

CNC3000 Series

CNC3460/500

Operating manual

4822 873 20356
861212

Numerical Control



Industrial &
Electro-acoustic Systems

PHILIPS

The publisher does not assume, on the basis of the information contained in this manual, any liability as to specifications.
For the specification of this numerical control reference should be made to the ordering data and the specification-catalogue exclusively.

All data are subjected to change without notice.

(c) PHILIPS EXPORT B.V. -EINDHOVEN- THE NETHERLANDS.
Industrial & Electro-acoustic Systems Division
1986

All rights are reserved. Reproduction in whole or in part is prohibited without the written consent of the copyright owner.

CONTENTS

SECTION		PAGE
1.	SWITCHING ON	1
1.1.	Reference point search	2
1.1.1.	How to proceed when hitting a software limit switch ..	4
1.2.	Zero point setting	4
2.	MANUAL	5
2.1.	Axis jogging	6
2.2.	Spindle jogging	8
2.3.	Manual menu	9
2.3.1.	Block search	10
2.3.2.	Reference point search	10
2.3.3.	Preset axis	11
2.3.3.1.	Reset axis	13
2.3.4.	Inch/metric	13
2.3.5.	Remote panel	14
2.3.6.	Diagnostic	14
2.3.7.	Handwheel (optional)	14
3.	MACHINE CONSTANTS	15
3.1.	Editing operator's machine constants	17
3.2.	Editing machine constants	19
4.	PART PROGRAM MEMORY	20
4.1.	Entering new programs	20
4.2.	Editing existing programs	24
4.2.1.	Searching a program	25
4.2.2.	Searching addresses	27
4.2.3.	Searching addresses with a specific value	28
4.2.4.	Adding a new block to the end of the program	29
4.2.5.	Editing a block	32
4.2.6.	Clearing a block	31
4.2.7.	Inserting a block	35
4.2.8.	Renumbering a part program	37
4.2.9.	Re-identifying a part program	38
4.2.10.	Program lock	40
4.2.11.	Entering mathematical functions	41
4.2.12.	Entering parametric values	42
4.3.	Clear program	43
4.4.	Clear all memory	45
4.5.	Part program menu	46
4.5.1.	Macro memory	47
4.5.2.	Point definitions	48
4.5.3.	Parameters	51
4.5.4.	Stored zero offsets	52
5.	TOOL MEMORY	55
5.1.	Edit tool information	55
5.2.	Clear tool memory	57
5.3.	Tool menu	58
5.3.1.	Tool life monitoring (optional)	60
5.3.2.	Spare tool memory (optional)	62
5.3.4.	Tool breakage memory (optional)	66
5.3.5.	Tool breakage monitor (optional)	67

SECTION		PAGE
6.	DATA I/O	67
6.1.	Read data	67
6.2.	Read part program data or macro data	68
6.2.1.	Read complete data carrier of part programs (or macro's)	68
6.2.2.	Read one program	69
6.3.	Store data	71
6.4.	Store part program data or macro data	73
6.4.1.	Store complete part program memory or macro memory ...	73
6.4.2.	Store one program or macro	74
7.	MANUAL PROGRAM/BLOCK SEARCH	75
7.1.	Program Search	75
7.2.	Block search in program	77
7.3.	Block search in macro	79
8.	AUTO	81
8.1.	Program execution	81
8.2.	Block delete	82
8.3.	Error messages during execution	82
8.4.	Displaying the running program	83
8.5.	Program test	84
9.	SINGLE	85
9.1.	Program block execution	85
9.2.	Block delete	86
9.3.	Error messages	86
9.4.	Displaying the running program	86
9.5.	Block test	86
10.	TEACH IN	87
10.1.	Teach in MDI	87
10.2.	Teach in/play back	89
10.2.1.	Extending the active program	91
10.2.2.	Entering a new program	92
10.2.3.	Activate guided programming	94
11.	PROGRAM INTERRUPTION	96
11.1.	Stop at end of a block	96
11.2.	Programming error	97
11.3.	Interrupt	98
11.3.1.	Jogging during interrupt	98
11.3.2.	Tooldata correction during interrupt	99
11.3.3.	Restart	100
11.3.4.	Restart with repositioning	101
11.3.5.	Abortion of a program during interrupt	103
11.4.	Interrupt menu	104
11.4.1.	Clear cycle during interrupt in cycle	104
11.4.2.	Repos	105
12.	CLEAR CONTROL	106

13.	DIAGNOSTICS	107
13.1.	Configuration check	109
13.2.	Power-up check	114
13.3.	External test programs	116
13.4.	Diagnostic mode	117
13.4.1.	Control teletext module tests	119
13.4.1.1.	Flat panel test	120
13.4.1.2.	CRT display test	121
13.4.2.	Central processor module test	122
13.4.3.	Memory module tests	125
13.4.4.	PROM test	127
13.4.5.	I/O Module tests	129
13.4.6.	Drive module tests	133
13.4.7.	Graphics module tests	137
13.4.8.	External test programs	139
13.4.9.	Service only tests	140
14.	SERVICE ONLY	141
14.1.	Control teletext module tests	144
14.1.1.	Flat panel test	145
14.1.2.	CRT display test	146
14.1.2.1.	CRT display test	147
14.1.2.2.	Linearity test	148
14.1.2.3.	VDU RAM test	149
14.1.2.4.	Display size test	151
14.2.	Central processor module tests	153
14.2.1.	CPU Module test	154
14.2.2.	Interrupt counter test	156
14.2.3.	Interrupt controller test	158
14.2.4.	V24 test	160
14.2.5.	Non-destructive RAM test	162
14.2.6.	Destructive RAM test	164
14.2.7.	PROM test	167
14.3.	Memory module tests	169
14.3.1.	Non-destructive RAM test	170
14.3.2.	Destructive RAM test	172
14.4.	PROM test	174
14.5.	I/O Module tests	175
14.5.1.	I/O module test	177
14.5.2.	Digital outputs test	179
14.5.3.	I/O Status	181
14.5.4.	Automatic I/O test	182
14.6.	Drive module tests	185
14.6.1.	Drive test	187
14.6.2.	Analog outputs test	188

SECTION	PAGE
14.7.	Graphics module tests 189
14.7.1.	RAM test 190
14.7.2.	PROM test 192
14.7.3.	Functional tests 194
14.7.3.1.	Write/read tests 195
14.7.3.2.	Vector test 197
14.7.3.3.	Bit map test 200
14.7.3.4.	Collision test 203
14.7.3.5.	Reset test 205
14.7.3.6.	Printer test 207
14.7.3.7.	Visual test 209
14.8.	External test programs 210
15.	HANDWHEEL 211
16.	REMOTE PANEL 214
16.1.	Remote panel diagnostics 219
17.	PROGRAM VERIFICATION 220
17.1.	Test programs with machine movement and I/O 222
17.1.1.	Testrun-1 223
17.1.2.	Testrun-2 228
17.1.3.	Testrun-4 229
17.2.	Test programs with graphics 230
17.2.1.	Testrun-5 231
17.2.1.1.	Relative/absolute position 239
17.2.1.2.	Printer 240
17.2.1.3.	Graphic parameters 241
17.2.1.4.	Cross-hairs 242
17.2.1.5.	Graphics cursor 244
17.2.2.	Testrun-6 250
17.2.3.	Testrun-7 252
17.2.3.1.	Collision on/off 254
17.2.3.2.	Tool on/off 256
17.2.4.	Graphics parameter 257
17.2.4.1.	Editing the graphics parameters list 258
17.2.4.2.	Explanation of the graphics parameters 262
17.2.4.3.	Program functions G98 and G99 265
18.	THE INTEGRATED PROGRAMMABLE LOGIC CONTROLLER 268
18.1.	The structure of the IPLC 270
18.2.	The IPLC memory and I/O data items 272
18.2.1.	Memory data items 274
18.2.1.1.	IPLC Local memory 275
18.2.1.2.	The window 276
18.2.1.3.	Timers and counters 277
18.2.2.	Digital input and output data items 278
18.3.	The CNC 'monitor' feature 279
18.3.1.	Editing the IPLC monitor 282
19.	Transmitting large programmes (BTR)..... 1
APPENDIX A	 287
A.1.	Error codes 288
A.2.	Diagnostic error codes 309

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 DIAGNOSTICS *V4.88*

HARDWARE CHECK

CPU	3390	PASSED
PROM		PASSED
RAM	96K	PASSED
DRIVE 1 2 3	LMS	PASSED
DRIVE 4 5	RMS	PASSED
DRIVE 6 7 8		NO RESPONSE
I/O 1	32 CH	PASSED
I/O 2 3 4		NO RESPONSE
CONTROL/TELET		PASSED
GRAPHICS	2 PL	<i>V4.89</i> PASSED

*→ als diagnostic switch off! [* -]*

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 DIAGNOSTICS *V4.88*

HARDWARE CHECK

CPU	3390	PASSED
PROM		PASSED
RAM	96K	PASSED
DRIVE 1 2	LMS	PASSED
DRIVE 3	LMS	FAILED
DRIVE 4 5	RMS	PASSED
DRIVE 6 7 8		NO RESPONSE
I/O 1	32 CH	PASSED
I/O 2 3 4		NO RESPONSE
CONTROL/TELET		PASSED
GRAPHICS	2 PL	<i>V4.89</i> PASSED

----- MANUAL -----

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.
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 9209 N

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
B	B	0.000 B RP
A	A	0.000 A RP
F	0.000 F	0.000 F-OVR 100 %
S	0 S	0 S-OVR 100 %
T	0 T	LIFE 0
G 0 17 25 27 40 51 53 63 71 72		90 94
M 5 9 10 22 41		

XYZBA

X

----- ACTUAL ----- IN-OUT

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 axes move at the same time to their reference points.

Procedure : (1) Check with ^{ch} 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 axes 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  9210      N

JOG CONTINUE

COMMAND      ACTUAL      DIST TO GO
X            X      11.111 X      0
Y            Y      22.222 Y      0
Z            Z      33.333 Z      0
B            B      44.444 B      0
A            A      55.555 A      0

F      0.000 F      0.000 F-OVR 100 %
S      0      S      0      S-OVR 100 %
T      0      T      LIFE      0
G 0 17 25 27 40 51 53 63 71 72      90 94
M      5  9  10 22 41

```

----- ACTUAL ----- **IN-OUT**

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 correct position, see part 2.3.3.

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  9210      N

JOG CONTINUE

COMMAND      ACTUAL      DIST TO GO
X            X      11.111 X      0
Y            Y      22.222 Y      0
Z            Z      33.333 Z      0
B            B      44.444 B      0
A            A      55.555 A      0

F      0.000 F      0.000 F-OVR 100 %
S      0      S      0      S-OVR 100 %
T      0      T      LIFE      0
G 0 17 25 27 40 51 53 63 71 72      90 94
M      5  9  10 22 41

```

----- ACTUAL ----- **IN-OUT**

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.

- 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.   DEMO
PM   9210               N

JOG CONTINUE

COMMAND      ACTUAL      DIST TO GO
X            X      11.111 X      0
Y JOG +      Y      307.221 Y      0
Z            Z      33.333 Z      0
B            B      44.444 B      0
A            A      55.555 A      0

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 51 53 63 71 72      90 94
M      5   9   10 22 41
  
```


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

- Select with the Jog step buttons
1, 10, 100 or 1000 increments.

1	10	100	1000

- Touch the relevant Jog Axis button

-X	+X
-Y	+Y
▼	▼
-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 +< of >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  9210      N

JOG STEP 100

COMMAND    ACTUAL    DIST TO GO
X JOG +    X      14.011 X
Y          Y      721.971 Y      0
Z          Z      33.333 Z      0
B          B      44.444 B      0
A          A      55.555 A      0

F      0.000 F      0.000 F-OVR 100 %
S      0      S      0      S-OVR 100 %
T      0      T      LIFE      0
G 0 17 25 27 40 51 53 63 71 72      90 94
M      5  9      10 22 41

```

----- ACTUAL ----- IN-OUT

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  9210      N  
  
JOG STEP 100  
  
MANUAL MENU:  
  
1 BLOCK SEARCH  
2 REFERENCE POINT SEARCH  
3 RESET AXIS  
4 INCH  
5 METRIC  
6 REMOTE PANEL ON  
7 DIAGNOSTIC  
8 HANDWHEEL
```

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 part 6.

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 axes 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 ~~>RESET AXIS<~~ as shown below.

```

MANUAL   RESET-AXIS
PM  9210      N

JOG CONTINUE

COMMAND      ACTUAL      DIST TO GO
X            X      11.111 X      0
Y            Y      22.222 Y      0
Z            Z      33.333 Z      0
B            B      44.444 B      0
A            A      55.555 A      0

F      0.000 F      0.000 F-OVR 100 %
S      0      S      0      S-OVR 100 %
T      0      T      LIFE      0
G 0 17 25 27 40 52 53 63 71 72      90 94
M      5 9 10 22 41

```

XYZBA

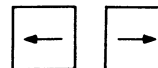
X

----- ACTUAL ----- IN-OUT

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.

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

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      9210      N

JOG CONTINUE

COMMAND      ACTUAL      DIST TO GO
X            X      11.111 X      0
Y            Y      22.222 Y      0
Z            Z      33.333 Z      0
B            B      44.444 B      0
A            A      55.555 A      0

F      0.000 F      0.000 F-OVR 100 %
S      0      S      0      S-OVR 100 %
T      0      T      LIFE      0
G 0 17 25 27 40 52 53 63 71 72      90 94
M      5 9      10 22 41

```

```

XYZBA      B
X100 Y20.25 Z300

```

----- ACTUAL ----- IN-OUT

- Touch the Store button



The values for the selected axes, displayed under >ACTUAL< are changed for the preset 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      9210      N

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
B            B      44.444 B      0
A            A      55.555 A      0

F      0.000 F      0.000 F-OVR 100 %
S      0      S      0      S-OVR 100 %
T      0      T      LIFE      0
G 0 17 25 27 40 52 53 63 71 72      90 94
M      5 9      10 22 41

XYZBA      B

```

----- ACTUAL ----- IN-OUT

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. Inch/metric.

Depending on a machine constant setting, the control switches on in Inch or Metric mode.

To change the control from inch to metric system or vice versa by means of the operator panel:

- Touch the Manual button 
- Touch the Menu button 
- Touch  >METRIC< or  >INCH<

The control now comes up in the selected mode.

To ensure safe operation, the operator is forced to search the reference points in all axes. (see part 1.).

REMARK: The programs residing in Memory are changed now (decimal point shift) but are not transferred to Inch (or metric). Hence they cannot be used under the newly chosen resolution. When changing back to the previous solution the existing programs are correct again.

! was gebeurt met inchoud andere schengens?

2.3.5. Remote panel (option)

When a remote panel is available proceed to chapter 15.

2.3.6. Diagnostic

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

2.3.7. Handwheel (option)

When a handwheel is available proceed to chapter 16.

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 9210 N

MACHINE CONSTANTS

■	0	C	2
■	2	C	128
■	4	C	1
■	9	C	2
■	10	C	6
■	11	C	0
■	14	C	71
■	16	C	4
■	18	C	0
■	19	C	1
■	27	C	48
■	28	C	24

■

■

EDIT-MC OPER-MC -----

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

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

- 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 **F 2** (below >OPER-MC<).

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

MANUAL MAN. OPER.
PM 9210 N

MACHINE CONSTANTS

■ N	80 C	1
N	84 C	1
N	240 C	0
N	242 C	0
N	290 C	0
N	292 C	0
N	340 C	0
N	342 C	0
N	390 C	0
N	392 C	0
N	440 C	0
N	442 C	0

■ NC
N80 C1

■ N

----- OPER-MC -----

- 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.

MANUAL



, SINGLE



, AUTO



or TEACH IN



.

four mc's: ? 023?

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  9210
VERSION NUMBER 6097/483
MACHINE CONSTANTS
```

■	Z	0	C	2
■	Z	2	C	128
■	Z	4	C	1
■	Z	9	C	2
■	Z	10	C	6
■	Z	11	C	0
■	Z	14	C	71
■	Z	16	C	4
■	Z	18	C	0
■	Z	19	C	1
■	Z	27	C	48
■	Z	28	C	24

```
■ NC
  No C2
```

```
■ Z
```

EDIT-MC -----

4. PART PROGRAM MEMORY.

4.1. ENTERING NEW PROGRAMS.

The operation modes Manual, Single and Auto permit manual program input.

- If available, make the memory enable switch.

- Touch the Prog.mem button



The monitor display shows e.g.:

```
MANUAL    MAN.OPER.  
PM      9210      N
```

```
PARTPROGRAM N    9210
```

```
■N9210  
N1 G54 Z200  
N2 T1 M67  
N3 G89 Z-10 B1 R20 K4 F200 S100 M3  
N4 G79 X40 Y35 Z10  
N5 G87 X85 Y50 Z-12.5 B1 R10 K3  
N6 G79 X125 Y105  
N7 M30
```

```
■GXYZBADRIJKLPFSTMHE ■  
N9210
```

```
MENU-G  ----- ID-DIR EDIT-ID RENUM-N
```

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

- Enter via the keyboard the program identification, e.g. 9007.

- The value can be checked in the word input field. When entering a wrong number, press Clear



and enter correct number.

- Touch the Enter button



The block input line indicates the program identification, e.g.
>N9007<.

- Touch Store button



As shown below, the program execution line still shows the active program and the program intervention line shows >PARTPROGRAM N9007<. On top of the space where the program will appear, N9007 is indicated.

```

MANUAL    MAN.OPER.
PM      9210      N
PARTPROGRAM N    9007
■N9007

```

```

N0XYZBADRIJKLPFSTMHE  G
N1

```

```

MENU-G  ----- ID-DIR  EDIT-ID  RENUM-N

```

The address selector field and the word input field show G.

The block selector line shows N1.

The first block of the program can be entered now.

If the first block number should be a number different from 1, proceed as follows:

- Select N with the Address selector button



- Enter with the keyboard the desired value, e.g. 20.

7	8	9
4	5	6
1	2	3
÷/+	0	-

- Touch Enter button



The block selector line shows N20 now, which will be the first block in the program.

To program the first block:

- Select the needed address with the Address selector buttons



- Enter the value via the keyboard



(The Clear button  clears this value).

- Touch the Enter button



The address and value appear in the block input line. The cursor of the Address-string jumps to the next address.

According to the last 3 steps, the other addresses can be added to the block input line until completion of the block:

```
MANUAL    MAN.OPER.
PM  9210      N
PARTPROGRAM N  9007
■N9007
```

```
NGXYZBADRIJKLPFSTMHE H
N1 G0 X100 Y20 S100 M3
```

```
MENU-G ----- ID-DIR EDIT-ID RENUM-N
```

- Touch the Store button



moves

The entered block is stored and ~~jumps~~ to the space under the program identification. The next block number appears in the bottom line.

The addresses of the next blocks may be entered and stored in the same way.

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

4.2. EDITING EXISTING PROGRAMS.

The operation modes Manual, MDI, Single and Auto allow existing programs to be edited.

In the operation modes MDI, Single and Auto the active program (shown in the program execution line) cannot be edited.

First search for the program to be edited, (e.g. N9037):

- If available make the memory enable switch.

- Touch the Prog.mem button



The monitor displays the first part of the active program:

```
MANUAL    MAN.OPER.
PM      9210      N
PARTPROGRAM N    9210
■N9210
N1 G54 Z200
N2 T1 M67
N3 G89 Z-10 B1 R20 K4 F200 S100 M3
N4 G79 X40 Y35 Z10
N5 G87 X85 Y50 Z-12.5 B1 R10 K3
N6 G79 X125 Y105
N7 M30
```

```
■NGXYZBADRIJKLPFSTMHE ■N
N9210
```

```
MENU-G  ----- ID-DIR  EDIT-ID  RENUM-N
```

If in manual mode and the active program must be edited, proceed to chapter 4.2.2.

If another (not-active) program must be edited proceed with part 4.2.1.

4.2.1. Searching a program

- Touch softkey F 3 (below >ID-DIR<).

The display shows the directory of programs:

```
MANUAL    MAN.OPER.
PM      9210      N

PARTPROGRAM N    9210

ALL MEMORY      24576 BYTES FREE
■N9208
N9999
N99979
N99972
N9210
N9005
N9007
N9030
N9315
N9314
N9001
```

```
■NGXYZBADRIJKLPFSTMHE  N
N9208
```

----- ID-DIR ----- RETURN

Depending on machine constant settings it is also possible to display the text which is incorporated in the program identification number or to display the status of the programs.

```
MANUAL    MAN.OPER.
PM      9210      N

PARTPROGRAM N    9210

ALL MEMORY      24576 BYTES FREE
■N9208 (      350  BYTE      )
N9999 (      272  BYTE      )
N99979 (      347  BYTE      )
N99972 (      320  BYTE      )
N9210 (      160  BYTE      READING)
N9005 (        53  BYTE      )
N9007 (         8  BYTE      )
N9030 (      589  BYTE      )
N9315 (         90  BYTE      )
N9314 (         77  BYTE      )
N9001 (      125  BYTE      )
```

```
■NGXYZBADRIJKLPFSTMHE  N
N9208 (      350  BYTE      )
```

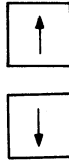
----- ID-DIR ----- RETURN

The program status comprises of the following:

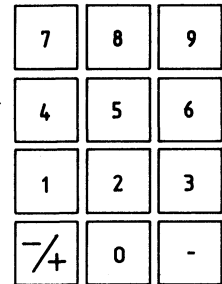
- Program length in bytes.
- Reading - A program has reading status when it is active or when it is output via DATA I/O or via DNC or when it is being edited.
- Writing - A program has writing status when it is input via DNC.
- Lock - A program has a locked status when it is protected against unauthorised editing via program lock, see chapter 4.2.10.

Two procedures enable the program to be selected:

1. - Select the program number with the Block Selector buttons



2. - Enter the program number via the keyboard.



- Touch the Block Search button



- Touch the Enter button



- Touch the Block search button



During program search, the programming mode line indicates >BUSY<. After the search procedure the first blocks of the selected program are displayed:

MANUAL MAN.OPER.
PM 9210 N

PARTPROGRAM N 9037

■ N9037 G54
N2 X-75 Z0
N3 Y0
N10 G1 F1000 S100 M3
N11 G43 X-50
N12 G44 Z-50
N13 X50
N14 Z50
N15 X-50
N16 Z0
N17 G40
N18 X-80 Z-30

■ GXYZBADRIJKLPFSTMHE N
N9037 G54

MENU-G ----- ID-DIR EDIT-ID RENUM-N

NOTE: If no program is active, the display shows the program directory immediately.

4.2.2. Searching addresses.

The CNC3360 enables the operator to search blocks, which contain a certain address.

If e.g. the blocks, which contain the M-address (unregarded the value of that address), must be found, proceed as follows:

- Select the address with the Address selector buttons.  

- Touch the downwards Block selector button  to find the first next block, containing the selected address.
or
- Touch the upwards Block selector button  to find the first preceding block, containing the selected address.

If no more blocks contain the selected address, the cursor stays at the last searched block.

4.2.3. Searching addresses with a specific value.

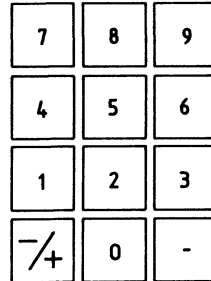
The CNC3360 enables the operator to search blocks which contain an address with a specific value.

If e.g. the blocks, which contain the address X100, must be found, proceed as follows:

- Select the address with the Address Selector buttons



- Enter the value with the keyboard.



- Touch Enter button.



- Touch Search button.



The first block, containing the address, is searched.

By pressing Search button



again, the next block is searched.

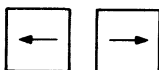
If the Search button is pressed when the last block containing the searched address is displayed the search will continue from the first block of the program.

4.2.4. Adding a new block to the end of the program.

After searching the program, the last block of the program has to be found.

The last block of the program can be selected in two ways:

1. - Select N address with the Address selector buttons



- Search for the last block number with the Block Search buttons



2. - If the block number is known:

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

- Enter the Block number via the keyboard.

- Touch the Enter button



- Touch the Block Search button



During Block search the programming mode line shows >BUSY<

After the search has been completed the relevant block is displayed in the block input line. In the list of blocks it is preceded by the cursor:

```
MANUAL    MAN.OPER.
PM  9210          N
PARTPROGRAM N  9037
N27 G43 Z25
N28 G41
N29 G3 X-50 Z0 I-75 K0
N30 G2 X0 Z-50 I0 K0
N31 X50 Z0 I0 K0
N32 X0 Z50 I0 K0
N33 X-50 Z0 I0 K0
N34 G3 X-75 Z-25 I-75 K0
N35 G40
N36 G1 Y10
```

na search stant blok up refel 2!

```
NGXYZBADRIJKLPFSTMHE  N
N36 G1 Y10
```

```
MENU-G  ----- ID-DIR  EDIT-ID  RENUM-N
```

- Select, if necessary, N-address with Address selector buttons.

←	→	
7	8	9
4	5	6
1	2	3
-/+	0	-

- Enter via the keyboard the new block number.

The block number is not permitted to be present in the program.

- Touch the Enter button.



The block number e.g. >N37< appears in the block input line and at the address selector field, the cursor jumps to the next address >G<.

The addresses may be entered now as described in part 4.1.:

- After entering an address value, touch the Enter button



The address and value appear in the block input line:

- After the block has been completed, touch the Store button.



As shown below, the new block is stored and appears in the list of blocks. The block input line displays the next block number.

```

MANUAL    MAN.OPER.
PM      9210          N

PARTPROGRAM N    9037

N27 G43 Z25
N28 G41
N29 G3 X-50 Z0 I-75 K0
N30 G2 X0 Z-50 I0 K0
N31 X50 Z0 I0 K0
N32 X0 Z50 I0 K0
N33 X-50 Z0 I0 K0
N34 G3 X-75 Z-25 I-75 K0
N35 G40
N36 G1 Y10
■ N37 M30

```

```

N0XYZBADRIJKLPFSTMHE  G
N38

```

```

MENU-G  ----- ID-DIR  EDIT-ID  RENUM-N

```


The addresses of the next blocks may be entered and stored in the same way.

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

4.2.5. Editing a block.

Search the relevant block as described in parts 4.2.1 to 4.2.3.

```
MANUAL    MAN.OPER.
PM      9210      N
```

```
PARTPROGRAM N    9037
```

```
  N17 G40
  N18 X-80 Z-30
  N19 G43 Z0
  N20 G41 X-50
  N21 X0 Z-50
  N22 X50 Z0
  N23 X0 Z50
  N24 X-60 Z-10
  N25 G40 X-75
  N26 Z0
  N27 G43 Z25
  N28 G41
```

```
NGXYZBADRIJKLPFSTMHE N
  N18 X-80 Z-30
```

```
MENU-G  ----- ID-DIR EDIT-ID RENUM-N
```

- Select with the address Selector buttons   the address to be cleared changed or added.

A.To clear this address:

- Touch the Enter button



Remark:

If an address with an equal sign must be cleared enter e.g. B1= without a value and touch Enter button.

B. To change or add this address:

- Enter the new address value via the keyboard

(The Clear button  can clear this value).

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

In all cases, the bottom line is updated according to the instruction.

Repeat the operation until the block is completed.

- Touch the Store button



As shown below, the changed block has been stored in the list of blocks. The bottom line displays the next block.

MANUAL MAN.OPER.
PM 9210 N

PARTPROGRAM N 9037

N17 G40
N18 X-80 Z-40
■ N19 G43 Z0
N20 G41 X-50
N21 X0 Z-50
N22 X50 Z0
N23 X0 Z50
N24 X-60 Z-10
N25 G40 X-75
N26 Z0
N27 G43 Z25
N28 G41

N GXYZBADRIJKLPFSTMHE G
N19 G43 Z0

MENU-G ----- ID-DIR EDIT-ID RENUM-N

The next block may be changed in the same way.

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

4.2.6. Clearing a block.

Search the relevant block as described in parts 4.2.1 to 4.2.3.

- Select -if necessary- the address N with the Address Selector buttons.  

- Touch the Enter button. 

In the block input line after the block number >(CLEAR)< appears:

- Touch the Store button. 

The block is now cleared in the memory.

The bottom line displays the next block.

It is possible to clear this block or to search for and edit a new block.

After clearing one or more blocks, the program can be renumbered by touching  below >RENUM-N<.

However, this is not obligatory; the program is executed in the same order without renumbering the program.

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

4.2.7. Inserting a block.

Search for the block preceding the new block to be inserted.
Search procedures are described in parts 4.2.1. to 4.2.3.

MANUAL MAN. OPER.
PM 9210 N

PARTPROGRAM N 9037

■ N18 Z0
N19 G43 Z0
N20 G43 Z25
N21 G41
N22 G3 X-50 Z0 I-75 K0
N23 G2 X0 Z-50 I0 K0
N24 X50 Z0 I0 K0
N25 X0 Z50 I0 K0
N26 X-50 Z0 I0 K0
N27 G3 X-75 Z-25 I-75 K0
N28 G40
N29 G1 Y10

N18 XYZBADRIJKLPFSTMHE G
N18 Z0

MENU-G ----- ID-DIR EDIT-ID RENUM-N

- Select >N< with the Address selector buttons.

←	→	
7	8	9
4	5	6
1	2	3
÷/+	0	-

- Enter via the keyboard the new block number e.g.
N800

The block number is not permitted to be present in the program.

- Touch the Enter button.



The block number e.g. >N800< appears in the bottom line and at the address string, the cursor jumps to the next address >G<:

The addresses may be entered now as described in part 4.1.:

- After entering an address value, touch the Enter button



- After the block has been completed, touch the Store button



As shown below, the new block is stored and inserted in the list of blocks after the searched block. The bottom line displays the next block number to be inserted.

```
MANUAL    MAN.OPER.  
PM      9210      N  
  
PARTPROGRAM N    9037  
  
N18 Z0  
■N800 G43 Z0  
N19 G43 Z25  
N20 G41  
N21 G3 X-50 Z0 I-75 K0  
N22 G2 X0 Z-50 I0 K0  
N23 X50 Z0 I0 K0  
N24 X0 Z50 I0 K0  
N25 X-50 Z0 I0 K0  
N26 G3 X-75 Z-25 I-75 K0  
N27 G40  
N28 G1 Y10
```

```
N[XYZBADRIJKLPFSTMHE [G  
N801
```

```
MENU-G  ----- ID-DIR EDIT-ID RENUM-N
```

It is possible to insert also the next block or to search and edit other blocks.

4.2.8. Renumbering a part program

After inserting one or more blocks, the program can be renumbered by touching F 5 below >RENUM-N<.

```
MANUAL    MAN.OPER.  
PM      9210      N  
  
PARTPROGRAM N    9037  
  
■N18 Z0  
N19 G43 Z25  
N20 G41  
N21 G3 X-50 Z0 I-75 K0  
N22 G2 X0 Z-50 I0 K0  
N23 X50 Z0 I0 K0  
N24 X0 Z50 I0 K0  
N25 X-50 Z0 I0 K0  
N26 G3 X-75 Z-25 I-75 K0  
N27 G40  
N28 G1 Y10  
N29 M30
```

```
■GXYZBADRIJKLPFSTMHE ■  
N18 Z0
```

```
MENU-G ----- ID-DIR EDIT-ID RENUM-N
```

However, this is not obligatory; the program is executed in the same order without renumbering the program.

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

- ~~alle~~ alle n=..... nummers van blokken moeten
aan wijzig zijn!

4.2.9. Re-identifying a part program

The control features the identification number of a program to be altered.

This will be useful when a part program is being read in from cassette which has the same identification number as a part program already in memory.

Search the required program as described in 4.2. and 4.2.1.

The display shows: MANUAL MAN.OPER.
PM 9210 N

PARTPROGRAM N 9210

```

■N9210
N1 G54 Z200
N2 T1 M67
N3 G89 Z-10 B1 R20 K4 F200 S100 M3
N4 G79 X40 Y35 Z10
N5 G87 X85 Y50 Z-12.5 B1 R10 K3
N6 G79 X125 Y105
N7 M30
  
```

■GXYZBADRIJKLPFSTMHE N
N9210

MENU-G ----- ID-DIR EDIT-ID RENUM-N

- Enter with the keyboard the
new identification number e.g:9209

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

- Touch softkey F4 below >EDIT-ID<.

