SIEMENS

SINUMERIK System 3

Interface description Part 1

SINUMERIK System 3

Interface description

Part 1
Valid for
SINUMERIK 3T/3M
Basic systems 0, 1, 2, 3
Edition 3.83

Interface description
Part 2
Valid for
SINUMERIK 3T/3M
Basic system 4
SINUMERIK 3TT
Separate edition

Siemens Aktiengesellschaft

SINUMERIK® - Documentation

Key to this edition

All previously published editions are listed below.

The column headed "Alterations" lists all sections which have been altered since the last edition.

Edition	Order No.	Alterations
A.3.81	E321/1806-101	First edition
A.3.83	E321/2015-101	Revised edition

Contents

Note on nomenclature

This manual applies to

- 3T control for lathes ,Basic systems 0,1,2 and 3
- 3M control for drilling/milling machines, Basic systems 0,1,2 and 3 and machining centres

Appropriate notes are made where the controls differ (3T/3M).
Chapter 7 contains the cable diagrams for 3T/3M.
Common diagrams are provided for external equipment and operating elements.

Inverse signals, which are active for a logic zero signal, are designated by an asterisk * .

As an aid to recognition symbols have been attached to the different operating modes and processes.

In the pulse diagrams capital letters are used for the signals being described. Heavy lines are used for actual signals and light lines for symbolic characteristics.

The purpose of the signals refers both to the interface NC-PC and the interface to the external interface control.

1. Connection and operation

1.1 NC components

1.2 Input/Output module

1. Connection and operation

1.1 NC components

SINUMERIK system 3 controls consist of the following components:

- logic components for the integral PC or
  input/output modules for the external interface control

- operator panel components with keyboard, universal
  and data display

- machine control panel

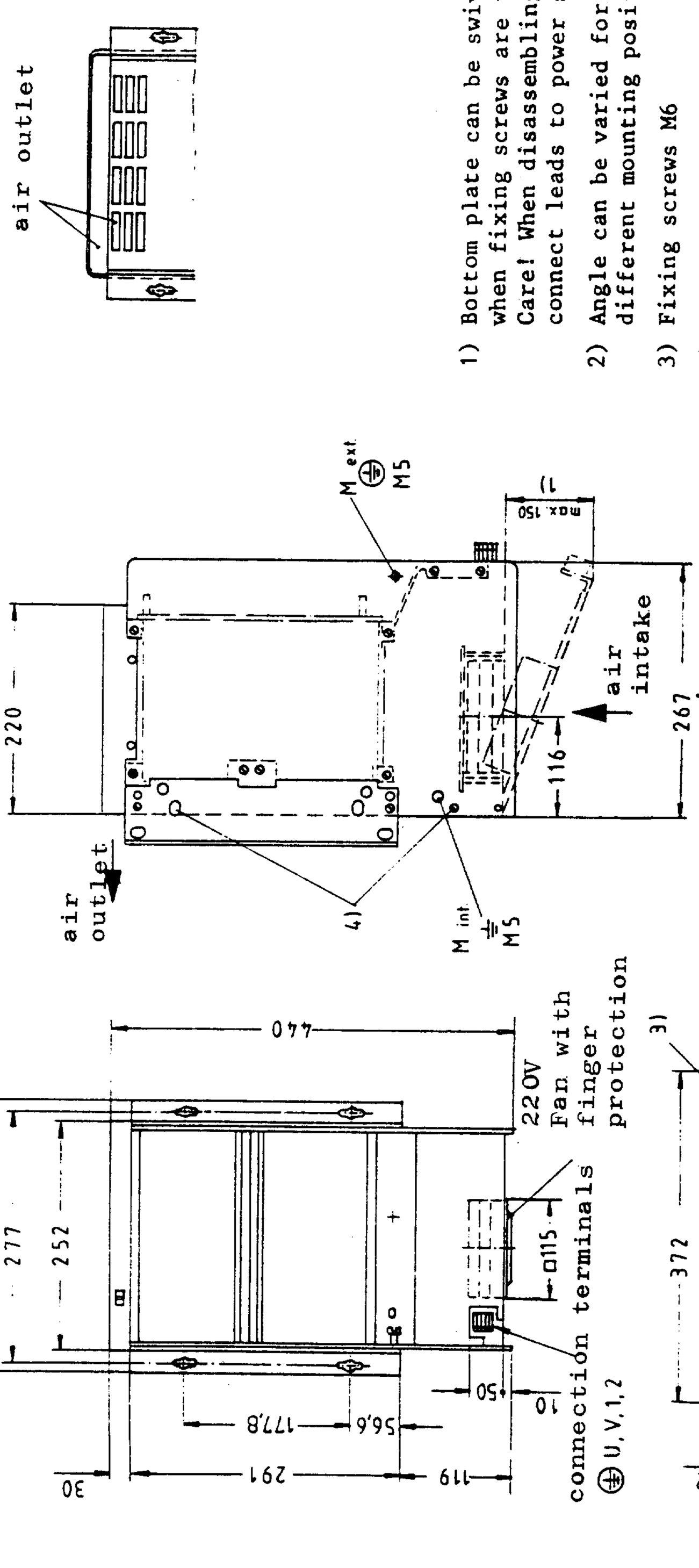
- handwheel

- tape components

- extension components

1.1.1 Dimension drawing of logic component 3T/3M

(Basic system 0)

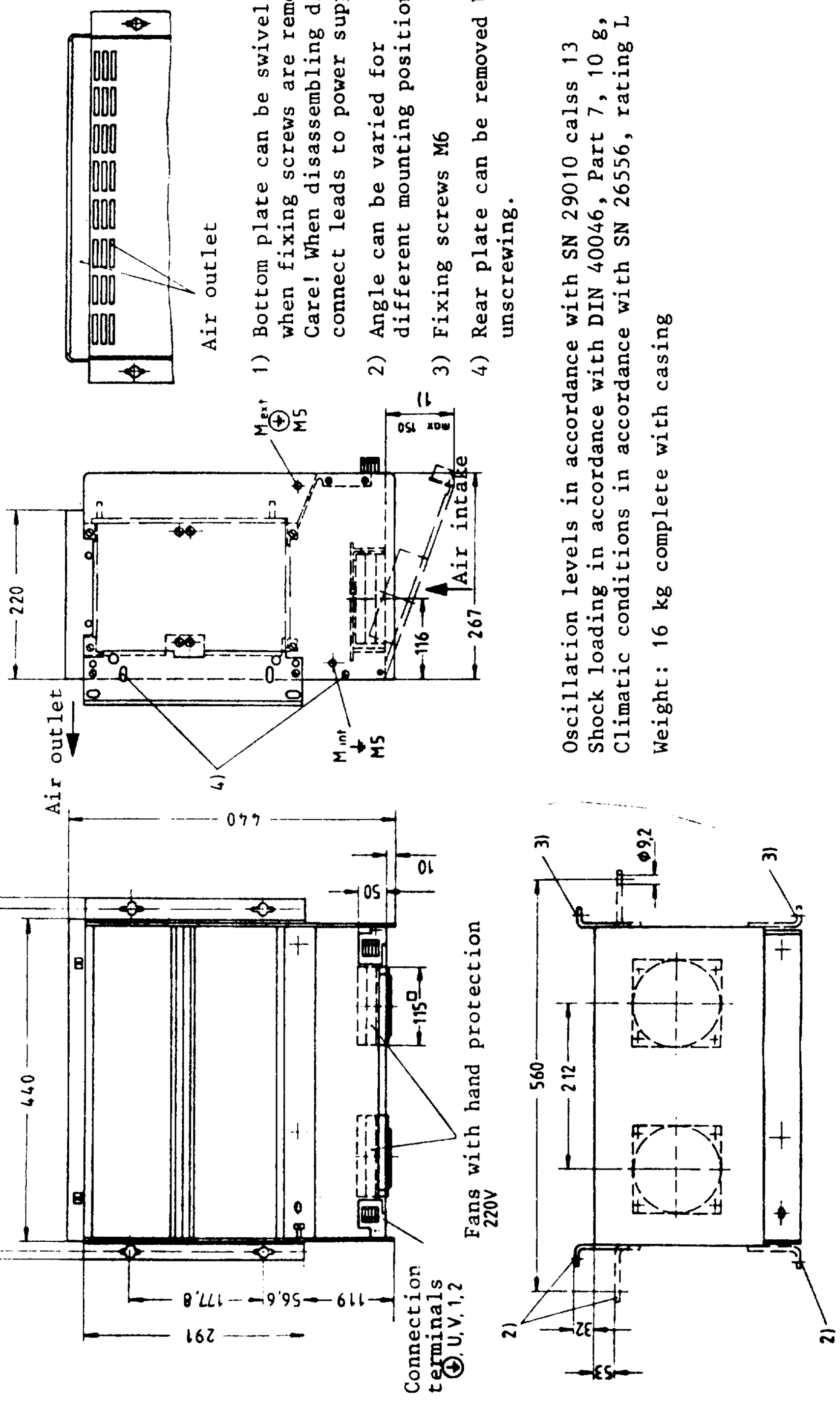


1) Bottom plate can be swivelled when fixing screws are removed. Care! When disassembling disconnect leads to power supply.
2) Angle can be varied for different mounting positions
3) Fixing screws M6
4) Rear plate can be removed by unscrewing.

Oscillation levels in accordance with SN 29010 calss 13
Shock loading in accordance with DIN 40046, Part 7, 10 g, 11 ms
Climatic conditions in accordance with SN 26556, rating L

Weight: 13 kg complete with casing

Dimension drawing of logic components 3T/3M (Basic systems 1,2)



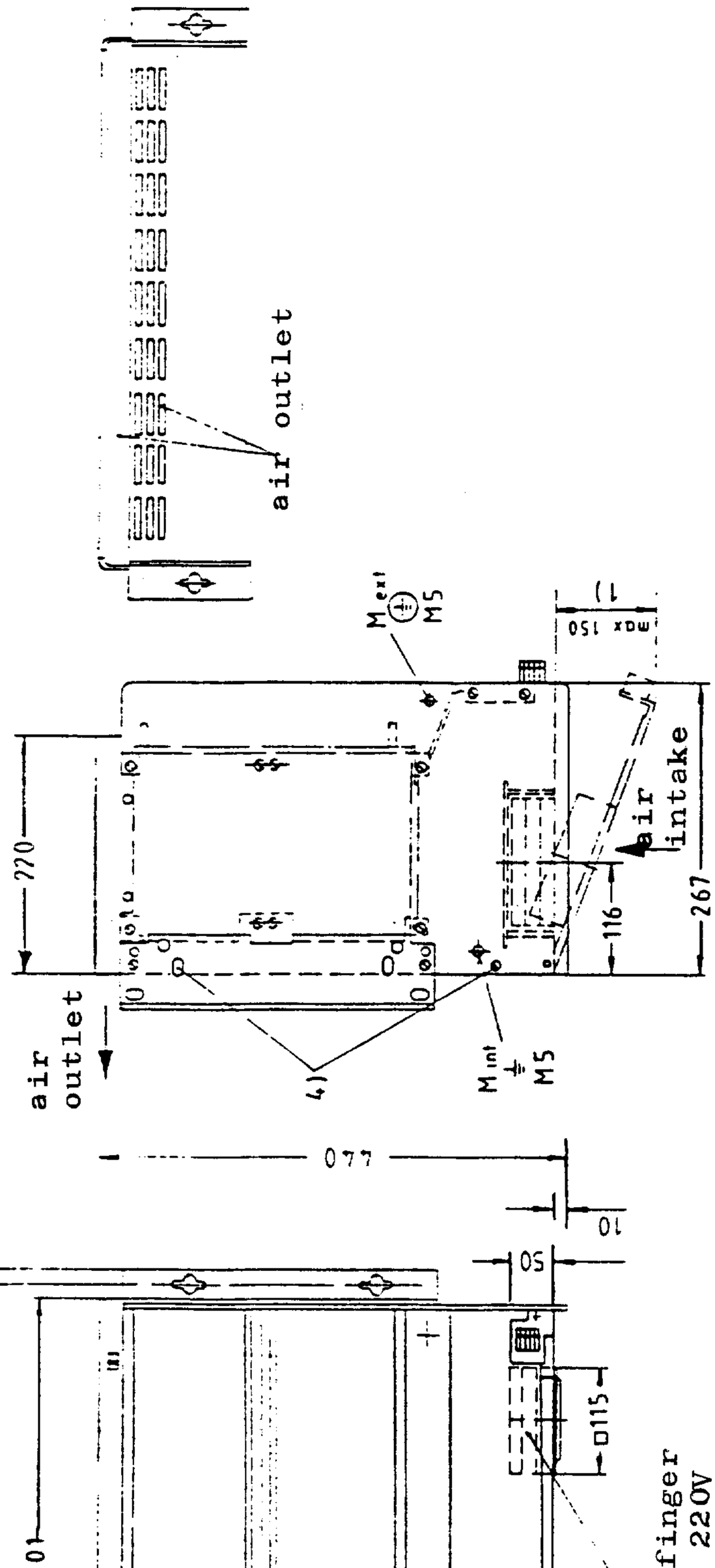
1) Bottom plate can be swivelled when fixing screws are removed. Care! When disassembling disconnect leads to power supply.
2) Angle can be varied for different mounting positions
3) Fixing screws M6
4) Rear plate can be removed by unscrewing.

Oscillation levels in accordance with SN 29010 calss 13
Shock loading in accordance with DIN 40046, Part 7, 10 g, 11 ms
Climatic conditions in accordance with SN 26556, rating L

Weight: 16 kg complete with casing

Dimension drawing of logic component 3T/3M

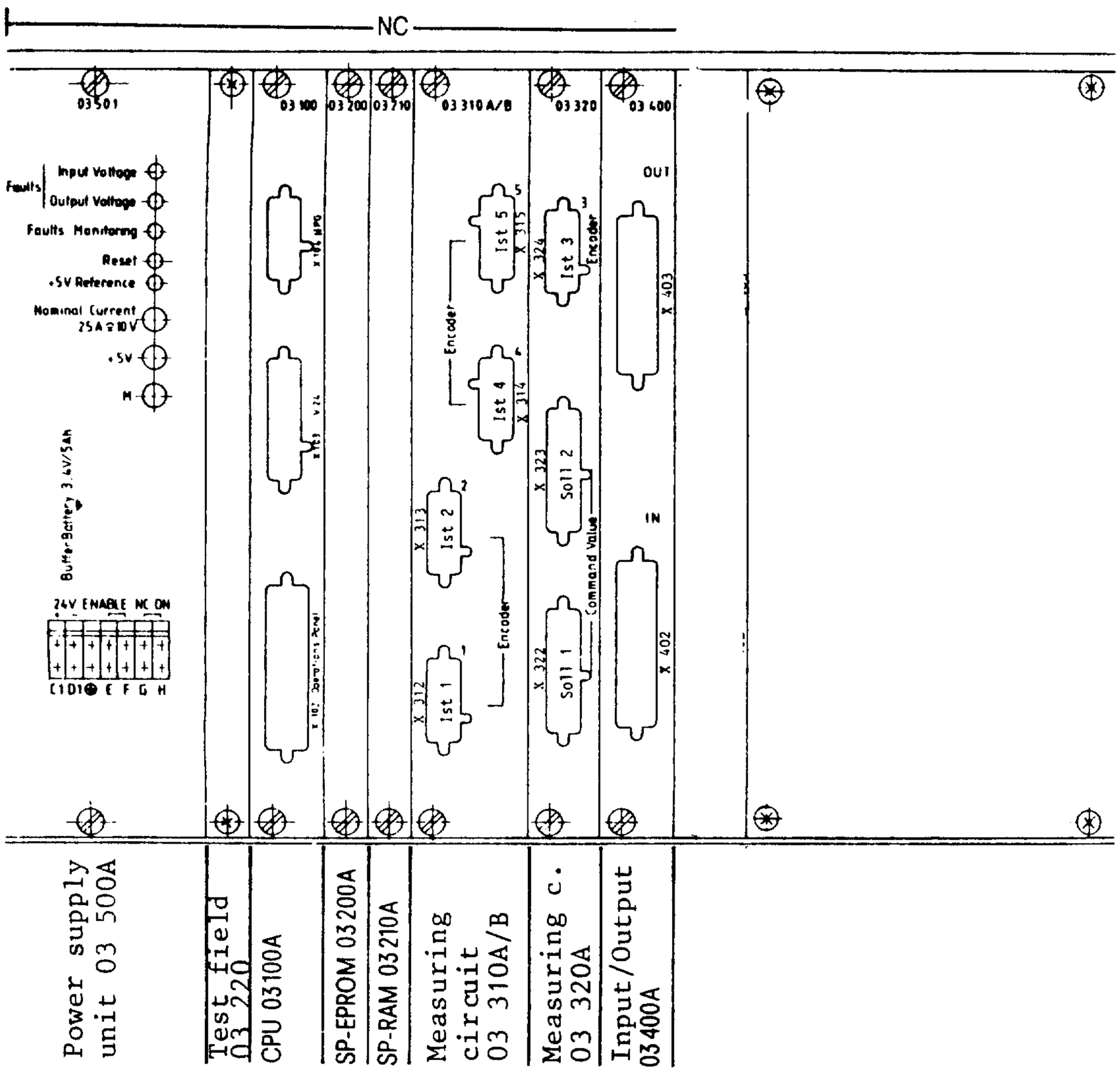
(Basic system 3)



Oscillation levels in accordance with SN 29010 class 13
Shock loading in accordance with DIN 40046, Part 7, 10 g, 11 ms
Climatic conditions in accordance with SN 26556, rating L

Weight: 33 kg complete with casing

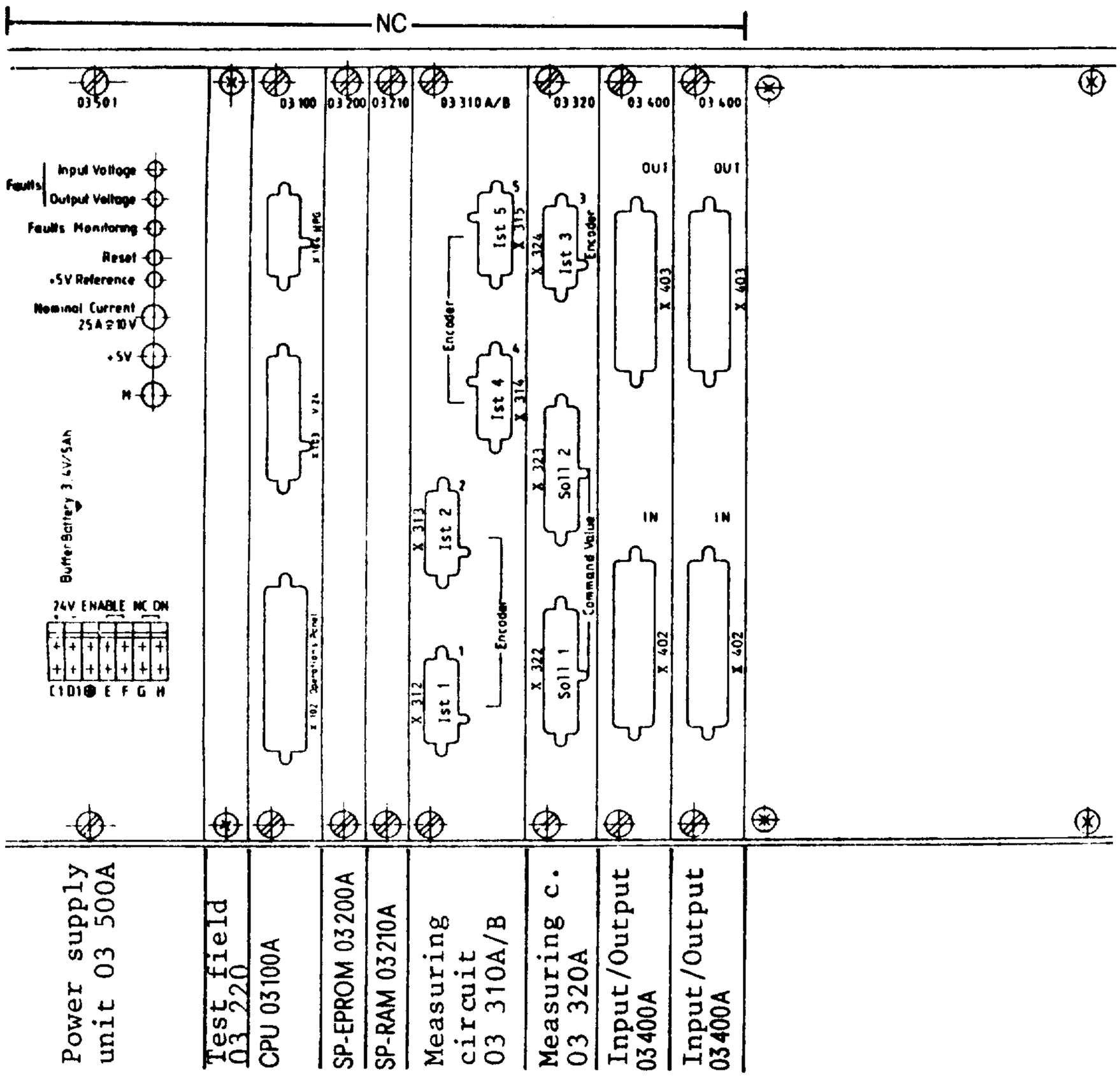
Logic component ; Basic system 0



Arrangement between measuring circuit plugs and axes

	03 310 A/B		03 320	03 310 B		03 320	
	Ist 1 X312	Ist 2 X313	Ist 3 X324	Ist 4 X314	Ist 5 X315	Soll 1 X322	Soll 2 X323
3T	X	Z	S	-	-	X,Z,S	-
3M	X	Y	Z	4.	S	X,Y,Z	4.,S

