999 <PHILIPS SHIELD SY
[HELP] [DEL <-] [PAGE] [MAC-FUN] [RETURN]

```

Fig. 4.1.4.-2

This enables upper-case characters to be entered into the block. A second page (PAGE 1) enables lower-case characters to be entered. The third (PAGE 2) enables mathematical functions to be entered as shown below.

The LINE EDIT function is a feature to make corrections in already existing texts or math functions. Entering complete lines of text etc. is best done with the help of an external programming facility.

```

MANUAL  MAN. OPER.
PM 99999 N 99999

PARTPROGRAM N 99999

PAGE 3 > Mathematical Functions
00= 0      10= .      20= (      30= sin()
01= 1      11= E      21= )      31= cos()
02= 2      12= =      22= "      32= tan()
03= 3      13= +      23= >      33= asin()
04= 4      14= -      24= <      34= acos()
05= 5      15= *      25= <>     35= atan()
06= 6      16= :      26= e      36= abs()
07= 7      17= (      27= pi     37= int()
08= 8      18= )      28= ^      38= rad
09= 9      19= ( )    29= sqrt() 39= deg

```

```

N99999 <PHILIPS SHIELD SY
[HELP] [DEL <-] [PAGE] [MAC-FUN] [RETURN]

```

Fig. 4.1.4.-3

The DEL <- softkey is for deleting (erasing) characters to the left of the cursor and can also be used for deleting characters entered via the address-string on the keypad.

Entering a character or a mathematical function is made in the same way, a simple example follows.

To complete the sentence in fig. 4.1.4.-3 to

(PHILIPS SHIELD SYMBOL)



Simply enter the values via the keypad.

The result is directly indicated in the input line.

M=22 B=11 0=24 L=21)=37

To insert character(s) place the cursor with the address selector button on the character in front of which the character(s) must be inserted.

Note: After selection of the first digit, an arrow indicates to the corresponding row.
Values <10 must be preceded with an 0.

The example below shows that key 1 of the keypad was pressed.

```

MANUAL   MAN.OPER.
PM 99999 N 99999



PARTPROGRAM N 99999

PAGE 1 > Text Functions
00= [OP] 10= [P] 20= [X] 30= [.] 40= [E]
01= [N] 11= [P] 21= [I] 31= [C] 41= [L]
02= [O] 12= [P] 22= [T] 32= [E] 42= [L]
03= [F] 13= [P] 23= [E] 33= [X] 43= [L]
04= [I] 14= [P] 24= [E] 34= [E] 44= [L]
05= [N] 15= [P] 25= [E] 35= [E] 45= [L]
06= [O] 16= [P] 26= [E] 36= [E] 46= [L]
07= [F] 17= [P] 27= [E] 37= [E] 47= [L]
08= [I] 18= [P] 28= [E] 38= [E] 48= [L]
09= [N] 19= [P] 29= [E] 39= [E] 49= [L]

N99999 <PHILIPS SHIELD SYM
[HELP] [DEL <-] [PAGE] [MAC-FUN] [RETURN]
    
```

Fig. 4.1.4-4

After completion of the characters and mathematical functions

- Select the RETURN softkey  (the part-program is displayed)
- Press the STORE button 

The new or edited block is now entered into the program.
Remember that text must be between brackets!

4.1.5. Macro - Functions.

After depressing the softkey **F4** below >MAC-FUN< the display shows:

```

MANUAL   MAN. OPER.
PM 99999 N 99999

PARTPROGRAM N 99999

PAGE 1  > Programmable Macros
00=
01=
02=
03=
04=
05=
06=
07=
08=
09=

TEXT MACROS

(Program Name: *****)

```

HELP DEL-FUN PAGE ADD-FUN RETURN

Fig. 4.1.5.-1

With this feature it is possible to store a line of text or a mathematical function under a macro number. For this purpose 20 macro numbers are available in two pages.

E.g. it is possible to store the line of the text as shown in fig. 4.1.5.-1 in a macro:

- Depress softkey **F4** below >ADD-FUN<.
- Enter a macro number (only one shown on the active page) with the keypad
- Depress softkey **F4** below >ADD-MAC<.

| | | |
|----|---|---|
| 7 | 8 | 9 |
| 4 | 5 | 6 |
| 1 | 2 | 3 |
| +/ | 0 | . |

The line of text is stored now as shown in the example below (stored in macro 00).

```

MANUAL   MAN. OPER.
PM 99999 N 99999

PARTPROGRAM N 99999

PAGE 1  > Programmable Macros
00= (Program Name: *****)
01=
02=
03=
04=
05=
06=
07=
08=
09=

ADD   MACRO nr █

(Program Name: *****)

```

HELP DEL-FUN PAGE ADD-MAC RETURN

Fig. 4.1.5.-2.





Remark : In the same way a line of text can be deleted from a macro number with the use of softkey >DEL-FUN< (changes to >DEL-MAC<).

The line of text can be used in other programs (example 1) or in the same program to repeat the contents of a block (example 2).

Example 1.



The line of text is used in the header of a new program:


Open via ID-DIR a new program e.g. N5222.
Place the cursor in front of N5222 and

- select >EDIT-FUN< 
- select >ED-LINE< 
- select >MAC-FUN< 
- select >RETURN< 



enter 00 via keyboard



- select >RETURN< 
- select >ED-LINE< 

Delete with >DEL<-<  the asterisks.

Enter the program name with the text functions.

- select >RETURN< 
- depress store button 

The display shows now:

```
MANUAL   MAN.OPER.  
PM 99999 N 99999  
  
PARTPROGRAM N 5222  
█N5222 (Program Name: BAR 10)
```

```
█NXYZABCDEFGHIJKLPRFSTHME  
█G  
N1  
  
█DELFUN █COPYFUN █RENUM-N █ED-LINE █RETURN
```

Fig. 4.1.5-3

Example 2

As can be seen in figure 4.1.5.-4 block 2 and 5 contain nearly the same information.

```
MANUAL   MAN.OPER.  
PM 99999 N 99999  
  
MACRO     N 99500  
  
█N99500 (CALCULATE INTERSECTION POINT  
TWO LINES)  
N1 E11=E3-E1 E12=E4-E2  
N2 E13=sqrt(E11+2+E12+2)  
N3 E11=E11:E13 E12=E12:E13  
N4 E13=E7-E5 E14=E8-E6  
N5 E15=sqrt(E13+2+E14+2)  
N6 E13=E13:E15 E14=E14:E15  
N7 E16=E13-E11  
N8 G29 E15=abs(E16)>.00005 N=14 E15  
N9 E16=E14-E12  
  
█NXYZABCDEFGHIJKLPRFSTHME  
█G  
N99500 (CALCULATE INTERSECTION POINT  
TWO LINES)  
█HELP █MENU-G ----- █EDITFUN █ID-DIR
```

Fig. 4.1.5-4

During programming the contents of block 3 is stored in a macro (e.g. macro no.5):

```

MANUAL   MAN.OPER.
PM 99999 N 99999

MACRO    N 99500

PAGE 1 > Programmable Macros
00= (Program Name: *****)
01=
02=
03=
04=
05= E13=sqrt(E11+2+E12+2)
06=
07=
08=
09=

ADD      MACRO nr █

E13=sqrt(E11+2+E12+2)

HELP DEL-FUN PAGE ADD-MAC RETURN

```

Fig. 4.1.5-5.

Remarks: This is done by deleting N3 with >DEL <-<. and then using the ADD-FUN

After programming block no.4 the contents of macro 05 is transferred to block 5 by entering 05 after selecting the >MAC-FUN< and >RETURN<.

```

MANUAL   MAN.OPER.
PM 99999 N 99999

MACRO    N 99500

PAGE 4 > Programmable Macros
00= (Program Name: *****)
01=
02=
03=
04=
05= E13=sqrt(E11+2+E12+2)
06=
07=
08=
09=

N5 E13=sqrt(E11+2+E12+2) █

HELP DEL <- PAGE MAC-FUN RETURN

```

Fig. 4.1.5-6

Now the contents can be adapted by deleting the incorrect characters with >DEL< and entering the correct characters with the text functions:

```

MANUAL  MAN. OPER.
PM 99999 N 99999

MACRO      N 99500

```

```

PAGE 1 > Text Functions
00= 01= 02= 03= 04= 05= 06= 07= 08= 09=
10= 11= 12= 13= 14= 15= 16= 17= 18= 19=
20= 21= 22= 23= 24= 25= 26= 27= 28= 29=
30= 31= 32= 33= 34= 35= 36= 37= 38= 39=
40= 41= 42= 43= 44= 45= 46= 47= 48= 49=

```

```

N5 E15=sqrt(E13+2+E14+2)



```

```

HELP DEL <- PAGE MAC-FUN RETURN

```

Fig. 4.1.5.-7.

- Depress >RETURN< 
- Depress STORE button 

```

MANUAL  MAN. OPER.
PM 99999 N 99999

MACRO      N 99500

```

```

N4 E13=E7-E5 E14=E8-E6
N5 E15=sqrt(E13+2+E14+2)

```

```

N6 XYZAB IJKLPRFSTHME
G

```

```

DELFUN COPYFUN RENUM-N ED-LINE RETURN

```

Fig. 4.1.5.8.

Note: In example 2, use is made of macro's (Subprograms), since there is no difference between editing of main programs or macro's.

4.1.6. Edit-Expression.

While being in MENU-G, the softkey >ED-EXPR< gives the following options:

```

HELP DEL <- PAGE SPECIAL RETURN

```

Fig. 4.1.6.-1

The options are described in sections 4.1.4. and 4.1.5.

There is however one exception under the softkey >SPECIAL< **F4**

HELP DEL <- CALC MAC-FUN RETURN

Fig. 4.1.6.2.

With the aid of the softkey >CALC< **F3** calculations can be performed.

Calculate the hypotenuse of a triangle with sides of 5 and 4.

- Enter resp. 29, 05, 28, 02, 13, 04, 28, 02 with the keypad

| | | |
|---------------------|---|---|
| 7 | 8 | 9 |
| 4 | 5 | 6 |
| 1 | 2 | 3 |
| $\frac{\square}{+}$ | 0 | . |

The display shows:

```

MANUAL  MAN.OPER.
PM 99999 N 99999

PARTPROGRAM N 99999

PAGE 3  > Mathematical Functions
00=0    10=^    20=^    30=sin()
01=1    11=E    21='    31=cos()
02=2    12=^    22="    32=tan()
03=3    13=+    23=>    33=asin()
04=4    14=-    24<    34=acos()
05=5    15=*    25<>    35=atan()
06=6    16=.    26=e    36=abs()
07=7    17<    27=pi   37=int()
08=8    18=>    28=^    38=rad
09=9    19=<()  29=sqrt() 39=deg

RAPID TRAVERSE
sqrt(5^2+4^2)
G
N99999 (PHILIPS SHIELD SYMBOL)

HELP DEL <- CALC MAC-FUN RETURN

```

Fig. 4.1.6-3.

- Depress softkey >CALC< **F3**

The display shows the result:

```

RAPID TRAVERSE
6.40312423743285
G
N99999 (PHILIPS SHIELD SYMBOL)

HELP DEL <- CALC MAC-FUN RETURN

```

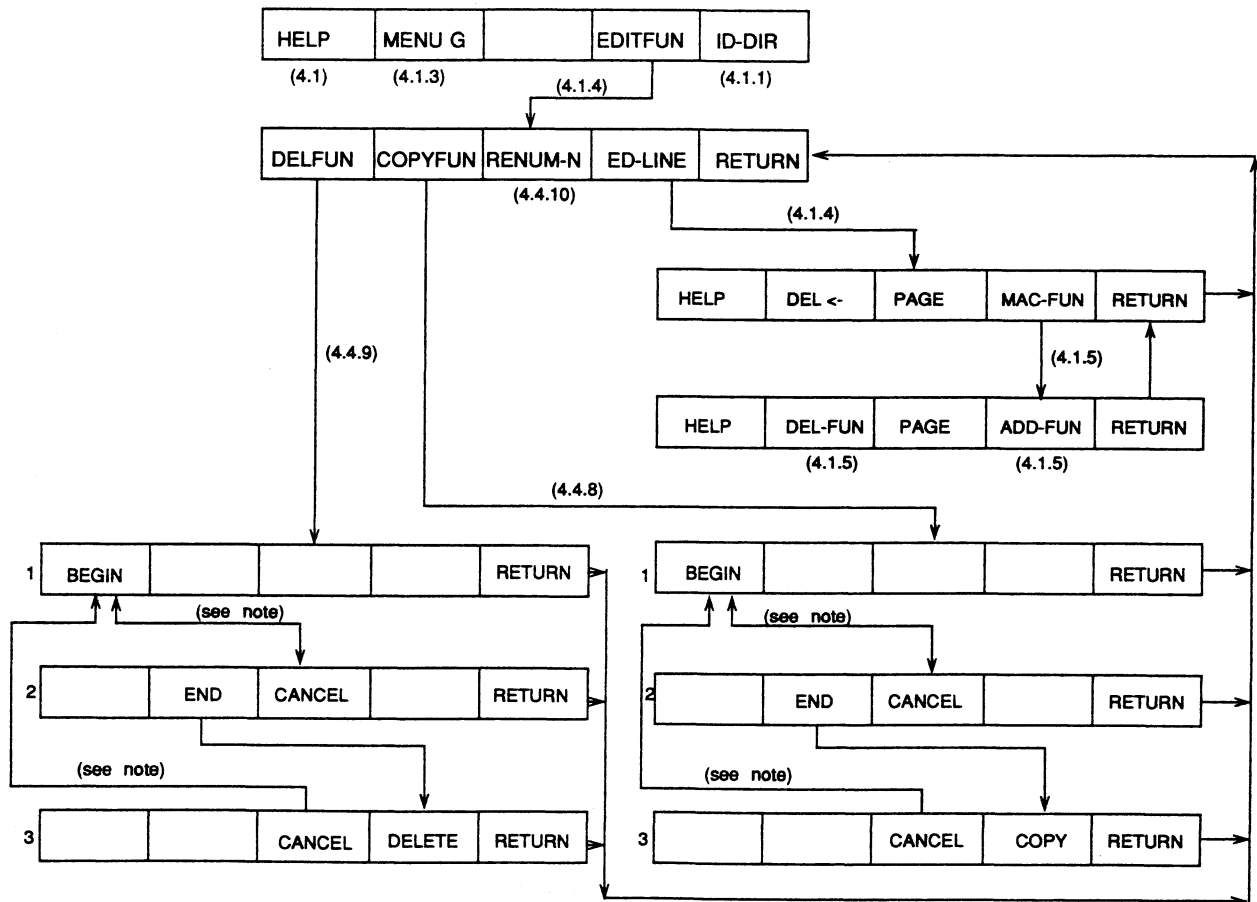
Fig. 4.1.6-4.

4.2 A GUIDE THROUGH THE SOFTKEYS

Most of the softkeys are self-explanatory and are generally only used in one type of procedure (sections 4.3 and 4.4). The various softkey levels are layered through the EDITFUN and ID-DIR softkeys and are programmed to change to allow selection of one or more procedures.

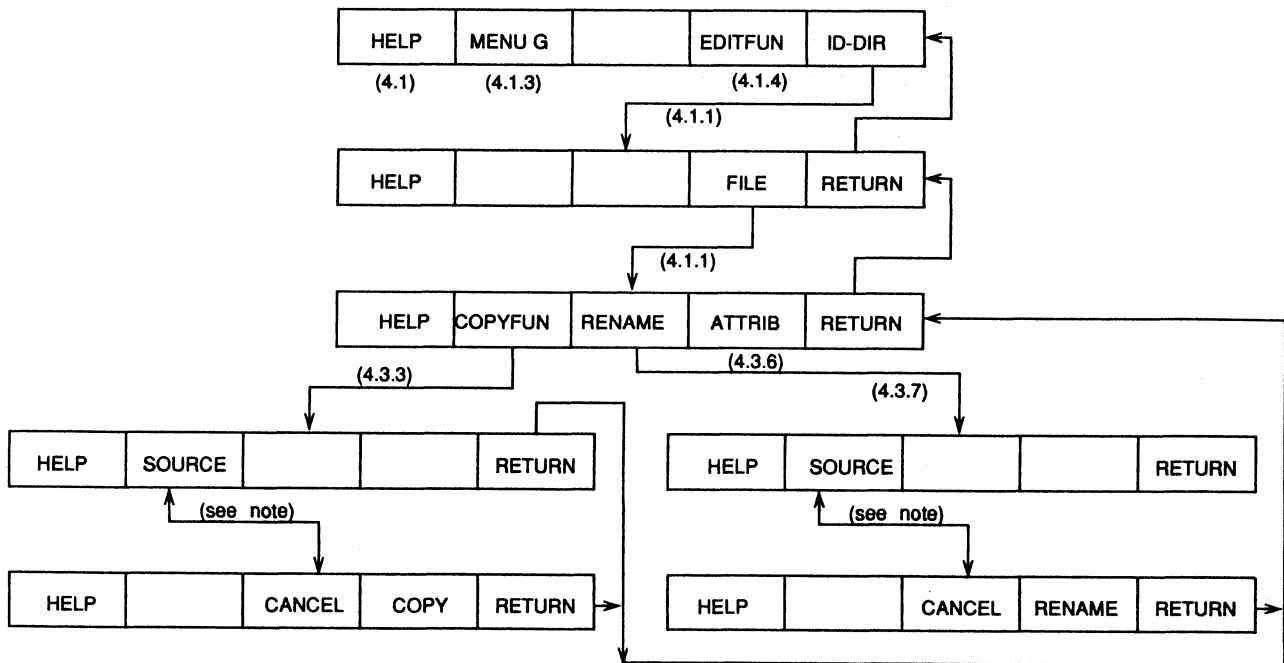
It is for this reason that the following sections only show how to access these various levels (selections).

4.2.1 Softkey levels through the EDITFUN softkey



Note: When an incorrect block number is entered (verified in the Input Field), the Cancel softkey will delete it and return to the previous softkey level. The correct block can now be entered (refer to relevant section)

4.2.2 Softkey levels through the ID-DIR softkey







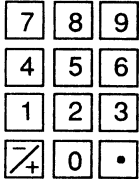
Note: When an incorrect part-program number is entered (verified in the Input Field), the Cancel softkey will delete it and return to the previous softkey level. The correct number can now be entered (refer to relevant section)

4.3 GENERAL PROGRAMMING AND EDITING PROCEDURES



The procedures given in the following sections are related to general activities such as displaying and copying part-programs, which in most cases take place in the part-program directory (4.1.1). For procedures relating to the actual blocks in the part-programs, reference should be made to section 4.4. Before starting a procedure it is recommended that the points given in the introductory part of section 4.1 be understood.

4.3.1 Create a new part-program

The following procedure should be used for entering new part-programs which is possible in any mode.

- Select the part-program directory (4.1)  → 
- If necessary select the >N< address  
- Enter the new program number via the keypad 

It must be a new program number; one that does not already exist in the directory.

- Press the ENTER button 
- Press the STORE button 

The new part-program can now be compiled in block form. An example of the display:

```

AUTO
PM 99999 N 99999
PARTPROGRAM N 5347
■N5347

NCXYZABIJKLPRFSTHME
G
M1

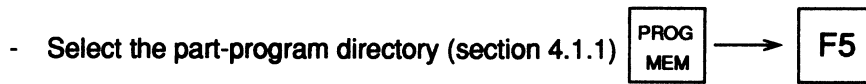
HELP MENU-G ----- EDITFUN ID-DIR
  
```

Fig. 4.3.1-1

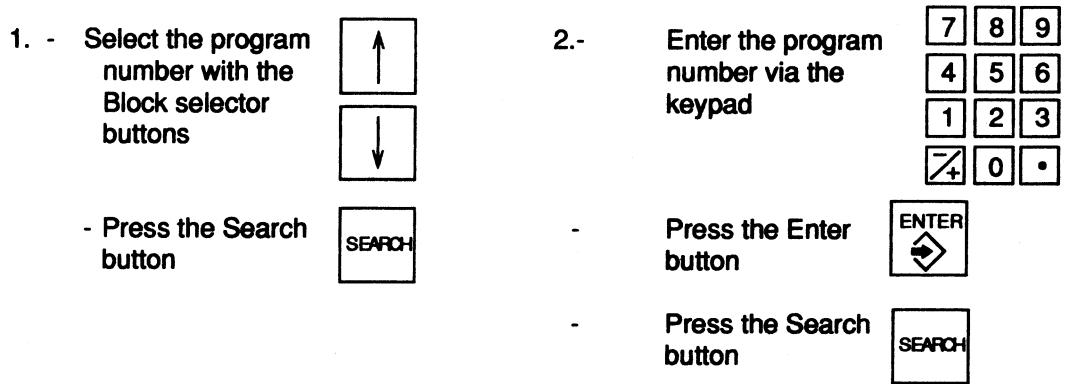
The first block number >N1< is indicated (a different number can be entered via the keypad) and the information can now be entered. The ENTER button must be pressed after entering each word. When a block is to be programmed with a G-function reference can be made to sections 4.1.2 and 4.1.3. When text or mathematical functions are to be entered refer to section 4.1.4. When the block has been completely entered press the STORE button. The next block is now in the input line and the associated data can be entered.

4.3.2 Display a program (search)

The following procedure should be used when a part-program needs to be viewed or edited.



The part-program can now be selected in one of two ways:



After the search procedure the first ten blocks (max) of the program will be displayed, an example is shown:

```

SINGLE
PM 99999 N 99999
PARTPROGRAM N 9900
■N9900 G98 X-200 Y-100 Z-50 I400 J200
  K100
N11 G99 X-100 Y-50 Z-40 I200 J100 K45
N1 G17 T2 M67
N2 G0 X0 Y0 Z0
N3 G87 X100 Y50 Z-20 B10 K10 F2000
  S100 M3
N4 G79 X0 Y0
N5 G0 Z20 T3 M67
N6 G81 Y10 Z-70 F1000 S100 M3
N7 G79 X-80 Y35 Z5


■NXYZBIJK
G
N9900 G98 X-200 Y-100 Z-50 I400 J200
  K100
HELP MENU-G ----- EDITFUN ID-DIR
  
```

Fig. 4.3.2-1

4.3.3 Copy a program

This procedure provides the facility to copy an existing part-program with a view to editing and creating a new part-program based on the original. Also programs can be copied from the part program memory to the macro memory and vice versa

4.3.3.1. To copy a program in the same memory:

- Select the part-program directory (4.1.1) or macro directory.
- Move the cursor to the part-program to be copied or enter the partprogram number via keypad and press ENTER 

- Select the FILE softkey 

The selection of softkeys now changes as shown below.

HELP COPYFUN RENAME ATTRIB RETURN

Fig. 4.3.3.1.-1

- Select the COPY-FUN softkey 

This will activate the following softkeys

HELP SOURCE ----- RETURN

Fig. 4.3.3.1-2

- Select the SOURCE softkey. 

An example of the input field with new softkeys

```
>PM COPY < 99100  
N  
N  
N99100 ( 2432 BYTES )  
HELP SOURCE CANCEL COPY RETURN
```

Fig. 4.3.3.1-3

- Enter the new part-program (or macro) number via the keypad



It must be a new program (or macro) number; one that does not yet exist in the directory.

- Press the ENTER button  (see note in section 4.2.2)

- Select the COPY softkey 

The part-program is now copied and entered into the directory as shown in the example.

```

MANUAL      MAN. OPER.
PM 99999  N 99999

PARTPROGRAM N 99999

ALL MEMORY 85120 BYTES FREE
N 9900 < 512 BYTES )
N 99999 < 2560 BYTES READING)
N 99100 < 2432 BYTES )
N 5347 < 256 BYTES )
N 5555 < 2432 BYTES )

>PM COPY < 99100

N
N
N9900 < 512 BYTES )


HELP SOURCE CANCEL COPY RETURN

```

Fig. 4.3.3.1-4

The cursor is returned to the first part-program in the directory. If more than 10 part-programs are already entered then the new part-program can be verified by scrolling through the directory with the line selector buttons.

4.3.3.2. To copy a program from one memory to the other:

- Select the part-program directory (4.1.1.) or macro directory.
- Move the cursor to the part-program to be copied or enter the partprogram number via keypad and press ENTER 

- Select the FILE softkey 

The selection of softkeys now changes as shown below

HELP COPYFUN RENAME ATTRIB RETURN

Fig. 4.3.3.2-1.

- Select the COPY-FUN softkey 

This will activate the following softkeys

HELP SOURCE ----- RETURN

Fig. 4.3.3.2-2.

- Select the SOURCE softkey 


An example of the input field with new softkeys



```
>PM COPY < 99100
N
N99100 ( 2432 BYTES )
HELP SOURCE CANCEL COPY RETURN
```

Fig. 4.3.3.2-3.

- Select the other memory

(Macro via menu ) → 

(P.M. via )

- Select FILE softkey 
- Select COPY-FUN softkey 

The display shows e.g.

```
MANUAL   MAN. OPER.
PM 99999 N 99999

MACRO     N

  ALL MEMORY 82688 BYTES FREE
  N 999100 < 640 BYTES      >
  N 999101 < 512 BYTES      >
  N 999102 < 384 BYTES      >
  N 999103 < 384 BYTES      >
  N 999105 < 256 BYTES      >
  N 999106 < 384 BYTES      >
  N 999115 < 384 BYTES      >
  N 999116 < 384 BYTES      >
  N 999118 < 256 BYTES      >
  N 999119 < 768 BYTES      >

>PM COPY < 99100

  N
N999100 < 640 BYTES      >

  HELP SOURCE CANCEL COPY RETURN
```

Fig. 4.3.3.-2-4.

- Enter the new part-program (or macro) via the keypad.



It must be a new program (or macro); one that does not yet exist in the directory.

- Press the ENTER button (see note in section 4.2.2.)



- Select the COPY softkey



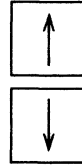
The program is now copied and entered into the directory of the other memory.

4.3.4 Clear a program

In the Manual, Single and Auto modes it is possible to clear (erase) part-programs as described in the following procedure. An active part-program, however, can only be cleared in the Manual mode and if partly or completely run, the Clear Control button must be pressed before starting the clearing procedure.

- Select the part-program directory (section 4.1.1)

- Select the program number with the line selector buttons



or enter the program number with the keypad and press ENTER



- Press the ENTER button



```

MANUAL   MAN. OPER.
PM 99999 N 99999

PARTPROGRAM N 99999

ALL MEMORY 85120 BYTES FREE
■ N 9900 < 512 BYTES >
N 99999 < 2560 BYTES READING >
N 99100 < 2432 BYTES >
N 5347 < 256 BYTES >
N 5555 < 2432 BYTES >
    
```

```

N
N
N5555 < CLEAR >

HELP ----- FILE RETURN
    
```

Fig. 4.3.4.-1

On the line under the address string, the part-program number is now followed by >(CLEAR)>.

- Press the STORE button



(To abandon the operation simply move the cursor one step up or down)

The part-program is now cleared from the memory and the cursor returns to the first program number in the directory.

Remember that locked programs cannot be cleared.

4.3.5 Clear all programs

The entire contents of the part-program memory can be cleared but can only be carried-out in the manual mode. Caution should be taken when using this facility, as any programs that need to be retained will have to be reloaded or re-entered manually (an external back-up memory should then be available).

The procedure is much the same as when clearing part-programs (section 4.2.5) except that the manual mode must always be selected and the cursor must be set at the top line of the directory in front of >ALL MEMORY<.

The example given below shows that the Enter button has been pressed and that by selecting the Store button the entire part-program memory will be cleared

```

MANUAL  MAN. OPER.
PM 99999 N 99999

PARTPROGRAM N 99999

■ ALL MEMORY 87552 BYTES FREE
N 9900 ( 512 BYTES )
N 99999 ( 2560 BYTES READING)
N 99100 ( 2432 BYTES )
N 5347 ( 256 BYTES )

```

```

F
N
ALL MEMORY CLEAR

HELP ----- FILE RETURN

```

Fig. 4.3.5-1

To abandon the operation simply move the cursor one step down.

4.3.6 Protect a part-program (Lock)

It is possible to protect a part-program from unauthorised or unintentional editing as described in the following procedure. Protected part-programs can only be viewed and are verified in the directory as described in section 4.1.1. The status (locked or unlocked) of the active program or the one being viewed cannot be changed.

- Select the part-program directory (4.1.1)



- Move the cursor to the part-program in question



- Select the FILE softkey F4

The selection of softkeys now changes as follows.

```

HELP COPYFUN RENAME ATTRIB RETURN

```

Fig. 4.3.6-1

- Select the ATTRIB softkey F4
- Select the LOCK softkey F3

(If the part-program is already protected the UNLOCK softkey is activated and can be used to release the program for editing).

The part-program is now protected (verified if the UNLOCK softkey is now activated in the field).

Remark: This feature is only operative when it is enabled

4.3.7 Change Identification number (Rename)

The following procedure should be used when a part-program identification number is to be changed.

- Select the part-program directory (4.1.1)
- Move the cursor to the part-program in question or enter the program number with keypad

and press Enter



- Select the FILE softkey



The selection of softkeys now changes as shown below.

HELP COPYFUN RENAME ATTRIB RETURN

Fig. 4.3.7.-1

- Select the RENAME softkey



This will activate the following softkeys

HELP SOURCE ----- RETURN

Fig. 4.3.7.-2

- Select the SOURCE softkey



An example of the input field with new softkeys

>PM EDIT ID < 99100

N
N
N99100 (2432 BYTES)



HELP SOURCE CANCEL RENAME RETURN

Fig. 4.3.7-3.

- Enter the new part-program number via the keypad.



It must be a new program number; one that does not yet exist in the directory.

- Press the ENTER button  (see note in section 4.2.2)
- Press the RENAME button 

The new part-program number is now entered into the directory as shown in the example.

```
MANUAL  MAN. OPER.  
PM 99999 N 99999  
  
PARTPROGRAM N 99999  
  
ALL MEMORY 87552 BYTES FREE  
N 9900 ( 512 BYTES )  
N 99999 ( 2560 BYTES READING )  
N 5555 ( 2432 BYTES )  
N 5347 ( 256 BYTES )  
  
>PM EDIT ID <  
  
N  
N  
N9900 ( 512 BYTES )  
  
HELP SOURCE ----- RETURN
```

Fig. 4.3.7.-4

The cursor is returned to the first part-program in the directory. If more than 10 part-programs are already entered and the one in question is not indicated it can be verified by scrolling through the directory with the line selector buttons.

4.3.8 Enter, change or delete (clear) title

This is possible by using softkeys in the same way as editing or compiling blocks (4.1.4)

4.4 BLOCK PROGRAMMING AND EDITING PROCEDURES

The procedures given in the following sections are related to the actual blocks themselves, such as inserting and modifying blocks. For procedures relating to general activities, reference should be made to section 4.3. Before starting a procedure it is recommended that the points given in the introductory part of section 4.1. be understood.

4.4.1 Enter block information

There are two ways of inputting block data which are:

- via the address-string and keypad
- via line editor.

1.Via the address-string and keypad

When entering data using this method it is necessary to move the cursor to the corresponding address-word and then enter the value using the keypad. After entering the value the ENTER button must be pressed. When the Block has been completed the STORE button must be pressed.

2.Via line editor.

It is possible to enter block data (completely) using the softkeys as described in section 4.1.4.

4.4.2 Scrolling

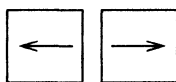
It is possible to scroll through the part-program by using the line selector buttons. Indeed scrolling can be made either block by block or address by address.

By selecting the G-address (with the address-selector buttons) for example, the part-program will be scrolled through with blocks containing the G-address. Furthermore, with the MENU G softkey selected (section 4.1.3) the description of each G-function and its associated address-string will also be displayed at the same time.






4.4.3 Search a block

The following procedure should be used when a particular block in a part-program needs to be viewed or edited.

- If necessary search for the part-program (section 4.3.2)
- Move the cursor in the address-string to letter >N< using the Address selector buttons



The block can now be selected in one of two ways:

- | | | | | | | | | | | | | | | | |
|--|--|---|---|---|---|---|---|---|---|---|---|---|----|---|---|
| <p>1. - Select the block number with the line selector buttons</p> |   | <p>2. - Enter the block number via the keypad</p> | <table border="1" style="border-collapse: collapse; text-align: center;"> <tr><td>7</td><td>8</td><td>9</td></tr> <tr><td>4</td><td>5</td><td>6</td></tr> <tr><td>1</td><td>2</td><td>3</td></tr> <tr><td>/+</td><td>0</td><td>.</td></tr> </table> | 7 | 8 | 9 | 4 | 5 | 6 | 1 | 2 | 3 | /+ | 0 | . |
| 7 | 8 | 9 | | | | | | | | | | | | | |
| 4 | 5 | 6 | | | | | | | | | | | | | |
| 1 | 2 | 3 | | | | | | | | | | | | | |
| /+ | 0 | . | | | | | | | | | | | | | |
| <p>- Press the Search button</p> |  | <p>- Press the Enter button</p> |  | | | | | | | | | | | | |
| | | <p>- Press the Search button</p> |  | | | | | | | | | | | | |

After the search procedure the block is moved to the top of the list and is also displayed in the input line; an example is shown.