The display shows:

MANUAL MAN.OPER. DEMO
PM 9209

PARTPROGRAM N 9209

```

■N9209
N1 G54 Z200
N2 T1 M67
N3 G89 Z-10 B1 R20 K4 F200 S100 M3
N4 G79 X40 Y35 Z10
N5 G87 X85 Y50 Z-12.5 B1 R10 K3
N6 G79 X125 Y105
N7 M30
  
```

■GXYZBADRIJKLPFSTMHE G
N9209

MENU-G ----- ID-DIR EDIT-ID RENUM-N

Note: As shown in the example on the previous page, when the program whose identification number was changed is also the active program the program number in the program execution line is changed too. However, if the operation modes Auto or Single are selected the display shows >END OF PROGRAM< in the intervention line.

AUTO
PM 9209
END OF PROGRAM

COMMAND		ACTUAL		DIST TO GO	
X		X	11.111	X	0
Y		Y	22.222	Y	0
Z		Z	33.333	Z	0
B		B	44.444	B	0
A		A	55.555	A	0
F	0.000	F	0.000	F-OVR	100 %
S	0	S	0	S-OVR	100 %
T	0	T		LIFE	0
G	0 17 25 27 40 51 53 63 71 72 90 94				
M	5 9 10 22 41				

----- ACTUAL PROGRAM IN-OUT

In this case:

- Touch Manual button



- Touch Clear Control button



4.2.10. Program lock

It is possible to protect programs against unauthorised editing.

A protected (locked) program can be examined only.

To lock a program:

- Search a program as described in chapters 4.2. and 4.2.1.
- Make the external program lock switch.

On the display >LOCK< appears in the softkey line.

- Touch the corresponding softkey.

The relevant program is locked now.

In the softkey line >LOCK< changes to >UNLOCK<.

To unlock a program proceed as described above, the softkey line automatically displays >UNLOCK< when a locked program is searched.

4.2.11. Entering mathematical functions.

Using parameter programming, mathematical functions can be called during editing at the control with the following buttons:

The Sign button  can change the sign of the number being edited

It cannot change the sign of the parameter.

The Operant button  can call mathematical operations as +, -, : and *.

E2=-9: Select >E<, touch  ,  ,  ,  ,
 .

E3=E4*E5: Select >E<, touch  ,  .
Select >E<, touch  ,  .

Touch  as many times until >+< changes into >*<.

Select >E<, touch  ,  .

E6=E7:8 Select >E<, touch  ,  .

Select >E<, touch  ,  .

Touch  as many times until >:< appears.

Select >BLANK< (behind >E<, touch  ,  .

4.2.12. Entering parametric values.

The control enables for all addresses to use the parametric notation.

The following is allowed:

```

MANUAL    MAN.OPER.
PM      9005      N

PARTPROGRAM N    9005

■ N1 Z10 B45 G=E1 X=E2 Y=E3 F=E17 S=E12
  M=E20

```

```

N0XYZBADRIJKLPFSTMHE  G
N2

```

```

MENU-G  ----- ID-DIR  EDIT-ID  RENUM-N

```

To enter parametric values:

- Select the address with the address selector buttons  
- Touch equal button  .
- Position the cursor to the E-address with the address selector buttons.  
- Enter parameter number with the keyboard

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

 .
- Touch Enter button  .
- After entering all the required addresses touch store button 

4.3. CLEAR PROGRAM.

The operation modes Manual, Auto and Single enable a program (not active) to be cleared.

(Clear an active program in Manual mode after Clear Control).

The procedure is as follows:

- Touch the Prog. mem. button  .

- Touch softkey  (below >ID-DIR<).

The monitor displays e.g.:

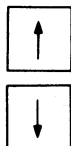
```
MANUAL  MAN. OPER.
PM  9209      N
PARTPROGRAM N  9209
ALL MEMORY    25216 BYTES FREE
■ N9208
N9999
N99979
N99972
N9209
N9005
N9007
N9030
N9315
N9314
N9001
```

```
■ GXYZBADRIJKLPFSTMHE  N
N9208
```

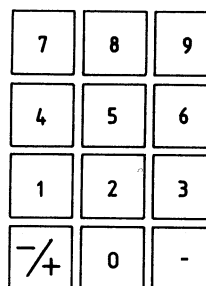
----- ID-DIR ----- **RETURN**

The desired program number may be selected in two ways:

- Select the program number with the Block Selector buttons, e.g. N9007

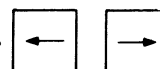


- Enter the program number via the keyboard.



- Touch the Enter button 
- Select >N< with the Address

selector buttons.



- Touch the Enter button



- Touch the Enter button



In the Block input line appears >CLEAR< behind the desired programnumber.

- Touch the Store button



.

The relevant program in the memory is cleared now.

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

MANUAL MAN.OPER.
PM 9209 N

PARTPROGRAM N 9209

ALL MEMORY 25216 BYTES FREE

N9208

N9999

N99979

N99972

■ N9209

N9005

N9007

N9030

N9315

N9314

N9001

■ GXYZBADRIJKLPFSTMHE N
N9209 (CLEAR)

----- ID-DIR ----- RETURN

CLEAR ALL MEMORY.

The operation mode Manual enables the entire Partprogram memory to be cleared.

The procedure is as follows:

- Touch the Manual button



- Touch the Prog.mem. button



- Touch softkey **F 3** (below >ID-DIR<)



- Select with the Block Selector buttons



>ALL MEMORY<.

- Touch the Enter button



The Block input line displays >ALL MEMORY CLEAR<. (see below).

MANUAL MAN.OPER.

PM 9209 N

PARTPROGRAM N 9209

■ALL MEMORY 25216 BYTES FREE

N9208

N9999

N99979

N99972

N9209

N9005

N9007

N9030

N9315

N9314

N9001

■GXYZBADRIJKLPFSTMHE N

ALL MEMORY CLEAR

----- ID-DIR ----- RETURN

- Touch the Store button



The entire Part program memory is cleared now. *except for locked programs*

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

4.5. PARTPROGRAM MENU.

The partprogram memories (see below) can be selected via the part program menu.

To select the partprogram menu:

- Touch the Prog. Mem button 
- Touch the Menu button 

```
MANUAL    MAN.OPER.  
PM  9210      N
```

```
PARTPROGRAM N  9210
```

PROGRAM MENU:

```
1 EDIT    MACRO  
2 EDIT    POINTS  
3 EDIT    PARAMETERS  
4 EDIT    STORED ZERO OFFSETS  
5 EDIT    EXTERNAL PROGRAM CALL  
6 EDIT    GRAPHIC PARAMETERS
```

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 stored zero offsets can only be edited being in manual mode).

```
AUTO  
PM  9210      N
```

```
PARTPROGRAM N  9210
```

PROGRAM MENU:

```
1 EDIT    MACRO  
2 DISPLAY POINTS  
3 DISPLAY PARAMETERS  
4 DISPLAY STORED ZERO OFFSETS  
5 DISPLAY EXTERNAL PROGRAM CALL  
6 EDIT    GRAPHIC PARAMETERS
```

Note that the menu choices 2 to 6 (but not Macro) are optional and are enabled by machine constants. If they are not enabled they will not be available as selections from the Program Menu.

To select the required memory:

- Touch the number corresponding to the required memory.

4.5.1. MACRO MEMORY

Macro's may be entered manually or by using Data-in. The procedure is identical with the one for part programs.

Part 4 up to 4.4 can be applied. When Part program is mentioned, Macro has to be read now.

The macro memory is selected via the program memory menu:

- Touch Prog.mem button
- Touch menu button
- Touch



The display shows e.g.:

```

MANUAL  MAN.OPER.
PM  9210      N

MACRO      N

ALL MEMORY  25216 BYTES FREE
■ N9001
N9006
N9258
N90256

```

```

■ GXYZBADRIJKLPFSTMHE ■
N9001

```

----- ID-DIR -----

The macro memory can only be edited in manual mode.

For DATA I/O see chapter 6.2. and 6.4.

4.5.2 Point definitions.

To check the actual coordinates of the point definitions:

- Touch the Part prog button
- Touch the Menu button
- Touch 2 .



The monitor now displays e.g. the picture shown below.
If defined, the coordinates are shown behind the pointnumber.

```

MANUAL    MAN.OPER.
PM  9210      N

POINTS

ALL MEMORY    25216 BYTES FREE
P0
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10

XYZBAL      P
P0
  
```

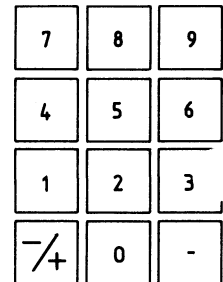
X - Y - Z ?

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

- Select the P-number with the Block selector buttons



- Enter the P-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 P list

The Clear button clear this value



can

- Touch the Enter button
- Touch the Search button

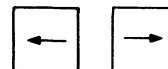


Make sure that control is in manual mode.

A. To change or enter a point definition:

- Search the P-number as described on the page before.

- Select the axis with the Address selector buttons



- Enter the value via the keyboard.

- The Clear button



can clear this value.

- Touch the Enter button



- Repeat the last 3 steps for all required axes.

The newly entered point definition line appears on the bottom line of the display.

- Touch the Store button



The new ~~zero offset~~ *Points* values appear in the point definition list.

Remark:

The point definitions can also be entered as polar coordinates, however only in absolute manner, as shown in line P4 (see picture on the previous page).

B2= angle, L2= length, both values are only for the mainplane axes. Point definitions are always absolute coordinates, however they can be used in an incremental program.

B. To clear a point definition:

- Search the P-number as described on the page before.

- Touch the Enter button



The control now shows >CLEAR< in the block input line behind the P-number.

- Touch the Store button



The point definition is now cleared.

C. To clear the point definition list, proceed as follows:

- Select >ALL MEMORY< with the Block selector buttons



- Touch the Enter button



The control shows now >ALL MEMORY CLEAR< in the block input line:

```
MANUAL    MAN.OPER.
PM  9210      N

POINTS

■ALL MEMORY    25216 BYTES FREE
P0
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
```

```
■XYZBAL      P
  ALL MEMORY CLEAR
```

- Touch the Store button



The point definition list is now cleared.

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

For DATA I/O , see chapter 6.

4.5.3 Parameters.

The present values of the parameters can be found and changed in the same way as described for the point definitions (part 4.5.2.).

Only now, 3 has to be touched.

The monitor shows e.g. the picture below.

```
MANUAL  MAN.OPER.
PM  9210      N

PARAMETERS

ALL MEMORY  25216 BYTES FREE
■E0  C - - -
E1
E2  7
E3
E4
E5
E6  .
E7
E8
E9
E10

■C      E
E0
```

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

For DATA I/O, see chapter 6.

4.5.4 Stored zero offsets.

This operation mode allows the stored zero point offsets to be displayed and edited. It is obtained by:

- Touch the Partprogram button



- Touch the Menu button



- Touch  .

The monitor now displays e.g. the picture shown below.
Already entered zero offsets values (e.g. G52) appear in the table.

```
MANUAL    MAN.OPER.
PM  9210          N

STORED ZERO OFFSETS

ALL MEMORY    25216 BYTES FREE
■ G51 X0 Y0 Z0 B0 A0
G52 X-88.889 Y1.972 Z-266.667 B0 A0
G53 X0 Y0 Z0 B0 A0
G54 X0 Y0 Z0 B0 A0
G55 X0 Y0 Z0 B0 A0
G56 X0 Y0 Z0 B0 A0
G57 X0 Y0 Z0 B0 A0
G58 X0 Y0 Z0 B0 A0
G59 X0 Y0 Z0 B0 A0

■ XYZBA          G
G51 X0 Y0 Z0 B0 A0
```

The search for a certain zero offset can be done in two ways:

- Select G-number with the Block selector buttons.



- Select G with the Address selector buttons.



- Enter the G-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 rest of the list of zero offsets.

The Clear button  can

- Touch the Enter button



- Touch the Search button

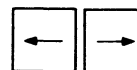


All zero offsets except G51 and G53 can be edited in the Manual mode.

A. To change or enter a zero offset:

- Search the G-number as described in the page before.

- Select the axis with the Address selector buttons



- Enter the offset value via the keyboard.

- The Clear button  can clear this value.

- Touch the Enter button



- Repeat the last 3 steps for all required axes.

The newly entered zero offset line appears on the bottom line of the display.

- Touch the Store button



The new zero offset values appear in the zero offset list.

B. To clear a zero offset:

- Search the G-number as described on the page before.

- Touch the Enter button



The control now shows >CLEAR< in the block input line behind the G-number

- Touch the Store button



The zero offset is now cleared.

C. To clear the zero offset list, proceed as follows:



- Select >ALL MEMORY< with the Block selector buttons



- Touch the Enter button



The control shows now >ALL MEMORY CLEAR< in the block input line:

```
MANUAL    MAN.OPER.
PM  9210      N

STORED ZERO OFFSETS

■ALL MEMORY    25216 BYTES FREE
G51 X0 Y0 Z0 B0 A0
G52 X-88.889 Y1.972 Z-266.667 B0 A0
G53 X0 Y0 Z0 B0 A0
G54 X0 Y0 Z0 B0 A0
G55 X0 Y0 Z0 B0 A0
G56 X0 Y0 Z0 B0 A0
G57 X0 Y0 Z0 B0 A0
G58 X0 Y0 Z0 B0 A0
G59 X0 Y0 Z0 B0 A0
```

```
■XYZBA      ■
  ALL MEMORY CLEAR
```

- Touch the Store button



The zero offset list is now cleared.

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

Remarks:

If one of the stored zero offsets is activated (G52 and/or G54-G59) the actual positions are recalculated when these values have been modified.

For DATA I/O see chapter 6.

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 in Teach-in, Single or Auto mode.

- Touch the Manual button 

- Touch the Tool mem button 

The monitor displays:

MANUAL MAN.OPER.
PM 9210 N

TOOL OFFSETS

ALL MEMORY				25216 BYTES FREE			
T	0	L	0	R	0	P	0
T	1	L	10	R	5	P	1
T	2	L	15.236	R	15.23	P	2
T	3	L	10.002	R	5	P	3
T	4	L	12.365	R	20.36	P	4
T	5	L	0	R	0	P	5
T	6	L	0	R	0	P	6
T	7	L	0	R	0	P	7
T	8	L	0	R	0	P	8
T	9	L	0	R	0	P	9
T	10	L	0	R	0	P	10

 LRP
TO LO RO PO

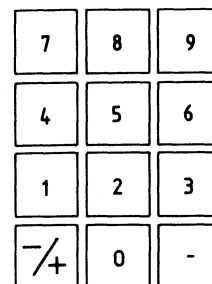
 T

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

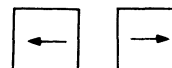


- Touch the Search button



To edit the toolinformation:

- 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  9210      N
```

TOOL OFFSETS

ALL MEMORY				25216 BYTES FREE			
T	0	L	0	R	0	P	0
T	1	L	10	R	5	P	1
T	2	L	15.236	R	15.23	P	2
T	3	L	10.002	R	5	P	3
T	4	L	12.365	R	20.36	P	4
T	5	L	0	R	0	P	5
T	6	L	0	R	0	P	6
T	7	L	0	R	0	P	7
T	8	L	0	R	0	P	8
T	9	L	0	R	0	P	9
T	10	L	0	R	0	P	10

```
TLRF
T6 L20.452 R20 P6
```

- 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  9210      N

TOOL OFFSETS

■ALL MEMORY      25216 BYTES FREE
T  0 L  0      R  0      P  0
T  1 L 10      R  5      P  1
T  2 L 15.236  R 15.23   P  2
T  3 L 10.002  R  5      P  3
T  4 L 12.365  R 20.36   P  4
T  5 L  0      R  0      P  5
T  6 L  0      R  0      P  6
T  7 L  0      R  0      P  7
T  8 L  0      R  0      P  8
T  9 L  0      R  0      P  9
T 10 L  0      R  0      P 10

■LRP      ■
ALL MEMORY CLEAR

```

- 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  9210          N

TOOL OFFSETS

TOOL MENU:

1 EDIT      TOOL LIFE
2 EDIT      TOOL SPARE
3 EDIT      TOOL BREAKAGE
4 DISPLAY   TOOL LENGTH MONITOR
```

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  9210          N

TOOL OFFSETS

TOOL MENU:

1 DISPLAY   TOOL LIFE
2 DISPLAY   TOOL SPARE
3 DISPLAY   TOOL BREAKAGE
4 DISPLAY   TOOL LENGTH MONITOR
```

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  9210      N

TOOL LIFE

ALL MEMORY    25216 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
T 10 C     0 A      0 R      0 P 10

TC          T
TO CO
```

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 P-number via the keyboard

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

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

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

- Touch Enter button



- Touch Store button



The actual tool life time 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  9210      N

SPARE TOOL

ALL MEMORY  25216 BYTES FREE
■ T  0=
T  1=
T  2=
T  3=
T  4=
T  5=
T  6=
T  7=
T  8=
T  9=
T 10=

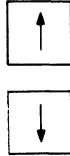
T  0=      T

INVERS  ACTIV  -----
```

← vul iets in !!!

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

- Select the T-number with the block selector buttons



- Enter the P-number via the keyboard

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

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

- Touch the Enter button
- Touch the Search button



- Enter number of the searched tool.

- Touch equal button



- Select T with the address selector buttons



- Enter the toolnumber of the spare tool.

- Touch Enter



The display shows e.g:

```

MANUAL   MAN.OPER.
PM  9210      N

SPARE TOOL

ALL MEMORY      25216 BYTES FREE
T  0=
T  1=
T  2=
T  3=
■ T  4=
T  5=
T  6=
T  7=
T  8=
T  9=
T 10=

T          T
T4=T8

INVERS  ACTIV  -----
  
```

When a tool has exceeded its life time or when the external tool sensors detect something wrong the relevant tool is displayed in inverse video:

MANUAL MAN.OPER.
PM 9209 N

SPARE TOOL

ALL MEMORY 24960 BYTES FREE
 T 0=
 T 1=
 T 2=
 T 3=
 T 4=T 8
 T 5=
 T 6=
 T 7=
 T 9=
 T 10=
 T 11=

T 0= T

INVERS ACTIV -----

In this case tool T8 is fetched at the next time tool 1 is called in the program.

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

MANUAL MAN.OPER.
PM 9209 N

SPARE TOOL

ALL MEMORY 24960 BYTES FREE
 T 0=
 T 1=
 T 2=
 T 3=
 T 4=T 8
 T 5=
 T 6=
 T 7=
 T 9=
 T 10=
 T 11=

T 0= T

INVERS ACTIV -----

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  .

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

MANUAL MAN. OPER.
PM 9209 N

SPARE TOOL

ALL MEMORY 24960 BYTES FREE
T 0=
T 1=
T 2=
T 3=
T 4=T 8
T 5=
T 6=
T 7=
T 9=
T 10=
T 11=

T
T1

T

INVERS ACTIV -----

- Touch softkey F 2 below >ACTIV<.

If the wrong tool is reactivated this can be corrected in the same way
as described above except F 1 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 (I11) 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.

Algemeen: nittig adressen in de memories?

- 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 F 3 (below >HALT<).

To restart transmission, touch softkey F 3 again.

Reading can be aborted by touching softkey F 4 (below >EXIT<).

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 F 1 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 transmission in every operation mode.

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).

To transmit data, the machine constants concerning data in/out, should be adjusted to the peripheral specifications (see part 3.).

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 read 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 DATA IN/OUT button DATA
IN/OUT .
- In the Softkey line appears >INPUT< (above softkey F 1 .).
- Touch softkey F 1 .

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

The display shows e.g:

```
MANUAL  MAN.OPER.
PM      9210      N

SPARE TOOL
ASCII  TS SPARE  T      IN
ALL MEMORY      25216 BYTES FREE
■ T  0=
T    1=
T    2=
T    3=
T    4=
T    5=
T    6=
T    7=
T    8=
T    9=
T   10=

■ T  0=

INPUT  ----- HALT  EXIT  RETURN
```

6.2. READ PART PROGRAM DATA OR MACRO DATA.

Reading part program data or macro 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.  DEMO
PM      9210          N

MACRO      N

■ALL MEMORY    25216 BYTES FREE
N9001
N9006
N9258
N90256
```

```
■GXYZBADRIJKLPFSTMHE ■
ALL MEMORY
```

----- ID-DIR -----

- 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 macroidentification 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 for macro memory.

- Touch the softkey  below >ID-DIR<.

- Enter via the keyboard the program identification, e.g. N9008.

- Touch the Enter button  .

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

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). *

To transmit data, the machine constants concerning data in/out, should be adjusted to the peripheral specifications (see part 3.).

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  .
- Start the external peripheral.

In the softkey line appears >OUTPUT< above softkey  .

- Touch softkey  .

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

The display shows e.g:

```
MANUAL  MAN.OPER.
PM  9210      N

STORED ZERO OFFSETS
ASCII  Z0 ZERO OFS G  57 OUT
■ALL MEMORY  25216 BYTES FREE
G51 X0 Y0 Z0 B0 A0
G52 X-88.889 Y1.972 Z-266.667 B0 A0
G53 X0 Y0 Z0 B0 A0
G54 X0 Y0 Z0 B0 A0
G55 X0 Y0 Z0 B0 A0
G56 X0 Y0 Z0 B0 A0
G57 X0 Y0 Z0 B0 A0
G58 X0 Y0 Z0 B0 A0
G59 X0 Y0 Z0 B0 A0
```

```
■XYZBA
  ALL MEMORY
```



```
----- OUTPUT   
```

The data of the relevant memory are ^{outputted} ~~stored~~ now.

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

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

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

F 3

To restart the transmission, touch the softkey **F 2** below >OUTPUT<.

Reading out can be aborted by touching softkey **F 4** (below >EXIT<).

Remarks:

- After output 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 memory 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      9210      N

PARTPROGRAM N      9210
ASCII PM N      9008 N 32 OUT
■ALL MEMORY      25216 BYTES FREE
N9030
N9315
N9314
N99972
N9210
N9001
N9008
N9025
N9037
N9049
N9054
```

```
■NGXYZBADRIJKLPFSTMHE ■
ALL MEMORY
```

```
----- OUTPUT HALT EXIT RETURN
```

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  9000      N

PARTPROGRAM N  9000

ALL MEMORY  54016 BYTES FREE
█ N  9000
  Z  9315
  Z  9314
  Z  99972
  Z  9210
  Z  9001
  Z  9008
  Z  9025
  Z  9037
  Z  9049
  Z  9054
  Z  9058

█ GXYZBABCRIJKLPFSTMHE █ N
  N9000
```

----- ID-DIR ----- **RETURN**

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.

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  >BLOCK SEARCH<.
- Touch softkey  (below >ID-DIR<).

The monitor displays the program identification numbers:

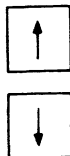
```
MANUAL    N-SEARCH
PM                                     N
JOG CONTINUE
■ N9030
  N9315
  N9314
  N99972
  N9210
  N9001
  N9008
  N9025
  N9037
  N9049
  N9054
  N9058
```

```
■ N9030
```

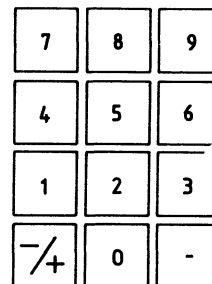
----- ID-DIR -----

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  9037      N
JOG CONTINUE

■ N9037 G54
N1 X-75 Z0
N2 Y0
N3 G1 F1000 S100 M3
N4 G43 X-50
N5 G44 Z-50
N6 X50
N7 Z50
N8 X-50
N9 Z0
N10 G40
N11 X-80 Z-30
```



N9037



----- ID-01R -----

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.

- 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 9037 N
JOG CONTINUE
■ N9037 G54
  N1 X-75 Z0
  N2 Y0
  N3 G1 F1000 S100 M3
  N4 G43 X-50
  N5 G44 Z-50
  N6 X50
  N7 Z50
  N8 X-50
  N9 Z0
  N10 G40
  N11 X-80 Z-30

```

N N9037

N

----- ID-DIR -----

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.

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

- Touch the Enter button



- Touch the Search 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 9037 N 10

JOG CONTINUE

N9 Z0
■ N10 G40
N11 X-80 Z-30
N12 G41 X-50
N13 X0 Z-50
N14 X50 Z0
N15 X0 Z50
N16 X-60 Z-10
N17 G40 X-75
N18 Z0
N19 G43 Z0
N20 G43 Z25

■ N10

■

----- ID-DIR -----

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

7.3 BLOCKSEARCH IN MACRO.

When the execution of a program is to be started in a Macro, proceed as follows:

- Search for the block in which the Macro is called, i.e. the block containing a G22 function. Refer to the procedure stated on the preceding page.

After the block has been searched for, the monitor displays:

```
MANUAL    N-SEARCH
PM    9315          N    4

JOG CONTINUE

N3 G0 X0 Y10 Z0 F1000 S100 M3
■ N4 G22 N=9315
N5 Y10
N6 M30
```

N
N4

N

----- ID-DIR -----

- Enter via the keyboard the Macro identification number

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

(number is contained in the block, e.g. **N** = 9315).

- Touch the Enter button



The number appears in the block input line.

- Touch the Search button



The monitor displays the first Blocks of the Macro:

MANUAL N-SEARCH
PM 9315 N
JOG CONTINUE
■ N9315 G54
N1 G18
N3 G0 X0 Y10 Z0 F1000 S100 M3
N4 G22 N=9315
N5 Y10
N6 ~~M30~~

← pn!!

macro

zu

■ N9315

■

----- ID-DIR -----

For continuing search in the Macro, refer to the preceding page.

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   9315          N   3

COMMAND      ACTUAL      DIST TO GO
X            X            0.000 X
Y      10.000 Y      111.500 Y-  101.500
Z            Z            0.000 Z
B            B            44.444 B
A            A            55.555 A

F      5000.000 F            0.000 F-OVR  0 %
S        100    S        100    S-OVR 100 %
T            T            LIFE      0
G 0 18 25 27 40 51 54 63 71 72      90 94
M      3   9   10 22 41

N9315 G54
N1 G18
■N3 G0 X0 Y10 Z0 F1000 S100 M3
N4 G22 N=9315
  
```

----- ACTUAL PROGRAM IN-OUT

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 >/N< are skipped. See >/N4< below.

AUTO
PM 9315 N /DELETE

COMMAND	ACTUAL	DIST TO GO
X	X 0.000	X 0
Y	Y 111.500	Y 0
Z	Z 0.000	Z 0
B	B 44.444	B 0
A	A 55.555	A 0
F 0.000	F 0.000	F-OVR 0 %
S 0	S 0	S-OVR 100 %
T 0	T	LIFE 0
G 0 17 25 27 40 51 53 63 71 72		90 94
M 5 9 10 22 41		

■ N9315 G54
N1 G18
N3 G0 X0 Y10 Z0 F1000 S100 M3
/N4 G22 N=9315

----- ACTUAL PROGRAM IN-OUT

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 errorcode appears on the screen (see part 18.2.).

8.4. DISPLAYING THE RUNNING PROGRAM.

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

```

AUTO
PM  9037          N

COMMAND          ACTUAL          DIST TO GO
X              X      0.000 X      0
Y              Y     111.500 Y      0
Z              Z      0.000 Z      0
B              B     44.444 B      0
A              A     55.555 A      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 71 72    90 94
M  5  9  10 22 41

■N9037 G54
N1 X-75 Z0
N2 Y0
N3 G1 F1000 S100 M3

```

----- ACTUAL **PROGRAM** **IN-OUT**

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 **F 4** (below >PROGRAM<).

The display shows now e.g.:

```

AUTO
PM  9037          N

■N9037 G54
N1 X-75 Z0
N2 Y0
N3 G1 F1000 S100 M3
N4 G43 X-50
N5 G44 Z-50
N6 X50
N7 Z50
N8 X-50
N9 Z0
N10 G40
N11 X-80 Z-30
N12 G41 X-50
N13 X0 Z-50
N14 X50 Z0
N15 X0 Z50
N16 X-60 Z-10

```

----- **ACTUAL** **PROGRAM** **IN-OUT**

To return to actual display, touch softkey **F 3** (below >ACTUAL<).

8.5. PROGRAM TEST.

Six 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  9037          N   2
```

COMMAND		ACTUAL		DIST TO GO
X		X-	75.000	X 0
Y		Y	111.500	Y 0
Z		Z	0.000	Z 0
B		B	44.444	B 0
A		A	55.555	A 0
F	0.000	F	0.000	F-OVR 100 %
S	0	S	0	S-OVR 100 %
T	0	T		LIFE 0
G 0	17 25 27	40 51 54	63 71 72	90 94
M	5 9	10 22 41		

```
N9037 G54
N1 X-75 Z0
■N2 Y0
N3 G1 F1000 S100 M3
```

```
----- ACTUAL  PROGRAM  IN-OUT
```

- 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  9030          N

COMMAND      ACTUAL      DIST TO GO
X            X-  35.000 X    0
Y            Y   187.558 Y    0
Z            Z   30.000 Z    0
B            B   44.444 B    0
A            A   55.555 A    0

F      0.000 F      0.000 F-OVR  0 %
S    500    S    500    S-OVR 100 %
T      0      T      LIFE    0
G 0 17 25 27 40 51 54 63 71 72    90 94
M    3  9   10 41

```

NGXYZBADRIJKLPFSTMHE N

MENU-G ----- ACTUAL PROGRAM IN-OUT

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

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

- Touch the Enter button



each time an address value is entered.

The addresses entered appear in the block input:

TEACH-IN MDI
PM 9030

N

COMMAND	ACTUAL	DIST TO GO
X	X- 35.000	X 0
Y	Y 187.558	Y 0
Z	Z 30.000	Z 0
B	B 44.444	B 0
A	A 55.555	A 0
F 0.000	F 0.000	F-OVR 0 %
S 500	S 500	S-OVR 100 %
T 0	T	LIFE 0
G 0 17 25 27 40 51 54 63 71 72		90 94
M 3 9	10 41	

NGXYZBADRIJKLPFSTMHE S 100
G1 Y20 Z20 F1000

MENU-G ----- ACTUAL PROGRAM IN-OUT

- 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 chapter 10.2.3.

To call the Teach in play back mode:

- Touch the Teach in button



The monitor displays the picture

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

```

TEACH-IN MDI      DEMO
PM  9030          N

COMMAND  ACTUAL  DIST TO GO
X-       35.000 X    0
Y        187.558 Y    0
Z        30.000 Z    0
B        44.444 B    0
A        55.555 A    0

F  0.000 F  0.000 F-OVR  0 %
S  500   S  500   S-OVR 100 %
T  0     T      LIFE   0
G 0 17 25 27 40 51 54 63 71 72  90 94
M  3  9  10 41

```

NGXYZBADRIJKLPFSTMHE N

MENU-G ----- ACTUAL PROGRAM IN-OUT

- Touch the Menu button



The monitor now displays:

```
TEACH-IN MDI
PM 9030          N  2
```

TEACH-IN MENU:

1 TEACH-IN PLAYBACK

- Touch the button

1

The monitor displays:

```
TEACH-IN PLAYBACK
PM 9030          N  2

JOG CONTINUE

COMMAND      ACTUAL      BEGIN
X            X- 35.000 X- 35.000
Y            Y  20.000 Y  20.000
Z            Z  20.000 Z  20.000
B            B  44.444 B  44.444
A            A  55.555 A  55.555

F 1000.000 F 0.000 F-OVR 100 %
S 100      S 100   S-OVR 100 %
T 0        T      LIFE 0
G 1 17 25 27 40 51 54 63 71 72 90 94
M 3 9      10 41
```

NGXYZBADRIJKLPFSTMHE N

MENU-G ----- ACTUAL PROGRAM IN-OUT

To show the active program:

- Touch softkey

F 4

(below >PROGRAM<).

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 (below >PROGRAM<).

F 4

Search the block following on the point where the new blocks have to be inserted. If blocks have to be added after the last block, search to the not yet existing block just after the last block.

