SIEMENS

SINUMERIK System 3

Operating instructions Part 1

SINUMERIK System 3

Operating instructions Part 1

Edition 8.83

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

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.4.81	E 321/1817	First edition
A.11.81	E 321/1890-101	S. 1-6, 4-2, 7-8, 7-9, 7-11, 8-3 - 8-5, 8-16, 8-21, 8-25, 8-26, 11-1 - 11-6, 12-8, 12-10, 12-11
A.4.82	E 321/1936-101	P. 3-2, 4-2, 4-3, 4-5, 5-2, 7-11, 9-7 - 9-13; Chap. 11
A.8.83	A19100-E821-B091-X-7600	Revised edition

Contents

1. Introduction

1.1 General

This operating manual serves generally for SINUMERIK 3T and 3M basic systems 0,1 and 2. The operation of each control is similar, the differences e.g. jogging the axes , are described for each control type. The operating concept of System 3 controls is characterised 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.

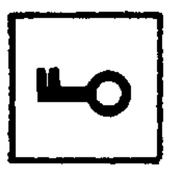
We reserve the right to change this description as a result of technical changes. At the end of this manual there are fold out drawings of the operator's panels related to the various control types. In order to follow the text it is helpful to fold out the appropriate illustration. The operator's panel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

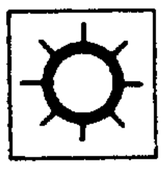
We reserve the right to modify this manual with respect to technical modifications.

1.2 Symbol clarification

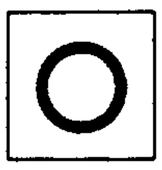
The following symbols are used in the operator's manual:



Key switch enabled



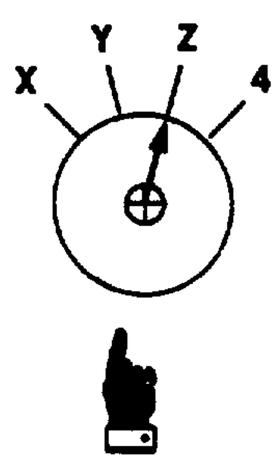
Lamp ON



Lamp OFF

Toggle switch OFF

Toggle switch ON



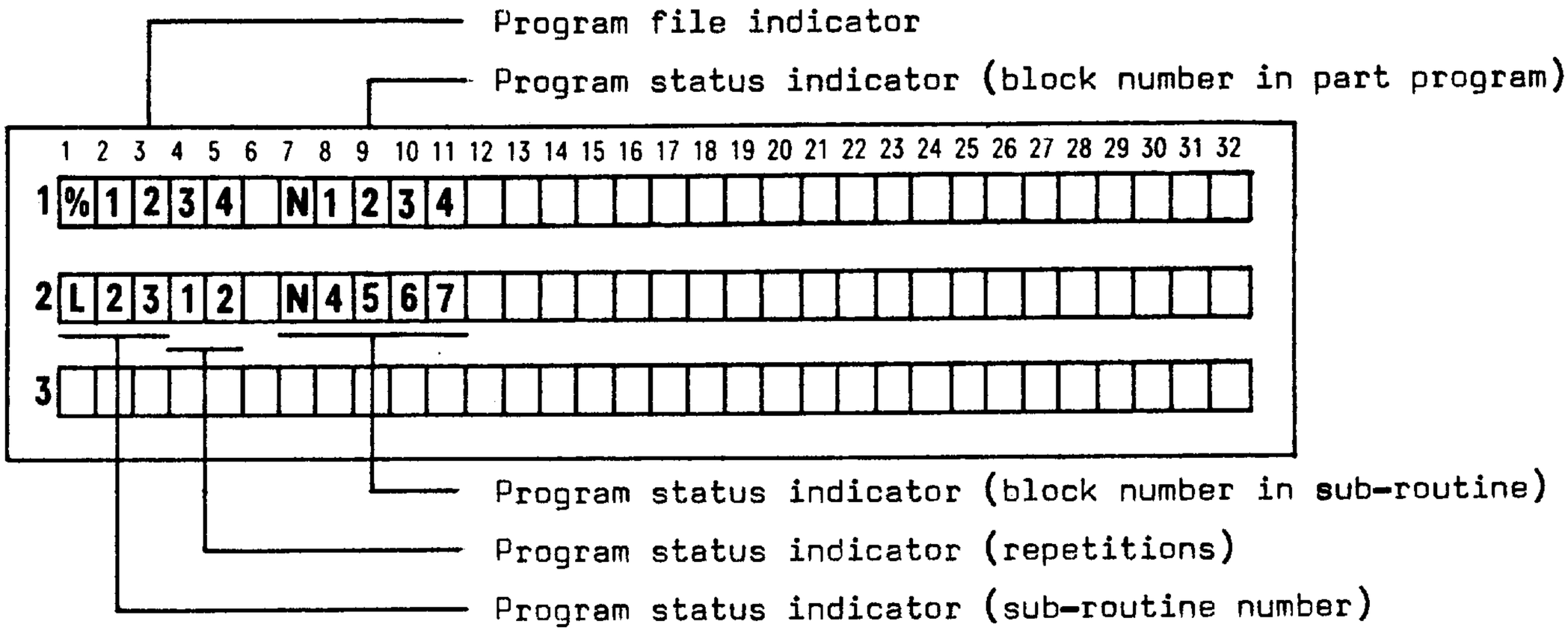
Rotary switch, e.g., axis selector switch set for the Z axis.
(only with SINUMERIK 3M)

Manual
Operation is only allowed in accordance with the conditions specified.

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
(only with SINUMERIK 3M)

1.3 Terminology



Program file indicator e.g., % 1234

The control differentiates between 9999 part programs.
It is possible to store 20 programs at the same time.
The program file indicator is used to call up and display the currently selected part program.

Program status indicator

The status indicator displays the current operating status and comprises:

- block number in part program
- sub-routine number with
- number of repetitions
- block number in sub-routine.

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.

These 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 modes 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	Abbreviation
	- Data output (interface)	DO
	- Data input (interface)	DI
	- Manual data input/Automatic	MDA
	- Jog, handwheel	JOG
	- Incremental feed	INC
	- Manual data input, part program	MDI-PP
	- Manual data input, tool offsets zero offsets machine parameters (MDI, setting data, test date)	MDI-SE-TE
	- Automatic	AUT
	- Return to reference (reference point approach)	REF

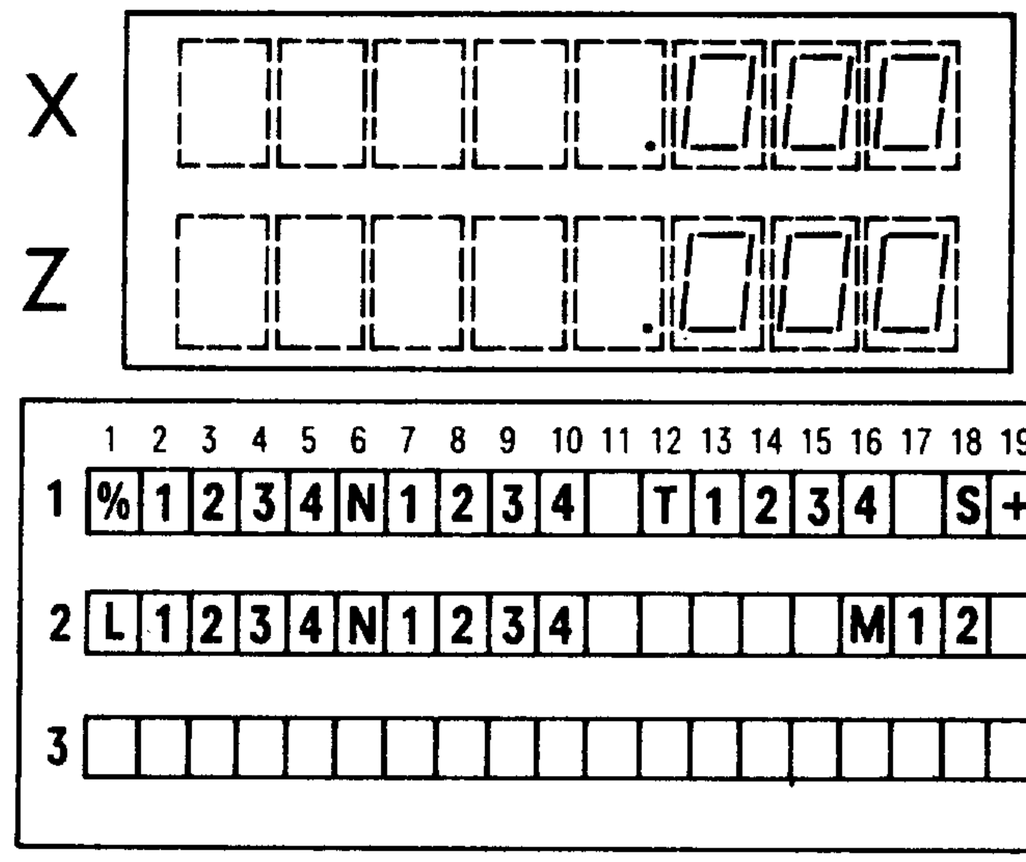
1.5 Input and Display List

	Data output via data interface of part program %, sub-routines L, tool offset data TO, test data TE 2.				
	Data output via data interface of part program %, sub-routines L, tool offset data TO, test data TE 3.				
	Input manual input block 4.1 Process manual input block 4.1 Store manual input block 4.2	* Tool offset data 8.1	* Zero offsets 8.2 * User data 8.3/ 8.4 * R-Parameters 8.5	* Alarms 8.6.1 * Interface copy 8.6.2 * Machine parameters 8.6.3	* Offset block 9.4
	Axis traverse using direction buttons or handwheel 5.				
	Basic displays Overwriting M, S, T functions 5.0	Automatic calculation of tool offsets 8.1.7	Automatic calculation of zero offsets 8.2.7	* Alarms 8.6.1 * Interface copy 8.6.2 * Machine parameters 8.6.3	Playback 4.3
	Incremental jog using direction buttons 6.				
	Basic display Overwriting M, S, T functions 6.0	Automatic calculation of tool offsets 8.1.7	Automatic calculation of zero offsets 8.2.7	* Alarms 8.6.1 * Interface copy 8.6.2 * Machine parameters 8.6.3	Playback 4.3
	Cancel part programs % sub-routines L 7.1	* Tool offset data 8.1	* Zero offsets 8.2 * User data 8.3/ 8.4 * R-Parameters 8.5	* Alarms 8.6.1 * Interface copy 8.6.2 * Machine parameters 8.6.3	Input, edit part programs% 7.3 Sub-routines L 7.4
	* Basic display	Input tool offset data 8.1	Input zero offsets 8.2 user data 8.3/ 8.4 R-parameters 8.5	* Alarms 8.6.1 * Interface copy 8.6.2 * Input machine parameters 8.6.3 * Drift offset 8.6.5	* Basic display
	Processing a part program 9.				
	Basic displays Overwriting M, S, T functions 9.0 Block search 9.5	Input tool wear and tool offsets 9.3	* Zero offsets 8.2 * User data 8.3/ 8.4 * R-parameters 8.5	* Alarms 8.6.1 * Interface copy 8.6.2 * Machine parameters 8.6.3	* Program indicator 9.4 * Offset block 9.4
	Return to datum using direction buttons 10.				
				* Alarms 8.6.1 * Interface copy 8.6.2 * Machine parameters 8.6.3	

Note: *Display only, no data input possible.

The numbers are the sections in the manual which deal with these functions.

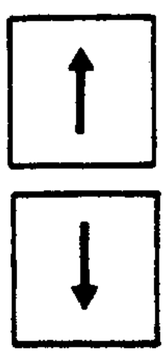
1.6 Data display



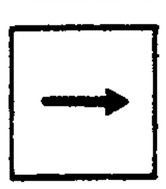
The composition of the display (as shown - Automatic 3T) is identical for all modes.

The lines 1, 2 and half of 3 are dependent on the mode selected. Blocks 17 - 29 of the third line are reserved for input. The last 3 blocks of line 3 contain the first alarm number of the current NC alarms.

A large quantity of data can be displayed. In order to search for specific information the following pushbuttons are available:-



PAGE
(Page backwards pushbutton no. 21 and
page forwards pushbutton no. 22)



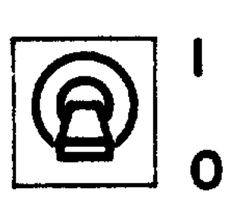
and the
cursor pushbutton
(cursor right pushbutton no. 20)

1.7 Switching on the control

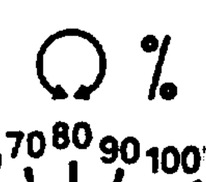
Before the first control switch on, check that the control has been commissioned by a qualified person.
Before starting set the switches to the following positions:

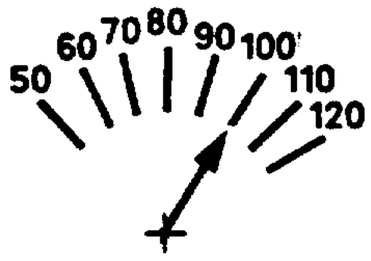
Single block (switch no. 37)

Block delete (switch no. 36)

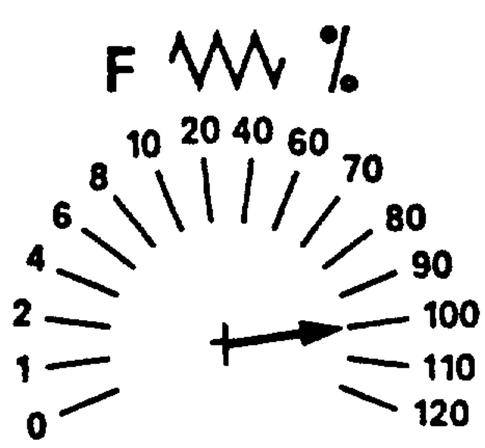


Dry run (switch no. 35)





Spindle speed override switch (switch no. 27) 100%

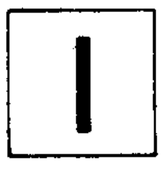


Feedrate override switch (no. 28) 100%

Rapid override active (no. 34)

In the following examples, a metric measuring system is assumed and programmed with decimal point programming.
The feedrate will be displayed on the screen in mm/min.

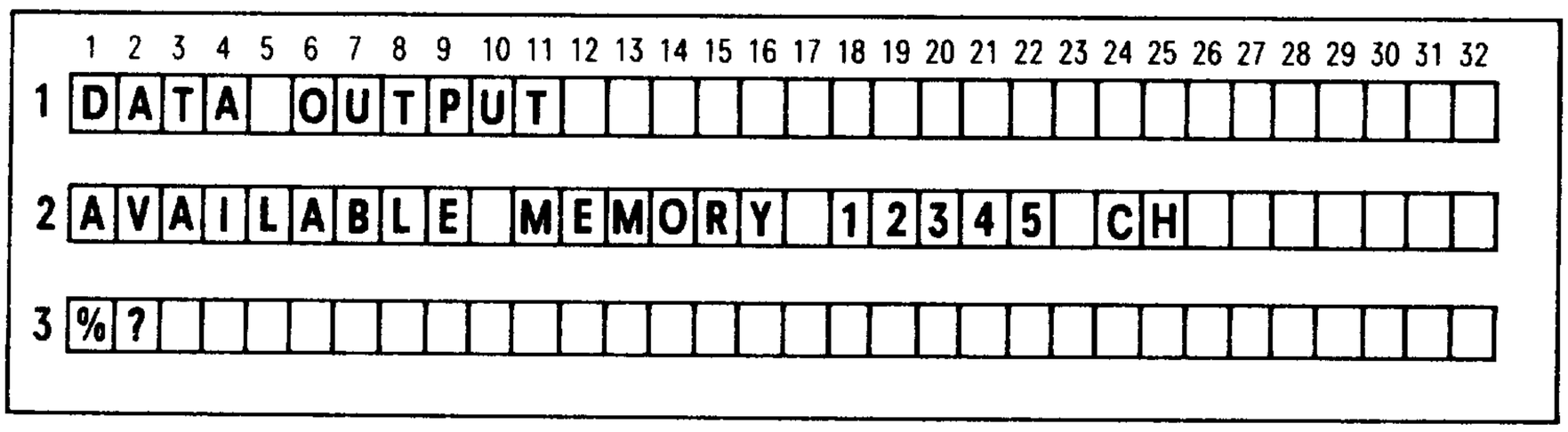
Power on



After switch on the basic automatic display is shown (see input and display list in section 1.5).

2. Data output DO

After selecting the operating mode the following display is shown:



Line 1: Operating mode and type of data output

Line 2: Available part program memory (CH means character and corresponds to one tape char.=ASCII character)

Line 3: Operator dialogue for selection of data output.

Data output can have following forms:

Main program	%
Sub-routine	L
Tool offset	TO
Machine parameter	TE

Operating sequence

Operating mode data output (mode selector switch 26)

Selection of the data type through repeatedly pressing this button (No.9). The type selected is displayed in the 3rd line (button 9) in the sequence %, L, TO, TE.

By pressing this button (no. 17) the data in the 3rd line are selected for output.

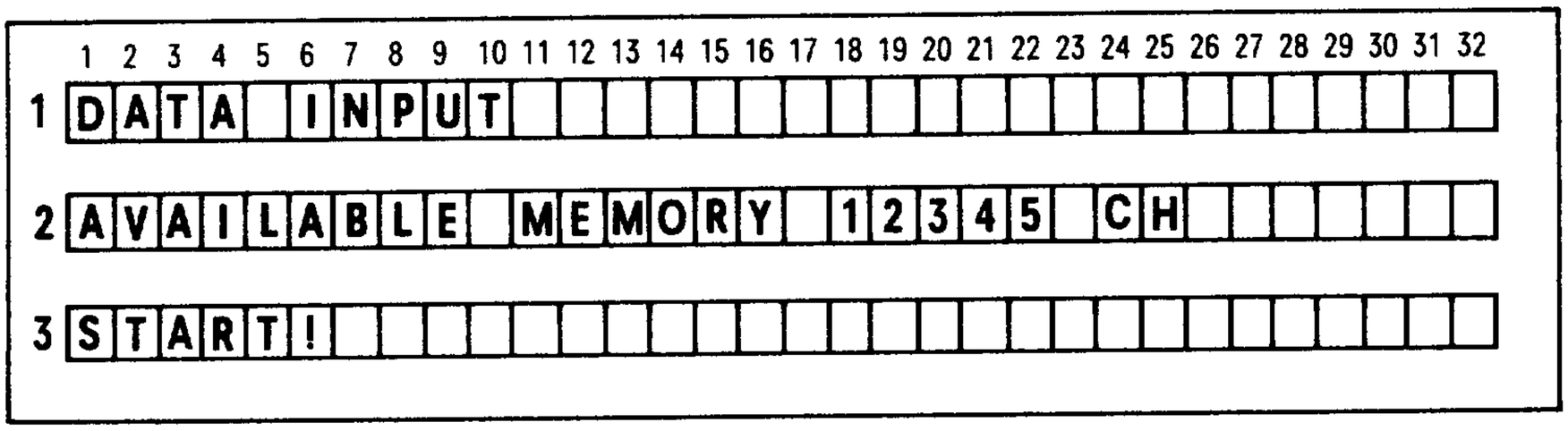
Start data output (button 19)
During data output the text CONTROL IN ACT is displayed in line 3.

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

The following display appears:



Line 1: Operating mode and type of data input.

Line 2: Available part program memory (CH means character and corresponds to one tape char.= ASCII character)

Line 3: Operator dialogue for start of data input.

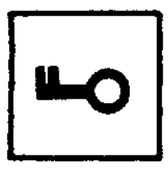
Data input can have following forms:

Main program	%
Sub-routine	L
Tool offset	TO
Machine parameter (switch interlocked)	TE

It is not necessary to predefine data type. It is recognised automatically during input.

Operating Sequence

Operating mode data input (mode selector switch 26)



Key switch (no. 39) enabled

(dependent on machine parameter)

Start data input (button 19).

During data input the text CONTROL IN ACT is displayed in line 3 and disappears on completion of data transfer. Alarm 238 (in the 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 recognised.

3.1 Data input check

The inputted data is 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 recognised read-in will stop and an alarm 277 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; V24 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:

PTR : Reader
PUN : Punch
R/P : Combined Reader/Punch devices. (e.g. Siemens printer PT 80).
also other devices which have similar interface specifications.

* See also the "SINUMERIK System 3 and 8 universal interface for serial data input/output" description.

4. Automatic using manual data input MDA

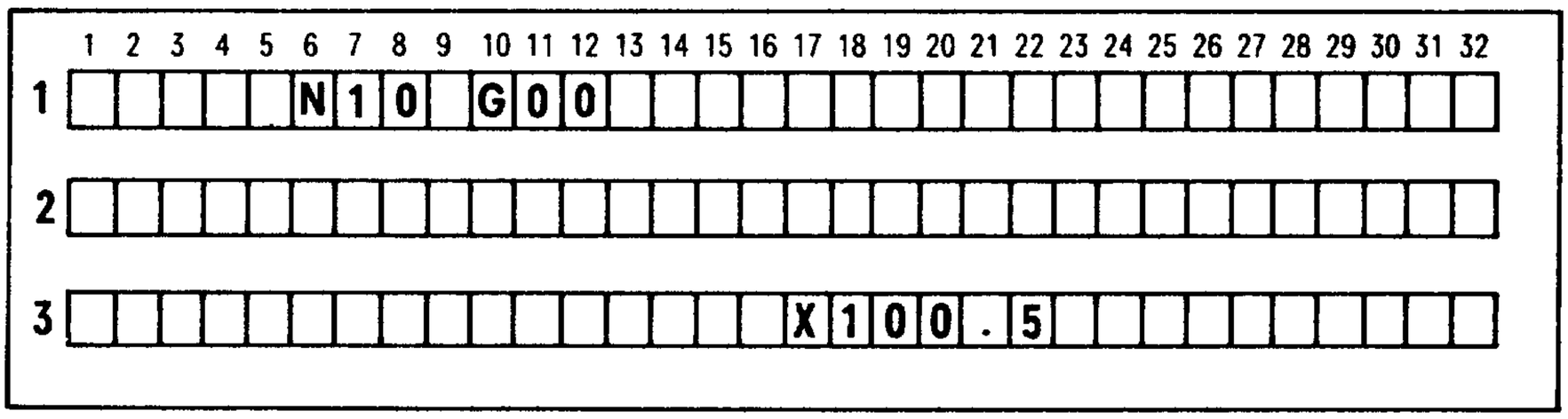
Three operating methods are possible in this mode:

- manual data input
- teach in
- playback

4.1 Manual data input

Direct input and execution are possible manually.

Operating mode MDA (mode selector switch 26)



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. 33). It remains displayed.

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

The next block can now be entered.

A cutter radius compensation (CRC) or tool tip compensation may be programmed but not a contour section.

Program input can then be continued manually.

If the mode selector switch (no. 26) 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

All remaining programmed paths are cancelled.

4.1.2 MDI edit

Cancelling the input line using Clear (no. 18)

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".

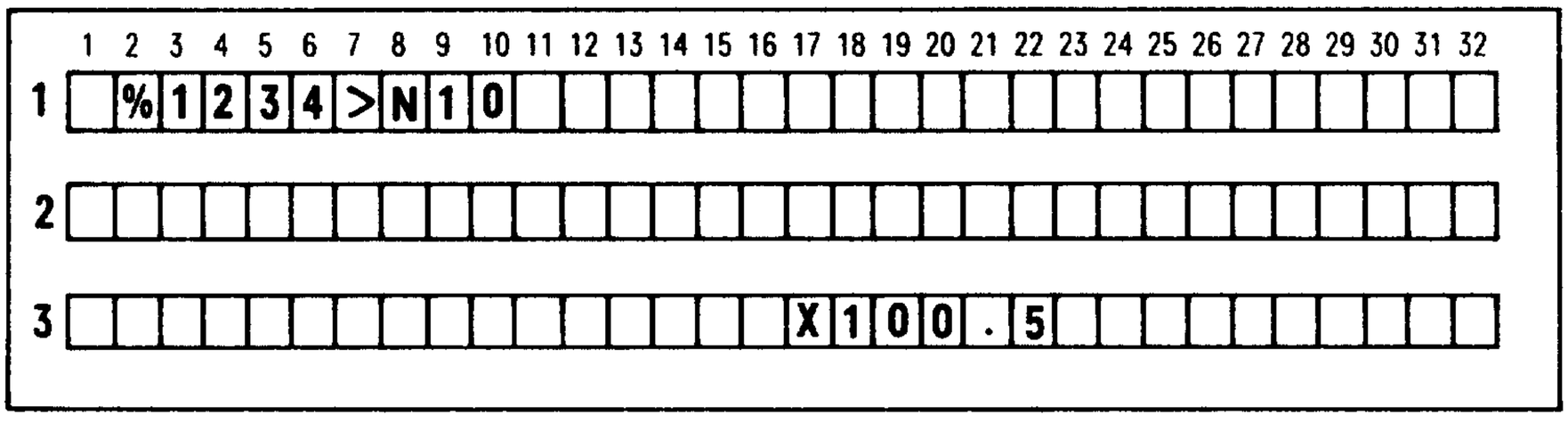
Upon return to MDI, paths traversed with JOG or INC are taken into consideration.
In case of an interrupted MDI bloc the paths traversed with JOG or INC are calculated and the programmed end point is being approached.

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

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 26)



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

The Cycle Start button (no. 33) then decodes the program number for the part program memory.

To start the program press the Start button (no. 23).

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. 33). It remains displayed. If Playback (see 4.3) has been selected, the Cycle Start button (no. 33) must be pressed twice.

Using the Start button (no. 19) 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 occurred (e.g. data input), all modal functions must be re-entered 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.

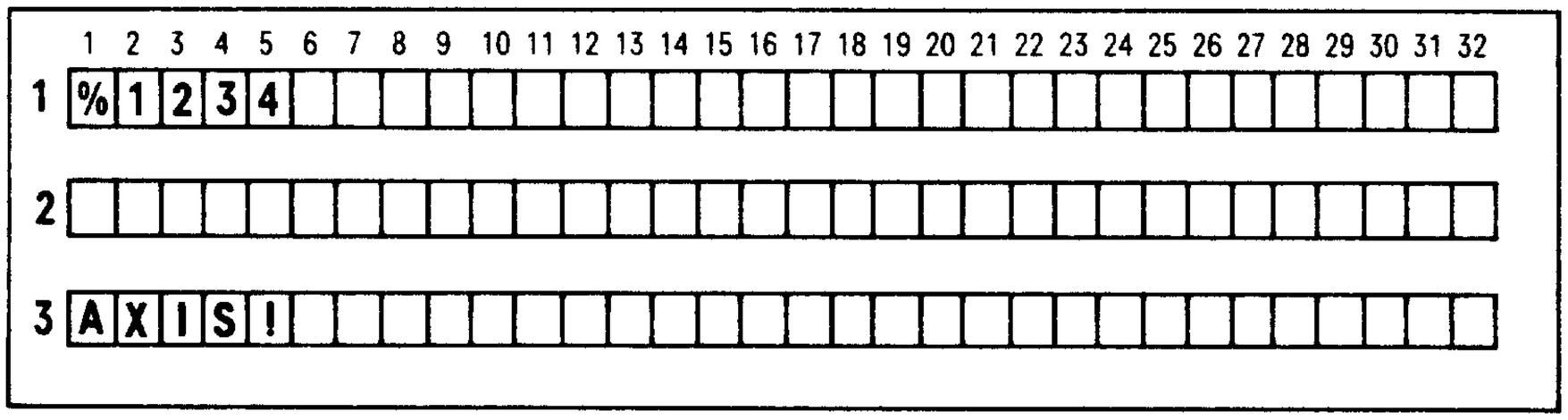
Start program in teach-in
Mode selector switch on MDA.

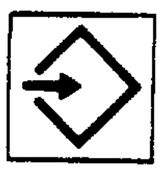
e.g. % 1234 LF input button (no. 16)

Press Cycle Start button (no. 33) and
Start button (no. 23) to begin a
program.

Select setting-up mode JOG or INC using
selector switch (no. 26).

The following display appears:





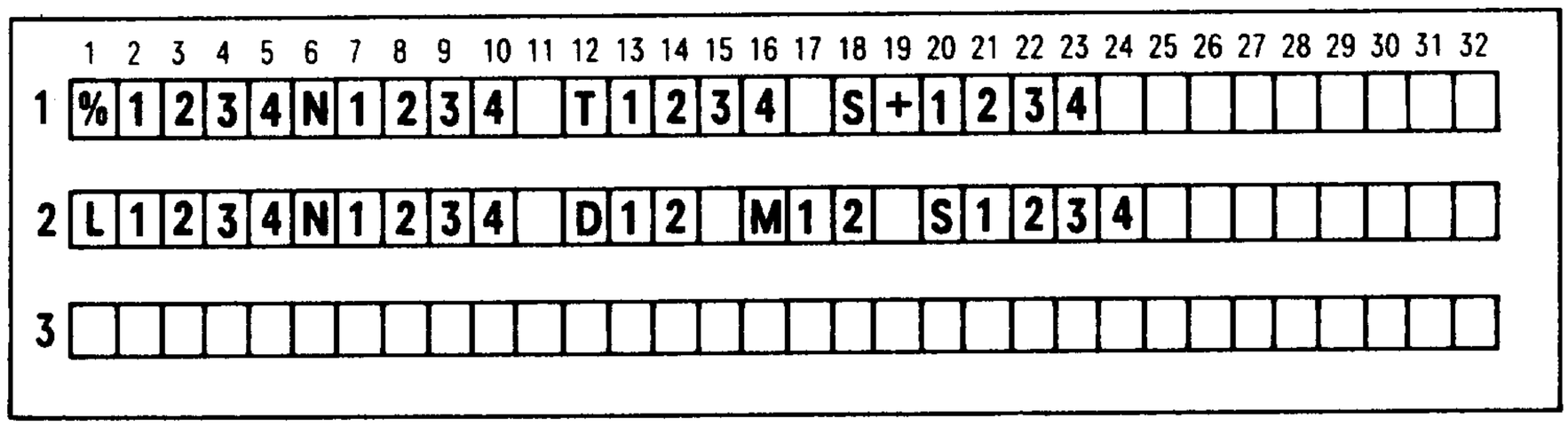
Co-ordinates reached in the jog mode are stored as program blocks (linear interpolation) by reading in the appropriate axis addresses, e.g. X, and pressing the Input (no. 16) and Start (no. 19) buttons.

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

5. Handwheel JOG

Operating mode JOG (selector switch 26)

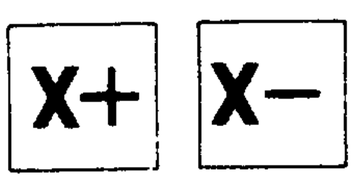
The following display appears:



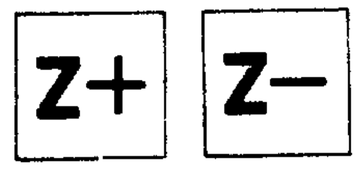
In this mode the S, M and T functions can be overwritten in memory (see Chapter 9).

5.1 Jog feed and rapid

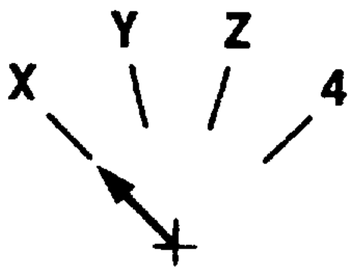
For 3T



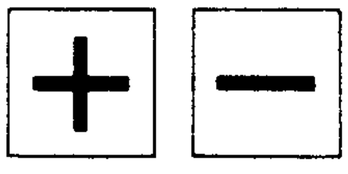
Direction pushbuttons (no. 29)



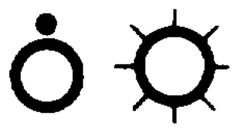
For 3M



Axis selection switch (e.g., X) (no. 42)

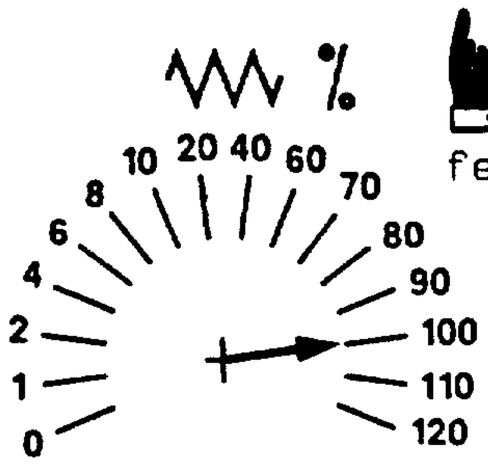


Direction pushbuttons (no. 29)

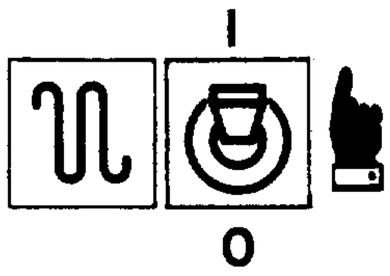


Feedhold (no. 2) should not be active

In order to rapid traverse, the force rapid traverse pushbutton can be pressed (no. 30).



The traversing speed can be overriden with the feedrate override switch (no. 28).

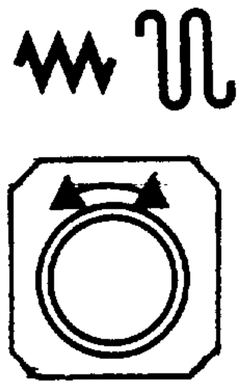


If traversing at rapid traverse with the toggle switch (no. 34) in the rapid traverse override position, the rapid traverse override (no. 28) is active in the range from 0 to 100%.

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

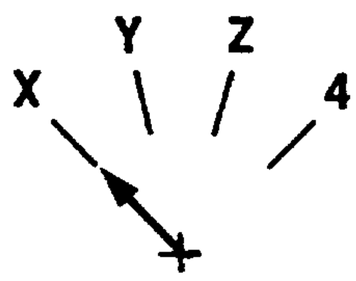
The handwheel moves the axes in the same manner as JOG.



Handwheel movement is selected in the JOG mode (selector switch 26) just as for "Feed and Rapid JOG".

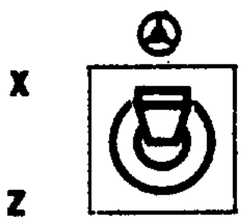
Only <u>one</u> handwheel can be connected.

For 3M

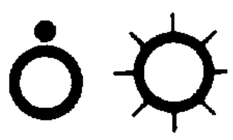


Handwheel assigned to axis using selector switch (no. 42).

For 3T



Handwheel assigned to axis using toggle switch (no. 41)



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

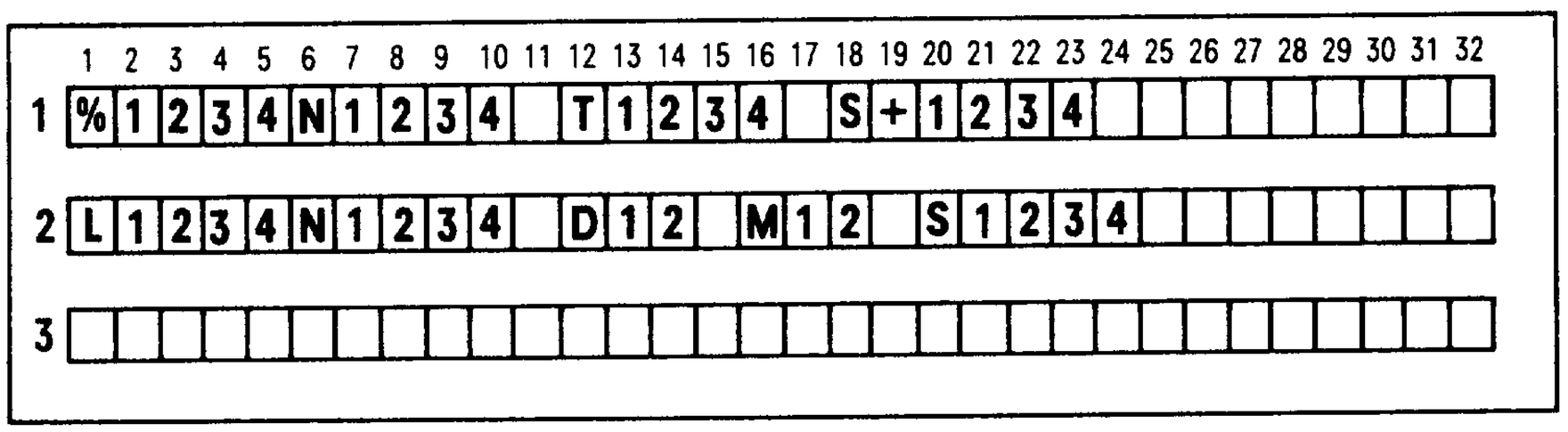
When a handwheel is fitted both this and the direction buttons can be used for jog operation. If the handwheel and direction buttons are used simultaneously, the buttons take precedence.