```

MANUAL   MAN.OPER.
PM 99999 N 99999

PARTPROGRAM N 99100

■N12 G98 X-700 Y-500 Z-500 I10 J10 K15
N13 G17
N14 G22 N=99009 (PARPAS)
N15 G18
N16 G98 X-700 Y-500 Z-500 I10 J10 K15
N17 G17
N18 G22 N=99001 (PHILIPS)
N19 G18
N20 G98 X-700 Y-500 Z-500 I10 J10 K15
N21 G17
N22 G22 N=99007

MXYZBIJK
G
N12 G98 X-700 Y-500 Z-500 I10 J10 K15
HELP MENU-G ----- EDITFUNK ID-DIR
    
```

Fig. 4.4.3.-1

4.4.4 Search an address

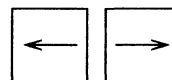
The following procedures should be used when blocks containing a certain address need to be viewed or edited.

The first procedure is to be used when searching for blocks which contain the same address regardless of the value entered with it. The second is for searching blocks which contain both the same address and value.

Procedure (1)

- If necessary search for the part-program (section 4.3.2)

- Select the address with the Address Selector buttons



- Momentarily press the appropriate line selector button



to find the following or

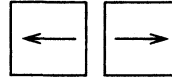
preceding block.

When the last block has been found, the cursor will not be able to enter further into the program, only backwards.

Procedure (2)

- If necessary search for the part-program (section 4.3.2)

- Select the address with the Address Selector buttons



- Enter the value via the keypad



- Press the Enter button



- Press the Search button



The first block containing the address is searched and further blocks can be found each time the Search button is pressed. When the last block is found and the Search button is again pressed, searching will then restart from the first block.

4.4.5 Insert a block

The following procedure should be used when a new block needs to be added to a part-program.

- If necessary search for the part-program (section 4.3.2)
- Search for the block which will precede the new block (section 4.2.3 and 4.2.4).

As shown in the example below, after the preceding block has been searched the cursor is set at the G-address (or another) in the address-string line.

```

MANUAL   MAN. OPER.
PM  9900 N  9900

PARTPROGRAM N  99999

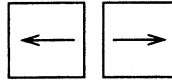
■N8 X70
N9 Y0
N10 G2 X-70 Y0 R70
N11 G1 Z10
N12 G0 X-60 Y0 (THE CIRCLE)
N13 G1 Z0
N14 G2 I0 J0
N15 G64 (THE WAVES)
N16 G2 R29.83 I-36.345 J-18.173
N17 G3 R29.83 I-12.115 J36.345
N18 G2 R29.83 I12.115 J-18.173

NXYZABCDEFGHIJKLPRFSTHME
G
N8 X70

HELP  MENU-G  -----  EDITFUN  ID-DIR
    
```

Fig. 4.4.5-1

- Select >N< with the Address Selector buttons



- Enter the new block number via the keypad (N800)



It must be a new block number and one that does not already exist in the program.

- Press the Enter button



The new block number is displayed in the bottom line and the cursor returns to the G-address in the address-string line; an example is given.

```

MANUAL   MAN. OPER.
PM  9900  N   9900

PARTPROGRAM N   99999

■ N8 X70
  N9 Y0
  N10 G2 X-70 Y0 R70
  N11 G1 Z10
  N12 G0 X-60 Y0 (THE CIRCLE)
  N13 G1 Z0
  N14 G2 I0 J0
  N15 G64 (THE WAVES)
  N16 G2 R29.83 I-36.345 J-18.173
  N17 G3 R29.83 I-12.115 J36.345
  N18 G2 R29.83 I12.115 J-18.173

NXYZAB IJKLPRFSTHME
G
N800

HELP  MENU-G  -----  EDITFUN  ID-DIR

```

Fig. 4.4.5-2

The address may now be entered in the usual way. The Enter button must be pressed after entering each word.

When the block is to be programmed with a G-function reference can be made to sections 4.1.2 and 4.1.3. When text or mathematical functions are to be entered refer to section 4.1.4.

- When the block has been completed, press the STORE button



As shown below, the new block (marked by the cursor) is inserted and stored in the list of blocks after the block that had been originally searched. The bottom line displays the next block number that can be inserted.

```
MANUAL   MAN.OPER.  
PM  9900 N  9900  
  
PARTPROGRAM N  99999  
  
N8 X70  
N800 (This block has been ADDED to the  
program)  
N9 Y0  
N10 G2 X-70 Y0 R70  
N11 G1 Z10  
N12 G0 X-60 Y0 (THE CIRCLE)  
N13 G1 Z0  
N14 G2 I0 J0  
N15 G64 (THE WAVES)  
N16 G2 R29.83 I-36.345 J-18.173  
  
NXYZABCDEFGHIJKLPRFSTHME  
G  
N801  
  
DELFUN COPYFUN RENUM-N ED-LINE RETURN
```

Fig. 4.4.5-3

It is possible to insert this new block or to search and edit other blocks. The blocks can also be renumbered, which is described in section 4.4.10)

4.4.6 Modify a block

Attention : Modify, delete, copy and renumber functions are to be used with care when the relevant program contains repeat functions. The CNC does not check for faults or adapts repeat information in blocks and the execution of a modified program can lead to error codes or unexpected execution of blocks.

The following procedure should be used when a block needs to be edited. It is possible to add, clear or change addresses in the block.

- If necessary search for the part-program (section 4.3.2)
- Search for the block in question (section 4.4.3 or 4.4.4)

As shown in the example below, after the block has been searched the cursor is set at the G-address (or another) in the address-string line)

```

MANUAL   MAN.OPER.
PM      9900  N   9900

PARTPROGRAM N  99999

█N16 G2 R29.83 I-36.345 J-18.173
N17 G3 R29.83 I-12.115 J36.345
N18 G2 R29.83 I12.115 J-18.173
N19 G3 R29.83 I36.345 J36.345 J1=1
N20 G2 R60 I0 J0 J1=2
N21 G2 R29.83 I36.345 J27.259
N22 G3 R29.83 I12.115 J-27.259
N23 G2 R29.83 I-12.115 J27.259
N24 G3 R29.83 I-36.345 J-27.259 J1=1
N25 G3 R60 I0 J0 J1=2
N26 G2 R29.83 I-36.345 J-36.345

█XYZAB IJKLPRFSTHME
G
N16 G2 I-36.345 J-18.173 R29.83

HELP  MENU-G  -----  EDITFUN  ID-DIR

```

Fig. 4.4.6-1

- If not already selected, set the cursor at the appropriate address using the Address Selector buttons. There are now two ways to continue.

1. - To add (or change the value of) an address

- Enter the value via the keypad
- | | | |
|----|---|---|
| 7 | 8 | 9 |
| 4 | 5 | 6 |
| 1 | 2 | 3 |
| +/ | 0 | . |

Further addresses can now also be added or changed in the same way

- Press the ENTER button 

The new address (or value) is now entered in the input line.

- Press the STORE button 

2. - To clear an address

- Press the ENTER button 

The address is now cleared from the input line

- Press the STORE button 

After the Store button has been selected (either case) the modified block can be verified at the top of the block list.

4.4.7 Clear a block

The following procedure should be used when a complete block is to be cleared from the part-program. This is also possible however, by using the DELETE softkey (section 4.4.9).

- If necessary search for the part-program (section 4.3.2)
- Search for the block in question (section 4.4.3 and 4.4.4)

As shown in the example below, after the block has been searched the cursor is set at the G-address (or another) in the address-string line.

```

MANUAL   MAN.OPER.
PM  9900  N   9900




PARTPROGRAM N  99999

█N25 G3 R60 I0 J0 J1=2
N26 G2 R29.83 I-36.345 J-36.345
N27 G3 R29.83 I-12.115 J18.173
N28 G2 R29.83 I12.115 J-36.345
N29 G3 X60 Y0 I36.345 J18.173
N30 G0 Z10
N31 G63
N32 G92 X1
N33 G64 X-50 Y29 <THE BIG CROSS>
N34 G1 Z0
N35 B1=10.553

N<XYZAB IJKLPRFSTHME
G
N25 G3 I0 J0 R60 J1=2

HELP MENU-G ----- EDITFUN IO-DIR
  
```

Fig. 4.4.7-1

- Select >N< with the Address Selector buttons  
- Press the ENTER button 

On the line under the address-string, the part-program number is now followed by >CLEAR<.

- Press the STORE button 

The block is now cleared from the memory and the cursor is set at the next block. The blocks can now be renumbered (if necessary) as described in section 4.4.10.


4.4.8 Copy a block or a group of blocks

The following procedure should be used when a block or a group of blocks need to be copied in a part-program.

- If necessary search for the part-program (section 4.3.2)
- Search for the block or the first block to be copied (section 4.4.3 and 4.4.4) or enter the

relevant block number with the keypad

| | | |
|---|---|---|
| 7 | 8 | 9 |
| 4 | 5 | 6 |
| 1 | 2 | 3 |
| ↗ | 0 | . |

 and press ENTER button. 

As shown in the example below, after the block has been searched the cursor is set at the G-address (or another) in the address-string line.

```

MANUAL    MAN. OPER.
PM  9900 N 9900

PARTPROGRAM N 99100

■N2 G22 N=99001 (PHILIPS)
N3 G18
N4 G98 X-700 Y-500 Z-500 I10 J10 K15
N5 G17
N6 G22 N=99008 (MAHO)
N7 G18
N8 G98 X-700 Y-500 Z-500 I10 J10 K15
N9 G17
N14 G22 N=99009 (PARPAS)
N15 G18
N16 G98 X-700 Y-500 Z-500 I10 J10 K15

NXYZABCLPRFSTHME
G
N2 G22 N=99001 (PHILIPS)
HELP MENU-G ----- EDITFUN ID-DIR

```

Fig. 4.4.8-1

- Select the EDITFUN SOFTKEY

| |
|----|
| F4 |
|----|

This will activate the following softkeys

DELFUN COPYFUN RENUM-N ED-LINE RETURN

Fig. 4.4.8-2.


- Select the COPY-FUN softkey

| |
|----|
| F2 |
|----|

The selection of softkeys will change as follows:

BEGIN END ----- RETURN

Fig. 4.4.8-3

- Select the BEGIN softkey  (see note in section 4.2.1)

An example of the input field with new softkeys

```

>PM 99100 COPY < B:2 E:
NXYZABCLPRFSTHME
G
N2 G22 N=99001 (PHILIPS)
BEGIN END CANCEL ----- RETURN

```

Fig. 4.4.8-4

- Select >N< with the Address Selector buttons




Scroll through until the cursor is at the block **following** the **last** block to be copied.

Or enter the relevant blocknumber with the keypad



and press ENTER button



- Select the END softkey  (see note 1 in section 4.2.1)

An example of the input field with new softkeys

```

>PM 99100 COPY < B:2 E:6
NXYZABCLPRFSTHME
G
N5 G22 N=99008 (MAHO)
BEGIN END CANCEL COPY RETURN

```

Fig. 4.4.8-5

Note: It is now possible to insert the block(s) at any place in the part-program by selecting the block

following this location, using the Line Selector buttons.



Or enter the relevant blocknumber with the keypad



and press ENTER button.



- Select the COPY softkey **F4**

The block or group of blocks are now copied into the part-program. Further copies of the same block(s) can be made by selecting the COPY softkey. **F4**

```

MANUAL   MAN.OPER.
PM      9900  N   9900

PARTPROGRAM N   99100

■N7 G18
N8 G98 X-700 Y-500 Z-500 I10 J10 K15
N9 G17
N2 G22 N=99001 (PHILIPS)
N3 G18
N4 G98 X-700 Y-500 Z-500 I10 J10 K15
N5 G17
N14 G22 N=99009 (PARPAS)
N15 G18
N16 G98 X-700 Y-500 Z-500 I10 J10 K15
N17 G17

>PM 99100   COPY < B:2       E:6

NXYZABCLPRFSTHME
G
N7 G18

BEGIN      END   CANCEL COPY RETURN

```

Fig. 4.4.8.-6.

- After completion, select the CANCEL softkey **F3**

The copied blocks can be verified by scrolling through the part-program.

Use the RENUM-N softkey **F3** to renumber the part program (see 4.4.10).

```

MANUAL   MAN.OPER.
PM      9900  N   9900

PARTPROGRAM N   99100

■N7 G18
N8 G98 X-700 Y-500 Z-500 I10 J10 K15
N9 G17
N10 G22 N=99001 (PHILIPS)
N11 G18
N12 G98 X-700 Y-500 Z-500 I10 J10 K15
N13 G17
N14 G22 N=99009 (PARPAS)
N15 G18
N16 G98 X-700 Y-500 Z-500 I10 J10 K15
N17 G17

NXYZABCLPRFSTHME
G
N7 G18

DELFUN COPYFUN RENUM-N ED-LINE RETURN

```

Fig. 4.4.8.-7

Remarks : It is also possible to copy block(s) from one program to another program or macro.

To do so define the block(s) to be transferred to the other program as described above, but search the relevant program and the block in this program in front of which the blocks must be entered before selecting the COPY softkey

4.4.9 Delete a group of blocks.

The following procedure should be used when a group of blocks need to be deleted in a part-program.

- If necessary search for the part-program (section 4.3.2)
- Search for the block or the first block to be deleted (section 4.4.3 and 4.4.4).

As shown in the example below, after the block has been searched the cursor is set at the G-address (or another) in the address-string line.

```

MANUAL   MAN. OPER.
PM  9900  N   9900

PARTPROGRAM N   9900

■ N8 G79 Y-35
  N9 G79 X80
  N10 G79 Y35
  N12 G0 Z50 M30
    
```

```

NXYZABLPFSTHME
G
N8 G79 Y-35

HELP  MENU-G  -----  EDITFUN  ID-DIR
    
```

Fig. 4.4.9-1

- Select the EDITFUN softkey F4

This will activate the following softkeys

```

DELFUN  COPYFUN  RENUM-N  ED-LINE  RETURN
    
```

Fig. 4.4.9-2

- Select the DEL-FUN softkey F1

The softkey line will change as follows:

```

BEGIN  END  -----  RETURN
    
```

Fig. 4.4.9-3

- Select the BEGIN softkey F1 (see note 1 in section 4.2.1)





An example of the input field with new softkeys


```

>DELETE < B:8      E:
N<XYZABLPFSTHME
G
N8 G79 Y-35
BEGIN  END  CANCEL  ----- RETURN

```

Fig. 4.4.9-4

- Select >N< with the Address Selector buttons  
- Scroll through until the cursor is at the block following the last block to be deleted.  

Or enter the relevant blocknumber with the keypad and press ENTER button 

- Select the END softkey  (see note in section 4.2.1)

An example of the input field with new softkeys

```

>DELETE < B:8      E:12
N<XYZABCDEFGHIJKLPRFSTHME
G
N12 G0 Z50 M30
BEGIN  END  CANCEL  DELETE  RETURN

```

Fig. 4.4.9-5

- Select the DELETE softkey 

The group of blocks is now deleted. This can be verified by scrolling through the part-program.

4.4.10 Renumber blocks-softkey

The following procedure can be used to number the blocks in sequential order starting from beginning to end.

- If necessary search for the part-program (section 4.3.2)

- Select the EDITFUN softkey F4

This will activate the following softkeys

DELFUN COPYFUN RENUM-N ED-LINE RETURN

Fig. 4.4.10.-1


- Select the RENUM-N softkey F3

The blocks are now renumbered in sequential order. This can be verified by scrolling through the part-program.

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5. TOOL MEMORY

The information in the tool memories can be checked in every operation mode.

- Touch tool mem button 


The display shows the tool memory. (See chapter 5.1 to select a tool.

To select the tool sub-memories see part 5.3.

5.1 EDIT TOOL INFORMATION

The tool memory only can be edited *in the Manual mode* or during intervention Teach-in, Single or Auto mode.

- Touch the Manual button 

- Touch the Tool mem button 

The monitor displays:

```
MANUAL  MAN.OPER.
PM 99100 N 99100

TOOL OFFSETS



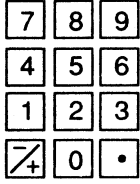


ALL MEMORY 86656 BYTES FREE
■ T0 L0 R0 R1=0 G0 P0
  T1 L0 R0 R1=0 G0 P1
  T2 L0 R0 R1=0 G0 P2
  T3 L0 R0 R1=0 G0 P3
  T4 L0 R0 R1=0 G0 P4
  T5 L0 R0 R1=0 G0 P5
  T6 L0 R0 R1=0 G0 P6
  T7 L0 R0 R1=0 G0 P7
  T8 L0 R0 R1=0 G0 P8
  T9 L0 R0 R1=0 G0 P9

POSITION IN MAGAZINE
TP
P
■ T0 L0 R0 R1=0 G0 P0



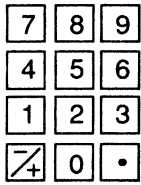

HELP -----
```

Fig. 5.1-1

Selecting a tool number can be done in two ways:

- Select the toolnumber - with the Block selector buttons  
- Enter the toolnumber via the keyboard 
- Touch the Enter button 
- Touch the Search button 

To edit the tool information:

- Select the address with the Address Selector buttons  
- Enter the compensation value via the keyboard 
- Touch the Enter button 

The value entered appears in the bottom line:

```

MANUAL   MAN OPER.
PM 99100 N 99100

TOOL OFFSETS

ALL MEMORY 86656 BYTES FREE
T0 L0 R0 R1=0 G0 P0
T1 L0 R0 R1=0 G0 P1
T2 L0 R0 R1=0 G0 P2
T3 L0 R0 R1=0 G0 P3
T4 L0 R0 R1=0 G0 P4
■ T5 L0 R0 R1=0 G0 P5
T6 L0 R0 R1=0 G0 P6
T7 L0 R0 R1=0 G0 P7
T8 L0 R0 R1=0 G0 P8
T9 L0 R0 R1=0 G0 P9

TOOL RADIUS
TLRR1GP
■ R
T5 L12.365 R0 R1=0 G0 P5

HELP -----
  
```

Fig. 5.1-2

- After all addresses have been entered, touch the Store button 

The compensation values appear in the list.

The next toolnumber appears in the bottomline on the monitor.

The procedure is terminated by selecting the same or another operation mode.



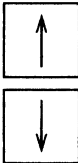

Remark : Since T0 is employed to clear the tool compensations, it cannot be used to enter the length- and radius compensation values.

For DATA I/O, see chapter 6.

5.2 CLEAR TOOL MEMORY

The operation mode Manual enables the Tool memory to be cleared.

The procedure is as follows:

- Touch the Manual button 
- Touch the Tool mem button 
- Select with the Block selector buttons  >ALL MEMORY<
- Touch the Enter button 

The bottom line displays >ALL MEMORY CLEAR<

```

MANUAL  MAN. OPER.
PM 99100 N 99100

TOOL OFFSETS

■ ALL MEMORY 86656 BYTES FREE
T0 L0 R0 R1=0 G0 P0
T1 L0 R0 R1=0 G0 P1
T2 L0 R0 R1=0 G0 P2
T3 L0 R0 R1=0 G0 P3
T4 L0 R0 R1=0 G0 P4
T5 L12.365 R20.36 R1=0 G0 P5
T6 L0 R0 R1=0 G0 P6
T7 L0 R0 R1=0 G0 P7
T8 L0 R0 R1=0 G0 P8
T9 L0 R0 R1=0 G0 P9
  
```

```

TIP
T
ALL MEMORY CLEAR

HELP -----
  
```

Fig. 5.2-1



- Touch the Store button 

The entire Tool memory is cleared now.

5.3 TOOL MENU

The tool sub-memories (see below) can be selected via the tool menu.

To select the tool menu:

- Touch the Tool Mem button 
- Touch the Menu button 

The display shows:

```
MANUAL  MAN. OPER.  
PM 99100 N 99100  
  
TOOL OFFSETS  
  
TOOL MENU:  
  
1 EDIT    TOOL LIFE  
2 EDIT    TOOL SPARE
```

HELP -----

Fig. 5.3-1

The monitor now displays the memories containing the related constants. By means of the first word >EDIT< or >DISPLAY<, the control indicates if the contents of that memory can be edited or only displayed. (E.g. the tool memories can only be edited being in manual mode or during intervention).

```
AUTO  
PM 99100 N 99100  
  
TOOL OFFSETS  
  
TOOL MENU:  
  
1 DISPLAY TOOL LIFE  
2 DISPLAY TOOL SPARE
```

HELP -----

Fig. 5.3-2

Remark : All the memories are optional. The contents of the tool menu may vary according to the options available.

To select the required memory:

- Touch the number corresponding to the required memory.

5.3.1 Tool life monitoring (optional)

The control features life time monitoring for each tool in the tool memory. In the tool life memory a tool life can be entered, which will be decreased in periods of a minute during G1, G2, G3, M3, M4 with the relevant tool active.

The tool life memory can be checked in every operation mode.

To edit the tool life memory:

- Select Manual mode



- Select the tool life memory as described in part 5.3.

The display shows:

```

MANUAL   MAN. OPER.
PM 99100 N 99100

TOOL LIFE

ALL MEMORY   86656 BYTES FREE
■ T 0 C      0 A      0 R      0 P 0
  T 1 C      0 A      0 R      0 P 1
  T 2 C      0 A      0 R      0 P 2
  T 3 C      0 A      0 R      0 P 3
  T 4 C      0 A      0 R      0 P 4
  T 5 C      0 A      0 R      0 P 5
  T 6 C      0 A      0 R      0 P 6
  T 7 C      0 A      0 R      0 P 7
  T 8 C      0 A      0 R      0 P 8
  T 9 C      0 A      0 R      0 P 9

TOOL NUMBER
■
■
T0 C0 A0
HELP -----
    
```

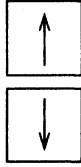
Fig. 5.3.1-1

Meaning of the addresses:

- T- Toolnumber corresponding to the T-number in the main tool memory
- C- Programmed tool life time in minutes.
C=0 means life time monitoring is ineffective for that tool
- A- Actual (used) tool life time
- R- Remaining tool life time
- P- Tool magazine position - equal to tool position in main tool memory

The search for a tool number can be done in two ways:


- Select the T-number with the block selector buttons



- Enter the T-number via the keyboard



When the cursor comes down to the bottom line of the list, the next touch of the Search down Button will call the next part of the T list

The Clear button  can clear this value

- Touch the Enter button



- Touch the Search button



- Select address C with the address selector buttons



- Enter the tool life in minutes with the keyboard



- Touch Enter button



- Touch Store button



The actual tool life remains unaltered.
The remaining tool life time is updated with $R=C-A$.

Clearing the actual tool life time for a specific tool is done by

selecting the tool and touching Enter



and Store



To clear the whole tool life memory select >ALL MEMORY< and touch Enter



and Store



5.3.2 Spare tool memory (optional)

The control allows to assign a spare tool to each tool in the tool memory.

As soon as tool life time of the original tool is exceeded or a tool breakage is detected the spare tool is taken instead of the original tool at the next tool change for that tool.

To assign a spare tool:

Select spare tool memory as described in part 5.3.

The display shows:

```

MANUAL   MAN. OPER.
PM 99100 N 99100

SPARE TOOL

ALL MEMORY 86656 BYTES FREE
■ T 0=
  T 1=
  T 2=
  T 3=
  T 4=
  T 5=
  T 6=
  T 7=
  T 8=
  T 9=

E.G. T1 WITH SPARE TOOL T11: T1=T11
T
T
T0=


HELP ----- ATTRIB -----
  
```



Fig. 5.3.2-1

The search for a tool number can be done in two ways:

- Select the T-number with the block selector buttons  
- Enter the T-number via the keyboard 

When the cursor comes down to the bottom line of the list, the next touch of the Search down Button will call the next part of the T list

The Clear button  can clear this value

- Touch the Enter button 
- Touch the Search button 

- Enter number of the searched tool
- | | | |
|----|---|---|
| 7 | 8 | 9 |
| 4 | 5 | 6 |
| 1 | 2 | 3 |
| ↗+ | 0 | • |

- Touch equal button



- Enter the toolnumber of the spare tool
- | | | |
|----|---|---|
| 7 | 8 | 9 |
| 4 | 5 | 6 |
| 1 | 2 | 3 |
| ↗+ | 0 | • |

- Touch Enter



The display shows e.g.:

```
MANUAL   MAN.OPER.
PM 99100 N 99100
```

SPARE TOOL

```
■ T 7=
  T 8=
  T 9=
  T 10=
  T 11=
  T 12=
  T 13=
  T 14=
  T 15=
  T 16=
  T 17=
```

E.G. T1 WITH SPARE TOOL T11: T1=T11

```
■ T
  T
T7=T20
```

HELP ----- ATTRIB -----

Fig. 5.3.2-2

- Touch Store



When a tool has exceeded its life time it is displayed in inverse video:

```

MANUAL   MAN. OPER.
PM 5555 N 5555
MEG
SPARE TOOL

ALL MEMORY 86656 BYTES FREE
T 0=
T 1=
T 2=
T 3=
T 4=
T 5=
T 6=
T 7= T 20
T 8=
T 9=

E.G. T1 WITH SPARE TOOL T11: T1=T11
T
T
TO=

HELP ----- ATTRIB -----

```

Fig. 5.3.2-3

In this case tool T20 is fetched at the next time tool T7 is called in the program.

A tool to which no spare tool is assigned is also displayed in inverse video when the tool lifetime is exceeded etc.

```

MANUAL   MAN. OPER.
PM 5555 N 5555

SPARE TOOL

ALL MEMORY 86656 BYTES FREE
T 0=
T 1=
T 2=
T 3=
T 4=
T 5=
T 6=
T 7=
T 8=
T 9=

E.G. T1 WITH SPARE TOOL T11: T1=T11
T
T
TO=

HELP ----- ATTRIB -----

```

Fig. 5.3.2-4

After changing this tool the inverse display is reset as follows:




- Select the tool number

- Enter the tool number with the keyboard



- Touch Enter button



- Touch Enter button 
- Touch softkey  below >ATTRIB<.
- Touch softkey  below >UNLOCK<.

The inverse display disappears now.

```

MANUAL   MAN. OPER.
PM  9002  N   9002

SPARE TOOL


ALL MEMORY  116352 BYTES FREE
■ T  0=
  T  1=
  T  2=
  T  3=
  T  4=
  T  5=
  T  6=
  T  7=T  20
  T  8=
  T  9=

E.G. T1 WITH SPARE TOOL T11: T1=T11
■ T
  T
T0=

HELP  -----  LOCK  UNLOCK  RETURN

```

Fig. 5.3.2-5

If the wrong tool is reactivated this can be corrected in the same way as described above except  must be touched now.

Remark : Inverse display in the spare tool memory is not giving an error code or tool change. The error code e.g. for life time (l11) is caused by the tool life memory. This means that in this case the tool life memory must be changed too otherwise the error code will be displayed again after continuing the program.

6. DATA I/O

6.1 READ DATA

Data can be sent to the control by peripheral equipment (e.g. papertape reader or magnetic tape reader-etc).

To transmit data, the machine constants concerning data in/out, should be adjusted to the peripheral specifications.

The control allows programs and macros to be read in all modes.

The data for the other memories, such as tool data, point definition data can be ready in only in manual mode or during intervention in the other operation modes.

During data input another memory can be selected for displaying or editing.

Once the relevant memory is selected proceed as follows:

- Touch the DATA IN/OUT button

DATA
IN/OUT

- In the Softkey line appears >INPUT< above softkey F2.

- Touch softkey

F2

In the data input/output line the data code and the memory code appear.

The display shows e.g.:

```
MANUAL   MAN. OPER.
PM      9002                N

SPARE TOOL
DATA    TS SPARE    T      IN
ALL MEMORY 132864 BYTES FREE
■ T  ○=
T    ○=
T    ○=
T    ○=
T    ○=
T    ○=
T    ○=
T    ○=
T    ○=
T    ○=
T    ○=
T    ○=
T    ○=
T    ○=

E. G. T2 IS SPARE FOR T1: T1=T2
■ T
T○=

HELP  -----  HALT  CANCEL  RETURN
```

Fig. 6.1-1

- Start the external data input peripheral.

The data for the relevant memory are being read now.

After the input sequence has been completed, the display shows the first part of the list with the new data.

The data transmission can be interrupted by touching softkey **F3** (below >HALT<).

To restart transmission, touch softkey **F2** again.

Reading can be aborted by touching softkey **F4** (below >CANCEL<)..

Remarks: - If the data carrier does not contain all the line numbers of the relevant memory, only the values on tape are stored and the missing line numbers are not updated or cleared.

- When the data carrier contains previous to the relevant memory data, data for other memories, there are two possibilities:

A. After every memory data an EOT is on the tape.

In this case the control shows: >ERROR D43< (wrong memory code) when reading the EOT.

Touch softkey **F2** again and the next data will be read.

Repeat this until the control found the correct memory code.

B. Only one EOT at the end of the complete data carrier is present.

In this case the control reads the data carrier without storing any information until the correct memory code is encountered.

- Once reading is started, another operation mode can be selected, machining can be started etc. The data transmission continues until an EOT is encountered. The data input/output line shows the progress of the transmissions in every operation mode.

6.2 READ PART PROGRAM DATA OR MACRO DATA

Reading part program data is somewhat different from reading the data for the other memories, because multiple programs and macro's can be stored in these memories.

A data carrier can contain a number of programs and/or macro's.

For reading a complete data carrier, see part 6.2.1.

For reading one specific program of the data carrier, see part 6.2.2.

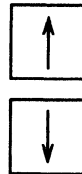
6.2.1 Read complete data carrier of part programs (or macro's)

- Touch the Prog. Mem button 

- Touch softkey  (below >ID-DIR<)

If the memory contains already one or more programs;

- Select >ALL MEMORY< with the Block selector buttons



The monitor displays e.g.:

```

MANUAL   MAN. OPER.
PM      9002           N

PARTPROGRAM N  25000



■ ALL MEMORY  132096 BYTES FREE
N      9001
N      9002
N      95600
N      25000
  
```

```

N
N
ALL MEMORY
HELP ----- FILE RETURN
  
```

Fig. 6.2.1-1

To read in macro's, first:

- Touch Menu button  and  button for macro memory

See chapter 6.1 to start data transmission.





After the input sequence has been completed, the new program identification numbers are added to the listing under >ALL MEMORY<.


Remarks:

- If the cursor is not placed before >ALL MEMORY<, the data input operation causes the CNC to search for the program or macro identification number shown in the bottom line, as a result of which error code D47 or D34 - D36 (program not identified) may appear.
- A program or macro with an identification number, already stored in the memory, is *not* read in. The input operation stops and error code D10 (program exists) is generated. The error can be cleared and the transmission can be restarted or aborted as described in 6.1. After restart, the control starts storing again at the *next* program or macro.

6.2.2 Read one program

(The data carrier contains several programs or macro's, one of which is to be read in).

- Touch the Prog. mem button 
- Touch Menu button  and  button or macro memory
- Touch the softkey  below >ID-DIR<.
- Enter via the keyboard the program

| | | |
|---|---|---|
| 7 | 8 | 9 |
| 4 | 5 | 6 |
| 1 | 2 | 3 |
|  | 0 | . |

 identification number, eg N9008

Touch the Enter button 

This program- or macronumber >N9008< appears in the block input line.



See chapter 6.1 to start data transmission.

After completing the input sequence the new program identification number is added to the listing under >ALL MEMORY<.

Remarks:

- The programs or macro's on the data carrier, which have not been selected are read in, however not stored in the memory. The same applies to programs or macro's following the selected one, which are only read in until EOT is reached.
- If an input operation is interrupted by error code D47 (program not identified), it may be caused by a previous program or macro being terminated by the character EOT.

In this case:

- Touch the Clear button 
- Touch the softkey  below >INPUT<.

6.3 STORE DATA

Data can be sent from the control to peripheral equipment (e.g. paper tape reader/puncher, magnetic tape recorder, etc.).

To transmit data, the machine constants concerning data in/out, should be adjusted to the peripheral specifications.

The control allows programs to be read out in all modes.

Data output is possible during machining.

During data output another memory can be selected for displaying or editing.

A data carrier can contain a number of memory data items.

Once the relevant memory is selected proceed as follows:

- Touch Data in/out button

| |
|----------------|
| DATA IN/OUT |
|----------------|

In the softkey line appears >OUTPUT< above softkey F3

- Start the external peripheral

- Touch softkey

| |
|----|
| F3 |
|----|

In the data input/output line the data code and the memory code appear.

The display shows e.g.:

```
MANUAL  MAN.OPER.
PM  9002                N

STORED ZERO OFFSETS
ASCII  Z0 ZERO OFS G  56 OUT
ALL MEMORY  132096 BYTES FREE
█ G51 X0 Y0 Z0 A0 B0
  G52 X-88.889 Y1.972 Z-266.667 A0 B0
  G53 X0 Y0 Z0 A0 B0
  G54 X0 Y0 Z0 A0 B0
  G55 X0 Y0 Z0 A0 B0
  G56 X0 Y0 Z0 A0 B0
  G57 X0 Y0 Z0 A0 B0
  G58 X0 Y0 Z0 A0 B0
  G59 X0 Y0 Z0 A0 B0

