SIEMENS

SINUMERIK System 3

Operating instructions Part 2

SINUMERIK
System 3

Operating instructions Part 2

Edition 8.84
Part 1 Basic Systems 0, 1, 2
Part 2 Basic System 3
Part 3 Basic System 4 and 3TT

Introduction	Chapter 1
Data output (Interface)	Chapter 2
Data input (Interface)	Chapter 3
Automatic Manual data input	Chapter 4
Handwheel	Chapter 5
Incremental mode	Chapter 6
Manual data input Part program	Chapter 7
Manual data input Zero offsets Tool offsets Machine parameters	Chapter 8
Automatic mode	Chapter 9
Return to datum	Chapter 10
Manual data input with operator dialogue, part program MDI-PP	Chapter 11
Appendix	Chapter 12

Siemens Aktiengesellschaft

SINUMERIK® - Documentation

Key to Editions

Up to the present edition the editions listed below have been issued.

In the column "alterations" the chapters are listed which have been altered with respect to the preceding edition.

Edition	Order Number	Alterations
A.04.82	E 321/1935	First edition
A.10.82	E 321/1935	PP. 0-3, 1-5, 1-7, 3-1, 7-4, 9-14, 12-5
A.03.83	E 321/2016	Revised edition
A.09.83	A19100-E321-B116	Revised edition
A.08.84	E80210-T31-X-A5-7600	PP. 1-8, 4-3, 7-2, 7-4, 7-9, 7-11, 8-4, 8-6, 9-3, 9-18, 12-9, 12-16, -12-26

Contents Page

1. INTRODUCTION 1-1

1.1. General 1-1
1.2. Symbol clarification 1-2
1.3. Terminology 1-3
1.4. Operating modes 1-4
1.5. Input and display list 1-6
1.6. Data display 1-7
1.7. Power-up 1-8
1.8. Actual position display 1-9

2. DATA OUTPUT DO 2-1

3. DATA INPUT DI 3-1

3.1. Data input check 3-3
3.2. Interface section and equipment 3-4

4. AUTOMATIC USING MANUAL DATA INPUT MDA 4-1

4.1. Manual data input 4-1
4.1.1. MDI stop 4-3
4.1.2. MDI edit 4-3
4.1.3. MDI interruption 4-3

4.2. TEACH IN 4-4
4.2.1. Interruption of teach in 4-5
4.3. PLAYBACK 4-6

5. HANDWHEEL JOG 5-1

5.1. Jog feed and rapid 5-2
5.2. Operation from handwheel 5-4

6. INCREMENTAL MODE NC 6-1

Page

7. MANUAL DATA INPUT, PART PROGRAM MDI-PP 7-1

7.1. Program reset 7-3
7.2. Program select 7-4
7.3. Data input into memory via keyboard 7-5
7.4. Program edit 7-7
7.4.1. Data insert 7-7
7.4.2. Single word edit 7-8
7.4.3. Single word delete 7-10
7.4.4. Block delete 7-11

8. MANUAL INPUT OF ZERO OFFSETS, TOOL OFFSETS,
TEST DATA MDI - SE - TE 8-1

8.1. Tool offsets 8-1
8.1.1. Tool offsets 3T 8-1
8.1.1.1. Position of tool cutter point 8-2
8.1.2. Tool offsets 3M 8-3
8.1.3. Activation of selected offset values 8-3
8.1.4. Input/edit offset value 8-4
8.1.5. Tool wear edit 8-4
8.1.6. Reset offset values 8-5
8.1.6.1. Reset selected offset value 8-5
8.1.7. Automatic calculation of tool geometry data with 3T . 8-6

8.2. Zero offsets 8-9
8.2.1. Reference points 8-9
8.2.2. Adjustable zero offsets (XMW, ...) 8-10
8.2.3. Zero offset measurement 8-11
8.2.4. Zero offset display 8-12
8.2.5. Adjustable zero offset reset 8-13
8.2.6. Entering adjustable zero offsets 8-13
8.2.7. Automatic calculation of zero offset with 3T 8-14

Page

8.3. Programmable spindle speed limitation 8-18
8.3.1. Oriented spindle stop 8-19

8.4. Bit-oriented user data 8-20
8.5. R parameters 8-21

8.6. Data and display selection 8-22
8.6.1. Alarm display 8-23
8.6.2. Interface copy 8-24
8.6.2.1. I/O signals (NC interface) 8-24
8.6.2.2. I/O signals (PC machine) 8-25
8.6.3. NC machine parameters 8-26
8.6.4. Commissioning values 8-27
8.6.5. Setting the drift compensation 8-29

9. AUTOMATIC MODE AUT 9-1

9.1. Automatic mode instruction 9-4

9.2. Display of command value - actual value difference .. 9-5

9.3. Offset block 9-6

9.4. Continuation of automatic operation following program interruption 9-7
9.4.1. Overview 9-7

9.5. Program interruption through set up 9-9
9.5.1. Retract for tool inspection 9-9
9.5.2. Touch on method 9-10

9.6. Block search in automatic operation 9-11
9.6.1. Search to an interrupted block 9-11

Page

9.7. Program test 9-14
9.7.1. Dry run 9-14

10. RETURN TO DATUM REF 10-1

11. MANUAL DATA INPUT WITH OPERATOR DIALOGUE
PART PROGRAM MDI - PP 11-1
11.1. Input of part program into the memory 11-1
11.2. Summary (Data input 3T) 11-4
11.3. Example Program input 3T 11-5
11.4. Summary (Data input 3M) 11-6
11.5. Example Program input 3M 11-7

12. APPENDIX 12-1
12.1. Operator panel and machine panel 3T 12-1
12.2. Operator panel and machine panel 3M 12-3
12.3. Abbreviations, operator panel texts and
text interpretation 12-5
12.4. Operator data 12-7
12.5. Alarm list 12-8
12.6. Alarm description 12-10
12.7. Tape reader (technical data) 12-33

1. INTRODUCTION

1.1. General

This operating manual serves generally for SINUMERIK 3T and 3M in basic system 3. The operation of each control is similar, the differences e.g. jogging of axes, are described for each control type.

The operating concept of System 3 controls is characterized by its systematic unified operating logic. Operation is simplified by operator dialogue.

The operating steps are described in sequence using the symbols on the operating panel as illustration.

This operator's manual is arranged according to the mode selector switch.

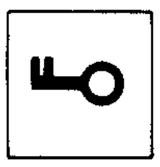
We reserve the right to change this description as a result of technical changes. At the end of this manual there are fold out drawings of the operator's panels related to the various control types. In order to follow the text it is helpful to fold out the appropriate illustration. The operator's panel is divided into modules which are also clarified in the appendix.

The operating elements are explained when first encountered in the text and reference is made to the pushbutton number detailed on the fold out drawings.

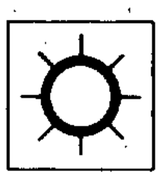
We reserve the right to modify this manual with respect to technical modifications.

1.2. Symbol clarification

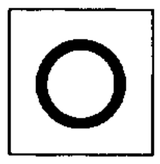
The following symbols are used in the operator's manual:



Key switch enabled



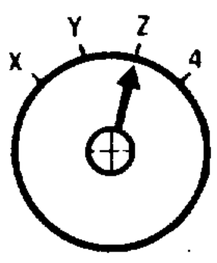
Lamp ON



Lamp OFF

Toggle switch OFF

Toggle switch ON



Rotary switch, e.g., axis selector switch set for the Z axis

{ }

Curved brackets:
Operation is to be conducted only according to the condition indicated laterally

X1234.567 Address with specified number of decades (as shown 7 decades, with 3 decimal places)

4 4th axis; axis is designated by machine parameter

1.3. Terminology

Program file indicator

The control differentiates between 10000 part programs.
It is possible to store 100 programs at the same time.
The program file indicator is used to call up and display the currently selected part program.

- Program file indicator, e.g. % 1234

Program status indicator

The status indicator displays the current operating status and comprises:

- Block number in the part program	N 1234
- First subroutine number with number of runs	L 1201
- Block number in the number of subroutine runs	N 1234
- Second subroutine number with number of runs	L 1301
- Block number in the number of subroutine runs	N 1234
- Third subroutine number with number of runs	L 1401
- Block number in the number of subroutine runs	N 1234

Select

Display selection with a pushbutton (e.g. part program)

Cursor

Edit indicator

Page

Page of data

1.4. Operating modes

An NC controls the movement of tools about a workpiece in accordance with a previously entered part program. An NC machine must be loaded with a workpiece, tools and other preparatory work carried out before the final process can begin.

The preparations are:

- Moving the tool or workpiece to the correct start position as shown on the setting up drawings.

- Loading the part program into the control memory

- Checking or entering the zero offsets

- Checking or entering the tool offsets.

For these preparations the control must be in the respective mode so that the preparatory operations can be established by the control. These operating modes may be selected by using the mode selector switch on the machine control panel.

The following modes are available:
(abbreviations in letters)

Symbol	Description	Screen Text	Abbreviation
	Data output (interface)	DATA OUTPUT	DO
	Data input (interface)	DATA INPUT	DI
	Manual data input/ Automatic	MDA	MDA
	Jog, handwheel	JOG	JOG
	Incremental feed	INC FEED	INC
	Manual data input, part program	MDI PARTPROGRAM	MDI-PP
	Manual data input tool offsets zero offsets machine data Setting Data Testing Data	 MDI SE-TE	 MDI SE-TE
	Automatic	AUTOMATIC	AUT
	Reference Point Approach	REFERENCE POINT	REF

1.5. Input and Display List

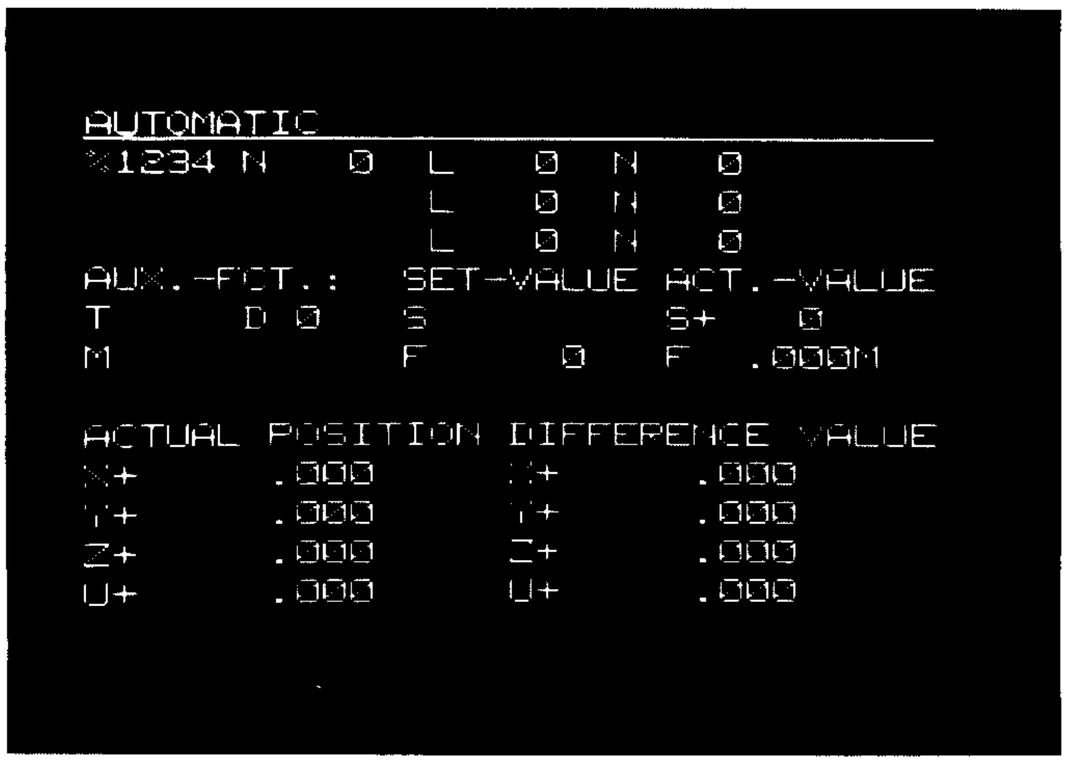
	Data output via data interface of part program % subroutine L, tool data TO, machine data TE					
	Data input via data interface of part program %, subroutine L, tool data TO, machine data TE 1.8.		2. 3.	* Alarms 8.6.1. * Interface page 8.6.2. * Machine data 8.6.3.	Data output via data interface 2. Data input via data interface 3.	* Position indicator
	Basic display Input manual input block 4.1. Process manual input block 4.1. Store manual input block 4.2.	* Tool offset data 8.1.	Zero offset 8.2. * User data 8.3./ 8.4. * R-parameter 8.5.	* Alarms 8.6.1. * Interface page 8.6.2. * Machine data 8.6.3.	* Offset block * Program 9.4. indicator 9.4.	* Position indicator 1.8.
	Axis Traverse using direction buttons or handwheel 5.					
	Basic displays Overwriting of M, S, T-functions 5.0.	Automatic determination of tool offsets 8.1.7.	Automatic determination of zero offsets 8.2.7.	* Alarms 8.6.1. * Interface page 8.6.2. * Machine data 8.6.3.	Playback 4.3.	* Position indicator 1.8.
	Incremental Jog using direction buttons 6.					
	Basic displays Overwriting of M, S, T-functions 6.0.	Automatic determination of tool offsets 8.1.7.	Automatic determination of zero offsets 8.2.7.	* Alarms 8.6.1. * Interface page 8.6.2. * Machine data 8.6.3.	Playback 4..3.	* Position indicator 1.8.
	Cancel part program% subroutines L 7.1.	* Tool offset data 8.1.	* Zero offset 8.2. * User data 8.3./ 8.4. * R-parameter 8.5.	* Alarms 8.6.1. * Interface page 8.6.2. * Machine data 8.6.3.	Input, edit part programs% 7.3. subroutines L 7.4.	* Position indicator 1.8.
	* Basic displays	Input tool offset data 8.1.	Input zero offsets 8.2. User data 8.3./ 8.4. R-parameter 8.5.	* Alarms 8.6.1. * Interface page 8.6.2. * Machine data 8.6.3. * Drift offset 8.6.5.	* Basic display	* Position indicator 1.8.
	Processing a Part Program					
	Basic displays Overwriting of M, S, T-functions 9.0. Block search 9.5.	Input tool wear and tool offsets 9.3.	* Zero offset 8.2. * User data 8.3./ 8.4. * R-parameter 8.5.	* Alarms 8.6.1. * Interface page 8.6.2. * Machine data 8.6.3.	* Program indicator 9.4. * Offset block 9.4.	* Position indicator 1.8.

	Reference Point * Position indicator 1.8.	Approach using	direction buttons	10. * Alarms 8.6.1. * Interface page 8.6.2. * Machine data 8.6.3.		* Position indicator 1.8.

Note: * only display, no input permitted.

The numbers stated for the functions refer to the chapters of the operating instruction.

1.6. CRT



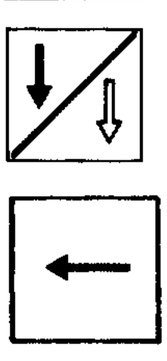
The arrangement of the pages (shown here - Automatic 3M) is generally identical for all the operating modes. The CRT has 16 lines, each capable of containing 32 characters.
The 1st line states the operating mode selected.

The 14th line displays the first NC alarm number with its alarm text.

The last 15 characters of the last (16th) line are reserved as input line.

Since the CRT displays a large amount of data, the following push-buttons are available for the purpose of searching for specific information:

PAGE keys
(backward scroll, key no. 22, and forward scroll, key no. 23)
(when displaying part programs, one should switch block-wise forward)



and the
Cursor keys
(cursor left, key no. 24, and cursor right, key no. 25)

Faulty inputs are not accepted; the faulty words are displayed by inverted flashing. The input can be deleted with the "clear" key (no. 29).

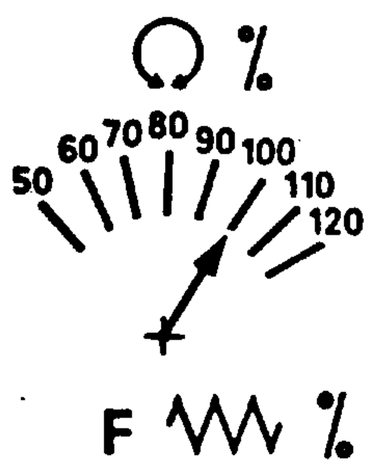
1.7. Power-up

Before the control is powered up for the first time, one should make sure that the control was started up by qualified personnel. Before starting, set the switches to the following positions:

Single block (switch no. 40)

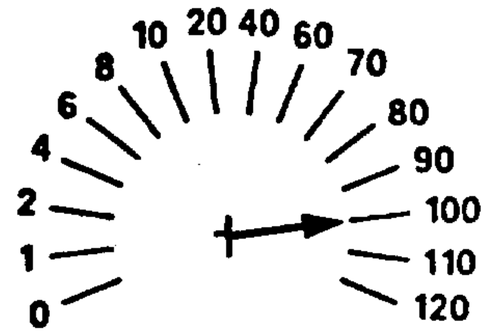
Block delete (switch no. 41)

Dry run (switch no. 42)



Spindle speed override switch (no. 32) 100%

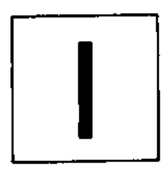
Feed rate override switch (no. 33) 100%



Rapid traverse override action (no. 43)

In the following, the assumption will be that input and programing were done in metric.
The feed rate displayed on the pages is in mm/min.

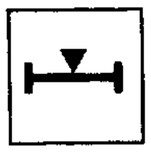
Power ON



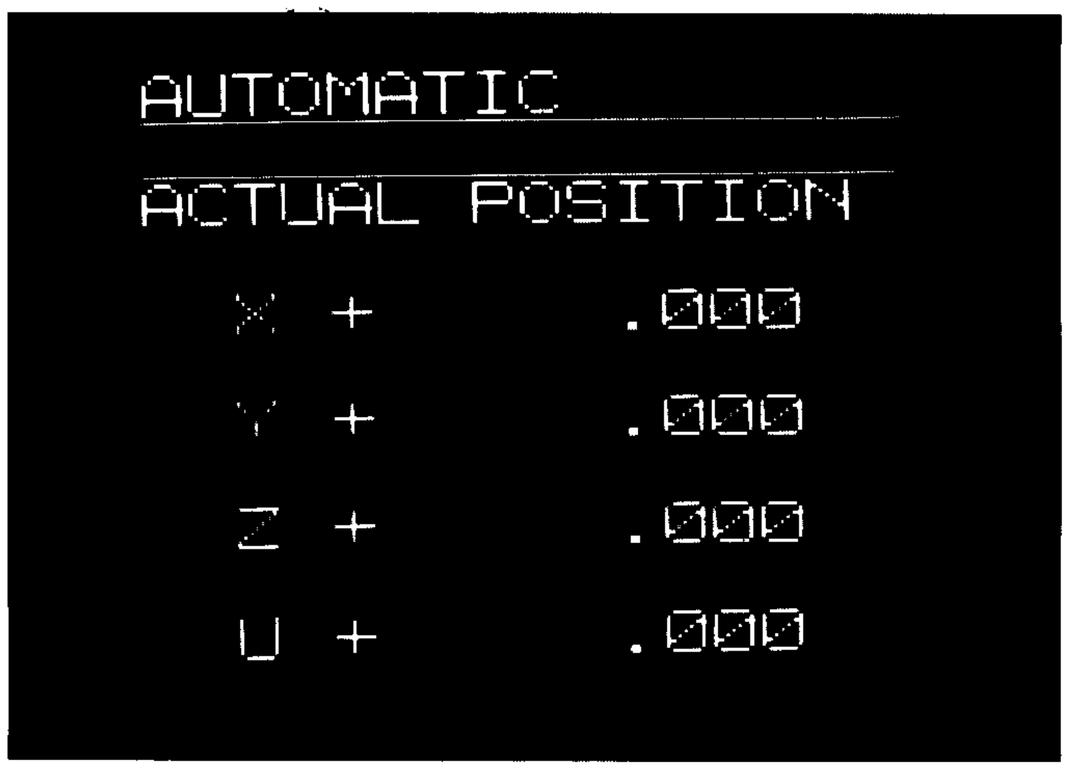
After the control has been powered up (key no. 37), the page will show the basic display of the current operating mode (see the input and display list of section 1.5.)

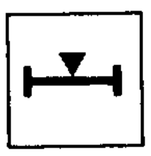
1.8. Actual position display

The position display in large format can be selected in any mode of operation.



Select position display (key no. 18)



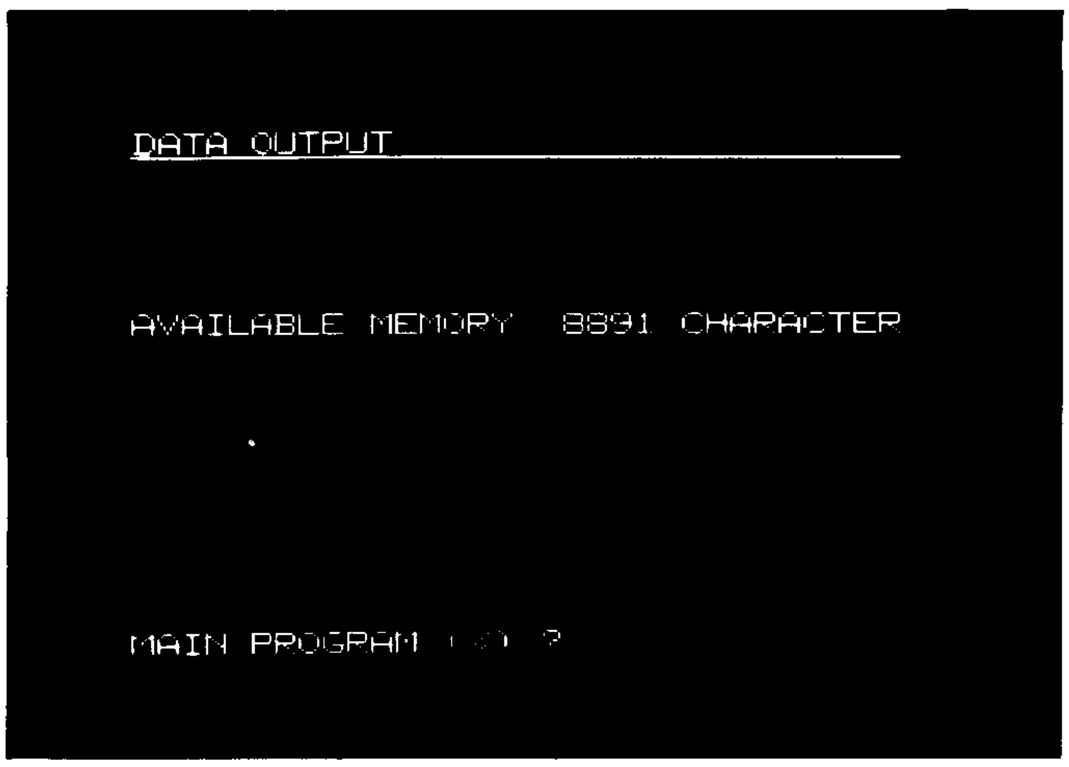


Deactivate (key no. 18)

After the position display in large format has been deactivated, the page returns to the basic display of the current operating mode.

2. DATA OUTPUT (DO)

After the operating mode has been selected, the following page is displayed:



Line 3: Statement of data to be output

Line 6: Available part program memory
(Tape characters = ASC II characters)

Line 15: Operator dialogue for selection of output data

The following can serve as output data:

Main Program	%
Subroutines	L
Tool offsets	TO
Machine data	TE

Operating sequence

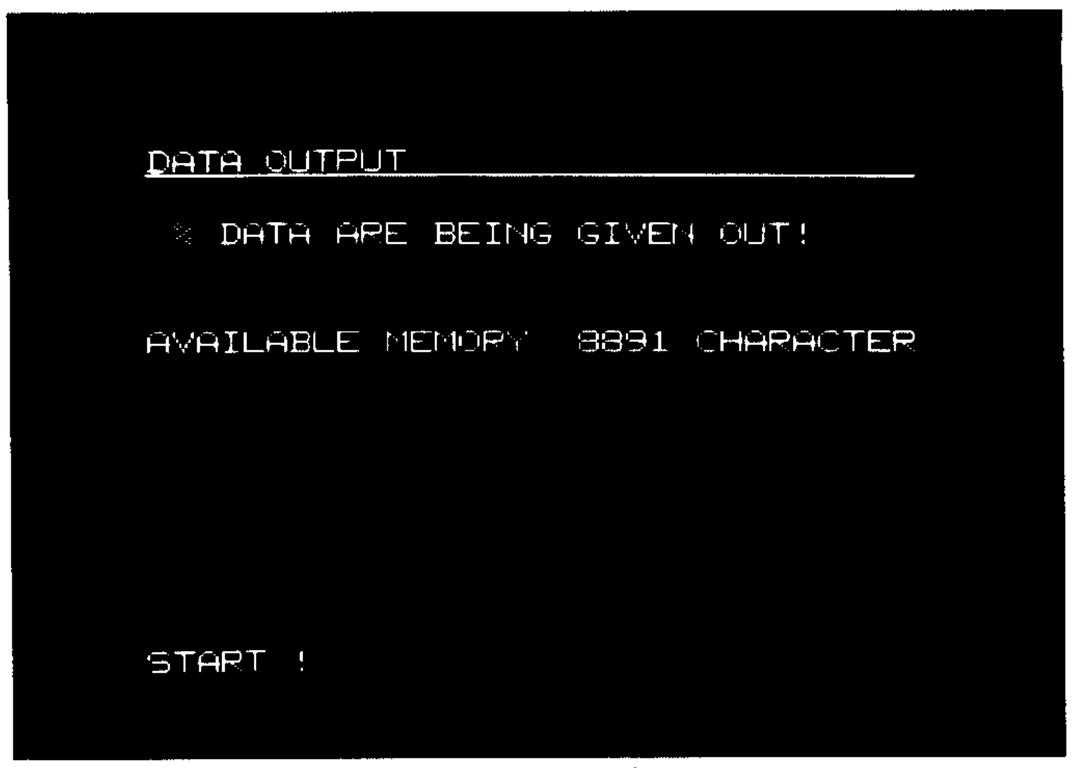
Operating mode data output (mode selector switch 31)

NO

Switching forward to select the mode shown in the 15th. line (key 27) in the sequence %, L, T0, TE

YES

By pressing this button (no. 26) the data in the 3rd line are selected for output.



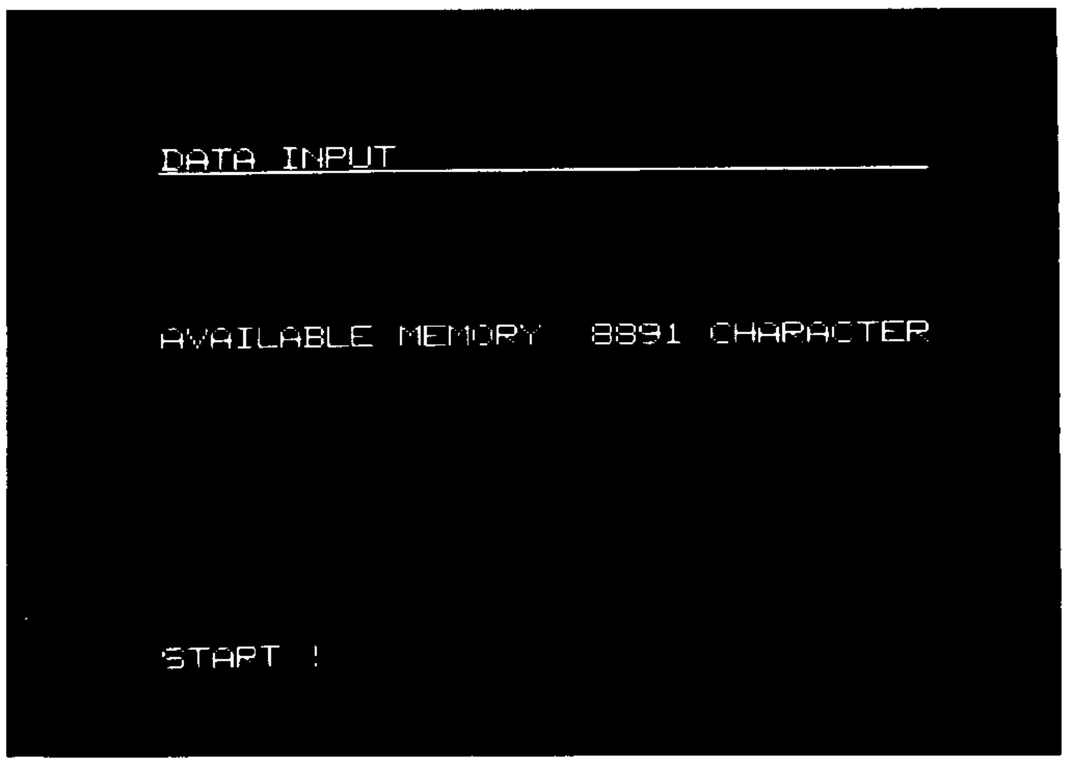
Start data output (button 28)
During data output the text CONTROL IN ACT/ON is displayed in line 15.

Only one type of data output is possible per operation.
The output code (ISO or EIA) is predetermined by user data.

Approx. 0.3 m of tape with transport holes is produced automatically at the beginning and end of the program.
If longer transport tape is required this must be manually executed on the punch.

3. DATA INPUT (DI)

The following page is displayed:



Line 3: Statement of the data type read-in

Line 6: Still available part program memory
(Tape characters = ASC II characters)

Line 15: Operator dialogue for initiating the data input

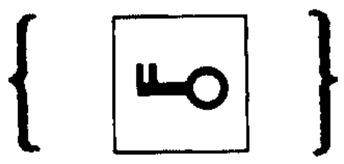
The following types of data can serve as input:

Main programs	%
Subroutines	L
Tool offsets	TO
Machine data (switch interlocked)	TE

The data type is recognized automatically during reading.

Operating sequence

Operating mode data input (mode selector switch 31)



Key switch (no. 38) enabled
{} (dependent on machine parameter)

Start data input (button 28)
During data input the text CONTROL IN ACTION is displayed in line 15 and disappears on completion of data transfer.
Alarm 238 (in case of uncontrolled data transfer) appears, if no data comes from the reader within 20 s.

The read-in procedure continues until the finish criteria of M02 or M30 is recognized.

3.1. Data input check

The inputted data are checked for simple errors.

- Character parity

  For ISO every character must have an even number of bits (logic "1"). EIA must have an odd number of bits. (On tape this corresponds to the number of holes per character.)

- Block parity

  The number of characters in a block including (LF) must be even. Block parity checking can be activated via user data.

- Double read-in

  If a part program is read-in twice, it will be compared with the stored program.

  If an error is recognized, read-in will stop and an alarm is displayed.

3.2. Interface section and equipment

The following type of interface is provided for data transfer:

Full duplex { 20 mA line current
RS 232C; V.24 to DIN 66020

The interface data input and output can be separately modified using machine parameters.

Inputs/outputs are only possible to and from the internal memory.

The following devices can be connected:

Reader, punch devices, combined reader/punch devices, e.g. Siemens printer PT 80.

4. AUTOMATIC USING MANUAL DATA INPUT MDA

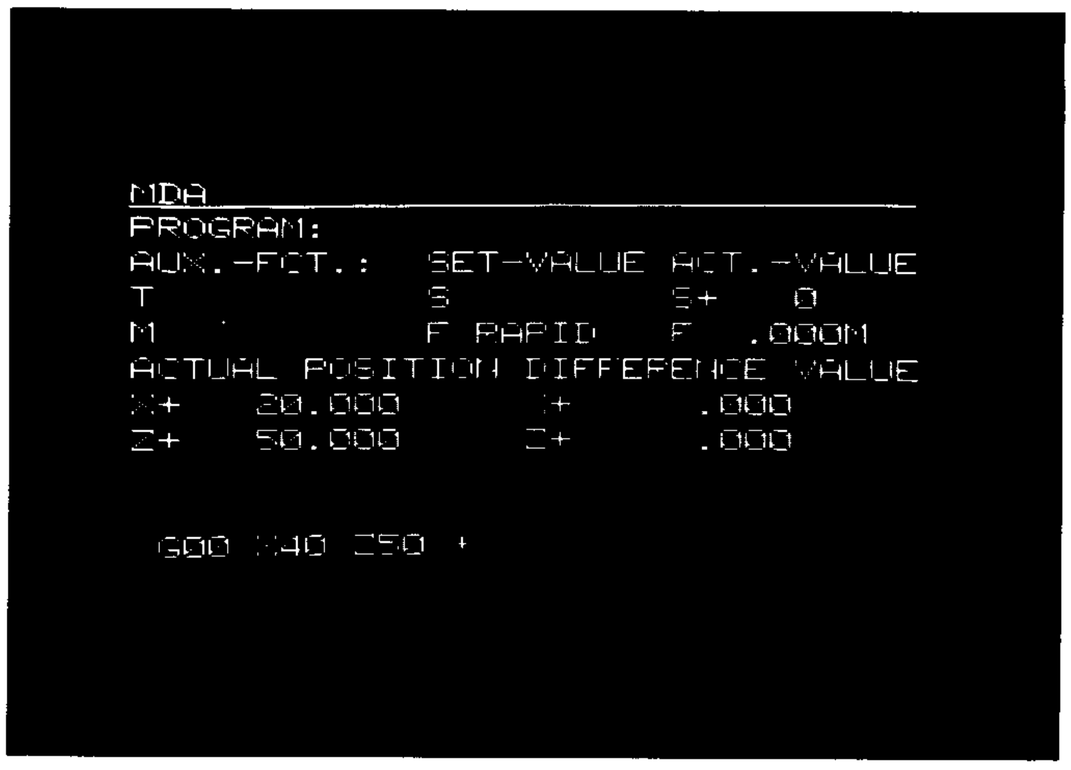
Three operating methods are possible in this mode:

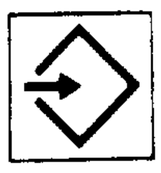
- manual data input
- teach-in
- playback

4.1. Manual data input

Direct input and execution are possible manually.

Operating mode MDA (mode selector switch 31)





Block input word for word including LF using the normal data input rules.
The block entered is shown on the display.

The block is executed by pressing the Cycle Start button (no. 44). It remains displayed.

The executed block can be cancelled using the Cancel button (no. 14).

The next block can now be entered.

A FRK may be programmed but not a contour section.

Program input can be continued manually.

If the mode selector switch (no. 31) is turned from MDA to AUT or vice versa, reset occurs automatically.

4.1.1. MDI stop

If an error is found in a block being processed, this block can be stopped.

Reset (no. 12)

All remaining programmed paths are cancelled.

4.1.2. MDI edit

Cancelling the input line using Clear (no. 29)

The block entered (but not executed) can be completely cleared using Cancel (no. 14). New data input via input line.

4.1.3. Interruption of MDI

MDA can be interrupted by means of the operating modes JOG, INC or MDI-PP. This corresponds to "Automatic interrupted".

The bottom line displays:

Upon return to MDI, paths traversed with JOG or INC are taken into consideration.