To search:

- Enter the desired block number via the keyboard

- Touch the Enter button



- Touch the Search button



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

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

```
TEACH-IN PLAYBACK
PM 9030          N 8
JOG CONTINUE
N2 X-85 Z10
N8 G91
N9 G1 F1500
N10 G43 X10.337
N11 G42 Z5
N12 X9.663 Z30
N13 G90 X-35 Z30
N14 G3 X-24.998 Z70 I-10 K45
N15 G91 X-5.002 Z-28.341 I-40.002
K-7.552
N16 G2 X66.1 Z8.341 I30 K28.341
N17 G90 X27.622 Z75 I-5 K50
```

NGXYZBADRIJKLPFSTMHE N

MENU-G ----- ACTUAL PROGRAM IN-OUT

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.

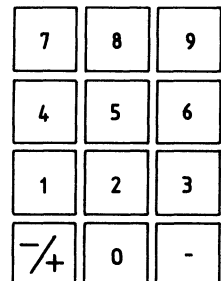
It is recommended to give CLEAR CONTROL after having terminated the operation causing the active block to be automatically left.

?

10.2.2. Entering a new program.

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

- Enter the program identification number via the keyboard



- Touch the Enter button



- Touch the Store button



The programming execution line now indicates the new program number.
>N1< appears in the block input line:

TEACH-IN PLAYBACK
PM 9555

COMMAND		ACTUAL		BEGIN
X		X-	15.000	X- 15.000
Y		Y	0.000	Y 0.000
Z		Z	55.000	Z 55.000
B		B	44.444	B 44.444
A		A	55.555	A 55.555
F	0.000	F	0.000	F-OVR 100 %
S	0	S	0	S-OVR 100 %
T	0	T		LIFE 0
G	0 17 25 27 40 51		53 63 71 72	90 94
M	5 9		10 41	

NOXYZBADRIJKLPFSTMHE G
N1

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 in 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 blocknumber 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. Activate guided programming.

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

F 1

There are 2 possibilities now:

1. The control is equipped with no graphics module. In this case the address string is adapted to the entered G-function:

```
TEACH-IN PLAYBACK
PM 9209          N 5

JOG CONTINUE

COMMAND      ACTUAL      BEGIN
X            X      40.000 X      40.000
Y            Y      50.000 Y      50.000
Z            Z      11.000 Z      11.000
B            B      44.444 B      44.444
A            A      55.555 A      55.555

F      200.000 F      0.000 F-OVR 100 %
S      100      S      100      S-OVR 100 %
T      1        T          LIFE 0
G 0 17 25 27 40 51 54 63 71 72 89 90 94
M      3 9      10 22 41

TAPPING CYCLE
NXYZBIJFSMH  G
G84
```

FREE-G ACTUAL PROGRAM IN-OUT

Also the meaning of the address is displayed e.g.
G 84 = Tapping cycle.

[Teletext plaatjes ?]

2. The control is equipped with a graphics module. In this case not only the address string is adapted to the entered G-function but also the control shows one or more pictures to explain the meaning of the addresses visually.

TEACH-IN PLAYBACK
PM 9209

N 5

JOG CONTINUE

COMMAND		ACTUAL		BEGIN	
X		X	40.000	X	40.000
Y		Y	50.000	Y	50.000
Z		Z	11.000	Z	11.000
B		B	44.444	B	44.444
A		A	55.555	A	55.555
F	200.000	F	0.000	F-OVR	100 %
S	100	S	100	S-OVR	100 %
T	1	T		LIFE	0
G	0 17 25 27 40 51 54 63 71 72 89 90 94				
M	3 9		10 22 41		

TAPPING CYCLE
N~~G~~XYZBIJFSMH
G84

G

FREE-G **PICTURE** **ACTUAL** **PROGRAM** **IN-OUT**

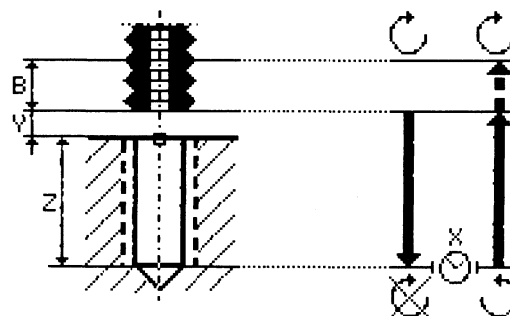
To show the picture, touch softkey **F 2** (below >PICTURE<).

The display shows e.g.:

TEACH-IN PLAYBACK
PM 9209

N 5

JOG CONTINUE



TAPPING CYCLE
N~~G~~XYZBIJFSMH
G84

G

FREE-G **PICTURE** **ACTUAL** **PROGRAM** **IN-OUT**

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. *inverse.* MANUAL I <) until the block has been finished:

```

AUTO          RUN
PM  9037      N  2
                MANUAL
JOG CONTINUE

COMMAND      ACTUAL      DIST TO GO
X            X-  75.000 X      0
Y      0.000 Y    25.251 Y-   25.251
Z            Z      0.000 Z      0
B            B    44.444 B      0
A            A    55.555 A      0

F  5000.000 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 71 72  90 94
M  5  9  10 22 41

N9037 G54
N1 X-75 Z0
N2 Y0
N3 G1 F1000 S100 M3

----- ACTUAL  PROGRAM IN-OUT

```

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

The program can be started again:

- Touch the Auto *style* button 
- Touch the Start button 

11.2. PROGRAMMING ERROR.

If we have a programming error (e.g. P 35), the control stops at the beginning of the erroneous block:

```

AUTO
PM 9037                      N 23
                                ERR P35

COMMAND      ACTUAL      DIST TO GO
X            X- 50.000 X    0
Y            Y   0.000 Y    0
Z            Z   0.000 Z    0
B            B  44.444 B    0
A            A  55.555 A    0

F 1000.000 F   0.000 F-OVR 100 %
S 100      S 100    S-OVR 100 %
T 0        T      LIFE   0
G 3 17 25 27 41 51 54 63 71 72 90 94
M 3 9      10 22 41

N21 G41
N22 G3 X-50 Z0 I-75 K0
N23 G2 X0 Z-50 I0 K0
N24 X50 Z0 I0 K0

----- ACTUAL PROGRAM IN-OUT

```

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

- Touch the Manual button



- Touch the Clear button



The error code has now disappeared.

Now we have to clear the error, either by changing the program block (part 4.2.) or changing the machine status in Manual- or Teach in mode.

Proceed with:

- Touch the Auto button



- Touch the Start button



The error codes and their meanings are listed in Appendix A.

11.3 INTERRUPT.

- Touching the Feedhold button  or the 

- In case of a major error in the control

In both cases, the execution of the program is stopped.
On the monitor >INTERVENTION< appears in the second line:

```

AUTO
PM 9037          N 4
INTERVENTION

COMMAND          ACTUAL          DIST TO GO
X-               52.001 X         0
Y               0.000 Y         0
Z               0.000 Z         0
B               44.444 B         0
A               55.555 A         0

F 1000.000 F      0.000 F-OVR 100 %
S 100      S      100 S-OVR 100 %
T 0        T              LIFE 0
G 1 17 25 27 43 51 54 63 71 72 90 94
M 3 9      10 22 41

N3 G1 F1000 S100 M3
N4 G43 X-50
N5 G44 Z-50
N6 X50

----- ACTUAL PROGRAM IN-OUT

```

During the interruption of a program it is possible:

- to move in the jogging mode; see part 11.3.1.
- to change tool data; see part 11.3.2.
- to restart; see part 11.3.3.
- to restart with repositioning; see part 11.3.4.
- to abort the program under execution; see part 11.3.5.
- to clear a cycle; see part 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 tool breakage), proceed as follows:

- Touch the Manual button 

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

```

AUTO      MAN.OPER.
PM 9037      N 4
INTERVENTION  MANUAL
JOG CONTINUE

COMMAND    ACTUAL      DIST TO GO
X JOG +    X- 52.001 X
Y          Y  0.000 Y  0
Z          Z  0.000 Z  0
B          B 44.444 B  0
A          A 55.555 A  0

F 3000.000 F  0.000 F-OVR  0 %
S 100      S 100    S-OVR 100 %
T 0        T        LIFE  0
G 1 17 25 27 43 51 54 63 71 72 90 94
M 3 9      10 22 41

```

----- ACTUAL ----- IN-OUT

- Restart; see part 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.
PM 9037      N 4
INTERVENTION  MANUAL
TOOL OFFSETS

ALL MEMORY      24960 BYTES FREE
T 0 L 0         R 0 P 0
T 1 L 10        R 5 P 1
T 2 L 15.236    R 15.23 P 2
T 3 L 10.002    R 5 P 3
T 4 L 12.365    R 20.36 P 4
T 5 L 0         R 0 P 5
T 6 L 0         R 0 P 6
T 7 L 0         R 0 P 7
T 8 L 0         R 0 P 8
T 9 L 0         R 0 P 9
T 10 L 0        R 0 P 10

```

- Change the tool data by searching the relevant tool number and entering the new data. See also part 5.1.
- Restart; see part 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 toolcompensation 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 in 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 toolcompensation changed, the program can be restarted from the beginpoint of the interrupted block.

- Touch Menu button



The display shows:

```

      AUTO      MAN.OPER.
PM  9037      N  4
INTERVENTION  MANUAL
JOG CONTINUE
  
```

INTERVENTION MENU:

```

1 CLEAR CYCLE
2 REPOS
  
```

- Touch 2 >REPOS<

- Touch Auto AUTO
→ or Single SINGLE
→ button

- Touch the Start button I

The display shows:

```

      AUTO      REPOS
PM  9037      N  4
  
```

COMMAND		ACTUAL		DIST TO GO	
X-	75.000	X-	52.001	X-	22.999
Y		Y	0.000	Y	0
Z		Z	0.000	Z	0
B		B	44.444	B	0
A		A	55.555	A	0
F	1000.000	F	0.000	F-OVR	0 %
S	100	S	100	S-OVR	100 %
T	0	T		LIFE	0
G 1	17 25 27	40 51 54	63 71 72		90 94
M	3 9	10 22 41			

```

N3 G1 F1000 S100 M3
N4 G43 X-50
N5 G44 Z-50
N6 X50
  
```

----- ACTUAL PROGRAM IN-OUT

The axes now return to the beginpoint of the interrupted block, taking in account - if applicable - the new toolcompensation (see Remark in part 11.3.3.).

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 beginpoint 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 we want the program to be aborted, proceed as follows:

- Touch the Manual button



The monitor displays e.g:

```

AUTO      MAN.OPER.
PM  9037      N  5
INTERVENTION  MANUAL
JOG CONTINUE

COMMAND      ACTUAL      DIST TO GO
X-           50.000 X      0
Y-           0.000 Y      0
Z-          27.499 Z      0
B-          44.444 B      0
A-          55.555 A      0

F  1000.000 F      0.000 F-OVR 100 %
S   100      S      100  S-OVR 100 %
T    0      T          LIFE    0
G 1 17 25 27 44 51 54 63 71 72  90 94
M  3  9  10 22 41

```

----- ACTUAL ----- IN-OUT

- Touch the Clear Control button



The control is fully cleared and in Manual mode:

```

MANUAL      MAN.OPER.
PM  9037      N
JOG CONTINUE

COMMAND      ACTUAL      DIST TO GO
X-           50.000 X      0
Y-           0.000 Y      0
Z-          27.499 Z      0
B-          44.444 B      0
A-          55.555 A      0

F    0.000 F      0.000 F-OVR 100 %
S     0      S      0    S-OVR 100 %
T     0      T          LIFE    0
G 0 17 25 27 40 51 53 63 71 72  90 94
M  5  9  10 22 41

```

----- ACTUAL ----- IN-OUT

intervention INTERRUPT MENU.

The *intervention* 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 9037          N 4
INTERVENTION
```

INTERVENTION MENU:

```
1 CLEAR CYCLE
2 REPOS
```

- 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 9054          N 30
INTERVENTION CYCLE
```

COMMAND		ACTUAL		DIST TO GO	
X		X-	80.000	X	0
Y		Y	0.000	Y	0
Z		Z	2.000	Z	0
B		B	44.444	B	0
A		A	55.555	A	0
F	1000.000	F	0.000	F-OVR	100 %
S	100	S	100	S-OVR	100 %
T	0	T		LIFE	0
G	0 17 25 27	40 51 54 63 71 72 81 90 94			
M	3 9	10 22 41			
N10 G81 Y2 Z-10 F1000 S100 M3					
N20 G79 X-90 Z0					
N30 G79 X-80					
N40 G79 X-70					

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 9054 N 30
CLEAR CYCLE

COMMAND      ACTUAL      DIST TO GO
X            X-      80.000 X      0
Y            Y      0.000 Y      0
Z            Z      2.000 Z      0
B            B      44.444 B      0
A            A      55.555 A      0

F 1000.000 F 0.000 F-OVR 100 %
S 100 S 100 S-OVR 100 %
T 0 T LIFE 0
G 0 17 25 27 40 51 54 63 71 72 81 90 94
M 3 9 10 22 41

N20 G79 X-90 Z0
N30 G79 X-80
N40 G79 X-70
N50 G79 X-60

----- ACTUAL PROGRAM IN-OUT

```

The cycle is cleared.

After touching the Start button I, the program continues to go to the starting position of the block, following on the fixed cycle block and preceeds from there on.

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 part 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 toolcompensation 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  9054      N

JOG CONTINUE

COMMAND    ACTUAL    DIST TO GO
X          X-      80.000 X      0
Y          Y       0.000 Y      0
Z          Z       2.000 Z      0
B          B      44.444 B      0
A          A      55.555 A      0

F          0.000 F       0.000 F-OVR 100 %
S          0     S       0     S-OVR 100 %
T          0     T          LIFE      0
G 0 17 25 27 40 51 53 63 71 72      90 94
M   5   9   10 22 41

```

----- ACTUAL ----- IN-OUT

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.

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 REF.POINT

JOG CONTINUE

MANUAL MENU:

- 1 BLOCK SEARCH
- 2 REFERENCE POINT SEARCH
- 3 RESET AXIS
- 4 INCH
- 5 METRIC
- 6 REMOTE PANEL ON
- 7 DIAGNOSTIC
- 8 HANDWHEEL

(4) Press button 7

The screen will then show the Diagnostic menu:

MANUAL

JOG CONTINUE

DIAGNOSTIC MENU:

- 1 CONFIGURATION CHECK
- 2 POWER UP CHECK
- 3 EXTERNAL TEST PROGRAM"S
- 4 DIAGNOSTIC MODE

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 13.4.7 and 14.1.2.3 and no faults are detected then a service engineer must be called to test the whole CNC.

13.1 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) Press button

1

The screen will then show the display:

MANUAL CONF.CHECK DEMO

JOG CONTINUE

CONFIGURATION CHECK

SOFTWARE VERSION	6401/401
MEMORY IN USE	4K
MEMORY FREE	40K
RAM SIZE	96K
DRIVES	5
IN/OUT	1
GRAPHICS	8PL V400

The display is explained line by line below:

>SOFTWARE VERSION<

The software version number indicates exactly which software is used in the CNC, and hence which facilities are available.

>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 CONF.CHECK DEMO
PM 9000 N

JOG CONTINUE

CONFIGURATION CHECK

SOFTWARE VERSION	6401/401	
MEMORY IN USE	4K	
MEMORY FREE	40K	
RAM SIZE	136K	MC 2=160
DRIVES	5	
IN/OUT	1	
GRAPHICS	8PL V400	

In this case the Central Processor Module and Memory Module must be checked with the relevant tests in Sections 13.4.2 and 13.4.3 and in Chapter 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 CONF.CHECK DEMO

JOG CONTINUE

CONFIGURATION CHECK

SOFTWARE VERSION	6401/401	
MEMORY IN USE	4K	
MEMORY FREE	40K	
RAM SIZE	96K	
DRIVES	5	MC 1= 7
IN/OUT	1	
GRAPHICS	GPL V400	

The procedures to test a faulty Drive Module are described in Section 13.4.4 and in Chapter 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 faulty I/O Modules (Note that in MC0; 0= one I/O Module, 1= two, 2= three). In this case the screen will display:

MANUAL CONF.CHECK DEMO

JOG CONTINUE

CONFIGURATION CHECK

SOFTWARE VERSION	6401/401
MEMORY IN USE	4K
MEMORY FREE	40K
RAM SIZE	96K
DRIVES	5
IN/OUT	1
GRAPHICS	BPL V400

MC 0= 1

The Power-up Check can be used to find which I/O Modules are faulty; see Section 13.2. The I/O Modules can be further checked with the tests in Section 13.4.5 and in Chapter 14.

>GRAPHICS<

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

If 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 procedures to test faulty Graphics Modules is described in Section 13.4.7 and in Chapter 14.

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

MANUAL CONF.CHECK DEMO

JOG CONTINUE

CONFIGURATION CHECK

SOFTWARE VERSION	6401/401
MEMORY IN USE	4K
MEMORY FREE	41K
RAM SIZE	96K
DRIVES	5
IN/OUT	1

In this case the CNC is not defective.

When the Configuration Check is no longer required, Manual Mode can be re-entered by pressing the relevant button for any operation mode.

13.2 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) Press button 2

If no module failures are detected the screen will, for example, show the display:

```
POWER-UP CHECK (V4.02)

HARDWARE CHECK

CPU          (3390)      PASSED
PROM          PASSED
RAM          96K        PASSED
DRIVE 1 2 3   LMS        PASSED
DRIVE 4 5     RMS        PASSED
DRIVE 6 7 8   NO RESPONSE
IN/OUT 1 2 3 4 NO RESPONSE
CONTROL/TELET PASSED
GRAPHICS      8 PL      (V4.00) PASSED
```

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

Note that in the above display example the third Drive Module (>DRIVE 6 7 8<) and the I/O Modules (>IN/OUT 1 2 3 4<) are not installed. This is indicated by >NO RESPONSE< in the display.

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

```
POWER-UP CHECK V4.02

HARDWARE CHECK

CPU          3390          PASSED
PROM          PASSED
RAM          40K          FAILED
DRIVE 1 2 3   LMS          PASSED
DRIVE 4 5     RMS          PASSED
DRIVE 6 7 8   NO RESPONSE
IN/OUT 1      32 CH        PASSED
IN/OUT 2 3 4  NO RESPONSE
CONTROL/TELET PASSED
GRAPHICS      8 PL V4.00  PASSED
```

----- MANUAL -----

In the above example the CPU RAM has failed the Power-up Check.

The failed module can be checked further with the relevant tests in this chapter and Chapter 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 soft key F 4, 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 13.4.

Manual mode is re-entered by pressing the soft key F 3, below >MANUAL<.

13.3 EXTERNAL TEST PROGRAMS

CAUTION : This mode is for the use of qualified service personnel only!

Special test programs for detailed fault analysis can be loaded from an external source in this mode.

If this mode is selected accidentally Manual mode can be re-entered by pressing softkey F 3 , below >MANUAL<.

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) Press button 4

The screen will show the display:

DIAGNOSTICS V4.02

```

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

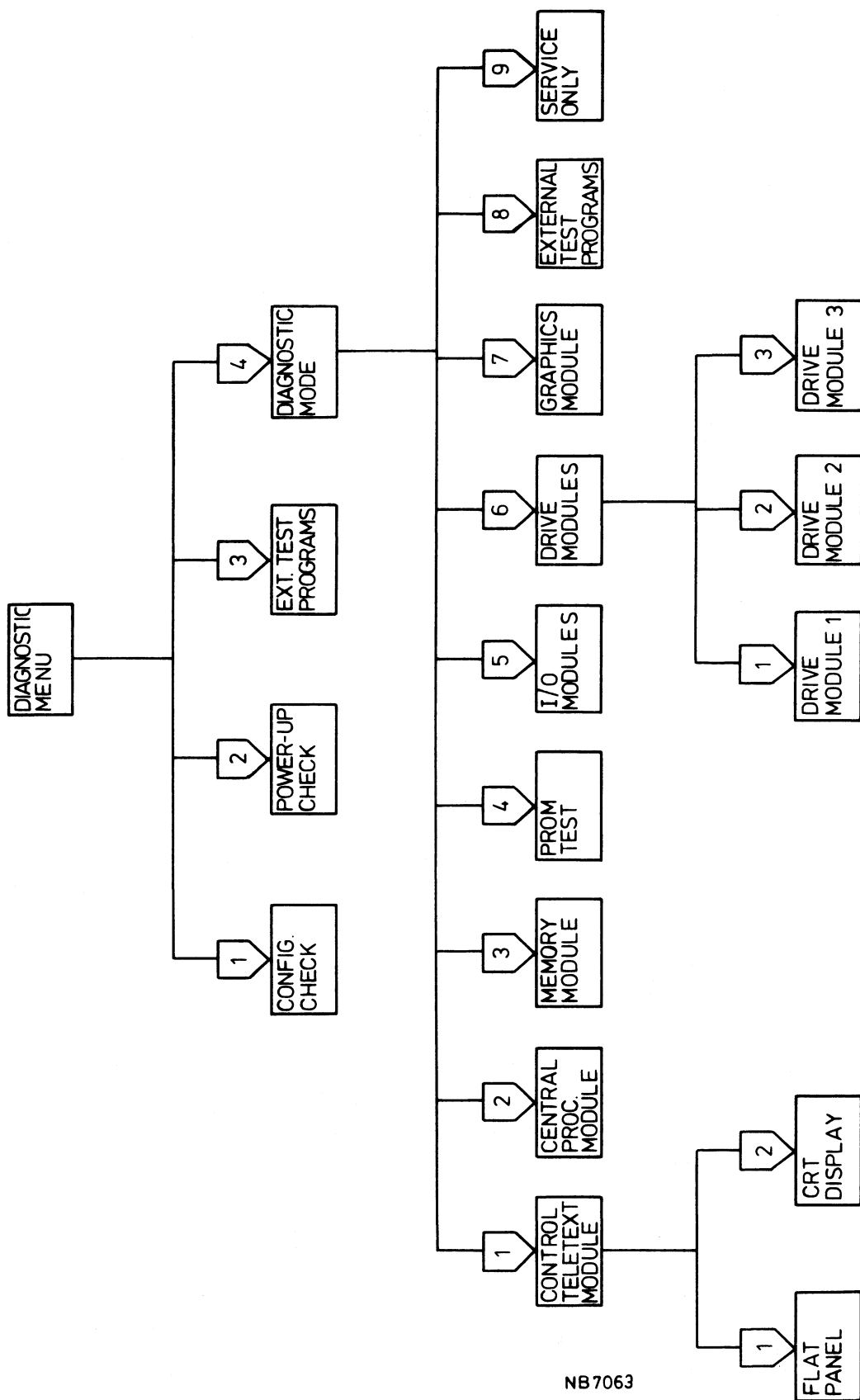
```

----- MANUAL -----

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

The Diagnostic Mode menu can also be entered from the initial Power-up screen display by pressing the soft key F 4, below >DIAG<.

The Manual Menu can be re-entered from the Diagnostic Mode Menu by pressing soft key F 3, below >MANUAL<.



NB 7063

13.4.1 Control Teletext Module Tests

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

The screen will show the display:

```
DIAGNOSTICS V4.02
SELECTED: CONTR.TELET.MOD.

1 FLAT-PANEL
2 CRT-DISPLAY
```

----- MANUAL -----

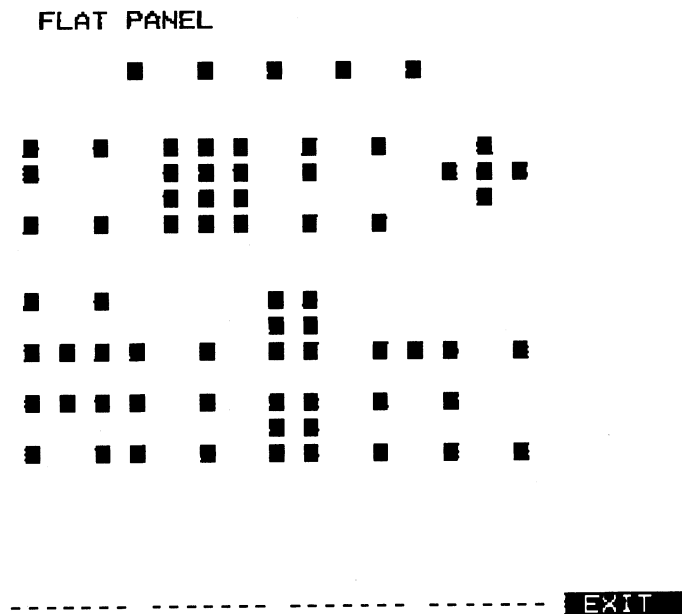
This is a menu to select either of the Control Teletext Module tests. These are explained below.

13.4.1.1 Flat Panel Test

Press button

1

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



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.

If several buttons do not cause a response it is probable that the Control Teletext Module is faulty.

If the test cannot be called because a button appears to be faulty then the flat panel must be replaced, although only suspected of failure.

The Control Teletext Module test menu is re-entered by pressing the softkey **F5** , below >EXIT<.

13.4.1.2 CRT Display Test

Press button

2

After a short delay the screen will display a block of characters. The characters will change through the ASCII character-set in order and through several colour combinations of character and background. For example:

DIAGNOSTICS V4.02

SELECTED: CRT-DISPLAY

CHARACTER TO DISPLAY: 51

```

QQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
QQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
QQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
QQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
QQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
QQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
QQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
QQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
QQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
QQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
QQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
QQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
QQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
QQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
QQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
QQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
QQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
QQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
QQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
QQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
QQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ

```

----- CONT EXIT

Any faults in the CRT Display will be made apparent by distortion of the display or illegibility of the characters.

The changes on the screen can be halted (and started again) by pressing

the softkey

F 4

, below >STOP< (or below >CONT<).

The Control Teletext Module test menu is re-entered by pressing the

soft key

F 5

, below >EXIT<.

13.4.2 Central Processor Module Test

This test is started by pressing button 2 when in Diagnostic Mode.

The screen will show the display:

DIAGNOSTICS V4.02
SELECTED: CENTR.PROC.MOD.

CPU RAM TEST

TESTING

----- EXIT

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 V4.02
SELECTED: CENTR.PROC.MOD.

CPU RAM TEST

TESTING

MODULE OK

----- EXIT

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

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

```
DIAGNOSTICS V4 02
SELECTED: CENTR.PROC.MOD.

CPU RAM TEST
```

TESTING

ERROR 50: RAM NOT CONTIGUOUS

----- STEP CONT EXIT

Note that the test will halt at the first fault detected. The test can be continued by pressing either softkey **F 3** (below >STEP<) or softkey **F 4** (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 Appendix A.

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 **F 5** , below >EXIT<.

13.4.3 Memory Module Tests

The Memory Module is an optional extension 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 it 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.

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

```
DIAGNOSTICS V4.02
SELECTED: MEMO.MOD.
```

```
RAM TEST
```

```
TEST RUN:      1
```

```
TESTING
```

```
MODULE OK
```

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

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

```
DIAGNOSTICS V4.02
SELECTED: MEMO.MOD.

RAM TEST
TEST RUN: 0
```

TESTING

ERROR 50: RAM NOT CONTIGUOUS

----- STEP CONT EXIT

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 Appendix A.

The Memory Module can be tested further with the tests in Chapter 14 and, if necessary, replaced.

The meanings of the error codes (for example; >ERROR 19<) are given in Appendix A.

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

13.4.4 PROM Test

This test is started by pressing button while in Diagnostic Mode
(or button , if the Memory Module is not installed).

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

```
DIAGNOSTICS V4.02
SELECTED: PROM TEST

PROM TEST
```

```
TEST READY
```

```
MODULE OK
```

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

Note that the display shows >MODULE OK<.

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

DIAGNOSTICS V4.02
SELECTED: PROM TEST

PROM TEST

ERROR 51: PROM CHECKSUM

----- STEP CONT EXIT

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 **F 3** (below >STEP<) or softkey **F 4** (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 Appendix A.

The Diagnostic Mode is re-entered by pressing soft key **F 5** , below >EXIT<.

13.4.5 I/O Modules Tests

The I/O Modules are optional boards, each of which provides 32 digital I/O channels. These channels are connected to interfaces or Programmed Logic Controllers, via which they are used to sense and control components of the machine tool that are either ON or OFF (for instance, cutting-fluid pumps).

Up to eight I/O Modules can be installed in the CNC, but one or two are usual.

Note: If no I/O Modules are installed then the I/O Modules tests will not be listed in the Diagnostic Mode menu. The menu choices below it will then be 'moved up' one number (i.e. >DRIVE MODULES< will be menu choice 5, etc).

If any I/O Modules are installed they can be tested by pressing button

while in Diagnostic Mode (or button , if a Memory Module is not installed).

The screen will then, for example, show the display:

```
DIAGNOSTICS V4.02
SELECTED: 32 INP./OUTP.MOD.

123456789 123456789 123456789 12
IN 1      10110011100010111011101011011111

OUT 1      00000000000000000000000000000000

PARITY INPUTS OK
PARITY OUTPUTS OK

ON LEFT RIGHT ----- EXIT
```


This facility to change the output status can be used to test an I/O Module, its output cables and the interface or Programmed Logic Controller. Suitable test equipment and special cables and connectors will be needed, however. These are described in detail in Chapter 14.

The I/O Modules test also automatically checks the parity of the inputs and outputs by comparing the hardware-generated parity bits (one per 32 inputs or outputs) with values calculated by software.

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

```

          123456789 123456789 123456789 12
IN 1      11111110000000000000000000000000

OUT 1     00000000000000000000000000000000

PARITY INPUTS BAD
PARITY OUTPUTS OK
ERROR 35: PARITY INPUTS

----- STEP  CONT  EXIT
```



100

100

F 5

13.4.6 Drive Modules Tests

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

The screen will show the display:

```
DIAGNOSTICS V4.02
SELECTED: DRIVE MODULES

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

----- MANUAL -----

This menu is used to select the Drive Module to be tested:

- Press button to test the first and second channels (usually axes X and Y).
- Press button to test the third and fourth channels (usually axes Z and B).
- Press button 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 V4.02
SELECTED: DRIVE MODULE 1

DRIVE: 1   LMS
DRIVE STATUS: 100011
```

TESTING

MODULE OK

----- EXIT

The test will continue to run.

The line >DRIVE STATUS:< in the display is followed by a six-digit binary number which indicates the states of six functions of the Drive Module. These are explained below, taking the binary digits in order from left to right:

- (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 bit will repeatedly change if an RMS/LMS Drive Module is tested, as the test switches between channels)
- (4) Pre-alarm
 - 0 = no pre-alarm
 - 1 = pre-alarm

(5) 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 V4.02
SELECTED: DRIVE MODULE 3

DRIVE: 6 RMS
DRIVE NOT RESPONDING
```

TESTING

ERROR 29: DRIVE NOT RESPONDING

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

In this case the test will halt at the first fault detected. The test can be continued by pressing either softkey **F 3** (below >STEP<) or softkey **F 4** (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 Appendix A.

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 soft key

F 5

, below >EXIT<.

Manual Mode is re-entered from the Drive Module selection menu by

pressing softkey

F 3

, below >MANUAL<.

13.4.7 Graphics Modules Test

This test is selected by pressing button while in Diagnostic Mode (or button if either the Memory Module or the I/O Modules are not installed, or button if both are not installed).

If no faults are detected the screen will show the display:

```
DIAGNOSTICS V4.02
SELECTED: GRAPH.MOD.
```

```
RAM TEST
TEST RUN:      4
```

```
TESTING
```

```
MODULE OK
```

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

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 V4.02
SELECTED: GRAPH.MOD.

RAM TEST

TEST RUN: 0

TESTING

ERROR 53: GRAPHICS RAM ERROR

----- EXIT

The meanings of the error codes (e.g. >ERROR 50: RAM NOT CONTIGUOUS<) are detailed in Appendix A.

In this case the Graphics Module must be tested further with the tests in Chapter 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 soft key F 5, below >EXIT<.

13.4.8 External Test Programs

See Section 13.3

13.4.9 Service Only Tests

As there are a large number of tests that can be used in the Service Only mode these are described separately in Chapter 14.

