

SIEMENS

SINUMERIK Primo SG

Operating instructions

SINUMERIK Primo SG

Part 1 Operator's manual

Edition 09.84

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SINUMERIK^R - Documentation

Edition key

The following editions have been published upto the present edition.

The revised sections from the previously published editions have been described in the column of revisions.

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Edition	Order-Number	Revisions
E.05.82	E 321/1905	-
E.10.82	E 321/1973	Revised edition
E.09.84	E 80210-T98-X-A3-7600	Revised edition

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1. Introduction

1.1 General

The following operator's manual is valid for the SINUMERIK Primo SG when used for a grinding machine application and for SINUMERIK Primo SG/2 for general automation jobs.

The decision that whether it is Primo SG or Primo SG/2, is made by the machine data M601, bit 0:

0 = Primo SG

1 = Primo SG/2.

The differences in the operation of two systems have been given in text specially. The operating steps are represented in their operating sequences. In this context, symbols of the control operator's panel and the external machine control panel are used.

The annexure contains diagrams showing the operator's and machine control panels.









The individual operator's elements are explained when they first appear in the text, thereafter they are referred to by their associated key numbers.

Projected functions may be available in the control. There is, however, no entitlement to these functions with a new delivery or in the case of service.

We reserve the right to change this manual for technical reasons.





1.2 Operating modes

The following operating modes are differentiated between:

-  Data output (11)
-  Data input (10)
-  Manual data input SE-TE (9)
setting and machine data
-  Set actual value (8)
-  Reference point approach (7)
-  Jog (6)
-  Automatic (5)
-  Automatic single block (4)

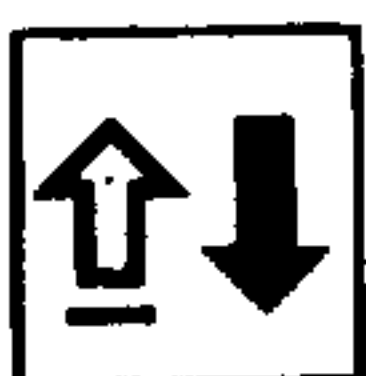
1.3 Keyboard

The Primo SG is operated in a logical sequence via a dual function keyboard. The yellow indicator lamp above the keyboard indicates whether upper or lower case is effective.

Indicator ON: Lower case effective	Indicator OFF: Upper case effective
Change to upper case with X, Y, Z, D, E, F, G, M, S, H, N, R, @	Change to lower case with    
@ is selected by extended pressing the G-key	

The keyboard comprises the address and numerics keyboard and the function keys.

The function keys have the following meaning:



- Search forwards/backwards (14)
Page towards the end of memory by pressing for a short time; page backwards towards the start of memory by pressing for a longer time; search for block numbers and words in program memory.



- Clear (15)
Deletion of blocks and words in program memory; clearing the contents of the universal display; clearing alarms.



- Word exchange (16)
Overwriting of words and blocks in the program memory.



- Input (17)
Input of data into the memory (machine data, setting data, program).
Insertion of words and block numbers in an existing program.

1.4 Display

The display comprises three position displays for the X, Y and Z axes and the universal display.

It is possible to display either the relative position or the distance to go of the individual axes through setting data R142.

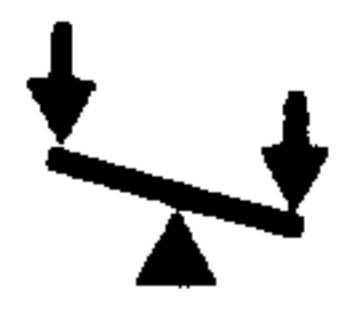
The universal display serves for the input and display of machine data, setting data and programs, as well as for diagnostic purposes.

A 16 segment display serves to identify the numerical values in the universal display.

16 Segment and universal displays

The 16 segment display is used to identify the decimal value on the universal display.

16 Segment display □□□□	Universal display contents □□□□□□□□
N G @ X Y Z D E F H M S	Block number/Jump target/Sub-routine Preparatory function Special function Path information Path information Path information X feed Y feed Z feed Parameter Output Miscellaneous function Spindle speed
R 0 0 0	Block search parameter
R 0 0 1 to R 0 9 9	Free parameter
R 1 0 0 to R 1 4 3	Fixed parameters
M 6 0 0 to M 6 6 4	Machine parameters
E R R	Alarm numbers (<u>ERROR</u>)
E D M P	Display after selection of the program memory (<u>EDIT MAIN PROGRAM</u>)
C L M P	Unprotected program memory reset (<u>CLEAR MAIN PROGRAM</u>)
E M T Y	Cancel program memory (<u>EMPTY</u>)
C L S E	Reset Parameters R001 - R099 (<u>CLEAR SETTING DATA</u>)
SUM 1 to SUM 4	EPROM bit sum alarm

Universal display indicator lamps descriptionPosition not yet reached (18)

The "position not yet reached" lamp is illuminated if one or more of the three axes are in motion or the "In position limit" has not yet been reached (machine data M637, M638, M639). If the lamp remains on after the command position difference is cancelled (position display "static"), drift equalisation must be completed.

Action:

Observe the following errors under R139, R140 and R141 when the axes are stationary and enter values into R115, R116 and R117 until the following errors are smaller than the "In position limits".

Rapid traverse (19)

The lamp is illuminated when positioning in rapid traverse in the following modes:

- Jog, so long as the rapid override key is pressed.
- Reference point approach, from pressing the direction key up until reaching the deceleration cam.
- Automatic and single block where rapid (G00) is programmed.
The lamp extinguishes after programming a feedrate with G01.

Dwell time (20)

The LED is illuminated for the duration of a programmed dwell.

Dressing in case of Primo SG /
feed hold in case of Primo SG/2 (21)Primo SG:

The dressing lamp may be illuminated by either pressing the dressing key (34) or through G83. The lamp is extinguished at the end of the grinding cycle or with NC-reset.

The dressing cycle is written as a subroutine. The subroutine number of this dressing cycle is defined in machine parameter M651.

Automatic Mode:

The "Dressing Cycle" can be called conditionally by G82 or unconditionally by G83 from the program.

The "Dressing Cycle" called with G82 is executed if the "Dressing Cycle" key has been previously pressed.

The "Dressing Cycle" lamp illuminates immediately the key has been pressed or on decoding G83. The lamp then goes out at the end of the Dressing Cycle or through NC-reset.

Jog Mode:

The "Dressing Cycle" is immediately executed after pressing the "Dressing Cycle" key or through the start of the G83 cycle.

Primo SG/2:

The LED is lit, in case the feed enable is missing and is switched off with the feed enable. The function "Dressing" is not affected from here.



Grinding wheel change in case of Primo SG /
read in disable in case of Primo SG/2 (22)

Primo SG:

The grinding wheel diameter is checked internally. If the remaining diameter becomes smaller than the minimum grinding wheel diameter, the "change wheel" lamp illuminates in the universal display. The current program can be completed but no subsequent start is permitted.

The working diameter is calculated from:

diameter of the new wheel -
dressing amount in the dressing axis (R108).

After changing the grinding wheel, the wheel is moved to the dressing position in the Jog mode. Subsequently the SE parameters R121 and R123 are loaded with the absolute dressing position on switching to "Preset" mode and pressing the "Dressing Cycle" pushbutton. The "Change Wheel" lamp immediately goes out and the dressing commands (SE parameters R103 - R105) are automatically cleared.

Primo SG/2:

The LED is lit, in case the feed enable is missing and is switched off with the feed enable. The function "Grinding Wheel Change" is not affected from here.

Program interrupt (23)

If a program is interrupted with M00, single block, a mode change or when waiting for "NC Start" following the interruption of the "Free to Move" signal, the "Program interrupt" lamp is illuminated. The lamp goes out after a new program start.

Program active (24)

The lamp is illuminated if a programmed block is being executed.

2. Program memory (operating mode data input)2.1 Memory areas and input formats

Block Number		Input		
		Address	Format	
M A I N P R O G R A M	N1	G	00 - 99	Preparatory functions
	.	@	21, 40-48, 60, 61	Special functions
	.	X	+ 999.9999 mm or	Path information as per input resolution Path information for part division
	.	Y	+ 9999.999 mm or	
	.	Z	+ 99999.99 mm or	
	.		+ 9.999999 in.	
	.		+ 99.99999 in.	
	.		+ 999.9999 in.	
	.		0 - 65000	
	N999	D E F	0 - 12000.00 mm/min or 0 - 12000.00 mm/min or 0 - 120000.0 mm/min 0 - 47.2400 in/min 0 - 472.4000 in/min. 0 - 4724.000 in/min	Feedrate as per input resolution
S U B - R O U T I N E S	N1000	S	0 - 9999 RPM 0 - 99 m/sec (ft/sec)	Wheel speed Wheel peripheral speed
	.	H	00 - 99	Parameter output
	.	M	00 02 17 30	Program stop End of tape End of subroutine End of program
	.		00 - 99	BCD-Output
	.	R001- R099	As for path informa- tion and the feedrate	Parameter
	N9999			

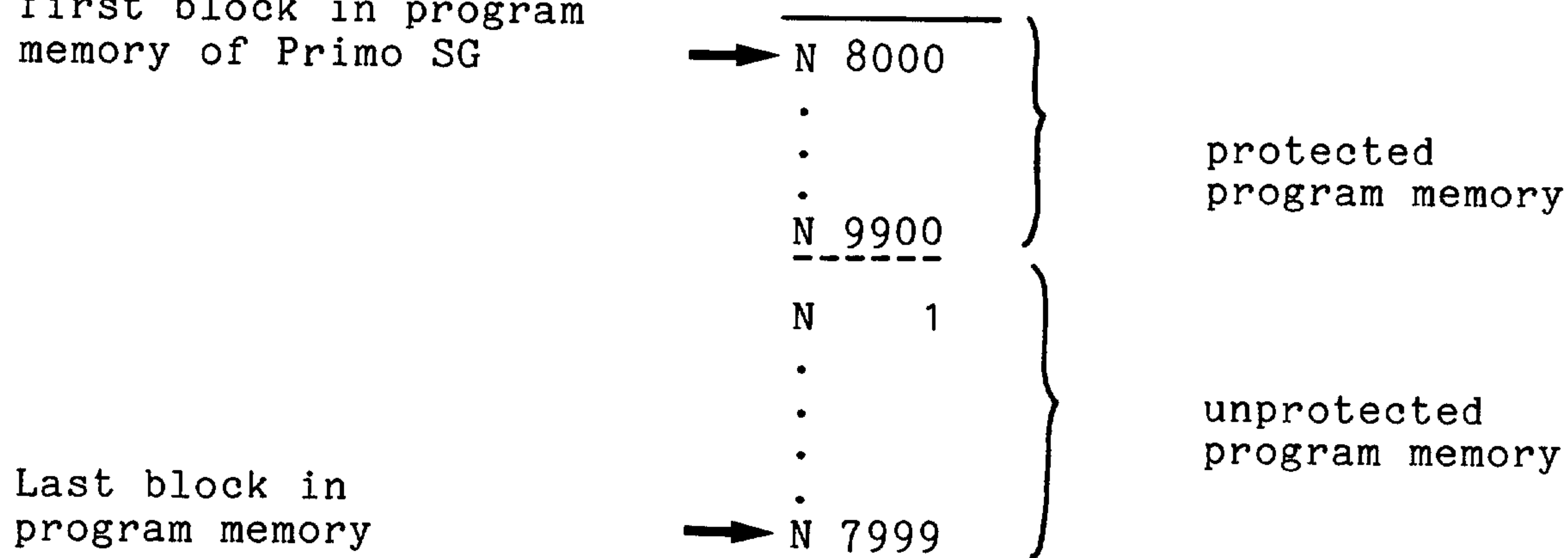
Machine parameter M636 is loaded with the limit of the protected and unprotected memory areas as a block. The limit is between 0 to 9999. The protected memory area is not displayed, may not be output or modified though it may be erased through a special routine.

Memory start ... M636 = Protected memory area
 M636 + 1 ... Memory end = Unprotected memory area

The defined block number in the machine parameter must be in the program.

Example: M636 = 9900

First character and
 first block in program
 memory of Primo SG



Last block in
 program memory

The display and input of program data is only possible in the Data Input mode (No. 10).

A program memory search causes an E D M P display or E M T Y if the unprotected memory area is empty.

There are fixed subroutines and cycles in the protected memory area which must not be modified.

Note: If a block number is defined only "N" (without digits), then it is defined internally as NO, which means that the protected program memory is extended up to the last N without digits, if a "0" is entered in the machine data M636.

2.2 Resetting the program memory

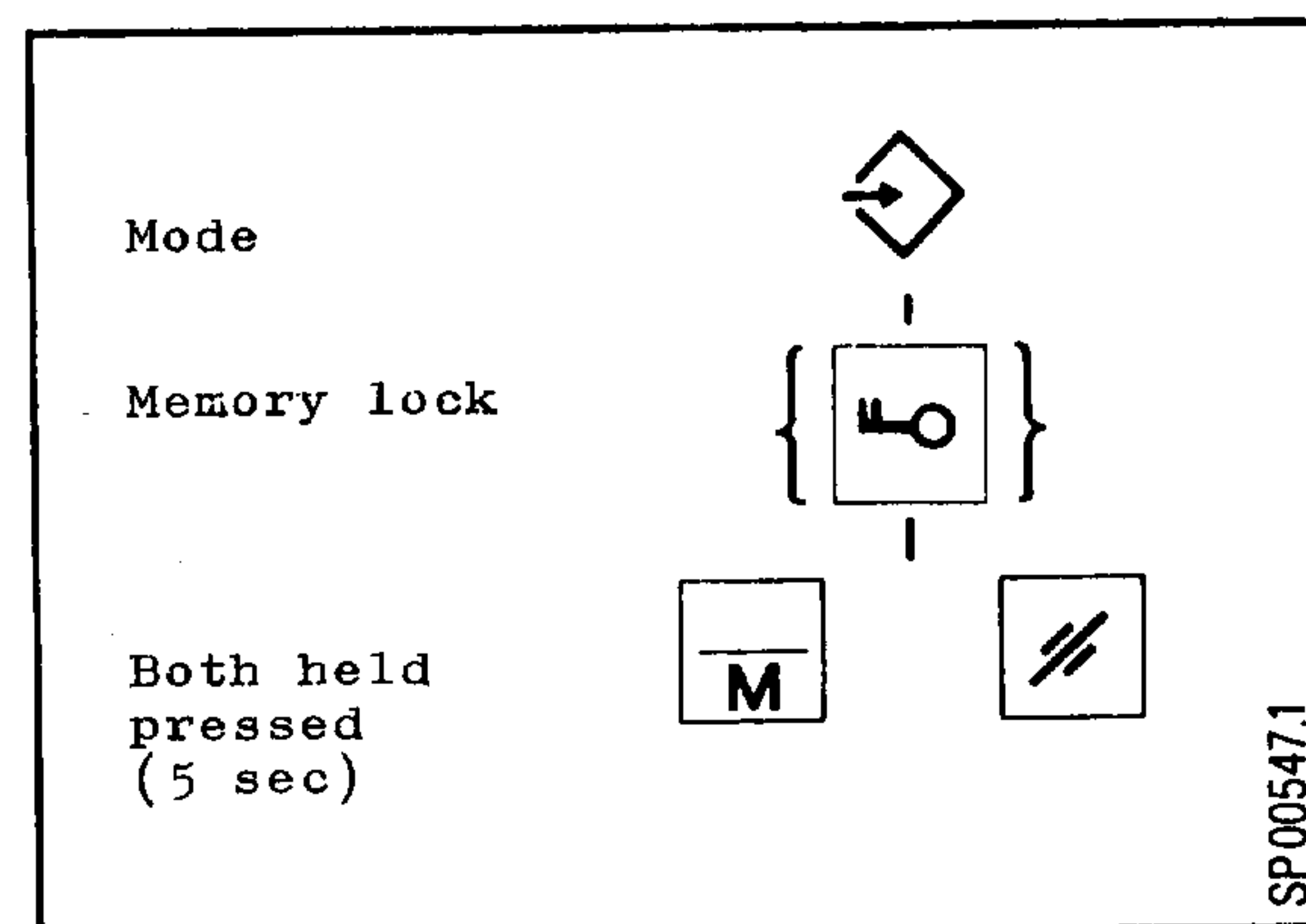
Memory lock is active!

2.2.1 Unprotected area

CLMP flashes on the display.
If CLMP does not flash, the unprotected memory area is reset.

After having selected the memory contents with the page key (14) an empty store should result in "EMTY" being displayed in the universal display.

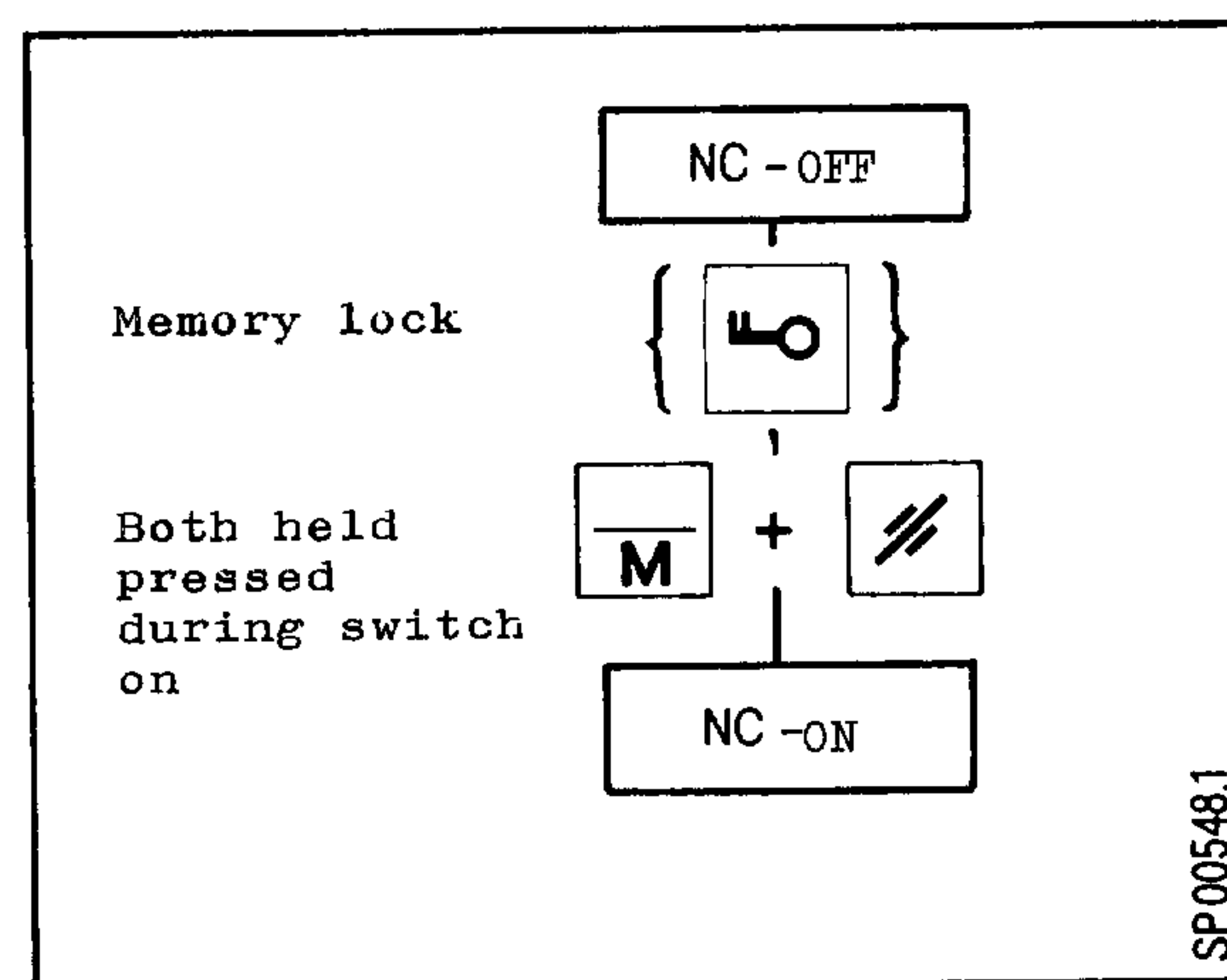
Operating sequence:



2.2.2 All areas

If the program memory is wholly reset after the selection of memory, EMTY appears on the universal display.

