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SINUMERIK 3G
Difference Description for
SINUMERIK System 3

**Installation
Guide**

SINUMERIK

**Service-
Documentation
02.91 Edition**

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To permit comparison, the Section numbers of the 3M/T/TT Installation Guide are given in brackets.

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SINUMERIK 3G: Differences with respect to 3M/3T

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3G Machine data description

14

SINUMERIK 3G Difference Description for SINUMERIK System 3

Service-Documentation

Installation Guide

February 1991 Edition

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Printing history

Brief details of this edition and previous editions are listed below.

The status of each edition is shown by the code in the "Remarks" column.

Status code in "Remarks" column:

A . . . New documentation **B** . . . Unrevised reprint with new Order No.
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Other functions not described in this documentation might be executable in the control. This does not, however, represent an obligation to supply such functions with a new control or when servicing.

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13 SINUMERIK 3G: Differences with Respect to 3M/3T

13.1 General

Sections 1 to 12 of the SINUMERIK System 3 Installation Guide are basically applicable to the 3G too.

Section 13 merely lists the differences with respect to the SINUMERIK 3M/3T. The index lists the original section, which is shown in brackets after the page number.

Example:

13.2 Checklist 13-2 (1.1)

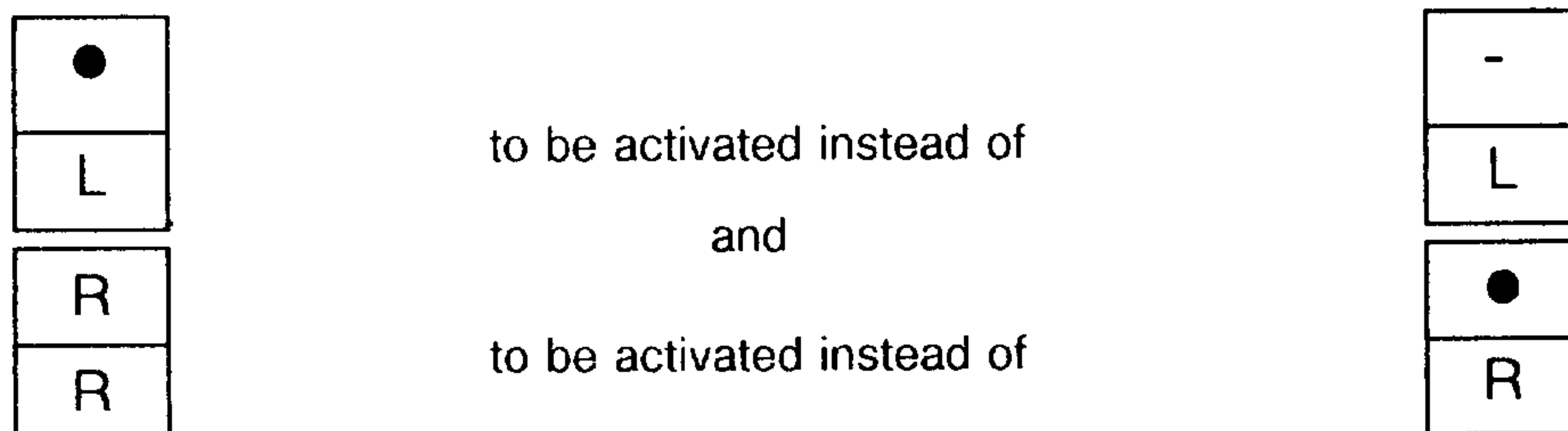
i.e section 13.2 for 3G and (1.1) in the original.

Section 7 is replaced in its entirety by Section 14!

The machine data lists and setting data lists in this section are based on 1 µm input resolution. However, it is also possible to set other resolutions on the controller:

- 0.1 µm und 10 µm
- 0.0001 degrees, 0.001 degrees and 0.01 degrees
- 0.0001 inches and 0.00001 inches

The input limits for these machine data are listed in Section 14. Since the keyboard assignment has changed with respect to the 3M/3T, attention must be paid to the following in the case of the 3G in terms of PLC status display, PLC display modules and maintenance operation:



Using PLC versions ≥ 08 (for Single PLC) and ≥ 02 (for Dual PLC)

the same keyboard assignment can be obtained by setting bit 1.4 in DB 9.

The maximum machine data values indicate the maximum physical/mathematical value of this variable. Higher values may also be input; however, this input may result in errors on account of internal value limitation.

If, for instance, the maximum speed (TE No. 130ff), acceleration (TE No. 120ff), Kv factor (TE No. 150ff) or multgain (TE No. 220ff) is not entered correctly, axis reciprocation may occur.

 Serial No.

13.2 Checklist

Observe the preliminary remarks (page 3-1)!
 Complete the checklist using a pencil or take a copy and keep the completed version in the log book. Place a cross next to the "Yes" after each completed section. Enter all required values where indicated. Explanations regarding the various sections are contained in the Installation Guide.

First start-up			Second start-up		
Name	Office	Date	Name	Office	Date
Customer	Location	From To	Final customer	Location	From To

1. Are the preconditions for installation fulfilled?	Yes <input type="radio"/>
2. Visual inspection: Supply connection, EMERGENCY STOP, earthing, position encoders	Yes <input type="radio"/>
3. a) System software identification b) PLC basic program	Yes
4. Voltage test: Input voltage at 03500 power supply unit:	V DC
Input voltage at 03700 operator panel:	V DC
Input voltage at power supply component: 3 x	V
5. Enter machine data, in particular: traversing range limits, feedrate, rapid traverse and spindle speed	Yes <input type="radio"/>
6. Axis position control loops started up Axis speed, tacho-generator compensation, multiplication factor, closed-loop gain (Kv factor), acceleration, exact positioning, position control loop monitors, analog spindle speed. All settings performed and tested?	Yes <input type="radio"/>

Drive optimization				
Axis	1	2	3	4
Maximum speed V_{max} (mm / min)				
Tacho-gen. compensation U_{max} at V_{max} (V)				
Closed-loop gain (m/min/mm)				

7. Have all basic functions been tested?
 Has the functional check using test tape (customer's) been performed? Yes

8. Generation of a machine data tape with plain text
 Tape deposited on controller Yes
 Plain text in machine data list completed and attached to log book?
 Options list checked off? Yes
 Non-conformance jumperings entered in list? Yes
 Have the following functions been explained to the customer? Yes
 Drift compensation
 Reference point setting
 Backlash compensation
 Input of these values in the machine data and generation of the tape and its depositing Yes
 Has the installation report been written and signed by the customer? Yes
 Has a copy of this checklist been attached to the log book? Yes

Signature 1st start-up.....
 2nd start up.....

13.3 NC machine data, 1 µm measuring system resolution

(Complete list for 1 µm even if machine data in tape form and record are available).

SYSTEM 3G MACHINE DATA							
No.*)	S.....	Explanation	Max. value	No.*)	S.....	Explanation	Max. value
100	Stop tolerance range 1	32000 µm +)	190	Backlash compensation	± 255 µm +)
101						
102						
103						
110	Clamping tolerance	32000 µm +)	200	Kv factor with rapid traverse G00	10 000 0.01 s ⁻¹
111						
112						
113						
120	Acceleration (not with rapid traverse G00)	6000 0.01m/s +)	210	Reference point shift	± 9999 µm +)
121						
122						
123						
130	Maximum speed	30000 mm/min +)	220	Multgain	32000 CX min/m
131						
132						
133						
140	Setpoint limiting	8192 VELO	230	Drift compensation	± 2000 VELO
141						
142						
143						
150	Kv factor (not with rapid traverse G00)	10000 0.01 s ⁻¹	240	Stop tolerance range 2	32000 µm +)
151						
152						
153						
160	Pos. limit switch	± 99999999 µm	250	PLC values	± 16000
161						
162						
163						
170	Neg. limit switch	± 99999999 µm	251		
171						
172						
173						
180	Reference point coordinates	± 99999999 µm	252		
181						
182						
183						
				253		
				254		
				255		
				256		
				257		
				258		
				259		
				260		
				261		
				262		
				263		

+) See Section 14 for limit values for degrees and inches
 *) Last digit 0 = 1st axis 2 = 3rd axis
 1 = 2nd axis 3 = 4th axis

Machine data, 1 µm measuring system resolution

No.*)	S.....	Explanation	Max. value	No.*)	S.....	Explanation	Max. value
264	PLC values	± 16000	330	.....	Feedrate override up to 16th switch position	150 %
265						
266						
267						
268						
269						
270						
271						
272						
273						
274						
275						
276						
277						
278						
279						
280	Modulo	± 99999999	351	.....	Contour monitoring treshold	27000 mm/min +)
281			352	.....	Contour monitoring delay	32000 +) mm Test 850 125·1000
282			353	.....	Positon monitoring deleay	16000 ms
283			354	.....	Set speed limit	12000 VELO
284	Cutoff speed	30000 mm/min	355	.....	Circle end point monitoring	32000 µm +)
285			356	.....	Compensat. movement threshold	32000 µm +)
286			357	.....	Spindle drift	+ 500 VELO
287			358	.....	Dynamic smoothing exponent for thread	5
288	Manual rapid traverse	30000 mm/min	359	.....	Maximum speed for 2 gears	9999 rev/min
288			360	.....	
290						
291						
292	Manual feed	30000 mm/min				
293						
294						
295						
299	Inclined axis angle	± 45000 x10 ³ Grad				
300	Acceleration with rapid traverse G00	6000 0.01 m/s ²				
301						
302						
303						
304	Maximum speed with rapid traverse G00	30000 mm/min				
305						
306						
307						

+) See Section 14 for limit values for degrees and inches

Machine data, 1 µm measuring system resolution

No.')	S.....	Explanation	Max. value	No.')	S.....	Explanation	Max. value
367	Spindle speed tolerance	99 %	380	.....	Position limit for M 19	1000 1/11 deg.
368	Maximum spindle speed tolerance	99 (100) %	381	.....	Software version	-
369	Tolerance for speed at rest	125 0.01 %	382	.....	R parameter display limit	291
370	Maximum spindle speed	9999 rev/min	383	.....	Increase in sampling time	± 20 1/2 ms
373	Reference point approach speed	30000 mm/min +)	384	.....	Hardware 5 or 8 MHz	-
374	Incremental feedrate	30000 mm/min +)	386	.....	Accelerating time constant for 2 gears	32000 (4 ms)
375	Dry run feedrate	30000 mm/min +)	387	.....	R parameter assignment for rapid parameter-calculation	399
376	Spindle servo inhibit delay	16000 ms	387	.....	R parameter assignment for rapid parameter-calculation	399
377	Minimum Spindle motor tspeed	8192 VELO	390	.....	Groove signal prolongation	16000 ms
378	Spindle cutoff speed for M 19	9999 rev/min				
379	Gain	1000 rev/min/360				

+) See Section 14 for limit values for degrees and inches

13.3.1 List for 0.1 µm input resolution

Axis-specific machine data (TEST)

The same figures apply to rotary axes with 0.0001 degrees input resolution, mm being replaced by degrees.

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
10 * S..... 50	Stop tolerance range 1 +)	32000	0.1 µm
11 * S..... 200	Clamping tolerance +)	32000	0.1 µm
12 * S..... 50	Acceleration (without G00) +)	6000	0.001m/s ²
13 * S..... 10000	Max. speed +)	3000	mm/min
14 * S..... 8192	Setpoint limit	8192	VELO
15 * S..... 1666	Kv factor (without G00)	10000	0.01 s ⁻¹
16 * S... + 9999999	Software limit switch pos.	± 99 999 999	0.1 µm
17 * S... - 9999999	Software limit switch neg.	± 99 999 999	0.1 µm
18 * S..... 0	Reference point value	± 99 999 999	0.1µm
19 * S..... 0	Backlash compensation +)	± 255	µm
20 * S..... 0	Kv factor for rapid traverse G00	10000	0.01 s ⁻¹
21 * S..... 0	Reference point shift +)	± 9999	µm
22 * S..... 2400	Multgain	32000	C · mm/min
23 * S..... 0	Drift compensation	± 2000	VELO
24 * S.....	Stop tolerance range 2	32000	0.1 µm

Axis assignment

*	3G
0	1st axis
1	2nd axis
2	3rd axis
3	4th axis

+) See Section 14 for limit values and dimensions for degrees or inches

13.3.1 List for 0.1 μm input resolutionPLC machine data in NC, 0.1 μm measuring system resolution

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
250 S..... 0	PLC machine data in NC	± 16000	-
251 S..... 0			
252 S..... 0			
253 S..... 0			
254 S..... 0			
255 S..... 0			
256 S..... 0			
257 S..... 0			
258 S..... 0			
259 S..... 0			
260 S..... 0			
261 S..... 0			
262 S..... 0			
263 S..... 0			
264 S..... 0			
265 S..... 0			
266 S..... 0			
267 S..... 0			
268 S..... 0			
269 S..... 0			
270 S..... 0			
271 S..... 0			
272 S..... 0			
273 S..... 0			
274 S..... 0			
275 S..... 0			
276 S..... 0			
277 S..... 0			
278 S..... 0			
279 S..... 0			

Common machine data (TEST), 0.1 µm measuring system resolution

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
280 S..... 360000 281 S..... 360000 282 S..... 360000 283 S..... 360000	Modulo No. 1st axis +) 2nd axis 3rd axis 4th axis	999999999	10 ⁻⁴ deg.
284 S..... 500 285 S..... 500 286 S..... 500 287 S..... 500	Cutoff speed 1st axis +) 2nd axis 3rd axis 4th axis	3000	mm/min
288 S..... 10000 289 S..... 10000 290 S..... 10000 291 S..... 10000	Manual rapid traverse 1st axis +) 2nd axis 3rd axis 4th axis	3000	mm/min
292 S..... 5000 293 S..... 5000 294 S..... 5000 295 S..... 5000	Manual feed 1st axis +) 2nd axis 3rd axis 4th axis	3000	mm/min
299 S..... 0	Angle of inclination	± 45000	10 ⁻³ deg.
300 S..... 0 301 S..... 0 302 S..... 0 303 S..... 0 304 S..... 0 305 S..... 0 306 S..... 0 307 S..... 0	Acceleration with rapid traverse G00 1st axis +) 2nd axis 3rd axis 4th axis	6000	0.001 m/s ²

+) See Section 14 for limit values and dimensions for degrees or inches

13.3.1 List for 0.1 μm input resolutionCommon machine data (TEST), 0.1 μm measuring system resolution

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
330 S..... 10	2nd switch position	150	%
331 S..... 20	3rd switch position	150	%
332 S..... 30	4th switch position	150	%
333 S..... 40	5th switch position	150	%
334 S..... 50	6th switch position	150	%
335 S..... 60	7th switch position	150	%
336 S..... 70	8th switch position	150	%
337 S..... 80	9th switch position	150	%
338 S..... 90	10th switch position	150	%
339 S..... 100	11th switch position	150	%
340 S..... 110	12th switch position	150	%
341 S..... 120	13th switch position	150	%
342 S..... 130	14th switch position	150	%
343 S..... 140	15th switch position	150	%
344 S..... 150	16th switch position	150	%
351 S..... 0	Threshold speed for contour monitoring	27000	0.1 mm/min
352 S..... 0	Tolerance band for contour monitoring	32000	$\frac{\text{mm} \cdot \text{Test 850}}{125 \cdot 1000}$
353 S..... 500	Position monitoring delay	16000	ms
354 S..... 10000	Set speed limit	12000	VELO
355 S..... 10	Circle end point monitoring	32000	0.1 μm
356 S..... 10	Threshold for inserting compensating movements with CRC	32000	0.1 μm
357 S..... 0	Spindle drift	± 500	VELO
358 S..... 0	Dynamic smoothing exponent for thread (2 ^{x-1}) times sampling time	5	-

+) See Section 14 for limit values and dimensions for degrees or inches

2) Feedrate override

Common machine data (TEST), 0.1 µm measuring system resolution

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
359 S..... 500	Maximum speed of 2 gears	9999	rev/min
360 S..... 1000		9999	rev/min
367 S..... 5	Spindle speed tolerance	99	%
368 S..... 10	Maximum spindle speed tolerance	99 (100)	% (mon. cutoff)
369 S..... 50	Tolerance for speed at rest	125	0.01 %
370 S.....	Maximum spindle speed	9999	rev/min
373 S..... 10000	Reference point approach speed +)	3000	mm/min
374 S..... 500	Incremental feedrate +)	3000	mm/min
375 S..... 2000	Dry run feedrate +)	3000	mm/min
376 S..... 1000	Servo inhibit delay	16000	ms
377 S..... 0	Minimum spindle motor speed	8192	VELO
378 S..... 0	Spindle cutoff speed for M 19	9999	rev/min
379 S..... 0	Gain for M 19	10000	1/mm · 360
380 S..... 0	Position limit for M 19	1000	1/11 deg.
381 S..... 0	Software version	(32000)	
382 S..... 290	R parameter display limit	500	-
383 S..... 0	Change in sampling time	± 20	1/2 ms
384 S..... 0	5 or 8 MHz hardware	1	
386 S..... 0	Accelerating time constant for gear 1	32000	4 ms

+) See Section 14 for limit values and dimensions for degrees or inches

2) Feedrate override

Common machine data (TEST), 0.1 µm measuring system resolution

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
387 S..... 0	Accelerating time constant for gear 2	32000	4 ms
388 S..... 0	Start standard R parameters	399	-
389 S..... 0	Start fast R parameters	399	-
390 S..... 0	Groove signal prolongation	16000	ms

+) See Section 14 for limit values and dimensions for degrees or inches

13.3.2 List for 10 µm input resolution

Axis-specific machine data (TEST)

The same figures apply to rotary axes with 0.01 degrees input resolution, mm being replaced by degrees.

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
10 * S..... 50	Stop tolerance range 1 +)	32000	10 µm
11 * S..... 200	Clamping tolerance +)	32000	10 µm
12 * S..... 50	Acceleration +)	6000	0.1m/s ²
13 * S..... 10000	Max. speed +)	300000	mm/min
14 * S..... 8192	Setpoint limit	8192	VELO
15 * S..... 1666	Kv factor	10000	0.01 s ⁻¹
16 * S... + 9999999	Software limit switch pos.	± 999 9999	10 µm
17 * S... - 9999999	Software limit switch neg.	± 999 9999	10 µm
18 * S..... 0	Reference point value	± 999 9999	10 µm
19 * S..... 0	Backlash compensation +)	± 255	µm
20 * S..... 0	Kv factor with rapid traverse G00	10000	0.01 s ⁻¹
21 * S..... 0	Reference point shift +)	± 9999	10 µm
22 * S..... 2400	Multgain	32000	C·mm/min
23 * S..... 0	Drift compensation	± 2000	VELO
24 * S.....	Stop tolerance range 2	32000	10 m

Axis assignment

*	3G
0	1st axis
1	2nd axis
2	3rd axis
3	4th axis

+) See Section 14 for limit values and dimensions for degrees or inches

13.3.2 List for 10 µm input resolution

PLC machine data in NC, 10 µm measuring system resolution

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
250 S..... 0	PLC machine data in NC	± 16000	-
251 S..... 0			
252 S..... 0			
253 S..... 0			
254 S..... 0			
255 S..... 0			
256 S..... 0			
257 S..... 0			
258 S..... 0			
259 S..... 0			
260 S..... 0			
261 S..... 0			
262 S..... 0			
263 S..... 0			
264 S..... 0			
265 S..... 0			
266 S..... 0			
267 S..... 0			
268 S..... 0			
269 S..... 0			
270 S..... 0			
271 S..... 0			
272 S..... 0			
273 S..... 0			
274 S..... 0			
275 S..... 0			
276 S..... 0			
277 S..... 0			
278 S..... 0			
279 S..... 0			

Common machine data (TEST), 10 µm measuring system resolution

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
280 S..... 360000 281 S..... 360000 282 S..... 360000 283 S..... 360000	Modulo No. 1st axis +) 2nd axis 3rd axis 4th axis	9999999	10 ⁻² deg.
284 S..... 500 285 S..... 500 286 S..... 500 287 S..... 500	Cutoff speed 1st axis +) 2nd axis 3rd axis 4th axis	300000	mm/min
288 S..... 10000 289 S..... 10000 290 S..... 10000 291 S..... 10000	Manual rapid traverse 1st axis +) 2nd axis 3rd axis 4th axis	300000	mm/min
292 S..... 5000 293 S..... 5000 294 S..... 5000 295 S..... 5000	Manual feed 1st axis +) 2nd axis 3rd axis 4th axis	300000	mm/min
299 S..... 0	Angle of inclination	± 45000	10 ⁻³ deg.
300 S..... 0 301 S..... 0 302 S..... 0 303 S..... 0	Acceleration with rapid traverse G00 1st axis +) 2nd axis 3rd axis 4th axis	6000	0.1 m/s ²
304 S..... 0 305 S..... 0 306 S..... 0 307 S..... 0	Maximum speed with rapid traverse G00 1st axis +) 2nd axis 3rd axis 4th axis	300000	mm/min

+) For limit values and dimensions for degrees or inches please refer to Section 14

Common machine data (TEST), 10 µm measuring system resolution

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
330 S..... 10	2nd switch position	150	%
331 S..... 20	3rd switch position	150	%
332 S..... 30	4th switch position	150	%
333 S..... 40	5th switch position	150	%
334 S..... 50	6th switch position	150	%
335 S..... 60	7th switch position	150	%
336 S..... 70	8th switch position	150	%
337 S..... 80	9th switch position	150	%
338 S..... 90	10th switch position	150	%
339 S..... 100	11th switch position	150	%
340 S..... 110	12th switch position	150	%
341 S..... 120	13th switch position	150	%
342 S..... 130	14th switch position	150	%
343 S..... 140	15th switch position	150	%
344 S..... 150	16th switch position	150	%
351 S..... 0	Threshold speed for contour monitoring	2700	10 mm/min
352 S..... 0	Tolerance band for contour monitoring	32000	<u>mm-Test 850</u> 125-1000
353 S..... 500	Position monitoring delay	16000	ms
354 S..... 10000	Set speed limit	12000	VELO
355 S..... 10	Circle end point monitoring	32000	10 µm
356 S..... 10	Threshold for inserting compensating movements with CRC	32000	10 µm
357 S..... 0	Spindle drift	± 500	VELO
358 S..... 0	Dynamic smoothing exponent for thread (2 ^{x-1}) times sampling time	5	-

+) See Section 14 for limit values and dimensions for degrees or inches

2) Feedrate override

Common machine data (TEST), 10 µm measuring system resolution

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
359 S..... 500	Maximum speed of	9999	1 rev/min
360 S..... 1000	2 gears	9999	1 rev/min
367 S..... 5	Spindle speed tolerance	99	%
368 S..... 10	Maximum spindle speed tolerance	99 (100)	% (mon. cutoff)
369 S..... 50	Tolerance for speed at rest	125	0.01 %
370 S..... 0	Maximum spindle speed	9999	1 rev/min
373 S..... 10000	Reference point approach speed +)	300000	mm/min
374 S..... 500	Incremental feedrate +)	300000	mm/min
375 S..... 2000	Dry run feedrate +)	300000	mm/min
376 S..... 1000	Servo inhibit delay	16000	ms
377 S..... 0	Minimum spindle motor speed	8192	VELO
378 S..... 0	Spindle cutoff speed for M 19	9999	rev/min
379 S..... 0	Gain for M 19	10000	1/mm · 360
380 S..... 0	Position limit for M 19	1000	1/11 deg.
381 S..... 0	Software version	(32000)	
382 S..... 0	R parameter display limit	500	-
383 S..... 0	Change in sampling time	± 20	1/2 ms
384 S..... 0	5 or 8 MHz hardware	1	
386 S..... 0	Accelerating time constant for gear 1	32000	4 ms

+) See Section 14 for limit values and dimensions for degrees or inches

2) Feedrate override

Common machine data (TEST), 10 µm measuring system resolution

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
387 S..... 0	Accelerating time constant for gear 2	32000	4 ms
388 S..... 0	Start standard R parameters	399	-
389 S..... 0	Start fast R parameters	399	-
390 S..... 0	Groove signal prolongation	16000	ms

+) See Section 14 for limit values and dimensions for degrees or inches

13.3.3 List for 0.0001 inch input resolution

Axis-specific machine data (TEST)

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
10 * S..... 50	Stop tolerance range 1 +)	32000	10 ⁻⁴ inches
11 * S..... 200	Clamping tolerance +)	32000	10 ⁻⁴ inches
12 * S..... 50	Acceleration +)	6000	0.1 inch/s ²
13 * S..... 10000	Max. speed +)	300000	10 ⁻² inch/min
14 * S..... 8192	Setpoint limit	8192	VELO
15 * S..... 1666	Kv factor	10000	0.01 s ⁻¹
16 * S... + 9999999	Software limit switch pos.	± 999 9999	10 ⁻⁴ inches
17 * S... - 9999999	Software limit switch neg.	± 999 9999	10 ⁻⁴ inches
18 * S..... 0	Reference point value	± 999 9999	10 ⁻⁴ inches
19 * S..... 0	Backlash compensation +)	± 255	10 ⁻⁴ inches
20 * S..... 0	Kv factor with rapid traverse G00	10000	0.01 s ⁻¹
21 * S..... 0	Reference point shift +)	± 9999	10 ⁻⁴ inches
22 * S..... 2400	Multgain	32000	C·inch/min
23 * S..... 0	Drift compensation	± 2000	VELO
24 * S..... 0	Stop tolerance range 2	32000	10 ⁻⁴ inches

Axis assignment

*	3G
0	1st axis
1	2nd axis
2	3rd axis
3	4th axis

+) See Section 14 for limit values and dimensions for degrees or inches

13.3.3 List for 0.0001 inch input resolution

PLC machine data in NC, 0.0001 inch measuring system resolution

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
250 S..... 0			
251 S..... 0			
252 S..... 0			
253 S..... 0			
254 S..... 0			
255 S..... 0			
256 S..... 0			
257 S..... 0			
258 S..... 0			
259 S..... 0			
260 S..... 0			
261 S..... 0			
262 S..... 0			
263 S..... 0			
264 S..... 0	PLC machine data in NC	± 16000	-
265 S..... 0			
266 S..... 0			
267 S..... 0			
268 S..... 0			
269 S..... 0			
270 S..... 0			
271 S..... 0			
272 S..... 0			
273 S..... 0			
274 S..... 0			
275 S..... 0			
276 S..... 0			
277 S..... 0			
278 S..... 0			
279 S..... 0			

Common machine data (TEST), 0.0001 inch measuring system resolution

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
280 S..... 360000 281 S..... 360000 282 S..... 360000 283 S..... 360000	Modulo No. 1st axis +) 2nd axis 3rd axis 4th axis	-	
284 S..... 500 285 S..... 500 286 S..... 500 287 S..... 500	Cutoff speed 1st axis +) 2nd axis 3rd axis 4th axis	300000	10 ⁻² inch/min
288 S..... 10000 289 S..... 10000 290 S..... 10000 291 S..... 10000	Manual rapid traverse 1st axis +) 2nd axis 3rd axis 4th axis	300000	10 ⁻² inch/min
292 S..... 5000 293 S..... 5000 294 S..... 5000 295 S..... 5000	Manual feed 1st axis +) 2nd axis 3rd axis 4th axis	300000	10 ⁻² inch/min
299 S..... 0	Angle of inclination	± 45000	10 ⁻³ deg.
300 S..... 0 301 S..... 0 302 S..... 0 303 S..... 0	Acceleration with rapid traverse G00 1st axis +) 2nd axis 3rd axis 4th axis	6000	0.1 inch/s ²
304 S..... 0 305 S..... 0 306 S..... 0 307 S..... 0	Maximum speed with rapid traverse G00 1st axis +) 2nd axis 3rd axis 4th axis	300000	10 ⁻² inch/min

+) See Section 14 for limit values and dimensions for degrees or inches

Common machine data (TEST), 0.0001 inch measuring system resolution

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
330 S..... 10	2nd switch position	150	%
331 S..... 20	3rd switch position	150	%
332 S..... 30	4th switch position	150	%
333 S..... 40	5th switch position	150	%
334 S..... 50	6th switch position	150	%
335 S..... 60	7th switch position	150	%
336 S..... 70	8th switch position	150	%
337 S..... 80	9th switch position	150	%
338 S..... 90	10th switch position	150	%
339 S..... 100	11th switch position	150	%
340 S..... 110	12th switch position	150	%
341 S..... 120	13th switch position	150	%
342 S..... 130	14th switch position	150	%
343 S..... 140	15th switch position	150	%
344 S..... 150	16th switch position	150	%
351 S..... 0	Threshold speed for contour monitoring +)	27000	10 ⁻¹ inch/min
352 S..... 0	Tolerance band for contour monitoring +)	32000	<u>0.1 inch-Test 850</u> 125-1000
353 S..... 500	Position monitoring delay	16000	ms
354 S..... 10000	Set speed limit	12000	VELO
355 S..... 10	Circle end point monitoring +)	32000	10 ⁻⁴ inches
356 S..... 10	Threshold for inserting compensating movements with CRC +)	32000	10 ⁻⁴ inches
357 S..... 0	Spindle drift	± 500	VELO
358 S..... 0	Dynamic smoothing exponent for thread (2 ^{x-1}) times sampling time	5	-

+) See Section 14 for limit values and dimensions for degrees or inches
 2) Feedrate override

Common machine data (TEST), 0.0001 inch measuring system resolution

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
359 S..... 500 360 S..... 1000	Maximum speed of 2 gears	9999 9999	rev/min rev/min
367 S..... 5	Spindle speed tolerance	99	%
368 S..... 10	Maximum spindle speed tolerance	99 (100)	% (mon. cutoff)
369 S..... 50	Tolerance for speed at rest	125	0.01 %
370 S.....	Maximum spindle speed	9999	rev/min
373 S..... 10000	Reference point approach speed +)	300000	10 ⁻² inch/min
374 S..... 500	Incremental feedrate +)	300000	10 ⁻² inch/min
375 S..... 2000	Dry run feedrate +)	300000	10 ⁻² inch/min
376 S..... 1000	Servo inhibit delay	16000	ms
377 S..... 0	Minimum spindle motor speed	8192	VELO
378 S..... 0	Spindle cutoff speed for M 19	9999	rev/min
379 S..... 0	Gain for M 19	10000	1/mm · 360
380 S..... 0	Position limit for M 19	1000	1/11 deg.
381 S..... 0	Software version	(32000)	
382 S..... 0	R parameter display limit	500	-
383 S..... 0	Change in sampling time	± 20	1/2 ms
384 S..... 0	5 or 8 MHz hardware	1	
386 S..... 0	Accelerating time constant for gear 1	32000	4 ms

+) See Section 14 for limit values and dimensions for degrees or inches

Common machine data (TEST), 0.0001 inch measuring system resolution

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
387 S..... 0	Accelerating time constant for gear 2	32000	4 ms
388 S..... 0	Start standard R parameters	399	-
389 S..... 0	Start fast R parameters	399	-
390 S..... 0	Groove signal prolongation	16000	4 ms

+) See Section 14 for limit values and dimensions for degrees or inches

13.3.4 List for 0.00001 inch input resolution

Axis-specific machine data (TEST)

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
10 * S..... 50	Stop tolerance range 1 +)	32000	10 ⁻⁵ inches
11 * S..... 200	Clamping tolerance +)	32000	10 ⁻⁵ inches
12 * S..... 50	Acceleration (without G00) +)	6000	0.1 inch/s ²
13 * S..... 10000	Max. speed +)	30000	10 ⁻² inch/min
14 * S..... 8192	Setpoint limit	32000	0.01 s ⁻¹
15 * S..... 1666	Kv factor (without G00)	10000	0.01 s ⁻¹
16 * S... + 9999999	Software limit switch pos.	± 9999 9999	10 ⁻⁵ inches
17 * S... - 9999999	Software limit switch neg.	± 9999 9999	10 ⁻⁵ inches
18 * S..... 0	Reference point value	± 9999 9999	10 ⁻⁵ inches
19 * S..... 0	Backlash compensation +)	± 255	10 ⁻⁵ inches
20 * S..... 0	Kv factor with rapid traverse G00	10000	0.01 s ⁻¹
21 * S..... 0	Reference point shift +)	± 99990	10 ⁻⁵ inches
22 * S..... 2400	Multgain	32000	C · inch/min
23 * S..... 0	Drift compensation	± 2000	VELO
24 * S..... 0	Stop tolerance range 2	32000	10 ⁻⁵ inches

Axis assignment

*	3G
0	1st axis
1	2nd axis
2	3rd axis
3	4th axis

+) See Section 14 for limit values and dimensions for degrees or inches

PLC machine data in NC, 0.00001 inch measuring system resolution

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
250 S..... 0	PLC machine data in NC	± 16000	-
251 S..... 0			
252 S..... 0			
253 S..... 0			
254 S..... 0			
255 S..... 0			
256 S..... 0			
257 S..... 0			
258 S..... 0			
259 S..... 0			
260 S..... 0			
261 S..... 0			
262 S..... 0			
263 S..... 0			
264 S..... 0			
265 S..... 0			
266 S..... 0			
267 S..... 0			
268 S..... 0			
269 S..... 0			
270 S..... 0			
271 S..... 0			
272 S..... 0			
273 S..... 0			
274 S..... 0			
275 S..... 0			
276 S..... 0			
277 S..... 0			
278 S..... 0			
279 S..... 0			

Common machine data (TEST), 0.00001 inch measuring system resolution

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
280 S..... 360000 281 S..... 360000 282 S..... 360000 283 S..... 360000	Modulo No. 1st axis +) 2nd axis 3rd axis 4th axis	-	-
284 S..... 500 285 S..... 500 286 S..... 500 287 S..... 500	Cutoff speed 1st axis +) 2nd axis 3rd axis 4th axis	30000	10 ⁻² inch/min
288 S..... 10000 289 S..... 10000 290 S..... 10000 291 S..... 10000	Manual rapid traverse 1st axis +) 2nd axis 3rd axis 4th axis	30000	10 ⁻² inch/min
292 S..... 5000 293 S..... 5000 294 S..... 5000 295 S..... 5000	Manual feed 1st axis +) 2nd axis 3rd axis 4th axis	30000	10 ⁻² inch/min
299 S..... 0	Angle of inclination	± 45000	10 ⁻³ deg.
300 S..... 0 301 S..... 0 302 S..... 0 303 S..... 0	Acceleration with rapid traverse G00 1st axis +) 2nd axis 3rd axis 4th axis	6000	inch/s ²
304 S..... 0 305 S..... 0 306 S..... 0 307 S..... 0	Maximum speed with rapid traverse G00 1st axis +) 2nd axis 3rd axis 4th axis	30000	10 ⁻² inch/min

+) See Section 14 for limit values and dimensions for degrees or inches

Common machine data (TEST), 0.00001 inch measuring system resolution

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
330 S..... 10	2nd switch position	150	%
331 S..... 20	3rd switch position	150	%
332 S..... 30	4th switch position	150	%
333 S..... 40	5th switch position	150	%
334 S..... 50	6th switch position	150	%
335 S..... 60	7th switch position	150	%
336 S..... 70	8th switch position	150	%
337 S..... 80	9th switch position	150	%
338 S..... 90	10th switch position	150	%
339 S..... 100	11th switch position	150	%
340 S..... 110	12th switch position	150	%
341 S..... 120	13th switch position	150	%
342 S..... 130	14th switch position	150	%
343 S..... 140	15th switch position	150	%
344 S..... 150	16th switch position	150	%
351 S..... 0	Threshold speed for contour monitoring +)	27000	10 ⁻² inch/min
352 S..... 0	Tolerance band for contour monitoring +)	32000	$\frac{0.1 \text{ inch} \cdot \text{Test 850}}{125 \cdot 1000}$
353 S..... 500	Position monitoring delay	16000	ms
354 S..... 10000	Set speed limit	12000	VELO
355 S..... 10	Circle end point monitoring +)	32000	10 ⁻⁵ inches
356 S..... 10	Threshold for inserting compensating movements with CRC +)	32000	10 ⁻⁵ inches
357 S..... 0	Spindle drift	± 500	VELO
358 S..... 0	Dynamic smoothing exponent for thread (2 ^{x-1}) times sampling time	5	-