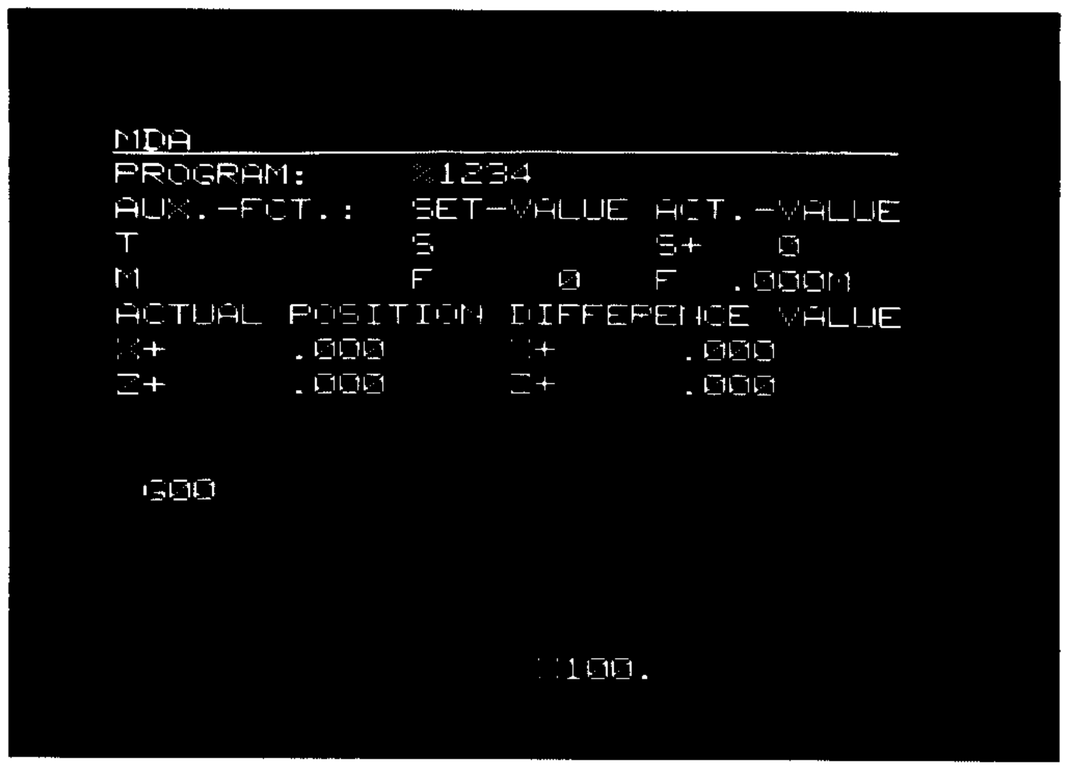
In case of an interrupted MDI block the paths traversed with JOG or INC are calculated and the programmed end point is being approached.

Upon continuation of MDI, the next traversing block is being referred to the last MDI block.

4.2. "TEACH-IN"

Blocks executed as described in 4.1. in MDI can be transferred consecutively into the program memory.

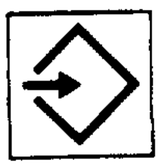
Operating mode MDA (selector switch 31)



At the start of the program, a program number is defined using the Input button (no. 16).

The Cycle Start button (no. 44) then decodes the program number for the part program memory.

To start the program press the Start button (no. 28).



Block input word for word including LF using the normal data input rules. The block entered is shown on the display.

The block is executed by pressing the Cycle Start button (no. 44). It remains displayed.
If Playback (see 4.3.) has been selected, the Cycle Start button (no. 44) must be pressed twice.

Using the Start button (no. 28), the executed block can be transferred to the part program store.
Following transfer the block disappears from the display. The next block can now be entered.

If the program is only in absolute data (G90), an incorrectly processed block can be omitted (no transfer using Start button) and only the next block with the correct final position is transferred.

Stored blocks can be edited in the MDI-PP mode (see chapter 7). In each case, only the last program entered is associated with the MDI-auto mode. After interruption by switching modes, the program can be continued in MDA. If, however, reset has occured (e.g. data input), all modal functions must be reentered in the first block of the continued program.

4.2.1. Interruption of "TEACH IN"

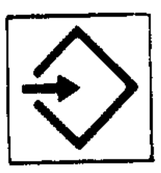
(see also 4.1.3.)

4.3. "Playback"

In the setting-up mode, the position moves are stored in the program memory as command values. Any missing feedrates, switching and auxiliary functions can be added using program edit.

Start program in teach-in

Mode selector sitch on MDA
(Selector switch 31)

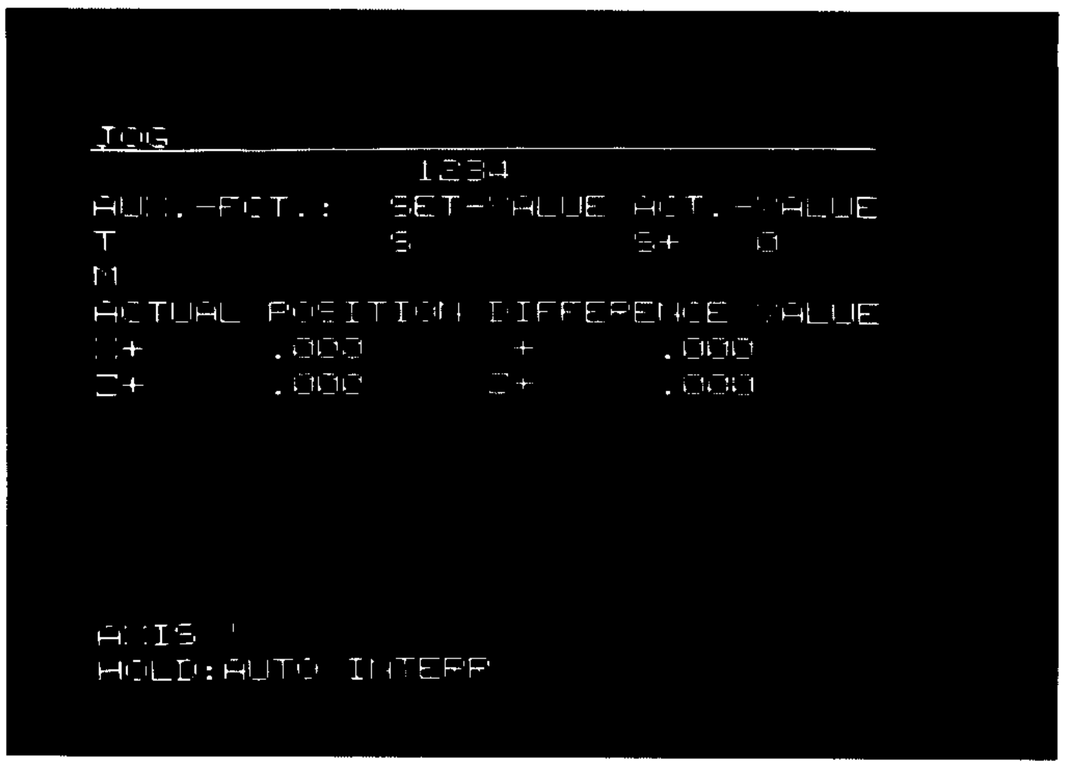


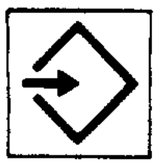
e.g. % 1234 LF input button (no. 16)

Press Cycle Start button (no. 44) and Start button (no. 28) to begin a program.

Select setting-up mode JOG or INC using selector switch (no. 31).

The following display appears:





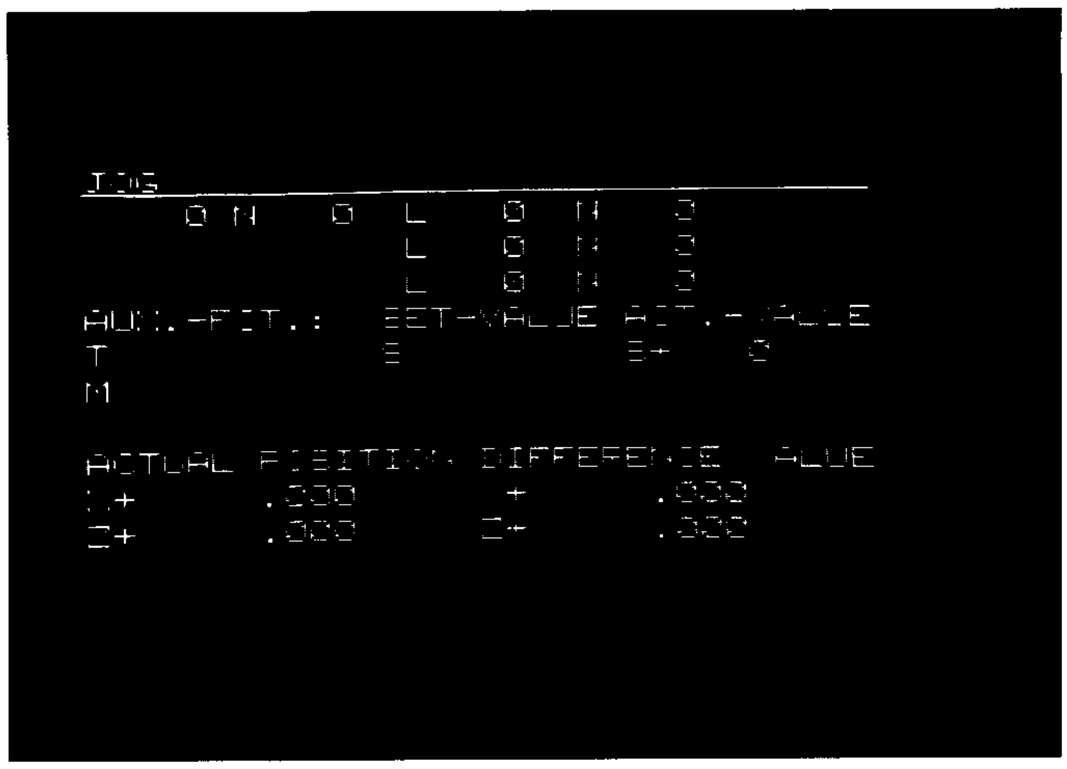
Coordinates reached in the jog mode are stored as program blocks (linear interpolation) by reading in the appropriate axis addresses, e.g. X, and pressing the Input (no. 16) and Start (no. 28) buttons.

G01 must be active from a program block already entered in MDA-teach-in.

5. HANDWHEEL JOG

Operating mode JOG (selector switch 31)

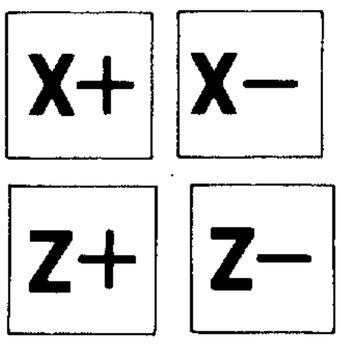
The following display appears:



In this mode, the S, M and T functions can be overwritten in memory (see Chapter 9).

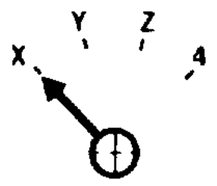
5.1. Jog feed and rapid

For 3T

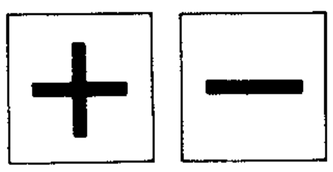


Direction pushbuttons (no. 34)

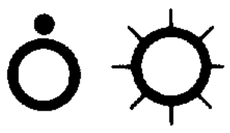
For 3M



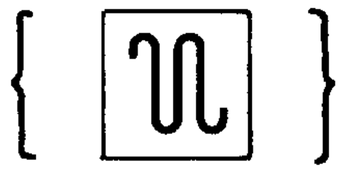
Axis selection switch (e.g. X) (no. 47)



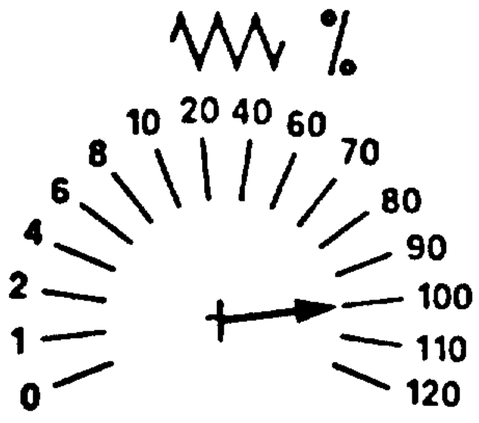
Direction pushbuttons (no. 34)



Feedhold (no. 2) should not be active

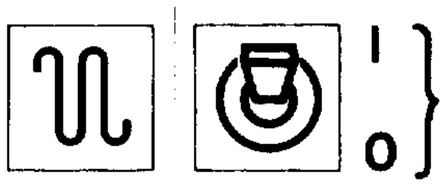


In order to rapid traverse, the force rapid traverse pushbutton can be pressed (no. 35).



The traversing speed can be overriden with the feed-rate override switch (no. 33)

For 3T

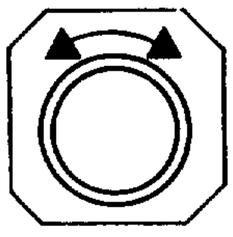
{  } If traversing at rapid traverse with the toggle switch (no. 43) in the rapid traverse override position, the rapid traverse override (no. 33) is active in the range from 0 to 100%.

Regardless of the position of this switch, the position 0% on the feedrate override switch results in stop for feedrate or rapid.

5.2. Operation from handwheel

The handwheel moves the axes in the same manner as JOG.

Handwheel movement is selected in the JOG mode (selector switch 31) just as for "Feed and Rapid JOG".

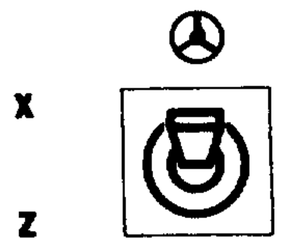


Only one handwheel can be connected.

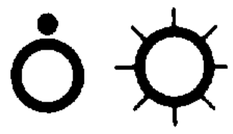
For 3M

Handwheel assigned to axis using selector switch (no. 47).

For T3



Handwheel assigned to axis using toggle switch (no. 46).



Feed hold (no. 2) must not be active.

When a handwheel is fitted both this and the direction buttons can be used for jog operation. If the handwheel and direction buttons are used simultaneously, the buttons take precedence.

Using setting data (see appendix), the handwheel can be used for 1 , 10 , or 100 per space division.

The weighting is established through the "bit-oriented user data" (see appendix).

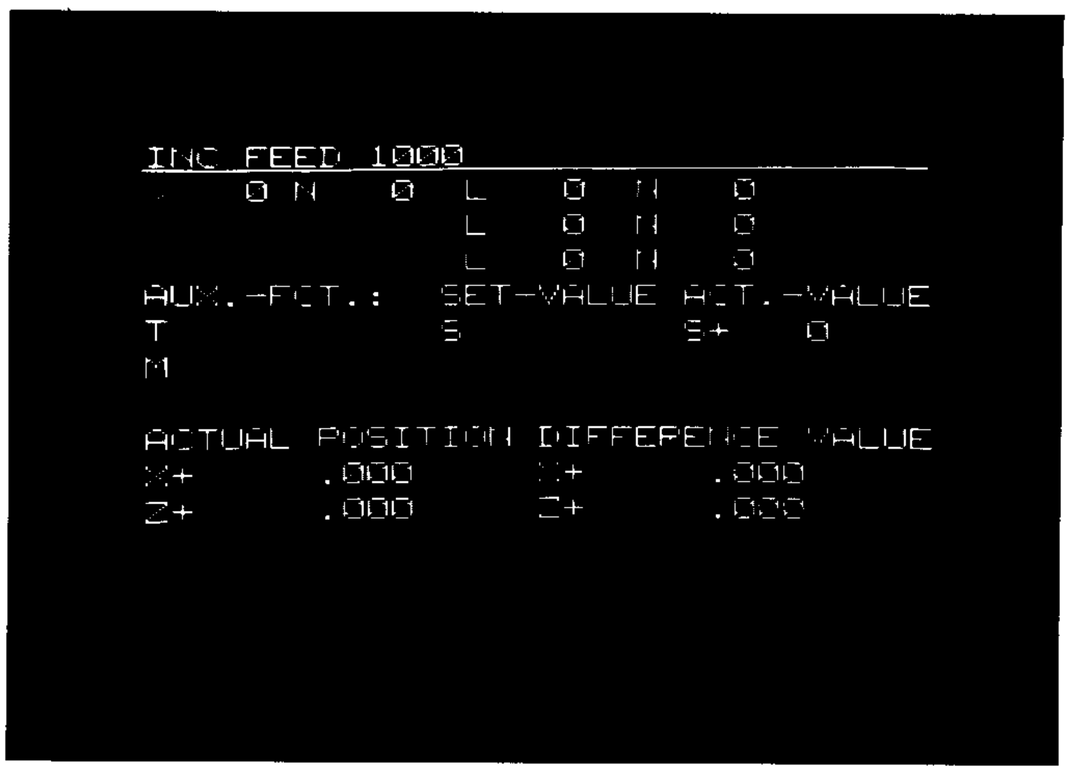
Mixed operation, i.e. 1 axis assigned to the handwheel and 1 axis to the direction buttons, is not possible.

6. INCREMENTAL MODE INC

Incremental jog mode can be used to move off the contour or to set up when a handwheel is not fitted.
A manual parallel-axis movement is possible.

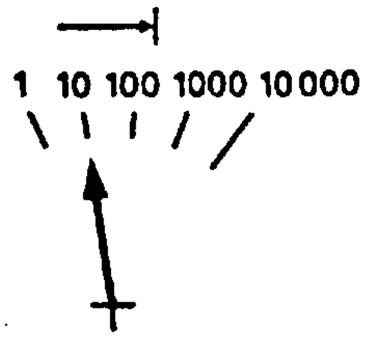
Feedrate F is defined by a machine parameter and dependent on the rapid override switch (no. 33).

→| INC mode (selector switch 31)



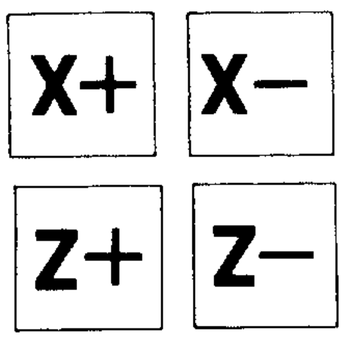
In this operating mode M, S and T functions can be overwritten in memory (see Chapter 9).

Operating sequence



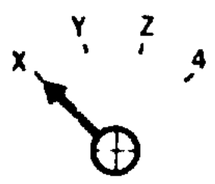
Preselect increment size using mode selector switch (no. 31).

With 3T

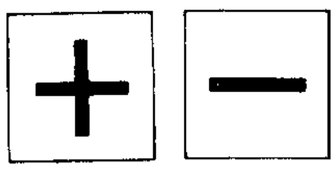


Press the required direction pushbutton (no. 34).

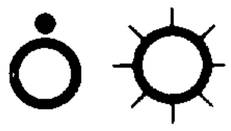
With 3M



Axis selector switch (e.g. X) (no. 47)



Direction pushbuttons (no. 34)



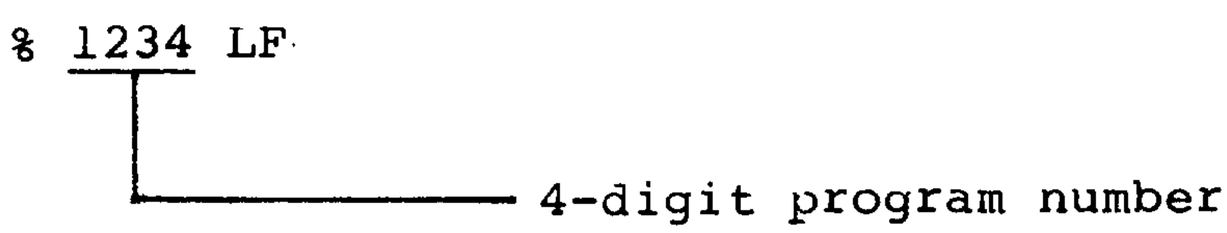
Feed hold (no. 2) must not be active.

The incremental step movements are executed modally.

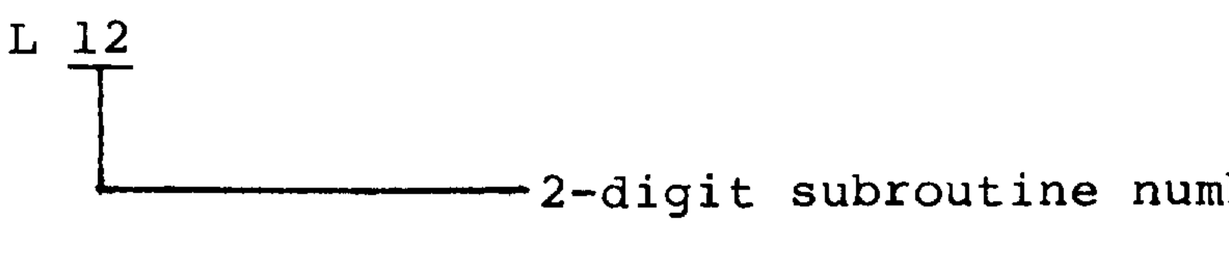
7. MANUAL DATA INPUT, PART PROGRAM MDI-PP

Part programs are only filed in the part program store and processed from there. The NC assigns automatically the memory area for part programs and subroutines (no special operation required). Up to 100 part programs and subroutines can be written into the memory simultaneously.

Part programs can be numbered and are given the following identification:



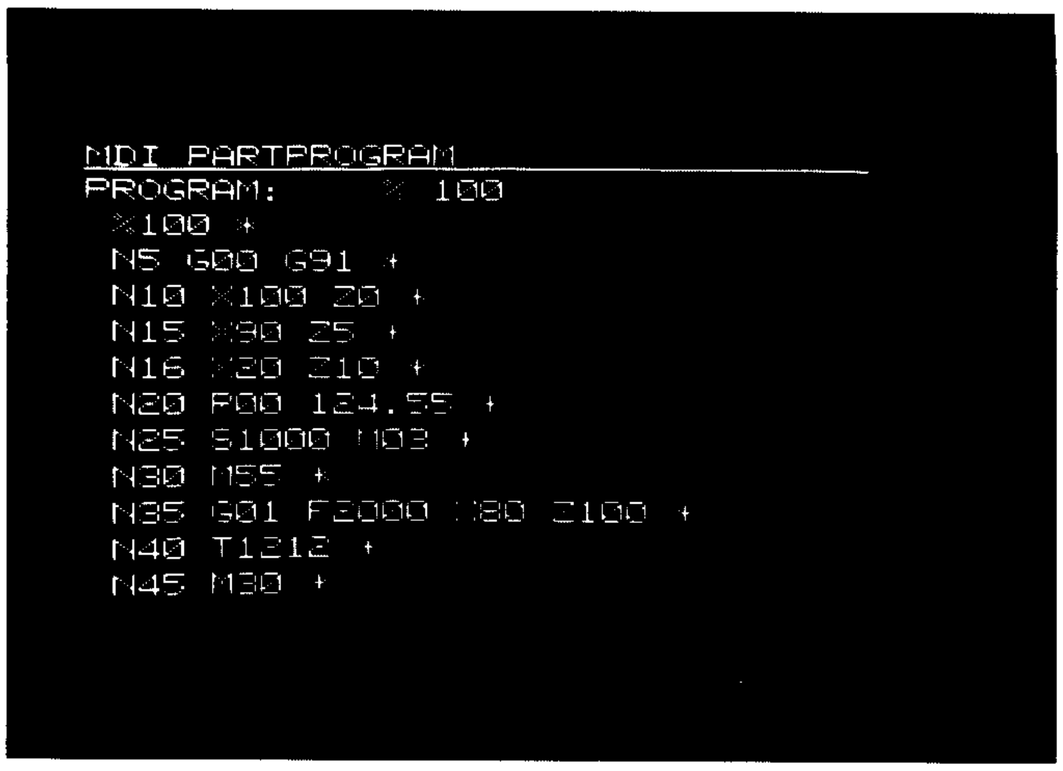
Sub-routines are identified by a 2-digit number:



Any part program without a program number is assigned a 0 by the NC and is neither displayed nor punched out. Only one part program without a program number can be filed in the program store.

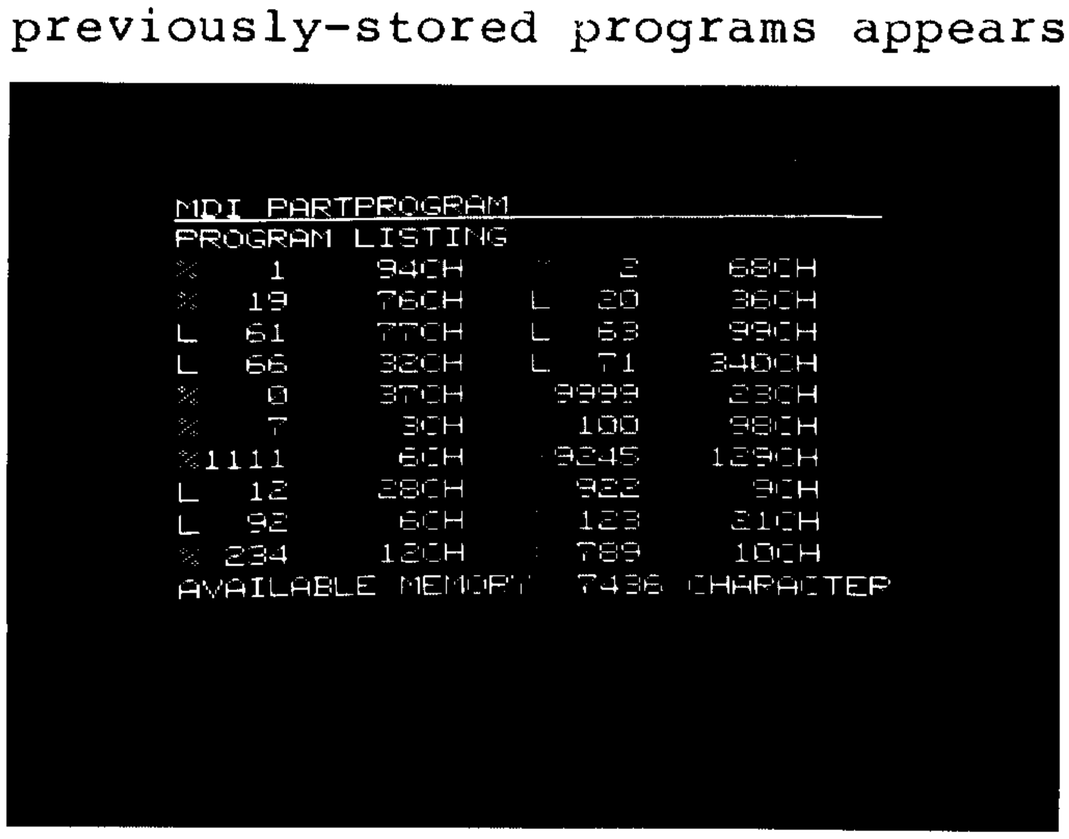
Operating sequence

Mode selector switch to MDI-PARTPROGRAM (no. 31)
The following display appears:



The display shows already stored programs, if there are any (above % 100) (block end character LF = *).

If the mode is switched to the basic display (//) (no. 5) using the button Display Switchover (no. 17), a list of previously-stored programs appears.



Using the buttons no. 22, no. 23, 5 pages can be selected which contain information about:

- unassigned memory space (here 7436)
- available part programs (with associated program length)
- available subroutines (with associated program length)

With this display no input is possible, but the programs can be cleared.

7.1. Program reset

{ }

Key switch enabled (no. 38)
{ } dependent on machine parameter
Switch mode to basic display

% 5

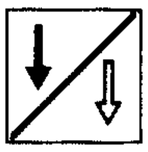
Input the program number and press the "Cancel" push-button (no. 14). The program will be reset. Subroutines are cleared in the same manner (e.g. L5, cancel).

By inputting % and pressing the Cancel button (no. 14), all main programs can be cleared. By inputting L and pressing the Cancel button (no. 14) the subroutines L01-L79 are cleared. The remaining subroutines L80-L99 are cleared individually.

7.2. Program select

Switch mode to part program input (no. 31)

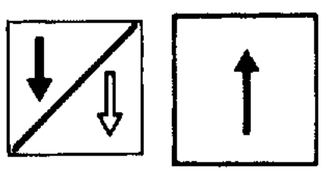
% 50



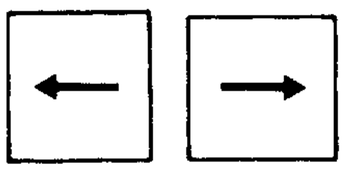
Search for, e.g. program % 50

N15

Search for, e.g. block number N15
Before the required block number is searched for the appropriate program number must be selected.



On pressing a "page" pushbutton, (page forwards or page backwards, nos. 22, 23), the display will change one block at a time.



The "Cursor" pushbutton (no. 24, 25) will shift the cursor one program word.

7.3. Data input into memory via keyboard

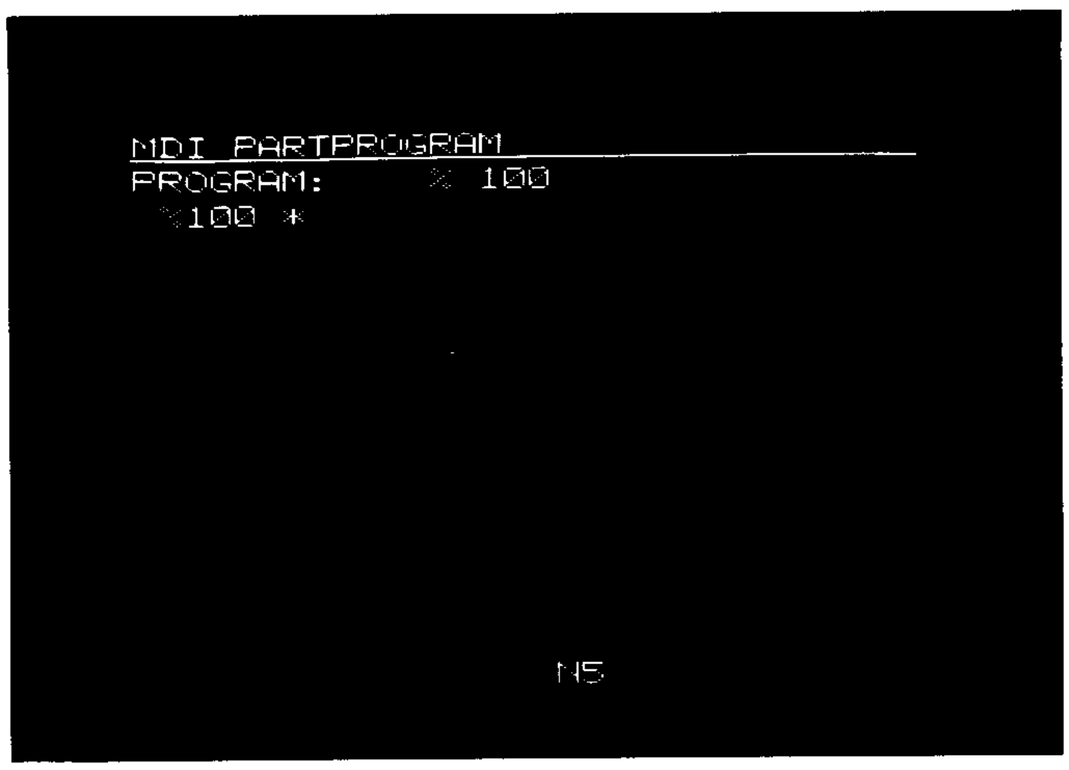
{ F5 }

Key switch enabled (no. 38)
{ } dependent on machine parameter

% 100

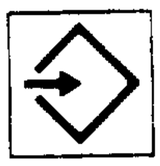
The new input of a program follows the selection of a program number, which is not currently in the memory (in case % 100). If the program % 100 is already stored, it will be displayed. The cursor is located behind the first program number.

When a program is not in store, the first block % 100 LF will automatically be stored and displayed on line 3. The cursor is located behind the LF. The program blocks can now be entered via the operator's keyboard.

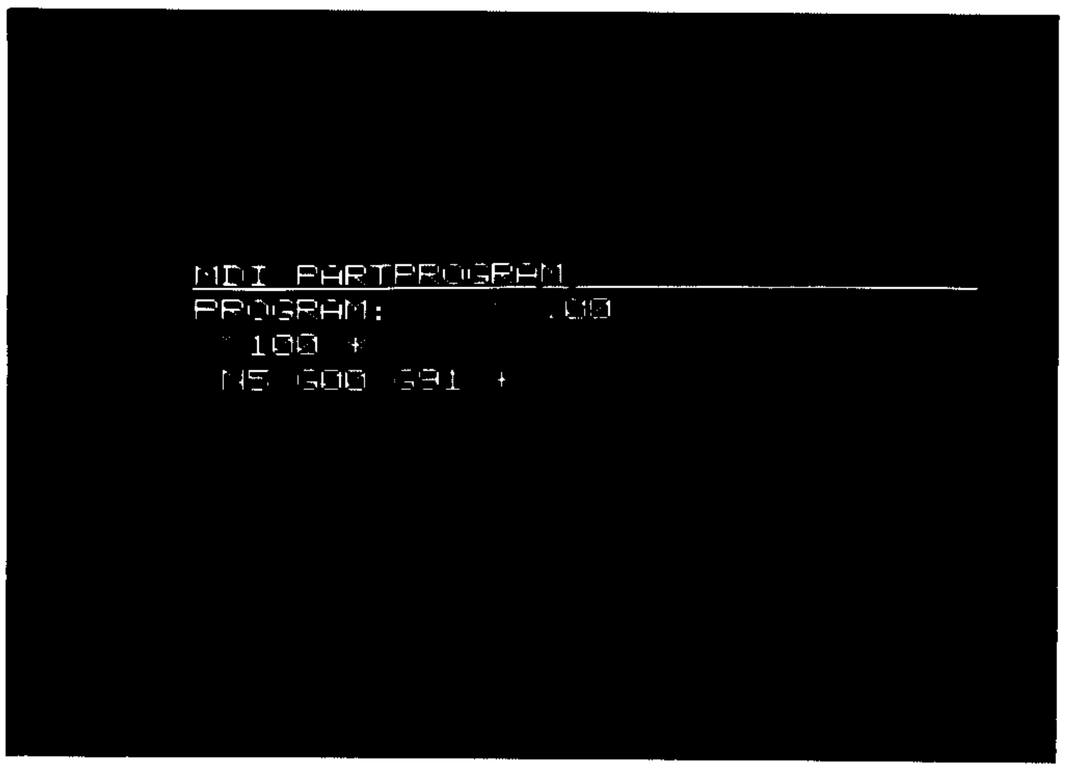


Example:

N5 G00 G91 LF Enter information, each word individually



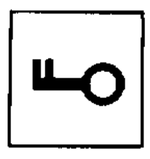
and conclude with the "Input" pushbutton (no. 16)



During the program or correction entries, a check is made of the block length (max. 120 characters) and the amount of free program memory. Incorrect conditions will give an alarm.

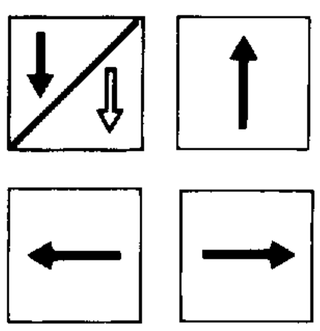
Incorrect conditions will prevent the transfer of data from the data input line.

7.4. Program edit

{  } Key switch enabled (no. 38)
{ } dependent upon machine parameter.

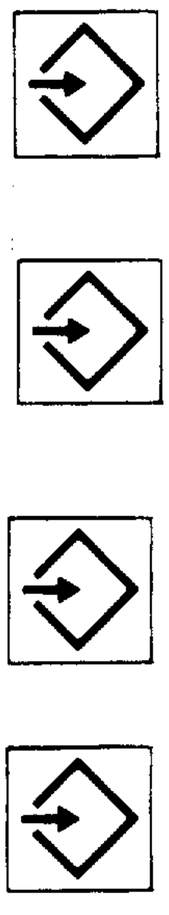
7.4.1. Data insert

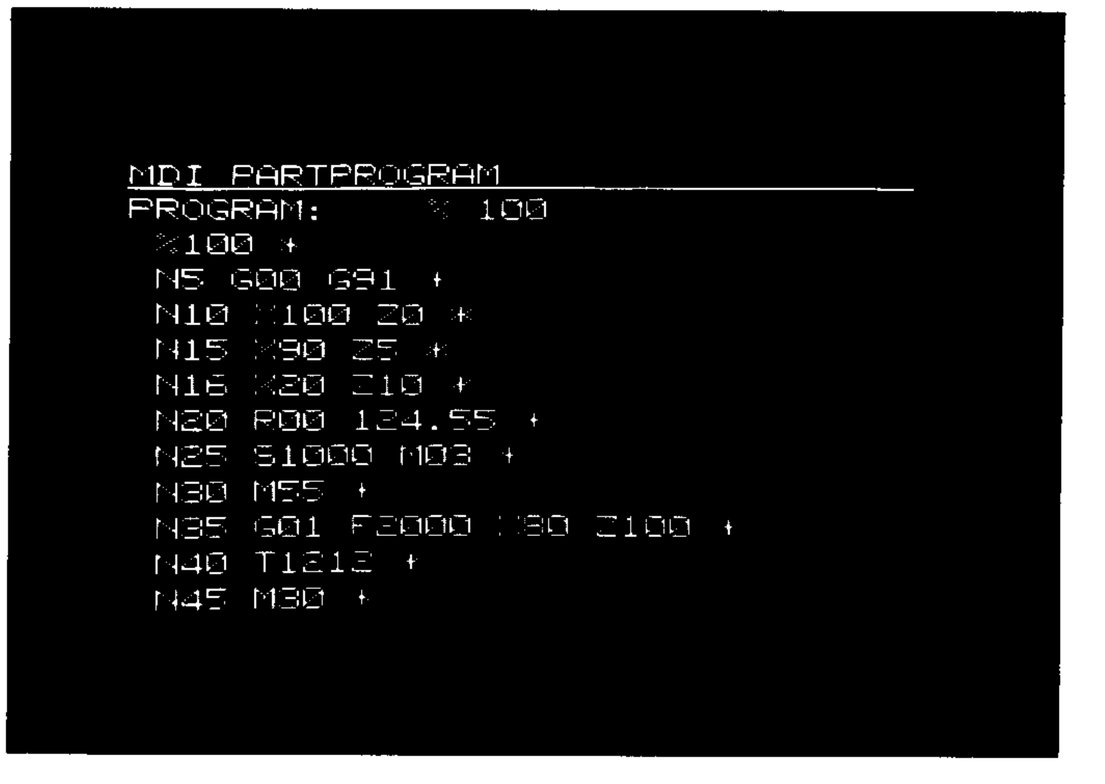
In the previously entered program % 100 the block N16 X20 Z10 LF should be entered.
Select the program as described in section 6.2.