Operating sequence:



2.3 Display of the program memory

2.3.1 Block number selection (Block search)

Operating sequence:

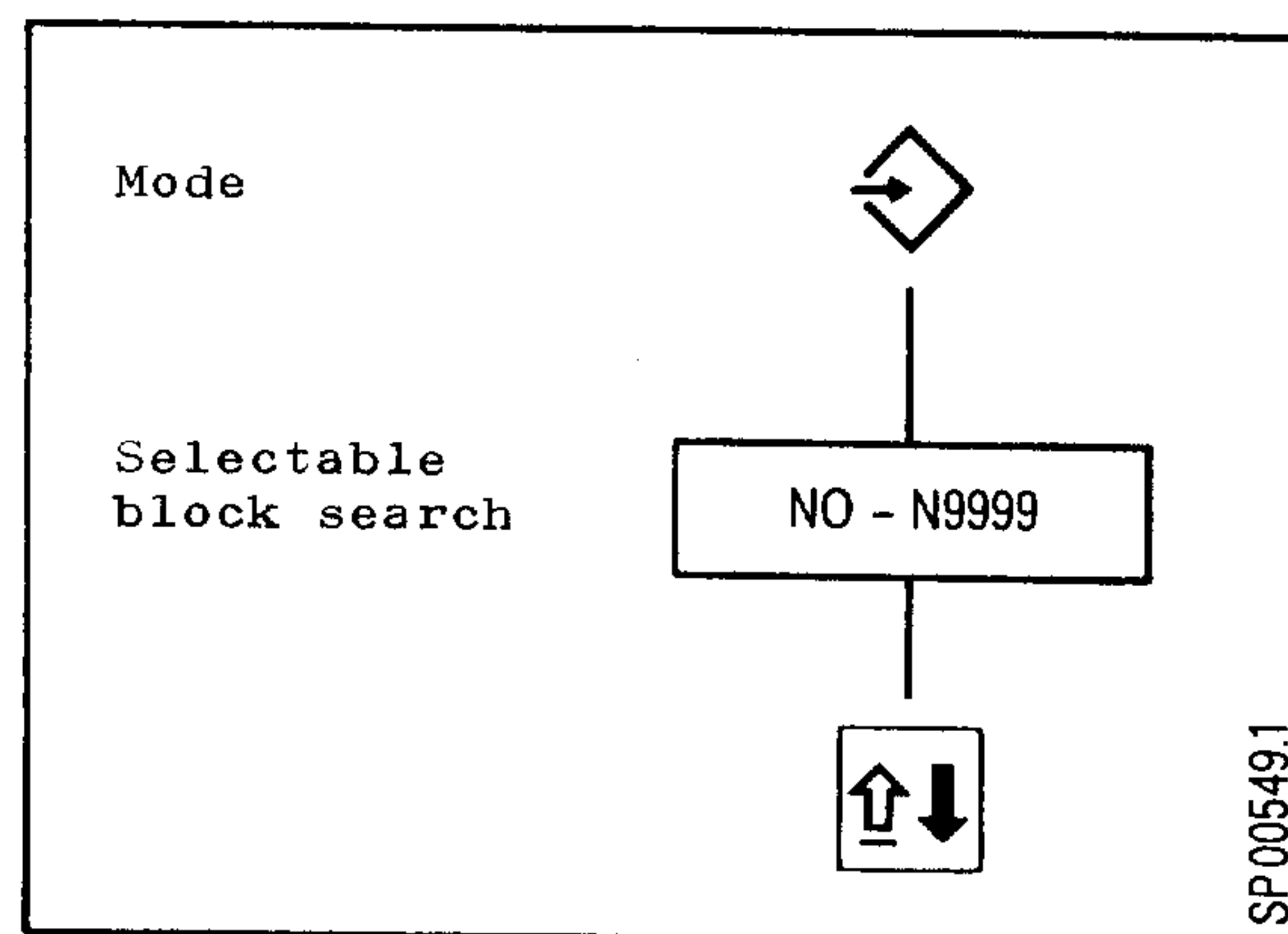
When starting a block number selection (block search), it is sensible to start from the beginning of the program memory, since searching is only activated towards the end of the memory.

No represents selection of the start of the memory.


If the required block number is not found, then the beginning of the memory is displayed (first block number). EMTY is displayed, if the program memory is empty.

Display of the protected memory area is not possible. If it is required to be displayed, machine parameter M636 should be changed.

The end of the program is indicated by a %.



2.3.2 Searching for a word

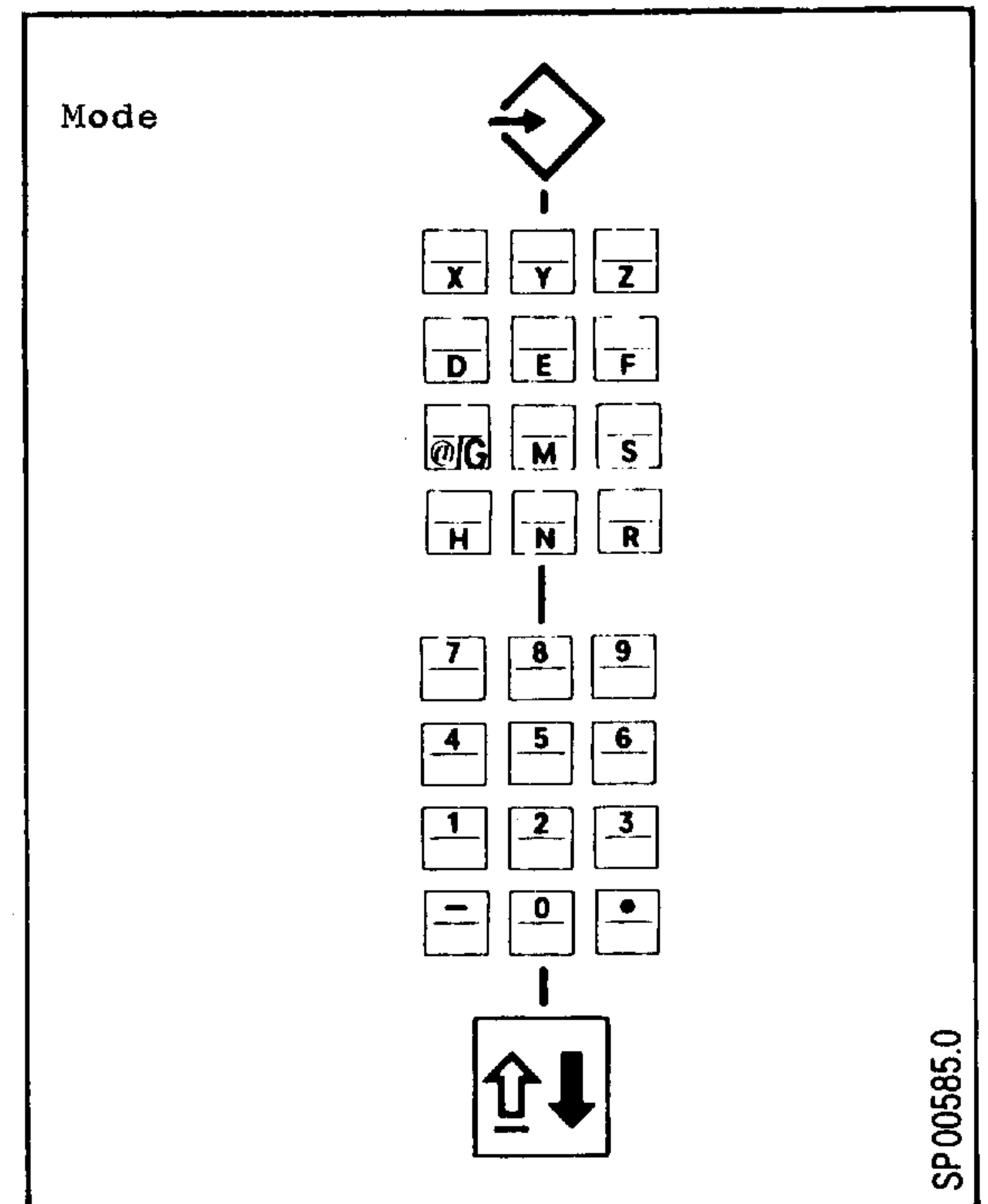
It is sensible to start at the beginning of the memory at the start of the search, as the search is only executed towards the end of the memory. The beginning of the memory is selected with NO + 

If the selected word is not present or is not found in the memory, then the start of the memory is displayed (first block number). If the word appears more than once then the first occurring word that is found towards the end of memory is displayed. By repeating the operating sequence the search is advanced. With an empty memory EMTY is displayed.

The display of the protected memory area is not possible.

After searching for a particular block number or a word it is possible to page forwards with the search key (14) or by extended pressing the key backwards towards the start of the memory.

Operating sequence:



2.4 Entering data into the program memory

Memory lock is active.

Operating sequence:

All entered data is stored in the program memory following the last displayed word (inserted).

Alarm 90 is displayed if the unprotected memory is full.

Input (inserting) into the protected memory is not possible.

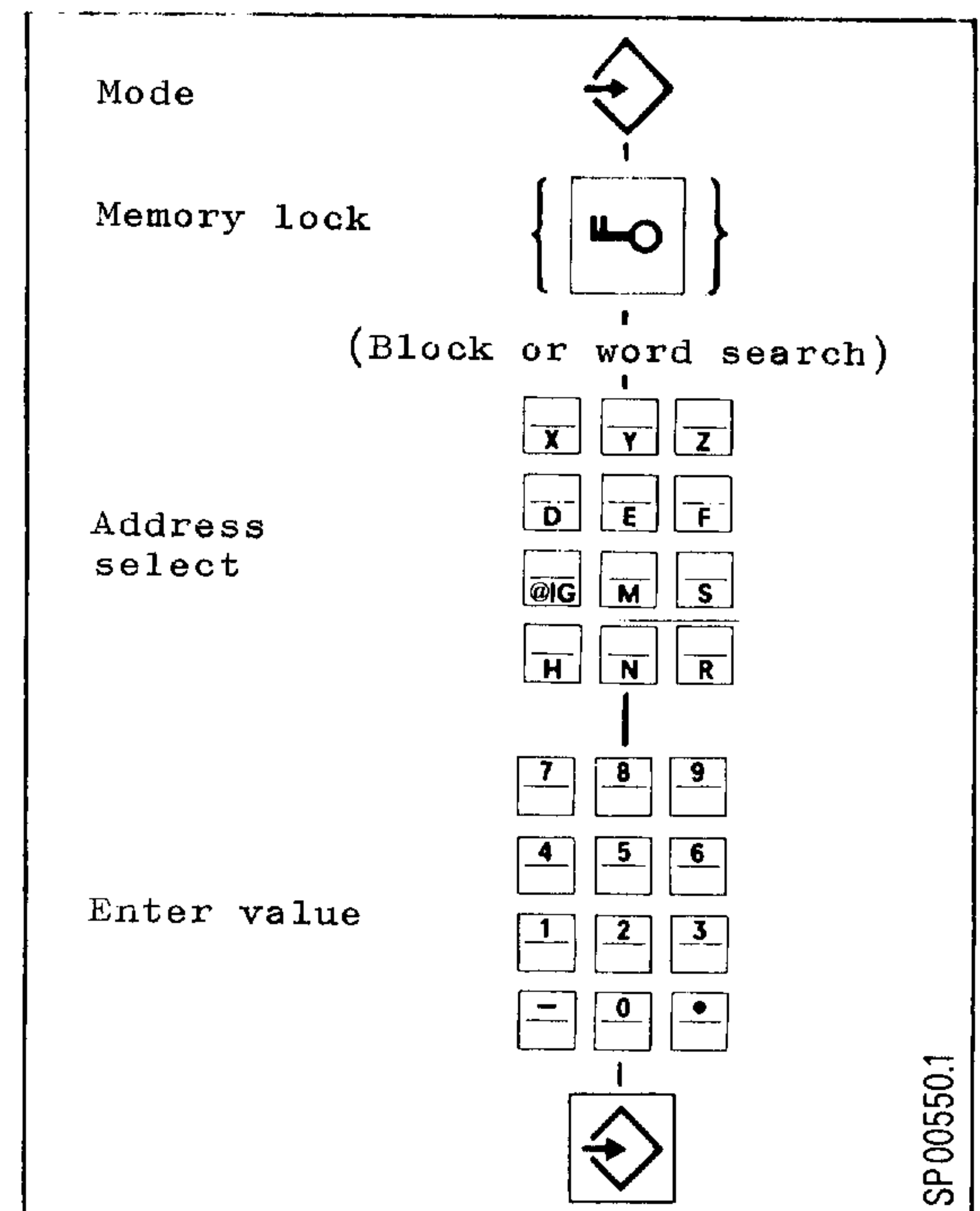
It is not necessary to use block numbers that are consecutive or increasing in number.

When inputting (inserting) during memory lock, the universal display is extinguished when the input key is pressed. The start of the NC-program memory is displayed when the search key (14) is pressed.

Automatic block number generation in jumps of 5 with simultaneous input is possible:



It is, however, only active behind the current last block in program memory.



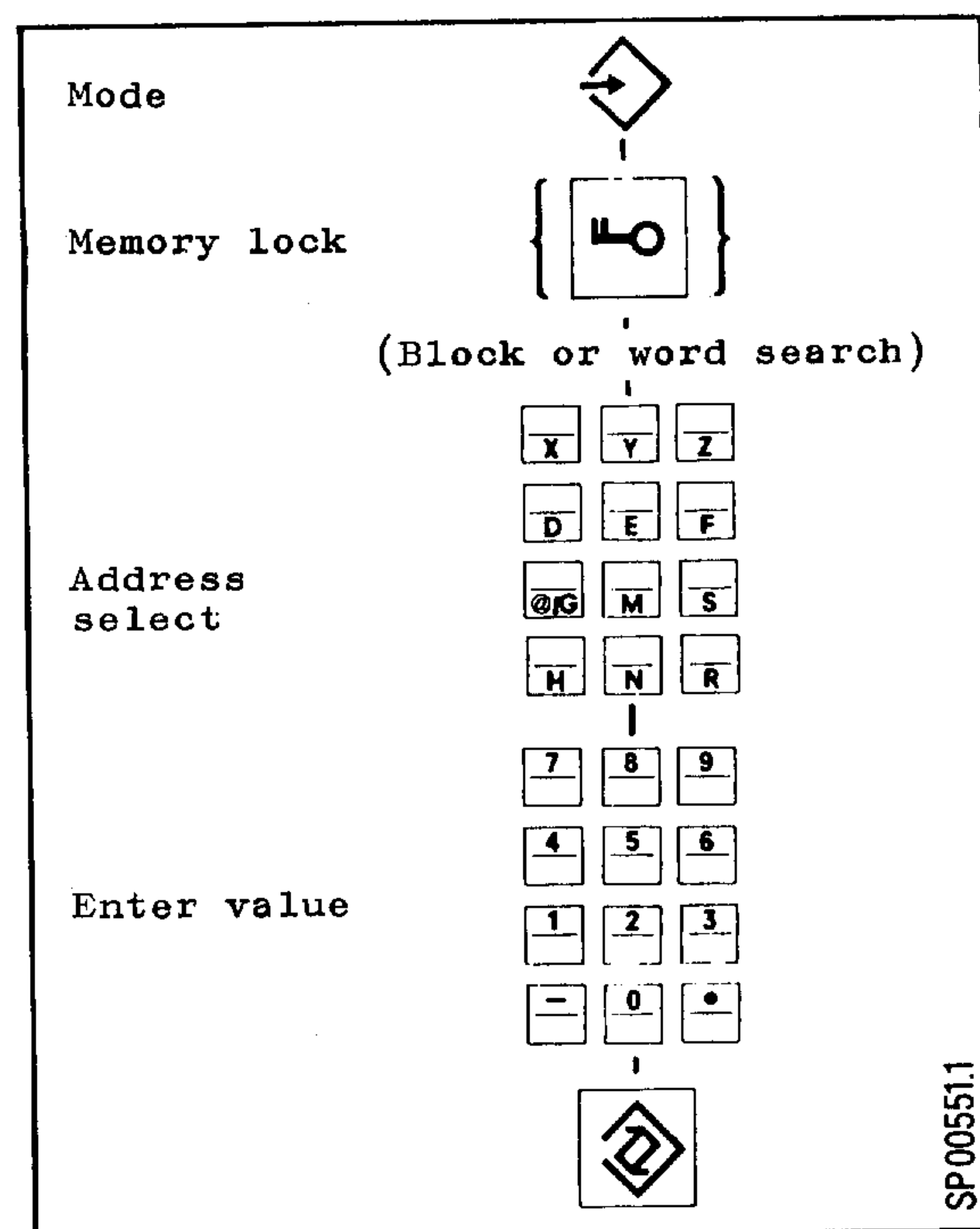
2.5 Overwriting a word

Memory lock is active.

The last displayed word in the program memory is overwritten by an entered word.

Overwriting the protected program is not possible.

Operating sequence:



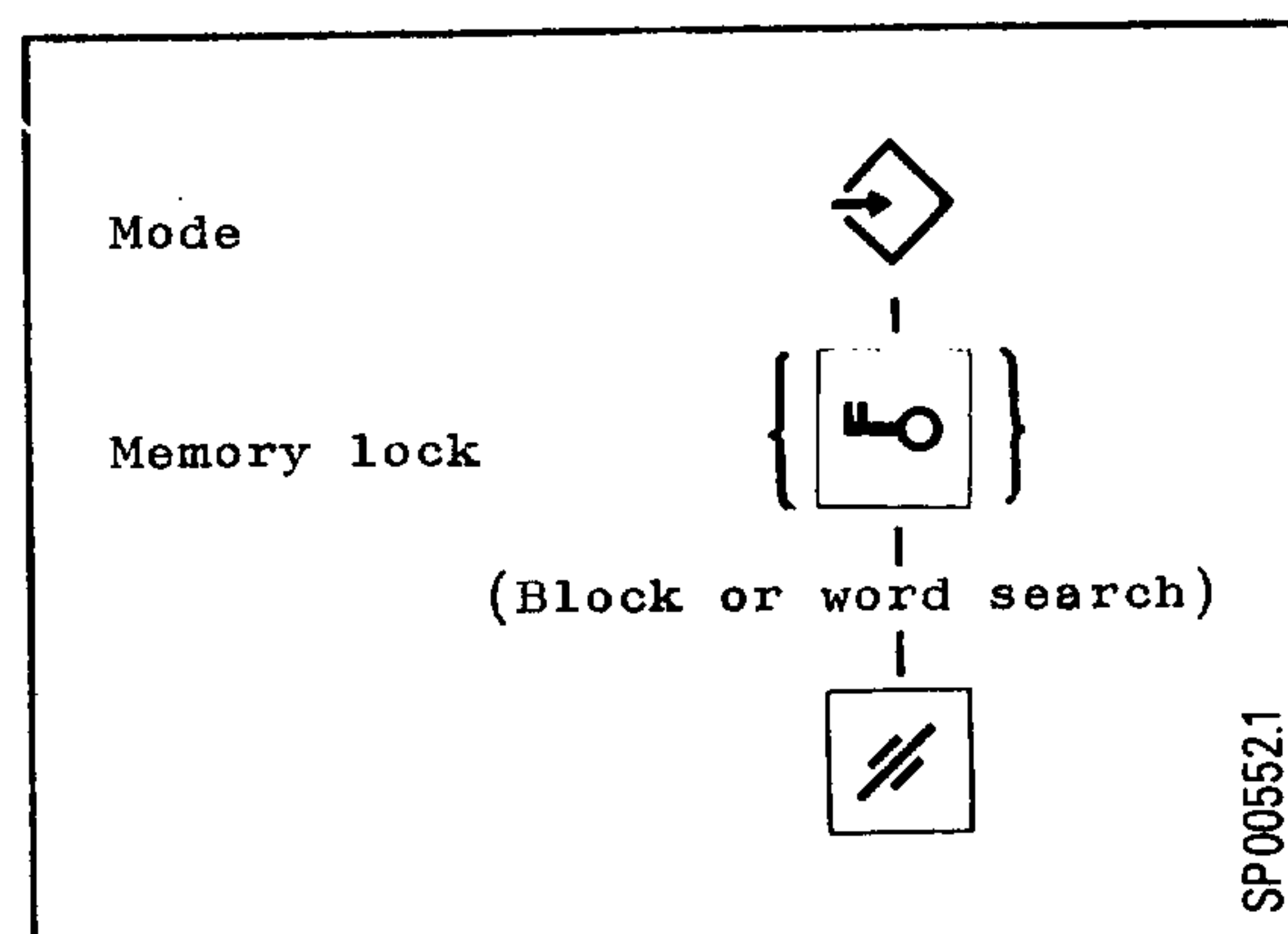
2.6 Cancelling a word/block

Memory lock is active.

The cancel key (No. 15) cancels the currently displayed word in the program memory.

Cancelling the block number causes the whole block to be erased.

Operating sequence:



The cancel key also serves to reset the input state:

If a word has been entered into the universal display using the address and numerical keyboard, but not transferred into memory using the function keys, then the entered word (in the universal display) may be deleted with the clear key.

The protected program memory cannot be cancelled.

2.7 Parameter assignment

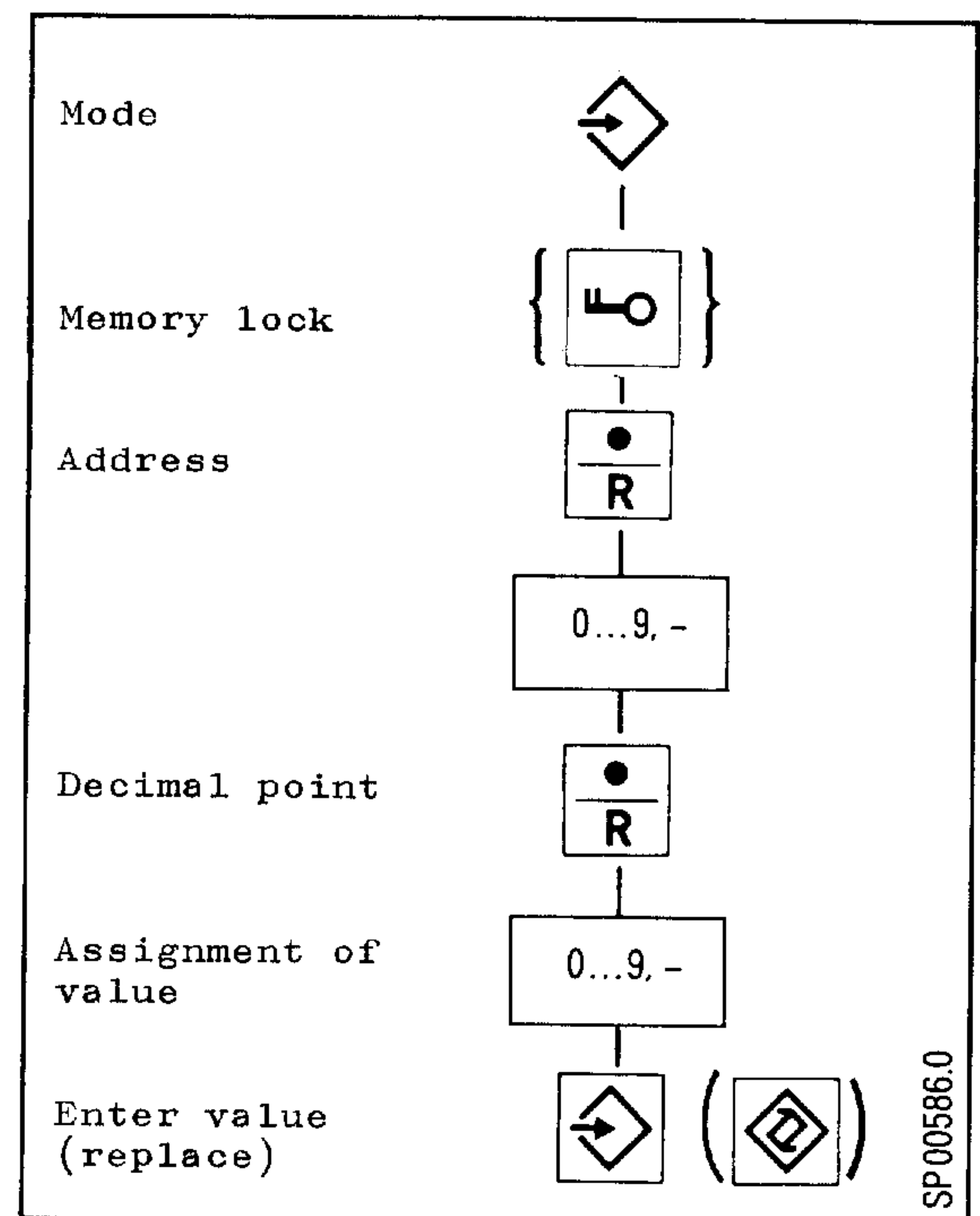
Memory lock is active.