+) See Section 14 for limit values and dimensions for degrees or inches

2) Feedrate override

Common machine data (TEST), 0.00001 inch measuring system resolution

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
359 S..... 500	Maximum speed of 2 gears	9999	rev/min
360 S..... 1000		9999	rev/min
367 S..... 5	Spindle speed tolerance	99	%
368 S..... 10	Maximum spindle speed tolerance	99 (100)	% (mon. cutoff)
369 S..... 50	Tolerance for speed at rest	125	0.01 %
370 S..... 0	Maximum spindle speed	9999	rev/min
373 S..... 10000	Reference point approach speed	30000	10 ⁻² inch/min
374 S..... 500	Incremental feedrate	30000	10 ⁻² inch/min
375 S..... 2000	Dry run feedrate	30000	10 ⁻² inch/min
376 S..... 1000	Spindle servo inhibit delay	16000	ms
377 S..... 0	Minimum spindle motor speed	8192	VELO
378 S..... 0	Spindle cutoff speed for M 19	9999	rev/min
379 S..... 0	Gain for M 19	10000	1/mm · 360
380 S..... 0	Position limit for M 19	1000	1/11 deg.
381 S..... 0	Software version	(32000)	
382 S..... 0	R parameter display limit	500	-
383 S..... 0	Change in sampling time	± 20	1/2 ms
384 S..... 0	5 or 8 MHz hardware	1	
386 S..... 0	Accelerating time constant for gear 1	32000	4 ms

+) See Section 14 for limit values and dimensions for degrees or inches

2) Feedrate override

Common machine data (TEST), 0.00001 inch measuring system resolution

Manual input (with standard values set automatically)	Explanation	Maximum input value	Dimension
387 S..... 0	Accelerating time constant for gear 2	32000	4 ms
388 S..... 0	Start standard R parameters	399	-
389 S..... 0	Start fast R parameters	399	-
390 S..... 0	Groove signal prolongation	16000	4 ms

+) See Section 14 for limit values and dimensions for degrees or inches

13.4 PLC machine data

Note:

Applicable to SINUMERIK 3G, from 4B/5 MHz onwards

No.	S.....	Explanation		No.	S.....	Explanation	
250				266		user	
251				267		user	
252				268		user	
253				269		user	
254				270		user	
255				271		user	
256							
257							
258							
259							
260							
261							
262		user					
263		user					
264		user					
265		user					

PLC machine data bits

PLC machine data bits for user

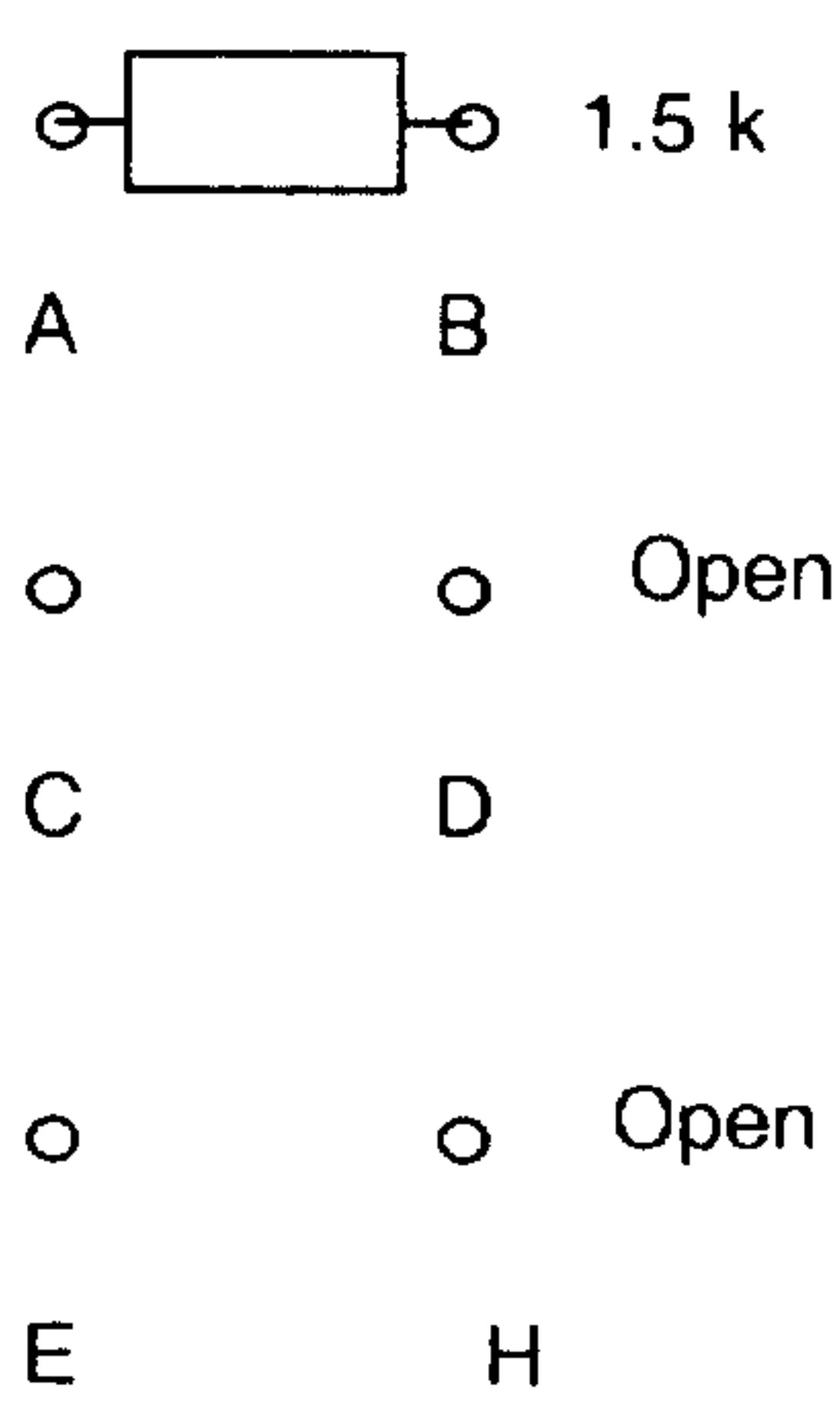
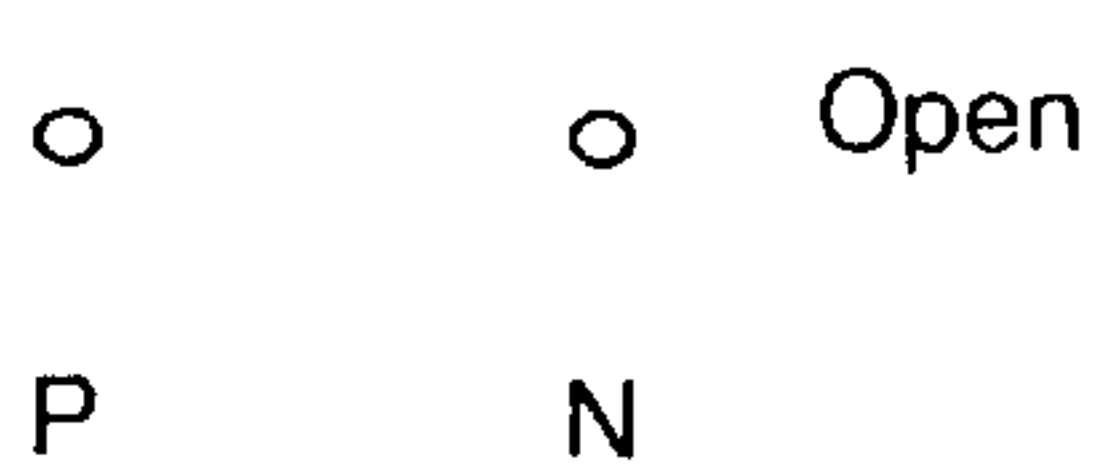
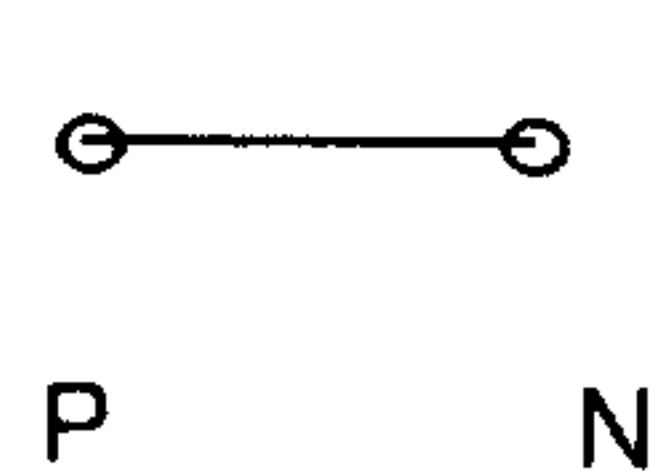
No.	Bit							
	7	6	5	4	3	2	1	0
450								
451								
452								
453								
454								
455								
456								
457								
458								
459								
460								
461								

No.	Bit							
	7	6	5	4	3	2	1	0
462								
463								
464								
465								
466								
467								
468								
469								
470								
471								
472								
473								
474								
475								
476								
477								
478								
479								

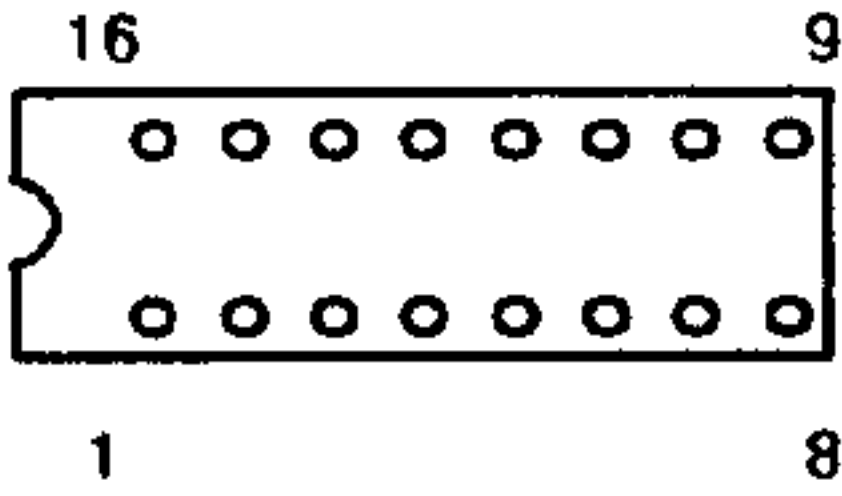
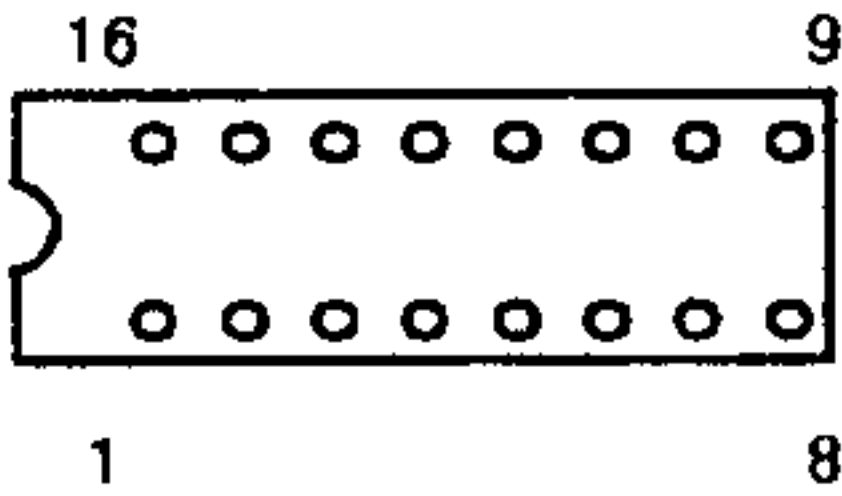
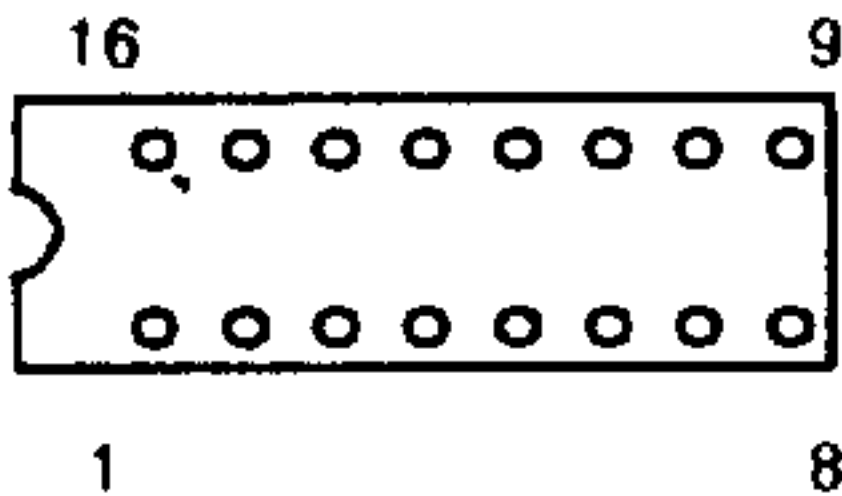
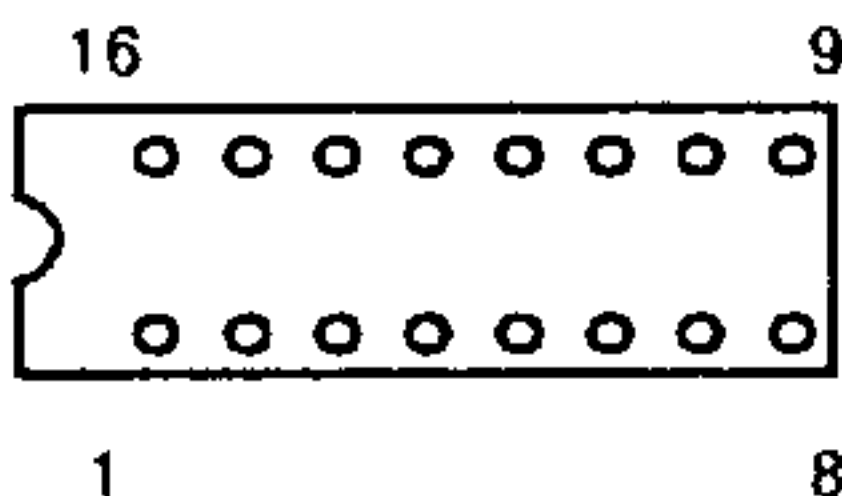
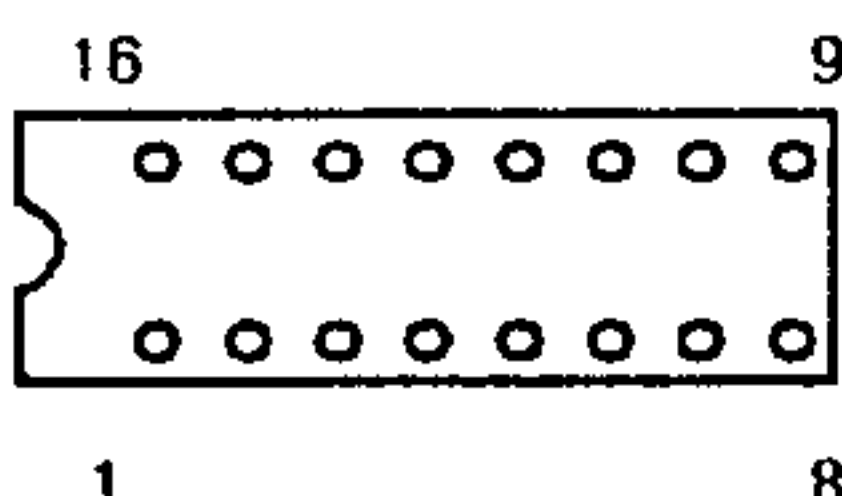
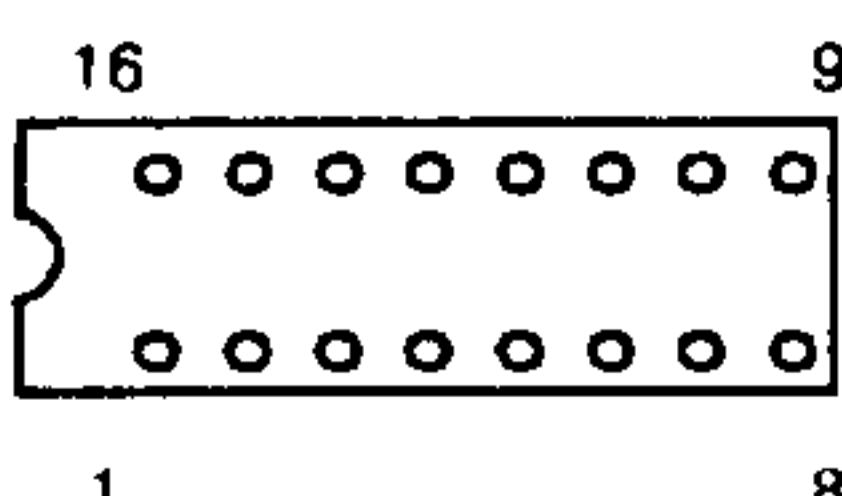
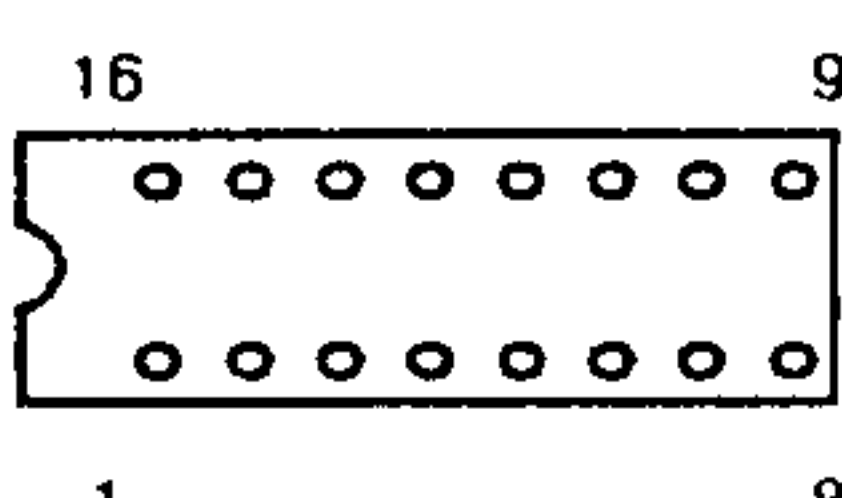
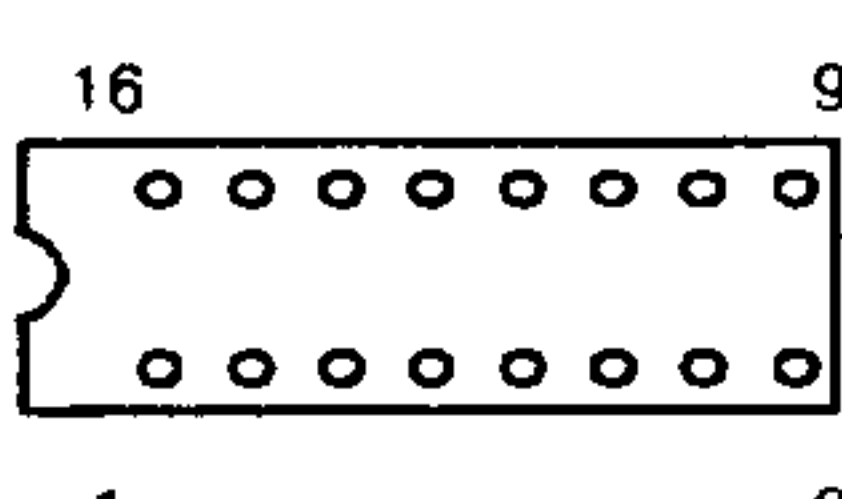
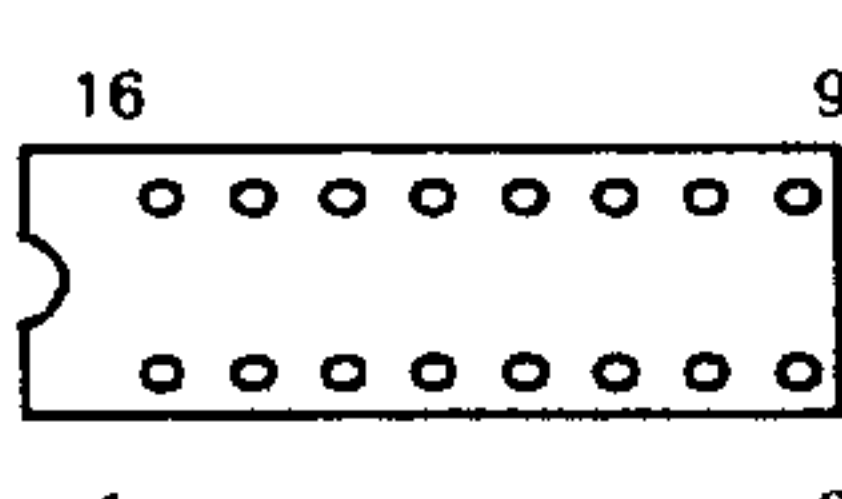
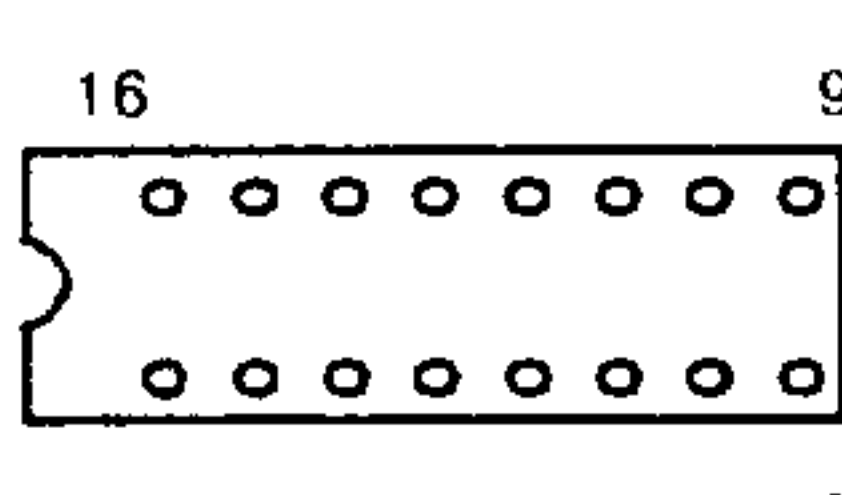
13.5 Non-conformance standard jumpering

Note:

Only enter in the event of non-conformance (deviation)

Description	Module	Standard jumpering	Special jumpering	
				Yes
20 mA interface	03840	NC active	NC passive	
Sensor output	03315/03316 03350/03351	Relay contact or open collector 	Different sensor outputs See Section 8 (Interface)	
Speed controller ready	03320 03325/03326 03350/03351	Signal used 	Signal not used 	
Setpoint output	03325/03326 03350/03351	Setpoint frame CVG connected with NC-M	Different setpoint circuit	

13.6 Jumper assignments for input/output modules

OPTION	PCB type	Subrack	Slot	Address assignment Byte No.	Jumper assignment
					
					
					
					
					
					
					
					
					
					

13.7 Available options according to delivery note

Available		Order code	Options
Yes	No.		
		A03	3 axis
		A04	4 axis
		B02	Tape reader without winder
		B03	Tape reader with winder
		B05	Controller without operator panel
		B07	V.24 (RS 232C) / TTY switching
		B41	Metric / inch switching
		B61	3D interpolation
		B74	Cycle operator prompting
		C75	64 K program memory expansion
		C76	128 K program memory expansion
		E42	Oriented spindle stop and incremental spindle positioning from PLC
		E43	S-analog and constant grinding wheel peripheral speed
		E60	FMS functions
		E85	Angular infeed grinding
		E86	Output of reverse signals
		E91	Electronic gear
		E92	Electronic gear measuring circuit expansion
		H12	Grinding wheel radius compensation
		H56	Leadscrew error compensation
		J22	Display text in German
		J23	Display text in French
		J24	Display text in Italian
		J25	Display text in Spanish
		J85	Machine control panel

Available options according to delivery note

Available		Order code	Options	
Yes	No.			
		K11	Integrated EXE 10-fold	(1st axis)
		K12	Integrated EXE 10-fold	(2nd axis)
		K51	Integrated EXE 5-fold	(1st axis)
		K52	Integrated EXE 5-fold	(2nd axis)
		K53	Integrated EXE 5-fold	(3rd axis)
		K54	Integrated EXE 5-fold	(4th axis)
		N30	Internal DUAL PLC	
		N32	PLC130W-B memory (EPROM) : 8 K	
		N34	PLC130W-B memory (EPROM) : 16 K	
		N35	PLC II in NC tier	
		N38	16 K PLC RAM	
		N39	32 K PLC RAM	
		N41	External DUAL PLC	
		N43	PLC I in NC tier	
		N60	Digital input 32 inputs	420-3 PCB
		N65	Digital output 32 outputs	445-3 PCB
		N70	Digital output 16 outputs	444-3 PCB
		N81	Digital input / output 48 inputs, 24 outputs	03400 PCB
		N82	Digital output 16 outputs,	03460 PCB
		N83	Digital input 96 inputs,	03410 PCB
		N84	Digital output 48 outputs,	03421 PCB
		N85	Digital input / output 32 inputs, 32 outputs	03450 PCB
		N87	03485 as PLC link	

Available options according to delivery note

Available		Order code	Options
Yes	No.		
		N90	Digital input 16 inputs, 432-3 PCB
		N91	EU interface module
		N92	EU interface module
		N93	CC interface module
		N94	EU interface module
		N96	CC/EU interface module
		N97	03845 as PLC link, superseded by N87
		N98	03845 as CC/EU link
		P03	PLC expansion unit
		P23	Power supply unit for PLC expansion











13.8 NC standard machine data bits

As in the case of the standard machine data (Section 13.7), these bits may be set simultaneously.

No.	Bit							
	7	6	5	4	3	2	1	0
N 400S	0	0	0	0	0	0	0	0
N 401S	0	0	0	0	0	0	0	0
N 402S	0	0	0	0	0	0	0	0
N 403S	1	0	0	1	0	0	0	0
N 404S	1	0	0	1	0	0	0	0
N 405S	0	0	0	0	0	0	0	0
N 406S	0	0	0	0	0	0	0	0
N 407S	0	0	0	0	0	0	0	0
N 408S	0	0	0	0	1	0	0	1
N 409S	1	0	0	0	0	0	0	0
N 410S	0	0	0	0	0	1	1	1
N 411S	1	1	0	0	0	0	1	0
N 412S	1	1	0	0	0	0	1	0
N 413S	0	0	0	0	0	0	0	0
N 414S	0	0	0	0	0	0	0	0
N 415S	0	1	0	0	0	0	0	0
N 416S	0	0	0	0	0	1	0	1
N 417S	*	0	0	0	0	0	0	1
N 418S	0	0	0	0	0	0	0	0
N 419S	0	0	0	0	0	0	0	0
N 424S	0	0	0	0	0	0	0	0
N 425S	0	0	0	0	0	0	0	0
N 426S	0	0	0	0	0	0	0	0
N 427S	0	0	0	0	0	0	0	0
N 428S	0	0	0	0	0	0	0	0
N 429S	0	0	0	0	0	0	0	0
N 430S	0	0	0	0	0	0	1	0
N 431S	0	0	0	0	0	0	1	0
N 432S	0	0	0	0	0	0	0	0
N 433S	0	0	0	0	0	0	0	0
N 434S	0	0	0	0	0	0	0	0
N 435S	0	0	0	0	0	0	0	1
N 436S	0	0	0	0	1	1	1	1
N 437S	0	0	0	0	1	1	1	1
N 438S	0	0	0	0	0	0	0	0
N 439S	0	0	0	0	0	0	0	0
N 440S	0	0	0	0	0	0	0	0
N 441S	0	0	0	0	0	0	0	0
N 442S	0	0	0	0	0	0	0	0
N 443S	0	0	0	0	0	0	0	0
N 444S	0	0	0	0	0	0	0	0
N 445S	0	0	0	0	0	0	0	0
N 446S	0	0	0	0	0	0	0	0
N 447S	0	0	0	0	0	0	0	0
N 448S	0	0	0	0	0	0	0	0
N 449S	0	0	0	0	0	0	0	0

* Version with machine control panel via customer module = 1
Version with machine control panel without customer module = 0.

13.9 Delete functions, specification of controller type

Delete machine data		
Delete user program (PP and subroutines)		
Delete setting data (R parameters)		
3G with standard machine data		
3G with standard machine data and logic submodule		

Procedure for Software Updates

NC:

1. Print out machine data, subroutines (observe cycle inhibit), main programs and R parameters on tape or floppy disk.
2. If the integral software is below 58, the machine data should be recorded in writing.
3. Basic version 4A: Simultaneously perform Cancel 2, 3 followed by Cancel 4 with Power On Reset.
 4B: Perform Cancel 3 followed by Cancel 2 and 4 simultaneously, each time with Power On Reset.
4. Activate standard machine data using Input 6 (without logic submodule) or Input 8 (with logic submodule) and Power On Reset.
5. Re-input the saved programs as described in 1. and 2.
6. Perform Power On Reset to activate the machine data.

PLC:

Ensure NC-PLC compatibility!

13.10 NC machine data list with standard machine data

13.10.1 Axis-specific machine data (MD)

Manual input (with standard values set auto- matically)	Explanation	Resolution		Maximum input value	Dimension of input value	
		Metric Degr. mm/°)	Inch (")		Metric Degr. mm/°)	Inch (")
100 – 103 S ... 50	Stop tolerance range 1	10 ⁻⁴	–	32000	10 ⁻⁴	–
		10 ⁻³	10 ⁻⁵		10 ⁻³	10 ⁻⁵
		10 ⁻²	10 ⁻⁴		10 ⁻²	10 ⁻⁴
110 – 113 S ... 200	Clamping tolerance	10 ⁻⁴	–	32000	10 ⁻⁴	–
		10 ⁻³	10 ⁻⁵		10 ⁻³	10 ⁻⁵
		10 ⁻²	10 ⁻⁴		10 ⁻²	10 ⁻⁴
120 – 123 S ... 50	Acceleration	10 ⁻⁴	–	6000	10 ⁻⁴	–
		10 ⁻³	10 ⁻⁵		10 ⁻³	0.1
		10 ⁻²	10 ⁻⁴		10 ⁻¹	1
130 – 133 S ... 10000	Maximum speed	10 ⁻⁴	–	3000	1	–
		10 ⁻³	10 ⁻⁵	30000	1	10 ⁻²
		10 ⁻²	10 ⁻⁴	300000	1	10 ⁻²
140 – 143 S ... 8192	Setpoint limit	10 ⁻⁴	–	8192	VELO	VELO
		10 ⁻³	10 ⁻⁵			
		10 ⁻²	10 ⁻⁴			
150 – 153 S ... 9999999	Kv factor	10 ⁻⁴	–	10000	0.01s ⁻¹	0.01s ⁻¹
		10 ⁻³	10 ⁻⁵			
		10 ⁻²	10 ⁻⁴			
160 – 163 S + 9999999	Software limit switch positive	10 ⁻⁴	–	± 99999999	10 ⁻⁴	–
		10 ⁻³	10 ⁻⁵	± 99999999	10 ⁻³	10 ⁻⁵
		10 ⁻²	10 ⁻⁴	± 9999999	10 ⁻²	10 ⁻⁴
170 – 173 S – 9999999	Software limit switch negative	10 ⁻⁴	–	± 99999999	10 ⁻⁴	–
		10 ⁻³	10 ⁻⁵	± 99999999	10 ⁻³	10 ⁻⁵
		10 ⁻²	10 ⁻⁴	± 9999999	10 ⁻²	10 ⁻⁴
180 – 183 S ... 0	Reference point coordinates	10 ⁻⁴	–	± 99999999	10 ⁻⁴	–
		10 ⁻³	10 ⁻⁵	± 99999999	10 ⁻³	10 ⁻⁵
		10 ⁻²	10 ⁻⁴	± 9999999	10 ⁻²	10 ⁻⁴

Axis-specific machine data (MD)

Manual input (with standard values set auto- matically)	Explanation	Resolution		Maximum input value	Dimension of input value	
		Metric Degr. mm/°)	Inch (")		Metric Degr. mm/°)	Inch (")
190 – 193 S ... 0	Backlash compensation	10 ⁻³	– 10 ⁻⁴	± 255	10 ⁻³	– 10 ⁻⁴
200 – 203 S ... 0	Kv factor with rapid traverse G00	10 ⁻⁴ 10 ⁻³ 10 ⁻²	– 10 ⁻⁵ 10 ⁻⁴	10000	0.01s ⁻¹	0.001s ⁻¹
210 – 113 S ... 0	Reference point shift	10 ⁻³	– 10 ⁻⁴	± 9999	10 ⁻³	– 10 ⁻⁴
220 – 223 S ... 2400	Multgain	10 ⁻⁴ 10 ⁻³ 10 ⁻²	– 10 ⁻⁵ 10 ⁻⁴	32000	Cxmm/min	Cxmm/min
230 – 233 S ... 0	Drift compensation	10 ⁻⁴ 10 ⁻³ 10 ⁻²	– 10 ⁻⁵ 10 ⁻⁴	± 2000	VELO	VELO
240 – 243 S ... 50	Stop tolerance range 2	10 ⁻⁴ 10 ⁻³ 10 ⁻²	– 10 ⁻⁵ 10 ⁻⁴	+ 32000	10 ⁻⁴ 10 ⁻³ 10 ⁻²	– 10 ⁻⁵ 10 ⁻⁴
280 – 283 S ... 3600000	Modulo number	10 ⁻⁴ 10 ⁻³ 10 ⁻²	– 10 ⁻⁵ 10 ⁻⁴	+ 99999999 + 99999999 + 9999999	– 10 ⁻³ 10 ⁻²	10 ⁻⁴ – –
284 – 287 S ... 500	Cutoff speed	10 ⁻⁴ 10 ⁻³ 10 ⁻²	– 10 ⁻⁵ 10 ⁻⁴	3000 30000 300000	1 1 1	– 10 ⁻² 10 ⁻²
288 – 291 S ... 1000	Manual rapid traverse	10 ⁻⁴ 10 ⁻³ 10 ⁻²	– 10 ⁻⁵ 10 ⁻⁴	3000 30000 300000	1 1 1	– 10 ⁻² 10 ⁻²
292 – 295 S ... 5000	Manual feed	10 ⁻⁴ 10 ⁻³ 10 ⁻²	– 10 ⁻⁵ 10 ⁻⁴	3000 30000 300000	1 1 1	– 10 ⁻² 10 ⁻²

Axis-specific machine data (MD)

Manual input (with standard values set auto- matically)	Explanation	Resolution		Maximum input value	Dimension of input value	
		Metric Degr. mm/°)	Inch (")		Metric Degr. mm/°)	Inch (")
300 – 303 S ... 0	Acceleration with rapid traverse G00	10 ⁻⁴	–	6000	10 ⁻³	–
		10 ⁻³	10 ⁻⁵		10 ⁻²	0.1
		10 ⁻²	10 ⁻⁴		10 ⁻¹	1
304 – 307 S ... 0	Maximum speed with rapid traverse G00	10 ⁻⁴	–	3000	1	–
		10 ⁻³	10 ⁻⁵	30000	1	10 ⁻²
		10 ⁻²	10 ⁻⁴	300000	1	10 ⁻²

13.10.2 Common machine data (MD)

Manual input (with standard values set automatically)	Explanation	Resolution		Maximum input value	Dimension of input value	
		Metric Degr. mm/°)	Inch (")		Metric Degr. mm/°)	Inch (")
250 S..... 0	PLC machine data (see Section 13.12)	-	-	-	-	-
251 S..... 0						
252 S..... 0						
253 S..... 0						
254 S..... 0						
255 S..... 0						
256 S..... 0						
257 S..... 0						
258 S..... 0						
259 S..... 0						
260 S..... 0						
261 S..... 0						
262 S..... 0						
263 S..... 0						
264 S..... 0						
265 S..... 0						
266 S..... 0						
267 S..... 0						
268 S..... 0						
269 S..... 0						
270 S..... 0						
271 S..... 0						
299 S..... 0	Angle of inclination	-	-	± 45000	10 ⁻³	10 ⁻³
330 S..... 10	2nd switch pos.	-	-	150	%	%
331 S..... 20	3rd switch pos.	-	-	150	%	%
332 S..... 30	4th switch pos.	-	-	150	%	%
333 S..... 40	5th switch pos.	-	-	150	%	%
334 S..... 50	6th switch pos.	-	-	150	%	%
335 S..... 60	7th switch pos.	-	-	150	%	%
336 S..... 70	8th switch pos.	-	-	150	%	%
337 S..... 80	9th switch pos.	-	-	150	%	%
338 S..... 90	10th switch pos.	-	-	150	%	%
339 S... 100	11th switch pos.	-	-	150	%	%
340 S... 110	12th switch pos.	-	-	150	%	%
341 S... 120	13th switch pos.	-	-	150	%	%
342 S... 130	14th switch pos.	-	-	150	%	%
343 S... 140	15th switch pos.	-	-	150	%	%
344 S... 150	16th switch pos.	-	-	150	%	%