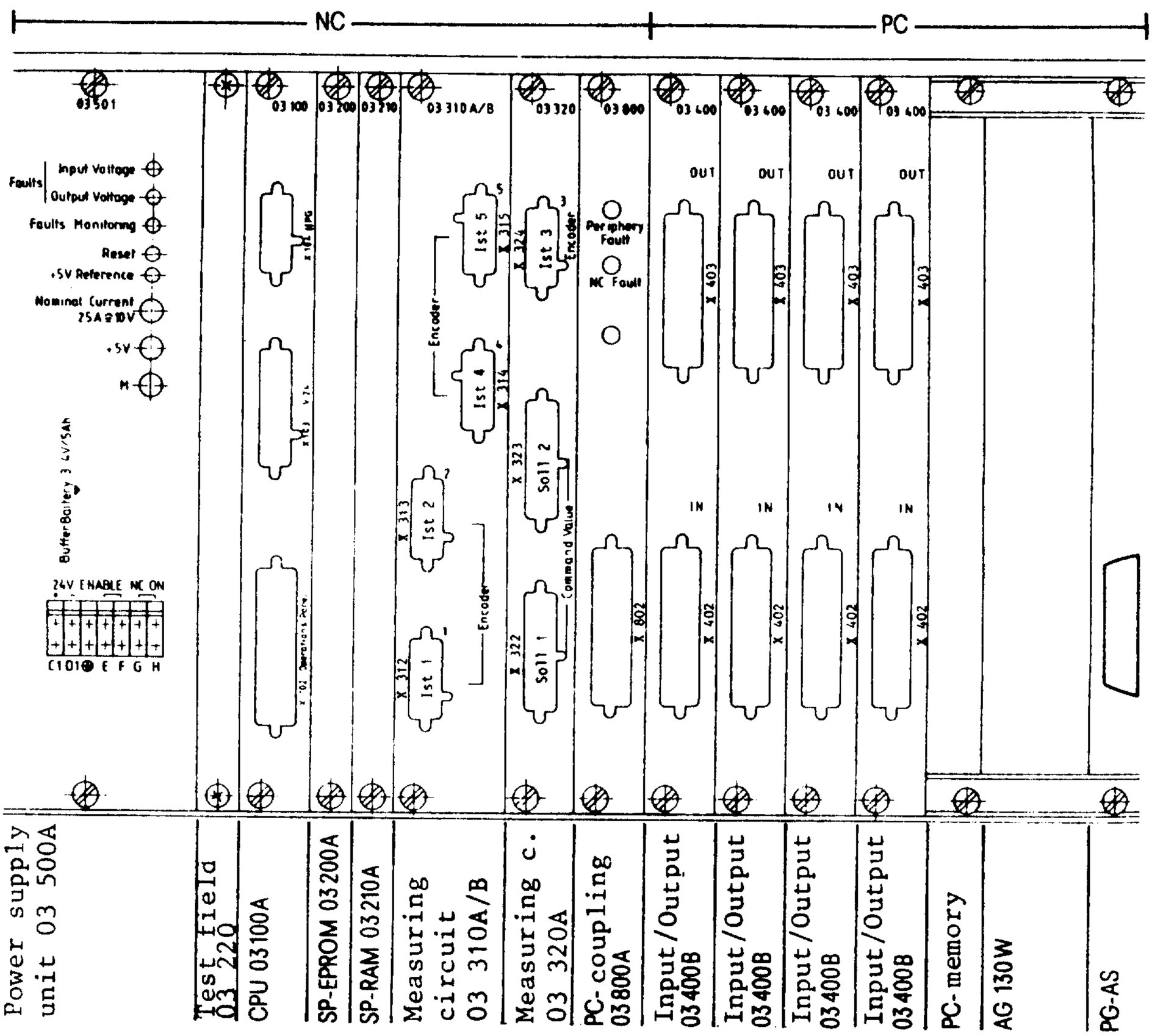
Logic component ; Basic system 1



Arrangement between measuring circuit plugs and axes

	03 310 A/B		03 320	03 310 B		03 320	
	Ist 1 X312	Ist 2 X313	Ist 3 X324	Ist 4 X314	Ist 5 X315	Soll 1 X322	Soll 2 X323
3T	X	Z	S	-	-	X,Z,S	-
3M	X	Y	Z	4.	S	X,Y,Z	4.,S

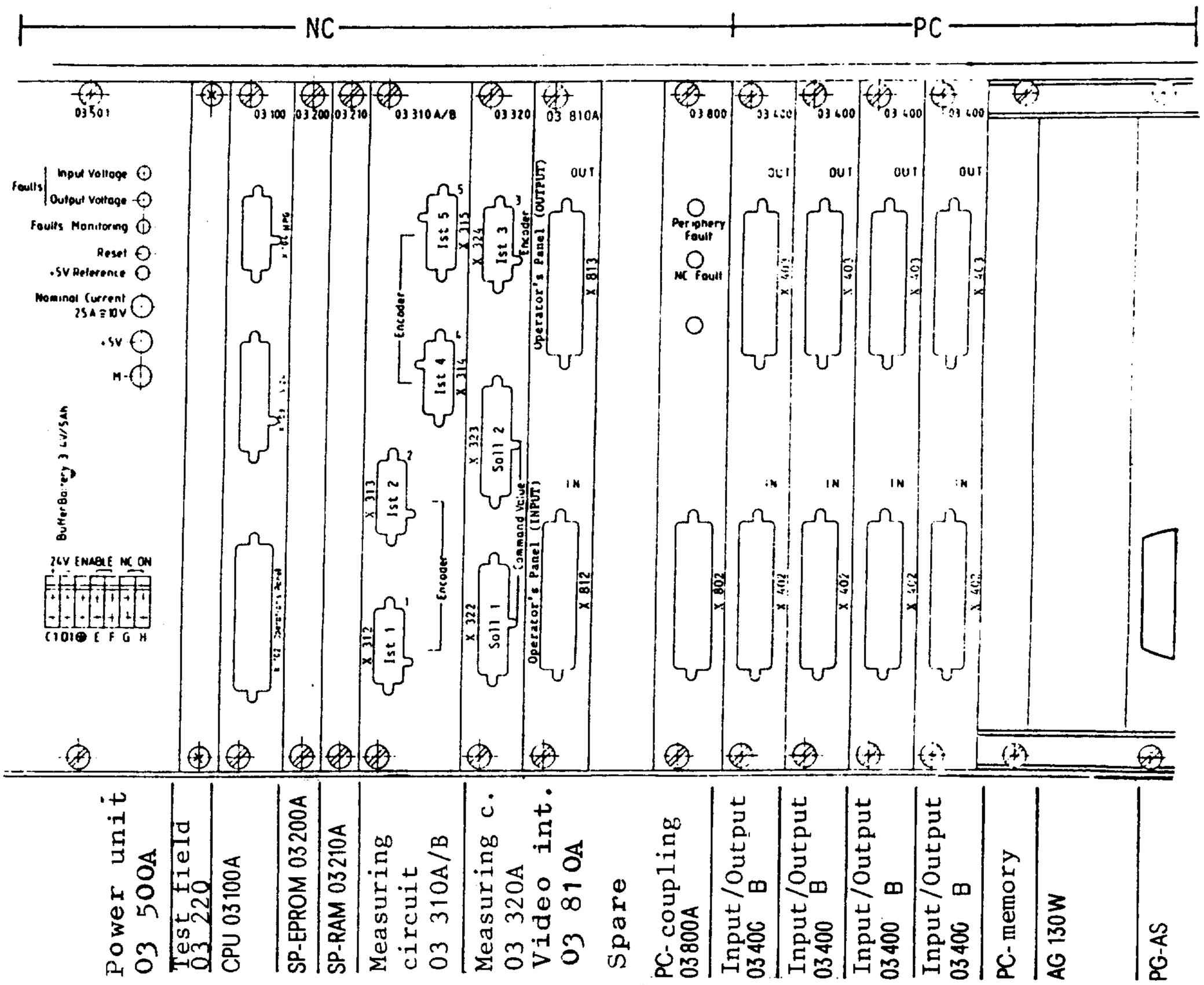
Logic component ; Basic system 2



Arrangement between measuring circuit plugs and axes

	03 310 A/B		03 320	03 310 B		03 320	
	Ist 1 X312	Ist 2 X313	Ist 3 X324	Ist 4 X314	Ist 5 X315	Soll 1 X322	Soll 2 X323
3T	X	Z	S	-	-	X,Z,S	-
3M	X	Y	Z	4.	S	X,Y,Z	4.,S

Logic component; Basic system 3

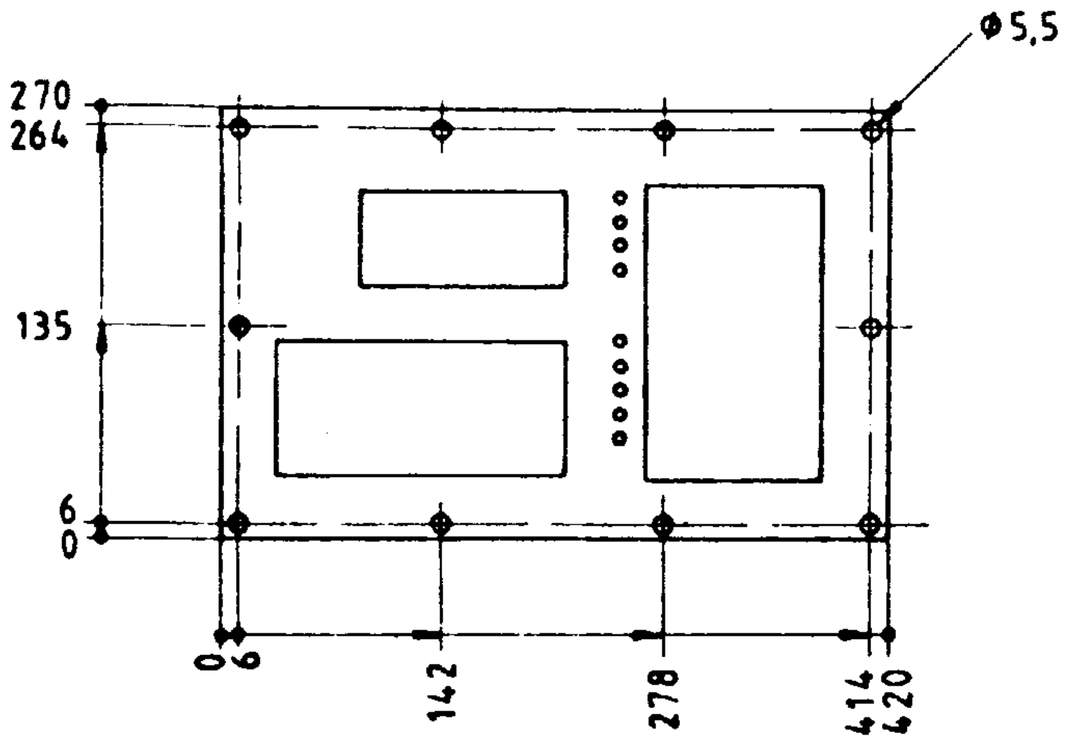


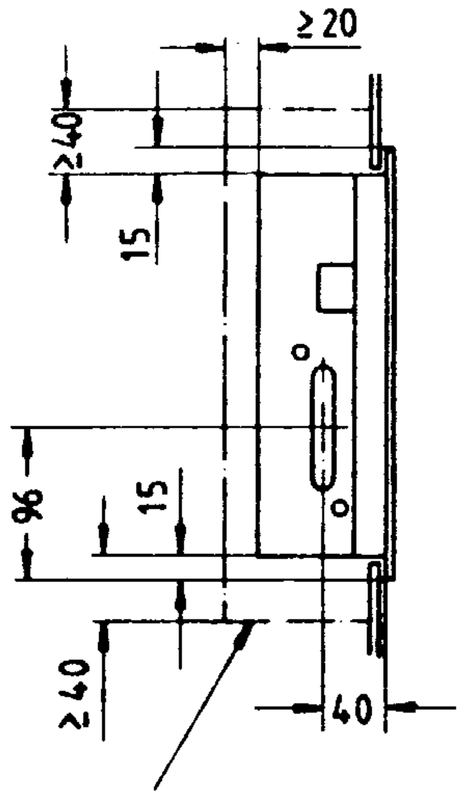
Power unit 03 500A
Test field 03 220
CPU 03100A
SP-EPROM 03200A
SP-RAM 03210A
Measuring circuit 03 310A/B
Measuring c. 03 320A Video int. 03 810A
Spare
PC-coupling 03800A
Input/Output 03400 B
Input/Output 03400 B
Input/Output 03400 B
Input/Output 03400 B
PC-memory
AG 130W
PG-AS

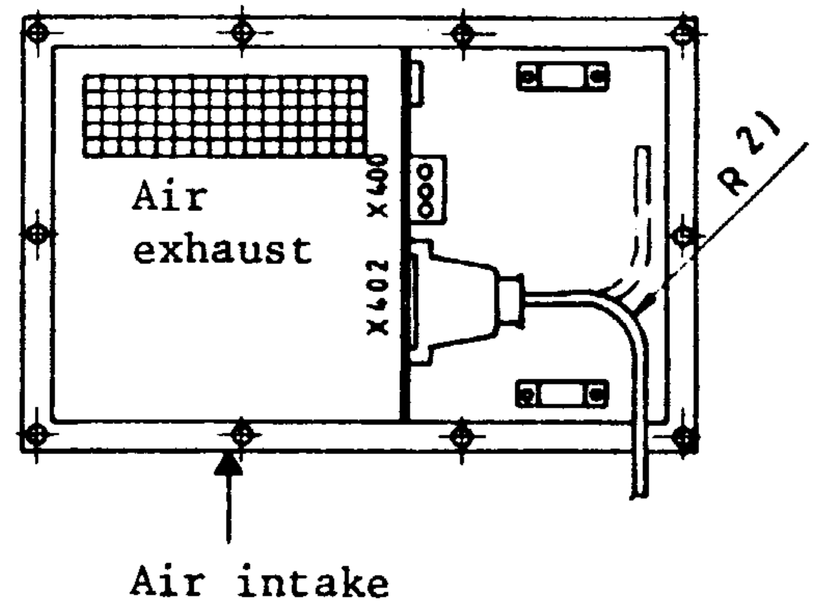
Arrangement between measuring circuit plugs and axes

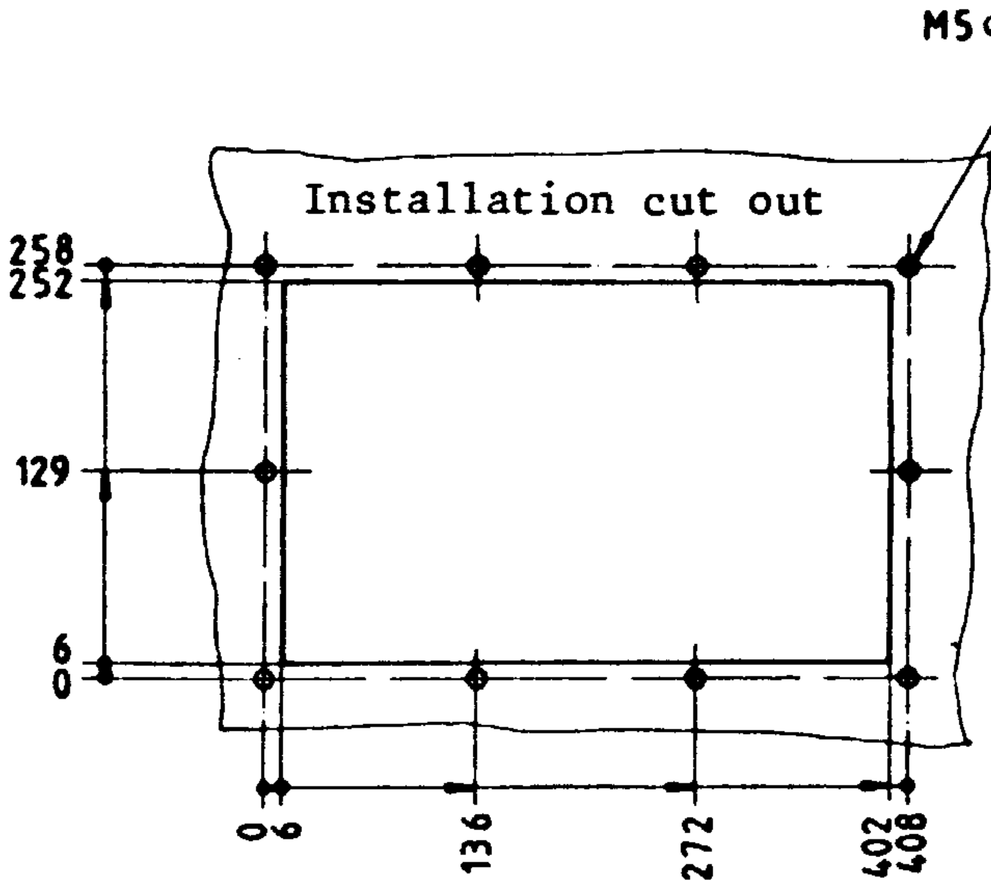
	03 310 A/B		03 320	03 310 B		03 320	
	Ist 1 X312	Ist 2 X313	Ist 3 X324	Ist 4 X314	Ist 5 X315	Soll 1 X322	Soll 2 X323
3T	X	Z	S	-	-	X,Z,S	-
3M	X	Y	Z	4.	S	X,Y,Z	4.,S

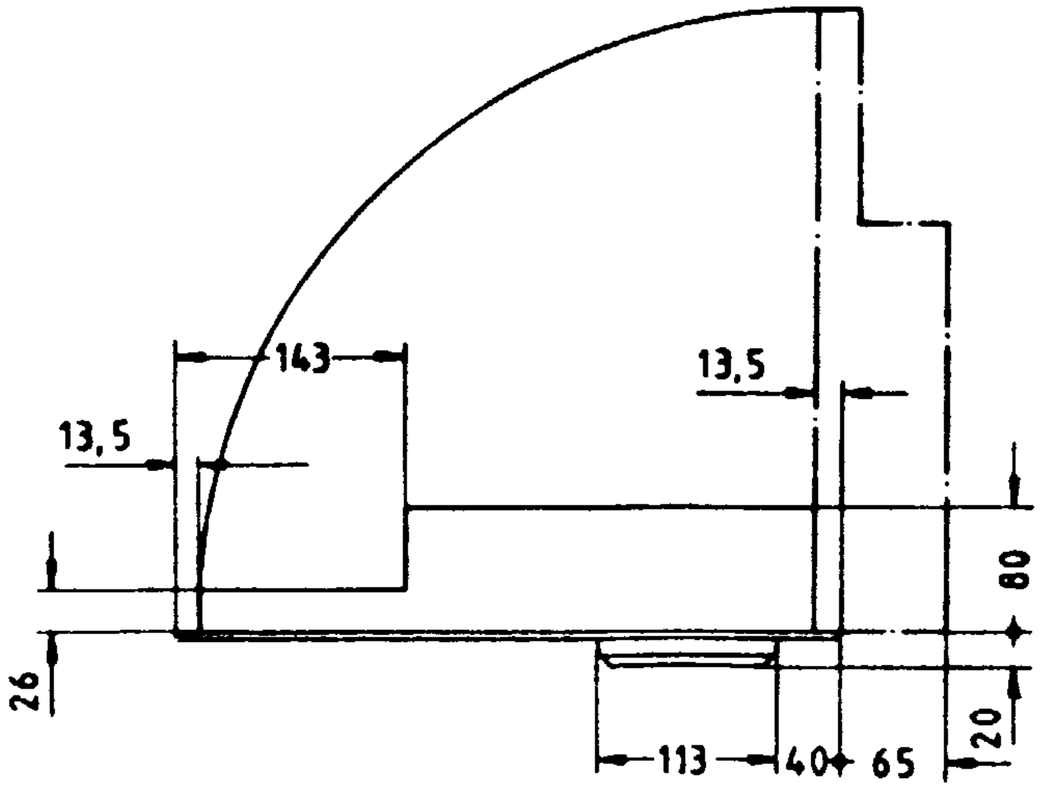
1.1.2 Dimension drawing of operator panel component 3T/3M (Basic system 0,1,2)









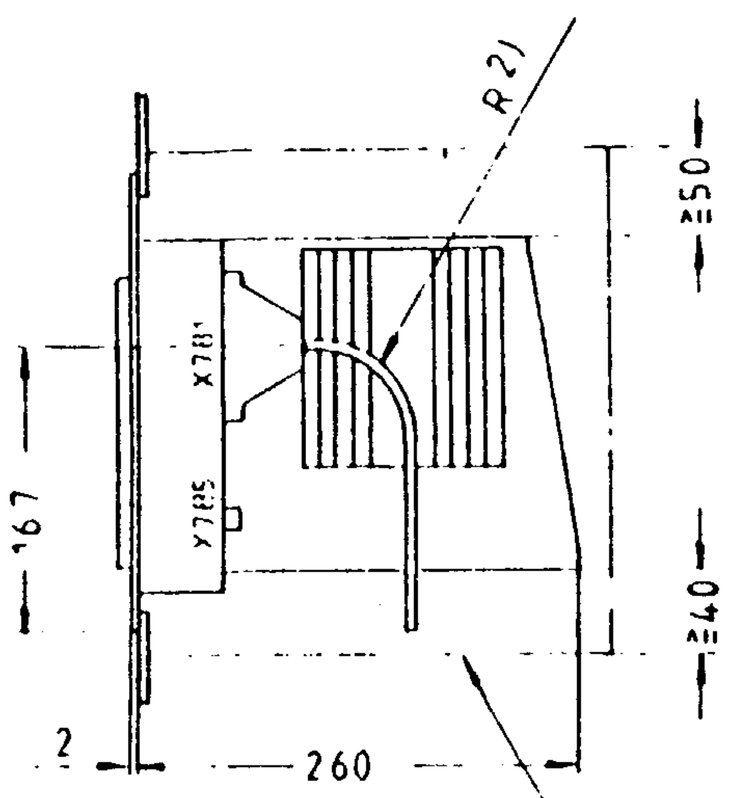


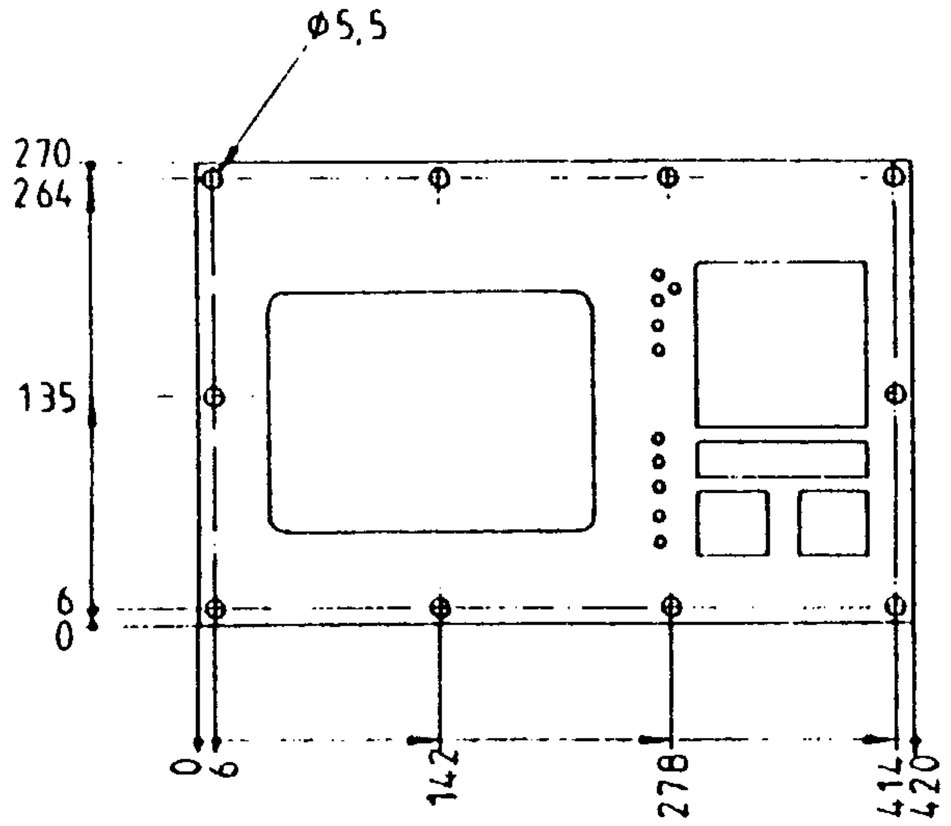
2) Appropriate cable, for Siemens cable R ≥ 100