Using setting data (see appendix) the handwheel can be used for 1 µm, 10 µm, or 100 µm per scale 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

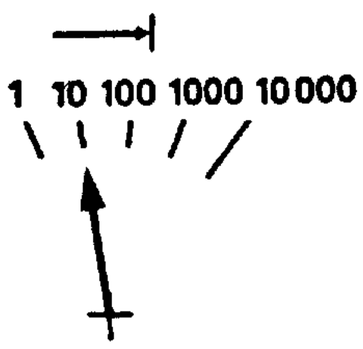
Incremental jog mode can be used to move off the contour or to set up when a handwheel is not fitted. A manual defined parallel-axis movement is possible.
Feedrate F is defined by a machine parameter and dependent on the rapid override switch (no. 28).

→| INC mode (selector switch 26)



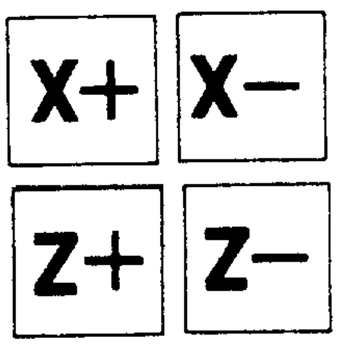
In this operating mode M, S and T functions can be overwritten in memory

Operating sequence



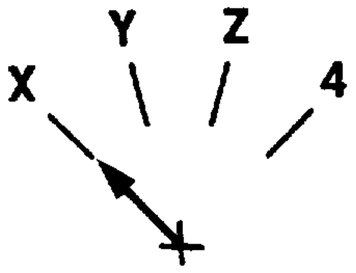
Preselect increment size using mode selector switch (no. 26).

With 3T

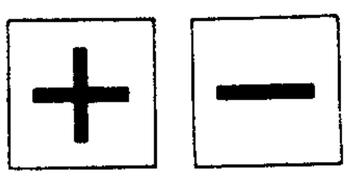


Press the required direction pushbutton (no. 29)

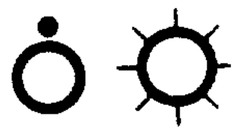
With 3M



Axis selector switch (e.g., X) (no. 42)



Direction pushbuttons (no. 29)



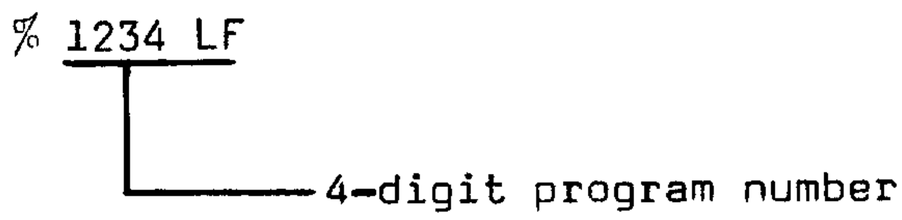
Feed hold (no. 2) must not be active.

The incremental step movements are executed modally.

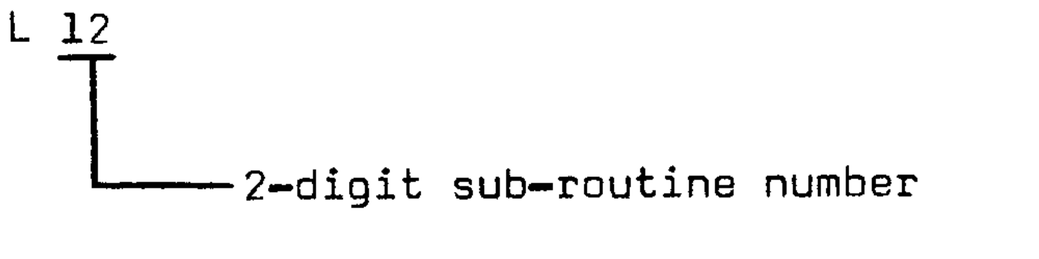
7. Manual data input, part program MDI-PP

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 sub-routines (no special operation required). Up to 20 part programs and sub-routines can be written into the memory simultaneously.

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



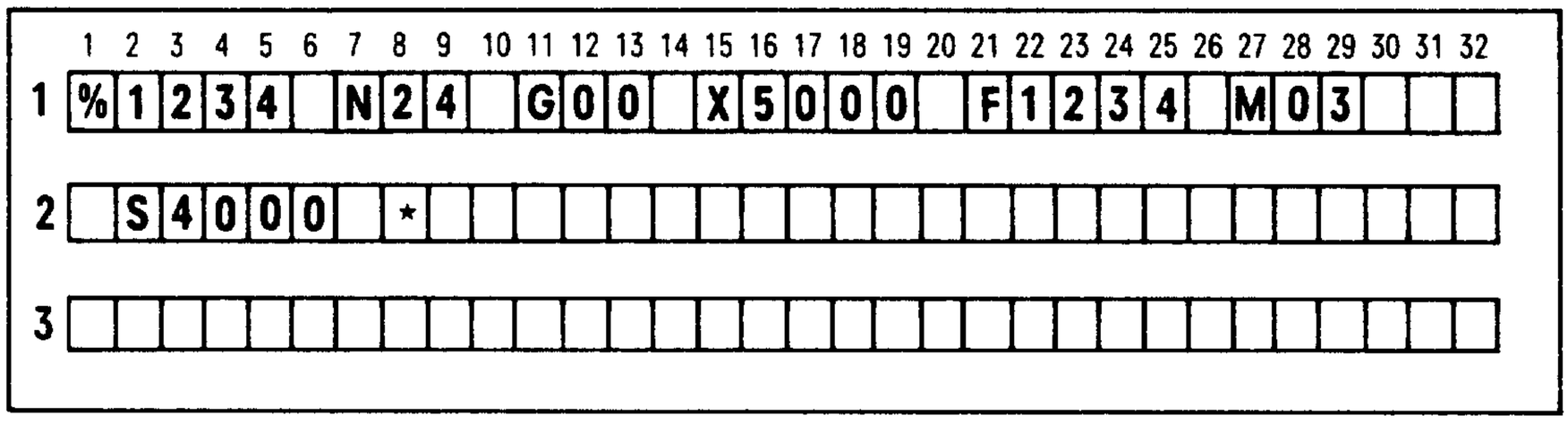
Sub-routines are identified by a 2-digit number:



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.

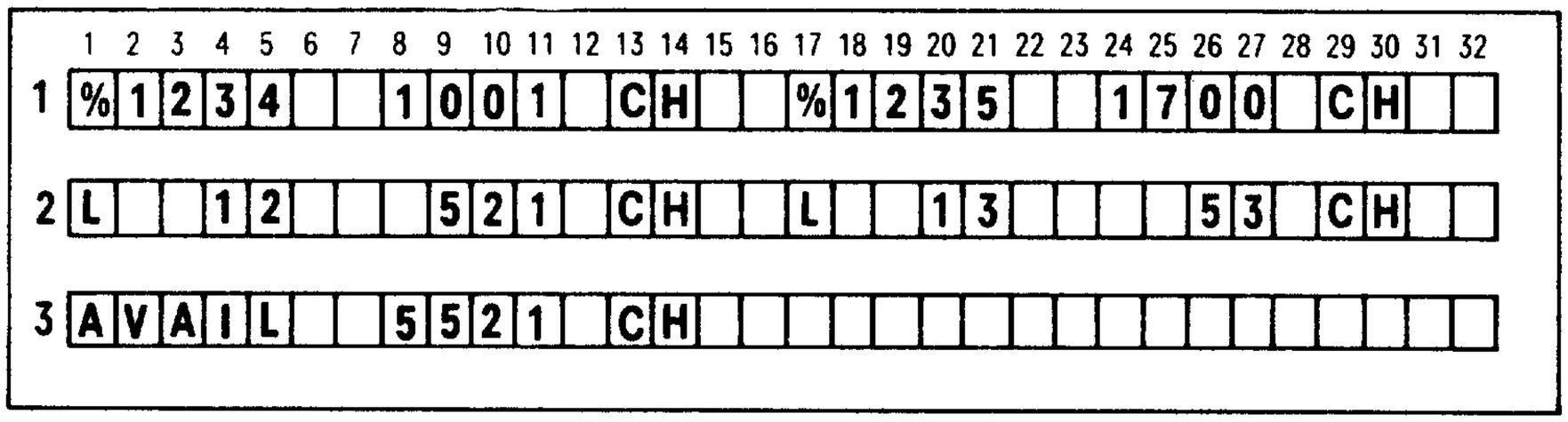
Operating sequence

Mode selector switch to MDI-PP (no. 26).
The following display appears:



The display always shows the last program block entered.

If the mode is switched to the basic display (//) using the button Display Switchover (no. 23), a list of previously-stored programs appears.

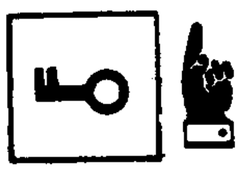


Using the buttons no. 21, no. 22, 5 pages can be selected which contain information about:

- unassigned memory space (here 5521 CH, CH for character, 1 CH = 1 tape character)
- available part programs (with associated program length)
- available sub-routines (with associated program length)

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

7.1 Program reset



Keyswitch enabled (no. 39)

dependent on machine parameter

Switch mode to basic display

% 5

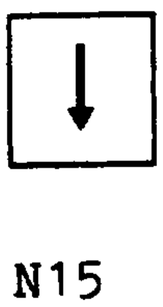
Input the program number and press the "Cancel" pushbutton (no. 14). The program will be reset. Sub-routines are cleared in the same manner (e.g., L5 cancel).

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 sub-routines L01-L79 are cleared. The remaining sub-routines L80-L99 are cleared individually.

7.2 Program select

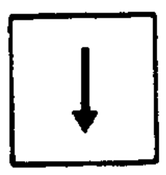
Switch mode to part program input (no. 9)

% 50

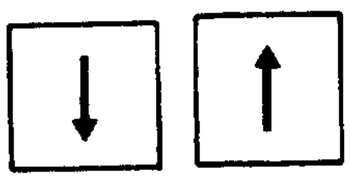


Search for, e.g. program % 50

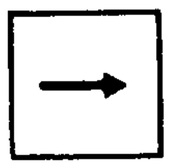
N15



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

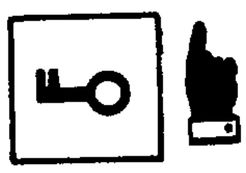


On pressing a "page" pushbutton, (Page forwards no. 21, or page backwards no. 22) the display will change one block at a time.



The "Cursor" pushbutton (no. 20) will shift the cursor one program word.

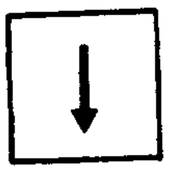
7.3 Data input into memory via keyboard



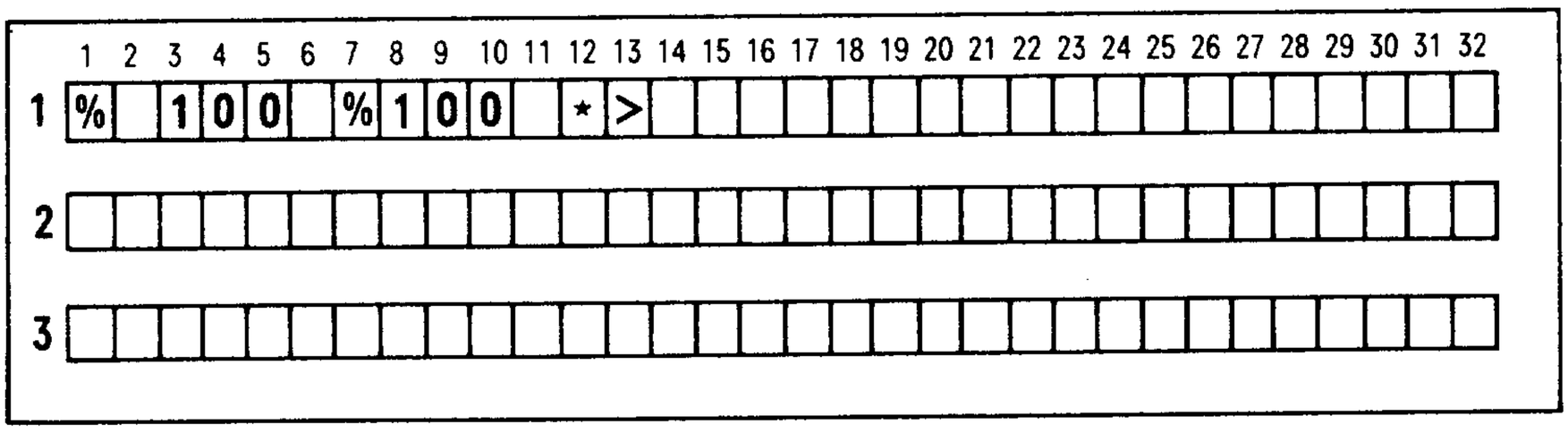
Keyswitch enabled (no. 39)

dependent on machine parameter.

% 100



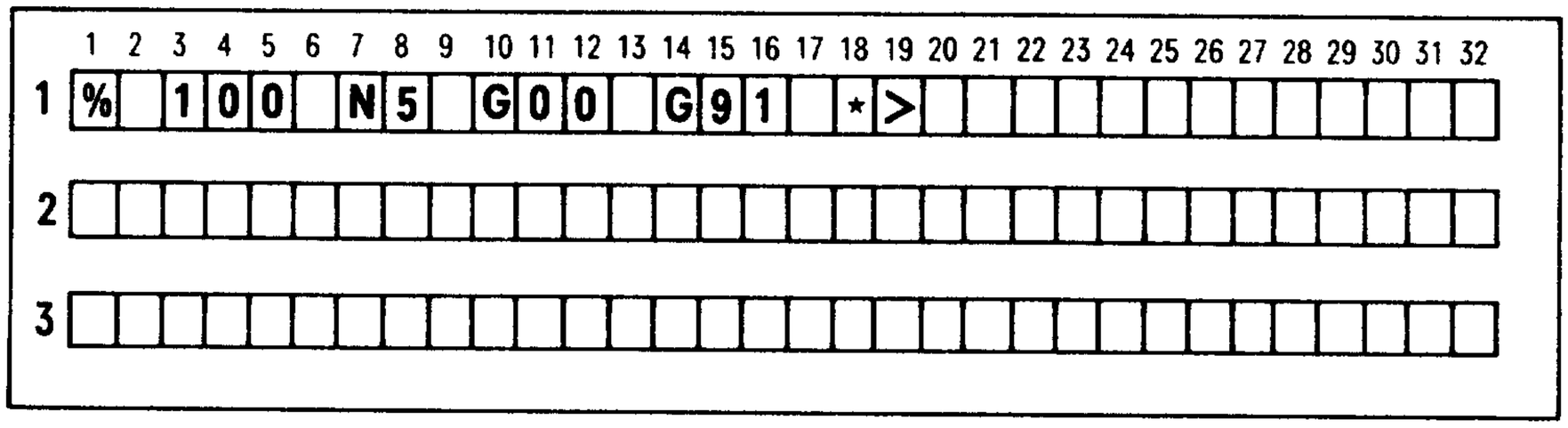
The new input of a program follows the selection of a program number, which is not currently in the memory (in this case % 100). If the program % 100 is already stored it will be displayed. The cursor is located behind the first program number.
When a program % 100 is not in store, the first block "%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



Example:

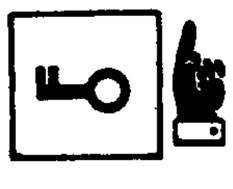
N5 G00 G91 LF Enter information, each word individually

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



During 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. The block should, however, be limited to 80 characters, since this is the maximum number which can be displayed.
Incorrect conditions will prevent the transfer of data from the data input line.

7.4 Program edit



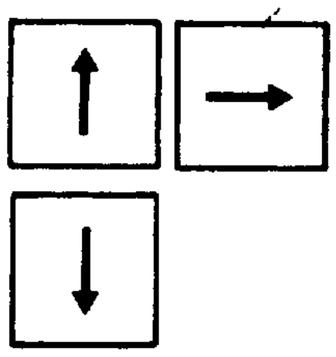
Keyswitch enabled (no. 39)

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 7.2



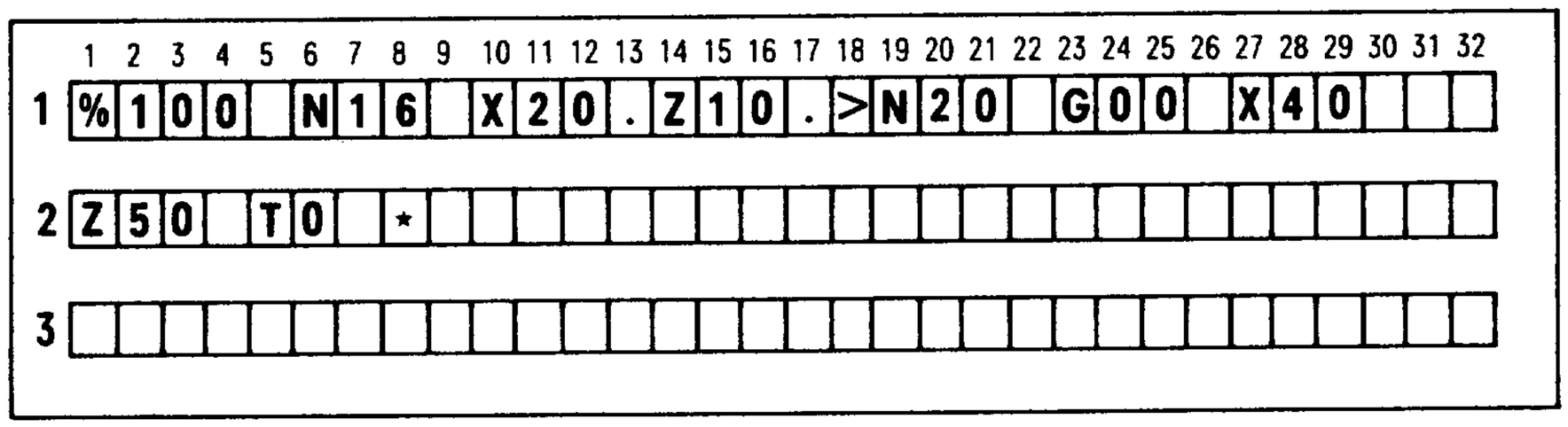
The page and cursor pushbuttons (nos. 21, 22) are used to bring the cursor in front of the block where the new block is to be inserted.

N16

Block N16 is inserted (see Section 7.3)

X20

Z10



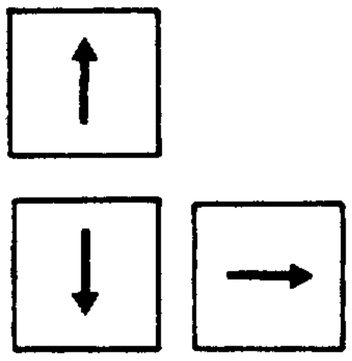
LF

After input of LF, block N20 disappears and only block N16 is displayed.

7.4.2 Single word edit

In block N16 the value Z 10 should be changed to Z20.

Select the program as described in Section 7.2.

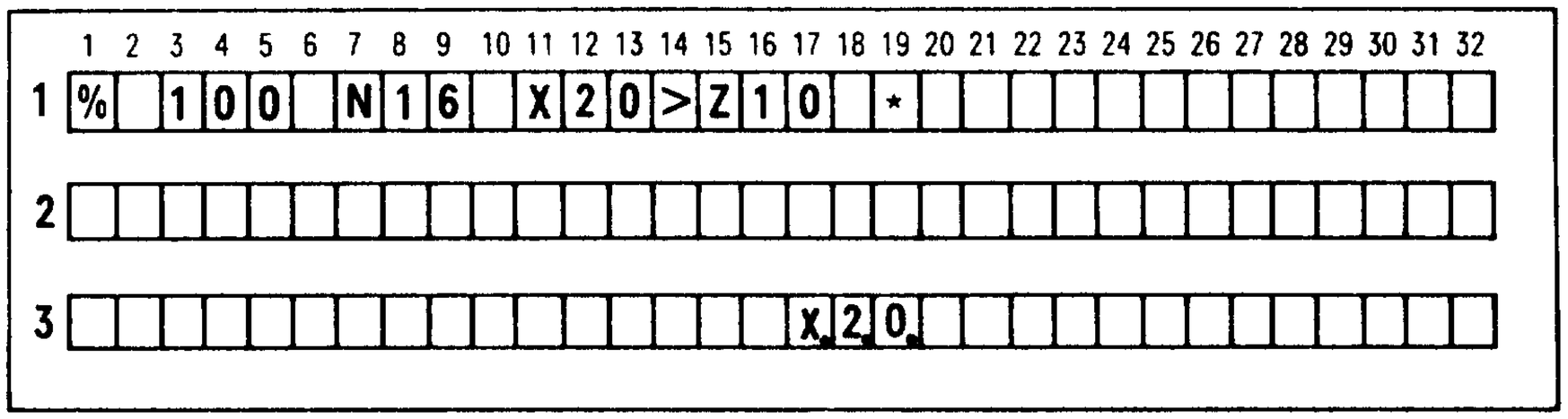


The page and cursor pushbuttons are operated to bring the cursor in front of the word to be changed. In this example Z10.

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

X20.

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

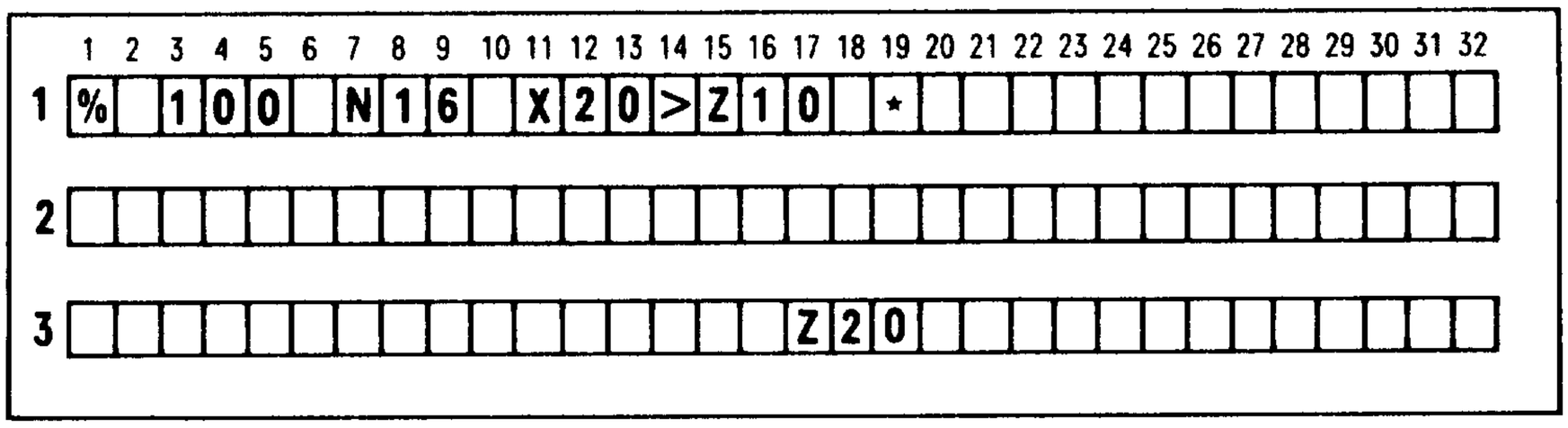


This incorrect entry will be indicated by dots because the entered address does not correspond to the address to be changed. This information will not be transferred to the memory.

The "Clear" pushbutton (no. 18) clears the incorrect entry.

Z20.

Changing Z10 to Z20,



and 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.

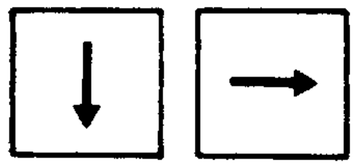
Where the address is to be changed the old word must first be deleted and then the new word entered.

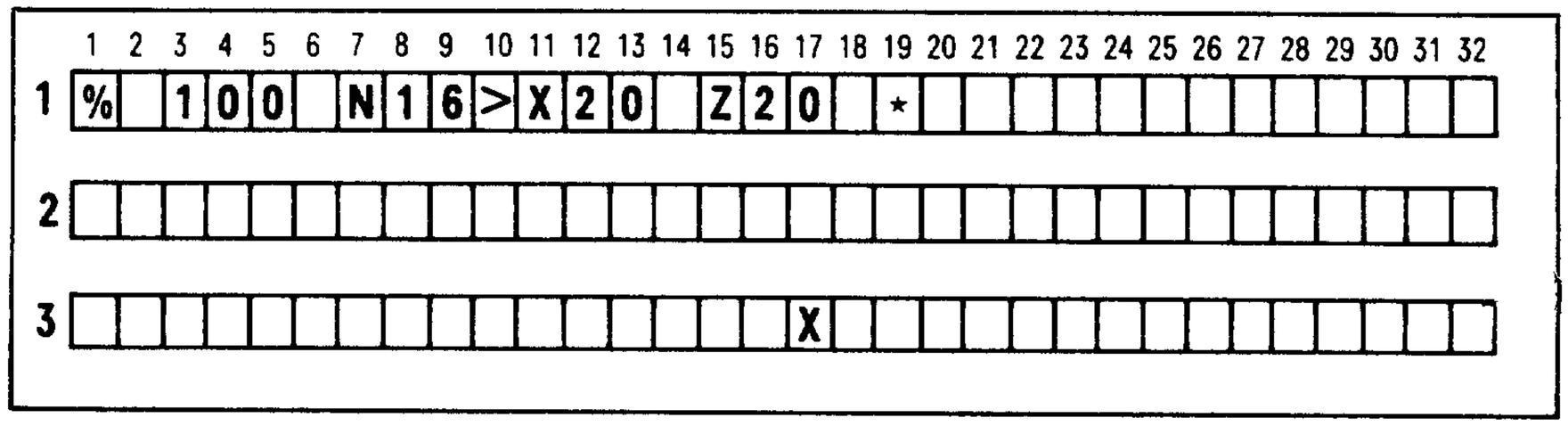
7.4.3 Single word delete

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 move the cursor in front of X20.





X

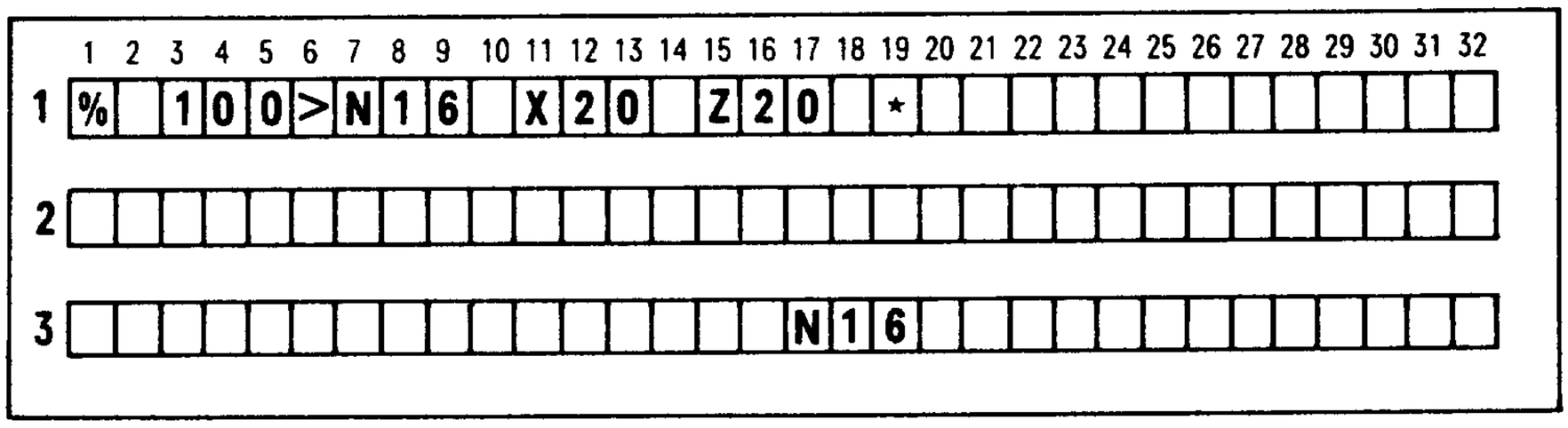
Enter the address X and conclude with the "Cancel" pushbutton (no. 14). The programmed X value is deleted.

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.

Select the program, as described in Section 7.2.



N16

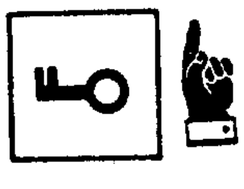
Enter the block number and press the "Cancel" pushbutton (no. 15). Block N16 will be deleted.

N0

Blocks without block number can be cancelled by inputting N0 and pushing the Cancel key (No. 15).

In the mode MDI-PP when TE, T0 or Z0 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 MDI-SE-TE



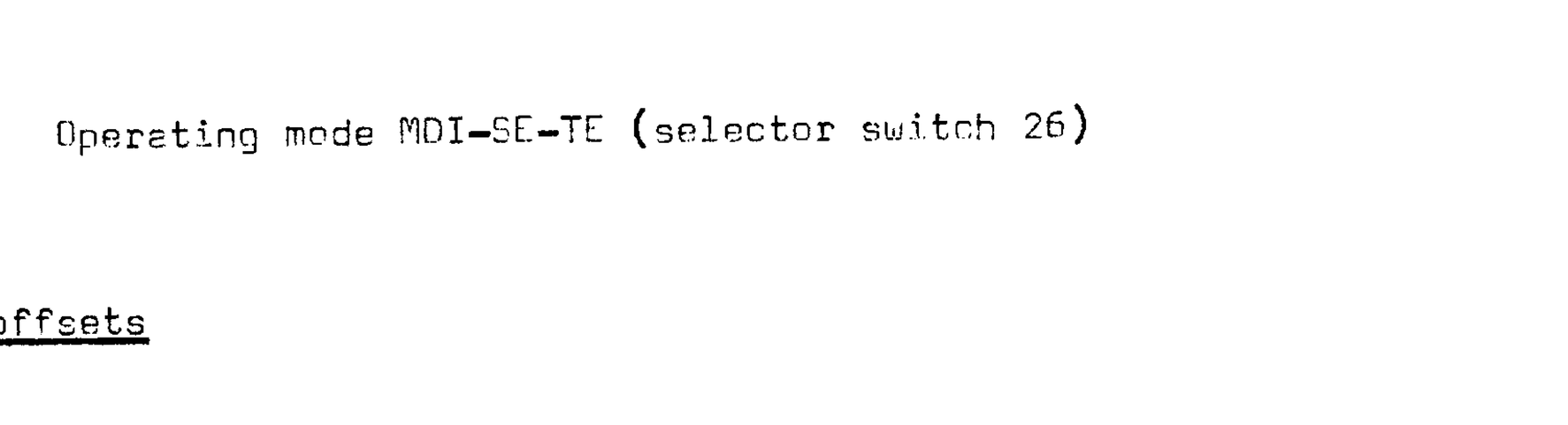
Keyswitch enabled (no. 39) for input, dependent on machine parameter.

Operating mode MDI-SE-TE (selector switch 26)

8.1 Tool offsets

8.1.1 Tool offsets 3T

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

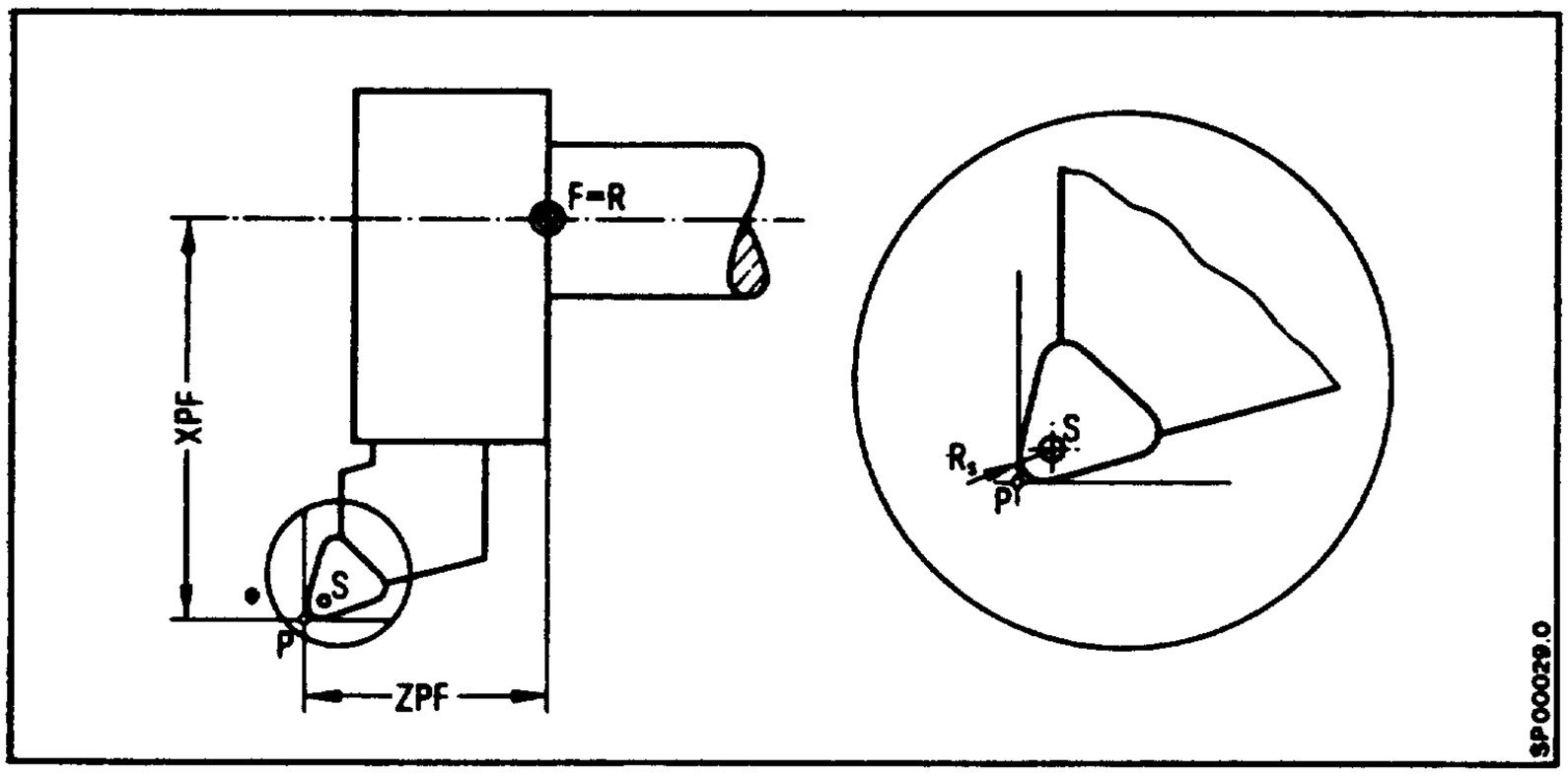


16 tool offsets can be selected with one display per value. For lathes, 4 values are required for an exact definition of the tool offset.

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 3 of the display.