Parameter assignment differs somewhat from inputting as described in section 2.4:

In this case the parameter number and value must be entered.

Parameters are entered without a decimal point. The decimal point serves solely to separate the parameter number and its value and is, however, not displayed.

Operating sequence:



3. Setting data memory / Machine data memory

3.1 Memory areas and input formats - setting data

Parameter	Display type	Format	USE	Input Possibilities
R000		± 99999999 ± 9.999999 ± 99.99999 ± 999.9999 ± 9999.999 ± 99999.99 ± 999999.9	Block search	Entry is always permitted in the MDI/SE-TE mode, and dependent upon machine parameter M612, also in the Automatic, Jog, Reference point approach and Set Position modes.
R001 to R099	*		Freely available for program and subroutines	
R100 R101 R102	k *		X Y Z Corrections	
R103 R104 R105	k *		X Y Z Dressing sums	
R106	a *		Minimum wheel diameter	
R107	a *		Diameter of the new wheel	
R108			Dressing axis 1 = X, 2 = Y, 3 = Z	
R109 R110 R111	a		X Free to move distance Y Z	
R112 R113 R114	a		D E F Jog Feed	
R115 R116 R117	a		X Y Z Drift Compensation	
R118 R119 R120	k *	as R001-R107	X Zero shift Y (G92, Set Position) Z	
R121 R122 R123	k		X Absolute dressing position Y Z (Machine zero)	No inputs possible These parameters can be read in the NC program. Arithmetic summing is not allowed
R124 R125 R126	k *		X Y Position display values Z	
R127 R128 R129	a		X Absolute position with respect to the machine zeros Y Z	
R130 R131 R132	a		X Command/Position Y Z Difference	
R133 R134 R135	a		X Y Part command value Z	Only displayed
R136 R137 R138	a		X Y Part position value Z	
R139 R140 R141	a		X Y Following error Z	
R142		0 or 1	Display 0 = position, 1 = command position difference	Input always permitted
R143		1, 2, 5 or 10	Handwheel weighting	

for better orientation
(←programming manual) sec.6

Display Type:

a = axis specific
k = cartesian
* = inch or mm dependant on machine data M601.7

Parameter	METRIC	INCH
R000	0...9999	0...9999
R001 R005	-999999.9	-9999.999
R006 R029	-99999.99	-999.9999
R030 R089	-9999.999	-99.99999
R090 R099	-9999999	-9999999

- The input address is always R.

It is possible to display and enter parameters in all operating modes (see operating modes selector switch No. 3) with the exception of data input (10) and data output (11).

The parameters may also be modified using the keyboard whilst a program is running.

By using machine parameter M612 a protected memory area may be defined. The protected setting data may only be entered in the manual input SE-TE mode (9).

Example: M612 = 56

R 000	}	unprotected setting data
.		
R 056		
-----	}	protected setting data
R 057		
.		
R 143		

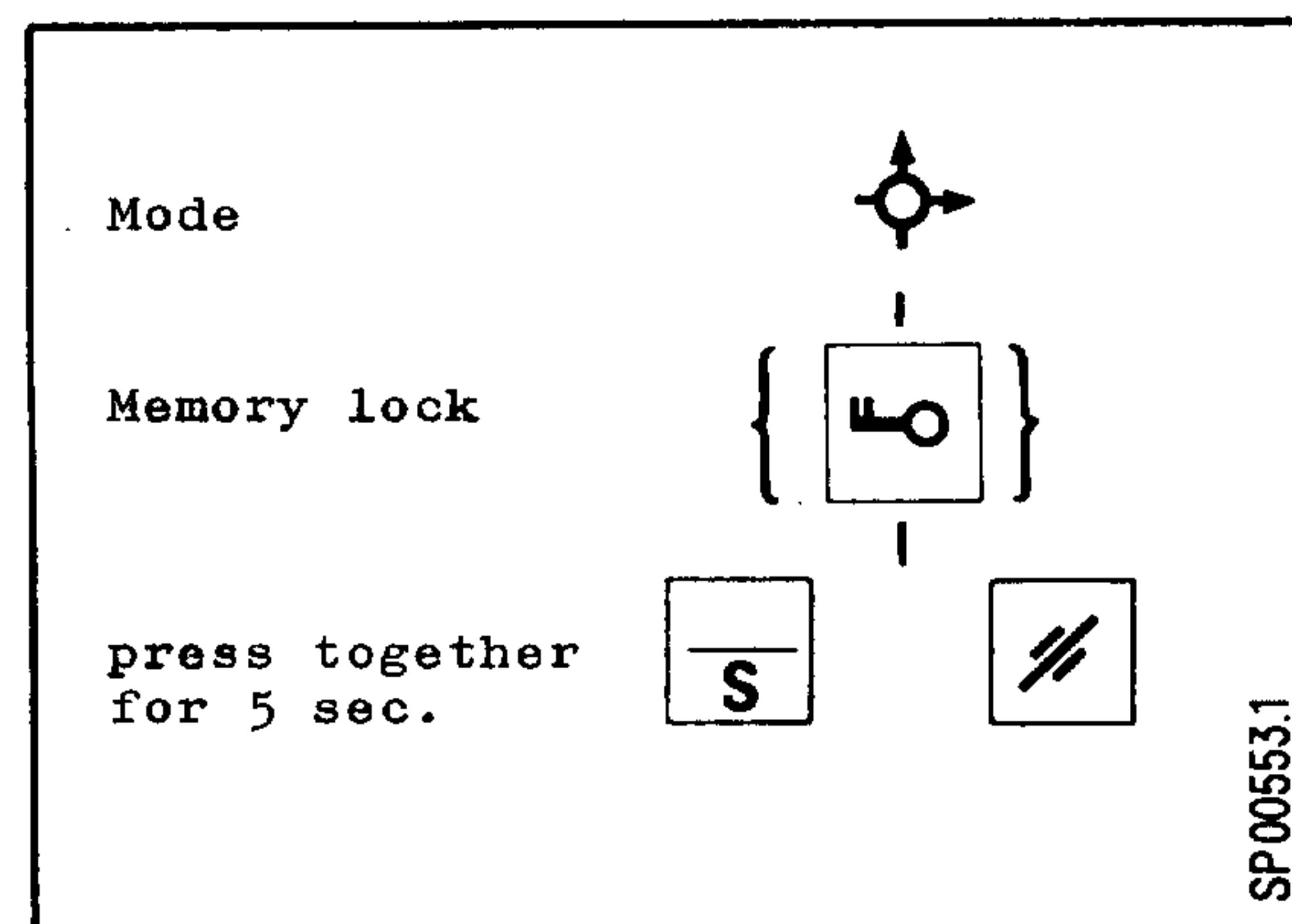
3.2 Erasing the setting data memory

Memory lock is active.

3.2.1 Free parameters R000 - R099

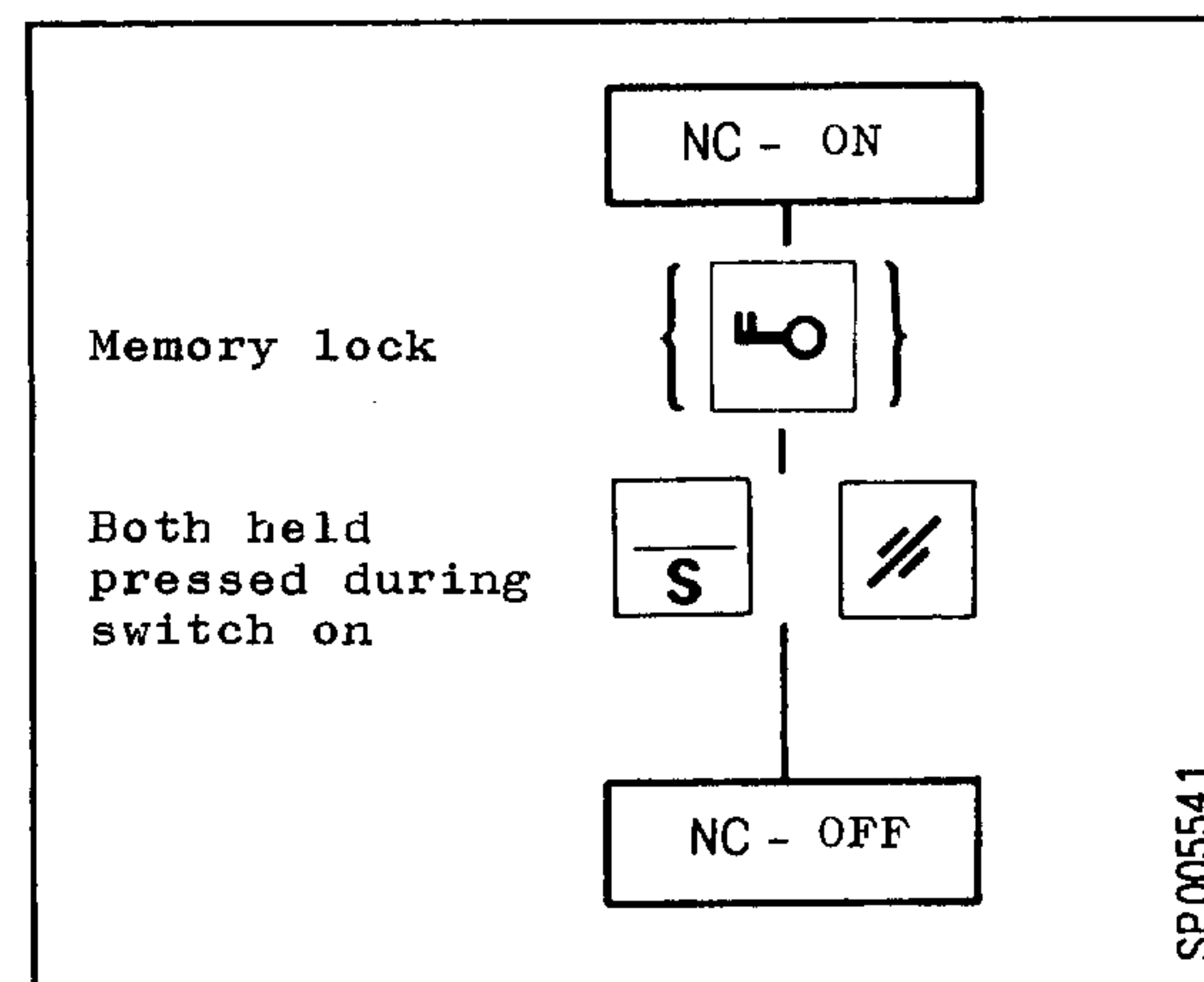
CLSE flashes on the display. If CLSE is static, R000 - R099 are reset.

Operating sequence:



3.2.2 Total parameters R000 - R143

Operating sequence:



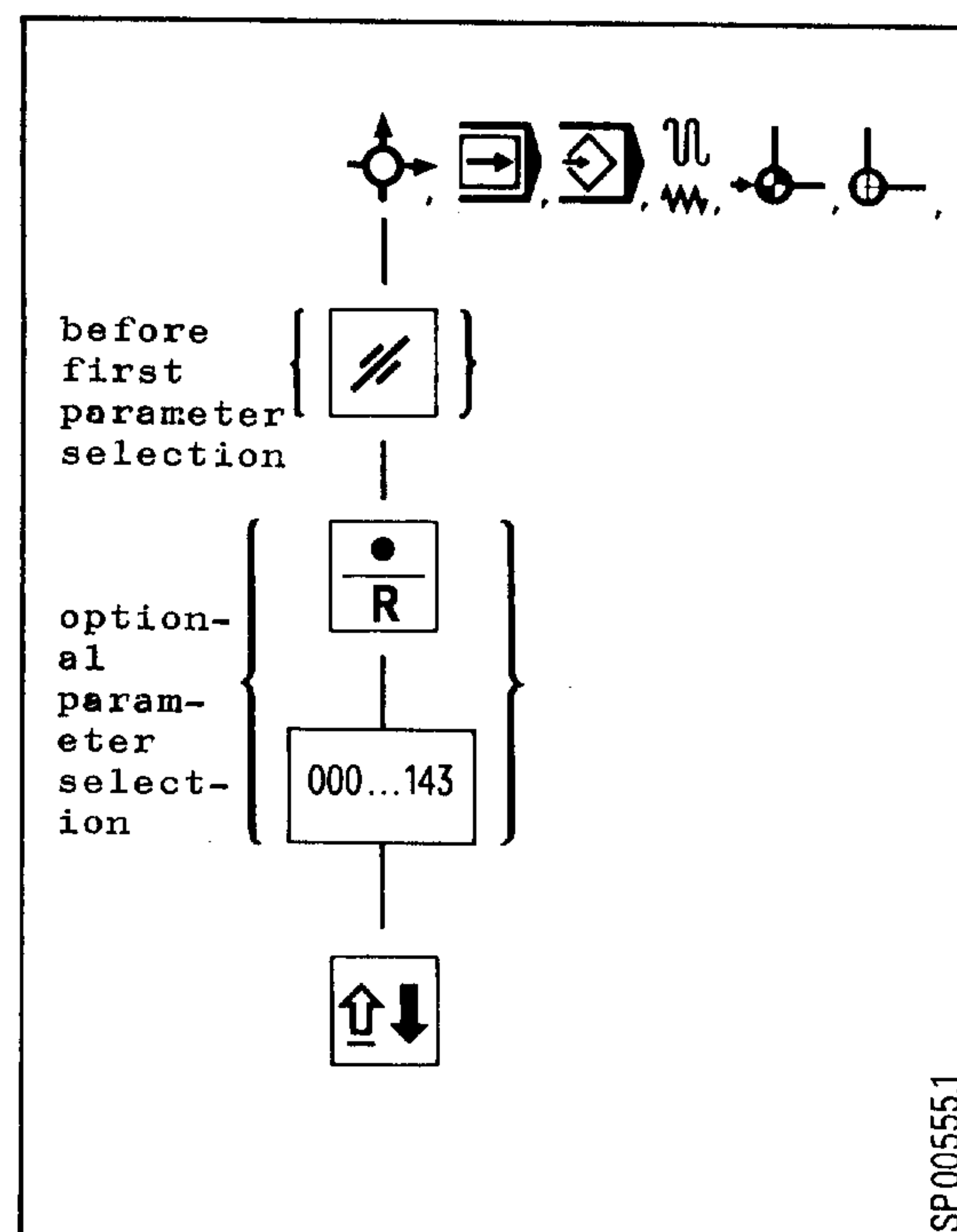
3.3 Display memory of the setting data

Without parameter number search:

Repeatedly pressing the search key (No. 14) advances the display towards R143.

Extended presses of the search key cause the display to advance towards R000.

Operating sequence:



3.4 Entery of setting data parameters

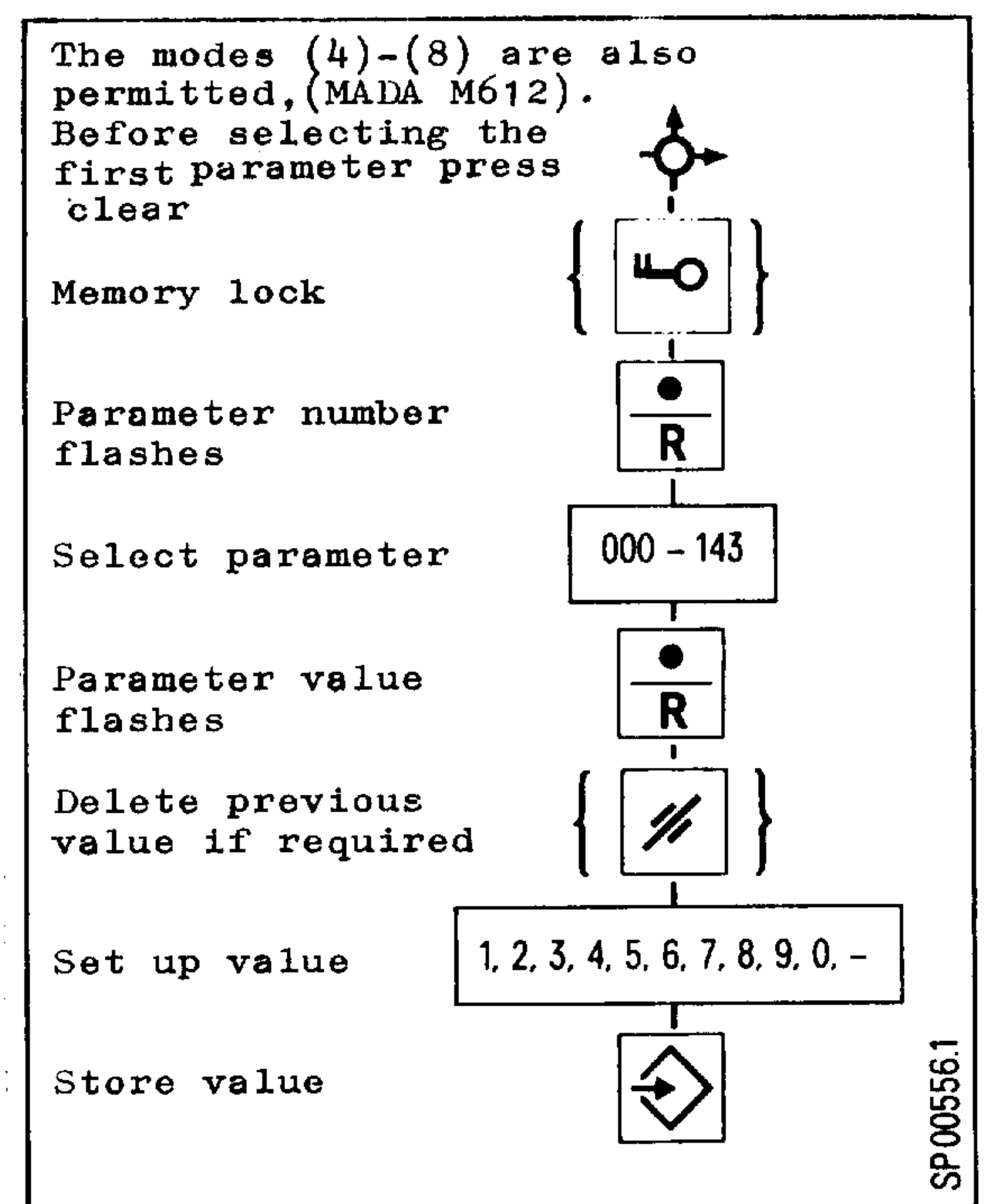
Memory lock is active.

Protected parameters may only be inputted in the manual input SE-TE mode. Unprotected parameters may also be entered in the single block, automatic, jog, reference point approach and preset modes.

The numerical value to be loaded should always be given without decimal point.

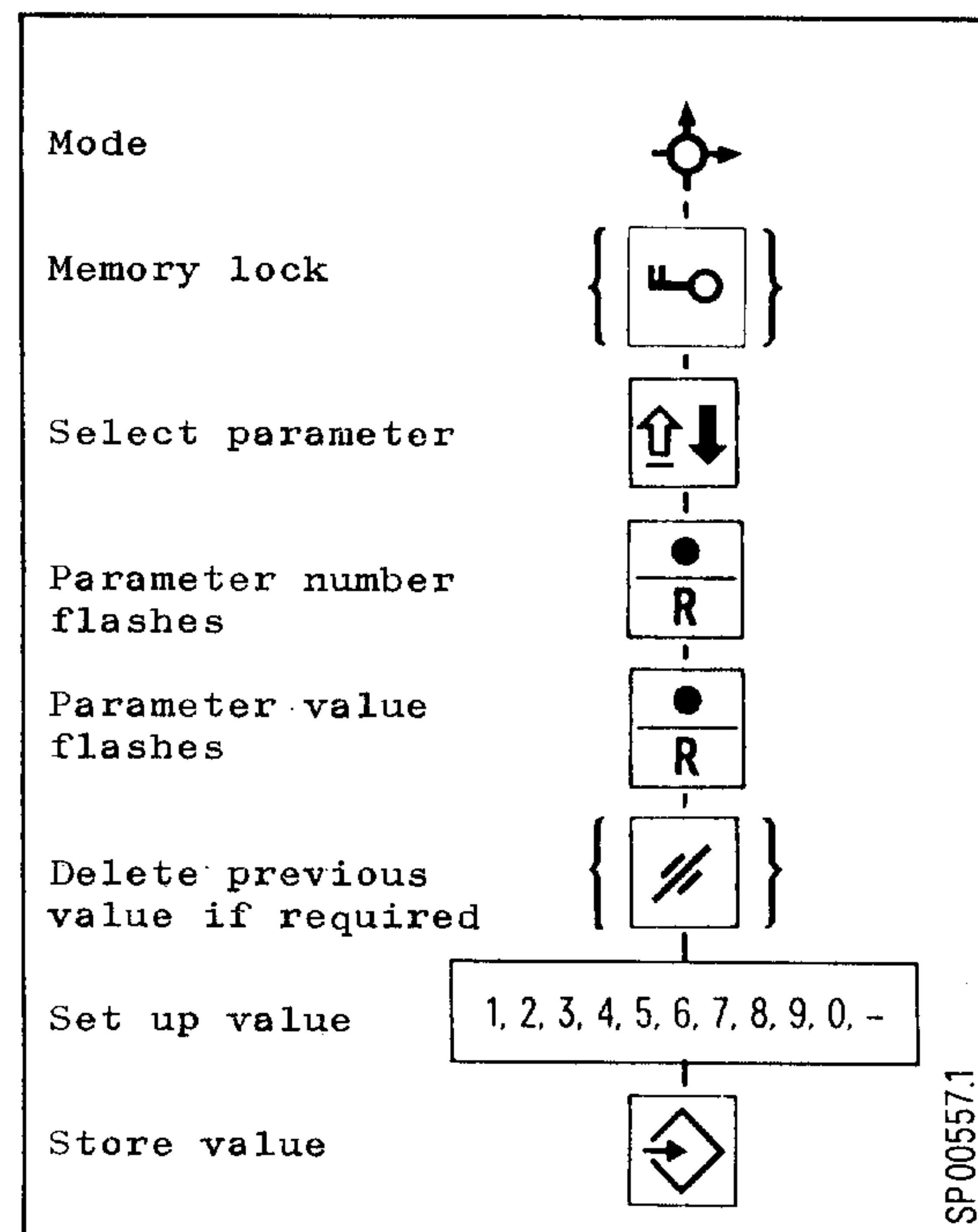
With numerical parameter search

Operating sequence:



Parameter selection
with the search key (14)

Operating sequence:



3.5 Machine data memory

Machine parameters are entered and stored in CMOS memory.