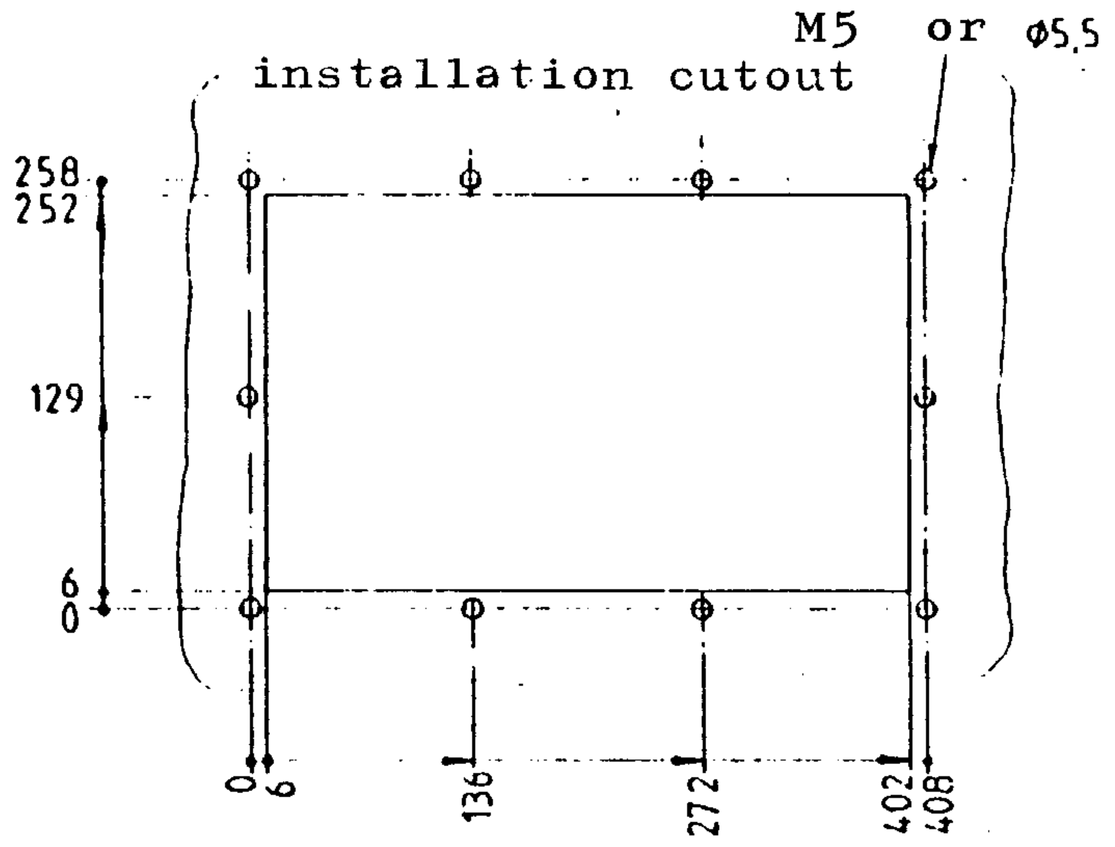
1) Circulating air temperature max. 55°C
temperature change max. 1.1 K/min
permissible humidity class F from DIN 40040
air free from corrosive gases

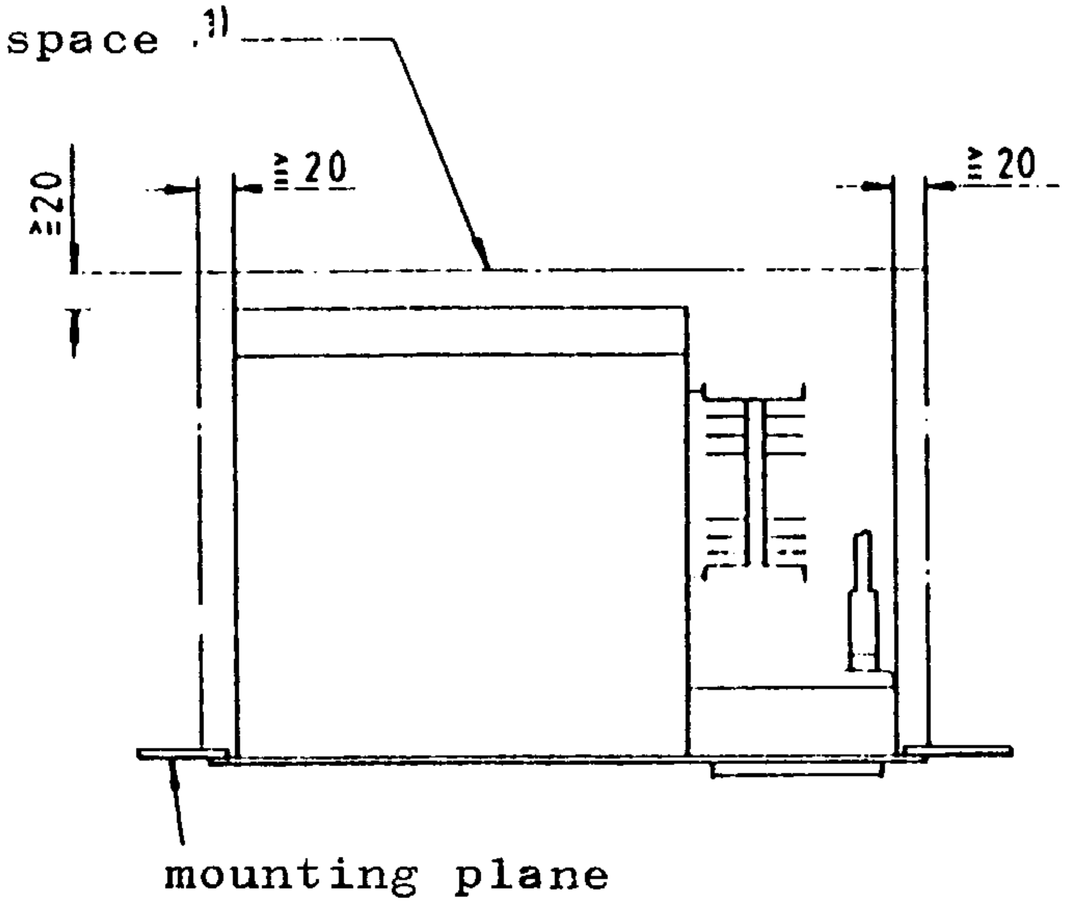
Protection class from DIN 40050:
front side: IP 54, rear side: IP 0

Dimension drawing of the operator panel component 3T/3M (Basic system 3)









2) Appropriate cable ,
with Siemens cable R = 100

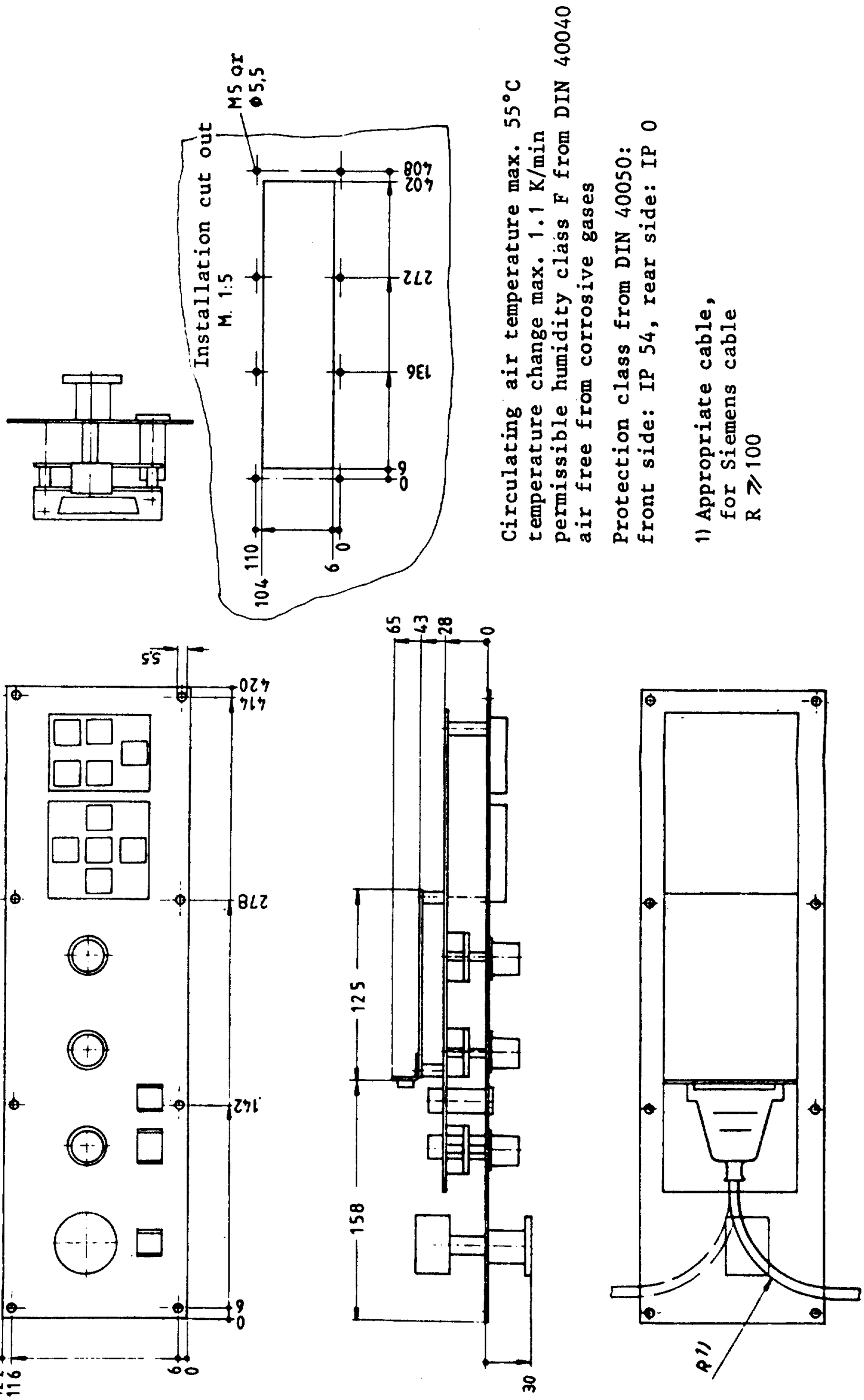
1) Required surface area = 1.0 m^2
with additional internal
=0.5 m^2

Temperature on the front
side = 45 °C
Ambient temperature
= 55 °C
Temperature change max 1.1 K/min
Permissable humidity class F
according to DIN 40040
Air intake free from corrosive gases
Protection according to DIN 40C50
front side : IP54
rear side : IP50

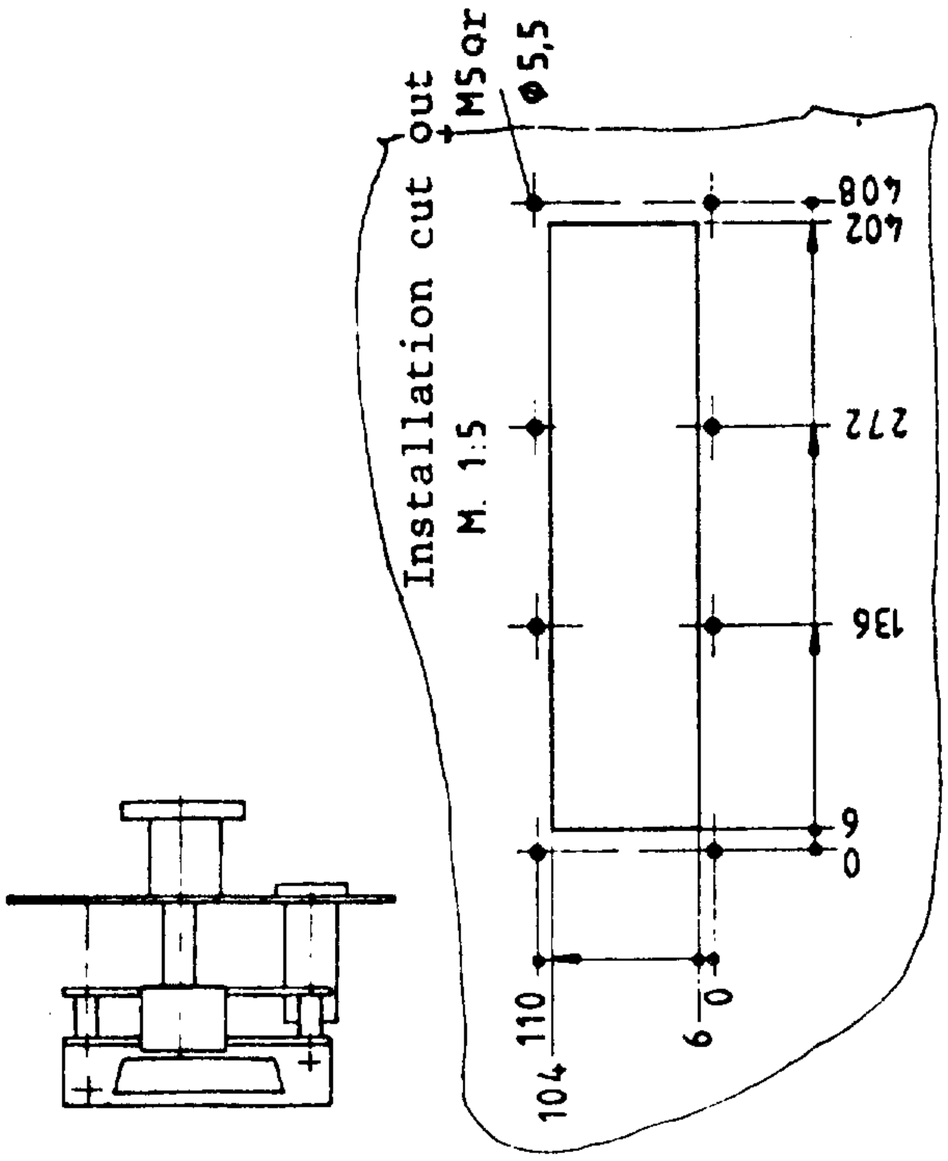
Weight : 7 kg

without underlying surface area

1.1.3 Dimension drawing of machine control panel 3T



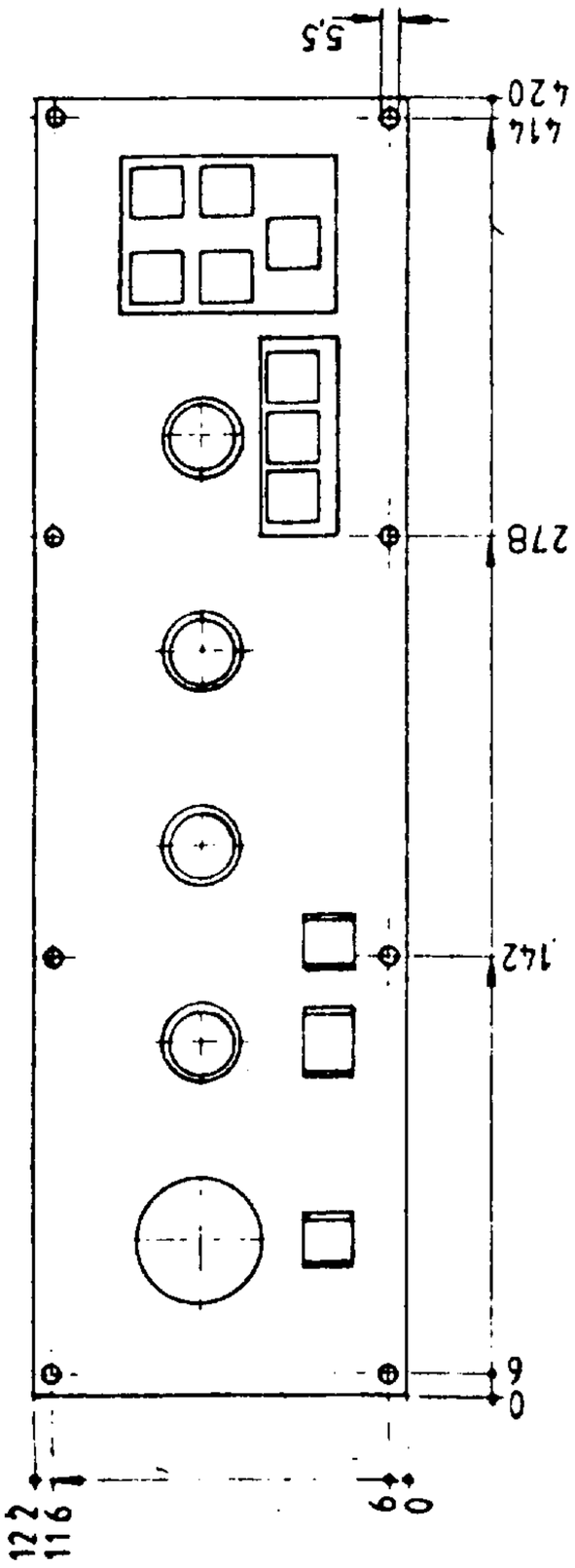
1.1.4 Dimension drawing of machine control panel 3M

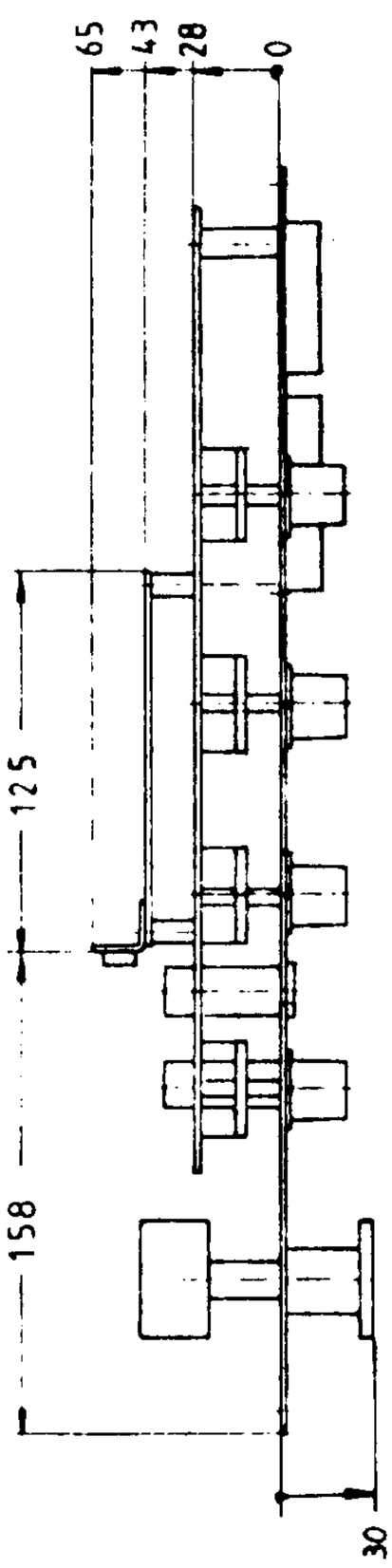


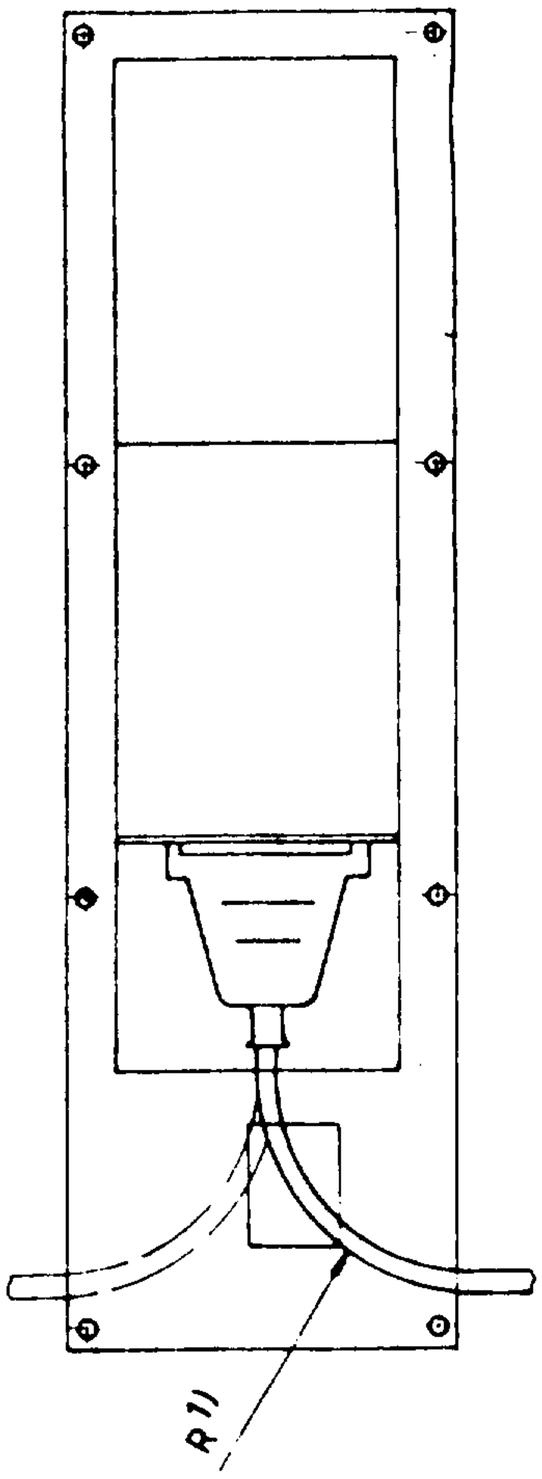
Circulating air temperature max. 55°C
temperature change max. 1.1 K/min
permissible humidity class F from DIN 40040
air free from corrosive gases

Protection class from DIN 40050:
front side: IP 54, rear side: IP 0

1) Appropriate cable,
for Siemens cable
R ≥ 100







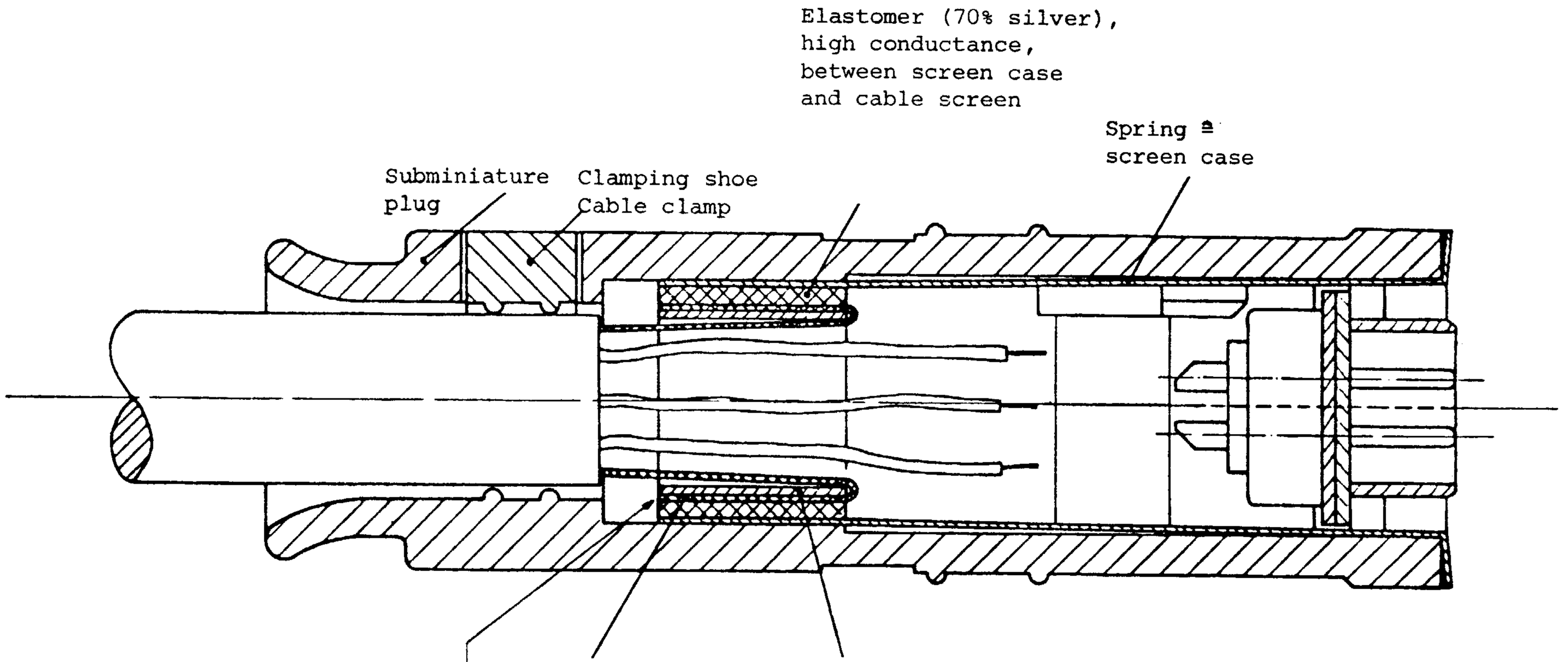
1.1.5 Cables and plugs

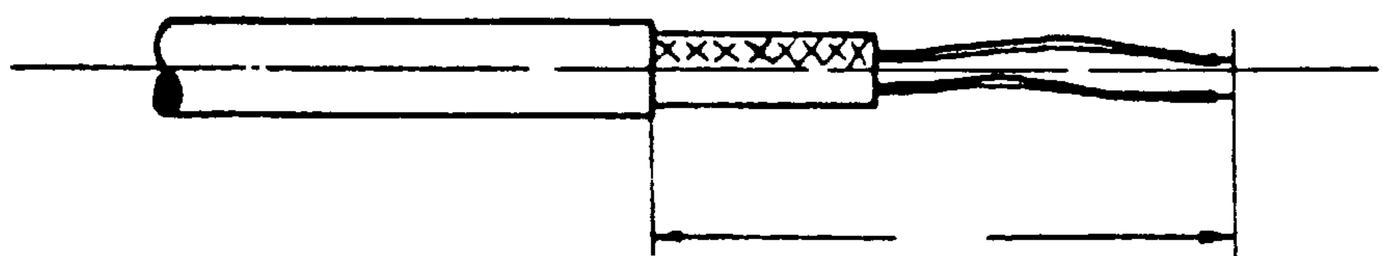
The various components should only be connected using the recommended cables in accordance with the cable and equipment summary in section 6.