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 9 (or button 8 if either the Memory Module or the I/O Modules are not installed, or button 7 if both are not installed).

The screen will show the display:

DIAGNOSTICS V4.02

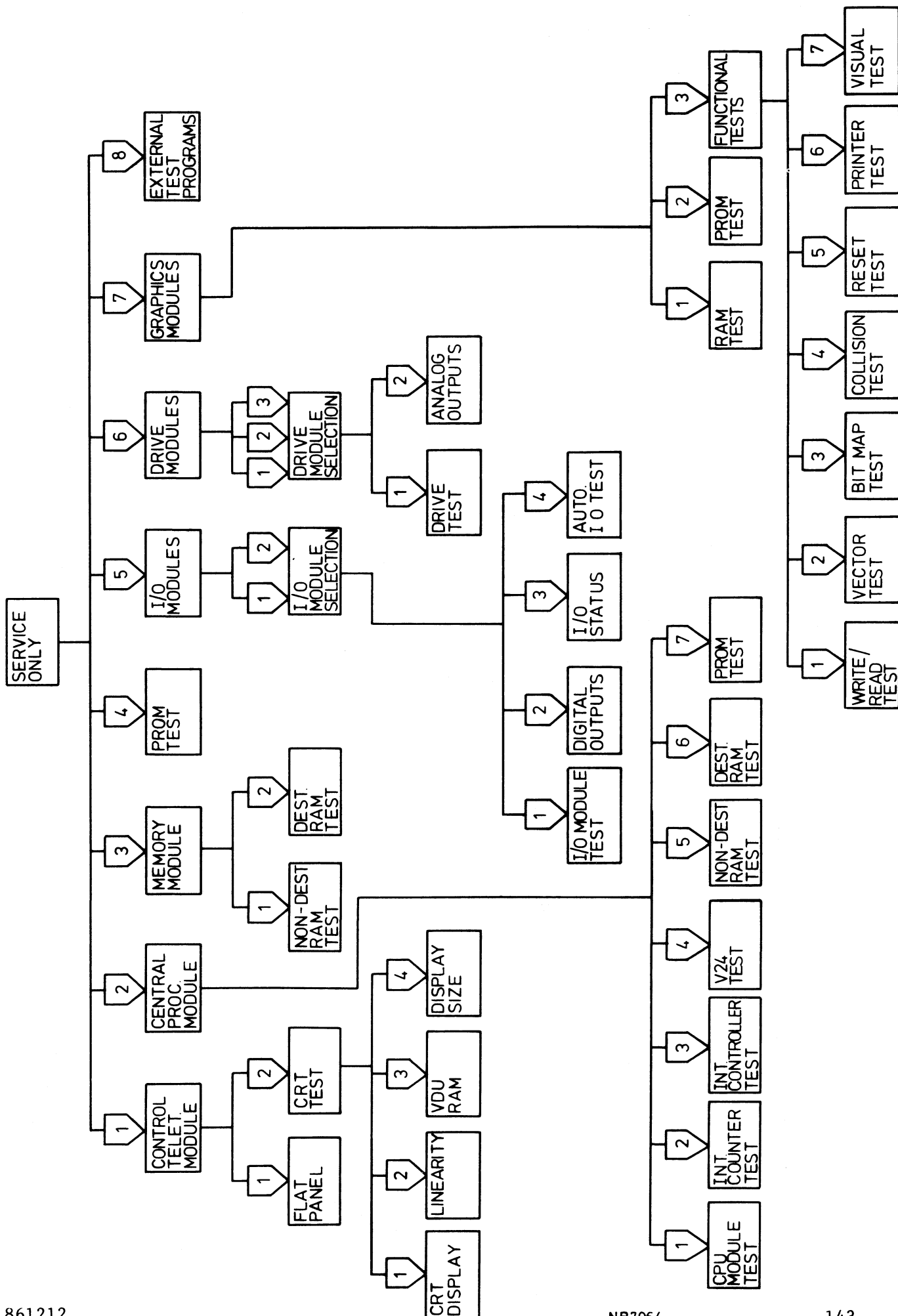
SERVICE ONLY

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

----- 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 F 3 , below >MANUAL<



14.1 CONTROL TELETEXT MODULE TESTS

These tests are selected by pressing button ☐ 1 when in Service Only mode.

The screen will show the display:

```
DIAGNOSTICS V4.02      SERVICE ONLY
SELECTED: CONTR.TELET.MOD.

1 FLAT-PANEL
2 CRT-DISPLAY
```

----- MANUAL -----

This is a menu to select either 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 V4.02 SERVICE ONLY
SELECTED: CONTR.TELET.MOD.

1 CRT-DISPLAY
2 LINEARITY
3 VDU RAM
4 DISPLAY SIZE

----- MANUAL -----

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).

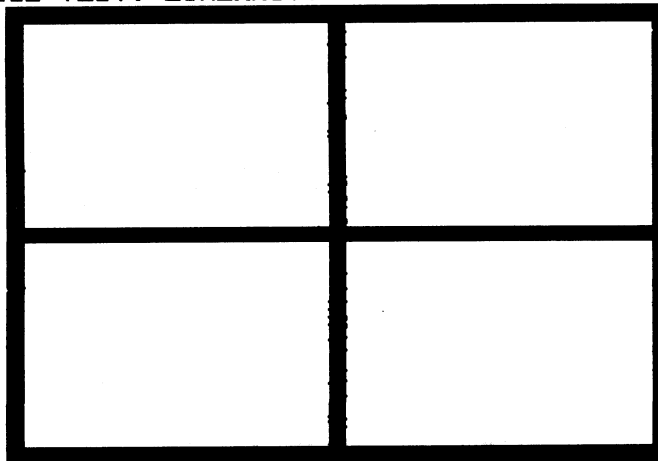
14.1.2.2 Linearity Test

Press button

2

The screen will show the display:

DIAGNOSTICS V4.02 SERVICE ONLY
SELECTED: CONTR. TELET. MOD.
SUB TEST: LINEARITY



----- EXIT

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 V4.02    SERVICE ONLY
SELECTED: CONTR.TELET.MOD.
SUB TEST: VDU RAM
VDU RAM TEST

START ADDRESS:      MEMORY LENGTH:
F0800                2 K
```

----- EXIT

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 V4.02    SERVICE ONLY
SELECTED: CONTR. TELET. MOD.
SUB TEST: VDU RAM
VDU RAM TEST

START ADDRESS:      MEMORY LENGTH:
FO800                2 K
```

TESTING

ERROR 13: RAM

----- STEP CONT EXIT

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.

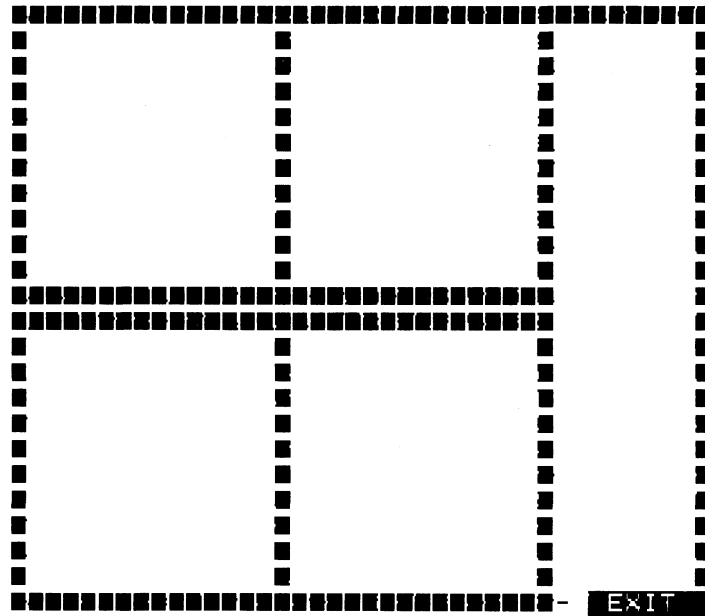
The CRT Display test menu is re-entered by pressing soft key F 5 , below >EXIT<.

14.1.2.4 Display Size Test

Press button

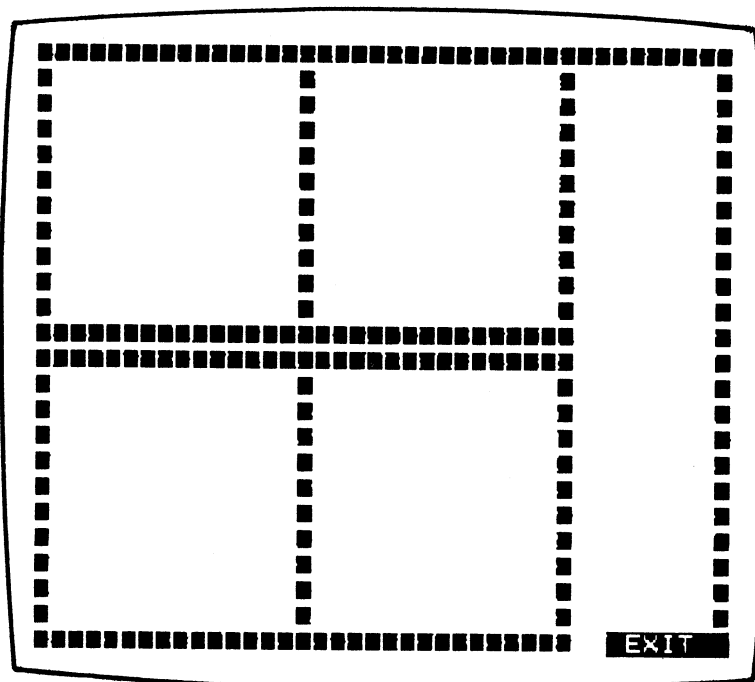
4

The screen shows the display:



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:



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 F 5 , 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 V4.02 SERVICE ONLY
SELECTED: CENTR.PROC.MOD. VERSION 3390

1 CPU MODULE
2 INTERRUPT COUNTER
3 INTERRUPT CONTROLLER
4 V24 TEST
5 NON DEST. RAM TEST
6 DEST. RAM TEST
7 PROM TEST
```

----- 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 V4.02 SERVICE ONLY
SELECTED: CENTR.PROC.MOD. VERSION 3390
SUB TEST: CPU MODULE
CPU RAM TEST
```

TESTING

----- 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 V4.02      SERVICE ONLY
SELECTED: CENTR.PROC.MOD.  VERSION 3390
SUB TEST: CPU MODULE
CPU RAM TEST
```

TESTING

ERROR 50: RAM NOT CONTIGUOUS

----- STEP CONT EXIT

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 softkey F 5 , below >EXIT<.

14.2.2 Interrupt Counter Test

Press button

2

The screen will show the display:

```
DIAGNOSTICS V4.02      SERVICE ONLY
SELECTED: CENTR.PROC.MOD.  VERSION 3390
SUB TEST: INTERRUPT COUNTER

INTERRUPT COUNTER
COUNTER IN TEST:    2
```

TESTING

TEST OK

----- EXIT

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 V4.02    SERVICE ONLY
SELECTED: CENTR.PROC.MOD.  VERSION    0
SUB TEST: INTERRUPT COUNTER

INTERRUPT COUNTER

COUNTER IN TEST:    0
EXPECTED VALUE:    8000
RECEIVED VALUE:    A001
```

TESTING

ERROR 1: SLOW ERROR

----- STEP CONT EXIT

The test will halt at the first fault detected. The test can be continued by pressing either softkey **F 3** (below >STEP<) or softkey **F 4** (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 Appendix A.

In this case the Central Processor Module must be replaced.

The Central Processor Module tests menu is re-entered by pressing softkey **F 5** , below >EXIT<.

14.2.3 Interrupt Controller Test

Press button

3

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

DIAGNOSTICS V4.02 SERVICE ONLY
SELECTED: CENTR.PROC.MOD. VERSION 3390
SUB TEST: INTERRUPT CONTROLLER
INTERRUPT CONTROLLER

TESTING

TEST OK

----- EXIT

If the test detects a fault, the screen will show the display:

```
DIAGNOSTICS V4.02      SERVICE ONLY
SELECTED: CENTR.PROC.MOD. VERSION  0
SUB TEST: INTERRUPT CONTROLLER
INTERRUPT CONTROLLER
```

```
ENABLED  INTERRUPTS:  11111110
RECEIVED INTERRUPTS:    10011
INTERRUPTS DISABLED
```

TESTING

ERROR 21: INTERRUPT NOT RESPONDING

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

The test will halt at the first fault detected. The test can be continued by pressing either softkey **F 3** (below >STEP<) or softkey **F 4** (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 Appendix A.

In this case the Central Processor Module, or the Interrupt Controller integrated circuit, must be replaced.

Note that the press-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 **F 5** , below >EXIT<.

14.2.4 V24 Test

If the V24 connection is suspected of having faults the V24 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 V4.02      SERVICE ONLY
SELECTED: CENTR.PROC.MOD.  VERSION 3390
SUB TEST: V24 TEST

V24 TEST
UART NR:   2
TRANSMITTED DATA:  FB
```

TESTING

TEST OK

----- EXIT

If the test detects a fault the screen will, for example, display:

```
DIAGNOSTICS V4.02      SERVICE ONLY
SELECTED: CENTR.PROC.MOD.  VERSION 3390
SUB TEST: V24 TEST

V24 TEST
UART NR:    1
DTR/DSR SHOULD BE:    1
```

TESTING

ERROR 9: DTR/DSR

----- STEP CONT EXIT

The test will halt at the first fault detected. The test can be continued by pressing either softkey **F 3** (below >STEP<) or softkey **F 4** (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 meaning of the error codes (e.g. >ERROR 09 : DTR/DSR<) are described in detail in Appendix A.

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 **F 5** , below >EXIT<.

14.2.5 Non-destructive RAM Test

Press button 5

If the test detects no faults the screen will display:

```
DIAGNOSTICS V4.02 SERVICE ONLY
SELECTED: CENTR.PROC.MOD. VERSION 3390
SUB TEST: NON DEST. RAM TEST
CPU RAM TEST
TEST RUN: 7
START ADDRESS: 80000 MEMORY LENGTH: 96 K
```

TESTING

TEST OK

----- 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, for example, display:

```
DIAGNOSTICS V4.02 SERVICE ONLY
SELECTED: CENTR.PROC.MOD. VERSION 3390
SUB TEST: NON DEST. RAM TEST

CPU RAM TEST

TEST RUN: 0
START ADDRESS: 80000
               90000

MEMORY LENGTH: 56 K
               32 K
```

TESTING

ERROR 50: RAM NOT CONTIGUOUS

----- STEP CONT EXIT

In this case the test will halt at the first fault detected. The test can be continued by pressing either softkey **F 3** (below >STEP<) or softkey **F 4** (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 50 RAM NOT CONTIGUOUS<) are described in detail in Appendix A.

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.

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 soft key

F 5 , below >EXIT<.

14.2.6 Destructive RAM Test

Press button

6

The screen will show the display:

```
DIAGNOSTICS V4.02      SERVICE ONLY
SELECTED: CENTR.PROC.MOD.  VERSION 3390
SUB TEST: DEST. RAM TEST

RAM TEST

TEST WILL DESTROY ENTIRE RAM CONTENTS
PUSH <START> TO RUN THE TEST
```

----- **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).

not

The test is started by pressing softkey F 4 , below >START<.

If no fault is detected the screen will display:

```
DIAGNOSTICS V4.02      SERVICE ONLY
SELECTED: CENTR. PROC. MOD.  VERSION 3390
SUB TEST: DEST. RAM TEST
RAM TEST
TEST RUN:      3
```

TESTING

TEST OK

----- 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 V4.02 SERVICE ONLY
SELECTED: CENTR.PROC.MOD. VERSION 3390
SUB TEST: DEST. RAM TEST
RAM TEST
TEST RUN: 0
EXPECTED VALUE: F4
RECEIVED VALUE: 59
ERROR AT ADDRESS: 8E000

TESTING

ERROR 13: RAM

----- STEP CONT EXIT
```

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 soft key

F5 , below >EXIT<.

14.2.7 PROM Test

Press button

7

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

```
DIAGNOSTICS V4.02 SERVICE ONLY
SELECTED: CENTR.PROC.MOD. VERSION 3390
SUB TEST: PROM TEST
PROM TEST
```

TEST READY

TEST OK

----- EXIT

Note that the display shows >TEST OK<.

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

```
DIAGNOSTICS V4.02      SERVICE ONLY
SELECTED: CENTR.PROC.MOD.  VERSION 3390
SUB TEST: PROM TEST
PROM TEST
```

```
PROM 6 BAD ?
```

```
ERROR 51: PROM CHECKSUM
```

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

The test will halt at the first fault detected. The test can be continued by pressing either softkey **F 3** (below >STEP<) or softkey **F 4** (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 Appendix A.

The number of the faulty PROM integrated circuit will be shown in the display, if it can be identified by the test.

In this case the Central Processor Module, or the system software PROM integrated circuits, must be replaced (note that the PROMs are always replaced as a set).

The Central Processor Module test menu is re-entered by pressing soft key **F 5** , below >EXIT<.

14.3 MEMORY MODULE TESTS

If the optional Memory Module is installed these tests are selected by pressing button while in Service Only mode.

The screen will then show the display:

```
          DIAGNOSTICS V4.02      SERVICE ONLY
SELECTED: MEMO.MOD.

1 NON DEST. RAM TEST
2 DEST. RAM TEST
```

----- 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 soft key , below >EXIT<.

14.3.1 Non-destructive RAM Test

Press button

1

If the test detects no faults the screen will display:

```
DIAGNOSTICS V4.02      SERVICE ONLY
SELECTED: MEMO.MOD.
SUB TEST: NON DEST. RAM TEST

CPU RAM TEST

TEST RUN:      6
START ADDRESS:      MEMORY LENGTH:
      80000              96 K
```

TESTING

TEST OK

----- **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 V4.02      SERVICE ONLY

SELECTED: MEMO.MOD.
SUB TEST: NOM DEST. RAM TEST

RAM TEST

TEST RUN:      0
START ADDRESS: 98000      MEMORY LENGTH: 32 K
               A2000      8 K
```

TESTING

ERROR 50: RAM NOT CONTIGUOUS

----- STEP CONT EXIT

The test will halt at the first fault detected. The test can be continued by pressing either softkey **F 3** (below >STEP<) or softkey **F 4** (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 Appendix A.

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 soft key **F 5** below >EXIT<.

14.3.2 Destructive RAM Test

Press button

2

The screen will show the display:

```
DIAGNOSTICS V4.02      SERVICE ONLY
SELECTED: MEMO.MOD.
SUB TEST: DEST. RAM TEST
RAM TEST
TEST WILL DESTROY ENTIRE RAM CONTENTS
PUSH <START> TO RUN THE TEST
```

```
----- [START] [EXIT]
```

CAUTION : This test will result in the loss of the entire contents of the Memory Module's RAM storage being erased. Some part programs and macros will be lost.

The test is started by pressing soft key F 4, below >START<.

If the first test detects no faults the display will show >TEST OK<. The test will be repeated continuously and the line >TEST RUN< will show the number of tests successfully completed.

If a test detects a fault the screen will show the display:

```
DIAGNOSTICS V4.02      SERVICE ONLY
SELECTED: MEMO MOD.
SUB TEST: DEST. RAM TEST
RAM TEST
TEST RUN:      0
EXPECTED VALUE: E2
RECEIVED VALUE: 0
ERROR AT ADDRESS: B0000

TESTING

ERROR 13: RAM
```

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

The test will halt at the first fault detected. The test can be continued by pressing either softkey F 3 (below >STEP<) or softkey F 4 (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 50 RAM NOT CONTIGUOUS<) are described in detail in Appendix A.

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 Memory Module, or the faulty RAM, must be replaced.

The Memory Module tests menu is re-entered by pressing soft key F 5 below >EXIT<.

14.4 PROM TEST

This test is selected by pressing button when in Service Only mode (or button 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 MODULES TESTS

If the optional I/O Modules are fitted these tests can be selected by pressing button when in Service Only mode (or button if the Memory Module is not installed).

The screen will show the display:

```
DIAGNOSTICS V4.02 SERVICE ONLY
SELECTED: 32 INP./OUTP.MOD.

1 I/O MODULE 1
2 I/O MODULE 2
```

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

This is a menu to select the I/O Module to be tested:

-Press button to select the first I/O Module

-Press button to select the second I/O Module

Manual mode can be re-entered if a module is not selected by pressing soft key below >MANUAL<.

When an I/O Module is selected, as above, the screen will show the display:

```
DIAGNOSTICS V4.02      SERVICE ONLY
SELECTED: 32 INP./OUTP.MOD.

1 I/O MODULE
2 DIGITAL OUTPUTS
3 I/O STATUS
4 AUTOMATIC I/O
```

----- MANUAL -----

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 descibed in the following sections.

Manual mode can be re-entered from the I/O Modules test menu by pressing soft key F 3 below >MANUAL<.

14.5.1 I/O Module Test

Press button

1

The screen will show the display:

```
DIAGNOSTICS V4.02      SERVICE ONLY
SELECTED: 32 INP./OUTP.MOD.
SUB TEST: I/O MODULE

      123456789 123456789 123456789 12
IN      00000000000000000000000000000000
OUT     00000000000000000000000000000000
```

```
PARITY INPUTS OK
PARITY OUTPUTS OK
```

```
ON  LEFT  RIGHT  -----  EXIT
```

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.

Each output can be selected individually by moving the cursor (shown on output 1 above) with the soft keys **F 2** (below >LEFT<) and **F 3** (below >RIGHT<).

The status of a selected output can be changed by pressing the soft key **F 1** (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 soft key below >EXIT<.

F 5

14.5.2 Digital Outputs Test

Press button

2

The screen will show the display:

```
DIAGNOSTICS V4.02 SERVICE ONLY
SELECTED: 32 INP./OUTP.MOD.
SUB TEST: DIGITAL OUTPUTS
OUT
AUTO MODE
OUTPUT 13 SHOULD BE HIGH
```

----- EXIT

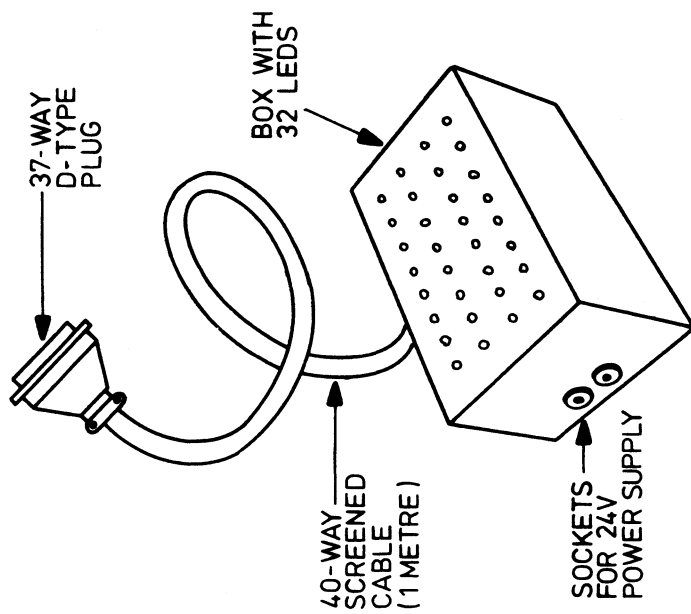
The 32 outputs are automatically switched ON in numerical sequence repeatedly by this test. The number of each output is shown as this is done (in the above example output 13 should be ON).

This test is of most use 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.

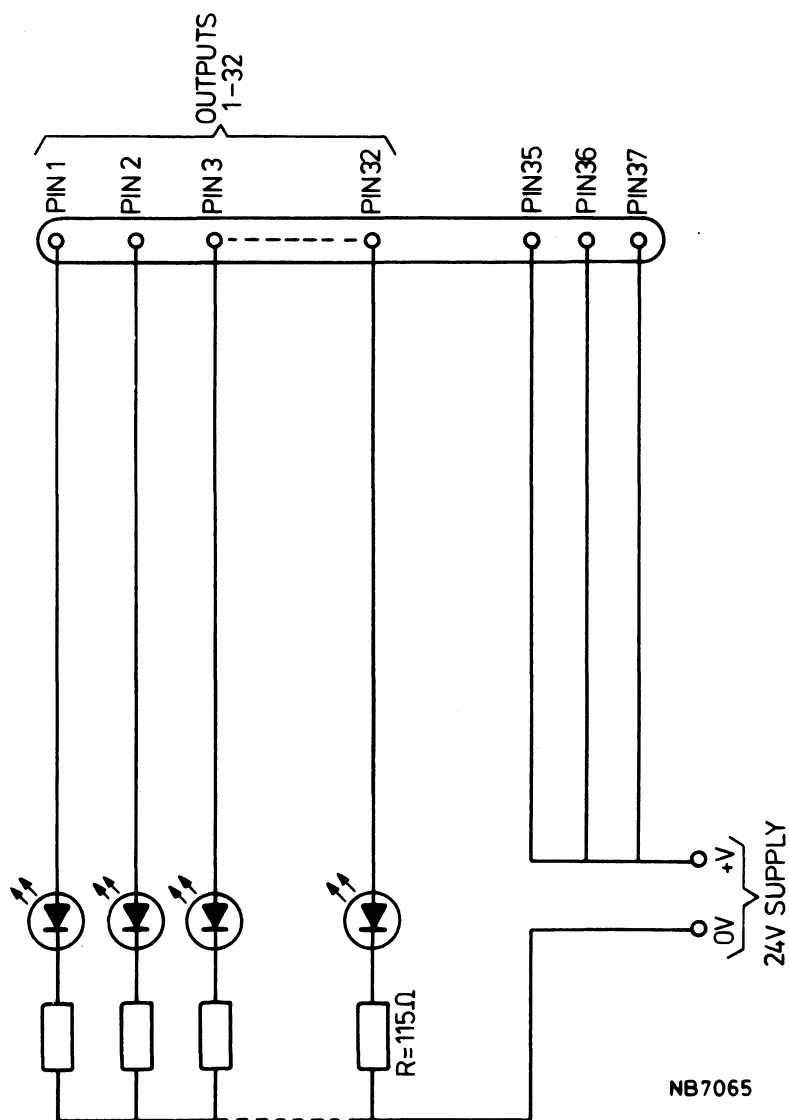
If any of the outputs fail to switch to ON when shown in the screen display the I/O Module is faulty and must be replaced:

The I/O Modules test menu is re-entered by pressing soft key below >EXIT<.

F 5



TEST BOX DESIGN



TEST BOX CIRCUIT DIAGRAM

14.5.3 I/O Status

Press button

3

The screen will show the display:

DIAGNOSTICS V4.02 SERVICE ONLY

SELECTED: 32 INP./OUTP.MOD.

SUB TEST: I/O STATUS

[illegible]

PARITY INPUTS OK
PARITY OUTPUTS OK

EXIT

This is a display of the current statuses of the inputs and outputs. No control of the statuses is possible in this test; it is used solely for observation.

The input and output parity is checked in the same way as described in Section 13.4.5.

The I/O Modules test menu is re-entered by pressing soft key below >EXIT<.

F S

14.5.4 Automatic I/O Test

This test is always used in conjunction with a test lead that connects the corresponding inputs and outputs of the I/O Module together. This test lead needs an external 24 volt power supply. It is illustrated overleaf.

When the test lead is connected the test is started by pressing

button 4

If no faults are detected the screen will show the display:

```
DIAGNOSTICS V4.02      SERVICE ONLY
SELECTED: 32 INP./OUTP.MOD.
SUB TEST: AUTOMATIC I/O
INPUTS-OUTPUTS
I/O IN TEST:  1
```

TESTING

TEST OK

----- EXIT

If a fault is detected the screen will show the display:

```
DIAGNOSTICS V4/02      SERVICE ONLY
SELECTED: 32 INP./OUTP.MOD.
SUB TEST: AUTOMATIC I/O
INPUTS-OUTPUTS
I/O IN TEST: 1
EXPECTED VALUE: 0
```

ERROR IN I/O NR: 1

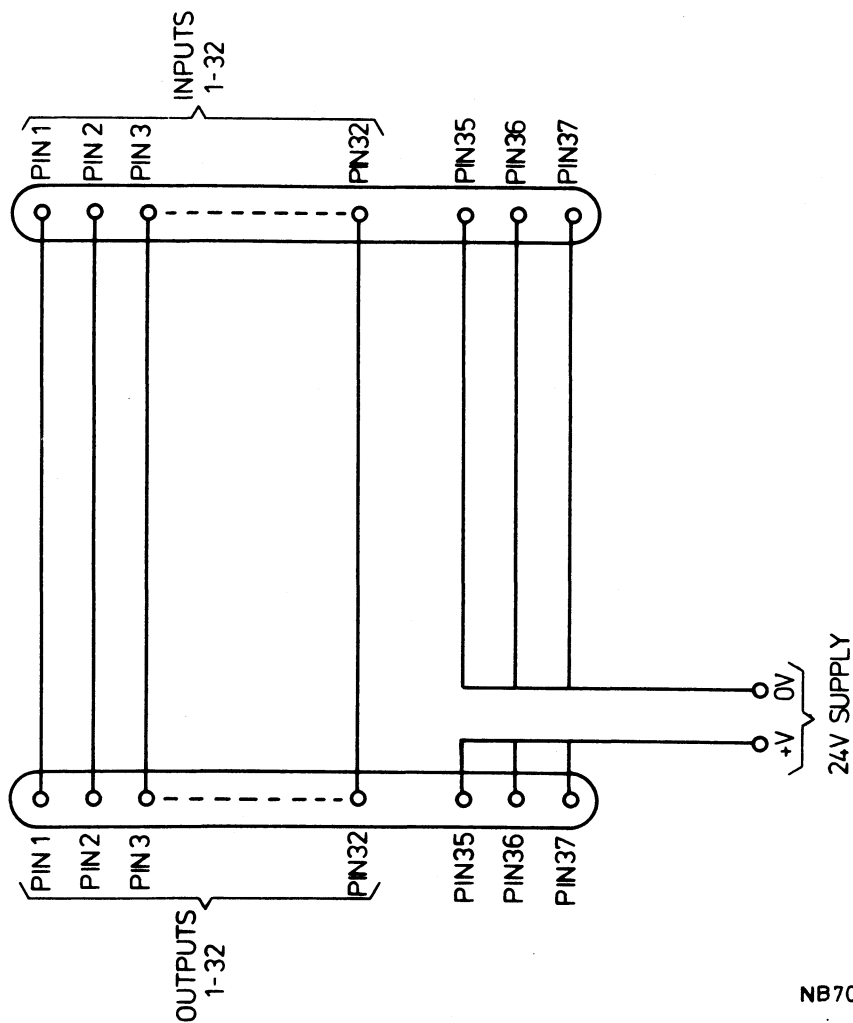
ERROR 16: I/O NOT CORRESPONDING

----- STEP CONT EXIT

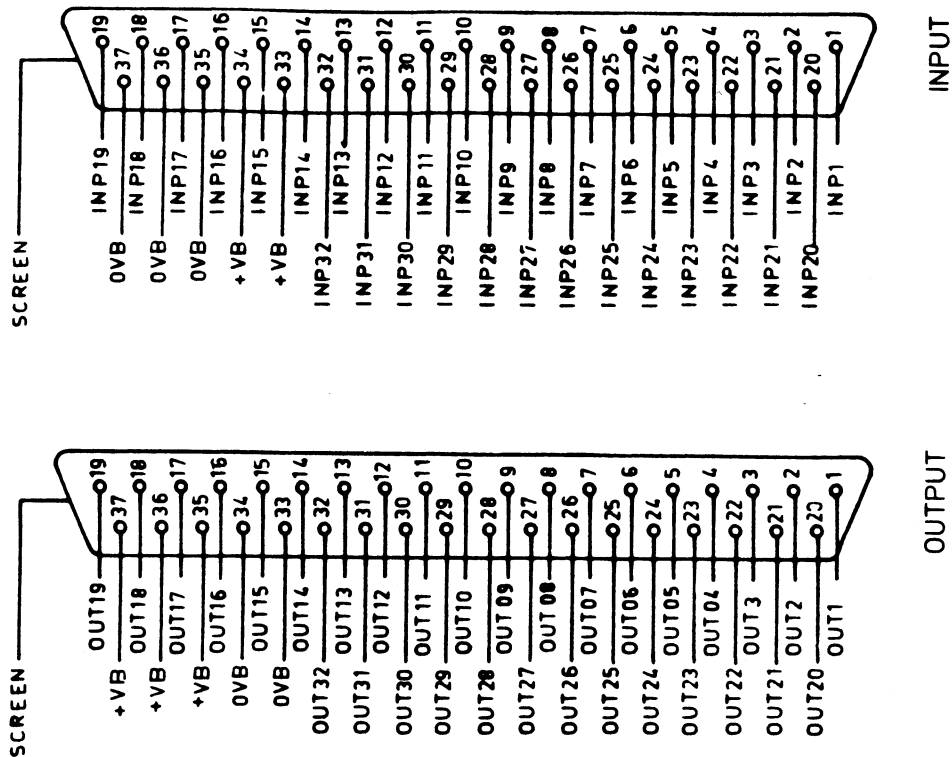
The test will halt at the first fault detected. The test can be continued by pressing either softkey **F 3** (below >STEP<) or softkey **F 4** (below >CONT<). If >STEP< is pressed the test will continue until the next fault is detected, if >CONT< is pressed the test will continue repeatedly and will 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 Appendix A.

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 **F 5** below >EXIT<.



NB7066

I/O MODULE SOCKET
PIN LAYOUT

These tests are selected by pressing button when in Service Only mode (or button if either the Memory Module or the I/O Modules are not installed, or button if both are not installed).

The screen will show the display:

```
DIAGNOSTICS V4.02      SERVICE ONLY
SELECTED: DRIVE MODULES

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

----- MANUAL -----

This menu is used to select the Drive Module to be tested:

- Press button to test the first and second channels (usually axes X and Y).
- Press button to test the third and fourth channels (usually axes Z and B).
- Press button to test the fifth and sixth channels (optional; 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 softkey F3 , below >MANUAL<.