The "Page" and "Cursor" keys are used to bring the cursor in front of the N20 block.

Block N16 is inserted (see Section 7.3.)

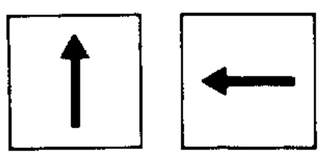




7.4.2. Single word edit

In block N16 the value Z10 should be changed to Z20.

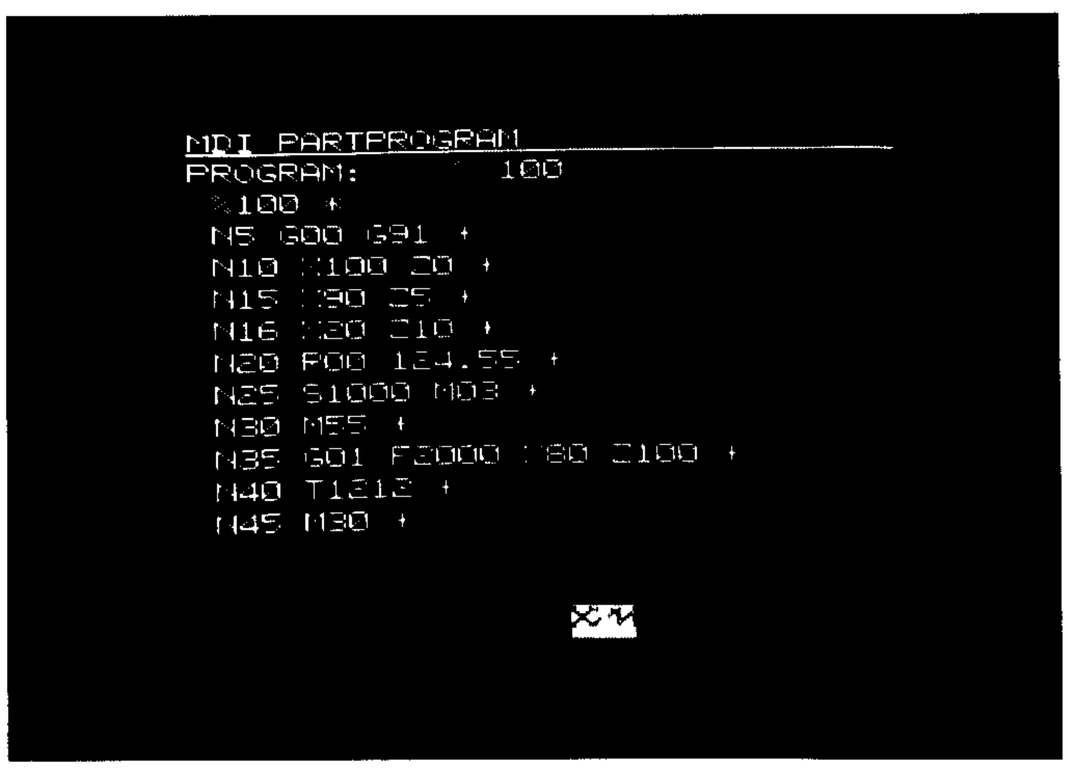
Select the program as described in Section 7.2.



The page and cursor pushbuttons (nos. 22, 23, 24, 25) are operated to bring the cursor in front of the word to be changed. In this example Z10.

X20. An example of an incorrect entry. Enter X20 instead of Z20,

and conclude the input with the "Edit" pushbutton (no. 15).

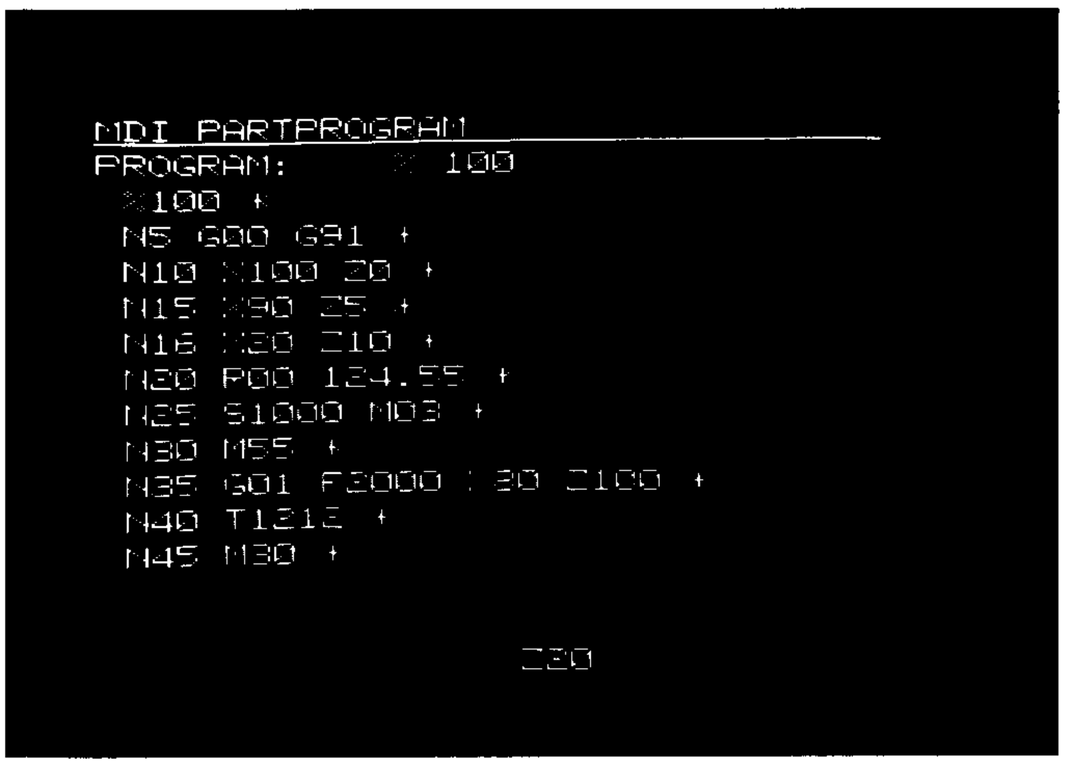


This incorrect entry will be indicated by dots because the entered address does not correspond to the address to be changed.

This information will not be transferred to the memory.

The "Clear" pushbutton (no. 29) clears the incorrect entry.

Z20. Input of the correct value Z20.



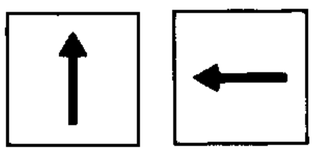
Conclude the input with the "Edit" pushbutton (no. 15).

Single words to be changed can be entered on the input line. Only the numeric value of an address can be changed.

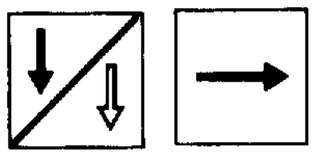
Where the address is to be changed the old word must first be deleted and then the new word entered.

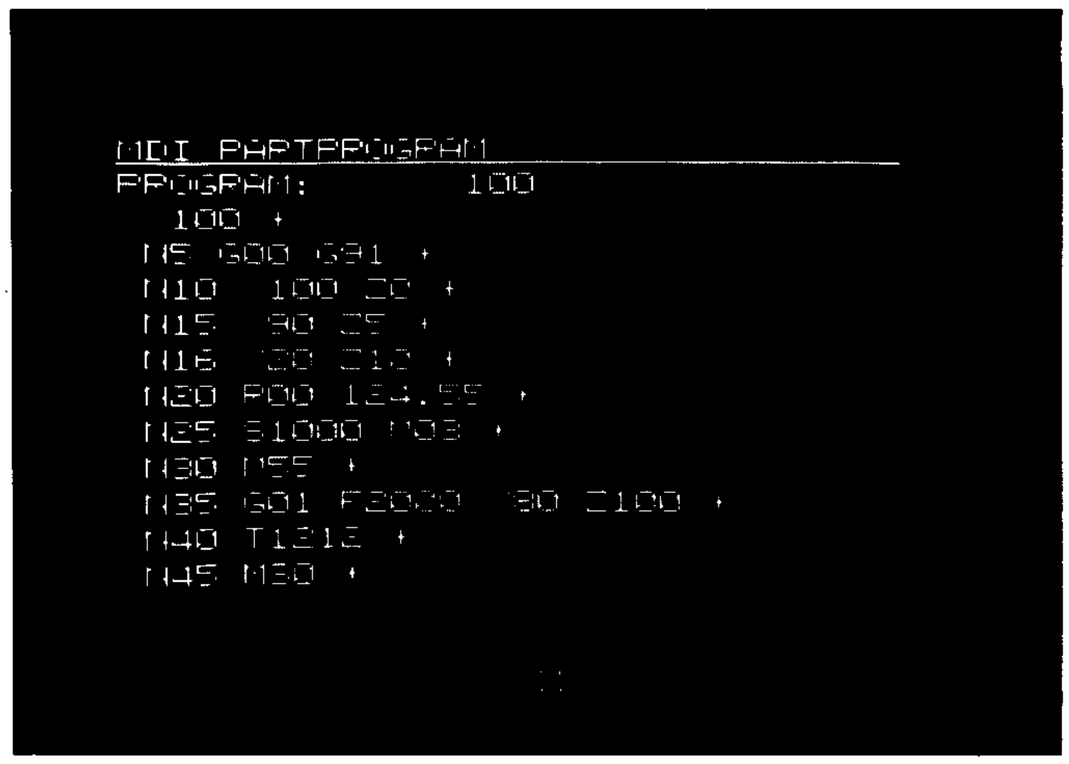
7.4.3. Single word delete

In block N16 the value X20 is to be deleted.
Select the program as described in Section 7.2.



With the page and cursor pushbuttons (nos. 22, 23, 24, 25) move the cursor in front of X20.





X

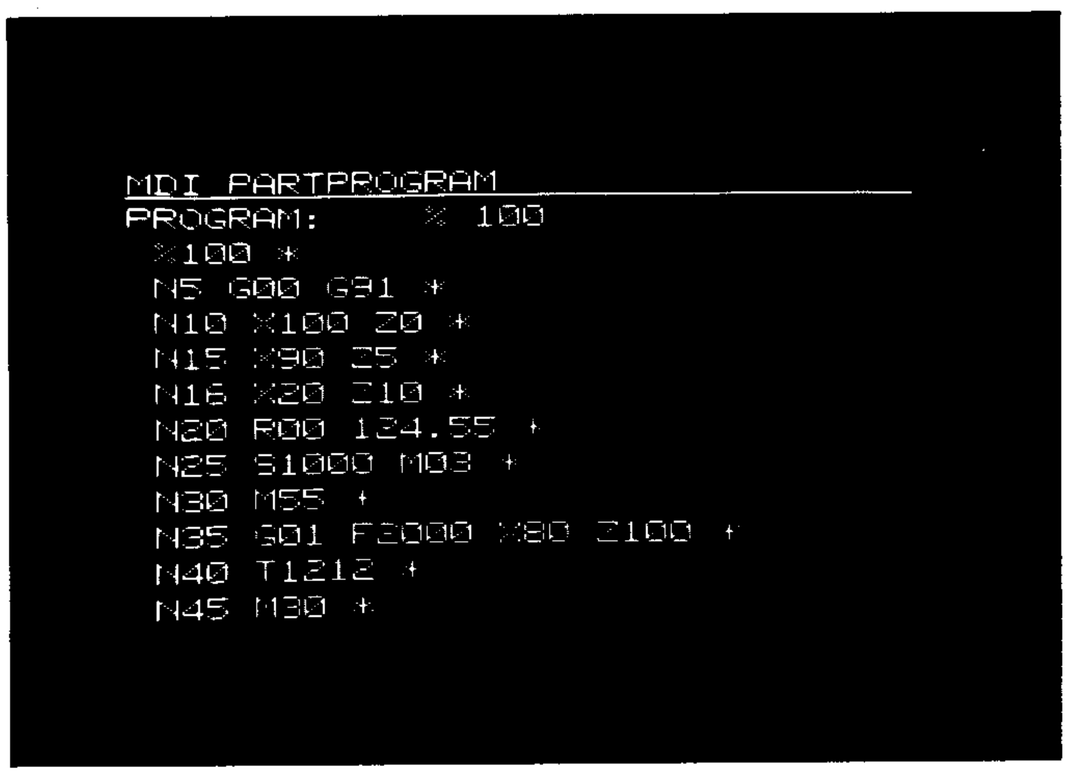
Enter the address X and conclude with the "Cancel" pushbutton (no. 14). The programmed X value is deleted.

LF cannot be deleted. (Only when a complete block is deleted, see Section 7.4.4.)

7.4.4. Block delete

Block N16 should be deleted.

Enter the program, as described in Section 7.2. and select N16.



N16

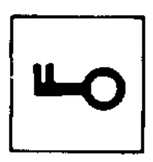
Enter the block number and press the "Cancel" push-button (no. 14). Block N16 will be deleted.

N0

Blocks without block number can be cancelled by inputting N0 and pushing the Cancel key (no. 14).

In the mode MDI-PP when TE, TO or ZO are active, the appropriate display is shown but no input is possible (see Input and Display List 1.5.).

8. Manual input of zero offsets, tool offsets, test data

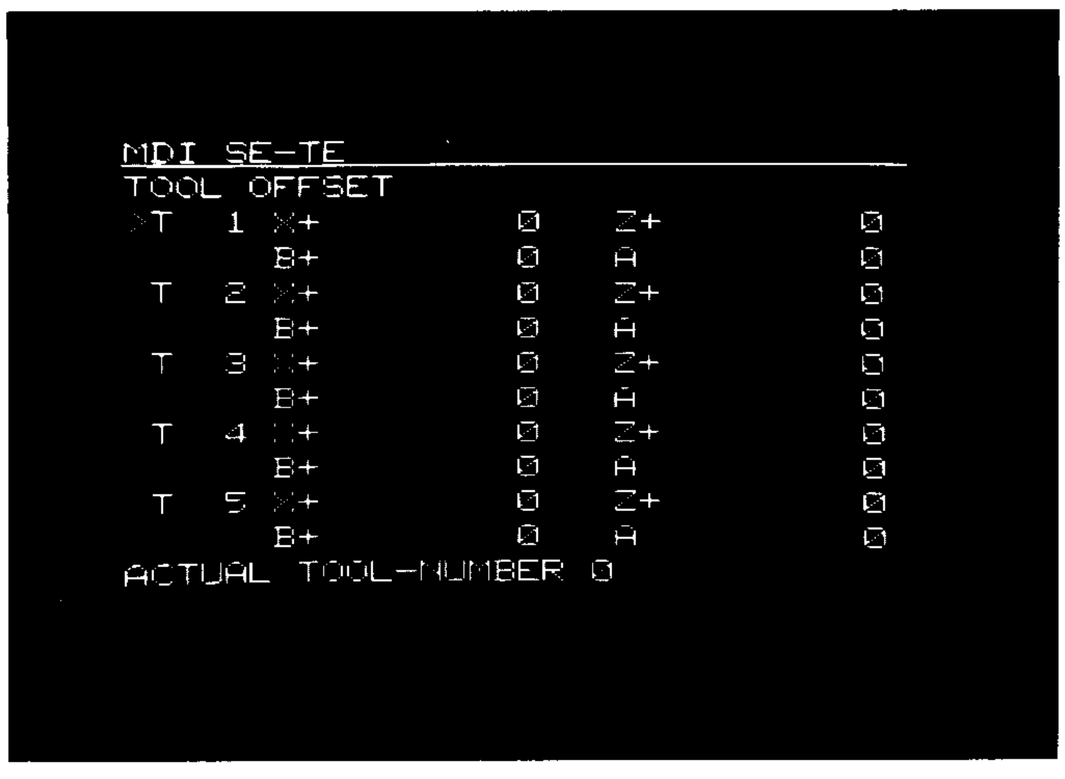
{  } Key switch enabled (no. 38) for input,
{ } dependent on machine parameter.

Operating mode MDI-SE-TE (selector switch 31)

8.1. Tool offsets

8.1.1. Tool offsets 3T

The tool offset mode (no. 6) is selected automatically.

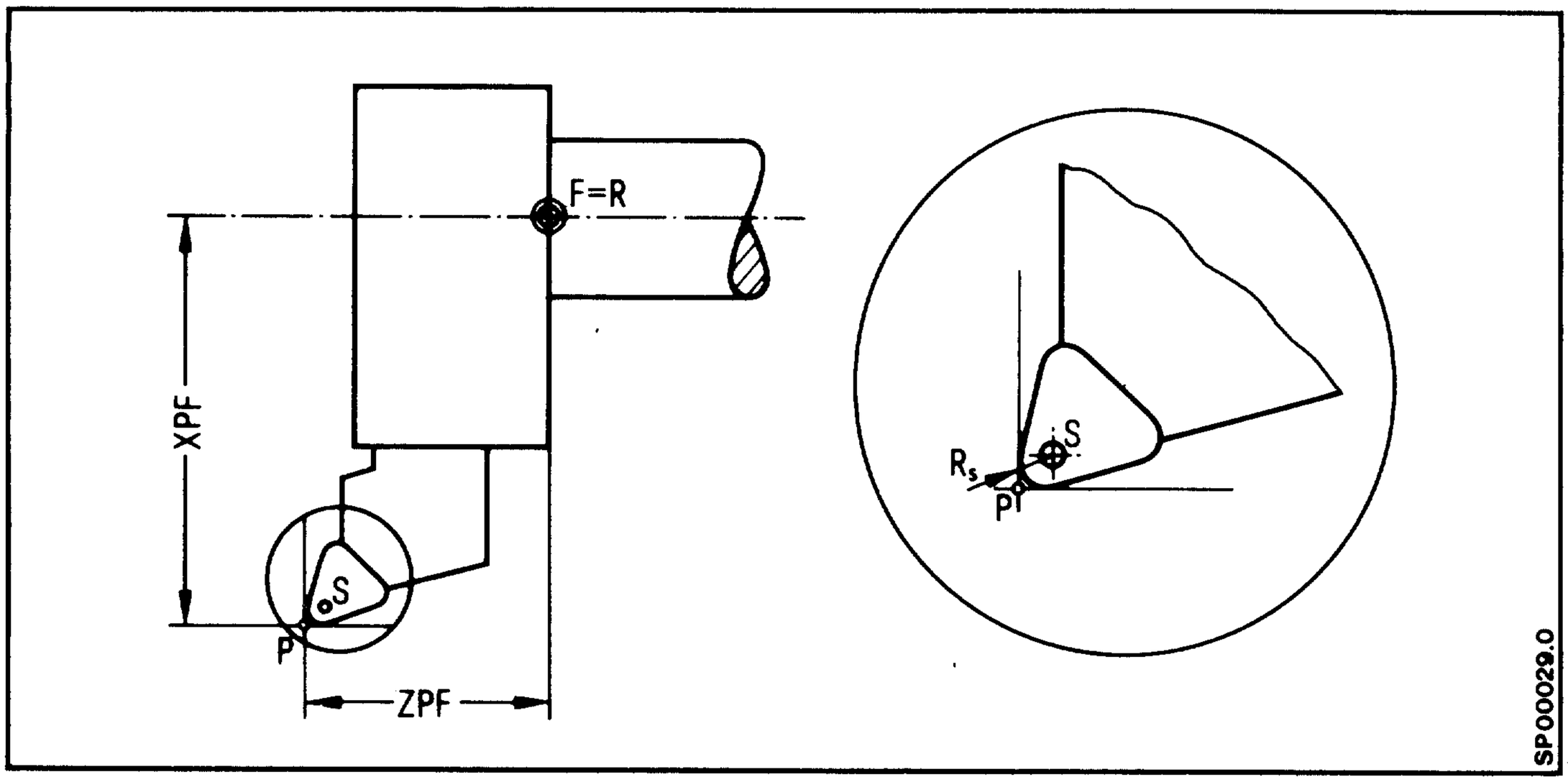


16 tool offsets can be selected with one display per value. For lathes, 4 values are required for an exact definition of the tool offset.

T1-T16 X and Z - tool geometry
B - tool tip radius
A - tool position

The tool offset number of the tool being used is shown in line 13 of the display.

8.1.1.1. Position of tool cutter point



P = Theoretical tip point

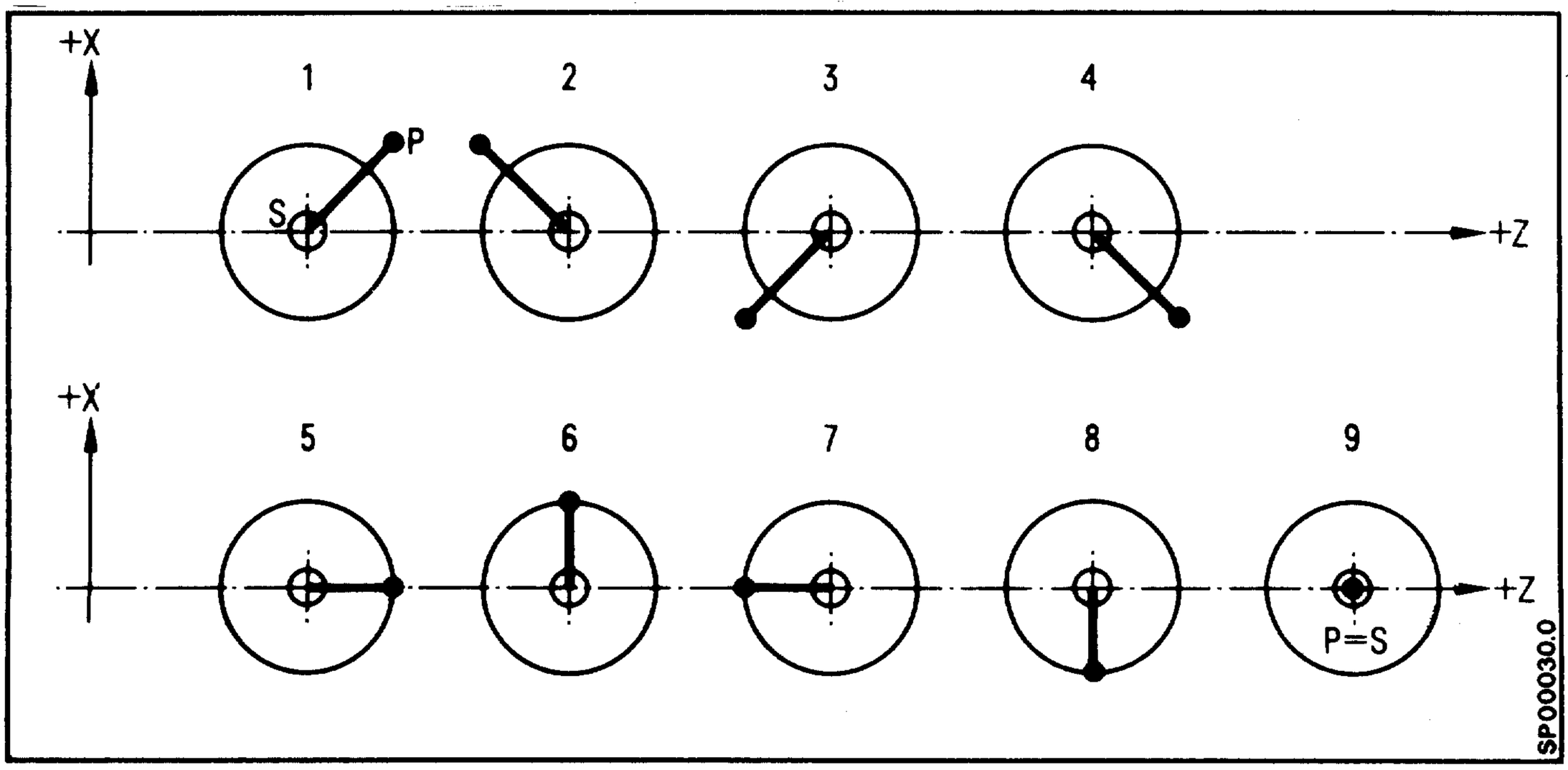
S = Tool tip radius centre point

R_S = Tool tip radius

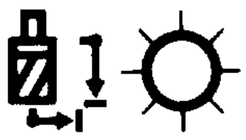
In order to calculate the equidistant points (left or right) the control mode needs a fourth value of tool offset, describing the position of the cutting edge.

There are nine codes in total which define the position of the tool tip "P" with respect to the tool tip radius centre point "S".

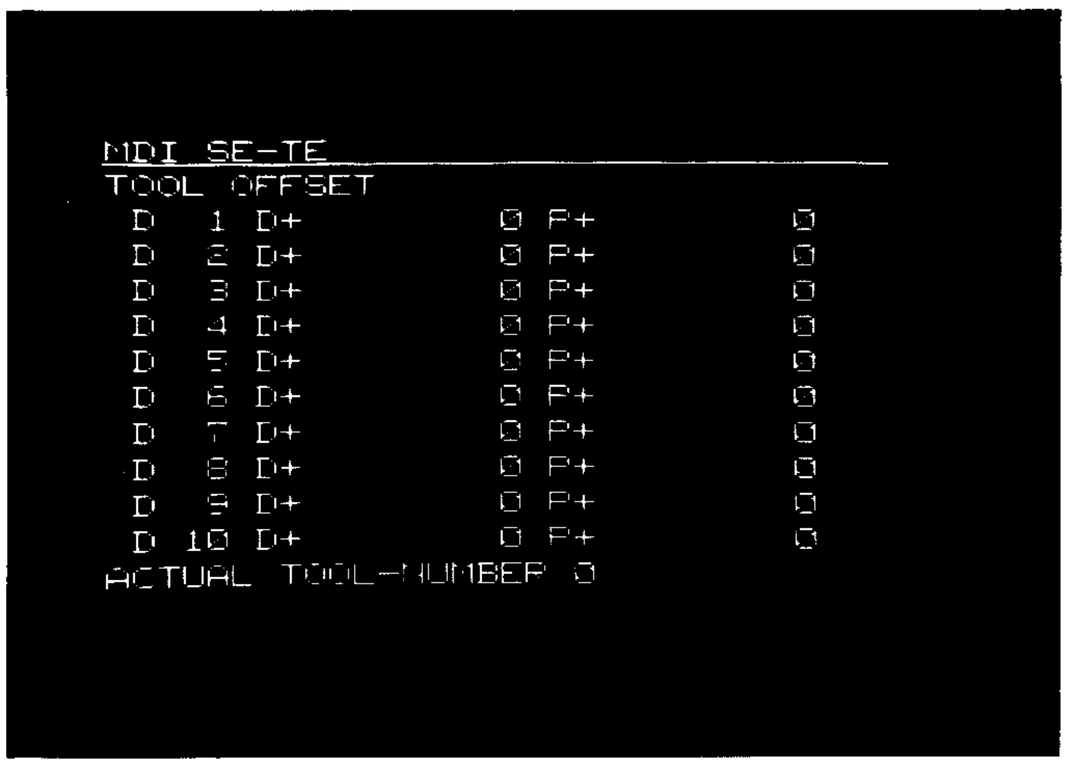
Line of sight is always from S to P.



8.1.2. Tool offsets 3M



Tool offset (no. 6) is selected automatically.

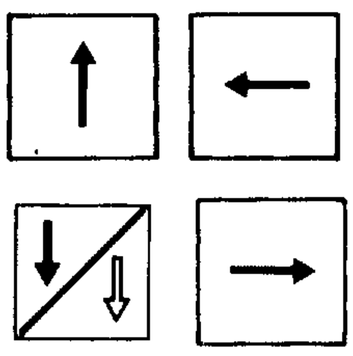


32 offset values can be selected.

D1 - D32: D - length of cutter
P - radius of cutter

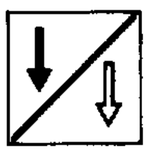
The active tool offset number is displayed in line 13.

8.1.3. Activation of selected offset values



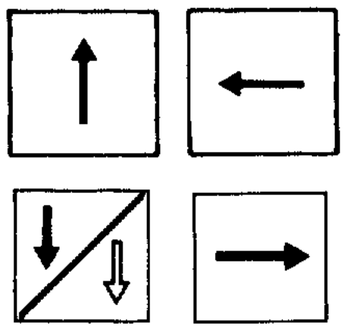
Preselect the required tool offset using the page and cursor buttons (nos. 22, 23, 24, 25).

Return to first offset value



continuous scanning forwards through offset value displays.

8.1.4. Input/edit offset values

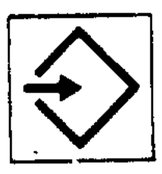


Select the required tool offset number.

Address pushbuttons (no. 11) for 3T

Address pushbuttons (no. 11) for 3M

Numbers (desired value)



"Input" pushbutton (no. 16). Store value (active as absolute).

8.1.5. Tool wear edit

Edit button (no. 15) (active as additive)
Serves to input tool wear in the range:
± 0.999 mm
± 0.0999 inch

The input range is checked during data entry. Input interlock using the key switch (no. 38) is dependent on an additional machine parameter.

Tool wear edit is also possible in the AUT (automatic) mode (even when the program is active).

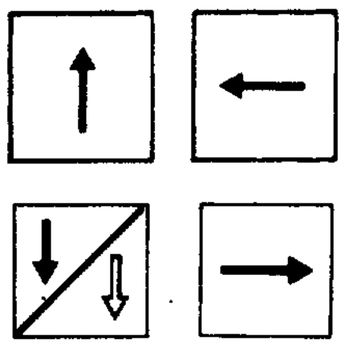
8.1.6. Reset offset value

D - for 3M

T - for 3T

Reset of all tool offsets

8.1.6.1. Reset selected offset value



Preselect required tool offset number

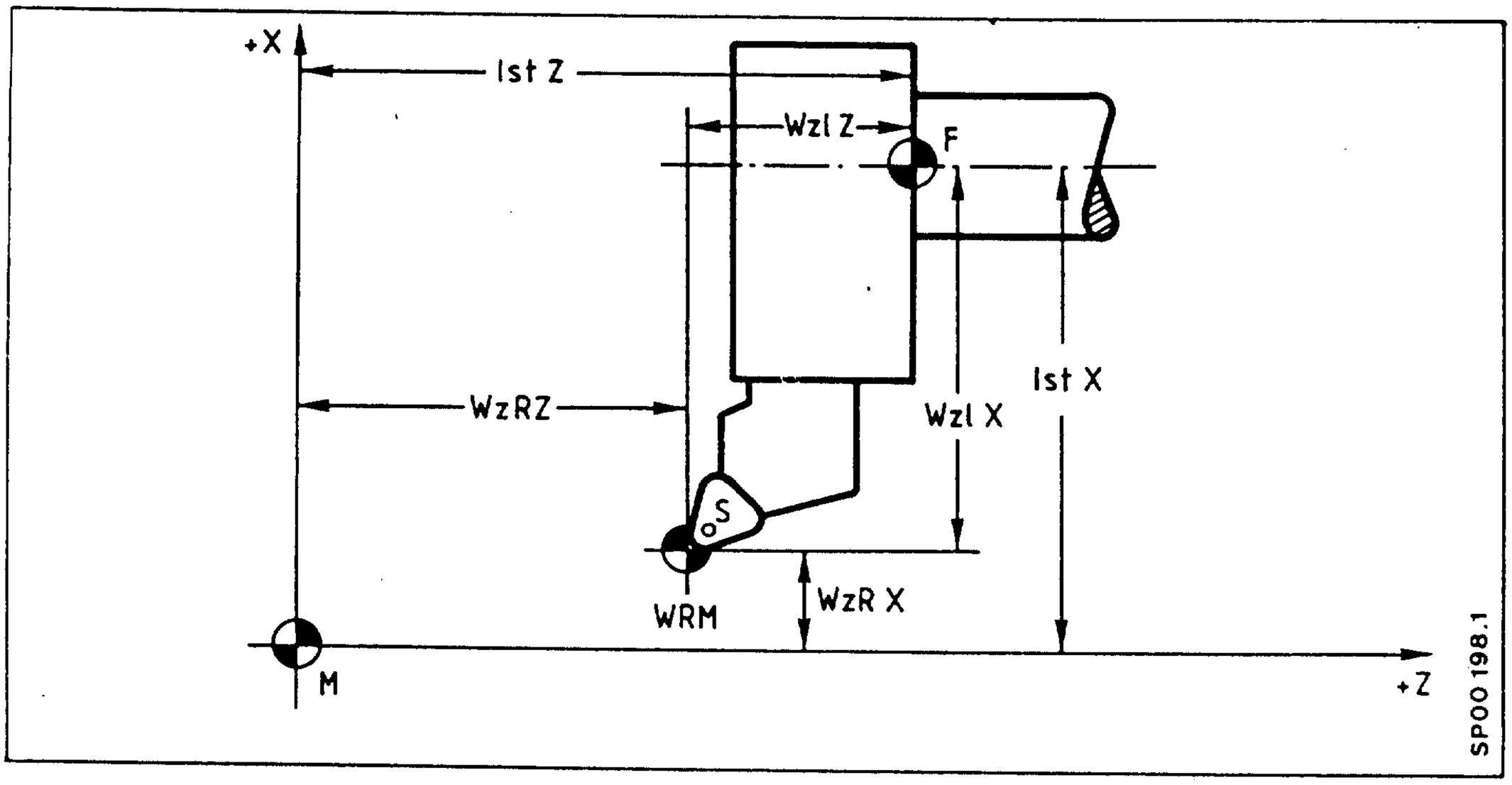
X Z B A Address buttons (no. 11) for 3T

D P Address buttons (no. 11) for 3M

Cancel button (no. 14)
The value selected by the address button is cancelled.

8.1.7. Automatic calculation of tool geometry data with 3T

Operating sequence with operator dialogue



Ist X, Ist Z = actual coordinate of each axis

M = machine zero point

F = slideways reference point

WRM = reference point of measuring device (machine parameter)

Operating mode return to datum
(selector switch 31); see Chapter 10

Actual data stores are set to reference value.

Operating mode JOG (selector switch 31)

Traverse to tool reference plane (WZR) with the tool tip (setting up), e.g. using an optical system.

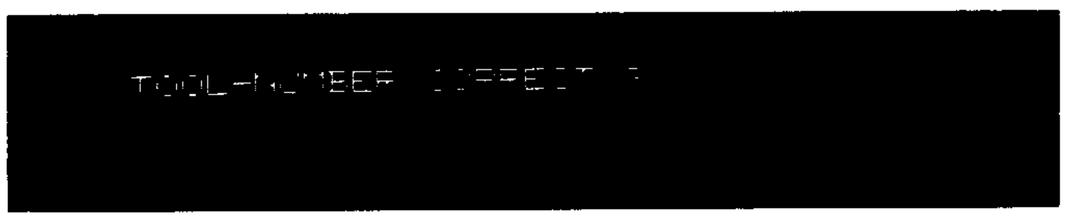
and/or

Operating mode INC (selector switch 31)

Traverse to tool reference point (WZR) with the tool tip (setting up).