The cable lengths given in the tables and accessory lists are maximum lengths.

As shown in the installation drawing the screen of the cable is connected to the subminiature plug. All cables to the interface control or the machine should be protected from damage e.g. by using cable ducting.

Care is required to prevent the ingress of oil, coolant or swarf.
Do not run signal cable and power cables together. Cables from other controls must not be passed through the control components.
Screw all plugs firmly to the front plate of the modules.

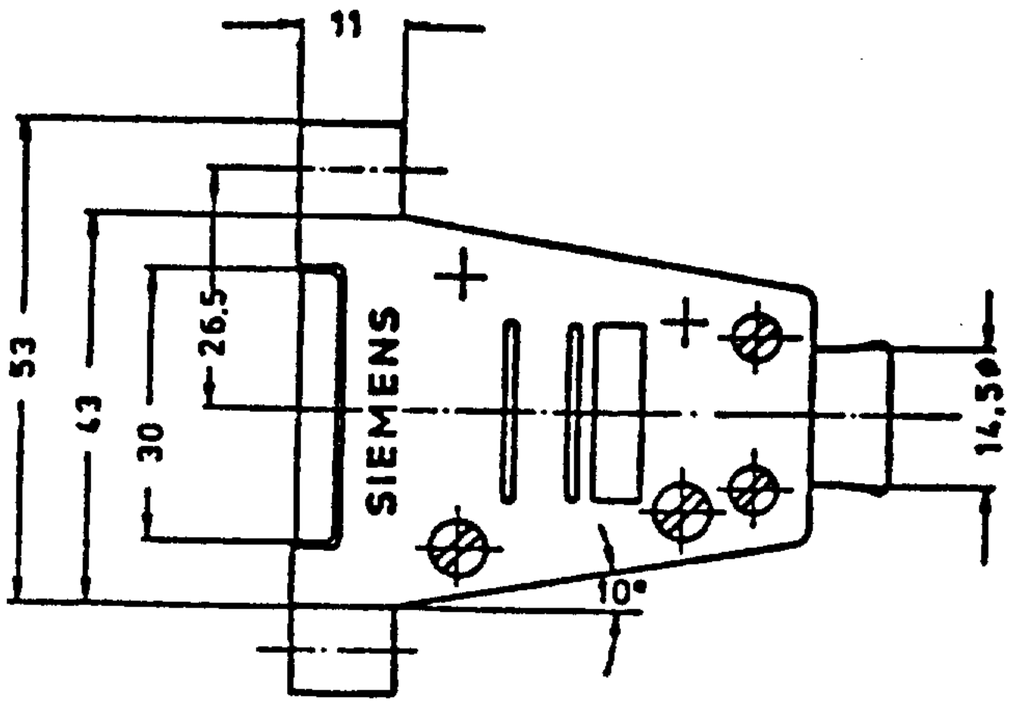


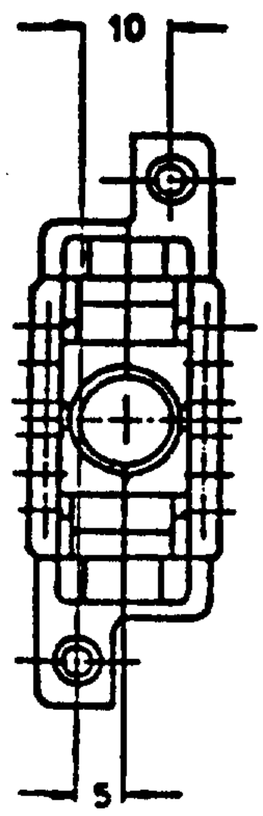


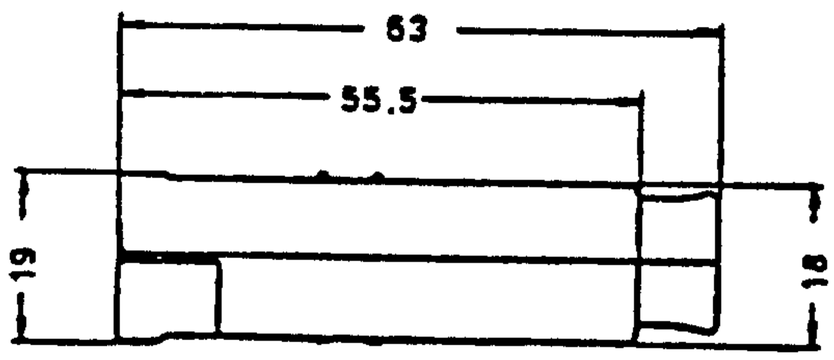
totale cable strip length
15 pole: 37 mm
25 pole: 37 mm
50 pole: 45 mm

Scale: 4:1

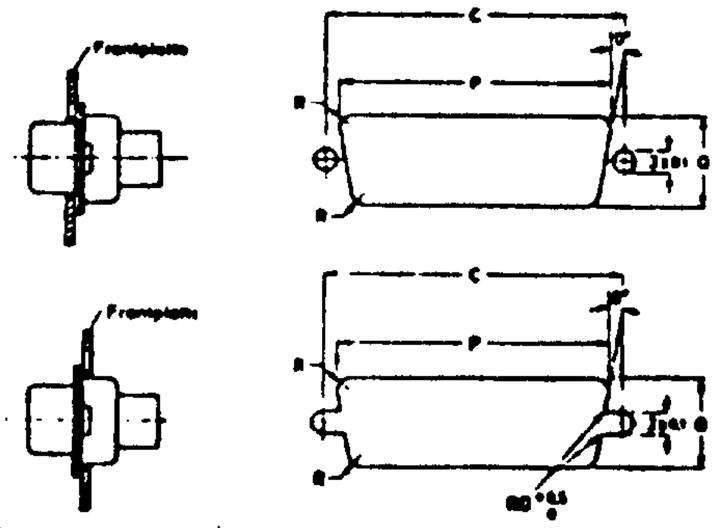
Assembly drawing: Cable/
Subminiature plug



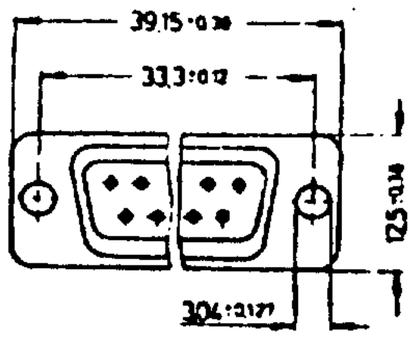




Installation instructions



	C(±0,2)	P(±0,2)	Q(±0,2)	R(±0,2)
15	33,3	28,8	11,4	3,4
15	33,3	30,5	12,3	2,1



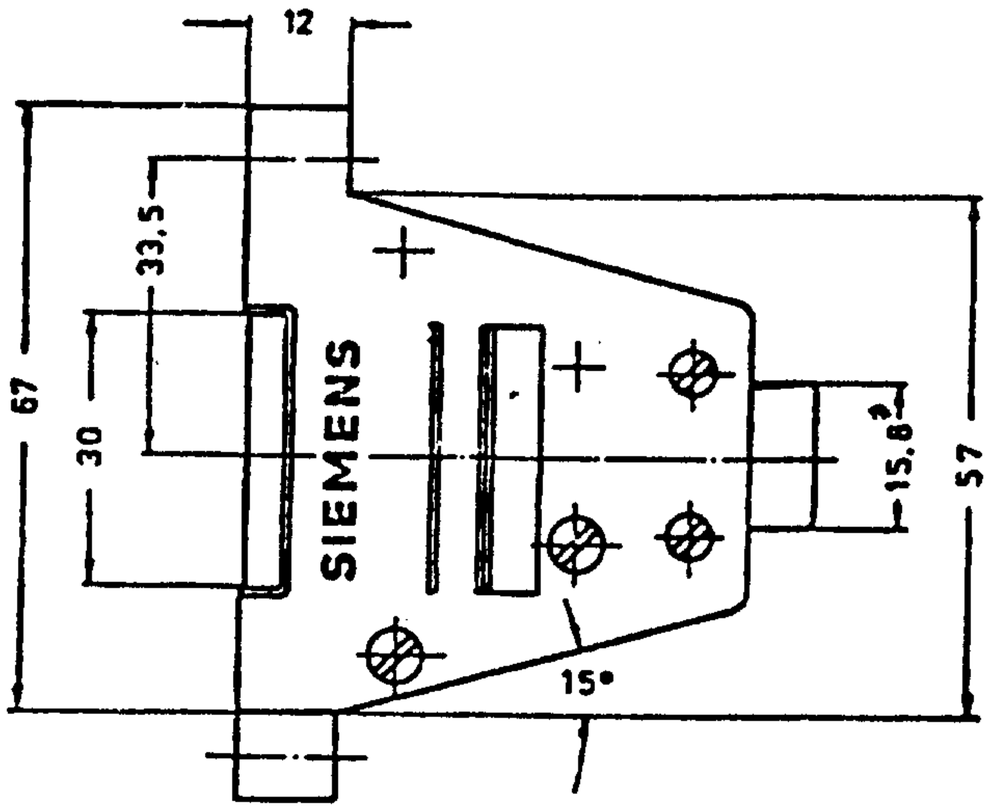
15 pole socket

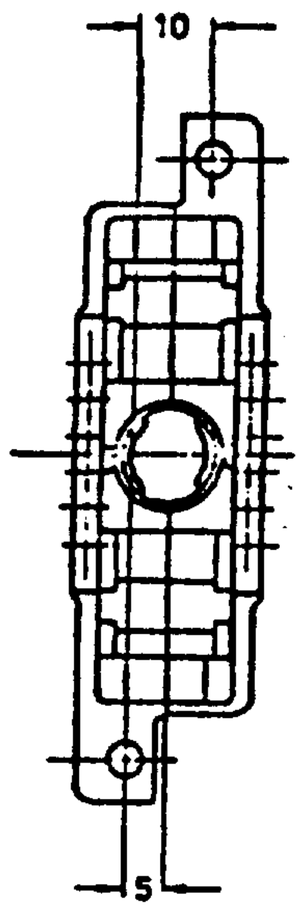
(plug has same dimensions)

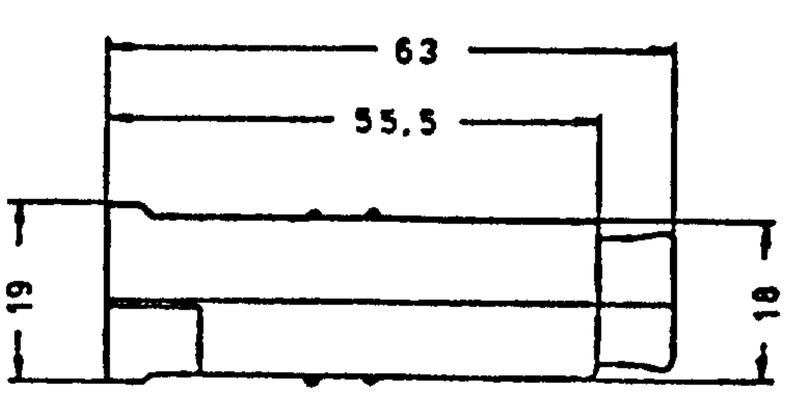
Subminiature 15 pole socket

(complete with housing): machine readable code 6FC9 341-1EC

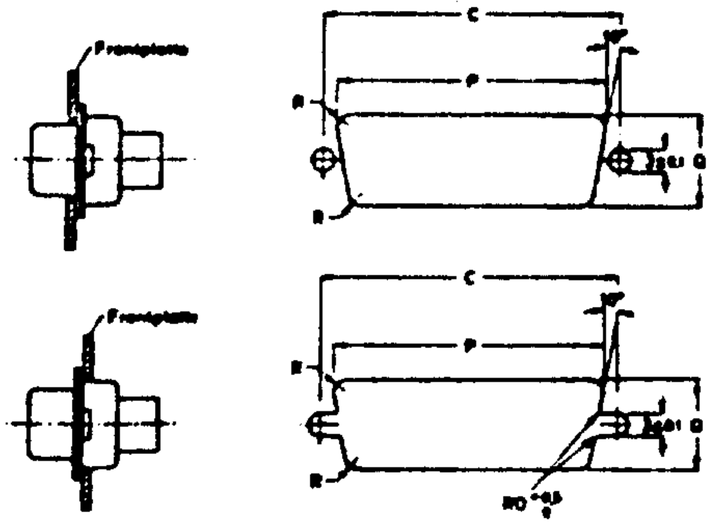
Subminiature 15 pole socket housing: ID no. 400 90 802



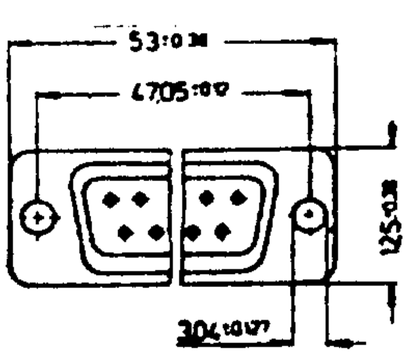




Installation instructions



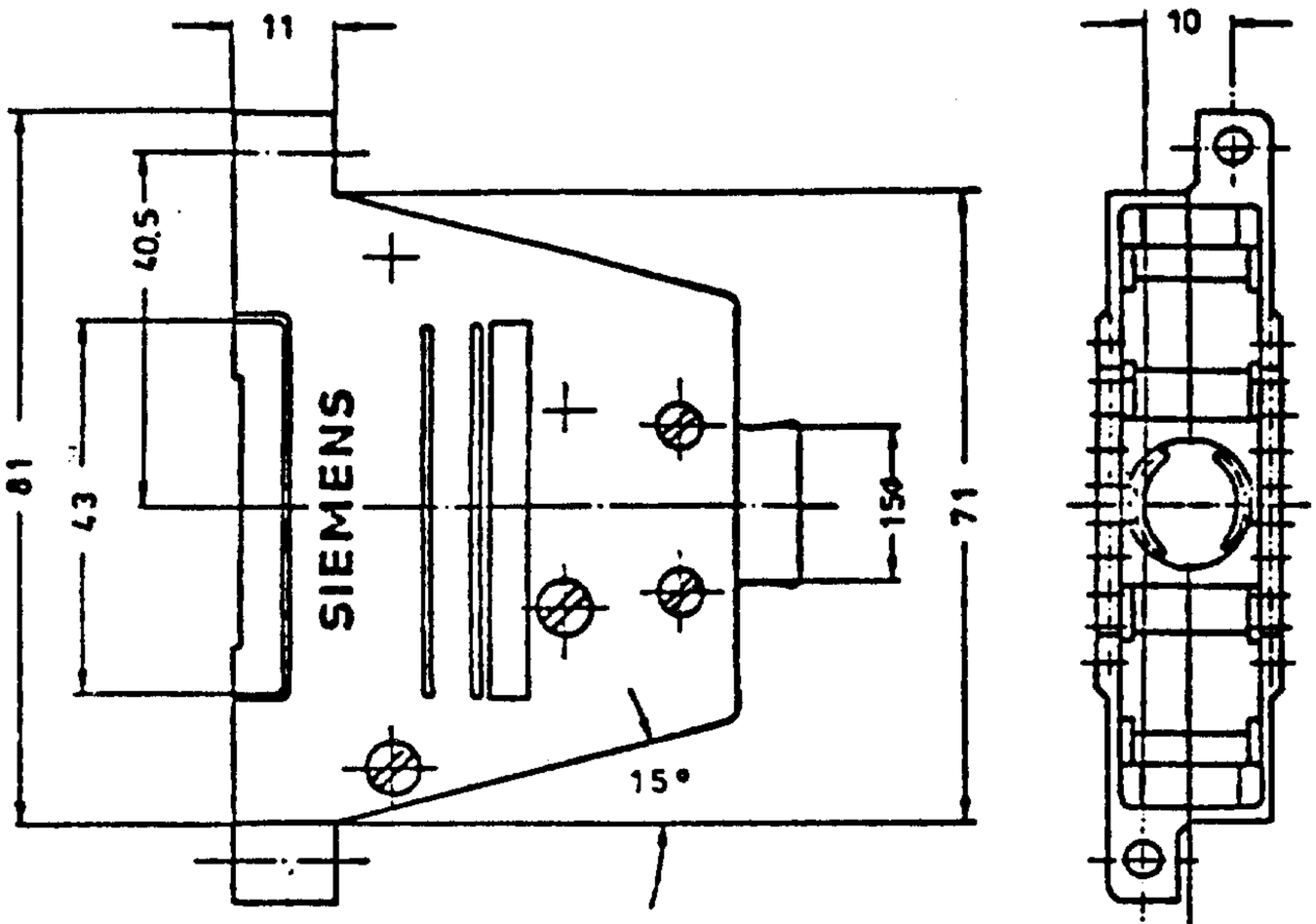
	C(±0,2)	P(±0,2)	Q(±0,2)	R(±0,2)
25	47,0	42,5	11,4	3,4
25	47,0	44,3	12,3	2,1

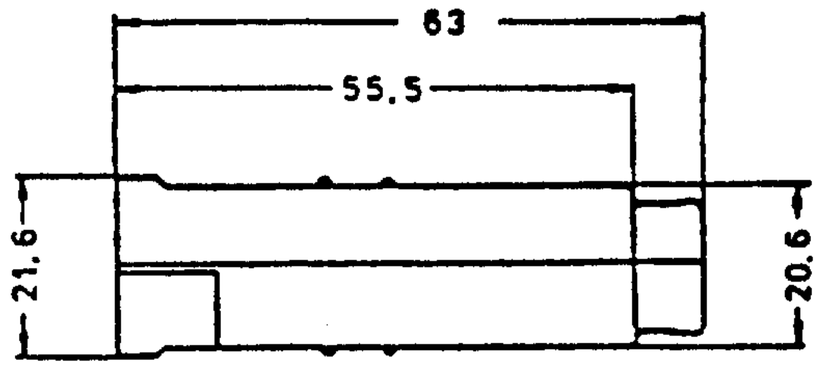


25 pole socket
(plug has same dimensions)

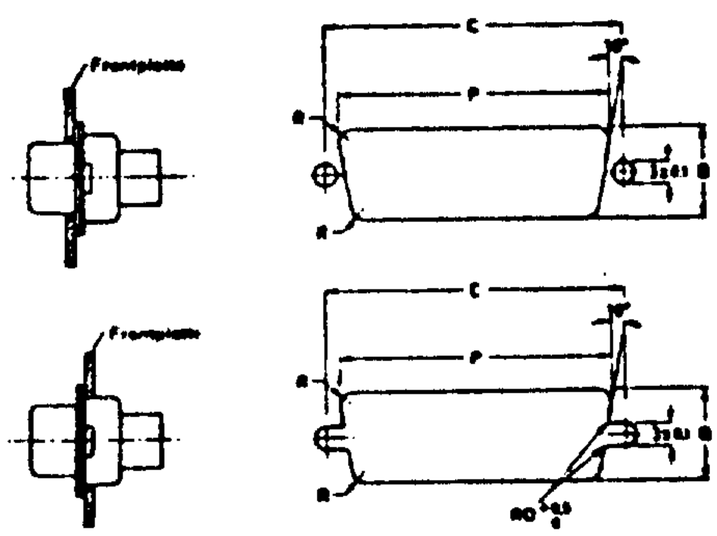
Subminiature 25 pole socket
(complete with housing): machine readable code: 6FC9 341-1ED

Subminiature 25 pole housing: ID no. 400 90 851

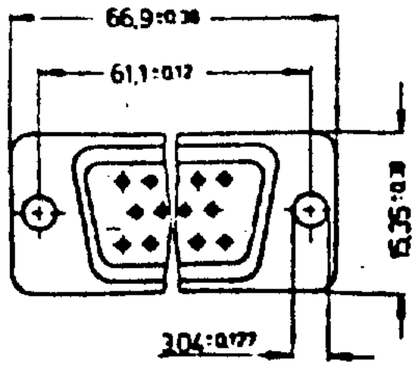




Installation instructions



	C(±0,2)	P(±0,2)	Q(±0,2)	R(±0,2)
50	61,1	56,3	14,1	3,4
50	61,1	58,3	15,3	2,1



50 pole socket
(plug has same dimensions)

Subminiature 50 pole plug
(complete with housing): machine readable code 6FC9 341-1EE

Subminiature 50 pole housing: ID no. 400 90 908

1.1.6 Earth connection

The frame of the logic component section is used as reference potential and is therefore very important for the correct functioning of the complete control.

The subminiature plugs and cable screens provide the earth connections between this frame and the other components.

An M5 earthing screw is provided on the frame of the logic component section for the earth conductor (see diagram). Other earth wires can also be connected starwise.

The earthing cable to the logic rack must have a cross-sectional area of at least 10 mm^2.

The earth potential should be routed to the components of the control using the cable screens. The components may have additional earthing cables of cross-sectional areas greater than or equal to 4 mm^2.