2) Feedrate override

Common machine data (MD)

Manual input (with standard values set auto- matically)	Explanation	Resolution		Maximum input value	Dimension of input value	
		Metric Degr. mm/°)	Inch (")		Metric Degr. mm/°)	Inch (")
351 S..... 0	Threshold speed for contour monitoring	10 ⁻⁴	–	27000	0.1	–
		10 ⁻³	10 ⁻⁵	27000	1	10 ⁻²
		10 ⁻²	10 ⁻⁴	2700	10	10 ⁻¹
352 S..... 0	Tolerance band for contour monitoring	10 ⁻⁴	–	32000		
		10 ⁻³	10 ⁻⁵	32000		
		10 ⁻²	10 ⁻⁴	32000		
353 S..... 0	Position monitoring delay	–	–	16000	ms	ms
354 S... 10000	Set speed limit	–	–	12000	VELO	VELO
355 S..... 10	Circle end point monitoring	10 ⁻⁴	–	32000	10 ⁻⁴	–
		10 ⁻³	10 ⁻⁵	32000	10 ⁻³	10 ⁻⁵
		10 ⁻²	10 ⁻⁴	32000	10 ⁻²	10 ⁻⁴
356 S..... 10	Threshold for inserting compensating movements with CRC	10 ⁻⁴	–	32000	10 ⁻⁴	–
		10 ⁻³	10 ⁻⁵	32000	10 ⁻³	10 ⁻⁵
		10 ⁻²	10 ⁻⁴	32000	10 ⁻²	10 ⁻⁴
357 S..... 0	Spindle drift	–	–	± 500	VELO	VELO
358 S..... 0	Dynamic smoothing exponent for thread	–	–	5	(2 ^{x-1})-cycle time	
359 S..... 500	Maximum speed of gears	–	–	9999	rev/min	rev/min
360 S.... 1000		–	–	9999	rev/min	rev/min
367 S..... 5	Spindle speed tolerance at rest	–	–	99	%	%
368 S..... 10	Maximum spindle speed tolerance	–	–	99 (100)	%	%
369 S..... 50	Tolerance for speed	–	–	125	0.01 %	0.01 %
370 S.....	Maximum spindle speed	–	–	9999	rev/min	rev/min

Common machine data (MD)

Manual input (with standard values set auto- matically)	Explanation	Resolution		Maximum input value	Dimension of input value	
		Metric Degr. mm/°)	Inch (")		Metric Degr. mm/°)	Inch (")
373 S... 10000	Reference point approach speed	10 ⁻⁴	-	3000	1	-
		10 ⁻³	10 ⁻⁵	30000	1	10 ⁻²
		10 ⁻²	10 ⁻⁴	300000	1	10 ⁻²
374 S..... 500	Incremental feedrate	10 ⁻⁴	-	3000	1	-
		10 ⁻³	10 ⁻⁵	30000	1	10 ⁻²
		10 ⁻²	10 ⁻⁴	300000	1	10 ⁻²
375 S..... 200	Dry run feedrate	10 ⁻⁴	-	3000	1	-
		10 ⁻³	10 ⁻⁵	30000	1	10 ⁻²
		10 ⁻²	10 ⁻⁴	300000	1	10 ⁻²
376 S.... 1000	Spindle servo inhibit delay	-	-	16000	ms	ms
377 S..... 0	Minimum spindle motor speed	-	-	8192	VELO	VELO
378 S..... 0	Spindle cutoff speed M 19	-	-	9999	rev/min	rev/min
379 S..... 0	Gain M 19	-	-	10000	1/min·360	1/min·360
380 S..... 0	Position limit M 19	-	-	1000	1/11 deg.	1/11 deg.
381 S..... 0	Software version	-	-	(32000)	-	-
382 S..... 290	R parameter input limit	-	-	499	-	-
383 S..... 0	Increase sampling time	-	-	± 20	1/2 ms	1/2 ms
384 S..... 0	5 or 8 MHz software	-	-	8	MHz	MHz
386 S..... 0	Accelerating time	-	-	32000	4 ms	4 ms
387 S..... 0	constants for gears 1 + 2	-	-			

Common machine data (MD)

Manual input (with standard values set auto- matically)	Explanation	Resolution		Maximum input value	Dimension of input value	
		Metric Degr. mm/°)	Inch (")		Metric Degr. mm/°)	Inch (")
388 S..... 0	Start for "standard" parameters	-	-	399	-	-
389 S..... 0	Start for "fast" parameters	-	-	399	-	-
390 S..... 0	Groove signal prolongation	-	-	16000	ms	ms

13.10.3 Basic compatibility of NC and PLC versions of SINUMERIK 3G

Basic versions 4A and 4B/5MHz with single and dual PLCs

**13.10.3 Basic compatibility of NC and PLC versions of SINUMERIK 3G
Basic versions 4A and 4B/5MHz with single and dual PLCs**

Single PLC

Versions		NC software version															Package 1: display program					
		5MHz GWE: S34..									8MHz S37..			8MHz SMD S39..								
		56	58	61	01	02	03	04	05	06	01	02	03	01	02	03	01	02	03	04	05	06
PLC basic program version	01	X	X																			
	02	X	X																			
	03	X	X														X	X	X			
	04	X	X														X	X	X			
	05			X	X	X	X	X	X	X							X	X	X			
	06			X	X	X	X	X	X	X							X	X	X			
	07			X	X	X	X	X	X	X										X	X	X
	08			X	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X
	09			X	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X
Package 1: Display program version	01	X	X	X	X	X	X	X	X													
	02	X	X	X	X	X	X	X	X													
	03	X	X	X	X	X	X	X	X													
	04			X	X	X	X	X	X	X	X	X	X	X	X							
	05			X	X	X	X	X	X	X	X	X	X	X	X							
	06			X	X	X	X	X	X	X	X	X	X	X	X							

PLC basic program version: 6FC3 981-7CAA**

Display program version: 6FC9 371-2FA**

Dual PLC

Versions			NC software version												Package 1: display program						
			5MHz GWE: S34..						8MHz S37..			8MHz SMD S39..									
			61	01	02	03	04	05	06	01	02	03	01	02	03	PLC 1: 01	01 01	01 02	01 03	01 04	02 05
PLC basic program version	PLC1	PLC2																			
	01	01	X	X	X	X	X	X								X	X	X	X	X	X
	02	02	X	X	X	X	X	X								X	X	X	X	X	X
	04	04					X	X	X	X	X	X	X	X		X	X	X	X	X	X
	05	05					X	X	X	X	X	X	X		X	X	X	X	X	X	X
	06	06					X	X	X	X	X	X	X		X	X	X	X	X	X	X
Package 1: Display program version	01	01	X	X	X	X	X	X													
	01	02	X	X	X	X	X	X													
	01	03	X	X	X	X	X	X													
	01	04	X	X	X	X	X	X	X	X	X	X	X								
	02	05	X	X	X	X	X	X	X	X	X	X	X								

PLC basic program version: PLC1:6FC3 981-7CB**

PLC2:6FC3 981-7CC**

Display program version: PLC1:6FC9 371-2FB**

PLC2:6FC9 371-2FC**

13.11 NC machine data bits (TEST)

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
400S		No additional stroke after Gxx 82-84 6)	Reciprocation Gxx 81 only with feed 6)	Endless rotating axis only with feed 6)	No full-revolution with rotary axis 6)	Basic setting G51 2) | G52 2) | G53 2)		
401S	6)	No check M03, M04, M05 in the NC 6)	M103, M104, M105 as M03, M04, M05 to the PLC 6)	Compensation after ref. point app. 1st axis 3) 4)	M05 without effect on Spindle 1 3) 4)	Braking ramp with Reset 4)	S overstore effective with Input 2) 4)	IPO/position controller 1:1 in calculation 3) 5)
402S								
403S 1st axis	Axis available			Software limit switch active		Sign change for actual part position	Sign change for set speed	Ref. point approach in neg. direction
404S 2nd axis	Axis available			Software limit switch active		Sign change for actual part position	Sign change for set speed	Ref. point approach in neg. direction
405S 3rd axis	Axis available			Software limit switch active		Sign change for actual part position	Sign change for set speed	Ref. point approach in neg. direction
406S 4th axis	Axis available			Software limit switch active		Sign change for actual part position	Sign change for set speed	Ref. point approach in neg. direction
407S	Enable NC-Start without ref. point	Reset without effect on spindle	M00 activates spindle stop	Sign change set spindle position	Speed in 0.1 rev/min	Spindle pulse encoder available	Sign change actual spindle value	Actual spindle value times 2
408S	No delay at limit switch	Reset position inch input (G70)	F external in input system		Short-circuit S input data	Auxiliary functions output before trav.	Output of auxiliary ② functions with block search	
409S	Machine data entered		Feedrate not contour related 1)				Measuring-circuit PCB available	
410S LO Active with			R parameters user data	Preset mode	Part program correction	Dry run feedrate	P number input cursor	Transfer of S,M,G,L



Only active after Power On Reset

Function available from software version

1) S3701 4) S3901

2) S3702 5) S3902

3) S3703 6) S3903

Machine data bits (TEST)

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
411S V.24 (RS 232C) input	Device coding (input device) ⑤			Baud rate (input device) ⑥				
412S V.24 (RS 232C) output	Device coding (output device) ⑤			Baud rate (output device) ⑥				
413S	EIA - code ① 1)							
414S	DC control character without parity V.24 (RS232C)	No. conversion as per MD 413, 428, 429 1)	No time watchdog V24 (RS 232C) 3) 4)	V.24 (RS232C) Reset also with CTS = "0" (-12V) 3) 5)		NC Ready common disable 1)		
415S		External data input					Thread cutting and rotational feedrate	
416S	End of block with CRLF				High-speed meas.	NC alarm texts		V.24 (RS 232C)
417S	Customer module	Direct circle radius programming			Spindle override active thread		Kv factor measured	14 bit DAC
418S		Inclined axis		Auto IR during reciproc.			Dividing head	
419S	Internal display bits							
424S	M104 without effect on S 1	Rapid cycle calc. R parameters	Diameter monitoring with para. change	R parameter rotary axis for P11-P16	Inhibit manual dressing position	Software limit switch for inclined axis	Override 0 % with Gxx63	Reciproc. interrupt for single block
425S	Direction of spindle rotation via PLC 1)	Rapid cycle calc. for PI, P11 ... P16 1)	Store block No. in display 2)	No "SINUMERIK 3G" text 1)	V.24 (RS 232C) output without trailer	Dual PLC	F external	G0195 for active spindle speed 1)
426S	Spindle monitoring with act. speed 1)	Diameter monitoring 1)	No output of M17 to PLC 3) 4)	Whl width monit. with para. change 1)	Wheel width monitoring 1)	Automatic allowance for wheel width 1)	Z programming with GxxBx as stroke	No dwell time after external subrout.
427S		No M 19 abort on reset 1)	M 19 with axis movemen 1)				Parallel programming 6)	

Function available from software version:



Only active after Power On Reset

- 1) S3701 4) S3901
- 2) S3702 5) S3902
- 3) S3703 6) S3903

Machine data bits (TEST)

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
428S	EIA - code for multiplication sign							
429S	EIA - code for multiplication sign							
430S 1st axis	Without inch/metric conversion 4)	Set speed x 10	Rotary axis	Diameter program	Calliper axis for Gxx93	Input / Output Resolution		
431S 2nd axis	Without inch/metric conversion 4)	Set speed x 10	Rotary axis	Diameter program	Calliper axis for Gxx93	Metric: 10 µm	0,1 µm	0,1 µm
432S 3rd axis	Without inch/metric conversion 4)	Set speed x 10	Rotary axis	Diameter program	Calliper axis for Gxx93	Inch: 0.0001"	0.00001" a)	-
433S 4th axis	ohne Zoll/ Metrisch Wandlg. 4)	Drehzahl- Sollwert x 10	Rund- achse	Durch- messer- programm	Meß- zgn.achse f. Gxx93	Rund: 0,01 °	0,001 °	0,0001 °
434S 1st axis	Actual part position pulse weighting using							
	1/4	1/2	2	4	Coding of axis name			⑧
435S 2nd axis	1/4	1/2	2	4	Coding of axis name			⑧
436S 3rd axis	1/4	1/2	2	4	Coding of axis name			⑧
437S 4th axis	1/4	1/2	2	4	Coding of axis name			⑧
438S								
439S	Set part position x 4 1)	Set part position x 2 1)	Post inter- polation 1)	1st and 3rd axis ref. point app. after angle change 2)	1st axis ref. point app. after angle change. 2)	G 97 not initial setting with NC-Start 2)	Gxx96 without absolute- value gen. 1)	Gxx96 wit- hout angle allowance 1)
450S.. 455S	See Section 13.12 for PLC machine data bits							
456S	PLC MADA transm. on Power on reset 1)							
457S.. 479S	See Section 13.12 for PLC machine data bits							



Only active after Power On Reset

Function available from software version:

- 1) S3701 4) S3901
2) S3702 5) S3902
3) S3703 6) S3903

The following machine data may be overwritten by the PLC:

No. 120 - 123	Acceleration
No. 150 - 153	Kv factor
No. 160 - 163	Software limit switch positive
No. 170 - 173	Software limit switch negative
No. 180 - 183	Reference point value
No. 240 - 243	Stop tolerance range 2
No. 299	Inclined axis angle
No. 390	Groove signal prolongation
No. 379	Position control loop gain (M19)
No. 380	Position tolerance for M19
No. 386	Accelerating time constant for gear 1
No. 387	Accelerating time constant for gear 2

The following machine data bits may be overwritten by the PLC:

No. 403 - 406	Bits 0, 1, 2	Sign change for set / actual values Approach to reference point
No. 407	Bits 0, 1	Sign change for actual spindle value, actual spindle value $\underline{y} * 2$
No. 418	Bit 6	Inclined axis
No. 411		V.24 (RS 232C) input
No. 412		V.24 (RS 232C) output
No. 426	Bits 3, 6	Wheel width monitoring, diameter monitoring
No. 439	Bits 0, 1	Gxx 96 without angle allowance and without absolute-value generation

a) Not with 3GE Function available from:

- 1) S3701 3G-4B 5/8 MHz
- 2) S3702 3G-4B 5/8 MHz
- 3) S3703 3G-4B 5/8 MHz
- 4) S3901 3G-4B SMD
- 5) S3902 3G-4B SMD
- 6) S3903 3G-4C

5 Device coding
Significance of bits

Bit	7	6	Number of stop bits
0	1	1	1 stop bit
1	0	0	1 1/2 stop bits
1	1	1	2 stop bits

Bit	5	Parity type
0	0	Odd
1	1	Even

Bit	4	Parity type
0	0	Without parity
1	1	With parity

Bit	3	Evaluate availability (DSR)
0	0	No
1	1	Yes

6 Baud rate

Bit	2	1	0	Baud
0	0	0	0	110
0	0	0	1	150
0	1	0	0	300
0	1	1	0	600
1	0	0	0	1200
1	0	1	0	2400
1	1	0	0	4800
1	1	1	0	9600

7 Auxiliary function output with search

Bit	1	0	Output
0	0	0	None
0	0	1	After Cycle-Start
1	0	0	During search
1	0	1	-

8 Coding of axis name

Axis name	Bit
X	0000
Y	0001
Z	0010
U	0110
V	0111
W	1000
A	0011
B	0100
C	0101
Key lock	1111

13.12 PLC machine data

Ident No.	Explanation	Maximum input value NC side	
250	Standard FBs	+ 9999	
251		-”-	
252		-”-	
253		-”-	
254		-”-	
255		-”-	
256		-”-	
257		-”-	
258		-”-	
259		-”-	
260	-”-		
261	-”-		
262	User	-”-	
263		-”-	
264		-”-	
265		-”-	
266		-”-	
267		-”-	
268		-”-	
269		-”-	
270		-”-	
271		-”-	
272	Standby	-”-	
273		-”-	
274		-”-	
275		-”-	
276		-”-	
277		-”-	
278		-”-	
279		-”-	

Display (TEST)

MD No.	Axis	Display	I / O resolution		Dimension of input value	
			Metric mm/°	Inch (")	Metric mm/°	Inch (")
800 S	1st	Following error	10 ⁻⁴	–	10 ⁻⁴	–
801 S	2nd	Following error	10 ⁻³	10 ⁻⁵	10 ⁻³	10 ⁻⁵
802 S	3rd	Following error	10 ⁻²	10 ⁻⁴	10 ⁻²	10 ⁻⁴
803 S	4th	Following error				
810 S 5)	1st	Actual value (meas. sys.)	10 ⁻⁴	–	10 ⁻⁴	–
811 S	2nd	Actual value (meas. sys.)	10 ⁻³	10 ⁻⁵	10 ⁻³	10 ⁻⁵
812 S	3rd	Actual value (meas. sys.)	10 ⁻²	10 ⁻⁴	10 ⁻²	10 ⁻⁴
813 S	4th	Actual value (meas. sys.)				
820 S	1st	Set speed	VELO = $\frac{10V}{8192}$			
821 S	2nd	Set speed				
822 S	3rd	Set speed				
823 S	4th	Set speed				
830 S	1st	Actual part position	10 ⁻⁴	–	10 ⁻⁴	–
831 S	2nd	Actual part position	10 ⁻³	10 ⁻⁵	10 ⁻³	10 ⁻⁵
832 S	3rd	Actual part position	10 ⁻²	10 ⁻⁴	10 ⁻²	10 ⁻⁴
833 S	4th	Actual part position	Position control sampling time: 9 ms			
840 S	1st	Contour monitoring	10 ⁻⁴	–	10 ⁻⁴	–
841 S	2nd	Contour monitoring	10 ⁻³	10 ⁻⁵	10 ⁻³	10 ⁻⁵
842 S	3rd	Contour monitoring	10 ⁻²	10 ⁻⁴	10 ⁻²	10 ⁻⁴
843 S	4th	Contour monitoring				
850 S	1st	Measured Kv factor	0.001	$\frac{m/min}{mm}$	0.001	$\frac{inch/min}{inch}$
860 S	–	Set speed, spindle 1	VELO = $\frac{10V}{8192}$			
861 S	–	Spindle position	$\frac{360^\circ}{4096}$			

5) Can be read by the PLC from S3902 onwards

PLC machine data bits

No.									NC 1	NC 2	NC 1	NC 2
	7	6	5	4	3	2	1	0	DB 9	DB 20	DB 22	
450										DL 94	-*	
451										DL 94	-	
452		Reset key not act on k/lock		M 19 chge signal ext.	M/S/H chge signal ext.	Group signal S5-432 mod.	Time alarms 10 s | 2s		DL 0	-	DL 95	-*
453	Time alarms 1 s | 200 ms | 100 ms | 20 ms | 10 ms				ELG 2) Com. pack.	Number of NCs = 1 =		DR 0	-	DR 95	-*	
454	Binary coded for menu display No. of DB								DL 1	-	DL 96	-*
455		External dual PLC	PC key via MO.1	3G keys (.,-)	Menu for status progr. 1)	2. Logic sub-mod. 1	MSTT via logic sub-mod. Gray C	MSTT via logic sub-mod. 1 : 1	DR 1	-	DR 96	-*
456	PLC-MD input								DL 2	DL 36	DL 97	DL 97
457		M signal latching	MSTT from flag	MSTT from I/O device 1)			Standard S transf. 1)	Standard M de-coder 1)	DR 2	DR 36	DR 97	DR 97
458									DL 3	DL 37	DL 98	DL 98
459								NC as ELG 2)	DR 3	DR 37	DR 98	DR 98
460						4)	4)	4)	DL 4	DL 38	DL 99	DL 99
461	4)	4)	4)	4)	4)	4)	4)	4)	DR 4	DR 38	DR 99	DR 99

PLC machine data bits

No.									NC 1	NC 2	NC 1	NC 2
	7	6	5	4	3	2	1	0	DB 9	DB 20	DB 22	
462									DL 5	DL 39	DL 100	DL 100
463	4)	4)	4)	4)				4)	DR 5	DR 39	DR 100	DR 100
464	Machine data bits for user								DL 6	DL 40	DL 101	DL 101
465	Machine data bits for user								DR 6	DR 40	DR 101	DR 101
466 to 457	Machine data bits for user								DL 7	DL 41	DL 102	DL 102
									DR 13	DR 47	DR 108	DR 108

MD = Machine data
MSTT = Machine control panel

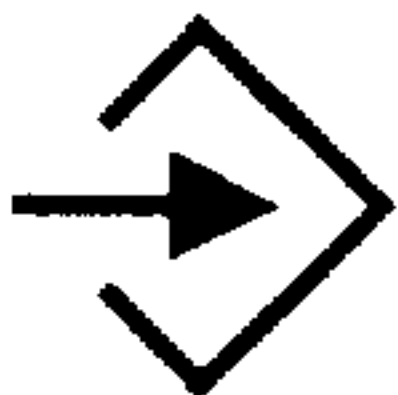
= 1 = 00 = 1NC
 01 = 2NC
 10 = 3NC
 11 = 4NC

- 1) Presetting without DB9 or MD in NC
- 2) ONLY in DB9
- 3) ONLY in NC
- 4) PLC-MD for computer link
(see Interface Part 2)

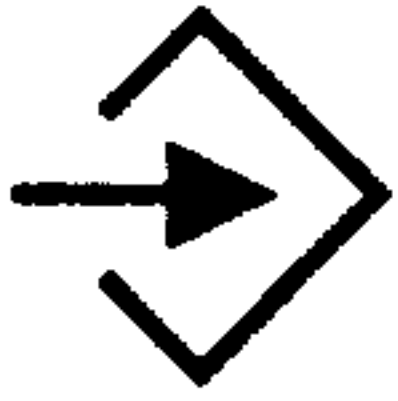
DL/DR for NC3/NC4 see Section 7
 * Common MD only in NC1

13.13 Setting data

13.13.1 R Parameter display and input

Input No.	Address	Display / Input		Sign	Number of decades	Dimension
25	N	Setting data bits	X	-	8	-
26	N	Setting data bits	X	-	8	-
100 to 199	R	R parameters	X	±	9	-
200 to 203	R	Pass counter levels 1 ... 4	X	+	9	-
204 to 206	R	Minimum grinding wheel diameter wheels 1 ... 3	X	+	5.3	mm
207 to 209	R	Diameter of new grinding wheel wheels 1 ... 3	X	+	5.3	mm
210	R	Reversal time for left-hand reversal point	X	+	6	ms
211 to 219	R	Specified value for PLC auxiliary axes	X	±	5.3	mm
220	R	Reversal time for right-hand reversal point	X	+	6	ms
221 to 229	R	Feedrate for PLC auxiliary axes	X	±	5.2	mm/min
230 to 241	R	Compensation	X	±	5.3	mm
242 to 253	R	Dressing sum	X	±	5.3	mm
254 to 265	R	Zero offset	X	±	5.3	mm
266 to 268	R	Dressing axis	X	+	1	-

R Parameter display and input

Input No.	Address	Display / Input		Sign	Number of decades	Dimension
269 to 277	R	Wheel radius compensation data	X	+	5.3	mm
278	R	Determination of left-hand/right-hand reversal point on deselection reciproc. (Gxx80)	X	+	1	-
279 to 290	R	Absolute dressing position wheels 1 ... 3	X	±	5.3	mm
291	R	Meas. path, meas. input	-	+	9	mm
292 to 295	R	Absolute actual value at machine zero relative to axes 1 ... 4	-	±	5.3	mm
296 to 299	R	Contents of actual-value display, axes 1 ... 4 (Cartesian)	-	±	5.3	mm
300 to 302	R	Minimum grinding wheel width wheels 1 ... 3	X	+	5.3	mm
303 to 305	R	Width of new grinding wheel	X	+	5.3	mm
306 to 308	R	Dressing axis, minimum width	X	+	1	-
309	R	Temporarily freely assignable R parameter	X	±	9	-
310 to 313	R	DRF values axes 1 ... 4	X	+	5.3	-
314 to 349	R	Temporarily freely assignable R parameters	X	±	9	-
350 to 499	R	Freely assignable R parameters	X	±	9	-

13.13.2 Setting data bits

Setting data bits No. 25 (Operator data)

Bit \ Input	0	1
7	Cycles operator prompting OFF	Cycles operator prompting ON
6	No text transfer to memory	Text transfer to memory
5	Punch out ISO code	Punch out EIA code
4		
3	Program start with %	Program start with LF
2	Tape block parity OFF	Tape block parity ON
1	R parameter text display OFF	R parameter text display ON
0	Output comments with single block OFF	Output comments with single block ON

Setting data bits No. 26 (Operator data)

Bit \ Input	0	1
7		
6		
5		
4		
3		
2	Handwh. pulse weight. Increment per division 0	Handwh. pulse weight. Increment per division 100
1	Handwh. pulse weight. Increment per division 0	Handwh. pulse weight. Increment per division 10
0	Handwh. pulse weight. Increment per division 0	Handwh. pulse weight. Increment per division 1

Setting data bits No. 25 and 26 may also be modified by the PLC.

13.14 Alarm list

Acknowledge alarms with



3rd decade 1st + 2nd decades	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				Axis 1			Axis 1	Axis 1
01				Axis 2			Axis 2	Axis 2
02				Axis 3			Axis 3	Axis 3
03				Axis 4			Axis 4	Axis 4
10	Axis 1			Axis 1	Axis 1	Axis 1	Axis 1	Axis 1
11	Axis 2			Axis 2	Axis 2	Axis 2	Axis 2	Axis 2
12	Axis 3			Axis 3	Axis 3	Axis 3	Axis 3	Axis 3
13	Axis 4			Axis 4	Axis 4	Axis 4	Axis 4	Axis 4
22	Spindle pulse encoder contam. error			Maximum spindle speed too high	Spindle measuring-circuit monitor *)	EMERGENCY STOP	Controller not ready	
23	Time monitor V.24 (RS232C) interface	Overflow 2 Hardware error reader	Inhibit step error	Overflow	Parity	Control word over written	Overflow 1	Inhibit step parity error
		← USART hardware error →				← READER hardware error →		
24							Overtemperature	
25		Block without LF or > 120 characters			Operator error V.24 (RS232C) interface	Parity error in memory	Program not in memory	Block not in memory
26								Coincidence not found in search
27	Memory overflow	Stored program ≠ tape program	Tape format error	Tape input inhibited	Block with more than 120 characters	Block parity error	Invalid EIA character	Character parity error

Acknowledge alarms with



3rd decade 1st + 2nd decades	8	7	6	5	4	3	2	1
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
28	Sub-routine error		Gxx80 programmed more than once	3G: decoding error				General decoding errors
30	Circle end point error	No half / full degree pos. with rot. axes			Zero offset or tool with illegal value	G92 P programming error	Option not available	Circle not in selected plane
31		Too many axes to traverse	No F word programmed or too large		Thread lead programming error			
32							Illegal program block with selected CRC	
33								Modulo number = 0 with rotary axis
34								
35								NC-Start without reference point
36								
37						Block number error operator prompt.		Wrong format operator prompt.

Acknowledge alarms with



**

3rd decade 1st+2nd decades	8	7	6	5	4	3	2	1
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
50	Axis programmed twice or more than 2 axes		Wheel radius compensation contour error		Block structure error		More than 6 geometry params.	General
← Reparable programming errors →								
51		Subroutine start in JOG and INC prohib by G06	Block not fully displayable	Selected block number not available	Block with more than 120 characters	Memory overflow	Input inhibited	Input only in reset state
52	K _V -factors not recorded contour monitoring error	K _V -factors for axes not identical	Subroutine call	DRF activated with Gxx12 programming		Stop during threading	Impermissible PLC signal	Strobe input error
54	Parameter value too high for NC-PLC	Parameter value not displayable for PLC				Minimum wheel width reached	Minimum wheel diameter reached	Reciprocation terminated
55	Option not available							Operator prompt. cycle &L ≠ L
Restart								
70		Memory * shift CANCEL 4					Address code error in machine data	
71								Battery alarm

* cause: Software change without CANCEL 4

** Input line (bottom line) must be deleted **completely!**

Error 70 X may not be deleted with RESET nor with CLEAR!

Error 71X may be deleted with CLEAR!

See Operator's Guide, Part 3 for detailed description of alarms!

13.14 Alarm list

Decoding errors

3rd decade 1st+2nd decades	9 8 7 6 5 4 3 2 1 0									
	38	Option not available	Dwell time too long	G factor not allowed	Format G factor	Address not allowed	1st block character incorrect	Format comment			Format with block number
39	No axis feedrate	Wrong division number	Axis for dividing head missing	No division programmed	Modulo division with linear axis	Rotary axis not to reciprocate	With Gxx33 axis or I/K missing	Rot. axis: Modulo number missing	With G93: rot. axis or diameter prog.	1st or 3rd axis is rotary axis
40	Too many parameter calculations	Too many interpolation parameters	Format interpolation parameters	Program interpolation error	G factor in wrong sequence	Format or G factor error	Axis not available	Format parameter assignment	Negative feedrate	Feedrate programming error
41	Format M factor	Axis programmed twice	No inclined axis / wheel	Feedrate parameter	Oper. character error	Format parameter calculation	R para. character not recognized	DP error with parameter	No equals sign	Result parameter error
42	Axis recip. programmed more than once	Axis recip. already programmed	Reversal time too long	Reciprocation I/K params. missing	Reciprocation axes wrong	Reciprocation stroke not program.	Format J/K parameters	Too many sparking-out strokes	Gxx33: too many axes	Not possible with S1
43	3rd axis prog. at same time as G06		Assignment Gxx85	Format jump condition	Spindle speed too high	Format spindle speed	Rot. axis programmed repeatedly	Gxx33: axis for I missing	Gxx96: wrong axis	Format H factor
44	Axis feedrate missing or 0		G93 without feed axis	Gxx93: G91 not allowed	Gxx93: axis code error	G93 without meas. value param.	G93 programmed more than once	Measuring axis not available	3rd axis must not be measuring axis	More than one measuring axis
45	Circle radius error				Axis programmed more than once			Combination G29 / Gxx33		Path feedrate missing or 0
46	1 jump or subroutine on call				Syntax/format spindle position					Circle end point error
47	No sequence block available		Combination R298 / 3rd axis		CRC : cutter position error	Subroutine: M17 in wrong sequence	Subroutine: pass counter is R0	Nesting depth exceeded	Start block No. > 9999	Format subroutine call

Decoding errors

		3rd decade									
		9	8	7	6	5	4	3	2	1	0
48	Format auxiliary axes	More than 1 auxiliary axis		External subroutine call	SNS: block not available	Subroutine not available	Block not in subroutine	Main program not available	Jump dest. not in prog. memory	Block not in subroutine	
49					Division by zero		G21/G22 dressing axis missing	Minimum wheel width missing	Minimum wheel diameter	Overflow param. calculation	

13.15 NC interface signals

Direction of transfer PLC → NC
 (Applicable to 4A, 4B/5MHz)

NC		PLC-NC interface								PLC
Test		Data bit								3G DB20 = 1 =
No.	Byte	7	6	5	4	3	2	1	0	
7	0	Mode selector								34 L
		D	C	B	A	D	C	B	A	
7	1	Key-oper. switch	Dry run	Feed evaluation 1:10	Single block	Block search	Spindle override switch			34 R
7	2	Rap. trav. override active	Rapid traverse override	Direction keys	+	Axis selection	B	A	Servo enable 1	35 L
7	3		Data start	Data start	Reset	DRF handwheel	NC Start	*Deceleration 2	Servo enable 2	35 R
8	4		Grinding wheel code	B	A	Spindle enable	Feed enable	*Deceleration 3	Servo enable 3	36 L
8	5	* EMERG-ENCY STOP	Input enable			General axis inhibit	No operator panel	*Deceleration 4	Servo enable 4	36 R
8	6		Key lock		Feed enable 1		External input 1	Axis inhibit 1	Follow-up oper. 1	37 L
8	7	V.24 (RS232C) inhibit		Cycle inhibit	Feed enable 2		External input 2	Axis inhibit 2	Follow-up oper. 2	37 R
9	8	Synchronise			Feed enable 3		External input 3	Axis inhibit 3	Follow-up oper. 3	38 L
9	9	Handwheel inhibit			Feed enable 3		External input 4	Axis inhibit 4	Follow-up oper. 4	38 R

= 1 = NC1 DB20, NC2 DB22
 NC3 DB24, NC4 DB26

Direction of transfer PLC → NC
(Applicable to 4B/5MHz)

NC		NC interface control or PLC										PLC
Test		Data bit										3G DB20 =1=
No.	Byte	7	6	5	4	3	2	1	0			
10	0	Actual rotation clockwise	Speed limit	Spindle in set range	stopped	4th axis	3rd axis	2nd axis	1st axis	Travel command		39 L
10	1	Program running	NC alarm	NC Ready 2	NC Ready 1	Rapid traverse	Thread	Probe deflected	Program stop M00			39 R
10	2	Spindle position reached	Gxx96	V.24 (RS232C) active	Gear 2	Reference point reached		4	3	2	1	40 L
10	3	Spindle at rotation limit										40 R
11	4	STROBE SIGNALS										41 L
		M	S	H	Reverse	M02/M30 Reset						
11	5	BCD output										41 R
		D 10 ¹	C 10 ¹	B 10 ¹	A 10 ¹	D 10 ⁰	C 10 ⁰	B 10 ⁰	A 10 ⁰			
11	6	BCD output										42 L
		D 10 ³	C 10 ³	B 10 ³	A 10 ³	D 10 ²	C 10 ²	B 10 ²	A 10 ²			
11	7	BCD output										42 R
		D 10 ⁵	C 10 ⁵	B 10 ⁵	A 10 ⁵	D 10 ⁴	C 10 ⁴	B 10 ⁴	A 10 ⁴			

=1= NC1 DB20, NC2 DB22
NC3 DB24, NC4 DB26

Direction of transfer PLC → NC
 (Applicable to 4B/8MHz)

NC		PLC-NC interface								PLC
Test		Data bit								3G DB20 = 1 =
No.	Byte	7	6	5	4	3	2	1	0	
7	0	Mode selector								34 L
		D	C	B	A	D	C	B	A	
7	1	Key-oper. switch	Dry run	* Feed evaluation 1:10	Single block	Block search	Spindle override switch			34 R
7	2	Rap. trav. override active	Rapid traverse override	Direction keys	+	-	Axis selection			35 L
7	3		Data start	Reset	DRF handwheel	NC-Start	Servo enable 1			35 R
8	4		Grinding wheel code		Spindle enable	Feed enable	Servo enable 2			36 L
8	5	* EMERG-ENCY STOP	Input enable		General axis inhibit	No operator panel	Servo enable 3			36 R
8	6		Key lock		Feed enable 1	External input 1	Follow-up oper. 1			37 L
8	7	V.24 (RS232C) inhibit		Cycle inhibit	Feed enable 2	External input 2	Follow-up oper. 2			37 R
9	8	Synchronization			Feed enable 3	External input 3	Follow-up oper. 3			38 L
9	9	Handwheel inhibit			Feed enable 4	External input 4	Follow-up oper. 4			38 R

= 1 = NC1 DB20, NC2 DB22
 NC3 DB24, NC4 DB26

Direction of transfer PLC → NC
(Applicable to 4A and 4B/8MHz)

NC		NC interface control or PLC										PLC
No.	Test	Data bit										3G DB20 = 1 =
		7	6	5	4	3	2	1	0			
10	0	Actual rotation clockwise	Speed limit	Spindle in set range	stopped	4th axis	3rd axis	2nd axis	1st axis	Travel command		39 L
10	1	Program running	NC alarm	NC Ready 2	NC Ready 1	Rapid traverse	Thread	Probe deflected	Program stop M00			39 R
10	2	Spindle position reached	Gxx96	V.24 (RS232C) active	Gear 2	Reference point reached	4	3	2	1	40 L	
11	4	STROBE SIGNALS										41 L
		M	S	H	Reverse +	Reverse -	M02/M30 Reset					
11	5	BCD output										41 R
		D 10 ¹	C 10 ¹	B 10 ¹	A 10 ¹	D 10 ⁰	C 10 ⁰	B 10 ⁰	A 10 ⁰			
11	6	BCD output										42 L
		D 10 ³	C 10 ³	B 10 ³	A 10 ³	D 10 ²	C 10 ²	B 10 ²	A 10 ²			
11	7	D 10 ⁵	C 10 ⁵	B 10 ⁵	A 10 ⁵	D 10 ⁴	C 10 ⁴	B 10 ⁴	A 10 ⁴			42 R

= 1 = NC1 DB20, NC2 DB22
NC3 DB24, NC4 DB26

13.16 PLC interface signals

PLC output signals to NC

Group	Byte address				Bit number							
	NC1	NC2	NC3	NC4	7	6	5	4	3	2	1	0
Ready signals	Q64	Q74	Q84	Q94	*Emergency Stop	Operator panel inhibit	Key lock	V.24 (RS-232C) inhibit	Cycle lock	Hand-wheel inhibit	Reset	Data start
Program influencing	Q65	Q75	Q85	Q95	NC-Start (ST)	Enable start (FRST)	Input enable		Syn-chroni-zation			
Feedrate influencing	Q66	Q76	Q86	Q96	Feed enable			External input 1	External input 2	External input 3	External input 4	DRF hand-wheel
Spindle influencing	Q67	Q77	Q87	Q97		Grinding wheel code B	A	Set spindle rotation clockwise	Spindle enable	Spindle resynch-ronizing	Follow-up oper-ation spindle 1	
Axes general	Q68	Q78	Q88	Q98								General axis inhibit
Axis-specific signals	Q69	Q79	Q89	Q99		1	1	1	1	1		
	Q70	Q80	Q90	Q100		2	2	2	2	2		
	Q71	Q81	Q91	Q101		3	3	3	3	3		
	Q72	Q82	Q92	Q102		4	4	4	4	4		
	Q73	Q83	Q93	Q103								
						Follow-up oper-ation	Axis inhibit	*Refer-ence point decelera-tion	Feed enable	Servo enable		

▲ From 4B/8MHz version

PLC input signals to NC

Group	Byte address				Bit number							
	NC1	NC2	NC3	NC4	7	6	5	4	3	2	1	0
Ready signals	164	174	184	194	Program running			NC Ready 2	NC Ready 1	V.24 (RS 232C) active		
	165	175	185	195				NC alarm				
Program commands	166	176	186	196	Probe deflected	Thread Gxx33			Rapid traverse	v = constant Gxx96		
	167	177	187	197	Program stop M00	Program end M02/M30						
Spindle	168	178	188	198	Actual spindle rotation clockw.	Spindle speed limit	Spindle in set range	Spindle position reached	Spindle stopped			Gear 2
Axis-specific signals	169	179	189	199	Reverse +	Reverse -					1	1
	170	180	190	1100							2	2
	171	181	191	1101							3	3
	172	182	192	1102							4	4
	173	183	193	1103					Spindle speed at limit			
											Ref. point reached	Travel command

▲ From 4B/8MHz version

13.17 Operating systems

SINUMERIK 3G is supplied in two different hardware versions. Both versions use the same check-sum test. An EPROM error is displayed on screen. When the check-sum test is activated, the alarm EPROM ERROR FOUND AT....is displayed. The complete software must then be replaced.