Select tool offset mode (no. 6) and switch display with Display button (no. 17).

The following text appears in the 15th line:



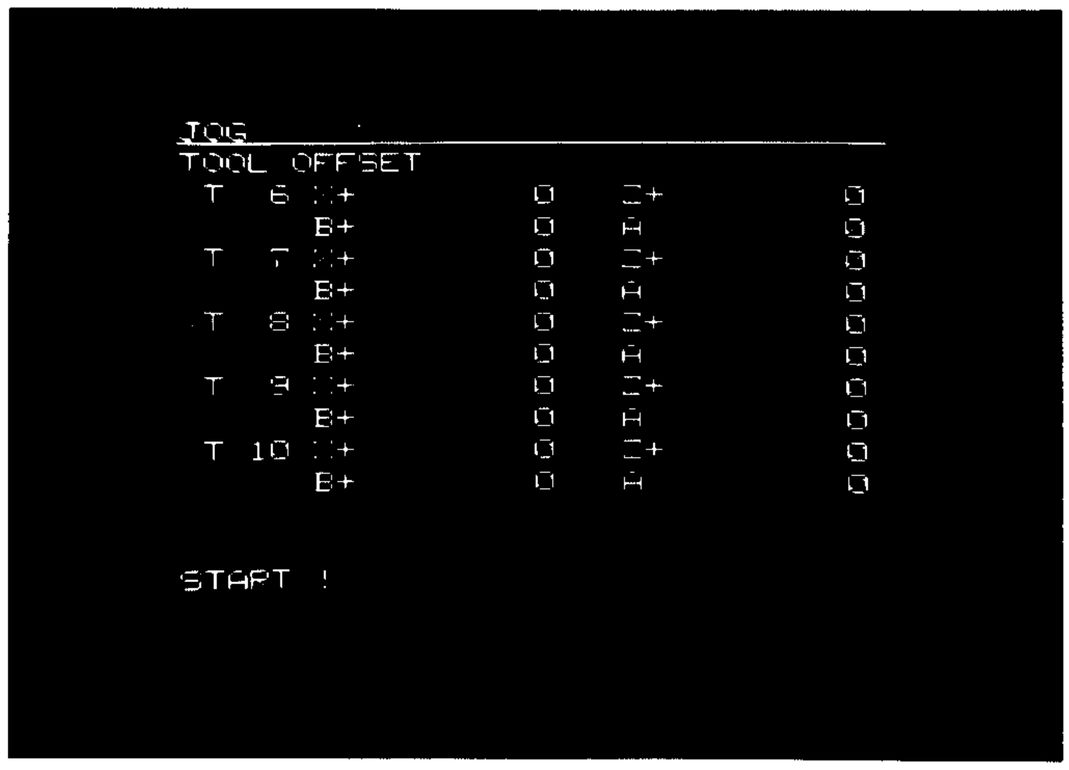
NO

Switch tool offset display until the cursor is positioned at the required tool offset number.

YES

Displayed tool offset number is correct.

The following display appears:



By pressing the Start button (no. 28) the automatic routine "Calculation of tool length" is initiated.

Tool length = actual coordinate - tool reference value

TL X = actual X - TR X
TL Z = actual Z - TR Z

The tool lengths thus calculated for X and Z are filed in the preselected tool offset store (here e.g. T14).

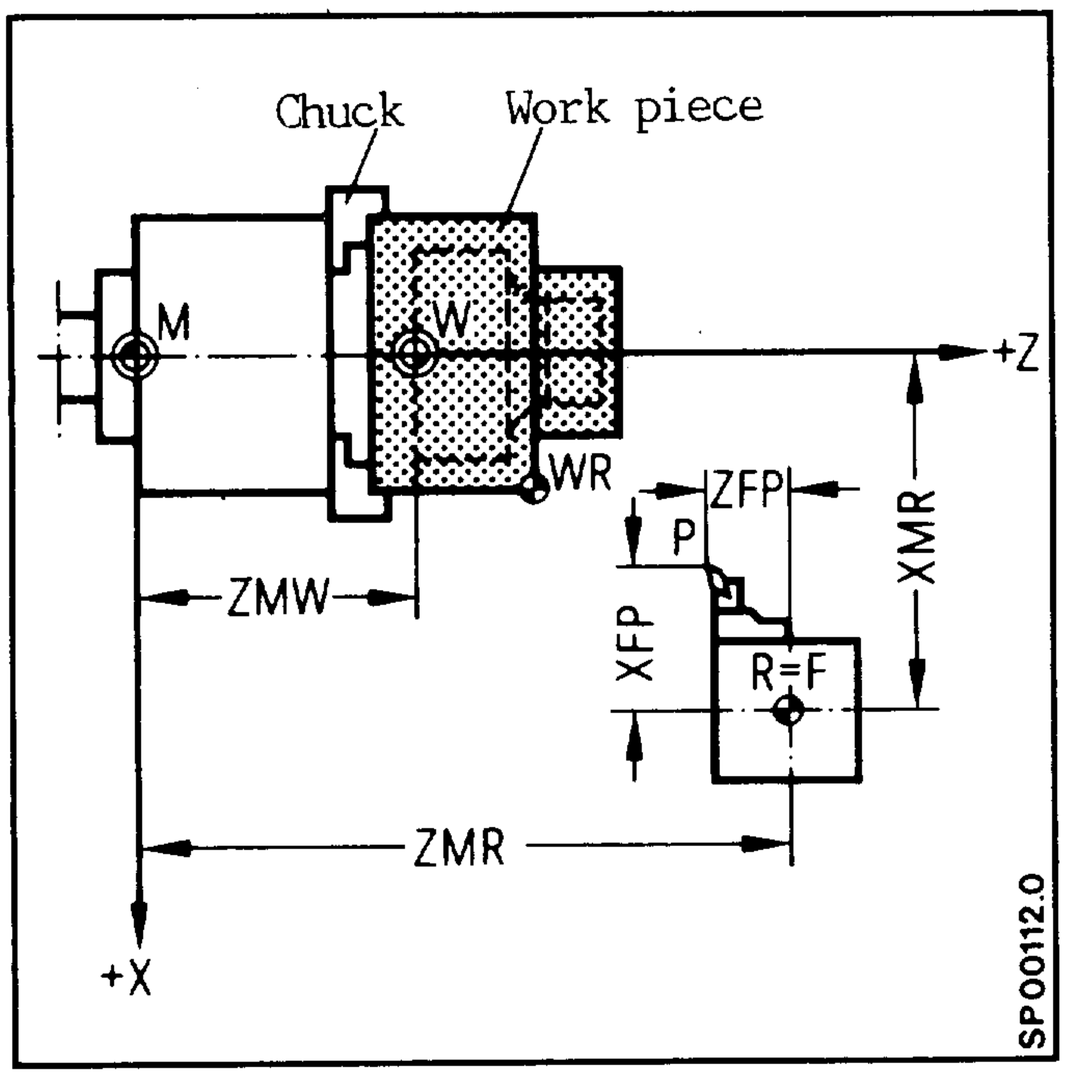
For input of cutter radius and tool position refer to Section 8.1.1.

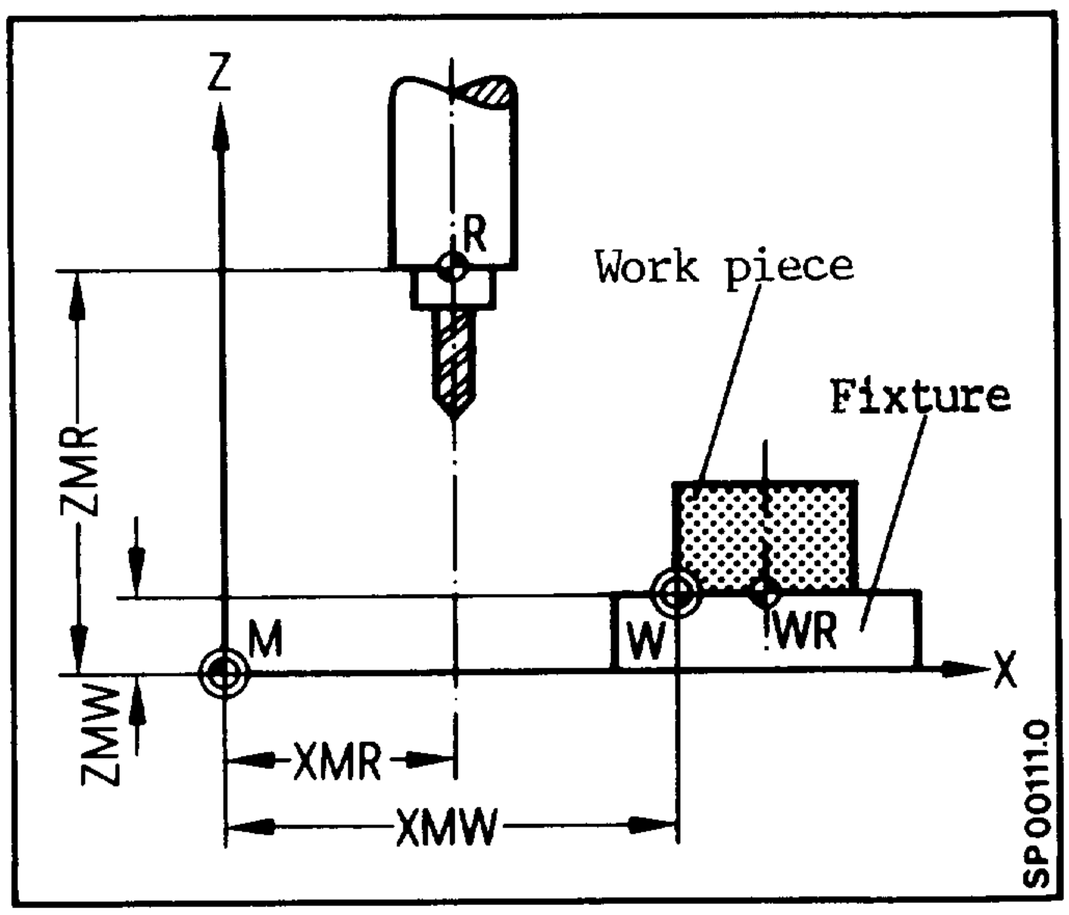
8.2. Zero offsets

8.2.1. Reference points

The respective reference point coordinate values will be entered automatically into the actual value memory counter after return to the reference point. The reference point coordinates are the fixed distances between the reference point R and the machine zero point M.

Spannvorrichtung = Chuck
Werkstück = Workpiece





Drawing: reference points

F = Slide reference point
M = Machine zero point
W = Workpiece zero point
R = Machine reference point
WR = Workpiece reference point
XMR, ZMR, etc. = Reference point coordinate for each axis
XMW, ZMW, etc. = The sum of all zero point offsets for each axis

NV = preset ZO (G54...) + add. ZO (G59) + ext ZO (PC)

8.2.2. Adjustable zero offsets (XMW, ...)

The actual memory and the position read-out are referenced to the machine zero M after a return to datum.

The part program for the workpiece is referenced to the workpiece zero.

The machine zero point M and the workpiece zero point W need not be identical. Dependent upon the nature and the size of the workpiece the distance between the machine zero point M and the workpiece zero point W can be varied.

So that the variable distance XMW does not have to be taken into account in the program, a settable zero offset (NV) is entered. In the program blocks the settable zero offset distance will be included in the axis commands every time that axis is programmed.

WARNING:
Zero offsets are always taken into account (in absolute or incremental programming). When a program is run and the first move is in incremental, the operator should ensure the adjustable zero offset has been cancelled.

8.2.3. Zero offset measurement

On return to datum the actual value counter is referenced to the machine zero point M.

After setting up the workpiece, the slides are jogged to the workpiece zero W or to the workpiece reference point WR.

When the workpiece zero point W is reached, the settable zero offset is calculated as follows:

Settable NV = Displayed position - tool length

e.g.: | XMW = XMF - XFP |

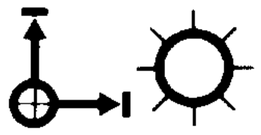
If the machine is jogged to the workpiece reference point, the formula is:

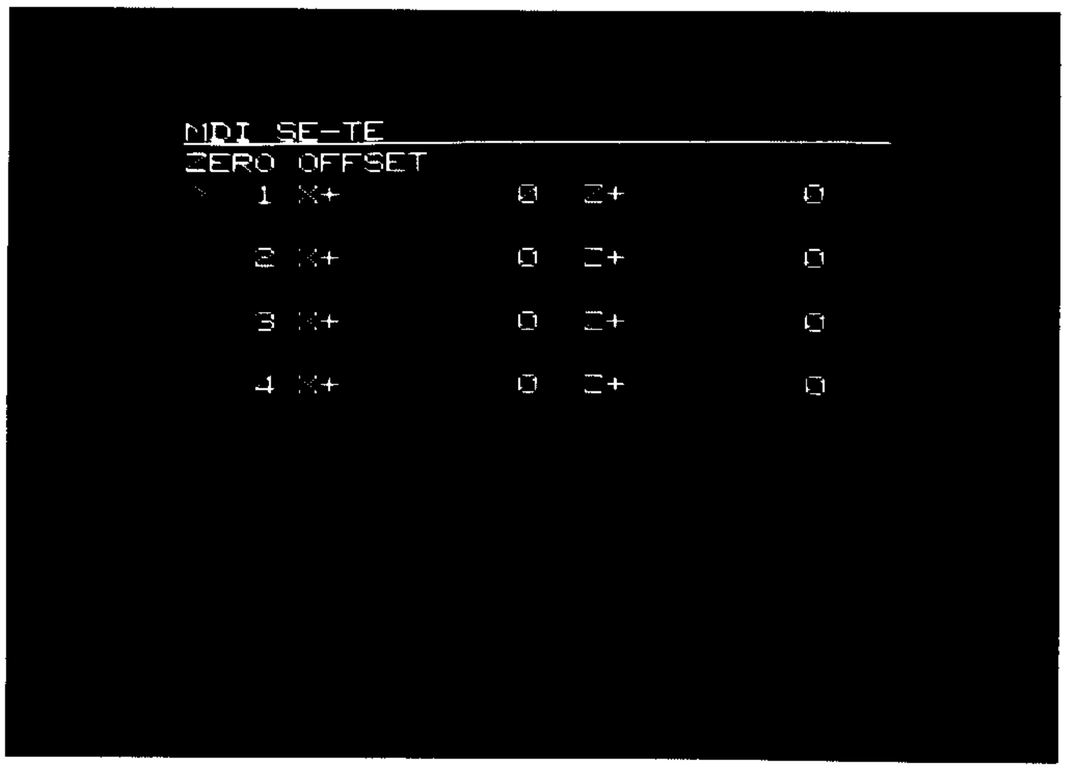
Settable ZV = Displayed position - tool length - Difference (Workpiece reference point/workpiece zero point)

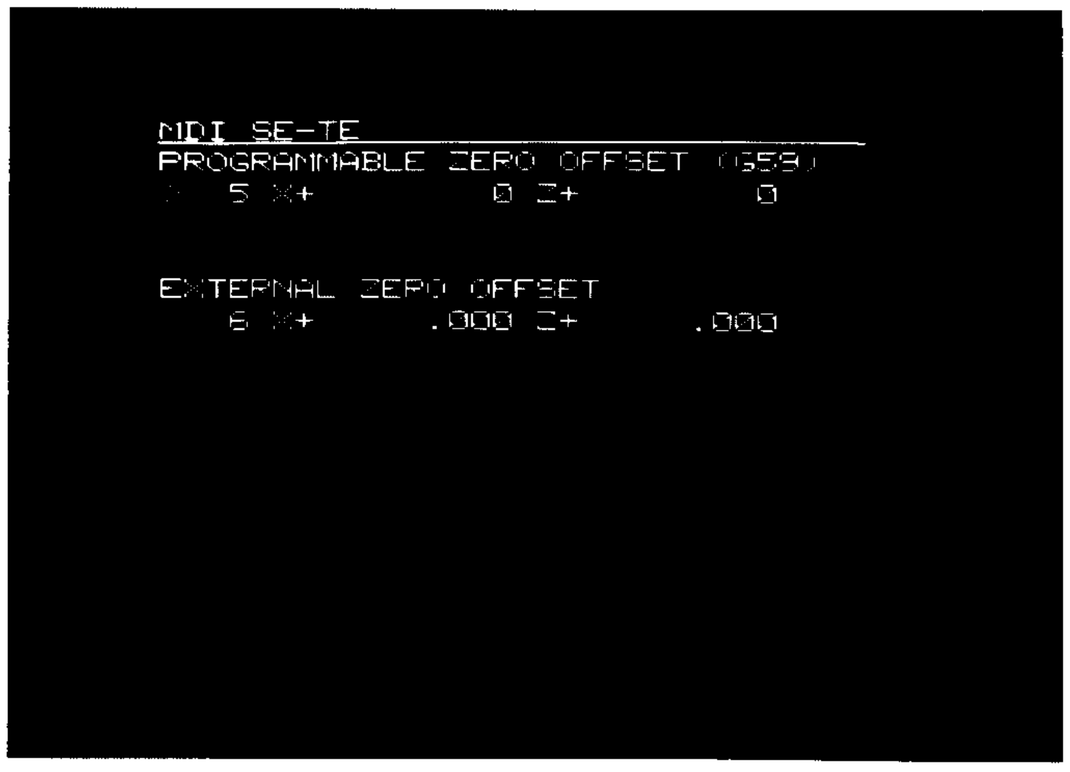
e.g. | XWM = XMF - XFP - Δ WR |

8.2.4. Zero offset display

Select zero offset mode (no. 7) using Display Switch button (no. 17)





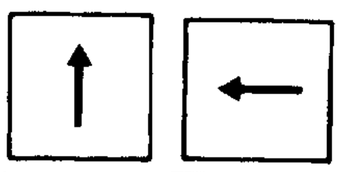


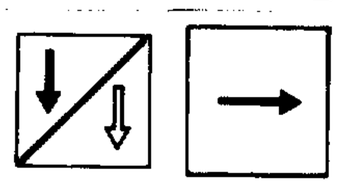
Display of adjustable zero offset

(3T 1-2, 3M 1-4),
programmable zero offset (5),
external zero offset (6),

for all the axes selected.

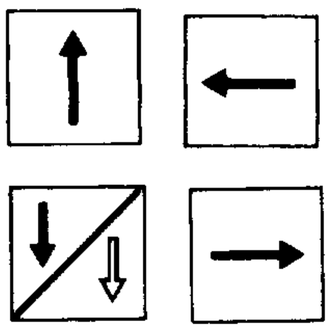
Preselect required zero offset





No input is possible with the programmable (5) and external (6) offsets.

8.2.5. Adjustable zero offset reset



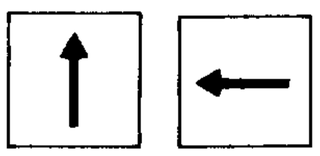
Select required number using page and cursor buttons (nos. 22, 23, 24, 25)

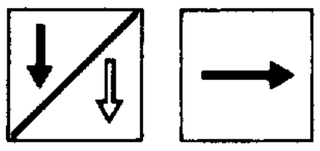
[X] [Z] Address buttons (no. 11) for 3T

[X] [Y] [Z] [4] Address buttons (no. 11) for 3M

The value is cleared using the Cancel button (no. 14) and the corresponding address button.

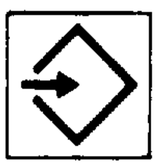
8.2.6. Entering adjustable zero offsets





Preselect required zero offset

e.g. X1000.

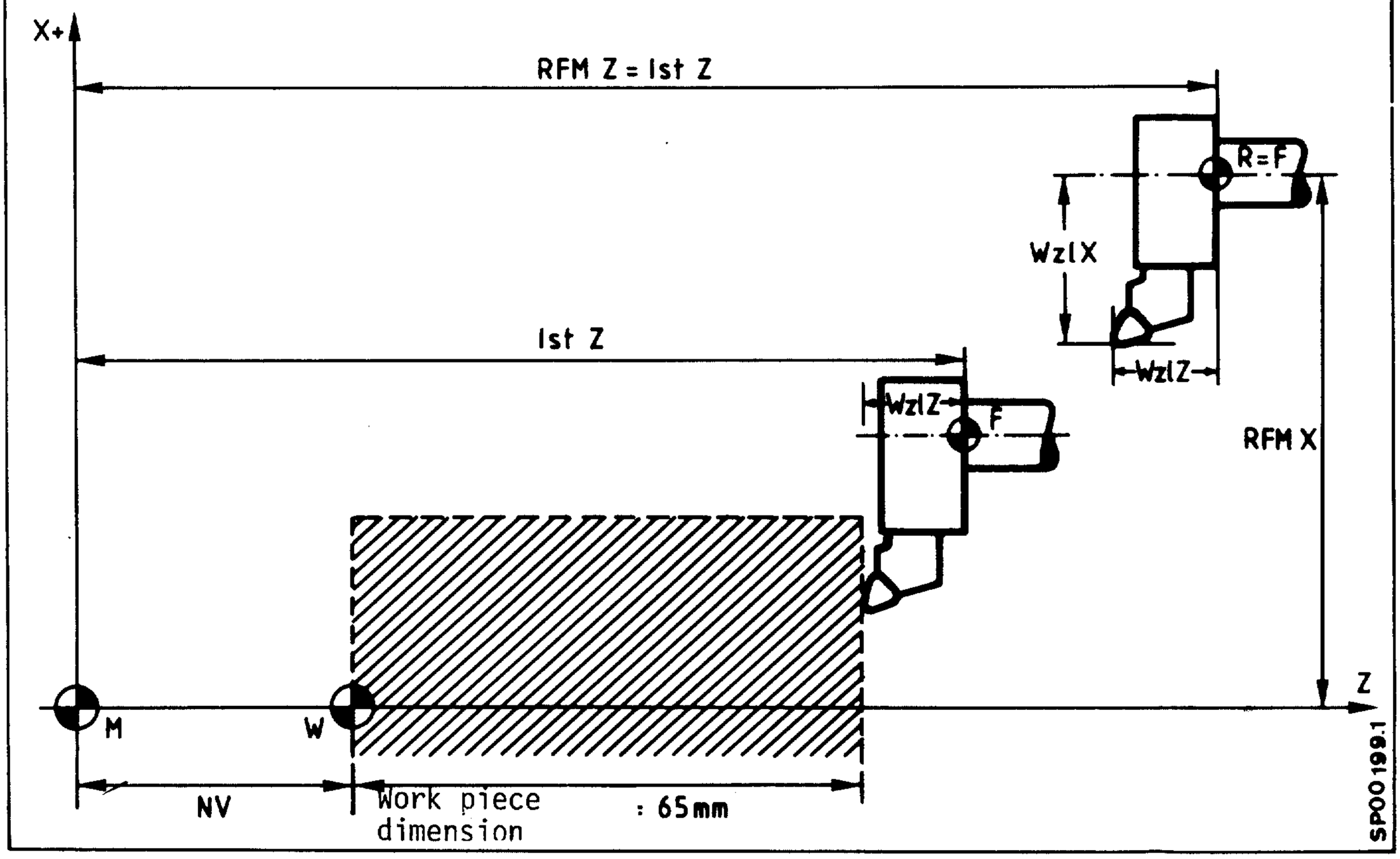


By inserting the X value and then pressing the input button (no. 16) the new value is stored for the X axis.

8.2.7. Automatic calculation of zero offset with 3T

Operating sequence using operator dialogue

Werkstückmaß = workpiece



M = machine zero point

F = slide reference point

R = machine reference point

W = workpiece zero point

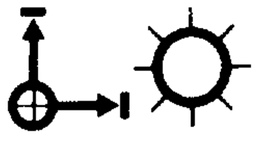
Operating mode return to datum (selector switch 31)
(see Chapter 10)
Actual value counter is set to reference value.

Jog mode (selector switch 31)
Traverse the tool tip to a known point on the workpiece (setting up). (Use workpiece drawing.)

and/or

Incremental mode (selector switch 31)
Traverse the tool tip to a known point on the workpiece (setting up).

Select zero offset mode (no. 7) using the Display Switch button (no. 17).



Line 15 displays the following text:

```
ZERO OFFSET NUMBER CORRECT ?
```

NO

Switch zero offset display until required zero offset number appears.

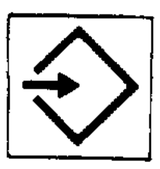
YES

Displayed zero offset number is correct.

Line 15 displays the following text:

X
65

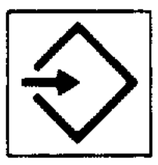
Enter the workpiece dimension associated with the tool tip (e.g. X + 65 mm)



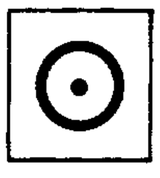
Line 15 displays the following text:

T12

Enter the tool offset number for the tool being used on the workpiece.



Line 15 displays the following text:



Pressing the Start button (no. 28) initiates the automatic routine "Calculation of zero offset".

Zero offset = actual value - (component dimension + tool length)

ZV X = actual X - (comp. dim. X + tool length X)

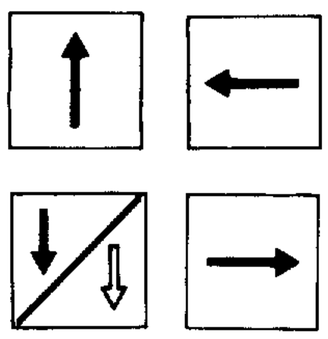
ZV Z = actual Z - (comp. dim. Z + tool length Z)

The zero offsets thus calculated for X or Z are filed in the preselected zero offset store (here e.g. 1).

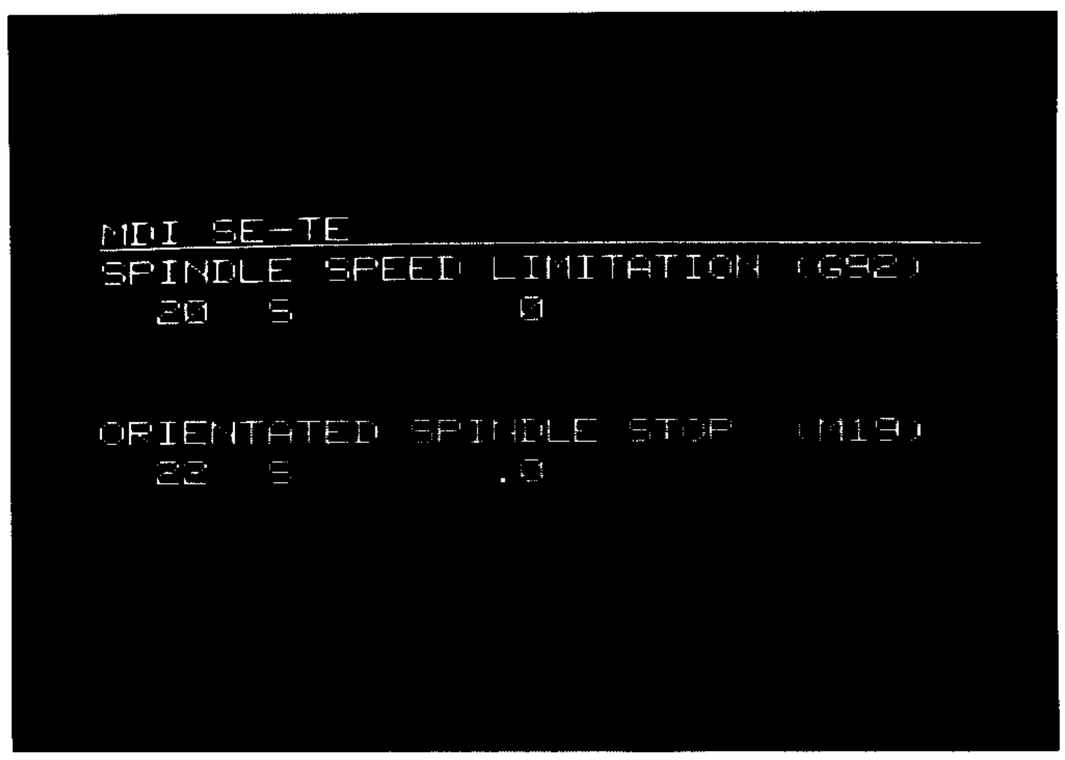
The automatic calculation of zero offsets is carried out for each axis separately. The component dimension input also defines the axis.

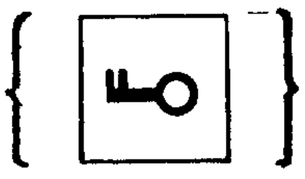
8.3. Programmable spindle speed limitation

The speed limitation (see programming manual) programmed using G92 S... is displayed and can be modified using the input buttons.



Select display no. 20 using page or cursor buttons (nos. 22, 23, 24, 25).



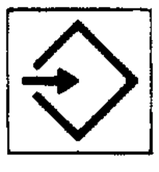


Input can be interlocked via key switch (no. 38) { } (dependent on machine parameter)

S 800

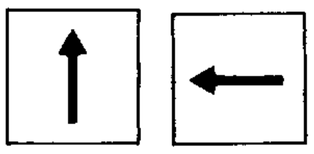
Input limit speed

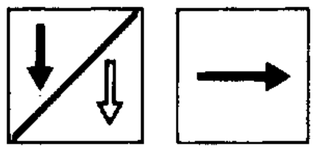
e.g. 800 U/min



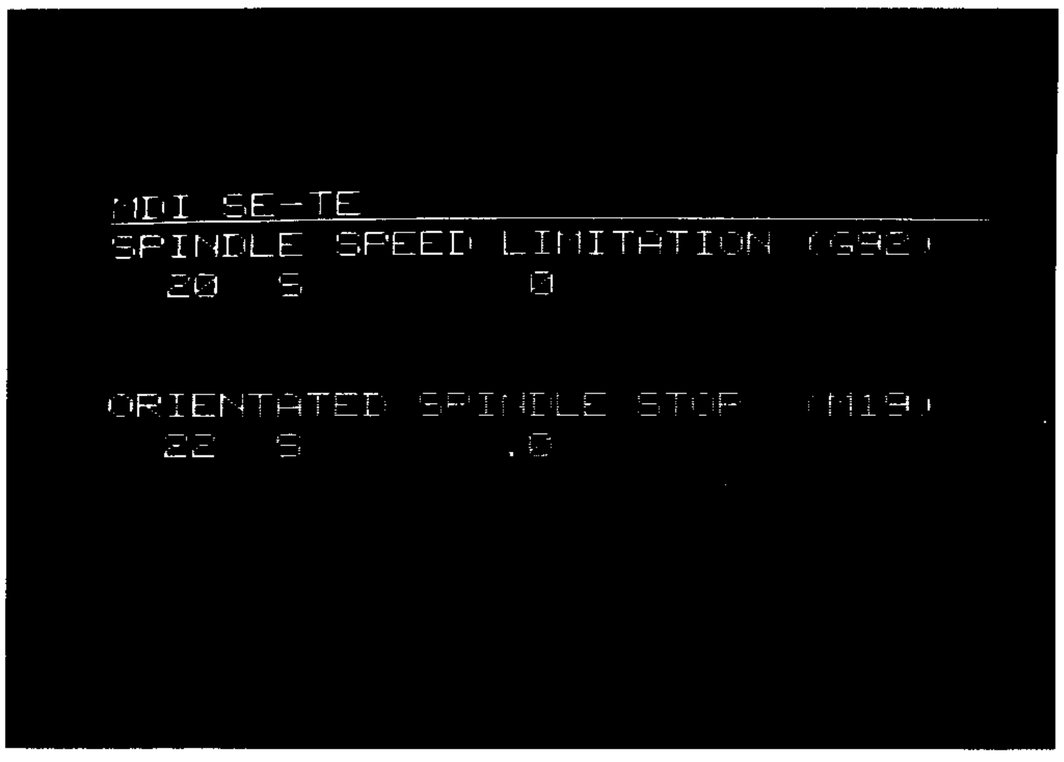
8.3.1 Oriented spindle stop

The oriented spindle stop programmed under M19 S... (see the programming instructions) is displayed and can be modified by using the input keys.





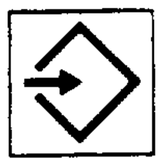
Preselect the page with the "Page" or "Cursor" keys (nos. 22, 23, 24, 25).



{ F5 }

The input can be interlocked with key switch (no. 38)
{ } (dependent on machine datum)

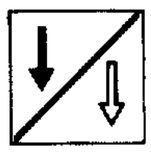
S 156.5



Input S is in degrees (here 156.5°) from the zero point, seen in M03 direction.

8.4. Bit-oriented user data

Preselect display no. 25 using the page buttons (no. 22, 23)



MDI SE-TE
SETTING DATA NUMBER 25
N
0
0
0 CODE PUNCH OUT 0=ISO 1=EIA
0
0 PROGRAM START WITH LF 1=ON
0 TAPE BLOCK PARITY 0=OFF 1=ON
0 OPERATOR GUIDING 0=OFF 1=ON
0 DISPLAY WORKPIECE SYSTM 1=ON

SINUMERIK SYSTEM 3

MDI SE-TE
SETTING DATA NUMBER 26
N
0
0
0
0
0
0 HANDWHEEL CALIBRATION 100
0 HANDWHEEL CALIBRATION 10
0 HANDWHEEL CALIBRATION 1

N000000100

The user's data are presented in text form.

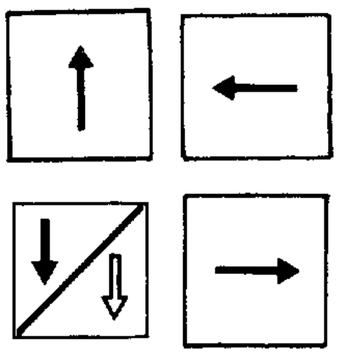
{ } Key switch interlock (no. 38)
{ } (dependent on machine parameter)

N11101010 Input user datum

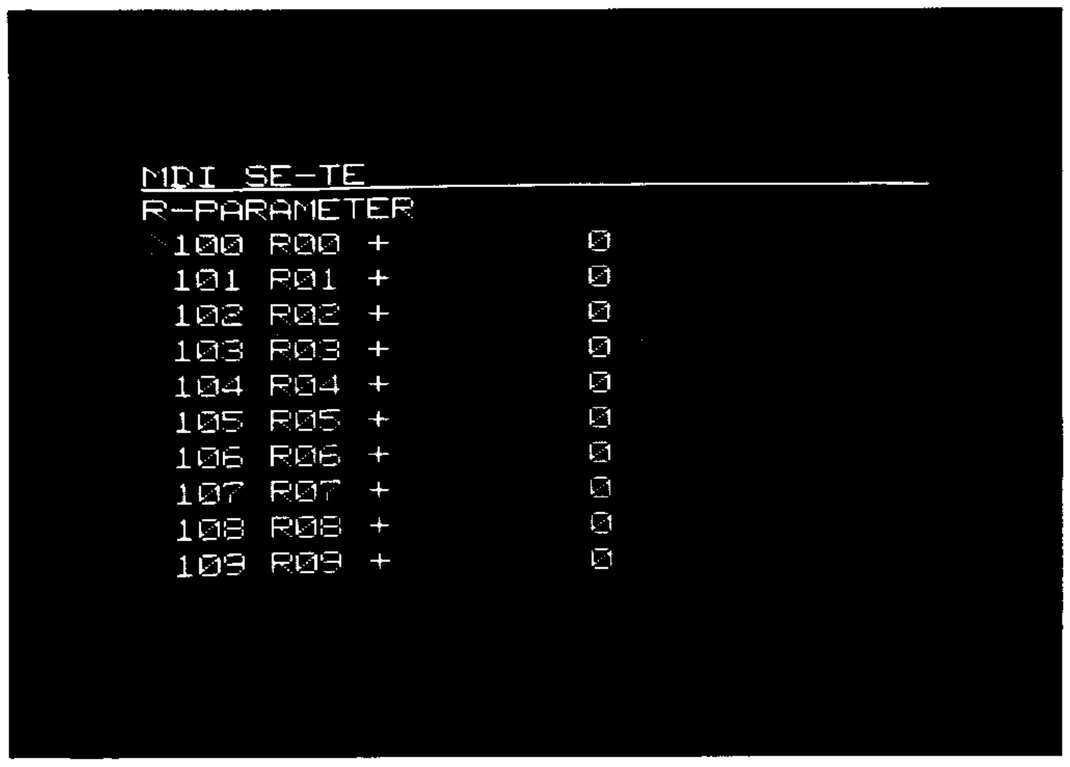
The appendix contains a list of bitorientated user data. When entering the data, the leading zeros can be disregarded.