1.1.7 Power supply

The logic components, PC and operator panel are designed for connection to a supply voltage of 24V d.c.

A power supply unit must be used to generate the 24V d.c from the mains voltage.

	3T/M BS 0,1	3T/M BS 2	3T/M BS 3
Nominal connection voltage	24 V-	24 V-	24 V-
Input voltage range inclusive of ripple	20 to 30 V	20 to 30 V	20 to 30 V
Input capacitance	8100 µF	8100 µF	8100 µF
Power consumption Logic component 1) U_E=20 V U_E=24 V U_E=30 V	 I_E = 3,9 A I_E = 3,2 A I_E = 2,6 A	 I_E = 5,0 A I_E = 4,2 A I_E = 3,4 A	 I_E = 5,4 A I_E = 4,5 A I_E = 3,6 A
Power consumption Operator panel 2) U_E=20 V U_E=24 V U_E=30 V	 I_E = 1,0 A I_E = 0,8 A I_E = 0,7 A	 I_E = 1,0 A I_E = 0,8 A I_E = 0,7 A	 I_E = 2,2 A I_E = 1,8 A I_E = 1,5 A

1) Power consumption of the logic components NC + PC without the in-/outputs of the I/O boards.

2) without the machine control panel

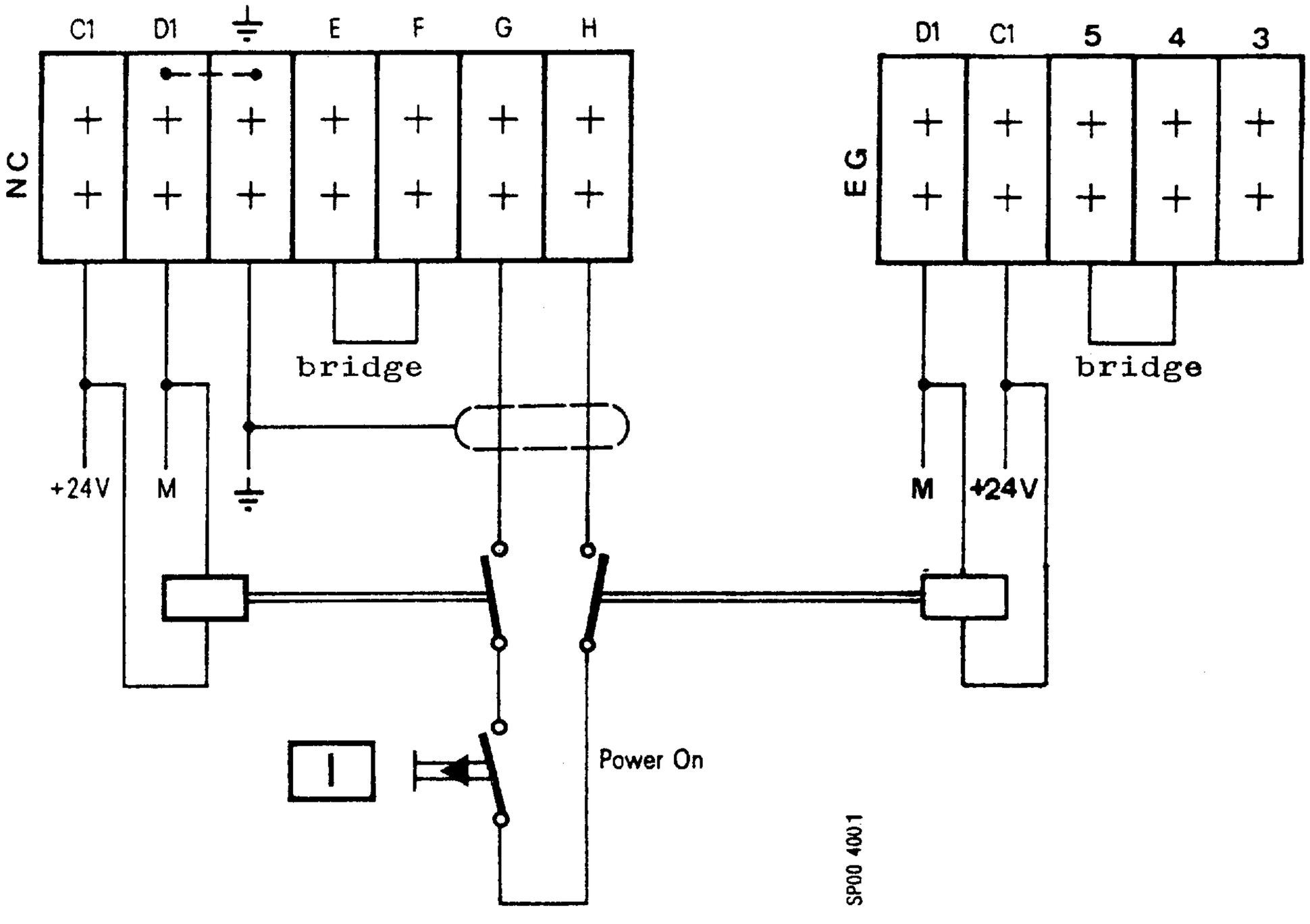
Logic component power supply connection

The connection is made to the terminal strip on the front of the 24V-power supply 03 500 (NC)
= connection cross section : 1.5

24V power supply of the extension unit (EG)
= connection cross section : 1.5

Unused cores of multicor cables should not be connected, i.e. they should be paralled together.

Power on cross section : 2x1 screened



The M-side of the D1-input terminal is connected to the chassis. (earthed)

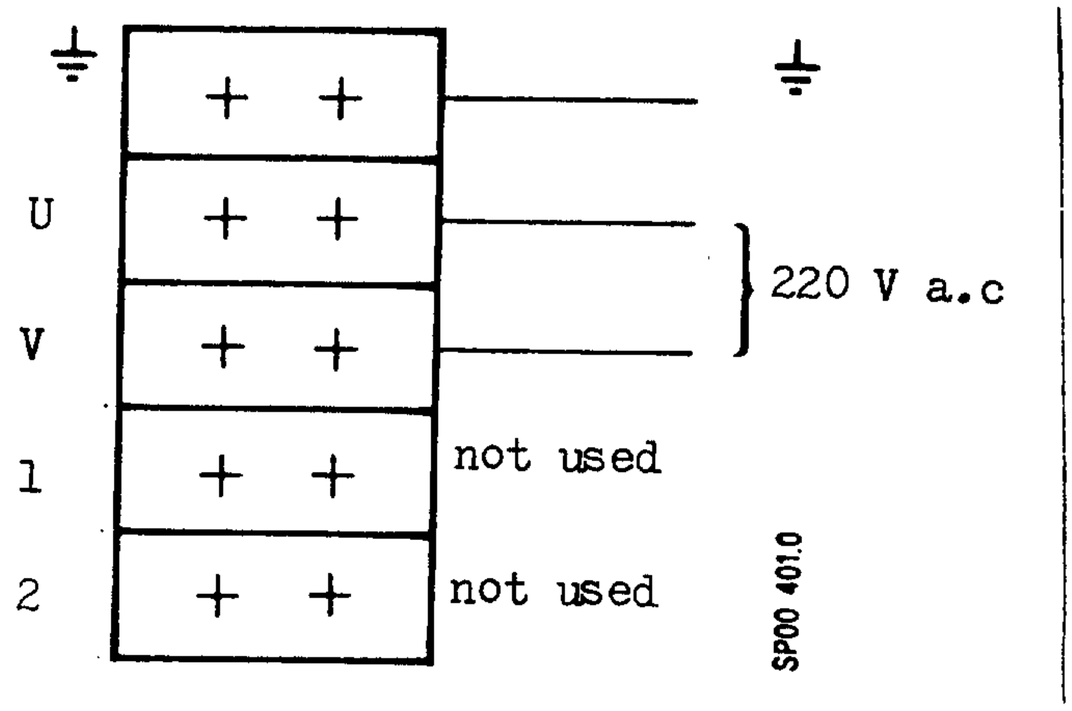
Note: When using external switching elements for power on, no latching pushbutton or toggle switch should be used. Terminals E-F (remove bridge) may be used as an external enable (potential free - e.g. relay contact).

Power supply connection to fan for logic components

Voltage: 220 V, 50 c/s

Conductor cross-section: 1 ϕ

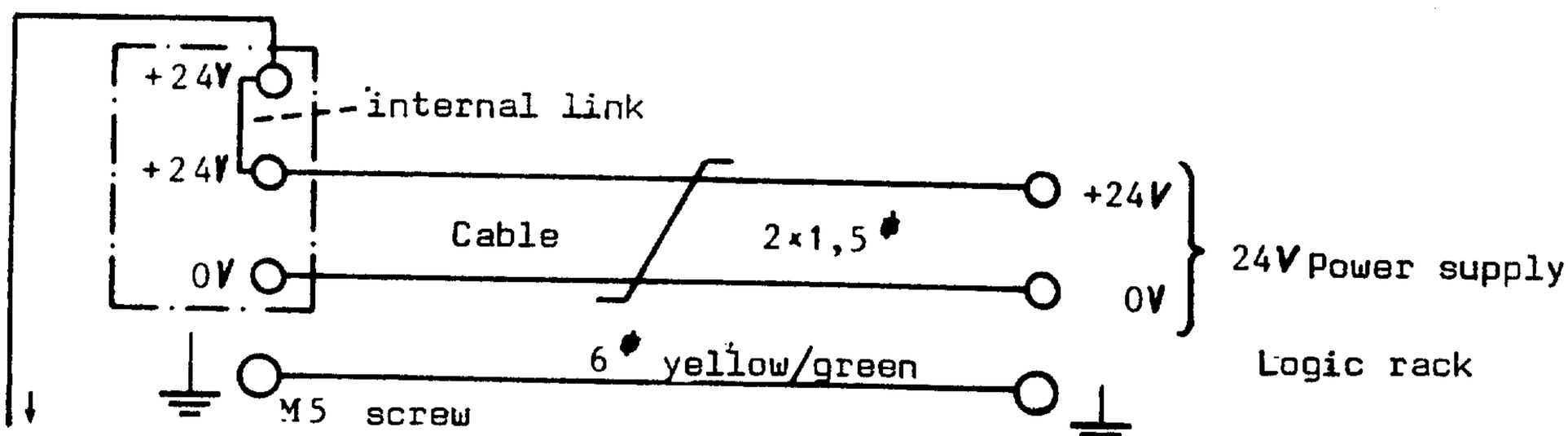
Terminal strip X1



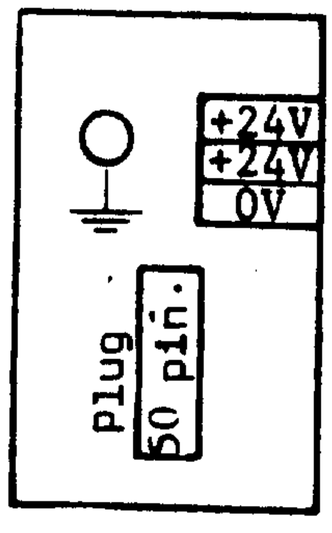
Note:

Terminal strip XZ on the right hand side of the frame is not used.

Operator's panel power supply connection



connecting module on the operator's panel



1.1.8 Climatic and mechanical conditions
(For exact ambient conditions see: VDE 0160 and DIN 40040)

Ambient temperature:

during operation 0 °C to +55 °C
during storage or transport -40 °C to +70 °C

Max. permissable temperature change: 1.1 K/min.

Humidity:
20% to 75% relative humidity, temporarily to 95% (see above)

Concentration of aggressive gases and air -borne particles:
MWC * (maximum working place concentration)

Mechanical conditions:
short-time vibrations up to max. 2.5g are permitted (see above).

* (MWC values available from the Ministry of Work and Social Security).

1.1.9 Preventative measures against magnetic interference

The screen picture may give rise to oscillation if the CRT-unit is subject to electromagnetic fields.

Normally, units that generate magnetic fields (such as transformers, fans, cables carrying alternating current etc.) should be placed at least 300 mm from the CRT-unit.

1.2 Input/output boards

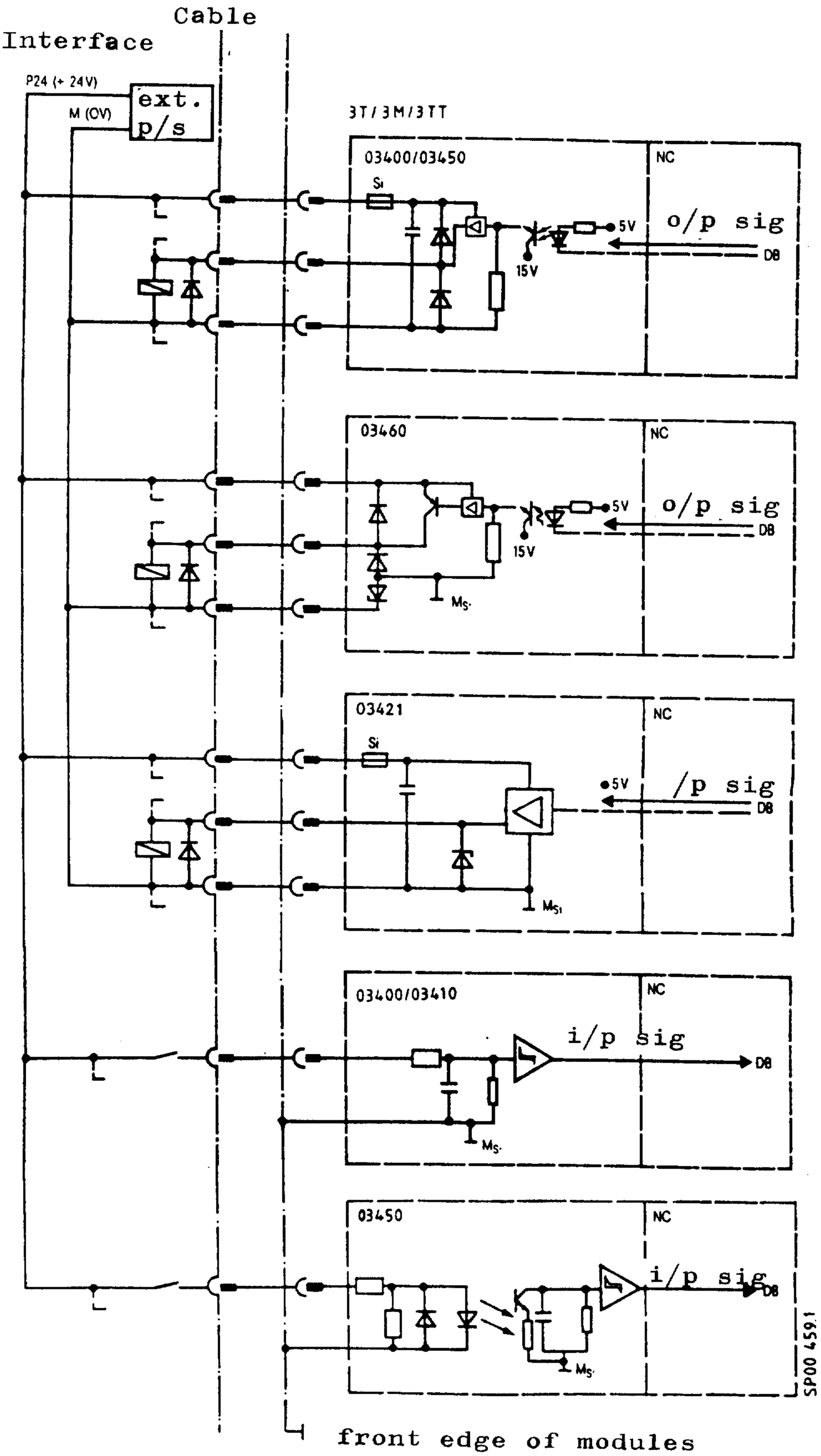
The input/output modules are specific to SINUMERIK system 3. They may be used universally as input/output modules within the PC or the expansion unit.

Separate power supplies may be used for the input- and output signals.

1.2.1 Overview of the available SINUMERIK I/O modules

Module	Inputs	Outputs	Output current (rated value)
03400 (N81)	48	24	100 mA
03410 (N83)	96	-	-
03421 (N84)	-	48	500 mA
03450 (N85)	32	32	100 mA
03460 (N82)	-	16	2 A

1.2.2 Signal flow and connection



(M_s = $M_{control}$)

1.2.3 Electrical characteristics

	03400 /N81	03410 /N83	03420 /N83	03450 /N85	03460 /N82
Number of inputs	48	96		32	
Potentially isolated	no	no		yes	
Input voltage (rated value)	24V-	24-		24V-	
Input voltage - for "0" signal - for "1" signal	 -3V to +5V +14V to +30V	 -3V to +5V +14V to +30V		 -2.1V to +5V +15V to +30V	
Input current with "1" signal typ.	5.2 mA	5.2 mA		6.5 mA	
Delay time - for tpLH - for tpHL	 0.37...0.68 ms 0.70...1.45 ms	 0.37...0.68 ms 0.70...1.45 ms		 1.8 ms 2.2 ms	
Cable conductor length max.	50 m	50 m		50 m	
Number of outputs	24		48	32	16
Potentially isolated	yes		no	yes	yes
Supply voltage U_p - rated value - ripple U_{ss} - permissable range (incl. ripple)	 24V- 3.6V 20V to 30V		 24V- 3.6V 18V to 32V	 24V- 3.6V 20V to 30V	 24V- 3.6V 20V to 30V
Output current with "1" signal - rated value	 100 mA		 500 mA	 100 mA	 2 A
Short circuit protection	none		electronic	none	electronic
Limitation of inductive switch-off voltage to	-0.7V		- 0.7V	-0.7V	-13V
Switching power for lamps max.	--- 3)		10W	---3)	10W
Switching frequency with - resistive load max. - lamps max. - inductive load 1)	 100 Hz 11 Hz 2 Hz		 100 Hz 11 Hz 2 Hz	 100 Hz 11 Hz 2 Hz	 100 Hz 11 Hz 2 Hz
Total loading 2) at 55°C	50 %		50 %	50 %	50 %
Signal level of outputs - with "0" signal max. - with "1" signal max.	 output open U_p - 1.7V		 output open U_p -1.5V	 output open U_p -1.7V	 output open U_p -1.7V
Cable conductor length max.	50 m		50 m	50 m	50 m
Isolation voltage External connection to the housing: -to VDE 0160 -tested with	 --- ---	 --- ---	 --- ---	 --- ---	 --- ---
Current consumption - internal (with 5V) - internal (with 24V) Space requirement (1 SEP= 15.24mm)	 1 A 0.15 A $1^2/_3$SEP	 0.52 A --- $1^2/_3$SEP	 0.25 A 0.12 A $1^2/_3$SEP	 0.8 A 0.12 A $1^2/_3$SEP	 0.5 A 0.34 A $1^2/_3$SEP
Weight approx.	0.4 kg	0.4 kg	0.3 kg	0.4 kg	0.6 kg

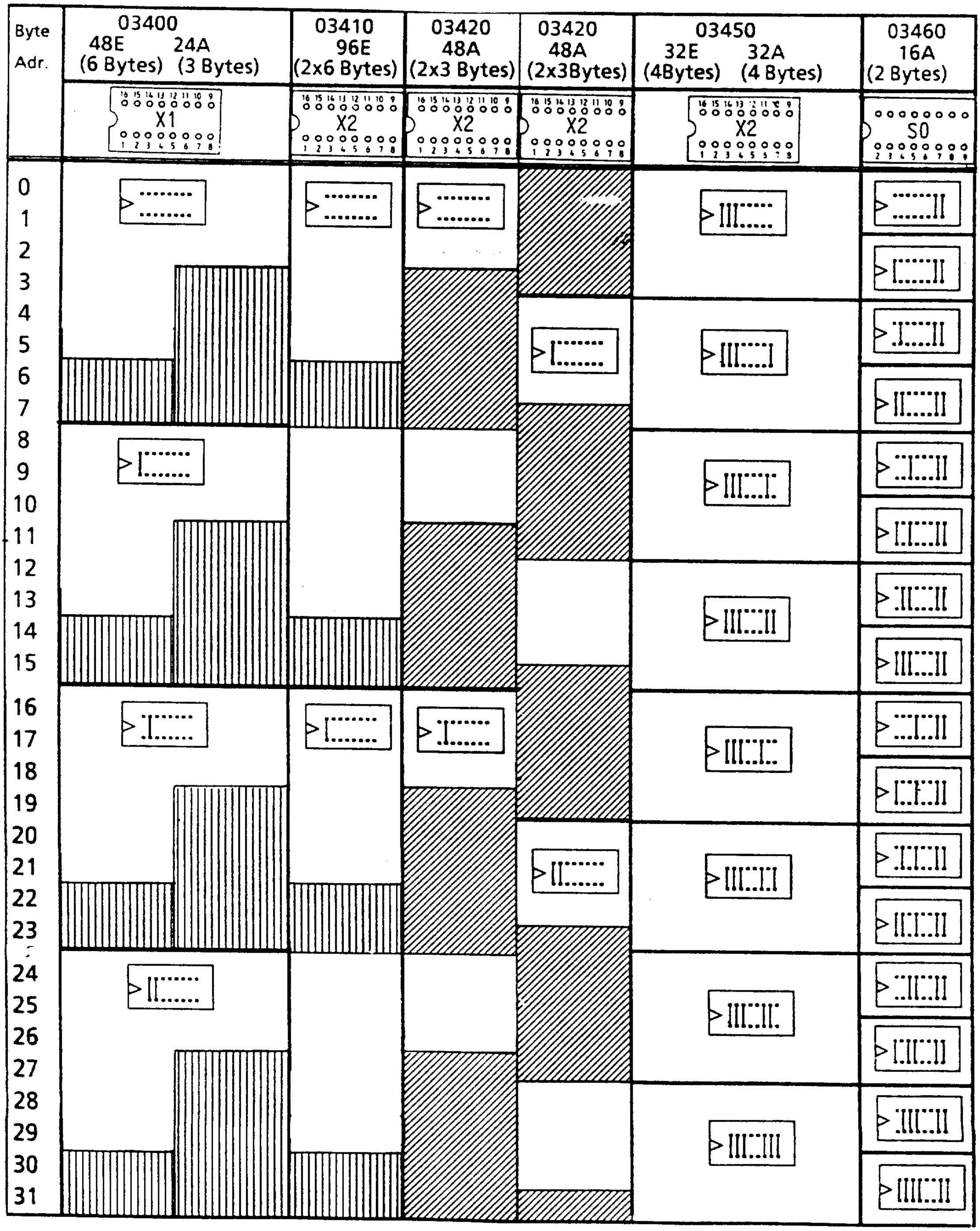
1) At rated loading. Higher values are permissable at lower loading levels.

2) Referred to the sum of the rated currents of all the outputs.

3) Maximum switch on current 350 mA.
With indicator lamp control : 12V-lamps with preresistance or
24V-lamps with preheating

1.2.4 Addressing the I/O modules

The boards may be inserted in the rack in any convenient order. Each module is assigned a number through which the address range is determined.



Byte Adr.	03400 48E (6 Bytes) 24A (3 Bytes)	03410 96E (2x6 Bytes)	03420 48A (2x3 Bytes)	03420 48A (2x3Bytes)	03450 32E (4Bytes) 32A (4 Bytes)	03460 16A (2 Bytes)
	X1	X2	X2	X2	X2	S0
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
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49						
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55						
56						
57						
58						
59						
60						
61						
62						
63						

Addresses not generally available

Addresses may be occupied by other modules

1.2.5 Input/output connections

Module 03400:

Separate plugs are used for connecting both the inputs and the outputs , subminiature 50 pole pin connection.