8.1.1.1 Position of tool cutter point



P = Theoretical tip point

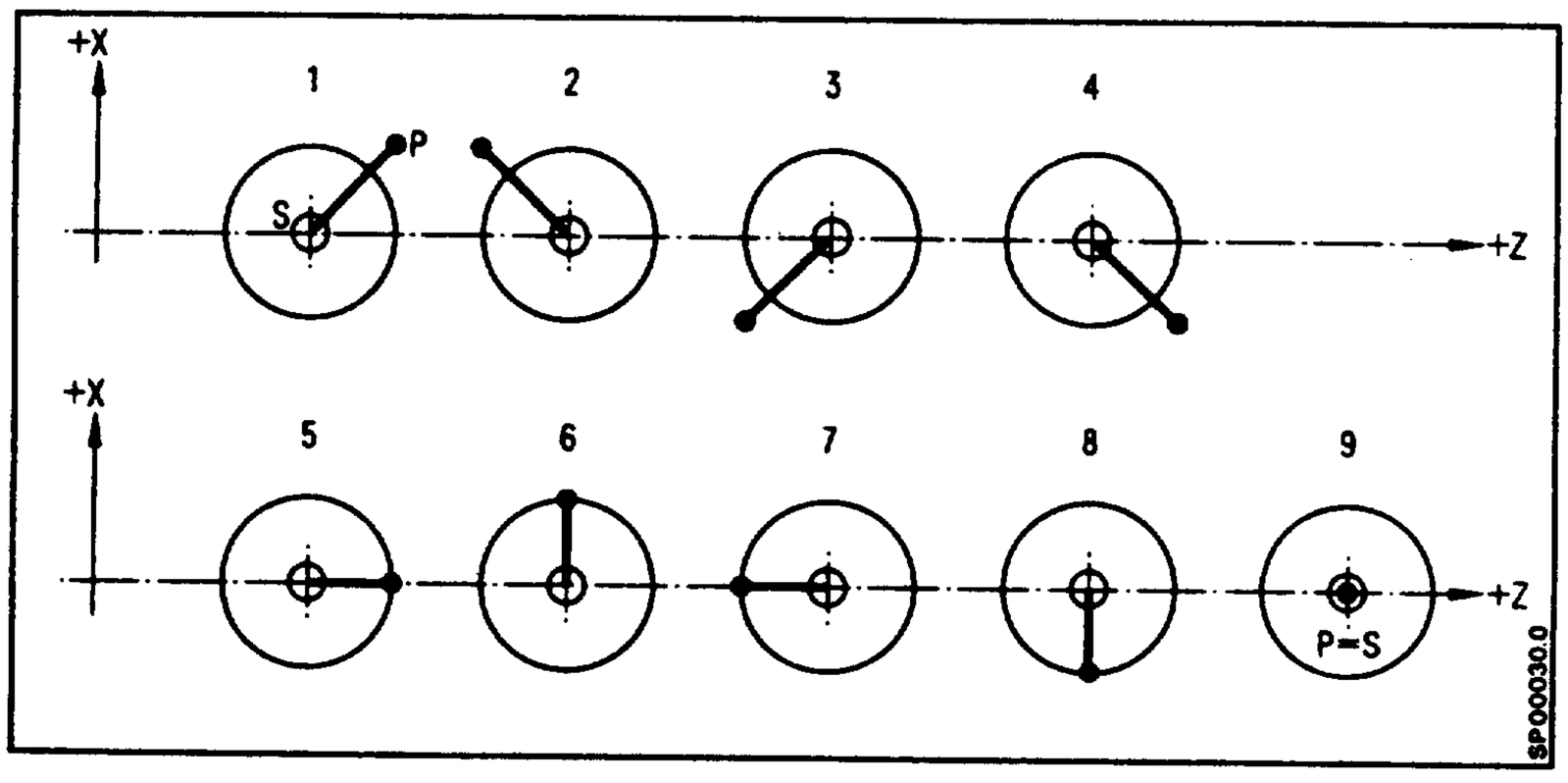
S = Tool tip radius centre point

R_S = Tool tip radius

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

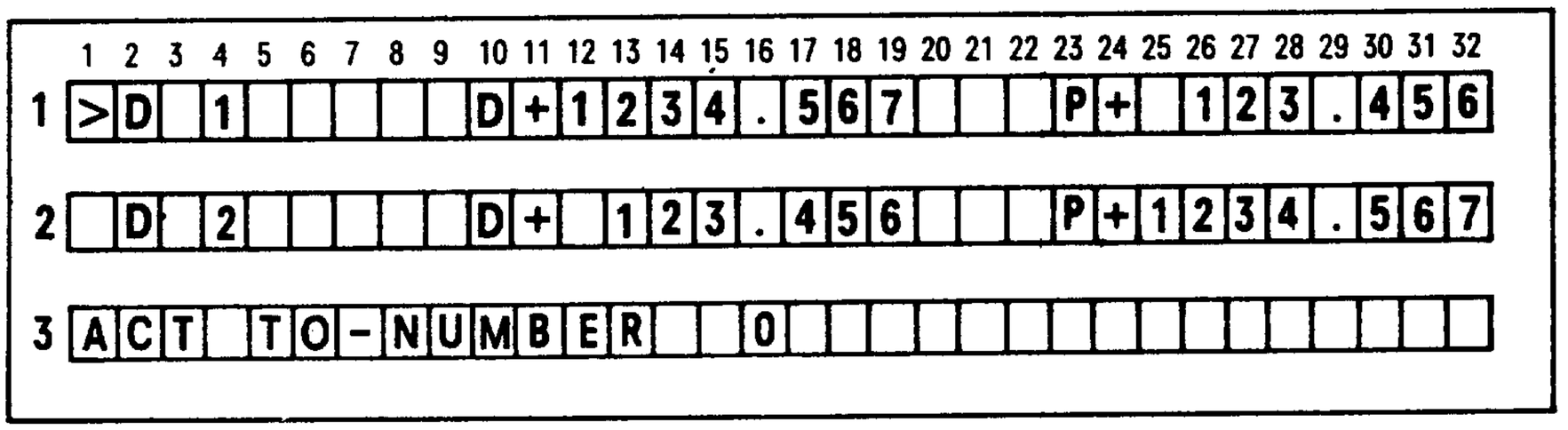
There are nine codes in total which define the position of the tool tip "P" with respect to the tool tip radius centre point "S".

Line of sight is always from S to P.



8.1.2 Tool offsets 3M

Tool offset (no. 6) is selected automatically.



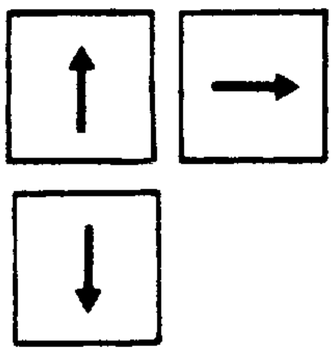
32 offset values can be selected with 2 values per display.

D1 - D32: D - length of cutter

P - radius of cutter

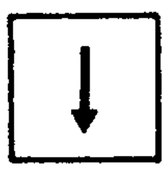
The active tool offset number is displayed in line 3.

8.1.3 Activation of selected offset values



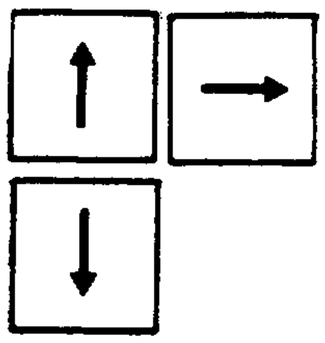
Preselect the required tool offset using the page and cursor buttons (nos. 20, 21, 22).

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.

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

D P 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 keyswitch (no. 39) is dependent on an additional machine parameter.

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

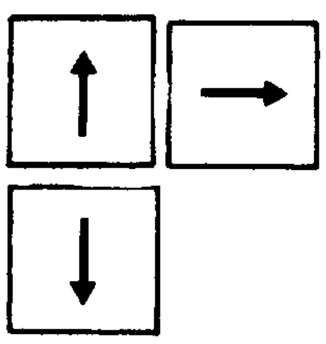
8.1.6 Reset offset values

[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

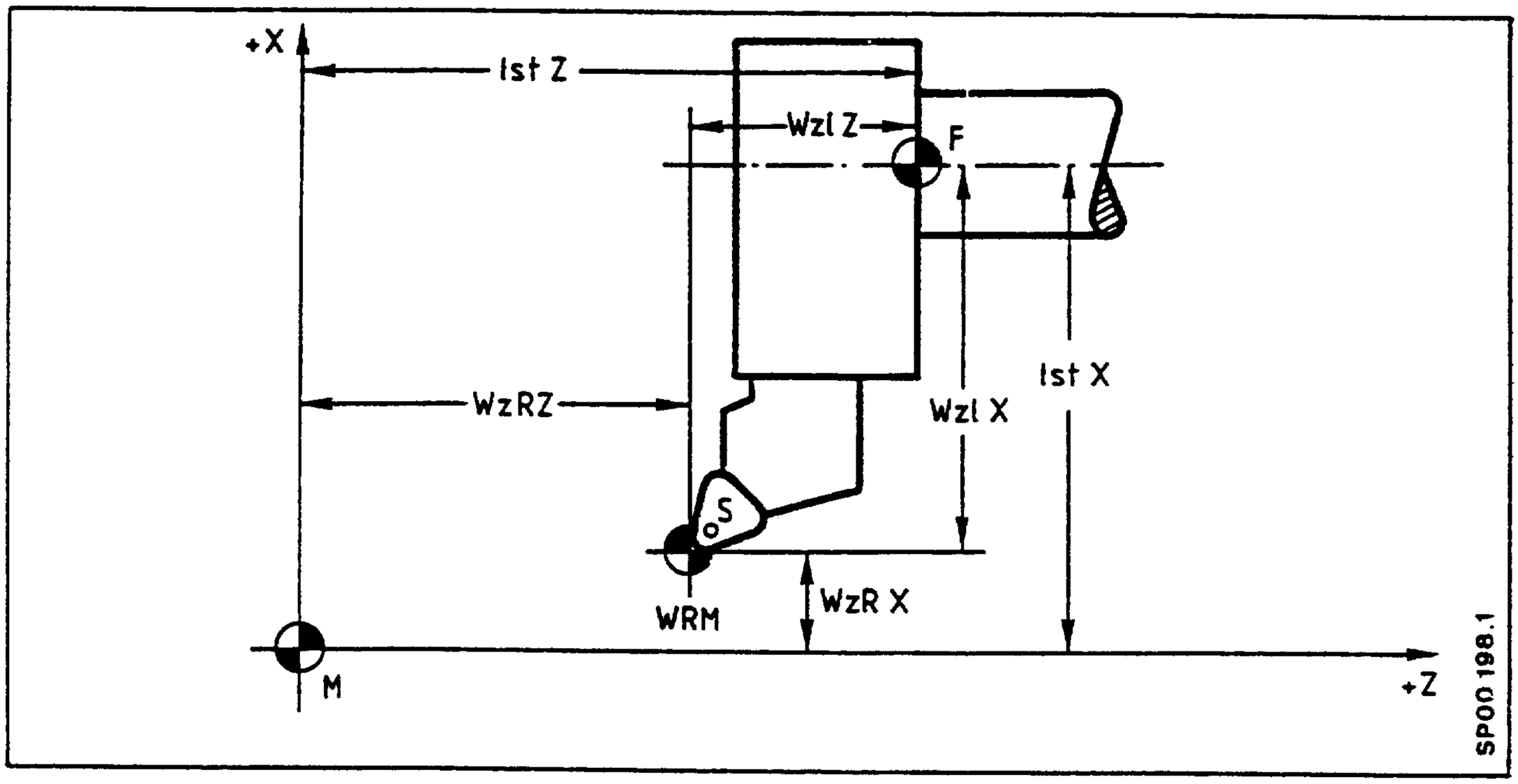
[D] [P] Address buttons (no. 11) for 3M

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 co-ordinates 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 23); see Chapter 10

Actual data stores are set to reference value.

Operating mode JOG (selector switch 26)

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

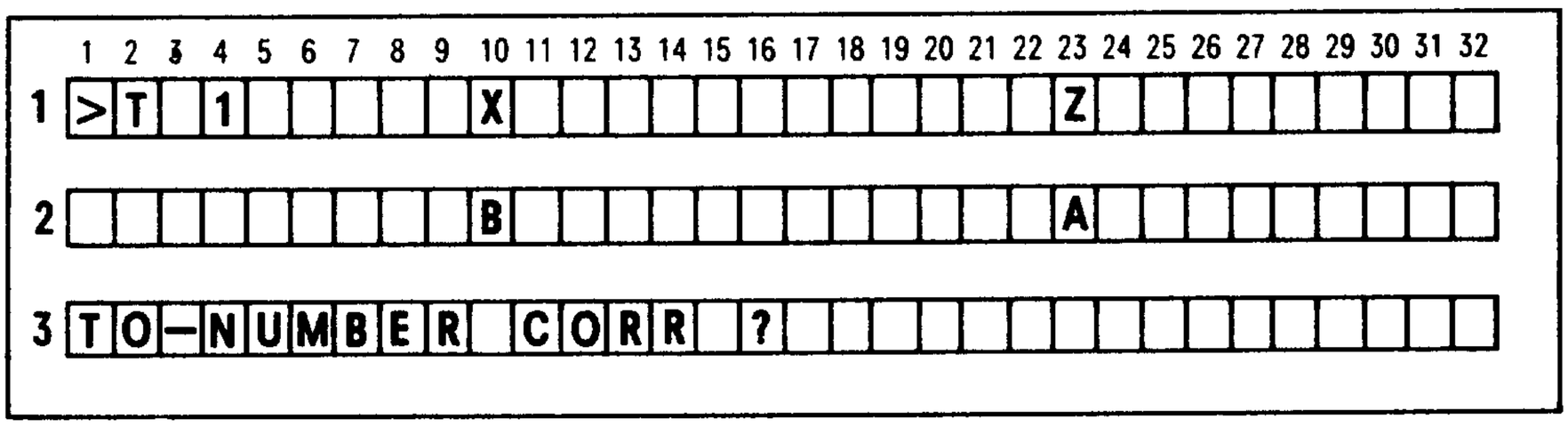
and/or

Operating mode INC (selector switch 26)

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

Select tool offset mode (no. 6) and switch display with Display button (no. 23)

The display below appears



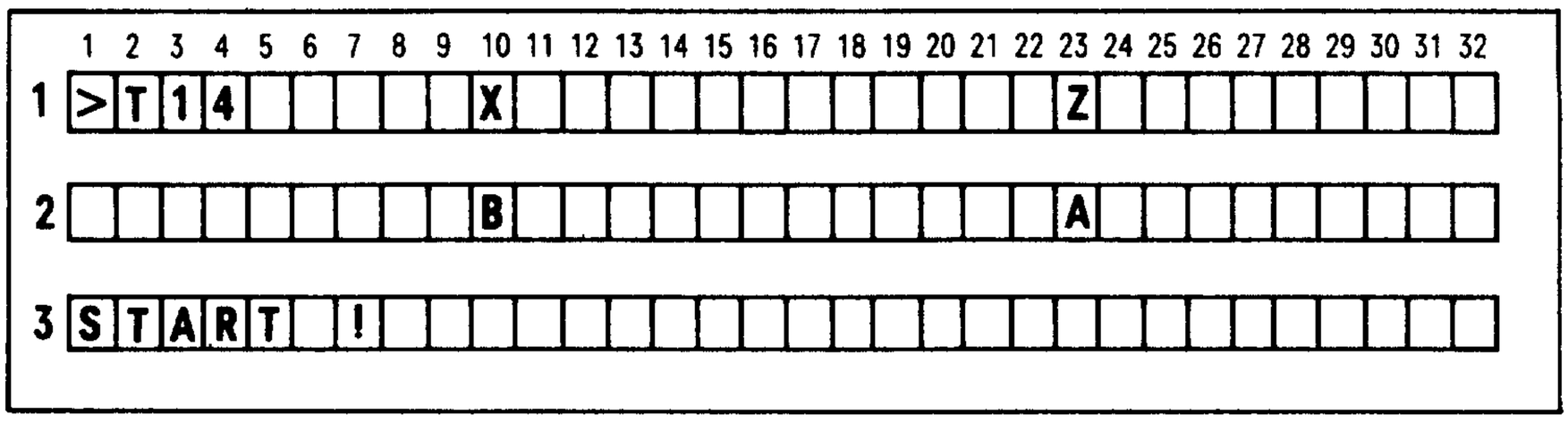
NO

Switch tool offset display until required tool offset number appears.

YES

Displayed tool offset number is correct (e.g. T14).

The following display appears



By pressing the Start button (no. 19) the automatic routine "Calculation of tool length" is initiated.

Tool length = actual co-ordinate - tool reference value

TL X = actual X - TR X

TL Z = actual Z - TR Z

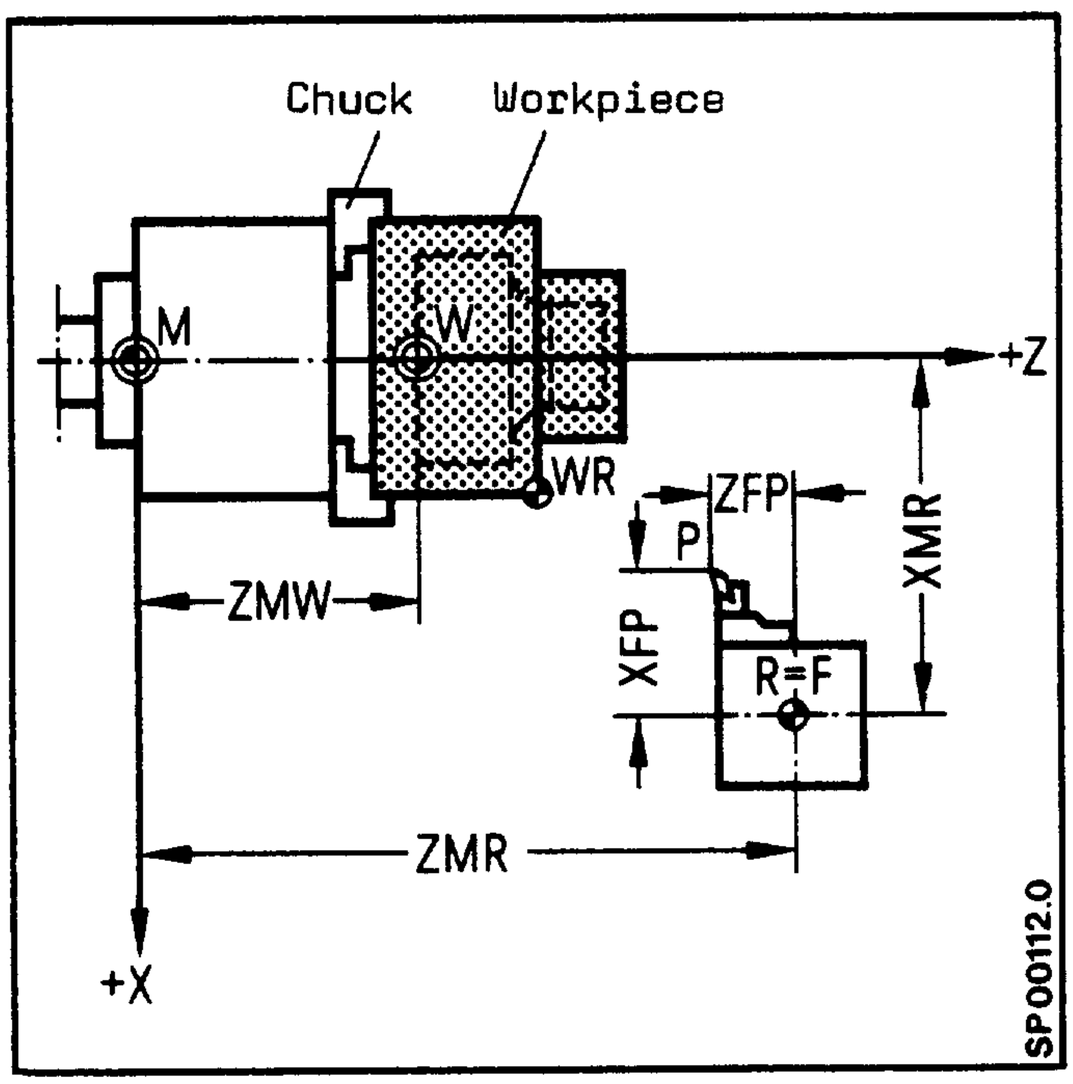
The tool lengths thus calculated for X and Z are filed in the preselected tool offset store (here e.g. T14).

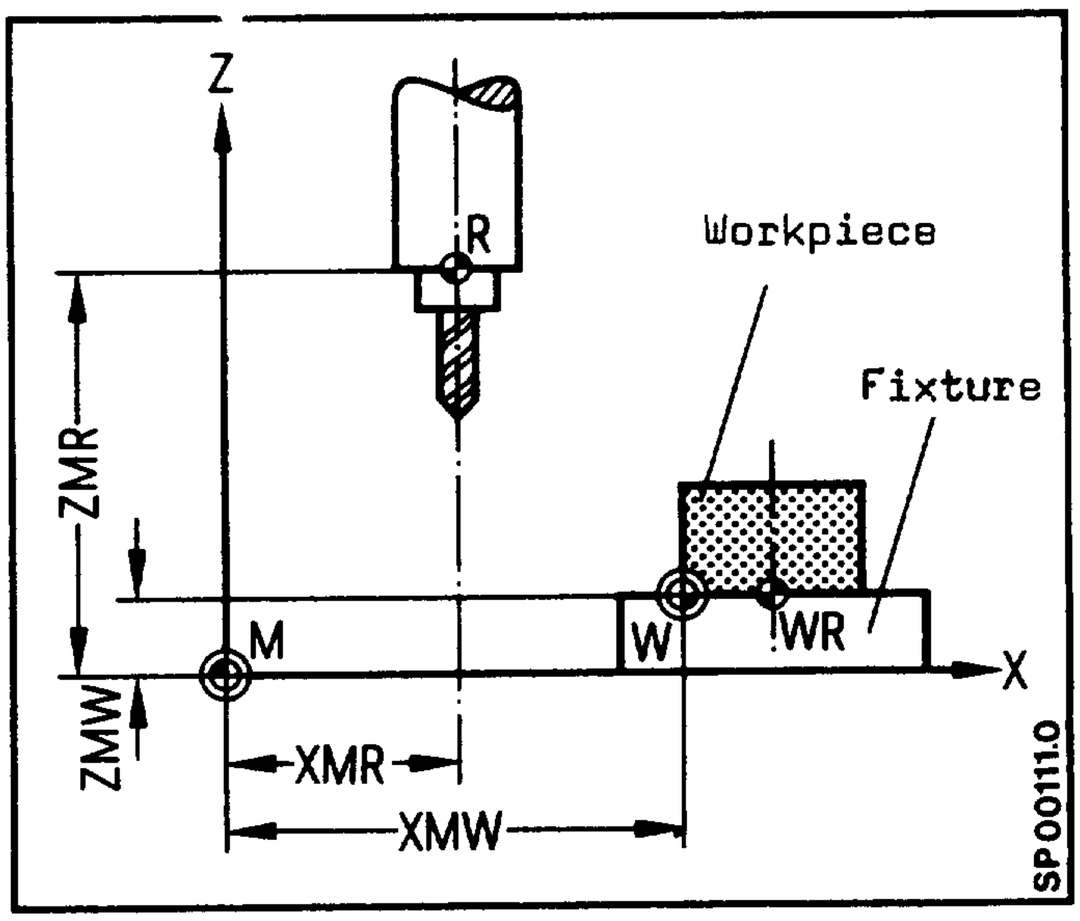
For input of cutter radius and tool position refer to Section 8.1.1.

8.2 Zero offsets

8.2.1 Reference Points

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





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 co-ordinate for each axes
XMW, ZMW, etc. = The sum of all zero point offsets for each axes.

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

8.2.2 Adjustable zero offsets (XMW, ...)

The actual memory and the position readout 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 (ZO) 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 ZO = Displayed position - tool length

e.g., | XMW = XMF - XTF |

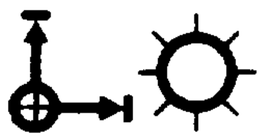
If the machine is jogged to the workpiece reference point, the formula is:

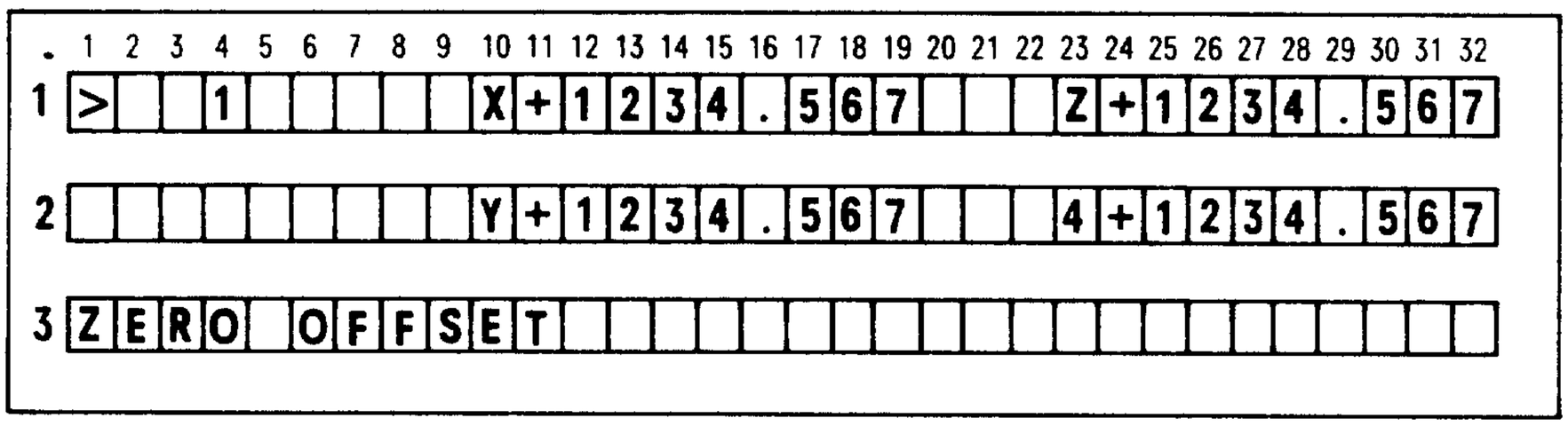
Settable ZO = Displayed position - tool length - Difference (Workpiece reference point / workpiece zero point)

e.g., | XMW = XMF - XFP - △ WR |

8.2.4 Zero offset display

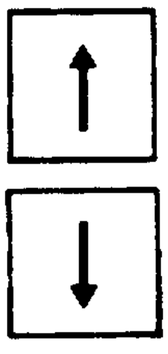
Select zero offset mode (no. 7) using
Display Switch button (no. 23)





Display of adjustable zero offset

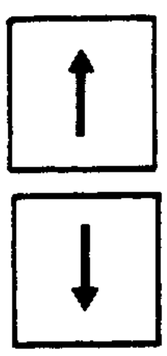
programmable zero offset (5),
external zero offset (6)
for all the axes selected.



Preselect required zero offset

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

8.2.5 Adjustable zero offset reset



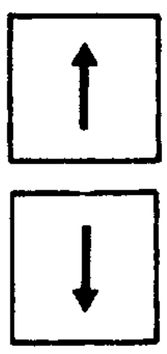
Select required number using page buttons

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

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

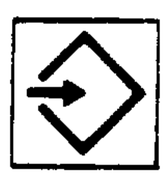
The value is cleared using the Cancel button (no. 14) and the corresponding address button.

8.2.6 Entering adjustable zero offsets



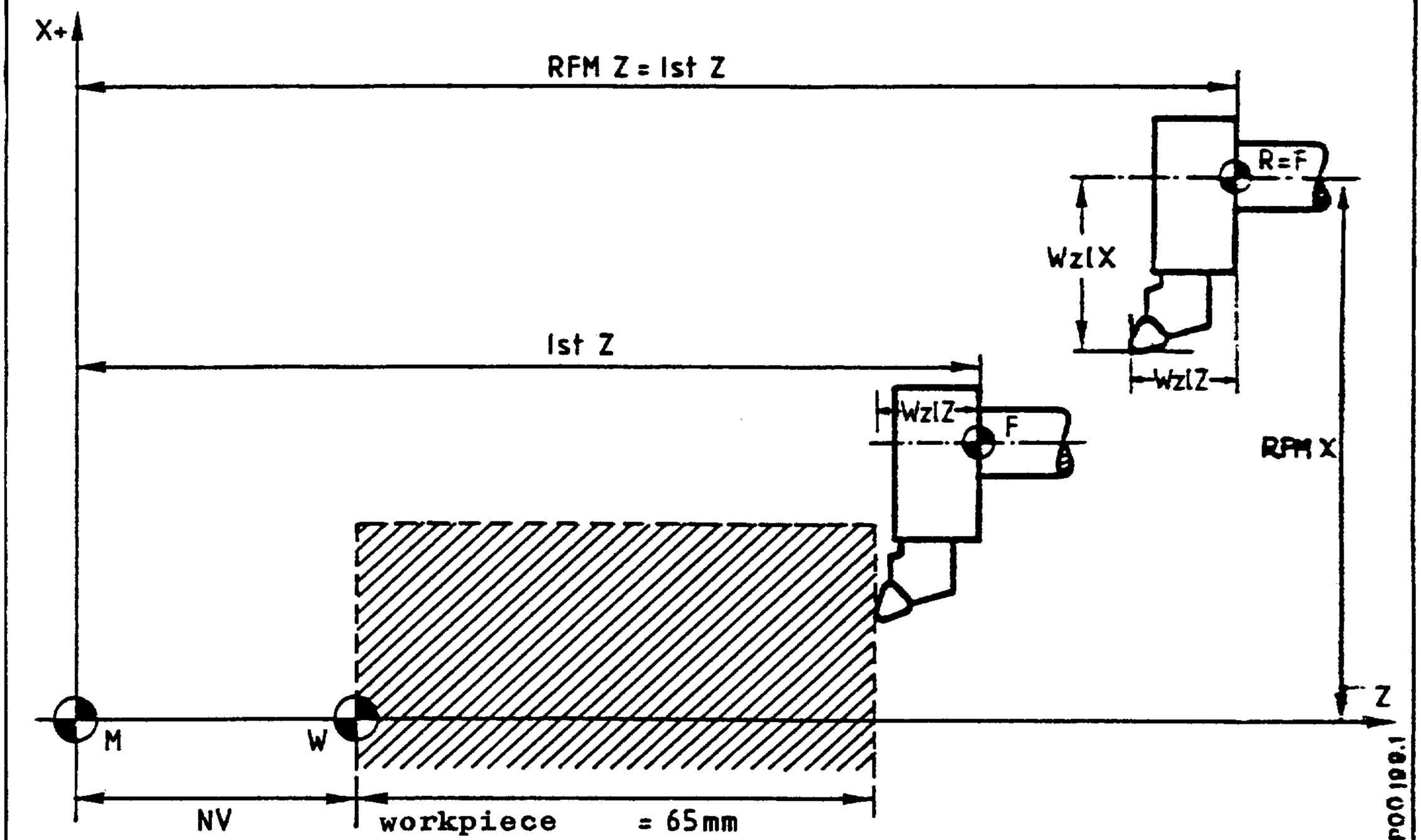
Preselect required zero offset

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.



M = machine zero point

F = slide reference point

R = machine reference point

W = workpiece zero point (WZL = tool length)

Operating mode return to datum (selector switch 26)

(see Chapter 10)

Actual value counter is set to reference value.

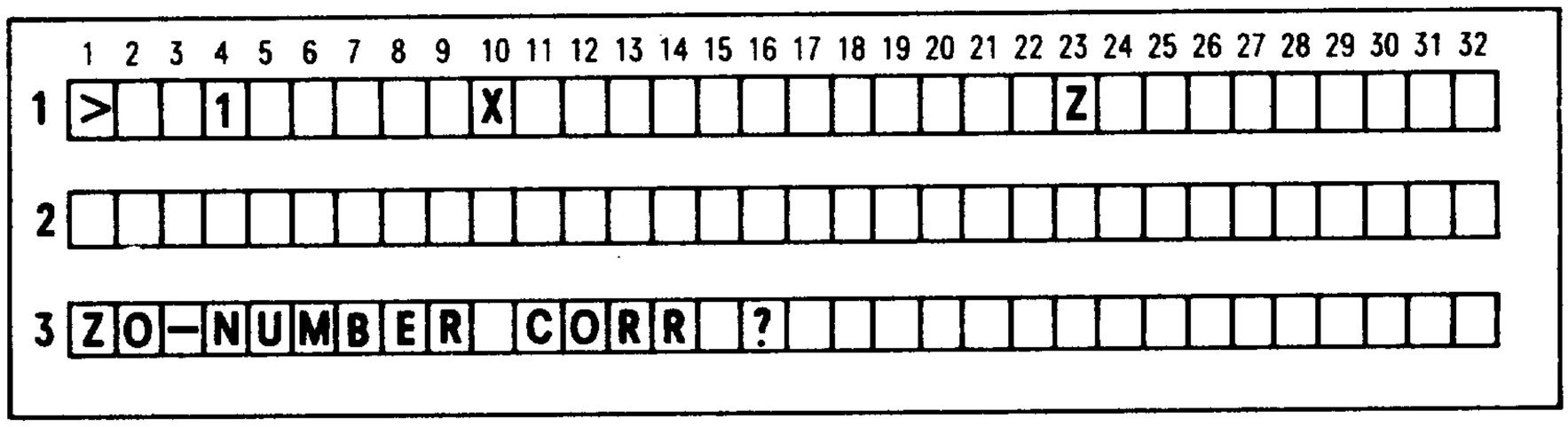
Jog mode (selector switch 26)
Traverse the tool tip to a known point on the workpiece (setting up). (Use workpiece drawing).

and/or

Incremental mode (selector switch 26)
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. 23)

The following display appears (e.g. 3T)



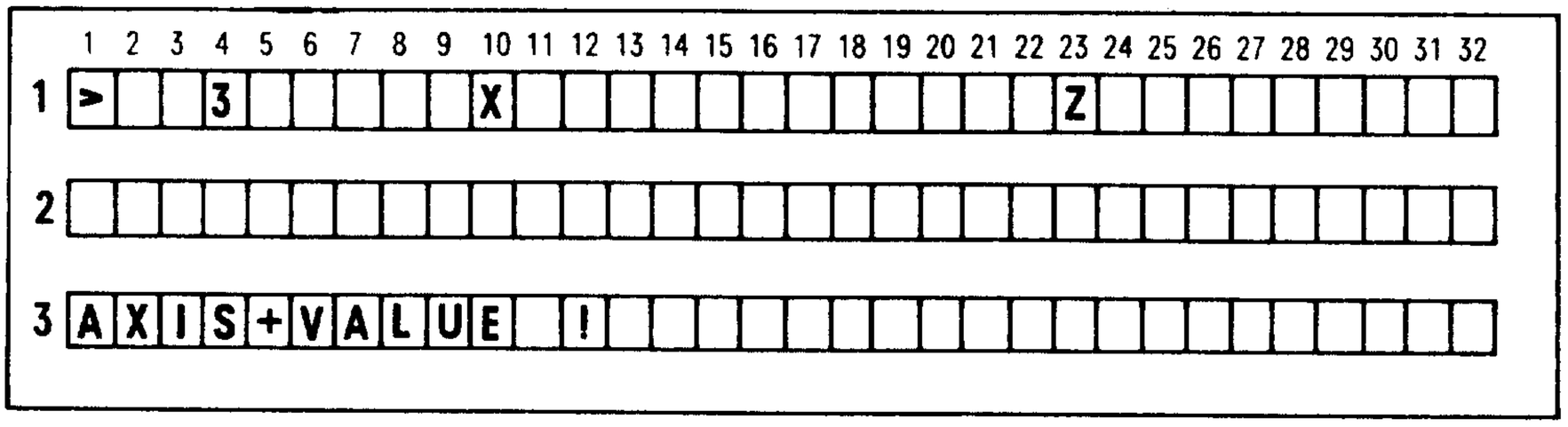
NO

Switch zero offset display until required zero offset number appears.

YES

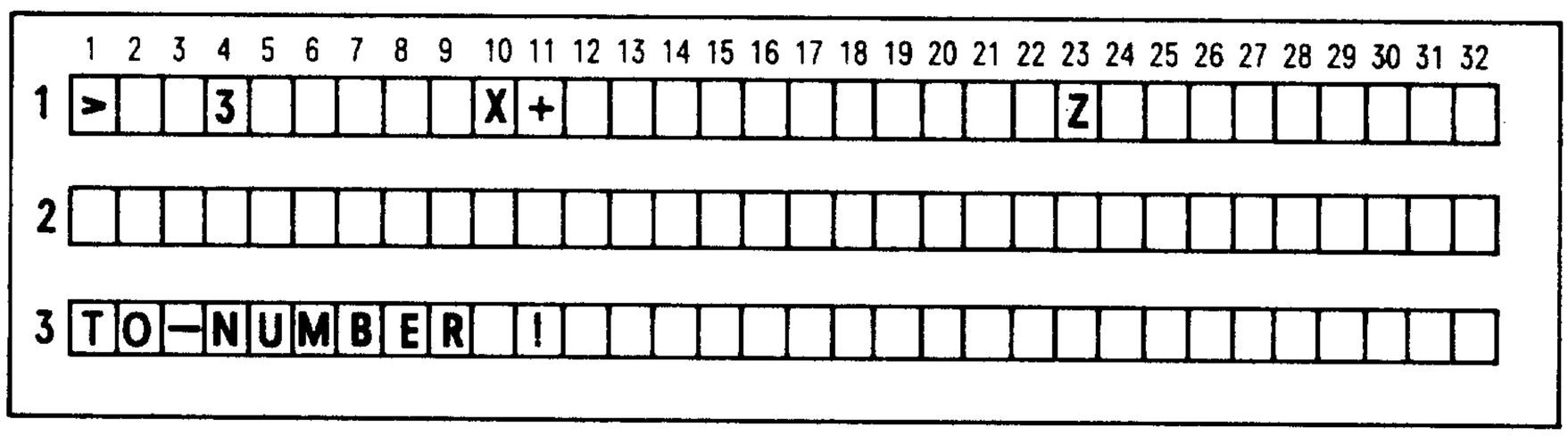
Displayed zero offset number is correct (e.g. 2).