- **Basic version 4A (03200 board)**

When the software is replaced the basic system and language must be ordered:

- Item No. 548 818.9001. XX Basic system
- Item No. 548 818.9002. XX English
- Item No. 548 818.9003. XX German
- Item No. 548 818.9004. XX French
- Item No. 548 818.9005. XX Italian
- Item No. 548 818.9006. XX Spanish

The basic system comprises EPROMs 3 to 20 and 25 to 32 and is identical for all languages. The languages are located on EPROMs 1, 2 and 21 to 24. The EPROM type is 2532 and is located on the 03200 board. XX refers to the software version.

- **Basic version 4B, 5MHz (6FX1120-2CA00 board)**

When the software is replaced the complete operating system must be ordered:

- Item No. 570 802.9003. XX English
- Item No. 570 802.9013. XX German
- Item No. 570 802.9023. XX French
- Item No. 570 802.9033. XX Italian
- Item No. 570 802.9043. XX Spanish

The operating system comprises 4 EPROMs (type 27256). These 4 EPROMs are located on the EPROM submodule (6FX1120-60B00 board). Together with one or two RAM sub-modules (6FX1126-0BL00 board) this EPROM submodule is inserted in the memory module (6FX1120-2CA00 board). The EPROM submodule plugs into the lowest location. XX refers to the software version.

- **Basic version 4B, 8MHz (6FX1120-2CA00 board)**

When the software is replaced the complete operating system must be ordered:

- Item No. 570 830.9003. XX English
- Item No. 570 830.9013. XX German
- Item No. 570 830.9023. XX French
- Item No. 570 830.9033. XX Italian
- Item No. 570 830.9043. XX Spanish

- **Basic version 4B-SMD and basic version 4C (6FX1120-2CA00 board)**

The software is located on two submodules and can be replaced singly.
Basic submodule at slot 1 of the memory module
Item No. 570 837.9001.XX

Language submodule on slot 2 of the memory module
Item No. 570 837.9002.XX English
Item No. 570 837.9012.XX German
Item No. 570 837.9022.XX French
Item No. 570 837.9032.XX Italian
Item No. 570 837.9042.XX Spanish

13.18 Special features of spindle start-up

The following points must be borne in mind at spindle start-up, depending on the software version and number of axes used:

- **Up to Software Version 58.3**

- 2 axes (1st and 2nd axes) are defined, the set spindle value is present at the setpoint output for the third axis

Machine data preconditions:

S-analog (Option E43) = 1

S short-circuit MD 408, bit 3 = 0

Pulse encoder available MD 407, bit 2 = 1 (must also be set if pulse encoder not available)

- 2 axes (1st and 3rd axes) or more are defined, the set spindle value is present at the setpoint output for the fifth axis (spindle)

Machine data preconditions:

S-analog (Option E43) = 1

S short-circuit MD 408, bit 3 = 0

Pulse encoder available MD 407, bit 2 = 1 (must also be set if pulse encoder not available)

2nd meas. circuit option MD 409, bit 1 = 1

- **From Software Version 58.4 (corresponding to version 3461)**

- S-analog (Option E43) = 1

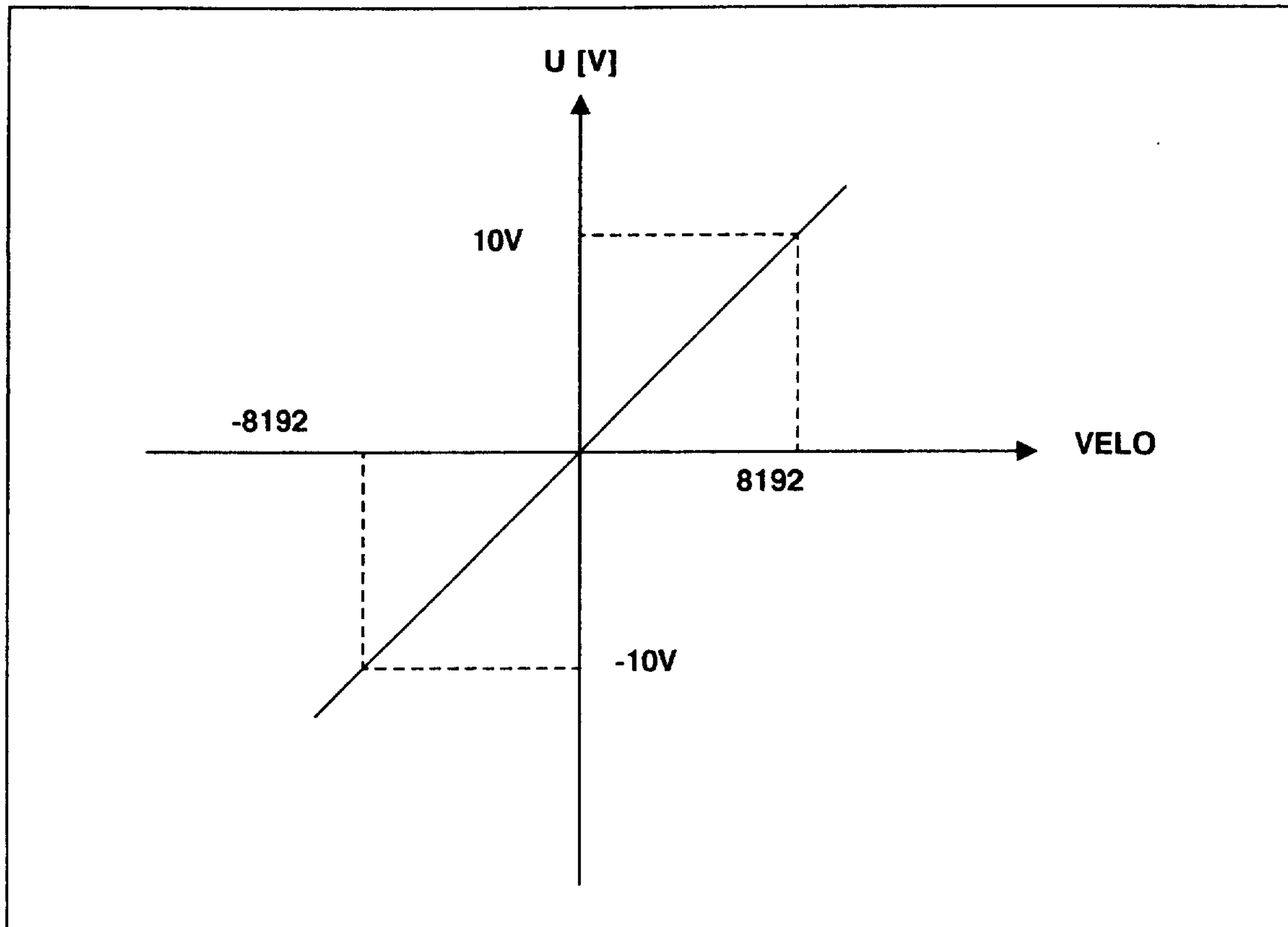
- 2 axes (1st and 2nd axes) are defined if option
2nd measuring circuit MD 409, bit 1 = 0 → setpoint, 3rd axis
= 1 → setpoint, 5th axis

- 2 axes (1st and 3rd axes) or more are defined, option
2nd measuring circuit MD 409, bit 1 = 1 must be set, setpoint 5th axis.

- See Installation Guide for all other machine data!

13.18.1 Analog spindle speed

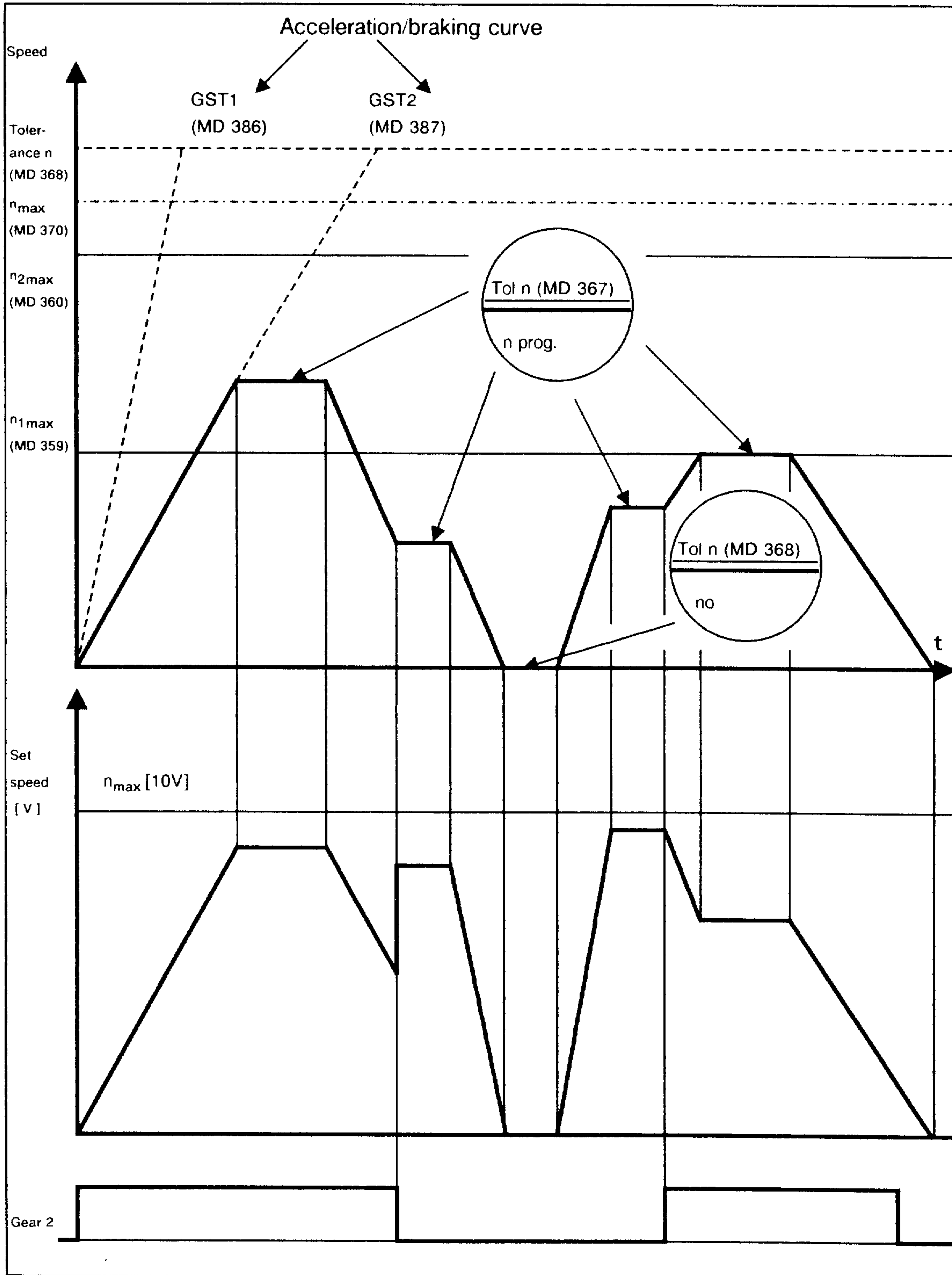
The specified value for analog spindle speed is output via the measuring-circuit boards. This value can be viewed in TEST No. 860 in VELO units (8192 Velo = 10 V).



The specified value is converted in the controller, taking the gear into account, using the maximum speed entered in TEST No. 359 and No. 360. The value entered (in rev/min) must always correspond to the same motor speed (and thus to the same setpoint voltage U). When programming this speed and gear, 8192 units (roughly 10V) are output for the maximum spindle speed entered.

Example: 2 gears

MD	Gear
No. 359 S 1000	1
No. 360 S 2000	2



Gear change response of 4B/8MHz version.

The following interface inputs must be observed:

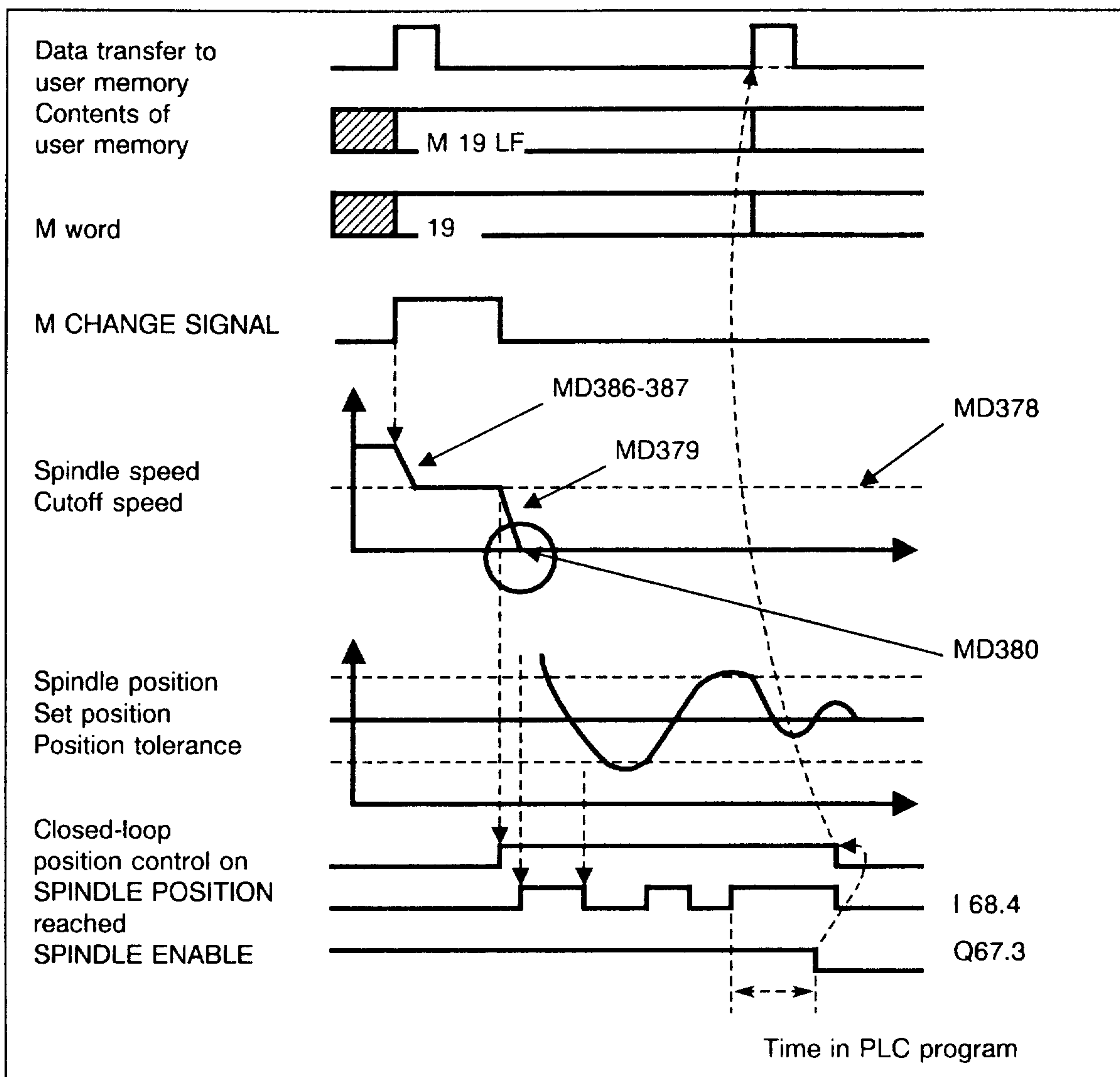
Q67.3 Spindle stop, terminates positioning

Q68.4 Position reached, message from NC to PLC, spindle is within position limit.

The following PLC machine data must be observed:

The spindle enable must be set by the PLC if M19 is to be executed by the NC (at least one PLC cycle time in advance).

M 19 Principle:



Positioning is initiated when M19 S1 is programmed in NC programs. After the cutoff speed has been reached, the spindle is subject to closed-loop position control. The effect of MD379 is similar to that of the MDs for the Kv factors of the axes. If the tolerance limit is not reached, the NC signals to the PLC "Position reached". The spindle remains under closed-loop position control until the PLC signals Spindle Stop. The spindle position can be viewed in the service values in Test 861 (0 to 360 °, corresponding to 0 to 4096 pulses, for an encoder with 1024 pulses per revolution: resolution 1/11 °).

When programming M19 Spindle Stop must not be present, otherwise positioning is not initiated.

If positioning is to be performed with the spindle at rest, the PLC machine data "Prolong M19 change signal" must be set to "1" and "Spindle Stop" cancelled by the PLC program in the same PLC cycle when M19 is output. If positioning differs in the various gears, the acceleration must be modified using machine data 386-387. PLC specification is possible from M19 onwards, see Difference Description for Interface Description, Part 2, for 3G.

M19 with Axis Movement:

There are three possibilities for M19, with and without axis movement:

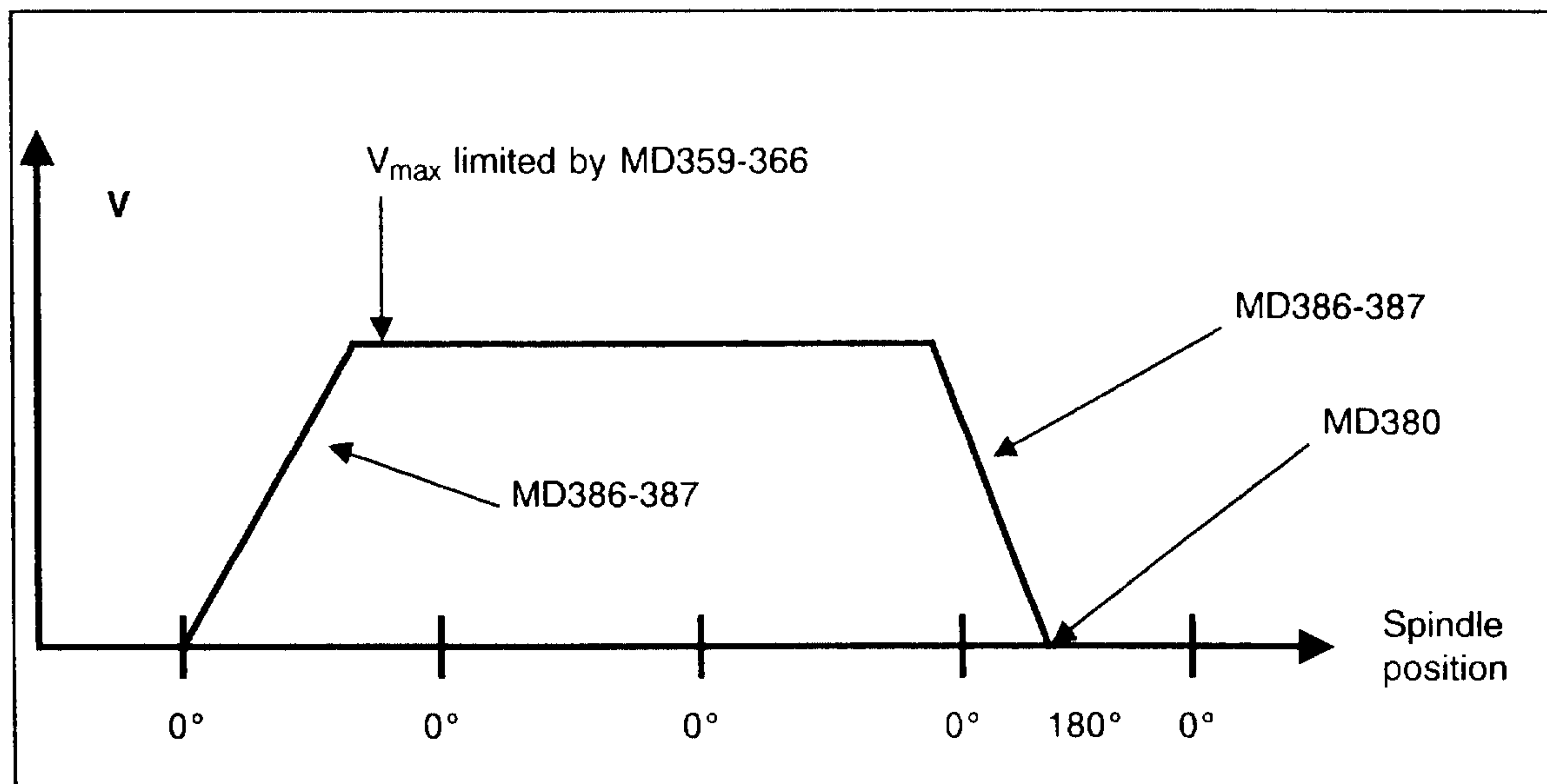
1. The next block is not started until positioning is terminated with Spindle Stop.
2. The next blocks are also processed during spindle positioning.
3. Positioning is not interrupted even with M30. Only active if MD408, bit 3 is set to 0 (S short-circuit).

In all cases M19 is terminated with Spindle Stop.

Incremental Spindle Positioning by PLC, Option E42:

This function makes it possible for the spindle to be positioned over a number of revolutions. The set position and the speed are specified by the PLC. The spindle is subject to closed-loop position control throughout the entire positioning sequence.

Principle:



- MD 373 acts as Kv factor.
- Actual value can be viewed in service values in Test 861.
- Set value can be viewed in service values in Test 860.

See also Difference Description, Part 2, for SINUMERIK 3G.

13.18.2 Oriented spindle stop M19

Note:

M19 is an optional feature (Option E42; valid from 4B/8 MHz onwards)

The following NC machine data must be observed:

		Standard
MD 357	Spindel drift	0
MD 378 ¹⁾	Spindle cutoff speed M19	200
MD 379 ¹⁾	Gain M19	200
MD 380 ¹⁾	Position limit M19	10
MD 386 ¹⁾	Accelerating time constant	0
and	for gears 1 and 2	
MD 387		
MD 407, bit 1	Sign change actual value	0
MD 407, bit 2	Pulse encoder available	1

The MD for the spindle must be entered in line with the spindle data.
S-analog and pulse encoder must be available.

1) These machine data may be overwritten by the PLC.

13.19 Inch / Metric switching

Note:

Inch / metric switching is an optional feature.

'Metric' or 'Inch' may differ between the input system and the machine system.

	Metric input system		Inch input system	
	Machine system		Machine system	
	Metric	Inch	Metric	Inch
Measuring circuits	Metric	Inch	Metric	Inch
• Display:				
• Path and feedrate	Metric	Metric	Inch	Inch
• Reference points	Metric	Inch	Metric	Inch
Reset position	G71	G71	G70	G70
Zero offset	Metric	Metric	Inch	Inch
Path programming				
• General				
• Using G70	Inch	Inch	Inch	Inch
• Using G71	Metric	Metric	Metric	Metric
• G93 R ...	Metric	Inch	Metric	Inch
Feedrate programming				
• Using G70	mm/min	mm/min	Inch/min	Inch/min
• Using G71	mm/min	mm/min	Inch/min	Inch/min
Gxx96 programming				
• Using G70	m/s	m/s	ft/s	ft/s
• Using G71	m/s	m/s	ft/s	ft/s
Machine data	Metric	Inch	Metric	Inch
F external depends on the machine data.				

Overview: Differences between input system and machine system

13.20 Setpoint specification

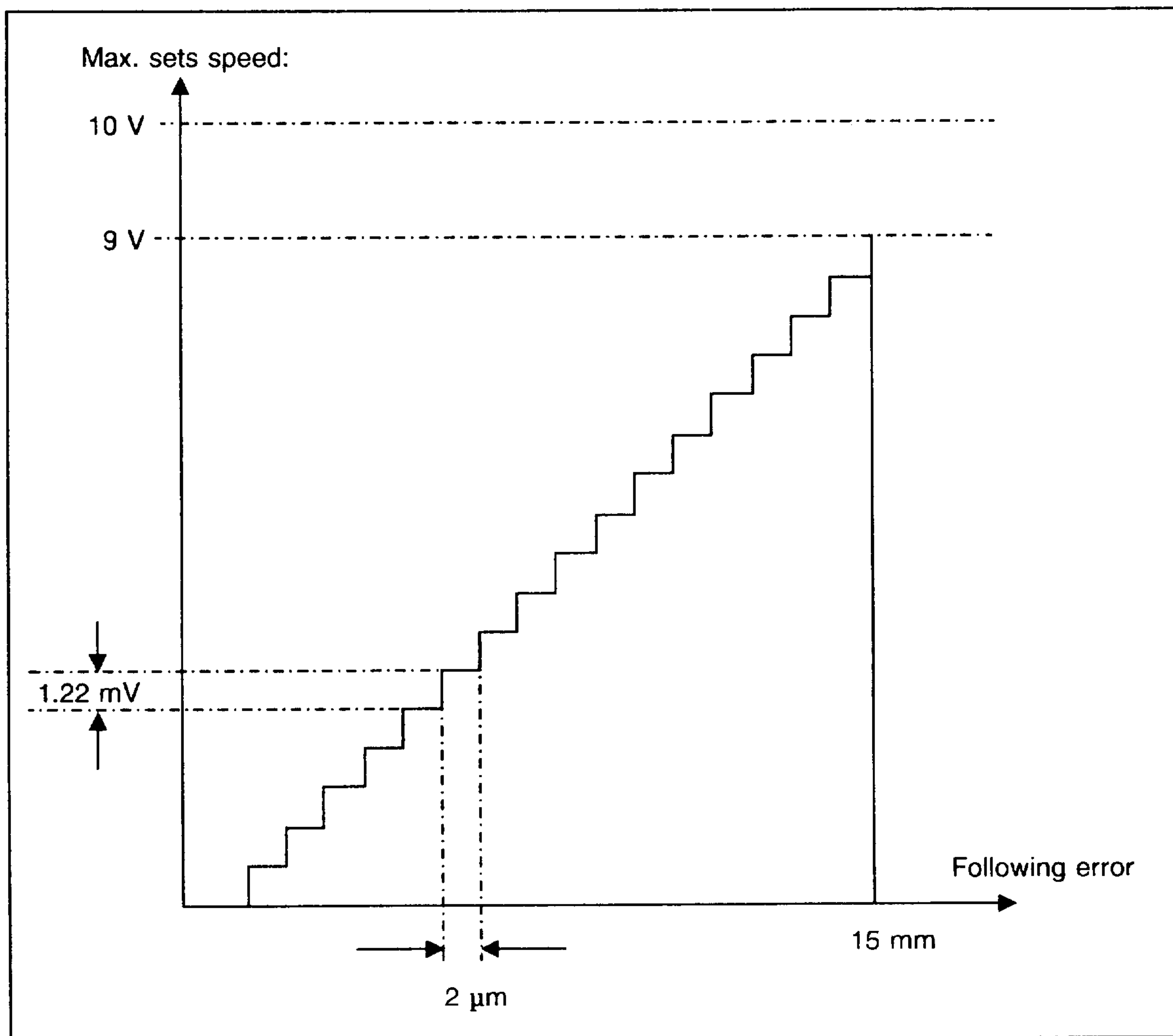
Difficulties in understanding setpoint specification in open and closed position control loops are repeatedly encountered. The notes below should be of assistance.

The SINUMERIK 3G can specify a set speed of not more than 10V in 8192 increments, i.e. the smallest possible increment is 1.22 mV. The maximum set speed is defined in MD 140...143 within input limits 0 to 8192 VELOS, one VELO corresponding to 1.22 mV.

MD 130...133 define the maximum speed for traversing by the individual axes (0...15000 mm/min at 0.001 mm input resolution); the axes are matched in terms of their servo gain factor via the multgain (MD220...223) and Kv factor (MD150...153). Given Kv 1 the following conditions now apply in the open position control loop:

Example 1:

$V_{\max} = 15000$ mm/min, i.e. 15 mm following error,
max. set speed: 9V, i.e. 7373 x 1.22 mV



This example shows that a 1.22 mV higher setpoint is specified every 2 μm given the set values, i.e. it is not with every 0.5 μm increment that a higher setpoint is output:

- 0.007 V for a following error of 0.011 mm,
- 0.600 V for a following error of 1.000 mm,
- 3.870 V for a following error of 6.450 mm.

If the position controller is now closed, then

- at rest each increment from the encoder is compensated immediately with a voltage excursion of 1.22 mV,
- each programmed position is precisely approached plus/minus half the input resolution using the programmed feedrate.

This is because the position controller always stops at a "step" as a result of its natural drift and can therefore compensate each increment, even if a "step" corresponds to a higher value in the open position controller.

Example 2:

At low maximum speeds the position controller operates on the same principle: $V_{\text{max}} = 1000$ mm/min, i.e. 1 mm following error, maximum set speed: 9V.

The ensuing conditions are as follows: 1.22 mV corresponds to 0.136 μm , i.e. in order to specify 0.5 μm for example, 4 "steps" are output immediately. In this case the sequence is the same as for Example 1 but in reverse: for every 0.5 μm increment a number of setpoint steps are skipped and a correspondingly higher setpoint is output immediately:

- 0.099 V for a following error of 0.011 mm,
- 5.810 V for a following error of 0.645 mm,
- 9.000 V for a following error of 1.000 mm.

The above also applies to input resolutions of 0.1 μm and 10 μm :

Given 10 μm , however, V_{max} and the increments are higher by a factor of 10, while they are smaller by a factor of 10 for 0.1 μm .

13.21 SINUMERIK 3G machine control panel









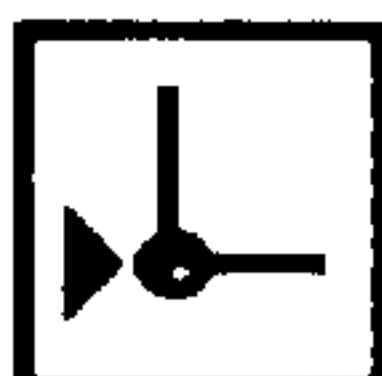
Linking of 3G machine control panel to PLC via I / O Module

PLC-inputs	Bit-No.							
	7	6	5	4	3	2	1	0
IB 48	Mode selector code				Feedrate / rapid traverse override switch code			
	D Pin 8	C Pin 7	B Pin 6	A Pin 5	D Pin 4	C Pin 3	B Pin 2	A Pin 1
IB 49	Key-operated switch Pin 16	Dry run Pin 15	Feedrate evaluation Pin 14	Single block Pin 13	Spindle override switch code			
					Block search Pin 12	A Pin 11	A Pin 10	A Pin 9
IB 50	Rapid traverse override active Pin 25	Rapid traverse override Pin 24	Direction keys		Axis selector code		X	X
			+ Pin 23	- Pin 22	B Pin 21	C Pin 20		
IB 51	Spindle OFF Pin 33	Spindle ON Pin 32	Feed HOLD Pin 31	Feed START Pin 30	Free **) Pin 29	Cycle Start Pin 28	Free **) Pin 27	Free **) Pin 26
IB 52	Free **) Pin 41	Free **) Pin 40	Free **) Pin 39	Free **) Pin 38	Free **) Pin 37	Free **) Pin 36	Free **) Pin 35	Free **) Pin 34
IB 53	Free **) Pin 49	Free **) Pin 48	Free **) Pin 47	Free **) Pin 46	Free **) Pin 45	Free **) Pin 44	Free **) Pin 43	Free **) Pin 42

Notes:

- Pin 17 is not available.
- Pins 18 and 19 are not wired to the machine control panel; they may be used as customer keys.

**) Freely assignable by means of customer keys

Position	Terminal	Symbol	Code				Signal name
			D	C	B	A	
1	1		0	0	0	1	DO
* 2	3		0	0	1	1	DI
3	5						
* 4	7		0	0	1	0	PRESET
5	9						
→ +) 6	11	 	1	0	1	0	JOG
+ 7	13		1	0	1	1	INC
+ 8	15		1	0	0	1	
+ 9	17		1	0	0	0	
+ 10	19		1	1	0	1	
+ 11	21		1	1	0	1	
+ 12	23		0	1	0	1	MDI-PP
+ 13	25		0	1	0	0	MDI-SE-TE
+ 14	27		0	1	1	0	AUT
15	29						
→ +) 16	31		1	1	1	0	REF

Code table for mode selector (Gray code) S15 (according to circuit diagram 03720) test no. 7, byte 0

Software Delete Functions (during changeover):

Mode change general:

- Difference between specified and actual values (distance to go) is deleted,
- Feed hold,
- R292...R299 are updated,
- Program number, block search cursor, alarms,
- input line are retained,
- Submode is reset.

Mode change *:

- Program running, program status (N, L, P), Auto IR,
- operator prompting line, V.24 (RS 232C) are deleted,
- Block processing is reset.

Mode change +:

- Program running -- Auto IR,
- Reciprocation is terminated,
- Program status (N, L, P), operator prompting
- prompting, subroutine call in JOG/INC are retained.

1000

1000

1000

1000

1000

1000

1000

14 3G Machine Data Description

14.1 General

The machine data are entered in the TEST data memory. Input is only possible using data protection switch S1.