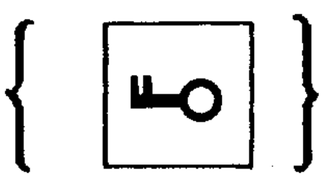
8.5. R parameters

The R parameters (see programming manual) can be displayed and modified.



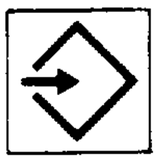
Select display nos. 100 to 199 (parameters R00 to R99) using the page buttons (nos. 22, 23) and the cursor button (nos. 24, 25).





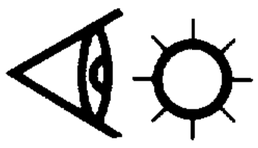
Key switch interlock (no. 38)
{ } (dependent on machine parameter)

R00 Input on R parameter
1000.5 z.B. R00 1000.5



8.6. Data and display selection TE

Select "Test" (no. 8) on appropriate button.



Switch display (no. 17).

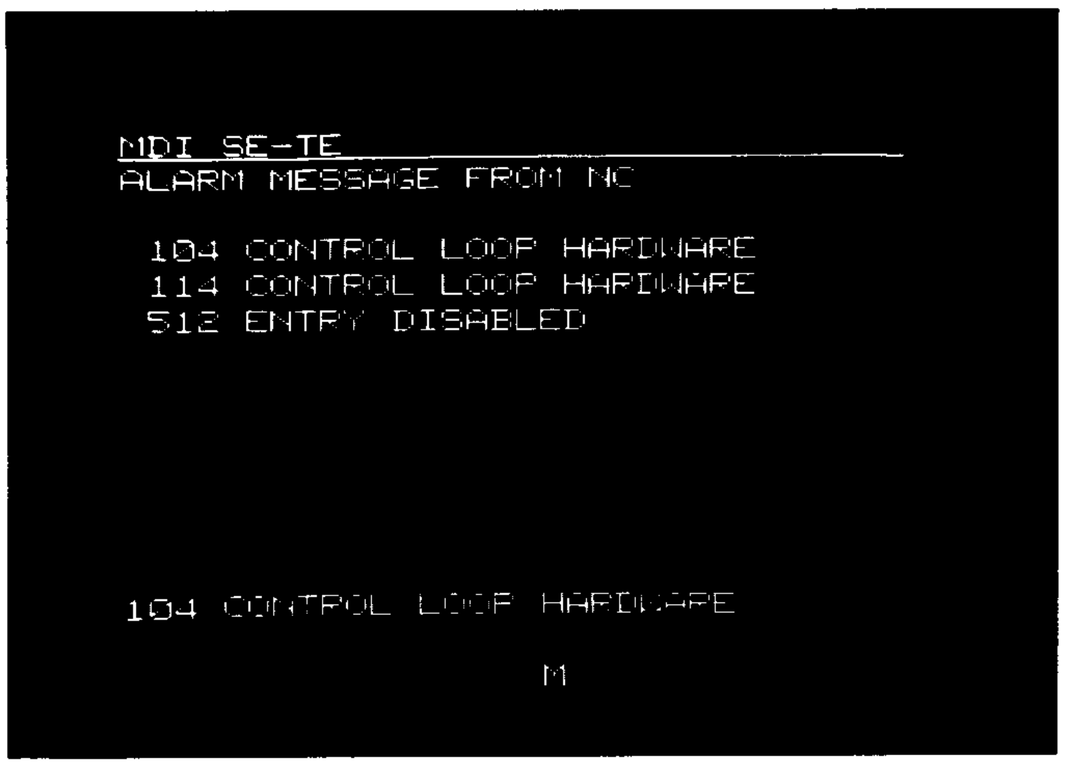
The following data are displayed with TEST:

Ident. number	Data type
1 - 2	Alarms
7 - 9	Input signals
10 - 11	Output signals
35 - 41	PC input signals
48 - 54	PC output signals
100 - 419	Machine data
800 - 861	Service values

Scanning through display numbers using page buttons (nos. 22, 23)

A change in value can only be made in the MDI-SE-TE mode (selector switch 31) and protected using the machine data protection switch (see commissioning instructions).

8.6.1. Alarm display



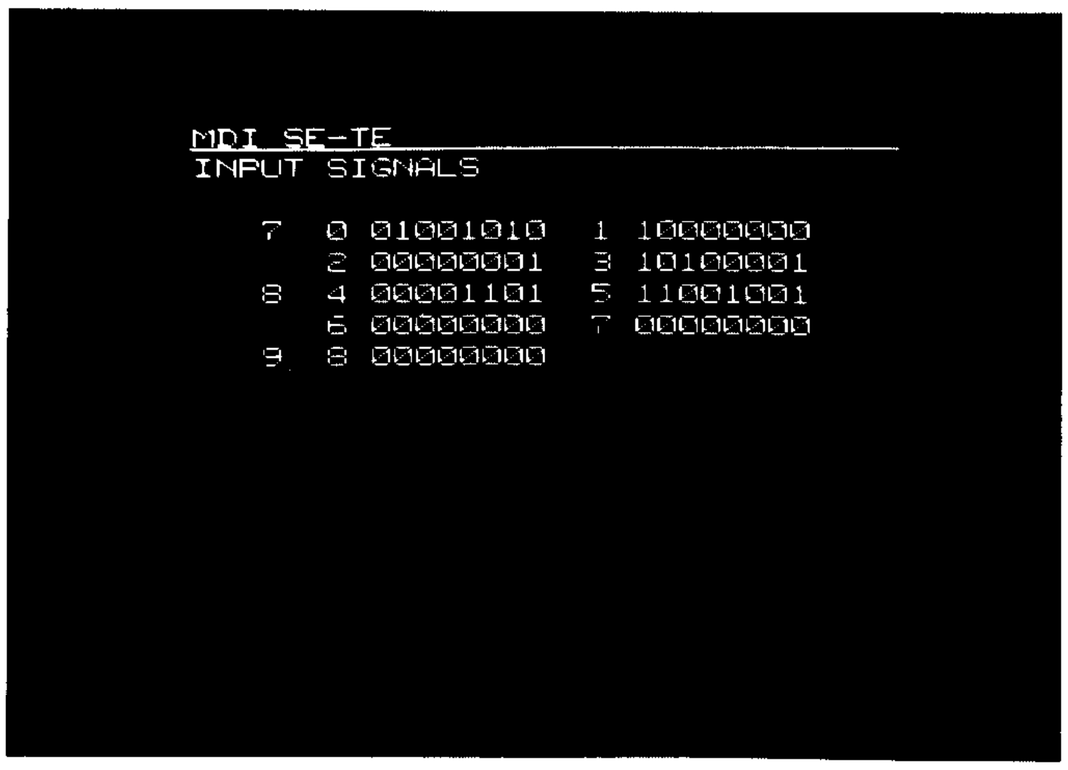
The first NC alarm number of existing alarms is generally displayed on the 14th line. In addition, max. 10 NC alarms existing at the same time are displayed in plaintext (short description of origin of error).

A 2-digit PC alarm may be displayed at the end of the 14th line via external data input.

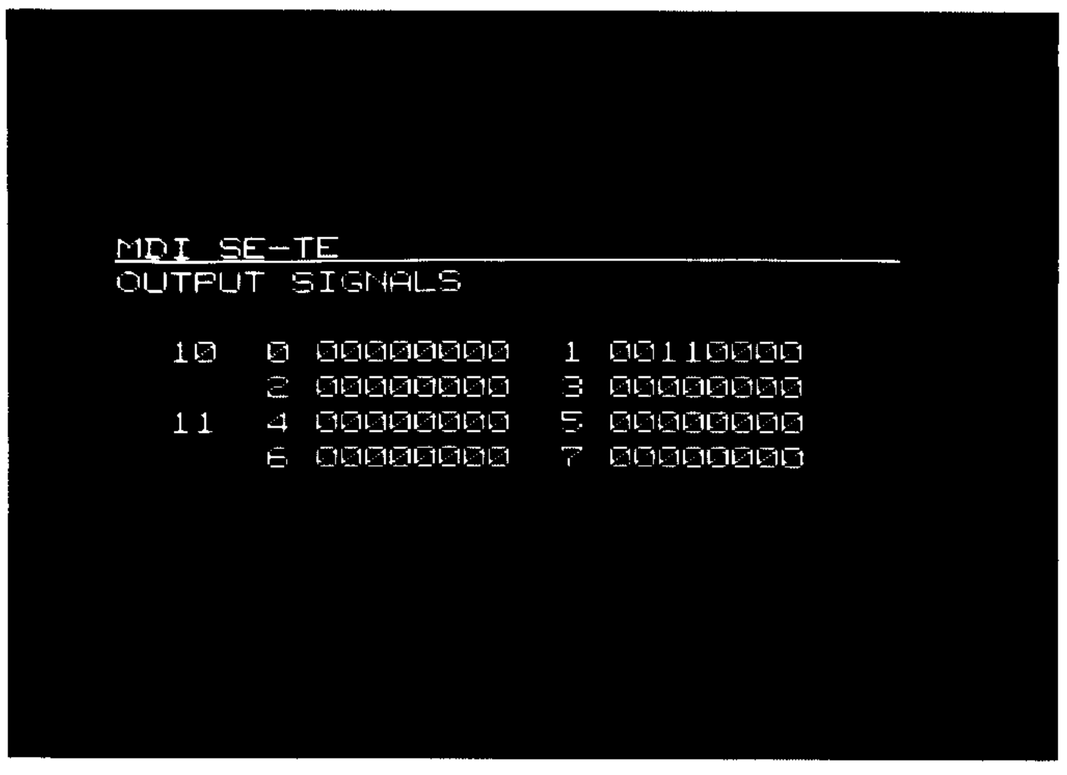
8.6.2. Interface image

8.6.2.1. Input/output signals (NC - PC)

The I/O signals of the interface section between the NC and the PC can be displayed at any time with the help of the integrated interface diagnostic. No inputs are possible.



9 bytes of the NC input signals are displayed.

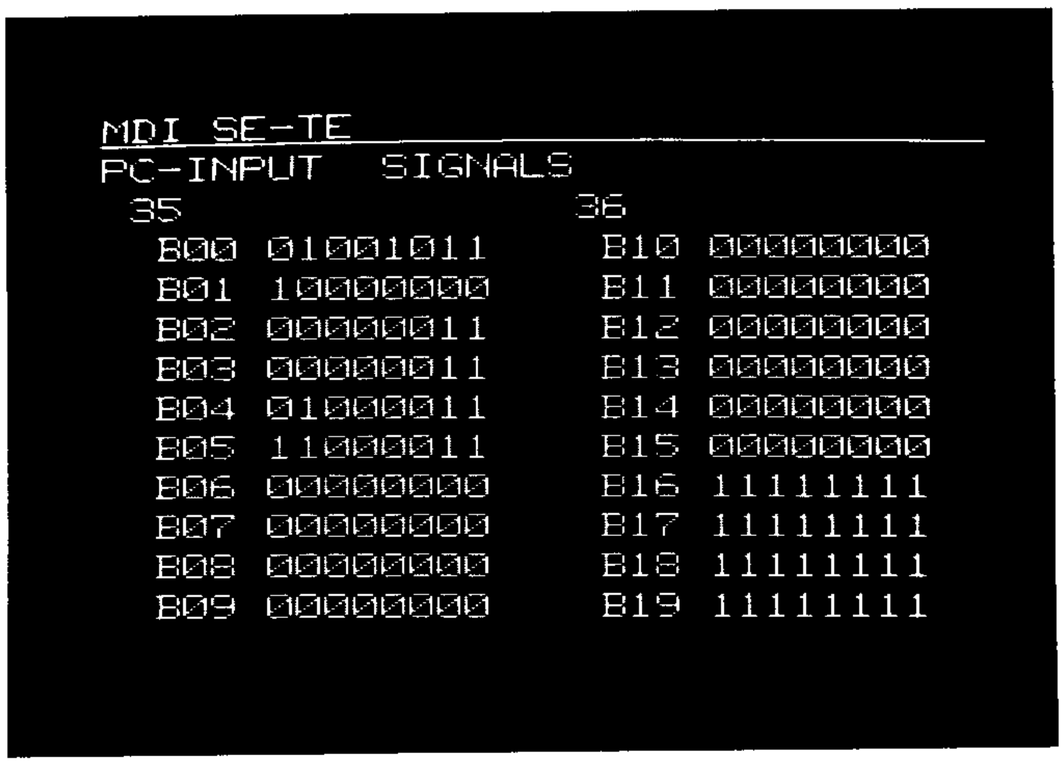


8 bytes of the NC's output signals are displayed.

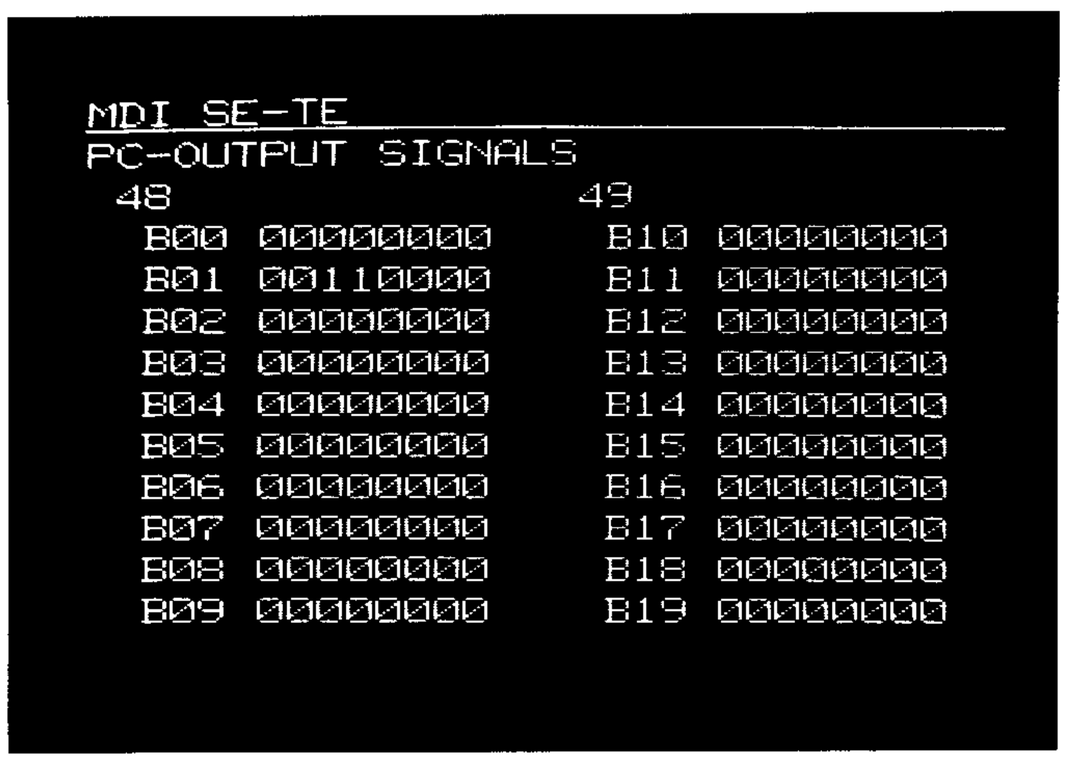
8.6.2.2. Input/output signals (PC machine)

The interface images between PC and machine can be displayed under the ident. no. 35-54.

No input is possible.

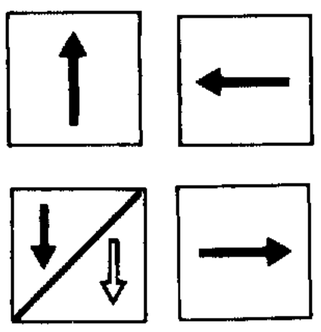


64 bytes of the input signals are displayed.



64 bytes of the output signals are displayed.

8.6.3. NC machine parameters

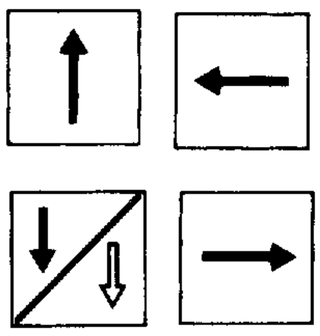


Select display nos. 100 to 419 using the page and cursor buttons (nos. 22, 23, 24, 25).

Machine parameters are determined and read in during commissioning.

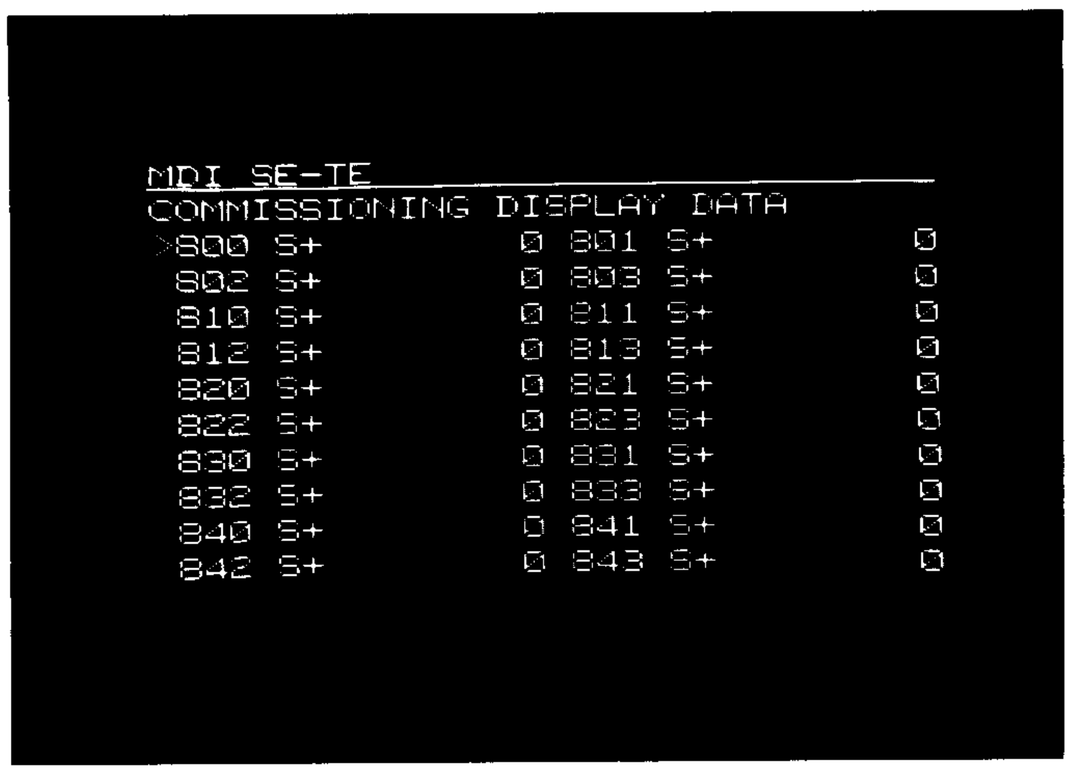
Axis-specific machine parameters (100-349)
General machine parameters (350-399)
Machine parameter bits (400-419)

8.6.4. Commissioning values



Select display nos. 800 to 861 using the page and cursor buttons (nos. 22, 23, 24, 25).

No input possible.

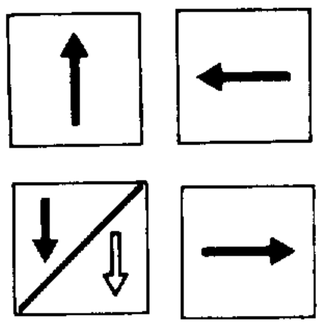


The following values are displayed:

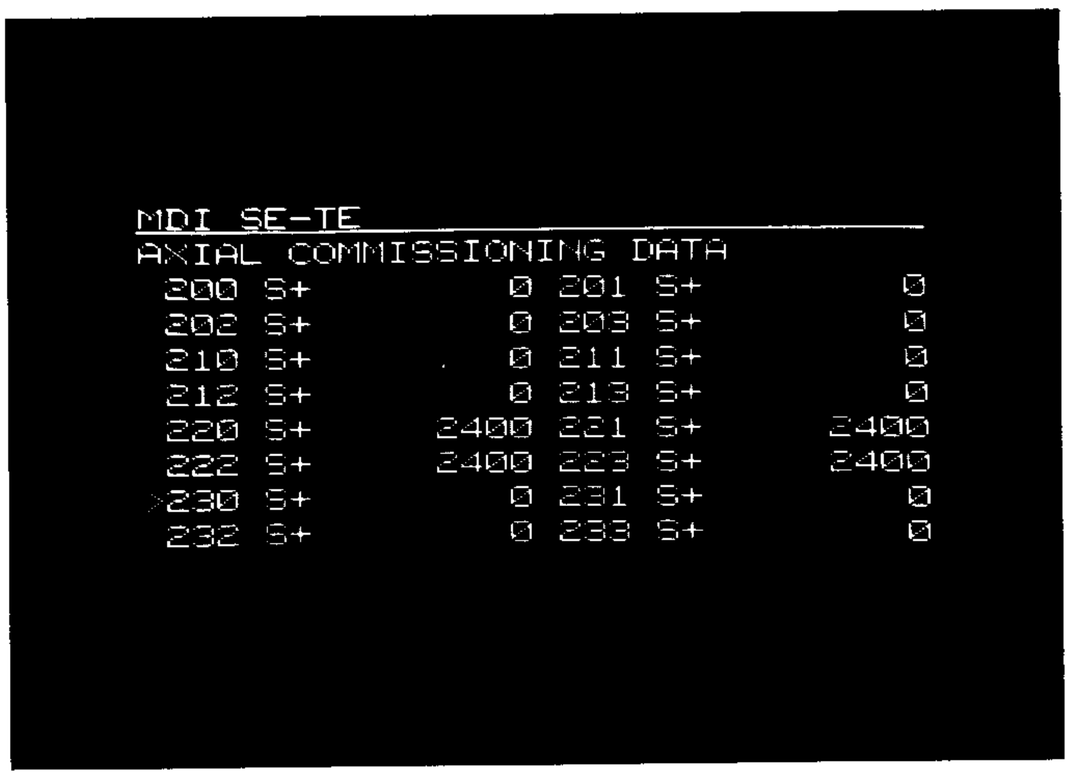
Ident. no.	Axis		Display
	3T	3M	
800 S	X	X	Following error
801 S	Z	Y	Following error
802 S	-	Z	Following error
803 S	-	4th	Following error
810 S	X	X	Actual value (measuring system)
811 S	Z	Y	Actual value (measuring system
812 S	-	Z	Actual value (measuring system)
813 S	-	4th	Actual value (measuring system
820 S	X	X	Speed command value
821 S	Z	Y	Speed command value
822 S	-	Z	Speed command value
823 S	-	4th	Speed command value
830 S	X	X	Partial actual value
831 S	Z	Y	Partial actual value
832 S	-	Z	Partial actual value
833 S	-	4th	Partial actual value
840 S	X	X	Contour deviation
841 S	Z	Y	Contour deviation
842 S	-	Z	Contour deviation
843 S	-	4th	Contour deviation
850 S	X	X	KN factor measured
851 S	Z	Y	KN factor measured
852 S	-	Z	KN factor measured
853 S	-	4th	KN factor measured
860 S	-	-	Speed command value (spindle)
861 S	-	-	Spindle position

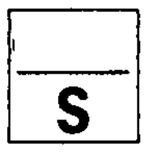
8.6.5. Setting the drift compensation

Voltage drift will occur in the analog components of the measuring loop as a result of temperature changes. This drift will result in deviations from the command value and can be counteracted by setting the drift compensation.



Select display nos. 200 - 233 using the page and cursor buttons (nos. 22, 23, 24, 25).





Edit button (no. 15)

The drift value is transferred automatically to the display. This drift compensation setting is not protected by the service switch. The drift compensation setting applies to the axis selected by the cursor.

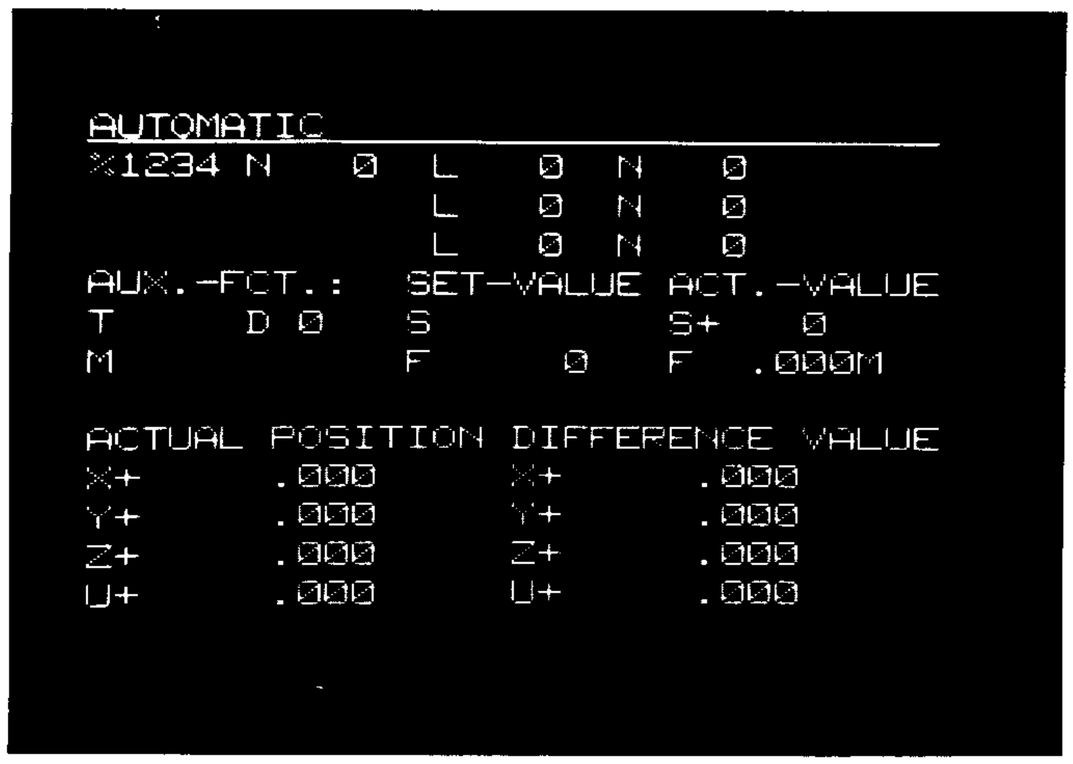
Display number Cursor position	Axis	
	3T	3M
230	X	X
231	Z	Y
232	-	Z
233	-	4th

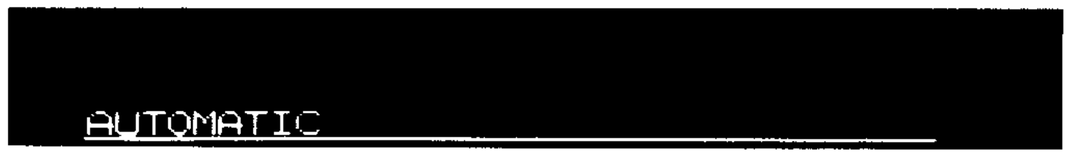
9. Automatic mode AUT

The control calls up the program blocks one after the other and executes them. After a block has been executed, the next prepared block is read-in and executed.

A "prepared block" means axis movements programmed in this block are calculated to include "settable zero offsets" and "tool offsets". The only source of data for this is the NC program store.

Automatic mode (selector switch 31)





Mode (automatic)

Display of the actual program arrangement in all nestings. Display of the subroutines with program numbers indicators and processing indicators (see Chapter 1.3.).

T, D, M functions (AUX.-FCT.:)

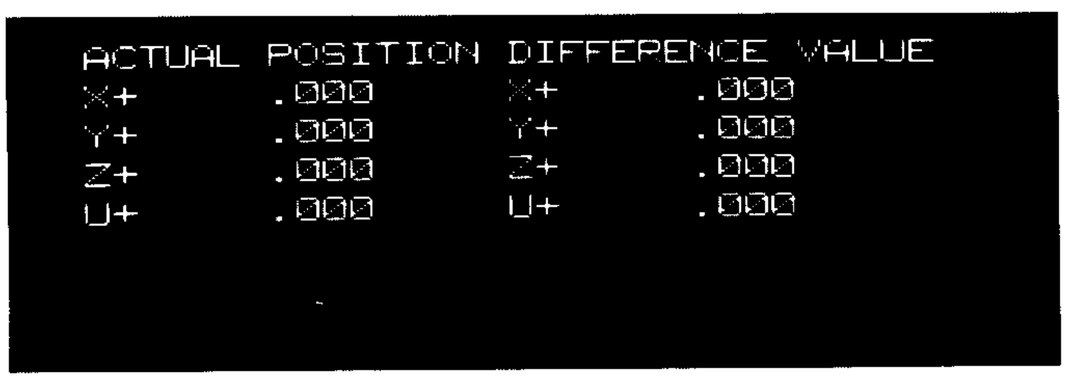
T for the 3T: Tool number with offset number
(2+2 decades)
T for the 3M: Tool number (4 decades)
D offset number D is only shown here for the 3M
M programmed additional function

S, F (SET VALUE)

S programmed spindle speed
F programmed feed rate
(dimensions as the actual feed rate)

S, F (ACT.-VALUE)

S current spindle speed
F current feed rate
(dimension "R" = per revolution)
(dimension "M" = per minute)



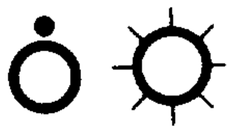
Actual values (ACTUAL POSITION)

Display of actual values of all axes (machine position)

Command actual difference (DIFFERENCE VALUE)

The distance to go to the endpoint of the block is shown for all axes.

The programmed feedrate has the same designation as the actual feedrate.



If feed hold is applied (no. 2), the following programmed parameters can be overwritten:

Spindle speed	S ⑨
Tool number	T ③
Auxiliary function	M ⑧

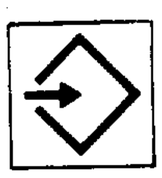
Before executing, the program number indicator must be set to the required value.

Operating sequence

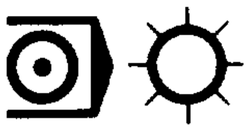
In those cases when control is not in "Reset"

Automatic mode (selector switch 31)

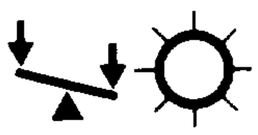
Input the required program number



The program is started by pressing the Cycle Start button (no. 44).



"Program active" lamp lights (no. 1)



During operation the "Not in position" lamp (no. 3) stays on until axis motion stops.

9.1. Automatic mode instructions

Displays

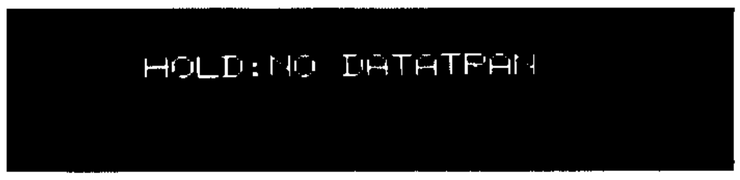
Instruction displayed in line 16.

Automatic mode interrupt

Single block executed

Programmed program hold M00

By pressing the Cycle Start button (no. 44) the next block is read-in, calculated and executed.

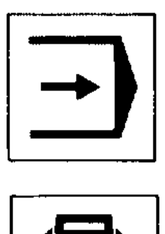


No enable for data input

Dwell active

Operating functions

Single (no. 40)

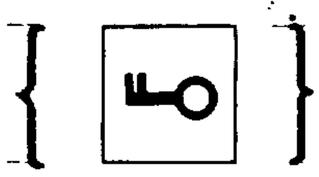


Each time the "Cycle" button is pressed a single block is called up, calculated and executed.

Skip (no. 41)

The blocks marked "/" are not used in the program sequence (block delete).

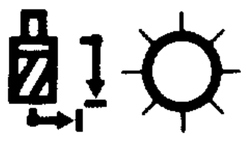
9.2. Display tool offsets, zero offsets, machine parameters

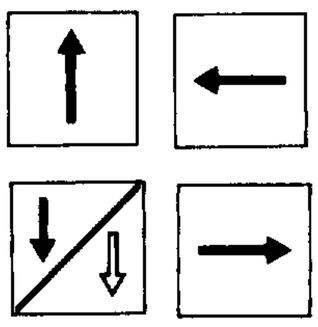


Enable key switch (no. 38) for input { } (dependent on machine parameters.

For 3T: Select tool offset (no. 6)

For 3M:



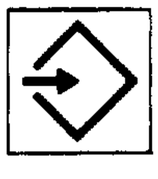


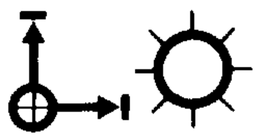
Select tool number

e.g. Tool wear value can be entered even
B.999 during active program (interlocked via key switch)
Tool wear value input: max. ± 0.999 mm
±0.0999 inch

and/or

e.g. Tool offset value can be entered even
B10.000 during active program (interlocked via key switch)





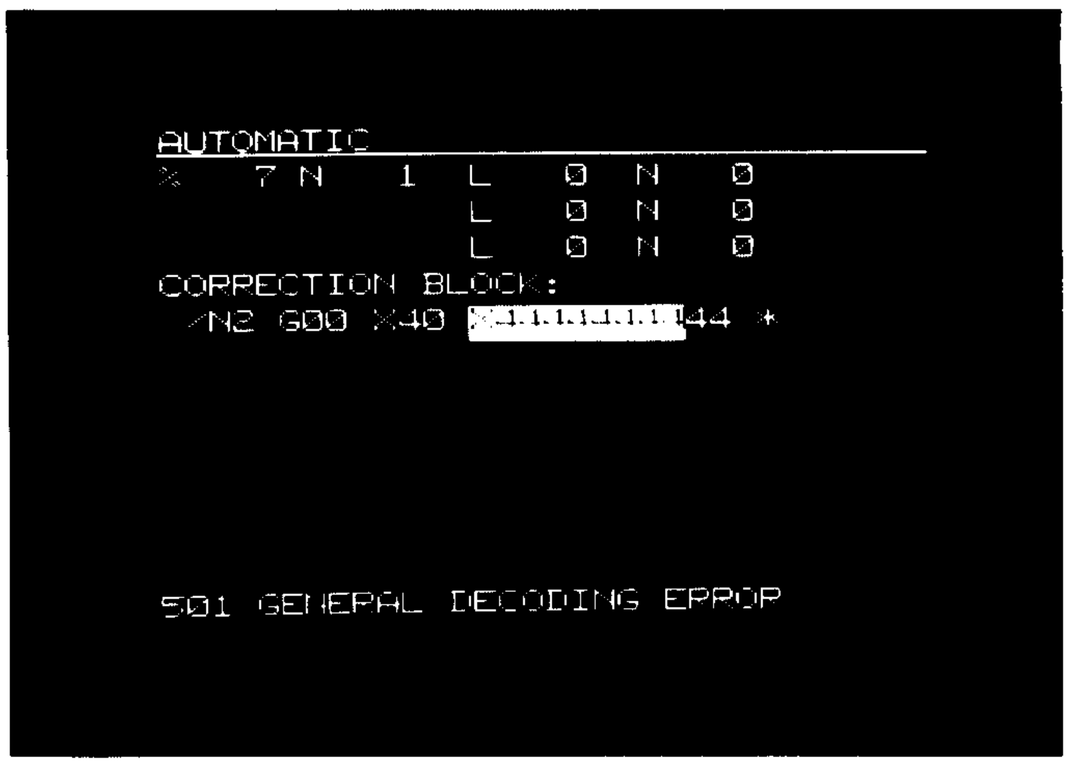
Zero offset display (no. 7).
No input possible.

Test display (no. 8) (machine parameters).
No input possible.

9.3. Correction block display

Display of the current program block which can still be modified.

Select part program (no. 9)



Display of active program with all subroutine nestings. Display of subroutine with program number indicator and status indicator. No input possible.