The addressing is from M600 to M664.

In order to select the parameter memory, the "M-key" must be held pressed during control switch-on. The entry and display of machine parameters is similar to that for setting data.

Difference: In this case the "M" key is pressed initially instead of the "R" key.

Par (Adr)	2 ⁷	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰	
M600R	available axes			software-limits active	inclined (5) U-axis	measurement error suppression			available axes, inclined X-axis, measurement error suppression, soft. lim. act.
M601R	X-axis	Y-axis	Z-axis			Z-axis	Y-axis	X-axis	inch-/ metric display, selection of Primo SG or Primo SG/2, reference point approach with jog rapid traverse, swinging with/without exact stop.
M602R	inch					swinging	Ref. pt. with jog rapid	SG SG/2	guage
M603R	guage					rotary axis			rotary axis
M604R	X-axis	Y-axis	Z-axis			Z-axis	Y-axis	X-axis	reference point approach not required
M605R	reference point approach not required					H-word output BCD	S-word 10 ⁰ 10 ¹	output 10 ² 10 ³	H- and S- output
M606R	X-axis	Y-axis	Z-axis						X-axis; in-/output resolution(1) and pulse weighting(2)
M607R	input resolution				Pulse weighting				Y-axis; in-/output resolution(1) and pulse weighting(2)
M608R		0.1 um	10 um		4	2	1/2	1/4	Z-axis; in-/Output resolution(1) and pulse weighting
M609R		0.1 um	10 um		4	2	1/2	1/4	reference point approach
M610R		0.1 um	10 um		4	2	1/2	1/4	
M611R	X-neg. dir.	Y-neg. dir.	Z-neg. dir.					ref. pt. appr. necc.	
M612R	(3)	(3)	even parity	parity check	EIA code	600	300	110	(4) V24 interface
M613R	X-comm. value neg.	Y-comm. value neg.	Z-comm. value neg.			Z-act. value neg.	Y-act. value neg.	X-act. value neg.	act- and command value polarity change
M614R						(6) Ø - programming			diameter programming
M615R						Z-axis	Y-axis	X-axis	
M616R							Program start ident.	V.24 data in-/output	memory lock inactive program start identifier

(1) 1 um input — * resolution if bits 2⁶ and 2⁵ = 0

(2) pulse weighting is 1 if bits 2³, 2², 2¹ and 2⁰ = 0

	1 stop bits	1.5 stop bits	2 stop bits
2 ⁶	1	0	1
2 ⁷	0	1	1

(4) 1200 baud if bits 2², 2¹ and 2⁰ = 0

(5) the workplace rotational axis is Z, the advance axis is X

(6) diameter programming should not be selected for Z if X is an inclined axis.

Machine data may only be reset if the current value is overwritten.

Machine data entry is without decimal point!

	input limits		sign	step	units	
M612R	0	144	+	1	parameter number	protected SE range
M613R	1	255	+	1	16 ms	time for change signal
M614R	0	255	+	1	$\frac{1}{2}$. input resolution	standstill monitoring X
M615R	0	255	+	1	$\frac{1}{2}$. input resolution	standstill monitoring Y
M616R	0	255	+	1	$\frac{1}{2}$. input resolution	standstill monitoring Z
M617R	0	127	+	1	10 V/127	max. speed X axis
M618R	0	127	+	1	10 V/127	max. speed Y axis
M619R	0	127	+	1	10 V/127	max. speed Z axis
M620R	1	255	+	1	16 ms	delay time for change signal
M621R	1	255	+	1	8 ms	time untill standstill monitoring activation
M622R	0	255	+	1	$\frac{1}{2}$. input resolution	X axis backlash
M623R	0	255	+	1	$\frac{1}{2}$. input resolution	Y axis backlash
M624R	0	255	+	1	$\frac{1}{2}$. input resolution	Z axis backlash
M625R	0	255	+	1	1/100 m/min/mm	kV factor - gain
M626R	0	32000	+	1	$\frac{1}{2}$. input resolution	max. following error - X
M627R	0	32000	+	1	$\frac{1}{2}$. input resolution	max. following error - Y
M628R	0	32000	+	1	$\frac{1}{2}$. input resolution	max. following error - Z
M629R	0	376	+	65535	$\frac{10 \cdot \text{input resolution}}{\text{min.}}$	creep speed reference point approach.
M630R	100	32000	+	1	$\frac{1}{2}$. input resolution	X axis ref. shift
M631R	100	32000	+	1	$\frac{1}{2}$. input resolution	Y axis ref. shift
M632R	100	32000	+	1	$\frac{1}{2}$. input resolution	Z axis ref. shift
M633R	0	65535	+	1	$\frac{384 \cdot U_{\text{max}} \cdot \text{input res.}}{V_{\text{max}} \cdot 10}$	X axis multigain
M634R	0	65535	+	1	$\frac{384 \cdot U_{\text{max}} \cdot \text{input res.}}{V_{\text{max}} \cdot 10}$	Y axis multigain
M635R	0	65535	+	1	$\frac{384 \cdot U_{\text{max}} \cdot \text{input res.}}{V_{\text{max}} \cdot 10}$	Z axis multigain
M636R	0	9999	+	1	block number	protected memory area
M637R	0	255	+	1	1/2 . input resolution	X-axis exact stop limit
M638R	0	255	+	1	1/2 . input resolution	Y-axis exact stop limit
M639R	0	255	+	1	1/2 . input resolution	Z-axis exact stop limit
M640R	0	1200000	+	1	$\frac{10 \cdot \text{input resolution}}{\text{min}}$	jog rapid
M641R	0	9999999	±	1	input resolution	X-axis ref. value
M642R	0	9999999	±	1	input resolution	Y-axis ref. value
M643R	0	9999999	±	1	input resolution	Z-axis ref. value
M644R	0	1200000	+	1	$\frac{10 \cdot \text{input resolution}}{\text{min}}$	creep speed automatic.
M645R	0	1200000	+	1	$\frac{10 \cdot \text{input resolution}}{\text{min}}$	X-axis max. speed
M646R	0	1200000	+	1	$\frac{10 \cdot \text{input resolution}}{\text{min}}$	Y-axis max. speed
M647R	0	1200000	+	1	$\frac{10 \cdot \text{input resolution}}{\text{min}}$	Z-axis max. speed
M648R	0	65535	+	1	$\frac{512 \cdot a \text{ (m/s}^2\text{)}}{\text{input resolution}}$	acc/dec X-axis
M649R	0	65535	+	1	$\frac{512 \cdot a \text{ (m/s}^2\text{)}}{\text{input resolution}}$	acc/dec Y-axis
M650R	0	65535	+	1	$\frac{512 \cdot a \text{ (m/s}^2\text{)}}{\text{input resolution}}$	acc/dec Z-axis
M651R	1000	9900	+	1	block no.	Dressing sub. no.
M652R	1000	9900	+	1	block no.	Grinding cyc.1 sub. no.
M653R	1000	9900	+	1	block no.	Grinding cyc.2 sub. no.
M654R	1000	9900	+	1	block no.	Grinding cyc.3 sub. no.
M655R	1000	9900	±	1	block no.	Grinding cyc.4 sub. no.
M656R	1000	9900	±	1	block no.	Grinding cyc.5 sub. no.
M657R	0	9999999	±	1	input resolution	+ X software limit
M658R	0	9999999	±	1	input resolution	+ Y software limit
M659R	0	9999999	±	1	input resolution	+ Z software limit
M660R	0	9999999	±	1	input resolution	- X software limit
M661R	0	9999999	±	1	input resolution	- Y software limit
M662R	0	9999999	±	1	input resolution	- Z software limit
M663R	0	9999999	±	1	$\sin \cdot 10^7$	sine ; inclined plunge
M664R	0	9999999	±	1	$\cos \cdot 10^7$	cosine; inclined plunge.

See the commissioning manual of Primo SG for a more detailed description.

4. Jog mode (No. 6)

4.1 Direction keys

Select the required axis (X, Y, Z). Jog the selected axis by pressing the direction key + or -. The traverse speed is governed by R112, R113 and R114. The feedrate override switch and the 1:10 feedrate weighting (with Primo SG) are active. Rapid override is active always.

The direction and rapid traverse keys form part of the external machine control panel and are active for the duration that they are pressed.

4.2 Handwheel

Select the handwheel mode on the external machine operator's panel.

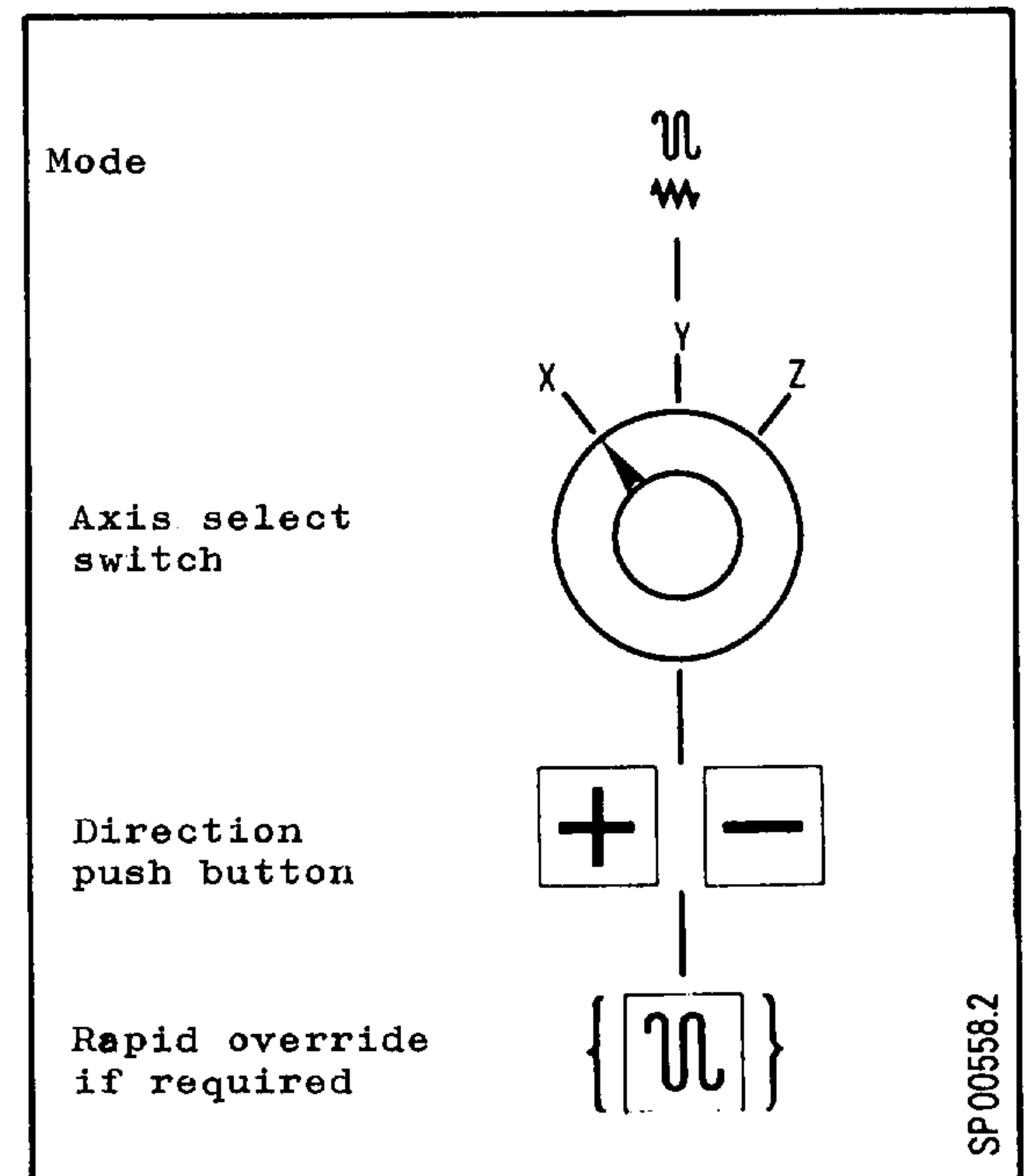
Select the desired axis.

Move the selected axis by rotating the handwheel.

In the setting datum R143, weighting factor must be set to 1, 2, 5 or 10.

The feedrate override switch, feedrate weighting 1:10 (with Primo SG) and rapid override, override are disabled in the handwheel mode.

Operating sequence:



4.3 S, H and M function output

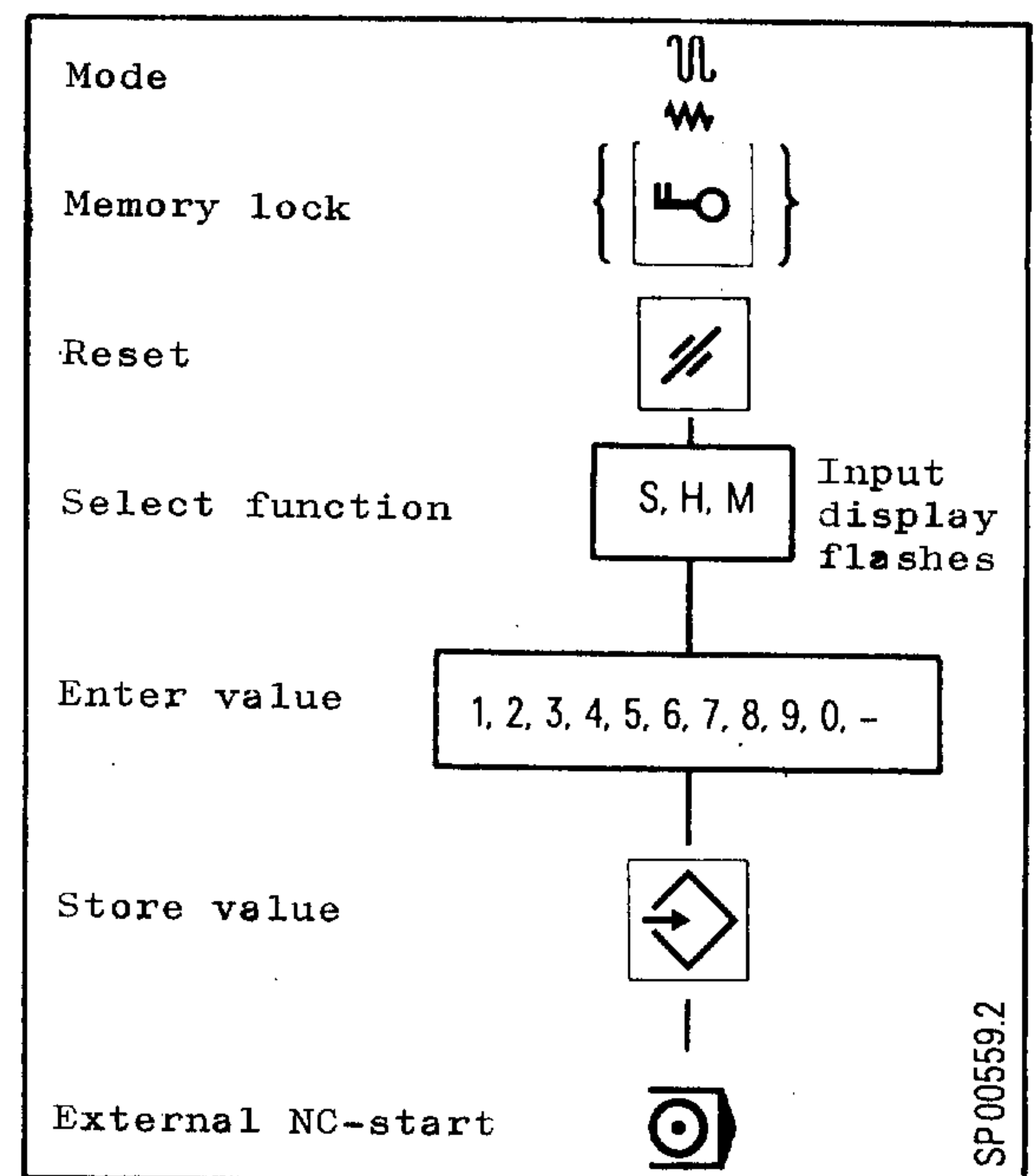
Only at standstill!

By pressing the reset key
(No. 15), this mode is cleared.

S, H and M functions are output
via the interface, in case it
is not regulated via memory
lock (see programming manual,
section 4).

An external clear signal can-
cels the S, H and M function
interface outputs.

Operating sequence:



4.4 Selection of G-functions

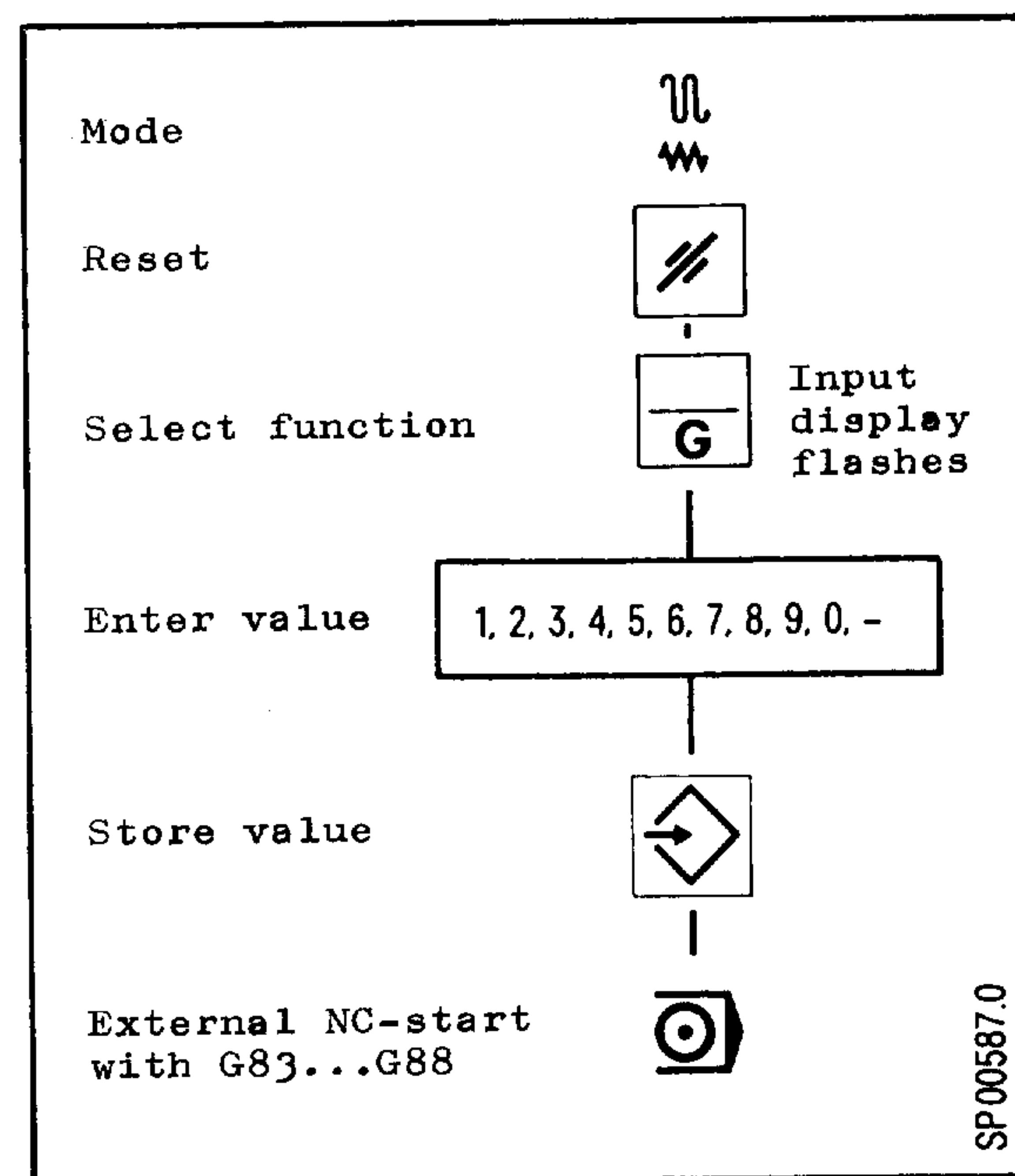
G-function selection refers to:

G06 - Fixed angle interpolation
 G83 - Dressing cycle
 G84 - Grinding cycle 1
 G85 - Grinding cycle 2
 G86 - Grinding cycle 3
 G87 - Grinding cycle 4
 G88 - Grinding cycle 5

By outputting the G83-G88 G-functions their corresponding cycles are activated. If a cycle is interrupted due to change of operating mode then it may not be continued from this position. Restart is necessary!