Overview

100 - 243	NC axis-specific data for programmed axes
250 - 279	PLC machine data
280 - 307	NC axis-specific data for programmed axes
330 - 390	NC common data for all axes or for spindle etc.
400 - 449	NC machine data bits
450 - 479	PLC machine data bits

14.2 NC axis-specific machine data

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
1	100	S	+	Stop tolerance range 1
2	101			
3	102			
4	103			

	Units meas. system	Input limits		Step	Units
Metric; degrees	$1/2 \cdot 10^{-4}$ mm; deg.	0	32 000	1	10^{-4} mm; deg.
	$1/2 \cdot 10^{-3}$ mm; deg.	0	32 000	1	10^{-3} mm; deg.
	$1/2 \cdot 10^{-2}$ mm; deg.	0	32 000	1	10^{-2} mm; deg.
Inch	$1/2 \cdot 10^{-5}$ inches	0	32 000	1	10^{-5} inches
	$1/2 \cdot 10^{-4}$ inches	0	32 000	1	10^{-4} inches

The position is considered to have been reached when the axis has reached the set position \pm the entered stop tolerance range (positioning).

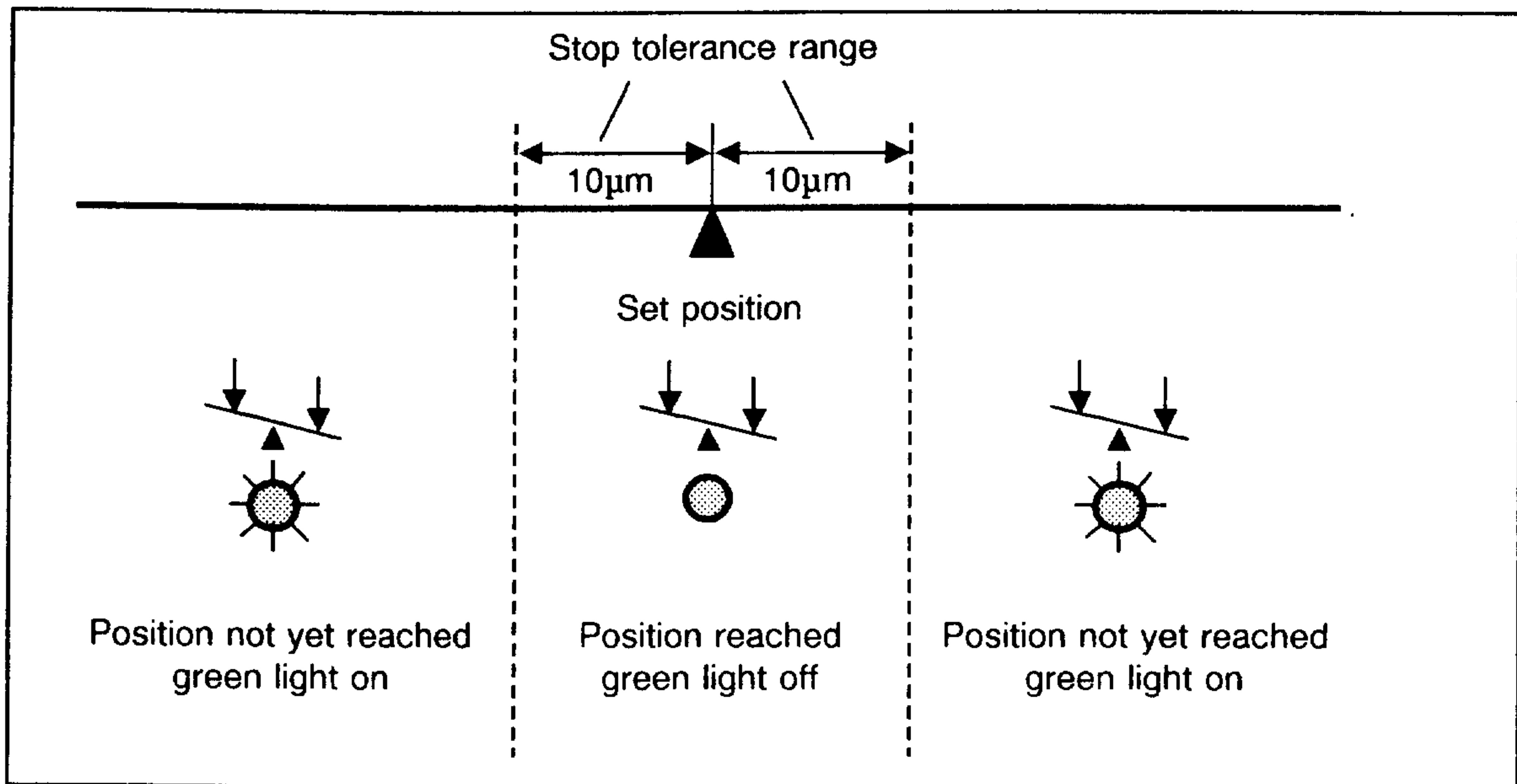
Effect of monitoring:

If the set position is not reached within these limits, the position pilot lamp remains lit and no more travel commands are executed.

Remedy: Drift compensation.

Example:

MD No. 100 S10



Positioning in the stop tolerance range is **not** performed in continuous-path operation. A sequential error arising from a large number of consecutive positioning processes is not produced since the position controller is not “shut down” as a result of the STOP TOLERANCE RANGE, the next block simply being processed ahead of the end position of the current block. The actual distance traversed is now as follows: remainder of active block + travel of following block. If the axis stops for an instant, e.g. because another axis is about to traverse, or if there is no axis movement in this program block, the following error is adjusted to 0 and the axis is exactly positioned.

The stop tolerance range is not active with Gxx81 to Gxx84, unless requested by means of R210 = R220 = 1.

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
1	110	S	+	Clamping tolerance and measuring-circuit monitoring at rest
2	111			
3	112			
4	113			

	Units meas. system	Input limits		Step	Units
Metric; degrees	$1/2 \cdot 10^{-4}$ mm; deg.	0	32 000	1	10^{-4} mm; deg.
	$1/2 \cdot 10^{-3}$ mm; deg.	0	32 000	1	10^{-3} mm; deg.
	$1/2 \cdot 10^{-2}$ mm; deg.	0	32 000	1	10^{-2} mm; deg.
Inch	$1/2 \cdot 10^{-5}$ inches	0	32 000	1	10^{-5} inch
	$1/2 \cdot 10^{-4}$ inches	0	32 000	1	10^{-4} inch

The NC monitors the position at rest (position holding).

The following possibilities could exist:

- a) If servo enable for an axis is cancelled by the interface control, this means that the axis is no longer held in position by the NC. The interface control must itself hold the axis in position as a result of clamping. The clamped axis may be forced out of position as a result of mechanical factors.
- b) High mechanical forces or drive system faults may move the axis out of position.

The clamping tolerance entered must be **greater than the stop tolerance range**. Alarms 101, 111, 121 and 131 are triggered if the clamping tolerance is exceeded after the position monitoring time delay, MD No. 353.

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
1	120	S	+	Acceleration (can be separately set for rapid traverse G00; see MD 300ff)
2	121			
3	122			
4	123			

	Units meas. system	Input limits		Step	Units
Metric; degrees	$1/2 \cdot 10^{-4}$ mm or deg.	0	6 000	1	10^{-3} m/sec ² ; 1 $\frac{\text{deg}}{\text{sec}^2}$
	$1/2 \cdot 10^{-3}$ mm or deg.	0	6 000	1	10^{-2} m/sec ² ; 10 $\frac{\text{deg}}{\text{sec}^2}$
	$1/2 \cdot 10^{-2}$ mm or deg.	0	6 000	1	10^{-1} m/sec ² ; 100 $\frac{\text{deg}}{\text{sec}^2}$
Inch	$1/2 \cdot 10^{-5}$ inches	0	6 000	1	0.1 $\frac{\text{Inch}}{\text{sec}^2}$
	$1/2 \cdot 10^{-4}$ inches	0	6 000	1	1 $\frac{\text{Inch}}{\text{sec}^2}$

The acceleration value is applicable to each axis separately.

The values also apply to deceleration (braking).

The axes need not be set to the same acceleration values. In continuous-path operation the controller uses the lowest acceleration value of the axes involved.

Note: Values of 50 ... 100 (= 0.5 ... 1 m/sec²) may be used.

These values (120 ... 123) do not apply to thread cutting;
MD No. 358S applies in this case.

These machine data may be overwritten by the PLC.

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
1	130	S	+	Acceleration stop limit (maximum axial speed)
2	131			
3	132			
4	133			

	Units meas. system	Input limits		Step	Units
Metric; degrees	$1/2 \cdot 10^{-4}$ mm; deg.	0	3 000	1	mm/min; deg./min
	$1/2 \cdot 10^{-3}$ mm; deg.	0	30 000	1	mm/min; deg./min
	$1/2 \cdot 10^{-2}$ mm; deg.	0	300 000	1	mm/min; deg./min
Inch	$1/2 \cdot 10^{-5}$ inches	0	30 000	1	10^{-2} inches/min
	$1/2 \cdot 10^{-4}$ inches	0	300 000	1	10^{-2} inches/min

The entered value signifies the limit speed to which the axis can accelerate (*rapid traverse limit*). With rapid traverse G00 programmed this traverse speed is used.
 From software version S3903 onwards the rapid traverse speed **can** be defined separately via machine data 304 ... 307.
 The machine data 130 ... 133 are then only effective for feedrate.

Example:

Maximum speed: 1st axis 12 m/min
 2nd axis 12 m/min
 3rd axis 10 m/min
 4th axis 4 m/min

When traversing at a programmed feedrate of 10 m/min (manual feed or rapid traverse), the speed is as follows:

1st axis	10 m/min	
2nd axis	10 m/min	
3rd axis	10 m/min	At limit MD No. 132
4th axis	4 m/min	With limit MD No. 133

Example:

2nd and 3rd axes at 45 degrees in programmed rapid traverse (15m/min). Both axes traverse at a rate of 10 m/min, corresponding to a path speed of 14.142 m/min since the 3rd axis has been limited to 10 m/min in MD No. 132.

Inclined axis: $MD\ 130 = U_{max} \cdot \cos\ \Psi$

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
1	140	S	+	Definition of maximum set speed
2	141			
3	142			
4	143			

Measuring-circuit module	Input limits		Step	Units
03320	1	2 048	1	1 VELO 1 = $\frac{10 \text{ Volts}}{2 048}$
03325/03350	1	8 192	1	1 VELO 2 = $\frac{10 \text{ Volts}}{8 192}$

Note:

Exceeding the limit results in IPO Stop and the drive reciprocates.

This input specifies the maximum voltage value which is output as the set speed (output voltage limitation as a result of stopping interpolation).

This voltage value should be roughly 10% above the maximum speed voltage, otherwise any overshooting is not compensated. In other words, given a set speed of 9V for rapid traverse, 2048 or 8192 (for 10V corresponding to a control reserve of 10%, see also MD 354).

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
1	150	S	+	Servo gain (can be set separately for rapid traverse G00; see MD 200ff)
2	151			
3	152			
4	153			

		Input limits		Step	Units
		1	10 000	1	0.01 sec ⁻¹

Conversions:

$$K_v (0.01 \text{ s}^{-1}) = 1666 K_v \left(\frac{\text{m/min}}{\text{mm}} \right)$$

or

$$K_v (0.01 \text{ s}^{-1}) = 1666 K_v \left(\frac{\text{mm/min}}{\mu\text{m}} \right)$$

Servo gain is axis-specific. Axes not engaged in continuous-path operation can be programmed with different values from axes in continuous-path operation. Axes operating simultaneously in continuous-path operation require the same gain (= same following error at same speed = 45 °).

These machine data may be overwritten by the PLC.

Note:

Refers to machine axis in the case of an inclined axis.

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
1	160	S	±	Software limit switch positive
2	161			
3	162			
4	163			

	Units meas. system	Input limits			Step	Units
Metric; degrees	1/2 · 10 ⁻⁴ mm; deg.	0	+	99999999	1	10 ⁻⁴ mm; deg
	1/2 · 10 ⁻³ mm; deg.	0	+	99999999	1	10 ⁻³ mm; deg
	1/2 · 10 ⁻² mm; deg.	0	+	9999999	1	10 ⁻² mm; deg
Inch	1/2 · 10 ⁻⁵ inches	0	+	99999999	1	10 ⁻⁵ inches
	1/2 · 10 ⁻⁴ inches	0	+	9999999	1	10 ⁻⁴ inches

The mechanical range limit switch can be complemented by the software limit switch. The absolute cartesian position of the positive range limit for each axis must be input. The software limit switch only becomes active after approach to the reference point and with the request bit set (MD Nos. 403 - 406, bit 4). Alarms 1, 11, 21 and 31 are displayed when the positive software limit switches are reached.

These machine data may be overwritten by the PLC.

Notes:

Input signals for hardware limit switches are **not** provided. Their function can only be achieved by means of the following:

- Feed hold (disadvantageous on account of ramp, slow)
- Servo inhibit (best because fast with return function)
- Emergency Stop (fast, with jump function but additional effects so disadvantageous)

Software limit switches are overtravelled in spite of automatic reduction (See Section 14.4).

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
1	170	S	±	Software limit switch negative
2	171			
3	172			
4	173			

	Units meas. system	Input limits		Step	Units
Metric; degrees	1/2 · 10 ⁻⁴ mm; deg.	0	+ 999999999	1	10 ⁻⁴ mm; deg
	1/2 · 10 ⁻³ mm; deg.	0	+ 99999999	1	10 ⁻³ mm; deg
	1/2 · 10 ⁻² mm; deg.	0	+ 9999999	1	10 ⁻² mm; deg
Inch	1/2 · 10 ⁻⁵ inches	0	+ 999999999	1	10 ⁻⁵ inches
	1/2 · 10 ⁻⁴ inches	0	+ 9999999	1	10 ⁻⁴ inches

The mechanical range limit switch can be complemented by the software limit switch. The absolute Cartesian position of the negative range limit for each axis must be input. The software limit switch only becomes active after approach to the reference point and with the request bit set (MD Nos. 403 - 406, bit 4). Alarms 2, 12, 22 and 32 are displayed when the negative software limit switches are reached, depending on the axis.

These machine data may be overwritten by the PLC.

Notes on Software Limit Switches Positive/Negative:

Inclined Axis

The software limit switches are input in cartesian values. The NC automatically allows for the offset in the Z axis during travel in X, i.e. the customary hardware limit switches are also replaced in the case of inclined axis machines.

Diameter Programming

The software limit switches are always entered as radius values. Take MD 424 bit 2 into account.

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
1	180	S	±	Reference point coordinates
2	181			
3	182			
4	183			

	Units meas. system	Input limits		Step	Units
Metric; degrees	$1/2 \cdot 10^{-4}$ mm; deg.	0	+ 999999999	1	10^{-4} mm; deg
	$1/2 \cdot 10^{-3}$ mm; deg.	0	+ 99999999	1	10^{-3} mm; deg
	$1/2 \cdot 10^{-2}$ mm; deg.	0	+ 9999999	1	10^{-2} mm; deg
Inch	$1/2 \cdot 10^{-5}$ inches	0	+ 99999999	1	10^{-5} inches
	$1/2 \cdot 10^{-4}$ inches	0	+ 9999999	1	10^{-4} inches

The difference between the absolute machine zero and the specified reference point in the cartesian system is entered for the respective axis. These values are set as actual values after approach to the reference point, taking into account the zero offset, dressing sum and correction of the selected grinding wheel.

Diameter programming preset (MD Nos. 430 to 433 bit 4) is active with approach to the reference point. The reference point values are radius values; twice the value is displayed in the case of diameter programming.

With an inclined axis the reference point **must** first be approached in the X axis, then in the Z axis.

This sequence ceases to be compulsory from software version S3702 onwards.

These machine data may be overwritten by the PLC.

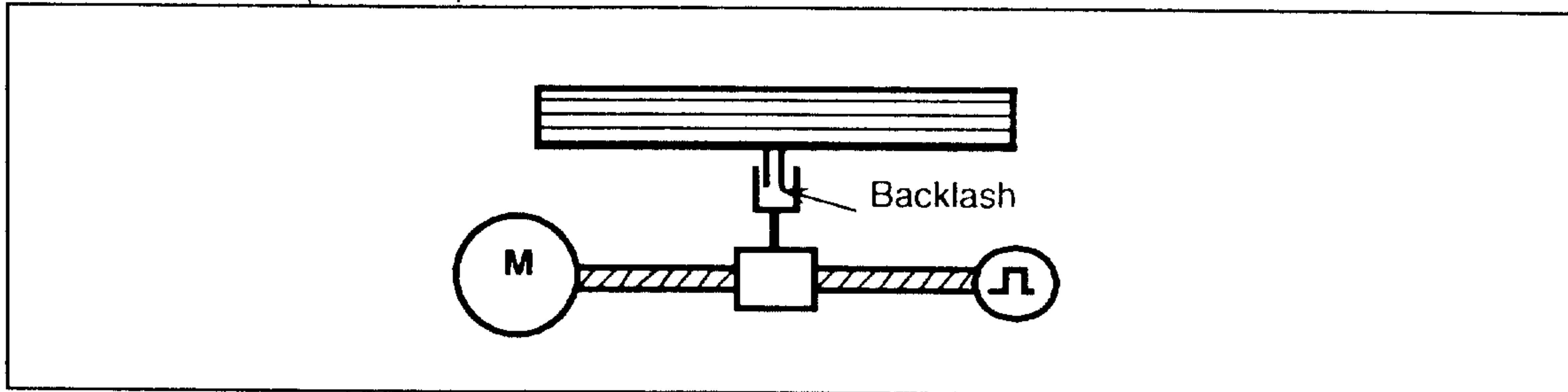
TEST data memory

Axis number	Ident number	Address	Sign	Display / input
1	190	S	±	Backlash compensation
2	191			
3	192			
4	193			

	Units meas. system	Input limits	Step	Units	
Metric; degrees	$1/2 \cdot 10^{-4}$ mm; deg.	0	± 255	1	10^{-4} mm; deg
	$1/2 \cdot 10^{-3}$ mm; deg.	0	± 255	1	10^{-3} mm; deg
	$1/2 \cdot 10^{-2}$ mm; deg.	0	± 255	1	10^{-2} mm; deg
Inch	$1/2 \cdot 10^{-5}$ inches	0	± 255	1	10^{-5} inches
	$1/2 \cdot 10^{-4}$ inches	0	± 255	1	10^{-4} inches

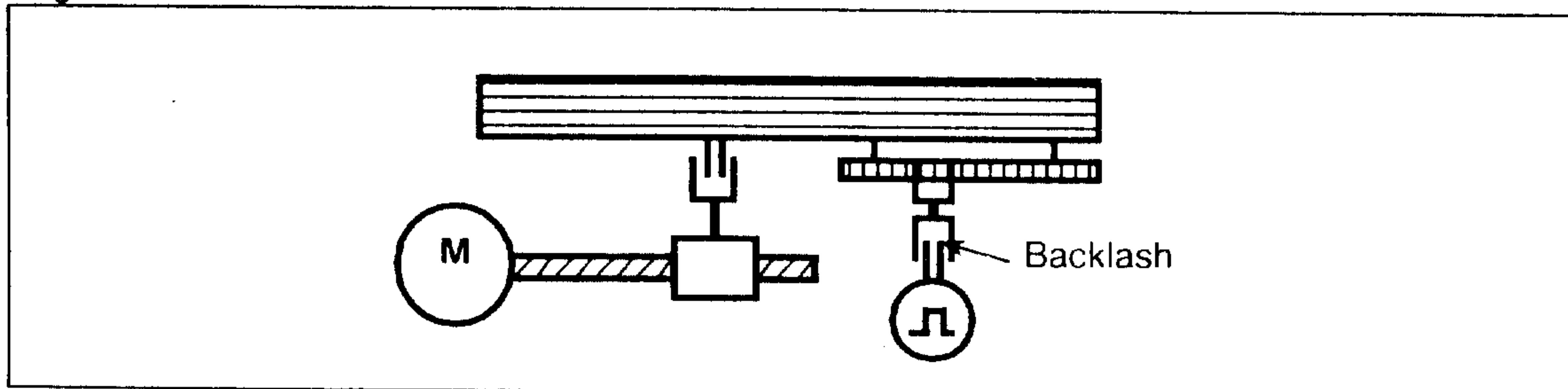
There is positive and negative backlash. A value of up to $\pm 255 \mu\text{m}$ is entered for each axis for this purpose. The value must be positive for positive backlash and negative for negative backlash.

Positive backlash (standard)



Actual encoder value precedes actual value (table)

Negative backlash



Actual value (table) precedes actual encoder value

Axis number	Ident number	Address	Sign	Display / input
1	200	S	+	Servo gain with rapid traverse G00
2	201			
3	202			
4	203			

The servo gain (Kv) can be set separately for rapid traverse blocks if necessary. This option is used on machines with large moving masses. The drives are then optimized for all feed movements ²⁾ and rapid traverse override in the JOG mode with the larger Kv factor from MD 150ff; this MD ¹⁾ then operates in the programmed rapid traverse blocks if a value greater than zero is entered. Input limits as for MD 150 ... 153.

1) with the smaller value

2) (Working speeds)

TEST data memory

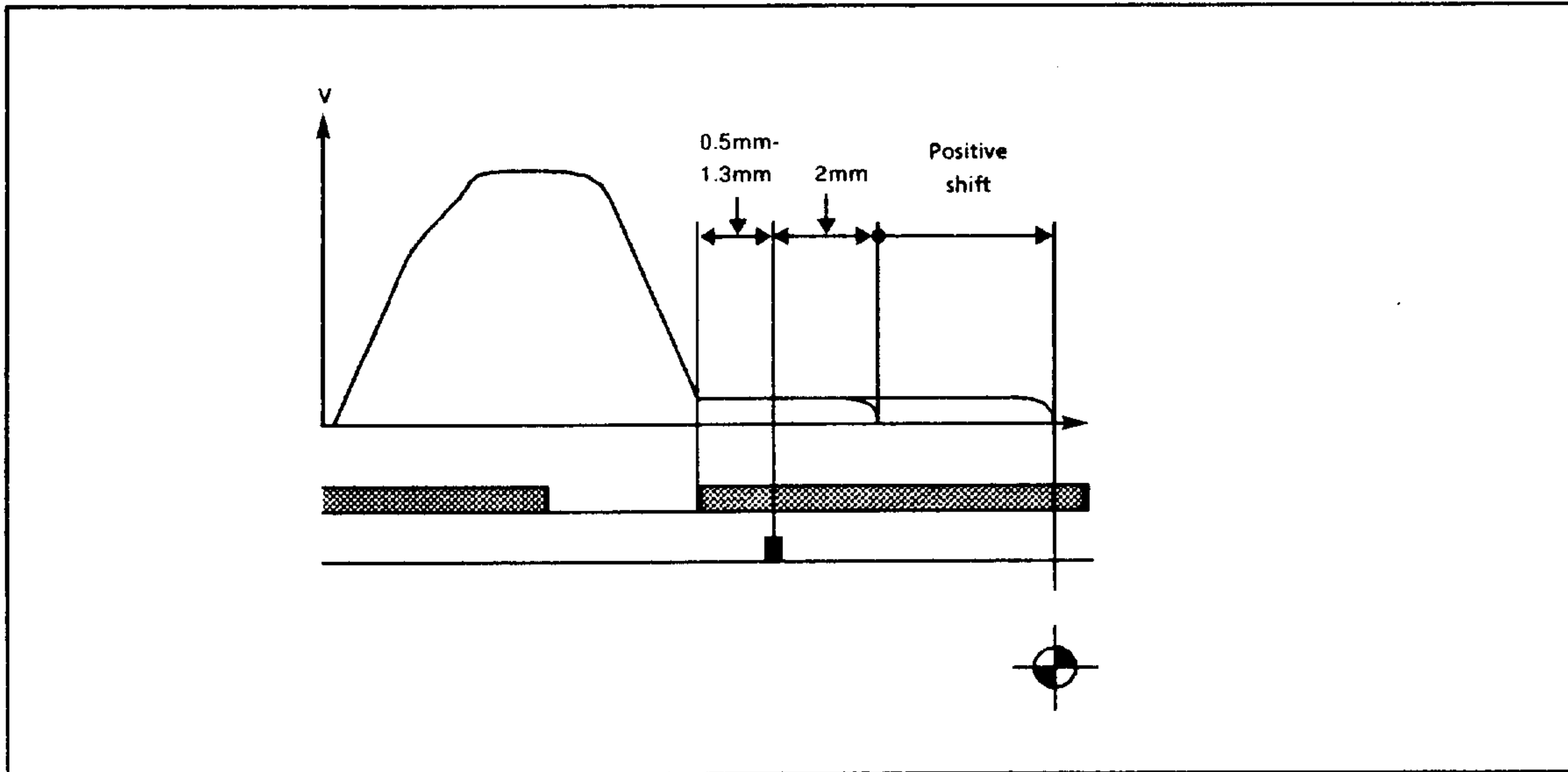
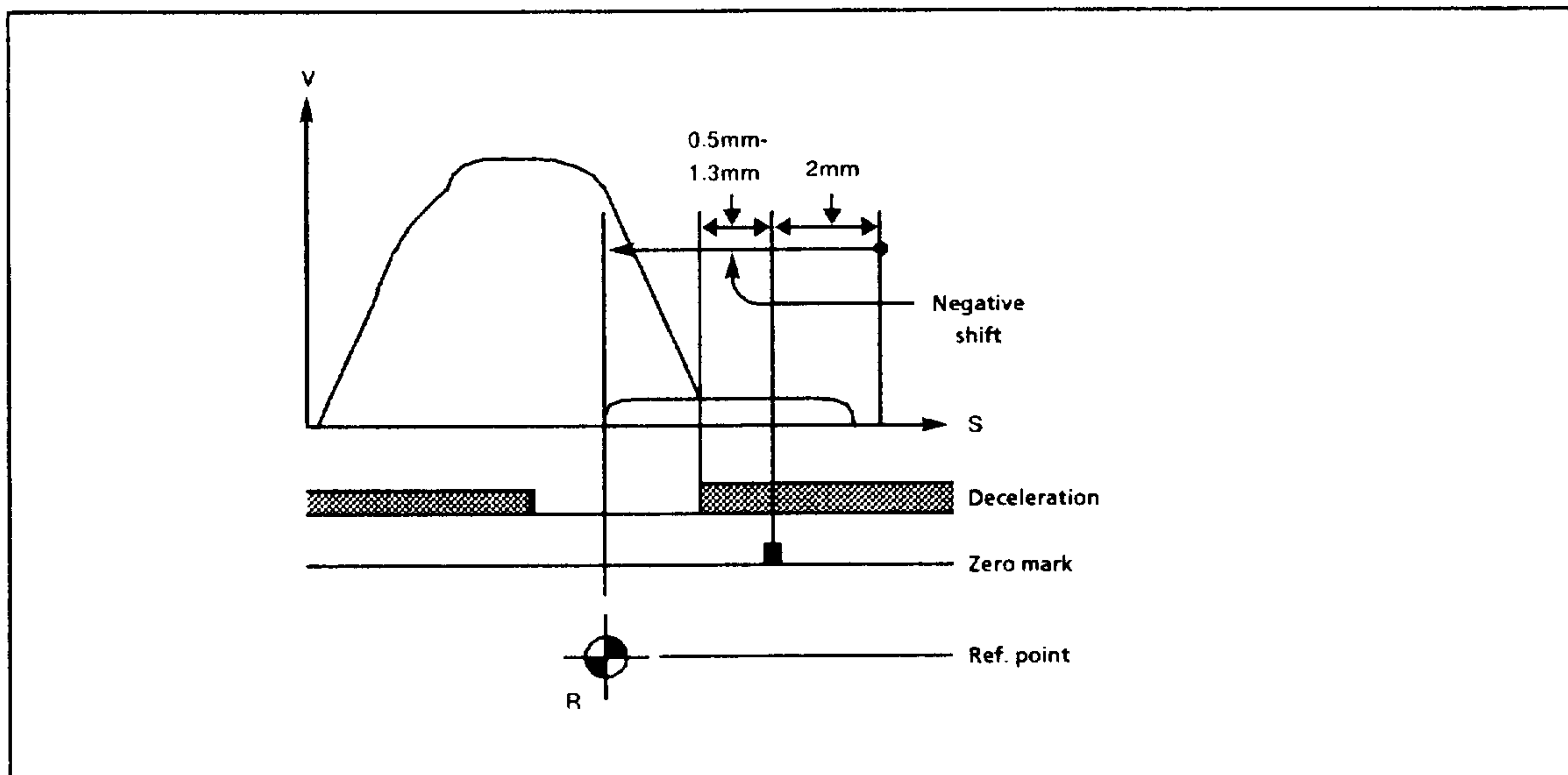
Axis number	Ident number	Address	Sign	Display / input
1	210	S	±	Reference point shift
2	211			
3	212			
4	213			

	Units meas. system	Input limits		Step	Units
Metric; degrees	1/2 · 10 ⁻⁴ mm; deg.	0	9999	1	10 ⁻⁴ mm; deg
	1/2 · 10 ⁻³ mm; deg.	0	9999	1	10 ⁻³ mm; deg
	1/2 · 10 ⁻² mm; deg.	0	9999	1	10 ⁻² mm; deg
Inch	1/2 · 10 ⁻⁵ inches	0	9999	1	10 ⁻⁵ inches
	1/2 · 10 ⁻⁴ inches	0	9999	1	10 ⁻⁴ inches

Reference point shift allows the reference points of the measuring system to be moved. Instead of mechanical shifting or rotation of the measuring device (and hence of the * deceleration cam) the reference point can be electrically shifted by up to ± 9999 µm.

Notes for positive approach of reference point.

- When the input is positive the axis traverses in the positive direction by the input value beyond the normal reference point (2000 µm after zero mark).
- When the input is negative the axis traverses after travelling beyond the zero mark to the value resulting from the difference between 2000 µm + input value.
- In the event of reference point shift in excess of roughly - 2000 µm, the software recognizes after overtravelling the zero mark that the travel is in the wrong direction and reverses the direction of travel.

Case 1: Shift in positive direction**Case 2: Shift in negative direction**

Approach to the reference point is possible if the cam is on the switch.

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
1	220	S	+	Multiplication factor for servo gain
2	221			
3	222			
4	223			

	Units meas. system	Input limits		Step	Units
Metric; degrees	1/2 · 10 ⁻⁴ mm; deg.	1	32 000	1	see text
	1/2 · 10 ⁻³ mm; deg.				
	1/2 · 10 ⁻² mm; deg.				
Inch	1/2 · 10 ⁻⁵ inches	1	32 000	1	see text
	1/2 · 10 ⁻⁴ inches				

The multiplication factor for servo gain, known in short as multgain, is used for full utilization of the axes having different maximum speeds, even though the Kv factor is identical. The Kv factor is entered by means of machine data 150-153. When tacho-generator compensation differs, multgain can be used for precise matching of the Kv factors.

Metric system:

$$\text{MULTGAIN} = \frac{3 \cdot 10^7}{V_{\max}} \cdot \frac{U_{\max}}{10} \cdot \text{measuring system resolution [10}^{-3} \text{ mm]}$$

Imperial system:

$$\text{MULTGAIN} = \frac{3 \cdot 10^7}{V_{\max} \cdot 0,1} \cdot \frac{U_{\max}}{10} \cdot \text{measuring system resolution [10}^{-5} \text{ inches]}$$

$V_{\max} \left[\frac{\text{mm}}{\text{min}} \right]$ = Maximum axis speed as input in MD Nos. 130 - 133 as the acceleration stop limit.

$U_{\max} \text{ [V]}$ = Set speed voltage for V_{\max} (tacho-generator compensation).

Example:

$$\begin{aligned}
 V_{\max} &= 10\,000 \text{ mm/min} \\
 U_{\max} &= 9\text{V} \\
 \text{measuring system resolution} &= 1 \cdot 10^{-3} \text{ mm}
 \end{aligned}$$

$$\text{MULTGAIN} = \frac{3 \cdot 10^7}{10000} \cdot \frac{9 \text{ V}}{10 \text{ V}} \cdot 1 = 2700 \frac{\text{min}}{\text{mm}}$$

If the MULTGAIN factors are input as described, the Kv factor entered in MD Nos. 150-153 corresponds to the value active at the machine in line with its input dimension.

Table showing MULTGAIN for various input values with 10^{-3} mm input resolution:

V _{max.} m/min	Multigain factor min/mm			
	U _{max.} 4V	U _{max.} 5V	U _{max.} 8V	U _{max.} 9V
15		1000	1600	1800
14		1071	1714	1929
13		1154	1846	2077
12		1250	2000	2250
11		1364	2182	2455
10		1500	2400	2700
9		1667	2667	3000
8		1875	3000	3375
7		2143	3429	3857
6		2500	4000	4500
5		3000	4800	5400
4		3750	6000	6750
3		5000	8000	9000
2		7500	12000	13500
1	12000	15000	24000	27000
0.8	15000	18750	30000	32000
0.75	16000	20000	32000	
0.6	20000	25000		
0.5	24000	30000		
0.4	30000	32000		

Inch System:

V _{max} Inch/min	Multigain factor min/inch
	U _{max} 9 x
600	4500
500	5400
400	6750
300	9000
200	13500
100	27000

Note:

The entered value can be multiplied by 10 by means of machine data 430 ... 433 bit 6. This is required since the input value must not exceed 32000.

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
1	230	S	+	Drift compensation
2	231			
3	232			
4	233			

Measuring-circuit module	Input limits		Step	Units
03320	0	500	1	1 VELO 1 = $\frac{10 \text{ Volts}}{2048}$
03325/03350	0	2000	1	1 VELO 2 = $\frac{10 \text{ Volts}}{8192}$

In order to eliminate analog drift with software correction, it is possible to adjust the following error at rest to "0" by entering the drift value manually. Automatic compensation is also possible in MDI-TE-SE mode at No. 230... and in test mode with S:



Compensation must be performed separately for each axis.

If the value with automatic drift compensation exceeds 100 (03320 board) or 400 (03325/03350 board), alarms 105, 115, 125 or 135 are displayed (see Section 4).

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
1	240	S	+	Stop tolerance range 2
2	241			
3	242			
4	243			

	Units meas. system	Input limits		Step	Units
Metric; degrees	$1/2 \cdot 10^{-4}$ mm; deg.	0	32 000	1	10^{-4} mm; deg.
	$1/2 \cdot 10^{-3}$ mm; deg.	0	32 000	1	10^{-3} mm; deg.
	$1/2 \cdot 10^{-2}$ mm; deg.	0	32 000	1	10^{-2} mm; deg.
Inch	$1/2 \cdot 10^{-5}$ inches	0	32 000	1	10^{-5} inches
	$1/2 \cdot 10^{-4}$ inches	0	32 000	1	10^{-4} inches

Same behaviour as with machine data 100 to 103 (stop tolerance range 1).

The current following error (MD 800 to 803) is compared with stop tolerance range 2.
Stop tolerance range 2 is activated with Gxx62.

These machine data may be overwritten by the PLC.
Valid from version 4B/8MHz (S3701) onwards.

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
	250			
	251			
	252			
	253			
	254			
	255			
	256			
	257			
	258			
	259			
	260			
	261			
	262			
	263			
	264	S	±	PLC-values
	265			
	266			
	267			
	268			
	269			
	270			
	271			
	272			
	273			
	274			
	275			
	276			
	277			
	278			
	279			

On request (MD 456 bit 7 = 1) machine data 250 to 271 are transferred to DB20 (DB22, DB24, DB26) DW 109 to 130 with Power On Reset. Simultaneously machine data bits MD 450 to 479 are transferred to DW 94 to 108. DR52 is then set to 1 (machine data available).

Machine data MD 272 to 279 may be read normally by the PLC.
 Valid from software version S3701 onwards.

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
1	280	S	+	Modulo number
2	281			
3	282			
4	283			

	Units meas. system	Input limits		Step	Units
Metric; degrees	$1/2 \cdot 10^{-4}$ mm; deg.	0	+ 999999999	1	10^{-4} mm; deg.
	$1/2 \cdot 10^{-3}$ mm; deg.	0	+ 99999999	1	10^{-3} mm; deg.
	$1/2 \cdot 10^{-2}$ mm; deg.	0	+ 9999999	1	10^{-2} mm; deg.

If the increasing actual value of a rotary axis reaches the modulo number, this counter is reset and counting (as well as the display) recommences at zero.

If the actual values decreases and passes through zero, the counter is set to the modulo number minus 1 increment.