ZERO POINT SHIFT NUMBER
█ G
█ G51 X0 Y0 Z0 A0 B0

HELP  -----  HALT  CANCEL  RETURN
```

Fig. 6.3-1

The data of the relevant memory are stored now.

The output of data is finished when the data input/output is cleared and the softkey line displays:

HELP **INPUT** **OUTPUT** ----- **RETURN**

Fig. 6.3-2

Remarks:

- After input of each memory data the control stores EOT on the tape.
- Once reading out is started, another operation mode can be selected, machining can be started etc. The data transmission continues until the complete data from the relevant memory is stored. The data input/output line shows the progress of the transmission in every operation mode.





6.4 STORE PART PROGRAM DATA OR MACRO DATA

Storing part program data or macro data is somewhat different from storing the data for the other memories, because multiple programs and macro's can be present in these memories.

A data carrier can contain a number of programs and/or macro's.

For storing the complete part program macro or macro memory, see part 6.4.1.
For storing one part program or one macro see part 6.4.2.

6.4.1 Store complete part program memory or macro memory

- Touch the Prog. Mem. button 
- Touch the softkey  below >ID-DIR<.
- Select >ALL MEMORY< with the Block selector buttons 


The monitor displays:

```
MANUAL MAN. OPER.  
PM 9002 N  
  
PARTPROGRAM N 9002  
  
■ ALL MEMORY 132096 BYTES FREE  
N 9001  
N 9002  
N 95600  
N 25000
```



```
■  
N  
ALL MEMORY  
HELP ----- FILE RETURN
```

Fig. 6.4.1-1

See chapter 6.3 to start data transmission.

6.4.2 Store one program or macro

The partprogram memory or the macro contains several programs, one of these is to be stored).

- Touch the Prog. Mem. button 
- Touch the softkey  below >ID-DIR<.

The display shows:

```





MANUAL   MAN.OPER.
PM  9002          N
PARTPROGRAM N  9002
ALL MEMORY 132096 BYTES FREE
■ N  9001
  N  9002
  N  95600
  N  25000
    
```

```

N
N
N9001
HELP ----- FILE RETURN
    
```

Fig. 6.4.2-1

If the memory contains more programs, the program can be searched in two ways:

- Select the program or macro number with the Block selector buttons  
- Enter the program or macro number via the keyboard 
- Touch the Enter button 

See chapter 6.3 to start the data transmission.

6.5 INTERRUPTING DATA I/O TRANSMISSION

The data transmission can be interrupted by touching softkey F3 below >HALT<.

To restart the transmission, touch the softkey F2 below >START<.



Data transmission is aborted by touching softkey F4 below >CANCEL<.

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7. MANUAL PROGRAM/BLOCK SEARCH

Execution of a program can be started at any block of that program via Manual program/block search. The Manual program/block search can be selected via the Manual menu (part 2.3).

7.1 PROGRAM SEARCH

- Touch the Manual button 
- Touch the Menu button 
- Touch **1** >BLOCK SEARCH<
- Touch softkey **F5** (below >ID-DIR<).



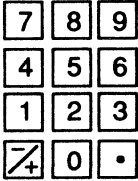



The monitor displays the program identification number

```
MANUAL  N-SEARCH
PM  9002      N
JOG CONTINUE
■N  9001
N  9002
N  95600
N  25000
```

```
■N
N
N9001
HELP ----- BTR-ON ----- ID-DIR
```

Fig. 7.1-1

The desired program number can be selected in two ways:

- Select the program number with the Block Selector buttons 

- Enter the program number via the keyboard 
- Touch the Search  button
- Touch the Enter button 
- Touch the Search button 

As long as the program is being searched for the top line of the monitor signals >BUSY<.

After the search has been completed, the display shows e.g.:

```

MANUAL  N-SEARCH
PM  9002      N

JOG CONTINUE

■N9002
N1 G99 X95 Y95 Z0 I200 J200 K-10
N2 G98 X80 Y80 Z20 I300 J300 K-50
N3 G0 X100 Y100 Z200
N4 T2 M67
N5 G0 Z10 S1000 M3
N6 G1 Z-2 F625
N7 G64
N8 B1=12
N9 X1=200 Y1=200 B1=92
N10 X1=200 Y1=200 B1=220

■
■N
N9002

HELP ----- BTR-ON ----- ID-DIR



```

Fig. 7.1-2

If SINGLE or AUTO is selected now, the program can be executed, starting from the first block.

It is also possible to search for another block in the program, according to the instructions on the next page, and execute the program from there on.

7.2 BLOCKSEARCH IN PROGRAM

- Touch the Manual button 
- Touch the Menu button 
- Touch 1 >BLOCK SEARCH<

The monitor displays a list of block numbers and their contents, starting with the active block, e.g.:

```

MANUAL  N-SEARCH
PM  9002      N

JOG CONTINUE

■N9002
N1 G99 X95 Y95 Z0 I200 J200 K-10
N2 G98 X80 Y80 Z20 I300 J300 K-50
N3 G0 X100 Y100 Z200
N4 T2 M67
N5 G0 Z10 S1000 M3
N6 G1 Z-2 F625
N7 G64
N8 B1=12
N9 X1=200 Y1=200 B1=92
N10 X1=200 Y1=200 B1=220



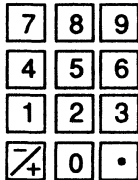



N
N
N9002

HELP ----- BTR-ON ----- ID-DIR
  
```

Fig. 7.2.1

If the wrong program is displayed, first search the right program (see part 7.1), otherwise proceed:

The relevant block can be selected in two ways:

- Select the block number with the Block Selector button  
- Enter the block number via the keyboard 
- Touch the Search button 
- Touch the Enter button 
- Touch the Search button 

As long as the block is being searched for the top line of the monitor signals >BUSY<.

After the search has been completed, the relevant block appears on the monitor as the second block in the list, preceded by the cursor:

```
MANUAL  N-SEARCH  
PM 9002      N 10  
  
JOG CONTINUE  
  
N9 X1=200 Y1=200 B1=92  
■ N10 X1=200 Y1=200 B1=220  
N11 X100 Y100 B1=82  
N12 G64  
N13 GO Z200 M30
```

```
  N  
  N  
N10  
  
HELP ----- BTR-ON ----- ID-DIR
```

Fig. 7.2-2

If SINGLE  or AUTO  is selected now, the program

can be executed, starting from the block searched for.

8. AUTO

This mode allows automatic program execution.

8.1 PROGRAM EXECUTION

The program execution line of the monitor displays the actual program- and blocknumber.

To execute a program:

-Search, if necessary, the right program- and blocknumber with Manual block search (part 7).

- Touch the Auto button 

- Touch the Start button 

At the top line >RUN< appears, to indicate that the program is running:

```

AUTO          RUN
PM 99100 MM 99001 N 4

COMMAND      ACTUAL      DIST TO GO
X            X- 34.657 X   0
Y            Y 120.000 Y   0
Z 10.000    Z  0.000 Z 10.000
A            A  0.000 A   0
B            B  0.000 B   0

F 5000.000  F  0.000 F-OVR  0 %
S  0        S  0      S-OVR 100 %
T  0        T  1      LIFE   0
G 0 17 25 27 40 51 54 63 70 72 90 94
M  5  9  10 22 44

N3 T1 M67
N4 G0 X-70 Y0 Z10 (THE FRAME)
N5 G1 Z0 F500
N6 Y120

HELP ----- DISPLAY
  
```

Fig. 8.1.-1

Touching the Feedhold button  or the Feed/Speedhold button  causes the execution of a program to be interrupted (see part 11).

8.2 BLOCK DELETE

If the delete function is activated, all blocks starting with / are skipped. See >/N2< below.

```

AUTO
PM 99100          N          /DELETE

COMMAND          ACTUAL          DIST TO GO
X-              34.657 X        0
Y              120.000 Y        0
Z              0.000 Z         0
A              0.000 A         0
B              0.000 B         0

F 0.000 F 0.000 F-OVR 100 %
S 0 S 0 S-OVR 100 %
T 0 T 0 LIFE 0
G 0 17 25 27 40 51 53 63 70 72 90 94
M 5 9 10 22 44

■N99100
N1 G54
/N2 G22 N=99001
N3 G18

HELP ----- DISPLAY
  
```

.Fig. 8.2-1

To activate this function, touch the Delete button



On the monitor /DELETE will be displayed.

Touch the Delete button



again to deactivate the function.

8.3 ERROR MESSAGES DURING EXECUTION

In case of a warning, the corresponding error code appears on the display. The control continues execution.

In case of a programming error, a P-error code appears on the display. The control stops at the beginning of the block (see part 18.1).

In case of major error, the control stops via interrupt.
The corresponding error code appears on the screen (see part 18.2).

8.4 DISPLAYING THE RUNNING PROGRAM

During operation in SINGLE or AUTO, the display shows e.g.:

```

AUTO
PM 99100          N

COMMAND          ACTUAL          DIST TO GO
X-              34.657 X          0
Y              120.000 Y          0
Z              0.000 Z           0
A              0.000 A           0
B              0.000 B           0

F 0.000 F 0.000 F-OVR 100 %
S 0 S 0 S-OVR 100 %
T 0 T 0 LIFE 0
G 0 17 25 27 40 51 53 63 70 72 90 94
M 5 9 10 22 44

■ N99100
  N1 G54
  /N2 G22 N=99001
  N3 G18

HELP ----- DISPLAY
  
```

Fig. 8.4-1

Due to the extensive axis, feed, speed, tool, active G and M functions information, only a small part of the running program is displayed.

To display a larger part of the program, touch softkey F5 (below >DISPLAY<).

The softkey line shows now:

```

AX-MON PM-MON ----- PLC-MON RETURN
  
```

Fig. 8.4-2

- Touch softkey **F2** below >PM-MON<

The display shows e.g.:

```
AUTO
PM 99100          N

■N99100
N1 G54
/N2 G22 N=99001
N3 G18
N4 G98 X-700 Y-500 Z-500 I10 J10 K15
N5 G17
N6 G22 N=99008
N7 G18
N8 G98 X-700 Y-500 Z-500 I10 J10 K15
N9 G17
N10 G22 N=99001
N11 G18
N12 G98 X-700 Y-500 Z-500 I10 J10 K15
N13 G17
N14 G22 N=99009 (PARPAS)
N15 G18
N16 G98 X-700 Y-500 Z-500 I10 J10 K15

PROGRAM ----- RETURN
```

Fig. 8.4-3

To return to actual display, touch softkey **F5** (below >RETURN<.), **F5** >DISPLAY<, **F1** >AX_MON<.

8.5 PROGRAM TEST

Eight test modes are provided for program verification. These allow part programs to be debugged and tested in the RAM memory of the CNC. These test modes and the program verification procedures are described in detail in Chapter 17.

9. SINGLE

This mode allows execution of a program block.

9.1 PROGRAM BLOCK EXECUTION

The programming execution line of the monitor displays the actual program- and blocknumber.

To execute a block:

- Search, if necessary, the right block (and programnumber) with Manual block search (part 7).

- Touch the Single button 

```

SINGLE
PM 99100          N 2


COMMAND          ACTUAL          DIST TO GO
X-              34.657 X          0
Y              120.000 Y          0
Z              0.000 Z           0
A              0.000 A           0
B              0.000 B           0

F 0.000 F 0.000 F-OVR 0 %
S 0 S 0 S-OVR 100 %
T 0 T 0 LIFE 0
G 0 17 25 27 40 51 54 63 70 72 90 94
M 5 9 10 22 44



N99100
N1 G54
■N2 G22 N=99001
N3 G18

HELP ----- DISPLAY
  
```

Fig. 9.1-1

- Touch the Start button 

At the top line >RUN< appears, to indicate that the block is in execution. After execution, >RUN< disappears and the next block is shown.

Touching the Feedhold button  or the Feed/Speedhold button 

causes the execution of the block to be interrupted (see part 11).

9.2 BLOCK DELETE

See part 8.2.

9.3 ERROR MESSAGES

See part 8.3.

9.4 DISPLAYING THE RUNNING PROGRAM

See part 8.4.

9.5 BLOCK TEST

See part 8.5.

Instead of the Auto button , use the Single button 

10 TEACH IN

Operation mode Teach-in enables two main operations to be executed:

- MDI, input and execution of certain functions.
- PLAYBACK, input and execution of a program block by block, checking and, if needed, correction.

10.1 TEACH IN MDI

Input and execution of certain functions.

For input and execution of certain functions without storing them in a program, proceed as follows:

- Touch the Teach-In button



The monitor displays:

```

TEACH-IN MDI
PM 99999          N

COMMAND          ACTUAL          DIST TO GO
X                X      35.000 X      0
Y                Y     162.749 Y      0
Z                Z      5.000 Z      0
A                A      0.000 A      0
B                B      0.000 B      0

F      0.000 F      0.000 F-OVR 100 %
S      0      S      0      S-OVR 100 %
T      0      T      0      LIFE 0
G 0 17 25 27 40 51 53 63 66 72 90 94
M 5 9 41

NGXYZABDIJKLPRFSTHME
N

HELP  MENU-G  -----  DISPLAY
    
```

Fig. 10.1-1

If a program is under execution >TEACH< appears in the second line. At the end of the block, the picture shown above appears

- Select the addresses with the Address Selector buttons



- Enter the addresses values via the keyboard



- Touch the Enter button



each time an address value is entered.

The addresses entered appear in the block input:

```

TEACH-IN MDI
PM 99999          N

COMMAND          ACTUAL          DIST TO GO
X                X    35.000 X    0
Y                Y   162.749 Y    0
Z                Z    5.000 Z    0
A                A    0.000 A    0
B                B    0.000 B    0

F    0.000 F    0.000 F-OVR 100 %
S    0      S    0      S-OVR 100 %
T    0      T    0      LIFE   0
G 0 17 25 27 40 51 53 63 66 72    90 94
M    5  9   41

NGXYZABDIJKLPRFSTHME
S 100
G1 Y20 Z10 F1000

HELP  MENU-G  -----  DISPLAY

```

Fig. 10.1-2

- To execute the entered functions, touch the Start button



During execution >RUN< appears on the monitor.

After execution >RUN< as well as the entered address(es) disappear

10.2 TEACH IN/PLAY BACK

Play back enables a program to be input, executed, checked, if necessary corrected and stored block by block.

The command value may be entered via the keyboard or the command position can be jogged at. In fact, the value under >ACTUAL< is the new command value when touching the Store button.

To support the building of a program in Teach in play back, the control enables guidance to the operator by means of the address-string and graphics. If the G-address is entered, automatically the address-string only shows the for this G-function applicable addresses and in most cases it shows one or more pictures in which the addresses are visually explained. See section 10.2.3.

To call the Teach in play back mode:

- Touch the Teach in button



The monitor displays the picture:

```

TEACH-IN MDI
PM 99999          N

COMMAND          ACTUAL          DIST TO GO
X                X      35.000 X      0
Y                Y    162.749 Y      0
Z                Z      5.000 Z      0
A                A      0.000 A      0
B                B      0.000 B      0

F      0.000 F      0.000 F-OVR 100 %
S      0      S      0      S-OVR 100 %
T      0      T      0      LIFE   0
G 0 17 25 27 40 51 53 63 66 72   90 94
M      5  9  41

NGXYZABDIJKLPRFSTHME
N

```

HELP MENU-G ----- DISPLAY

Fig. 10.2-1

If a program is under execution >TEACH< appears in the second line. At the end of the block, the picture shown above:

- Touch the Menu button 

The monitor now displays:

```


TEACH-IN MDI
PM 99999          N

TEACH-IN MENU:
1 TEACH-IN PLAYBACK

```

HELP -----

Fig. 10.2-2

- Touch the button 

The monitor displays:

```

TEACH-IN PLAYBACK
PM 99999          N
JOG CONTINUE

COMMAND          ACTUAL          BEGIN
X                X          35.000 X          35.000
Y                Y          162.749 Y          162.749
Z                Z           5.000 Z           5.000
A                A           0.000 A           0.000
B                B           0.000 B           0.000

F          0.000 F          0.000 F-OVR 100 %
S          0          S          0          S-OVR 100 %
T          0          T          0          LIFE  0
G 0 17 25 27 40 51 53 63 66 72          90 94
M  5  9          41

NGXYZABDIJKLPRFSTHME
N

HELP  MENU-G  -----  DISPLAY

```

Fig. 10.2-3

To show the active program:

- Touch softkey **F5** (below >DISPLAY<)

- Touch softkey **F2** (below >PM MON<)

Play back enables this program to be extended or a new program to be input.

10.2.1 Extending the active program

Bring the control in the Teach in play back mode as described in part 10.2.

- Select program display by touching softkey **F4** (below >PROGRAM<)

Search the block *following* on the point where the new blocks have to be inserted.

To search:

- Enter the desired block number via the keyboard

| | | |
|----|---|---|
| 7 | 8 | 9 |
| 4 | 5 | 6 |
| 1 | 2 | 3 |
| +/ | 0 | . |

- Touch the Enter button

| |
|-------|
| ENTER |
| ↵ |

- Touch the Search button



The block searched for appears in the second line of the program list:

```
TEACH-IN PLAYBACK
PM 99999 N 15

JOG CONTINUE

N14 G2 I0 J0
N15 G64 (THE WAVES)
N16 G2 R29.83 I-36.345 J-18.173
N17 G3 R29.83 I-12.115 J36.345
N18 G2 R29.83 I12.115 J-18.173
N19 G3 R29.83 I36.345 J36.345 J1=1
N20 G2 R60 I0 J0 J1=2
N21 G2 R29.83 I36.345 J27.259
N22 G3 R29.83 I12.115 J-27.259
N23 G2 R29.83 I-12.115 J27.259
N24 G3 R29.83 I-36.345 J-27.259 J1=1
```

```
QWXYZABCDEFGHIJKLMNPRSTHME
N
N15
PROGRAM ----- RETURN
```

Fig. 10.2.1-1

Next, the block number has to be entered and the Enter button touched. The new block number appears in the block input line.

The addresses may be entered now in the usual way.

- When all addresses required have been entered, touch the Start button



The functions entered are executed now, i.e. the M-functions are output, the axes start moving, etc.

In the top line >RUN< appears.

After >RUN< has disappeared, the block entered may still be changed, extended and executed again for a recheck.

If found correct, the block is stored via the Store button

The block is inserted into the program now.

In the block input line the next block number appears.

A next block may be entered now or the operation may be terminated by selecting another operation mode.

It is recommended to give CLEAR CONTROL after having terminated the operation causing the active block to be automatically left.

10.2.2 Entering a new program

Enter the new program number via the directory in prog.mem. and activate the empty program via manual block search

The programming execution line now indicates the new program number. Select with the softkeys the axis display.

```

TEACH-IN PLAYBACK
PM 9200

JOG CONTINUE

COMMAND          ACTUAL          BEGIN
X                X 35.000 X 35.000
Y                Y 162.749 Y 162.749
Z                Z 5.000 Z 5.000
A                A 0.000 A 0.000
B                B 0.000 B 0.000

F 0.000 F 0.000 F-OVR 100 %
S 0 S 0 S-OVR 100 %
T 0 T 0 LIFE 0
G 0 17 25 27 40 51 53 63 66 72 90 94
M 5 9 41


NXYZABDIJKLPRFSTHME
G
NI

[HELP] [MENU-G] ----- [DISPLAY]

```

Fig. 10.2.2-1

The addresses may be entered now in the usual way.

- Touch the Start button  as soon as all addresses needed have been entered.

The functions entered are executed now, i.e. the M-functions are output, the axes start moving, etc.

>RUN< appears at the top line.

After >RUN< has disappeared, the block entered may still be changed, extended and executed again for a recheck.

If found correct, the block is stored via the Store button

The block is inserted into the program. The next block number appears in the block input line.

A next block may be entered now or the operation terminated by selecting another operation mode.

It is recommended to give CLEAR CONTROL after having terminated the operation causing the active block to be automatically left.

10.2.3 Active guided programming

Guided programming is activated by touching softkey below >MENU-G<).

F2

The display shows:

```

TEACH-IN MDI

COMMAND          ACTUAL          DIST TO GO
X                X          35.000 X          0
Y                Y          162.749 Y          0
Z                Z           5.000 Z          0
A                A           0.000 A          0
B                B           0.000 B          0

F          0.000 F          0.000 F-OVR 100 %
S          0      S          0      S-OVR 100 %
T          0      T          0      LIFE 0
G 0 17 25 27 40 51 53 63 66 72      90 94
M          5 9      41
MODAL G C 17 63 40 180
BLOCK NUMBER
NGXYZABIRSTHMB1B2L1L2P1E
N

HELP FREE-G ----- DISPLAY

```

Fig. 10.2.3-1

To explain the meaning of an address visually,

touch the softkey **F1** under >HELP<.

The softkey line shows:

----- **PICTURE** ----- **RETURN**

Fig. 10.2.3-2

To show the picture, touch softkey **F2** (below >PICTURE<).

The display shows e.g.:

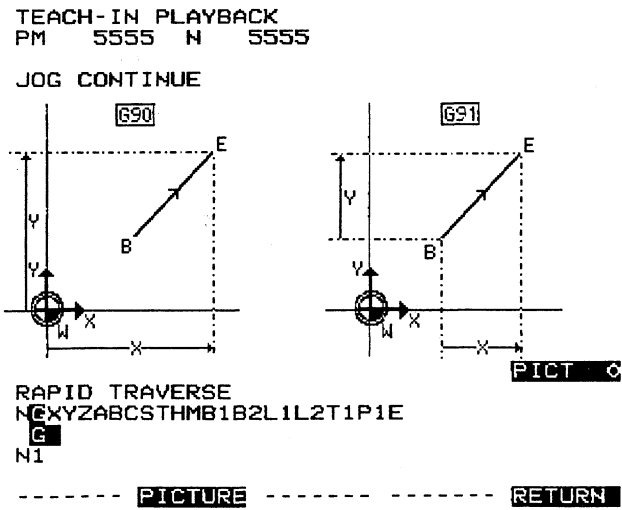


Fig. 10.2.3-3

If the picture shows >PICT O<, the softkey F2 may be touched to show the next picture.

11. PROGRAM INTERRUPTION

11.1 STOP AT END OF A BLOCK

Selecting another operation mode causes the program to be stopped at the end of the block.

The monitor indicates (e.g. >MANUAL< until the block has been finished:

```

AUTO          RUN
PM 99999          N 5
                MANUAL
JOG CONTINUE

COMMAND      ACTUAL      DIST TO GO
X            X- 70.000 X 0
Y            Y  0.000 Y 0
Z  0.000 Z  0.988 Z- 0.988
A            A  0.000 A 0
B            B  0.000 B 0

F  500.000 F  0.000 F-OVR 0 %
S  0        S  0      S-OVR 100 %
T  0        T  1      LIFE 0
G 1 17 25 27 40 51 54 63 66 72 90 94
M  5  9  41



N3 T1 M67
N4 G0 X-70 Y0 Z10 (THE FRAME)
N5 G1 Z0 F500
N6 Y120

HELP ----- DISPLAY
    
```

Fig. 11.1-1

When the block has been finished, the selected operation mode becomes active. The control stand now at the begin of the next block.

The program can be started again:

- Touch the Auto button 
- Touch the Start button 

11.2 PROGRAMMING ERROR

If we have a programming error (e.g. P 04), the control stops at the beginning of the erroneous block:

```

AUTO          RUN
PM 99999          N 5
                ERR P 04

COMMAND      ACTUAL      DIST TO GO
X            X- 70.000 X 0
Y            Y  0.000 Y 0
Z            Z 10.000 Z 0
A            A  0.000 A 0
B            B  0.000 B 0

F  0.000 F  0.000 F-OVR 100 %
S  0        S  0      S-OVR 100 %
T  0        T  1      LIFE 0
G 0 17 25 27 40 51 54 63 66 72 90 94
M  5  9  41


N3 T1 M67
N4 G0 X-70 Y0 Z10 (THE FRAME)
N5 G1 Z0
N6 Y120

ACTUAL AXES ----- RETURN
    
```

Fig. 11.2-1

The program can be restarted after the error has been cleared:


- Touch the Manual button 

- Touch the Clear button 

The error code has now disappeared.

Now the error must be restored, either by changing the program block (part 4.2) or changing the machine status in Manual- or Teach in mode.

After doing this, proceed with:

- Touch the Auto button 

- Touch the Start button 

The error codes and their meanings are listed in section 18.

11.3 INTERRUPT

- Touching the Feedhold button  or the Feed/Speedhold button 

- In case of a major error detected by the control.

In both cases, the execution of the program is stopped.

On the monitor >INTERVENTION< appears in the second line:

```

AUTO
PM 99999          N 6
INTERVENTION

COMMAND          ACTUAL          DIST TO GO
X-              X- 70.000 X-      0
Y              Y 6.742 Y      0
Z              Z 0.000 Z      0
A              A 0.000 A      0
B              B 0.000 B      0

F 500.000 F 0.000 F-OVR 100 %
S 0 S 0 S-OVR 100 %
T 0 T 1 LIFE 0
G 1 17 25 27 40 51 54 63 66 72 90 94
M 5 9 41

N5 G1 Z0 F500
N6 Y120
N7 X70
N8 Y0

HELP ----- DISPLAY
    
```

Fig. 11.3-1

During the interruption of a program it is possible:

- to move in the jogging mode; see section 11.3.1
- to change tool data; see section 11.3.2
- to restart; see section 11.3.3
- to restart with repositioning; see section 11.3.4
- to abort the program under execution; see section 11.3.5
- to clear a cycle; see section 11.4.1

11.3.1 Jogging during interrupt

If it is required to move the axes during the interruption of a program (e.g. in case of a tool breakage), proceed as follows:

- Touch the Manual button



- Jog the axes by touching the Jog buttons as described in section 2.1.

```

AUTO      MAN. OPER.
PM 99999          N 6
INTERVENTION     MANUAL
JOG CONTINUE

COMMAND      ACTUAL      DIST TO GO
X JOG +      X-      11.501 X
Y            Y      6.742 Y
Z            Z      0.000 Z
A            A      0.000 A
B            B      0.000 B

F 3000.000 F      0.000 F-OVR 0 %
S 0          S      0      S-OVR 100 %
T 0          T      1      LIFE 0
G 1 17 25 27 40 51 54 63 66 72 90 94
M 5 9 41
    
```

HELP ----- DISPLAY

Fig. 11.3.1-1

- Restart; see section 11.3.3 and 11.3.4.

11.3.2 Tooldata correction during interrupt

If a program run has been interrupted, e.g. as a result of tool breakage, the tool compensations have to be corrected, so as to meet the new tool dimensions before restarting the program.

- Touch the Manual button



- Touch the Tool mem button



The monitor displays e.g.:

```

AUTO      MAN. OPER.
MM 99001  N      5
INTERVENTION  MANUAL
TOOL OFFSETS

ALL MEMORY 87296 BYTES FREE
T0 LO RO R1=0 GO
T1 LO RO R1=0 GO
T2 LO RO R1=0 GO
T3 LO RO R1=0 GO
T4 LO RO R1=0 GO
T5 LO RO R1=0 GO
T6 LO RO R1=0 GO
T7 LO RO R1=0 GO
T8 LO RO R1=0 GO
T9 LO RO R1=0 GO

TOOL CORRECTION NUMBER
T
T0 LO RO R1=0 GO
HELP -----

```

Fig. 11.3.2-1

- Change the tool data by searching the relevant tool number and entering the new data. See also section 5.1.
- Restart; see section 11.3.3 and 11.3.4.

11.3.3 Restart

If a program run has been interrupted and the axes are jogged or the tool compensation changed, the program can be restarted by touching the

Single  or Auto  button and then the Start button 

The axes now return to the interruption point, taking into account - if applicable - the new tool compensation.

The axes move in the following sequence:

- first the auxiliary axis, next the positioning axes and finally the tool axis.

>INTERVENTION< is indicated in the second line until the interruption point has been reached.

On reaching this position, the block is executed from this position on.

Remark: When the tool compensations have been changed during the interruption of a program, make sure that the restarting points are approached with due regard to the new compensation values.

11.3.4 Restart with repositioning

If a program run has been interrupted and the axes are jogged or the tool compensation changed, the program can be restarted from the begin point of the interrupted block.

- Touch the Menu button 

The display shows:

```

AUTO
PM 99999          N 6
INTERVENTION

INTERVENTION MENU:
1 CLEAR CYCLE
2 REPOS
  
```

HELP -----

Fig. 11.3.4-1

- Touch 1 >REPOS<
- Touch Auto AUTO
▶ or Single SINGLE
▶ button
- Touch the Start button ▶
▶
▶

The display shows:

```

AUTO          REPOS
PM 99999          N 6

COMMAND      ACTUAL      DIST TO GO
X- 70.000 X- 25.001 X- 44.999
Y  0.000 Y  1.248 Y- 1.248
Z          Z  0.000 Z  0
A          A  0.000 A  0
B          B  0.000 B  0

F 500.000 F  0.000 F-OVR  0 %
S  0      S  0      S-OVR 100 %
T  0      T  1      LIFE  0
G 1 17 25 27 40 51 54 63 66 72 90 94
M  5  9  41

N5 G1 Z0 F500
N6 Y120
N7 X70
N8 Y0

HELP ----- DISPLAY
  
```

Fig. 11.3.4-2

The axes now return to the begin point of the interrupted block, taking into account - if applicable - the new tool compensation (see Remark in section 11.3.).

The axes move in the following sequence:

- first the auxiliary axis, next to the positioning axes and finally the tool axis.

- >REPOS< jumps from the third line to the top line and disappears as soon as the begin point of the interrupted block is reached.

On reaching this point, the control starts to execute the interrupted block from this point on.

11.3.5 Abortion of a program during interrupt

If a program run has been interrupted, e.g. due to damage of the workpiece resulting from tool breakage, and the program must be aborted, proceed as follows:

- Touch the Manual button 

The monitor displays e.g.:

```

AUTO      MAN. OPER.
PM 99999          N 6
INTERVENTION      MANUAL
JOG CONTINUE

COMMAND      ACTUAL      DIST TO GO
X-           70.000 X      0
Y            17.606 Y      0
Z            0.000 Z      0
A            0.000 A      0
B            0.000 B      0

F 500.000 F 0.000 F-OVR 100 %
S 0 S 0 S-OVR 100 %
T 0 T 1 LIFE 0
G 1 17 25 27 40 51 54 63 66 72 90 94
M 5 9 41

HELP ----- DISPLAY

```

Fig. 11.3.5-1

- Touch the Clear Control button 

The control is fully cleared and in Manual mode:

```

MANUAL      MAN. OPER.
PM 99999          N
JOG CONTINUE

COMMAND      ACTUAL      DIST TO GO
X-           70.000 X      0
Y            17.606 Y      0
Z            0.000 Z      0
A            0.000 A      0
B            0.000 B      0

F 0.000 F 0.000 F-OVR 100 %
S 0 S 0 S-OVR 100 %
T 0 T 0 LIFE 0
G 0 17 25 27 40 51 53 63 66 72 90 94
M 5 9 41

HELP ----- DISPLAY

```

Fig. 11.3.5-2

11.4 INTERRUPT MENU

The interrupt menu contains functions to give support during interrupt.

If there is an interrupt, this menu can be found by touching the Menu button



The display shows:

```

AUTO
PM 85200
INTERVENTION CYCLE) N 8

INTERVENTION MENU:
1 CLEAR CYCLE
2 REPOS
    
```

HELP

Fig. 11.4-1

- Select the function by entering the corresponding number.

11.4.1 Clear cycle during interrupt in cycle

If a program run has been interrupted in a fixed cycle, the monitor displays:

```

AUTO
PM 85200
INTERVENTION CYCLE) N 8

COMMAND      ACTUAL      DIST TO GO
X             X-      80.000 X         0
Y             Y         0.000 Y         0
Z             Z-      10.000 Z         0
A             A         0.000 A         0
B             B         0.000 B         0

F 1000.000 F         0.000 F-OVR 100 %
S 100      S 100      S-OVR 100 %
T 0        T 0        LIFE      0
G 0 17 25 27 40 51 53 63 66 72 81 90 94
M  9      41

N7 G79 X-90 Z0
N8 G79 X-80
N9 G79 X-70
    
```

HELP

DISPLAY

Fig. 11.4.1-1

To stop the execution of the cycle and skip to the next block:

- Touch the Menu button



- Touch 1 >CLEAR CYCLE<

>INTERVENTION CYCLE< changes into >CLEAR CYCLE<:

```

AUTO
PM 85200          N 8
CLEAR CYCLE

COMMAND          ACTUAL          DIST TO GO
X-               X- 80.000 X-      0
Y-               Y-  0.000 Y-      0
Z-               Z- 10.000 Z-      0
A-               A-  0.000 A-      0
B-               B-  0.000 B-      0

F 1000.000 F      0.000 F-OVR 100 %
S 100      S      100   S-OVR 100 %
T 0        T        0    LIFE   0
G 0 17 25 27 40 51 53 63 66 72 81 90 94
M 9 9      41

N7 G79 X-90 Z0
N8 G79 X-80
N9 G79 X-70

```

HELP ----- DISPLAY

Fig. 11.4.1-2

The cycle is cleared.

After touching the Start button ↻, the program continues to go to the starting position of the block, following on the fixed cycle block and can be restarted by pressing Start button again. ↻

When the interrupt was not during a cycle, >NO CYCLE< is indicated after touching the Enter button.

11.4.2 Repos

This is described in section 11.3.4.


12. CLEAR CONTROL

Clear control of the CNC may be required when some operation has to be aborted, e.g. as a result of a program run being interrupted, the active block cannot be executed any further and the program has to be executed from the beginning.

CLEAR CONTROL causes the control to jump to a standard condition:

- the control will return to the beginning of the actual program
- the monitor will display tool T0. This means that the control assumes there is no tool in the spindle and no compensation values have to be taken into account. The tool compensation values will be taken into account *after* the first toolchange.
- the status of G- and M-codes will return to the same situation as after switching on. Only the spindle range and the stored zero offset will remain unaltered.
- the measuring unit (inch or metric) remains unaltered.

To execute Clear control:

- Touch the Manual button  (if not in Manual mode)

- Touch the Clear Control button 

The top line briefly displays >BUSY<.

The control assumes the Manual mode now.