When a Drive Module is selected, as above, the screen will show the display:

```
DIAGNOSTICS V4.02      SERVICE ONLY
SELECTED: DRIVE MODULES

1 DRIVE TEST
2 ANALOG OUTPUTS
```

----- 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



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 V4.02 SERVICE ONLY
SELECTED: DRIVE MODULES
SUB TEST: ANALOG OUTPUTS
ALL DRIVES
ANALOG OUTPUTS
OUTPUT-VOLTAGE:      0 mV
```

----- -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 F 3 (below > -V OUT<) and F 4 (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

soft key F 5 , below >EXIT<.

These tests are selected by pressing button when in Service Only mode.(or button if either the Memory Module or the I/O Modules are not installed, or button if both are not installed). The screen will show the display:

DIAGNOSTICS V4.02 SERVICE ONLY
SELECTED: GRAPH.MOD.

1 RAM TEST
2 PROM TEST
3 FUNCTIONAL TESTS

----- **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 , below >MANUAL<.

14.7.1 RAM Test

Press button

1

If no faults are detected the screen will show the display:

```
DIAGNOSTICS V4.02      SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: RAM TEST
RAM TEST      8 PLANES GRAPHIC    V4.00
TEST RUN:      5
```

TESTING

----- EXIT

The display will show >TEST READY< then >TEST OK<. The test will continue to run and >TESTING<, >TEST READY< and >TEST OK< will appear in repeated sequence. The line >TEST RUN:< shows how many tests have been completed.

If the test detects a fault the screen will show the display:

DIAGNOSTICS V4/02 SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: RAM TEST
RAM TEST 8 PLANES GRAPHIC V4/00
TEST RUN: 4

2 planes!

TESTING

ERROR 53: GRAPHICS RAM ERROR

----- STEP CONT EXIT

In this case the Graphics Module must be replaced.

The Graphics Module test menu is re-entered by pressing softkey
below >EXIT<.

F5

14.7.2 PROM Test

Press button 2

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

DIAGNOSTICS V4.02 SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: PROM TEST
PROM TEST 8 PLANES GRAPHIC V4.00

TEST READY

TEST OK

----- EXIT

If the test detects a fault the screen will display:

```
DIAGNOSTICS V4.02      SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: PROM TEST
PROM TEST      8 PLANES GRAPHIC  V4.00
```

ERROR 54: GRAPHICS PROM CHECKSUM ERROR

----- STEP CONT EXIT

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 below >EXIT<.

F 5

14.7.3 Functional Tests

Press button

3

The screen will show the display:

```
DIAGNOSTICS V4.02    SERVICE ONLY
SELECTED: GRAPH.MOD.
```

```
1 WRITE/READ
2 VECTOR
3 BIT MAP
4 COLLISION
5 RESET
6 PRINTER
7 VISUAL TEST
```

----- MANUAL -----

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 V4.02    SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: WRITE/READ
WRITE/READ    8 PLANES GRAPHIC    V4.00
```

TEST READY

TEST OK

----- EXIT

If a fault is detected the screen will show the display:

```
DIAGNOSTICS V4/02    SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: WRITE/READ
WRITE/READ    8 PLANES GRAPHIC    V4.00
```

TESTING

ERROR 53: GRAPHICS RAM ERROR

----- STEP CONT EXIT

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
below >EXIT<.

F5

2



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

DIAGNOSTICS V4/02 SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: VECTOR
VECTOR 8 PLANES GRAPHIC V4/00

TEST READY

TEST OK

----- EXIT

If a fault is detected the screen will show the display:

DIAGNOSTICS V4.02 SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: VECTOR
VECTOR 8 PLANES GRAPHIC V4.00

TESTING

ERROR 55: BAD GRAPHICS FUNCTION

----- STEP CONT EXIT

In this case the Graphics Module must be replaced.

The Functional Tests menu is re-entered by pressing softkey
below >EXIT<.

F 5 ,

14.7.3.3 Bit Map Test

Press button

3

The screen will show the display:

```
DIAGNOSTICS V4.02    SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: BIT MAP
BIT MAP      8 PLANES GRAPHIC  V4.00
NO EXIT POSSIBLE, WAIT FOR TEST READY
```

TESTING

----- EXIT

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 V4.02 SERVICE ONLY

SELECTED: GRAPH.MOD.
SUB TEST: BIT MAP

BIT MAP 8 PLANES GRAPHIC V4.00

TEST READY

TEST OK

----- EXIT

If a fault is detected the screen will display:

```
DIAGNOSTICS V4.02      SERVICE ONLY  
SELECTED: GRAPH.MOD.  
SUB TEST: BIT MAP  
BIT MAP      8 PLANES GRAPHIC  V4.00
```

TESTING

ERROR 55: BAD GRAPHICS FUNCTION

----- **EXIT**

In this case the Graphics Module must be replaced.

The Functional Tests menu is re-entered by pressing softkey
below >EXIT<.

F 5 ,

14.7.3.4 Collision Test

Press button

4

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

DIAGNOSTICS V4.02 SERVICE ONLY

SELECTED: GRAPH.MOD.

SUB TEST: COLLISION

COLLISION 8 PLANES GRAPHIC V4.00

TEST READY

TEST OK

----- EXIT

If a fault is detected the screen will show the display:

```
DIAGNOSTICS V4.02      SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: COLLISION
COLLISION      8 PLANES GRAPHIC  V4.00
```

TEST READY

ERROR 55: BAD GRAPHICS FUNCTION

----- EXIT

In this case the Graphics Module must be replaced.

The Functional Test menu is re-entered by pressing softkey F 5 ,
below >EXIT<.

14.7.3.5 Reset Test

Press button

5

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

DIAGNOSTICS V4.02 SERVICE ONLY

SELECTED: GRAPH.MOD.

SUB TEST: RESET

RESET 8 PLANES GRAPHIC V4.00

TEST READY

TEST OK

----- EXIT

If a fault is detected the screen will show the display:

```
DIAGNOSTICS V4.02      SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: RESET
RESET      8 PLANES GRAPHIC  V4.00
```

TEST READY

ERROR 55: BAD GRAPHICS FUNCTION

----- EXIT

In this case the Graphics Module must be replaced.

The Functional Tests menu is re-entered by pressing softkey F5 ,
below >EXIT<.

14.7.3.6 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 V4.02      SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: PRINTER
PRINTER      8 PLANES GRAPHIC  V4.00
```

TEST READY

TEST OK

----- EXIT

If a fault is detected the screen will show the display:

```
DIAGNOSTICS V4.02      SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: PRINTER
PRINTER      8 PLANES GRAPHIC  V4.00
```

TEST READY

ERROR 55: BAD GRAPHICS FUNCTION

----- EXIT

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

F 5

,

below >EXIT<.

14.7.3.7 Visual Test

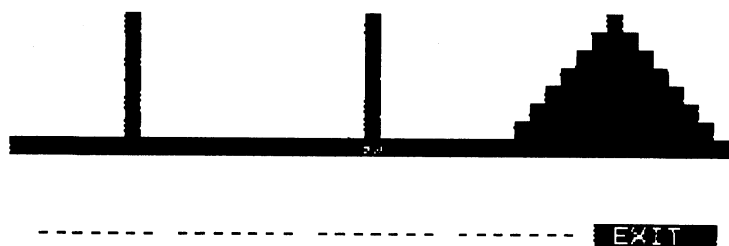
Press button

7

The screen will initially show the display:

DIAGNOSTICS V4.02 SERVICE ONLY
SELECTED: GRAPH.MOD.
SUB TEST: VISUAL TEST

all been 8 plays!



This is ~~an~~ animated display of the solution to the 'Towers of Hanoi' problem. This 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 Tests menu is re-entered by pressing softkey
below >EXIT<.

F5

14.8 EXTERNAL TEST PROGRAMS

These tests are for the use of qualified service personnel only. See Section 13.3.

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 MAN.OPER.

JOG CONTINUE

MANUAL MENU:

- 1 BLOCK SEARCH
- 2 REFERENCE POINT SEARCH
- 3 RESET AXIS
- 4 INCH
- 5 METRIC
- 6 REMOTE PANEL ON
- 7 DIAGNOSTIC
- 8 HANDWHEEL

3. Press button 8 to select the Handwheel facility.

The screen will return to the Manual display, but with the top line showing >HANDWHEEL<:

MANUAL HANDWHEEL

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
B		B	0.000	B	0
A		A	0.000	A	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 20 25 27 40 51 53 63 66 68 71 72					
M 5 9			41		

XYZBA

X

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

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
B		B	0.000	B	0
A		A	0.000	A	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 20 25 27 40 51 53 63 66 68 71 72				
M	5 9		41		

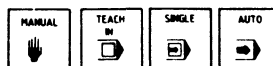
XYZBA
Y-HW

Y

In the above example the Y-axis has been selected.

The Handwheel unit can now be used to cause movement on 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 MC 750).

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 button to put the CNC into Manual mode



2. Press the Menu button



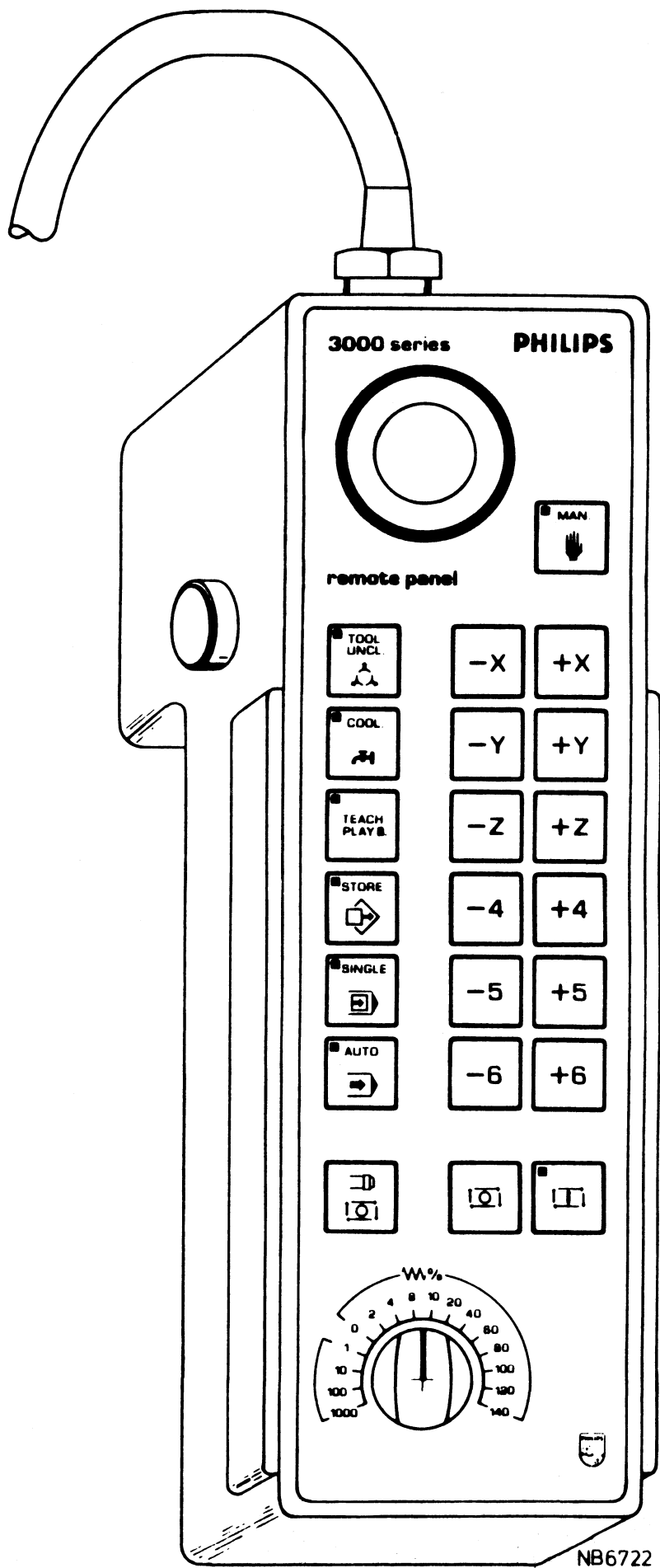
The screen will display the Manual menu:

MANUAL MAN.OPER.

JOG CONTINUE

MANUAL MENU:

- 1 BLOCK SEARCH
- 2 REFERENCE POINT SEARCH
- 3 RESET AXIS
- 4 INCH
- 5 METRIC
- 6 REMOTE PANEL ON
- 7 DIAGNOSTIC
- 8 HANDWHEEL



3. Press button 6 to select the Remote Panel facility.

The screen will return to the Manual display, but with the additional line >REMOTE PANEL OFF<:

MANUAL MAN.OPER.

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
B		B	0.000	B 0
A		A	0.000	A 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 20 25 27 40 51 53 63 66 68 71 72				
M 5 9			41	

----- ACTUAL ----- **IN-OUT**

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.

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
B		B	0.000	B 0
A		A	0.000	A 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 20 25 27 40 51 53 63 66 68 71 72				
M 5 9			41	

----- ACTUAL ----- **IN-OUT**

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.

JOG CONTINUE REMOTE PANEL OFF

MANUAL MENU:

1 BLOCK SEARCH
2 REFERENCE POINT SEARCH
3 RESET AXIS
4 INCH
5 METRIC
6 REMOTE PANEL OFF
7 DIAGNOSTIC
8 HANDWHEEL

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.

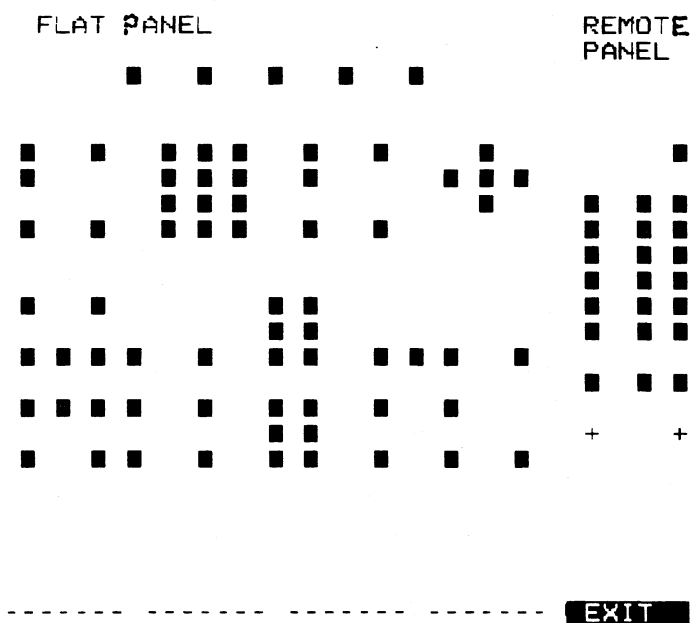
16.1. REMOTE PANEL DIAGNOSTICS

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 13.4.1.1.
2. Press any button of the Remote Panel.

The Remote Panel will be added to the display of the Flat Panel test:



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.

All new part programs must 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 six special test programs; TESTRUN-1, TESTRUN-2, TESTRUN-4, TESTRUN-5, TESTRUN-6 and TESTRUN-7.

These test programs enable new part programs to be checked as they are run on the CNC. The six test programs can be regarded as divided into two groups:

- test programs that run the part program as if an actual machining operation is taking place, and which may allow machine movement and I/O (TESTRUN-1, TESTRUN-2, TESTRUN-3. See section 17.1)
- test programs that run the part program and produce from it an animated-graphics screen display (TESTRUN-5, TESTRUN-6, TESTRUN-7. See section 17.2)

A part program can be run with a test program in either Auto or Single 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. While a part program is being run with a test program only the following buttons will operate:

- Feedrate Hold button



- Feedrate/Spindle Speed Hold button



- Feedrate Override buttons



- Spindle Speed Override buttons



If a command for a manual tool-change occurs during the running of a part program with a test program the CNC will halt and the message >INTERVENTION T< will appear in the screen display. The part program

can be continued by pressing the Tool Unclamp button



twice.

The test programs will detect any simple programming errors and will indicate them by halting the part program and showing the message >ERR< on line 3 of the screen display, followed by an error code to identify the particular error. (The meanings of the error codes are given in Appendix A).

A menu to select one of the test programs is obtained as follows:

- (1) Start the CNC, perform the Reference Point Search, load and select the part program to be tested. The part program number will be shown on line 2 of the screen display.

- (2) Press either the Auto button  or the Single button 

(Auto mode causes the part program to be run in a continuous fashion, Single mode causes the part program to be run a block at a time as the start button is pressed).

- (3) Press the menu button 

The screen will show the display:

AUTO
PM 9900

DEMO
N

SINGLE/AUTO MENU:

```
1 TESTRUN:      MOTION,      IO
2 TESTRUN:      MOTION, NO IO
4 TESTRUN: NO    MOTION, NO IO
5 TESTRUN: GRAPHICS 2,5D WIRE PLOT
6 TESTRUN: GRAPHICS 3D WIRE PLOT
7 TESTRUN: GRAPHICS MILLING SIMULATION
8 EXIT SUBMODE
```

This is the menu to select the particular test program to be used. The selections from it are described in sections 17.1 and 17.2.

17.1 TEST PROGRAMS WITH MACHINE MOVEMENT AND I/O

The test programs 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

The test program 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 programs 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.

17.1.1 TESTRUN-1

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 1

The screen will show the display:

```

AUTO      TESTRUN-1  DEMO
PM  9900      N

COMMAND    ACTUAL      DIST TO GO
X          X      11.111 X      0
Y          Y      22.222 Y      0
Z          Z      33.333 Z      0
B          B      44.444 B      0
A          A      55.555 A      0

F      0.000 F      0.000 F-OVR 100 %
S      0      S      0      S-OVR 100 %
T      0      T      0
G
M

■N9900
N1 G54
N2 G98 X-330 Y-165 Z-690 I690 J350
K200

----- ACTUAL  PROGRAM IN-OUT

```

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 9900 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 soft key F 4 below >PROGRAM<.

The screen will show, for example, the display:

```
AUTO      TESTRUN-1  DEMO
PM      9900      N

■N9900
N1 G54
N2 G98 X-330 Y-165 Z-690 I690 J350
  K200
N3 G99 X-330 Y-155 Z-690 I662 J340
  K150
N5 G0 X-300 Y17.5 Z-552
N6 G1 Z-600 F1500 S200 M3
N7 X-251 Y17.5
N8 G3 X-176 Y-70 R78
N9 G1 X-13.5 Y-70
N10 X-13.5 Y42.5
N11 X61.5 Y-70
N12 X224 Y-70
N13 G3 X286.5 Y-40 R78
N14 G1 X260 Y-13.5
N15 G2 X186.5 Y17.5 R42

----- ACTUAL PROGRAM IN-OUT
```

The test program is re-entered by pressing soft key F 3 below >ACTUAL<.

The status of the digital inputs and outputs can be seen by pressing soft key F 5 below >IN-OUT<

The screen will show, for example the display:

```

AUTO      TESTRUN-1 DEMO
PM  9900      N

          1          2          3
        12345678901234567890123456789012
IN  1  .....
IN  2  .....
IN  3  .....
OUT 1  .....1.11.....
OUT 2  1111111111.....
OUT 3  .....
AREA  .....

■N9900
N1 G54
N2 G98 X-330 Y-165 Z-690 1690 J350
K200

----- ACTUAL PROGRAM IN-OUT

```

The test program is re-entered by pressing soft key F 3 below >ACTUAL<.

(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 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-1  DEMO
PM  9900      N      5
ERR P04

COMMAND    ACTUAL      DIST TO GO
X           X- 300.000 X      0
Y           Y   17.500 Y      0
Z           Z- 600.000 Z      0
B           B   44.444 B      0
A           A   55.555 A      0

F      0.000 F      0.000 F-OVR 100 %
S      0      S      0      S-OVR 100 %
T      0      T      0
G
M

N3 G99 X-330 Y-155 Z-690 I662 J340
K150
N5 G1 X-300 Y17.5 Z-250
N6 G1 Z-600 F1500 S200 M3

----- ACTUAL PROGRAM IN-OUT
```

The meanings of the error codes are given in Appendix A.

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< 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 inputs) 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) are used to check the machine tool movement.

The test programs 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 test programs are of three different types:

TESTRUN-5 - three-view, 2-D graphics

TESTRUN-6 - single-view, 3-D graphics

TESTRUN-7 - Three-view, 2-D milling simulation graphics

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:

```

AUTO      TESTRUN-5  DEMO
PM  9900      N

COMMAND    ACTUAL      DIST TO GO
X          X- 300.000 X    0
Y          Y   17.500 Y    0
Z          Z- 600.000 Z    0
B          B   44.444 B    0
A          A   55.555 A    0

F    0.000 F    0.000 F-OVR 100 %
S    0      S    0      S-OVR 100 %
T    0      T    0
G
M

■N9900
N1 G54
N2 G98 X-330 Y-165 Z-690 I690 J350
K200

PARAM ----- ACTUAL PROGRAM IN-OUT

```

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 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 list of the Graphics Parameters can be obtained by pressing soft key F1 below >PARAM<.

The screen will show, for example, the display:

```
AUTO      TESTRUN-5  DEMO
PM      9900      N

GRAPHIC PARAMETERS

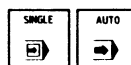
ALL MEMORY 27008 BYTES FREE
■N0 (WINDOW MANUAL )
N1 (WINDOW CURSOR ) X-586.207
  Y-310.345 Z-758.621 I1206.897
  J586.207 K310.345
N2 (ROUGH CONTOUR ) X-280 Y-115
  Z-640 I590 J250 K100
N3 (START/END BLOCK)
N4 (INTERVENTION )
N5 (DWEELL )
N6 (END CONTOUR )
N7 (TOOL MOTIONS )

BLOCK NUMBER
■XYZBIJK      ■N
NO
```

----- PICTURE ----- PROGRAM -----

The Graphics Parameters and their uses are explained in Section 17.2.4. The test program is re-entered by pressing either the Auto

or the Single buttons



A listing of the part program being checked can be obtained by pressing soft key F 4 below >PROGRAM<.

The screen will show, for example, the display:

```
AUTO      TESTRUN-5  DEMO
PM      9900      N
```

```
■N9900
N1 G54
N2 G98 X-330 Y-165 Z-690 I690 J350
  K200
N3 G99 X-330 Y-155 Z-690 I662 J340
  K150
N5 G0 X-300 Y17.5 Z-250
N6 G1 Z-600 F1500 S200 M3
N7 X-251 Y17.5
N8 G3 X-176 Y-70 R78
N9 G1 X-13.5 Y-70
N10 X-13.5 Y42.5
N11 X61.5 Y-70
N12 X224 Y-70
N13 G3 X286.5 Y-40 R78
N14 G1 X260 Y-13.5
N15 G2 X186.5 Y17.5 R42
```

```
PARAM ----- ACTUAL PROGRAM IN-OUT
```

The test program is re-entered by pressing soft key F 3 below >ACTUAL<.

The status of the digital inputs and outputs can be seen by pressing soft key F 5 below >IN-OUT<.

The screen will show, for example, the display:

```

AUTO      TESTRUN-5  DEMO
PM      9900      N

                1          2          3
            12345678901234567890123456789012
IN   1  .....
IN   2  .....
IN   3  .....
OUT  1  .....1.11.....1.....
OUT  2  1111111111.....
OUT  3  .....
AREA  .....

■N9900
N1 G54
N2 G98 X-330 Y-165 Z-690 I690 J350
K200

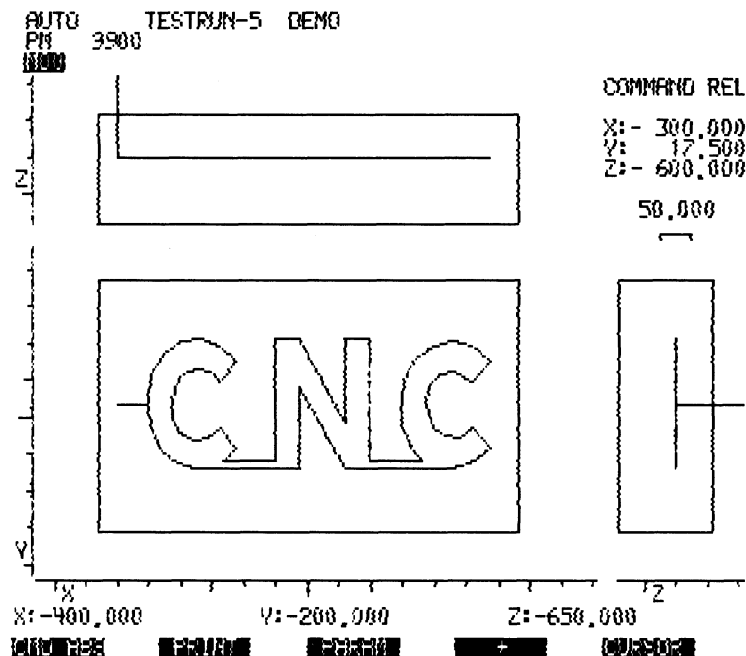
PARAM  ----- ACTUAL  PROGRAM IN-OUT

```

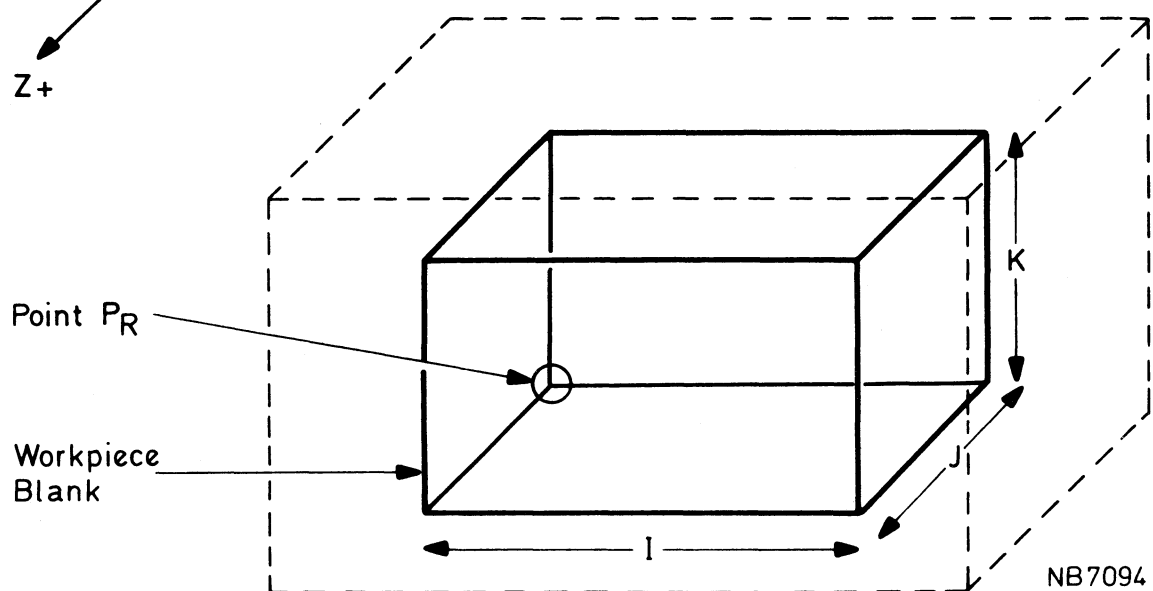
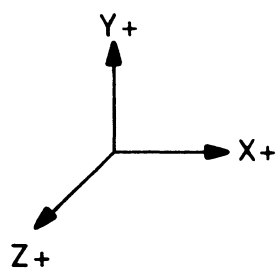
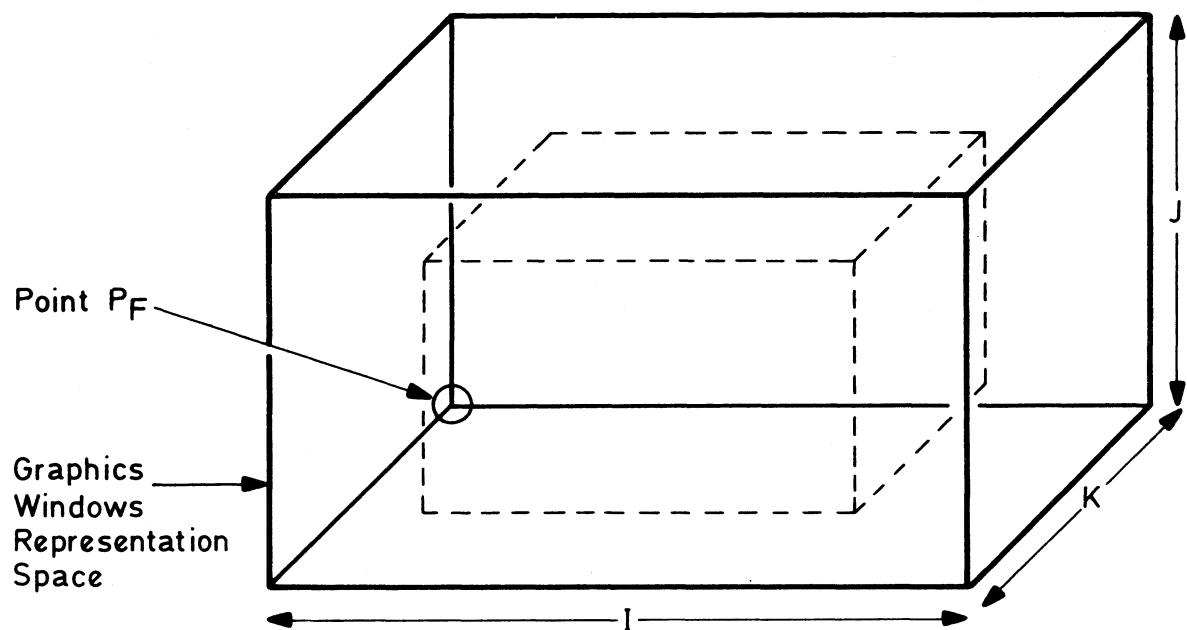
The test program is re-entered by pressing soft key F 3 below >ACTUAL<

- (3) The part program is run with TESTRUN-5 by pressing the Start button 

The part program will be run under the supervision of TESTRUN-5. and analysed to produce an animated-graphics display, for example:



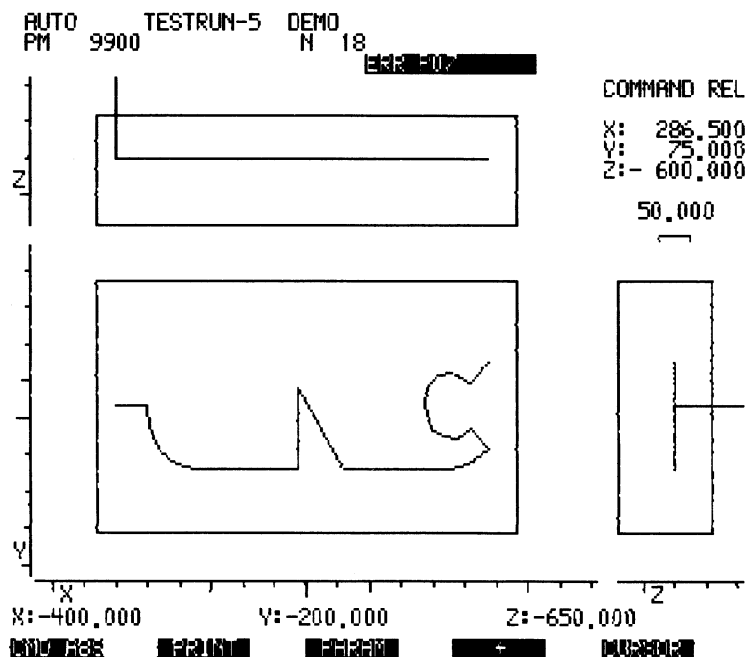
The programmed path of the tool-tip is shown in the three views. These can be imagined as views through top, front and side 'graphic windows'. The three graphic windows are at right-angles to each other in a box configuration called a 'representation space' (see illustration opposite). The size of the 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 17.2.4). The representation space will normally be defined to be larger than, and to contain, the workpiece.