These machine data become active when machine data 430 to 433, bit 5 have been set (definition of rotary axis).

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
1	284	S	+	Cutoff speed
2	285			
3	286			
4	287			

	Units meas. system	Input limits		Step	Units
Metric; degrees	$1/2 \cdot 10^{-4}$ mm; deg.	0	3 000	1	mm/min; deg./min
	$1/2 \cdot 10^{-3}$ mm; deg.	0	30 000	1	mm/min; deg./min
	$1/2 \cdot 10^{-2}$ mm; deg.	0	300 000	1	mm/min; deg./min
Inch	$1/2 \cdot 10^{-5}$ inches	0	30 000	1	10^{-2} inches/min
	$1/2 \cdot 10^{-4}$ inches	0	300 000	1	10^{-2} inches/min

The speed entered by means of 284S to 287S is effective during approach to the reference point as long as the signal "Delay at reference point" is active (see also MD Nos. 210 to 213).

The cutoff speed is also used as braking feed in interpolation. In the event of different axis values, braking is performed with the low value.

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
1	288	S	+	Manual rapid traverse
2	289			
3	290			
4	291			

	Units meas. system	Input limits		Step	Units
Metric; degrees	$1/2 \cdot 10^{-4}$ mm; deg.	0	3 000	1	mm/min; deg./min
	$1/2 \cdot 10^{-3}$ mm; deg.	0	30 000	1	mm/min; deg./min
	$1/2 \cdot 10^{-2}$ mm; deg.	0	300 000	1	mm/min; deg./min
Inch	$1/2 \cdot 10^{-5}$ inches	0	30 000	1	10^{-2} inches/min
	$1/2 \cdot 10^{-4}$ inches	0	300 000	1	10^{-2} inches/min

The entered value applies on an axis-specific basis to 100% rapid traverse override switch position and 1:1 feed evaluation, unless the value is limited by the input in MD Nos. 130 - 133.

This value is not used for programmed rapid traverse G00 (MD Nos. 130 - 133).

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
1	292	S	+	Manual feed
2	293			
3	294			
4	295			

	Units meas. system	Input limits		Step	Units
Metric; degrees	$1/2 \cdot 10^{-4}$ mm; deg.	0	3 000	1	mm/min; deg./min
	$1/2 \cdot 10^{-3}$ mm; deg.	0	30 000	1	mm/min; deg./min
	$1/2 \cdot 10^{-2}$ mm; deg.	0	300 000	1	mm/min; deg./min
Inch	$1/2 \cdot 10^{-5}$ inches	0	30 000	1	10^{-2} inches/min
	$1/2 \cdot 10^{-4}$ inches	0	300 000	1	10^{-2} inches/min

The entered value applies on an axis-specific basis to 100% rapid traverse override switch position and 1:1 feed evaluation, unless the value is limited by the input in MD Nos. 130 - 133.

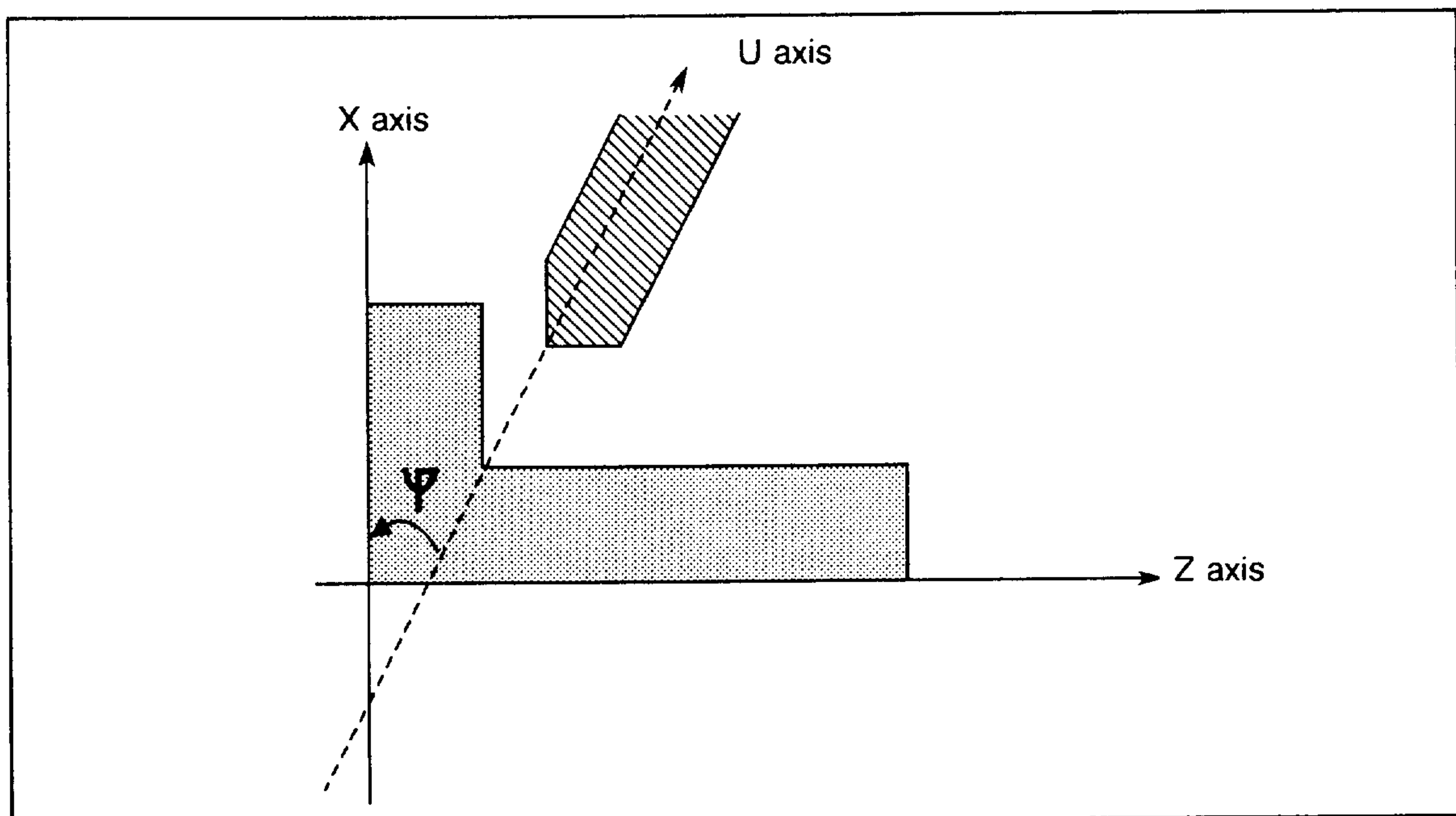
14.3 NC common machine data

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
	299	S	+	Inclined axis angle

	Input limits	Step	Units
0	± 45 000	1	10 ⁻³ degrees

At this point angle ψ of the inclined U axis or grinding wheel is entered.



The machine data may be overwritten by the PLC. The "Axis inhibit" PLC signal must be present.
POWER ON RESET must be performed after the machine data has been changed in MDI-SET mode.

Caution!

After a modification to the angle the reference point must be re-approached in the X and Z axes.

Repeating the approach is not necessary in the Z axis from software versions S3902 and S3703 onwards if MD 401 bit 4 is set to "1".

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
1	300	S	+	Acceleration for rapid traverse G00
2	301			
3	302			
4	303			

	Units meas. system	Input limits		Step	Units
Metric; degrees	$1/2 \cdot 10^{-4}$ mm deg.	0	6 000	1	10^{-3} m/sec ² ; 1 deg/sec ²
	$1/2 \cdot 10^{-3}$ mm deg.	0	6 000	1	10^{-2} m/sec ² ; 10 deg/sec ²
	$1/2 \cdot 10^{-2}$ mm deg.	0	6 000	1	10^{-1} m/sec ² ; 100 deg/sec ²
Inch	$1/2 \cdot 10^{-5}$ inches	0	6 000	1	0.1 Inch/sec ²
	$1/2 \cdot 10^{-4}$ inches	0	6 000	1	1 Inch/sec ²

The acceleration value is applicable to each axis separately.

The values also apply to deceleration (braking).

The axes need not be set to the same acceleration values. In continuous path operation, the controller uses the lowest acceleration value of the axes involved.

Note:

Values of 50 ... 100 (= 0,5 ... 1 m/sec²) may be used.

These values (300 ... 303) apply only with programmed rapid traverse blocks G00
 In all other instances, machine data 120 ... 123 are effective.

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
1	304	S	+	Maximum speed with rapid traverse G00
2	305			
3	306			
4	307			

See Machine data 130 ... 133 for dimensions and limit values. From software version S3903 onwards, separate maximum speeds can be input for rapid traverse.
Values greater than zero indicate that MD 130 to 133 are valid only for feedrates.

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
				Feedrate override % value
	330	S	+	2nd switch position
	331	S	+	3rd switch position
	332	S	+	4th switch position
	333	S	+	5th switch position
	334	S	+	6th switch position
	335	S	+	7th switch position
	336	S	+	8th switch position
	337	S	+	9th switch position
	338	S	+	10th switch position
	339	S	+	11th switch position
	340	S	+	12th switch position
	341	S	+	13th switch position
	342	S	+	14th switch position
	343	S	+	15th switch position
	344	S	+	16th switch position

		Input limits		Step	Units
		1	150	1	%

The % figures of the 15 positions of the feedrate override switch can be specified individually with these machine data. Consequently a finer setting is possible, for example, within a selectable range.

Starting at 0 %, any % figures may be entered in 1% increments. However, the first position (far left switch position) is preset at 0 % , the upper limit being 150 %.

With automatic setting of the machine data the standard values are entered in the machine control panel.

Changes to these machine data are only active after POWER ON RESET!

351 S: Threshold Speed for Contour Monitoring

351 S	Units meas. system	Input limits		Step	Units
Metric; degrees	1/2 · 10 ⁻⁴ mm deg.	0	27 000	1	0.1 mm/min;deg./min
	1/2 · 10 ⁻³ mm deg.	0	27 000	1	mm/min; deg./min
	1/2 · 10 ⁻² mm deg.	0	2 700	1	10 mm/min;deg./min
Inch	1/2 · 10 ⁻⁵ inches	0	27 000	1	0.1 Inch/sec ²
	1/2 · 10 ⁻⁴ inches	0	27 000	1	1 Inch/sec ²

352 S: Tolerance Band for Contour Monitoring

352 S	Units meas. system	Input limits		Step	Units
Metric; degrees	1/2 · 10 ⁻⁴ mm deg.	0	32 000	1	$\frac{\text{mm} \cdot \text{Test 850}}{125 \cdot 1000}$
	1/2 · 10 ⁻³ mm deg.	0	32 000	1	
	1/2 · 10 ⁻² mm deg.	0	32 000	1	
Inch	1/2 · 10 ⁻⁵ inches	0	32 000	1	$\frac{0.1 \text{ Inch} \cdot \text{Test 850}}{125 \cdot 1000}$
	1/2 · 10 ⁻⁴ inches	0	32 000	1	

Only after at least 3 seconds at constant speed is the Kv factor determined (display MD 850 ... 853 in 0.001 m/min/mm usual values between 500 and 1800); it remains stored until new machine data are input. After the Kv factors have been determined for all axes (otherwise alarm 528) a check is performed for equality.

A deviation in excess of 50 triggers alarm 527.

$$\text{Determination of tolerance band: } \frac{\text{MD} \cdot 352 \cdot 125}{\text{Kv} \cdot 1000} \quad (\mu\text{m})$$

See Section 6 for a detailed description of contour monitoring.

If the tolerance entered is 0, the controller automatically uses the standard value 2000. When 1 to 2000 are entered for the tolerance band these values are active.

e.g. MD No. 352, 1000 is entered, $\text{Kv} = 1$

$$\frac{\text{m/min}}{\text{mm}}$$

$$\text{Determination of tolerance band: } \frac{1000 \cdot 125}{1 \cdot 1000} = 125 \mu\text{m}$$

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
	353	S	+	Position monitoring delay

		Input limits		Step	Units
		0	16 000	1	1 ms

Note:

Standard value: 500

This input delay is active as follows:

1. During positioning (digital zero) the clamping tolerance (No. 110 - No. 113) is only activated after this time has expired. The time set must be such that the highest following error can be worked off without triggering alarms 101, 111, 121 and 131.
2. Delay for output of the servo inhibit signal after EMERGENCY STOP and other errors which result in immediate shutdown of the axes.
3. Delay for output of the servo inhibit signal if servo enable for a moving axis is cancelled by the interface control.
4. Delay for alarms 101 ... 131 (zero-speed monitoring) on exceeding the maximum set speed (Nos. 140 ... 143).

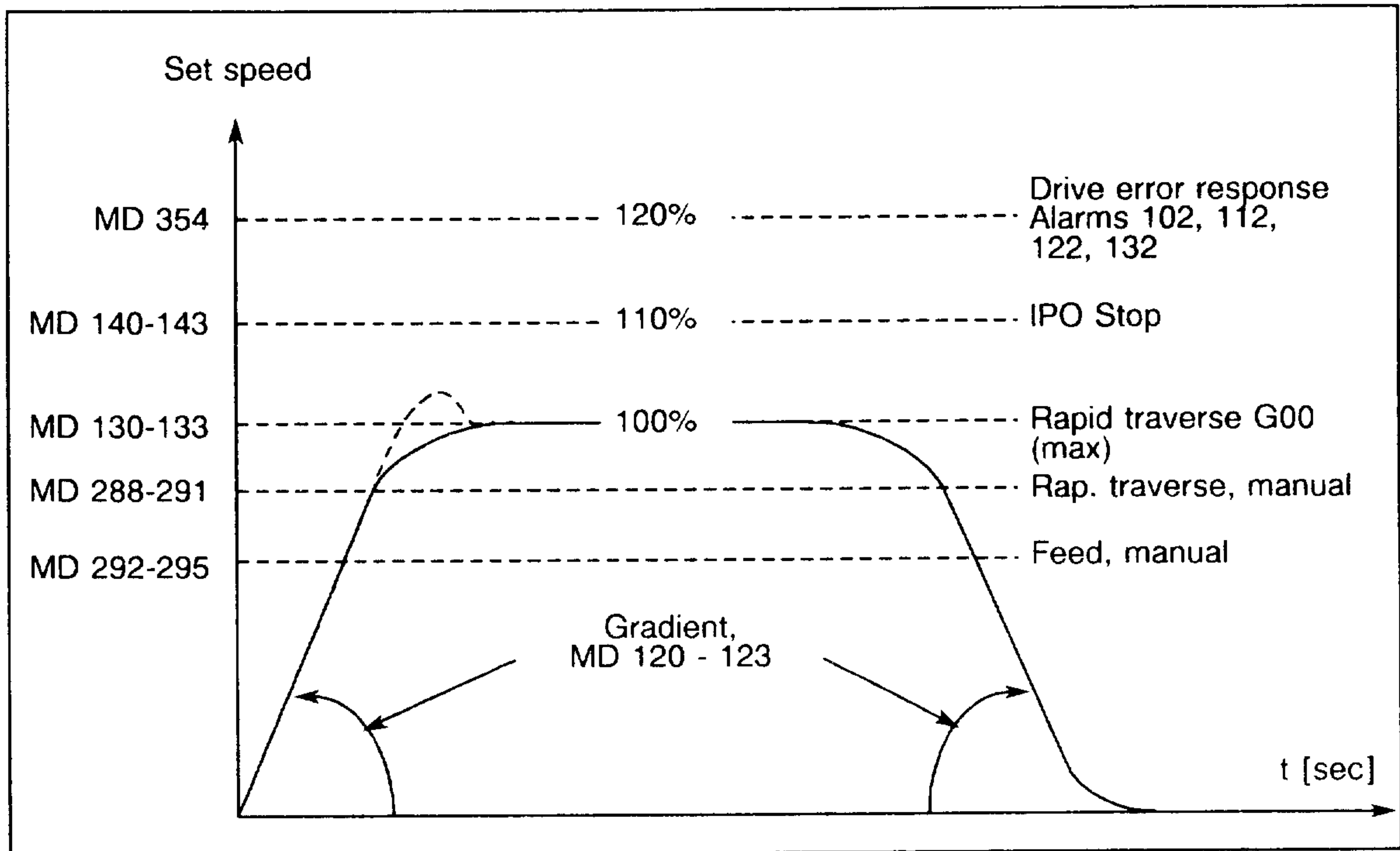
TEST data memory

Axis number	Ident number	Address	Sign	Display / input
	354	S	+	Threshold for set speed monitoring (drive error)

Measuring-circuit module	Input limits		Step	Units
03320	1	3 000	1	1 VELO 1 = $\frac{10 \text{ Volts}}{2048}$
03325/03350	1	12 000	1	1 VELO 2 = $\frac{10 \text{ Volts}}{8192}$

This monitor triggers alarms 102, 112, 122, 132 if the specified set speed is too high (measuring-circuit and drive error). The input must exceed the largest definition value for the maximum set speed entered in Nos. 140 - 143.

Recommendation: Approx. 20 % higher.



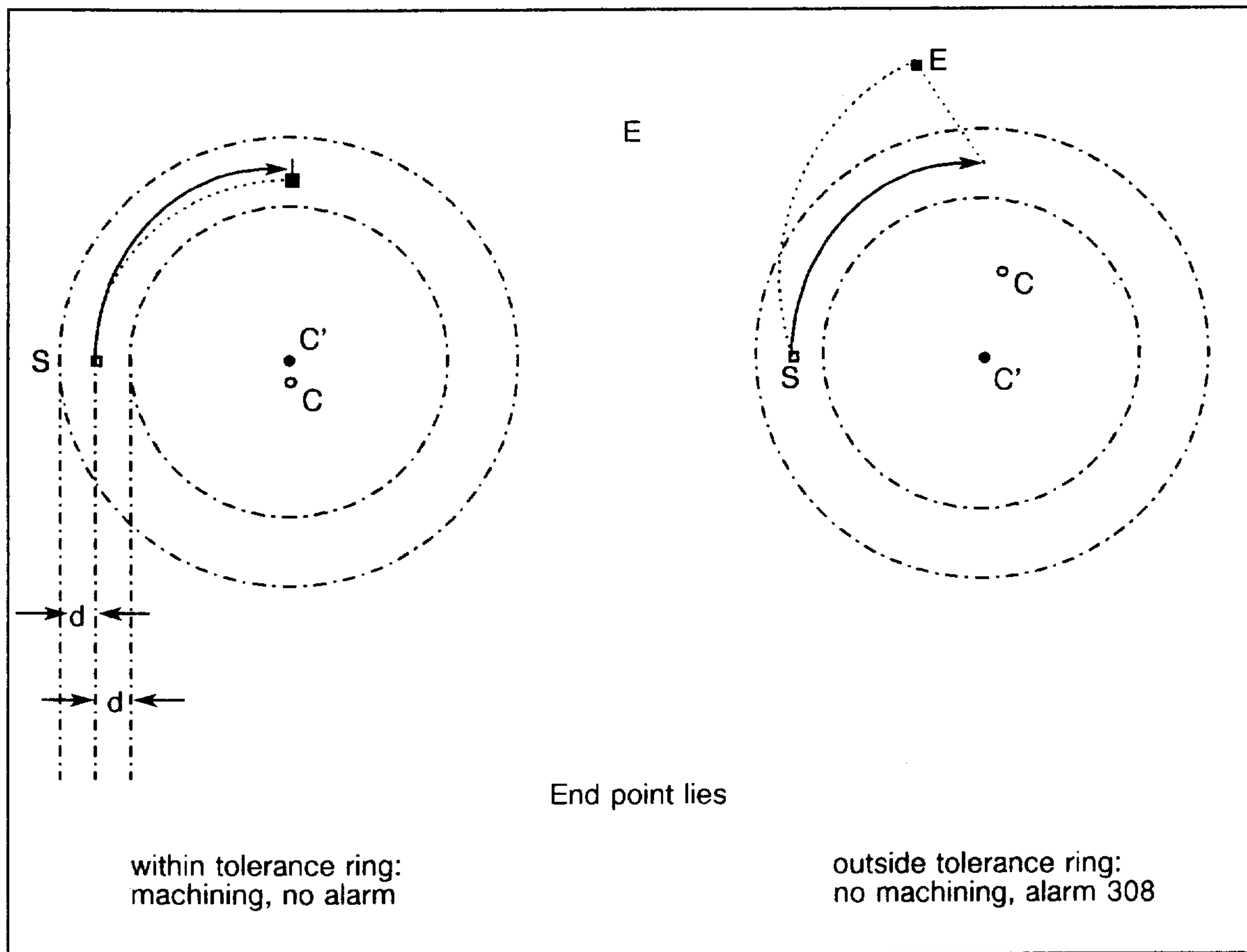
TEST data memory

Axis number	Ident number	Address	Sign	Display / input
	355	S	+	Circle end point monitoring

	Units meas. system	Input limits		Step	Units
Metric; degrees	$1/2 \cdot 10^{-4}$ mm; deg.	0	32 000	1	10^{-4} mm; deg.
	$1/2 \cdot 10^{-3}$ mm; deg.	0	32 000	1	10^{-3} mm; deg.
	$1/2 \cdot 10^{-2}$ mm; deg.	0	32 000	1	10^{-2} mm; deg.
Inch	$1/2 \cdot 10^{-5}$ inches	0	32 000	1	10^{-5} inches/min
	$1/2 \cdot 10^{-4}$ inches	0	32 000	1	10^{-4} inches/min

The input value specifies a circular ring (tolerance ring) equidistant from the **programmed arc**, irrespective of the programmed end point. If the programmed end point lies within the tolerance ring, the incorrectly programmed circular path is traversed until the end point can be approached radially. If the programmed end point is outside the tolerance ring, this is recognized at the buffer; the block is not released for processing and alarm 308 is displayed.

The same sequence also applies in the event of a correctly programmed radius ($C = C'$) and an incorrectly programmed end point.



- = Tolerance ring limits
- ===== = Required circular path (with C and E)
- = Path traversed (with C')
- S = Starting point
- E = End point (correctly programmed)
- D = Input value (n355)
- C = Required centre point
- C' = Programmed centre point (incorrectly programmed)

TEST data memory

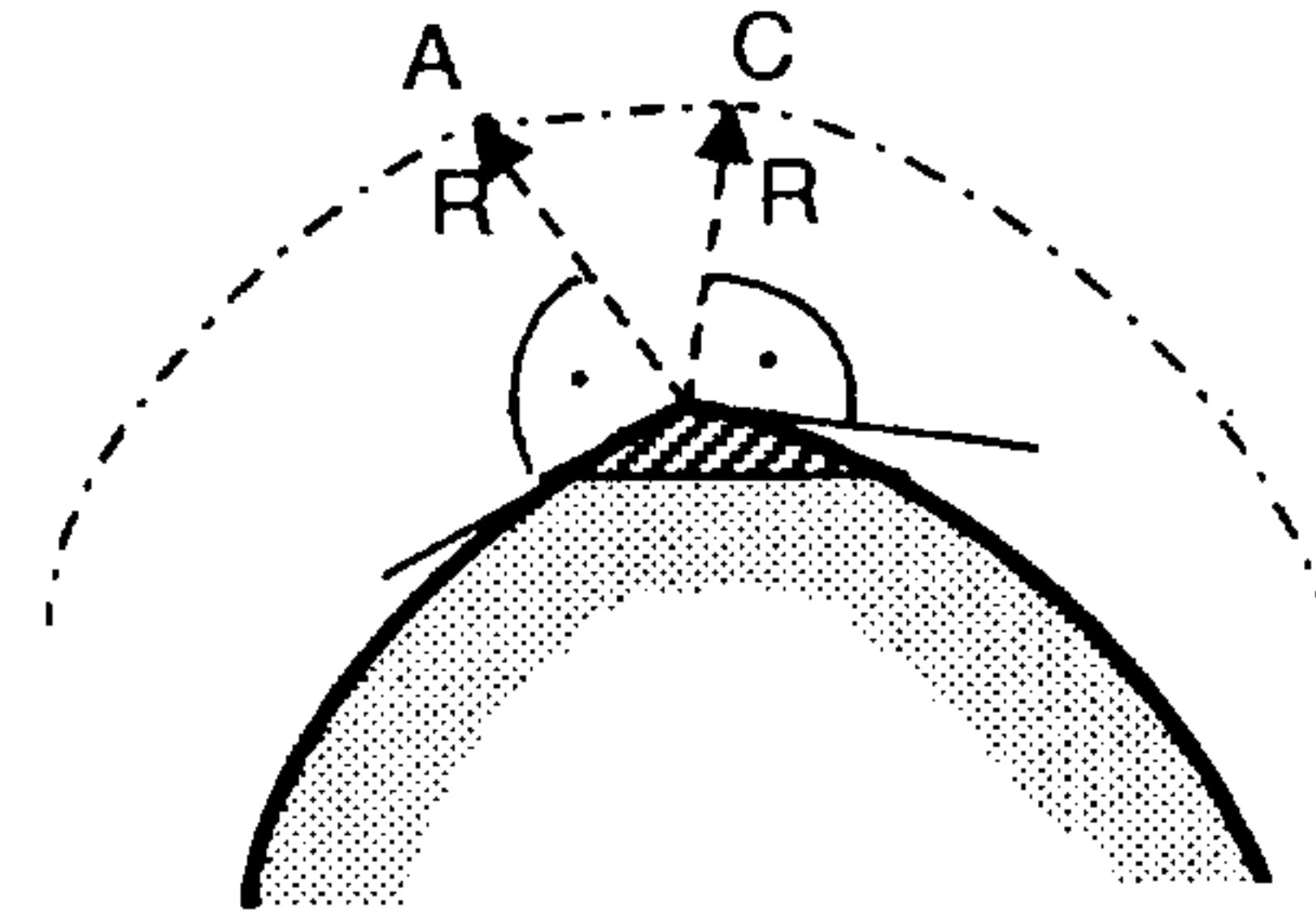
Axis number	Ident number	Address	Sign	Display / input
	356	S	+	Threshold for inserting compensating movement with CRC

	Units meas. system	Input limits		Step	Units
Metric; degrees	$1/2 \cdot 10^{-4}$ mm; deg.	0	32 000	1	10^{-4} mm; deg.
	$1/2 \cdot 10^{-3}$ mm; deg.	0	32 000	1	10^{-3} mm; deg.
	$1/2 \cdot 10^{-2}$ mm; deg.	0	32 000	1	10^{-2} mm; deg.
Inch	$1/2 \cdot 10^{-5}$ inches	0	32 000	1	10^{-5} inches
	$1/2 \cdot 10^{-4}$ inches	0	32 000	1	10^{-4} inches

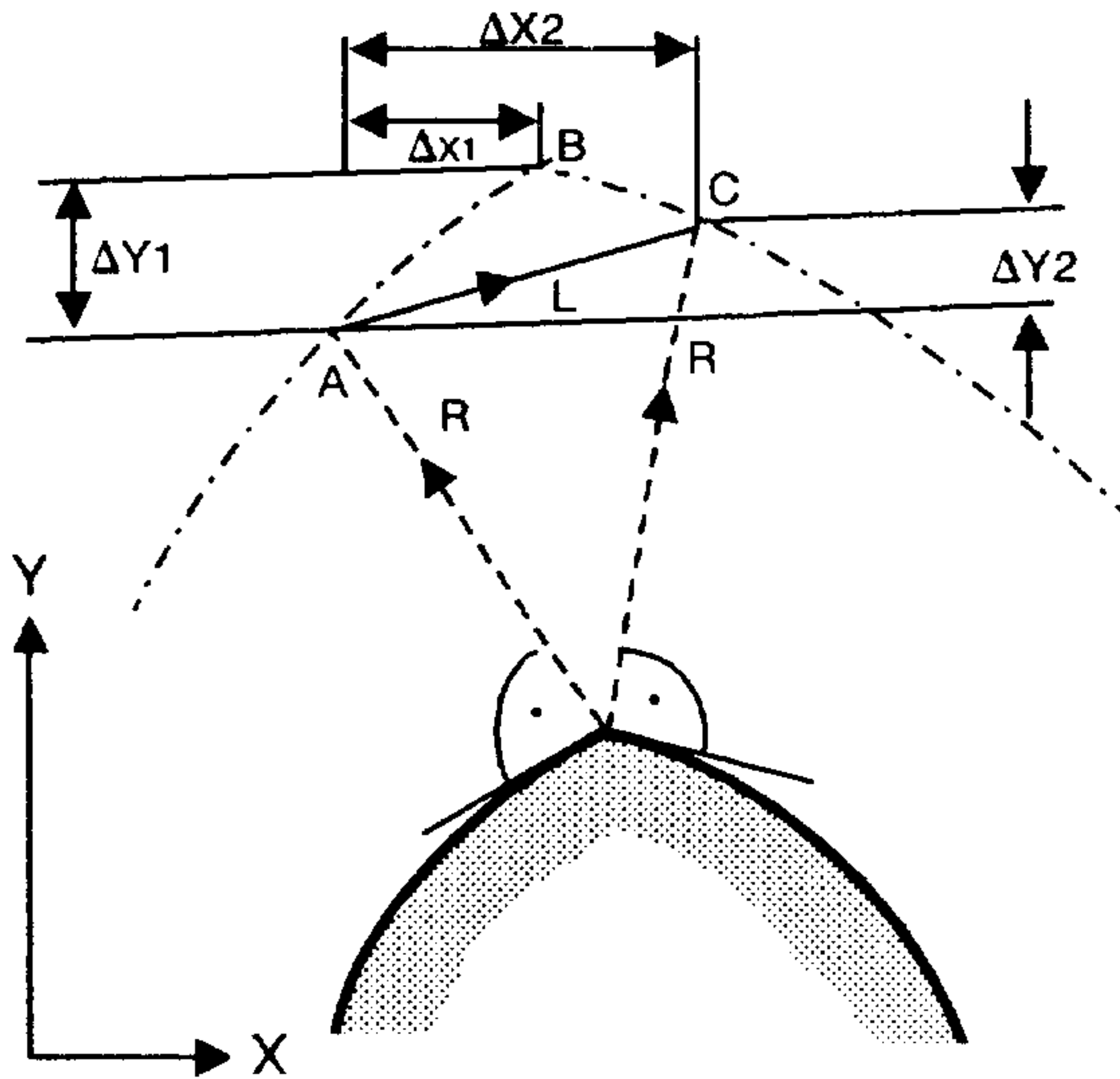
At transitions from a circular contour to a straight contour or to another circular contour one or more intermediate blocks are inserted for linear compensating movement(s) (see Programming Guide). The programmed feedrate is maintained with these compensating movements over the grinding wheel radius centre path and over the workpiece contour during machining. This produces differences in the feedrate. In order to prevent the speed from dipping when the paths are inadequate, the compensating movement is shortened or eliminated beneath threshold "d" as follows:

TEST data memory

$\Delta X1, \Delta Y1 < d:$



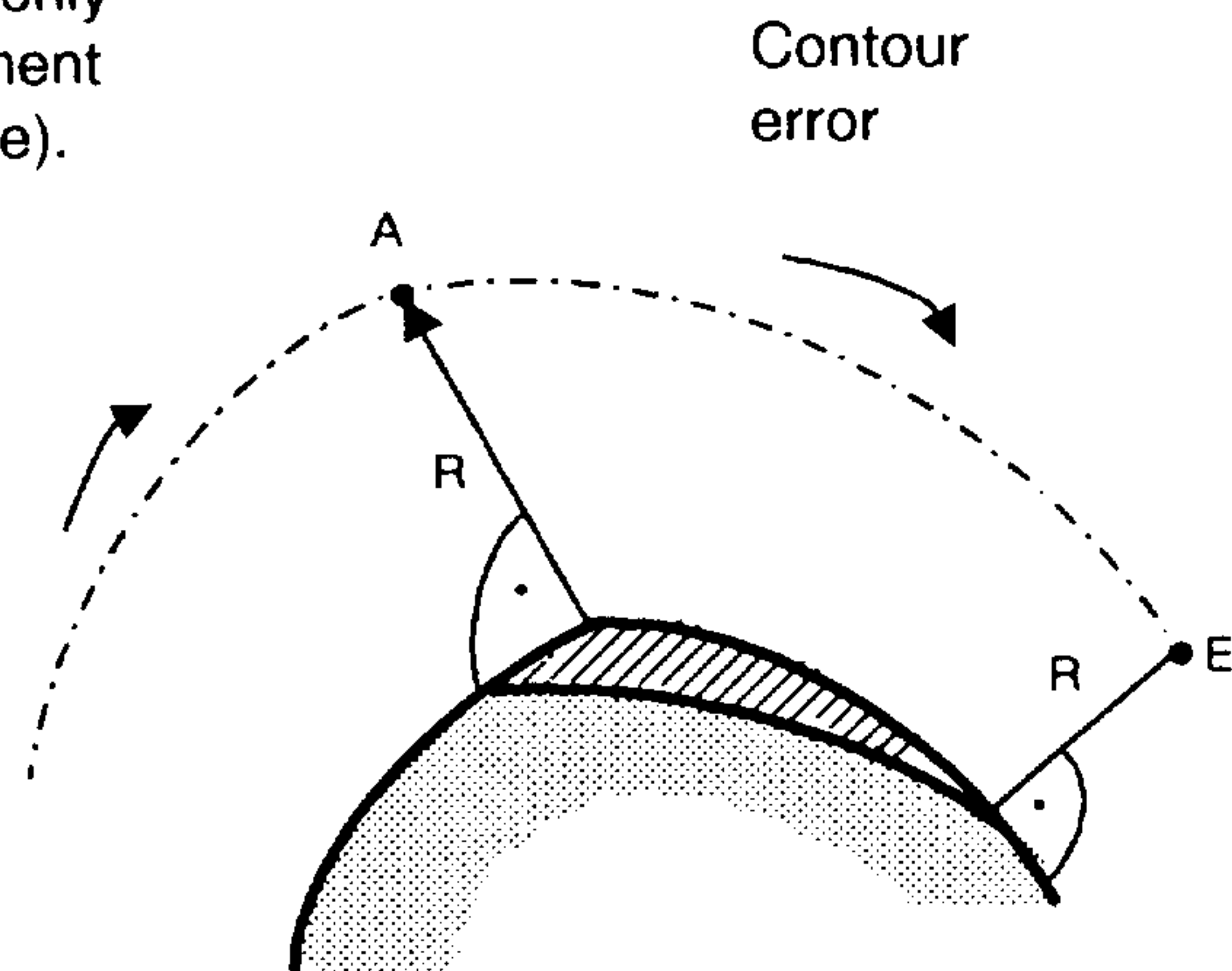
Shortened compensating movement A-C



$\Delta X1, \Delta X2, \Delta Y1, \Delta Y2 < d:$

The threshold is not active at transitions with only linear interpolation. The compensating movement is always carried out (See Programming Guide).

- Grinding wheel radius centre path
- ▨ Contour error



No compensating movement. The proper correction is only reached at the end (E) of the block.

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
Spindle	357	S	+	Drift compensation for spindle

		Input limits		Step	Units
		0	500	1	$\text{Velo 2} = \frac{10 \text{ V}}{8192}$

This machine data determines the drift compensation value with analog spindle speed output. When a low set speed has been specified in the positive and negative directions, the value must be varied in the appropriate direction until the spindle has the same actual speeds in both directions of rotation.