The following display appears



X
65

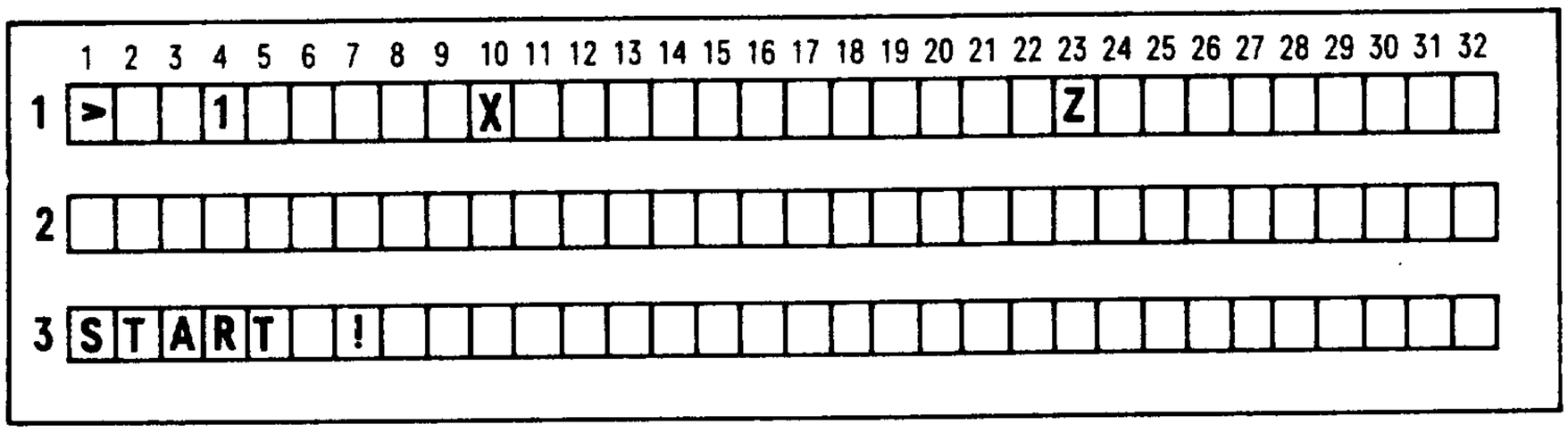
Input component dimension (e.g. X + 65 mm) associated with tool tip.



T12

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

The following display appears



Pressing the Start button (no. 19) initiates the automatic routine "Calculation of zero offset".

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

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

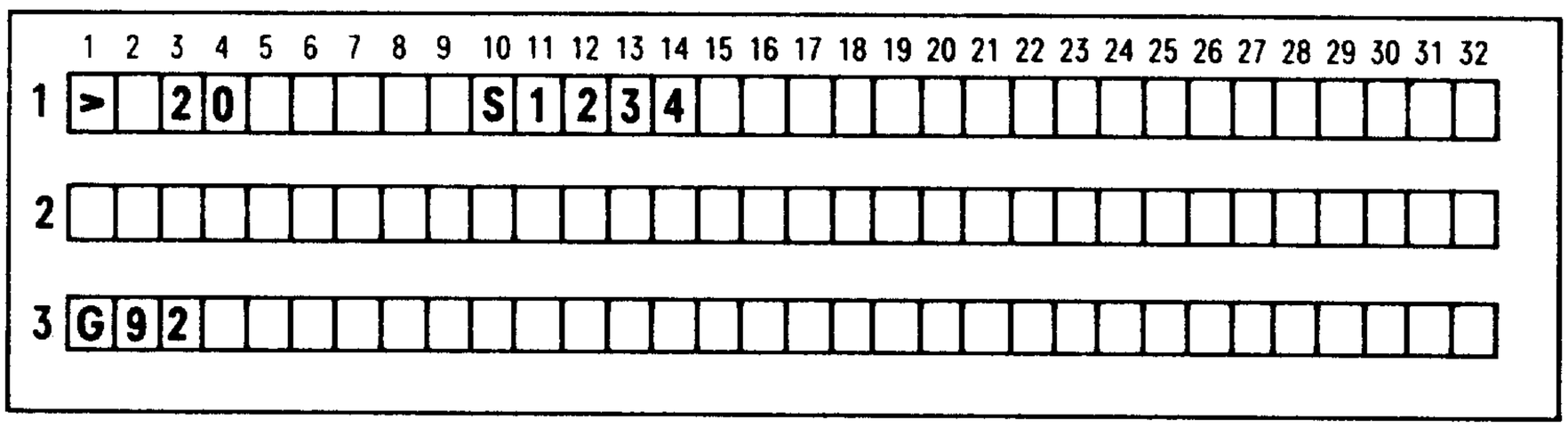
The zero offsets thus calculated for X and Z are filed in the preselected zero offset store (here e.g. 1).

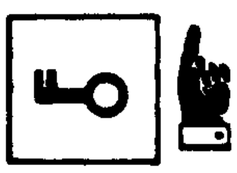
The automatic calculation of zero offsets is carried out for each axis separately. The component dimension input also defines the axis.

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 buttons
(nos. 21, 22)



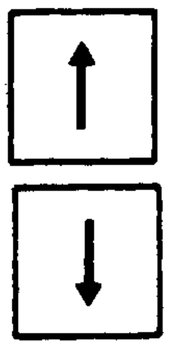


Input can be interlocked via keyswitch (no. 39)
(dependent on machine parameter).

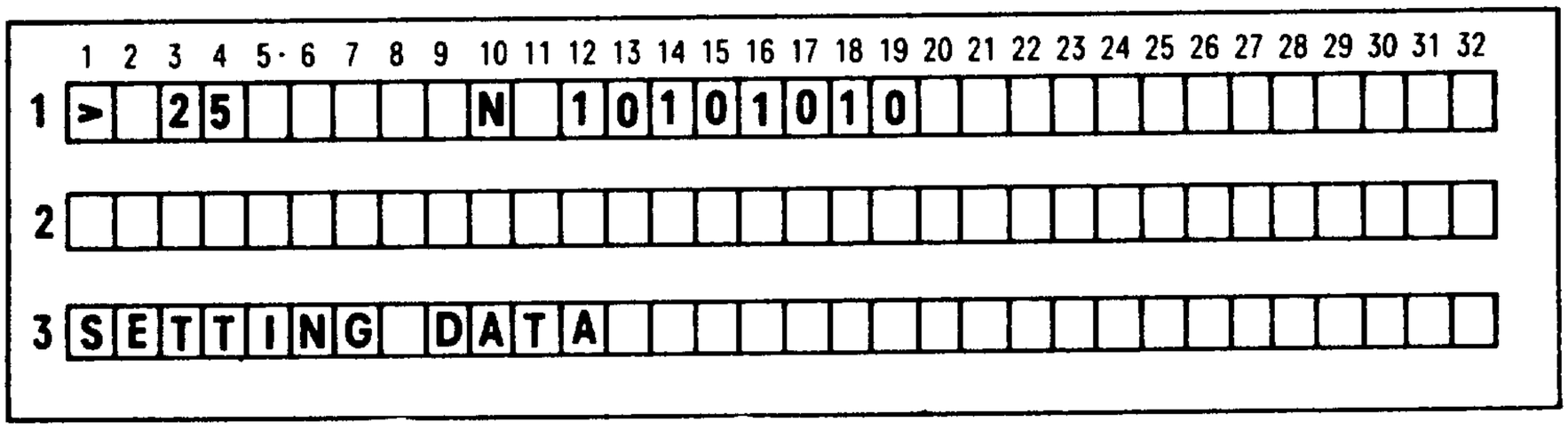
S 800

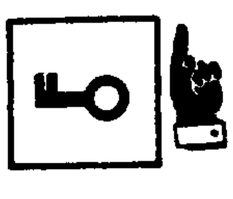
Input limit speed
e.g. 800 RPM.

8.4 Bit-oriented user data



Preselect display no. 25 using the page buttons (nos. 21, 22)

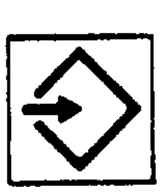




Keyswitch interlock (no. 39)

(dependent on machine parameter)

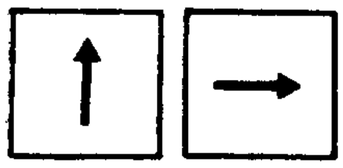
N11101010 Input user datum



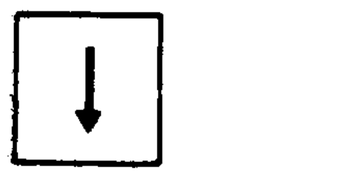
The appendix contains a list of bit-oriented user data.

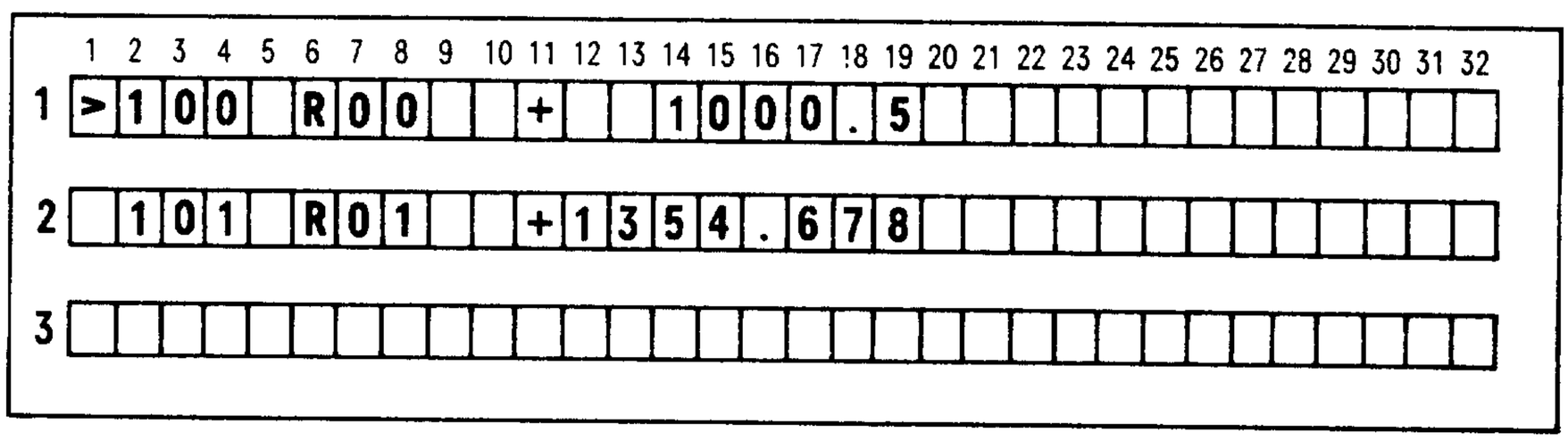
8.5 R parameters

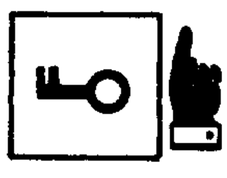
The R parameters (see programming manual) can be displayed and modified.



Select display nos. 100 to 149 (parameters R00 to R49) using the page buttons (nos. 21, 22) and the cursor button (no. 20)







Keyswitch interlock (no. 39)

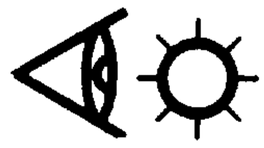
(dependent on machine parameter)

R00 Input on R parameter

1000.5 e.g. R00 1000.5

8.6 Data and display selection TE

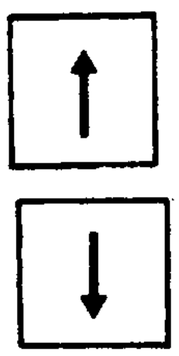
Select "Test" (no. 8) on appropriate button.



Switch display (no. 23)

The following data are displayed with TEST:

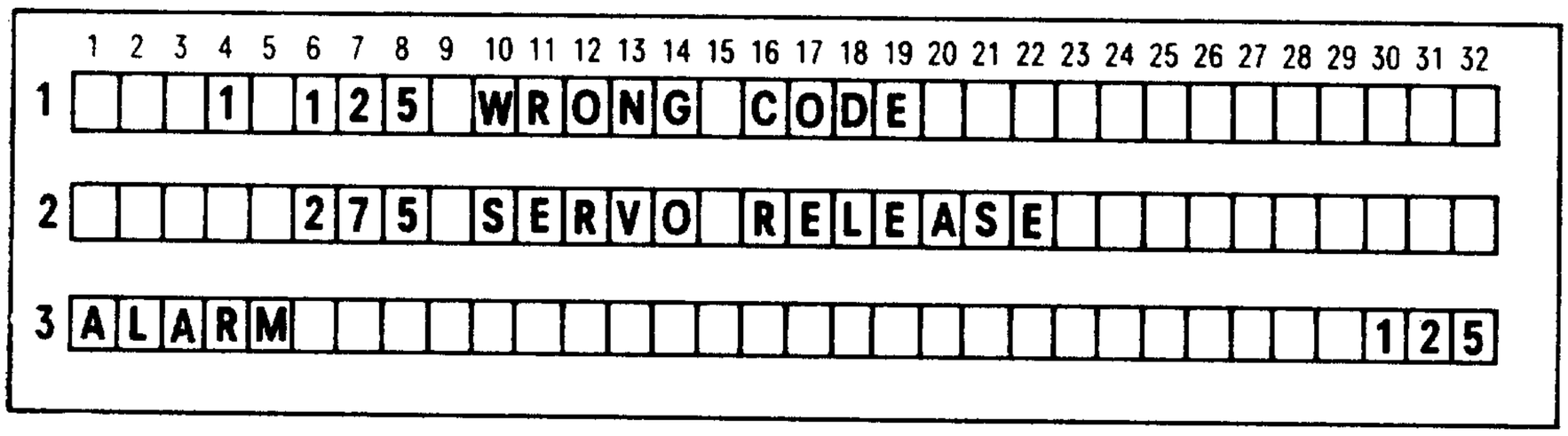
Ident. number	Data type
1 - 2	Alarms
7 - 9	Input signals
10 - 11	Output signals
100 - 443	Machine parameters
800 - 861	Commissioning values



Scanning through display numbers using page buttons (nos. 21, 22)

A change in value can only be made in the MDI-SE-TE mode (selector switch 26) and protected using the machine **data protection switch** (see commissioning instructions).

8.6.1 ALARM DISPLAY

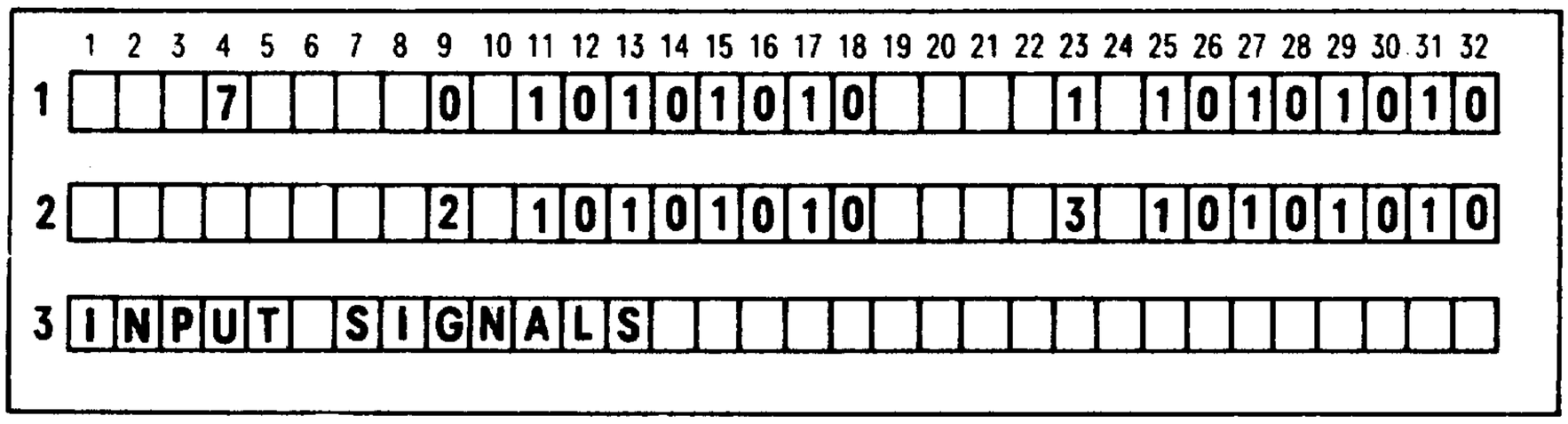


The first alarm number of any active NC alarms is always displayed in the last 3 spaces of line 3. In addition, up to 4 active alarms are shown in plain text (brief description of fault source) in two consecutive displays.

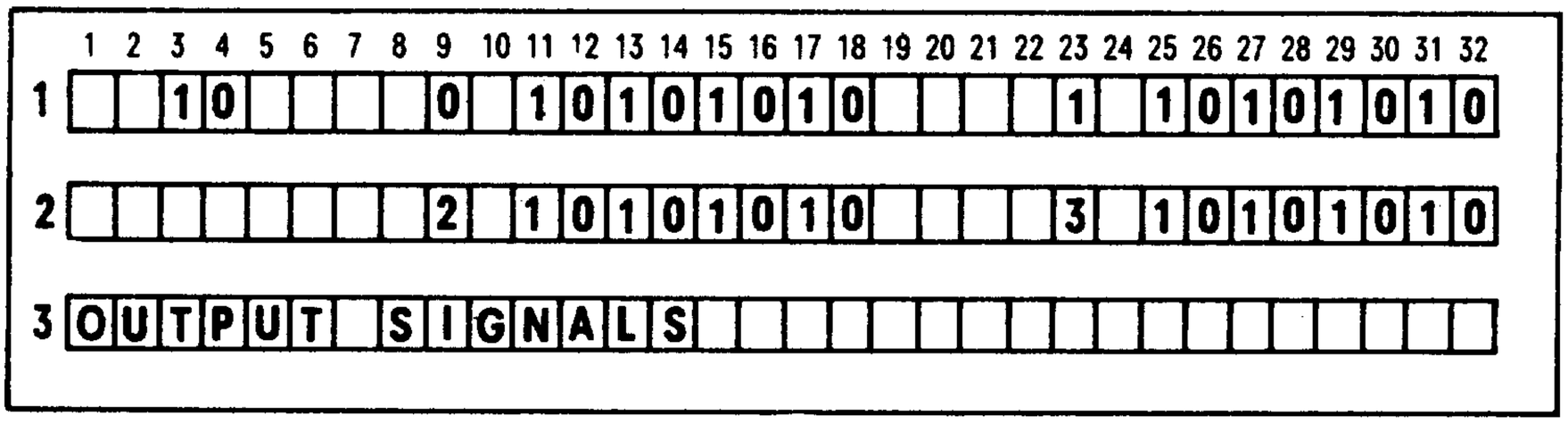
Scanning via page buttons (nos. 21, 22)

8.6.2 Interface copy

With the aid of the integral interface diagnostics it is possible at any time to display the I/O signals of the interface section between the NC and the interface control or between the NC and the PC.
No Input is possible. For specific interface signals and their actraction see fig. below.



9 bytes of the NC input signals are shown in three displays (N7, N8, N9).



8 bytes of the NC output signals are shown in the displays (N10, N11).

Input interface SINUMERIK System 3 versions 0,1,2

NC		NC - Interface control or PC								PC		
Test ◁ No.	Byte	7	6	5	4	3	2	1	0	Data module 9 DW	Relative byte addr.	Marker byte
7	0	Operating mode switch D	C	B	A	Feedrate/rapid ovveride switch D	C	B	A	1 H	0	0
7	1	Key-switch	Dry run	Block delete	Single block	Block search	Spindle override switch C	B	A	1 L	1	1
7	2	Rapid override active	Rapid override	Direction buttons +	-	Axis selector swit B	A	*Decele-ration X	Controller enable X	2 H	2	2
7	3	4th axis main axis				X	NC start	*Decele-ration Y	Controller enable Y	2 L	3	3
8	4	Coding C	Gear stages B	A	Spindle rotation cw	Spindle enable	Feed enable	*Decele-ration Z	Controller enable Z	3 H	4	4
8	5	* E. stop	Data input enable	Mirror image Y	X	Axis inhibit	without operator panel	*Decele-ration 4th axis	Controller enable 4th axis	3 L	5	5
8	6	Mod. signal		External data input Code signal for mod.	E	D	C	B	A	4 H	6	6
8	7				External data input parameter					4 L	7	8
		H	G	F	E	D	C	B	A			
9	8				External data input parameter					5 H	8	7
		Q	P	O	N	M	L	K	I			

Output interface

NC		NC - Interface control or PC								PC		
Test ◁ No.	Byte	7	6	5	4	Data bit 3	2	1	0	Data module 9 DW	Relative byte addr.	Marker byte
10	0	Mod. signal M	S	T		4th axis	Motion command Z	Y	X	7 H	12	12
10	1	Program active		NC BB2	NC BB1	Rapid	Thread cutting	M02/ M30 Reset	Programmed stop M00	7 L	13	13
10	2	BCD output 10^1 D	10^1 C	10^1 B	10^1 A	10^0 D	10^0 C	10^0 B	10^0 A	8 H	14	15
10	3									8 L	15	16
11	4									9 H	16	17
11	5	BCD output 10^3 D	10^3 C	10^3 B	10^3 A	10^2 D	10^2 C	10^2 B	10^2 A	9 L	17	14

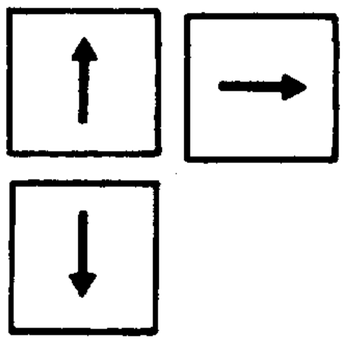
Input interface SINUMERIK System 3 versions 0,1,2

NC		NC - Interface control or PC								PC		
Test ◁ No.	Byte	7	6	5	4	3	2	1	0	Data module 9 DW	Relative byte addr.	Marker byte
7	0	Operating mode switch D	C	B	A	Feedrate/rapid ovveride switch D	C	B	A	1 H	0	0
7	1	Key-switch	Dry run	Block delete	Single block	Block search	Spindle override switch C	B	A	1 L	1	1
7	2	Rapid override active	Rapid override	Direction buttons X+	X-	Z+	Z-	*Decele-ration X	Controller enable X	2 H	2	2
7	3	X	2nd X-software lim. act.			Handwheel X	NC start	*Decele-ration Z	Controller enable Z	2 L	3	3
8	4	Coding C	Gear stages B	A	Spindle rotation cw	Spindle enable	Feed enable			3 H	4	4
8	5	* E. stop	Data input enable	Mirror image Z	Mirror image X values	Axis inhibit	without operator panel			3 L	5	5
8	6	Mod. signal	External data input Code signal for mod.		E	D	C	B	A	4 H	6	6
8	7	External data input parameter H	G	F	E	D	C	B	A	4 L	7	8
9	8	External data input parameter Q	P	O	N	M	L	K	I	5 H	8	7

Output interface

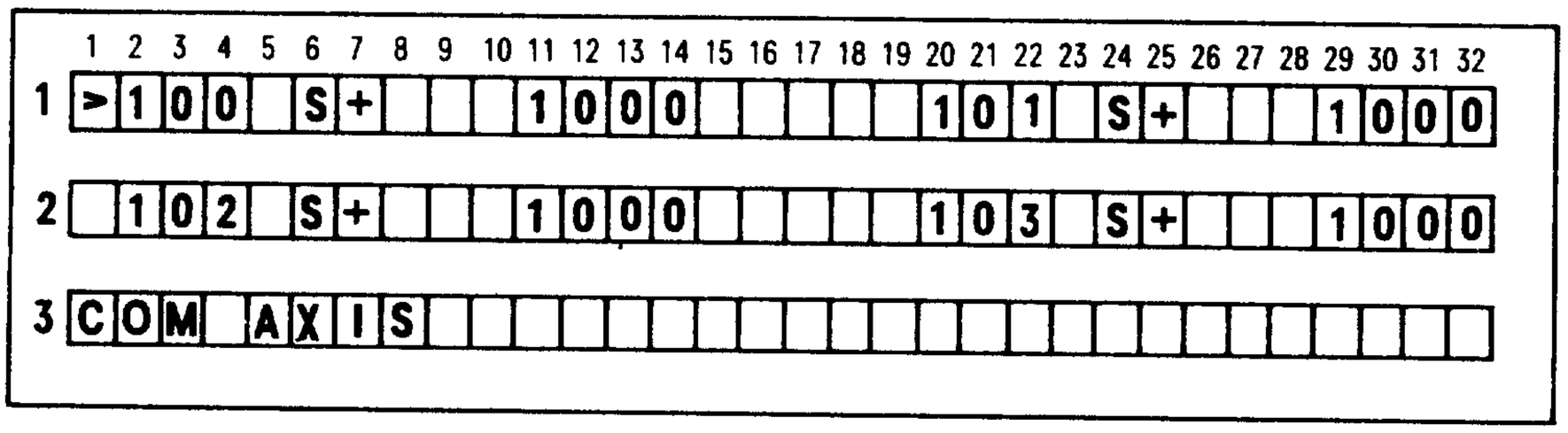
NC		NC - Interface control or PC								PC		
Test ◁ No.	Byte	Data bit 7	6	5	4	3	2	1	0	Data module 9 DW	Relative byte addr.	Marker byte
10	0	Mod. signal M	S	T				Motion command Z	X	7 H	12	12
10	1	Program active		NC BB2	NC BB1	Rapid	Thread cutting	M02/ M30 Reset	Programmed stop M00	7 L	13	13
10	2	BCD output 10^1 D	10^1 C	10^1 B	10^1 A	10^0 D	10^0 C	10^0 B	10^0 A	8 H	14	15
10	3									8 L	15	16
11	4									9 H	16	17
11	5	BCD output 10^3 D	10^3 C	10^3 B	10^3 A	10^2 D	10^2 C	10^2 B	10^2 A	9 L	17	14

8.6.3 NC-machine parameters

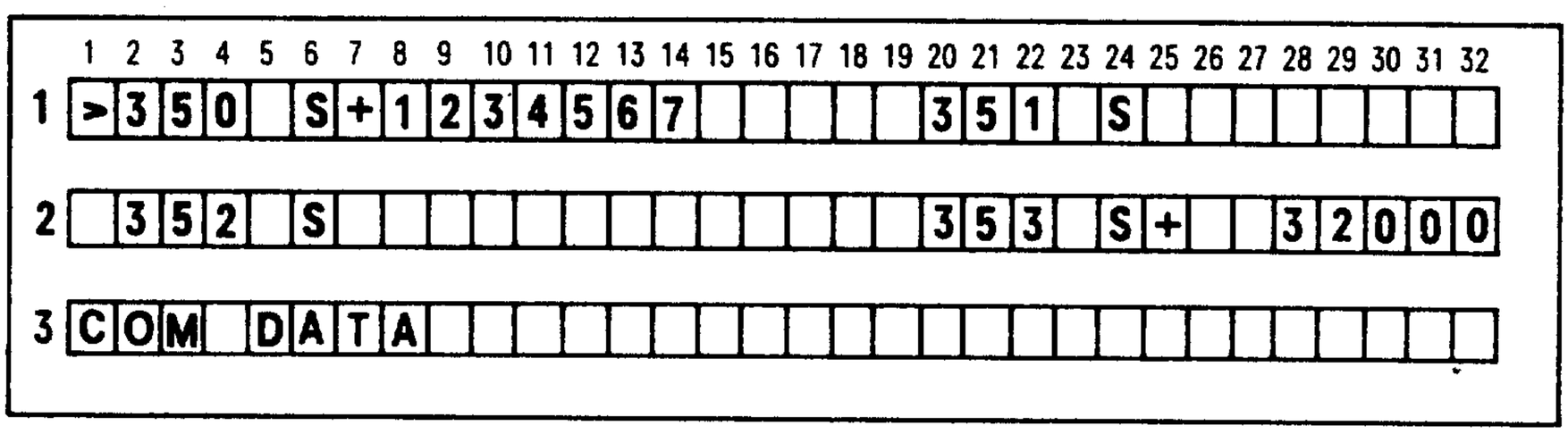


Select display nos. 100 to 443 using the page and cursor buttons (nos. 21, 22, 20).

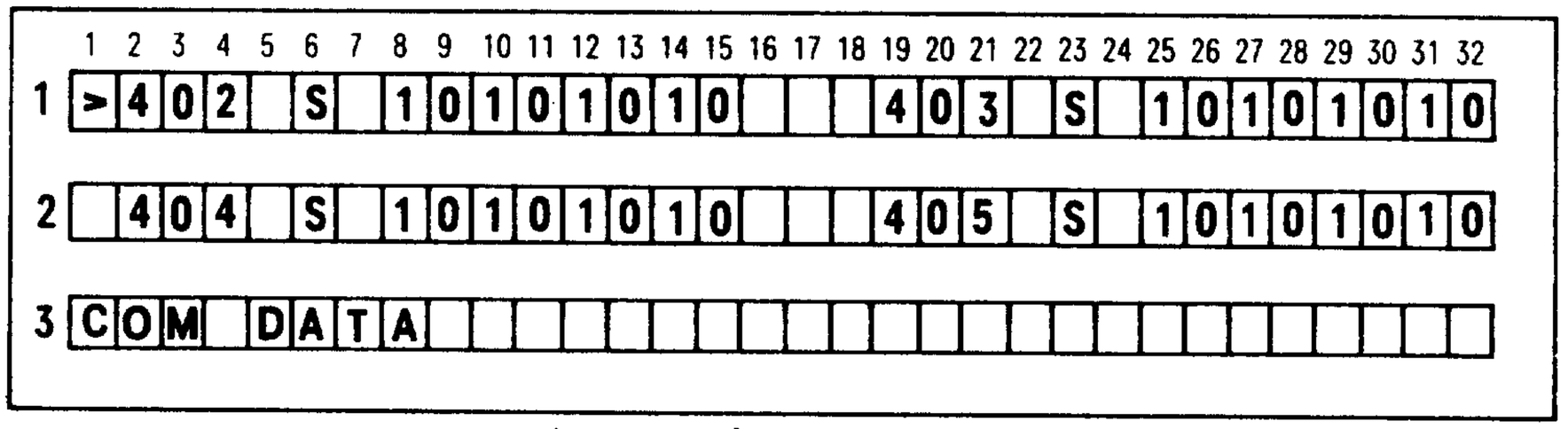
Machine parameters are determined and read in during commissioning.



Axis-specific machine parameters (100-349).

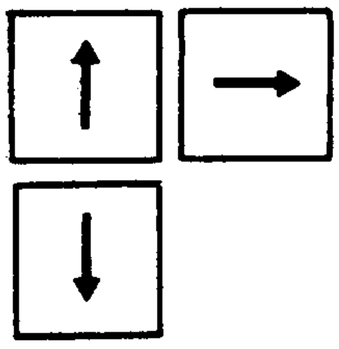


General machine parameters (350-399)



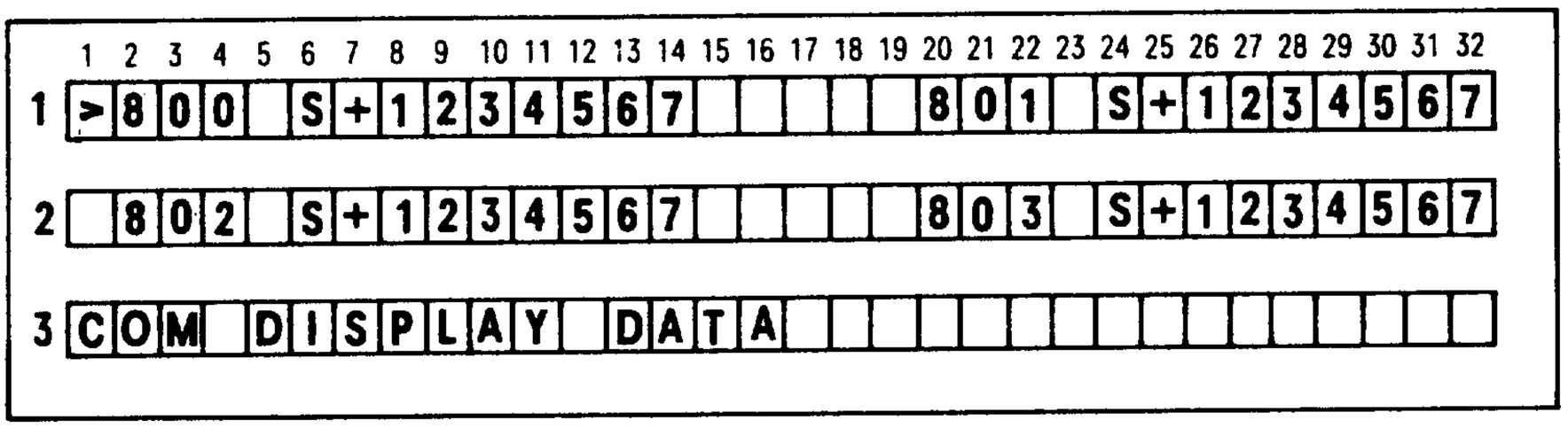
Machine parameter bits (400-443)

8.6.4 Commissioning values



Select display nos. 800 to 841 using the page and cursor buttons (nos. 21, 22, 20).

No input possible.

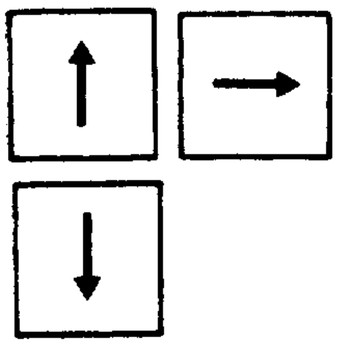


The following values are displayed.

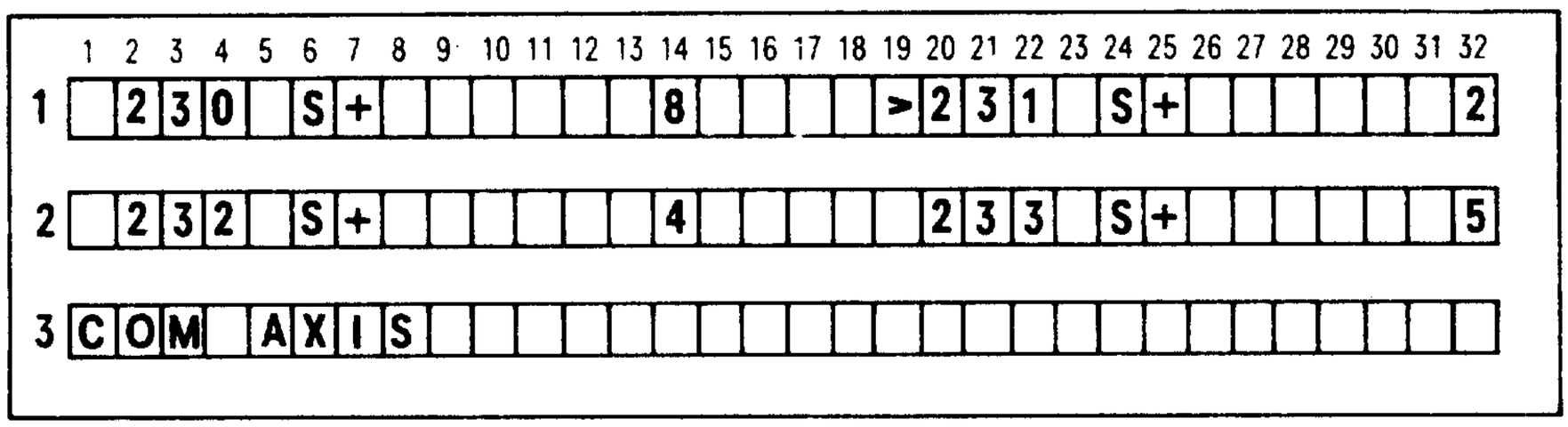
Ident. number	Axis		Display
	3T	3M	
800 S	X	X	Following error
801 S	Z	Y	Following error
802 S	-	Z	Following error
803 S	-	4th	Following error
810 S	X	X	Actual value (measuring system)
811 S	Z	Y	Actual value (measuring system)
812 S	-	Z	Actual value (measuring system)
813 S	-	4th	Actual value (measuring 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	KV factor measured
851 S	Z	Y	KV factor measured
852 S	-	Z	KV factor measured
853 S	-	4th	KV 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. 20, 21, 22)



S

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.