Offset block

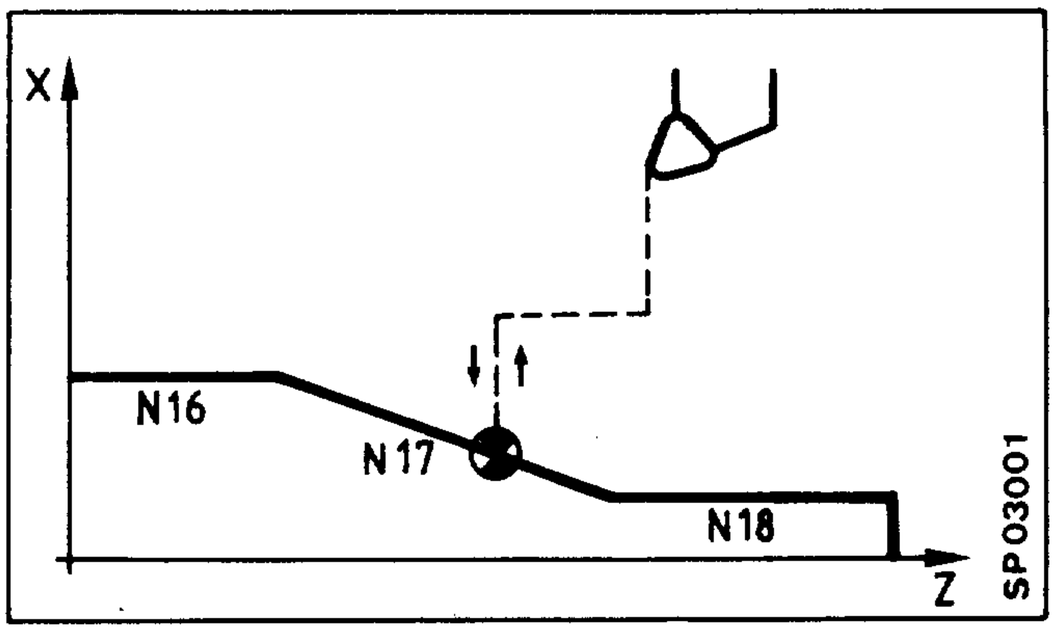
Incorrect characters which have been detected during decoding are indicated in the display by the addition of commas.
These incorrect words can be corrected (e.g. G4123 4-digit G code) in the MDI-PP mode (see Chapter 7).

9.4. Continuation of automatic operation following program interruption

9.4.1. Overview

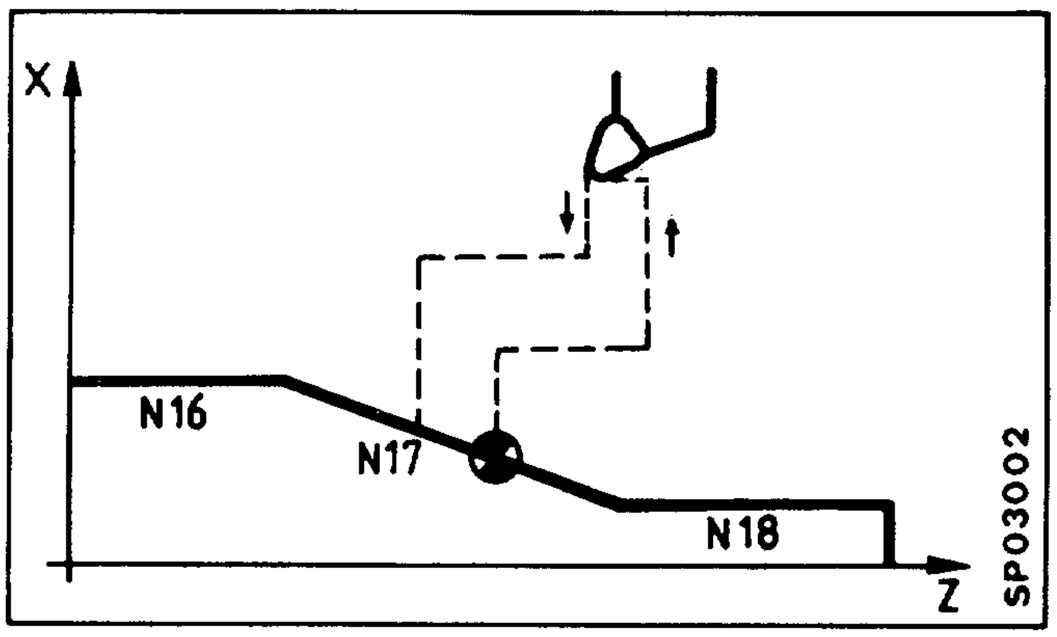
There are four possible ways in which automatic operation may be restartet following program interruption.

a) Retract for tool inspection



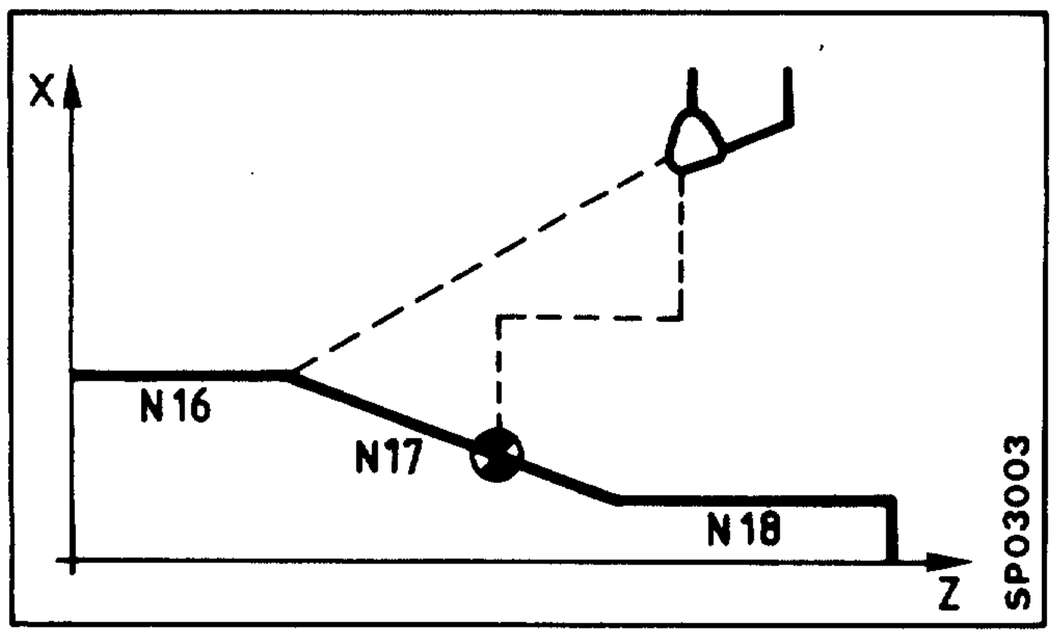
Using incremental feed the tool is repositioned to the point of interruption.
Tool offsets remain unaltered.

b) Touch on method



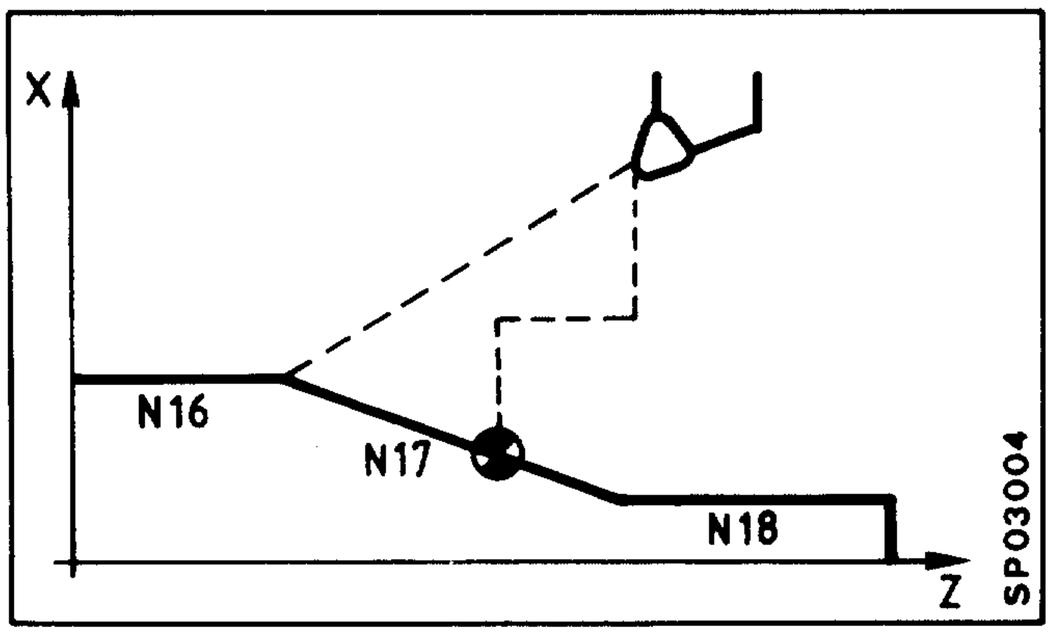
Touch on somewhere within the interrupted block using jog. Tool length may vary.
Tool tip radius compensation remaines unaltered.

c) Search to an interrupted block



The control directs the tool automatically in linear interpolation to the start point of the interrupted block.
(SINUMERIK 3T) Tool offsets may vary.

d) Search to an arbitrary block



The control directs the tool automatically in linear interpolation to the end point of the selected block. In the example opposite, block N16 has been selected. Tool offsets may vary.

9.5. Program interruption through set up

9.5.1. Retract for tool inspection

Automatic operating mode (AUT) is interrupted through set up (JOG, INC):

Hold Auto Interr

Interruption of automatic operation

The cursor for the program number and machining are not altered. The tool is moved away from the workpiece using incremental jog to facilitate tool inspection, and subsequently repositioned to the point of interruption. If JOG is to be used at this point, then the operator must note the position of interruption (displayed axis values). After returning to automatic mode machining may be restarted with "cycle start".
Other interruptions lead to alarm 511.

If the axes are moved by JOG or INC and are not returned to their original position, the exact block end point is approached in the programmed axes after "cycle" start. Non-programmed axes are only traced, after they have been programmed.

This is also valid for the end of a single block.

The CRC/TRC must not be changed.

9.5.2. Touch on method

Automatic operating mode (AUT) is interrupted through set up (JOG, INC).

Hold: Auto Interr.	Interruption of automatic operation

Departure is made from the contour by using incremental feed or jog, for toolchanging for example. After entering the new tool length offsets (tool tip radius compensation remains unaltered), the new tool is repositioned to some point within the interrupted block.

After returning to automatic, machining may be started with "cycle start".
All other interruptions lead to alarm 511.

If the axes are not repositioned to the point of interruption, following cycle start, the axes which are programmed are directed to the absolute block end point. Axes which are not programmed are not initially updated, only when they are eventually called in the program.

This is also valid at the end of a single block.

9.6. Block search in automatic operation

9.6.1. Search to an interrupted block

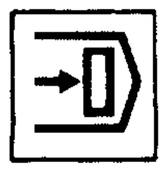
Following interruption of automatic operation, because of tool breakage for example, it is possible to reposition the tool automatically to the starting point of the interrupted block using the "search to an interrupted block" function. The function is particularly useful if the circumstances make it difficult to accurately determine the whereabouts of the interrupted contour.
The SINUMERIK 3T automatically directs the tool in linear interpolation to the starting point of the interrupted block. During block search, the control takes account of any new tool offsets inclusive of tool tip radius/cutter radius compensation.

Operating sequence with operator guidance

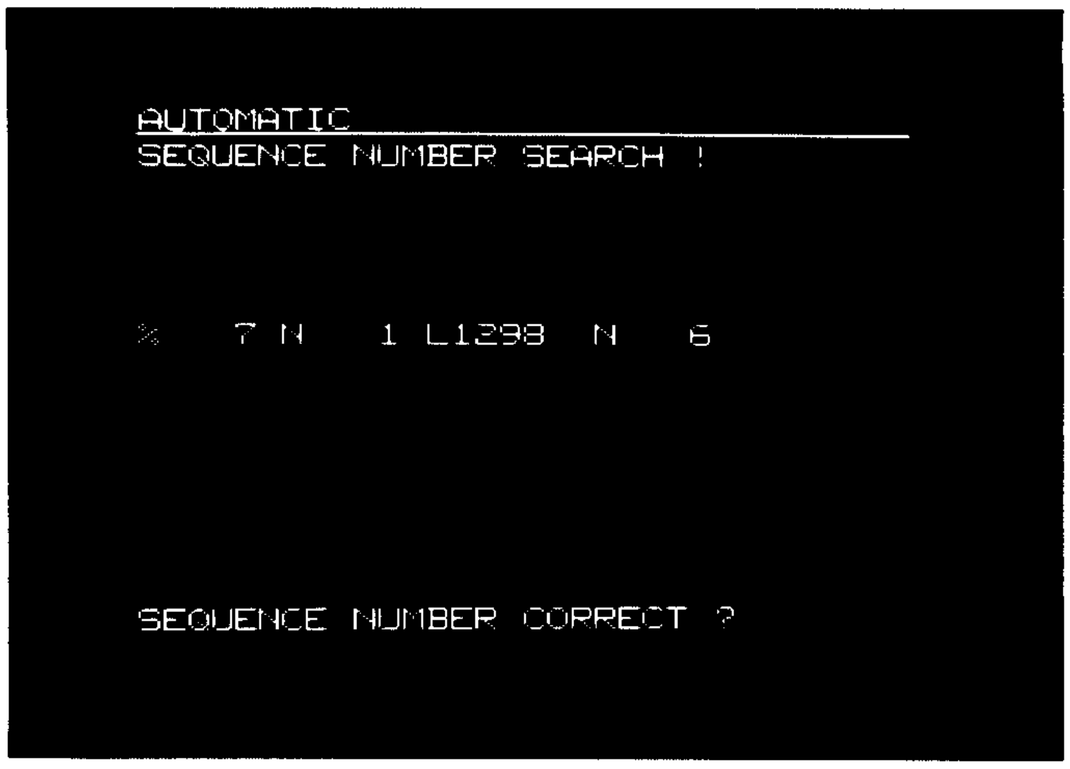
{ } {} Key switch (no. 38) enabled, where data entry is key protected (machine data)

{ } {} "Reset" pushbutton (no. 12), if control is not already in "reset" state.

Select automatic operating mode (selector switch 31)



Search pushbutton (no. 39)



The last active program state is displayed here; the program status indicator (block number) shows the last completely processed block, including the first nesting level. Line 15 displays the text for the operator dialogue.

YES

Block search to the displayed program status. The program is to be continued from the start of the block in which the interruption resulted.

Appears during the block search.
The control calculates the contour up to the displayed program block without any axis movement.

Appears following completion of the block search.
Request to press the cycle start button (no. 44).

Cycle start automatically traverses the axes to the starting point of the interrupted block (displayed program status) and thereafter the program is continued. Any deletable blocks are ignored, if the block skip (no. 41) is active.
The automatic screen is restored.

Dependent upon machine data, the switching and auxiliary functions (M, S, T, H) may be either outputted during block search, inhibited altogether, or outputted at the same time as cycle start (no. 44). In the latter case only the last programmed M, S, T, and H words are outputted. Any missing switching and auxiliary functions must be added following cycle start, with feed hold active.

9.6.2. Search to an arbitrary block

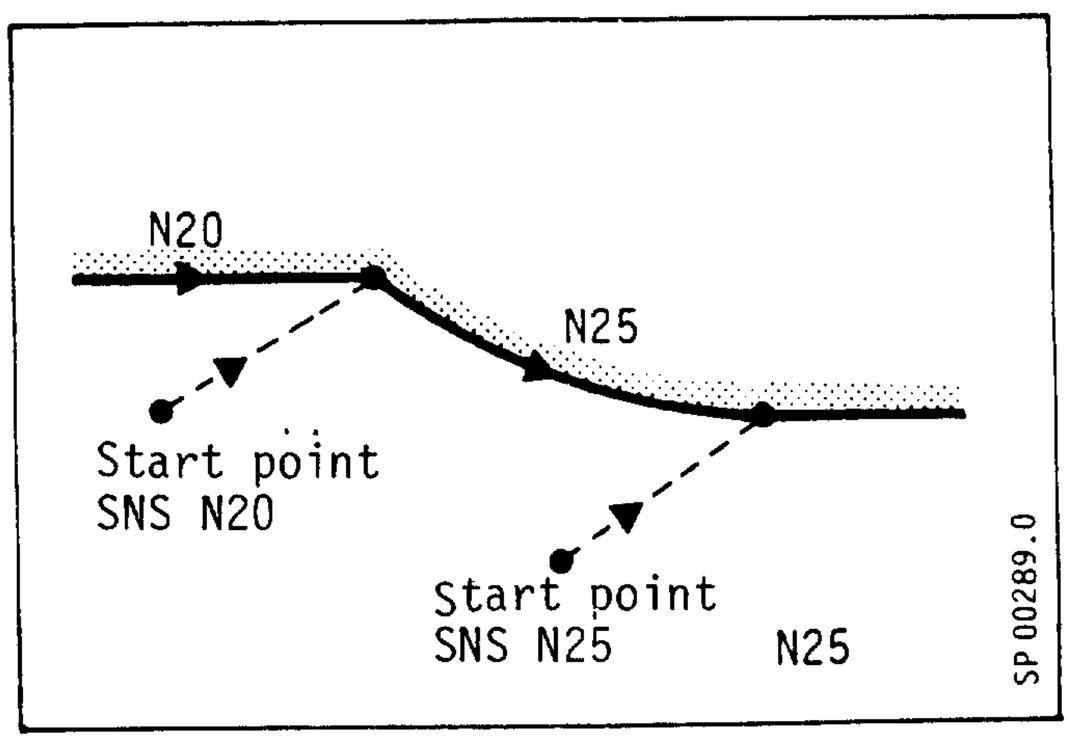
This search function allows program access at any arbitrary block of a part program or subroutine in the first level.
All calculations (tool dimensions, zero offset, parameter calculations, intersectional cutter radius and tool tip radius compensation) are carried out during the search.

The control automatically directs the tool to the end point of the selected block.

Dependent upon the part program construction, there are two operational sequences which apply in the case of block search:

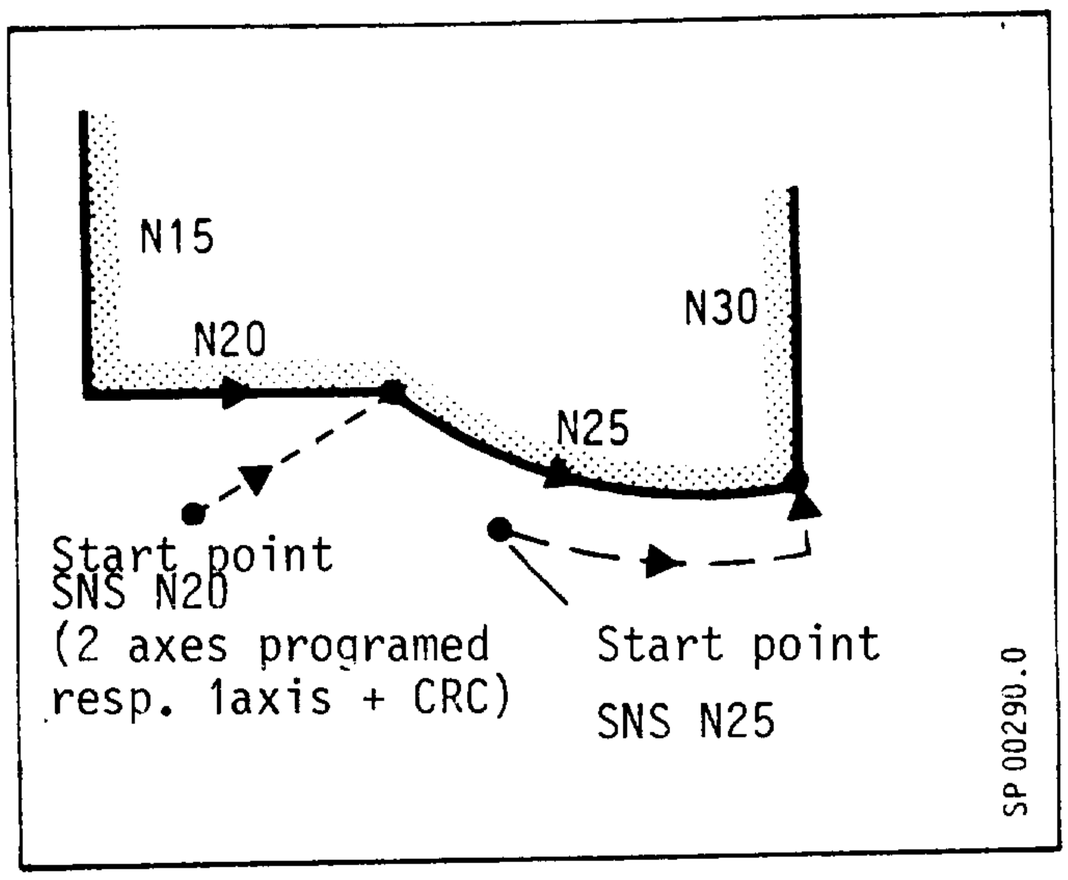
1. The first occuring path information of all axes are programmed with G90 (control knows therefore, the position of the workpiece zero point)

   3T: Using a sep up mode, position the tool in the vicinity of the contour, observing the correct machining direction, and before the end of the block that has been selected.



3M: If the selected contour includes either:
- 1 path movement and CRC is active or
- 2 path movements,

then the tool should be positioned using the set up mode, somewhere in the vicinity of the contour, observing the correct machining direction, and before the end of the block that has been selected.



If the selected block includes:
- 1 path movement,

then the tool should be positioned using the set up mode in the contour somewhere before the end of the selected block.

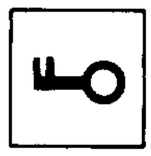
If the selected block includes:
- no path movement or
- 1 path movement without CRC,

then the axes are updated when they next appear in the program.

2. The path data of all axes are programmed with G91 (control does not know the position of the workpiece zero point)

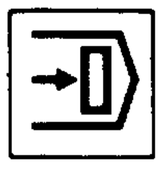
Before block search, all programmed axes must be on the position corresponding to the program start point. Following successful block search the operation is as described in the first part.

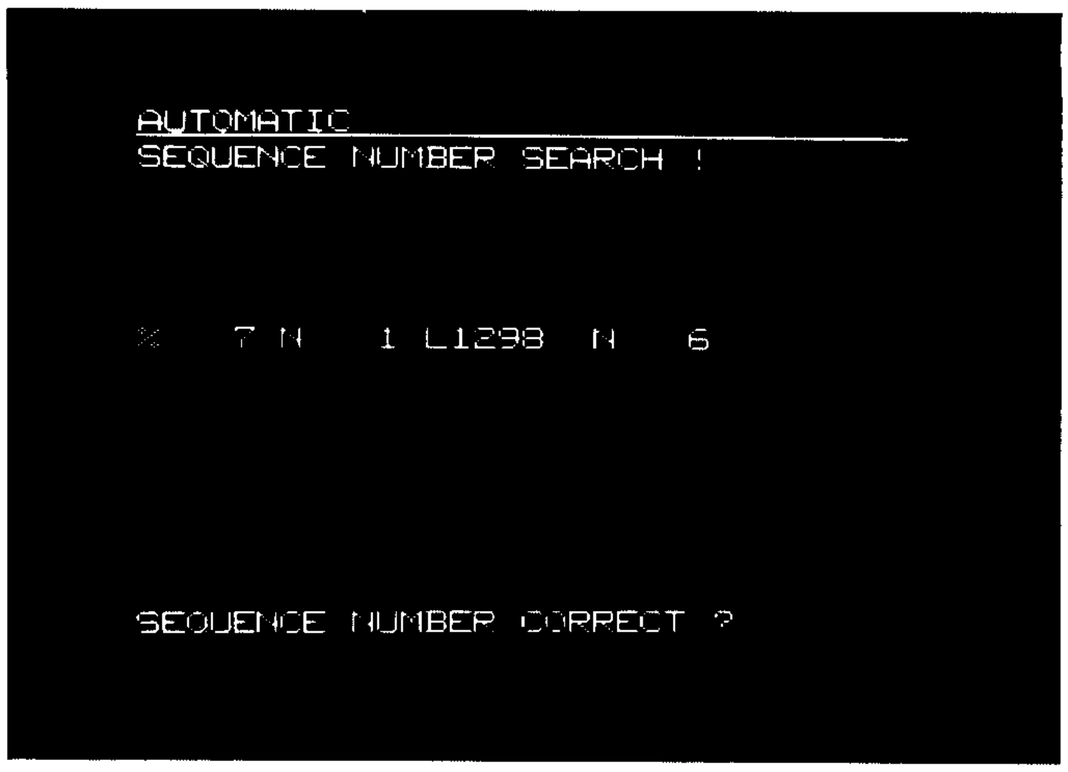
Operating sequence with operator guidance

{  } {} Key switch enabled (no. 38), where data entry is key protected (machine data)

{ } {} "Reset" pushbutton (no. 12), if the control is not in "reset" state already

Select automatic operation mode (selector switch 31)

 Search pushbutton (no. 39)



The program status, which was active most recently, is displayed. The machining cursor (block number) indicates the last block which was completely executed, inclusive of the first nesting level. The 15th row contains the operating guidance text.

NO Search to another block to that which is displayed.

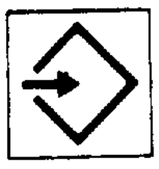
Row 15:

Operator guidance for the input of the block search target (e.g. N5, L1101, N10, selected main program 100)

N5

Input of the block number

L1101



Input of the subroutine number inclusive of the number of repetitions

N10

Input of the block number in the subroutine

YES

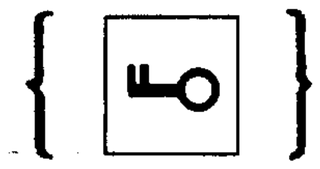
Block search to the displayed program status.
For continuing operation see: "Search to an interrupted block" (section 9.6.1.).

{ // }

Termination of SNS destination input
{ } (no SNS into the subroutine)

9.7. Program test

9.7.1. Dry run



If required, enable the key switch (no. 38) dependent upon machine data

Dry (no. 42)

Dry run feedrate
operational in automatic operation:

- Feedrates appearing in the program are suppressed. Dry run feedrate (TE 375) in mm/min is active.

- Rapid remains unaltered
  Feedrate and rapid override switches still function normally.

- With threading and feed/rev the dry run feedrate is simularly superimposed.

9.7.2. Syntax text

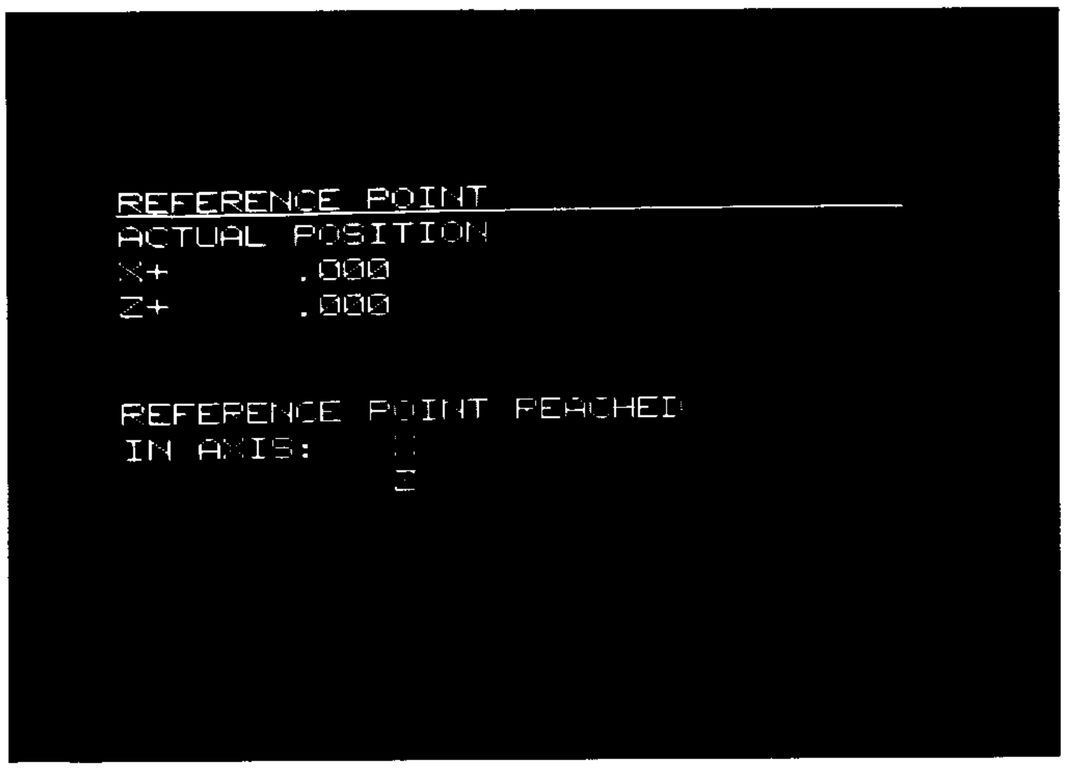
In automatic mode, the "Sequence Number Search" function can be used to check whether the programs to be processed comply with the program format. The sequence number search indicator is hereby set to the end of the part program. If an alarm is displayed, the block number of the last correct block will be indicated (for selection and operation sequence, see 9.4.2.).

10. Return to datum REF

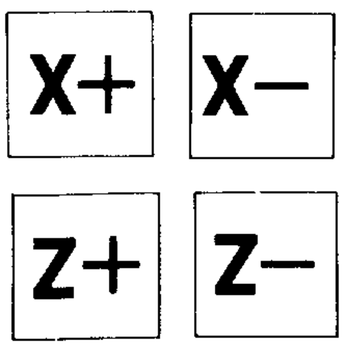
A reference or datum point is fixed for each axis of the machine and serves as the starting point for the program.

This establishes a reference between the measuring system and the machine which enables them to be synchronized at any time, even after the control has been switched off.

Return to datum mode (selector switch 31)

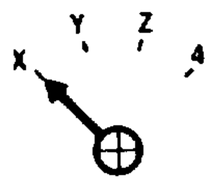


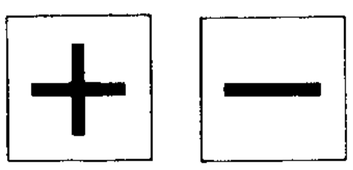
For 3T



After pressing the appropriate direction button (no. 34), the axis moves to the reference point (self-retaining direction).

For 3M





After pressing the appropriate direction button (no. 34), the axis moves to the reference point (self-retaining direction).

Line 1 of the display indicates the axes which have returned to datum.

The direction selected before the start of the move is checked. (Wrong direction: the operation will not take place, i.e. there is no movement.)

The reference point return for each axis must be done sequentially.

The actual value counter of the axis just moved to the reference point will be set with the value of the reference point coordinate.

Feed hold is active as is the feedrate/rapid override switch when the "Rapid override switch active" (no. 43) is actuated.

The return to datum speed is set by a machine parameter during commissioning.

11. Manual data input with operator dialogue, part program MDI-PP

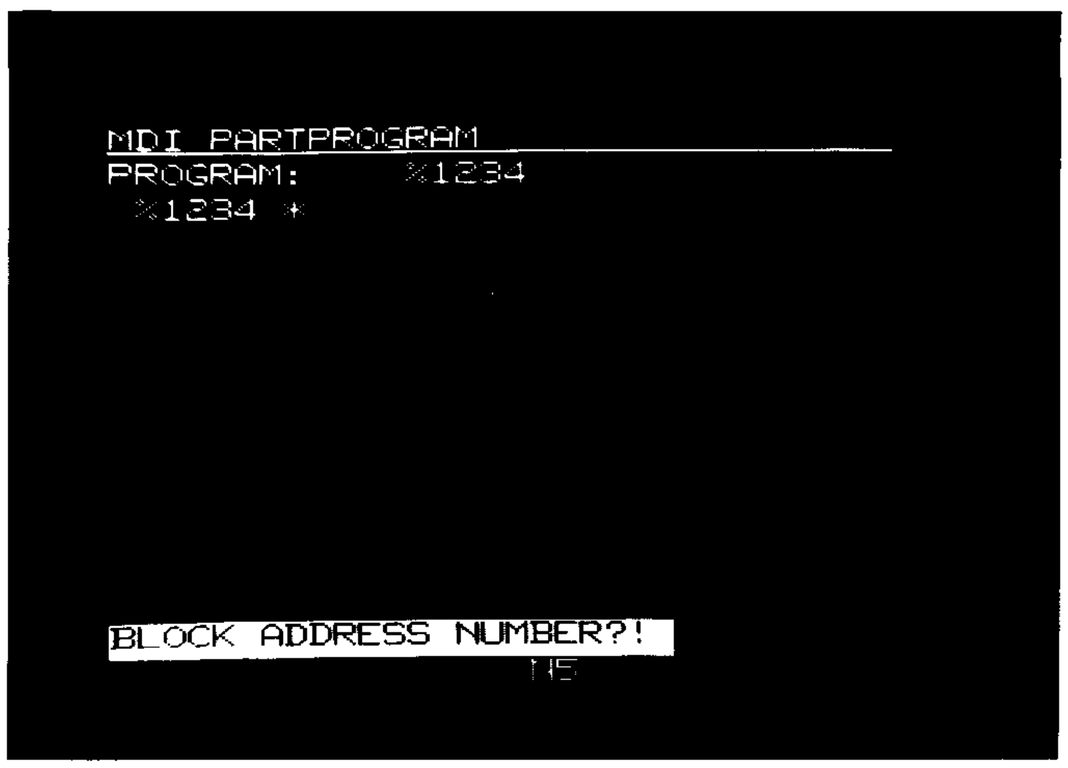
Dialogue function is activated via the bit-oriented user data (see 8.4.).

11.1. Input of part programs into the memory

{ F0 } Key switch enabled (no. 38)
{} dependent on machine parameter.

% 100

The new input of a program follows the selection of a program number, which is not currently in the memory (in this case %1234). If the programm %1234 is already stored, it will be displayed.
The cursor is located behind the first program number.
When a program %1234 is not in store, the first block "%1234 LF" will automatically be stored and displayed on line 3. The cursor is located behind the LF.