358 S Dynamic Smoothing Exponent for Thread

		Input limits		Step	Units
		0	5	1	$(2^x - 1) \cdot \text{cycle time}$

This influences the acceleration time for the feed drives during thread cutting in order to:

- achieve short acceleration distances for thread grinding
- take the acceleration time of the main spindle into account

The time base used is the actual-value sampling cycle time in the following equation $(2^x - 1) \cdot \text{times cycle time}$ ($x = \text{input value}$), see table below:

Input value	0	1	2	3	4	5
Cycle time	0	1	3	7	15	31
Ramp function	Jump		Ramp			

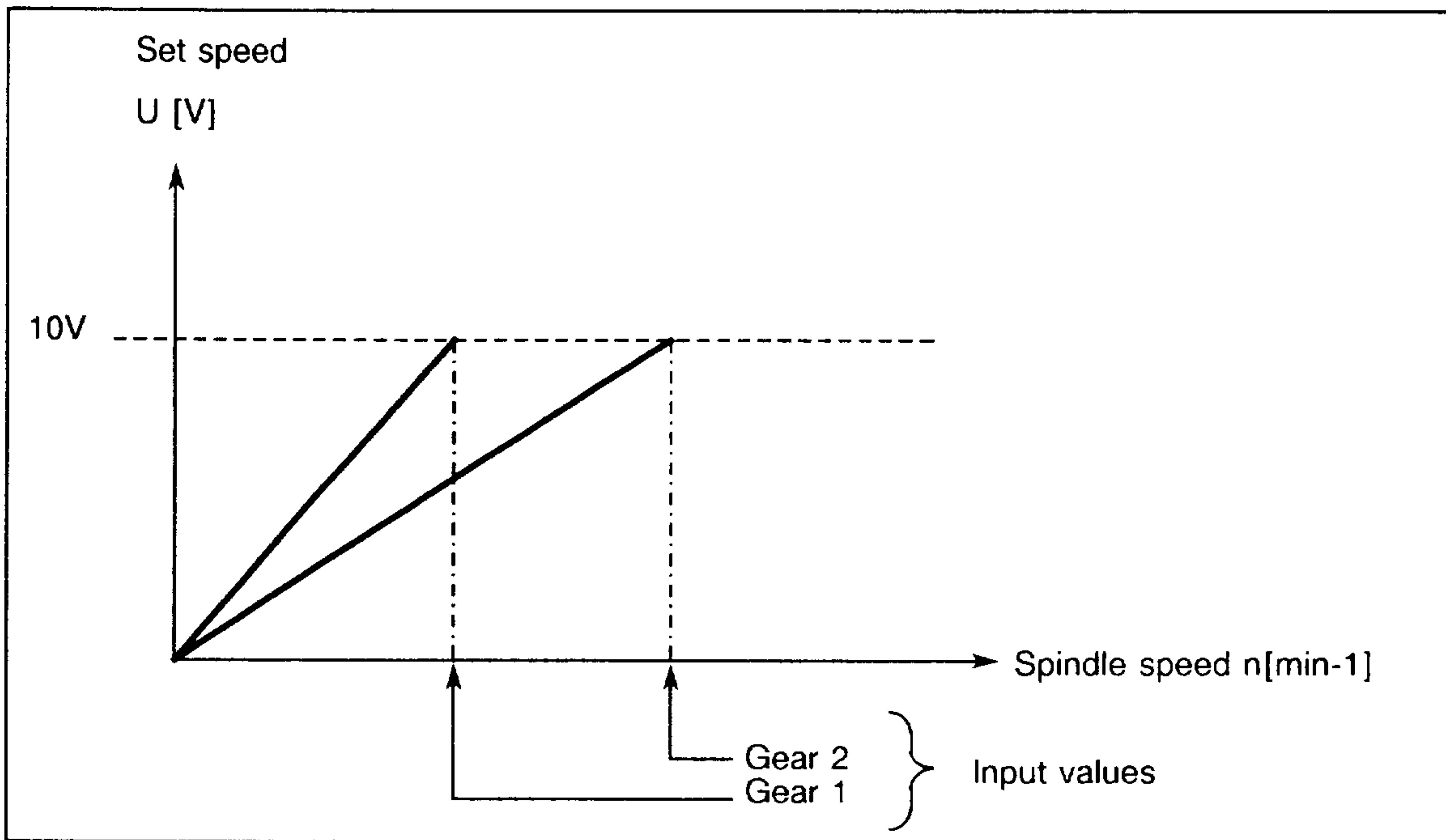
TEST data memory

Axis number	Ident number	Address	Sign	Display / input
Spindle	359 360	S	+	Maximum spindle speed for 2 gears

	Speed range	Input limits		Step	Units
	1 - 9999 mm ⁻¹	16	9 999	1	min ⁻¹
	0.1 - 999 mm ⁻¹	16	9 999	1	0.1 min ⁻¹

These machine data specify the maximum spindle speed reached in the individual gears at a set value of 10 V.

If no gear unit is available, the maximum permissible spindle speed must be entered for 359 and 360.



Assignment:

Gear	1	2
Input number	359	360

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
Spindle	367	S	+	Spindle speed tolerance

	Speed range	Input limits		Step	Units
	1 - 9999 rev/min	0	99	1	%
	0.1 - 999 rev/min	0	99	1	%

In the case of systems with analog spindle speed and spindle sensor the difference between the actual and set speeds is determined.

$$(\text{Set speed} - \text{tolerance}) < \text{actual speed} < (\text{set speed} + \text{tolerance}).$$

The actual speed is measured by means of a ROD encoder. Any deviations outside the tolerance range of the programmed spindle speed value are signalled to the PLC via input I 68.5 by cancelling the "spindle in set range" signal.

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
Spindle	368	S	+	Maximum spindle speed tolerance

	Speed range	Input limits		Step	Units
	1 - 9999 rev/min	0	99	1	%
	0.1 - 999 rev/min	0	99 (100)	1	%

In the case of systems with analog spindle speed and spindle sensor exceeding the maximum speed plus tolerance limit sets input signal I 68.6 in the PLC "spindle speed limit" and triggers alarm 225. This alarm stops the spindle.

Entering 100 switches the monitor off.

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
Spindle	369	S	+	Spindle speed tolerance at rest

	Speed range	Input limits		Step	Units
	1 - 9999 rev/min	0	125	1	0.01%
	0.1 - 999 rev/min	0	125	1	0.01%

In the case of systems with analog spindle speed and spindle sensor the actual speed is measured. In the event of falling below the spindle speed at rest, this is signalled to the PLC via input I 68.3 as a "spindle stopped" signal.

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
Spindle	370	S	+	Maximum spindle speed

	Speed range	Input limits		Step	Units
	1 - 9999 rev/min	1	9 999	1	1 rev/min
	0.1 - 999 rev/min	1	9 999	1	0.1 rev/min

This machine data allows the maximum spindle speed to be limited irrespective of the gear. If this machine data is less than MD 359 (maximum speed for gear 1), the 2nd gear is no longer engaged.

Use:

The PLC can specify chuck-dependent spindle speed limitation via the "broad window" between the NC and PLC.

Valid from 4B/8MHz version (S3701) onwards.

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
	373	S	+	Reference point approach speed

	Units meas. system	Input limits		Step	Units
Metric; degrees	$1/2 \cdot 10^{-4}$ mm; deg.	0	3 000	1	mm/min; deg./min
	$1/2 \cdot 10^{-3}$ mm; deg.	0	30 000	1	mm/min; deg./min
	$1/2 \cdot 10^{-2}$ mm; deg.	0	300 000	1	mm/min; deg./min
Inch	$1/2 \cdot 10^{-5}$ inches	0	30 000	1	10^{-2} inches/min
	$1/2 \cdot 10^{-4}$ inches	0	300 000	1	10^{-2} inches/min

The entered value is applicable to 100% feedrate override switch position.

Rapid traverse override OFF and feed evaluation 1:1 for all axes, unless the value is limited by the input in Test Nos. 130-133.

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
	374	S	+	Incremental feedrate

	Units meas. system	Input limits		Step	Units
Metric; degrees	$1/2 \cdot 10^{-4}$ mm; deg.	0	3 000	1	mm/min; deg./min
	$1/2 \cdot 10^{-3}$ mm; deg.	0	30 000	1	mm/min; deg./min
	$1/2 \cdot 10^{-2}$ mm; deg.	0	300 000	1	mm/min; deg./min
Inch	$1/2 \cdot 10^{-5}$ inches	0	30 000	1	10^{-2} inches/min
	$1/2 \cdot 10^{-4}$ inches	0	300 000	1	10^{-2} inches/min

The entered feedrate is only active with incremental feed.

Note:

Input practical to approx. 1000 $\frac{\text{mm}}{\text{min}}$

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
	375	S	+	Dry run feedrate

	Units meas. system	Input limits		Step	Units
Metric; degrees	$1/2 \cdot 10^{-4}$ mm; deg.	0	3 000	1	mm/min; deg./min
	$1/2 \cdot 10^{-3}$ mm; deg.	0	30 000	1	mm/min; deg./min
	$1/2 \cdot 10^{-2}$ mm; deg.	0	300 000	1	mm/min; deg./min
Inch	$1/2 \cdot 10^{-5}$ inches	0	30 000	1	10^{-2} inches/min
	$1/2 \cdot 10^{-4}$ inches	0	300 000	1	10^{-2} inches/min

The entered speed is active for the programmed feedrate with the dry run switch on if this feedrate is not limited on an axis-specific basis by MD Nos. 130-133.

The feedrate override switch is active.

The dry run switch is active with or without key-operated switch, depending on MD No. 410 bit 2.

Note:

In the case of handwheel override without programmed travel movement (see Programming Guide 3.17.2: Gxx12) the dry run feedrate is also used for this axis or these axes.

The maximum axis displacements should therefore be checked to prevent collisions.

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
Spindle	376	S	+	Main spindle *servo inhibit delay

		Input limits		Step	Units
		0	16 000	1	ms

After this delay has elapsed servo enable (*servo inhibit) is cancelled for the spindle when the set spindle value is 0 in order to prevent drifting.

The delay is active with the following:

- Cancellation of spindle enable signal
- Mxx05
- EMERGENCY STOP
- Measuring-circuit monitor responds
- Error 225 (speed limit exceeded).

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
Spindle	377	S	+	Minimum motor speed, spindle

		Input limits		Step	Units
		0	8192	1	1 VELO 2 = $\frac{10 \text{ Volts}}{8192}$

This machine data specifies the minimum motor speed; above this speed the motor can run smoothly.

Example:

Maximum motor speed = 3500 rev/min, corresponding to the maximum spindle speed.
 Minimum motor speed, for example, 50 rev/min.

$$\text{Input value} = \frac{50 \text{ rev/min}}{3500 \text{ rev/min}} \cdot 8192 = 120$$

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
Spindle	378	S	+	Spindle cutoff speed with M 19

	Speed range	Input limits		Step	Units
Metric; degrees	1 - 9999 rev/min	16	9999	1	1 rev/min
Inch	0.1 - 999 rev/min	16	9999	1	0.1 rev/min

This machine data indicates the spindle speed to which reduction with oriented spindle stop (M 19) and further travel are possible before positioning is performed along the set position control characteristic.

Only with Option E42.

The machine data may be overwritten by the PLC.
Valid from version 4B/8MHz (S3701).

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
Spindle	379	S	+	Position control loop gain (M 19)

	Speed value MD 407 bit 3	Input limits		Step	Units
Metric; degrees	0	0	10 000	1	$\frac{1/\text{min}}{360^\circ}$
Inch	1	0	10 000	1	$0.1 \cdot \frac{1/\text{min}}{360^\circ}$

Recommended value: 200.

With oriented spindle stop (M19) the spindle is included in the position control loop. The gain is described by the positioning gradient to the cutoff position. The gradient is defined as the spindle speed (in rev/min) given a misalignment of 360°.

Only with Option E42.

The machine data may be overwritten by the PLC.
 Valid from version 4B/8MHz (S3701).

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
Spindle	380	S	+	Positional tolerance for M 19

		Input limits		Step	Units
		0	1 000	1	1/11 degrees

The positional tolerance is given in pulse encoder increments.

1 increment corresponds to 360/4096 degrees.

With oriented spindle stop (M19) the message "POSITION REACHED" is output to the PLC via input I 68.4 as soon as the deviation from the specified position is within this tolerance.

Only with Option E42.

The machine data may be overwritten by the PLC.

Valid from version 4B/8MHz (S3701).

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
	381	S	+	Software update *)

The software update is factory stored in the EPROM and is transferred to 381S with Power On Reset (input limits: 0 ... 32000).

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
	382	S	+	R parameter input limit

	Speed value MD 407 bit 3	Input limits		Step	Units
	0	0	500	1	-

MD No. 382 specifies which parameters can be modified manually, via the NC-PLC interface or program. Parameters R291 to R299 may be read with the NC program and by the PLC.

*) A different input value is always converted with Power On Reset to the value entered in the EPROM.

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
	383	S	±	Increase in sampling time

		Input limits	Step	Units	
		0	20	1	1/2 ms

Machine data 383 is normally set to 0. The standard permanent position control sampling time is active.

However, this machine data makes it possible for this time to be increased or reduced. The sampling time should only be modified, following consultation with the relevant service department, if the set time (MD 383 = 0) is not sufficient. (See also MD419).

Axis number	Ident number	Address	Sign	Display / input
	384	S	+	5 or 8MHz hardware

		Input limits	Step	Units	
		-	-	1	-

This machine data indicates whether 5MHz or 8MHz hardware is available.

5: 5 MHz, 03841 module (6FX1122-2A*0*) switch S2, jumper 0 = 0

8: 8 MHz, 03841 module (6FX1122-2A*0*) switch S2, jumper 0 = 1

Display is initialized with POWER ON RESET.

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
Spindle 1	386	S	+	Accelerating time constant for 2 gears
Spindle 2	387			

		Input limits		Step	Units
		0	32 000	1	4 ms

The controller specifies the set acceleration value in ramp form as a function of this machine datum. The action of the machine data is similar to that of a variable ramp-function generator.

It is set by measuring the time interval from zero speed to maximum speed. This time is entered in the machine data after unit conversion.

Example:

Gear 1
 Accelerating time: 400 ms → 386 S 100

Gear 2
 Accelerating time: 580 ms → 387 S 145

These machine data may be overwritten by the PLC.

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
	388 389	S	+	Parameter limits for fast parameters

		Input limits	Step	Units	
		0	399	1	-

Parameter calculations can be performed at higher speed as a result of fast parameter processing (prerequisite: machine data 424 bit 6 and PLC signal 'cycle lock' set). MD Nos. 388-389 allow the user to omit R parameters from this function.

MD No. 388: Specifies the R parameter from which fast parameter processing is not valid.

MD No. 389: Specifies the R parameter from which fast parameter processing is to be resumed.

Condition: MD No. 389 \geq MD No. 388.

Definition of slow and fast parameters:

The following R parameters are always slow:

- R200 ... R203
- R211 ... R219
- R221 ... R265 and
- R310 ... R313

Optionally the following are slow:

- R(MD 388) ... R(MD 389) -1

The following R parameters are always fast:

- R400 ... R499 (independently of MD 388 and MD 389 !)

Unless always slow, the following may be fast:

- R000.R(MD 388) -1
- R(MD 389) ... R399

Note:

The benefits of fast R parameters become effective if the result parameters belong to the fast R parameter range. These results are not submitted for pre-decoding via the buffer memory but are entered directly in the R parameter memory. The pre-decoded R parameter calculations can be repeatedly reworked with the synchronization function, for example via the PLC interface or as a result of program branching due to external signals. This possibility must be considered during program generation and machine data definition in order to avoid errors.

TEST data memory

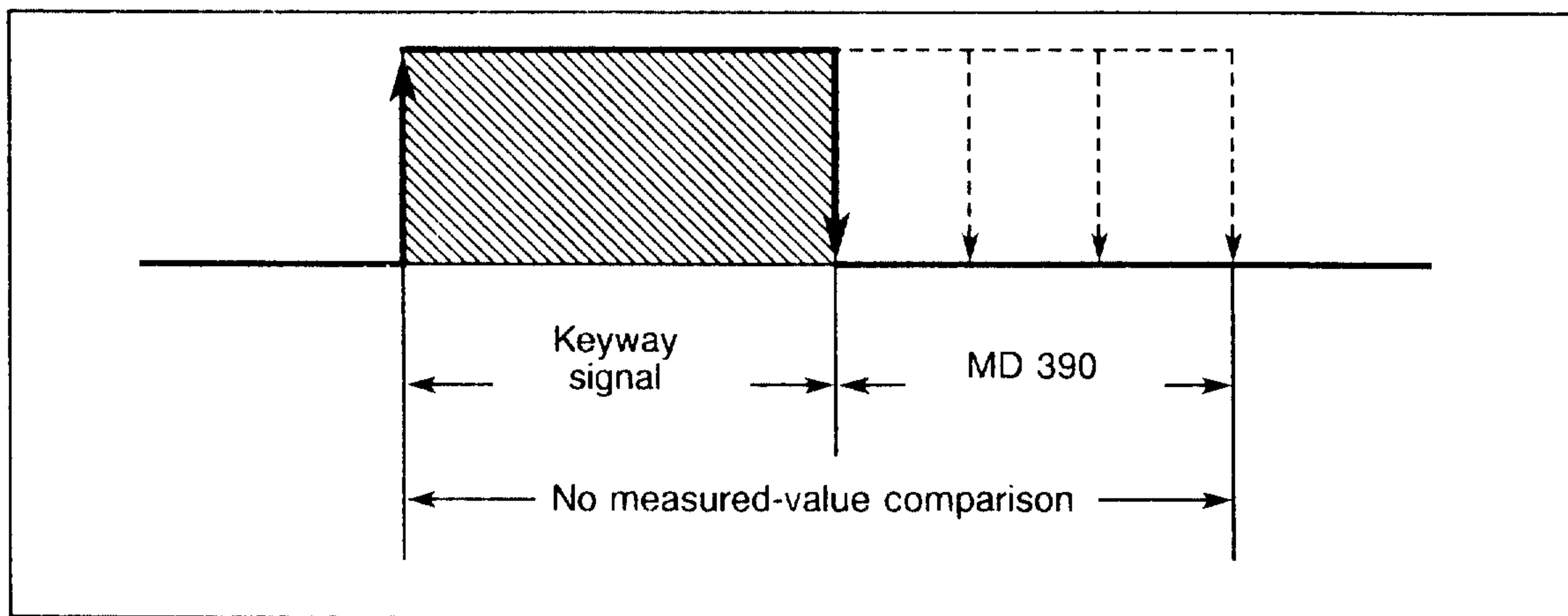
Axis number	Ident number	Address	Sign	Display / input
	390	S	+	Groove signal prolongation

Units measuring system	Input limits	Step	Units	
	0	16 000	18	ms

A keyway signal is evaluated during grinding using a calliper for interruptions. This signal is applied to the measuring-circuit module (03315, 03316, 6FX1125-1AA0* boards, X321 connector). In the case of a leading edge the actual measuring axis value is not evaluated in the controller; the trailing edge re-activates this axis.

From this instant MD 390 can be used to activate a time during which any transient reaction of the calliper is bridged.

This machine data may be overwritten by the PLC.



"Prologation for Keyway signal"

TEST data memory

Axis number	Ident number	Address	Sign	Display / input
	391	S	+	Changeover to IPO/position controller 1:1 prolongation

	Units measuring system	Input limits		Step	Units
		0	16 000	1	Position control cycle time · 2

This machine data is effective if MD 401.0 is set to "1". The changeover to an IPO/position control cycle ratio of 1:1 is delayed by this value. The changeover takes place if all axes are inside the exact stop tolerance range, no traverse command is present, the delay time set here has expired and if no programmed dwell time is effective. The changeover between two exact positioning blocks should be prevented by entering a value corresponding to a time value greater than 60 ms. Example: no multiplication of sampling time active, therefore position control sampling time is 9 ms. MD 390 = 4 → 9 ms · 2 · 4 = 72 ms delay.

14.4 Description of NC Machine Data Bits

The individual machine data bits are described in the order of the input numbers.

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
400		no additional stroke after Gxx82-84	Reciprocation Gxx81 only with feed	endless rotary axis only with feed	no full rotation with rotary axis	G51	Basic setting G52 | G53	

Bit 7: Always set to 0

Bit 6: No additional stroke after Gxx82-84

Bit 6 = 1: When reciprocating with Gxx82-84 the start position is approached after the last infeed irrespective of the infeed distance I.

Bit 6 = 0: At least one complete stroke follows the last infeed.

Bit 5: Reciprocation Gxx81 only with feed

Bit 5 = 1: Reciprocation movements with Gxx81 can only be enabled with feed. Programmed rapid traverse movements have no effect on the reciprocating axis driving reciprocation.

Bit 4: Endless rotary axis only with feed

Bit 4 = 1: An endless rotatory axis is always programmed with G01 and F word. Rapid traverse G00 makes no change.

Bit 3: No full rotation with rotatory axis

Bit 3 = 1: The maximum programmable value is smaller than the Module value. No rotation occurs with a path of ± 360 degrees (Modulo value).

Bit 2: A "1" is entered if the actual value display is not to take the corrections derived from R230-R241 into account in the reset state.

Bit 1: A "1" is entered if the actual value display is not to take the dressing amount derived from R242-R253 into account in the reset state.

Bit 0: A "1" is entered if the actual value display is not to take the zero offsets derived from R254-R265 into account in the reset state.

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
401		No check on M03, M04, M05 in the NC	M103, M104, M105 as M03, M04, M05 to the PLC	Compensation calculation after ref. point app. 1st axis	M 05 without effect on spindle 1	Braking ramp with Reset	S overstore effective with INPUT	IPO / pos. controller 1:1 in calculations

- Bit 6:** No check on M03, M04, M05 in the NC
Bit 6 = 1: The internal check of the spindle function M03, M04, M05 in the NC is suppressed (also for M103, M104, M105). Controls via the PLC only.
- Bit 5:** M103, M104, M105 as M03, M04, M05 to the PLC
Bit 5 = 1: The M-functions 103, 104, and 105 are transferred to the PLC as M03, M04, M05. The PLC program for spindle 1 can be programmed regardless of the number of spindles used.
- Bit 4:** Compensation calculation after ref. point app. 1st axis
Bit 4 = 1: On machines with inclined axis, the compensation amount for the 3rd axis is automatically calculated and incorporated after the reference point approach with the 1st axis. A reference point approach with the 3rd axis is not necessary.
- Bit 3:** M 05 without effect on spindle 1
Bit 3 = 1: Programming M05 has no effect on spindle 1.
Bit 3 = 0: M05 in the program has the same effect as M105.
- Note:** M03 and M04 have basically the same effect as M103 and M104.
- Bit 2:** Braking ramp with Reset
Bit 2 = 1: Braking takes place according to the braking characteristic following a reset from the PLC or operator panel.
Bit 2 = 0: Braking effected with maximum current by means of set value = zero
- Bit 1:** S overstore effective with INPUT
Bit 1 = 1: After an S word has been overstored, the value takes effect immediately the INPUT key is pressed.
Bit 1 = 0: Overstored value does not take effect until after INPUT and NC-START
- Bit 0:** IPO / pos. controller 1:1 in calculations
Bit 0 = 1: In arithmetic blocks, that is when no traverse command is present, the axes are in exact stop position and no dwell time is effective, the IPO/position control cycle ratio is set to 1:1. Programs with a large number of R parameter calculations can be processed more quickly. See MD 391 for delay factor.
Bit 0 = 0: The IPO/position controller ratio is not altered by the program.

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
402								

Always set to 0

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
403 bis 406	Axis is available			Software limit switch active		Sign change for actual part position	Sign change for set speed	Reference point approach in neg. direction

Bit 7: 1 must be set for existing axes. Hardware monitoring is activated.

Bit 6: Always set to 0.

Bit 5: Always set to 0.

Bit 4: A "1" is entered if the values input in MD No. 160 -163 and 170 - 173 are to be active after the reference points have been approached.

Bit 3: Always set to 0.

***Bit 2:** **Bit 2 = 1:** Positive actual part position: positive processing.
Bit 2 = 0: Positive actual part position: negative processing.

***Bit 1:** **Bit 1 = 1:** With positive axis movement the output set speed is: negative.
Bit 1 = 0: With positive axis movement the output set speed is: positive.

***Bit 0:** **Bit 0 = 1:** Reference point approach in positive direction.
Bit 0 = 0: Reference point approach in negative direction.

* These machine data bits may be overwritten by the PLC.

Position Encoder Selection Table

Interpolator unit	Linear axis										Rotary axis		
	0.5 µm										0.5 · 10 ⁻³ deg.		
Factor (machine data)	1	1	1	1	1	1	1	1	1	1	1	2	
Resolution	0.25 µm	0.25 µm	0.25 µm	0.5 µm	0.5 µm	1 µm	1 µm	1 µm	1 µm	0.5 µm	0.5 µm	1 µm	1 x 10 ⁻³ deg.
Pulse weighting, position controller (input X4 /pulse)	0.25 µm/p	0.25 µm/p	0.25 µm/p	0.5 µm/p	0.5 µm/p	1 µm/p	1 µm/p	1 µm/p	1 µm/p	0.5 µm/p	0.5 µm/p	1 µm/p	1 x 10 ⁻³ deg./p
Pulse weight. downstream of electronic pulse shaper	1 µm/p	1 µm/p	1 µm/p	2 µm/p	2 µm/p	4 µm/p	4 µm/p	4 µm/p	4 µm/p	2 µm/p	2 µm/p	4 µm/p	4 x 10 ⁻³ deg./p
Electronic pulse shaper												5 - fold	5 - fold
Encoder pulses / rev or grating constant	2 000	2 500	2 500	2 000	2 500	2 000	2 500	2 000	2 500	5 000	20 µm	20 µm	18 000
Max. input frequency per channel	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz
Spindle lead mm	2	2.5	2.5	4	5	8	10	10	10	10	-	-	Direct
V _{max} axis encoder-dependent m/min	6	6	6	12	12	24*	24*	24*	24*	12	15	30*	30 000° / min
Electric encoder limit speed	3000 rev/min	2400 rev/min	2400 rev/min	3000 rev/min	2400 rev/min	3000 rev/min	2400 rev/min	2400 rev/min	2400 rev/min	1200 rev/min	-	-	83.3 rev/min

* Rapid traversing speed = V_{max} axis, however not exceeding 30 m/min or 30 000 degrees/min
Axis-specific setting of factor (machine data) is possible

Rotary encoders for linear axes 6FC9 320-3C.

Position Encoder Selection Table

Interpolator unit	Linear axis										Rotary axis
	0.05 µm										0.5 · 10 ⁻⁴ deg.
Factor (machine data)	1	2	4	1	2	4	1	2	4	4	2
Resolution	0.025 µm	0.05 µm	0.1 µm	0.05 µm	0.1 µm	0.2 µm	0.05 µm	0.1 µm	0.1 µm	0.2 µm	1 x 10 ⁻⁴ deg.
Pulse weighting, position controller (input X4/pulse)	0.025 µm/p	0.05 µm/p	0.1 µm/p	0.05 µm/p	0.1 µm/p	0.2 µm/p	0.05 µm/p	0.1 µm/p	0.1 µm/p	0.2 µm/p	1 x 10 ⁻⁴ deg.
Pulse weight. downstream of electronic pulse shaper	0.1 µm/p	0.2 µm/p	0.4 µm/p	0.2 µm/p	0.4 µm/p	0.8 µm/p	0.2 µm/p	0.4 µm/p	0.8 µm/p	0.8 µm/p	4 x 10 ⁻⁴ deg.
Electronic pulse shaper										25 - fold	25 - fold
Encoder pulses / rev. or grating constant	20 000	10 000	5 000	10 000	5 000	2 500	20 000	10 000	5 000	20 µm	36 000
Max. input frequency per channel	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz
Spindle lead mm	2	2	2	2	2	2	4	4	4	-	Direct
V _{max} axis encoder-dependent m/min	0.6	1.2	2.4 *	1.2	2.4 *	4.8 *	1.2	2.4 *	4.8 *	4.8 *	2400° / min
Electric encoder limit speed	300 rev/min	600 rev/min	1200 rev/min	600 rev/min	1200 rev/min	2400 rev/min	300 rev/min	600 rev/min	1200 rev/min	-	8.33 rev/min

* Rapid traversing speed = V_{max} axis, however not exceeding 3 m/min or 3000 degrees/min
 Axis-specific setting of factor (machine data) is possible

Rotary encoders for linear axes 6FC9 320-3C.

Position Encoder Selection Table

Interpolator unit	Linear axis										Rotary axis	
	5.0 μm										5 · 10 ⁻³ deg.	
Factor (machine data)	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1	2		2
Resolution	1.25 μm	2.5 μm	2.5 μm	2.5 μm	2.5 μm	2.5 μm	2.5 μm	2.5 μm	5 μm	5 μm	10 μm	1 x 10 ⁻² deg.
Pulse weighting, position controller (input X4/pulse)	1.25 $\mu\text{m/p}$	2.5 $\mu\text{m/p}$	2.5 $\mu\text{m/p}$	2.5 $\mu\text{m/p}$	2.5 $\mu\text{m/p}$	2.5 $\mu\text{m/p}$	2.5 $\mu\text{m/p}$	2.5 $\mu\text{m/p}$	5 $\mu\text{m/p}$	5 $\mu\text{m/p}$	10 $\mu\text{m/p}$	1 x 10 ⁻² deg.
Pulse weight, downstream of electronic pulse shaper	5 $\mu\text{m/p}$	10 $\mu\text{m/p}$	10 $\mu\text{m/p}$	10 $\mu\text{m/p}$	10 $\mu\text{m/p}$	10 $\mu\text{m/p}$	10 $\mu\text{m/p}$	10 $\mu\text{m/p}$	20 $\mu\text{m/p}$	20 $\mu\text{m/p}$	40 $\mu\text{m/p}$	4 x 10 ⁻² deg.
Electronic pulse shaper												-
Encoder pulses / rev. or grating constant	2 000	1 000	1 000	1 000	1 000	1 000	1 000	500	1 000	1 000	500	9 000
Max. input frequency per channel	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz	500 kHz
Spindle lead mm	10	10	10	10	10	10	10	10	20	20	20	Direct
V _{max} axis encoder-dependent m/min	30	60	60	60	60	60	60	120	120	120	240	300 000° / min
Electric encoder limit speed	3000 rev/min	6000 rev/min	6000 rev/min	6000 rev/min	6000 rev/min	6000 rev/min	6000 rev/min	12000 rev/min	6000 rev/min	6000 rev/min	12000 rev/min	833 rev/min

* Rapid traversing speed = V_{max} axis, however not exceeding 300 m/min or 300 000 degrees/min
Axis-specific setting of factor (machine data) is possible

Rotary encoders for linear axes 6FC9 320-3C.

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
407	NC-Start without reference point enable	Reset has no effect on spindle	Spindle stop with M00	Sign change spindle 1 set value	Speed in 0.1 rev/min	Spindle pulse encoder available	Sign change spindle 1 actual value	Actual spindle value times 2

Bit 7: NC-Start without reference point enable

Bit 7 = 1: Start interlock is not active but reference point approach is possible.

Bit 7 = 0: After the controller has been powered up, the reference points for all axes must be approached, otherwise NC-Start is prevented in operating modes (AUTO and JOG) (alarm 351), (see also MD403, 404, AUTO and JOG 405, 406 bit 7).

Exception: If a measuring axis has been defined.

Bit 6: Reset has no effect on spindle

Bit 6 = 1: With S-analog the last effective spindle speed is not cleared for spindle 1 after a mode change, activation of 'Reset' key, M02, M30. If the spindle is to be stopped, either S1 = 0 or M0105 must be programmed.

Bit 6 = 0: As previously, spindle stop with mode change, reset, M02 and M30.

Bit 5: Spindle stop with M00

Bit 5 = 1: Bit set to 1: with S-analog the spindle is stopped for spindle 1 in "Automatic" mode with M00; after "NC-Start" the last programmed spindle speed is reactivated.

Bit 5 = 0: As previously, the spindle continues to rotate.

Bit 4: Sign change spindle 1 set value

Bit 4 = 1: With S-analog the output set value for spindle 1 is negative.

Bit 4 = 0: The output set value is positive.

Bit 3: Speed in 0.1 rev/min

Bit 3 = 1: Spindle speed S1 from 0.1 to 999 rev/min. The corresponding set value x 10 is programmed, e.g. for 99 rev/min program S1 = 990. The correct speed is displayed (99 rev/min). The maximum speed with the bit set is 999.9 rev/min.

Bit 3 = 0: Spindle speed S1 from 1 to 9999.

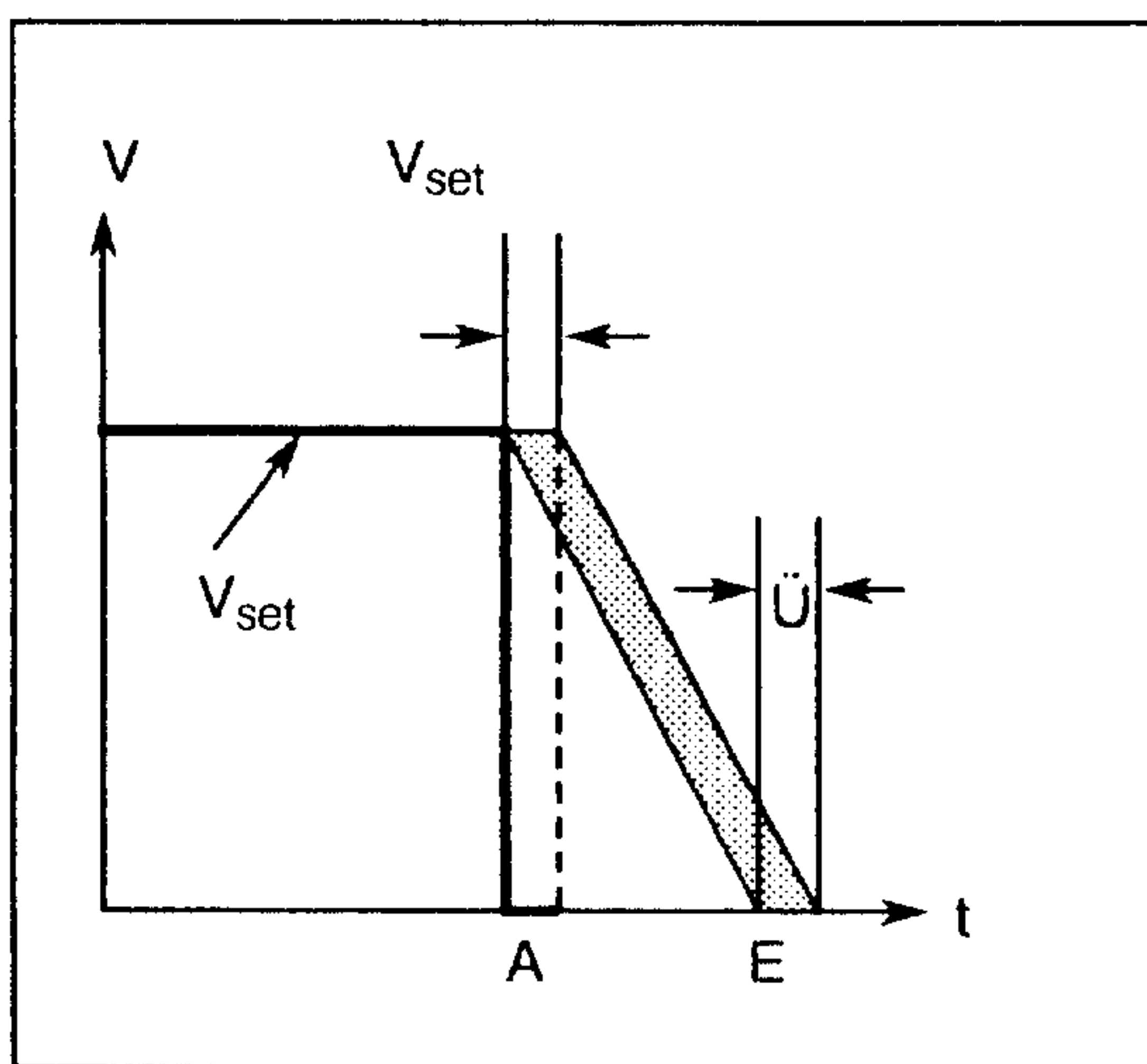
Bit 2: Spindle pulse encoder available**Bit 2 = 1:** Hardware monitoring of the spindle pulse encoder (alarm 224) is activated and the actual spindle value is displayed.**Bit 1:** Sign change spindle 1 actual value**Bit 1 = 1:** The sign of the measured actual spindle value is changed, e.g. a positive actual part position is processed as a negative value. For display and spindle monitoring.**Bit 0:** Actual spindle value times 2**Bit 0 = 1:** Actual spindle value is multiplied by 2. In order to ensure higher spindle speeds, the ROD encoder ratio to the spindle can be reduced (using 2:1 gearing). The actual spindle value must then be multiplied by 2. This makes it possible to double the maximum allowable spindle speed (to max. 999 rev/min or 999.9 rev/min).

* These machine data bits may be overwritten by the PLC.