Provided that G06 is shown in the display then both X and Z axes will move simultaneously under the angle defined in machine data M663 and M664 if the X axis is selected, i. e. axis selector switch and pressing a direction key (or handwheel).

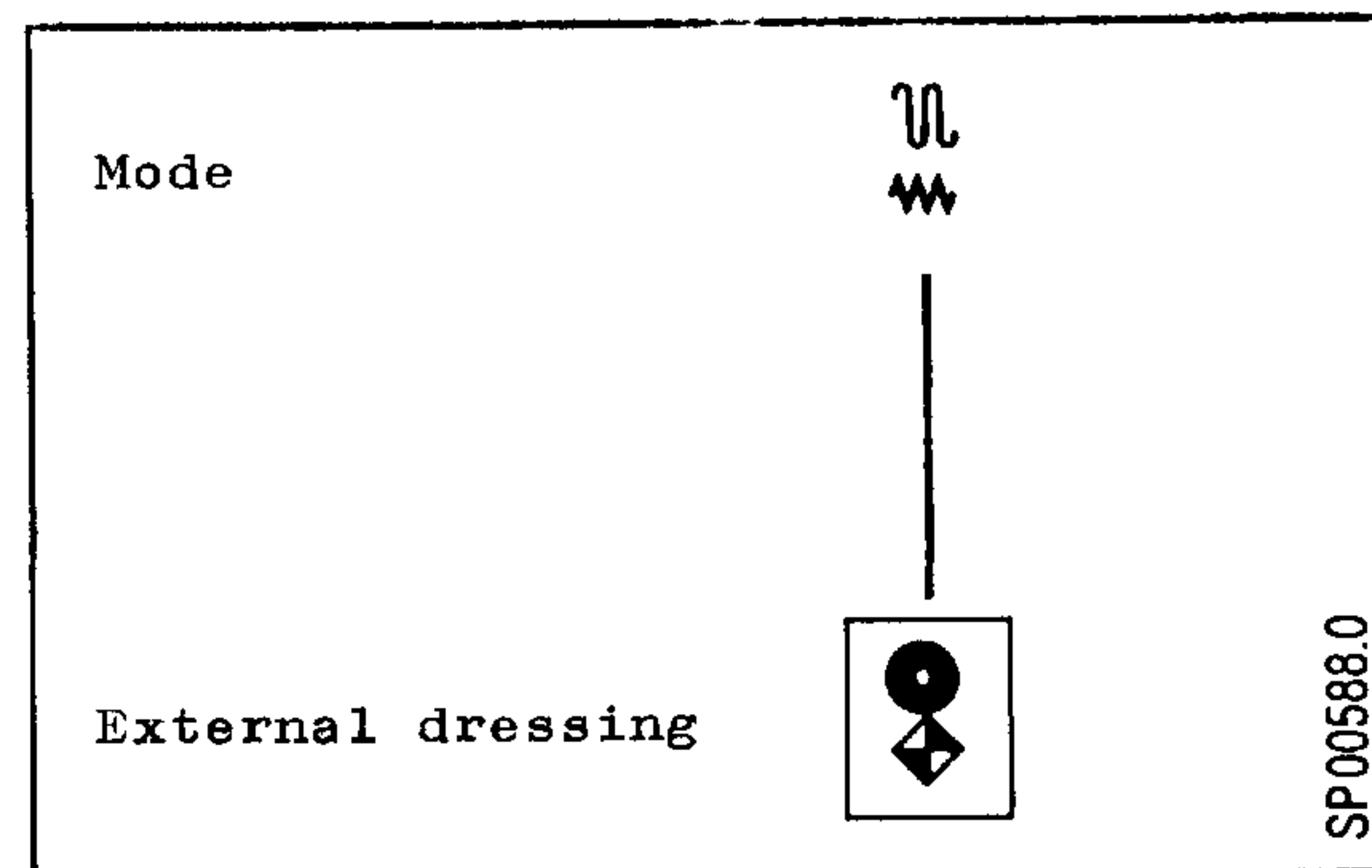
Operating sequence:



4.5 Call of the dressing cycle

The dressing cycle may be started by pressing the dressing key.

Operating sequence:



5. Return to reference point mode (7)

The approach is started for each axis by selecting the axis (axis selector switch) and pressing the defined (machine data M607) direction key. Direction key and axis code are self holding. The selected approach direction is checked by the control before starting. If the incorrect key is pressed, there is no resulting motion.

Interruption of the approach to reference point is possible by

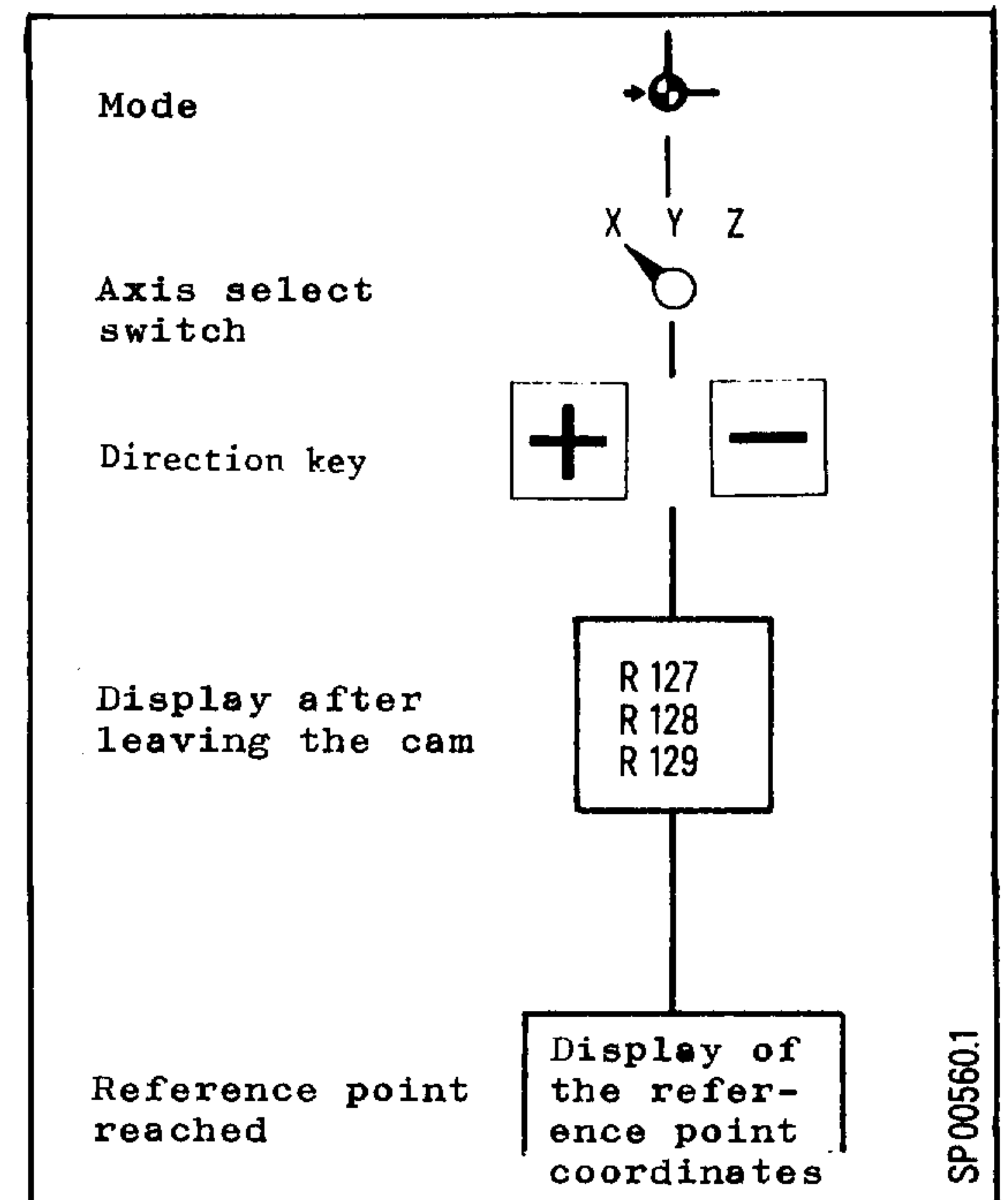
- feedrate override switch = 0%
- removal of feed release
- NC-reset or
- change of operating mode.

After NC-reset or changing the operating mode, the approach must be restarted. The feedrate override switch is active in the 0 % position.

After leaving the cam the universal display shows the absolute position referred to the machine (R127 - R129). When the reference point has been reached the position display shows the reference point co-ordinates taking the dressing sums, correction and zero offsets into account.

Note: If the direction key is once again pressed after the arrival of the reference point, then the approach to reference point is restarted.

Operating sequence:



After a reference point approach the software limits are active, provided that machine data M600, 4 = 1.

It is possible using machine data M603 to make the reference point approach axis specific.

If the handwheel mode is set it is not possible to approach reference points.

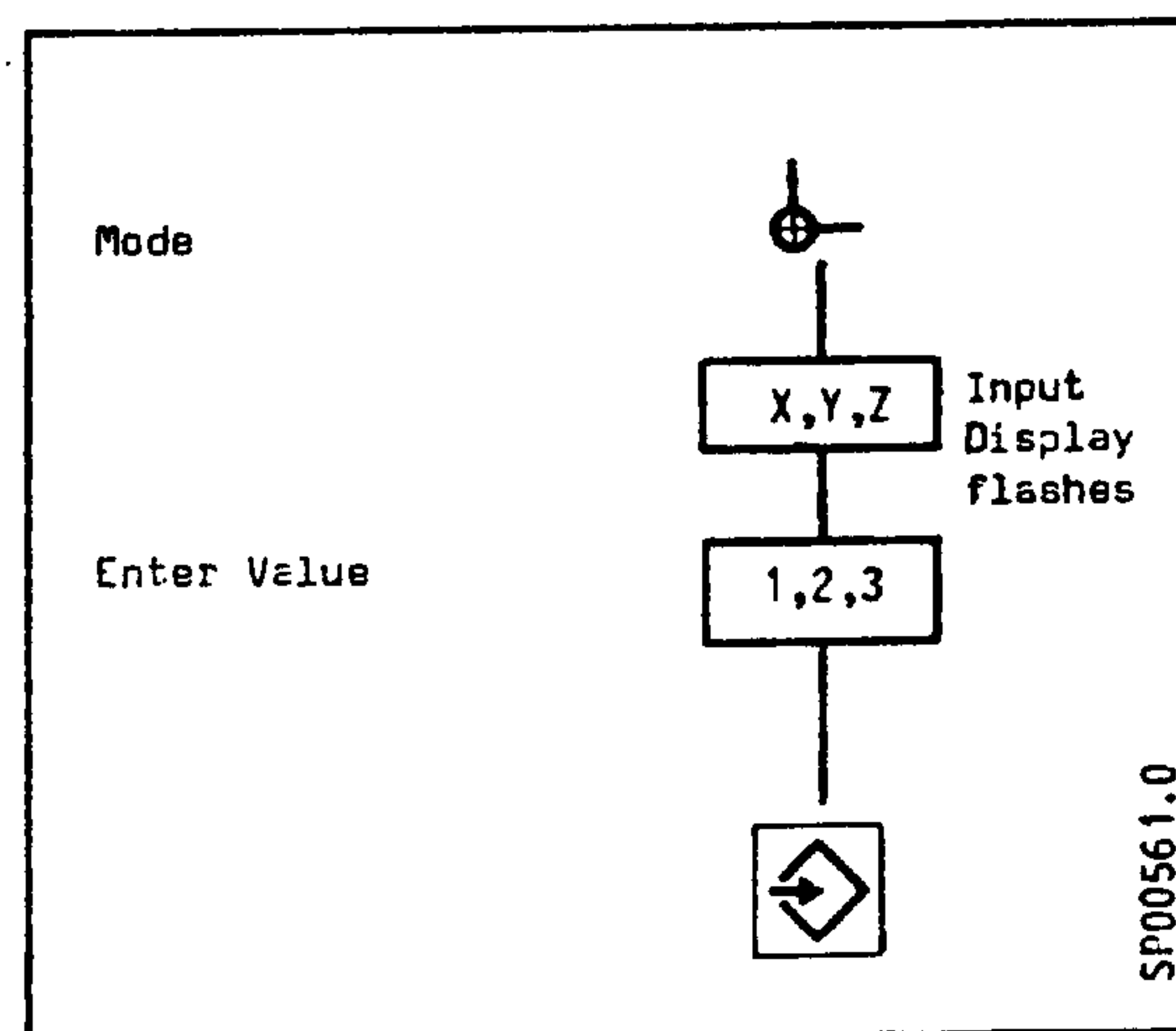
With rotary axes the reference point must always be approached in a positive direction.

6. Preset mode (No. 8)

6.1 Set actual value

Through the preset, the zero offset is calculated together with the other corrections and then is displayed as the inputted value on the position display.

Operating sequence:

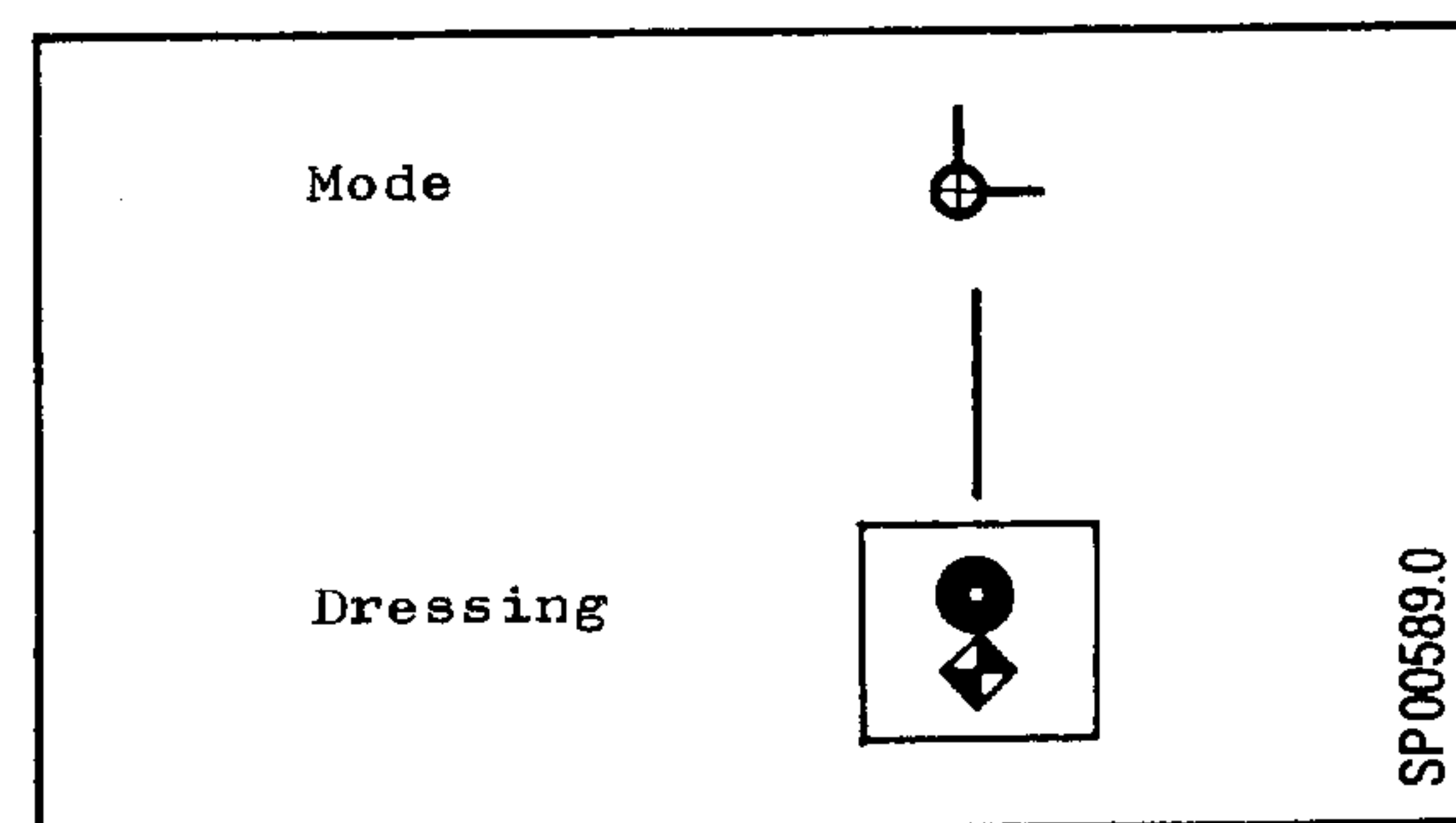


6.2 Storing the dressing position

Through pressing the dressing key, the actual positions of X, Y and Z referred to the machine zero points are transferred as the absolute dressing positions R121...R123.

The dressing sums R103...R105 are deleted at the same time.

Operating sequence:



7. Automatic (5) and single block (4) modes

7.1 Automatic operation (5)

The control calls the blocks up and evaluates them consecutively. When one block has been completed, the next which is already read in and prepared, is executed.

"Block prepare" means:

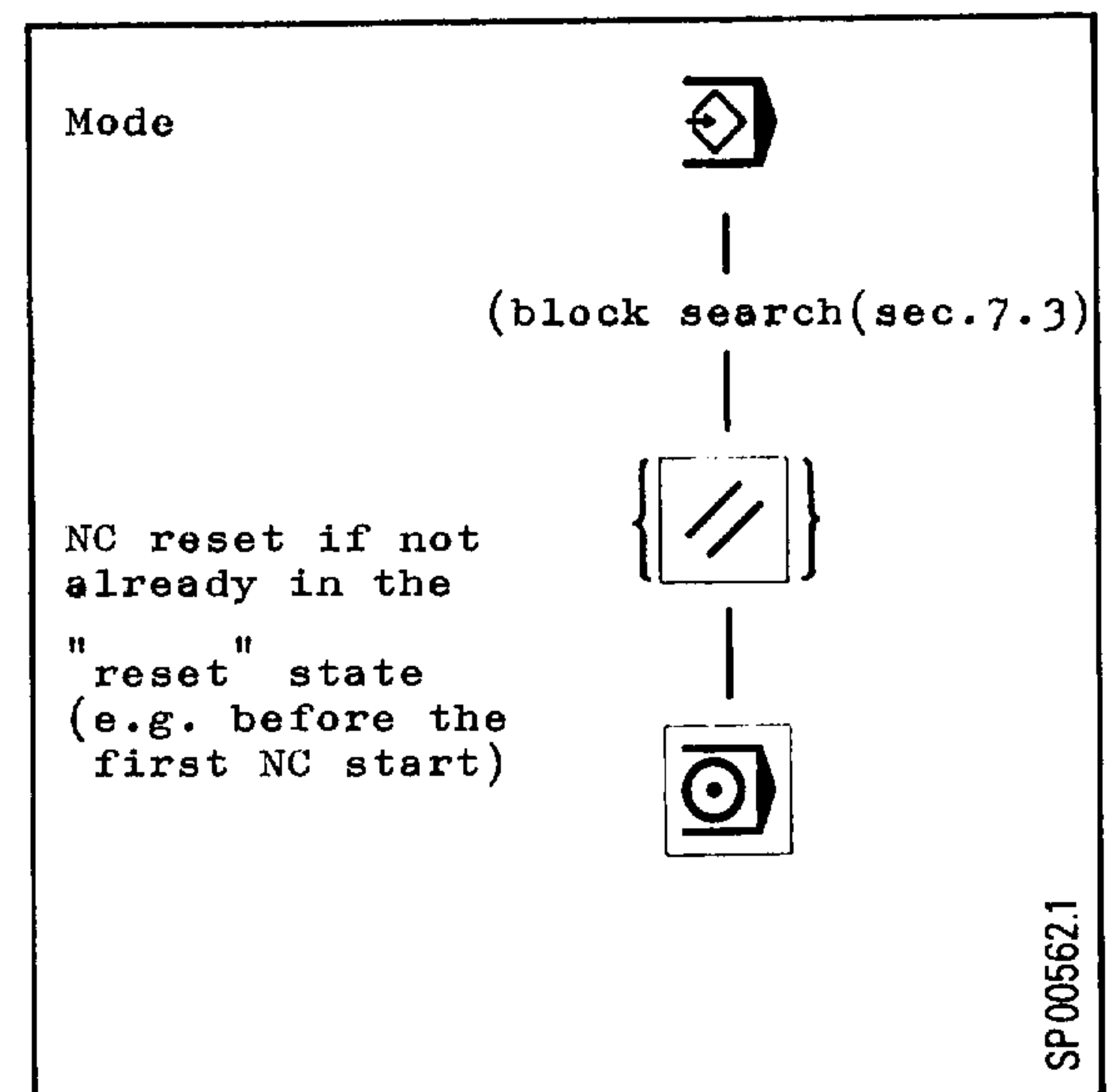
The distance to move for the programmed axis in this block must take into account the zero offset, dressing sums and correction. The internal NC program memory serves exclusively as a data source.

Operating sequence:

Pressing the "start" key (30) starts program operation. The "program running" lamp (24) lights.

The "position not yet reached" LED (18) indicates that at least one axis is in motion or has not reached its exact stop limit.

The display of parameters R000 - R143 and the entry of unprotected parameters are possible in this mode even in running program.



On pressing the N-key, the number of the block in active store is displayed on the universal display.

Depending upon the parameter R142, either the relative position or the command position difference (remaining distance up to end of block) may be displayed. The feedrate override switch and feedrate weighting 1:10 are active (with Primo SG).

7.2 Single block (4)

For each press of the "start" key (30) one block is called up, prepared and executed.