```

MANUAL   MAN. OPER.
PM 99999          N
JOG CONTINUE

COMMAND   ACTUAL   DIST TO GO
X-        X-      70.000 X      0
Y         Y-      84.037 Y      0
Z         Z       0.000 Z      0
A         A       0.000 A      0
B         B       0.000 B      0

F         0.000 F       0.000 F-OVR 100 %
S         0      S       0      S-OVR 100 %
T         0      T       0      LIFE  0
G 0 17 25 27 40 51 53 63 66 72   90 94
M   5  9  41
  
```

Fig. 12-1

HELP ----- **DISPLAY**

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13. DIAGNOSTICS

If the CNC is suspected of having faults its component modules can be checked by diagnostic tests. These tests are contained either in the Diagnostic menu or in the sub-menus that can be reached from it.

13.1 DIAGNOSTIC DURING SWITCHING ON

After powering on the control it checks the PC-boards for correct functioning.

If one or more of the PC-boards are defective, the control gives the relevant PC-board the indication >FAILED<.

```

                POWER-UP CHECK  V696
                HARDWARE CHECK
CPU 80286      10MC      PASSED
PROM          PASSED
LANGUAGE GER ENG 6601.696 PASSED
RAM          256K      PASSED
MEM.MOD.2     1024K    PASSED
DRIVE 1 2     LMS      PASSED
DRIVE 3       LMS      FAILED
DRIVE 4 5 6   RMS      PASSED
IN/OUT 1      PASSED
CONTROL/TELET PASSED
GRAPHICS      BPL      V697  PASSED
    
```

----- **MANUAL** -----

Fig. 13.1-1

By touching the softkey **F3**, below >MANUAL<, the control proceeds to the manual RPF mode. In most cases an error code will be displayed and the control does not execute any function.

As in the example above the display shows:

```

MANUAL REF.POINT
PM 99999          N
                ERR Z 02,Z 02
JOG CONTINUE

COMMAND          ACTUAL          DIST TO GO
X                X      0.000 X RP
Y                Y      0.000 Y RP
Z                Z      0.000 Z RP
A                A      0.000 A RP
B                B      0.000 B RP

F      0.000 F      0.000 F-OVR 100 %
S      0      S      0      S-OVR 100 %
T      0      T      0      LIFE 0
G 0 17 25 27 40 51 53 63 66 72 90 94
M 5 9 41

XYZAB

HELP ----- DISPLAY
    
```

Fig. 13.1-2

The defective board must be repaired or replaced by a spare board. This must never be done while the control is under power. Exchanging PC-boards must be done by qualified service engineers.

While the "power on check"-display is still on the display, detailed information about the defective board can be obtained, by making the external diagnostic switch.

The display shows:

```

POWER-UP CHECK  V696

HARDWARE CHECK

CPU  80286      10MC      PASSED
PROM                               6601.696  PASSED
LANGUAGE GER ENG 6601.696  PASSED
RAM                               256K      PASSED
MEM. MOD. 2      1024K    PASSED
DRIVE  1 2      LMS      PASSED
DRIVE  3        LMS      FAILED
DRIVE  4 5 6    RMS      PASSED
IN/OUT 1                               PASSED
CONTROL/TELET                               PASSED
GRAPHICS          8PL      V697  PASSED
  
```

----- **MANUAL** **DIAG** -----

Fig. 13.1-3

- Touch softkey  below >DIAG<.

The diagnostic menu is shown. Proceed to section 13.5.

If the manual mode was already selected, proceed to chapter 13.2 point (3).

13.2 DIAGNOSTIC MENU

The diagnostic menu is obtained as follows:

- (1) Make the external Diagnostic Switch (note that this prevents any movement of the machine tool slides or spindle while the diagnostic tests are run).

- (2) Press the Manual button



The CNC is then in Manual mode

- (3) Press the Menu button



The VDU screen will then show the Manual menu:

```
MANUAL  MAN.OPER.
PM 99999          N

JOG CONTINUE

MANUAL MENU:

1 BLOCK SEARCH
2 REFERENCE POINT SEARCH
3 RESET AXIS
6 REMOTE PANEL ON
7 DIAGNOSTIC
8 HANDWHEEL
```

Fig. 13.2-1

HELP -----

(4) Press button

7

The screen will then show the Diagnostic menu:

```
MANUAL  MAN.OPER.
PM 99999          N

JOG CONTINUE

DIAGNOSTIC MENU:

1 CONFIGURATION CHECK
2 POWER UP CHECK
4 DIAGNOSTIC MODE
```

Fig. 13.2-2

HELP -----

Note that >DIAGNOSTIC< is shown as line 4; this will only appear if the Diagnostic Switch has been made.

The Diagnostic menu is terminated by pressing the relevant key for any operation mode.

Note: If nothing at all appears on the screen during the above procedure then the diagnostic tests cannot be run. The CNC may have faulty Graphics Modules or a faulty Control Teletext Module. If these are checked using the tests detailed in Sections 14.3.7 and 14.1.2.3 and no faults are detected then a service engineer must be called to test the whole CNC.

13.3 CONFIGURATION CHECK

The Configuration Check compares the contents of the CNC's memory with the machine constant settings that were established during the commissioning of the machine tool.

The Configuration Check is selected as follows:

- (1) Select the Diagnostic Menu, as described in Section 13.2

- (2) Press button

1

The screen will then show the display:

```
MANUAL . MAN.OPER.  
PM 99100 N 99100  
  
JOG CONTINUE  
  
CONFIGURATION CHECK  
  
SOFTWARE VERSION 6601.691  
MEMORY IN USE      52K  
MEMORY FREE        85K  
RAM SIZE           1280K  
DRIVES             6  
IN/OUT             1  
GRAPHICS           8PL V691
```

HELP

Fig. 13.3-1

The display is explained line by line below:

>SOFTWARE VERSION<

The software version number indicates which software is used in the CNC. With the version number the facilities which are available can be checked.

>MEMORY IN USE<

The amount of memory currently occupied by part programs and macros is shown in kilobytes.

>MEMORY FREE<

The amount of memory currently available and unoccupied is shown in kilobytes.

>RAM SIZE<

The total amount of memory installed in the CNC is shown in kilobytes. The RAM size will depend upon the options that the CNC has installed.

Note that the RAM size will always be larger than the sum of the "Memory In Use" and the "Memory Free", as some memory is used by the CNC's operating system.

If the RAM size shown in the Configuration Check display is smaller than the value entered as MC2, the memory is defective. The screen will then show the display:

```
MANUAL  MAN.OPER.  
PM 99100 N 99100  
JOG CONTINUE  
ERR 0 23  
  
CONFIGURATION CHECK  
SOFTWARE VERSION 6601.691  
MEMORY IN USE 52K  
MEMORY FREE 85K  
RAM SIZE 256K MC 2=????  
DRIVES 6  
IN/OUT 1  
GRAPHICS 8PL V691
```

HELP -----

Fig. 13.3-2

In this case the Central Processor Module and Memory Module must be checked with the relevant tests in Sections 13.5.2 and 13.5.3 and in section 14.

>DRIVES<

The number of Drive Modules installed in the CNC is shown.

If this number is less than the number entered as MC1 there are faulty Drive Modules. The difference is the number of faulty Drive Modules. In this case the screen will show the display:

```
MANUAL  MAN.OPER.  
PM 99100 N 99100  
JOG CONTINUE  
CONFIGURATION CHECK  
SOFTWARE VERSION 6601.691  
MEMORY IN USE 52K  
MEMORY FREE 85K  
RAM SIZE 1280K  
DRIVES 0 MC 1= 8  
IN/OUT 1  
GRAPHICS 8PL V691
```

HELP -----

Fig. 13.3-3

The procedures to test a faulty Drive Module are described in Section 13.5.4 and in section 14.

>IN/OUT<

The number of I/O Modules installed in the CNC is shown.

If this number is less than the number entered in MC0 there are faulty I/O Modules; the difference is the number of fault I/O Modules (Note that in MC0; 0= one I/O Module, 1=two, 2=three). In this case the screen will display:

```
MANUAL  MAN.OPER.  
PM 99100 N 99100  
  
JOG CONTINUE  
  
CONFIGURATION CHECK  
  
SOFTWARE VERSION 6601.691  
MEMORY IN USE      52K  
MEMORY FREE        85K  
RAM SIZE           1280K  
DRIVES             6  
IN/OUT             1  
GRAPHICS           8PL V691  
MC 0= 1
```

HELP -----

Fig. 13.3-4

The Power-up Check can be used to find which I/O Modules are faulty; see Section 13.4. The I/O Modules can be further checked with the tests in Section 13.5.5 and in section 14.

>GRAPHICS<

The type and version number of the Graphics Module are shown (e.g. >8 PL V400< = eight-plane graphics, version 400).

In the display shows >GRAPHICS OPL V< then one of the two Graphics Modules is faulty; the number of Graphics Modules installed is given in MC9. Some failures of the Graphics Modules can result in the screen showing nothing at all.

The procedure to test faulty Graphics Modules is described in Section 13.5.7 and in section 14.

If no Graphics modules are installed in the CNC the screen will show the display:

```
MANUAL  MAN.OPER.  
PM 5555 N 5555  
  
JOG CONTINUE  
  
CONFIGURATION CHECK  
  
SOFTWARE VERSION 6601.691  
MEMORY IN USE      53K  
MEMORY FREE        84K  
RAM SIZE           1280K  
DRIVES             6  
IN/OUT             1
```

HELP -----

Fig. 13.3-5

In this case the CNC is *not* defective.

When the Configuration Check is no longer required, leave it by pressing the relevant button for any operation mode.

13.4 POWER-UP CHECK

The Power-up Check causes each of the modules in the CNC to run a hardware self-test. This enables the correct functioning of the CNC to be checked by one test, although not in detail.

The Power-up Check is performed automatically each time the CNC is switched on. It can also be selected, without switching off, as follows:

- (1) Select the Diagnostic Menu, as described in Section 13.2.
- (2) Press button 2

If no module failures are detected the screen will, for example, show the display (in this example the external diagnostic switch is made):

```

POWER-UP CHECK  V691
HARDWARE CHECK
CPU 80286      10MC      PASSED
PROM                      6601.691 PASSED
LANGUAGE GER ENG      6601.691 PASSED
RAM                      256K      PASSED
MEM.MOD.2      1024K     PASSED
DRIVE 1 2 3      LMS      PASSED
DRIVE 4 5 6      RMS      PASSED
IN/OUT 1                      PASSED
CONTROL/TELET                      PASSED
GRAPHICS      8PL      V691     PASSED
  
```

----- MANUAL DIAG -----

Fig. 13.4-1

If a failure is detected the screen will, for example, show the display:

```

POWER-UP CHECK  V691
HARDWARE CHECK
CPU 80286      10MC      PASSED
PROM                      6601.691 PASSED
LANGUAGE GER ENG      6601.691 PASSED
RAM                      256K      PASSED
MEM.MOD.2      1024K     PASSED
DRIVE 1 2      LMS      PASSED
DRIVE 3        LMS      FAILED
DRIVE 4 5 6    RMS      PASSED
IN/OUT 1                      PASSED
CONTROL/TELET                      PASSED
GRAPHICS      8PL      V691     PASSED
  
```

----- MANUAL DIAG -----

Fig.13.4-2

In the above example the 1st drive (on the second drive module) has failed the Power-up Check.

The failed module can be checked further with the relevant tests in this section and section 14.

Note that if a PROM memory failure is detected by the Power-up Check it may not be possible to enter the Diagnostic Mode. The system software PROM integrated circuits must then be replaced, without any further testing.

The Diagnostic Mode can be entered from the completed Power-up

Check by pressing softkey **F4**, below >DIAG< (except when the Diagnostic Switch is not made and no failures have been detected by the Power-up Check; the CNC will then automatically enter Manual Mode). See section 13.6.

Manual mode is re-entered by pressing the softkey **F3**, below >MANUAL<.

13.5 DIAGNOSTIC MODE

In the Diagnostic Mode a number of tests can be performed which check the operation of specific modules. Some selections from the Diagnostic Mode will lead to further menus, as shown in the Diagnostic Mode chart (see opposite).

The Diagnostic Mode is selected as follows:

- (1) Select the Diagnostic menu, as described in Section 13.2.

- (2) Press button

7

The screen will show the display:

DIAGNOSTICS V691

```
1 CONTR. TELET. MOD.  
2 CENTR. PROC. MOD.  
3 MEM. MOD.  
4 PROM TEST  
5 32 INP./OUTP. MOD.  
6 DRIVE MODULES  
7 GRAPH. MOD.  
8 SERVICE ONLY
```

----- **MANUAL** -----

Fig. 13.5-1

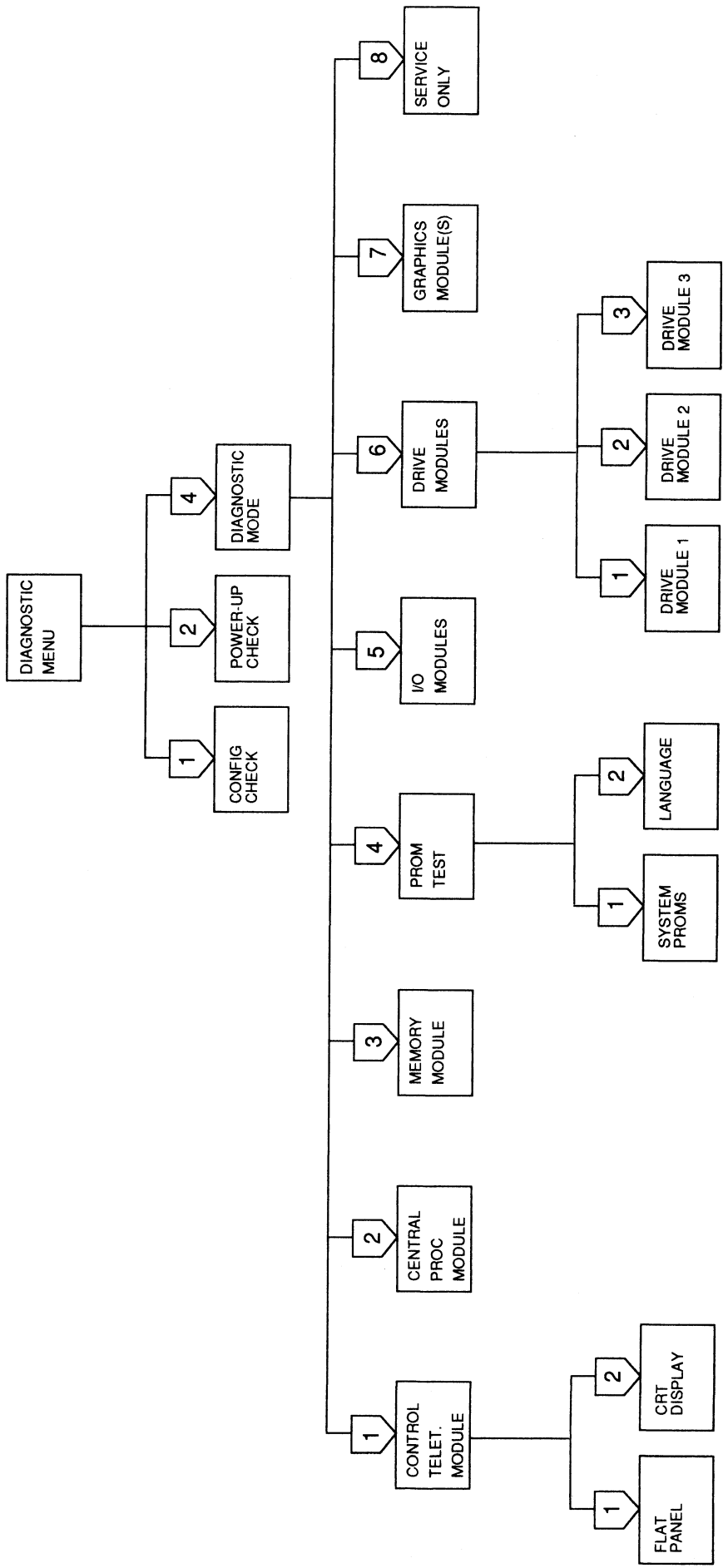
This is the Diagnostic Mode menu. The selections from it are explained below.

The diagnostic menu can also be entered from the initial Power-up screen display by pressing the softkey

F4

, below >DIAG<.

The Manual Menu can be re-entered from the Diagnostic Mode Menu by opening the external diagnostic switch.



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13.5.1 Control Teletext Module Tests

These tests are selected by pressing button 1 when in Diagnostic Mode.

The screen will show the display:

```
DIAGNOSTICS V691
SELECTED: CONTR. TELET. MOD.

1 FLAT-PANEL
2 CRT-DISPLAY
```

----- MANUAL -----

Fig. 13.5.1-1

This is a menu to select either one of the Control Teletext Module tests. These are explained below.

13.5.1.1 Flat Panel Test

Press button 1

The screen will show a picture of the CNC'S flat panel of press-button switches:

```
FLAT-PANEL
  ■ ■ ■ ■ ■
■ ■ ■ ■ ■ ■ ■ ■ ■ ■
■ ■ ■ ■ ■ ■ ■ ■ ■ ■
■ ■ ■ ■ ■ ■ ■ ■ ■ ■
■ ■ ■ ■ ■ ■ ■ ■ ■ ■
```

----- EXIT -----

Fig. 13.5.1.1-1

If any button (except F5) is pressed the corresponding square on the display will 'blink'.

If one of the buttons does not cause a response it is probable that the flat panel is faulty.

The screen will show the display:

```
DIAGNOSTICS V696
SELECTED: CENTR.PROC.MOD.

CPU RAM TEST
```

```
TESTING
```

```
----- EXIT
```

Fig. 13.5.2-1

After a short delay >INTERRUPT CONTROLLER< appears on the display, then >INTERRUPT COUNTER< and then >COUNTER NUMBER: 2<.

If the test detects no faults then >MODULE OK< will be shown on the display:

```
DIAGNOSTICS V696
SELECTED: CENTR.PROC.MOD.

CPU RAM TEST
```

```
TESTING
```

```
MODULE OK
```

```
----- EXIT
```

Fig. 13.5.2-2

The test will continue to run and the screen will repeatedly show the displays described above.

If the test detects any fault the display will show an error message, for example:

```
DIAGNOSTICS V696
SELECTED: CENTR.PROC.MOD.

CPU RAM TEST

TESTING

ERROR 19: PATTERN NOT CORRECT

----- STEP CONT EXIT
```

Fig. 13.5.2-3

Note that the test will halt at the first fault detected. The test can be continued by pressing either softkey **F3** (below >STEP< or softkey **F4** (below >CONT<). If >STEP< is pressed

the test will continue until the next fault is detected. If >CONT< is pressed the test will continue until completed and will not halt if a fault is detected; the faults can thus be quickly scanned with >CONT< and identified one by one with >STEP<. The meanings of the error codes (e.g. >ERROR 50: RAM NOT CONTIGUOUS<) are described in detail in section 18.

The Central Processor Module can then be tested further with the tests in Chapter 14, but will probably have to be replaced.

Note that this test cannot detect any failure of the PROM memory.

The Diagnostic Mode is re-entered by pressing softkey **F5**, below >EXIT<.

13.5.3 Memory Module Tests

A maximum of two extra Memory Modules are optional extensions to the CNC's RAM memory. It enables more part programs and macros to be stored.

Note: If the Memory Module is not installed the Memory Module test will not be listed in the Diagnostic Mode menu. The menu choices below >CENTR. PROC. MOD.< will then be 'moved up' one number (i.e. >PROM TEST< will then become menu choice 3, etc).

If the Memory Module is installed it can be tested by pressing button **3** while in Diagnostic Mode.

The display shows:

```
DIAGNOSTICS V696  
SELECTED: MEM.MOD.2  
  
1 MEM.MOD.2
```

Fig. 13.5.3-1

- Touch button 1 or, if applicable, button 2

If the test detects no faults the screen will show the display:

```
DIAGNOSTICS V696  
SELECTED: MEM.MOD.2  
  
TEST RUN: 2
```

```
TESTING  
MODULE OK
```

Fig. 13.5.3-2

```
----- EXIT
```

If the test does detect a fault the screen will, for example, show the display:

```
DIAGNOSTICS V696
SELECTED: MEM. MOD: 2

TEST RUN:      0

TESTING

ERROR 50: RAM NOT CONTIGUOUS

----- STEP CONT EXIT
```

Fig. 13.5.3-3

Note that the test will halt at the first fault detected. The test can be continued by pressing either softkey **F3** (below >STEP<) or softkey **F4** below >CONT<). If >STEP< is pressed

the test will continue until completed and will not halt if a fault is detected; the faults can thus be quickly scanned with >CONT< and identified one by one with >STEP<. The meanings of the error codes (e.g. >ERROR 50: RAM NOT CONTIGUOUS<) are described in detail in section 18. The Memory Module can be tested further with the tests in Chapter 14 and, if necessary, replaced.

The Diagnostic Mode menu is re-entered by pressing the softkey **F5**, below >EXIT<.

13.5.4 PROM test

This test is started by pressing button **4** while in Diagnostic Mode (or button **3**, if no extra Memory Module is installed).

The display shows:

```
DIAGNOSTICS V696
SELECTED: SYSTEM PROMS

1 SYSTEM PROMS
2 LANGUAGE
```

Fig. 13.5.4-1

To test the system software PROM's touch button

1

If no fault is detected the screen will show the display:

```
DIAGNOSTICS V696
SELECTED: SYSTEM PROMS
PROM TEST
```

```
TEST READY
MODULE OK
```

----- EXIT

Fig. 13.5.4-2

To test the language PROM's, touch button

2

If no fault is detected, the display shows:

```
DIAGNOSTICS V696
SELECTED: LANGUAGE
PROM TEST

LANGUAGES DETECTED:
GERMAN  ENGLISH
```

```
TEST READY
MODULE OK
```

----- EXIT

Fig. 13.5.4-3

Note that the detected languages may be different, as the control can obtain customized language PROM's.

E.g. >FRENCH ITALIAN< is also possible.

If a fault is detected the display will show an error message, for example:

```
DIAGNOSTICS V696
SELECTED: SYSTEM PROMS
PROM TEST
```

```
ERROR 51: PROM CHECKSUM
```

```
----- STEP CONT EXIT
```

Fig. 13.5.4-4

The system software PROM integrated circuits must then be checked further with the tests in Chapter 14, and, if necessary, replaced.

Note that the test will halt at the first fault detected. The test can be continued by pressing either

softkey **F3** (below >STEP< or softkey **F4** (below >CONT<). If >STEP< is pressed

the test will continue until the next fault is detected. If >CONT< is pressed the test will continue until completed and will not halt if a fault is detected; the faults can thus be quickly scanned with >CONT< and identified one by one with >STEP<. The meanings of the error codes (e.g. >ERROR 51 PROM CHECKSUM<) are described in detail in section 18.

The Diagnostic Mode is re-entered by pressing softkey **F5**, below >EXIT<.

- Remark:
- If the boot PROM is defective the control will stop executing all functions. Also testing is not possible.
Switching the control off and on gives an erratic display.
 - If the system PROM's go defective the control display will show in the topline an error as given in the example below and stops all functions:

```
* INT 6: UNKNOWN_OPCODE! *
```

Fig. 13.5.4-5

In this case the control must be switched off and on.

Via the power-on display the diagnostic mode can be entered.

If an output parity error is detected the screen will show the display:

```

DIAGNOSTICS
SELECTED: 32 INP./OUTP.MOD.

123456789 123456789 123456789 12
IN 1 111111011111111111111111110001111

OUT 1 0000000000000000000000000000000000000000000000000000000000000000

PARITY INPUTS OK
PARITY OUTPUTS BAD
ERROR 36: PARITY OUTPUTS

```

----- **STEP** **CONT** **EXIT** -----

Fig. 13.5.5-4

In either of these cases the I/O module is likely to be faulty and must be checked further with the tests in Chapter 14.

The I/O modules test menu is re-entered by pressing softkey **F5** below >EXIT<.

13.5.6 Drive Module Tests

These tests are selected by pressing button **6** while in Diagnostic Mode (or button **5**, if either the Memory Module or the I/O Modules are not installed, or **4**, if both are not installed).

The screen will show the display:

```

DIAGNOSTICS V696
SELECTED: DRIVE MODULES

1 DRIVE MODULE 1
2 DRIVE MODULE 2
3 DRIVE MODULE 3

```

----- **MANUAL** -----

Fig. 13.5.6-1

This menu is used to select the Drive Module to be tested:

- Press button 1 to test the first and second channels (usually axes X and Y).
- Press button 2 to test the third and fourth channels (usually axes Z and B).
- Press button 3 to test the fifth and sixth channels (optional; may not be installed).

The test is the same for all three Drive Modules.

If the test does not detect a fault the screen will display:

```
DIAGNOSTICS V696
SELECTED: DRIVE MODULE 1

DRIVE #      LMS
DRIVE STATUS: 100011

TESTING

MODULE OK

----- EXIT
```

Fig. 13.5.6-2

The test will continue to run.

The line >DRIVE STATUS:< in the display is followed by a six-digit binary number which indicates the status of six functions of the Drive Module. These are explained below, taking the binary digits in order from right to left:

- (1) Reference Point Finder
 - 0 = RPF enabled
 - 1 = RPF disabled
- (2) Area
 - 0 = Drive Module present
 - 1 = Drive Module not responding (ERROR 29)
- (3) Alarm
 - 0 = no alarm
 - 1 = alarm
- (4) Rotational/Linear Measurement System
 - 0 = LMS
 - 1 = RMS

(note that this will repeatedly change if an RMS/LMS Drive Module is tested, as the test switches between channels)

- (5) Pre-alarm
 - 0 = no pre-alarm
 - 1 = pre-alarm

- (6) 12 Volt Power Supply
 - 0 = 12V supply on
 - 1 = 12V supply off

These function values are useful for quick checks of the Drive Module's current operational status.

If a fault is detected by the test the screen will, for example, show the display:

```

DIAGNOSTICS V696
SELECTED: DRIVE MODULE 2

DRIVE 3    LMS
DRIVE STATUS: 110111

TESTING

ERROR 23: PRE-ALARM

----- STEP  CONT  EXIT

```

Fig. 13.5.6-3

In this case the test will halt at the first fault detected. The test can be continued by pressing either softkey **F3** (below >STEP<) or softkey **F4** (below >CONT<). If >STEP< is pressed

the test will continue until the next fault is detected. If >CONT< is pressed the test will continue until completed and will not halt if a fault is detected; the faults can thus be quickly scanned with >CONT< and identified one by one with >STEP<. The meanings of the error codes (e.g. >ERROR 29 DRIVE NOT RESPONDING<) are described in detail in section 18.


If the connection between a Drive Module and the machine tool is suspected of causing faults it can be checked by swapping the connector at the 'faulty' Drive Module with one from a 'good' Drive Module.

CAUTION! This must only be done while the external Diagnostic Switch is closed! Damage can be caused to the machine tool if it is allowed to move while the Drive Modules are wrongly connected.

Note that a Drive Module can be used as an analog I/O unit (for instance, for the Handwheel or for tool-wear sensors), not only for driving the axes and the spindle.

In most cases of fault the appropriate Drive Module must be replaced, but suspect Drive Modules (and the accuracy of their analog outputs) can be further checked, if necessary, with the tests in section 14.5.

The Drive Module selection menu is re-entered by pressing softkey **F5**, below >EXIT<.

The Diagnostic Mode menu is re-entered by touching the Menu  button

13.5.7 Graphics Modules Test

This test is selected by pressing button **7** while in Diagnostic Mode (or button **6** if either the Memory Module or the I/O Modules are not installed, or button **5** if both are not installed).

If no faults are detected the screen will show the display:

```
DIAGNOSTICS V696
SELECTED: GRAPH.MOD.

RAM TEST
TEST RUN: 39

TESTING

MODULE OK

----- EXIT
```

Fig. 13.5.7-1

The test will continue to run repeatedly and the two lines >RAM TEST< and >PROM TEST< will alternate on the screen.

The line >TEST RUN:< shows the number of tests that have been successfully completed.

If a fault is detected the screen will, for example, show the display:

```
DIAGNOSTICS
SELECTED: GRAPH.MOD.

RAM TEST
TEST RUN: 0

TESTING

ERROR 53: GRAPHICS RAM ERROR

----- EXIT
```

Fig. 13.5.7-2

The meanings of the error codes (e.g. >ERROR 50: RAM NOT CONTIGUOUS<) are detailed in section 18.

In this case the Graphics Module must be tested further with the tests in section 14 and, if necessary, replaced.

Note that some fault conditions of the Graphics Modules will result in the screen showing nothing at all. In this case the Graphics Modules can be tested by removal, as detailed below:

- (1) Switch off all mains power to the CNC
- (2) Remove the Graphics Modules and the Control Teletext Module from the CNC
- (3) Remove jumper W1 from the Control Teletext Module (see the Service Manual, this is not possible with the Version 3431)
- (4) Put the Control Teletext Module back into the CNC, switch the mains power back on and start the CNC. If the screen then shows a display the Graphics Modules are faulty and must be replaced.

The Diagnostic Mode is re-entered by pressing softkey

| |
|----|
| F5 |
|----|

, below >EXIT<.

13.5.8 Service Only Tests

As there is a large number of tests that can be used in the Service Only mode these are described separately in section 14.

14. SERVICE ONLY

The Service Only mode is one of the sub-menus of the Diagnostic menu, see Chapter 13. It contains tests which are more detailed and specific than those on the rest of the Diagnostic menu. These tests will be useful only to trained Service personnel. Unauthorised use of the Service Only mode can cause damage to the machine tool.

Some selections from the Service Only mode will lead to further menus, as shown in the Service Only chart (see overleaf).

The Service Only mode is selected as follows:

- (1) Select the Diagnostic Mode, as described in Section 13.4.
- (2) Press button **8** (or button **7** if either the Memory Module or the I/O Modules are not installed, or **6** button if both are not installed).

The screen will show the display:

DIAGNOSTICS V696 SERVICE ONLY

```
1 CONTR. TELET. MOD.
2 CENTR. PROC. MOD.
3 MEM. MOD.
4 PROM TEST
5 32 INP./OUTP. MOD.
6 DRIVE MODULES
7 GRAPH. MOD.
8 EXT. TEST PROG.
```

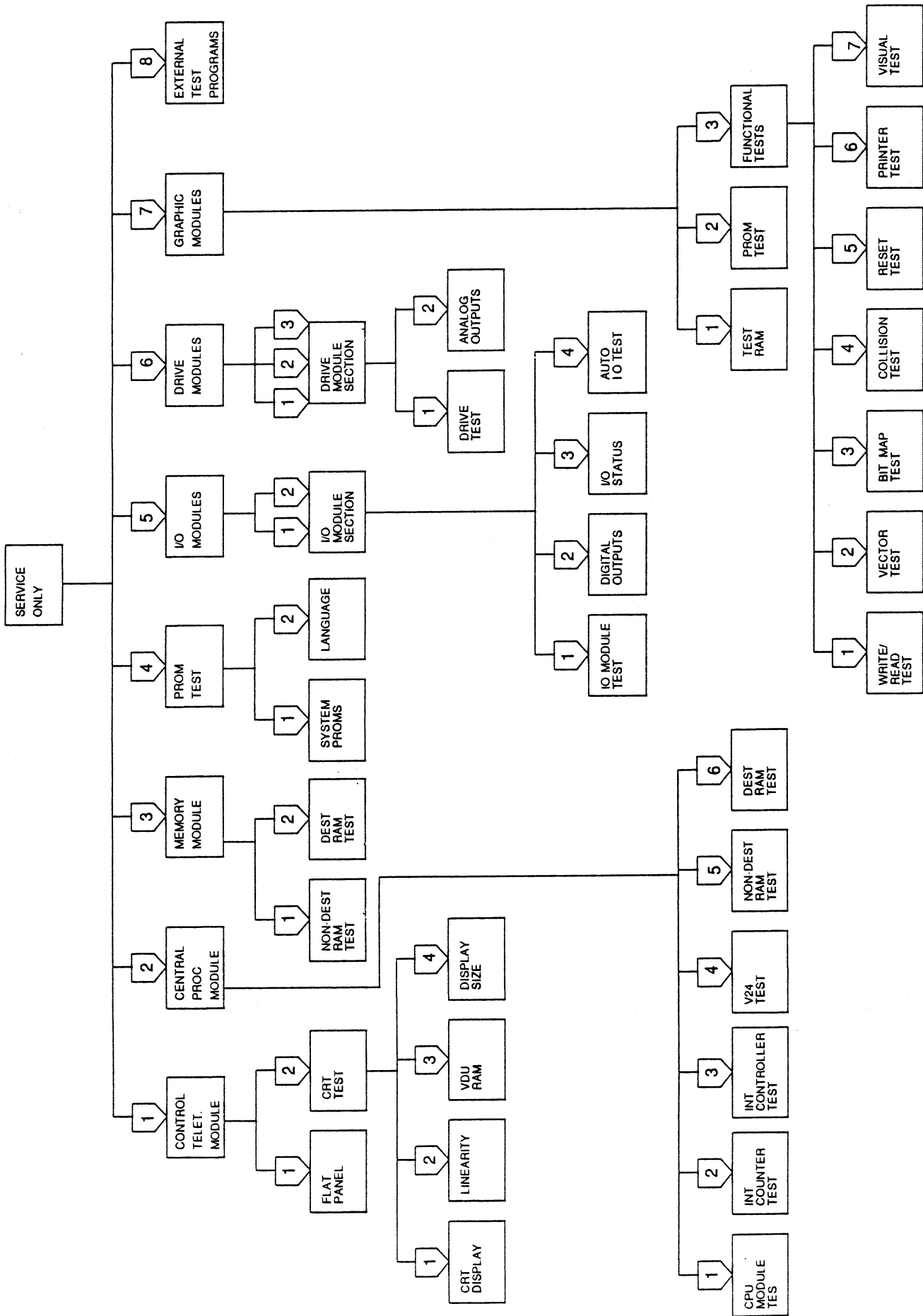
Fig. 14-1

----- **MANUAL** -----

This is the Service Only menu. The selections from it are explained in the following sections.

The Manual Mode can be re-entered from the Service Only menu by

pressing the softkey **F3**, below >MANUAL<.



14.1 CONTROL TELETEX MODULE TESTS

These tests are selected by pressing button **1** when in Service Only mode.

The screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: CONTR. TELET. MOD.

1 FLAT-PANEL
2 CRT-DISPLAY
```

----- **MANUAL** -----

Fig. 14.1-1

This is a menu to select either one of the Control Teletext Module tests. These are explained below.