NB7094

The size and position of the workpiece blank is defined in a similar way to the representation space. The point PR 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 17.2.4). 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 TESTRUN-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:



The meanings of the error codes are given in Appendix A.

When a program is halted by a detected error it cannot be re-started and must be aborted by pressing the Manual button



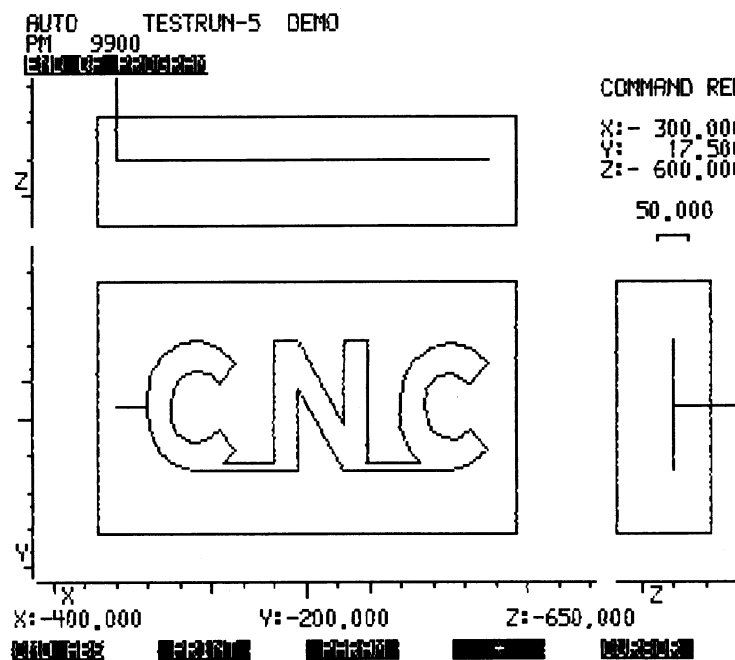
then the Clear Control button



The part program is then modified to remove the error (see Section 4.2).

The corrected part program can then be run with TESTRUN-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 17.2.4).

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:



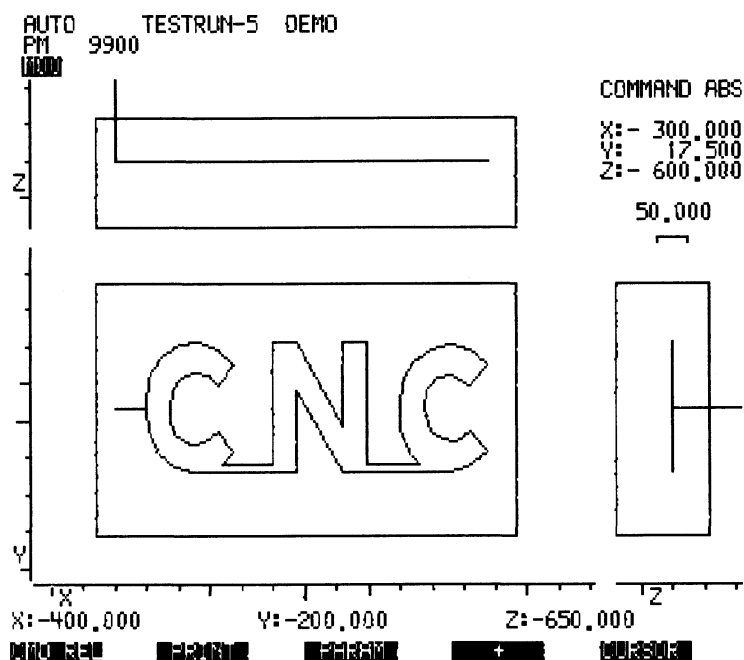
The test program TESTRUN-5 can be terminated by pressing the Menu button  to obtain the test program menu, then pressing button  to select >EXIT SUBMODE< (or by selecting another test program, if required). The CNC will then return to Auto or Single mode and the line >TESTRUN-5< will disappear from the display.

17.2.1.1 Relative/Absolute Position

When a part program is running with TESTRUN-5 the upper right of the screen display shows a table of the axis position values. This table is normally given with the axis values relative to the workpiece zero point. These can be changed to absolute axis values (i.e. relative to the machine tool zero point).

Press soft key F1 below >CMD ABS<.

The screen will then show the display:



Note that the table of axis values is now changed to absolute values.

The table can be changed back to relative axis values by pressing soft key F1 now below >CMD REL<.

17.2.1.2 Printer

If a printer or plotter is connected to the CNC (~~via the V24 port~~)
a hard-copy of the screen display can be obtained by pressing

soft key F 2 below >PRINT<.

parallel port.

Centronics

17.2.1.3 Graphic Parameters

The Graphic Parameters list is obtained by pressing soft key
below >PARAM<.

F 3

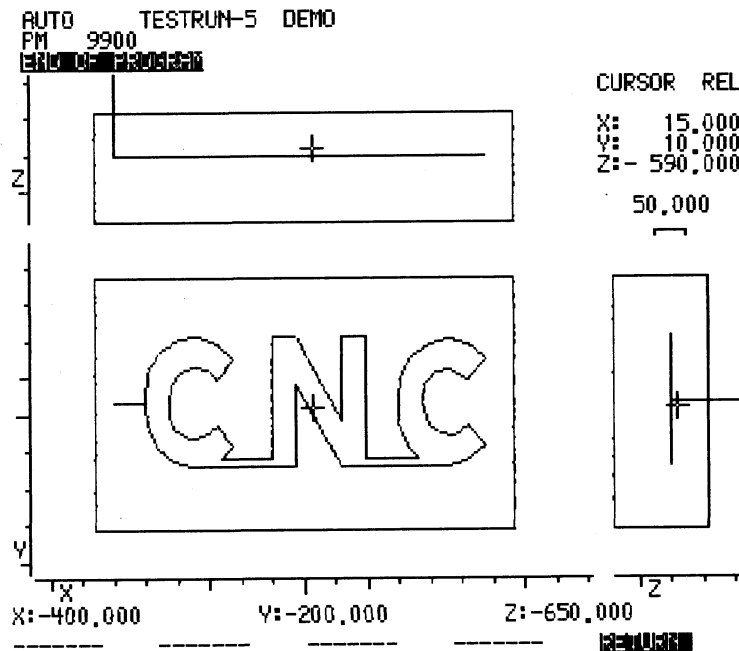
The Graphic Parameters and the associated screen displays are
described in Section 17.2.4.

17.2.1.4 Cross-hairs

After a part program has successfully completed running with TESTRUN-5 (or after each successful completion of a block in Single mode) a 'cross-hairs' cursor can be brought onto the screen.

Press soft key F4 below > + <.

The screen will show, for example, the display:



Note that the cross-hairs are now superimposed on the display, that the table at the top right of the display shows the relative axis values of the cross-hairs position and that the labels of the soft key are changed. The cross-hairs are used to establish the exact position of any points on the tool-path or workpiece. The cursor is moved to the desired point by using the axis movement buttons. The position of the cross-hairs can then be read from the table of axis values.

The axis values of the cross-hairs position shown in the table can be changed from relative axis values to absolute axis values (and vice versa) by using the relative/absolute position facility (see Section 17.2.1.1) before using the cross-hairs facility.

The 'zoom' facility of the graphics cursor (see Section 17.2.1.5) and the Graphics Parameters (see Section 17.2.4) 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 soft key

 below
>RETURN<.

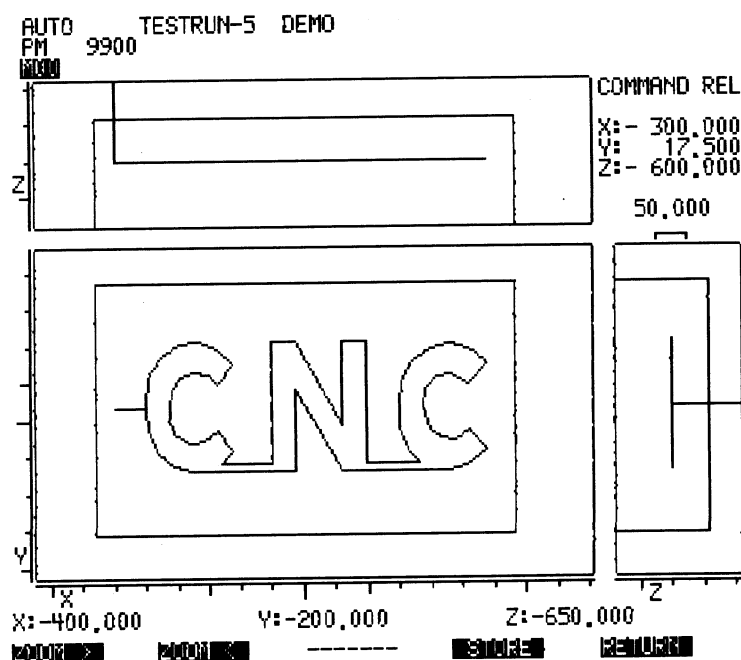
The cross-hairs will disappear and the normal TESTRUN-5 soft key labels will reappear.

17.2.1.5 Graphics Cursor

After a part program has successfully completed running with TESTRUN-5 (or after each successful completion of a block in Single mode) a 'graphics cursor' can be brought onto the screen.

Press soft key F 5 below >CURSOR<.

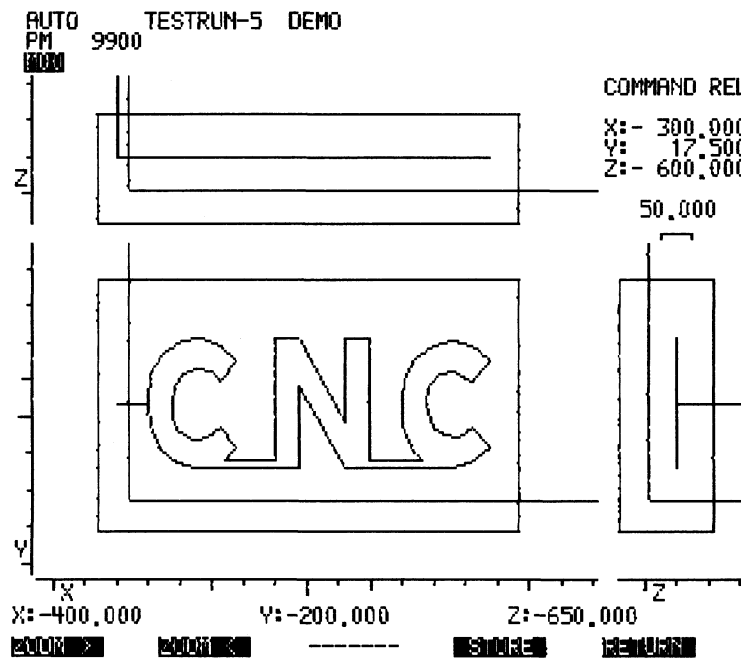
The screen will show, for example, the display:



Note that the graphics cursor is now superimposed on the display and that the labels on the soft keys have changed.

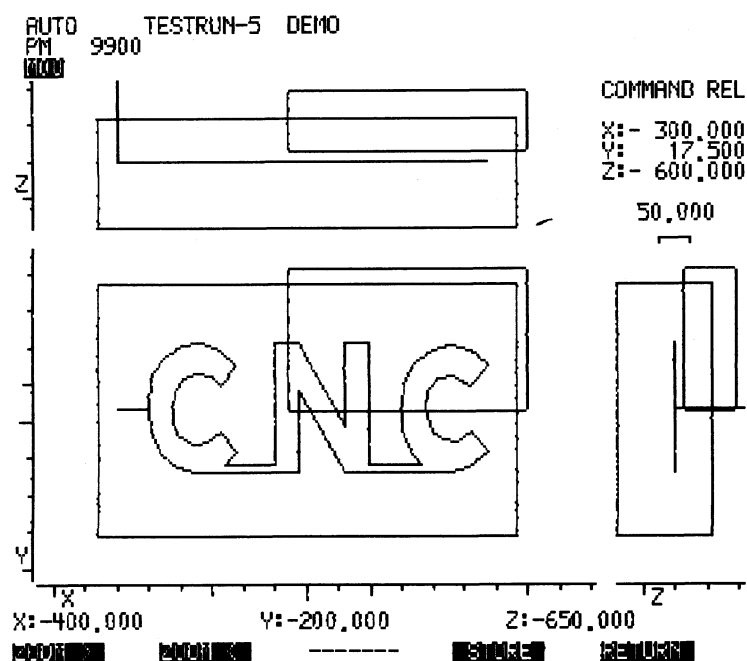
The graphics cursor can be regarded as a 'box' (in a similar way to the representation space of the graphics windows or the workpiece blank. See Section 17.2.1). The cursor can be used to enlarge parts of the tool-path or workpiece in the screen display and also to assist in re-defining the graphics windows manually.

The graphics cursor is moved by using the axis movement buttons. For example, in the display below the graphics cursor has been moved in the +X, +Y and +Z directions:



The graphics cursor is made smaller on the display by using soft key

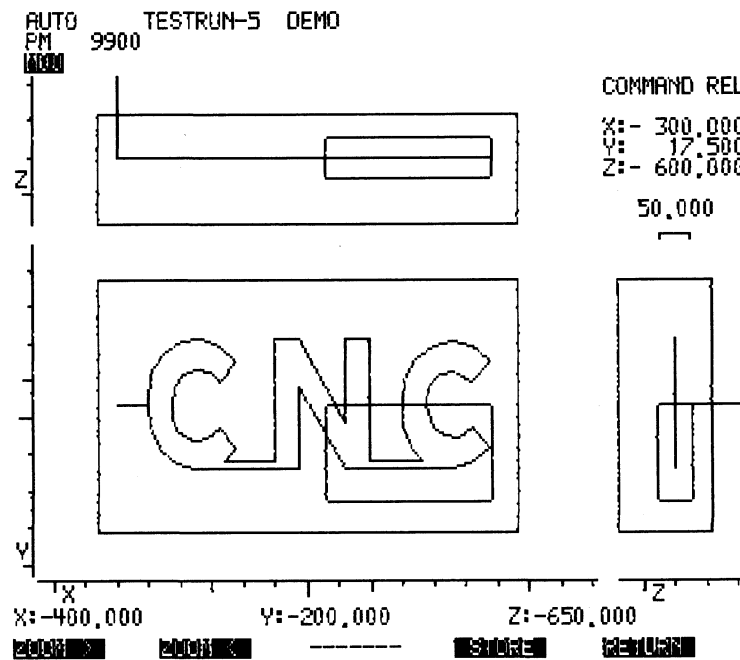
F 2 below > ZOOM< <, for example:



It is made larger again by pressing soft key **F 1** below > ZOOM> <.

Note that the graphics cursor cannot be made larger than the graphics window representation space. If an attempt is made to make the graphics cursor larger than the graphics window the graphics cursor will flash.

If a part of the display requires enlargement it is first framed with the graphics cursor (using the axis movement buttons and the soft keys F1 and F2). For example, as below:



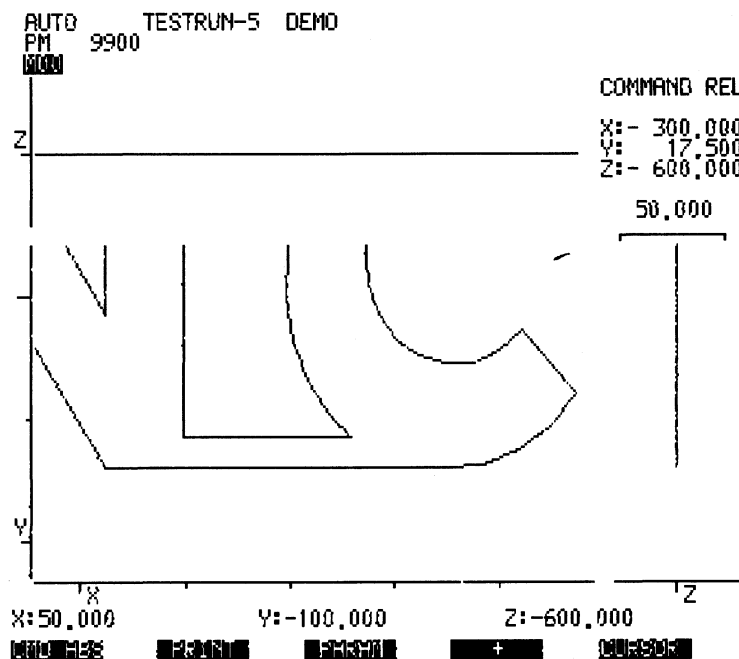
Then press soft key F 4 below >STORE<. The graphic cursors` position and size is then stored as block N1 of the Graphics Parameters list (see Section 17.2.4).

The CNC will then automatically return to the initial TESTRUN-5 display.

When the Start button



is next pressed the screen will show the display:

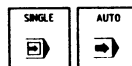


The section of the screen display which was framed by the graphics cursor is now enlarged to the size of the graphics windows.

Note that the graphics cursor cannot be used to reduce the size of the screen display, only to enlarge it.

An enlarged view is cancelled by first pressing the Manual button

then either the Auto or Single buttons



to re-enter

TESTRUN-5. The graphics windows will then be their initial size again, as set in the Graphics Parameters or by function G98 (see Section 17.2.4). The graphics cursor will not be reset and will remain in the selected position; this allows the enlarged display to be re-shown easily by pressing the Store button.

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 soft key

F 5

 below

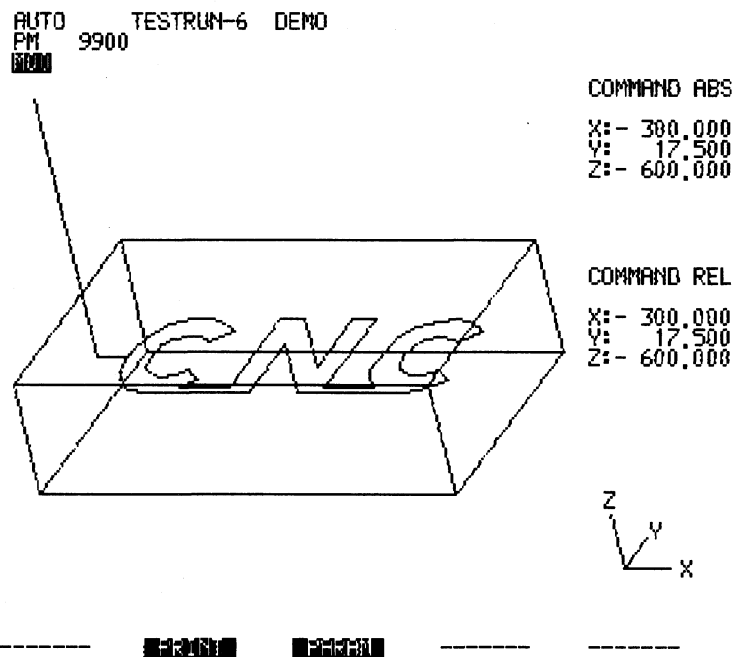
>RETURN<. The graphics cursor will disappear and the normal TESTRUN-5 soft key labels will reappear.

17.2.2 TESTRUN-6

This test program is obtained in the same way as TESTRUN-5 (see

Section 17.2.1), except that button 6 is used to select it from the test program menu.

After the Start button II has been pressed the part program will be run under the supervision of TESTRUN-6 and converted to produce an animated-graphics display, for example:



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 TESTRUN-6 is set by the size of the graphics windows and the viewpoint by the addresses B and B1 (these are described in block N0 of the Graphics Parameters list, see Section 17.2.4). 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 TESTRUN-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 TESTRUN-5 (see Section 17.2.1)

TESTRUN- 6 is used to check the movements of the machine tool for errors which are difficult to visualise with the three-view graphics of TESTRUN-5 or TESTRUN-7.

TESTRUN-6 is terminated by pressing the Menu button  to obtain the test program menu, then pressing button  to select >EXIT SUBMODE<.

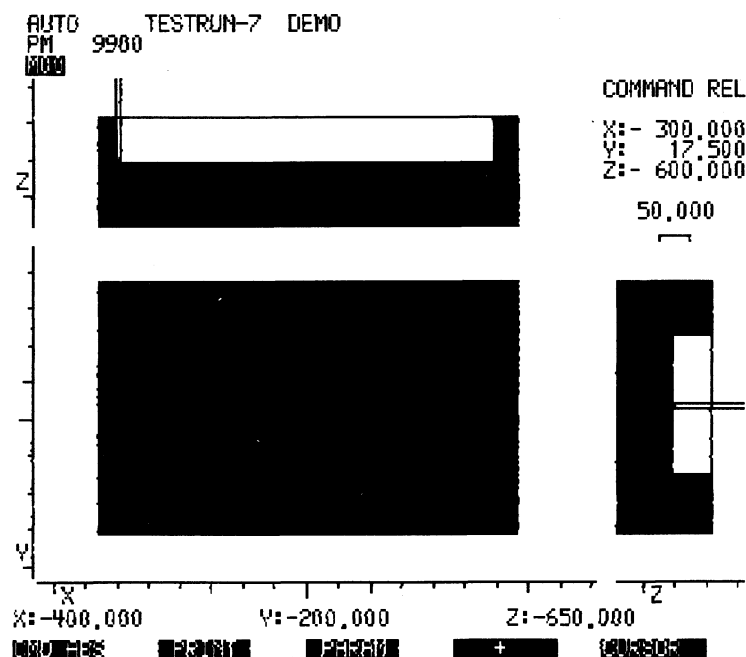
The CNC will then return to Auto or Single mode and the line >TESTRUN-6< will disappear from the display.

(Allen 8-planes graphic)

This test program is obtained in the same way as TESTRUN-5 (see

Section 17.2.1), except that button 7 is 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 TESTRUN-7 and converted to produce an animated-graphics display, for example:



The programmed movements of the tool-tip are shown in the three views, in a similar way to TESTRUN-5. Unlike TESTRUN-5 however, TESTRUN-7 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 TESTRUN-5 (see Sections 17.2.1 and 17.2.4).

While TESTRUN-7 is running the soft keys F4 and F5 are allocated the functions 'Collision On/Off' and 'Tool On/Off', these facilities are described in Sections 17.2.3.1 and 17.2.3.2. At other times (i.e. after execution of each block in Single mode, after the complete program has finished running in Auto mode) the soft keys will be allocated the functions described for TESTRUN-5. If the CNC is in Single mode the soft key labels >COLL ON< and >TOOL OF< may appear too briefly for them to be easily selected; in this case the

0% Feedrate Override button  can be used to slow down the execution of a block to allow time for selection of these facilities.

If TESTRUN-7 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 TESTRUN-5 (see Section 17.2.1).

TESTRUN-7 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.

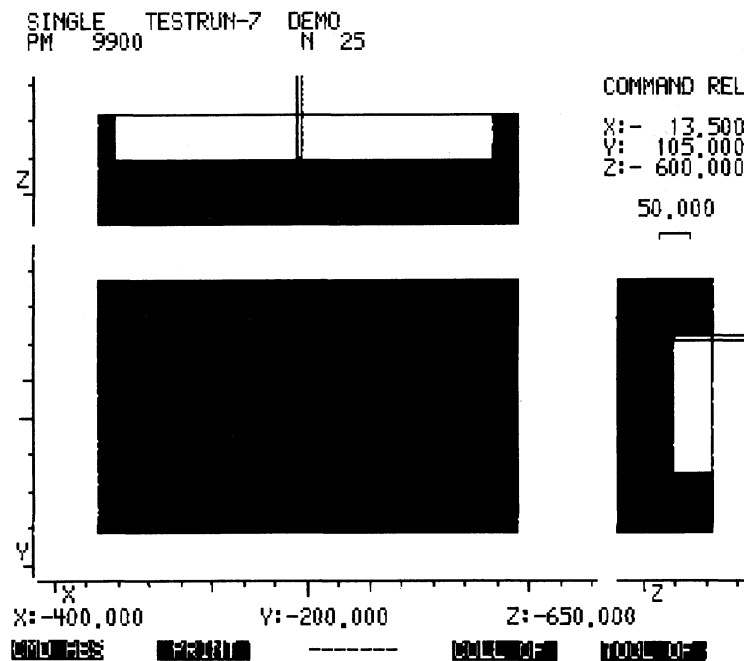
TESTRUN-7 is terminated by pressing the Menu button  to obtain the test program menu, then pressing button  to select >EXIT SUBMODE<.

The CNC will then return to Auto or Single mode and the line >TESTRUN-7< will disappear from the display.

17.2.3.1 Collision On/Off

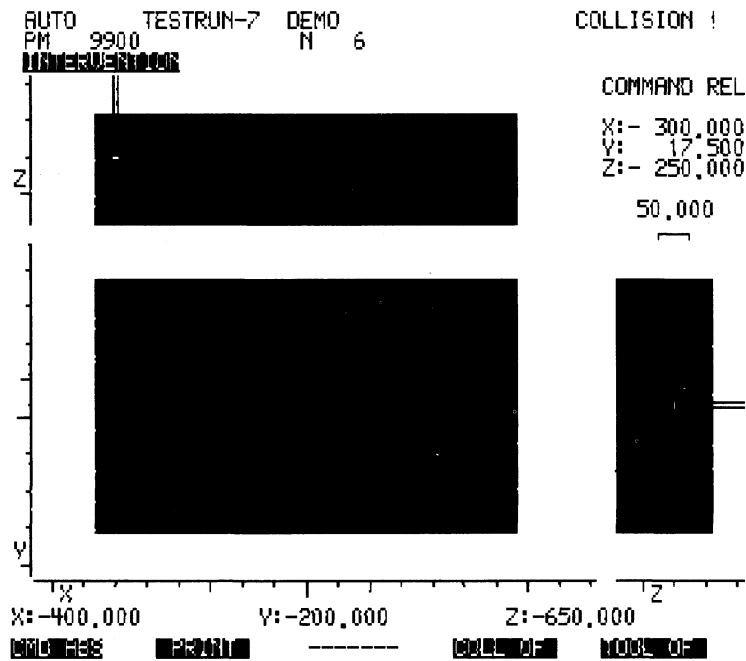
TESTRUN-7 has a facility to detect possible collisions between the tool and the workpiece or clamps. This facility is normally turned off to allow TESTRUN-7 to run uninterrupted. It is turned on (or off again) by pressing soft key F 4 below >COLL ON< (or >COLL OF<)

The screen will show, for example, the display:



Note that the soft key label has changed from >COLL ON< to >COLL OF<.

If a possible collision is detected the part program will stop and the screen will show the display:



In this case the part program must be modified to remove the possibility of collision.

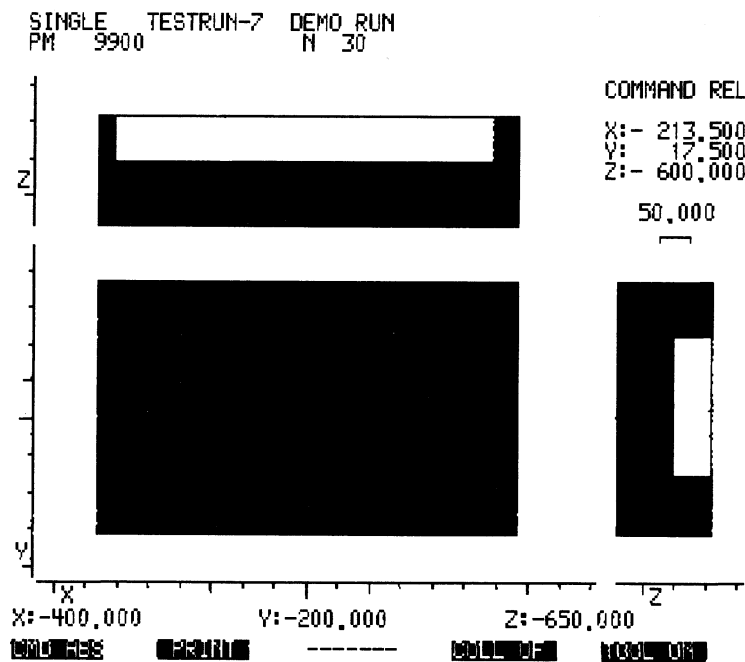
17.2.3.2 Tool On/Off

TESTRUN-7 can be run without the image of the tool in the display. This enables the part program to run faster under TESTRUN-7, as fewer calculations need to be performed by the CNC.

The tool image is turned off (or back on again) by pressing

soft key F 5 below >TOOL OF< (or >TOOL ON<).

The screen will show, for example, the display:



The tool image is no longer present in the display and the soft key label has changed to >TOOL ON<.

17.2.4 GRAPHICS PARAMETERS

The Graphics Parameters establish conditions for the running of the animated-graphics test programs (see Section 17.2). A list of the Graphics Parameters can be obtained for reference and editing when the soft key label >PARAM< appears at the bottom of the screen display, see Section 17.2.4.1. The Graphics Parameters are described in detail in Section 17.2.4.2.

17.2.4.1 Editing the Graphics Parameters List

→ ooh-19 PM/menu/6

The graphics Parameters list can be obtained only when TESTRUN-5, TESTRUN-6 or TESTRUN-7 has been selected (see Section 17.2) and when the part program is not running (i.e. before pressing the Start button, after each running block in Single mode or after running the whole part program in Auto mode).

Press soft key F1 or soft key F3 below >PARAM<. The screen will show, for example, the display:

```

AUTO      TESTRUN-7  DEMO
PM      9900          N

GRAPHIC PARAMETERS

ALL MEMORY 27008 BYTES FREE
■ N0 (WINDOW MANUAL  )
  N1 (WINDOW CURSOR  )
  N2 (ROUGH CONTOUR  )
  N3 (START/END BLOCK)
  N4 (INTERVENTION   )
  N5 (DWELL           )
  N6 (END CONTOUR    )
  N7 (TOOL MOTIONS   )
  N8 (PROJECTION      )
  N9 (PARAM.SELECTION)

BLOCK NUMBER
■ XYZBIJK      ■
NO

----- PICTURE ----- PROGRAM -----

```

The above display is for a Graphics Parameters list which has had no input of values (i.e. all values are default values).

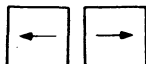
A block of the Graphics Parameters list is edited as follows:

- (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



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

- (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 Equals  and then the new desired value).