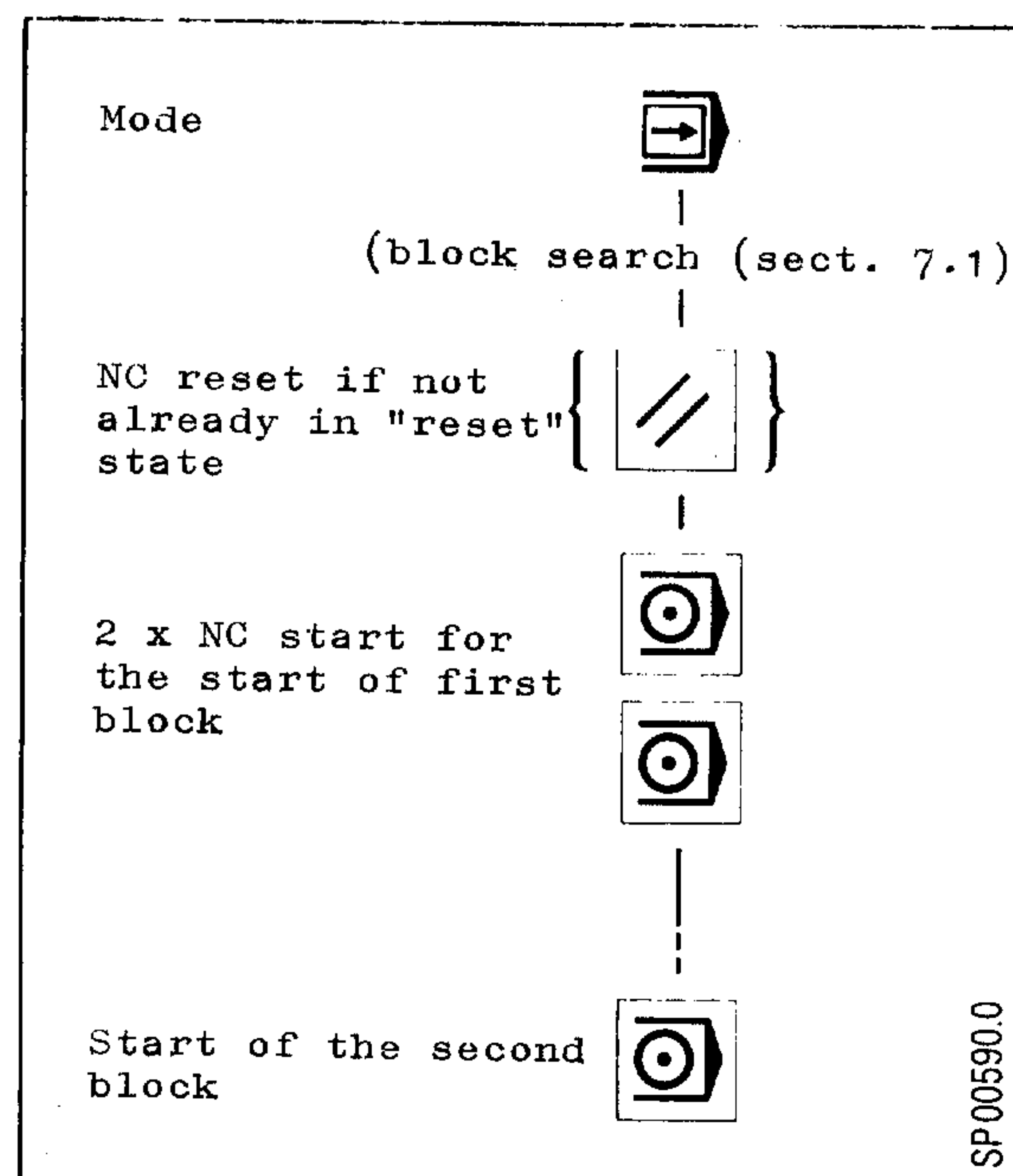
Operating sequence:

The NC-start key (30) must be pressed twice to start the first block.

During execution of the block, the "program running" (24) lamp lights. When the block is completed, the "program interruption" lamp (23) lights.

The universal display shows the number of the block which will be activated by the next press of NC-start.

Otherwise as automatic (section 7.1).



7.3 Block search

Block search may be activated in the automatic modes to allow e. g. multi-program operation.

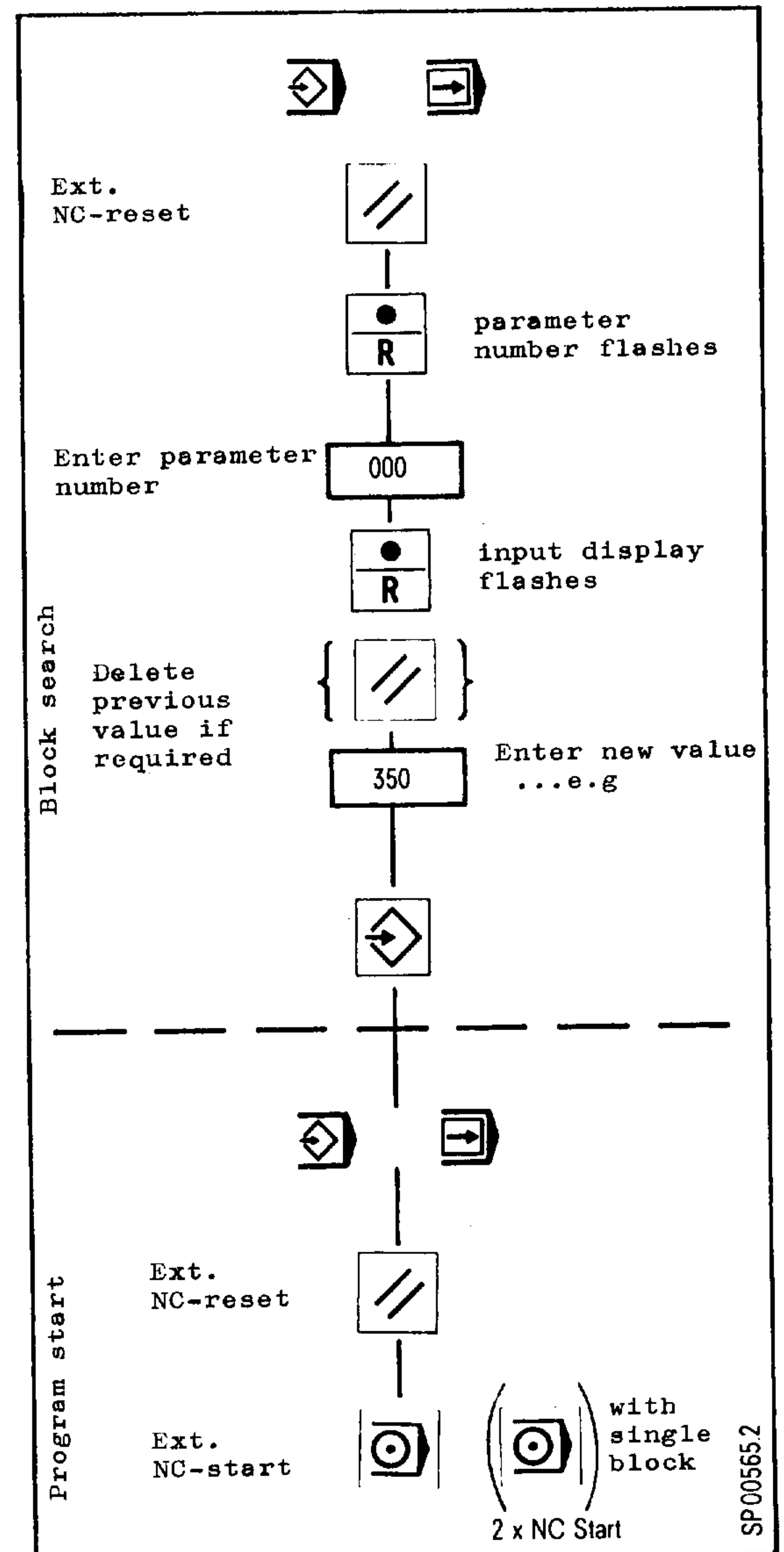
One needs to enter the block number in parameter R000, with which the machining program is to commence (e. g. block 350).

After NC-start the program commences from the pre-selected block number until it is deleted from R000.

If it is required to start with the first block in the memory, e. g. N5 and a protected memory area is defined in machine data 636, then the actual available first block number must be given in parameter R000.

(R000 5)

Operating sequence:



7.4 Influencing automatic operation

The execution of program may be halted or interrupted by the following methods:

- Removal of
read in enable:
The program stops after completion of the current block, the "program running" lamp remains lit.
Continuation of program with renewed read in enable.
- Removal of
feed release:
Traverse movements are halted, the "program running" and "position not yet reached" lamps remain lit.
Continuation of program with renewed read in enable.
- Removal of
controller release:
(Only meaningful with ESTOP)
- Feedrate override switch
to 0 %:
Traverse movements are halted, the "program running" and "position not yet reached" lamps remain lit.
- M00:
"Programmed Stop", the "program interrupt" lamp lights. Continuation of the program with NC-start.
- Dwell time (G04):
The program halts for the duration of the dwell time, the "dwell time" lamp lights.

- Single block:

The program halts after each block, the "program interruption" lamp lights.
Continuation with NC-start.
- Operating mode change from automatic to single block and vice versa:

The current block is interrupted and the "program interruption" lamp lights. Program continuation with NC-start.
- Operating mode change from automatic to jog:

The current block is interrupted and the "program interruption" lamp lights. Program continuation by changing mode back to automatic or single block and subsequent NC-start (no cycle start possible in jog operating mode). Interrupted blocks are executed up to completion.
- NC reset:

The program is terminated.
All LED's in the universal display are extinguished. The program is reset to the first block. The program may be started from the beginning by NC-start.

8. Data input/output via the V24/20 mA port

Note: Data input/output is not possible with an active alarm!
The keyboard should not be pressed during the transfer!
Time entries: see section 8.4.1.

Memory lock is active.

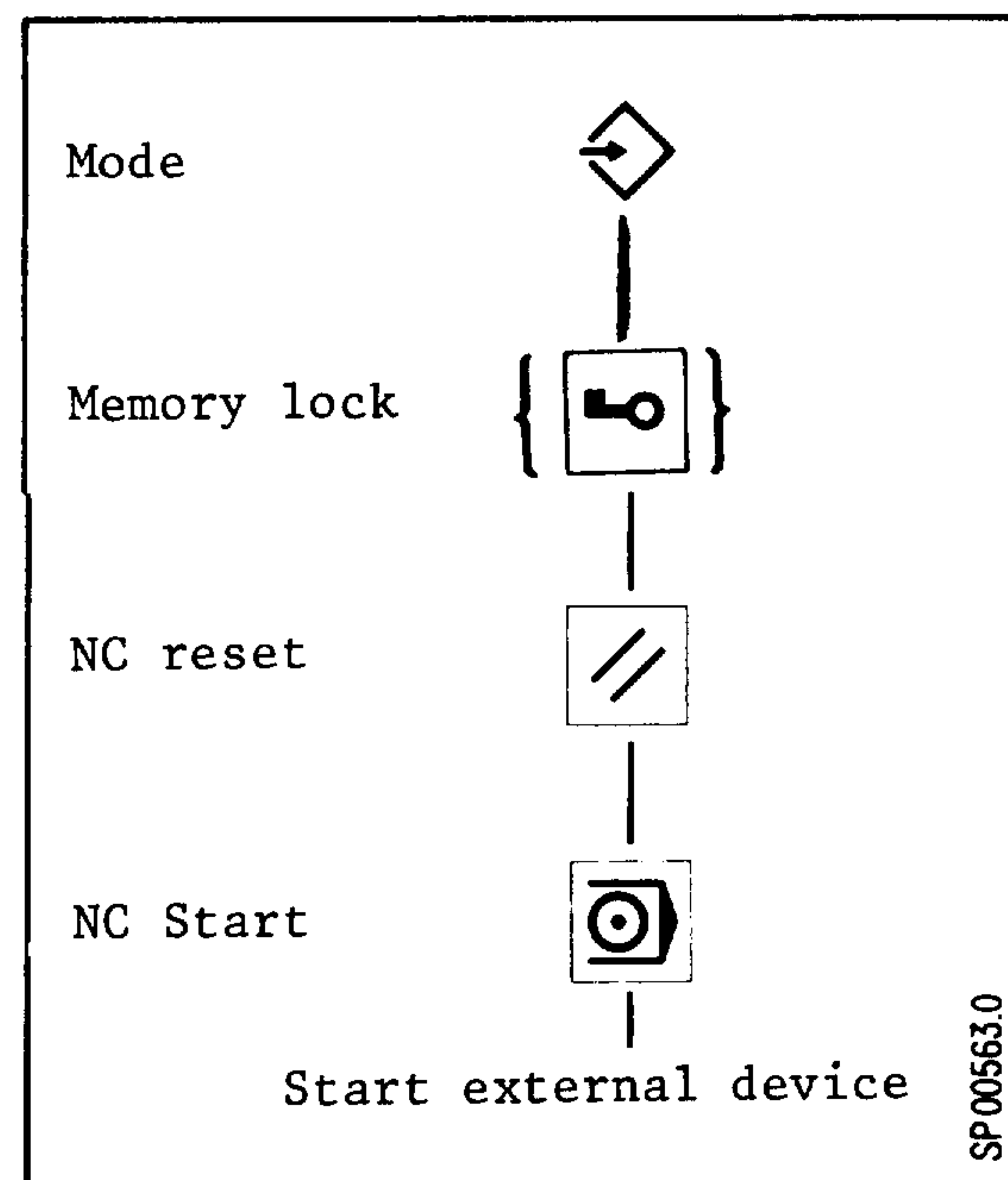
Via machine data M611 bit 0-1, the effectiveness of memory lock for data input/output via V.24/20 mA interface can be nullified.

8.1 Data input (10)

Operating sequence:

The operating sequence permits the transfer of:

- Machining program
(unprotected memory area)
with the start identifier
% 0001 LF or % LF: 0001 LF
- Setting data (R001-R099)
with the start identifier
% 002 LF or % LF: 0002 LF
- Machine data (press M-key
while switching the control on) with the start
identifier
% 003 LF or % LF: 0003 LF



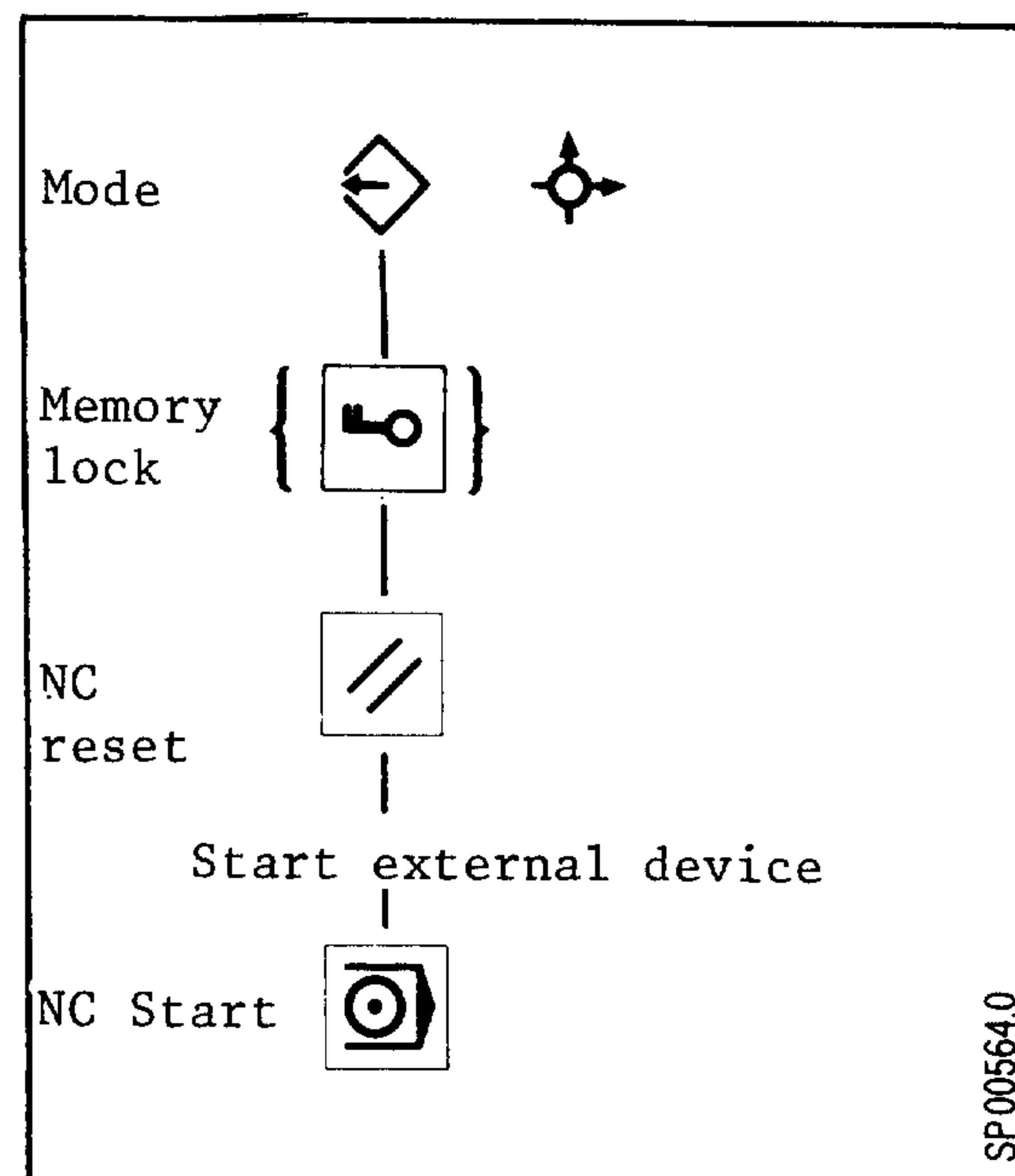
The start identifier is determined by machine data M611.
The finish identifier of all transfers is M02 LF %.
During the transfer the word currently being read in is shown in the display.

8.2 Data output (11)

Operating sequence:

The data output mode (11) permits the output of part programs (from the unprotected area) and machine parameters (after switching on with the "M" key held pressed).

Setting data (R000...R099) are output in the MDI/SE-TE (9) mode. During the transfer, the word currently being output is shown in the universal display.



The output code (EIA/ISO) is defined in machine data M608.3. NC-reset interrupts the transfer. It may be restarted with NC start.

8.3 Tape recorder ZE601 operating example

8.3.1 Primo SG - Tape recorder

1. Switch on both the recorder and control.
2. Switch the recorder to AUDIO.
If necessary set the counter to 0.
3. Switch the Primo SG to the Data output mode (11).
4. Press NC reset (machine control panel).
5. Depress the REC and PLAY buttons on the recorder.
6. Speak the part program text in the microphone.
7. Switch the recorder to DATA.
8. Press NC start (machine control panel):
The unprotected part program is transferred
(main programs and sub-routines).
As each word is transferred, it is displayed on the
universal display.
At the end of the part program transfer, EDMP is displayed on the universal display.
9. Note the counter value if necessary.
10. Switch the Primo SG to the MDI/SE-TE mode (9).
11. Press NC reset key (machine control panel).
12. Press NC start (machine control panel):
The control transfers the unprotected free parameters.
As each parameter is transferred, it is displayed.
When parameter R100 is displayed, the transfer of parameter is complete.
13. Note the counter value if necessary.

8.3.2 Tape recorder - Primo SG

1. Switch on both the recorder and control and, if necessary, advance the tape to a known counter value.
2. Switch the Primo SG to the data input mode (10).
3. Switch the recorder to DATA.
4. Press NC clear and then NC start (machine control panel).
5. Depress the recorder's PLAY button:
The unprotected part program is transferred.
(As each word is transferred, it is displayed on the universal display.)
At the end of the part program transfer EDMP is displayed on the universal display.
6. Press the HALT button on the recorder, if necessary.
7. Press NC reset key and then NC start (machine control panel).
8. Clear the recorder's HALT condition:
The control transfers the unprotected free parameters.
(As each parameter is transferred, it is displayed.)
When the transfer is complete, EDMP is displayed on the universal display.
9. Switch the recorder to STOP, as the program and parameters have been transferred.

Note: If the setting data control memory should be reset prior to data input see 2.4: Resetting the setting data memory.