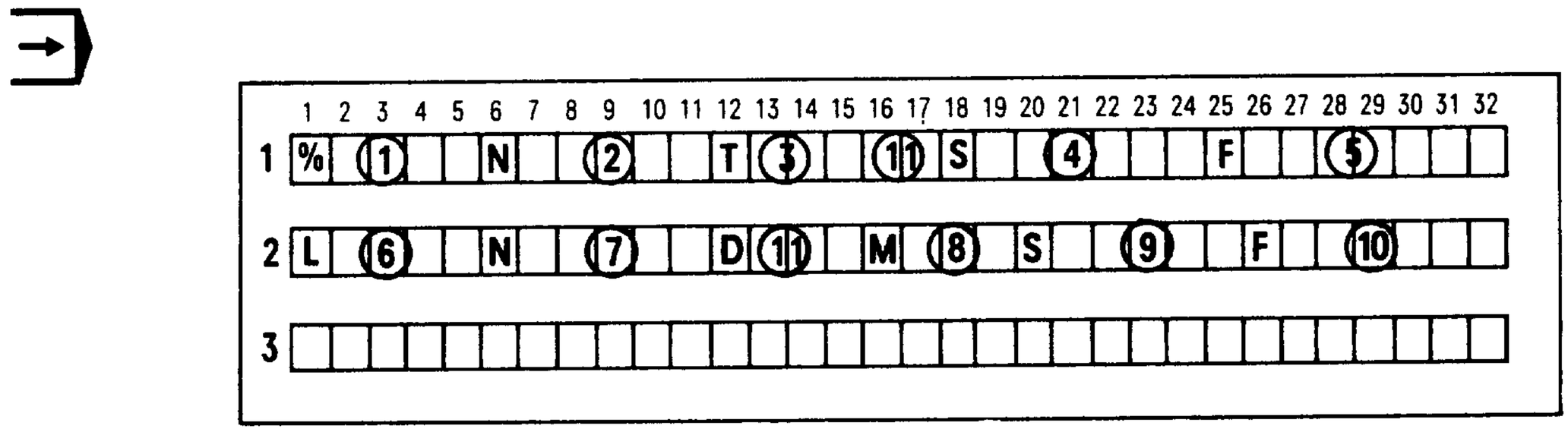
Display number	Axis	
	3T	3M
230	X	X
231	Z	Y
232		Z
233		4th

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 movement 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 26)

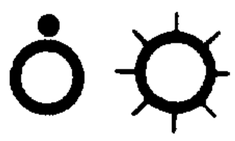


(1) Program number indicator; part program being executed
(2) Program status indicator; block number of part program
(3) for 3T: tool number with offset number (2 + 2 decades)
for 3M: tool number (4 decades)
(11) Offset no. D as shown here only applies to 3M
(4) Actual spindle speed
(5) Actual feedrate
(6) First nesting: sub-routine number indicator
(7) First nesting: program status indicator
(8) Programmed auxiliary function
(9) Programmed spindle speed
(10) Programmed feedrate

The display shows the programmed spindle speed and feedrate.
The actual feedrate is designated:

per revolution = "R"
or per minute = "M"

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

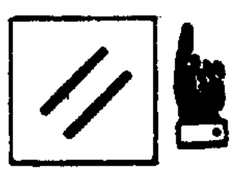


If feed hold is applied (no. 22) the following programmed parameters can be overwritten:

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.

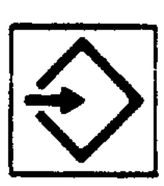
Operating sequence



In those cases when control is not in "Reset"

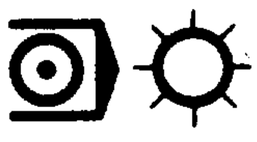
Automatic mode (selector switch 26)

% 20



Input the required program number

The program is started by pressing the Cycle Start button (no. 33)
"Programm 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 3.

HOLD▶AUTO INTERR — Automatic mode interrupt

HOLD▶SINGLE BLK — Single block executed

HOLD▶M00 — Programmed program hold M00

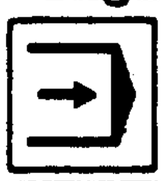
By pressing the Cycle Start button (no. 33) the next block is read in, calculated and executed.

HOLD▶NO DATATRAN — No enable for data input

HOLD▶DWELL — Dwell active

Operating functions

Single (no. 37)

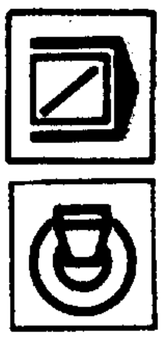


I

O

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

Skip (no. 36)

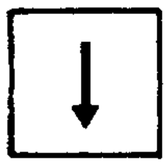


I

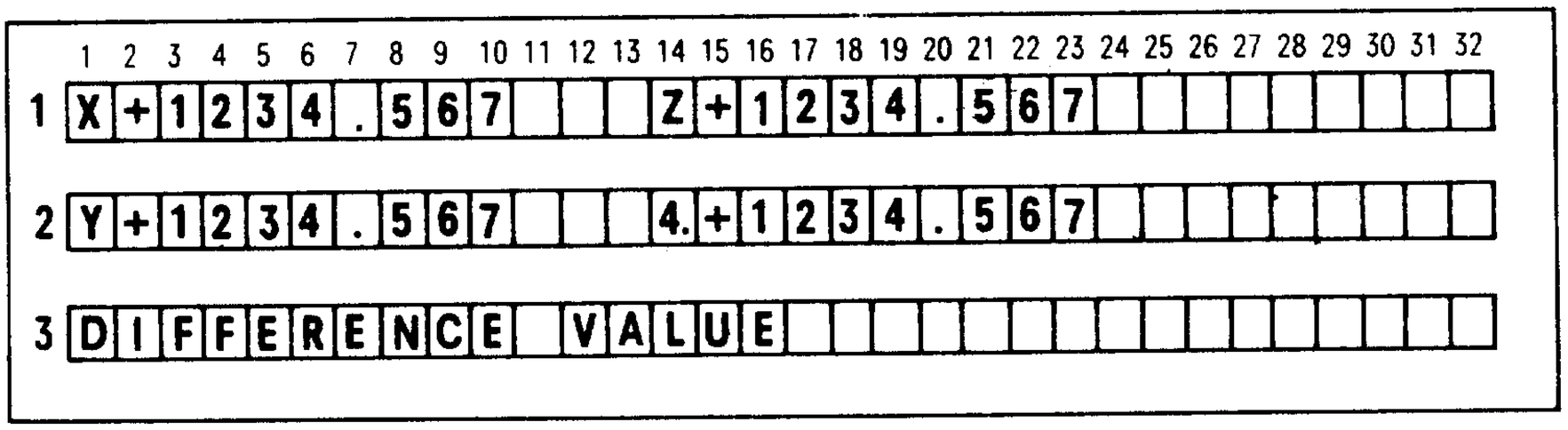
O

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

9.2 Display of command value - actual value difference



Select using page button (no. 22)



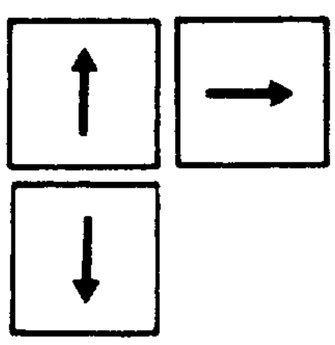
The display shows the distances to be traversed by all axes to the endpoint of the block.

9.3 Display tool offsets, zero offsets, machine parameters

Enable keyswitch (no. 39) for input dependent on machine parameters.

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

for 3M:



Select tool number

e.g. B.999

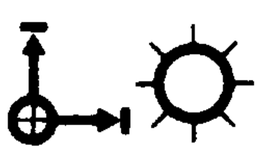
Tool wear value can be entered even during active program (interlocked via keyswitch)

Tool wear value input: max. ± 0.999 mm
± 0.0999 inch

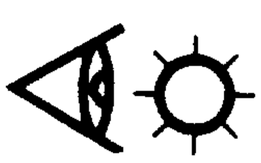
and/or

e.g. B10.000

Tool offset value can be entered even during active program (interlocked via keyswitch)



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



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

9.4 Display program indicator and offset block

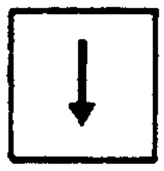
Program indicator

Select part program (no. 9)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	%	1	2	3	4	N	1	2	3	4																						
2	L	1	2	3	4	N	1	2	3	4		L	2	3	4	5	N	1	2	3	4		L	3	4	5	6	N	1	2	3	4
3	A	C	T	U	A	L		B	L	O	C	K																				

Display of active program with all sub-routine nesting.
Display of sub-routine with program number indicator and status indicator. No input possible.

Offset block



Select using page button (no. 22)
Display of active program block which can still be modified.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1		N	1	2	0	0		G	9	5		6	0	1		G	4	1	2		G	7	1		G	9	1						
2		X	−	4	6	0	.		Z	+	3	5	.		F	1	3		M	0	4		*										
3	C	O	R	R		B	L	O	C	K																						

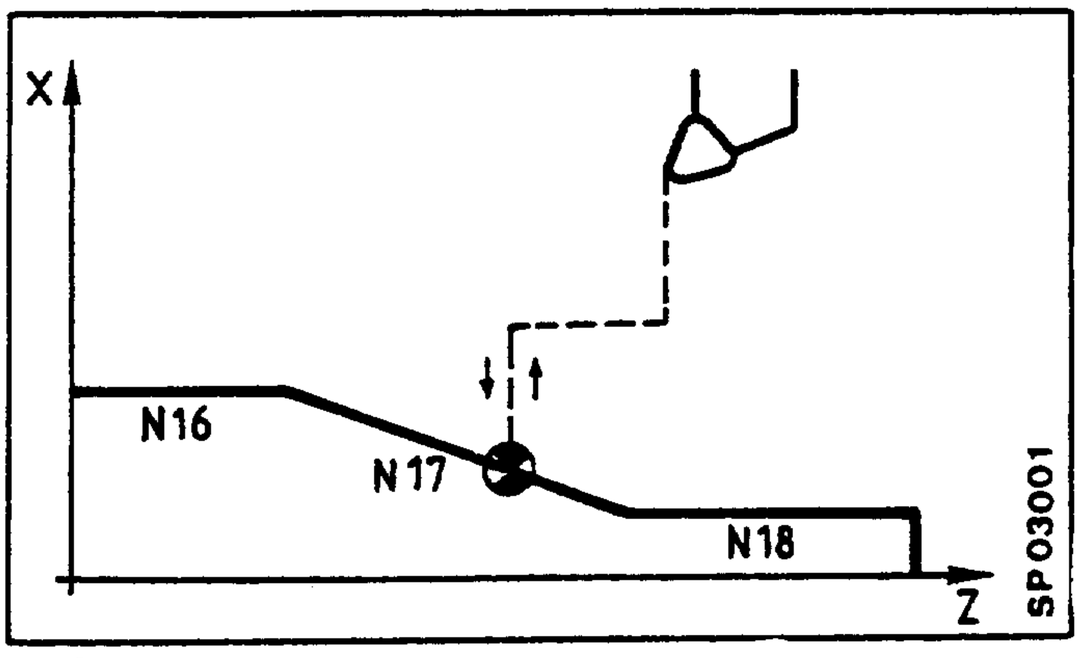
Incorrect characters which have been detected during decoding are indicated in the display by the addition of commas.
These incorrect words can be corrected (e.g. G, 4, 1, 2, 3 digit G code) in the MDI-PP mode (see Chapter 7).

9.5 Continuation of automatic operation following program interruption

9.5.1 Overview

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

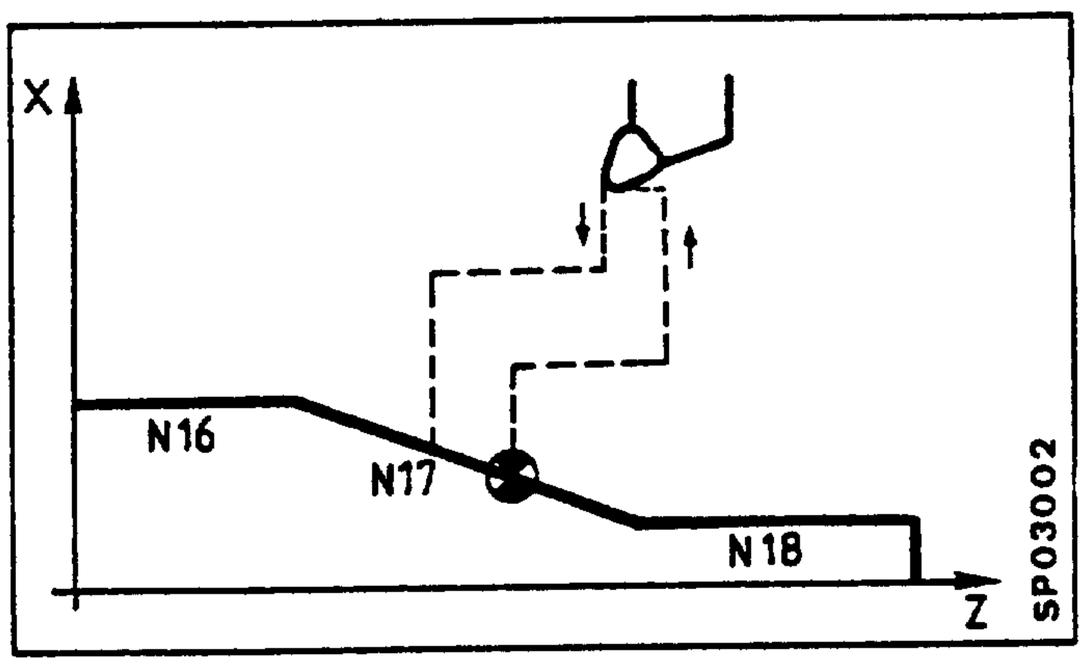
a) Retract for tool inspection



⊗ Interrupt point

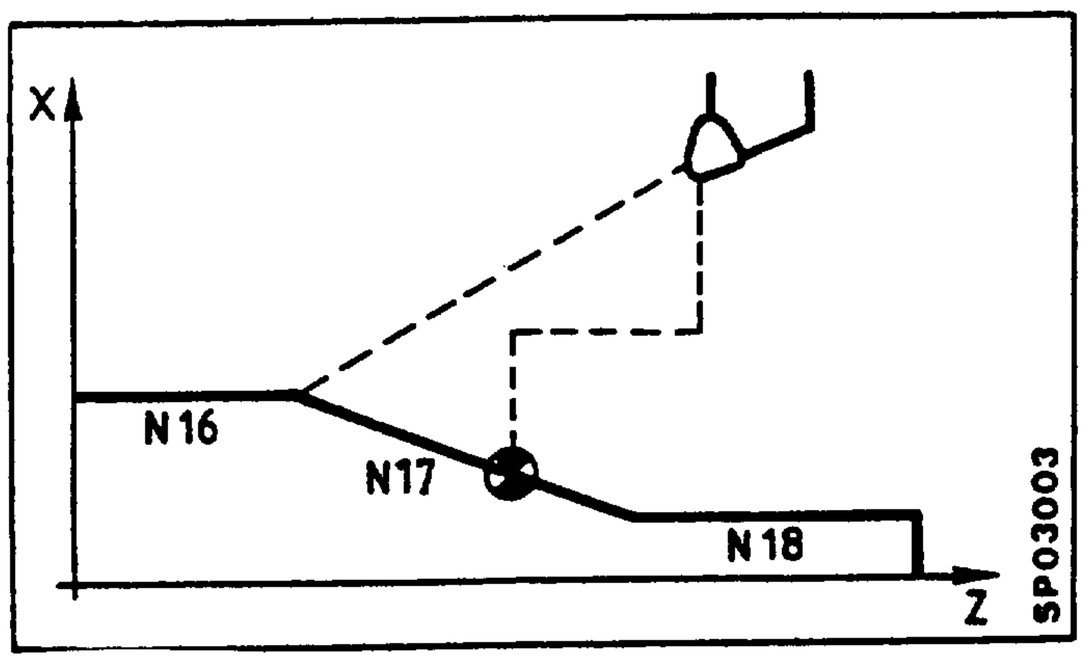
Using incremental feed the tool is repositioned to the point of interruption.
Tool offsets remain unaltered.

b) Touch on method



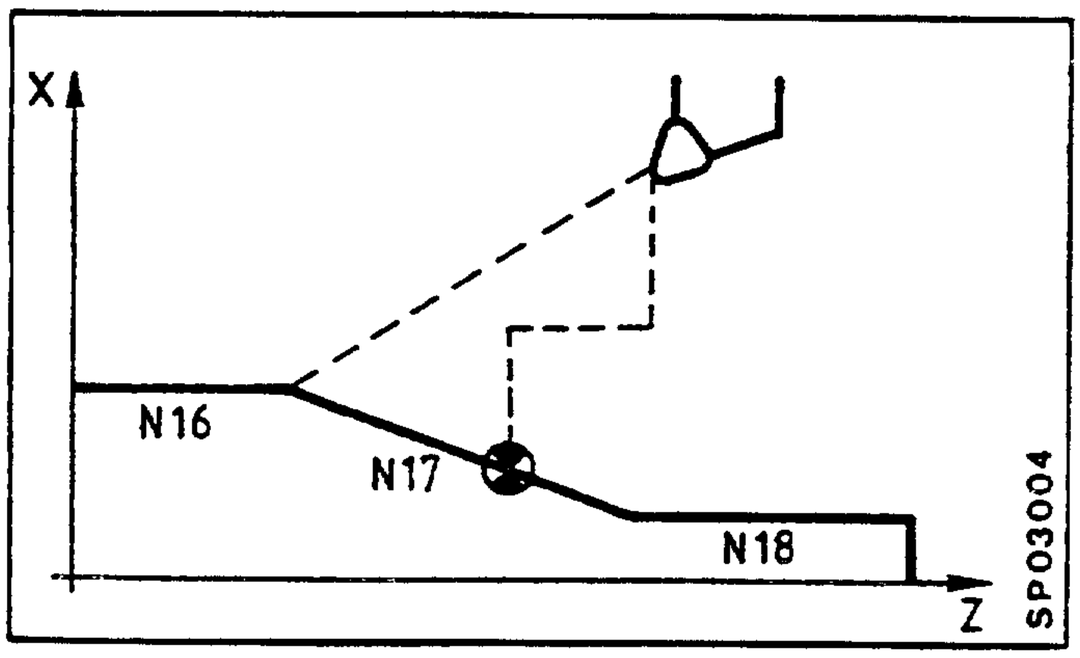
Touch on somewhere within the interrupted block using jog.
Tool length may vary.
Tool tip radius compensation remains unaltered.

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 arbitary block



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

In the example opposite,block 16 has been selected.

Tool offsets may vary.

9.6 Program interruption through set up

9.6.1 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 the axes are moved by JOG or INC and are not returned to their original position, the exact block endpoint 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.

In blocks with circular interpolation it is required to return exactly to the contour within one block. The CRC/TRC must not be changed.

9.6.2 Touch on method

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

HOLD>AUTO INTERR	Interruption of automatic operation

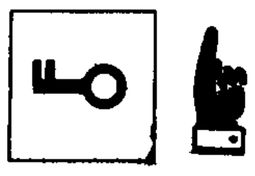
Departure is made from the contour by using incremental feed or jog, for toolchanging for example. After entering the new tool length offsets (tool tip radius compensation remains unaltered), the new tool is repositioned to some point within the interrupted block. After returning to automatic, machining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

9.7 Block search in automatic operation

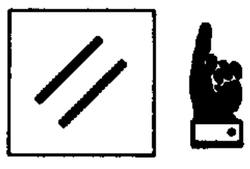
9.7.1 Search to an interrupted block

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

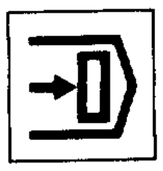


Key switch (No.39) enabled, where data entry is key protected (machine data)

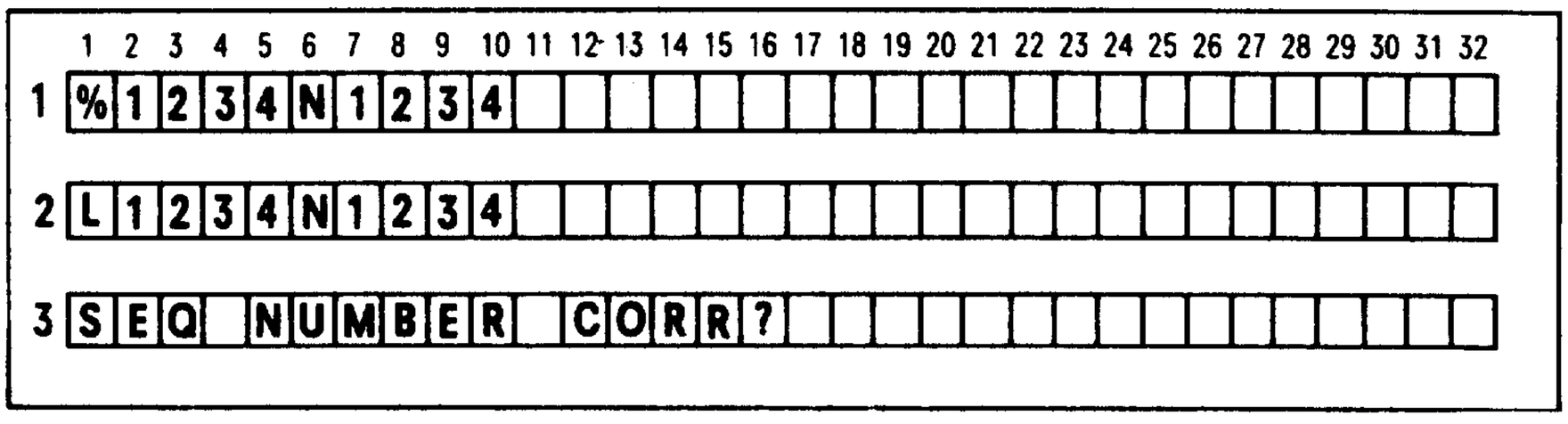


"Reset" pushbutton (No.12) if control is not already in "reset" state.

Select automatic operating mode (selector switch 36)



Search pushbutton (No.38)



The program status which was active most recently is displayed at this point. The machining cursor (block number) indicates the last block which was completely executed.

Row 1:
Program number and machining identifier

Row 2:
Subroutine number and machining identifier

Row 3:
Text for operator guidance

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.

CONTROL INACT

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

CYCLE START!

Appears following completion of the block search.
Request to press the cycle start button (No.33).

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.36) is active.
The automatic screen is restored.

Dependant upon machine data the switching and auxiliary functions (M,S,T) may be either outputted during block search, inhibited altogether, or outputted at the same time as cycle start (No.33). In the latter case only the last programmed M-,S- and T-words are outputted. Any missing switching and auxiliary functions must be added following cycle start,with feed hold active.

9.7.2 Search to an arbitary block

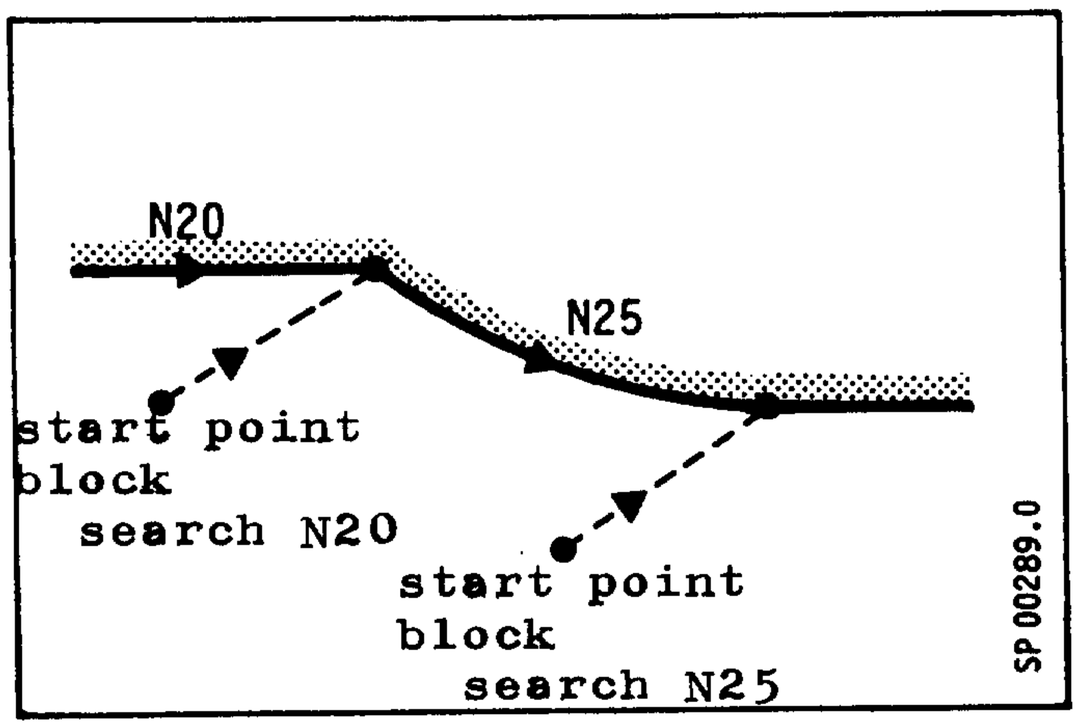
This search function allows program access at any arbitary block of a part program or subroutine in the first level. All calculations (tool dimensions, zero offsets, parameter calculations, intersectional cutter radius- and tool tip radius compensation) are carried out during the search.

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

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

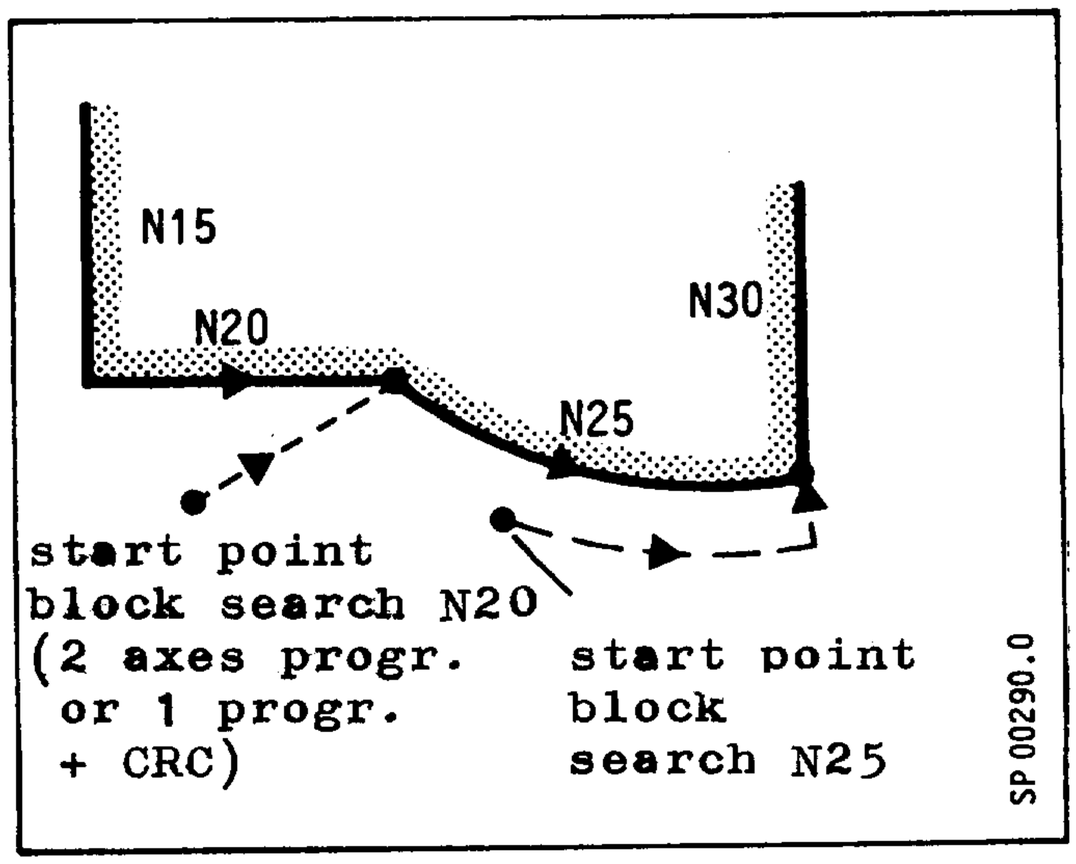
1. The first occuring path information of all axes are programmed with G90 (contol knows therefore, the position of the workpiece zero point)

   3T: Using a set 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 inludes 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 on the contour somewhere before the end of the selected block.

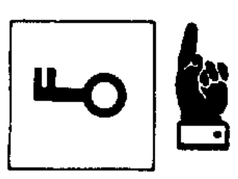
If the selected block includes:
- no path movement or
- 1 path movement without CRC,

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

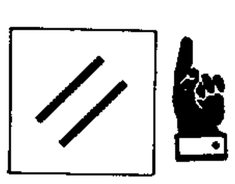
2. The path data of all axes are programmed with G91 (control does not know the position of the workpiece zero point)

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

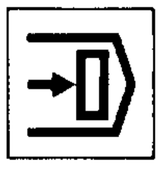


Key switch enabled (No.39), where data entry is key protected (machine data)

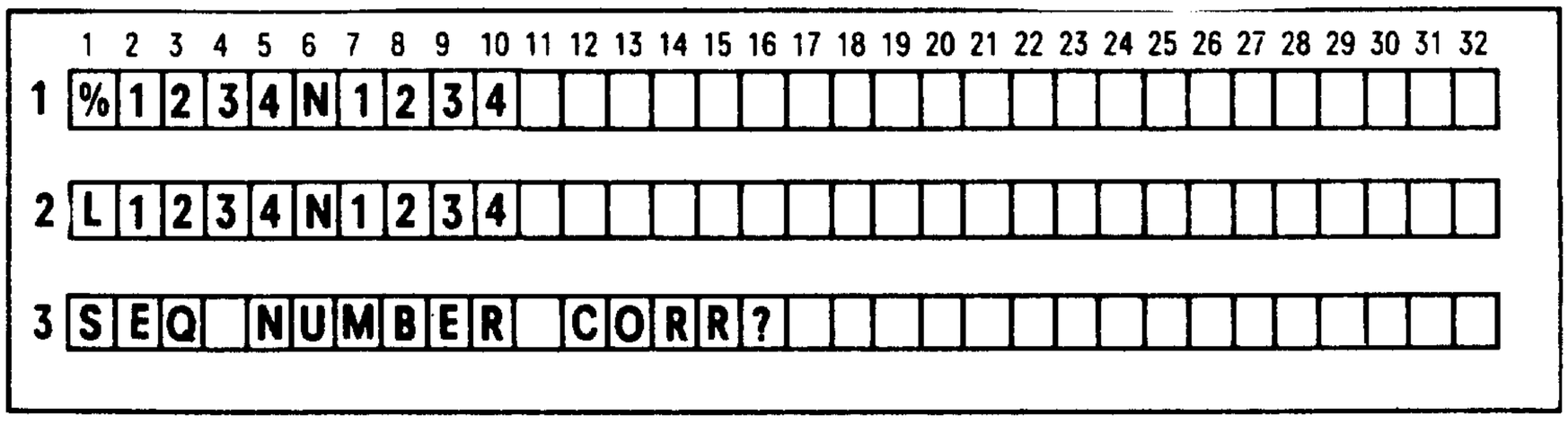


"Reset" pushbutton (No.12) if the control is not in "reset" state already

Select automatic operating mode (selector switch 26)



Search push button (No.38)



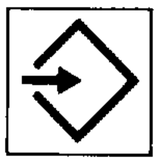
The program status,which was active most recently,is displayed. The machining cursor (block number) indicates the last block which was completely executed, inclusive of the first nesting level.
The third row contains the operating guidance text.

Search to another block to that which is displayed

Row 3:

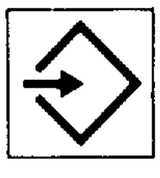
Operator guidance for the input of the block search target
(e.g. N5,L1101,N10, selected main program 100)

N5



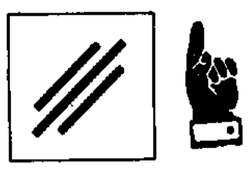
Input of the block number

L1101



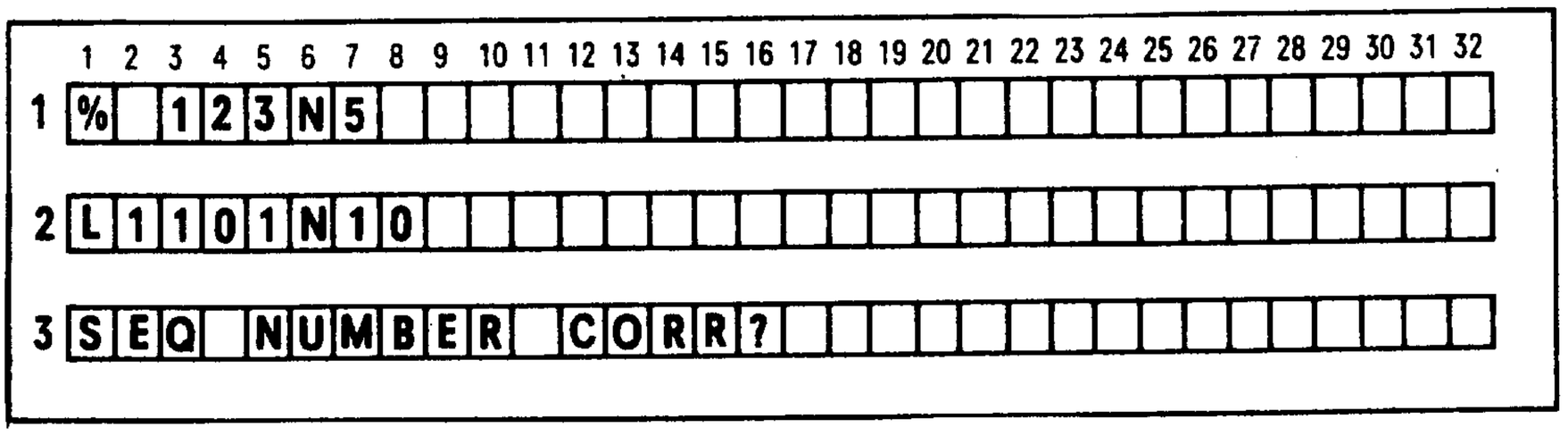
Input of the subroutine number inclusive of the number of repetitions

Completion of input of the search target
(no block search in subroutine)



N10

Input of the block number in the subroutine



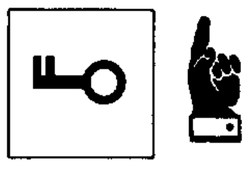
YES

Block search to the displayed program status

For continuing operation see:
"Search to an interrupted block" (section 9.7.1)

9.8 Program test

9.8.1 Dry run



If required, enable the key switch (No.39) dependant upon machine data

Dry (No.42)

Dry run feedrate
operational in automatic operation:

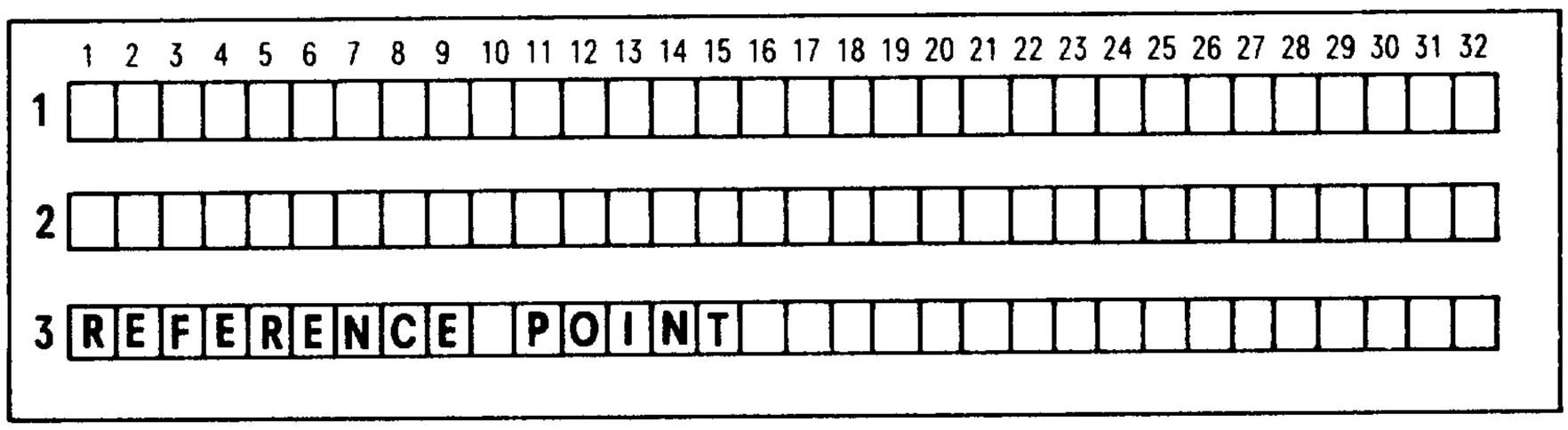
- Feedrates appearing in the program are suppressed
  Dry run feedrate (TE 375) in mm/min is active
- Rapid remains unaltered
  Feedrate- and rapid-override switches still function normally
- With threading and feed/rev the dry run feedrate is similarly superimposed.