- (4) Press the Enter button.

The new values will appear in the block input line of the display:

```

AUTO      TESTRUN-7  DEMO
PM      9900      N

GRAPHIC PARAMETERS

ALL MEMORY 27008 BYTES FREE
N0 (WINDOW MANUAL ) X-85 Y-125 Z-47
  B-45 I458 J253 K25 B1=78
■ N1 (WINDOW CURSOR )
  N2 (ROUGH CONTOUR )
  N3 (START/END BLOCK)
  N4 (INTERVENTION )
  N5 (DWELL )
  N6 (END CONTOUR )
  N7 (TOOL MOTIONS )
  N8 (PROJECTION )
  N9 (PARAM. SELECTION)

BLOCK NUMBER
■ XYZBIJK      ■
  N1

```

----- PROGRAM -----

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:

AUTO TESTRUN-7 DEMO
PM 9900 N

GRAPHIC PARAMETERS

ALL MEMORY 27008 BYTES FREE
N0 <WINDOW MANUAL > X-85 Y-125 Z-47
 B-45 I458 J253 K25 B1=78
■ N1 <WINDOW CURSOR >
 N2 <ROUGH CONTOUR >
 N3 <START/END BLOCK>
 N4 <INTERVENTION >
 N5 <DWELL >
 N6 <END CONTOUR >
 N7 <TOOL MOTIONS >
 N8 <PROJECTION >
 N9 <PARAM.SELECTION>

BLOCK NUMBER
■ XYZBIJK N
 N1

N

----- PROGRAM -----

The cursor will move automatically to the next block.

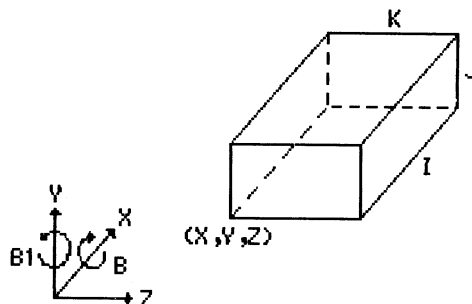
The values in a block can be completely cleared by first selecting the block, then pressing the Enter button  (with the cursor on the block number) and then pressing the Store button 

Note that if this is done with the cursor on the line >ALL MEMORY< then the entire memory contents will be lost!

To assist visualising the axes of movement a picture can be displayed. *→ when applicable* Press soft key F 2, below >PICTURE<. The screen will show the display:

AUTO TESTRUN-7 DEMO
PM 9900 N

GRAPHIC PARAMETERS



BLOCK NUMBER

NXYZBIJK

N0 X-85 Y-125 Z-47 B-45 I458 J253 K25

B1=78

----- PICTURE ----- PROGRAM -----

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 soft key F 4 below >PROGRAM<.

When editing of the Graphics Parameters is complete the Graphics Parameters list is terminated by pressing the key for any operation mode.

17.2.4.2 Explanation of the Graphics Parameters

The Graphics Parameters list contains ten blocks:

NO (WINDOW MANUAL)

Defines the graphic windows (see Section 17.2) by manual data input.
It has the format:

N0	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 TESTRUN-6 viewpoint (see Section 17.2.2)

NO is implemented only if its enabled by block N9, otherwise the values from any G98 function will be used (see Section 17.2.4.3).

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.

Well moselgh!

N1 (WINDOW CURSOR)

Displays the temporary graphics window values produced by using the >STORE< function of the graphics cursor (see Section 17.2.1.5). 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 NO, 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 17.2.4.3).

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 part program will be run.

→ NB. blocks used must contain executable code i.e. movements!

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 Tool Unclamp button twice.

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 (END CONTOUR)

Defines whether a graphics representation of the shape of the finished part will be generated by TESTRUN-5/6 from the machine tool's movements:

C = 0, no representation (~~default value~~)

C = 1, representation generated (default value)

N7 (TOOL MOTIONS)

Defines the representation of the tool-tip path during the running of a part program with TESTRUN-5/6

C = 0, no representation

C = 1, complete representation (default value)

C = 2, representation only outside the fixed machining cycles.

[only end contour of cycles]

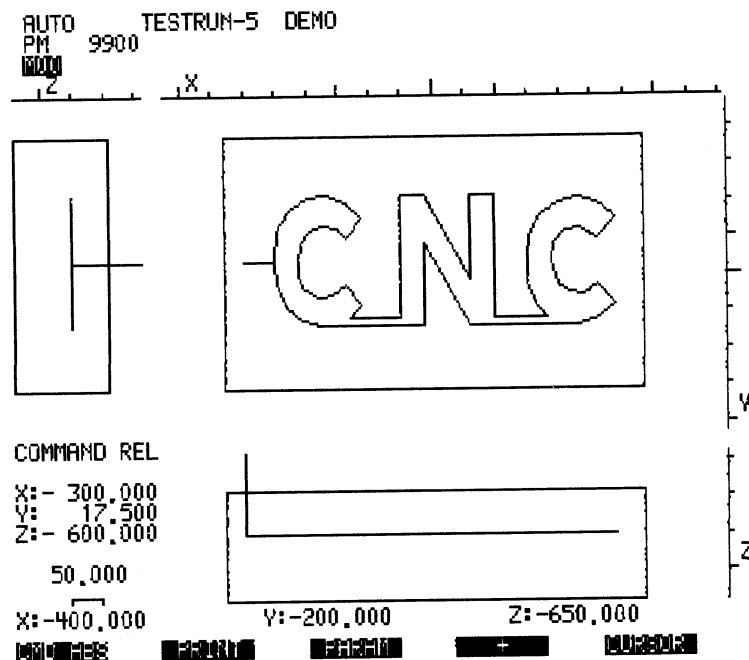
N8 (PROJECTION)

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 projections are used throughout this manual in the illustrations of screen displays. A first-angle projection is, for example:



N9 (PARAM. SELECTION)

Selects from where the definitions for the graphic windows and workpiece blank are taken:

C = 0, from Graphics Parameter list blocks N0 and N2 (default value)

C = 1, from preparatory blocks in the program memory containing G98 and G99 functions (see Section 17.2.4.3).

17.2.4.3 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 the Graphics Parameters do not need to be re-edited each time a part program is selected.

These definitions are given by program blocks before 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 they are de-activated (with block N9 of the Graphics Parameter list) and more exact address values are found by trial-and-error (using the crosshairs and graphics cursor functions, see Sections 17.2.1.4 and 17.2.1.5). 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 TESTRUN-5 and TESTRUN-7, and the size and viewpoint of the isometric projection for TESTRUN-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 - rotations (in degrees) of the workpiece blank about the Y-axis

Note that this format is similar to that of Graphics Parameter list block NO (see also Sections 17.2.1 and 17.2.2).

Program Function G99

The program block with this function defines the position and size of a rectangular workpiece blank for TESTRUN-5, TESTRUN-6 and TESTRUN-7. Irregularly-shaped workpieces can be represented by a composite of up to ten workpiece blanks, each with its own part program block (Note that some software versions only allow one G99 block). Clamps can be treated as small workpieces in a similar way. The format is :

N	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 Sections 17.2.1 and 17.2.3).

The Integrated Programmable Logic Controller (IPLC) is not installed in all CNCs, as its main function is as an 'intelligent interface' to enable differing types of machine tool to be controlled by the Philips` CNC 3000 series controllers (V.500 or later) without major revision of their system software. Machine tools which have been designed for use with the CNC 3000 series will probably not require an IPLC unless the manufacturer requires a programmable logic controller to execute operations on ancillary equipment (for example; pallet-changers and tool-magazines from another manufacturer, machine tools with adaptations for special purposes).

The IPLC is a software task that handles the majority of the digital inputs and outputs of the CNC. It enables the digital inputs and outputs to be program-configured for a particular machine tool and it can also execute program routines to perform machine tool operations that involve these digital inputs and outputs.

Examples of such operations are:

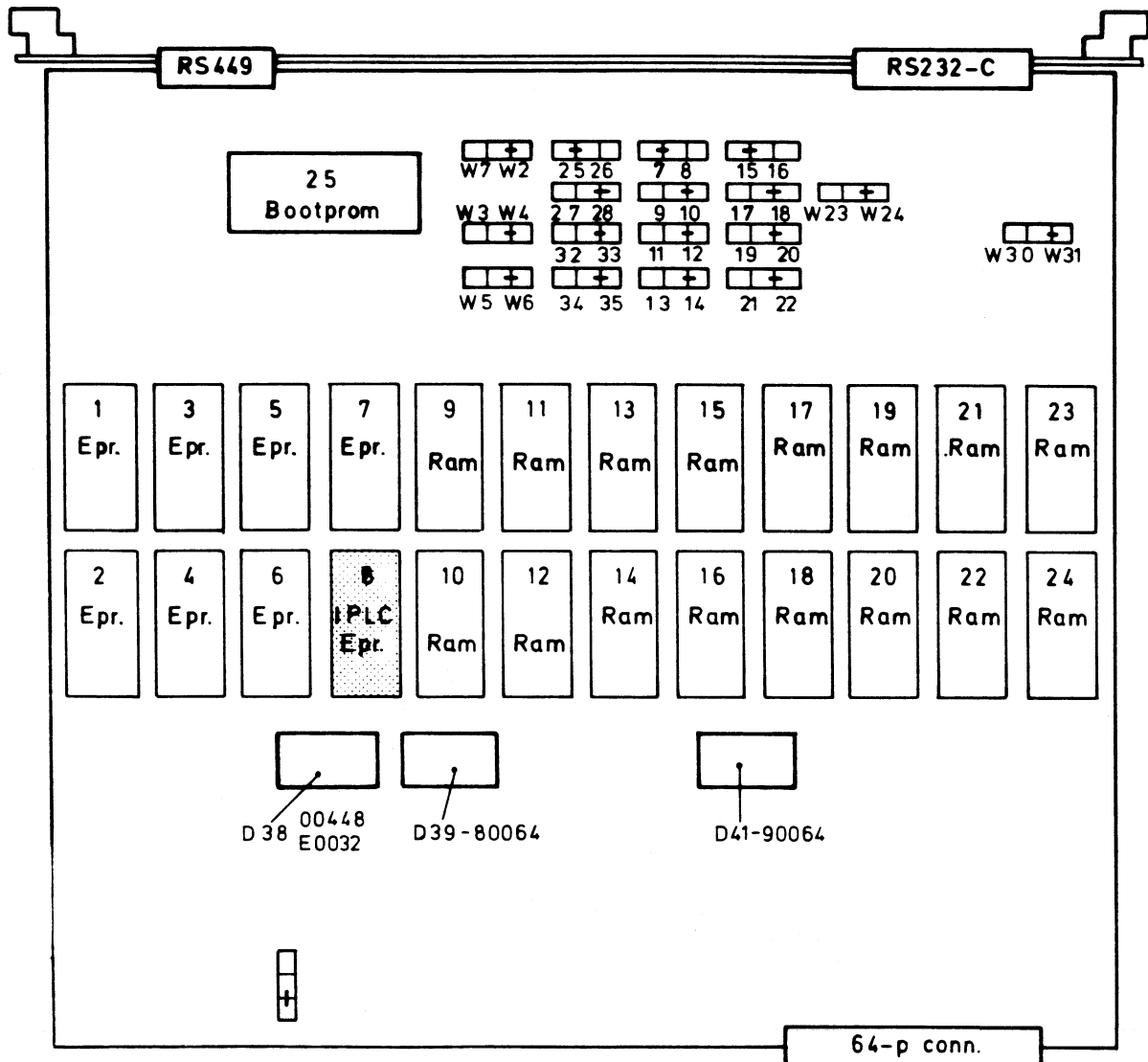
- switching lubricant or cutting-fluid pumps
- tool changes
- pallet changes
- initialisation procedures

The IPLC consists of system software that is held in PROM as part of the CNC's system software PROM set. The location of the IPLC PROM chip on the CNC's CPU Module is shown in the illustration overleaf (see also 'IPLC Installation Guide'). This IPLC software is executed cyclically every 100 milliseconds, its use of the CPU alternating with that of the standard CNC software (this cyclic execution time may differ in CNC versions later than V.500).

The program routines that are executed by the IPLC are written in 'IPLC Language'. During development and debugging an IPLC program is held in the part program RAM memory of the CNC. When a final debugged version of an IPLC program is produced, it is put onto PROMs for installation in production versions of the CNC. Because the IPLC program that is used in a production machine tool is in PROM memory it cannot be altered or modified by the user! Users can only replace the entire IPLC PROM chip, if it should prove faulty.

However, some knowledge of the operation of the IPLC and the use of the CNC's associated 'Monitor' feature will assist users in fault diagnosis, and consequently reduce the 'down-time' of faulty CNCs.

Complete details of the IPLC, its interaction with the CNC and its programming are given in the 'IPLC Programming Manual', the 'IPLC Installation Guide' and the 'PDS-6 User Manual'. These documents will only be of use to manufacturers and others who are involved in the creation and development of IPLC programs.



EPROMS are addressed 0000:0 to 7FFF:F (8x512K)

RAMS are addressed 8000:0 to 9FFF:F (16x64K)

NB7339

18.1. THE STRUCTURE OF THE IPLC

The structure of the IPLC is best described in terms of the communications between the components of the complete CNC software. These are shown in the 'structure diagram' overleaf, and are explained briefly in the paragraphs below.

The addresses in the areas of memory and the I/O map that are used by the IPLC are called 'data items'. These are of prime importance to the operation of the IPLC and are briefly described in Section 18.2.

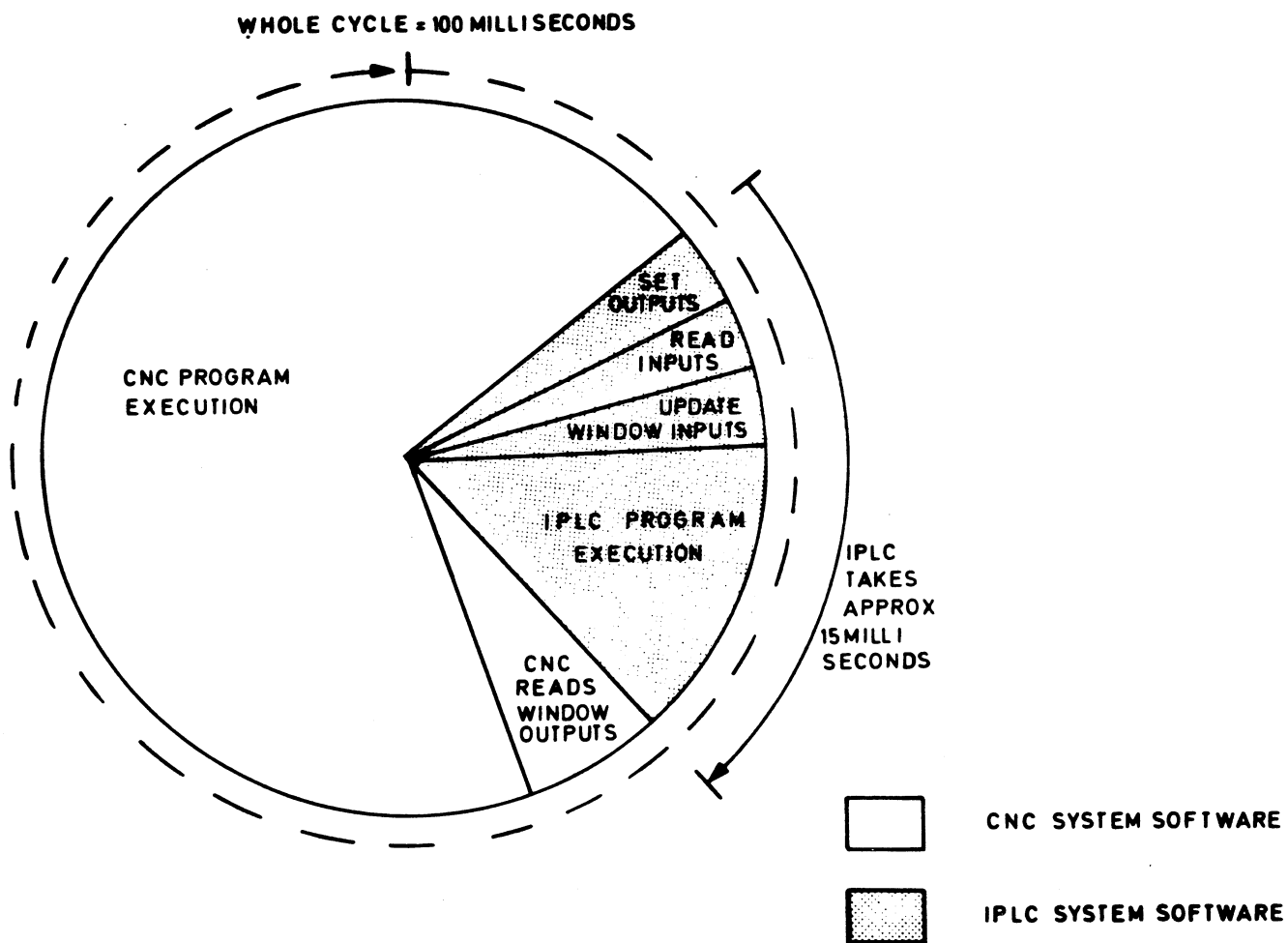
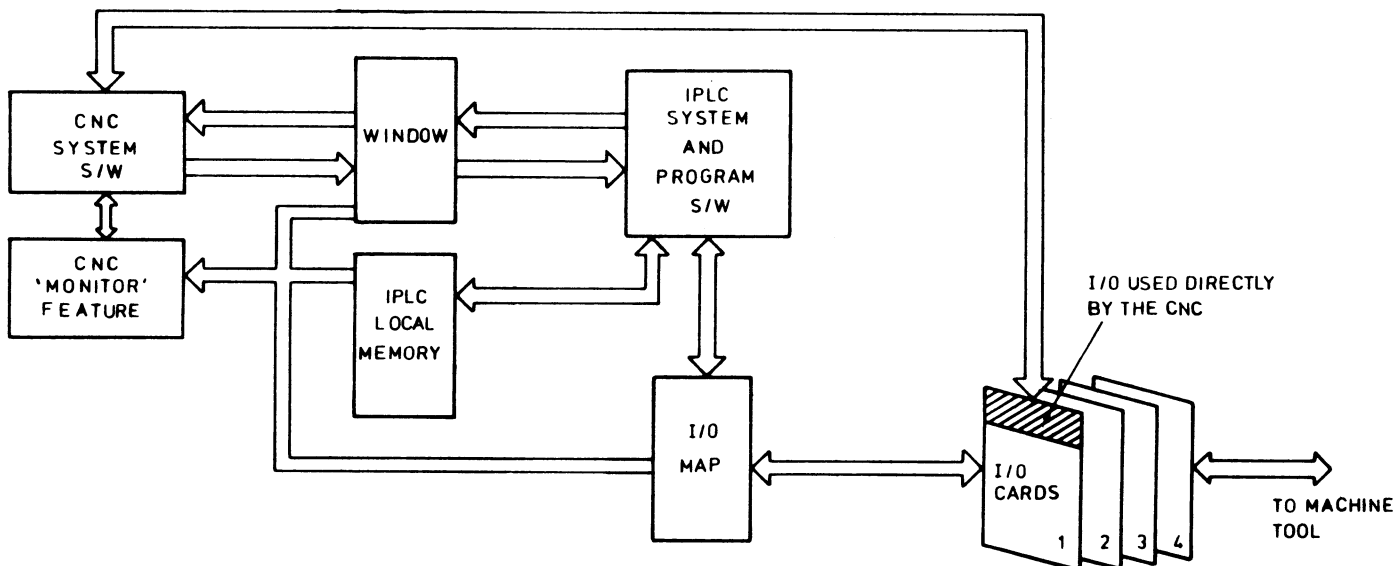
The cyclic way in which the IPLC software is executed defines several aspects of the IPLC's structure: Every 100 milliseconds the CNC system software passes control of the CPU to the IPLC system software, which executes the IPLC program and then passes control of the CPU back to the CNC system software. This CPU time-sharing is shown in the 'pie-chart' overleaf.

As the CNC system software and the IPLC system software share use of the CPU they cannot be active simultaneously. Because of this they cannot communicate directly with each other and an area of shared memory is used instead for indirect communication. This shared memory area is called the 'Window', see Section 18.2.1.

The IPLC must also have an area of memory to store data during the execution of the CNC system software, ready for the next IPLC cycle; this is the IPLC local memory. It is organised into 'timers', 'counters' and 'markers', see Section 18.2.2.

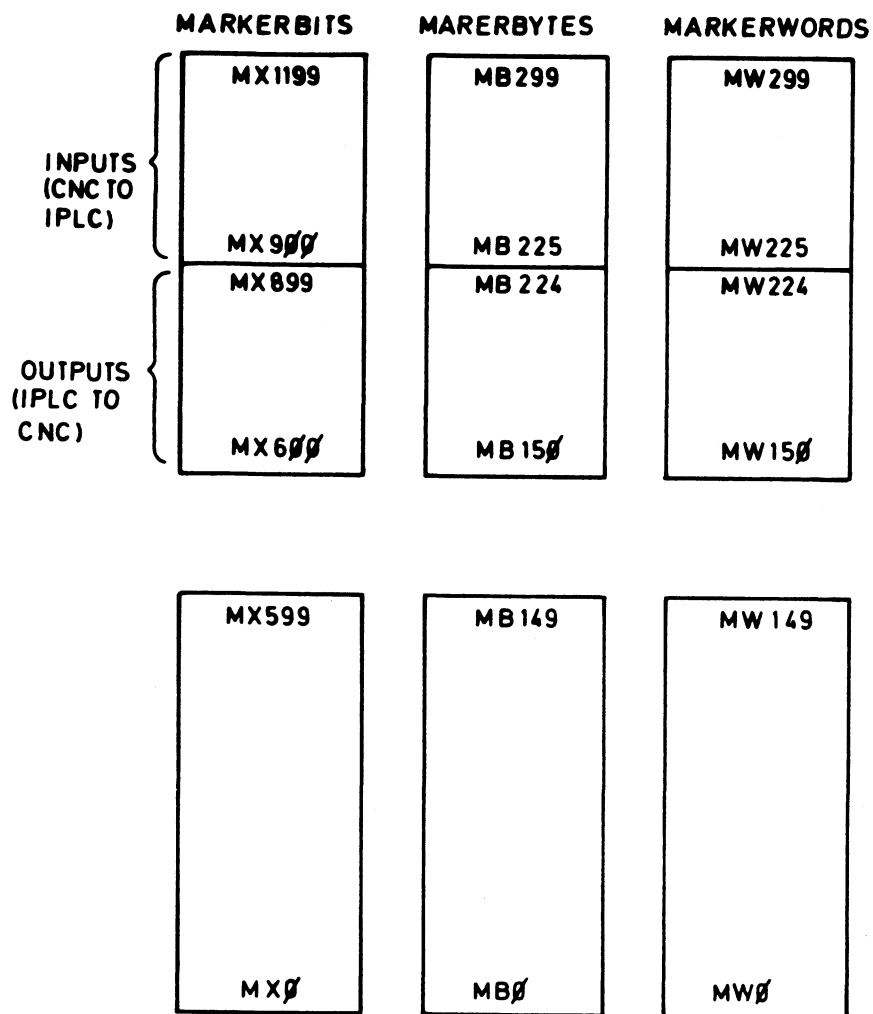
The digital inputs and outputs that the IPLC controls are those that are via the '32 Input/Output' modules. Up to four of these modules can be installed in the CNC, giving up to 128 inputs and 128 outputs. A number of these inputs and outputs are reserved for direct use by the CNC system software (these are denoted by a shaded area of the I/O Modules in the structure diagram). The inputs and outputs are accessed by the IPLC system software via the I/O Map, see Section 18.2.3.

The functioning of the IPLC can be observed for diagnostic purposes by means of the 'Monitor' feature of the CNC. This enables the values of the data items in the Window, the IPLC local memory and the I/O Map to be displayed on the screen of the CNC. The use of this feature is described in detail in Section 18.3.



The various types of address which can be used as instruction operands are called 'data items'. They are either locations in the RAM memory of the CNC, or locations in the I/O Map. In both cases their use in instructions is the same; a value will be read from a data item or written to a data item, depending on the instruction.

Some areas of the RAM memory are configured to act as timers and counters. These are controlled by the IPLC system software in response to IPLC program instructions. Each timer or counter has an associated group of data items that are used as instruction operands.



NB7333

18.2.1 Memory Data Items

An area of RAM memory in the CNC is used for operations concerning the IPLC. The data items in this area are called 'markers', their size is either 'bit', 'byte' (8 bits) or 'word' (16 bits). There are:

1200 markerbits	; MX0 to MB1199
300 markerbytes	; MB0 to MB299
300 markerwords	; MW0 to MW299

These are divided into two groups; one half of the memory is used as local memory for the IPLC and one half is used as 'shared' memory for communication between the IPLC and the CNC.

The area of shared memory is called the 'Window'. It is subdivided into two; half for communication from the IPLC to the CNC, half for communication from the CNC to the IPLC.

The division of the memory data items is shown in the chart opposite.

18.2.1.1 IPLC Local Memory

The IPLC local memory consists of:

600 markerbits	; MX0 to MX599
150 markerbytes	; MB0 to MB149
150 markerwords	; MW0 to MW149

These data items are used to store data values between executions of the IPLC. The IPLC local memory data items are not defined to any particular function; what each represents is decided by the programmer when writing an IPLC program. For example, a markerword could be used to store a value indicating which tool is currently in use, or a markerbit could be used to indicate whether a fixed cycle is executing or not.

The state of the IPLC local memory data items following start and initialization of the CNC and IPLC is decided by machine constants MC 1090 to MC 1094.

18.2.1.2 The Window

The Window is the area of RAM memory through which the IPLC and the CNC communicate. The Window consists of:

Communication IPLC --> CNC

300 markerbits ; MX600 to MX899
75 markerbytes; MB150 to MB224
75 markerwords; MW150 to MW224

Communication CNC --> IPLC

300 markerbits ; MX900 to MX1199
75 markerbytes; MB225 to MB299
75 markerwords; MW225 to MW299

These are collectively called the 'Window Markers' and values stored in them are 'Window variables'.

As the Window markers communicate with the CNC the precise function of each of them is fixed by the system software of the CNC. Window markers are of prime importance to IPLC programs. However, unless the user is creating programs in the IPLC Language their meanings do not need to be considered in detail.

18.2.1.3 Timers And Counters

Timers and counters are areas of the RAM memory. They are controlled by the IPLC system software so that they resemble 'hardware component' timers and counters in operation. Using IPLC Language instructions they can be started, stopped and zero'd, the current value can be read and a 'preset' value or time can be stored in them. An 'output bit' Q changes its boolean state from FALSE to TRUE (LOW to HIGH, or 0 to 1) when the current time equals the preset time in the timer, or when the current value of the counter reaches zero. This can be used to provide a boolean value to cause some action by the program.

Timers

Timers are used to measure time intervals. There are 50 timers in the IPLC, identified as 'T0' to 'T49'. Each timer can be one of the following types:

- pulse timer
- on-delay timer
- off-delay timer

A timer 'Txx' has three associated addresses:

elapsed time - Txx.ET
preset time - Txx.PT
output bit - Txx.Q

Counters

Counters are used to count events. There are 50 counters in the IPLC, identified as 'C0' to 'C49'. All counters work in the same way.

A counter 'Cxx' has three associated addresses:

current value - Cxx.CV
preset value - Cxx.PV
output bit - Cxx.Q

18.2.2 Digital Input And Output Data Items

The digital inputs and digital outputs of the '32 Input/Output' modules are all directly controlled by the IPLC except for:

Inputs 0 to 7

These inputs have predefined functions and are referred to as IS0 to IS7. They can be read by both the CNC and the IPLC.

Outputs 0 to 7

These outputs have predefined functions and are referred to as QS0 to QS7. They cannot be set by the IPLC as they are directly controlled by the CNC, but they can be read by the IPLC.

All the other inputs and output are set or read only by the IPLC. If all four '32 Input/Output' modules are installed these will be inputs IX8 to IX127 and outputs QX8 to QX127. The allocation of the inputs and outputs is as follows:

- module 1 - inputs: IS0 to IS7 and IX8 to IX31
 outputs: QS0 to QS7 and QX8 to QX31
- module 2 - inputs: IX32 to IX63
 outputs: QX32 to QX63
- module 3 - inputs: IX64 to IX95
 outputs: QX64 to QX95
- module 4 - inputs: IX96 to IX127
 outputs: QX96 to QX127

The inputs IX7 to IX127 and the outputs QX7 to QX127 do not have defined functions; their use will depend on the particular machine tool to which they are intended to connect. Some of these digital outputs and inputs can be grouped together as bytes or words by using the machine constants MC1080 to MC1085.

18.3. THE CNC 'MONITOR' FEATURE

The 'Monitor' feature of the CNC allows the values of the IPLC memory and digital I/O data items to be shown on the screen display. It can only be used when the IPLC is installed and is only available if machine constant MC15 is 1 (= IPLC active). This is indicated by the softkey label >MONITOR< appearing in the normal screen display:

MANUAL MAN.OPER.

JOG CONTINUE

COMMAND		ACTUAL		DIST TO GO	
X		X-	0.001	X	0
Y		Y	0.000	Y	0
Z		Z	0.000	Z	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		
G 0	17 25 27 40 51 53 63 66 68 71 72				
M	5 9		41		

----- ACTUAL ----- **MONITOR**

Press softkey **F 5** under >MONITOR<.

The screen will then show the display:

MANUAL MAN.OPER.

JOG CONTINUE

		1		2		3	
		1234567890	1234567890	1234567890	1234567890	12	
IN	1	.....	.....	.....	.....	.....	.....
IN	2	.....	.....	.....	.....	.....	.....
IN	3	.....	.....	.....	.....	.....	.....
OUT	1	..1.....	11.....	11.....	11.....	11.....	.....
OUT	2	..11.....	11.....	11.....	11.....	11.....	.....
OUT	3	.....	.....	.....	.....	.....	.....
AREA		111111					

----- **IPLC** IN-OUT ----- **RETURN**

This is the 'IN-OUT Monitor' display. The state of the digital inputs and outputs is shown.

The 'IPLC Monitor' shows the values of the IPLC memory data items.

Press softkey F 2 , below >IPLC<.

MANUAL MAN.OPER.

JOG CONTINUE

N0
N1
N2
N3
N4
N5
N6
N7
N8
N9

----- IPLC IN-OUT ----- RETURN

This is the IPLC Monitor display. No values are displayed, however, unless it has been 'edited' to select which data items are to be monitored. Editing is explained in the next section.

18.3.1. Editing the IPLC Monitor

When the IPLC Monitor is first used no values will be displayed, as shown in the previous section. The IPLC Monitor must first be put into 'edit' mode:

Press the Const. Mem. button , the screen will show the machine constant list (see Chapter 3).

Press the Menu button , the screen will show the 'machine constants menu':

MANUAL MAN.OPER.

MACHINE CONSTANTS

CONSTANTS MENU:

2 EDIT IPLC MONITOR

Press button 2 , the screen will show the IPLC Monitor in Edit mode:

MANUAL MAN.DPER.

INTERFACE MEMORY

■ NO
N1
N2
N3
N4
N5
N6
N7
N8
N9

LINE NUMBER
■ MBWCTIJKOPQ
NO

■ N

Up to ten data items can be displayed in the IPLC Monitor, identified by the line numbers 'N0' to 'N9'.

The line numbers are selected by the Up/Down cursor buttons ↑ ↓ ,
in the above screen display N0 is selected.

The data item types are selected from the line at the bottom of the screen with the Left/Right cursor buttons ← → . The data item types are indicated as follows:

M - markerbit
B - markerbyte
W - markerword
C - counter
T - timer
I - input bit
J - input byte
K - input word
O - output bit
P - output byte
Q - output word

The number of the selected data item type is entered using the numeric key pad.

For example, to display the value contained in markerbit MX23:

Line number N0 is already selected.