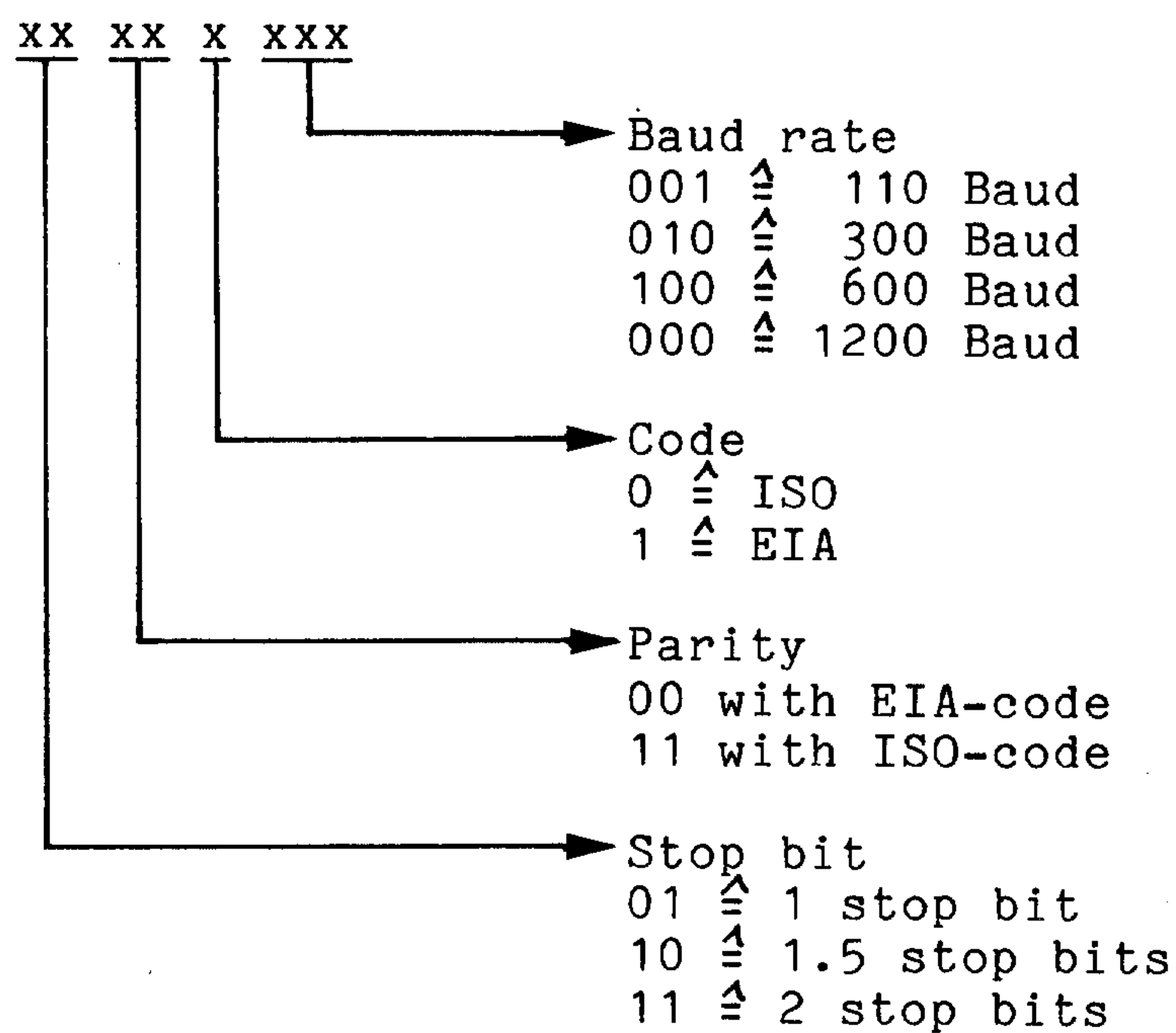
The program memory is automatically cleared by the action of reading-in.

8.4 Data transfer between SINUMERIK Primo SG and SINUMERIK system 3 / system 6 / system 8

The data transfer via the V.24-interface between Primo SG and system 3/6/8 is possible under the following conditions. With this, the part programs and the setting data memory (R001-R099) from and into the unprotected program memory and/or the setting data memory of Primo SG are transferred.

Prerequisites for SINUMERIK Primo SG

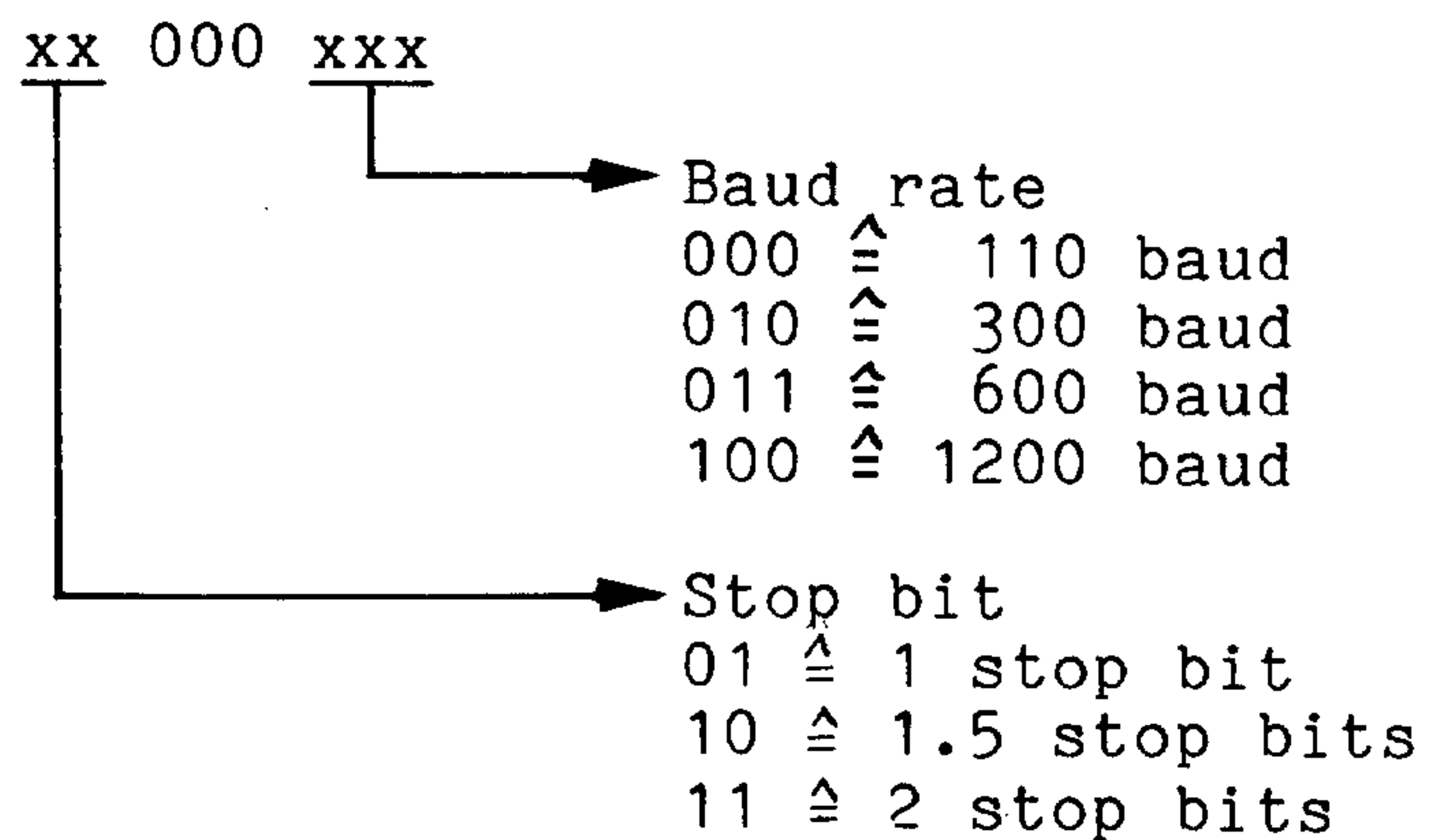
Machine data M608:



Machine data M611, bit 1 = 0 in case of transfer with system 3/8;
 = 1 in case of transfer with system 6.

Prerequisites for SINUMERIK system 3

Machine data 411 and 412



Machine data 416, bit 0 = 1

Machine data 416, bit 7 = 1

Setting data SE25, bit 3 = 0

Setting data SE25, bit 5 = 0: ISO-code
= 1: EIA-code

Prerequisite for SINUMERIK system 6

As option, the in-/output interface 1, 2 is required.

Machine data P311, 312 or 313: 00 110 xxx

baud rate	
010 $\hat{=}$	110 baud
101 $\hat{=}$	300 baud
110 $\hat{=}$	600 baud
111 $\hat{=}$	1200 baud

Machine data P341 = 2, if P311 is selected;
 = 3, if P312 is selected;
 = 4, if P313 is selected.

Setting data 1, PUNCH CODE = 1.

Prerequisite for SINUMERIK system 8

Machine data 428 or 429: xx 000 xxx

baud rate	
000 $\hat{=}$	110 baud
010 $\hat{=}$	300 baud
011 $\hat{=}$	600 baud
100 $\hat{=}$	1200 baud

Stop bit	
01 $\hat{=}$	1 stop bit
10 $\hat{=}$	1.5 stop bits
11 $\hat{=}$	2 stop bits

Setting data SE1, bit 3 = 0

Setting data SE1, bit 5 = 0

Setting data SE2, bit 2 = 0: = ISO-code
 = 1: = EIA-code

Software stand \geq 01

DNC operation may not be activated.

Prerequisite for SINUMERIK system 3 and 8

M30 or M02 should be programmed only in the last block of the program, because the transfer in case of systems 3/8 is stopped after M02/M03.

General prerequisites

It is applicable for the program key of Primo SG.

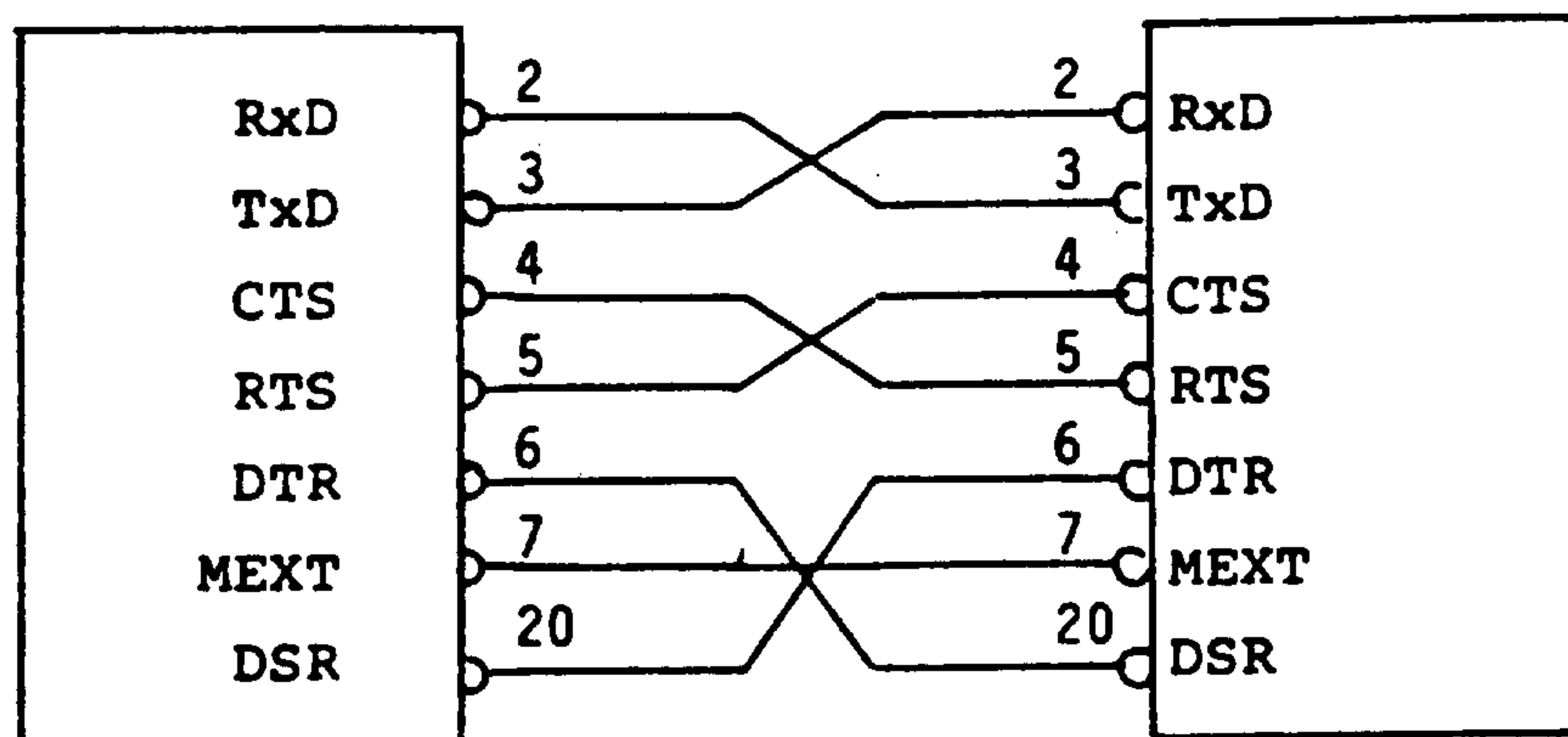
Memory lock of both the controls should be cleared, as it can be that with Primo SG, bit 0 of M611 = 0: then the memory lock can stay for Primo SG during reading in of the program, but it will be ignored. The baud rates, stop bits and the transfer code (ISO/EIA) must be same on both the controls.

Terminals

The transfer is presently possible only via V.24. For that, both the systems are to be connected as follows:

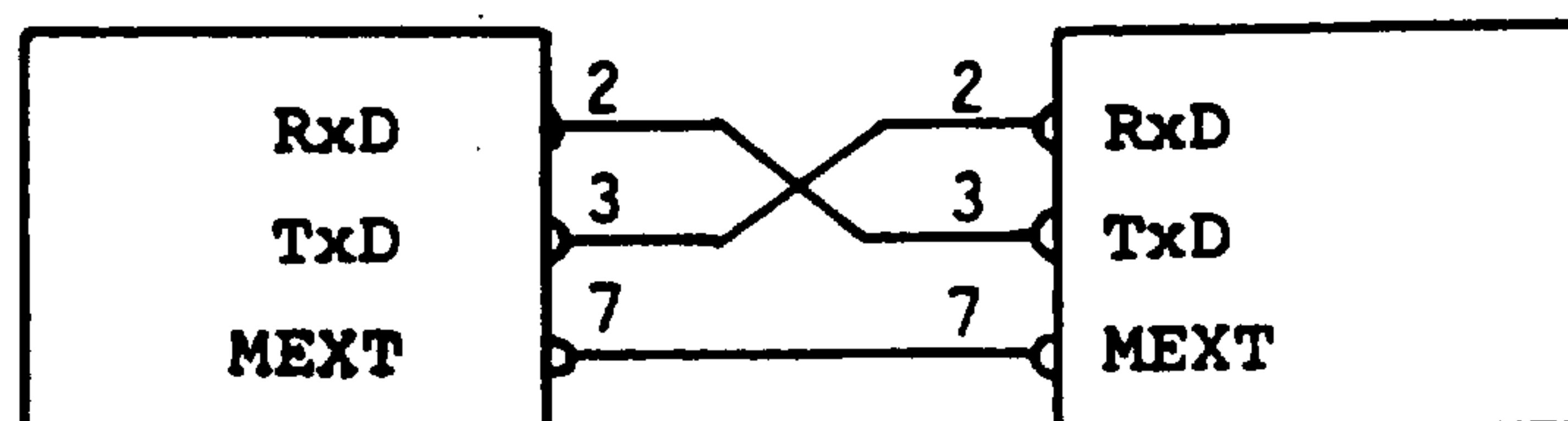
SINUMERIK system 3/system 8

SINUMERIK Primo SG



SINUMERIK system 6

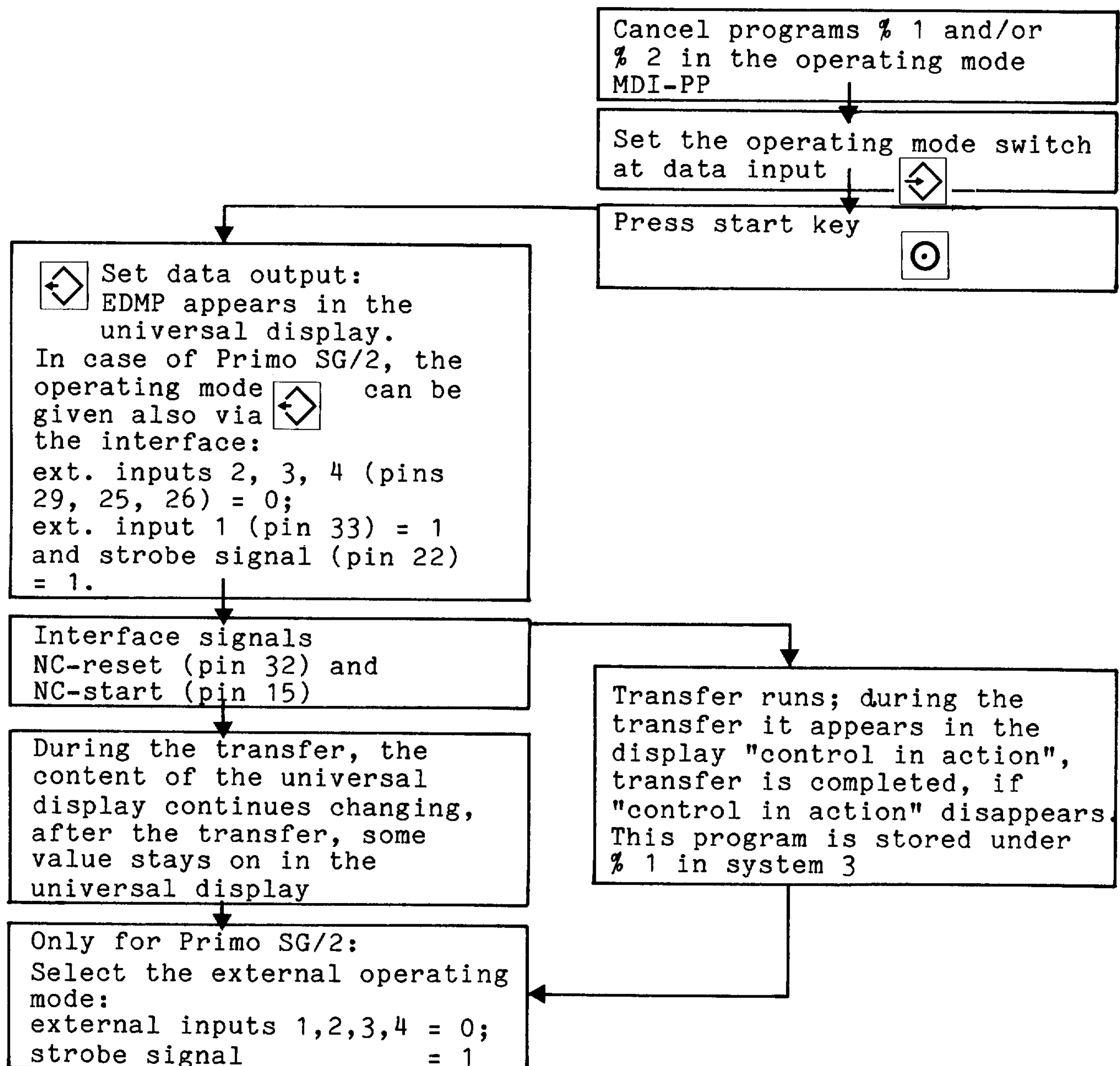
SINUMERIK Primo SG



8.4.1 Data transfer between Primo SG and system 3

Principle of operating sequence:

SINUMERIK Primo SG  SINUMERIK system 3




Remarks

The given operating sequence is applicable for the transfer of part programs. The transfer begins with the first block of the unprotected memory of Primo SG.

If the R-parameters R001...R099 are required to be transferred, the same operating sequence is applicable in principle.

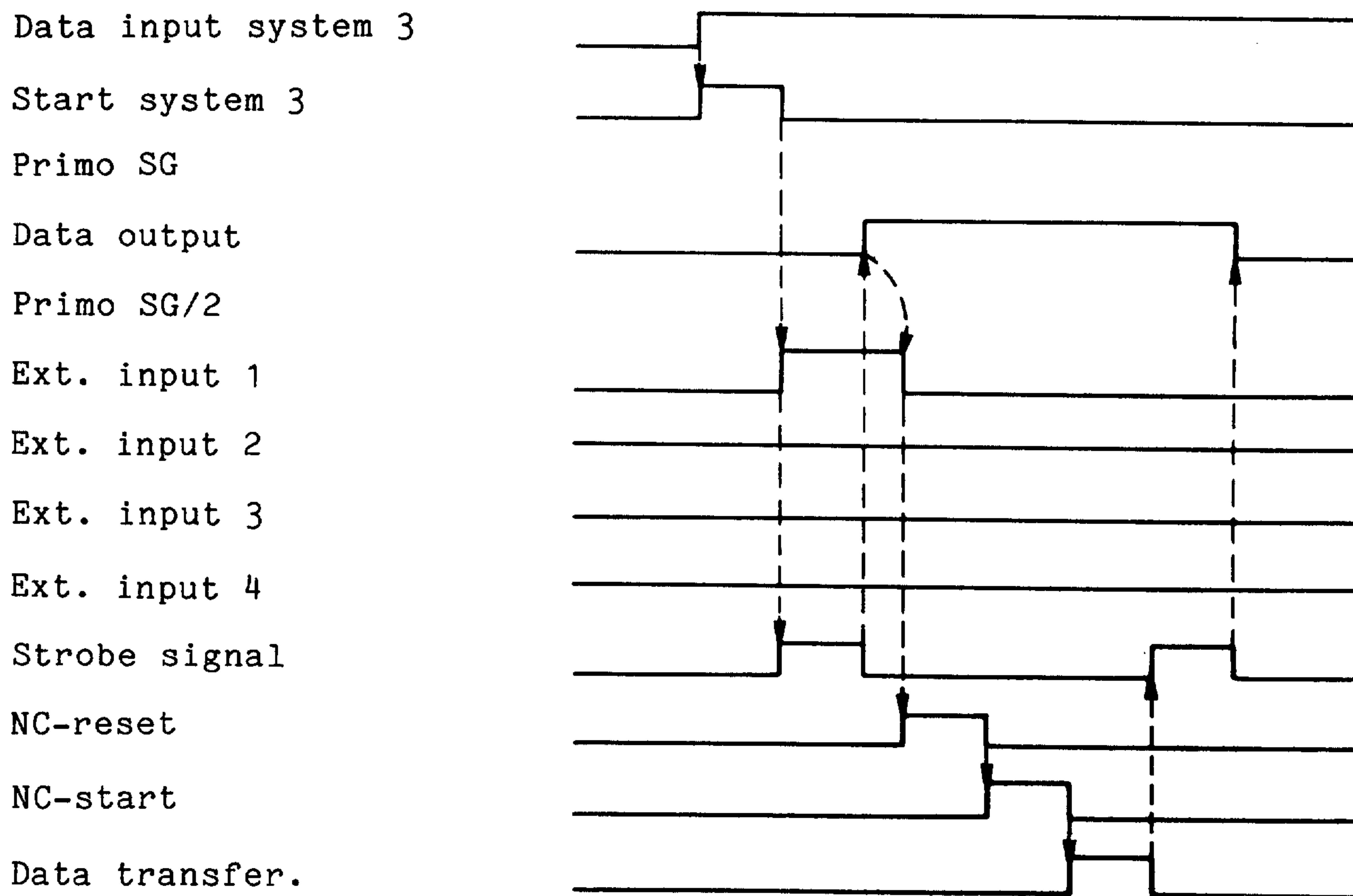
Differences:

- On the Primo SG, the operating mode MDI SE-TE  must be set (operating mode switch); in case of Primo SG/2, this can be set also via the interface: external inputs 3, 4 (pins 25, 26) = 0, external inputs 1, 2 (pin 33, 29) and strobe signal (pin 22) = 1.
- The parameters are stored with following format under % 2 in system 3:
R00 1 + 1234567 LF
R00 2 + 8901234 LF
⋮
R09 9 + 5678901 LF
M02

Note: The Primo SG transfers always 3 digits parameter numbers, however, system 3 identifies only 2 digits. Therefore, system 3 generates always one blank after the 2nd digit.