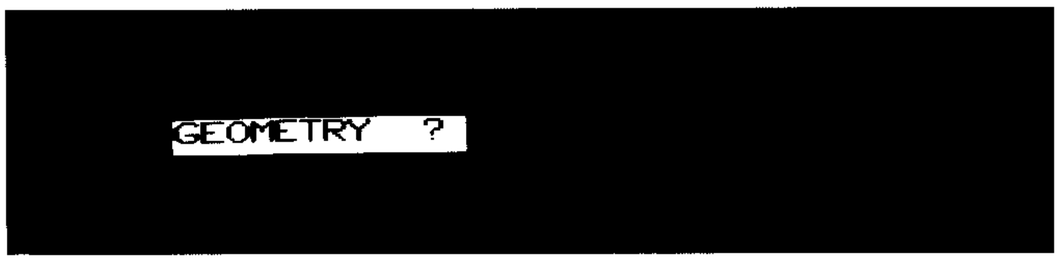


YES - Block number is stored

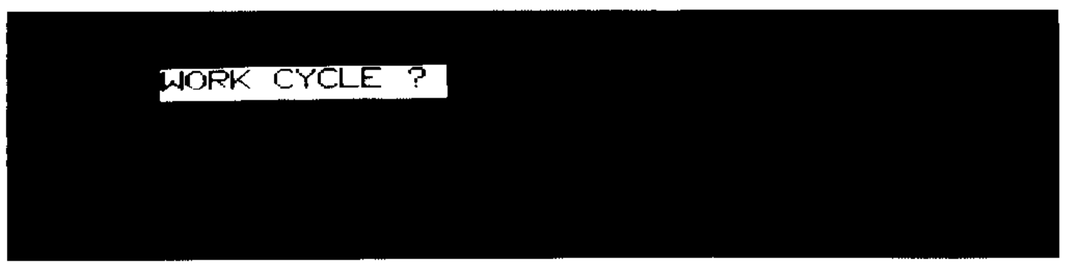
or

NO - Block number is not stored

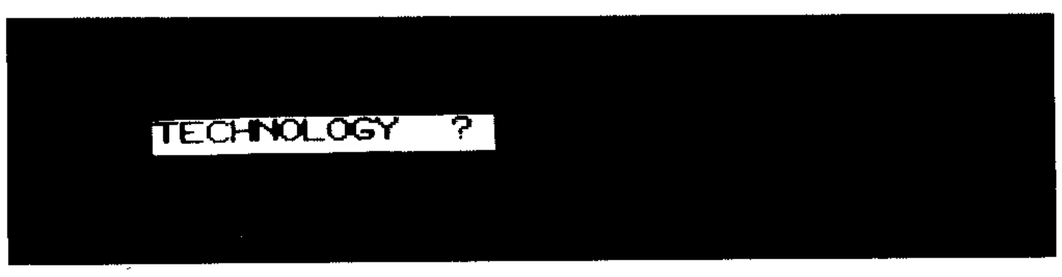
The requests to the operator appear in the 15th display line.
During the dialogue, the operator can answer with an "Input" and/or "YES" or "NO".
The operator dialogue function divides the part programs into 5 sections:



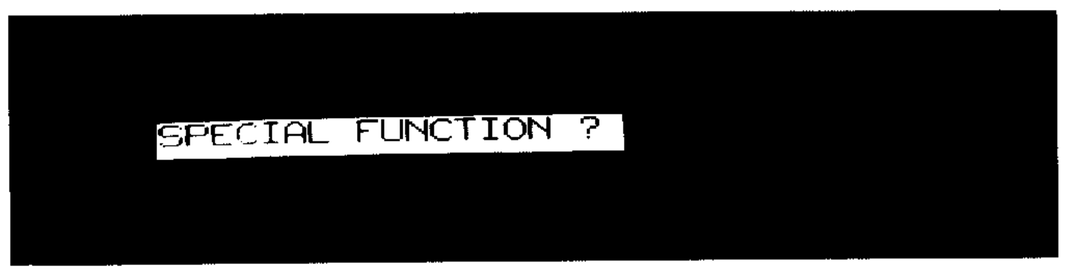
Geometric



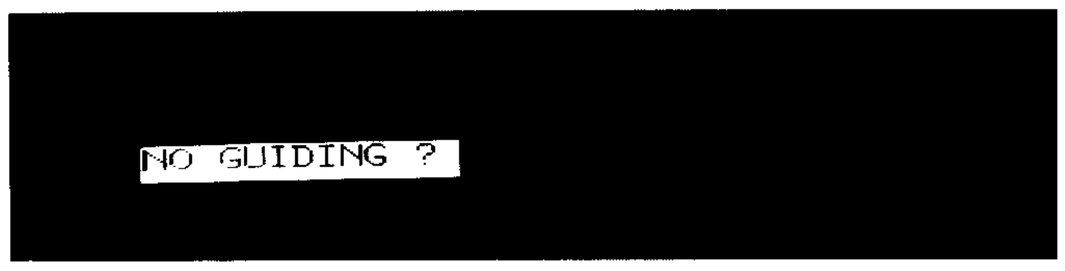
Work cycles



Technology



Special functions



No guiding

NO - causes a switching to the next section

or

YES - activates the selected function

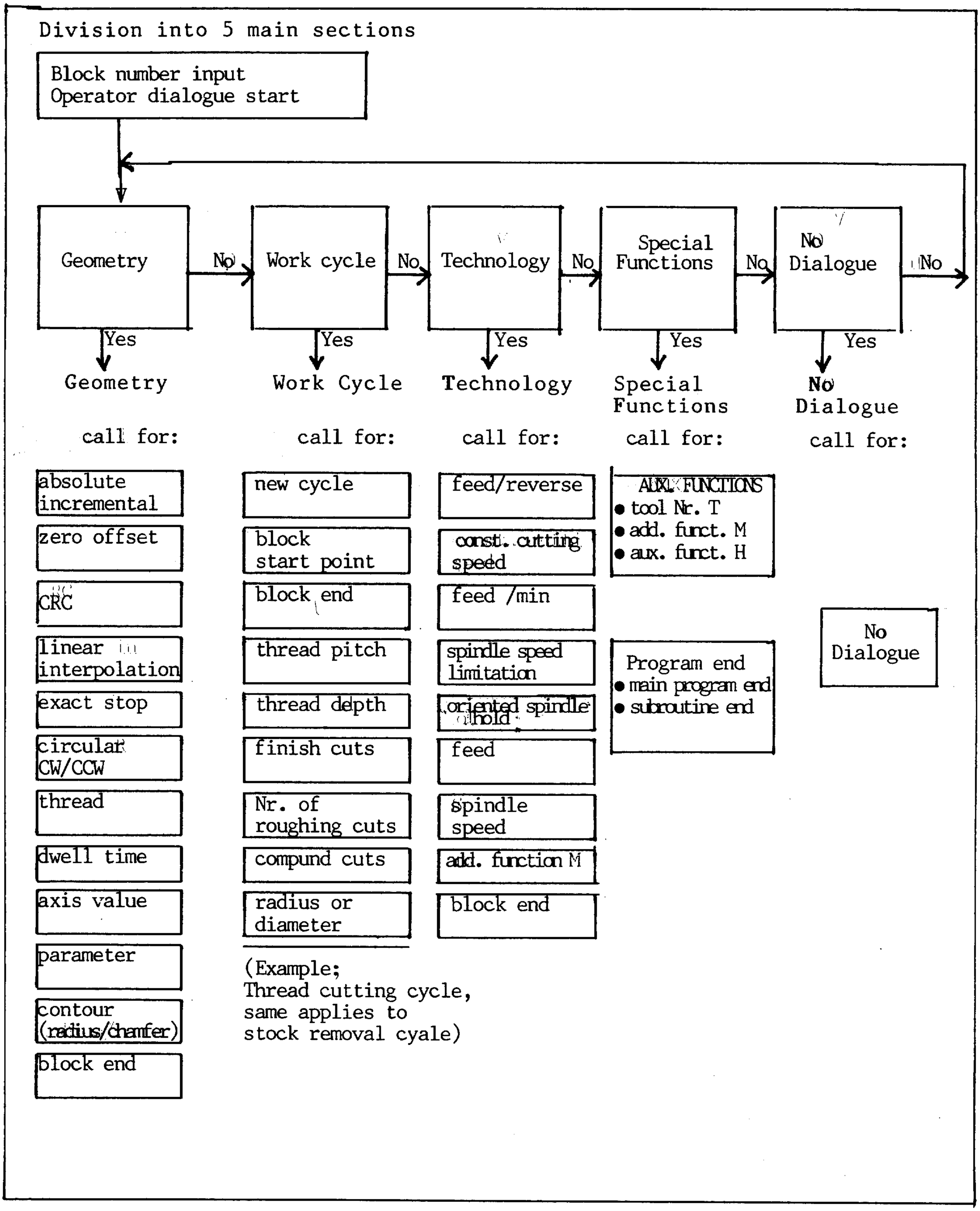
In the 5 sections can be entered the following functions:

Geometric	G90, G91 G53, G54, G55 (G56, G57) ① (G17, G18, G19) ① G40, G41, G42, (D) ① G00, G01, G02, G03, G33 G04 (G09) ②, (G60) ① (G63, G64) ① G59 Rdius, chamfer
Work cycles	Stock removal cycles Thread cutting cycles (parameter programming)
Technology	(G92 S..) ② G94 G95 (G96) ② F, S, M
Special functions	T.. M.. M17 M30
No guiding	All program corrections are possible (no operator dialogue)

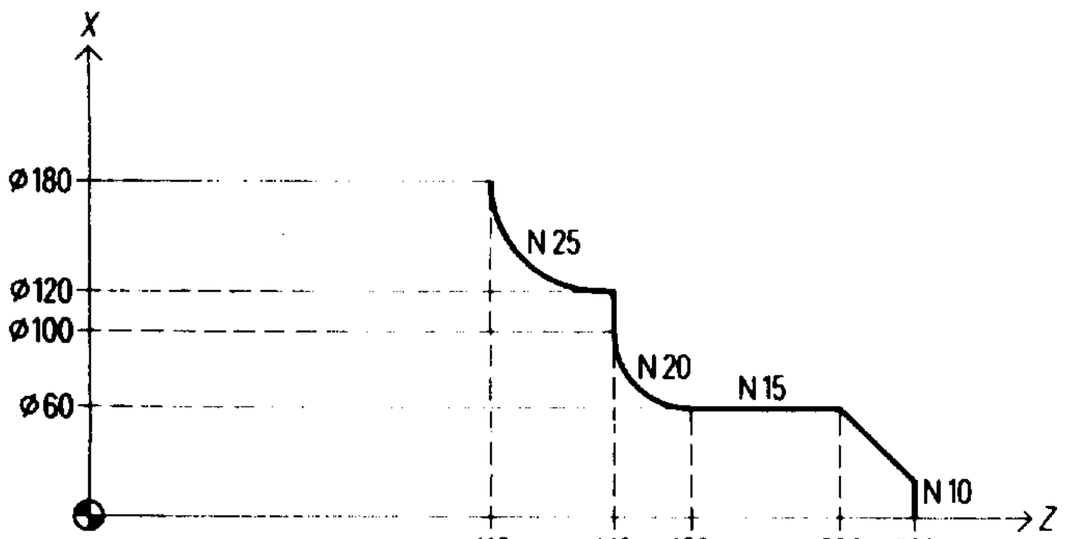
① only for 3M

② only for 3T

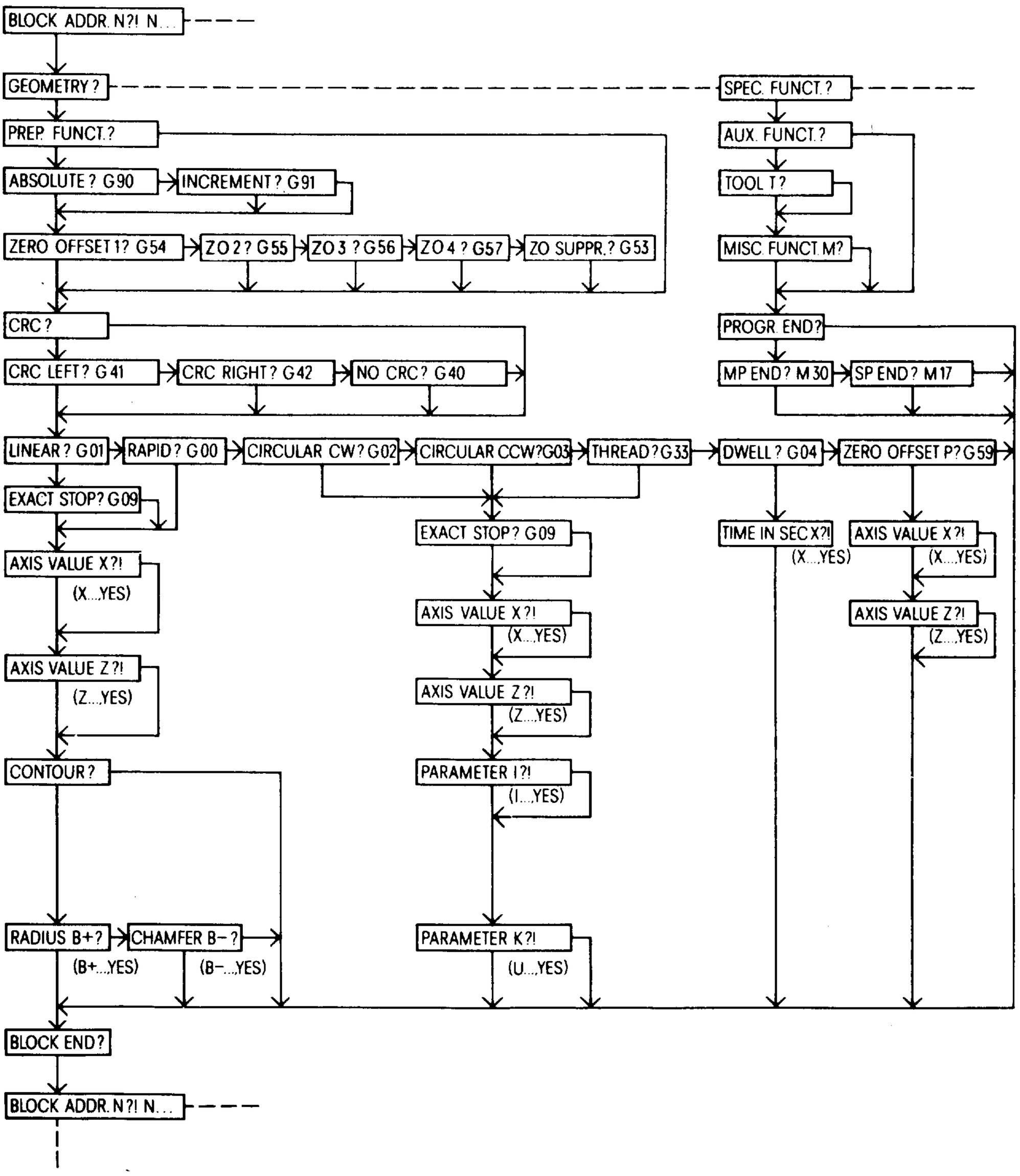
11.2 Overview (Data Input 3T)



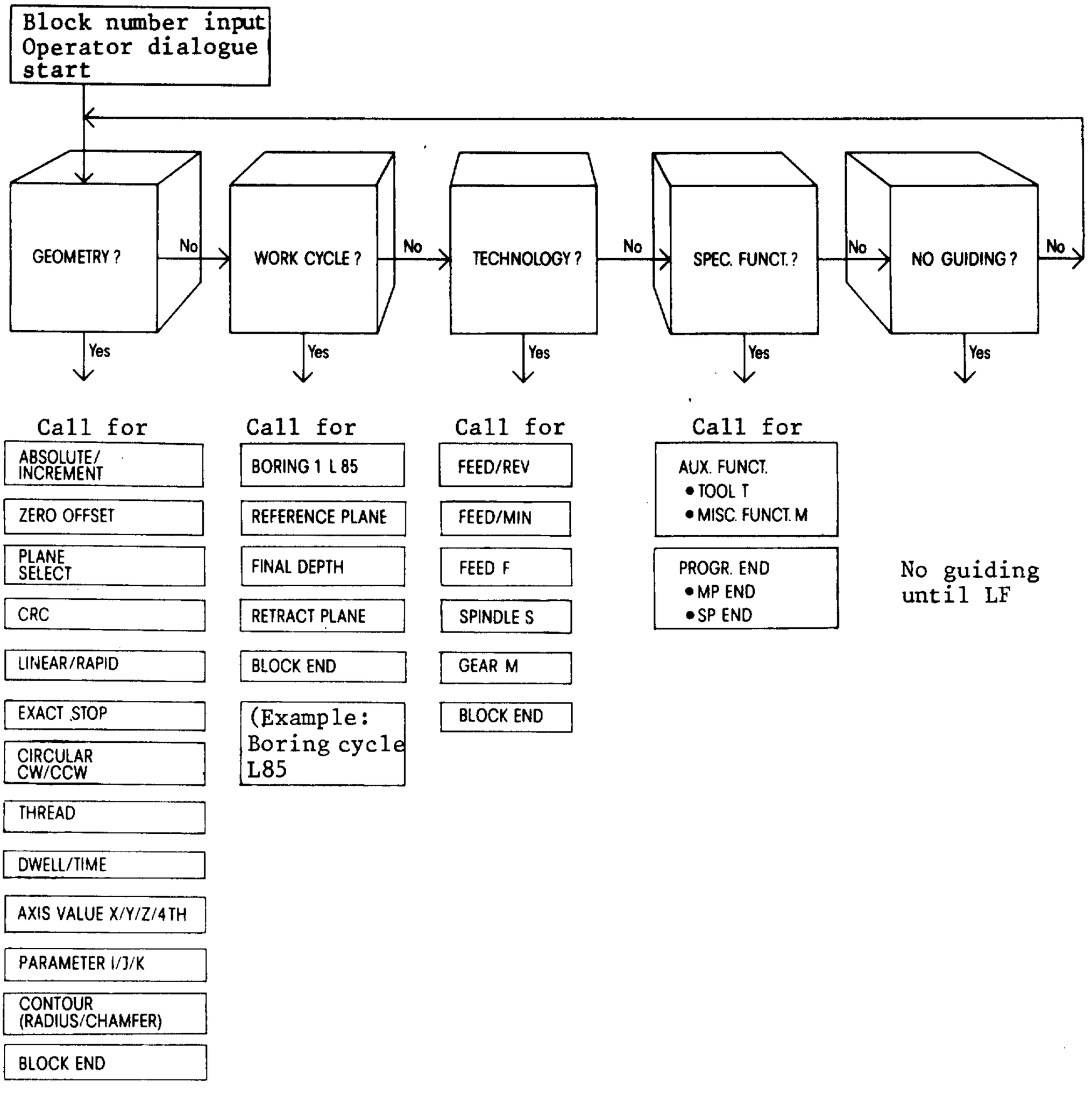
11.3. Example Program input 3T



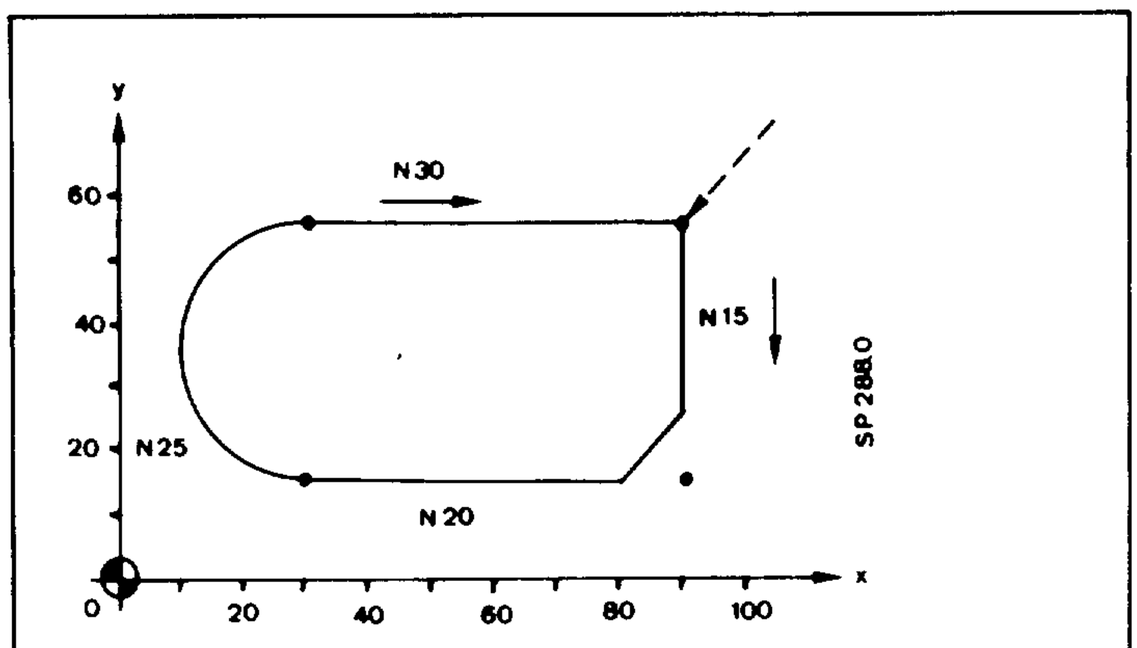
N5	G90	G54	G42	G00	X0	Z220	LF
N10	G01			X60		B-20	LF
N15				Z140		B20	LF
N20				X120			LF
N25	G02		X180	Z110	I30	K0	LF
N30	M30						LF
110	140	160		200	220		



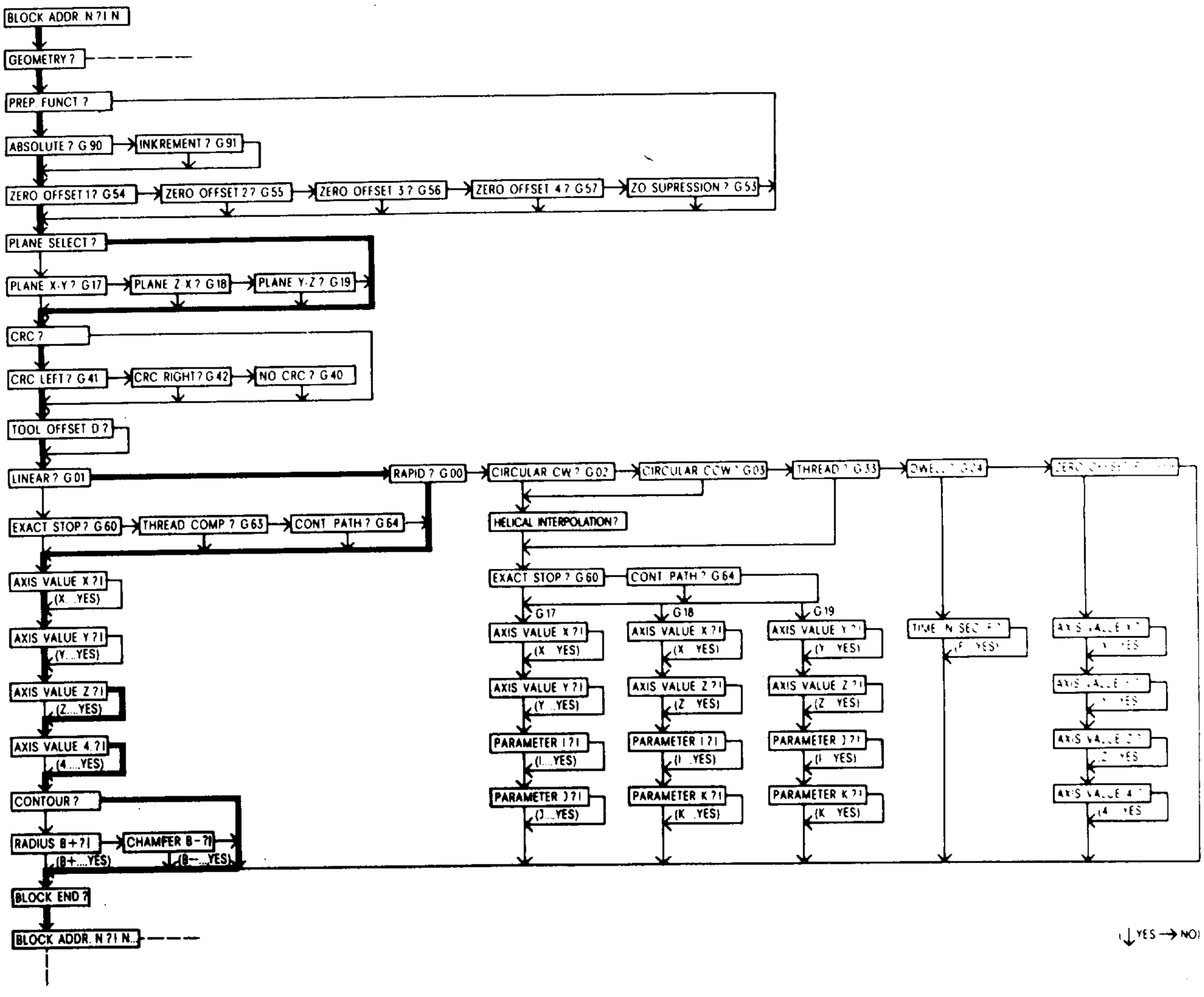
11.4 Summary (Data input 3M)



11.5. Example Program input 3M

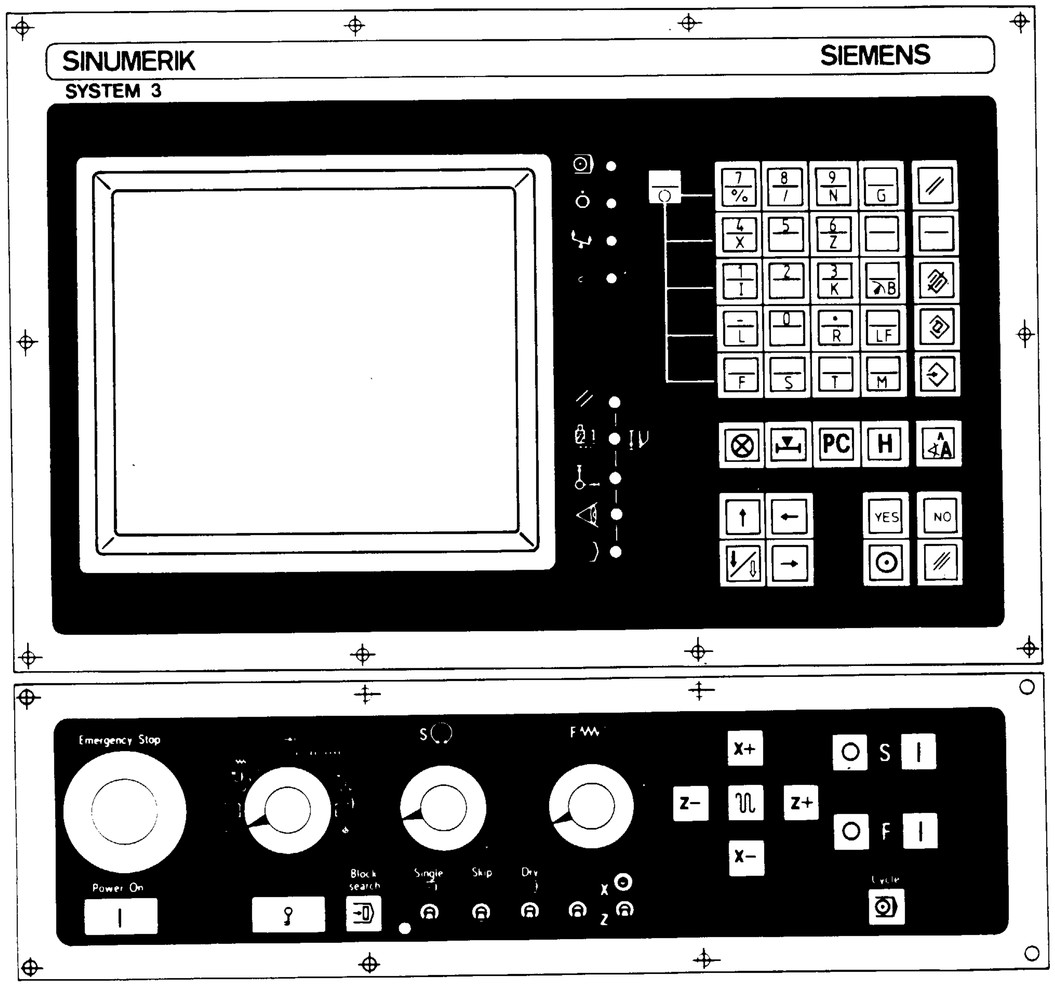



```
N5  G90 G54  G41  D5 G00 X90 Y55 LF
N10 G94 F500 LF
N15 G01 Y15  P-10 LF
N20     X30  LF
N25 G02 X30  Y55  I0 J20 LF
N30 G01 X90  LF
N35 M30 LF
```

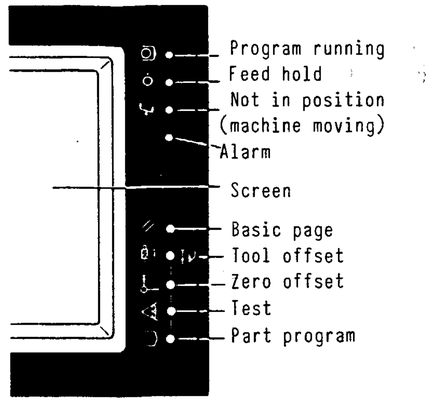


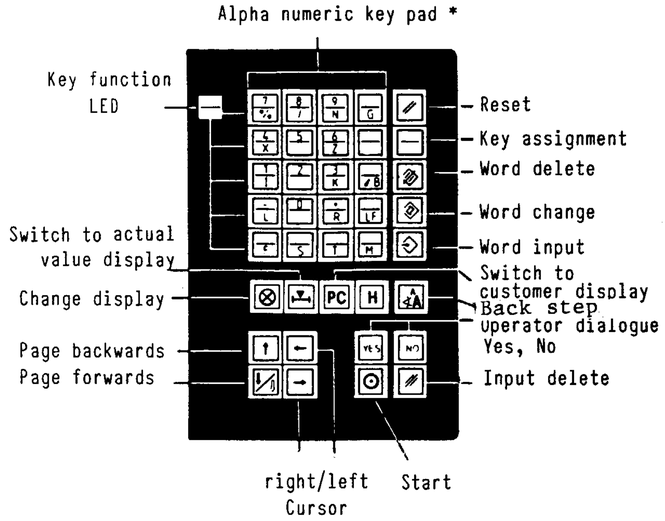
12. Appendix

12.1 Operator Panel and Machine Control Panel



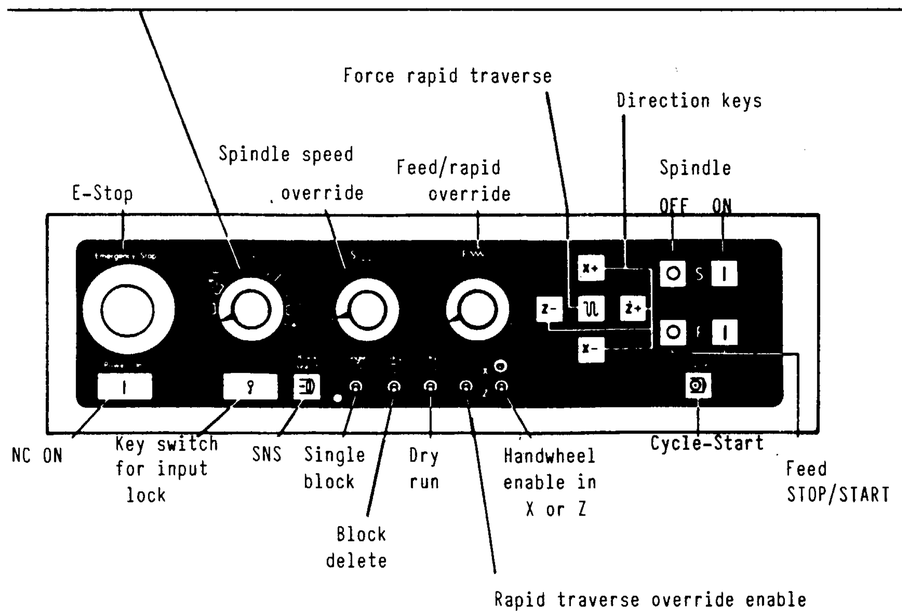
Operator Panel





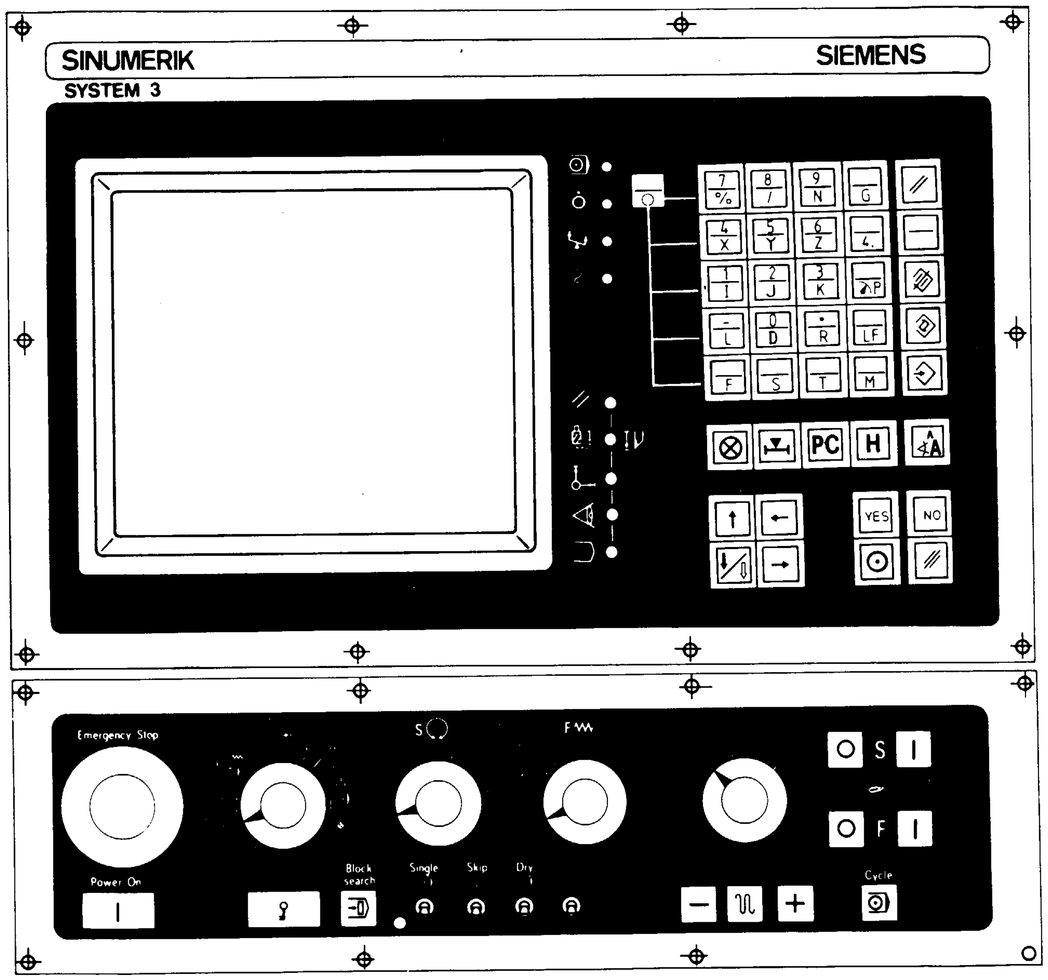
Machine Control Panel

Mode selector switch	Data output	Automatic with MDI	Feed rate	Incremental	Manual input	Reference point approach
	Data input	Teach-in, Playback	Rapid Traverse Handwheel	MDI Part prorgams	ZO,TO, TEST Automatic	

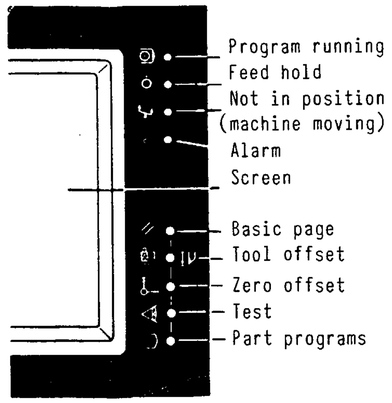


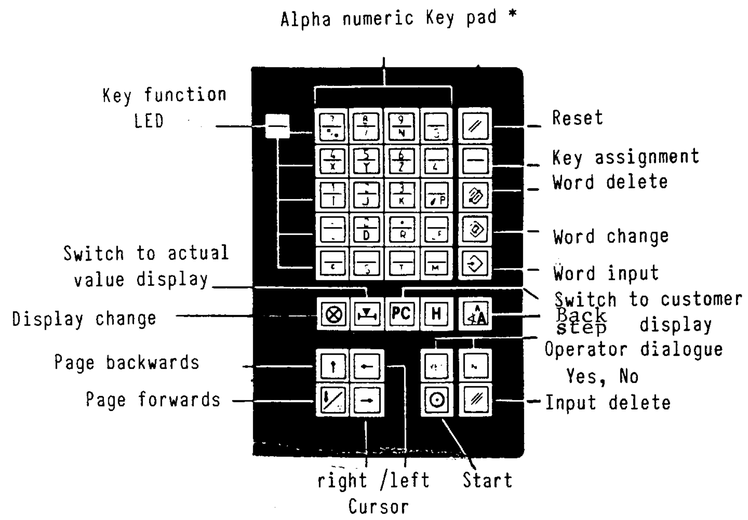
* The special character @ can be entered with double keying, in the sequence %. (percent followed by decimal point).
The 3T with C axis has additional C and J key functions.