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
408	No delay at limit switch	Reset state inch (G70)	F external in input system		Short-circuit for S input data	Auxiliary functions are output prior to travel	Auxiliary function output with block search	

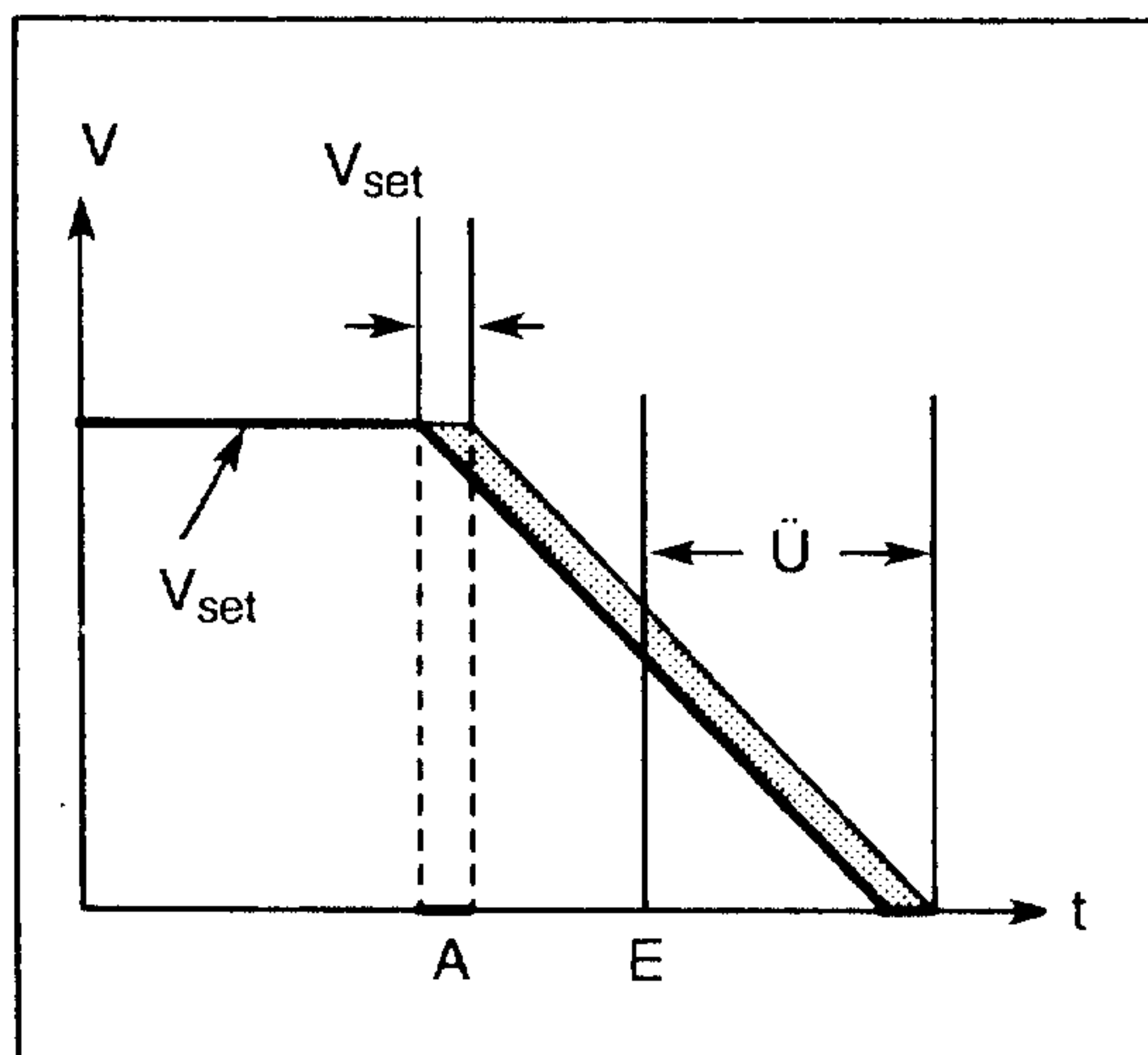
Bit 7: No delay at limit switch

Bit 7 = 1: When the software limit switch is reached only the following error S is reduced to zero. Overtravel O depends on instant A and the drive unit.



- C = Computer time
- A = Time range for detecting software limit switch
- E = Exact instant at which software limit switch is reached
- O = Overtravel time (software limit switch overtravelled)

Bit 7 = 0: When the software limit switch is reached, the digital speed is specified on the basis of the braking characteristic. Overtravel O is a function of acceleration (MD120-123), instant A, the speed and drive unit.



- C = Computer time
- A = Time range for detecting software limit switch
- E = Exact instant at which software limit switch is reached
- O = Overtravel time (software limit switch overtravelled)

Bit 6: Reset state inch (G70)**Bit 6 = 1:** Inch input system, Inch unit G70 is reset state inch.**Bit 6 = 0:** Metric input system, mm unit G71 is reset state.**Bit 5:** F external in input system**Bit 5 = 1:** External F value transferred to input system.**Bit 5 = 0:** External F value transferred to machine system.**Bit 4:** Always set to 0**Bit 3:** Short-circuit for S input data**Bit 3 = 0:** Evaluation of the short-circuit for S-input data programmed speed for S-analog via the PLC. The interface control decodes the programmed BCD data output by the NC and returns them to the NC via "external data input". The data may be modified in the interface control for special functions (gear engaging, chip breaking). NC-internal evaluation of the programmed spindle speed is not active. Mxx04 and Mxx05 are evaluated.**Bit 3 = 1:** The programmed spindle speed or cutting speed and Mxx03, Mxx04, Mxx05 are evaluated in the NC. Interface control transfer is possible for S via "external data input". The transferred value is active until "RESET" or program end; the programmed data are suppressed. If function blocks FB21 and FB22 are active in the PLC, the programmed S values are always processed via the PLC, even if bit 3 = 1, as described above for bit 3 = 0.**Bit 2:** Auxiliary functions are output prior to travel**Bit = 0:** Auxiliary function are output during travel.**Bit = 1:** Auxiliary function are output prior to travel.

According to the manufacturer, output of the auxiliary function must be specified with block search; see also Interface Description System 3, Part 2, Section 3.5.

Bit 1,0: Auxiliary function output with block search

Aux. function output with block search	Bit	
	1	0
No output	0	0
After NC-Start	0	1
During block search	1	0

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
409	Machine data entered						2nd measuring circuit inserted	

Bit 7: Machine data entered. This machine data enables the interface to the PLC.
Bit 7 = 1: This bit must always be set to 1. With the bit set, interface signals can be transferred.

Bit 6 - 2: Always set to 0

Bit 1: 2nd measuring circuit inserted.

MRPD	Previous designation	Conditions
- 6FX1125-1AA00 6FX1125-7AA00 6FX1125-1AA01 6FX1125-7AA01	03 310A or 03 315 and 03 325 or 03 316 and 03 326	3rd axis
- 6FX1125-1AA00 6FX1125-7AA00 6FX1125-1AA01 6FX1125-7AA01	03 310A/B or 03 315 and 03 325 or 03 316 and 03 326	3 axes + spindle and/or 4th axis

Given 2 axes + spindle this machine data may be used to specify the following:

Bit = 0: Set spindle value for 3rd axis

Bit = 1: Set spindle value for spindle

See also Section 13.18.

Bit 0 : Always set to 0

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
410			R parameters, user data	Preset	Part program correction	Dry run feedrate	Cursor	Transfer of S, M, H, L

Bit 7, 6: Always set to 0

for bit 5 to 0:

Key-operated switch active in certain operating modes. Input at customer's request. If the bit is set to 1 the appropriate mode is interlocked using the key-operated switch.

Bit 5 = 1: R parameters and user data cannot be modified through manual input.

Bit 4 = 1: Setting actual value, determining dressing position.

Bit 3 = 1: Correction and deletion of part programs.

Bit 2 = 1: Dry run feedrate.

Bit 1 = 1: Cursor for block search, input of program numbers in automatic mode.

Bit 0 = 1: Transfer of S, M, G5/G6, H and L functions.

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
411	Device coding (Input device)				Baud rate (Input device)			
412	Device coding (Output device)				Baud rate (Output device)			

(Baud rate and coding for input and output devices).

This machine data specifies the input/output device designation. N411 applies to the input and N412 to the output of the devices connected to the 03840 module, connector X843. The interface may be operated in full duplex mode as a V.24 (RS 232C) or 20 mA interface; for this purpose MD416 bit 0 must always be set to 1".

These machine data bits may be overwritten by the PLC (from 4B/8MHz version onwards).

	Machine data (binary)								Device
	B7	B6	B5	B4	B3	B2	B1	B0	
									Universal devices
	1	1	0	0	0	1	0	0	FACIT 4040 with PI81 (1200 BAUD)
	1	1	0	0	0	0	1	1	FACIT 4070 with MI77 interface (600 BAUD) 54C/S
	1	1	0	0	0	0	1	0	PT80 Siemens keyboard printer terminal commiss. data with STT104 interface (300 BAUD)
	1	1	0	0	0	1	0	0	SANYO M25020 cassette machine with ZE601 interface (1200 BAUD)
	1	1	0	0	0	1	0	0	SME (1200 BAUD)
	1	1	0	0	0	1	0	0	NC link Wire-controlled NC (1200 BAUD)
	1	1	0	0	0	1	0	0	FACIT 4030, (1200 BAUD) 120 C/S
	1	1	0	0	0	1	0	0	PG 675 (1200 BAUD) provided MD416, Bit 7 = 1
	1	1	0	0	0	1	1	1	GNT 27/28 reader

Machine data (binary)									Device
B7	B6	B5	B4	B3	B2	B1	B0	Special devices	
0	0	0	0	0	0	0	0	Output: PT80 (300 BAUD) Input: Siemens tape reader	
0	0	0	0	0	1	1	1	Siemens tape readers with and without winder (9600 BAUD)	
0	0	0	1	1	0	0	0	Teletype ASR-33 full duplex (110 BAUD)10C/S	
1	1	0	0	0	1	1	0	FANUC hand-held reader DC1/DC3 controlled (4800 BAUD)	
0	0	1	1	0	1	1	0	FANUC programming workstation (4800 BAUD)	
0	0	1	0	0	1	0	0	NC link with control char. DC1 to DC4 (1200 BAUD)	
0	0	1	0	0	1	1	1	FACIT 4040 with PI81 with control char. DC1 to DC4 (9600 BAUD)	

Bit 7 - 3: Device coding Significance of bits

Bit 7	Bit 6	Number of stop bits	Bit 5	Parity type	Bit 4	Parity bit	Bit 3	Evaluate availability (DSR)
0	1	1 stop bit	0	Odd	0	Without parity	0	No
1	0	1 1/2 stop bit	1	Even	1	With parity	1	Yes
1	1	2 stop bit						

Bit 0 - 2: Baud rate Significance of bits

Bit 2	Bit 1	Bit 0	Baud
0	0	0	110
0	0	1	150
0	1	0	300
0	1	1	600
1	0	0	1200
1	0	1	2400
1	1	0	4800
1	1	1	9600

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
413	EIA code for "c o m m e r c i a l a t" @							

Bit 7 bis 0: EIA code has no specification for @. Consequently, a corresponding specification must be selected. This tape bit pattern is to be entered here.

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
414	DC control character without parity V.24 (RS 232C)	No conversion in accordance with MD MD413, 428, 429	No time watch-dog V.24 (RS 232C)	V24 V.24 (RS 232C) Reset also with CTS = "0" (-12V)		NC-Ready common disable		

Bit 7: Bit 7 = 0: DC control signal without parity, DC1 = 11_H, DC2 = 12_H, DC3 = 13_H, DC4 = 14_H
Bit 7 = 1: DC control signal with parity, DC1 = 11_H, DC2 = 12_H, DC3 = 13_H, DC4 = 14_H
 See Installation Guide Part 2, Section 8, V.24 (RS 232C) interface

Bit 6: Bit 6 = 0: With comment texts the characters "@" "*" and "=" are converted in accordance with MD413, 428 and 429 for V.24 (RS 232C) interface.
Bit 7 = 1: No conversion

Bit 5: Bit 5 = 1: The time watchdog is disabled during data input via V.24 (RS 232C) interface.
Bit 5 = 0: The time watchdog is active and signals "time watchdog" if no character has been read in within 20 seconds.

Bit 4: Bit 4 = 1: A Reset can also be effected for the V.24 (RS 232C) interface with CTS signal "0" (-12V).
Bit 4 = 0: The interface signal "V.24 (RS 232C) active" cannot be deleted with Reset if pin 4 CTS = "0".

Bit 2: Bit 2 = 1: Only for 3GG
 If NC monitoring of one NC responds, operating readiness is also cancelled in the other NC.

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
415		External data input					Thread cutting and rotational feedrate	

Bit 7: Always set to 0

Bit 6: External data input (NC/PLC interface)
This machine data bit activates communication between the NC and PLC interface. The default is "1".

Bit 5 - 2: Always set to 0

Bit 1: **Bit 1 = 1:** Programming of thread-cutting feedrate with Gxx33 and feedrate in spindle revolutions with Gxx95 is enabled.

Bit 0: Always set to 0

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
416	Block end with CR LF				Highspeed measurement	NC alarm texts		V.24 (RS 232)

Bit 7: **Bit 7 = 0:** Program output is normally denoted with LF CR CR.
Bit 7 = 1: Program output is normally denoted with CR LF; this is required to store data with PGIN in PG 675 or PG 685.

Bit 6 - 4: Always set to 0

Bit 3: **Bit 3 = 1:** No evaluation of signals at the X321 connector of the 03315/03316 (6FX1125-1AA0*) measuring-circuit module.
Bit 3 = 0: Automatic stopping and repositioning in rapid traverse for the axis allocated by the program. The interrupt position is stored in R parameter 291 (without decimal point). Gxx27 may only be programmed once per NC block. Hardware recording of the instantaneous position with signal at the measuring input.

Bit 2: **Bit 2 = 1:** Bit must be set to 1.
Basic version includes alarm texts in addition to coded display.

Bit 1: Bit must be set to 0.

Bit 0: Bit must be set to 1:
V.24 (RS 232C) interface at the X843 connector of the 03840 (6FX1122-2A*0 *) module for the devices listed in Section 2.
Included in basic version.

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
417	Logic sub-module	Direct circle radius programming			Spindle active with threading		Kv factor measured	14 bit DAC

- Bit 7:** Bit must be set if the 02401 logic submodule is used. This machine data is set automatically with input 8.
- Bit 6:** **Bit 6 = 1:** A circle can be programmed by stating the end position coordinates and radius.
- Bit 5 - 4 :** Always set to 0
- Bit 3:** **Bit 3 = 1:** Spindle override is also active when programming Gxx33
- Bit 2:** Always set to 0
- Bit 1:** **Bit 1 = 0:** Measured Kv factor is deleted when modifying machine data.
Bit 1 = 1: Measured Kv factor is not deleted when modifying machine data (the first value measured remains stored). This is necessary if machine data are overwritten by the PLC (otherwise alarm 528 is triggered).
- Bit 0:** **Bit 0 = 0:** The bit must not be set with 03320 - 03323, 03340 measuring-circuit modules.

$$1 \text{ VELO} = \frac{10 \text{ V}}{2048}$$
- Bit 0 = 1:** The bit must be set with the 03325 and 03326 measuring-circuit modules.

$$1 \text{ VELO} = \frac{10 \text{ V}}{8192}$$

The following machine data must be observed in conjunction with this bit:
 Nos. 140-143, Nos. 230-233, No. 354.

The default for this bit is "1" using inputs 6-8.

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
418		Inclined axis		Auto IR during reciprocation			Dividing head	

Bit 7: Always set to 0

Bit 6: This bit must be set if the machine has an inclined axis. It may be overwritten by the PLC. POWER ON RESET must be performed with manual input.

Bit 5: Always set to 0

Bit 4: **Bit 4 = 1:** Reciprocation stopped after automatic mode interrupt as previously.
Bit 4 = 0: In the event of a mode change during automatic operation, the reciprocation axis continues to reciprocate and the feed axis stops. After "NC-Start" feed is continued.

Bit 3 - 2: Always set to 0

Bit 1: **Bit 1 = 1:** A number of divisions and division number can be programmed with Gxx68 and Gxx69 respectively.

Bit 0: Always set to 0

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
419								

Internal display bits

If all bits have been set to 1, the sampling time has been exceeded. The CPU capacity has not been sufficient to process all software options. Remedy: check and reduce the number of options or increase the sampling time (MD383).

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
424	M104 without effect on spindle 1	High-speed param. processing	Grinding wheel monitoring with dress. syst change	R parameter rounding	Recording of dressing position inter-locked	Software limit switch with inclined axis	Override 0 with Gxx63	Reciprocation interrupt with single block

- Bit 7:** **Bit 7 = 1:** With S analog input of M104 has no effect.
Bit 7 = 0: As previously.
- Bit 6:** **Bit 6 = 1:** High-speed parameter processing with cycle lock active.
Bit 6 = 0: No high-speed parameter processing.
- Bit 5:** **Bit 5 = 1:** Monitoring of the grinding wheel diameter is re-activated with each change to the corresponding dressing sum (R242-R253).
Bit 5 = 0: Monitoring is activated with each NC-Start provided machine datum 426 bit 6 = 1.
- Bit 4:** **Bit 4 = 1:** Inaccuracies in calculations involving decimals are rounded off to 0 starting at the 6th digit after the decimal point. $-0.000005 > R > 0.000005 \neq 0$. Roundings are only activated with program branchings.
Bit 4 = 0: No calculation. Rounding is only activated with program branchings.
- Bit 3:** **Bit 3 = 1:** "Manual recording of dressing position" is inhibited.
Bit 3 = 0: As previously, "manual recording of dressing position" is possible.
- Bit 2:** **Bit 2 = 1:** The software limit switches are not converted to cartesian values in the case of an "inclined axis".
Bit 2 = 0: The software limit switch values are interpreted as cartesian values.
- Bit 1:** **Bit 1 = 1:** Function Gxx63 (axis-specific override not active) also applies to override position 0.
Bit 1 = 0: 0% override also active with Gxx63.
- Bit 0:** **Bit 0 = 1:** In single block operation reciprocation (Gxx81) is interrupted.
Bit 0 = 0: In single block operation reciprocation continues.

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
425	Direction of spindle rotation via PLC	High-speed cycle cal. with P1, P11 .. P16	Store block No. in display	Without text "SINUMERIK 3G"	V.24 (RS 232C) output without trailer	Dual PLC	F external mm/min or mm/rev/min	G0195 with actual speed

- Bit 7:** **Bit 7 = 1:** Q67.4 is active (set spindle rotation clockwise).
Bit 7 = 0: Set spindle rotation cannot be specified by PLC.
- Bit 6:** **Bit 6 = 1:** In the case of cycle lock high-speed cycle processing is performed with jump conditions P1, P11 .. P16.
Bit 6 = 0: Cycle lock without affecting processing of jump conditions.
- Bit 5:** **Bit 5 = 1:** The last block number to be processed or which is just being processed remains in the display and is not set to 0 by a block without a block number.
- Bit 4:** **Bit 4 = 1:** The text "SINUMERIK 3G" is not displayed on the screen.
Bit 4 = 0: The text "SINUMERIK 3G" is displayed on the screen.
- Bit 3:** **Bit 3 = 1:** No trailer is output following data output via V.24 (RS232C) interface.
Bit 3 = 0: NC transmits 40 times 00_{Hex} after each data output (after M02).
- Bit 2:** **Bit 2 = 1:** When a 2nd PLC (dual PLC) is used, PLC stop is detected by the controller
- Bit 1:** **Bit 1 = 0:** F external is evaluated as linear feed with Gxx95.
Bit 1 = 1: F external is evaluated as feedrate per revolution with Gxx95.
- Bit 0:** **Bit 0 = 0:** The programmed feedrate per revolution is converted into units/min. Spindle override has no effect on the feedrate (as previously).
Bit 0 = 1: The feedrate is derived from the actual spindle speed.
Precondition: MD 407, bit 2 = 1. This function is only active in conjunction with G01.
Feedrate influencing is only possible via spindle override. Only zero feedrate override is active, unless Gxx63 is active in conjunction with MD 421, bit 1 = 1. The feedrate reduction ratio has no effect.
G00 and dry run disable feedrate per revolution.

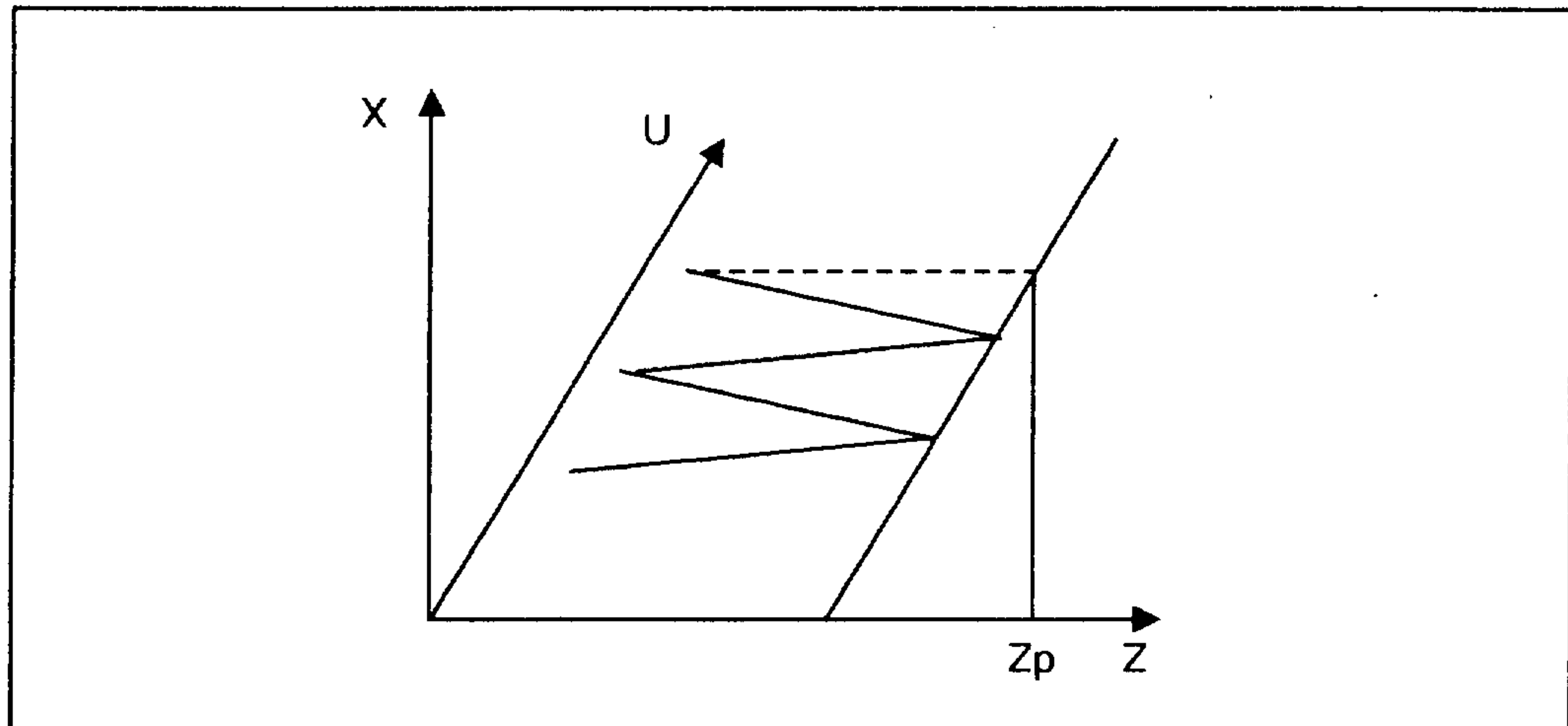
NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
426	Spindle monitoring with actual speed	Diameter monitoring	No output of M17 to PLC	Wheel width monitoring with para. modification	Wheel width monitoring	Automatic allowance for wheel width	Z program with G138X as stroke	No dwell after external subroutine

- Bit 7:** **Bit 7 = 1:** In the case of the spindle speed the actual speed is monitored (provided pulse encoder is available).
 Bit 7 = 0: The programmed speed is monitored.
- *Bit 6:** **Bit 6 = 1:** Monitoring of minimum grinding wheel diameter (parameters R204 to R206) with NC-Start.
 Bit 6 = 0: Monitoring not active.
- Bit 5:** **Bit 5 = 1:** M17 is not output to the PLC, this saves program execution times.
 Bit 5 = 0: M17 is output to the PLC.
- Bit 4:** **Bit 4 = 1:** Monitoring of the grinding wheel width is re-activated with each modification to the corresponding dressing sum (R242 - R253).
 Bit 4 = 0: Monitoring is activated with each NC-Start, provided machine data 426 bit 3 = 1.
- *Bit 3:** **Bit 3 = 1:** Monitoring of minimum grinding wheel width (parameters R300 to R302) with NC-Start.
 Bit 3 = 0: Monitoring not active.
- Bit 2:** **Bit 2 = 1:** The wheel width is automatically included when programming G21/G22.
 Bit 2 = 0: The wheel width must be taken into account by the programmer as previously.

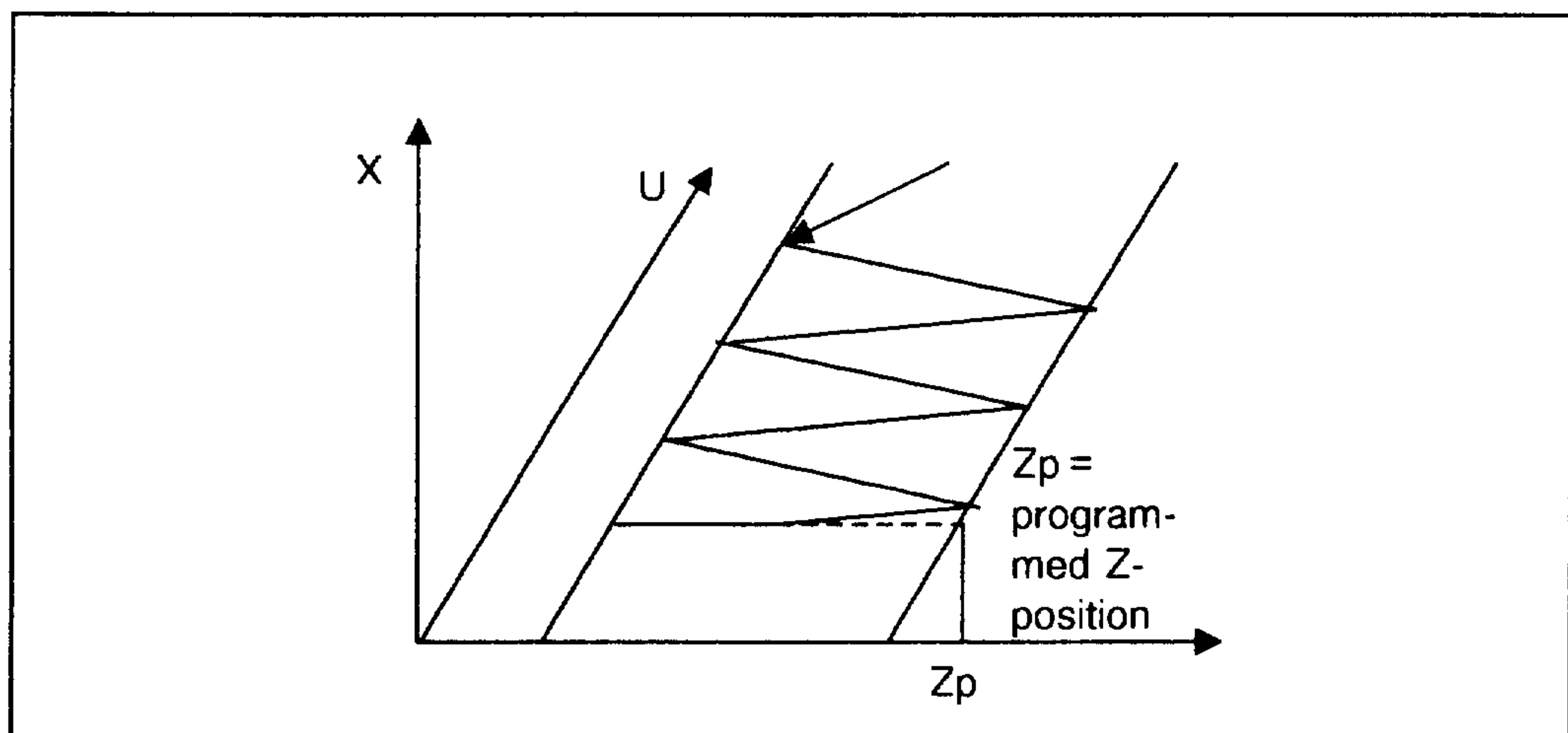
* These machine data bits may be overwritten by the PLC.

Bit 1: Precondition: inclined X axis, G138X.

Bit 1 = 1: the programmed Z value is interpreted as reciprocation.



Bit 1 = 0: the programmed Z value is interpreted as the target position (in relation to the X target position).



Bit 0: **Bit 0 = 1:** If an external subroutine is called while a dwell time is active, the dwell time is terminated.

Bit 0 = 0: After the dwell time has been terminated by an external subroutine, the dwell is re-started after return to the point of interruption.

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
427	No M19 abort on reset	M19 with axis movement						

Bit 7: Always set to 0

Bit 6: This bit may only be set if machine data MD427 bit 5 has also been set.

Bit 6 = 1: An M19 movement is not terminated on reset.

Bit 6 = 0: An M19 movement is also terminated on reset.

Bit 5: **Bit 5 = 1:** While M19 (spindle position) is active, additional NC blocks are processed.

Spindle positioning is disabled with cancellation of the "spindle enable" signal. Spindle position control may also be disabled using reset/M30 if MD bit "No M19 abort on reset" has not been selected (bit 6 = 0).

Bit 5 = 0: As long as M19 "spindle positioning" is active, no other NC blocks are processed.

Bit 6 has no effect or "No M19 abort on reset" cannot be selected. Spindle positioning can be disabled by means of reset /M30 or by cancelling the "spindle enable" signal.

N. B.

A previously input spindle speed Sref is not deleted with M19. If the direction of spindle rotation is active via the PLC, the spindle continues to rotate when the spindle position controller is disabled. The spindle also continues to rotate if the PLC specifies a new spindle speed.

Precondition: Option M19 (E42)

Bit 1: **Bit 1 = 1:** Editing may be carried out in the AUTOMATIC operating mode while another program is being processed. The program to be edited must be the last one in the program overview.

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
428	EIA code for multiplication sign (*)							

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
429	EIA code for equals sign (=)							

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
430 to 433	Without inch/metric conversion	Set speed x 10	Rotary axis	Diameter program	Calliper axis for Gxx93	Input resolution		

Bit 7: **Bit 7 = 1:**

Bit 6: **Bit 6 = 1:** The entered multgain value is multiplied by 10.

Bit 5: If the machine has a rotary axis, this axis is defined here. The modulo number (MD Nos. 280-283) is then automatically active for this rotary axis. The rotary axis can rotate continuously. Otherwise, the same definitions as for linear axes apply, except for degrees instead of mm (inches).

Bit 4: **Bit 4 = 0:** Path programmed over radius.
Bit 4 = 1: Path programmed over diameter.

Bit 3: **Bit 3 = 1:** The actual value of this "measuring axis" is evaluated as a comparison value when programming Gxx93. During this evaluation, this axis must be in follow-up mode.

Bit 2 - 0: Input resolution is defined.

Bit 2	Bit 1	Bit 0	Unit of measurement
0.01 mm	0.001 mm	0.0001 mm	Metric (linear)
0.0001 inches	0.00001 inches		Inch (linear axis)
0.1 deg.	0.001 deg.	0.0001 deg.	Degrees (rotary axis)

Bit 0 is disabled in the export version if this is not a rotary axis.

Bit 1 is disabled in the export version if the "inch" input system is selected.

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
434 to 437	Pulse weight. of act.part pos.with				Coding of axis name			
	1/4	1/2	2	4				

Bit 7 - 4: With this factor the pulses from the measuring system are weighted accordingly. If all bits are 0, the pulse weighting is considered to be 1.

Bit 3 - 0: Coding of axis name and assignment of letters for keyboard.

Axis name	Bit 3	Bit 2	Bit 1	Bit 0
X	0	0	0	0
Y	0	0	0	1
Z	0	0	1	0
U	0	1	1	0
V	0	1	1	1
W	1	0	0	0
A	0	0	1	1
B	0	1	0	0
C	0	1	0	1
Key lock	1	1	1	1

Key lock when corresponding NC key is depressed if no character is generated in program memory.

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
439	Set part position x 4	Set part position x 2	Post interpolation	1st and 3rd axis ref. point app. after angle change	1st axis ref. point app. after angle change	G97 not initial setting with NC-Start	Gxx96 without abs. value generation	Gxx96 without angle allowance

Bit 7 - 5: The standard position control cycle in the SINUMERIK 3G is 9 ms. The interpolation sampling time is twice this value (18 ms). This function makes it possible to activate machines with high Kv factors (> 3) and the position controller 4 or 8 times per interpolation sampling time and to incorporate post interpolation. This function is used wherever high surface quality standards are required. Post interpolation should not be used in conjunction with Kv factors < 3.

The following basic points are applicable (particularly to applications with 4 axes):

- The basic sampling time may have to be increased via MD383; this must be decided by the user on a case-to-case basis.
- The block change times may increase.
- The display (actual values, correction block, R parameters etc.) is updated less frequently.

Example:

MD 383, sampling time increased in 0.5ms increments	Interpolation sampling time	Position control cycles for		
		Bits 6 + 7 = 0	Bit 6 = 1 Bit 7 = 0	Bits 6 + 7 = 1
0	18	9	4.5	2.25
4	20	10	5	2.5
12	24	12	6	3
20	28	14	7	3.5

Setting bits 6 and/or 7 means that a uniform acceleration and braking ramp is no longer possible since the calculated specified value is output in 2 or 4 increments. Post interpolation is provided to offset this shortcoming. This ensures that the braking ramp is virtually uniform once more.

This function has already been fitted and tested in a 5MHz software version (S3701).
 The ensuing conditions are as follows (software could not be released until S3703 on account of existing malfunctions):

Number of axes	MD 439 Bit			MD 383	Sampling time (int)	Block change time
	7	6	5			
3	0	0	0	0	18 ms	53 ms
3	0	1	0	0	18 ms	53 ms
3	1	1	0	0	18 ms	73 ms
3	1	1	1	0	18 ms	76 ms
1	0	0	0	0	18 ms	53 ms
1	0	1	0	0	18 ms	53 ms
1	1	1	1	0	18 ms	53 ms
4	1	1	1	12	24 ms	73 ms

It was also noted that the interpolation sampling time with this software must be at least 22ms in the case of 4 axes.

The machine data are only active with POWER ON RESET.

Bit 4 - 3 : Always set to 0

Bit 4 : **Bit 4 = 1:** As for MD 439.3; in addition, the corresponding signal for the 3rd axis (171.1) is also reset.
 Reference point approach with the 1st axis also causes the interface signal "reference point reached" to be reset for the 3rd axis.

Bit 3 : **Bit 3 = 1:** The interface signal "reference point reached" 169.1 is reset when the angle is overwritten in MD 299. Only with overwriting by the PLC.
Bit 3 = 0: The interface signal is not changed.

Bit 2: **Bit 2 = 1:** After NC-Start, G97 does not automatically become active as the initial setting. If Gxx96 was active at the end of the previous program, Gxx96 remains active in this G after NC-Start. A speed limited with G92 S... does not change.

***Bit 1:** **Bit 1 = 1:** Calculation of spindle speed without absolute-value generation as regards dressing sum.
 If a positive dressing sum is used in the program, the amount of the dressing sum must **not** be used to calculate the spindle speed.

***Bit 0:** **Bit 0 = 1:** Calculation of spindle speed without angle allowance. In machines with perpendicular feed axis and linear wheel, an angle can be entered in MD 299 and fixed angle interpolation effected with G06. However, an allowance must **not** be made for the angle when calculating the spindle speed.

* These machine data bits may be overwritten by the PLC.

NC-MD	Bit-No.							
	7	6	5	4	3	2	1	0
456	Transmis- sion PLC- MD on PO-Reset							

Bit 7 : **Bit 7 = 1:** On Power On Reset the PLC machine data in the NC (MD250 to 271 and MD 450 to 479) are transferred automatically from the NC to the PLC (see also description of MD 250 to 279).

Bit 7 = 0: No transmission On Power on Reset.

Bit 6 - 0: Arbitrary

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Suggestions

Corrections

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Suggestions and/or corrections

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