10. Return to datum REF

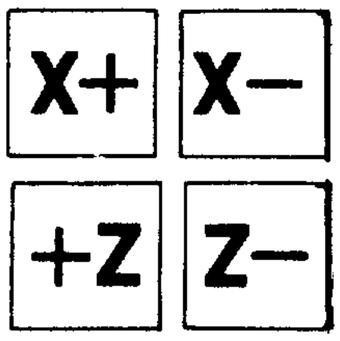
A reference or datum point is fixed for each axis of the machine and serves as the starting point for the program.

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

Return to datum mode (selector switch 26)

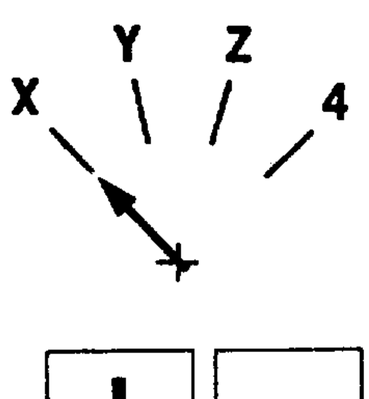


For 3T

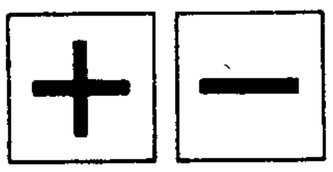


After pressing the appropriate direction button (no. 35), the axis moves to the reference point (self-retaining direction).

For 3M



The axis is selected on the axis selector switch (no. 42).



After pressing the appropriate direction button (no. 29) 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 co-ordinate.

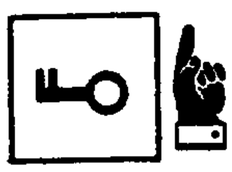
Feed hold is active as is the feedrate/rapid override switch when the "Rapid override switch active" (no. 34) is actuated.

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).

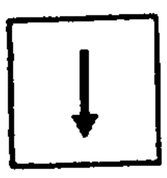
11.1 Input of part programs into the memory



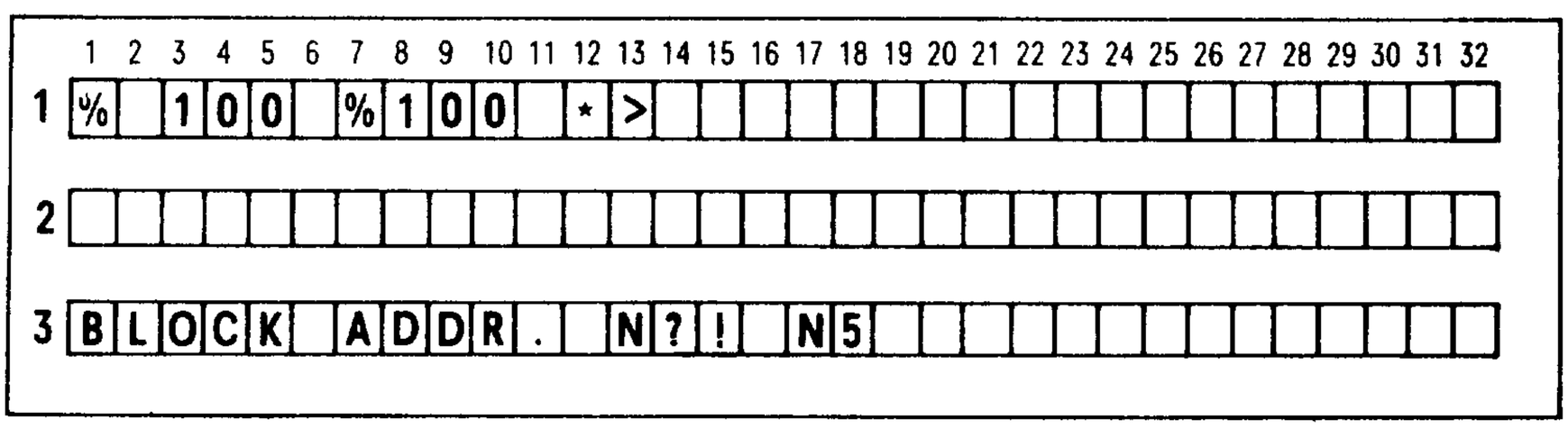
Keyswitch enabled (no. 39)

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 % 100). If the program % 100 is already stored it will be displayed. The cursor is located behind the first program number.
When a program % 100 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.



YES - Block number is stored

or

NO - Block number is not stored

The requests to the operator appear in the 3rd display line.
During the dialogue, the operator can answer with an "Input" and/or "YES" or "NO".

The operator dialogue function devides the part programs into 5 sections:

GEOMETRIC ? ? ? ?

WORK CYCLE ? ? ? ?

TECHNOLOGY ? ? ? ?

SPEC. FUNCT. ? ?

NO GUIDING ? ? ? ?

NO - caus a switching to the next section

or

YES - activates the selected function

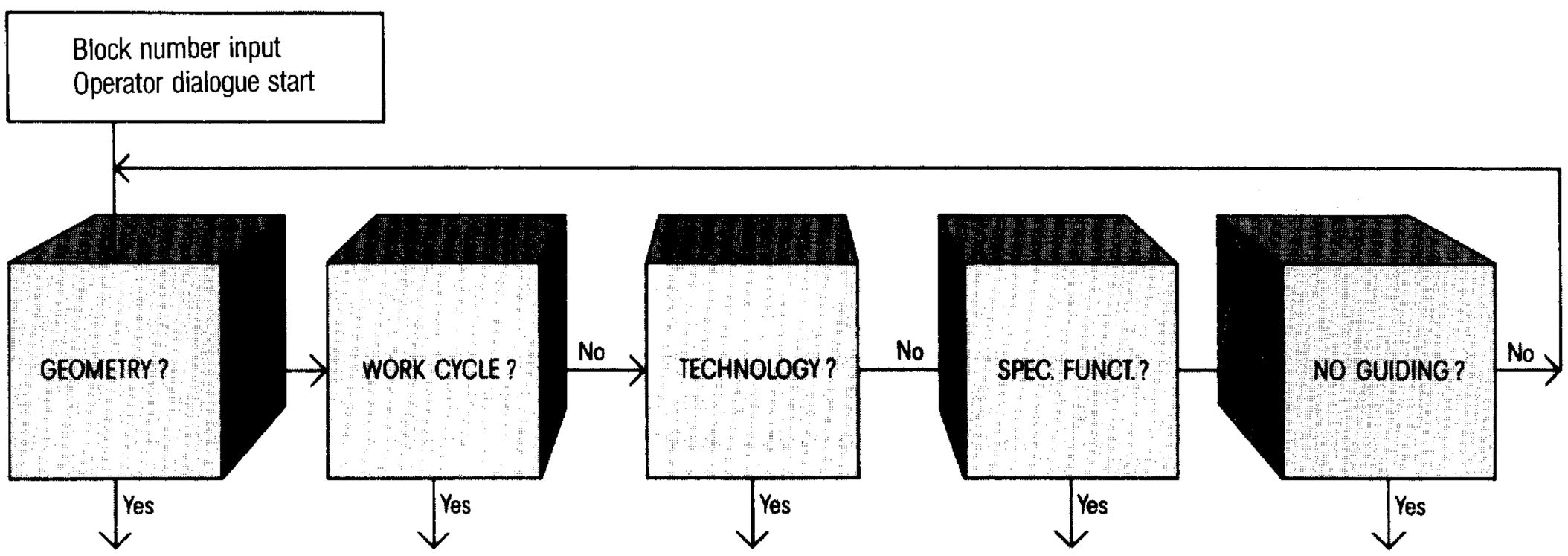
In the 5 sections can be entered the following functions:

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 Radius, 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

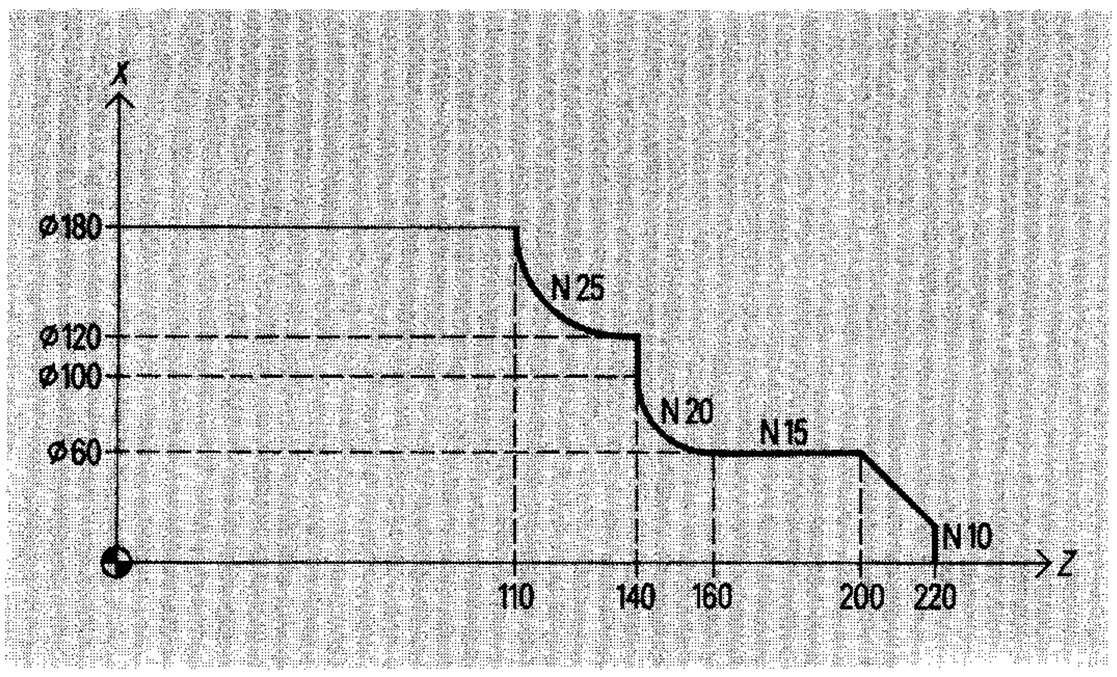
2) only for 3T

11.2 Summary (Data input 3T)

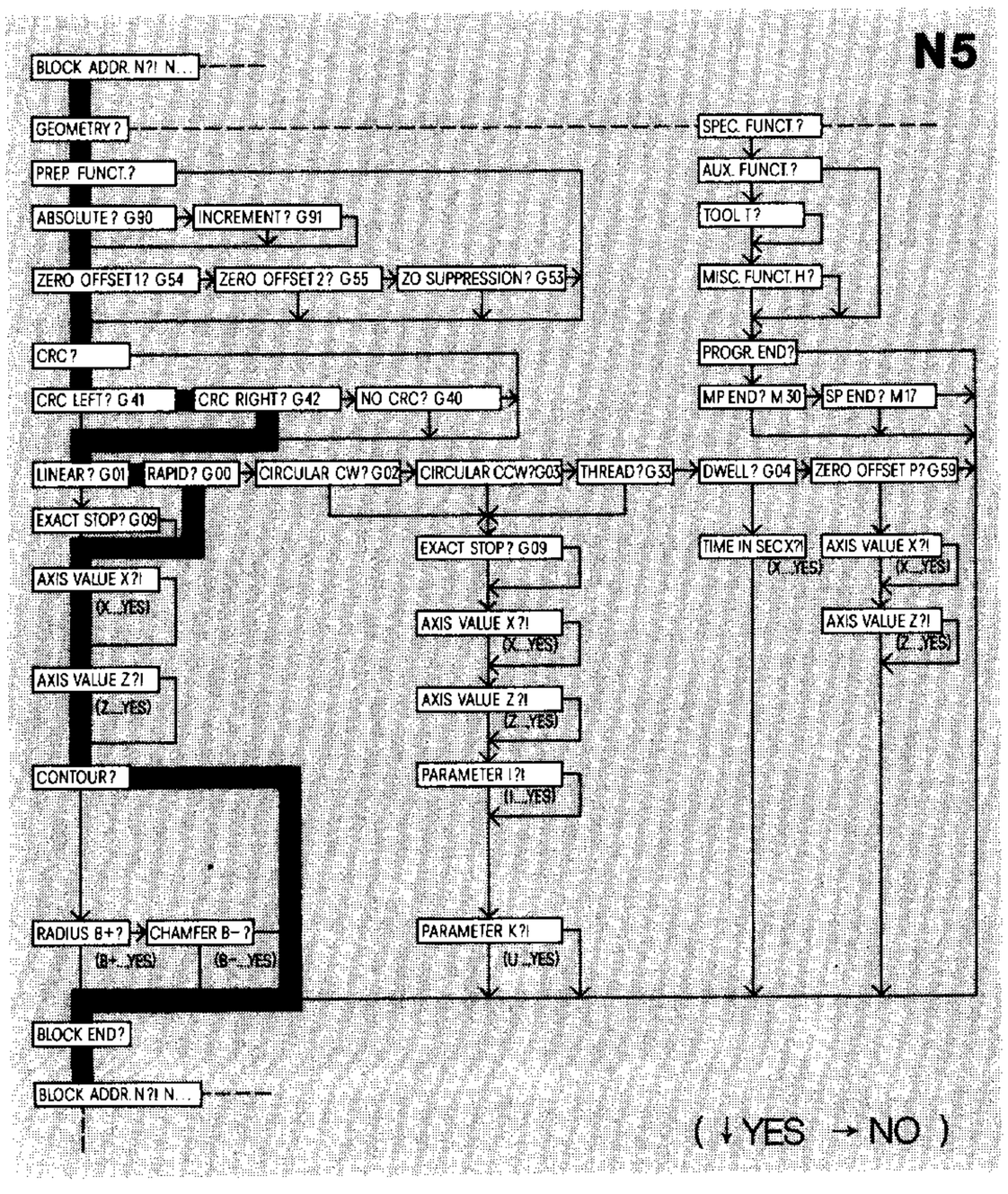


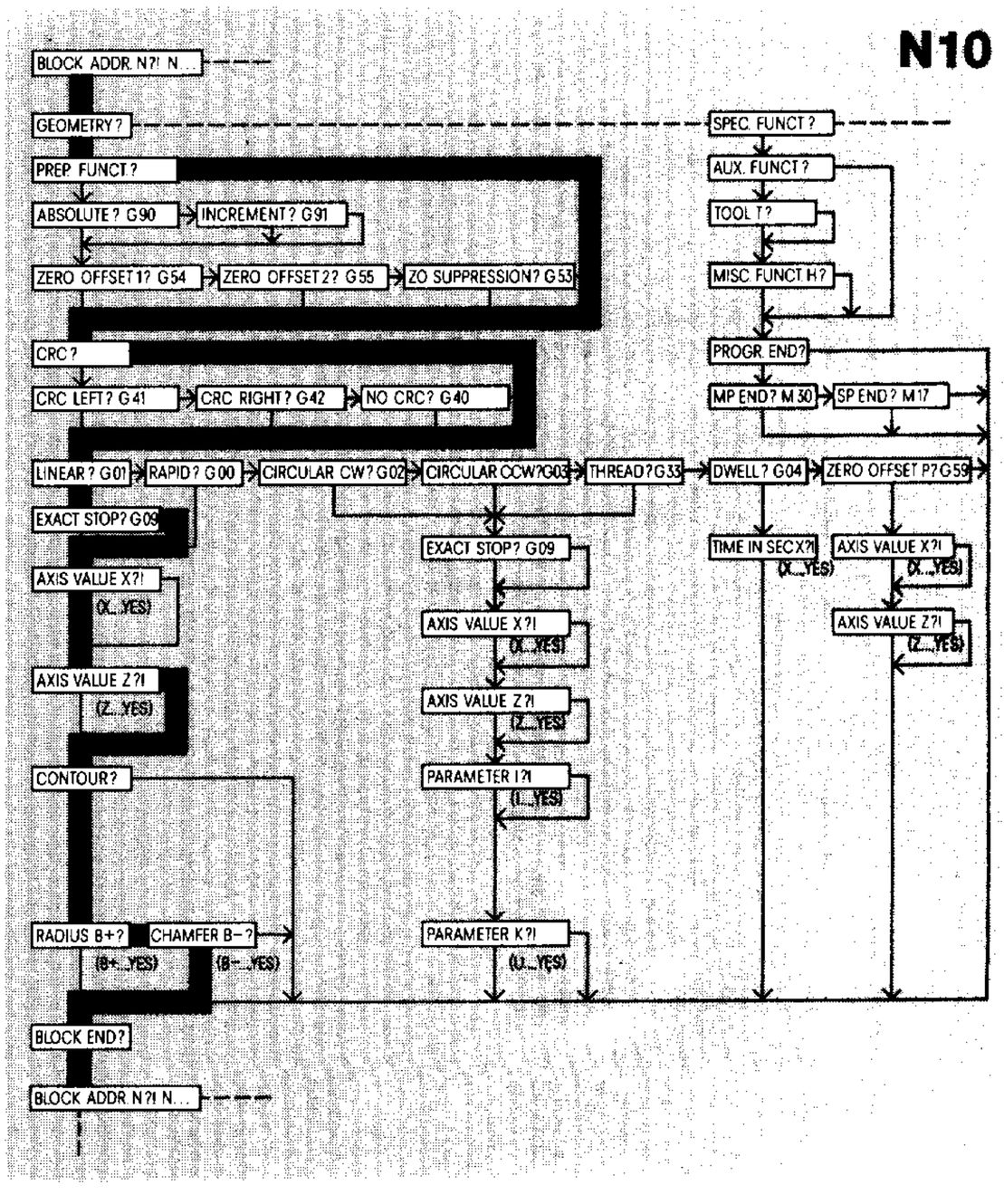
Call for	Call for	Call for	Call for	
ABSOLUTE/ INCREMENT	NEW CYCLE	FEED/REV	AUX. FUNCT. • TOOL T • MISC. FUNCT. M	
ZERO OFFSET	START POINT X/Z	CONST. CUTTING		
CRC	END POINT X/Z	FEED/MIN	PROGR. END • MP END • SP END	No guiding until LF
LINEAR/RAPID	THREAD PITCH	LIMITATION S		
EXACT STOP	THREAD DEPTH	FEED F		
CIRCULAR CW/CCW	FINISH CUT D	SPINDLE S		
THREAD	ROUGHING CUTS	GEAR M		
DWELL/TIME	COMPOUND FEEDS	BLOCK END		
AXIS VALUE X/Z	RAD. OR DIA.			
PARAMETER I/K	(Example: Thread cutting cycle, same as stock removal cycle)			
CONTOUR (RADIUS/CHAMFER)				
BLOCK END				

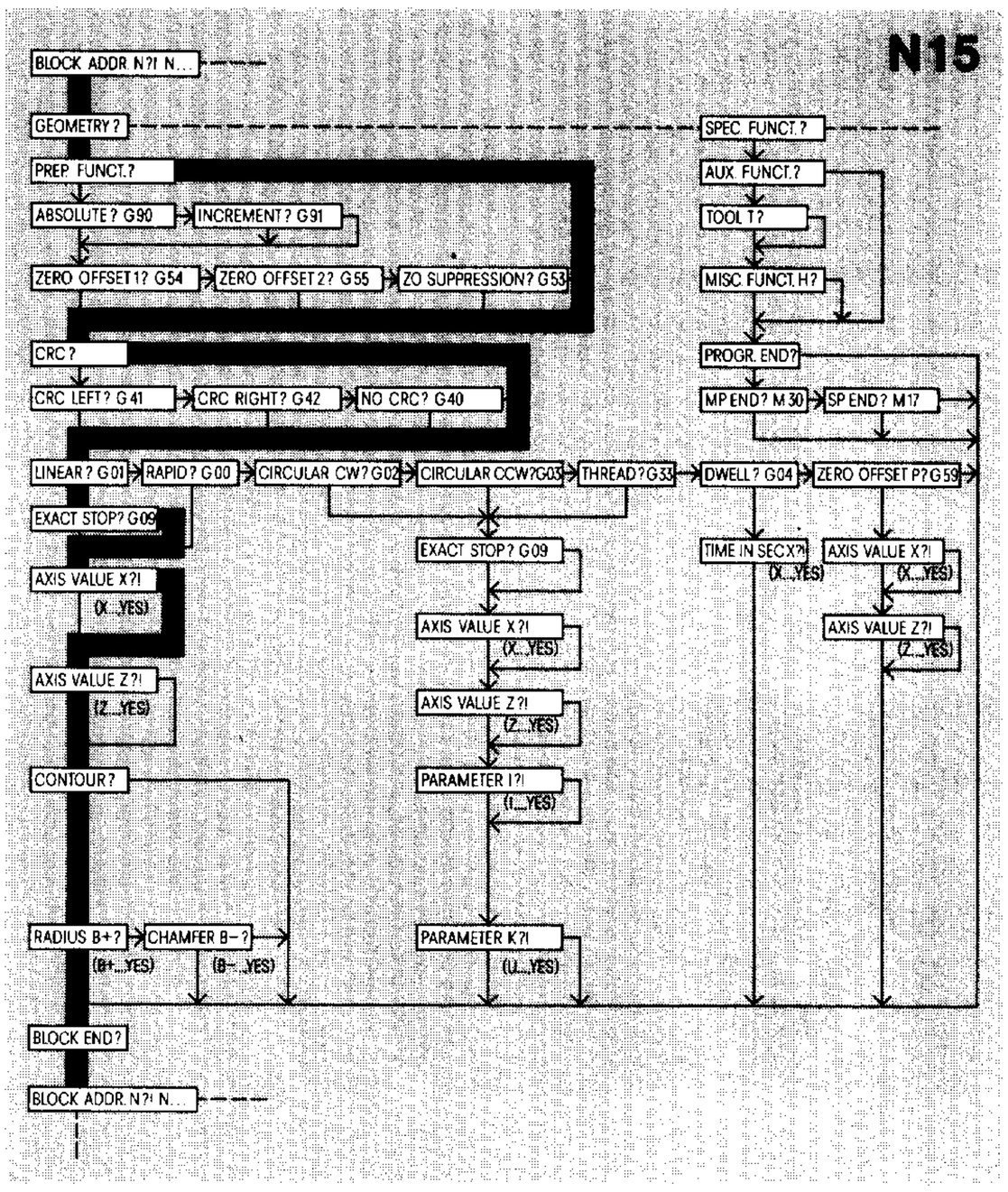
11.3 Example Program input 3T

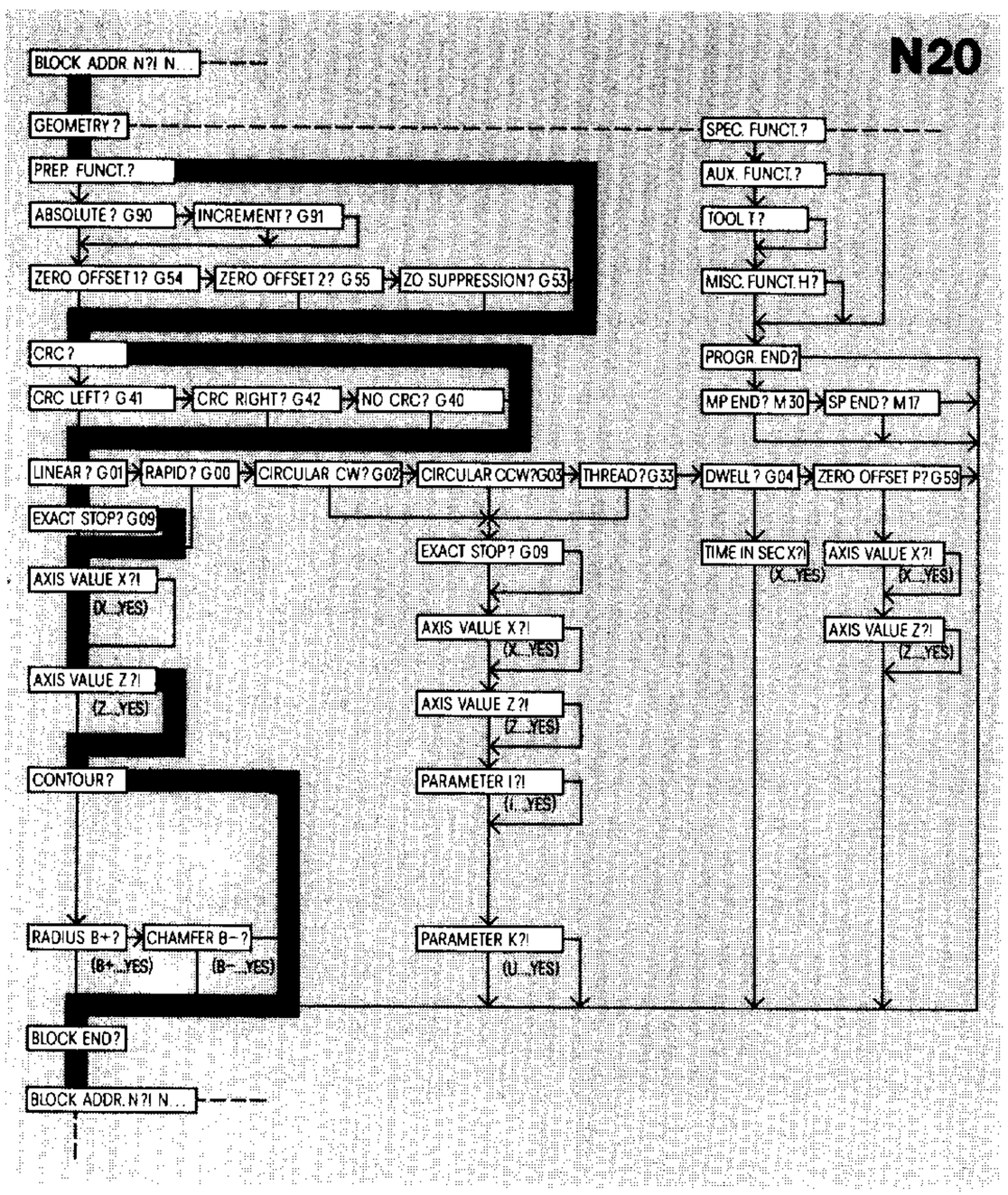


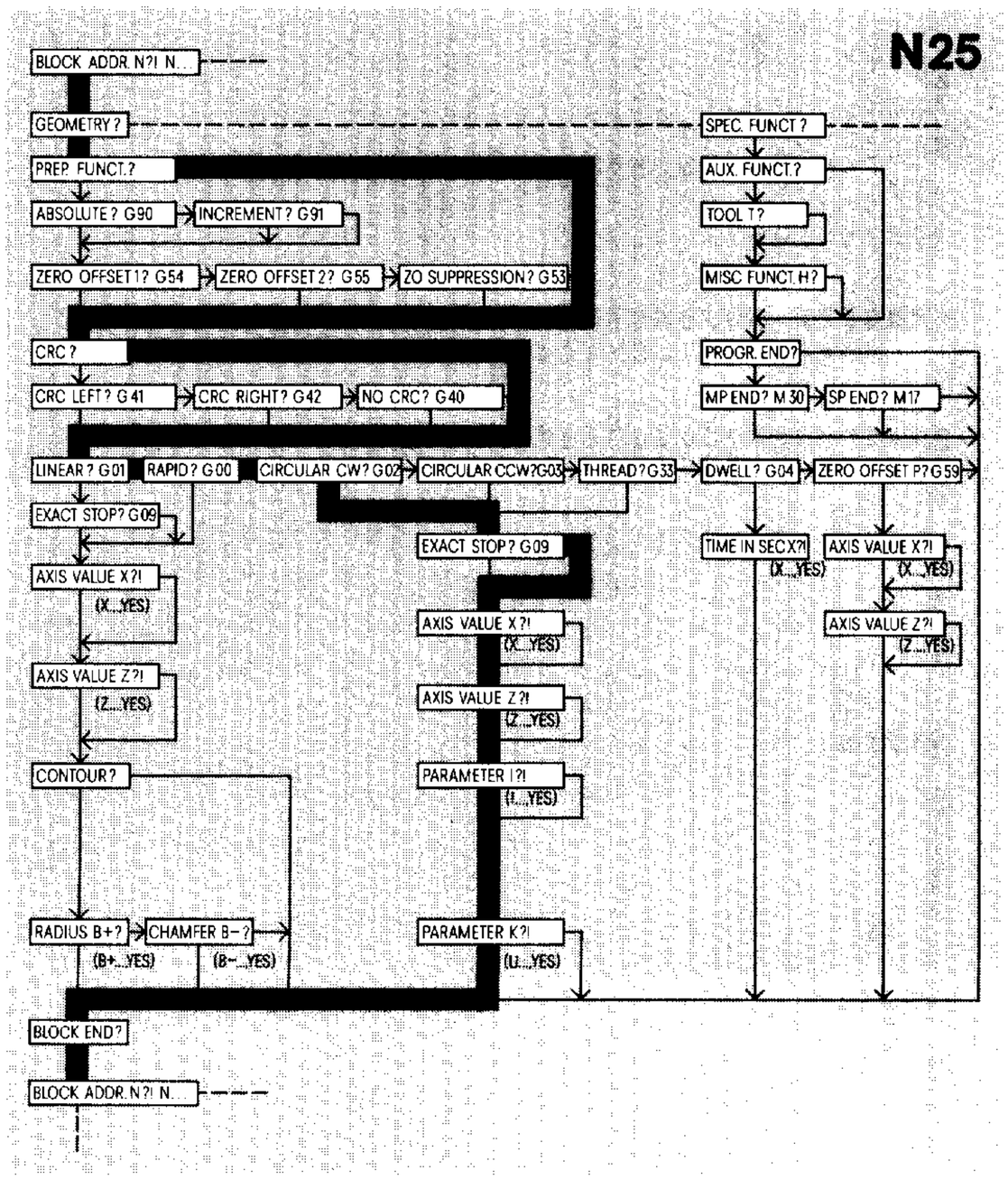
N5	G90	G54	G42	G00	X0	Z220	LF
N10	G01			X60		B-20	LF
N15				Z140		B20	LF
N20				X120			LF
N25	G02		X180	Z110	I30	K0	LF
N30	M30						LF

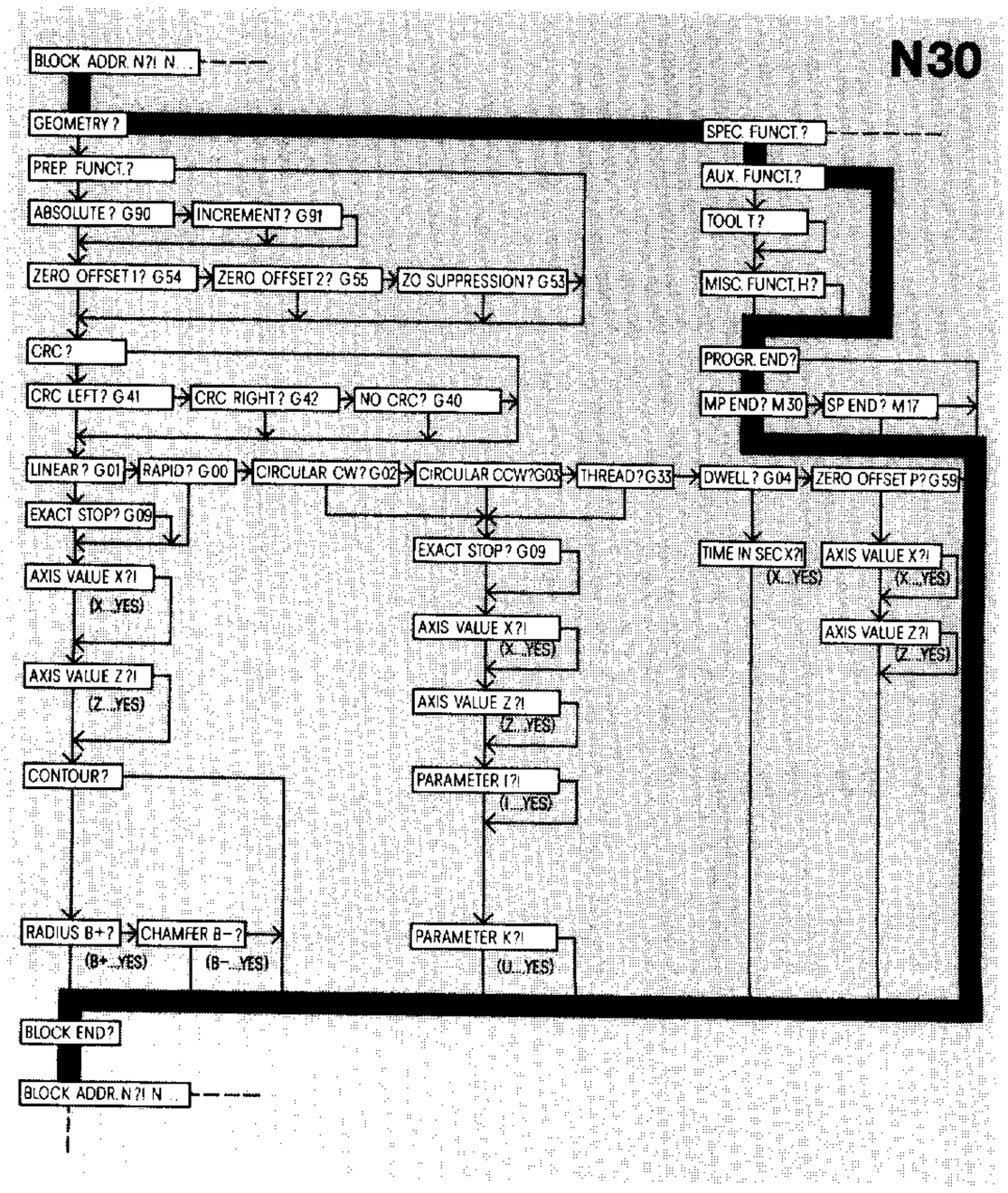




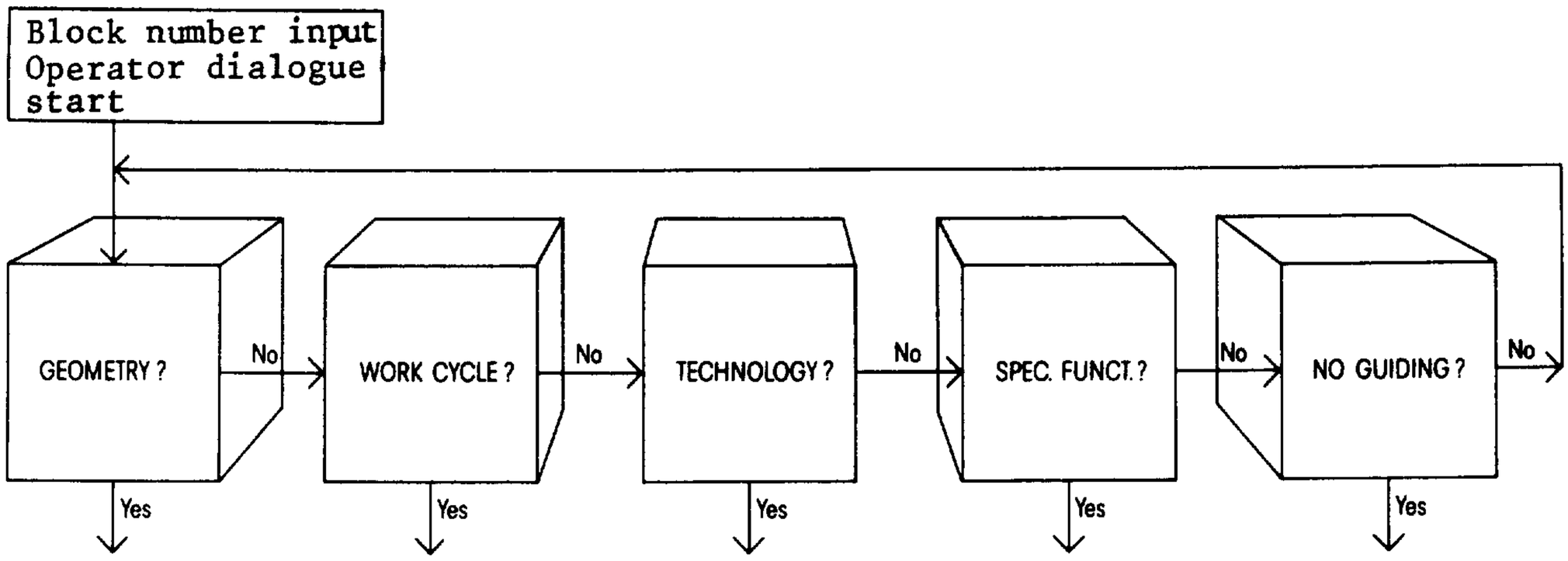

N15
BLOCK ADDR N?I N...
GEOMETRY ?
PREP. FUNCT.?
ABSOLUTE ? G90
INCREMENT ? G91
ZERO OFFSET 1? G54
ZERO OFFSET 2? G55
ZO SUPPRESSION? G53
CRC ?
CRC LEFT? G41
CRC RIGHT? G42
NO CRC? G40
LINEAR ? G01
RAPID ? G00
CIRCULAR CW? G02
CIRCULAR CCW?G03
THREAD ? G33
EXACT STOP? G09
AXIS VALUE X?I
(X...YES)
AXIS VALUE Z?I
(Z...YES)
CONTOUR?
RADIUS B+?
(B+...YES)
CHAMFER B-?
(B-...YES)
PARAMETER I?I
(I...YES)
PARAMETER K?I
(U...YES)
SPEC. FUNCT.?
AUX. FUNCT.?
TOOL T?
MISC. FUNCT. H?
PROGR. END?
MP END? M 30
SP END? M17
DWELL ? G04
TIME IN SEC X?I
(X...YES)
ZERO OFFSET P? G59
AXIS VALUE X?I
(X...YES)
AXIS VALUE Z?I
(Z...YES)
BLOCK END?
BLOCK ADDR. N?I N...