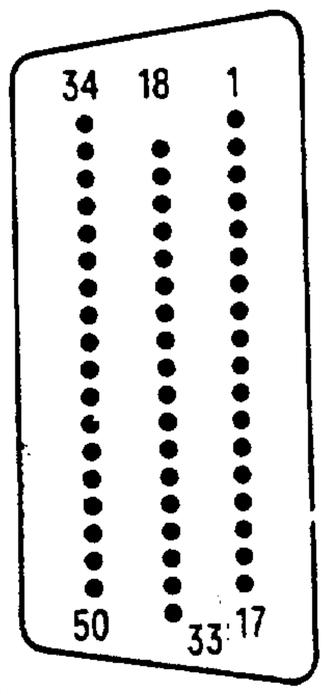
Cable : SINUMERIK standard cable 6FC9 340-2W.

Input plug X 402, IN

Byte	Plug - pin Bit							
	7	6	5	4	3	2	1	0
0	8	7	6	5	4	3	2	1
1	16	15	14	13	12	11	10	9
2	25	24	23	22	21	20	19	18
3	33	32	31	30	29	28	27	26
4	41	40	39	38	37	36	35	34
5	49	48	47	46	45	44	43	42

Plugs

X412, X413 IN



pin

view from front

face of board

Output plug X 403, OUT

Byte	Plug pin Bit							
	7	6	5	4	3	2	1	0
0	16	15	14	13	12	11	10	9
1	25	24	23	22	21	20	19	18
2	33	32	31	30	29	28	27	26
P24 (+24V)			1	2	3		Inputs	
Mext (0V)			34	35			Inputs	

Module 03410:4

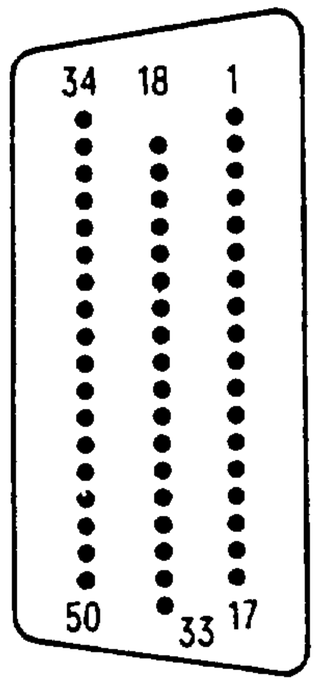
The connection is made to two 50 pole subminiature plugs with 48 inputs each ; pin connection.

Cable: SINUMERIK standard cable 6FC9 340-2W.

Input plug X 412, IN

Byte	Plug - pin Bit							
	7	6	5	4	3	2	1	0
0	8	7	6	5	4	3	2	1
1	16	15	14	13	12	11	10	9
2	25	24	23	22	21	20	19	18
3	33	32	31	30	29	28	27	26
4	41	40	39	38	37	36	35	34
5	49	48	47	46	45	44	43	42

Plugs X412, X413, IN



pin view from front face of board

Output plug X 413, OUT

Byte	Plug - pin Bit							
	7	6	5	4	3	2	1	0
8	8	7	6	5	4	3	2	1
9	16	15	14	13	12	11	10	9
10	25	24	23	22	21	20	19	18
11	33	32	31	30	29	28	27	26
12	41	40	39	38	37	36	35	34
13	49	48	47	46	45	44	43	42

Module 03421:

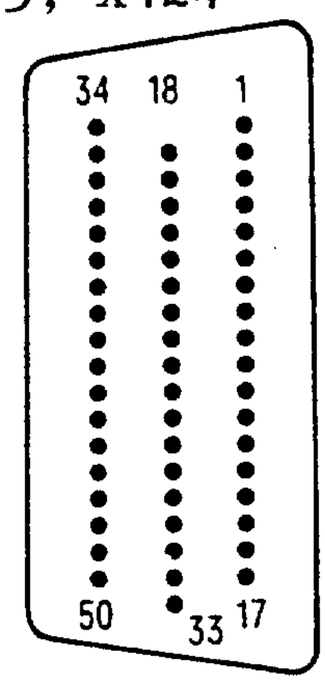
Connection is made to two 50 pole subminiature plugs with 24 outputs each, pin connection.

Cable : SINUMERIK standard cable 6FC9 340-2W.

Output plug X 423, OUT

Byte	Plug - pin Bit 7	6	5	4	3	2	1	0
0	16	15	14	13	12	11	10	9
1	25	24	23	22	21	20	19	18
2	33	32	31	39	29	28	27	26

Plugs
X423, X424



pin

view from front
face of board

Plug X422
with 03 421

Output plug, X424, OUT

Byte	Plug-pin Bit 7	6	5	4	3	2	1	0
8	16	15	14	13	12	11	10	9
9	25	24	23	22	21	20	19	18
10	33	32	31	30	29	28	27	26

Mext	(0V)	Input
P24	(+24V)	Input

Module 03450:

Separate 50 pole subminiature plugs are used for connecting the inputs and outputs.

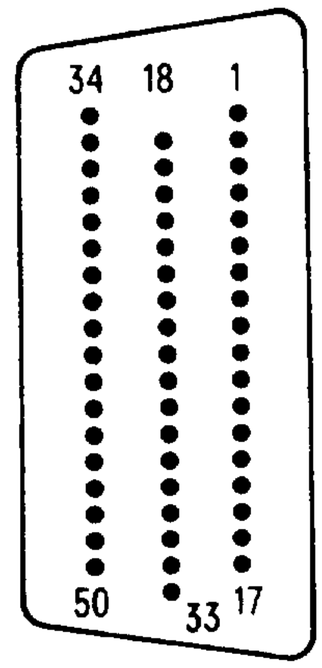
Cable: SINUMERIK standard cable 6FC9 340-2W.

Input plug X 454, IN

Byte	Plug - pin Bit 7	6	5	4	3	2	1	0	MEXT (0V) on plug pin
0	49	48	47	31	32	16	15	14	17 33 50
1	45	44	43	27	28	12	11	10	13 29 46
2	41	40	39	23	24	8	7	6	9 25 42
3	37	36	35	19	20	4	3	2	5 21 38

Plug

IN
OUT



pin

view from front face of board

Output plug X 453, OUT

Byte	Plug - pin Bit 7	6	5	4	3	2	1	0	Plug - pin Inputs MEXT (0V)	P24 (+24V)
										1
0	49	48	47	31	32	16	15	14	17 33 50	18
1	45	44	43	27	28	12	11	10	13 29 46	34
2	41	40	39	23	24	8	7	6	9 25 42	
3	37	36	35	19	20	4	3	2	5 21 38	

Module 03460:

One 50 pole subminiature plug is used for the connection, pin connection.

Cable: SINUMERIK standard cable 6FC9 340-2W.

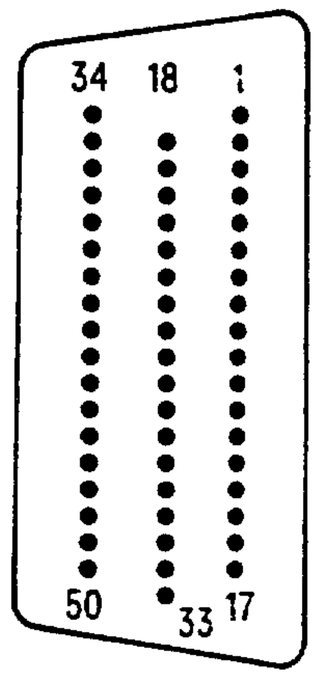
Terminal strip X464

MEXT	(0V)	Input
P24	(+24)	Input

MEXT may also be connected via pins of plug X463

24V connection via terminal strip X464

Plug X463, OUT



Plug

View from front face of board

Output plug X 463

Byte	Plug - pin Bit 7		6		5		4		3		2		1		0		Plug - pin Inputs MEXT (0V)
0	40	41	8	24	7	23	6	39	36	37	4	20	3	19	2	35	5 9 13 17 21 25
1	48	49	16	32	15	31	14	47	44	45	12	28	11	27	10	43	29 33 38 42 46 50

1.2.6 Selection of the receiver relays for the interface control

It is recommended to use relays with the following data:

- rated voltage $U_N = 24$ V
- maximum voltage $U_{max} \leq 30$ V
- energising voltage $U_{An} \approx 16$ V ($10V \leq U_{An} \leq 19V$)
- de-energising voltage $U_{Ab} \approx 2...4$ V ($\leq 10V$)

When selecting the relays account must be taken of the 0.75V voltage drop which occurs over the 16m long cable (3T/3M to the interface control) at 1.5A total current.

Relay recommendation

for

low voltage, type N relays; coil data: max. 31V, max. 60 mA.

dust-tight type	hermetically-sealed type
V23154 - D0720 - C110	V231162 - B0720 - C110 silver
V23154 - D0720 - C410	V231162 - B0720 - C410 gold

Contact capacity: dual spring contact with 4 changeover contacts

switching voltage	max. 100 V (silver);	24 V (gold)
switching current	max. 1 A (silver);	0.2 A (gold)
switching power	max. 30 W (silver):	5 W (gold)

for
220 V voltage, type N relays; coil data: max. 31 V, max. 60 mA
V23154 - D0720 - F104 V231162 - B0720 - F104 silver

Contact capacity: spring contact with 2 switchover contacts
switching voltage max. 220 V
switching current max. 5 A
switching power max. to 30 V ... 100 W; 30 - 50 V ... 80 W;
50 - 220 V ... 50 W

Recommended suppression diodes

Suppression diodes are required to reduce the voltage induced at switch-off in the relay coil to 20 V within 20 ns.

2. Operating elements

2.1 Operator panel and machine control panel 3T

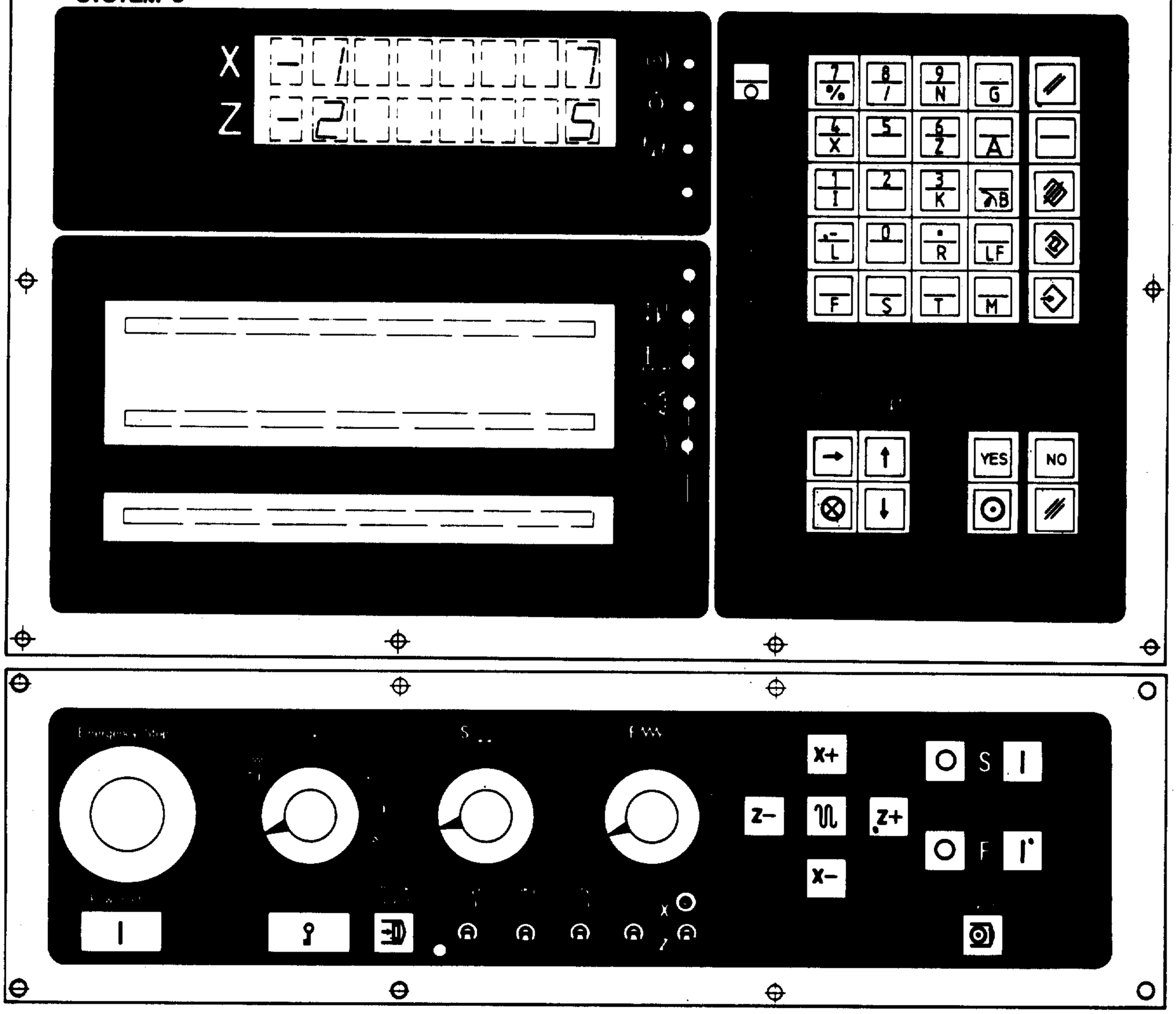
2.2 Operator panel and machine control panel 3M

2.3 Operating mode selector switch on the machine control panel.

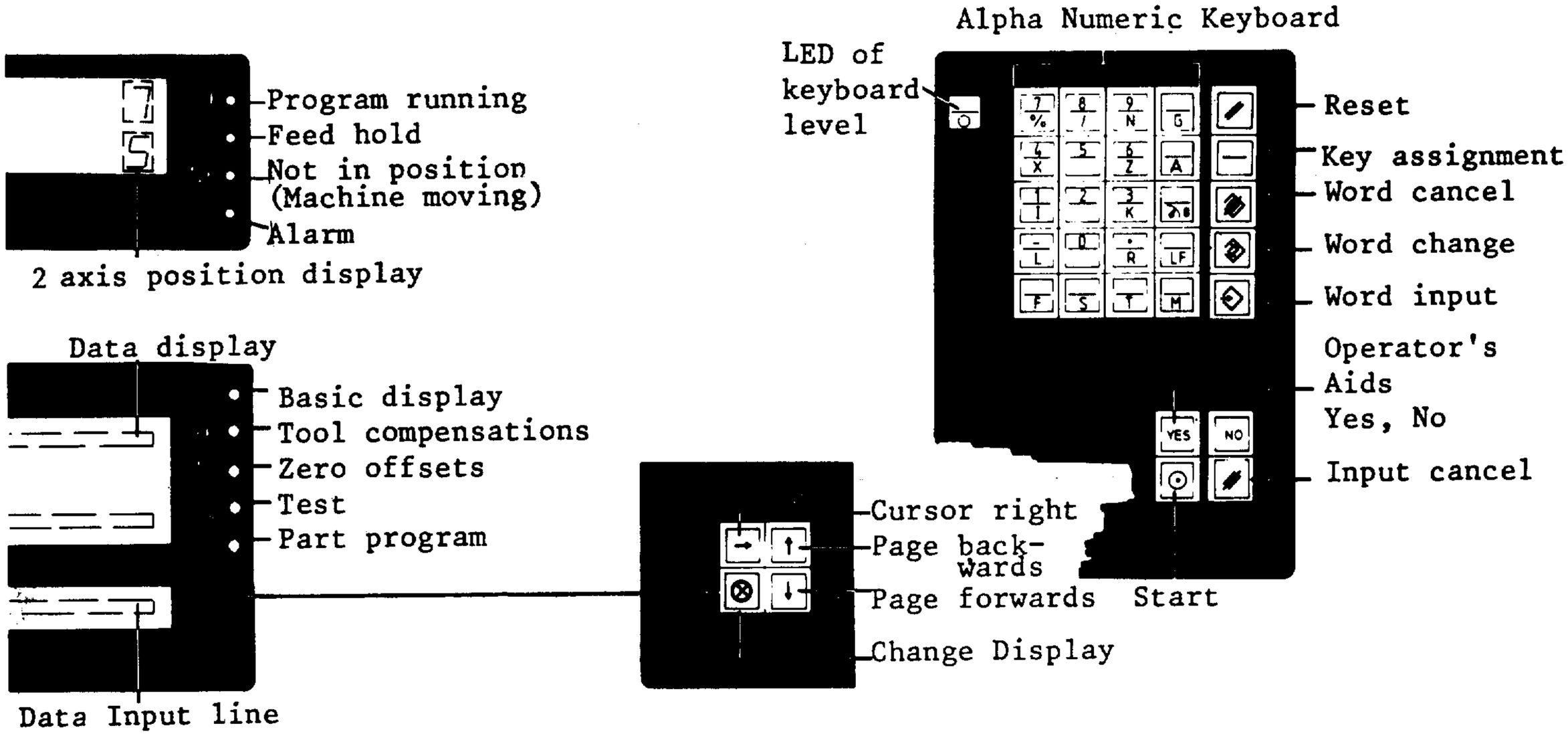
2. Operating elements

2.1 Operator panel and machine control panel 3T

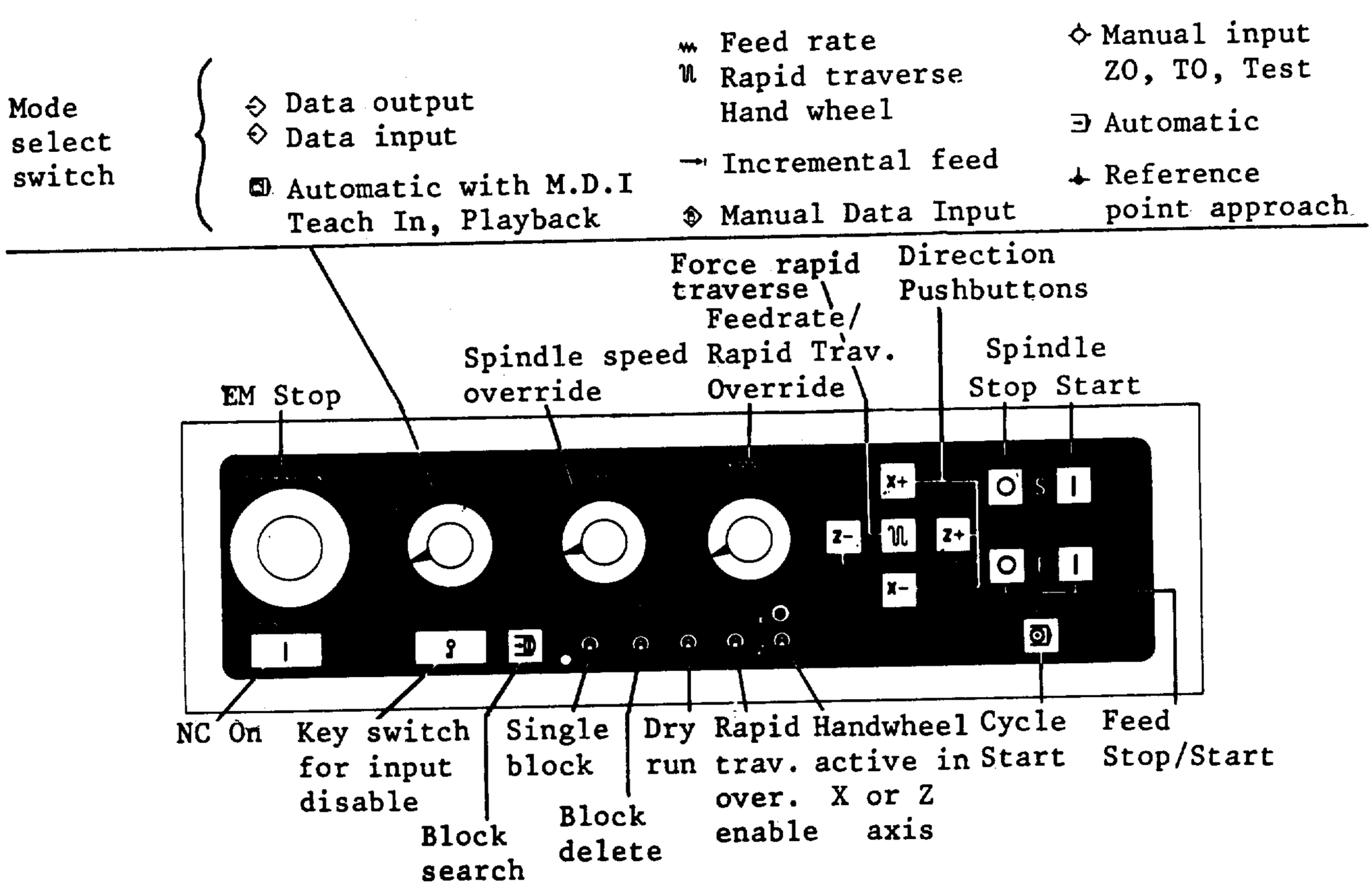
(Basic system 0,1,2)



Operator panel 3T (Basic system 0,1,2)