12.2 Operator Panel and Machine Control Panel 3 M

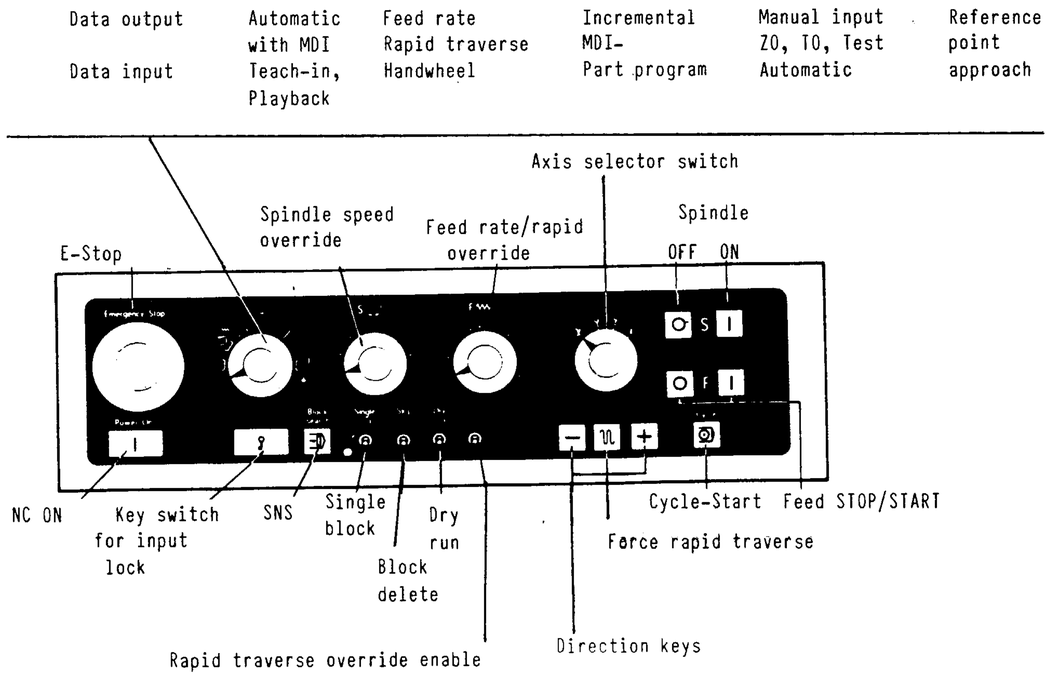


Operator Panel 3 T





Machine Control Panel



* The special character @ can be entered with double keying, in the sequence %. (percent followed by decimal point).

12.3. Abbreviations, operator panel texts and text interpretation

ACTUAL POSITION	Actual values
ACT. VALUE	S, F actual values
ALARM	Alarm
AUX. FCT.	M, T (D) functions (Auxiliary Functions)
AVAILABLE MEMORY	Available space for a part program storage
AXIS	Axis
AXIAL COMMISSIONING DATA	Machine data, axis specific
BLOCK SEARCH	Sequence number search
Cancel	Cancelling in the store
CH	Character
Clear	Delete of the input
CW	Clockwise
CCW	Counterclockwise
COMMISSIONING DISPLAY DATA	Machine data service values
CONTROL IN ACTION	Waiting message
CORRECTION BLOCK	Last block to be influenced by program correction
Cursor	Cursor
Cycle Start	NC start
DATA INPUT	Data input
DATA OUTPUT	Data output
DIFFERENCE VALUE	Difference between command and actual value
DRY	Dry run
Emergency Stop	Emergency stop
Feed	Feed
GENERAL COMMISSIONING	Machine data bits
HANDWHEEL CALIBRATION	Handwheel calibration
HOLD AUTO INTERR	Interrupt of automatic mode
HOLD NO DATATRAN	No release of read in

HOLD INTERR M00	Programmed hold
HOLD SINGLE BLOCK	Single block
HOLD DWELL TIME	Dwell
INC FEED	Incremental feed
INPUT SIGNALS	Input signals from the interface
JOG	Feedrate/Rapid traverse, jog, hand-wheel jog
M	Feedrate in mm/min
MDA	Automatic manual data input
MDI SE-TE	Manual data input
MISC. FUNCT.	M functions
OUTPUT SIGNALS	Output to the interface
OPERATOR GUIDING	Operator guiding
Page	Paging
PART PROGRAM	Part program
PC	Programmable control
PC FAULT	PC fault
Power On	Control on
Program	Program
R	Feedrate in mm/rev
RAPID	Rapid traverse
REFERENCE POINT	Reference point approached
SETTING DATA	Setting data
SEQ NUMBER CORRECT	Sequence number correct?
SET-VALUE	Command values for F, S
Single	Single block
Skip	Skip block
Spindle	Spindle
TAPE BLOCK PARITY	Tape block parity
TOOL NUMBER	Tool number
TOOL NUMBER CORRECT	Tool number correct?
ZERO OFFSET	Zerso offset
ZO NUMBER CORRECT	Zero offset number correct?

12.4. Operator data

Setting Data NUMBER 25

N	Bit = 0	Bit = 1
0		
0		
0	Punch in ISO code	Punch in EIA code
0		
0	Program start with %	Program start with LF
0	Block parity OFF	Block parity ON
0	Operator dialogue OFF	Operator dialogue ON
0	Actual value display in reference to machine zero point	Actual value display in reference to workpiece zero point

Setting Data NUMBER 26

N	Bit = 0	Bit = 1
0		
0		
0		
0		
0		
0	Handwheel pulse valuation increment per division 0	Handwheel pulse valuation increment per division 100
0	Handwheel pulse valuation increment per division 0	Handwheel pulse valuation increment per division 10
0	Handwheel pulse valuation increment per division 0	Handwheel pulse valuation increment per division 1

12.5 Alarm List

Clear	Nr.: 3rd. Decade / 1.+ 2nd Decade	8 Bit 7	7 Bit 6	6 Bit 5	5 Bit 4	4 Bit 3	3 Bit 2	2 Bit 1	1 Bit 0
	00				Axis 1			Axis 1	Axis 1
	01				Axis 2			Axis 2	Axis 2
	02				Axis 3			Axis	Axis 3
	03				Axis 4			Axis 4	Axis 4
	10	Measuring System contamination error: Axis 1			Drive enable for moving axis: Axis 1			Limit switch -: Axis 1	Limit switch +: Axis 1
	11	Axis 2			Axis 2			Axis 2	Axis 2
	12	Axis 3			Axis			Axis 3	Axis 3
	13	Axis 4			Axis 4			Axis 4	Axis 4
	22	Spindle encoder contamination error			Spindle speed too high	Spindle measuring loop *) monitor	E-Stop	Control not ready	
	23	Time monitor RS232 interface	Overflow 2 Reader Hardware Error	Step Lock error	Overflow	Parity	Control word superimpose	Overflow 1	Step lock parity error
	24							Over-temperature	
	25		Block w/o LF, or block 120 characters			Operator error RS232-Interface	Parity error in memory	Program not available in memory	Block not available in memory
	26							Stop at Threading 1)	No coincidence found in SNS
	27	Memory Overflow	Stored Prog. =/= tape prog.	Tape format error	Tape input locked	Block with more than 120 characters	Block parity error	Dissallowed EIA character	Character parity error
	28	Subroutine error	Intersection error						General decoding error
	29		Wrong input parameter	Wrong block sequence	Incorrect G02/G02	Incorrect radius value	Incorrect angle value	No intersection	Incorrect input value

V.24 alarms

Control Hardware* loop

Drift too high

Speed command value too high

Standstill monitor

Contour monitor

Contour Errors

*) cleared only with PORESET

1) Software edition Ø 2

Alarm List (Continued)

Clear **	Nr.: 3rd Decade / 1.+ 2nd Decade	8 Bit 7	7 Bit 6	6 Bit 5	5 Bit 4	4 Bit 3	3 Bit 2	2 Bit 1	1 Bit 0
	30	Circle end-point error				Zero offset too large/ tool offset not allowed		Option not available	Circle not in the selected plane
	31		Too many axes to be moved	No F-word programed or top high		Thread lead incorrectly programed			
//	32							Inadmissable block with CRC/TRC	
	33								
	34								
	35								NC start w/o reference point
	50	Axis 2x or more than 2 axes prorgamed	T2C/CRC contour error	contour error	error in toolef descrip-tion of contour	Incorrect block structure	Reparable Prog. errors	More than 6 geometry parameters	General
//	51	Software prelimit switch over travall.		Whole block cannot be displayed	Search block not available	Block with more than 120 characters	Memory overflow	Input locked	Input only in Reset condition
	52	KV-factors not defined	Axes KV-factors unequal				Stop at 1) Threading		Strobe input error
	53	Contour monitor errors: General input error	Last prog. not terminated	Only 2 axes permitted in Playback	Playback allowed only when axes stationary	Playback only OK when MDA	Playback not allowed as 1st block	Prog. Nr. already used	Block with more than 40 charact
						MDA errors			
Rerun	70							Incorrect address code in machine datum	
	71								Battery alarm

** The input line (bottom) must be completely cleared !
Error 70X cannot be cancelled with either RESET nor CLEAR !
Error 71X can be cancelled with CLEAR !

1) Software edition Ø 2

12.6. Alarm description

Alarm no.	Description and handling
1, 2 11, 12 21, 22 31, 32	Overtravel The alarm is also displayed when a software limit is reached (entered value under TEST N160-N173). (Inputs related to the reference point.) The axis is stopped under loop control, with the following error closed out. Jog the axis off in the opposite direction and clear the alarm with the red Reset pushbutton.
5, 15, 25, 35,	Controller enable for traversing axis lost The alarm is displayed, if a controller enable signal is lost. All axes are rapidly decelerated and the controlling loops disabled (EMERGENCY STOP). Establish why the controller enable signal has been lost. (Interface diagnostic test - see commissioning manual.) The alarm is cleared with red Reset pushbutton. A program restart is necessary.

Alarm no.	Description and handling
101, 111, 121, 131	<u>Clamping check</u> A clamping error occurs if the fixed "Clamping Tolerance at Stillstand" is exceeded or if an axis does not reach position in a pre-determined time interval. Possible causes: - An axis which should be stationary, is displaced by high mechanical forces or a servo controller, tacho, motor, mechanical or a measuring loop hardware fault is detected. - An axis stays out of position because for example, the drift is too high. - A mechanically clamped axis is forced out of position. - See Commissioning Manual, N353. <u>Handling:</u> - The Clamping Tolerance TEST N110 - N113 must be bigger than the Inposition Tolerance TEST N100 - N103. - The "Position Checking Delay" TEST N353 must be long enough to permit the following error to be fully closed before the time period has been exceeded. - An axis is forced out of position by another axis by the distance defined under TEST 110 - N113 (Clamping).

Alarm no.	Description and handling
102, 112, 122, 132,	<u>Speed command too high</u> This alarm is internally generated and displayed by the control, if the speed command value exceeds the value defined under TEST N354 (speed command limit). This command is generated, if a motor cannot follow the command output (maximum following error will be exceeded). Check that the value entered under TEST N354 is 20% larger than the "Command Value Limit" defined under N140 - N143.
103, 113, 123, 133	<u>Contour checking</u> This alarm is displayed, if the contour tolerance defined under N103...130 is exceeded and the drives are decelerated in current limit with a Ø command value. Additionally, the feed enables are removed from the drive controllers thus switching into the "Follow Up" mode. Clear the alarm with Reset. Generation of alarms 103...133 indicates that a drive controller is badly optimised or the K_V factor is too large or if TEST N351 and TEST 352 are defined with zeros. Alarms 103...133 are generated, if the tolerance defined in N352 is exceeded or when the drives are accelerating or decelerating and do not reach the new speed demanded within the time period defined by the K_V factor. Perhaps program G09 - exact stop.

Alarm no.	Description and handling
104, 114, 124, 134	<u>Measuring loop hardware fault</u> An alarm is generated if a measuring loop cable breaks, short circuits or signals are missing. A hardware fault on the measuring loop card initiates an immediate stop of all axes (see Commissioning Manual). Check the measuring loop cables.
105, 115, 125, 135	<u>Drift too high</u> The control corrects for drift (influence of temperature upon components) in the control loop (see chapter 8.6.5.). If the compensated drift exceeds ca. 500 mV, the alarm is displayed. The motion lamp stays switched in if a control loop or drive is not ready or a controller enable is missing or there is a hardware fault in the loop, or in the drive, or the drive drift is set incorrectly. Re-adjust the drift (Commissioning Manual). (Display the drift under TEST N230 - N233.)

Alarm no.	Description and handling
108, 118, 128, 138	<u>Contamination fault</u> A hardware signal from the EXE Unit indicates a linear scale fault (see Interface Description, Chapter 7).
222	<u>Servo loop not ready (loop input signal)</u> This is handled in the same way as a fault in the controller. The alarm is displayed, if the controller ready signal is lost (common from all axes!), e.g. blown fuse, overtemperature etc. This alarm initiates rapid deceleration of the feed drives and loss of the signal "Servo Controllers Ready". Bridge P - N "Servo Ready Simulation": if this is not used in the interface (see Commissioning Manual).
223	<u>EM Stop</u> is displayed, if EM Stop is active. Check if an emergency stop has been pressed or the machine has reached the emergency stop cam. (Interface test no. 8, byte 5, bit 7 = "0".) The alarm stops axis movement and disables the servos.

Alarm no.	Description and handling
224	<u>Spindle loop check</u> The spindle hardware check is only active if N407, bit 2 is "1" (encoder fitted). This signal is generated, if the input signals A, A*, B, B*, Z and Z* are faulty or missing. The alarm causes the spindle to stop. The respective signals must have different polarities (e.g. A A*).
228	<u>Spindle encoder contaminated</u> Alarm generation in preparation. ROD encoders do not have contamination signals. <u>Only</u> with scales fitted to EXE 600/601 (linear system) units Alarms 108...138

Alarm no.	Description and handling
	Reader hardware faults
231	Stop bit error, parity error This alarm is only active with the Siemens paper tape reader. - Machine parameter - Reader
232	Overrun 1 This alarm is only active with the Siemens paper tape reader. - Module MS600 on reader
233	Control word overwrite This alarm is only active with the Siemens paper tape reader. - Module MS600 on reader
234	Parity error Alarm 234 is triggered if data words from the reader (8 bit information + 1 parity bit) have odd parity. This type of error is unrelated to parity errors of ISO or EIA characters of tape (see alarm 271). MD411 or 412 bit 4 must be triggered as precondition for the display of alarm 234. Check MD setting and external unit.

Alarm no.	Description and handling
	Reader hardware faults
235	Overrun fault This alarm is triggered when a new character is sent before the control has read (stored) the previous one. - Check MD setting and external unit. - Error in USART interface - Cable
	USART hardware faults
236	Stop bit error This alarm is triggered when the number of stop bits set is incorrect. Check MD setting and external unit.
237	Overrun 2 This alarm is only active with the Siemens paper tape reader. - Reader - Module MS600 on reader
238	Time V.24 interface This alarm will be displayed, if the NC cannot output data within 20 seconds or does not receive any data over the same period. Cause: - External unit not switched on - Wrong cable - External unit blocks the CTS signal for longer than 20 seconds - In the NC does not receive a DC1 (11H) within 20 seconds during data output (when use is made of the control signals (DC1 - DC 4).

Alarm no.	Description and handling
242	Over-temperature The alarm is displayed, when the temperature of the modules reaches the temperature limit of 59.7°C - NC ready 1 is lost. The interface disables the read in enable, i.e. only the active block will be executed. Check the fans and the air ways. If the internal control temperature is lower than 59.7°C, the temperature switch on the CPU module must be checked. The CPU S2 sensor switches at 56°C.
251	Block not stored in memory e.g. when jumping to a block number
252	Program not stored in memory The selected part program does not exist in the memory.
253	Memory parity fault
254	Operating error V.24 interface - NC operating mode data output with data start from PC - V.24 memory available with data start from PC or operator's panel - Code for Siemens reader input in MD 412
257	Block without an LF or a block exceeding 120 characters or M02, M30 without LF
261	During search no coincidence was found This alarm is generated, if during program search the required block or subroutine was not found before the end of program, i.e. the searched block or subroutine is not stored in the program memory.
262	Stop during threading This alarm is an indication to the user that a stop was encountered during threading, and that the thread is damaged (feed per revolution stop).

Alarm no.	Description and handling
271	Character parity error Following the definition of the program start "%" or "EOR", the control automatically establishes the code structure to be either ISO or EIA. All the following characters are checked to see whether they conform to the established parity requirement. When not, alarm 271 is generated.
272	Invalid EIA character If, in spite of correct parity, a character not in conformity with the EIA code is read in, alarm 272 is displayed.
273	Block parity error When block parity (setting data) is active, all the characters within a block are counted. In the cases where the count is not even, alarm 273 is displayed. Independent of the setting data, when punching tape from the control, even block parity is generated and as necessary, spaces are punched.
274	Block within more than 120 characters This alarm is generated if a block has more than 120 characters. Only the characters which are stored are counted i.e. CR feed-holes spaces are not counted. Exception, within comments. - Divide the block up.

Alarm no.	Description and handling
275	<u>Tape input disabled</u> This alarm is generated: a) When trying to read-in part programs or subroutines with machine parameter "Key switch enable" set, and the key switch turned "OFF". b) When trying to read in a machine parameter (TE) tape with the data protect switch on the CPU not in the "FREE" position.
276	<u>Punched tape format error</u> Alarm 276 is generated if: a) the number of decades for an address is exceeded. b) a decimal point is sensed in the wrong position. c) a part program or subroutine is incorrectly defined or ended. d) the format for a deletion of programs is wrong.
277	<u>Stored Program @ the punched tape program</u> If a punched tape is read in more than once, the contents, block for block, are compared to the originally read-in stored program. Where a difference is recognised, alarm 277 is displayed. This alarm is also encountered, if a new program is to be stored with the same program number as a previously entered program. The currently stored program must be cancelled or the program number has to be changed. Contrary to storing a program, a read-in comparison does not change the "Available Memory" value.

Alarm no.	Description and handling
278	Memory capacity exceeded Alarm 278 is generated, if the memory capacity is not sufficient during read in. The data display can be used to check the available remaining memory capacity. Unimportant programs must be cancelled and re-read in later.
	Non-correctable programming faults
281	General The fault is indicated in the figure "Display of Correction Block".
287	Intersection point (@22) fault This alarm is displayed as a result of faulty L94 cycle parameter definitions.
288	Subroutine error - M17 in the main program. - Exceeding the nesting limits.
	Faulty contour description
291	Incorrect entry The input cannot be calculated with respect to the contour or the input is too big or an incorrect path would be traversed or the radius value is too big.

Alarm no.	Description and handling
292	No intersection point The programmed values entered do not provide an intersection point on the defined contour.
293	Incorrect angle value An angle is equal to or larger than 360° or the value is not correct for the defined contour.
294	Incorrect radius value The entered value is either too large or illegal for the defined contour.
295	G02/G03 incorrect The arc direction is wrong for the defined contour.
296	Incorrect block sequence For calculation purposes, more blocks are required: the block sequence is not compatible or the information is insufficient. E.g. N15 .... B15 LF N20 .... G03 I20 LF
297	Incorrect input parameter The programmed parameter sequence is illegal or incomplete for the defined contour. E.g. N15 .... X60 B15 LF (Z axis missing) N20 .... X90 B10 LF

Alarm no.	Description and handling
301	Arc not in the selected plane 3M: The interpolation parameters do not reflect the selected plane.
302	Option not available Check functional setup with machine parameters
304	Zero offset or tool offset: Illegal value Double value calculation feasible with six or more digit values.
308	Circle end point error Machine parameter "Circle end point checking" (N355). The programmed end point does not lie in a circle. The entered limits will be exceeded.
314	The thread lead is incorrectly programmed The thread lead is programmed unter I, J, K relative always to the leading axis, otherwise alarm 314 is activated. (e.g. X20000 Z10000 K1000)

Alarm no.	Description and handling
316	<u>F word not programmed</u> e.g. F word or feed per revolution not programmed.
317	<u>Too many axes are commanded to move</u> Only if traversing would have to be carried out along too many axes because of G41/G42.
322	<u>Illegal CRC block</u> With CRC active, G92, G59, G33 must not be programmed. Remedy: Define G40 earlier or program G41/G42, D00 (Cancel CRC) or G41/G42, T00 (Cancel CRC).
351	<u>Cycle start without a reference point approach</u>

Alarm no.	Description and handling
	Correctable programming faults
501	General The fault is highlighted on the "Correction Display" (block before decoding) by an identification character.
502	More than 6 geometry parameters programmed in one block. (Geometry parameters are: axes, interpolation parameters, radii, angles.)
504	Incorrect block construction e.g. N10 G02 X1000 LF (Interpolation parameter missing.) N20 G02 Z1000 I20 (I20 is not allowed in this block.)
505	Contouring cycle error Alarm displayed, if alarm 302 is also present. In this case the "contouring cycle" option is not available.
506	CRC contour definition faults The intermediate block move is too small for the selected compensation, e.g. if on calculating the offset a move opposite to that programmed is detected.
508	Axis programming twice or too many axes programmed

Alarm no.	Description and handling
511	<u>Enter only in the reset condition</u> This alarm is generated, if an illegal function is selected in the automatic mode. These modes are only permitted after the reset pushbutton has been pressed. The alarm is cancelled with .
512	<u>Input disabled</u> Input is only permitted, if the key switch is enabled or the data protection switch, S1, on the CPU 03 100 module is in the upper position or input cannot be made in the current mode.
513	<u>Memory full</u> This alarm is generated when the memory is full. This can be overcome by cancelling a stored program (see chapter 7.1.). These operations can only be completed in the control's reset mode.
514	<u>Block with more than 120 characters</u> When editing, the number of characters in a block are counted before they are stored. (The LF character must be the 120th character.) If the alarm is generated, the input LF must be changed. Remedy: Divide up the block.

Alarm no.	Description and handling
515	Selected block not stored This alarm is displayyed, if the called block is not defined in the currect program. The cursor is set to the beginning of the program, and the program is displayed.
516	Block cannot be totally displayed Even though the permitted block length of 120 characters is not exceeded, some block configurations do not permit the display of all characters. Remedy: Enter a "LF" to divide the block up and where the second block has no block number. Now both blanks can be altered to generate an acceptable program.
521	Error at Strobe input This alarm is generated, if an external data input code is incorrect, the value is too large or % is input with a program currently active.
523	See 262.

Alarm no.	Description and handling
527	Axis KV factors unequal This alarm is generated, if the measured KV factors for the axes are unequal. This would result in contour errors.
528	KV factors not defined After switch on and a change to machine parameters, this alarm is generated as information to the operator.

Alarm no.	Description and handling
	MDA alarms
531	Block with more than 40 characters Block with less than 40 characters must be entered.
532	Program number already available Program number introduced via MDA is already available in the program memory.
533	Playback as the first block not permitted A program number must be introduced by Teach-in and be stored correctly.
534	Playback only permitted when MDA is interrupted Another block must be stored in MDA.
535	Playback is only permitted when axes stationary It is not allowed to move any axes, if the block is to be stored.
536	More than 2 axes in one block Interpolation is only possible for up to 2 axes.

Alarm no.	Description and handling
537	Last program is not closed This is a warning not to introduce a new program until the old program in MDA is closed.
538	General MDA input error
702	Machine parameter address code incorrect Machine parameter must be changed (name, axis).
711	Battery alarm Check the battery voltage on the power supply module (03500). Change battery as necessary. Important: Change the battery with the control switched on in order that the data in the CMOS memory on 03210 or 03260 are not lost. Warning: For Basic Control 2 (with PC), the PC and the NC go into the stop state. An alarm is not displayed (see commissioning manual).

12.7. Tape reader (technical data)

Available optical tape reader.

The tape reader unit is adjusted for Myler or nontransparent paper tape. However, a transparency of up to 40% is acceptable.

Reader type: FANUC	without reels	with reels
Reading speed	for 50 c/s: 250 ± 25 characters/sec for 60 c/s: 300 ± 30 characters/sec	
Rewind speed	no rewind	50 c/s: 500 characters/sec 60 C/s: 600 characters/sec
Tape length capacity	Tumble box	187 mm dia. reels for approx. 150 m punched tape
Transfer speed (Baud rate)	9600 baud	

Loading the tape

Reader without reels	Reader with reels
Switch to "RELEASE". Open reader flaps. Placing and removing tape is possible. Place tape in the reader. See the load-tape drawing. Sprocket on side nearest to the operator. Information on tape to the right of the reader head. Close flap.	

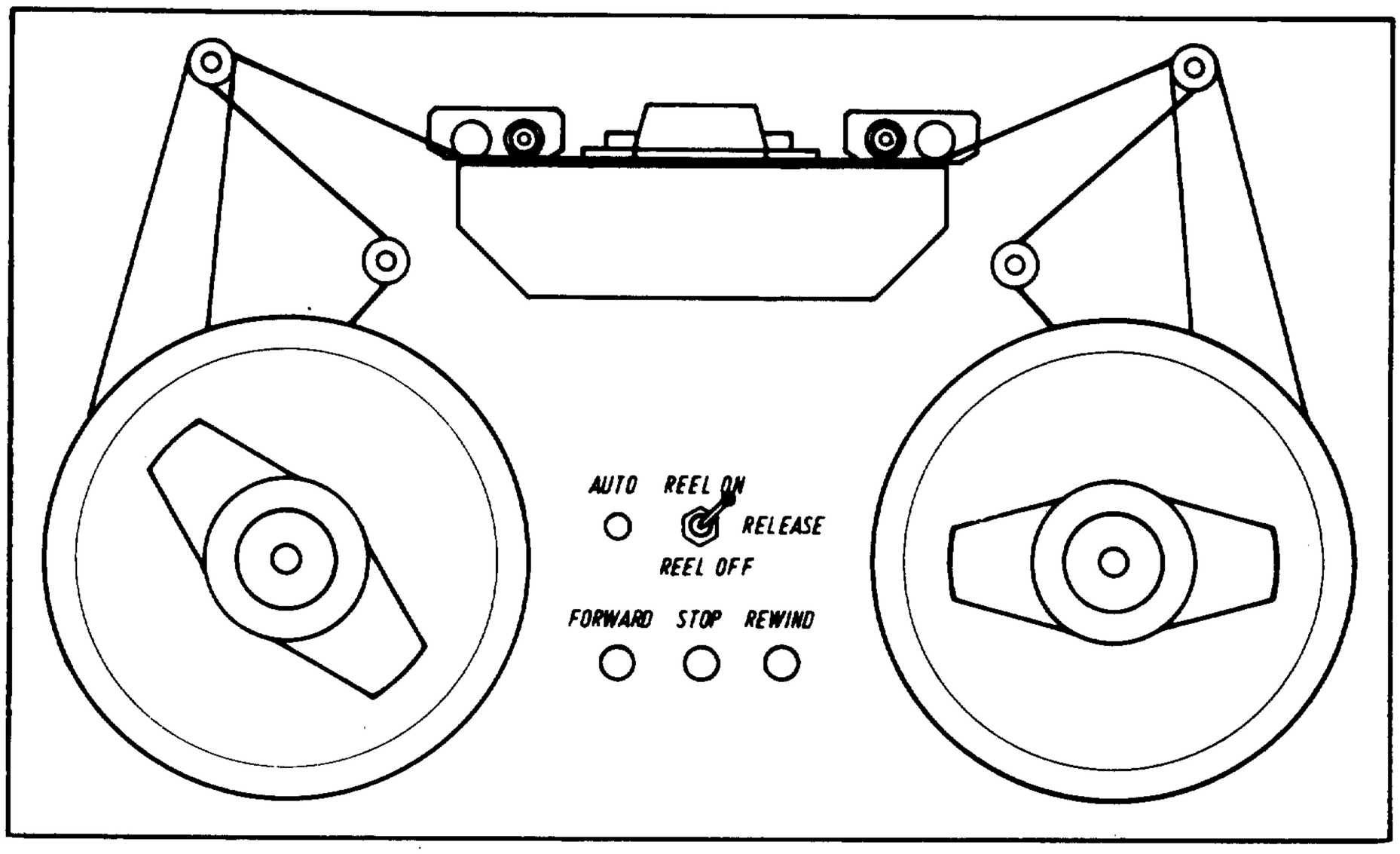
Manual mode

FORWARDS:	Toggle switch to "MANUAL"	"FORWARD"
REWIND:	-	"REWIND"
STOP:	Toggle switch to "RELEASE"	"STOP"

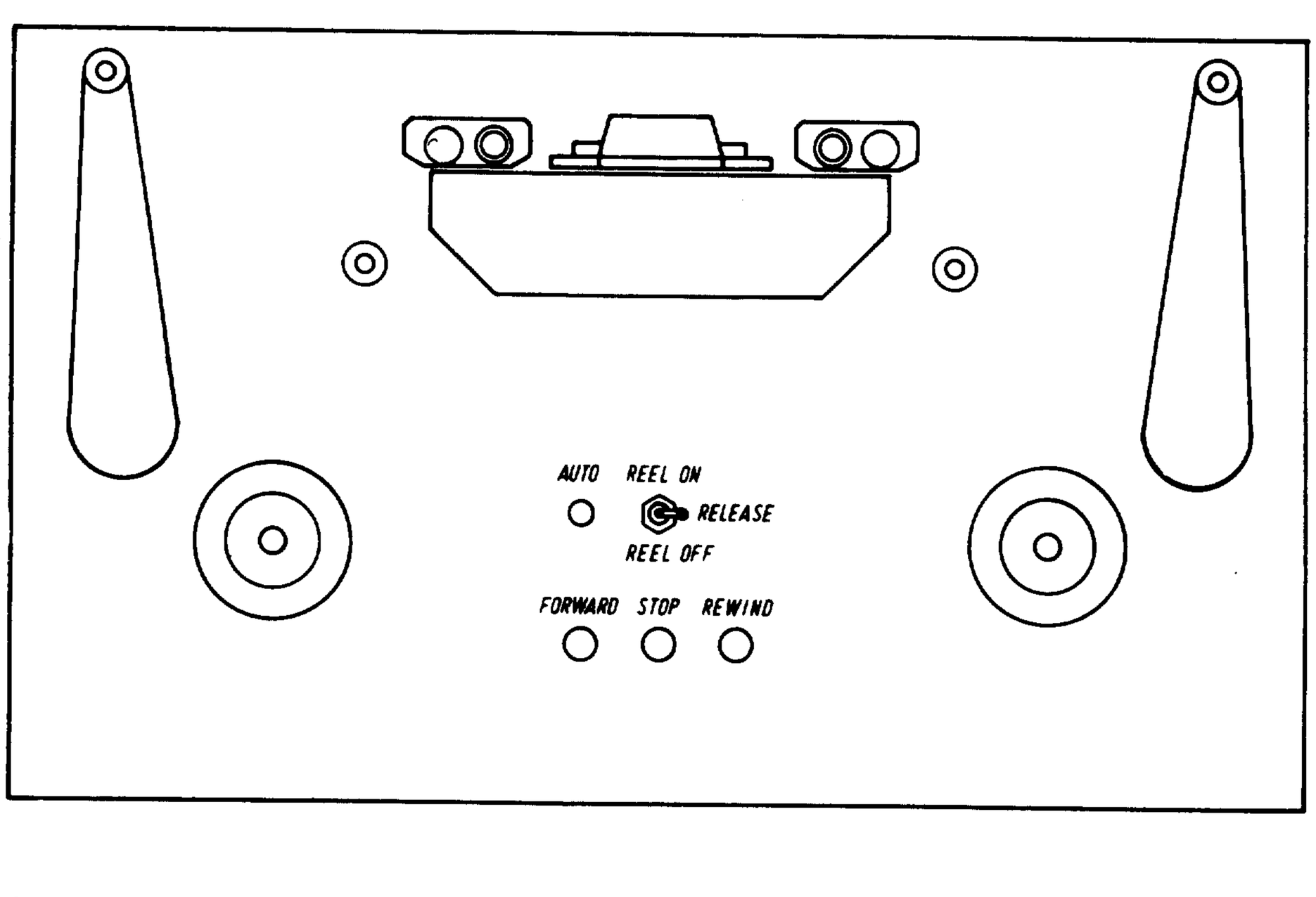
Program operation

Reader without reels	Reader with reels
Toggle switch to "AUTO"	Toggle switch to "REEL ON": reels enabled or "REEL OFF" reels disabled. When the control enables the reader in the automatic mode, the "AUTO" lamp comes on. Manual mode in these circumstances is not possible. The "AUTO" lampe can be reset with the reset pushbutton.

Reader with Reels

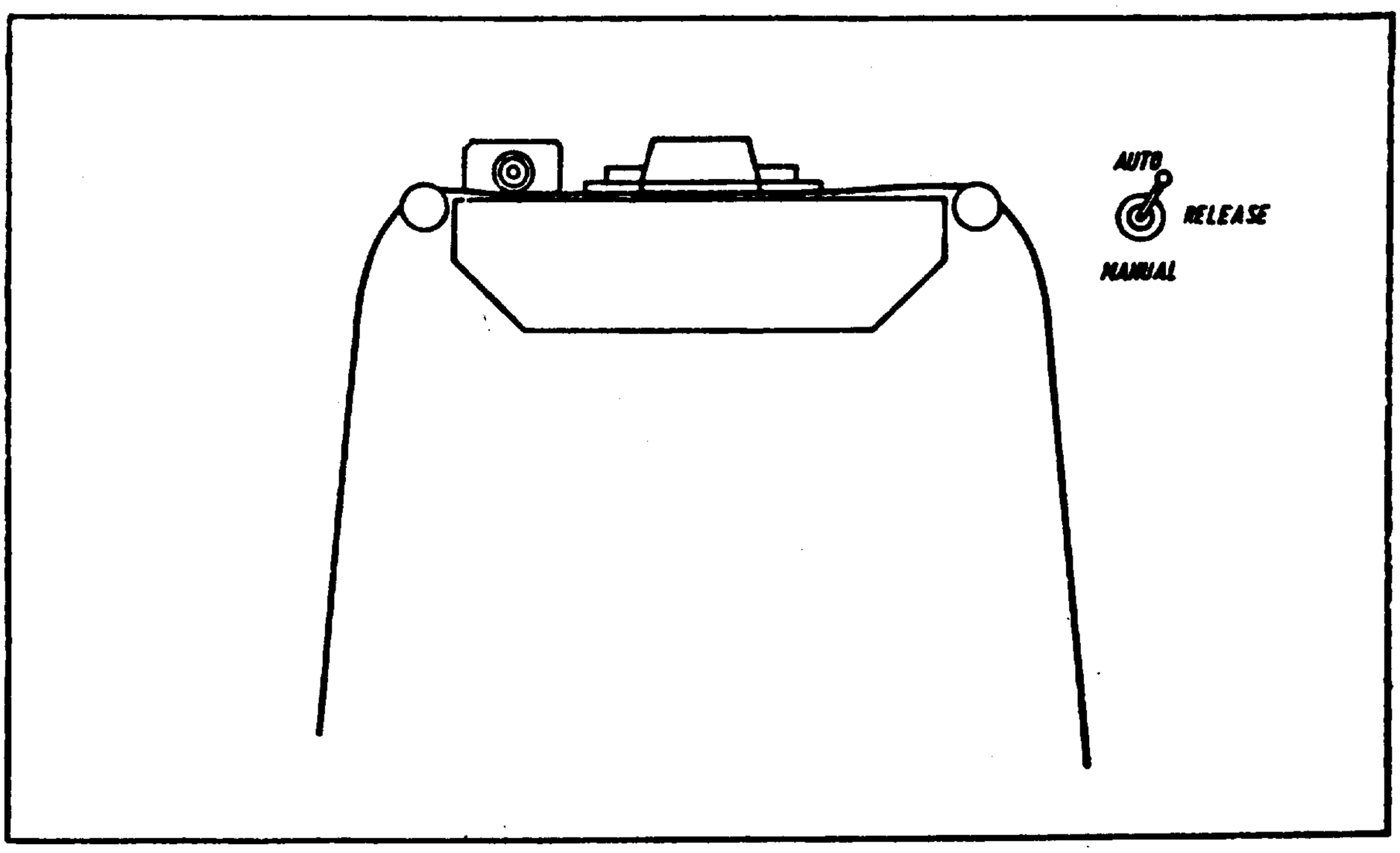


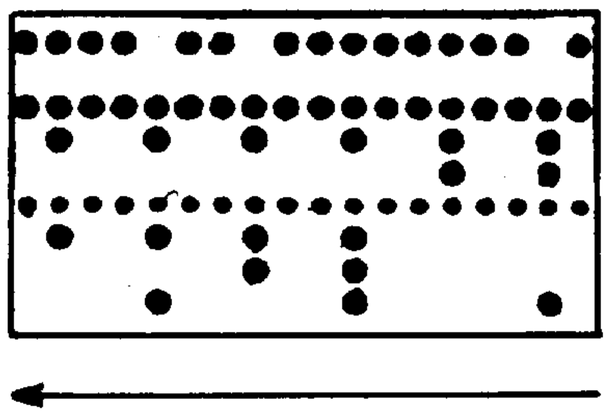
Operation with reels



Operation without reels

Reader without Reels





Tape Reading Direction

Siemens Aktiengesellschaft

Subject to change without prior notice

Bestell-Nr. E80210-T31-X-A5-7600
Printed in the Fed. Rep. of Germany
082214 PA 12841.