N20
BLOCK ADDR N?I N...
GEOMETRY ?
PREP. FUNCT.?
ABSOLUTE ? G90
INCREMENT ? G91
ZERO OFFSET 1? G54
ZERO OFFSET 2? G55
ZO SUPPRESSION? G53
CRC ?
CRC LEFT? G41
CRC RIGHT? G42
NO CRC? G40
LINEAR ? G01
RAPID ? G00
CIRCULAR CW? G02
CIRCULAR CCW?G03
THREAD ? G33
EXACT STOP? G09
AXIS VALUE X?I
(X...YES)
AXIS VALUE Z?I
(Z...YES)
CONTOUR?
RADIUS B+?
(B+...YES)
CHAMFER B-?
(B-...YES)
PARAMETER I?I
(I...YES)
PARAMETER K?I
(U...YES)
SPEC. FUNCT.?
AUX. FUNCT.?
TOOL T?
MISC. FUNCT. H?
PROGR. END?
MP END? M 30
SP END? M17
DWELL ? G04
TIME IN SEC X?I
(X...YES)
ZERO OFFSET P? G59
AXIS VALUE X?I
(X...YES)
AXIS VALUE Z?I
(Z...YES)
BLOCK END?
BLOCK ADDR. N?I N...


N25
BLOCK ADDR. N?I N...
GEOMETRY ?
PREP. FUNCT.?
ABSOLUTE ? G90
INCREMENT ? G91
ZERO OFFSET 1? G54
ZERO OFFSET 2? G55
ZO SUPPRESSION? G53
CRC ?
CRC LEFT? G41
CRC RIGHT? G42
NO CRC? G40
LINEAR ? G01
RAPID ? G00
CIRCULAR CW? G02
CIRCULAR CCW?G03
THREAD ? G33
EXACT STOP? G09
AXIS VALUE X?I
(X...YES)
AXIS VALUE Z?I
(Z...YES)
CONTOUR?
RADIUS B+?
(B+...YES)
CHAMFER B-?
(B-...YES)
PARAMETER I?I
(I...YES)
PARAMETER K?I
(U...YES)
SPEC. FUNCT.?
AUX. FUNCT.?
TOOL T?
MISC. FUNCT. H?
PROGR. END?
MP END? M 30
SP END? M17
DWELL ? G04
TIME IN SEC X?I
(X...YES)
ZERO OFFSET P? G59
AXIS VALUE X?I
(X...YES)
AXIS VALUE Z?I
(Z...YES)
BLOCK END?
BLOCK ADDR. N?I N...


N30
BLOCK ADDR. N?I N...
GEOMETRY ?
PREP. FUNCT.?
ABSOLUTE ? G90
INCREMENT ? G91
ZERO OFFSET 1? G54
ZERO OFFSET 2? G55
ZO SUPPRESSION? G53
CRC ?
CRC LEFT? G41
CRC RIGHT? G42
NO CRC? G40
LINEAR ? G01
RAPID ? G00
CIRCULAR CW? G02
CIRCULAR CCW?G03
THREAD ? G33
EXACT STOP? G09
AXIS VALUE X?I
(X...YES)
AXIS VALUE Z?I
(Z...YES)
CONTOUR?
RADIUS B+?
(B+...YES)
CHAMFER B-?
(B-...YES)
PARAMETER I?I
(I...YES)
PARAMETER K?I
(U...YES)
SPEC. FUNCT.?
AUX. FUNCT.?
TOOL T?
MISC. FUNCT. H?
PROGR. END?
MP END? M 30
SP END? M17
DWELL ? G04
TIME IN SEC X?I
(X...YES)
ZERO OFFSET P? G59
AXIS VALUE X?I
(X...YES)
AXIS VALUE Z?I
(Z...YES)
BLOCK END?
BLOCK ADDR. N?I N...

11.4 Summary (Data input 3M)



Call for

- ABSOLUTE/INCREMENT
- ZERO OFFSET
- PLANE SELECT
- CRC
- LINEAR/RAPID
- EXACT STOP
- CIRCULAR CW/CCW
- THREAD
- DWELL/TIME
- AXIS VALUE X/Y/Z/4TH
- PARAMETER I/J/K
- CONTOUR (RADIUS/CHAMFER)
- BLOCK END

Call for

- BORING 1 L 85
- REFERENCE PLANE
- FINAL DEPTH
- RETRACT PLANE
- BLOCK END

(Example: Boring cycle L85

Call for

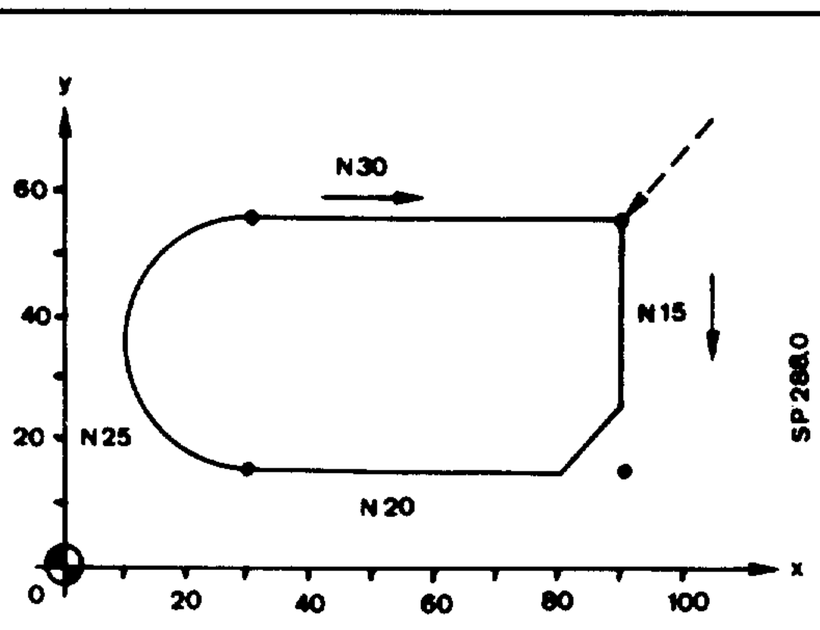
- FEED/REV
- FEED/MIN
- FEED F
- SPINDLE S
- GEAR M
- BLOCK END

Call for

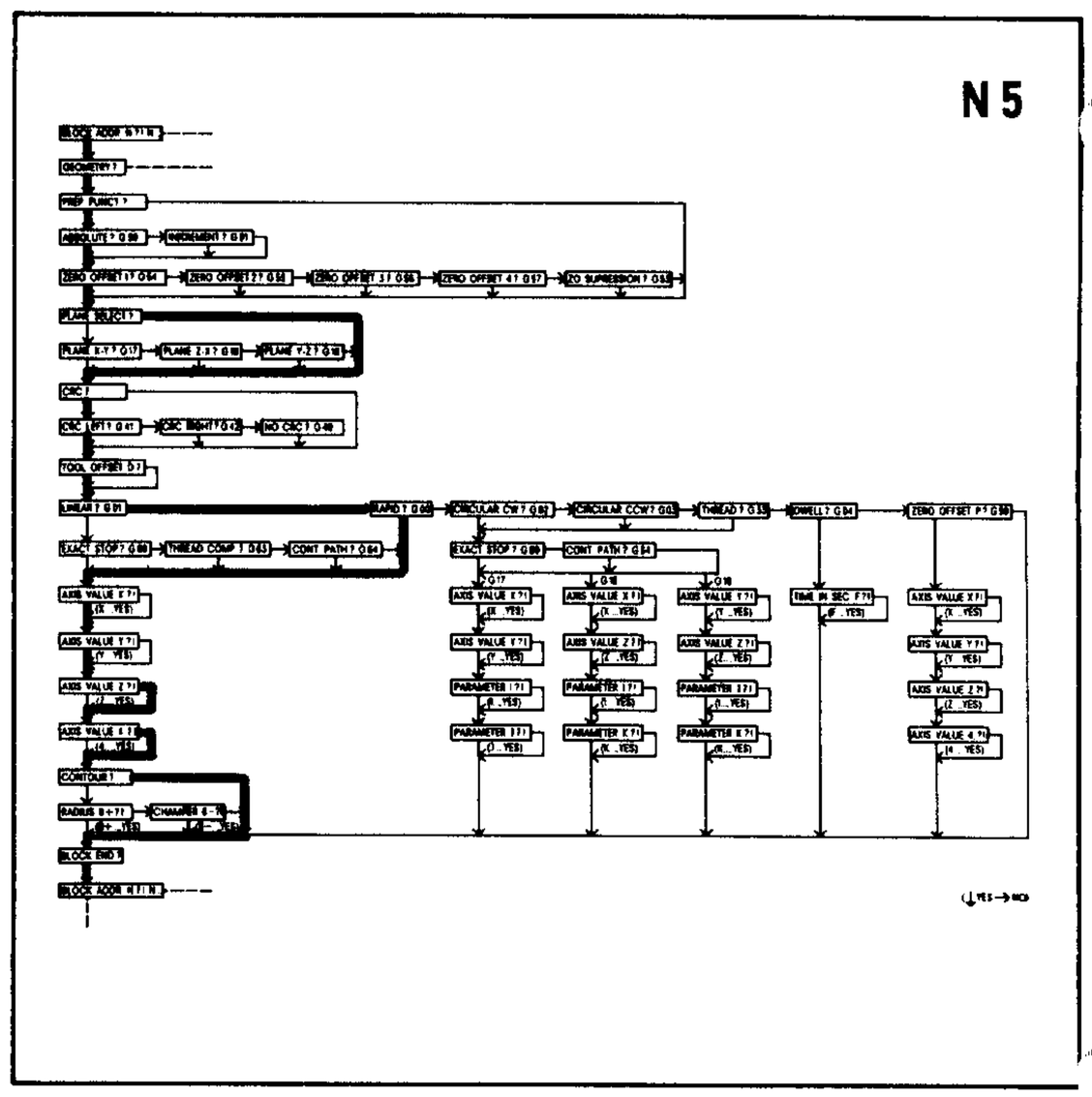
- AUX. FUNCT.
  - TOOL T
  - MISC. FUNCT. M
- PROGR. END
  - MP END
  - SP END

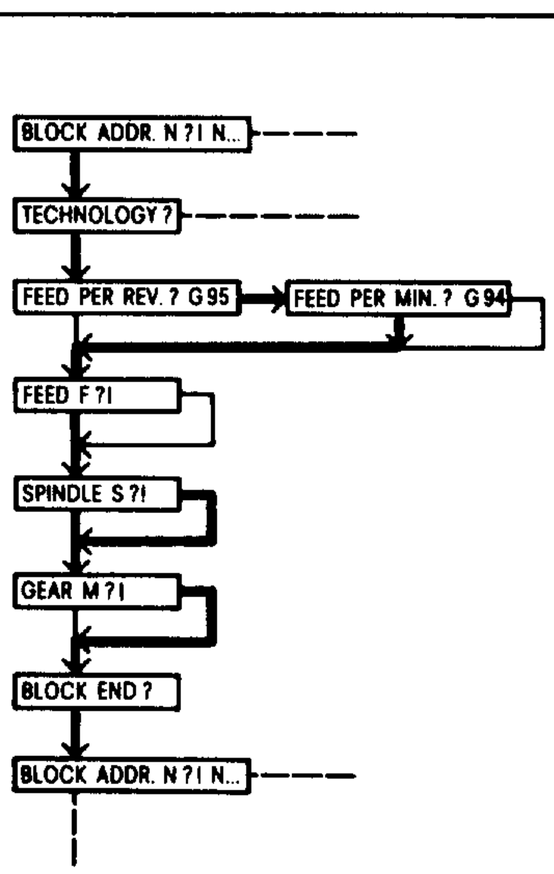
No guiding until LF

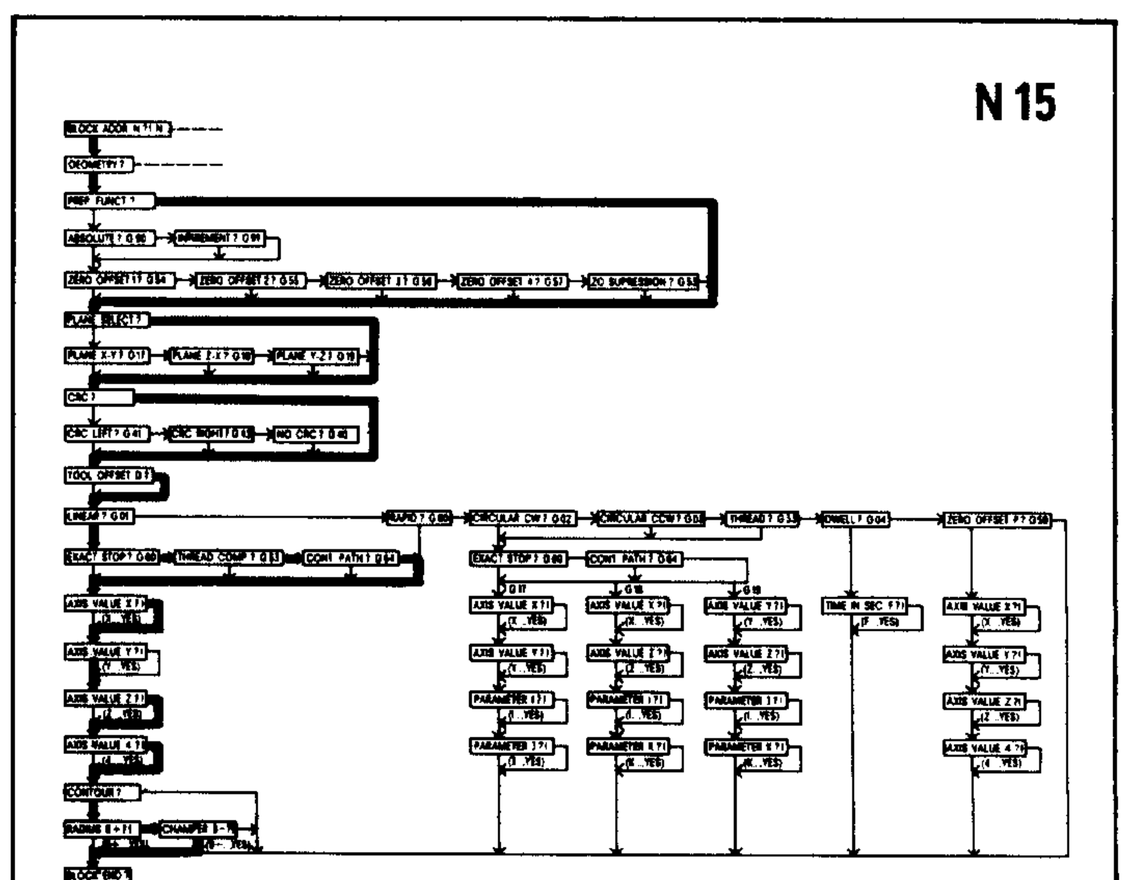
11.5 Example Program input 3M



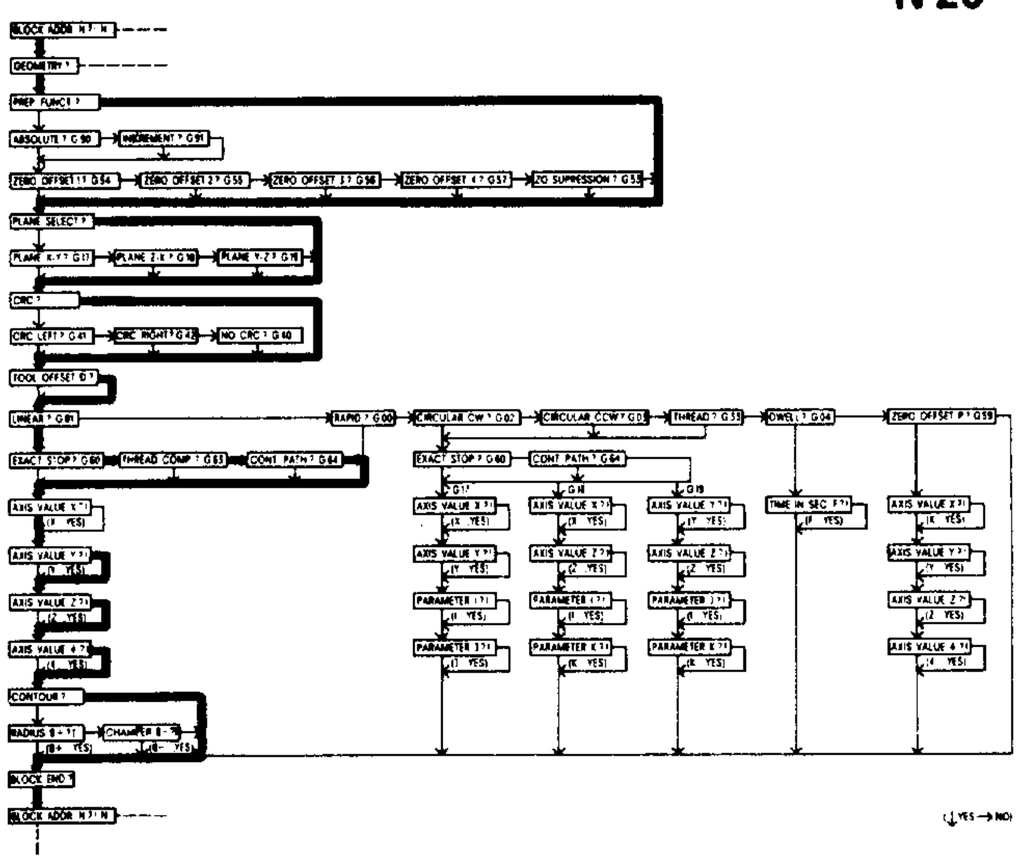

```
N5   G90 G54   G41   D5 G00 X90 Y55 LF
N10  G94 F500 LF
N15  G01 Y15   P-10 LF
N20       X30   LF
N25  G02 X30   Y55   I0 J20 LF
N30  G01 X90   LF
N35  M30 LF
```



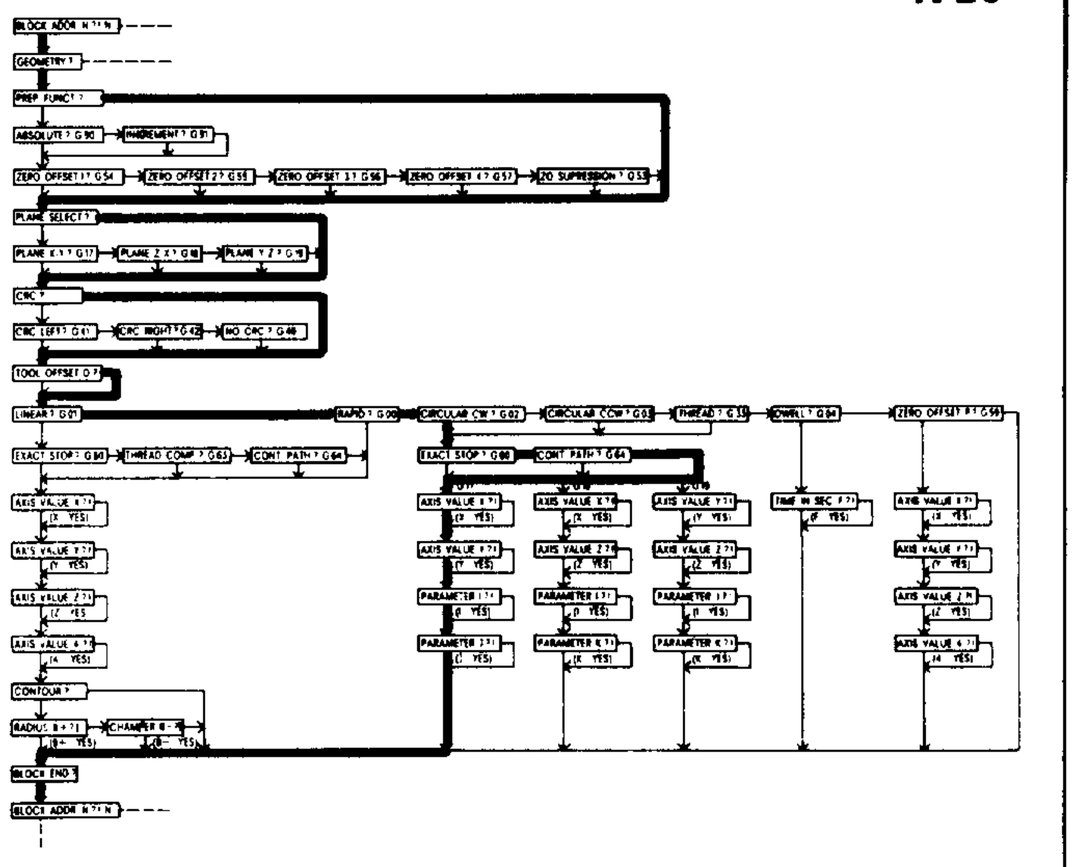




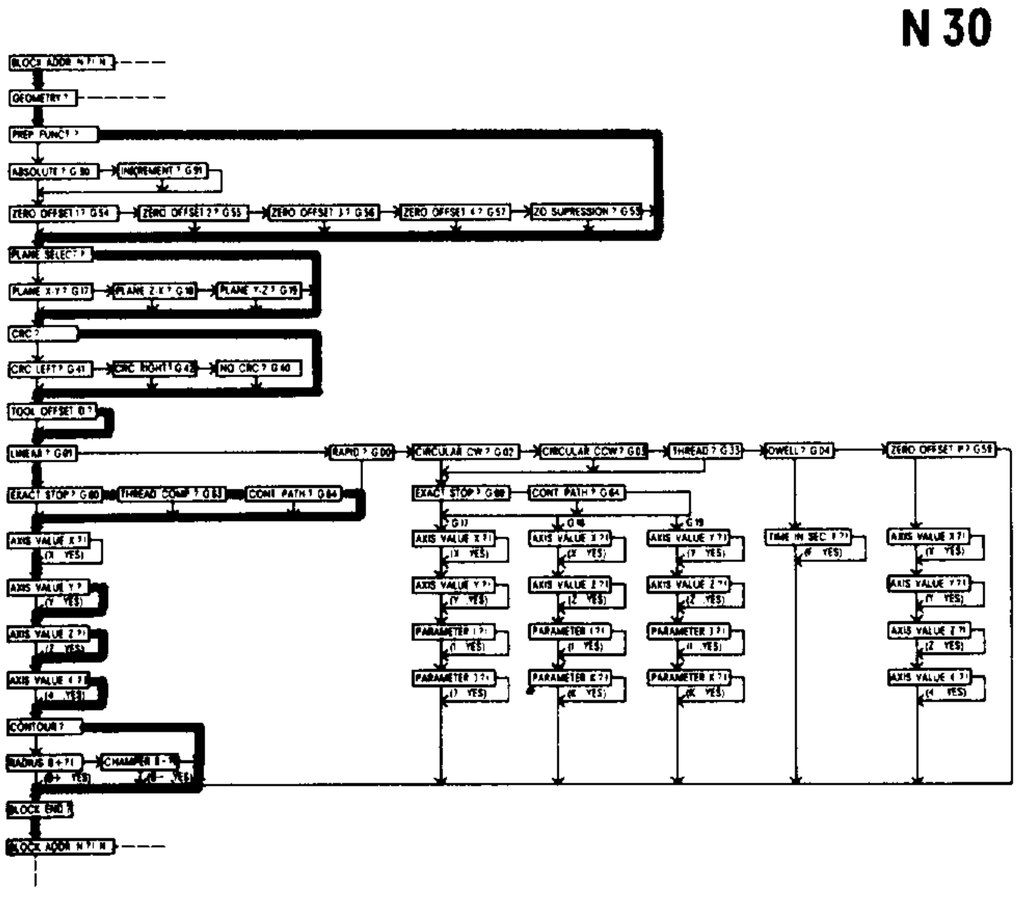
N 20



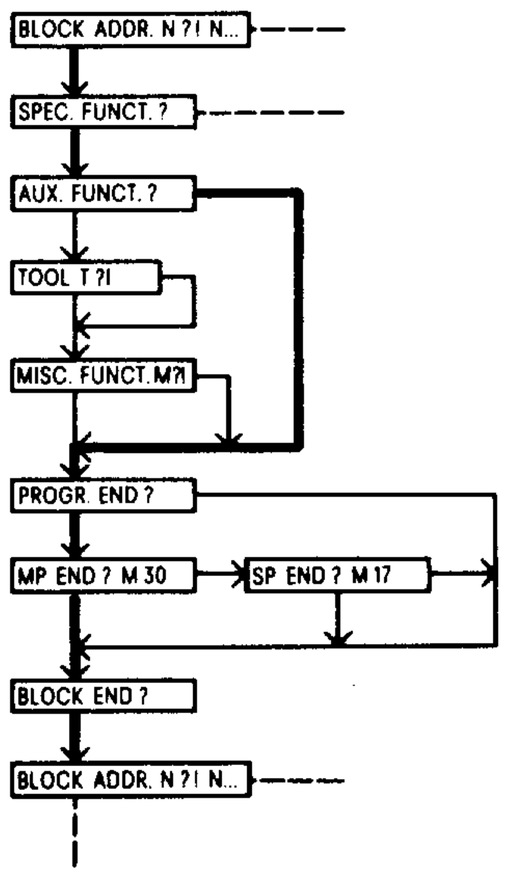
N 25



N 30

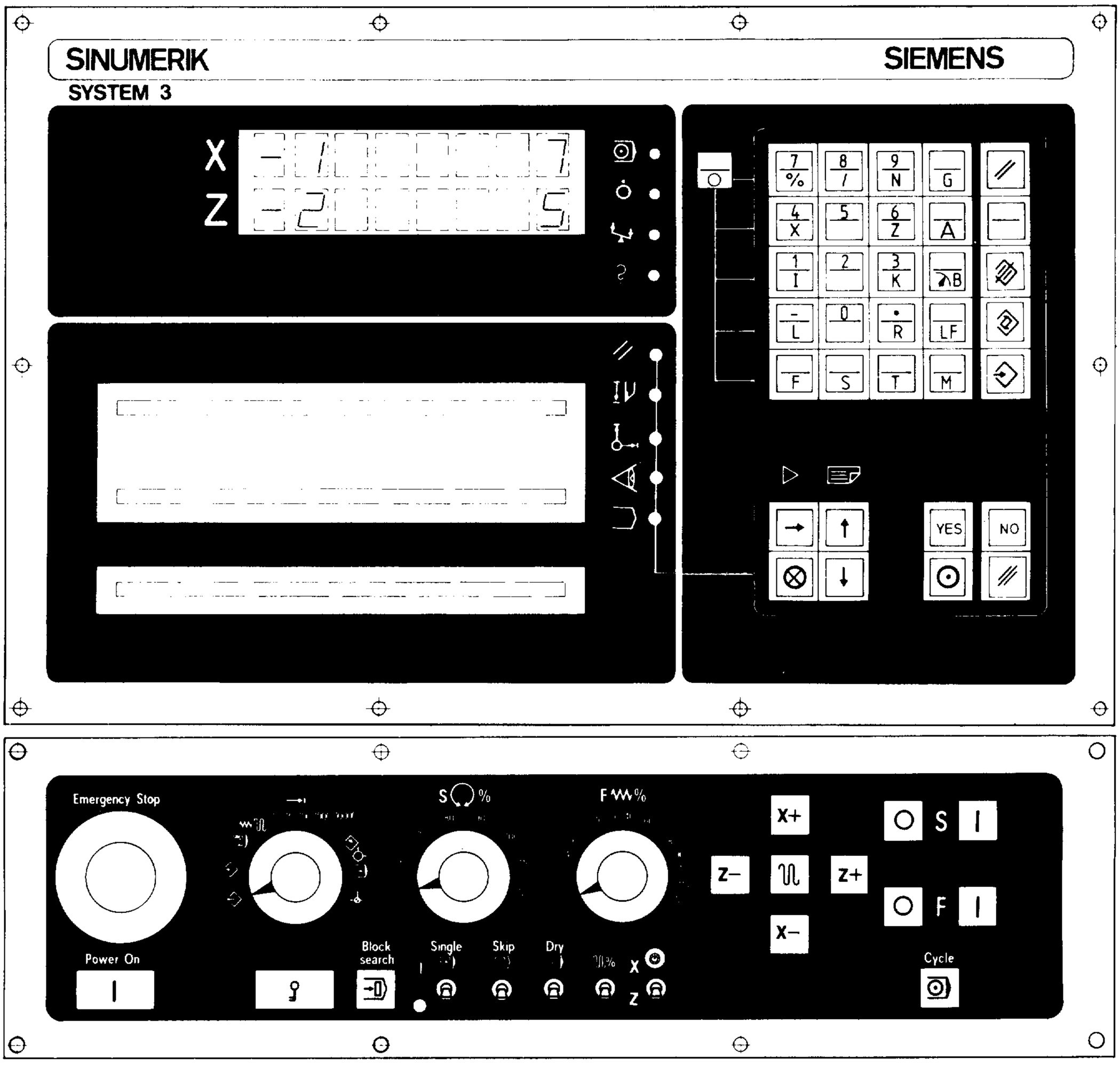


N 35

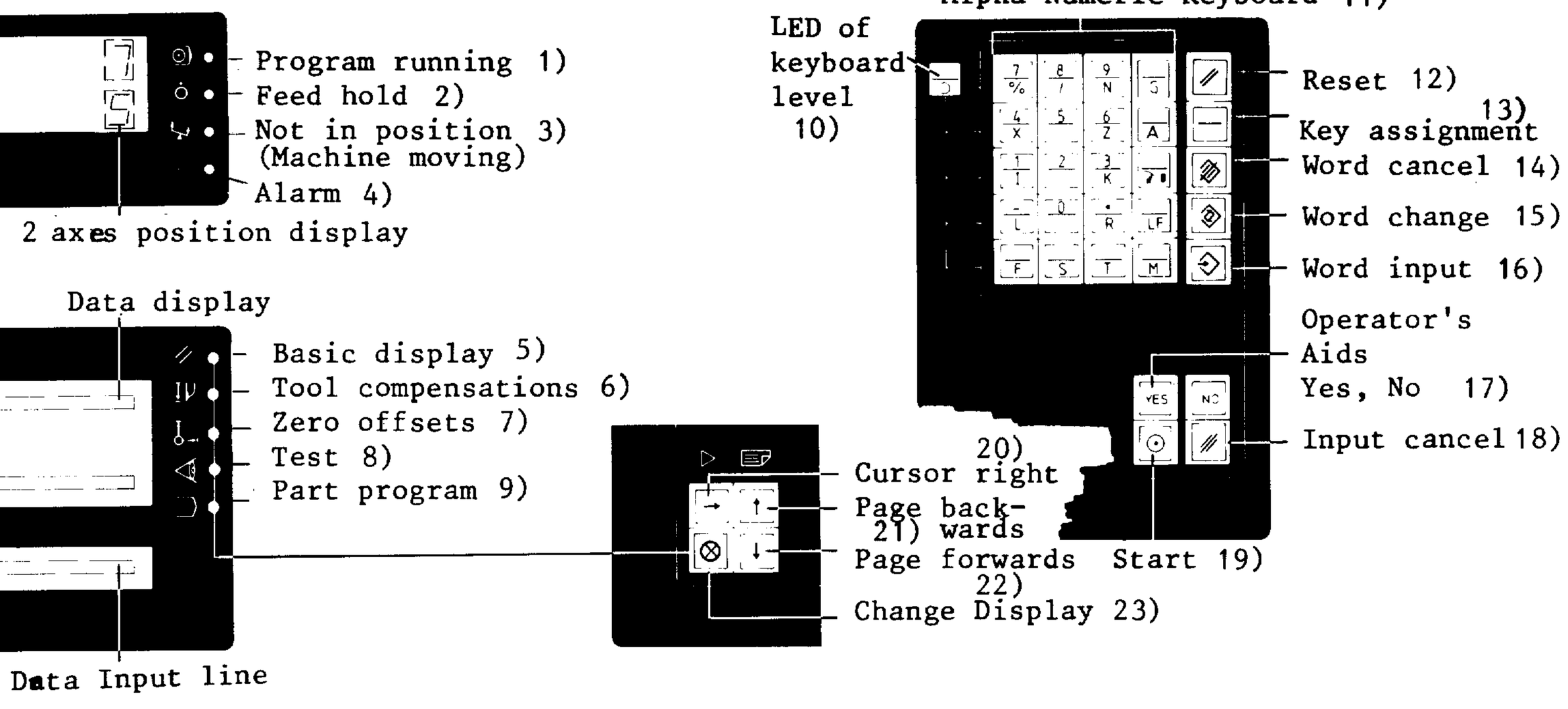


12. Appendix

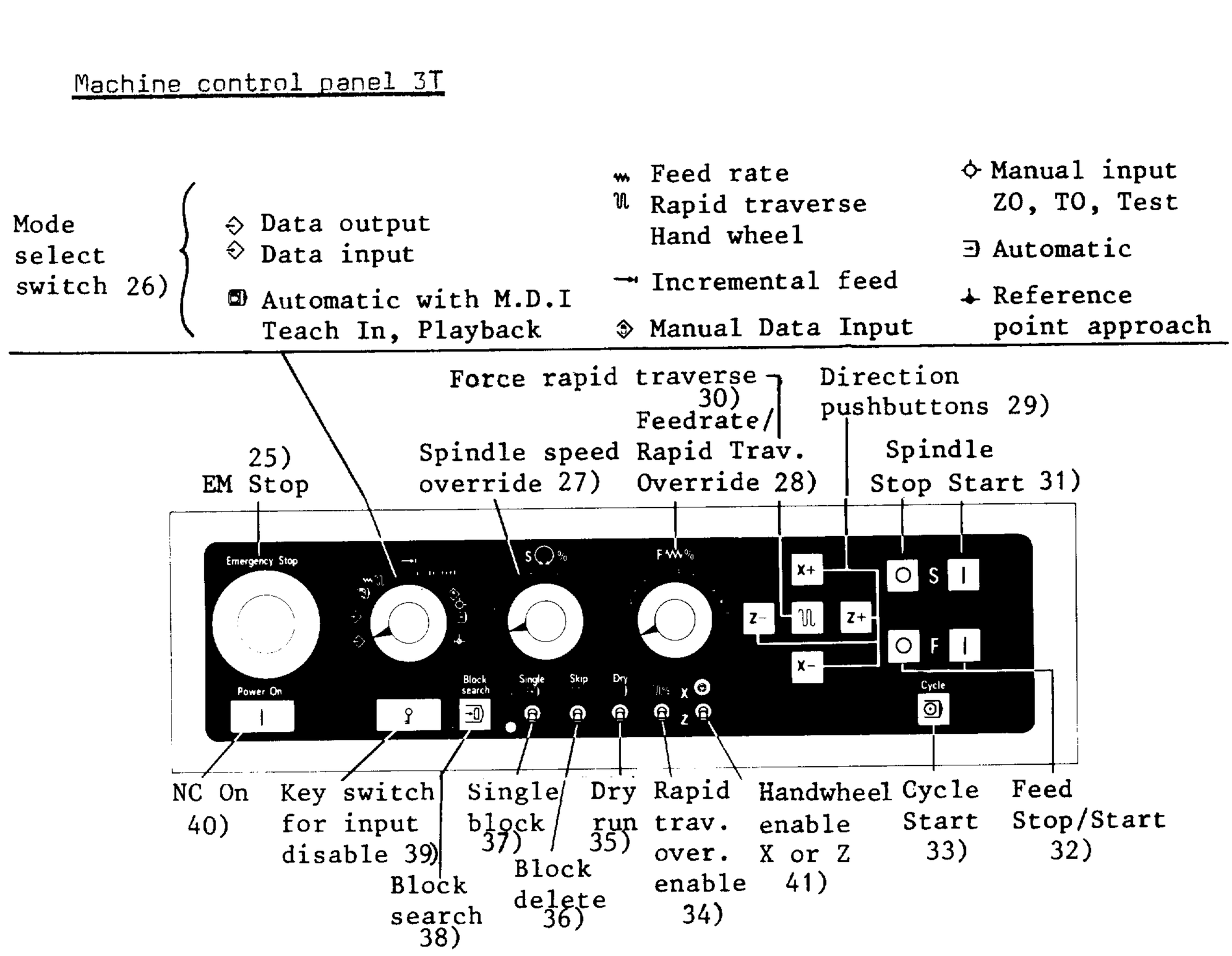
12.1 Operator panel and machine control panel 3T