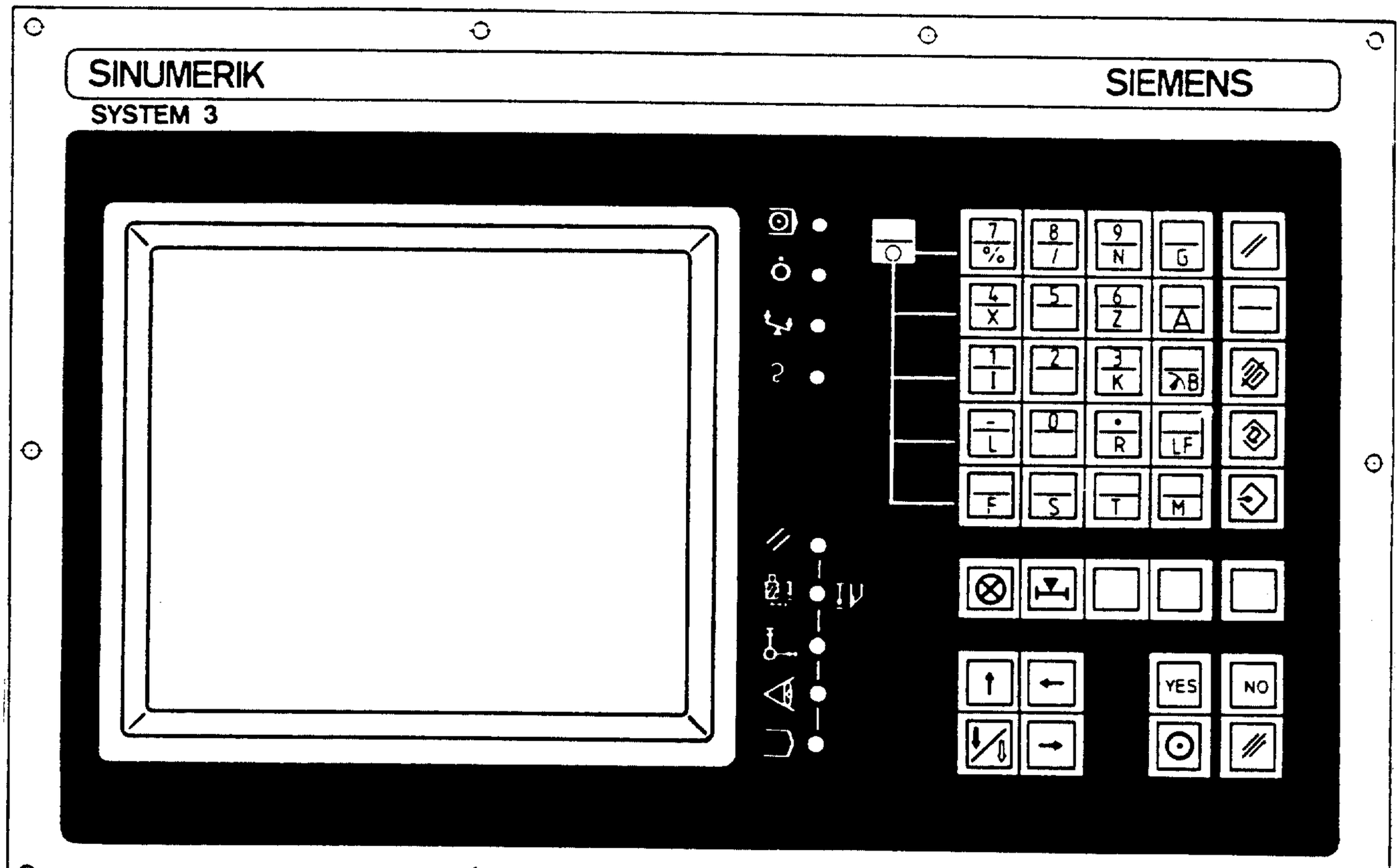


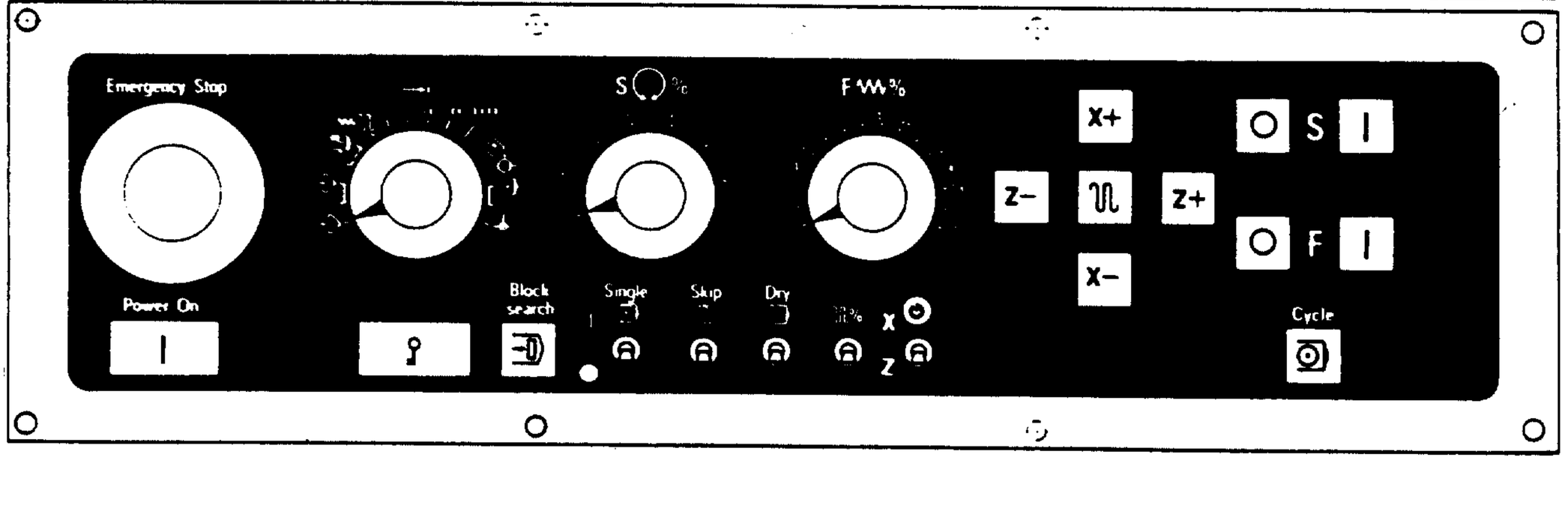
Machine control panel 3T



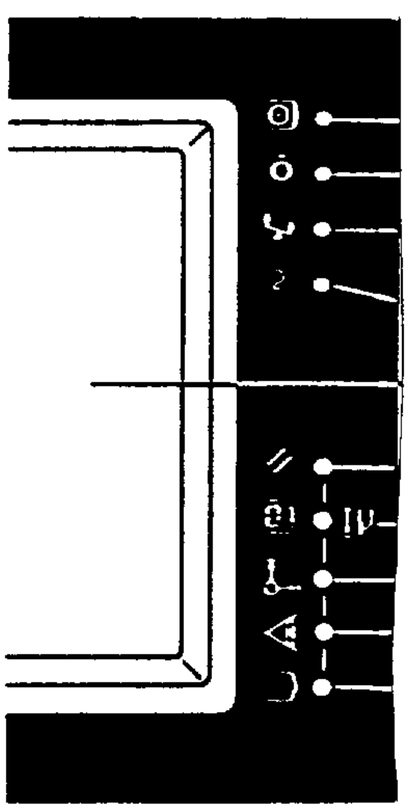
Operator panel and machine control panel 3T

(Basic system 3)



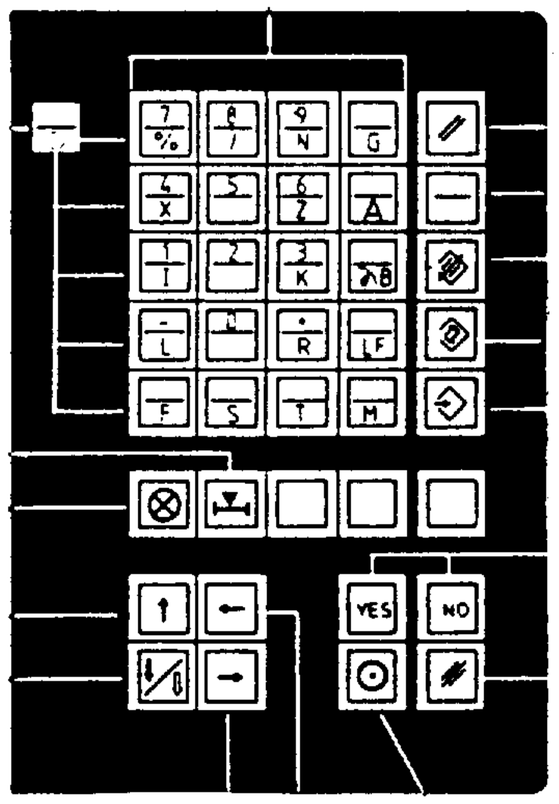


Operator panel 3T (basic system 3)



program running
feed hold
position not yet reached (machine moving)
alarm
CRT display
basic display
tool offsets
zero offsets
test
part program

LED for keyboard level
Switchover to position display
Change display
Page backwards
Page forwards



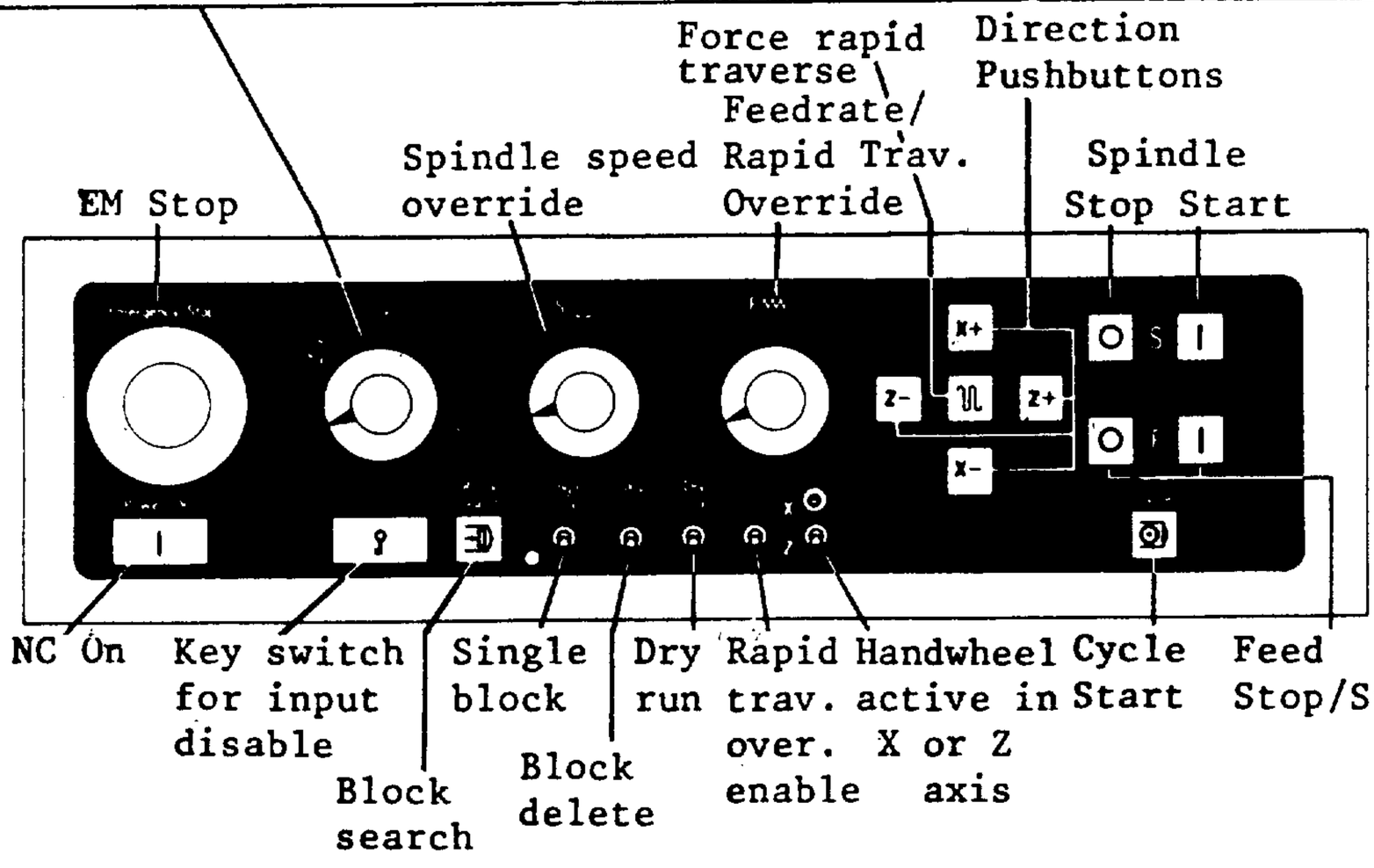
Address keys/ numerics keyboard
Reset Keyboard-level s/w
Cancel word
Change word
Input word
Operator guidance Yes,No
Input cancel
start
Cursor right, left

Machine control panel 3T

Mode select switch
- Data output
- Data input
- Automatic with M.D.I Teach In, Playback

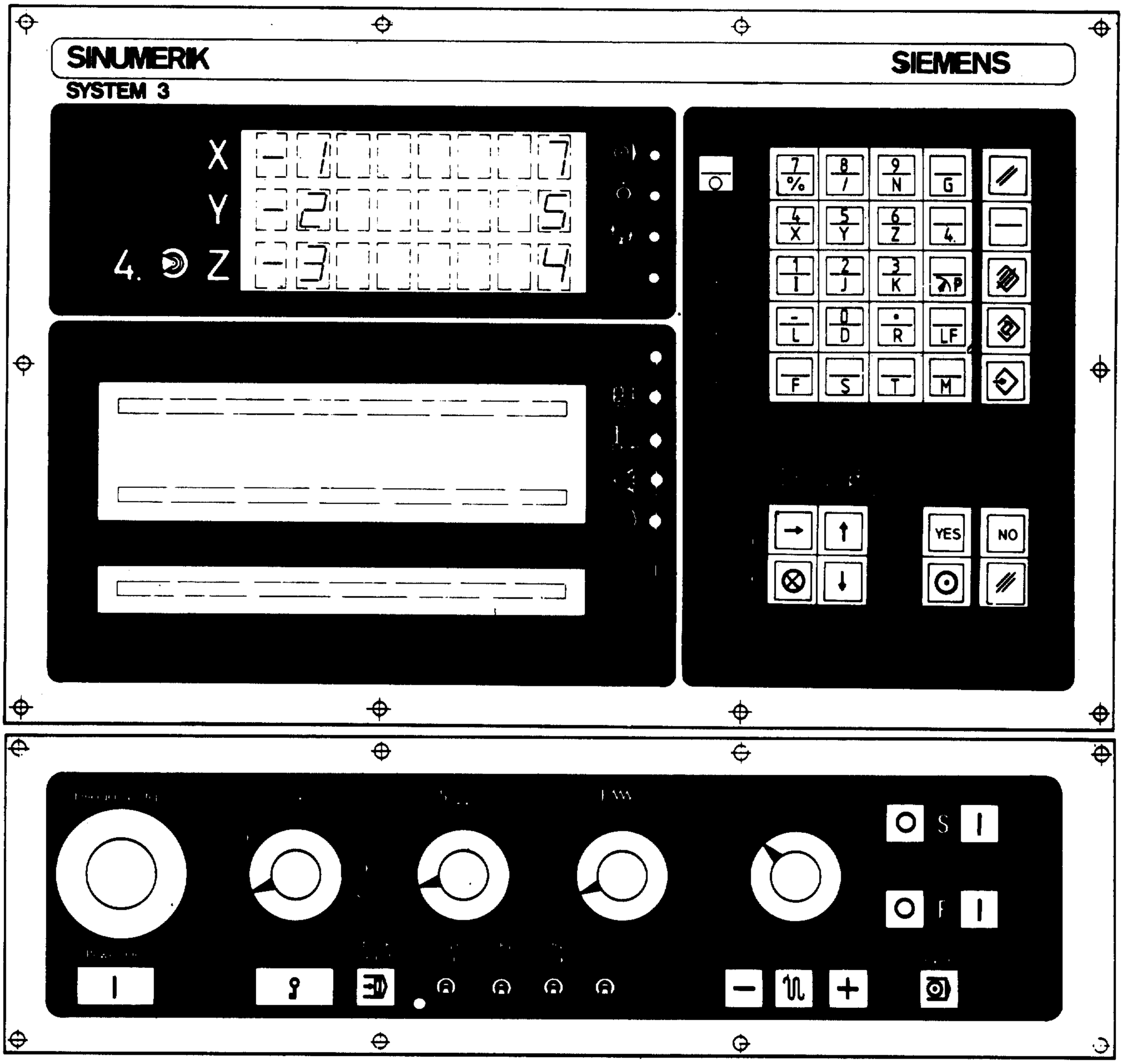
Feed rate
Rapid traverse Hand wheel
Incremental feed
Manual Data Input

Manual input ZO, TO, Test
Automatic
Reference point approach

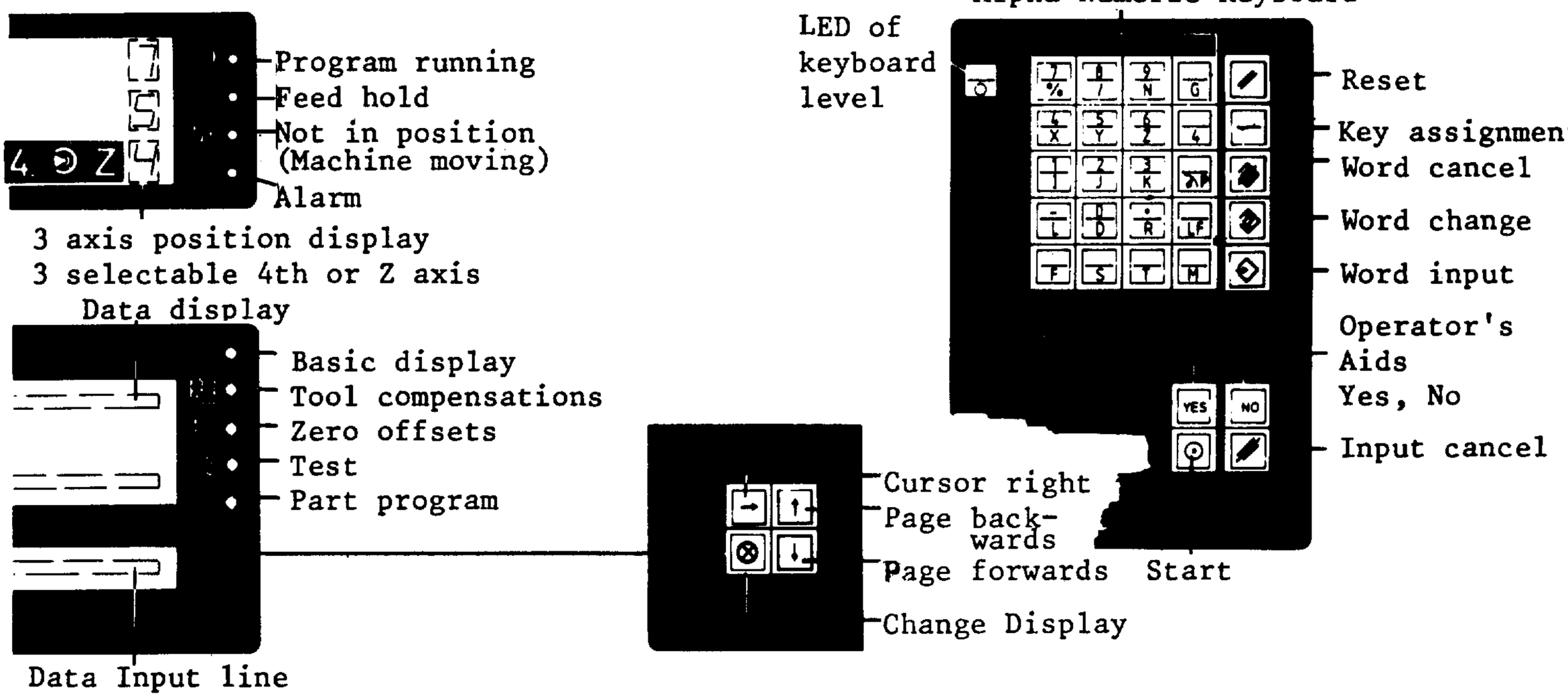


2.2 Operator panel and machine control panel 3M

(Basic system 0,1,2)

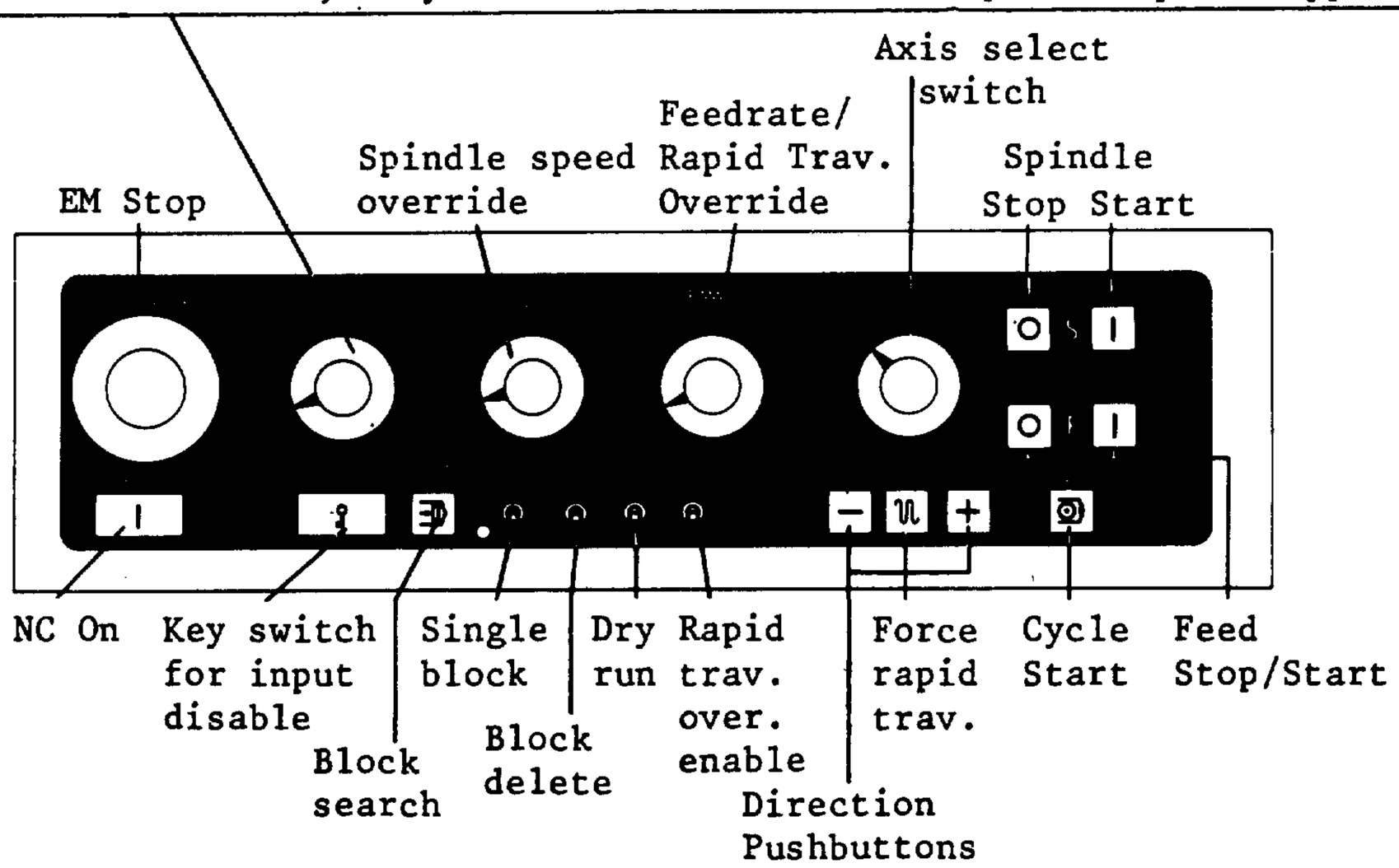


Operator panel 3M (Basic system 0,1,2)