Press the Up/Down cursor buttons to select >M< for 'markerbit', then

press buttons 2 and 3 on the numeric keypad, the screen will show the display:

MANUAL MAN.OPER. BUSY

INTERFACE MEMORY

■ N0
N1
N2
N3
N4
N5
N6
N7
N8
N9

MARKER BIT (MX)
N0 B W C T I J K O P Q
N0

M 23

Press the Enter button  , then the Store button  . The IPLC Monitor screen display then shows the value in MX23:

MANUAL MAN.OPER. BUSY

INTERFACE MEMORY

N0	M	23	0
N1			
N2			
N3			
N4			
N5			
N6			
N7			
N8			
N9			

MARKER BIT (MX)
 N1BUCTIJKOPQ
 N1

M

Data items of other types are selected in the same way and their values displayed. Timers will have their values shown in `hours:minutes:seconds:tenths of a second` and the values of counter and timer output bits are shown (>Q=<):

MANUAL MAN. OPER.

INTERFACE MEMORY

N0	M	23		0	
N1	B	58		0	
N2	W	46		0	
N3	C	5		0	Q = 1
N4	T	49	0:00:00:0	0	Q = 0
N5	I	96		0	
N6	J	8		0	
N7	O	127		0	
N8	O	95		0	
N9	O	96		0	

MARKER BIT (MX)
 M0 M1 M2 M3 M4 M5 M6 M7 M8 M9
 N9 096

M

(note that later versions of the IPLC may have timers that will be displayed as `days:hours:mins:secs:tenths`)

The IPLC Monitor edit mode is terminated by pressing the

Manual button , after a short delay the normal screen display is shown.

If the IPLC Monitor is subsequently shown again the data items selected during edit mode will have their values displayed.

19.

TRANSMITTING AND EXECUTING VERY LARGE PROGRAMS (BTR).

Programs which are so extensive that they do not fit into the control's user memory can nevertheless be executed using the BTR-feature.

Once BTR is selected the sequence of execution is:

- Reading in the first part of the program and storing this part in 5 macro's (subprograms).
- Starting the execution of the program, beginning with the first macro.
- After completion of the first macro, the second macro is automatically executed. The contents of the first macro is deleted.
- During execution of the first part of the program the next part of the program is read in the cleared macro('s).
- This is repeated until the complete program is transferred and executed.
- The main BTR program and the BTR macro's are deleted from memory.

To re-execute the program the sequence is repeated.

19.1. ENABLING BTR-FUNCTION.

If the CNC is NOT in LOCAL mode:

- Touch data in/out  .

- Touch menu button  .

Using DNC select >DNC-LOCAL<. (See section 19.2.3.)

Using data I/O select >DATA INPUT LOCAL<

Make sure that the block length is set in MC93, see section 19.4.

- Touch manual mode button  .

- Touch menu button  .

- Touch  to select N-SEARCH.

The display shows:

MANUAL N-SEARCH

JOG CONTINUE





----- ID-DIR  -----

- Touch softkey F 4 below >BTR-ON<.

The display shows:

MANUAL N-SEARCH

JOG CONTINUE

N

N

INPUT

RETURN

The BTR operation can be started immediately now or another operation mode can be selected and the BTR function can be started in a later stage.

19.2. STARTING BTR-FUNCTION.

19.2.1. Immediately after enabling the BTR-function.

Make sure that the data peripheral is set up and ready for use.

- Touch softkey  below >INPUT<.

The display shows e.g:

```

MANUAL  N-SEARCH
PM  9500      BTR      N      0
JOG CONTINUE
ASCII BTR      N      194 IN

```





INPUT -----  ----- 

- Select AUTO mode  .

The display shows e.g:

```

AUTO
PM  9500      BTR      N      0

ASCII BTR      N      207 IN
COMMAND ACTUAL DIST TO GO
X        X      0.000 X      0
Y        Y      0.000 Y      0
Z        Z      0.000 Z      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 68 71 72
M      5  9      41

■ NO
N1 G22 N=9999990
N2 G22 N=9999991
N3 G22 N=9999992

----- ACTUAL  

```

- Touch the start button  to execute the program.

It will take some time (depending on the value of MC93) before touching the start button results in executing the program because the control first must read in a adequate part of the program. Try touching the start button again after a few seconds.

19.2.2. Being in another operation mode:

- Select AUTO mode  .

- Touch data in/out  .

- Touch softkey  below >INPUT<.

See 19.2.1. for starting the program execution.

note that the control has made a small BTR program with program number N9999999.

The contents of the program is:

MANUAL MAN.OPER.

PARTPROGRAM N9999999

```
■ NO
N1 G22 N=9999990
N2 G22 N=9999991
N3 G22 N=9999992
N4 G22 N=9999993
N5 G22 N=9999994
N6 G29 E0 E0=1 N=1
```

■ GXYZBCABRIJKLPFSTME ■
NO

MENU-G ----- IO-DIR EDIT-ID RENUM-N

Displayed via manual  , prog.mem.  , search  .

DO NOT EDIT THIS PROGRAM.

Even if the program is displayed as shown above the BTR-function must be switched off (see 19.3) and on again to be able to start the BTR-function.

The program execution can be interrupted by touching feed hold

or feed/speed hold  .

All operations can be executed during intervention and the program can be restarted as described in chapter 11.

19.2.3. Using BTR with DNC.

- Touch program memory button  .

- Enter the relevant program ID-number
with the keyboard

- Touch the enter button  .

- Touch the data in/out button  .

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

Follow the instructions as given in section 19.2.1.

19.3. SWITCHING OFF BTR-FUNCTION.

- Touch manual button  .
- Touch menu button  .
- Touch  to select N-SEARCH.
- Touch softkey  below >BTR-OFF<.

19.4. MC93 BLOCK LENGTH.

Depending on the user memory space available for the parts of the main program, a macro length can be defined. The minimum length for the macro's is 4096. The maximum length is 262143 bytes. The control indicates the amount of free memory space in bytes:

- Touch manual button  .
- Touch prog. mem. button  .
- Touch softkey  below >ID-DIR<.

The display shows e.g:

```
MANUAL  MAN. OPER.
PM 95682      N
PARTPROGRAM N 95682
ALL MEMORY 163200 BYTES FREE
■ N 95682 ( 1664 BYTES      READING)
N 9019 ( 13696 BYTES      )
```

```
■ NGXYZBCABRIJKLPFSTME ■ N
N95682 ( 1664 BYTES      READING)
```

```
----- ID-DIR ----- RETURN
```

To set MC93 proceed as follows:

- Touch const. mem. button  .
- Touch softkey  below >OPER-MC<.

- Select MC93 with the cursor  .
- Set the cursor on C  and enter the appropriate value.
- Touch the enter button  and the store button  .
- Select another operation mode.

19.5. RESTRICTIONS AND CONVENTIONS.

The control generates a BTR main program with program number N9999999. During reading in 5 invisible macro`s are generated with macro numbers N9999990 to N9999994.

These numbers may not be used for other programs, resp. macro`s. If a program or macro with one of the numbers does reside in memory it will be deleted by the control.

The control is using parameter E0 in the BTR main program for calculations. Hence this parameter may not be used in the part program.

The long part program may contain macro calls, the macro`s must be in memory before starting execution of the part program.

Jump and repeat functions are not allowed since the long part program is divided into parts of undefined length and the target block can be in a part of the program which is not under execution yet.

It is not possible to perform manual block search. The program must be executed from the first block.

Editing of the macro`s made by the BTR-function is not possible.

A P P E N D I X A

The error codes that can be shown in the screen display of the CNC3460 machine tool controller are of two categories; normal error codes (Section A.1) and diagnostic error codes (Section A.2).

Note that the error codes listed in Tables 1 and 2 of this appendix are those error codes which are common to all Philips CNC3460 machine tool controllers. Controllers that have been 'customised' to suit a particular machine tool or a particular manufacturer will have additional error codes that are specific to their application. The meanings of such error codes will be found in the relevant documentation provided by the manufacturer of the machine tool.

A.1. ERROR CODES

If the CNC detects an error during normal operation it will show an error code in the upper right of the screen display. Depending on the error, it may also take some action to prevent the error from causing damage. The three most common types of action which may be taken by the CNC are:

- INTERRUPT - Interrupts generated during program execution cause the line >INT< to be shown in the screen display. The CNC is forced into Intervention mode - all axis and spindle drive analog outputs are reset (that is, go to zero volts), all digital outputs that anticipate axis or spindle motion are reset, reference-point finding is stopped, Search is stopped.
- OPEN LOOP - Open loop action does not result in any indication in the screen display. All analog outputs for the axes and spindle are reset - motion is stopped, but position is maintained.
- R-POINT - R-point action does not result in any message in the screen display until after the error has been cleared, when the line >REF.POINT< is shown to indicate that a reference point search must be performed for one or more axes. R-point action always occurs together with one of the two actions above.

The error codes that can be displayed consist of a letter prefix followed by a number. The letter prefix identifies the general type of the error, as below:

- # - hardware or system software
- M - memory (RAM and PROM)
- X - X-axis
- Y - Y-axis
- Z - Z-axis
- A - A-axis
- B - B-axis
- C - C-axis
- W - handwheel
- S - spindle
- P - programming (during execution) and geometry
- O - operating
- D - data I/O and DNC
- I - interface (various categories)
- G - graphics
- E - external

The above list of error prefixes is in descending order of seriousness, with the #-prefixed error codes the most serious. This is the order in which the error codes are held in the error code list in this section (Table 1).

Note that particular error codes may be more or less serious than the letter prefix suggests (for instance, some programming errors are more serious than some axis errors).

The exact seriousness of each error is given by its 'class', which defines what actions are taken by the CNC. These classes are from 'A' (most serious) to 'H' (least serious), as detailed below:

Class A: System Errors

These errors are caused by a serious failure of the CNC hardware or its system software.

The CNC will halt all axis movement and spindle rotation. It will show an error description in the display as well as an error code.

The CNC can only be cleared by switching it off and re-starting it.

Class B: Checksum Errors

These errors are caused by some failure of RAM or PROM memory. In some cases the memory failure can also cause errors of the other classes.

Interrupt, open loop and R-point actions will result from checksum errors.

The CNC can be cleared by the Clear button in Manual mode, but the error code will reappear in the screen display until an editing mode is selected.

Class C: Position-loss Errors

These errors are caused by the CNC being unable to find the current values for one or more axis positions.

Interrupt, open loop and R-point actions will result from position-loss errors.

The CNC can be cleared by the Clear button in Manual mode.

Class D: Emergency Stop Errors

These errors are caused by conditions which require that the analog outputs' voltages go to zero immediately.

Open loop and R-point actions will result from emergency stop errors. There should be no loss of position.

The CNC can be cleared by the Clear button in Manual mode.

Class E: Stop-execution Errors

These errors are caused by conditions that require that the execution of the part program is halted.

Interrupt action will result from stop-execution errors.

The CNC can be cleared by the Clear button in Manual mode.

Class F: Programming Errors

These errors are generally caused by programming errors that are detected before the block containing the error is executed.

No positive action will result from a programming error, but in Auto mode the execution of the program will be stopped at the end of the block preceding the block with the error.

The CNC can be cleared by the Clear button in Manual or Teach In modes.

Class G: Operating Errors

These errors are caused by the operator making an incorrect keyboard input while editing or while in Teach In or Manual Data Input modes.

No positive action will result from an operating error, but responses to operator keyboard inputs will be stopped.

The CNC can be cleared by the Clear button in any operation mode.

Class H: Warning Errors

These errors are caused by conditions which may result in more serious errors if no action is taken by the operator.

No actions will result from a Warning error.

The CNC can be cleared by the Clear button in any operation mode.

If more than one error is detected at the same time only the most serious error will be given priority and be displayed. The error codes are listed in Table 1 of this appendix, overleaf.

TABLE 1 - ERROR CODES

Error Code	Error Description	Error Class

HARDWARE AND OPERATING SYSTEM ERRORS

Note that hardware and OS errors indicate serious faults. If one of the error codes listed below is displayed a qualified service engineer should be called.

# 01	:	OS error: MTOS failure	A
# 02	:	Calculation error	C
# 03	:	Warning: temperature more than 65°C	H
# 05	:	Emergency stop from machine tool	D
# 96	:	OS error: division by zero	A
# 97	:	OS error: arithmetic overflow	A
# 98	:	OS error: unexpected interrupt	A
# 99	:	OS error: general	C

MEMORY ERRORS

M 01	:	MC memory checksum error	B
M 02	:	Tool memory checksum error	C
M 03	:	MC shadow memory checksum error	B
M 21	:	PROM checksum error (PROMs 1 to 4)	B
M 22	:	PROM checksum error (PROMs 5 to 8)	B
M 23	:	PROM checksum error (PROMs 9 to 12)	B
M 60	:	Ram test error (part program/macro memory)	C

AXIS ERRORS

Note that in the axis error codes below 'n' will be the axis designation, that is X,Y,Z,A,B or C

n 01	:	Linear measuring system pre-alarm (measuring system signal voltage is low)	H
n 02	:	Measuring system alarm (measuring system signal has failed)	C
n 03	:	Measuring system power supply failure	C
n 04	:	Following error too large	C
n 05	:	Software limit switch tripped	E
n 06	:	Commanded speed of movement is faster than rapid traverse (MC355)	E
n 07	:	Drifting outside no-motion window	D
n 08	:	Commanded speed of movement is faster than max feedrate (MC356)	E

HANDWHEEL ERRORS

W 01	:	HWl measuring system pre-alarm	H
		(measuring system signal voltage is low)	
W 02	:	HWl measuring system alarm	C
		(measuring system signal has failed)	
W 03	:	HWl measuring system power supply failure	C
W 04	:	External measuring system pre-alarm	H
		(measuring system signal voltage is low)	
W 05	:	External measuring system alarm	C
		(measuring system signal has failed)	
W 06	:	External measuring system power supply failure	C
W 99	:	Software limit switch tripped	E

SPINDLE ERRORS

S 01	:	Measuring system pre-alarm	H
		(measuring system signal voltage is low)	
S 02	:	Measuring system alarm	D
		(measuring system signal has failed)	
S 03	:	Measuring system power supply failure	D
S 04	:	Following error too large (closed-loop only)	D
S 05	:	M19 not inside window (MC 562)	D

PROGRAMMING ERRORS

P 01	:	Illegal word in block	F
P 02	:	Necessary word missing from block	F
P 03	:	Unknown G-function	F
P 04	:	No feedrate programmed	F
P 05	:	Circular movement not allowed in rotation axis (G02,G03)	F
P 06	:	Mirror image not allowed in tool axis in fixed cycle (G73)	F
P 07	:	Parameter out of range	F
P 08	:	Blocknumber not in program or macro (G14-G29)	F
P 09	:	Undefined macro (G22)	F
P 10	:	Nesting too deep (G14,G22)	F
P 11	:	No return defined (G22)	F
P 12	:	G-function in block not allowed in Teach In mode	F
P 13	:	Movement not linear (G43,G44)	F
P 14	:	No fixed cycle defined (G77,G79)	F
P 15	:	Spindle direction not programmed (G77,G79)	F
P 16	:	Point not defined	F
P 17	:	Axis programmed that is not on machine tool	F
P 18	:	Block reading error in active program	F
P 19	:	Motion direction not programmed (G43,G44)	F
P 20	:	Tool radius too large (G41,G42,G77,G79)	F
P 21	:	Divide by E-parameter with value zero	F
P 22	:	Reverse number order of block execution	F
P 23	:	Toolradius is zero (G77,G79)	F
P 24	:	Pocket milling overlap less than 20% or more than 100% (G79,MC720)	F
P 25	:	Speed not programmed	F
P 26	:	Parameter in MC out of range	F
P 27	:	T larger than number of tools (MC27,MC28)	F
P 28	:	E-parameter value not programmed	F
P 29	:	E-parameter calculation error	F
P 30	:	Inch program in metric mode, or vice-versa	F
P 31	:	Speed out of range	F
P 32	:	Decrement value in parameter cannot be zero (G14,G79)	F
P 33	:	4th axis is not U,V or W-axis (G20)	F
P 34	:	Programming error in next block (will always be displayed with a second error code to define the error)	F
P 35	:	Endpoint not in circle endpoint window (MC712)	F
P 36	:	Measuring probe collision in measuring cycle	D
P 37	:	Measuring surface not found (no probe contact)	F
P 38	:	Measured deltas larger than tolerance (G49)	F
P 39	:	No measured deltas available (G49)	F
P 40	:	Measuring cycle programmed and measuring probe not activated (MC840)	F
P 41	:	No program number (G23)	F
P 42	:	Block not found (G23)	F
P 43	:	Program not found (G23)	F
P 44	:	Called program is being edited (G23)	E
P 45	:	Return from call is to program that is being edited (G23)	E
P 47	:	Spindle rotation not allowed with active	F

probe (M03,M04,G45,G46 with MC840 active)
P 48 : Zero-point shift not allowed after axes rotation F
P 49 : Warning: tool radius larger than programmed radius of concavity H

GEOMETRY PROGRAMMING ERRORS

Note that some of the geometry programming error codes are general error codes which are always followed by a second subsidiary error code to define the exact type of error.

General error codes are identified in the table below by the list of associated subsidiary error codes that follow the error description (in brackets with an '&'). Subsidiary error codes are identified by an asterisk (*) next to the error code itself.

P 51*	:	Line with point only not allowed	F
P 52*	:	Line with angle only not allowed	F
P 53*	:	Line with point and angle only not allowed	F
P 54*	:	Line with tangent-point not allowed	F
P 55*	:	Line with intersection-point not allowed	F
P 56*	:	Chamfer not allowed	F
P 57*	:	Circle with point only not allowed	F
P 58*	:	Circle with centre-point only not allowed	F
P 59*	:	Circle with tangent-point not allowed	F
P 60*	:	Circle with intersection-point not allowed	F
P 61	:	Line-line intersection-point not computable	F
P 62	:	Circle-line intersection-point not computable	F
P 63	:	Line-circle intersection-point not computable	F
P 64	:	Circle-line tangent-point not computable	F
P 65	:	Rounding not allowed in line-circle	F
P 66	:	Circle-circle without rounding	F
P 67	:	Circle-circle rounding radius too large	F
P 68	:	Line-circle tangent-point not computable	F
P 69	:	Line-circle rounding radius too large	F
P 70*	:	Rounding not allowed	F
P 71	:	Undefined block	F
P 72	:	Block not allowed	F
P 73	:	Circle centre-point not allowed as line start-point	
P 74	:	'Kl=' , 'Jl=' or 'Rl=' definitions not allowed	F
P 80	:	Geometry error in next block (& P56,P57,P70)	F
P 81	:	Linear movement geometry error in next block (& P51,P52,P55,P57-60)	F
P 82	:	Linear movement and chamfer geometry error in next block (& P51,P52,P55-60,P70)	F
P 83	:	Linear movement, chamfer and tangent geometry error in next block (& P51-56)	F
P 84	:	Linear movement, chamfer, tangent and rounding geometry error in next block (& P51-56,P70)	F
P 85	:	Linear movement and rounding geometry error in next block (& P51,P52,P55,P56,P70)	F
P 86	:	Linear movement, rounding and tangent geometry error in next block (& P51-56)	F
P 87	:	Linear movement and rounding and tangent and	F

		rounding geometry error in next block (& P51-56,P70)	
P 88	:	Linear movement and tangent geometry error in next block (& P51-56)	F
P 89	:	Linear movement, tangent and rounding geometry error in next block (& P51-56,P70)	F
P 90	:	Linear-circular movement intersection geometry error in next block (& P51-56)	F
P 91	:	Linear-circular movement intersection and rounding geometry error in next block (& P51-56,P70)	F
P 92	:	Tangent geometry error in next block (& P51-56)	F
P 93	:	Tangent and rounding geometry error in next block (& P51-56,P70)	F
P 94	:	Circular movement intersection geometry error in next block (& P51,P52,P55,P56)	F
P 95	:	Circular movement and tangent geometry error in next block (& P51-56)	F
P 96	:	Circular movement, tangent and rounding geometry error in next block (& P51-56,P70)	F
P 97	:	Circular movement and rounding geometry error in next block (& P51,P52,P55,P56,P70)	F
P 98	:	Circular movement, rounding and tangent geometry error in next block (& P51-56)	F
P 99	:	Circular movement, rounding, tangent and rounding geometry error in next block (& P51-56,P70)	F
P100	:	Circular movement tangent-circle geometry error in next block (& P53-60,P70)	F
P101	:	Circular movement tangent-circle and tangent geometry error in next block (& P51-56)	F
P102	:	Circular movement tangent-circle, tangent and rounding geometry error in next block (& P51-56,P70)	F
P103	:	Circular movement tangent-circle and rounding geometry error in next block (& P53,P56-60,P70)	F
P104	:	Circular movement tangent-circle, rounding and tangent geometry error in next block (& P51-56)	F
P105	:	Circular movement tangent-circle, rounding, tangent and rounding geometry error in next block (& P51-56,P70)	F
P106	:	Circular movement circle geometry error in next block (& P51-57)	F
P107	:	Circular movement circle and rounding geometry error in next block (& P51,P52,P55,P56,P70)	F
P108	:	Circular movement circle, rounding and tangent geometry error in next block (& P51-56)	F
P109	:	Circular movement circle, rounding, tangent and rounding geometry error in next block (& P51-56,P70)	F
P110	:	Change to spare tool cannot programmed (done only by breakage or exceeded tool life)	F

OPERATING ERRORS

0 01	:	Editing of an active part program or macro not allowed	G
0 02	:	No block number entered	G
0 03	:	Searching not successful (edit or Manual mode)	G
0 04	:	Memory error during block reading	G
0 05	:	Block too large (more than 80 chars)	G
0 06	:	Block number already exists	G
0 07	:	Warning: memory overflow imminent	H
0 08	:	Memory overflow	G
0 09	:	Entered number out of range (T,N,E or P)	G
0 10	:	Part program number already exists	G
0 11	:	Block number not searched (use Search button)	G
0 12	:	No part program number entered	G
0 14	:	Memory error reading next block (G41,G42)	G
0 15	:	More than 3 axes before storing (playback)	G
0 17	:	M30 in active program (playback)	G
0 18	:	Insufficient RAM (more needed than MC2 value)	G
0 19	:	Invalid equals sign (=) in word	G
0 20	:	G-function that is not allowed in this mode (playback)	G
0 21	:	Teach In cannot start with part program points active (block with P1,P2,etc has not completed execution)	G
0 22	:	Duplicated position number in tool memory	G
0 23	:	MC data out of range	C
0 24	:	Measuring probe collision	D
0 25	:	Number of external program call allocations exceeds 99	G
0 26	:	External program call parameter is already allocated	G
0 27	:	Tool number is already allocated to a spare tool	H
0 28	:	External program call with unknown part program number	G
0 29	:	External program call with no part program number	G
0 30	:	Plane is not possible with this orientation of the axes	G
0 31	:	No orientation possible with 4th axis	G
0 32	:	4th axis is rotation axis (G20)	G
0 49	:	Program locked	G
0 50	:	Memory area is being read by an active program	G
0 51	:	Number of part programs in memory is equal to MC85, no more will be accepted (manual entry)	G

DATA IN/OUT ERRORS

D 01	:	CM or TM lists cannot be entered while a part program is being executed	G
D 02	:	No block number entered	G
D 03	:	Required record not found in memory	G
D 04	:	Error during data reading from input device	G
D 05	:	Block too large (more than 80 chars)	G
D 06	:	Block number already exists in part program	G
D 07	:	Warning: memory overflow imminent	H
D 08	:	Memory overflow	G
D 09	:	Program number less than 9000 or block number more than 8999	G
D 10	:	Part program number already exists	G
D 11	:	Block number has not been searched	G
D 12	:	No part program number	G
D 13	:	Illegal RAM-length; `end-code` cannot be stored	G
D 19	:	Invalid equals sign (=) in word	H
D 25	:	Number of external program calls is more than MC43	G
D 26	:	External call of program number that is already allocated	G
D 27	:	Tool number is already allocated to a spare tool	H
D 29	:	External program call without allocated part program number (not in Parameter list)	G
D 30	:	Address already entered (duplicated in block)	G
D 31	:	Illegal character (not in character set)	G
D 32	:	Parity error	G
D 33	:	Word length error	G
D 34	:	Cancel or system failure	G
D 35	:	Requested program number is less than 9000	G
D 36	:	Requested memory code is not on the tape (PM, CM, TM, etc, not found)	G
D 37	:	Address has illegal char in data	G
D 38	:	Address without data	G
D 39	:	Block does not start with block number	G
D 40	:	Algebraic expressions only allowed in parameter mode	G
D 41	:	Peripheral not ready	G
D 42	:	Framing error or baudrate overrun error	G
D 43	:	Unknown memory code (not PM, CM, TM, etc)	G
D 44	:	Non-existent address	G
D 45	:	Sign (+,-) not allowed on a non-signed word	G
D 46	:	Invalid or multiple equals sign (=) in word	G
D 47	:	Requested program not found on tape	G
D 48	:	Tape is in inch mode, CNC in metric mode, or vice versa	H
D 49	:	Program locked during I/O operation	H
D 50	:	Memory record is being accessed during data I/O	H

DNC-ERRORS

D 80	:	DNC out of synchronisation	G
D 81	:	Break detected in connection	G
D 82	:	Framing error	G
D 83	:	Parity error	G
D 84	:	Time-out error	G
D 85	:	Block check code failure (LSV-2 error)	G
D 86	:	DNC computer responds with `NOT READY`	G

INTERFACE ERRORS

I 01	:	Interface not initialised	D
I 02	:	Both 'home select' inputs are at the same level	E

TOOL MONITOR ERRORS

I 10	:	Tool breakage detected	E
I 11	:	Warning: tool life exceeded during machining	H
I 12	:	Tool to be changed into spindle has exceeded its tool life	E
I 13	:	Warning: 1st power level exceeded	H
I 14	:	Tool to be changed into the spindle has already had an I13 or I15 error	E
I 15	:	2nd power level exceeded	E
I 16	:	Tool measurement enabling signal not present	E
I 17	:	Tool measurement value is zero	E
I 18	:	Tool measurement value is too large	E
I 19	:	Measured tool length is larger than the previous value	E

EXTERNAL PROGRAM CALL ERRORS

I 20	:	Previous external call is still waiting (ext. prog. call buffer is full)	H
I 21	:	External program call without part program number (ext. prog. call buffer is empty)	H
I 22	:	Called program is being edited	F
I 23	:	No part program number in parameter for ext. prog. call	F
I 24	:	Part program number from parameter for ext. prog. call is not found in memory	F
I 34	:	Tool holder open (unclamped); cannot start machining	F
I 45	:	The 'next block permitted' signal is not present	H
I 58	:	Tool position value in tool memory is larger than max. value (MC28)	E

SPINDLE AND PROBE INTERFACE ERRORS

I 66	:	Measuring probe's infrared beam is obstructed <u>or</u> there is a measuring probe collision	D
I 68	:	Actual spindle speed is not the programmed speed <u>or</u> the spindle drive feedback signal has failed	E
I 87	:	Spindle has not stopped <u>or</u> the spindle stopped feedback signal has failed	E

GRAPHIC ERRORS

G 01	:	Programming error in window (G98 for Testruns 5 and 7)	F
G 02	:	Programming error in rough contour (G99 for Testruns 5 and 7)	F
G 20	:	Communication error between Centr. Proc. Mod. and Graph. Mod.	C

EXTERNAL ERRORS

E xx : External error codes are derived from six binary inputs which are only used in conjunction with the optional 'automation package'. The error code number (xx) is the decimal equivalent of the input six-bit binary number (that is; 01 to 63, no 00). The meaning of these numbers is given in the appropriate documentation of the machine tool manufacturer.

A.2. DIAGNOSTIC ERROR CODES

When CNC is checked for faults with the diagnostic tests contained in the Diagnostic and Service Only modes (see Chapters 13 and 14) the error codes that may be displayed are different to the normal error codes that are listed in Table 1.

These diagnostic error codes are numbers with no letter prefix. They are always preceded by the word >ERROR< and followed by a brief description of the error (for example, >ERROR 50 RAM NOT CONTIGUOUS<). Diagnostic error codes are shown at the bottom of the screen display, unlike normal error codes.

The diagnostic error codes are listed in Table 2 of this appendix, overleaf.

TABLE 2 - DIAGNOSTIC ERROR CODES

Error Number	Error Display text	Error Description

The CPU contains two counter chips (8253) which set the baudrate for the V11 and V24 UARTS, the following two errors (01 and 02) both suggest some fault with them.

01	SLOW ERROR	A counter has been found to be slower than the acceptable minimum speed.
02	FAST ERROR	A counter has been found to be faster than the acceptable maximum speed.

08	ALARM	This error refers to the Drive Modules: <u>LMS</u> - The voltage of the measurement signal to the Drive Module is below the minimum acceptable value. <u>RMS</u> - The phase difference between the two measurement signals to the Drive Module is less than the minimum acceptable value.

In both cases the measurement system or the connecting cables are defective (see also ERROR 23).

For the following six errors (09, 10, 11, 12, 14 and 15) to be detected the Central Processor Module V24 test must be run with a 'loopback connector' (joining DSR to DTR, CTS to RTS and Txd to RxD) on the V24 or V11 sockets (depending on which is selected by MC770). See section 14.2.4. These errors all suggest either faulty connections or a faulty UART.

09	DTR/DSR	The DTR output and the DSR bit in the UART status buffer do not agree.

10	FRAMING, OVERRUN OR PARITY	One (or more) of the framing, overrun or parity error bits in the UART status buffer is high. Probably UART failure.
11	RECEIVE/TRANSMIT	The transmitted data (one character) does not agree with the received data.
12	RTS/CTS	Transmitted character is not ready to send within acceptable maximum time, or RTS signal is not received.
13	(see ERROR 50)	
14	TRANSMIT	Data bus buffer has not emptied, transmission has not taken place.
15	RECEIVE	Transmitted character has not been received.

For the following two errors (16 and 17) to be detected the Automatic I/O Test must be run with a test lead. See section 14.5.4.

16	I/O NOT CORRESPONDING	The input and output of the channel under test do not agree.
17	INPUT OR OUTPUT	An input or an output of a channel which is <u>not</u> the one being currently tested has changed status (high-to-low or low-to-high).
19	PATTERN NOT CORRECT	The bit pattern that was written to RAM does not agree with the pattern subsequently read from RAM (see also ERROR 50).
21	INTERRUPT NOT RESPONDING	An interrupt has been given to the interrupt controller (8259) but the interrupt register has not been written to.

23	PRE-ALARM	This error only applies to LMS Drive Modules. The voltage of the measurement system signal to the Drive Module is low, but not yet below the acceptable minimum (see also ERROR 08).
29	DRIVE NOT RESPONDING	The selected Drive Module is not repending or is not installed.
35	PARITY INPUTS	The parity (even or odd) of the inputs does not agree with the setting of the input parity bit of the status byte of the module.
36	PARITY OUTPUTS	The parity (even or odd) of the outputs does not agree with the setting of the output parity bit of the status byte of the module.
50	RAM NOT CONTIGUOUS	The RAM memory has been tested and is not in an unbroken sequence from the lowest address to highest (see also below).
(13	RAM	The RAM memory has been tested and some undefined fault has been detected. Further information may be given in the screen display.)
51	PROM CHECKSUM	The checksum held for a PROM and the calculated checksum do not agree.
52	CHECKSUM BAD IN PROM	The checksums for all the PROMs are held in PROM No. 1. Either this PROM cannot be read or the checksums are not in the correct format (that is, with the next address after each checksum holding the checksum's 'ones complement').
53	GRAPHICS RAM ERROR	The RAM memory of the Graphics Module has been tested and a fault has been detected.
54	GRAPHICS PROM CHECKSUM ERROR	The PROM memory of the Graphics Module has been tested and a fault has been detected.

The selected graphics test has detected an error (see Section 14.7.3.).

The following three errors can only be detected during the loading of special test programs by service personnel. Users will not normally encounter them.

The test program being loaded is of the wrong type (that is, the record format is not correct for the CNC).

A framing, overrun or parity error has occurred during program loading.

The checksum and the calculated checksum do not agree in a record of the program being loaded.