The Manual Mode can be re-entered from the Control Teletext

Module tests menu by pressing softkey **F3**, below >MANUAL<.

14.1.1 Flat Panel Test

This test is the same as that described in Section 13.4.1.1.

14.1.2 CRT Display Test

Press button **2**

The screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: CONTR. TELET. MOD.

1 CRT-DISPLAY
2 LINEARITY
3 VDU RAM
4 DISPLAY SIZE
```

----- **MANUAL** -----

Fig. 14.1.2-1

This is a menu to select the CRT Display tests, these are explained in the following sections.

The Manual Mode can be re-entered from the CRT Display test menu

by pressing softkey **F3**, below >MANUAL<.

14.1.2.1 CRT Display Test

Press button **1**

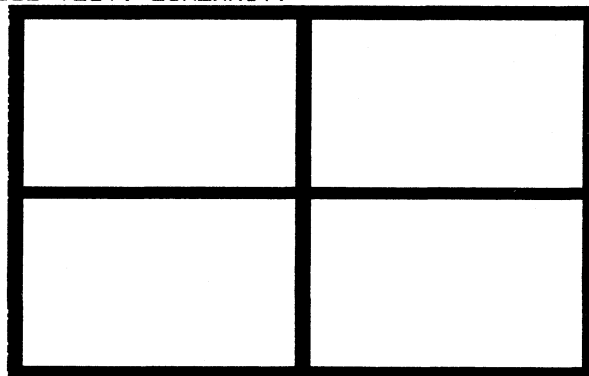
This test is the same as that described in Section 13.4.1.2, except that pressing >EXIT< will cause the CRT Display menu to be re-entered (i.e. not the Control Teletext Module test menu).

14.1.2.2 Linearity Test

Press button **2**

The screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: CONTR. TELET. MOD.
SUB TEST: LINEARITY
```



----- **EXIT** -----

Fig. 14.1.2.2-1

This is a test grid to check the monitor for distortion of straight lines. If the grid is distorted, the VDU must be adjusted or, if necessary, replaced. See the CNC Service Manual.

The CRT Display test menu is re-entered by pressing softkey **F5** below >EXIT<.

14.1.2.3 VDU RAM Test

Press button **3**

If no faults are detected the screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: CONTR. TELET. MOD.
SUB TEST: VDU RAM
VDU RAM TEST

START ADDRESS:      MEMORY LENGTH:
F0800                2 K
```

----- **EXIT**

Fig. 14.1.2.3-1

Note that the display shows the size of the VDU RAM memory and its start address in hexadecimal.

If a fault is detected the screen will show the display:

```
DIAGNOSTICS          SERVICE ONLY
SELECTED: CONTR. TELET. MOD.
SUB TEST: VDU RAM
VDU RAM TEST

START ADDRESS:      MEMORY LENGTH:
F0800                2 K
```

TESTING

ERROR 13: RAM

----- **STEP** **CONT** **EXIT**

Fig. 14.1.2.3-2

In this case the Control Teletext Module must be replaced.

Note that with some fault conditions there will be nothing on the screen. In this case the Graphics Modules (if installed) should first be checked by removal, see Section 13.4.7. If no faults are found in the

Graphics Modules the Control Teletext Module can only be checked by removal and replacement with a Control Teletext Module that is known to be fault-free. If this is not possible, or if the Control Teletext Module is not faulty, a Service Engineer must be called to check the whole system.

Note also that some fault conditions will produce 'bad' displays on the screen that will prevent use of the diagnostic tests. The Control Teletext Module can be diagnosed as having faults if the screen shows either of the following 'bad' displays:

- the display is correctly formatted, but the characters composing it are 'scrambled' making the on-screen messages meaningless (this indicates that either both the 2K VDU RAMs or the character PROM are faulty)
- the screen rapidly alternates 'good' and 'bad' displays (this indicates that one of the 2K VDU RAMs is faulty)

In both these cases the Control Teletext Module must be replaced.

The CRT Display test menu is re-entered by pressing softkey F5 below >EXIT<.

14.1.2.4 Display Size Test

Press button 4

The screen shows the display:

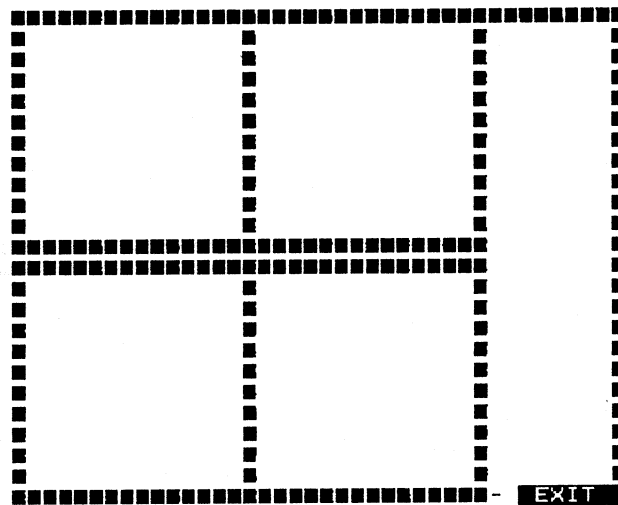


Fig. 14.1.2.4-1

This is a test grid to check whether the display on the monitor is adjusted to the correct size.

There are two standard sizes of VDU screen that are used with the CNC. The test grid should be 'framed' by the edge of the screen, as shown below, and the grid lines should be straight:

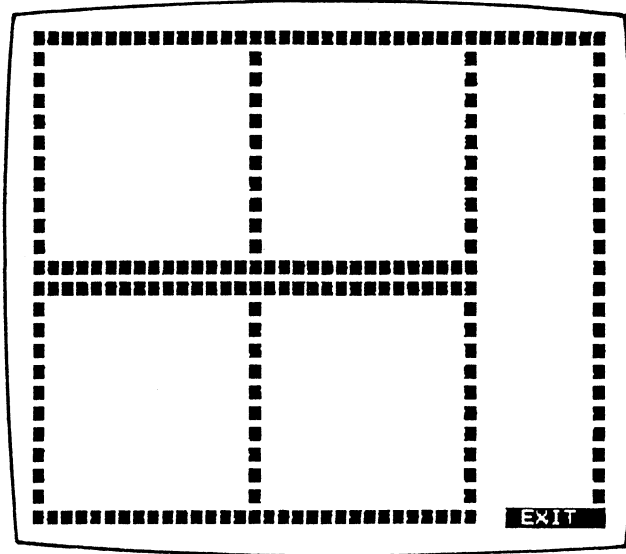


Fig. 14.1.2.4-2

If it is not, then the monitor must be adjusted, see the CNC Service Manual.

The CRT Display test menu is re-entered by pressing softkey F5 below >EXIT<.

14.2 CENTRAL PROCESSOR MODULE TESTS

These tests are selected by pressing button **2** when in Service Only mode.

The screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: CENTR.PROC.MOD.80286    10 MC

1 CPU MODULE
2 INTERRUPT COUNTER
3 INTERRUPT CONTROLLER
4 V24 TEST
5 NON DEST. RAM TEST
6 DEST. RAM TEST
```

Fig. 14.2-1

----- **MANUAL** -----

This is a menu to select one of the Central Processor Module tests. These are explained below.

The Manual Mode can be re-entered by pressing softkey **F3**, below >MANUAL<.

14.2.1 CPU Module Test

Press button **1**

The screen will initially show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: CENTR.PROC.MOD.80286    10 MC
SUB TEST: CPU MODULE

CPU RAM TEST
```

TESTING

Fig. 14.2.1-1

----- **EXIT** -----

After a short delay the line >CPU RAMTEST< will be replaced by >INTERRUPT COUNTER< and >COUNTER IN TEST: 2<, and then by >INTERRUPT CONTROLLER<. The first test is then completed. If no fault is detected the display will show >TEST OK<. The test will continue to run.

If a fault is detected the screen will, for example, show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: CENTR.PROC.MOD.80286    10 MC
SUB TEST: CPU MODULE
CPU RAM TEST
```

TESTING

ERROR 50: RAM NOT CONTIGUOUS

----- **STEP** **CONT** **EXIT**

Fig. 14.2.1-2

In this case the Central Processor Module must be tested further with the tests in the following sections (in the above example with the RAM tests).

The Central Processor Module tests menu is re-entered by pressing **F5** softkey, below >EXIT<.

14.2.2 Interrupt Counter Test

Press button **2**

The screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: CENTR.PROC.MOD.80286    10 MC
SUB TEST: INTERRUPT COUNTER
INTERRUPT COUNTER
COUNTER IN TEST:
```

TESTING

TEST OK

----- **EXIT**

Fig. 14.2.2-1

The number following COUNTER IN TEST:< will rapidly change through 0, 1 and 2 in succession.

If no fault is detected the display will show >TEST OK<. The test will continue to run.

If a fault is detected the screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: CENTR.PROC.MOD.80286    10 MC
SUB TEST: INTERRUPT COUNTER

INTERRUPT COUNTER
COUNTER IN TEST:  0
EXPECTED VALUE:  8000
RECEIVED VALUE:  A001
```

TESTING

ERROR 1: SLOW ERROR

----- STEP CONT EXIT

Fig. 14.2.2-2

The test will halt at the first fault detected. The test can be continued by pressing either softkey

F3

(below >STEP<) or softkey **F4** (below >CONT<). If >STEP< is pressed the test will continue until the next fault is detected, if >CONT< is pressed the test will continue repeatedly and will not halt if a fault is detected; the faults can thus be quickly scanned with >CONT< and identified one by one with >STEP<.

The meanings of the error codes (e.g. >ERROR 1: SLOW ERROR<) are detailed in section 18. In this case the Central Processor Module must be replaced.

The Central Processor Module tests menu is re-entered by pressing softkey **F5**, below >EXIT<.

14.2.3 Interrupt Controller Test

Press button 3

If the test detects no faults, the screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: CENTR.PROC.MOD.80286  10 MC
SUB TEST: INTERRUPT CONTROLLER
INTERRUPT CONTROLLER
```

TESTING

TEST OK

----- EXIT

Fig. 14.2.3-1

If the test detects a fault, the screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: CENTR.PROC.MOD.80286  10 MC
SUB TEST: INTERRUPT CONTROLLER
INTERRUPT CONTROLLER
```

ENABLED INTERRUPTS: 11111110

RECEIVED INTERRUPTS: 10011

INTERRUPTS DISABLED

TESTING

ERROR 21: INTERRUPT NOT RESPONDING

----- STEP CONT EXIT

Fig. 14.2.3-2

The test will halt at the first fault detected. The test can be continued by pressing either softkey

F3

(below >STEP<) or softkey F4 (below >CONT<). If >STEP< is pressed the test will continue until the next fault is detected, if >CONT< is pressed the test will continue repeatedly and will not halt if a fault is detected; the faults can thus be quickly scanned with >CONT< and identified one by one with >STEP<.

The meanings of the error codes (e.g. >ERROR 1: SLOW ERROR<) are detailed in section 18.

In this case the Central Processor Module, or the Interrupt Controller integrated circuit, must be replaced.

Note that the push-button keyboard of the CNC generates interrupts and that, in consequence, a serious Interrupt Controller fault will disable all or some of the keyboard buttons. In this case the Central Processor Module can only be tested by replacement with one known to be fault-free.

The Central Processor Module tests menu is re-entered by pressing softkey F5, below >EXIT<.

14.2.4 V24 Test

If the V24 or V11 connection is suspected of having faults the V24 and V11 connector must be detached and replaced by a 'loopback connector' (or 'dummy plug'). The V24 Test can then be run as follows:

Press button 4

If the test detects no faults the screen will display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: CENTR.PROC.MOD.80286    10 MC
SUB TEST: V24 TEST
V24 INTERNAL
CHANNEL:   B
TRANSMITTED DATA:  5A
```

TESTING

----- EXIT

Fig. 14.2.4-1

Note that firstly the internal V24 and V11 circuitries and secondly the external connection will be tested. (The line >V24 INTERNAL< changes to >V24 TEST<).

Channel A = V24 connector
Channel B = V11 connector

If the test detects a fault the screen will, for example, display:

DIAGNOSTICS V696 SERVICE ONLY
SELECTED: CENTR.PROC.MOD.80286 10 MC
SUB TEST: V24 TEST
V24 TEST
CHANNEL: A

TESTING
ERROR 9: DTR/DSR
----- STEP CONT EXIT

Fig. 14.2.4-2

The test will halt at the first fault detected. The test can be continued by pressing either softkey **F3** (below >STEP<) or softkey **F4** (below >CONT<). If >STEP< is pressed the test will continue until the next fault is detected; the faults can thus be quickly scanned with >CONT< and identified in detail in section 18.

If the V24 test detects no faults then the connector cable should be checked, either by replacement with a cable known to be fault-free or by testing its continuity with a multimeter wire-by-wire.

If the V24 test does detect a fault the Central Processor Module must be replaced.

The Central Processor Module tests menu is re-entered by pressing

softkey **F5**, below >EXIT<.

14.2.5 Non-destructive RAM Test

Press button **5**

If the test detects no faults the screen will display:

```

DIAGNOSTICS V696      SERVICE ONLY
SELECTED: CENTR.PROC.MOD.80286      10 MC
SUB TEST: NON DEST. RAM TEST

CPU RAM TEST

TEST RUN:      4
START ADDRESS:      80000      MEMORY LENGTH:      256 K

TESTING

TEST OK

----- EXIT

```

Fig. 14.2.5-1

The test will be repeated continuously and the number of tests that have been run without faults is shown next to >TEST RUN<.

If the test detects a fault the screen will, for example, display:

```

DIAGNOSTICS V696      SERVICE ONLY
SELECTED: CENTR.PROC.MOD.80286      10 MC
SUB TEST: NON DEST. RAM TEST

CPU RAM TEST

TEST RUN:      0
START ADDRESS:      ERROR      MEMORY LENGTH:

TESTING

ERROR AT ADDRESS:      E0001
ERROR 19: PATTERN NOT CORRECT

----- STEP  CONT  EXIT

```

Fig. 14.2.5-2

In this case the test will halt at the first fault detected. The test can be continued by pressing either soft-

key **F3** below >STEP< or softkey **F4** (below >CONT<). If >STEP< is pressed

the test will continue repeatedly and will not halt if a fault is detected; the faults can thus be quickly scanned with >CONT< and identified one by one with >STEP<. The meanings of the error codes (e.g. >ERROR 50 RAM NOT CONTIGUOUS<) are described in detail in section 18.

Compare the error address with the memory map in the Service manual to deduce the location of the faulty RAM chip.

The Destructive RAM Test, see next section, can be used to test the RAM further.

The Central Processor tests menu is re-entered by pressing softkey **F5** , below >EXIT<.

14.2.6 Destructive RAM test

Press button

6

The screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: CENTR.PROC.MOD.80286    10 MC
SUB TEST: DEST. RAM TEST
RAM TEST
TEST WILL DESTROY ENTIRE RAM CONTENTS
PUSH <START> TO RUN THE TEST
```

Fig. 14.2.6-1

----- **START** **EXIT**

Caution: This test will result in the entire contents of the RAM store being erased. All part programs and macros will be lost and the CNC will then be in the program condition it was in immediately after installation (i.e. system software, tool memory and machine constants loaded, but no user software at all).

The test is started by pressing softkey **F4**, below >START<.

If no fault is detected the screen will display:

```
DIAGNOSTICS V691      SERVICE ONLY
SELECTED: CENTR.PROC.MOD.80286    10 MC
SUB TEST: DEST. RAM TEST
RAM TEST
TEST RUN:      4
```

TESTING

TEST OK

Fig. 14.2.6-2

----- **EXIT**

If the first test detects no faults the display will show >TEST OK<. The test will continue to repeat and the line >TEST RUN:< will show the number of tests successfully completed.

If the test detects a fault the screen will, for example, show the display:

```
DIAGNOSTICS V696          SERVICE ONLY
SELECTED: CENTR.PROC.MOD.80286    10 MC
SUB TEST: DEST. RAM TEST
RAM TEST
TEST RUN:      0
EXPECTED VALUE: 3E
RECEIVED VALUE: FF
ERROR AT ADDRESS: E0001

TESTING

ERROR 13: RAM

----- STEP CONT EXIT
```

Fig. 14.2.6-3

The test will halt at the first fault detected. The test can be continued by pressing either softkey

F3

(below >STEP<) or softkey

F4

(below >CONT<). If >STEP< is pressed the test

will continue until the next fault is detected, if >CONT< is pressed the test will continue repeatedly and will not halt if a fault is detected; the faults can thus be quickly scanned with >CONT< and identified one by one with >STEP<.

The line >ERROR AT ADDRESS< gives the address of the detected error; this can be compared with the address map given in the Service Manual to identify the faulty RAM integrated circuit.

In this case the Central Processor Module, or the faulty RAM, must be replaced.

The Central Processor tests menu is re-entered by pressing softkey

F5

, below >EXIT<.

14.3 MEMORY MODULE TESTS

If the optional Memory Module is installed these tests are selected by pressing button **3** while in Service Only mode.

The screen will then show the display:

```
DIAGNOSTICS V691
SELECTED: MEM.MOD.
1 MEM.MOD.2
```

Fig. 14.3-1

----- MANUAL -----

This is a menu to select either of the Memory Module tests. These tests are explained in the following sections.

The Service Only menu is re-entered by pressing softkey **F5**, below >EXIT<.

14.3.1. Mem.Mod.test.

Press button **1** (or **2** if the optional second memory is installed)

If the test detects no faults the screen will display:

```
DIAGNOSTICS V691          SERVICE ONLY
SELECTED: MEM.MOD.
SUB TEST: MEM.MOD.2

TEST RUN:      ◊
ADDRESS BLOCKNR          SIZE K/BLOCKS

TESTING
```

Fig. 14.3.1-1

----- EXIT -----

The test will be repeated continuously and the number of tests that have been run without faults is shown next to >TEST RUN<.

If the test detects a fault the screen will display:

```
DIAGNOSTICS V691          SERVICE ONLY
SELECTED: MEM.MOD.
SUB TEST: MEM.MOD.2

TEST RUN:                0
ADDRESS BLOCKNR          SIZE K/BLOCKS
OH      0              ERROR  512  4096

TESTING
ERROR AT BLOCK/OFFSET    4096  43
ERROR 19: PATTERN NOT CORRECT

----- STEP  CONT  EXIT
```

Fig. 14.3.1-2

The test will halt at the first fault detected. The test can be continued by pressing either softkey

F3

(below >STEP< or softkey

F4

(below >CONT<). If >STEP< is pressed the test

will continue until the next fault is detected. If >CONT< is pressed the test will continue until completed and will not halt if a fault is detected; the faults can thus be quickly scanned with >CONT< and identified one by one with >STEP<. The meanings of the error codes (e.g. >ERROR 19 PATTERN NOT CORRECT<) are described in detail in section 18.

The lines on the screen below >START ADDRESS< and >MEMORY LENGTH< give the first addresses and the lengths of the blocks of RAM memory that respond to the test; these can be compared with the memory map in the Service Manual to deduce the location of the faulty RAM integrated circuit.

In this case the Memory Module must be tested further with the Destructive RAM Test, see next section.

The Memory Module tests menu is re-entered by pressing softkey

F5

, below >EXIT<.

14.4. PROM TEST

This test is selected by pressing button

4

when in Service Only mode (or button

3

if no Memory Module is installed).

This test is the same as that described in Section 13.4.3, except that pressing >EXIT< will cause the Service Only menu to be re-entered (i.e. not the Diagnostic Mode menu).

14.5 I/O MODULE TESTS

These tests can be selected by pressing button **5** when in Service Only mode (or **4** button if the Memory Module is not installed).

The screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: 32 INP./OUTP.MOD.

1 I/O MODULE 1
2 I/O MODULE 2
```

Fig. 14.5.1.

This is a menu to select the I/O Module to be tested:

- Press button **1** to select the first I/O Module
- Press button **2** to select the second I/O Module

Manual mode can be re-entered if a module is not selected by pressing soft key **F3** below >MANUAL<.

When an I/O Module is selected, as above, the screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: 32 INP./OUTP.MOD.

1 I/O MODULE
2 DIGITAL OUTPUTS
3 I/O STATUS
4 AUTOMATIC I/O
```

Fig. 14.5.2.

This is a menu to select one of the I/O Modules tests. These tests are the same for all the I/O Modules. They are described in the following sections.

Manual mode can be re-entered from the I/O Modules test menu by pressing softkey **F3** below >MANUAL<.

14.5.1. I/O Module Test

Press button **1**

The screen will show the display:

```
      DIAGNOSTICS V691      SERVICE ONLY
SELECTED: 32 INP./OUTP. MOD.
SUB TEST: I/O MODULE

      123456789 123456789 123456789 12
IN 1  0000000000000000000000000000010000

OUT 1  00000000000000000000000000000000

PARITY INPUTS OK
PARITY OUTPUTS OK

ON   LEFT  RIGHT  ----- EXIT
```

Fig. 14.5.1-1

The statuses of the 32 inputs and the 32 outputs are shown in two lines, labelled >IN< and >OUT< respectively and numbered 1 to 32 by the row of digits above them. The status of all the outputs and inputs in the above example is OFF (except input 28).

Each output can be selected individually by moving the cursor (shown on output 1 above) with the soft keys **F2** (below >LEFT<) and **F3** (below >RIGHT<).

The status of a selected output can be changed by pressing the soft key **F1** (below >OFF< if the output is ON, or below >ON< if the output is OFF).

This facility can be used to check individual outputs if the test-box described in Section 14.5.2. is connected to the I/O Module.

If the outputs are checked and are fault-free then individual inputs can be checked by connecting the inputs and outputs with the test lead described in Section 14.5.4.

If any faults are detected the I/O Module must be replaced.

The I/O Modules test menu is re-entered by pressing softkey **F5** below >EXIT<.

14.5.2. Digital Outputs Test.

Press button

2

The screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: 32 INP./OUTP.MOD.
SUB TEST: DIGITAL OUTPUTS
OUT
AUTO MODE
OUTPUT 12 SHOULD BE HIGH
```

```
PARITY OUTPUTS I/O MODULE      BAD
ERROR 36: PARITY OUTPUTS
```

```
----- STEP CONT EXIT
```

Fig. 14.5.2.1.

The 32 outputs are automatically switched ON in numerical sequence repeatedly by this test. The number of each output is shown as this is done (in the above example output 12 should be ON).

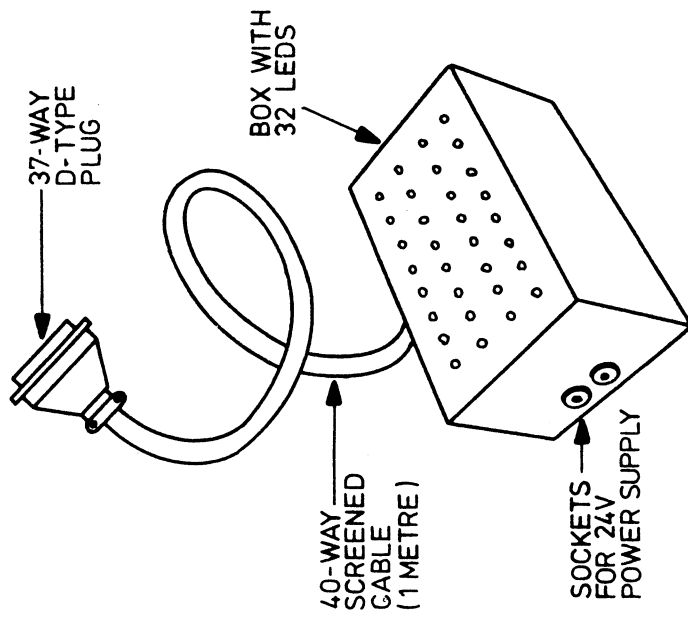
This test is most useful when run with a test-box connected to indicate the switching of each channel to ON. A suitable test-box with 32 LEDs is illustrated opposite (the wiring layout of the 37-way output socket is shown in Section 14.5.4). An external 24 volt power supply is needed for the test-box.

If any of the outputs fail to switch to ON when shown in the screen display the I/O Module is faulty and must be replaced.

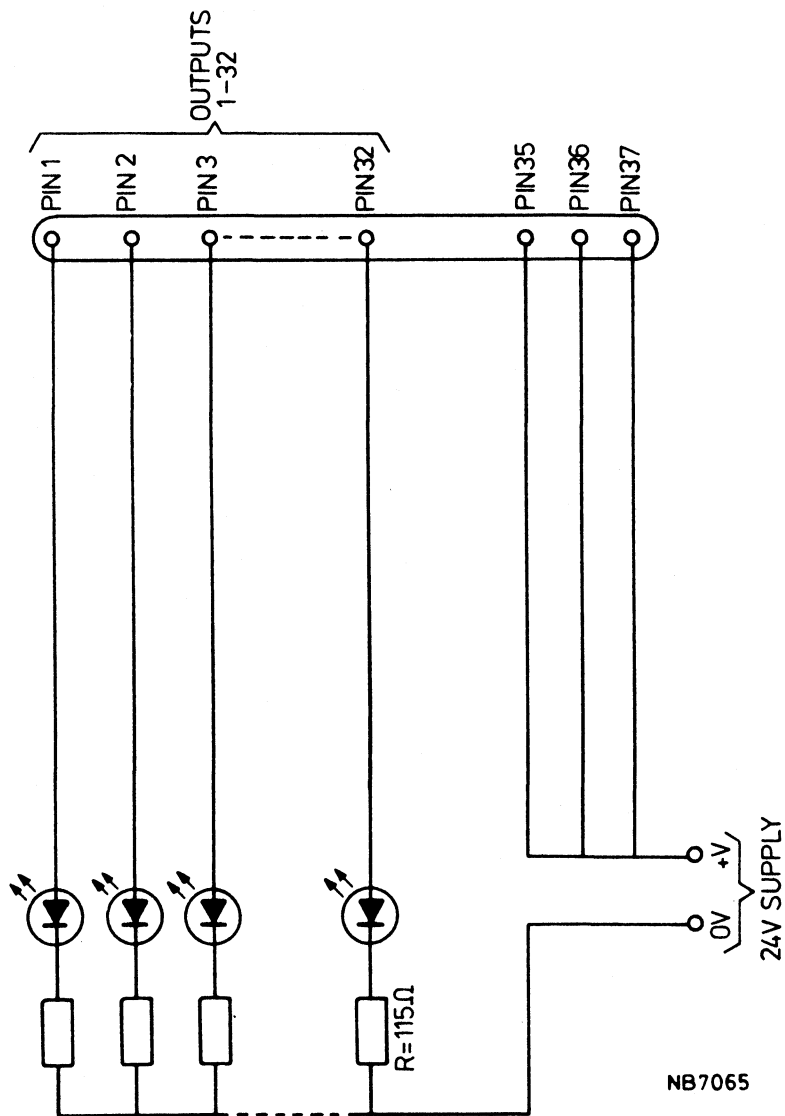
By touching soft key **F3** below >STEP< the test moves to the next output.

By touching soft key **F4** below >CONT< the test is continued until the next error is found.

The I/O Modules test menu is re-entered by pressing soft key **F5** below >EXIT<.



TEST BOX DESIGN



TEST BOX CIRCUIT DIAGRAM

If a fault is detected the screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: 32 INP./OUTP.MOD.
SUB TEST: AUTOMATIC I/O

INPUTS-OUTPUTS
I/O IN TEST: 9
EXPECTED VALUE: 0

ERROR IN I/O NR: 9

PARITY INPUTS OK
PARITY OUTPUTS OK
ERROR 16: I/O NOT CORRESPONDING
```

```
----- STEP CONT EXIT
```

Fig. 14.5.4.2.

The test will halt at the first fault detected. The test can be continued by pressing either softkey

F3

(below >STEP<) or softkey

F4

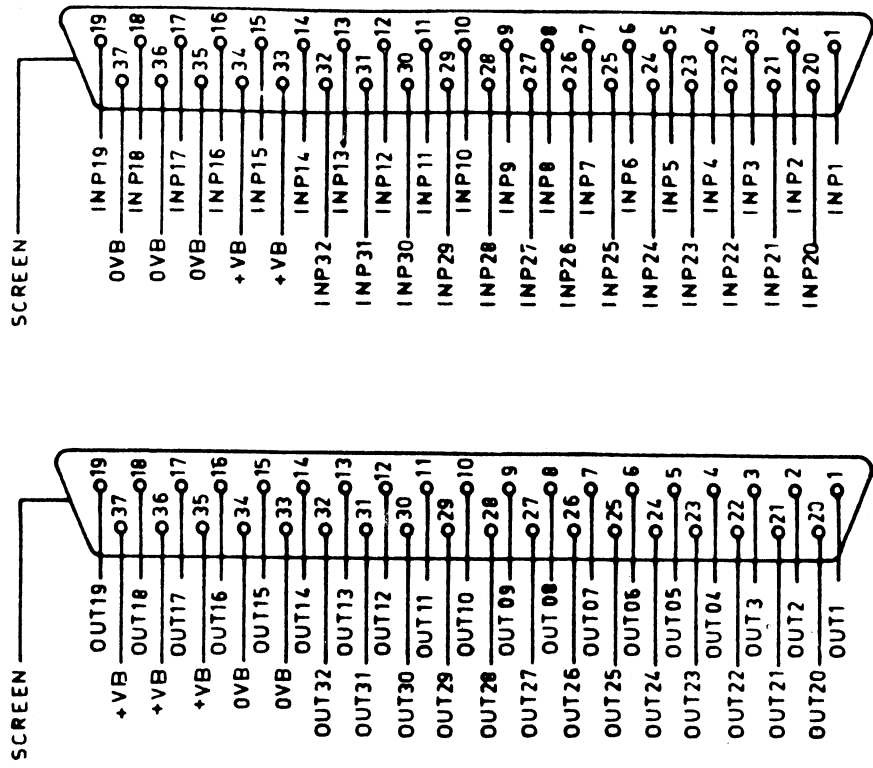
(below >CONT<). If >STEP< is pressed the test will continue until the next fault is detected, if >CONT< is pressed the test will continue repeatedly and will not halt if a fault is detected; the faults can thus be quickly scanned with >CONT< and identified one by one with >STEP<. The meanings of the error codes (e.g. >ERROR< 16: I/O NOT CORRESPONDING<) are described in detail in section 18.