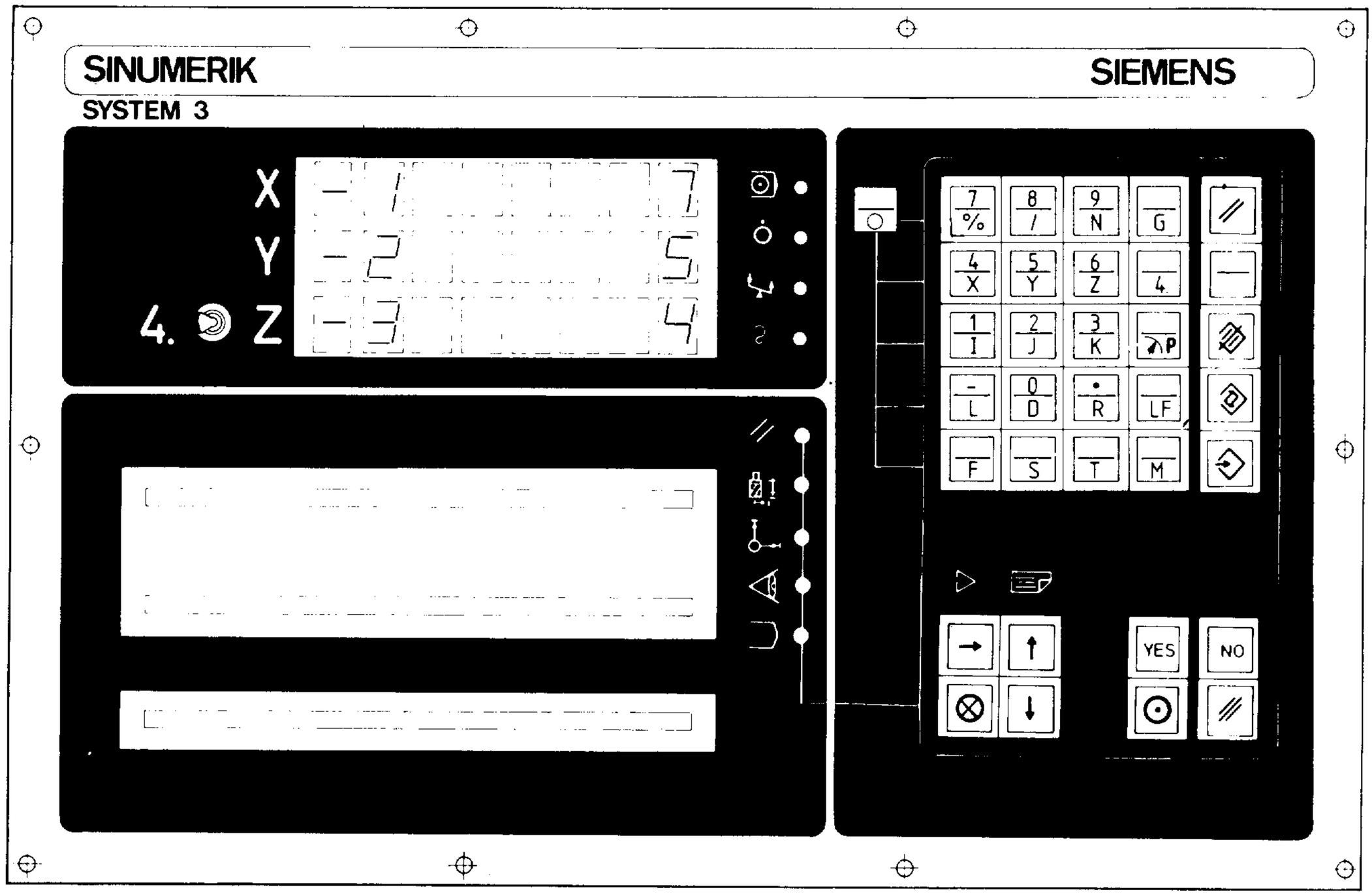
Operator panel 3T

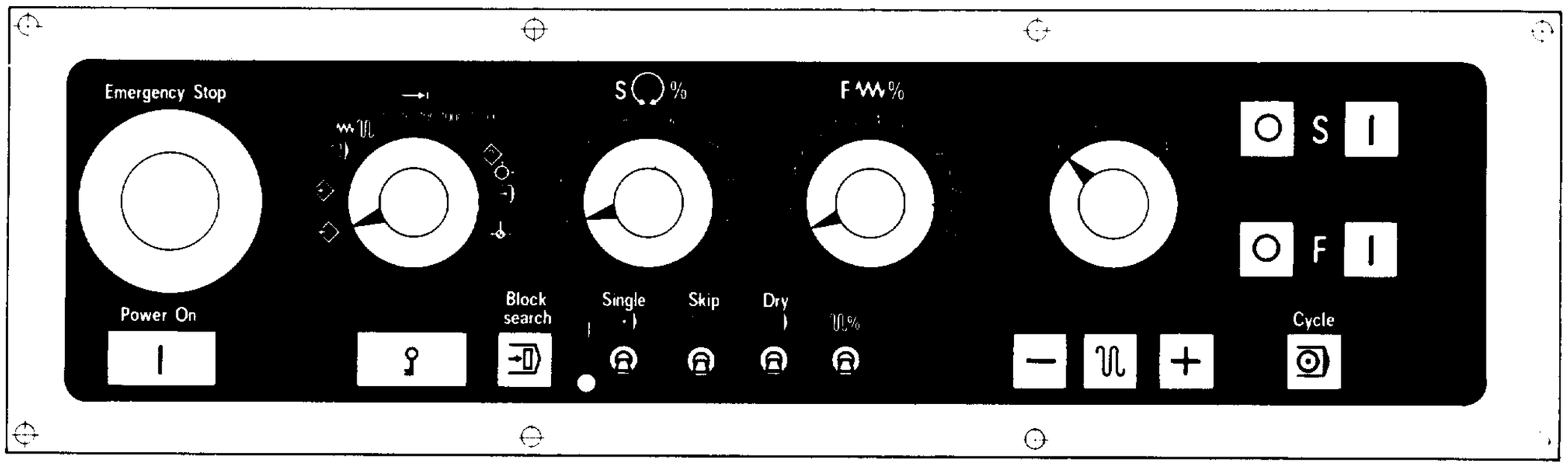


Machine control panel 3T

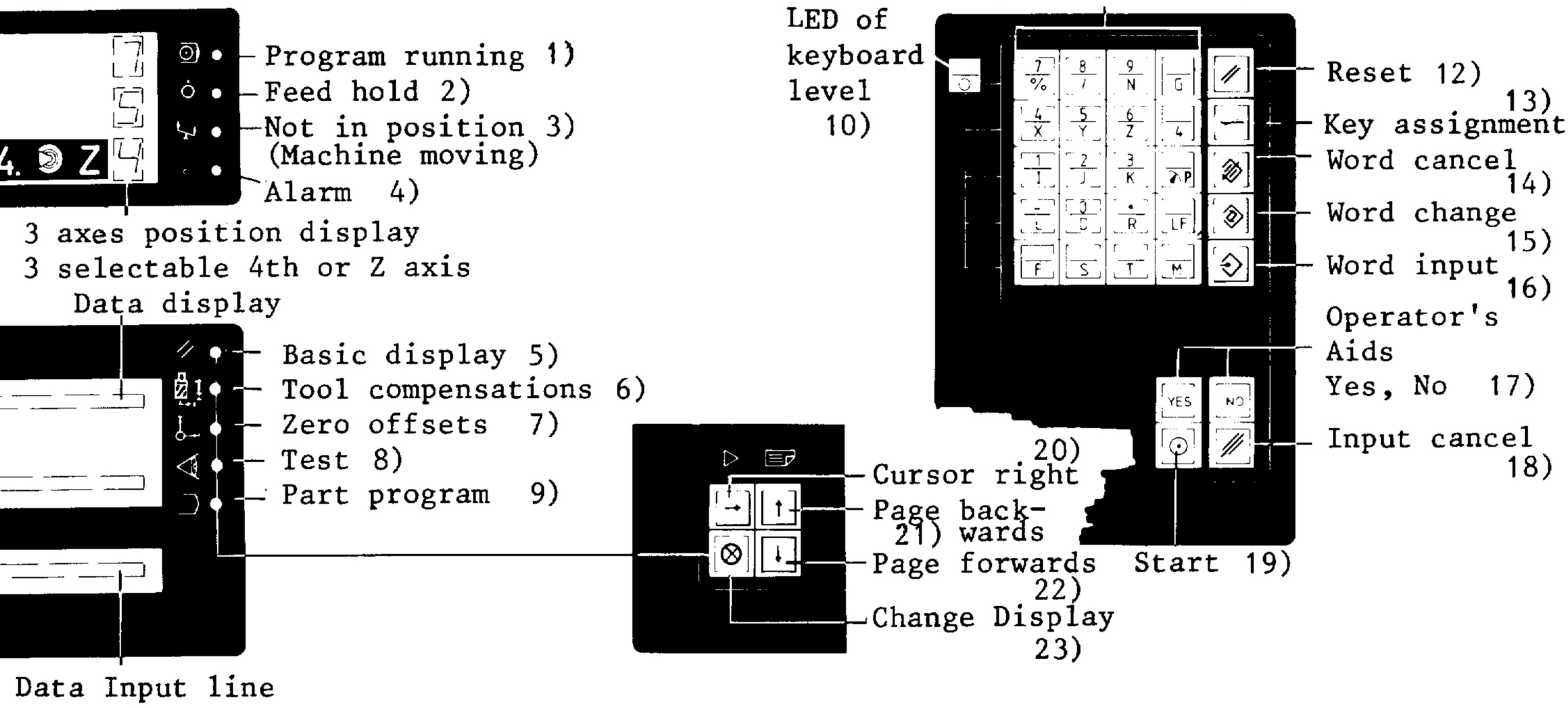


12.2 Operator panel and machine control panel 3M





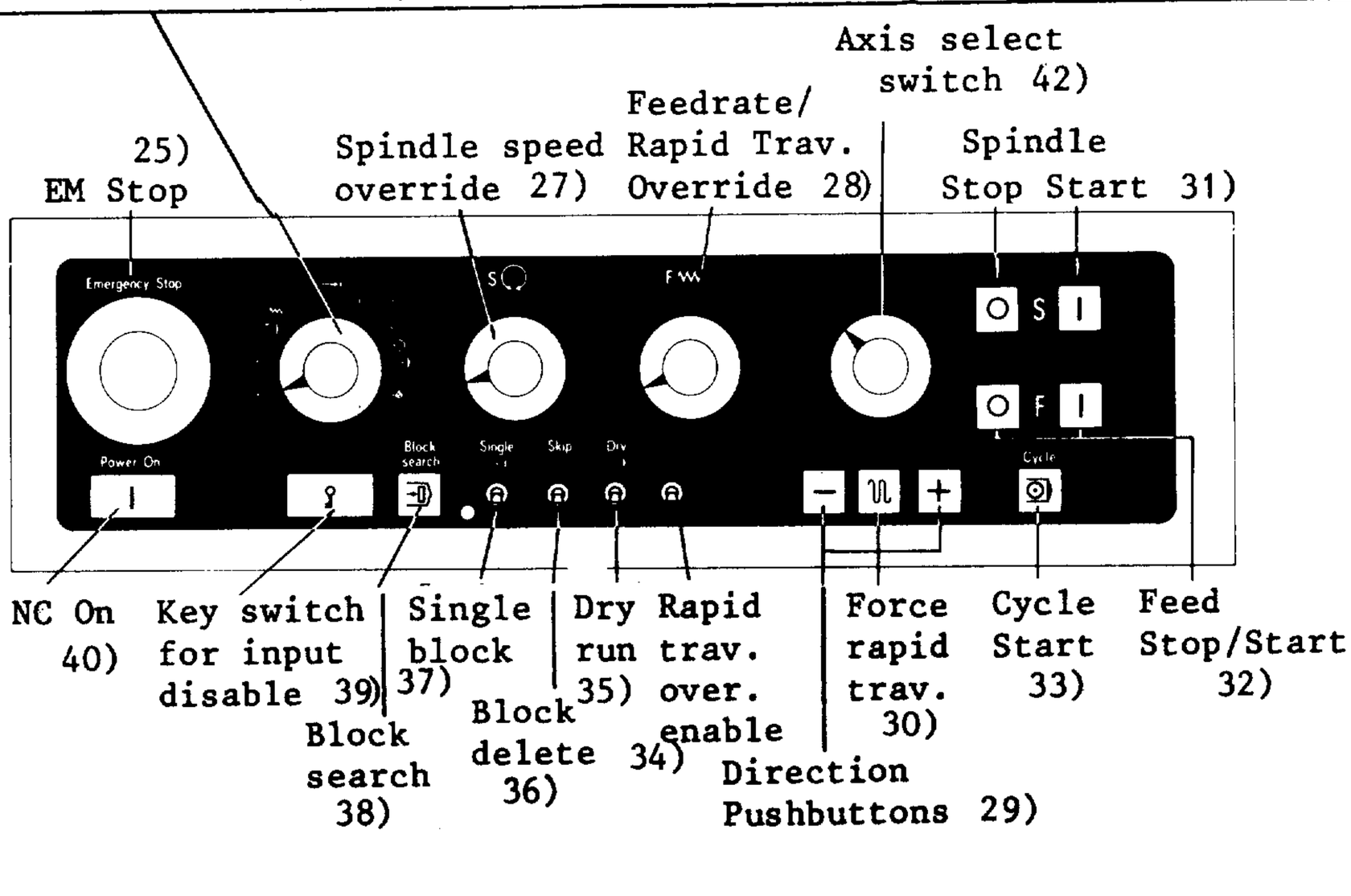
Operator panel 3M



Machine control panel 3M

Mode select switch 26)

- Data output
- Data input
- Automatic with M.D.I Teach In, Playback
- Feed rate
- Rapid traverse Hand wheel
- Incremental feed
- Manual Data Input
- Manual input ZO, TO, Test
- Automatic
- Reference point approach



12.3 Abbreviations, operator panel texts and text interpretation

ACTUAL BLOCK	Active program status indicator
ALARM	Alarm
AVAILABLE MEMORY	Part program space available
AXIS	Axis
Cancel	Clear memory
CH	Character (letter or numeral)
Clear	Input cancel
COM AXIS	Machine parameters; axis-specific for commissioning
COM DATA	Machine parameters; (commissioning data)
COM DISPLAY DATA	Machine parameters for commissioning
CONTROL IN ACTION	Control operational
CORR BLOCK	Last block which can be corrected in AUT mode
Cursor	Correction (edit) indicator
Cycle START	NC start
DATA INPUT	
DATA OUTPUT	
DIFFERENCE VALUE	Command-actual value difference
DRY	Feedrate dry run
Edit	Program edit
Emergency stop	
Ext	External data source
Feed	Feedrate
Hold	Feed hold
HOLD AUTO INTERR	Automatic interrupt
HOLD NO DATATRAN	No data input enable
HOLD MOO	Programmed stop

HOLD SINGLE BLOCK	
HOLD DWELL	
INC	Incremental feed
Input	
INPUT signals	Input signals from interface section
JOG	Feedrate/Rapid jog, handwheel jog
M	Feedrate in mm/min.
MDA	Automatic manual data input
MDI-SE-TE	Manual data input
OUTPUT SIGNALS	Output signals to interface section
Page	Page forwards or backwards
Part Progr	Part program
PC	Programmable control interface
PC FAULT	
Power on	
Progr	Program
PTR	Reader (paper tape reader)
PUN	Puncher
R	Feedrate in mm/rev.
RAPID	Rapid traverse
Reset	
REFERENCE POINT	Return to reference (datum)
R/P	Combined reader/punch device (full duplex)
SELECTED INFORMATION	
SETTING DATA	
SEQ. NUMBER CORR.	Correct program status indicator?
SET UP	
Single	Single block
Skip	Block delete

Spindle	
START	
Tape	Data source reader
Test	Machine parameters, interface diagnostics (testing data)
TO-NUMBER	Tool offset number
TO-NUMBER CORR.	Correct tool offset number?
TTY	Combined reader/punch device (half duplex)
ZERO OFFSET	
ZERO OFFSET EXT.	External zero offset
ZERO OFFSET G59	Programmed zero offset
ZO NUMBER CORR.	Correct zero offset number?

12.4 Operator data

Setting data

Bit/Value	0	1
0	Display of position data referred to machine	Display of position data referred to workpiece
1	Operator dialogue OFF	Operator dialogue ON
2	Tape block parity OFF	Tape block parity ON
3		
4		
5	ISO code punch out	EIA code punch out

Bit/Value	Handwheel calibration, increment/scale division		
	1	10	100
6	0 (1)	1	0
7	0 (1)	0	1

12.5 List of alarms

For more information see section 12.6

How to clear	3rd decade / 1 and 2 decade	8	7	6	5	4	3	2	1
		bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
	00				Servo enable to an axis in motion removed: axis 1			End limit negative: axis 1	End limit positive: axis 1
	01				axis 2			axis 2	axis 2
	02				axis 3			axis 3	axis 3
	03				axis 4			axis 4	axis 4
	10	Measuring circuit scales dirty			drift too high	position control hardware fault *)	contour monitoring	command value too high	standstill monitoring: axis 1
	11								axis 2
	12								axis 3
	13								axis 4
	22	Spindle pulse coder signal dirty				Spindle position control fault *)	Emergency stop	Servo not ready	
	23	V24 interface time elapsed	tape reader overflow 2	stop bit fault	data overflow	parity fault	control word overwritten	overflow 1	stop bit, parity fault
				← Hardware fault USTART →			← Hardware fault reader →		
	24						over temperature		
	25		block with no LF or 120 char				parity fault in memory	programme not found in memory	block not found in memory
	26							fault during threading 1)	block search: block not found
	27	memory overflow	stored prog. ≠ prog. on tape	tape format fault	tape input disabled	more than 120 char. in block	block parity fault	EIA char. faulty	character parity fault
	28	Subprog. fault .	L94 Parameters faulty						Decoding fault
	29		Parameters faulty	Info. not correct	G02/03 faulty	Radius not allowed	Angle not allowed	no. intersection	Non-allowed value entered
		← Fault in programme of contour →							

*) can only be cleared with Power on reset (POROSET)

1) to Software edition 05

List of alarms (continued)

Hcw	3 decade 1 and 2 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	Faulty arc end point				zero offset or tool offset non-allowed val.		option not present	arc not inselected plane
	31		more than two axes programmed	F word missing or too large		threading pitch fault			
//	32						cutter comp.plane cannot be defined	non allowed block with CRC	
	33								
	34								
	35								NC start without first re-ferencing
	50	axis twice or more than two axes prog.		cutter radius comp. contour fault		faulty block structure	programming fault	more than 6 geom. parameters	general
	51			block cannot be displayed	block number not found	more than 120 char. in block	memory full	Input blocked	Input only poss. after Reset
//	52	kV factor not measured	kV factor not equal						strobe input fault
	53	general i/p fault	last prog. not finished	2 axes in block	playback only if axes stood	playback only when MDA intrupt	playback as 1st block not allowed	prog. no already present	40 char. in block
a) Restart	70							declared name wrong	
	71								battery alarm

a) bottom now of display must be completely cleared
b) alarms in the 70 group cannot be cleared with either RESET or CLEAR
c) alarms in the 71 group can be cleared with CLEAR

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 a 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 push button. 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 Standstill" 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 alarm 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 N352 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 on 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 Nr. 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, B2 = "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 Both errors refer to the control bits which the reader receives from the control. Stop bit error: Invalid stop bits Parity error: Odd parity of the control word The software cannot determine which of the two faults have occurred. - Change port (Machine parameters) - Check the Machine parameters for the baud rate - Check the reader
232,	Overrun 1 The reader has not generated a control bit without which the word cannot be transferred from the reader. This is generally a hardware fault. - Replace the reader logic module.
233,	Control word overwrite The reader has loaded characters into the USART before the last transmission has finished. Characters are dropped. - Replace the reader logic module.

Alarm No	Description and handling
	Hardware fault USART
234	Parity error only active with FANUC reader This alarm is generated if the reader data word (8 bit information and 1 parity bit) is not even parity. This is not an ISO/EIA parity character fault from tape (See alarm 271) - Change port (+ machine parameters) - Check the machine parameters for the baud rate.
235	Overrun fault This alarm is generated if the control reads a character before the last character read has been stored. - Fault in the interrupt area - Faulty USART port. Change machine parameter (Baud rate)
236	Stop bit error This alarm is generated when no valid stop bit is recognised, at the end of a character. As the control's USART uses 2 stop bits, 7 data bits and 1 parity bit (exception: FANUC reader) the connected peripheral must be adapted accordingly. - Check the peripheral adaption.

Alarm No	Description and handling
237,	Overrun 2 This alarm is generated if the strobe signal is not received within 0,4 ms after the transmitted character. The reader stops on the next character without transmitting it. In the event that the sprocket hold does not stop over the reading head, the associated character is lost. When the reader is restarted alarm 237 is generated. - Change the reader logic module or the tape reader complete.
238,	V24 Time check This alarm is generated when reading in a tape and no data appears for a period of twenty seconds. Check whether the reader is connected. - the connecting cable is plugged in.
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.

Alarm No	Description and handling
251,	Block not stored in memory e.g. when jumping to a block number
252,	Program not stored in memory
253,	Memory parity fault
254,	V24 port operating error
257,	Block without an LF or a block exceeding 120 characters or M02, M 30 without LF
261,	During search no coincidence was found. This alarm is generated, if during program search the required block or sub-routine was not found before the end of program, i.e. the searched block or sub-routine 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,	<u>Character parity error</u> Following the definition of the program start "%" or "LF", 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,	<u>Invalid EIA character</u> If, in spite of correct parity, a character with a hole on the 8th track is read in, alarm 272 is displayed.
273,	<u>Block parity error</u> When block parity (setting data) is active, all the characters within a block are counted. In the cases where the count is not even, alarm273 is displayed. Independant of the setting data, when punching tape from the control, even block parity is generated and as necessary, spaces are punched.
274,	<u>Block with more than 120 characters</u> 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 sub-routines with machine parameter "Key switch eneble" 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 sub-routine is incorrectly defined or ended.
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 previosly 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 highlighted by commas separating every incorrect character on the "Correction Block" display.
287,	Intersection point (@22) fault This alarm is displayed as a result of faulty L94 cycle parameter definitions.
288,	Sub-routine 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.

Alarm no.	Description and handling
292,	<u>No intersection point</u> The programmed values entered do not provide an intersection point on the defined contour.
293,	<u>Incorrect angle value</u> An angle is equal to or larger than 360^{o} or the value is not correct for the defined contour.
294,	<u>Incorrect radius value</u> The entered value is either too large or illegal for the defined contour.
295,	<u>G02 / G03 incorrect</u> The arc direction is wrong for the defined contour.
296,	<u>Incorrect block sequence</u> For calculation purposes, more blocks are required: the block sequence is not compatible or the information is insufficient.
297,	<u>Incorrect input parameter</u> The programmed parameter sequence is illegal or incomplete for the defined contour.

Alarm no.	Description and handling
301,	Arc not in the selected plain 3M: The interpolation parameters do not reflect the selected plain.
302,	Option not available This alarm is generated for the following cases: - The option "Feed per revolution" is not available and G95/G96 are programmed. - The option "Threading" is not available and G33 is programmed. Remedy: Enhance the software and check the 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 under I, J, K relative always to the leading axis, otherwise alarm 314 is activated. (e.g., X20000 Z 10000 K10000).

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> More than 2 aces are programmed in one block without the additional function "3D-interpolation". With the additional function "3D-interpolation" more than 3 axes are programmed in one block
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)
323,	<u>CRC plain cannot be determined (3M)</u> Programming fault . The CRC plain cannot be determined if 2 axes are not programmed when CRC is selected.
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: axis, 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.
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 more than 2 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 displayed if the called block is not defined in the current 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 an "LF" to divide the block up and where the second block has no block number. Now both blocks 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,	Stop during threading For the user alarm indicates that the thread is destroyed by a stop (stop in the rev. feed rate)
527,	Axis K_V factors unequal This alarm is generated if the measured KV factors for the axes are unequal. This would result in contour errors.
528,	K_V 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,	**Play back 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.
523	Halt in threading For the user, the alarm indicates that the thread has been destroyed by a stop. (Halt in feed/rev.)

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 is 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 Mylar or non-transparent 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.	

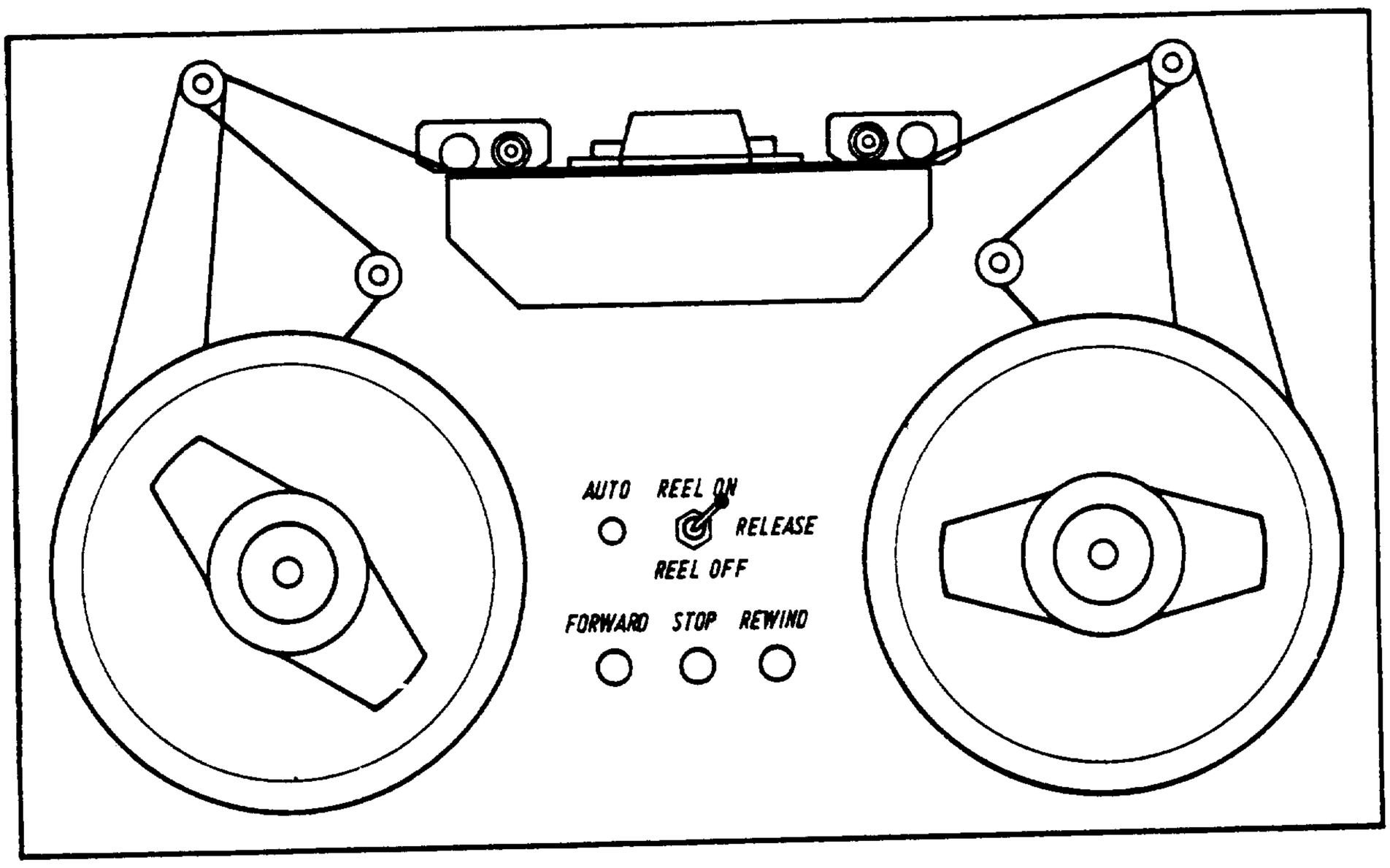
Manual mode

Forwards : Toggle switch to "MANUAL"	"FORWARD"
REWIND : ———	"REWIND"
STOP : Toggle switch to "RELEASE"	"STOP"

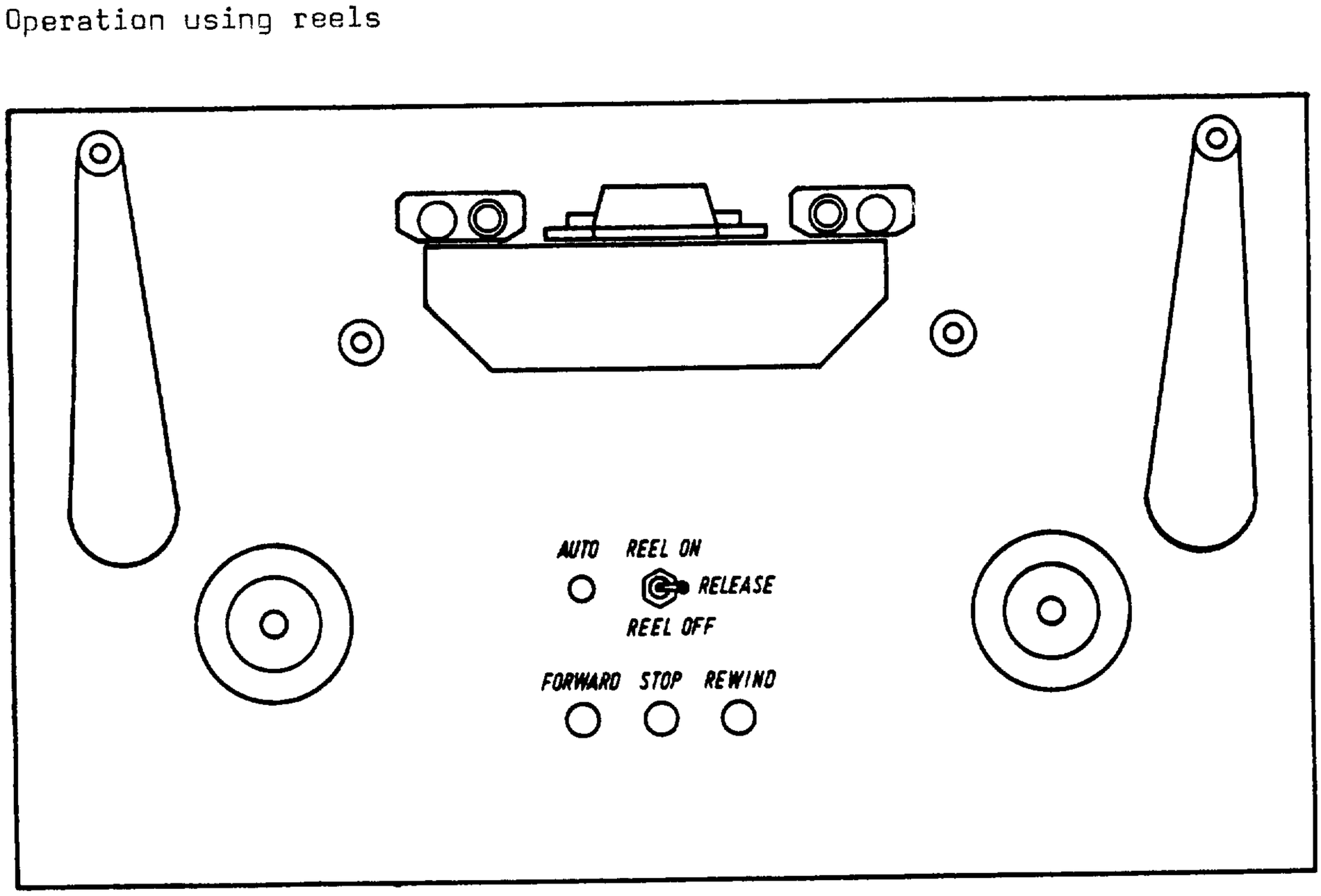
Program Operation

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" lamp can be reset with the reset push-button

Reader with reels

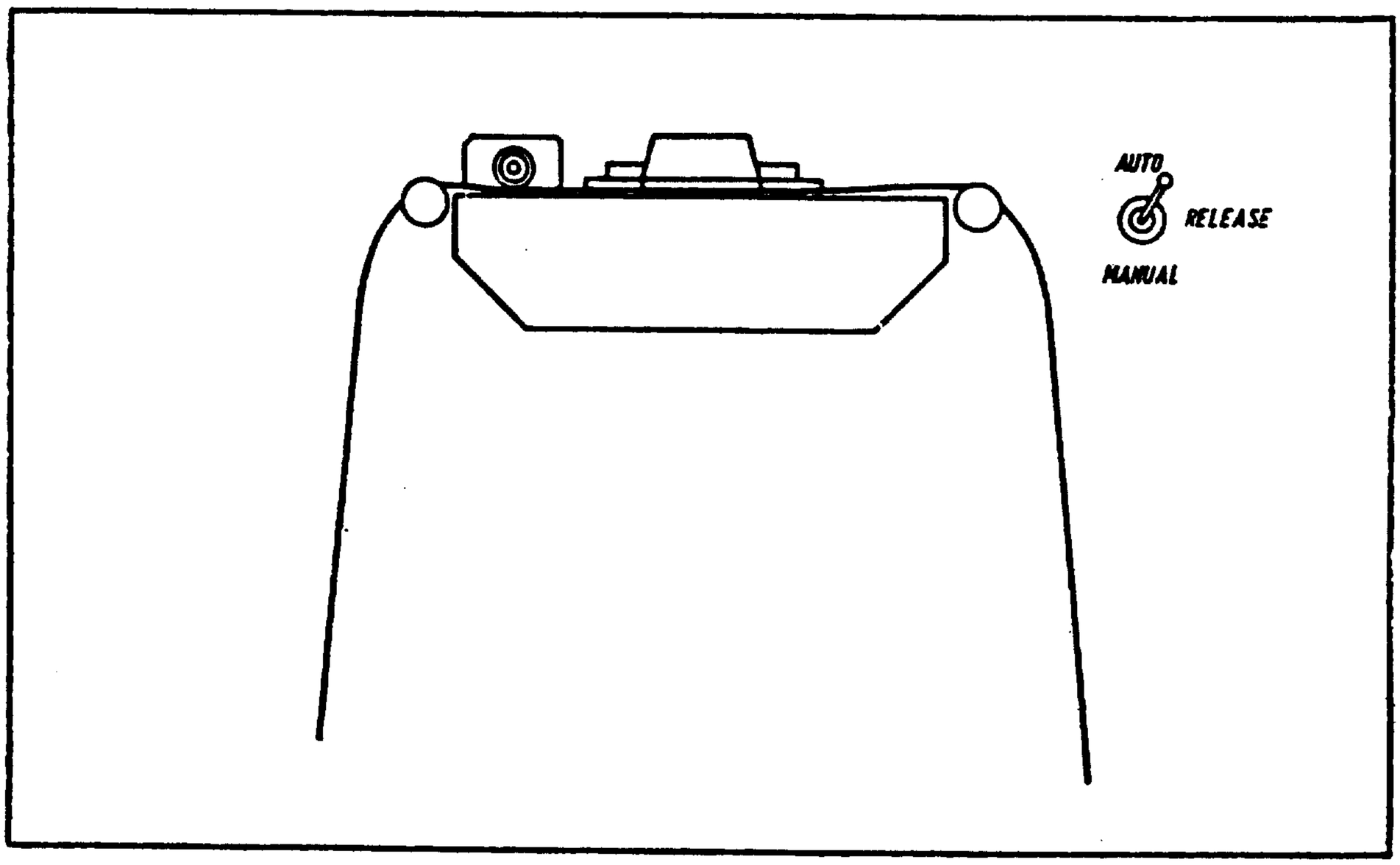


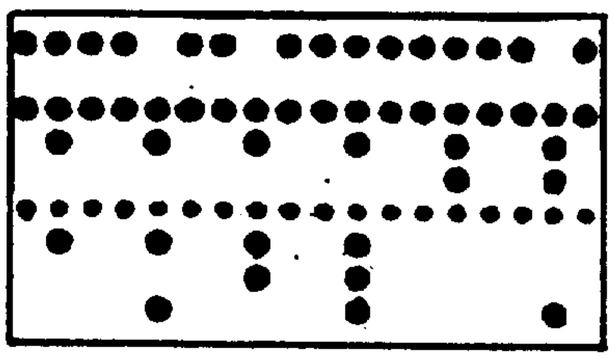
Operation using reels



Operation without reels

Reader without reels





Tape reading direction.

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