The transferred program is always stored under program number % 1 in system 3. Another program number cannot be selected. In case, different programs from Primo SG to system 3 are to be transferred one after the other, the currently transferred program in system 3 must be provided supplementary with one of 1, 2 and 3 different program numbers. The NC-start for Primo SG must be brought within a maximum of 20 sec after pressing the start (system 3).

The following time diagram folds good for the data transfer between Primo SG (SG/2) and SINUMERIK system 3.



The distance between the individual edges must be equal to the duration of minimum 32 ms. This time entry is applicable also for the following operating handlings in the sections 8.4.1 to 8.4.3.

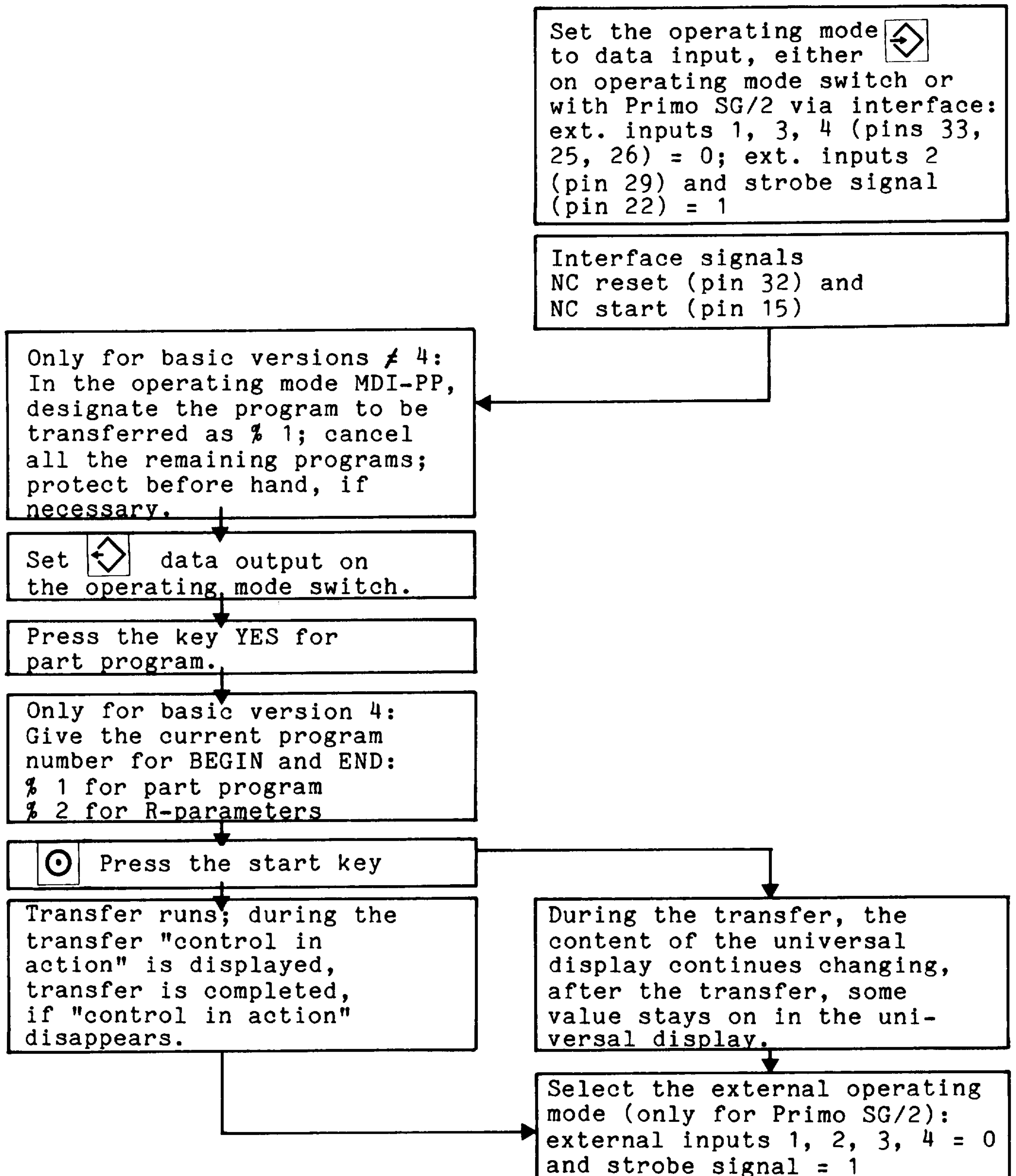
The time diagram is applicable in principle also for the V.24 transfer between Primo SG and external devices.

In that case, at the positions of data input and start system 3 (see diagram), the data input and start of external device are located.

Principle of operating sequence

SINUMERIK system 3

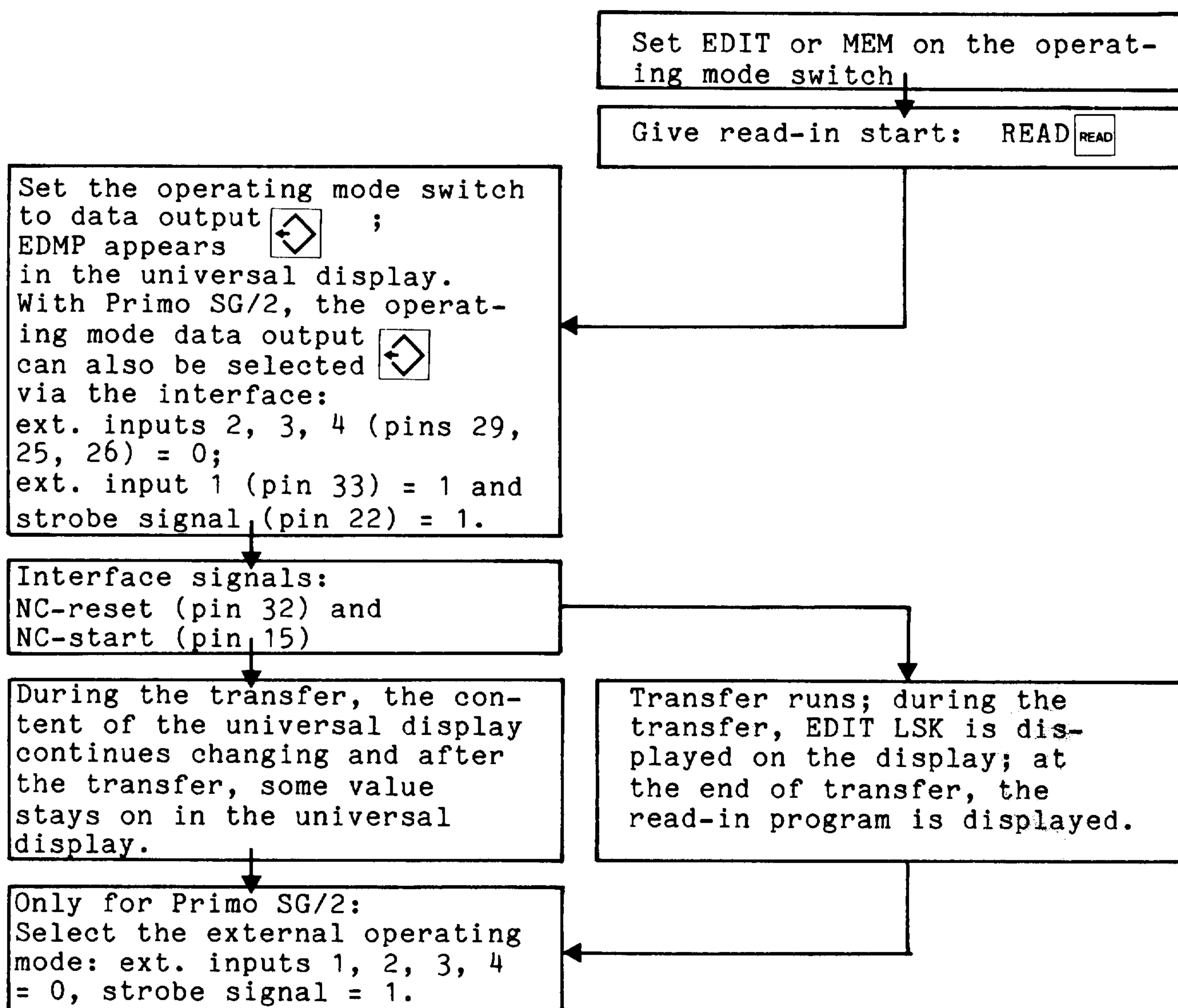
SINUMERIK Primo SG



8.4.2 Data transfer between Primo SG and system 6

Principle of operating sequence:

SINUMERIK Primo SG  SINUMERIK system 6

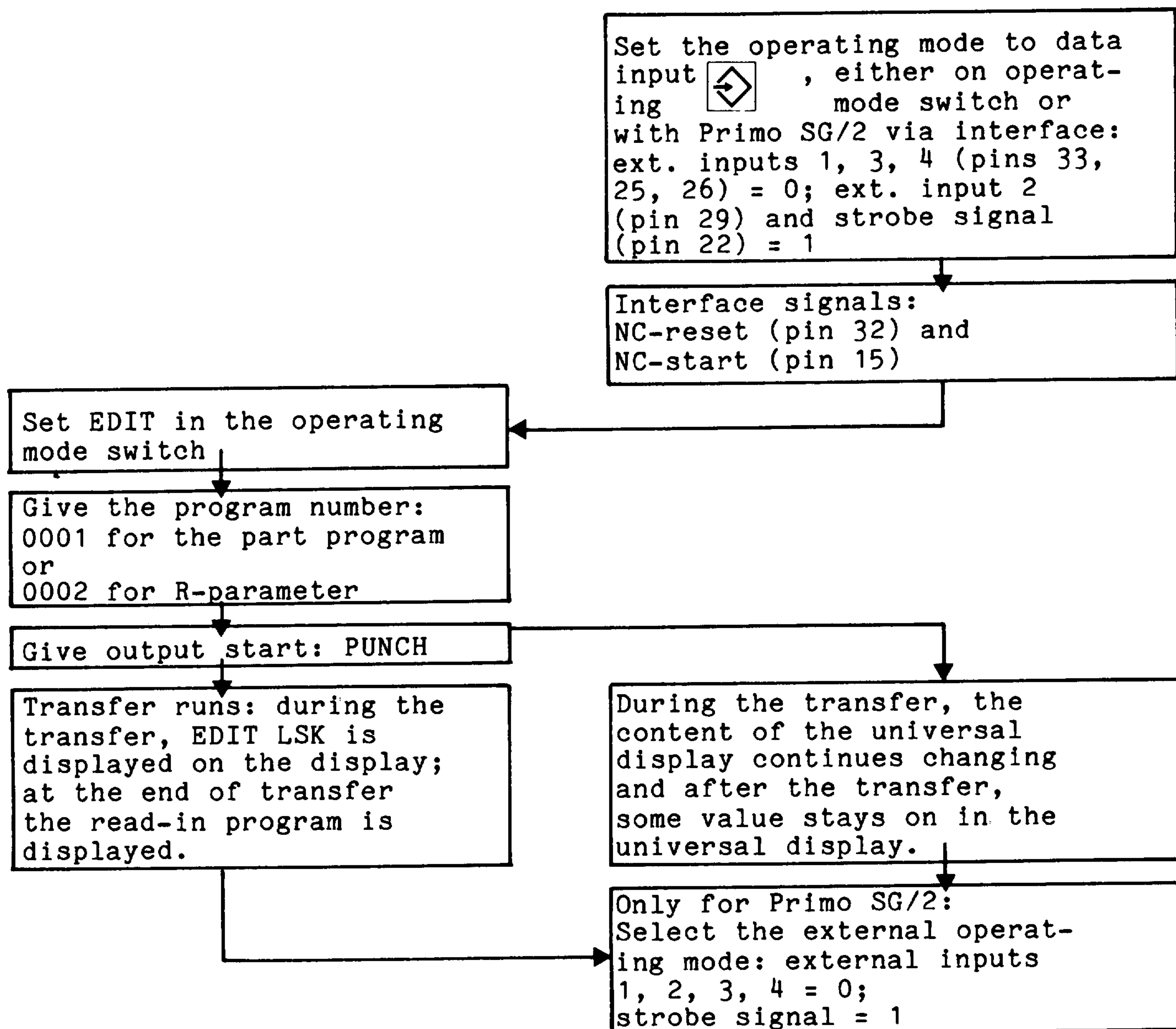


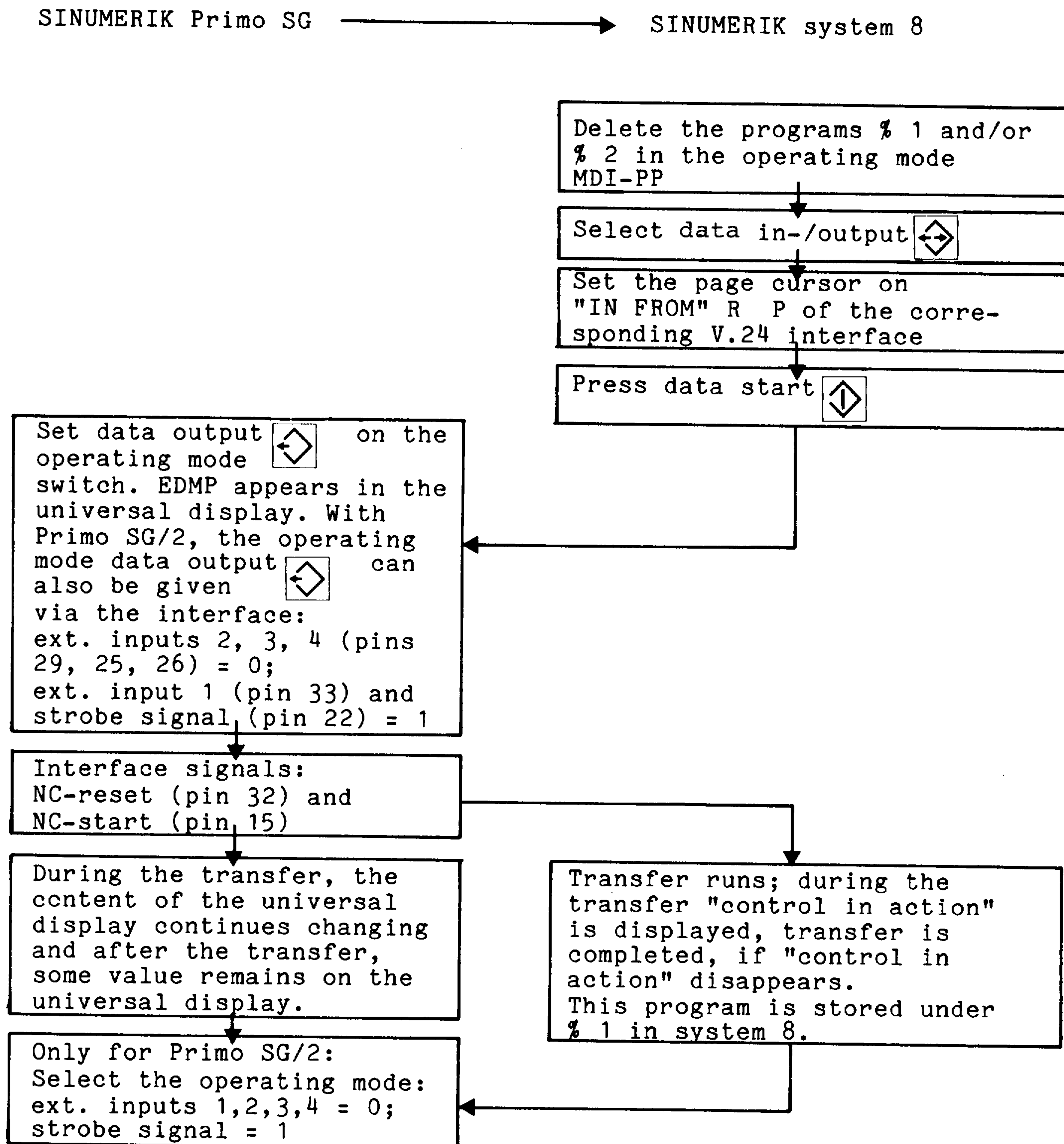
Remarks: See the remarks of data transfer between Primo SG and system 3.

Principle of operating sequence:

SINUMERIK system 6

SINUMERIK Primo SG

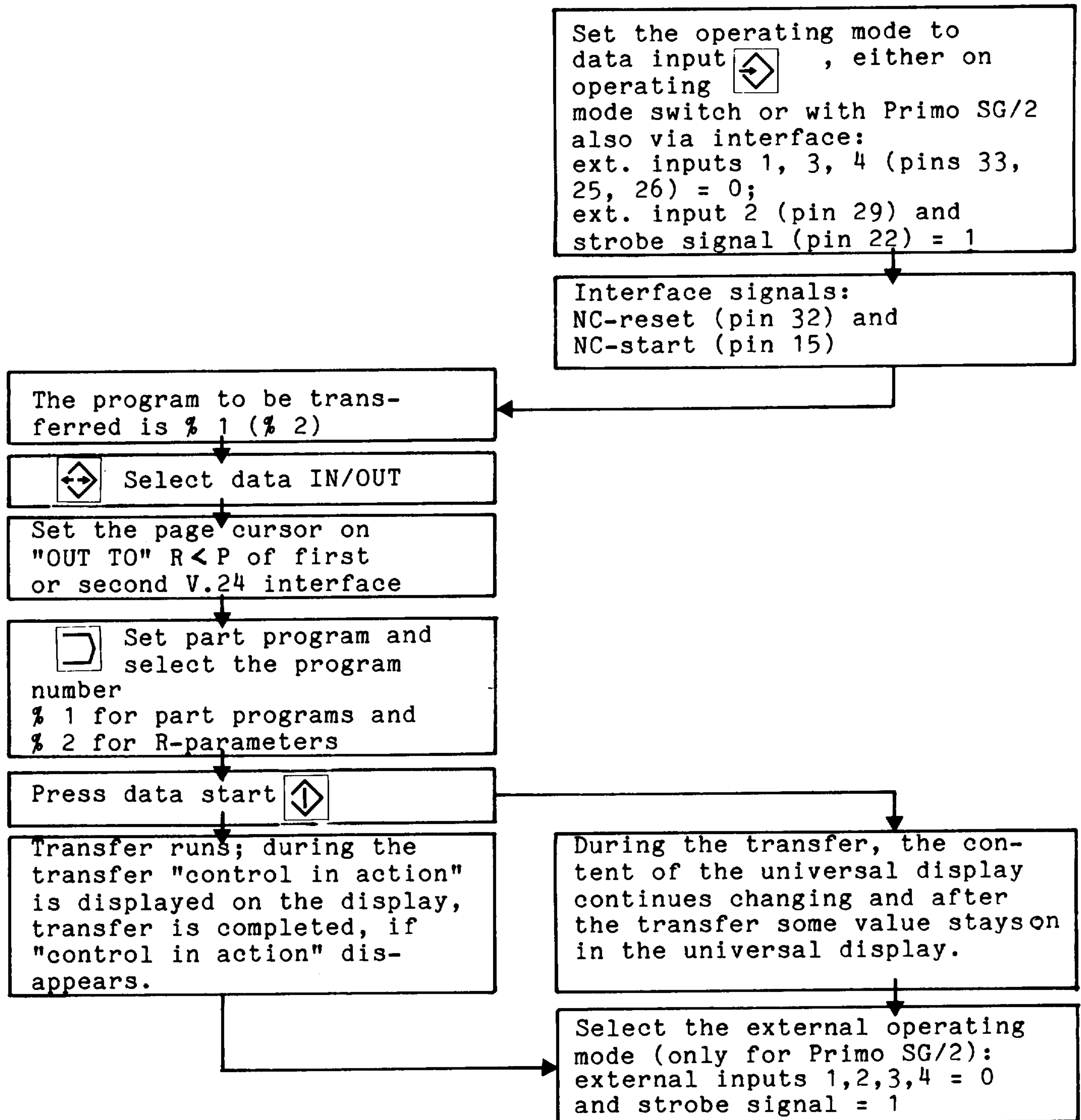


8.4.3 Data transferbetween Primo SG and system 8

Remarks: See remarks of data transfer between Primo SG and system 3.

Principle of operating sequence:

SINUMERIK system 8  SINUMERIK Primo SG



9. Prerequisites for demonstrating the control

The minimum requirements to demonstrate program input, program editing, erasing of programs and setting the actual position stores are:

- Mains cable, earthing cable and NC-ON pushbutton must be connected.
- Measuring systems must be connected for all defined axes:
activate the measuring circuit error suppression or connect dummy plugs to simulate the measuring circuits with the following links:
bridge 1: link 1-4-7-10
bridge 2: link 2-5-8-9
- Entry of machine parameters.
At least one axis must be defined.

For the dry run of the given program (without changing the position display) and for input and output data via the V.24/20mA port, the following signals must be provided to the 50 way interface plug:

"1" signal (+24 V) to pins: 2-5-8-9-12-13-16-17-22-30-31

Button for NC-start: pin 15

NC-reset: pin 32

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