If a fault is detected the I/O Module must be replaced.

The I/O Modules test menu is re-entered by pressing soft key

F5

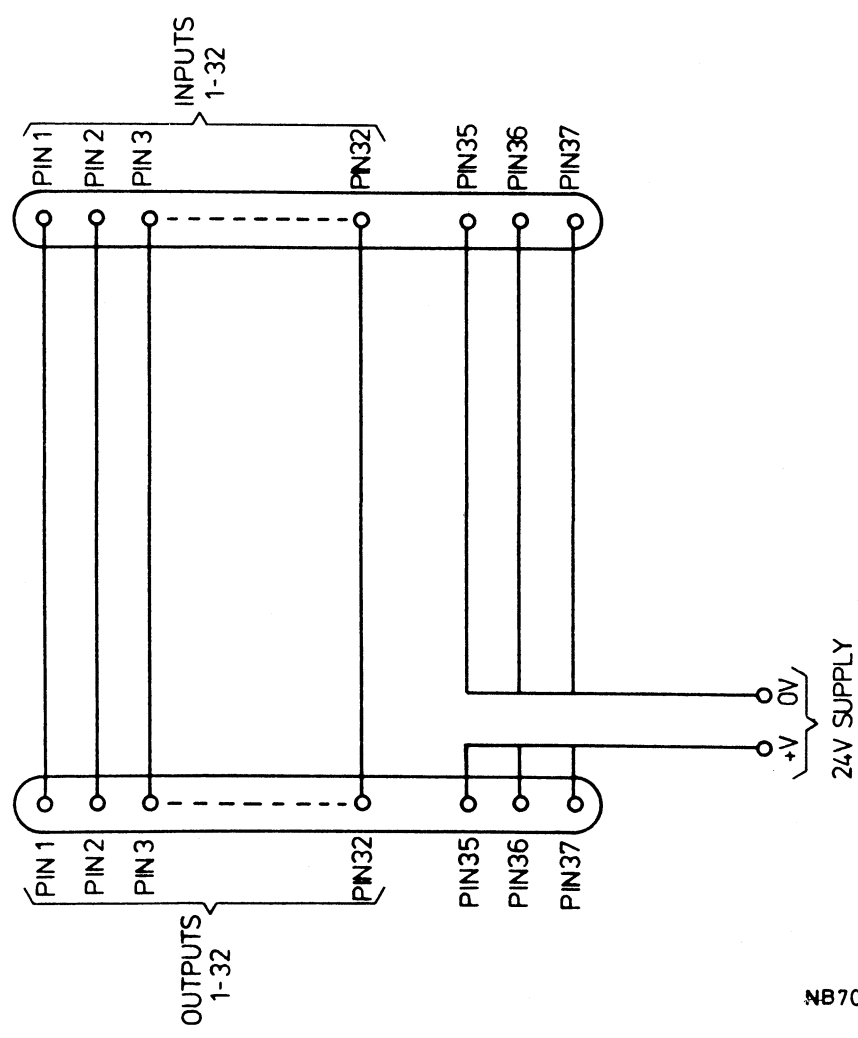
below >EXIT<.



INPUT

OUTPUT

I/O MODULE SOCKET
PIN LAYOUT



TEST LEAD CIRCUIT DIAGRAM

NB7066

14.6 DRIVE MODULE TESTS

These tests are selected by pressing button **6** when in Service Only mode (or button **5** if either the Memory or the I/O Modules are not installed, or button **4** if both are not installed).

The screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: DRIVE MODULES

1 DRIVE MODULE 1
2 DRIVE MODULE 2
3 DRIVE MODULE 3
```

-----**MANUAL**-----

Fig. 14.6.1.

This menu is used to select the Drive Module to be tested:

- Press button **1** to test the first and second channels (usually axes X and Y).
- Press button **2** to test the third and fourth channels axes Z and B).
- Press button **3** to test the fifth and sixth channels (optinal; may not be installed).

Usually used as analog I/O for the Handwheel or for tool-length sensors, etc).

If a Drive Module is not to be selected then Manual Mode can be re-entered by pressing soft key **F3** below >MANUAL<.

When a Drive Module is selected, as above, the screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: DRIVE MODULES

1 DRIVE TEST
2 ANALOG OUTPUTS
```

Fig. 14.6.2.

----- MANUAL -----

Either of two tests can be selected, as below. These tests are the same for all Drive Modules and are described in the following two sections.

14.6.1 Drive Test

Press button

1

This test is the same as that described in Section 13.4.6.

14.6.2 Analog Outputs Test

Press button

2

The screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: DRIVE MODULES
SUB TEST: ANALOG OUTPUTS
ALL DRIVES
ANALOG OUTPUTS
OUTPUT-VOLTAGE:      0 mV
```

Fig. 14.6.2.1.

----- -V OUT +V OUT EXIT -----

This mode allows the analog outputs from the Drive Modules to be manually raised or lowered in 25 mV steps by using the softkeys **F3** (below > -V OUT<) **F4** and (below > +V OUT<).

Both analog output voltages are tested with an accurate voltmeter at each 25 mV step across their range of outputs. If the voltage which has been manually set (and which is shown in the display) differs by more than 1% from either of the two voltages that are measured at the analog outputs then the Drive Module is faulty and must be replaced.

The Drive Module selection menu is re-entered by pressing softkey **F5** , below >EXIT<.

14.7 GRAPHICS MODULE TESTS

These tests are selected by pressing button **7** when in Service Only mode. (or button **6** if either Memory Module or the I/O Modules are not installed, or button **5** if both are not installed)

The screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: GRAPH.MOD.

1 RAM TEST
2 PROM TEST
3 FUNCTIONAL TESTS
```

Fig. 14.7.1.

----- **MANUAL** -----

This is a menu to select one of the Graphics Module tests. These are explained below.

The Manual Mode can be re-entered by pressing softkey **F3** below >MANUAL<.

14.7.1 RAM Test

Press button

1

If no faults are detected the screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: RAM TEST
RAM TEST      8 PLANES GRAPHIC  V697
TEST RUN:      8
```

TESTING

Fig. 14.7.1.1.

----- **EXIT**

The test will continuously run.

The line >TEST RUN:< shows how many tests have been completed.

If the test detects a fault the screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: RAM TEST
RAM TEST      8 PLANES GRAPHIC  V697
TEST RUN:      0
ERROR AT ADDRESS:  21000
```

TEST READY

ERROR 53: GRAPHICS RAM ERROR

Fig. 14.7.1.2.

----- **STEP** **CONT** **EXIT**

In this case the Graphics Module must be replaced.

The Graphics Module test menu is re-entered by pressing softkey **F5** below >EXIT<.

14.7.2 Prom Test

Press button

2

If the test detects no faults the screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: PROM TEST
PROM TEST      8 PLANES GRAPHIC  V697
```

TEST READY

TEST OK

----- **EXIT**

Fig. 14.7.2.1.

If the test detects a fault the screen will display

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: PROM TEST
      ◊ PLANES GRAPHIC  V128
```

ERROR 56: GRAPHICS COMMUNICATION

----- **STEP** **CONT** **EXIT**

Fig. 14.7.2.2.

In this case the PROM integrated circuits containing the system software of the Graphics Module is faulty. Either the PROMs or the whole Graphics Module must be replaced.

The Graphics Module test menu is re-entered by pressing softkey **F5** below >EXIT<.

14.7.3 Functional Tests

Press button

3

The screen will show the display:

```
DIAGNOSTICS V696. SERVICE ONLY
SELECTED: GRAPH.MOD.

1 WRITE/READ
2 VECTOR
3 BIT MAP
4 COLLISION
5 RESET
6 PRINTER
7 VISUAL TEST
```

----- MANUAL -----

Fig. 14.7.3.1.

This is a menu from which the Functional Tests can be selected., These tests are explained below.

The Graphics Module test menu is re-entered by pressing softkey **F3** below >MANUAL<.

14.7.3.1 Write/Read Test

Press button

1

If the test does not detect a fault the screen will show the display:

```
DIAGNOSTICS V696 SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: WRITE/READ

WRITE/READ 8 PLANES GRAPHIC V697
```

TEST READY

TEST OK

----- EXIT -----

Fig. 14.7.3.1.1.

If a fault is detected the screen will show the display:

```

                DIAGNOSTICS V696          SERVICE ONLY
    SELECTED: GRAPH.MOD.
    SUB TEST: WRITE/READ

    WRITE/READ   8 PLANES GRAPHIC   V697
  
```

```

    TEST READY

    ERROR 55: BAD GRAPHICS FUNCTION
  
```

```

----- EXIT
  
```

Fig. 14.7.3.1.2.

In this case the Memory of the Graphics Module is defective and the Graphics Module must be replaced.

The Functional Tests menu is re-entered by pressing softkey

| |
|-----------|
| F5 |
|-----------|

 below >EXIT<.

14.7.3.2 Vector Test

Press button

| |
|----------|
| 2 |
|----------|

The screen will initially show the display:

```

    *DIAGNOSTICS V696          SERVICE ONLY
    *SELECTED: GRAPH.MOD.
    *SUB TEST: VECTOR
    VECTOR          8 PLANES GRAPHIC   V697
    *
    <
    <
    <
    <
    *
    TESTING
    *
    <
    *----- EXIT
  
```

Fig. 14.7.3.2.1.

The display will then be progressively covered by 'asterisk' characters; these are placed randomly on the screen to test the graphics planes.

If the test detects no faults the screen will show the display;

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: VECTOR
VECTOR      8 PLANES GRAPHIC  V697
```

TEST READY

TEST OK

----- EXIT

Fig. 14.7.3.2.2.

If a fault is detected the screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: VECTOR
VECTOR      8 PLANES GRAPHIC  V697
```

TEST READY

ERROR 55: BAD GRAPHICS FUNCTION

----- EXIT

Fig. 14.7.3.2.3.

In this case the Graphics Module must be replaced.

The Functional Tests menu is re-entered by pressing softkey F5 , below >EXIT<.

14.7.3.3 Bit Map Test

Press button

3

The screen will show the display:

```
DIAGNOSTICS V691      SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: BIT MAP
BIT MAP      8 PLANES GRAPHIC  V691

NO EXIT POSSIBLE, WAIT FOR TEST READY
```

TESTING

----- EXIT

Fig. 1.4.7.3.3.-1

The screen will then change background colour eight times as the memory area for the bit-mapped graphics is tested.

If no faults are detected the screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: BIT MAP
BIT MAP      8 PLANES GRAPHIC  V697
```

TEST READY

TEST OK

----- EXIT

Fig. 14.7.3.3.2.

If a fault is detected the screen will display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: BIT MAP
BIT MAP      8 PLANES GRAPHIC  V697

ERROR AT ADDRESS:  254  242

TEST READY

ERROR 55: BAD GRAPHICS FUNCTION
----- EXIT
```

Fig. 14.7.3.3.3.

In this case the Graphics Module must be replaced.

The Functional Tests menu is re-entered by pressing softkey F5, below >EXIT<.

14.7.3.4.Collision Test

Press button 4

If the test detects no faults the screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: COLLISION
COLLISION  8 PLANES GRAPHIC  V697

TEST READY

TEST OK

----- EXIT
```

Fig. 14.7.3.4.1.

If a fault is detected the screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: COLLISION
COLLISION      8 PLANES GRAPHIC  V697
```

```
TEST READY

ERROR 55: BAD GRAPHICS FUNCTION
```

----- **EXIT**

Fig. 14.7.3.4.2.

In this case the Graphics Module must be replaced.

The Functional Test menu is re-entered by pressing softkey **F5**, below >EXIT<.

14.7.3.5 Reset Test

Press Button **5**

If the test detects no faults the screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: RESET
RESET      8 PLANES GRAPHIC  V697
```

```
TEST READY

TEST OK
```

----- **EXIT**

Fig. 14.7.3.5.1.

If a fault is detected the screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: RESET
RESET      8 PLANES GRAPHIC  V697
```

TEST READY

ERROR 55: BAD GRAPHICS FUNCTION

----- **EXIT**

Fig. 14.7.3.5.2.

In this case the Graphics Module must be replaced.

The Functional Test menu is re-entered by pressing softkey **F5**, below >EXIT<.

14.7.3.6.Printer Test

This test cannot be performed unless a printer is connected to the Graphics Modules.

If a printer is connected the test is started by pressing button **6**

If the test detects no faults the screen will show the display:

```
DIAGNOSTICS V691      SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: PRINTER
PRINTER      8 PLANES GRAPHIC  V691
```

TEST READY

TEST OK

----- **EXIT**

Fig. 14.7.3.6.-1.

If a fault is detected the screen will show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: PRINTER
PRINTER      8 PLANES GRAPHIC  V697
```

```
TEST READY
ERROR 55: BAD GRAPHICS FUNCTION
```

----- **EXIT** -----

Fig. 14.7.3.6.2.

The meanings of the error codes (e.g. >ERROR 55<: BAD GRAPHICS FUNCTION<) are described in detail in Appendix A.

The Functional Tests menu is re-entered by pressing softkey **F5** , below >EXIT<.

14.7.3.7. Visual Test

Press buton **7**

The screen will finally show the display:

```
DIAGNOSTICS V696      SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: VISUAL TEST
```



----- **EXIT** -----

Fig. 14.7.3.7.1.

This is an animated display of the solution to the 'Towers of Hanoi' problem. It provides a quick visual check of the functioning of the Graphics Module and the monitor. Any faults will be made apparent by the quality of the moving colour picture.

This test does not search for faults itself and is used only as a visual check. There is no 'error' display therefore.

The Functional Test menu is re-entered by pressing softkey **F5** below >EXIT<.

14.8 EXTERNAL TEST PROGRAMS

These tests are for the use of qualified service personnel only. See Section 13.3


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15. HANDWHEEL

The handwheel allows an axis to be moved in a manner similar to that of a manually-operated machine tool (i.e. the amount of axis movement is proportional to the amount of rotation of the Handwheel).

The Handwheel is made operational as follows:

1. Ensure that the reference points have been searched (i.e. that >REF. POINT< is not shown in the top line of the screen display).

Press the Manual button  to put the CNC into Manual mode.

2. Press the Menu button 

The screen will display the Manual menu:

```


MANUAL  HANDWHEEL
PM 99999          N

JOG CONTINUE

MANUAL MENU:

1 BLOCK SEARCH
2 REFERENCE POINT SEARCH
3 RESET AXIS
6 REMOTE PANEL ON
7 DIAGNOSTIC
8 HANDWHEEL
    
```

Fig. 15.1.

3. Press button  to select the Handwheel facility.

The screen will return to the Manual display, but with the top line showing >HANDWHEEL<:

```

MANUAL  HANDWHEEL
PM 99999          N

JOG CONTINUE

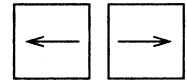
COMMAND      ACTUAL      DIST TO GO
X             X           0.000 X     0
Y             Y           0.000 Y     0
Z             Z           0.000 Z     0
A             A           0.000 A     0
B             B           0.000 B     0

F 0.000 F     0.000 F-OVR 100 %
S 0 S        0 S-OVR 100 %
T 0 T        0 LIFE     0
G 0 17 25 27 40 51 53 63 66 72 90 94
M 5 9 41
    
```

XYZAB

Fig. 15.2.

4. Select the axis to be moved by the handwheel with the Left/Right



Address

Selector buttons, then press



the Enter button

The screen will show, for example, the display:

```

MANUAL  HANDWHEEL
PM 99999          N
JOG CONTINUE

COMMAND      ACTUAL      DIST TO GO
X            X            0.000 X      0
Y HANDWHEEL  Y            0.000 Y      0
Z            Z            0.000 Z      0
A            A            0.000 A      0
B            B            0.000 B      0

F 0.000 F 0.000 F-OVR 100 %
S 0 S 0 S-OVR 100 %
T 0 T 0 LIFE 0
G 0 17 25 27 40 51 53 63 66 72 90 94
M 5 9 41

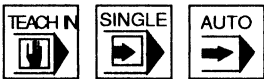
XYZAB
Y-HW
HELP -----
  
```

Fig. 15.3

In the above example the Y-axis has been selected.

The Handwheel unit can now be used to cause movement in the selected axis. The movement produced will be proportional to the amount that the Handwheel is rotated, but will be at a fixed speed (as set in MC750).

The Handwheel is turned off by pressing the appropriate button for any operational mode





16. REMOTE PANEL

The Remote Panel allows operators to control the machine tool while out of reach of the CNC control panel. This is useful in accurate initial placement of the tool, or in other operations requiring close observation of the machine tool during axis movement.

The buttons on the top of the Remote Panel perform exactly the same functions as their equivalents on the CNC control panel (see illustration opposite). The Remote Panel also has two 'security buttons' (or 'dead-man's handles') on its sides. Movement of the machine tool will occur only if one of these security buttons is depressed; this protects the operator and the machine tool from a number of possible accidents (e.g. dropped Remote Panel, unconscious or incapacitated operator).

The Remote Panel is made operational as follows:

1. Press the Manual  to put the CNC into Manual mode
2. Press the Menu button 

The screen will display the Manual menu:

```
MANUAL  MAN. OPER.
PM 99999          N


JOG CONTINUE

MANUAL MENU:

1 BLOCK SEARCH
2 REFERENCE POINT SEARCH
3 RESET AXIS
6 REMOTE PANEL ON
7 DIAGNOSTIC
8 HANDWHEEL
```

Fig. 16.1

HELP -----

3. Press button  to select the Remote Panel facility.

The screen will return to the Manual display, but with the additional line >REMOTE PANEL OFF<:

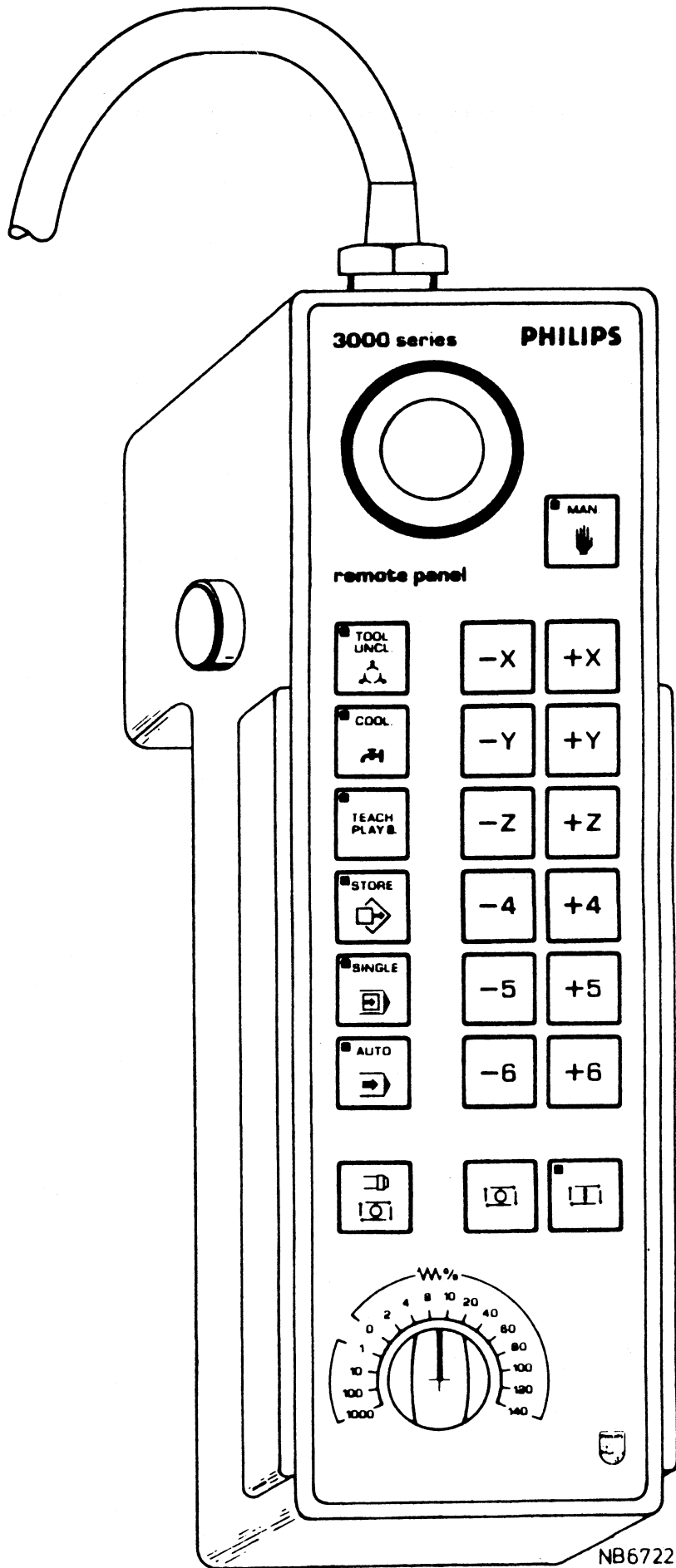


Fig. 16.1

NB6722

```

MANUAL  MAN.OPER.
PM 99999          N

JOG CONTINUE      REMOTE PANEL OFF

COMMAND          ACTUAL          DIST TO GO
X                X          0.000 X          0
Y                Y          0.000 Y          0
Z                Z          0.000 Z          0
A                A          0.000 A          0
B                B          0.000 B          0

F          0.000 F          0.000 F-OVR 100 %
S          0          S          0          S-OVR 100 %
T          0          T          0          LIFE 0
G 0 17 25 27 40 51 53 63 66 72          90 94
M  5  9  41

```

HELP **AXIS-5** ----- **DISPLAY**

Fig. 16.3.

This indicates that the Remote Panel is activated, but that no security button is pressed. Note that the red LED on the Manual button of the Remote Panel unit is now lit.

The Remote Panel can now be used.

When a security button is pressed to allow use, the display line >REMOTE PANEL OFF< will change to >REMOTE PANEL ON<:

```

MANUAL  MAN.OPER.
PM 99999          N

JOG CONTINUE      REMOTE PANEL ON

COMMAND          ACTUAL          DIST TO GO
X                X          0.000 X          0
Y                Y          0.000 Y          0
Z                Z          0.000 Z          0
A                A          0.000 A          0
B                B          0.000 B          0

F          0.000 F          0.000 F-OVR 140 %
S          0          S          0          S-OVR 100 %
T          0          T          0          LIFE 0
G 0 17 25 27 40 51 53 63 66 72          90 94
M  5  9  41


```

HELP **AXIS-5** ----- **DISPLAY**

Fig. 16.4.

Note that the red LED's on the buttons indicate conditions that are also shown in the screen display (e.g. selected mode - MANUAL, AUTO, SINGLE or TEACH-IN).

When the Remote Panel is no longer required it is de-activated as follows:

1. Press the Manual button  to put the CNC into Manual mode

(either from the Remote Panel or from the CNC control panel).

2. Press the Menu button  of the CNC control panel.


The screen will display the Manual menu:

```
MANUAL  MAN.OPER.  
PM 99999          N  
JOG CONTINUE      REMOTE PANEL OFF  
MANUAL MENU:  
1 BLOCK SEARCH  
2 REFERENCE POINT SEARCH  
3 RESET AXIS  
6 REMOTE PANEL OFF  
7 DIAGNOSTIC  
8 HANDWHEEL
```

Fig. 16.5.

HELP -----

Note that entry 6 of the Manual menu now reads >REMOTE PANEL OFF<

3. Press button  of the CNC control panel.

The screen will return to the normal Manual display and the red LED's on the Remote Panel will go out. The Remote Panel is now turned off.

16.1 REMOTE PANEL DIAGNOSTICS

The Remote Panel is tested automatically during the Power-up Check that is performed at start-up or selected from the Diagnostic menu (see Section 13.2.). While the Power-up Check is in progress all the red LED's on the Remote Panel will be lit to test them.

The buttons of the Remote Panel can be tested with the Flat Panel test available through the Diagnostic menu as follows:

1. Obtain the Flat Panel test, as described in Section 14.3.1.1.
2. Press any button of the Remote Panel.

The Remote Panel will be added to the display of the Flat Panel tests:

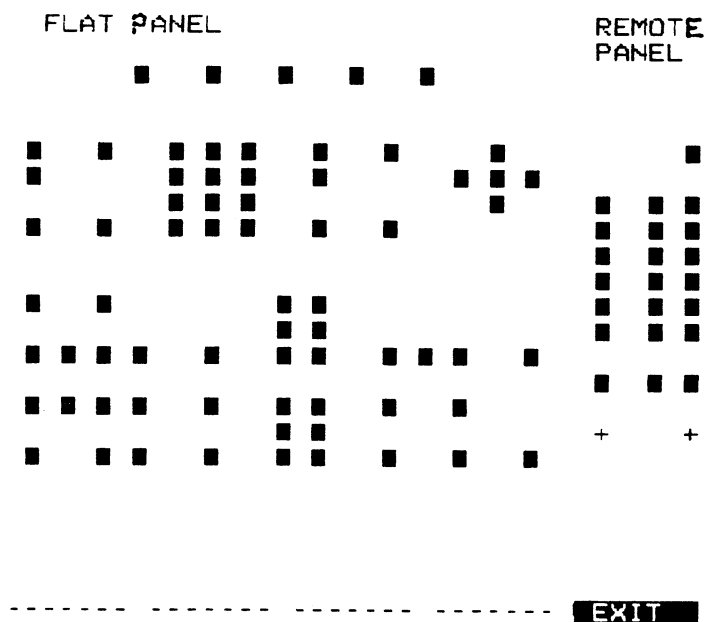


Fig. 16.1.-1

The buttons of the Remote Panel can then be tested in the same way as the buttons of the Flat Panel.

No other diagnostics are provided for the Remote Panel. A Remote Panel unit that is suspected of having faults that cannot be detected by the Power-up Check is best tested by replacement with a unit that is known to be functioning correctly.

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17. PROGRAM VERIFICATION.

All new programs should be thoroughly checked ('verified') before they are used on an actual machining operation.

This is done because:

- The program may contain errors which will prevent it from running (e.g. a word missing from a block, an illegal value in a word).
- The program may not be safe (e.g. may cause a collision between a tool and a workpiece clamp).
- The program may not produce the required sequence of machine movements (e.g. an omitted block, a wrong dimension).

Program verification on the CNC is assisted by eight special test facilities.

These test facilities enable part programs to be checked as they are run on the CNC. The eight test facilities can be regarded as divided into three groups:

- Testrun facilities that run the part program as if an actual machining operation is taking place, and which may allow machine movement and I/O
They are relegated to the Testrun menu. (See section 17.1).
- Test facilities that run the partprogram and produce from it an animated screen plot. (See section 17.2).
- Test facilities that runs the part program and produces from it a simulated animated-graphics screen display. (See section 17.3).



A part program can be run in a test mode in either Single or Auto mode; in Auto mode the part program runs continuously to the end, in Single mode the part program is executed a block at a time as the Start button is pressed.


Programs run in test mode are checked for all programming errors. When an error is trapped it is indicated in the display and via the >HELP< softkey an error explanation is given.

The menu to select one of the test programs is obtained as follows:

- (1) Power up the CNC, perform Reference Point Search, load and select the part program to be tested.

The part program number is shown on line 2 of the display.

- (2) Press either the Auto button  or the Single button 

- (3) Press the menu button 

The screen shows:

```
AUTO  
PM 9002 N 9002
```

SINGLE/AUTO MENU:

```
1 TESTRUN MENU  
3 CYCLE ENDCONTOUR 2,5D WIRE PLOT  
4 2D WIRE PLOT  
5 2,5D WIRE PLOT  
6 3D WIRE PLOT  
7 SIMULATION  
9 EXIT SUBMODE
```

HELP -----

Fig.17.-1

In the examples used in the program verification sections use is made of the following programs:

Sample program 1:

```
N99001 (PHILIPS SHIELD SYMBOL)  
N1 G98 X-80 Y-80 Z-5 I160 J220 K5  
N2 G99 X-75 Y-75 Z0 I150 J210 K5  
N3 T1 M67  
N4 G0 X-70 Y0 Z10 (THE FRAME)  
N5 G1 Z0 F500  
N6 Y120  
N7 X70  
N8 Y0  
N9 G2 X-70 Y0 R70  
N10 G1 Z10  
N11 G0 X-60 Y0 (THE CIRCLE)  
N12 G1 Z0  
N13 G2 I0 J0  
N14 G64 (THE WAVES)  
N15 G2 R29.83 I-36.345 J-18.173  
N16 G3 R29.83 I-12.115 J36.345  
N17 G2 R29.83 I12.115 J-18.173  
N18 G3 R29.83 I36.345 J36.345 J1=1  
N19 G2 R60 I0 J0 J1=2  
N20 G2 R29.83 I36.345 J27.259  
N21 G3 R29.83 I12.115 J-27.259  
N22 G2 R29.83 I-12.115 J27.259  
N23 G3 R29.83 I-36.345 J-27.259 J1=1  
N24 G3 R60 I0 J0 J1=2  
N25 G2 R29.83 I-36.345 J-36.345  
N26 G3 R29.83 I-12.115 J18.173  
N27 G2 R29.83 I12.115 J-36.345  
N28 G3 X60 Y0 I36.345 J18.173  
N29 G0 Z10  
N30 G63  
N31 G92 X1  
N32 G64 X-50 Y29 (THE BIG CROSS)  
N33 G1 Z0  
N34 B1=10.553  
N35 X-32 Y47 B1=79.447
```


N36 B1=100.553
 N37 X-14 Y29 B1=-10.553
 N38 B1=-169.447
 N39 X-32 Y11 B1=-100.553
 N40 B1=100.553
 N41 X-50 Y29 B1=169.447
 N42 G0 Z10
 N43 X-20 Y56 (THE SMALL CROSS)
 N44 G1 Z0
 N45 B1=-78.52
 N46 X-9 Y45 B1=-11.48
 N47 B1=-168.52
 N48 X-20 Y34 B1=-101.48
 N49 B1=101.48
 N50 X-31 Y45 B1=168.52
 N51 B1=11.48
 N52 X-20 Y56 B1=78.52
 N53 G63
 N54 G0 Z10
 N55 G92 X-2 Y1
 N56 G73 X-1 Y-1
 N57 G14 N1=32 N2=54
 N58 G73 X1 Y1
 N59 G92 X1 Y-1
 N60 X-55 Y80 (THE LETTER P)
 N61 G1 Z0
 N62 Y105
 N63 X-50
 N64 G2 X-50 Y89 R8
 N65 G1 X-55
 N66 Z10
 N67 G0 X-35 Y80 (THE LETTER H)
 N68 G1 Z0
 N69 Y105
 N70 G0 Z10
 N71 X-23 Y80
 N72 G1 Z0
 N73 Y105
 N74 G0 Z10
 N75 X-34.5 Y92.5
 N76 G1 Z0
 N77 X-23
 N78 G0 Z10
 N79 X-14 Y80 (THE LETTER I)
 N80 G1 Z0
 N81 Y105
 N82 G0 Z10
 N83 X-2 (THE LETTER L)
 N84 G1 Z0
 N85 Y80
 N86 X10
 N87 G0 Z10
 N88 X15 Y80 (THE LETTER I)
 N89 G1 Z0
 N90 Y105
 N91 G0 Z10
 N92 X23 Y80 (THE LETTER P)
 N93 G1 Z0
 N94 Y105
 N95 X28

```
N96 G2 X28 Y89 R8
N97 G1 X23
N98 G0 Z10
N99 X44 Y82 (THE LETTER S)
N100 G1 Z0
N101 G64
N102 G1 R1=0
N103 G3 R6 I50 J86.25 R1=0
N104 G1 R1=0
N105 G2 R6 I50 J98.75 R1=0
N106 G1 X56 Y103
N107 G63
N108 G0 Z10
N109 M30
```

Sample program 2:

```
N9002
N1 G98 X-250 Y-175 Z10 I550 J400 K-40
N2 G99 X-200 Y-125 Z0 I400 J320 K-20
N3 G0 X250 Y30 Z10 T1 M6
N4 G1 Z-25 F1000
N5 G43 X150 Y30 Z-25
N6 G41
N7 G1 B2=0 L2=150
N9 B2=330 L2=200
N10 B2=210 L2=200
N11 B2=180 L2=150
N12 B2=150 L2=100
N13 B2=135 L2=150
N14 B2=120 L2=100
N15 B2=90 L2=150
N16 B2=60 L2=100
N17 B2=45 L2=150
N18 B2=30 L2=100
N19 B2=0 L2=150
N20 G40
N21 G0 X250 Y-100 Z100 M30
```

17.1. TESTRUN MENU

To select the testrun menu press button

1

The display shows:

```
AUTO
PM 9002 N 9002
```

TESTRUN MENU:

```
1 TESTRUN: MOTION, IO
2 TESTRUN: MOTION, NO IO
4 TESTRUN: NO MOTION, NO IO
```

HELP

Fig.17.1.-1.

The test facilities in this section can allow the machine tool to move and I/O to occur, as below:

TESTRUN 1 - Machine tool movement and I/O.



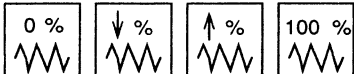
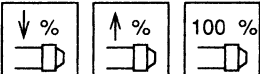
TESTRUN 2 - Machine tool movement, no I/O.

TESTRUN 4 - No machine tool movement, no I/O.

(TESTRUN 3 was present in older versions of the CNC, however became obsolete after adding the graphic test facilities. To maintain compatibility it simply has been deleted from the testrun menu).

The test facility TESTRUN-4 does not allow any machine tool movement or I/O, but is included in this section as it is closely related to TESTRUN-1 and TESTRUN-2. TESTRUN-4 is used to detect basic programming errors before TESTRUN-1 or TESTRUN-2 are used to check that the machine tool movement is safe and correct. As these test facilities allow movement of the machine tool it is strongly recommended that the following sections are carefully read and understood before any attempt is made to run a part program under them.

While a part program is being run with a testrun only the following buttons will operate:

- Feed Hold button 
- Feed/Speed Hold button 
- Feed override buttons 
- Spindle Speed override buttons 

If a command for a manual tool-change occurs during the running of a part program the CNC will halt and the message


>INTERVENTION T< appears in the display. The part program can be continued by pressing the Start

button. 

17.1.1.1. Testrun-1

This test program is obtained and started as follows:

- (1) Enter the test program menu, as described in section 17.1 Note that Single or Auto mode must be chosen at this point.

- (2) Press button 

The screen will show the display:

```

AUTO          TESTRUN-1
PM  9002  N   9002

COMMAND      ACTUAL      DIST TO GO
X            X      0.000 X      0
Y            Y      0.000 Y      0
Z            Z      0.000 Z      0
A            A      0.000 A      0
B            B      0.000 B      0


F      0.000 F      0.000 F-OVR 100 %
S            S            S-OVR 100 %
T            T            LIFE    0
G 0 17 25 27 40 51 53 63 70 72    90 94
M  5  9  10      22 41


■N9002
N1 G98 X-250 Y-175 Z10 I550 J400 K-40
N2 G99 X-200 Y-125 Z0 I400 J320 K-20
N3 G0 X250 Y30 Z10 T1 M6

HELP ----- DISPLAY
  
```

Fig. 17.1.1.-1.

Note that the mode (Single or Auto) and the test program name are shown in line 1 of the display, that the number of the part program being checked (PM 99999 in the above example) is shown in line 2 and that the first four lines of the part program (program number, blocks N1 to N3) and a cursor are shown in lines 19 to 22. The rest of the screen shows the normal display of axis data, tool data, commands and functions.

A listing of the part program being checked can be obtained by pressing softkey  below

>DISPLAY< and softkey  below >PM-MON<.

The screen will show, for example, the display:

```

AUTO          TESTRUN-1
PM  9002  N   9002

                1           2           3
            12345678901234567890123456789012

IN  1  .....
IN  2  .....

OUT 1  .....1.....
OUT 2  ...1.....


AREA  .....



█N9002
N1 G98 X-250 Y-175 Z10 I550 J400 K-40
N2 G99 X-200 Y-125 Z0 I400 J320 K-20
N3 G0 X250 Y30 Z10 T1 M6

----- IN-OUT ----- RETURN

```

Fig. 17.1.1.-2.

The test program is re-entered by pressing softkey below 

>RETURN<, pressing softkey below  >DISPLAY< and pressing softkey  below >ACTUAL<.

In the same manner the other programmer's/operator's assistance facilities can be called as described in section 2.3.7.

(3) The part program is run with TESTRUN-1 by pressing the Start button 

The part program will be run under the supervision of TESTRUN-1. During running the machine tool can move, outputs can be made and inputs will be acted upon by the CNC. All axis movement is at the test traverse rates set in the Machine Constants.

The part program blocks shown in the lower part of the display will 'scroll' down as the program runs and the cursor will indicate the block currently being executed.

CAUTION! During TESTRUN-1 the machine tool can move.
 The extremes of movement of the three axes are protected by limit switches, but the machine tool table may be able to make contact with the spindle (or tool, if one is mounted). Ensure that this (or any other collisions) will not happen before running a new part program with TESTRUN-1. The graphics test programs described in section 17.2 or 17.3 can be used to visualise the machine tool movement in order to detect and prevent possible collisions.

If a programming error is detected TESTRUN-1 will halt the running of the part program and an error message will be shown in the display, for example:

```

AUTO          TESTRUN-4
PM  9002  N   4
ERR P 04

COMMAND      ACTUAL      DIST TO GO
X            X  250.000 X   0
Y            Y   30.000 Y   0
Z            Z   10.000 Z   0
A            A   0.000 A   0
B            B   0.000 B   0

F  0.000 F   0.000 F-OVR 100 %
S  0      S   0      S-OVR 100 %
T  1      T   1      LIFE   0
G 0 17 25 27 40 51 53 63 70 72 90 94
M  5  9  10      22 41



N2 G99 X-200 Y-125 Z0 I400 J320 K-20
N3 G0 X250 Y30 Z10 T1 M6
N4 G1 Z-25
N5 G43 X150 Y30 Z-25

HELP ----- DISPLAY

```

Fig. 17.1.1.-3

When a program is halted by an error it cannot be re-started.



It must be aborted by pressing the Manual button  then the Clear Control button .

The part program is then modified to remove the error (see Section 4.2).

The corrected part program can then be run with TESTRUN-1 again.

The part program can be either re-run from the beginning or run on from the block at which the error was detected. This is done by selecting the appropriate block with Block Search (see Section 7.2) before selecting Auto or Single mode.

When the part program has run successfully to the end TESTRUN-1 can be terminated by pressing the

Menu button  to obtain the test program menu, then pressing button  to select >EXIT

SUBMODE< (or by selecting another test program, if required).

The CNC will then return to Manual mode and the line >TESTRUN-1> will disappear from the display.

17.1..2. Testrun-2

This test program is obtained and run in the same way as TESTRUN-1, except that button 2 is used to select it from the test program menu.

TESTRUN-2 is similar to TESTRUN-1 except in that there are no digital inputs or outputs (via the I/O Modules) when it is run. This is useful because:

- part programs can be checked for movement of the machine tool without unnecessary switching of the coolant pumps, etc.
- part programs which require an input (or outputs) in order to continue running to the end can be tested without any actual inputs occurring.

Movement of the machine tool will occur and care must be taken to prevent any possible collisions (see Section 17.1.1).

17.1.3. Testrun-4

This test program is obtained and run in the same way as TESTRUN-1, except that button 4 is used to select it from the test program menu.

TESTRUN-4 is similar to TESTRUN-1 except in that there is no movement of the machine tool (i.e. no output from the Drive Modules) and no digital inputs or outputs (via the I/O Modules) when it is run. This allows it to be used to detect programming errors before TESTRUN-1, TESTRUN-2 or the graphic test programs (Section 17.2 or 17.3) are used to check the machine tool movement.

17.2 TEST FACILITIES WITH GRAPHIC PLOTS.

The test facilities in this section run a part program, check it and produce from it animated-graphics displays. These animated graphics displays enable the programmed machine tool movements to be visualised without allowing any actual movement of the machine tool. This enables part programs to be checked for safety and correct movement before using the test programs that allow movement of the machine tool (as described in Section 17.1.).

The graphic plot facilities are of four different types:

- 3.- Cycle End-contour, 2.5-D Wire Plot.
- 4.- 2-D Wire Plot.
- 5.- 2.5-D Wire Plot.
- 6.- 3-D Wire Plot.

17.2.1. 3.- Cycle Endcontour, 2.5-D Wire Plot.

This test facility is obtained and started as follows:

- (1) Enter the test facility menu, as described in section 17.
Note that Single or Auto mode must be selected at this point.

- (2) Press button



The screen will show the display

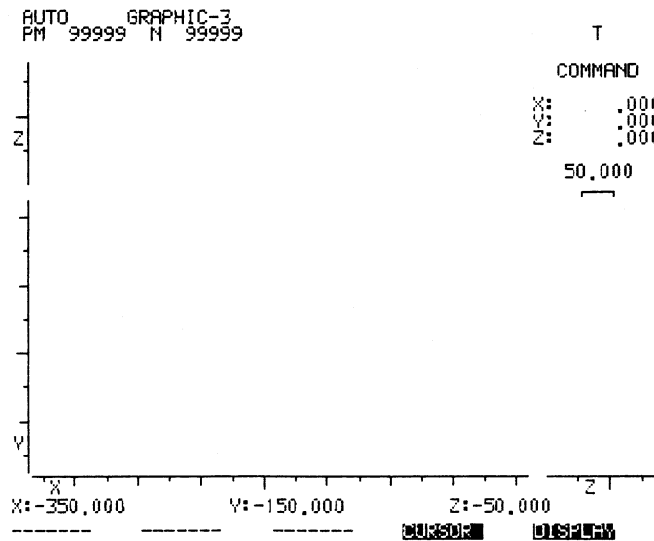


Fig. 17.2.1.-1

Note that the mode (Single or Auto) and the test program name are shown in line 1 of the display, and that the number of the part program being checked is shown in line 2.

- (3) Press start button



The display of this test is equal to the display of test 5, however only the endcontour of the fixed cycles is displayed. See section 17.2.4. for the softkey functions (note that the settings cannot be changed in this test).

17.2.2. 4.- 2-D Wire Plot.

This test facility is obtained and started as follows:

- (1) Enter the test facility menu, as described in section 17.
Note that Single or Auto mode must be selected at this point.

- (2) Press button 4

The screen will show the display:

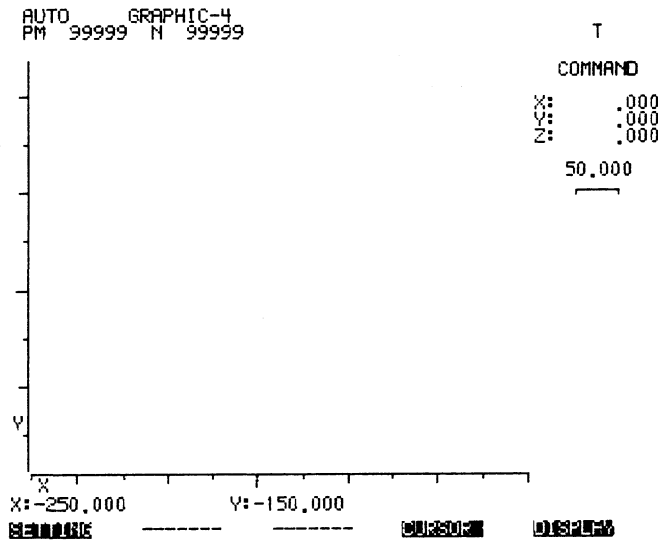


Fig.17.2.2.-1.

Note that the mode (Single or Auto) and the test program name are shown in line 1 of the display, and that the number of the part program being checked is shown in line 2.

- (3) Press the Start button ▶▶▶

This test is equal to the 3.5-D Wire Plot, but now only the main plain is shown enlarged. See section 17.2.4. for detailed information on programming and softkeys.

After the test has been completed the display shows e.g.:

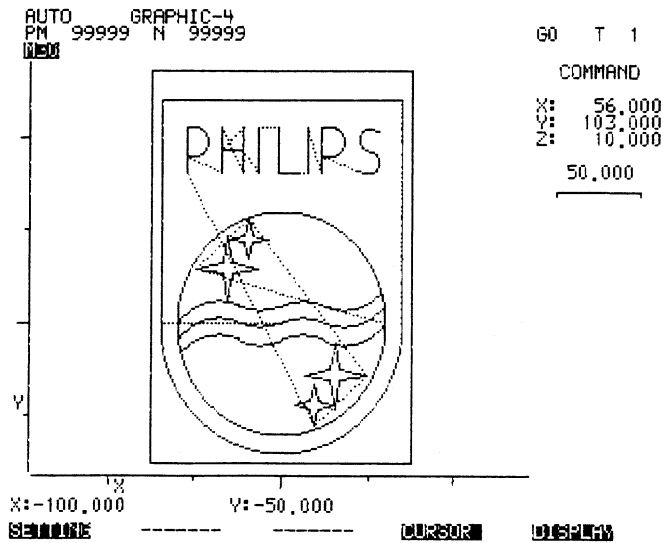


Fig.17.2.2.-2.

17.2.4. 5.- 2.5-D Wire Plot.

This test program is obtained and started as follows:

- (1) Enter the test program menu, as described in Section 17.

Note that Single or Auto mode must be chosen at this point.

- (2) Press button 5

The screen will show the display:

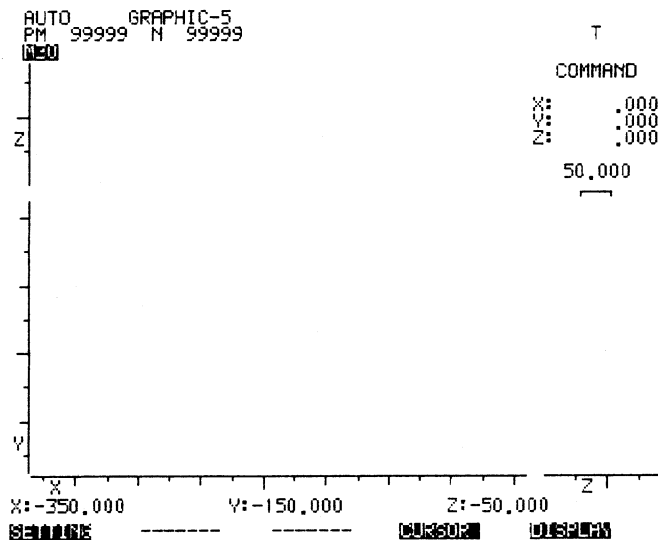


Fig. 17.2.4.-1

Note that the mode (Single or Auto) and the test program name are shown in line 1 of the display, and that the number of the part program being checked is shown in line 2.

A listing of the part program being checked can be obtained by pressing softkey F5 below

>DISPLAY< and softkey F2 below >PM-MON<

The screen will show, for example, the display:

```


AUTO      GRAPHIC-5
PM 99999  N 99999

N99999 G54 <PHILIPS SHIELD SYMBOL>
N1 G98 X-80 Y-80 Z-5 I160 J220 K5
N2 G99 X-75 Y-75 Z0 I150 J210 K5
N3 T1 M6
N4 G0 X-70 Y0 Z10 <THE FRAME>
N5 G1 Z0 F500
N6 Y120
N7 X70
N8 Y0
N9 G2 X-70 Y0 R70
N10 G1 Z10
N11 G0 X-60 Y0 <THE CIRCLE>
N12 G1 Z0
N13 G2 I0 J0
N14 G64 <THE WAVES>
N15 G2 R29.83 I-36.345 J-18.173
N16 G3 R29.83 I-12.115 J36.345

PROGRAM ----- RETURN
    
```

Fig. 17.2.4.-2.

The test program is re-entered by pressing softkey **F5** below >RETURN<

(3) The part program is run with test-5 by pressing the Start button 

The part program will be run under the supervision of test facility 5 and analysed to produce an animated-graphics display, for example:

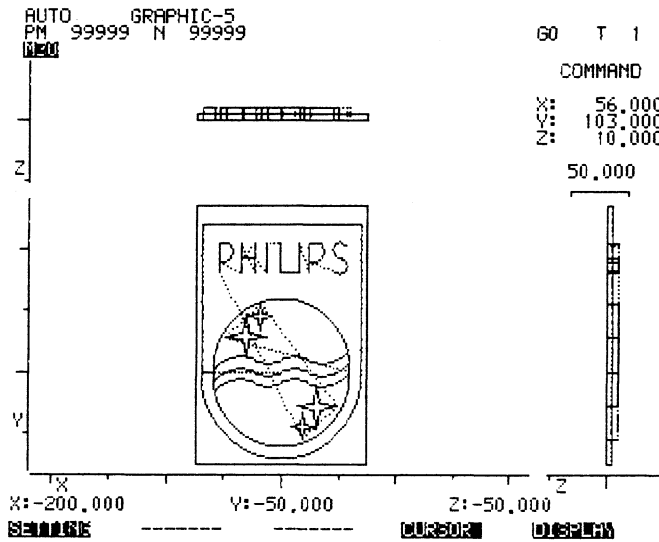
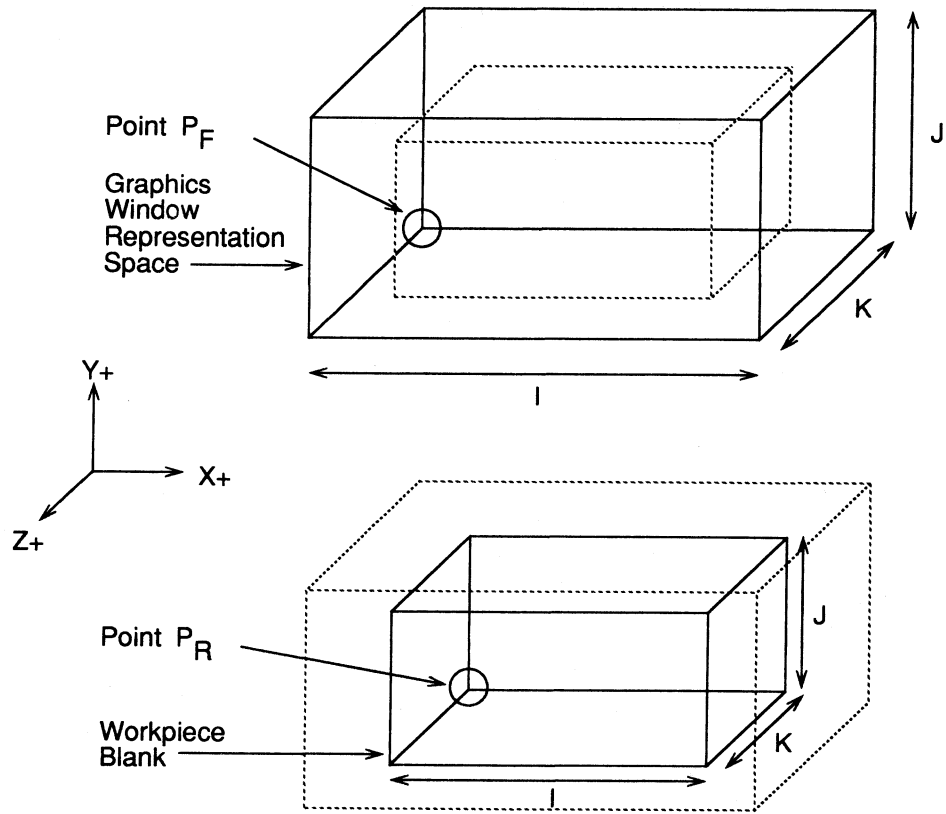


Fig. 17.2.4.-3.

The programmed path of the tool-tip is shown in the three views. These can be imagined as views through top, front and side 'graphic windows'. The three graphic windows are at right-angles to each other in a box configuration called a 'representation space' (see illustration opposite). The size of the representation space is defined by the three lengths I, J and K (parallel to the X, Y and Z axes respectively). The position of the representation space is defined by the X, Y and Z offsets of the point PF from the workpiece datum, or program zero point (point PF can be imagined as the lower left rear corner of the representation space, when viewed from in front of the machine tool table). The size and position of the representation space should be contained in the Graphic Parameters list. They can be either entered directly into the Graphics Parameters or given within the part program by a preparatory block containing the G98 function (see Section 17.4.3). The representation space will normally be defined to be larger than, and to contain, the workpiece.



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Fig. 17.2.4-4.

The size and position of the workpiece blank is defined in a similar way to the representation space. The point P_R is defined as an XYZ offset from the program zero point and IJK are defined as lengths parallel to the X, Y and Z axes (see illustration on previous page). The size and position of the workpiece blank must also be contained in the Graphics Parameters, either by direct entry or by a preparatory block containing the G99 function (see Section 17.4.3). The G99 function can be used to define irregular shaped workpiece blanks by regarding them as composed of several (up to ten) smaller workpiece blanks, each with a G99 function block. The G99 function is also used to define the position of clamps.

If testplot 5 detects a programming error the running of the part program will be halted and an error message will be shown in the display, for example:

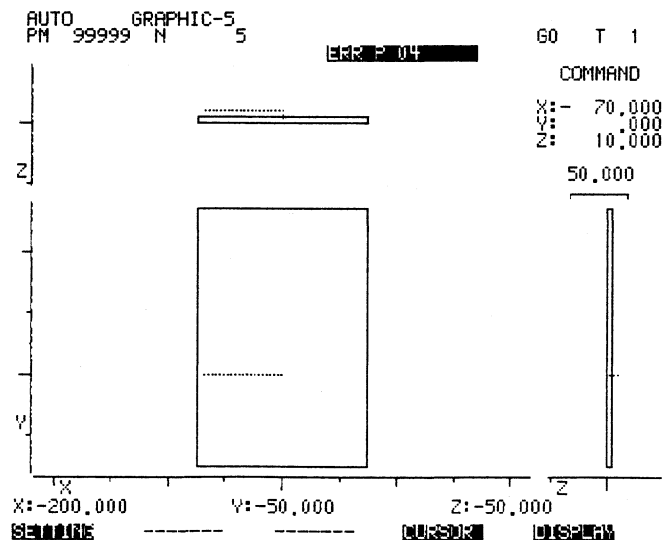




Fig. 17.2.4-5.

When a program is halted by a detected error it cannot be re-started and must be aborted by pressing the Manual button  then the Clear Control button .

The part program is then modified to remove the error (see Section 4.2).

The corrected part program can then be run with TEST-PLOT 5 again. The part program can be either re-run from the beginning or run on from the block at which the error was detected. This is done by selecting the appropriate block with Block Search (see Section 7.2.) before selecting Auto or Single mode, or by use of the Graphics Parameters (see Section 17.4.2).

When a part program will run without programming errors the animated-graphics display can be used to check the correctness of the programmed sequence of machine tool movements. This process is assisted by the functions allocated to the soft keys, as described in the following sections. After the part program has successfully run to its end the screen will show the display:

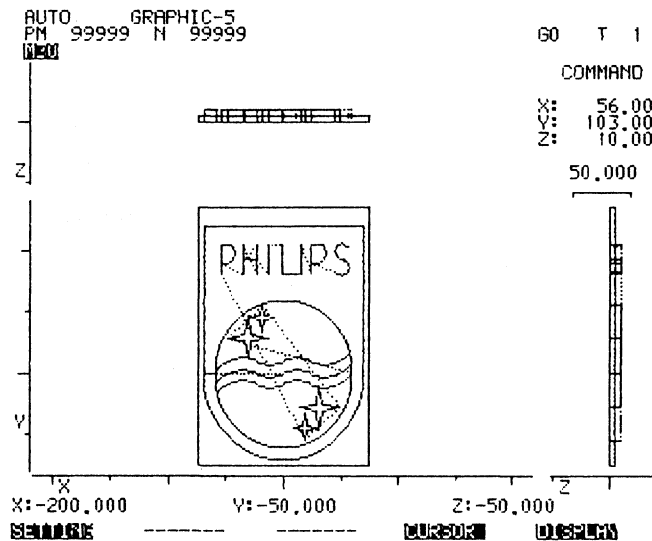




Fig. 17.2.4.-6.

The test program TEST PLOT 5 can be terminated by pressing the Menu button  to obtain the

test program menu, then pressing button  to select >EXIT SUBMODE< (or by selecting another test program, if required). The CNC will then return to Auto or Single mode and the line >GRAPHIC-5< will disappear from the display.

17.2.4.1. Printer

If a printer or plotter is connected to the CNC (via the centronics port on the Graphics Module) a hard-copy of the screen display can be obtained by pressing softkey **F2** below >PRINT<.

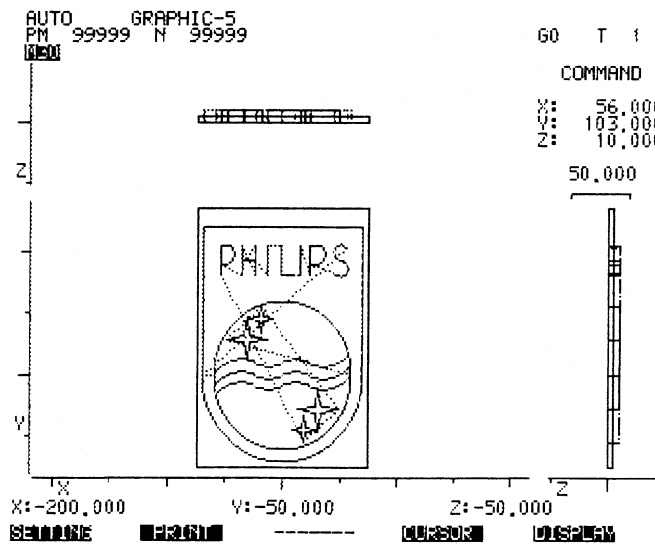


Fig. 17.2.4.1.-1.

Remember that the hard-copy can only be printed in black and white, overlapping colours are printed as black.

17.2.4.2.Settings

The wire plot can be run with a combination out of four settings.

After depressing softkey **F1** >SETTINGS<, the display shows:

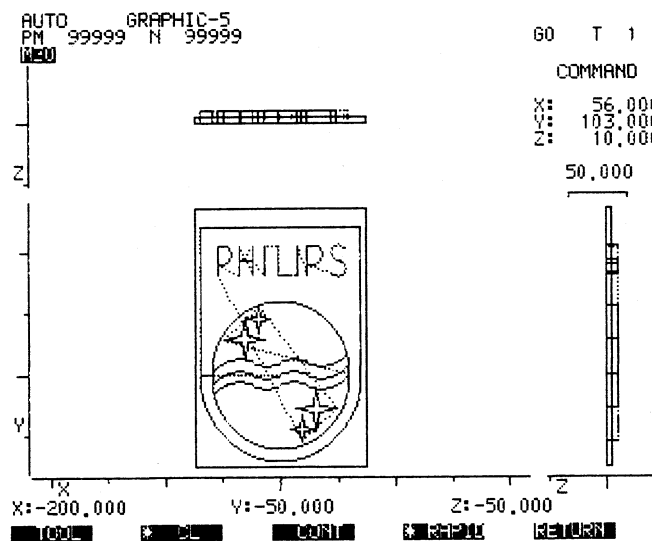


Fig. 17.2.4.2.-1.

This is the default setting:

- Tool display 'off'
- Cutter location 'on'
- Contour display 'off'
- Rapid motion display 'on'

Note that the 'on' function is indicated by the preceding asterisk.
 In the examples following sample part program 2 is used.
 The display shows after the default plot-run:

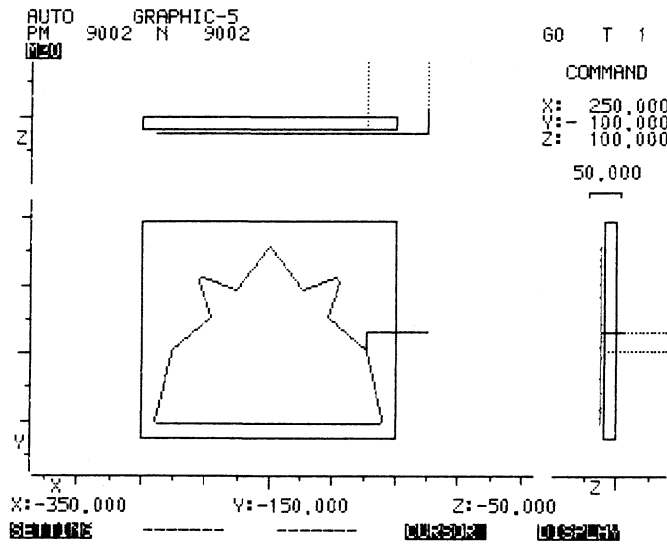


Fig. 17.2.4.2.-2.

Switch on the tool display by depressing softkey **F1** >TOOL<.

The display shows now after the plot-run:

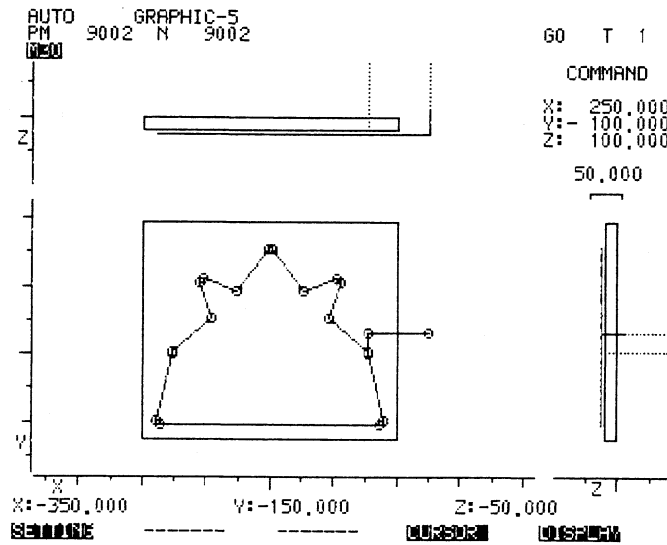


Fig. 17.2.4.2.-3.

Note that the tool diameter is shown on each location where the tool changes direction.

Switch off the cutter location display by depressing softkey **F2** >CL<

The display shows now after the plot-run:

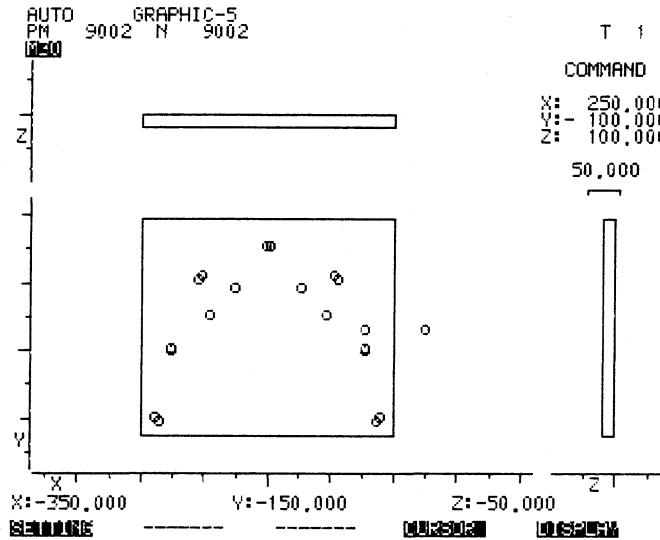


Fig. 17.2.4.2.-4.

Note that the tool centre path is not displayed anymore.

This becomes even more meaningful when the contour display is switched on by depressing softkey

F3 >CONT<.

The display shows now after the plot-run:

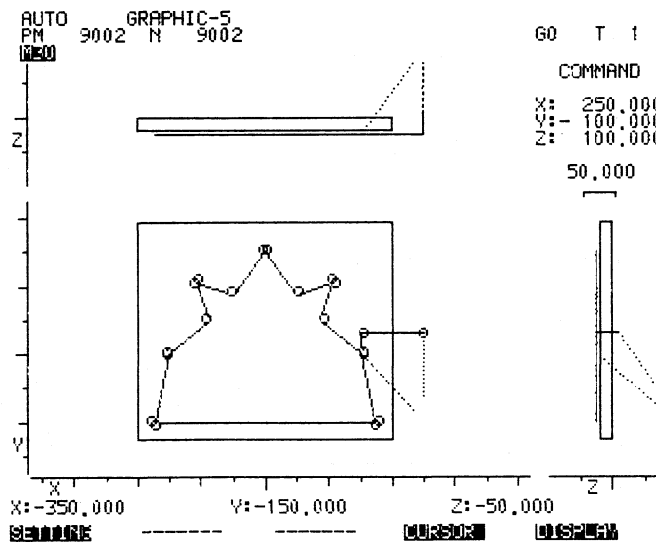


Fig. 17.2.4.2.-5.

The workpiece contour is displayed now and from the tool display can be seen that it is an outside contour.

Of course the tool path can be switched on again (depress 3 **F2** >CL<).

Now the display shows after the plot-run:

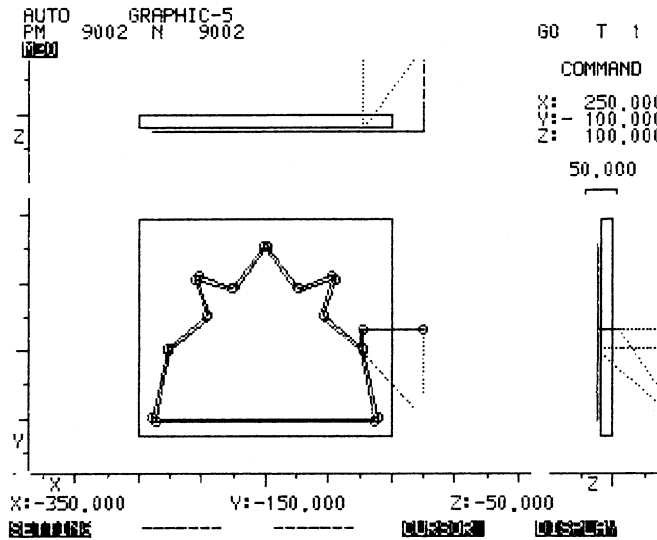


Fig. 17.2.4.2.-6.

Note that the rapid (G0) motion is displayed as a dotted line.

The rapid movements can be made invisible by depressing **F4** >RAPID<.

The display shows after the plot-run:

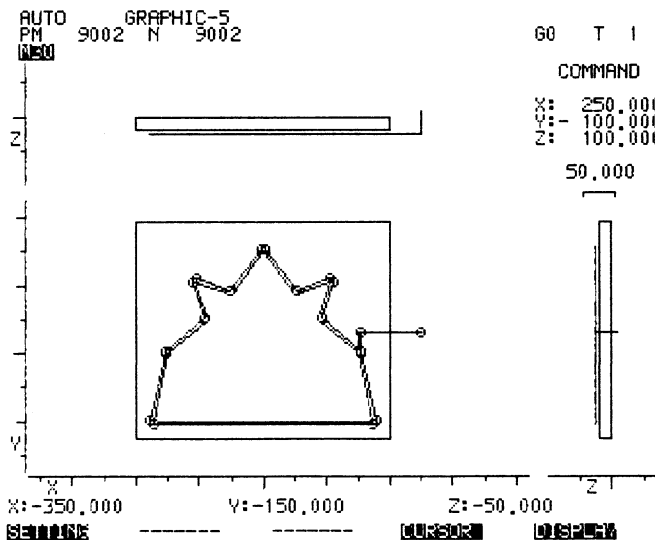


Fig. 17.2.4.2.-7.

17.2.4.3. Cross-hairs.

In wire plots -3, -4 and -5 and also in the graphic simulation a 'cross-hairs' cursor can be brought onto the screen under the following circumstances:

- After successful completion of a part program.
- After each successful completion of a block in single mode.
- After despressing feed/speed hold or feed hold.

Press softkey **F4** >CURSOR<.

The softkey labels change to:

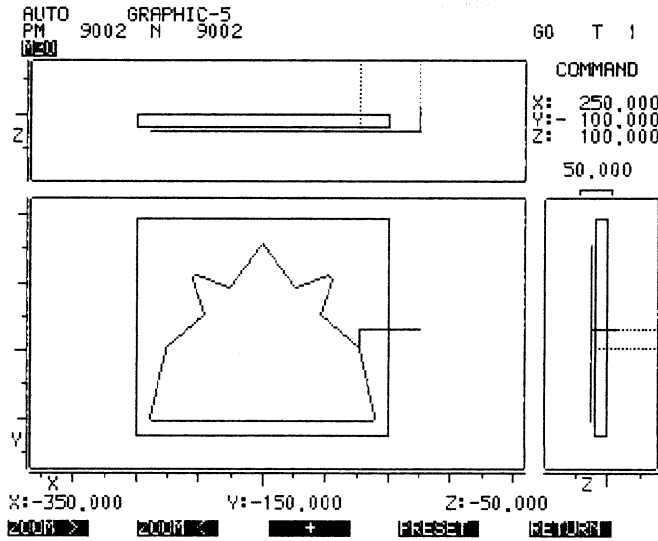


Fig. 17.2.4.3-1.

Press softkey **F3** ><.

The screen shows now e.g.:

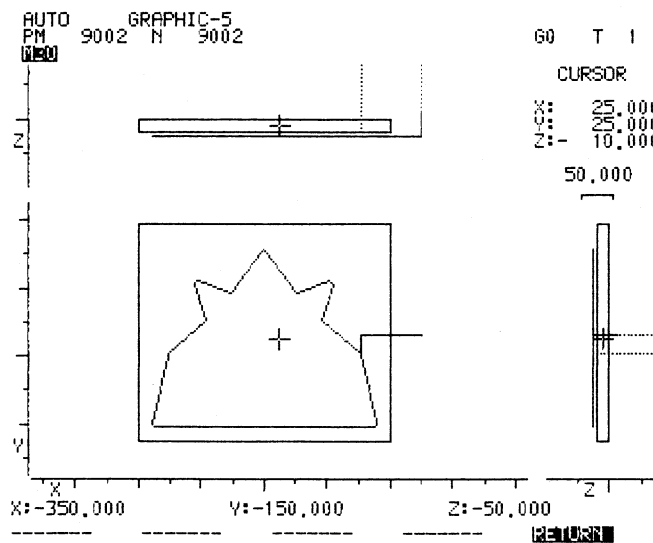
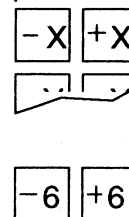


Fig. 17.2.4.3-2.

Note that the cross-hairs are now superimposed on the display, that the table at the top right of the display shows the absolute axis values of the cross-hairs position and that the labels of the softkey are changed.

The cross-hairs are used to establish the exact position of any points on the tool-path or workpiece.

The 'cross-hairs' cursor is moved to the desired point by using the jog- buttons



The position of the cross-hairs can be read from the table of the axis values.

The 'zoom' facility of the graphics cursor (see Section 17.2.4.4.) can be used to enlarge parts of the screen display. This enables the cross-hairs to be placed with greater accuracy.

The cross-hairs are terminated by pressing softkey below **F5** >RETURN< or by pressing

Start 

The cross-hairs will disappear and the normal softkey labels will reappear.

17.2.4.4. Graphics Cursor.

In wire plots -3, -4, -5 and 6 and also in the graphics simulation a 'Graphics Cursor' can be brought onto the screen under the following circumstances:

- After successful completion of a part program.
- After each successful completion of a block in Single mode.
- After depressing feed/speed hold or feed hold.

Press softkey **F3** >CURSOR<.

The screen shows: e.g.:

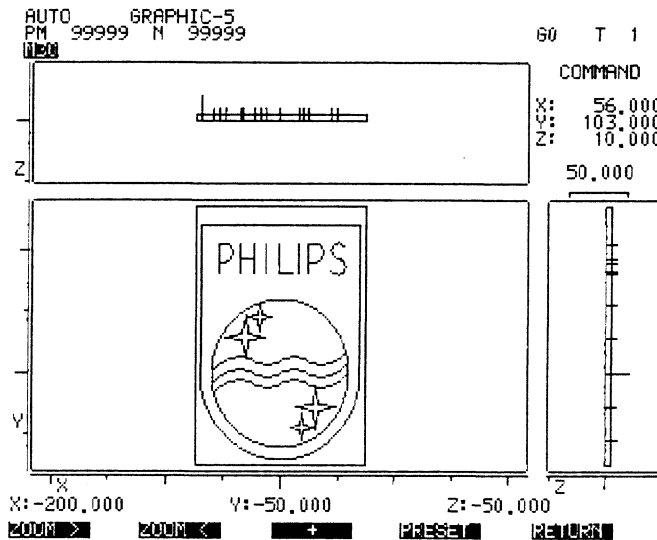


Fig. 17.2.4.4.-1

Note that the graphics cursor is now superimposed on the display and that the softkey labels have changed.

The Graphics Cursor can be regarded as a 'box' (in a similar way to the representation space of the graphics windows or the workpiece blank. See section 17.2.4.).

The cursor can be used to enlarge parts of the tool-path or workpiece in the display and also to assist in re-defining the graphics window manually.

The Graphics Cursor is moved by using the jog buttons.
 For example, in the display below the Graphics Cursor has been moved in the +X, +Y and +Z directions:

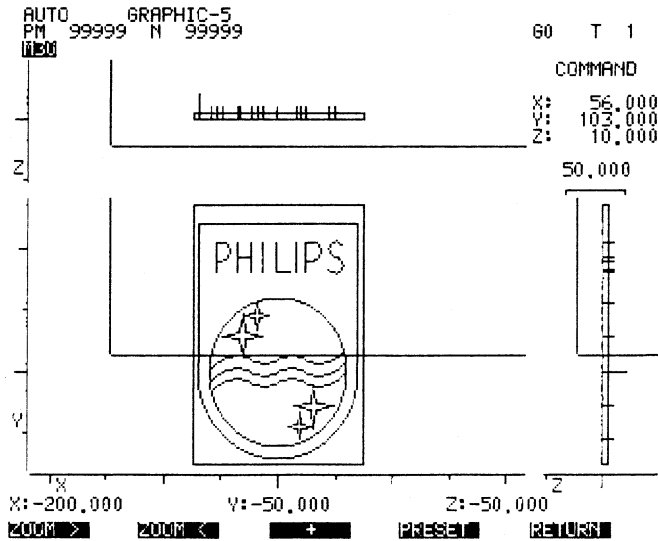


Fig. 17.2.4.4.-2.

The Graphics Cursor is made smaller by using softkey **F2** >ZOOM<<, for example:>

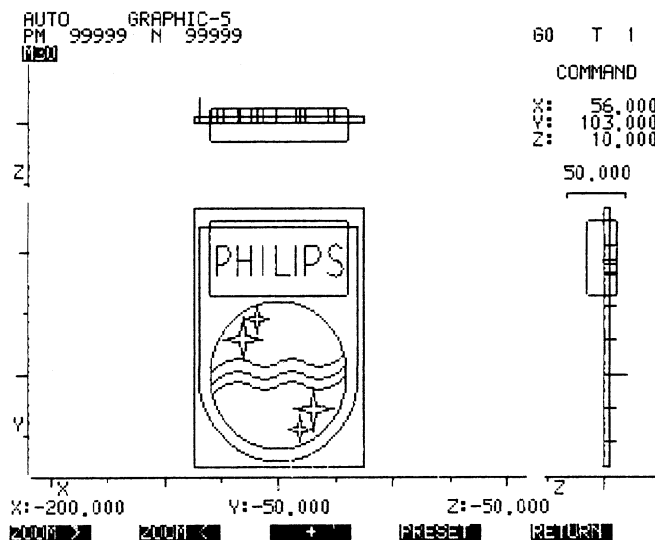



Fig. 17.2.4.4.-3.

It is made larger again by pressing softkey **F1** >ZOOM><.

Note that the Graphics Cursor cannot be made larger than the graphics window representation space. If an attempt is made to enlarge the Graphics Cursor beyond the graphics window, the Graphics Cursor flashes.

If a part of the display requires enlargement it is first framed with the Graphics Cursor (using the jog buttons and the softkey F1 and F2; an example is given below:

Depress the Start button .

The wire-plot is now executed with the new defined display window. The dimensional information is stored under N1 (actual window) in the graphic parameters.

After completion of the wire plot the screen shows:

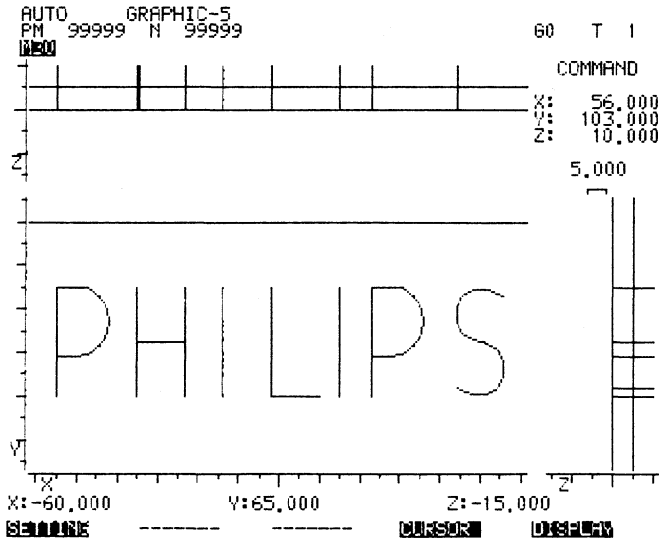


Fig. 17.2.4.4.-4.

The section of the screen display which was framed by the Graphics Cursor is now enlarged to the size of the graphics window.

Note that the Graphics Cursor *cannot* be used to *reduce* the size of the screen display, only to enlarge it.

The original graphics window is restored by pressing softkey **F4** >PRESET<.


If no initial size is set for the graphic window representation space in the Graphics Parameters, or in a G98 block, the CNC will adopt the largest possible values (i.e. the representation space will be bounded by the software limit switches). In this case the graphics cursor can be used to quickly find a suitable smaller representation space by trial and error. After the graphics cursor values have stored they can be copied from block N1 of the Parameter List to the preparatory G98 function block of the part program.

The graphics cursor is terminated by pressing softkey below **F5** >RETURN<. The graphics cursor will disappear and the normal wire-plot softkey labels will reappear.

17.2.5. 6.-3-D Wire Plot.

This test program is obtained in the same way as Wire plot-5 (see Section 17.2.4.), except that button is

6 used to select it from the test program menu.

After the Start button  has been pressed the part program will be run under the supervision of wire plot 6 and converted to produce an animated-graphics display, for example:

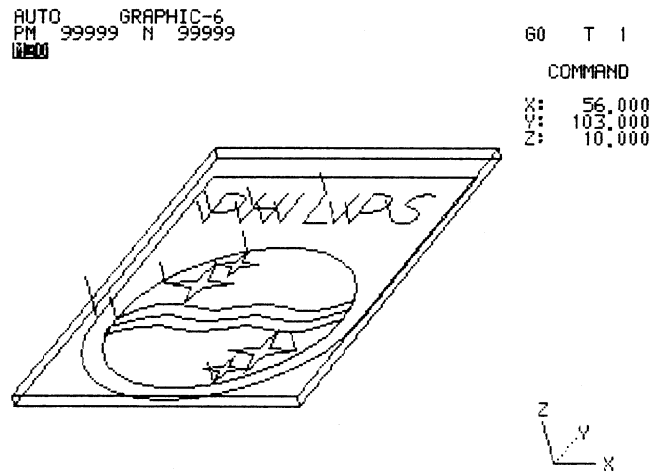


Fig. 17.2.5.-1.

SETTING **---** **ROTATE** **CURSOR** **DISPLAY**

The programmed path of the tool-tip is shown in a single three-dimensional display. This display is an 'isometric projection' not a perspective drawing (i.e. there is no diminuation due to the distance from the observer).

The size of the display in wire plot 6 is set by the size of the graphics windows and the viewpoint by the addresses B and B1 (these are described in block NO of the Graphics Parameters list, see Section 17.4). Address B defines the rotation of the workpiece about the X-axis in relation to the viewpoint (in degrees, positive clockwise seen from the left of the machine tool table), address B1 defines the rotation of the workpiece about the Y-axis (in degrees, positive anticlockwise seen from above).

If wire plot 6 detects a programming error the program is halted and an error message is shown in the display. In this case the procedure is the same as that for wire plot 5 (see Section 17.2.4.)

Wire plot 6 is used to check the movements of the machine tool for errors which are difficult to visualise with the three-view graphics of wire plot 5 or graphics simulation.

Wire plot 6 is terminated by pressing the Menu button  to obtain the test program menu, then

pressing button to select **9** >EXIT SUBMODE<.

The CNC will then return to Auto or single mode and the line >GRAPHIC-6< will disappear from the display.

The setting and cursor softkey facilities are equal to the ones described in section 17.2.4.1.-4.

It is possible to rotate the image by depressing softkey **F3** >ROTATE<

The rotation is done by depressing the jog buttons.

The axial cross indicates the position of the rotated image:

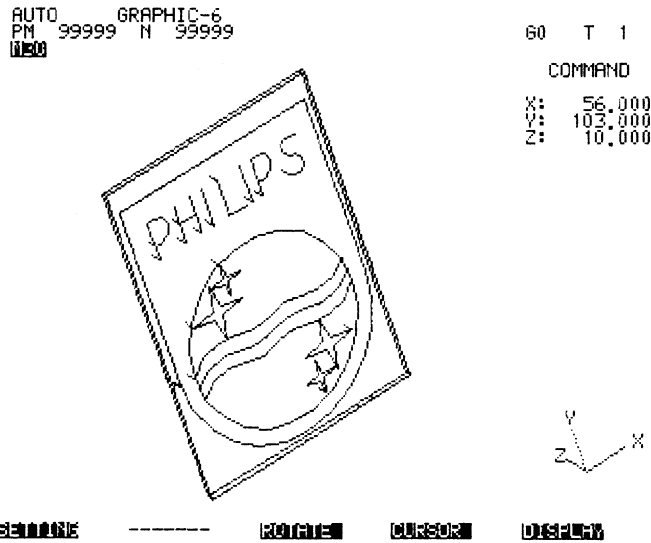


Fig. 17.2.5.-2.

It is possible to restore the original position by depressing softkey **F4** >PRESET<.

17.3. 7- GRAPHIC SIMULATION

This test facility is obtained by pressing button **7** in the Single/Auto menu.

After the Start button has been pressed the part program will be run under the supervision of graphic simulation and converted to produce an animated-graphics display, for example:

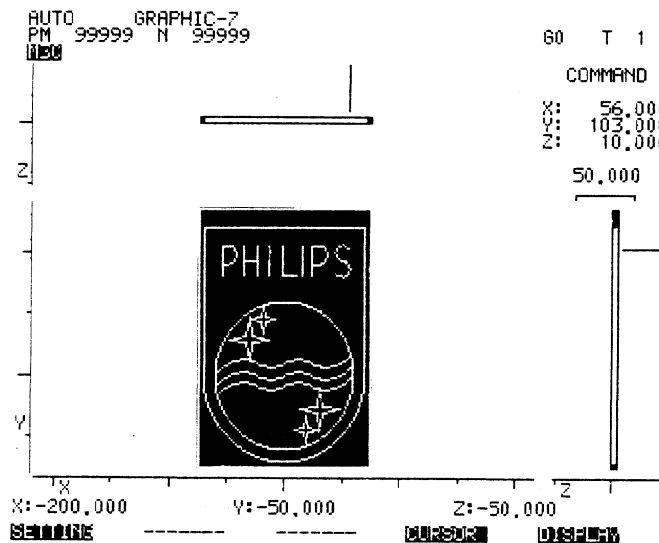


Fig. 17.3.-1.



The programmed movements of the tool-tip are shown in the three views, in a similar way to wire plot 5. Unlike wire plot 5 however, graphic simulation shows the workpiece blank as a solid (not a 'wire' outline) and shows the removal of material from it as the part is run.

The characteristics of the three-view display are set by the Graphics Parameters, or the G98 and G99 functions, exactly as for wire plot 5. (see Section 17.4.).

Remember that the feed override buttons are active during Graphics Simulation.

If graphics simulation detects a programming error the program is halted and an error message is shown in the display. In this case the procedure is the same as that for wire plot 5. (see Section 17.2.4.-5).

Graphics simulation is used as an animated-graphics simulation of the actual milling operation. By showing graphic representations of the tool and workpiece, not plots of the tool-tip's path, it allows the part program to be checked for safety and efficient machining.

Graphics simulations is terminated by pressing the Menu button  to obtain the test program menu, then pressing button  to select >EXIT SUBMODE<.

The CNC will then return to Auto or Single mode and the line >GRAPHIC-7< will disappear from the display.

17.3.1. Settings


Two settings are possible in graphics simulation:

- Tool display ON/OFF.
- Collision detection ON/OFF.

To change the settings depress feed/speed hold  or feed hold 

- Depress softkey  >SETTING<.

Toggle the setting-functions be depressing the relevant softkey (F1 or F2). Note that the asterisk indicates the 'ON' function.

After depressing Start  again the simulation continues with the new settings.

If for example in blocknr. 4 of sample program 2 instead of G1 a G0 is programmed and the collision detection is switched on, the display shows:

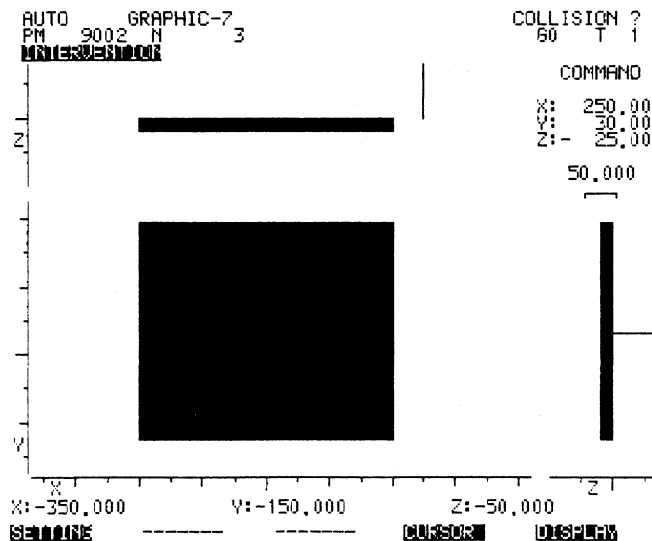




Fig. 17.3.1.-1.

17.4. GRAPHICS PARAMETERS

The Graphics Parameters establish conditions for the running of the animated-graphics test program (see Section 17.2). The Graphics Parameters can be obtained via the PROGRAM MEMORY-menu:

- Depress Prog.mem. 
- Depress 

The display shows:

```

MANUAL   MAN.OPER.
PM   9002  N   9002

GRAPHIC PARAMETERS





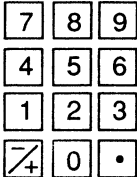
ALL MEMORY 116352 BYTES FREE
█ N0
  N1
  N2
  N3
  N4
  N5
  N6
  N7



GRAPHIC WINDOW DEFINITION
█ NXYZBIJKB1
  N█
  N0

HELP -----
  
```

Fig. 17.4.1.

17.4.1. Editing the Graphics Parameters List.

- (1) Select the desired block with the Up/Down Address Selector buttons  
- (2) Select the value to be changed with the Left/Right Address Selector buttons  
- (3) Enter the new value with the numeric key pad 

(Note that some of the entries will require the use of the equals sign. For example, value B1 of block N0 is entered by pressing button , then button Equal  and then the new desired value).

- (4) Press the Enter button .

The new values will appear in the block input line of the display:

```
MANUAL  MAN.OPER.
PM  9002  N  9002

GRAPHIC PARAMETERS

ALL MEMORY  116352 BYTES FREE
N0
N1
N2
N3
N4
N5
N6
N7

START POINT COORDINATE
XYZBIJKB1
N1 X100
HELP -----
```

Fig. 17.4.1.-1.

The cursor will move automatically to the next address.

Repeat steps 2, 3 and 4 for all desired new values in the block.

(5) Press the Store button 

The new values will be stored and shown in the Graphic Parameters list:

```
MANUAL  MAN.OPER.
PM  9002  N  9002

GRAPHIC PARAMETERS



ALL MEMORY  116352 BYTES FREE
N0
N1 X100 Y200 Z10 I100 J100 K-10
N2
N3
N4
N5
N6
N7

START POINT COORDINATE
XYZIJK
N2
HELP -----
```

Fig. 17.4.1.-2.

The cursor will move automatically to the next blok.

The values in a block can be completely cleared by first selecting the block, then pressing the Enter

button  (with the cursor on the block number) and then pressing the Store button 

Note that if this is done with the cursor on the line >ALL MEMORY< then the *entire graphic parameter memory contents will be lost!*

To assist visualising the axes of movement a picture can be displayed.

- Press softkey **F1** >HELP<
- Press softkey **F2** >PICTURE<.

The screen will show the display:

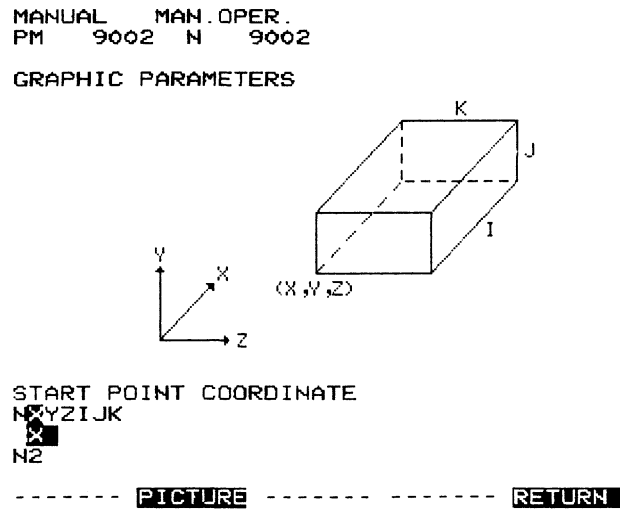


Fig. 17.4.1-3

This shows the reference point position (PF,PR) and the dimensions of the representation space. The machine tool itself can be imagined as being to the left of the representation space (i.e. if standing in front of the machine tool the reference point is at the lower left rear of the representation space).

The Graphics Parameters list is regained by pressing softkey **F5** below >RETURN<.

When editing of the Graphics Parameters is complete the Graphics Parameters list is terminated by pressing the key for any operation mode.

17.4.2. Explanation of the Graphics Parameters

The Graphics Parameters list contains eight blocks:

NO (WINDOW MANUAL)

Defines the graphic windows (see Section 17.2) by manual data input.

It has the format:

| | | | | | | | | |
|----|---|---|---|---|---|---|---|----|
| NO | X | Y | Z | B | I | J | K | B1 |
|----|---|---|---|---|---|---|---|----|

X, Y and Z define the point PF

I, J and K define the dimensions

B and B1 define the rotation of the workpiece (about the X and Y axes respectively, in degrees) for the Wire-plot 6 viewpoint (see Section 17.2.2).

If no values are entered the default values of X, Y, Z, I, J and K will be the values of the software limit switches (i.e. the largest possible graphic windows) and B and B1 will be 60° and - 30° respectively.

N1 (WINDOW CURSOR)

Displays the temporary graphics window values produced by using the >CURSOR< function . *No editing of this block is possible.* If the cursor has been used to find suitable graphics windows experimentally the values in N1 can be copied into the block N0, or to a preparatory G98 function block, to make them permanent.

N2 (ROUGH CONTOUR)

Defined the workpiece blank (see Section 17.2) by manual data input.

It has the format:

| | | | | | | |
|----|---|---|---|---|---|---|
| N2 | X | Y | Z | I | J | K |
|----|---|---|---|---|---|---|

X, Y and Z define the point PR

I, J and K define the dimensions.

N2 is implemented only if values have been put in it and if it is enabled by block N9. N2 only allows the workpiece to be defined as a single rectangular space; irregular workpieces must be defined by G99 functions (see Section 17.4.3).

N3 (START/END BLOCK)

Defines the first and last blocks of the part program section to be run with the graphic test programs:

N1 is the number of the first block

N2 is the number of the last block

If no values are present the entire program will be run.

N4 (INTERVENTION)

Defines how the graphics test programs respond to programmed halts for an intervention (e.g. M0 and M1 functions, tool changes):

C = 0, programmed halts ignored (default value)

C = 1, programmed halts processed normally

If C = 1 running of test programs is resumed following a halt by

pressing the Start button.

N5 (DWELL)

Defines how the graphics test programs respond to programmed dwells (G4 functions):

C = 0, programmed dwells ignored (default value)
 C = 1, programmed dwells processed normally

N6 (PROJECTION)

Defines the type of projection for the three-view graphics windows in TESTRUN-5 and TESTRUN-7:

C = 0, third-angle or European projection (default value)
 C = 1, first-angle or American projection

Third-angle projection are used throughout this manual in the illustrations of screen displays. A first-angle projection is, for example:

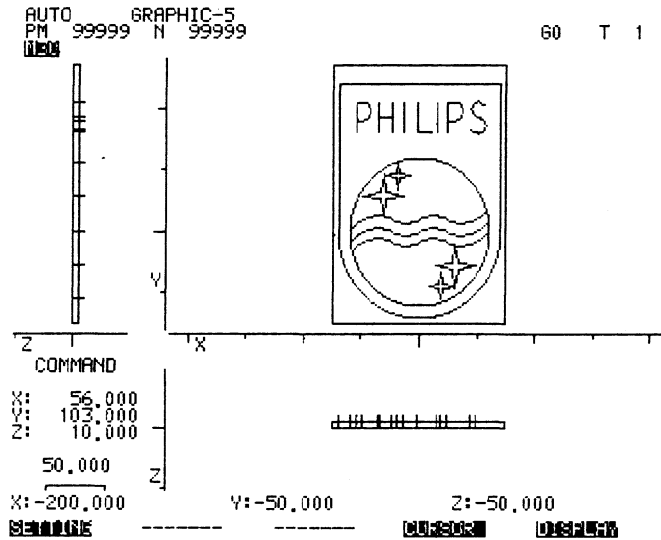


Fig. 17.4.2-1.

N7 (MAINPLANE PRESENTATION),

Select the main plane axes configuration.

The C-value corresponds to the numbers below the pictures:

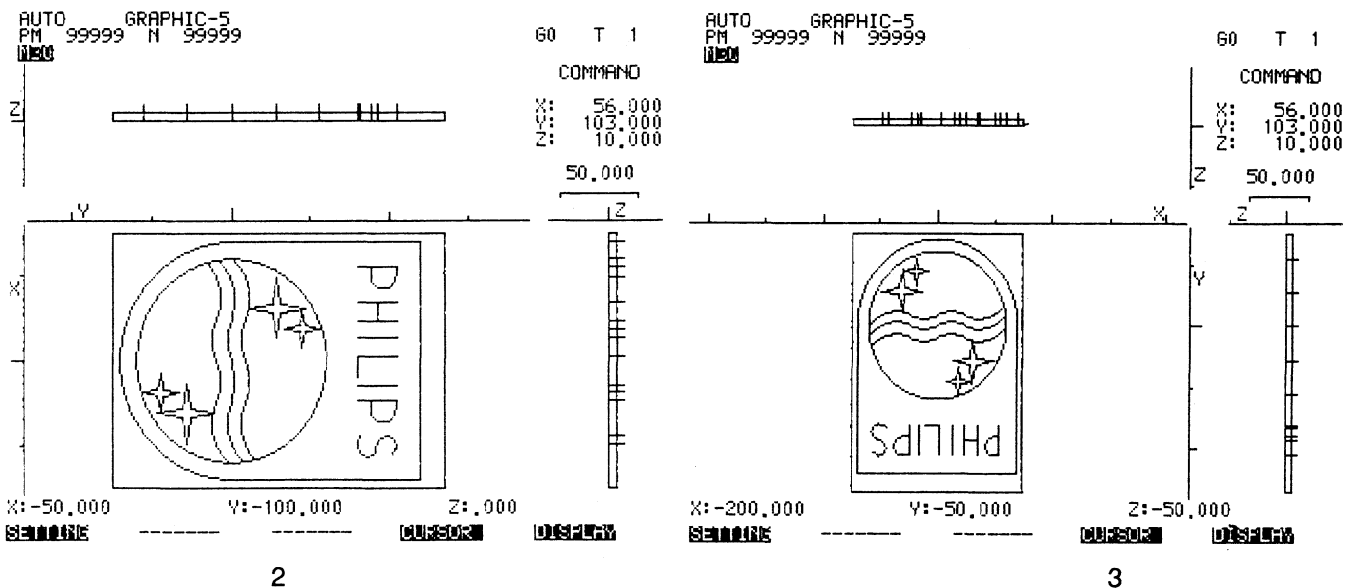


Fig. 17.4.2-2.

17.4.3 Program Functions G98 and G99

The positions and sizes of the workpiece blank and of the graphics windows can be defined in the part program, as well as in the Graphics Parameters list. This is done so that Graphics Parameters do not need to be re-edited each time a part program is selected.

These definitions are given by the first program blocks in the main program which contain the program functions G98 and G99. These preparatory program blocks can be initially written into the part program with approximate values. If they are then found to be unsatisfactory then more exact address values are found by trial-and-error (using the crosshairs and graphics cursor functions, see Sections 17.2.4.3. and 17.2.4.4). The improved address values can then be edited into the part program (see Section 4.2.5).

These preparatory program blocks are as follows:

Program Function G98

The program block with this function defines the position and size of the graphic windows for Wire plot 5 and Graphics simulation, and the size and viewpoint of the isometric projection for wire plot 6. It has the format:

| | | | | | | | | | |
|----------|------------|----------|----------|----------|----------|----------|----------|----------|-----------|
| N | G98 | X | Y | Z | B | I | J | K | B1 |
|----------|------------|----------|----------|----------|----------|----------|----------|----------|-----------|

Address definitions:

N - part program block number

G98 - function name

X, Y, Z - axis address values for point PF

B-rotation (in degrees) of the workpiece blank about the X-axis

I, J, K - graphics windows dimensions

B1 - rotation (in degrees) of the workpiece blank about the X-axis

Note that this format is similar to that of Graphics Parameter list block N0 (see also Sections 17.4.2 and 17.2.2).

Program Function G99

The program block with this function defines the position and size of a rectangular workpiece blank for wire plots 5 and 6 and Graphics simulation.

Irregularly-shaped workpiece can be represented by a composite of up to ten workpiece blanks, each with its own part program block. Clamps can be treated as small workpieces in a similar way. The format is:

| | | | | | | | |
|-----------|------------|----------|----------|----------|----------|----------|----------|
| N2 | G99 | X | Y | Z | I | J | K |
|-----------|------------|----------|----------|----------|----------|----------|----------|

Address definitions:

N - part program block number

G99 - function name

X, Y, Z - axis address values for point PR

I, J, K - workpiece blank dimensions

Note that this format is similar to that of Graphics Parameter list block N2 (see also Section 17.4.2 and 17.2.3).