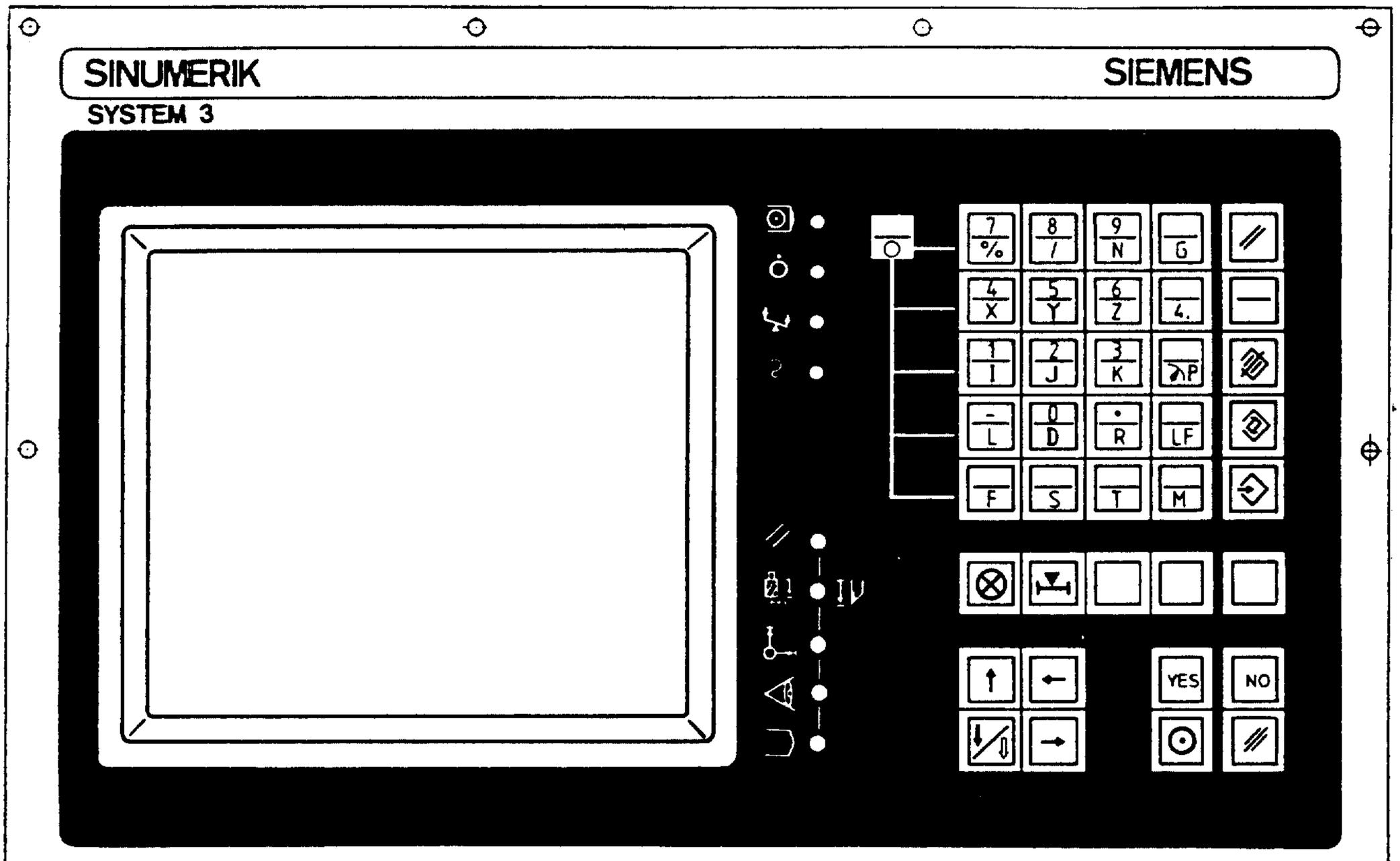
Machine control panel 3M

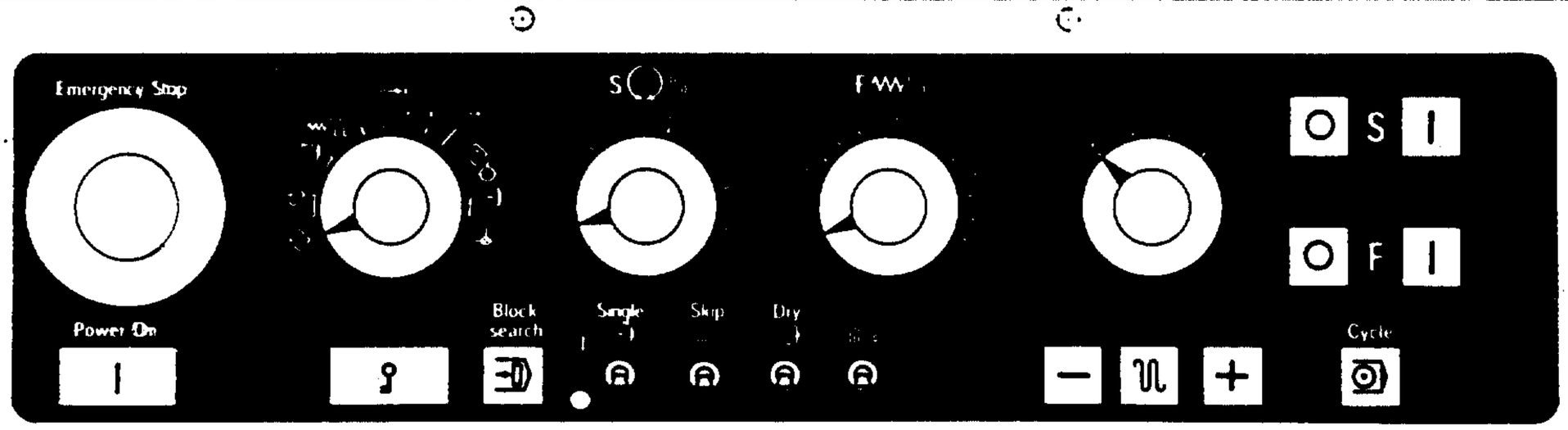
Mode select switch:
- Data output
- Data input
- Automatic with M.D.I Teach In, Playback
- Feed rate
- Rapid traverse Hand wheel
- Incremental feed
- Manual Data Input
- Manual input Z0, T0, Test
- Automatic
- Reference point approach



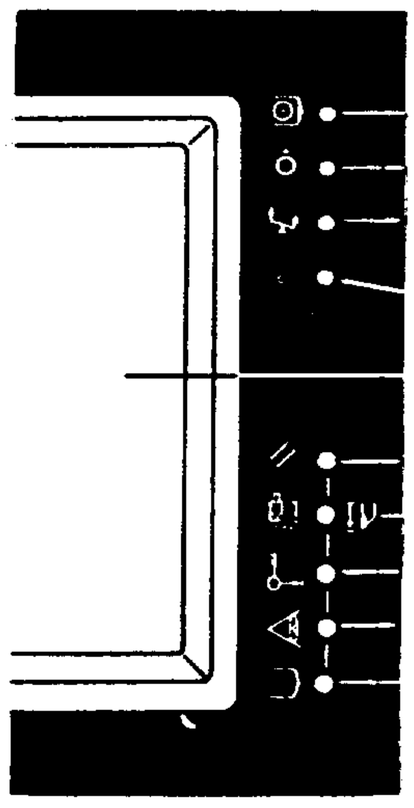
Operator panel and machine control panel 3M

(Basic system 3)





Operator panel 3M (Basic system 3)



Program running
Feed hold
Position not yet reached (machine in motion)
Alarm

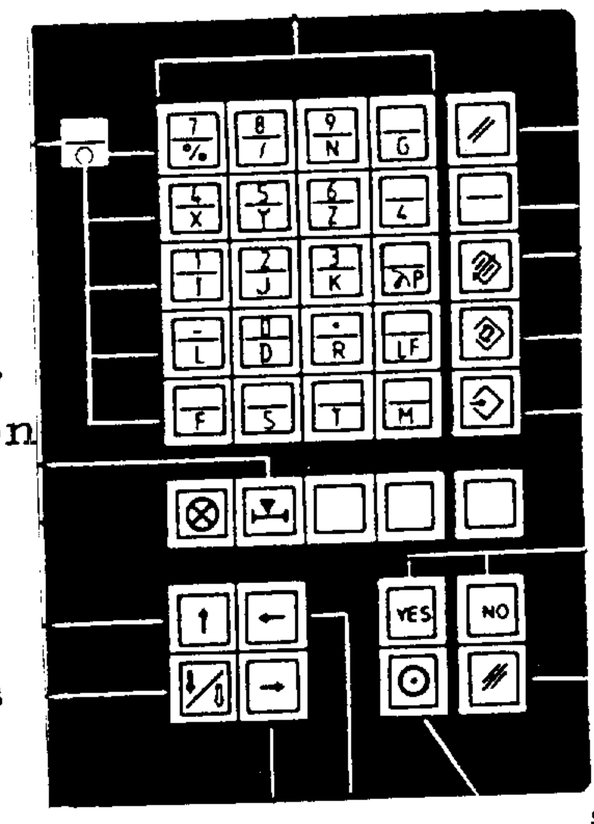
CRT display

Basic display
Tool offsets
Zero offsets
Test
Part program

LED for keyboard level

Switchover to position display
Change display
Page backwards forwards

Address keys/ numerics keyboard



Reset

Keyboard level switchover
Cancel word
Change word
Input word

Operator guidance
Yes, No

Input cancel

start

Cursor right, left

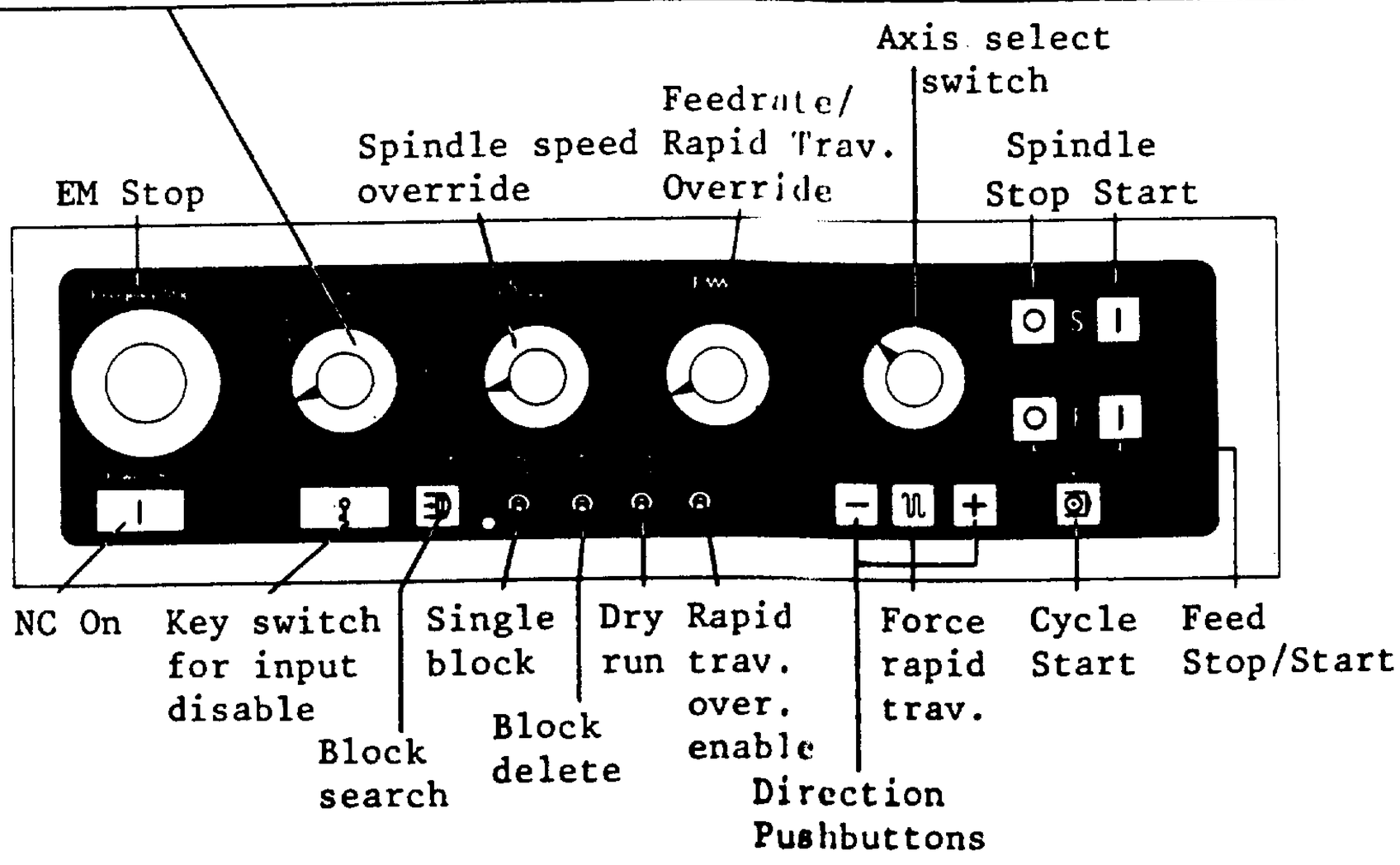
Machine control panel 3M

Mode select switch

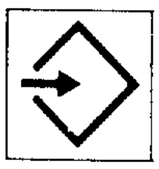
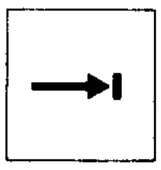
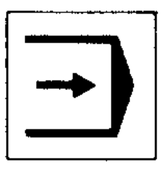
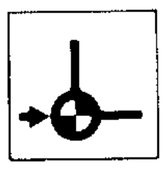
- Data output
- Data input
- Automatic with M.D.I Teach In, Playback

- Feed rate
- Rapid traverse Hand wheel
- Incremental feed
- Manual Data Input

- Manual input ZO, TO, Test
- Automatic
- Reference point approach



2.3 Operating modes of the machine control panel operating mode selector switch

Symbol	Description	Screen text	Abbrev-iation
	Data output interface	DATA OUTPUT	DO
	Data input interface	DATA INPUT	DI
	Manual data input/ automatic	MDA	MDA
	Jog, handwheel	JOG	JOG
	Incremental feed	INC FEED	INC
	Manual data input, part program	MDI PARTPROGRAM	MDI-PP
	Manual data input Setting data Testing data	MDI SE-TE	MDI SE-TE
	Automatic	AUTOMATIC	AUT
	Reference point approach	REFERENCE POINT	REF

The documentation refers to the abbreviated forms.

3. Interface description

SINUMERIK → interface control or SINUMERIK → PC

3.1 General

3.2 Types of interface control

3.3 Interface representation

3.4 NC output signals
Ready signals to the interface control

3.5 NC output signals
program commands to the interface control

3.6 NC input signals
Ready signals to the SINUMERIK

3.7 NC input signals
Program sequence control from interface control

3.8 NC input signals
Inhibit signals to the SINUMERIK

3.9 NC input signals
Spindle control signals to the SINUMERIK

3.10 External data transfer to the SINUMERIK

3. Interface description
SINUMERIK → interface control or SINUMERIK → PC

3.1 General

During execution of the program with the operating modes automatic (AUT) or manual data input/automatic (MDA), the other modes JOG, INC, MDI-PP, MDI-SE-TE can be activated at any time. However switching from AUT to MDA or vice-versa causes RESET.

All preparatory functions are carried during block search.

3 types of output for the switching and auxiliary functions are possible using machine parameters:

a) during block search the switching and auxiliary functions are not stored and not outputted;

b) during block search as each switching or auxiliary function is read in it is immediately outputted using a mod. signal;

c) during block search the last switching or auxiliary function of an address is stored in the NC; following NC start these stored functions are then outputted using a mod. signal. Only one M, S, or T function can be outputted.

If the appropriate machine data bit has not been set or M functions are missing, any missing switching or auxiliary functions can be restored by transfer from memory on reaching the pre-selected block.

3.1.1 Reset signals

With respect to the reset functions the following codes are used in the signal tables:

POWERESET Power on Reset

RESET Total reset; reset all unbuffered processors and memories except the block number store, position data store and machine data store.

results with:

a) POWERESET
b) end of program
c) pressing "Reset" button
d) changing mode selector switch
   DI ⟷ MDA
   AUT ⟷ REF

CLPOAC Reset of signal PROGRAM ACTIVE (3.4.4) and internal generation of feed hold in automatic operation AUT or MDA (clear program active)

results with:

a) RESET
b) block executed and auxiliary functions outputted

and

- AUT or MDA and M00
- AUT or MDA and single block position reached
- changing mode selector switch
  AUT → MDI — SE — TE
  MDA → JOG

3.1.2 Summary of reset signals

PORESET Resetting the control to its base state	has no effect on the following functions in the memory: Zero offset, tool offset, subroutines, machining programs, additive zero offsets, external zero offsets

RESET with reset button at end of program when changing operating mode DI ⟷ MDA AUT ⟷ REF	the following are not reset: position data store, block number store otherwise as for PORESET above

Total reset. The following are cleared:
programmed path data active in one block only,
reader active, buffer store, auxiliary functions, G functions,
automatic program sequence, subroutine operation

CLPROAC	at end of block in single block at end of block M00 when changing the operating mode AUT → MDI - SE - TE MDA → JOG	the following are <u>not</u> cleared: position data store, block number store, auxiliary and G functions, position store, buffer store, otherwise as for PORESET above

Program active reset
the following are reset:
automatic machining sequence

3.2 Types of interface control

Two types of interface are possible:

a) Relay interface control
   Input/output of parallel interface via the combined I/O modules.

b) PC interface control
   Integration of the PC in the logic section of the NC with or without an extension unit.

The signal interface for both types is identical in structure, signal form and signal level.

3.2.1 PC interface control

This interface control is the PC - AG 130W taken from the SIMATIC S5 automation system. The central processing unit of the PC consists of a processor and several stores:

- system program store for fixed system programs
- system data store for markers, counters, timers, process copiers of the I/O periphery and other system data
- user program store for functions programmed by the user
- user data store for data organised by the user.

The programmeable PC control allows the machine and the NC control to be matched. It links the inputs and outputs to and from the machine with the aid of the user orientated language STEP 5 thus adapting the program for different types of machine.

The coupling between PC and NC is effected by the bus systems of both controls. In this case the SINUMERIK accesses the PC memory asynchronously with the PC program cycle (direct memory access - DMA). The PC does not initiate data send. Coordination of the DMA from the SINUMERIK with other possible DMA circuitry in the PC results exclusively from the hardware design of the PC bus. Thus no other access is possible during SINUMERIK DMA.

The data transmitted in each cycle are usually 1 byte with max. 8 bits.

The interface control signals and the signals in the interface section of the machine control panel are transmitted in blocks in 16 ms cycles in all SINUMERIK modes.

AG 130W - Technical data

- central processor for rapid bit and word processing
- 12K EPROM for PC user programs (8K of this in CPU)
- 4.5K RAM for data (0.5K of this in CPU)
- 3 µs per binary function
- address range up to max. 512 inputs, from which 384 can be addressed using the combined I/O modules
- address range up to max. 512 outputs, from which 192 can be addressed using the combined I/O modules
- 2048 markers, 1024 of which are remanent
- 128 timers; range 0.01s to 9990s
- 64 counters; range 1 to 999

available operations:

- binary functions
  (AND, OR etc. in any combination)
- setting/resetting outputs and markers
- timing functions
- counting functions
- loading and transfer functions
- comparators
- function modules

3.2.2 Definition of input and output signals

NC output signals

In the case of the relay interface control the output signals are outputted via the electronic output stages (100 mA capacity) of the combined I/O modules.

For the PC version the signal representation for the software interface NC - PC in "Data module 9" of the PC applies. The NC files the output data in data module 9 of the PC. In the PC this data is transferred with the aid of the "Auxiliary functions" module from "Data module 9" to the "Marker area".

NC input signals

In the case of the relay interface control the input signals are received by the electronic input stages.

For the PC version the signal representation for the software interface NC - PC in "Data module 9" of the PC applies. The NC calls up the input data from data module 9 in the PC. In the PC this data is transferred with the aid of the "Auxiliary functions" module from the "Marker area" to the "Data module 9".

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

Basic system 3 ◢

3.3.2 Interface output 3T

NC	Test No.	Byte	Data bit 7	6	5	4	3	2	1	0
NC - Interface control or PC	10	0	Mod. signal M	S	T	Spindle position reached			Motion command Z	X
	10	1	Program active	V.24 active	NC BB2	NC BB1	Rapid	Thread cutting	MO2/ M30 Reset	Programmed stop M00
	10	2	10^1 D	10^1 C	10^1 B	10^1 A	10^0 D	10^0 C	10^0 B	10^0 A
	10	3								
	11	4								
	11	5	10^3 D	10^3 C	10^3 B	10^3 A	10^2 D	10^2 C	10^2 B	10^2 A

PC	Data module 9 DW	Relative byte addr:	Marker byte
	7 H	12	12
	7 L	13	13
	8 H	14	14
	8 L	15	15
	9 H	16	16
	9 L	17	17

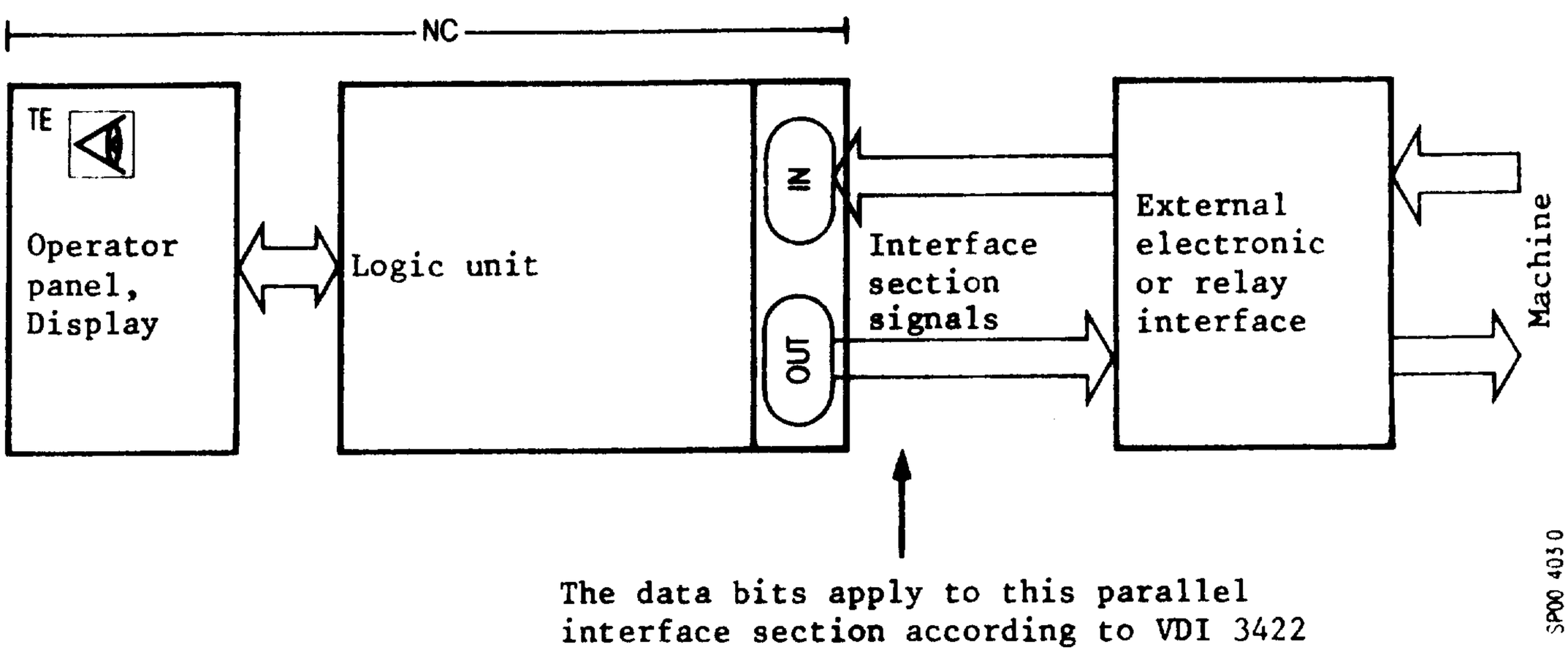
NC		NC - Interface control or PC								PC			
Test ◁		7	6	5	4	3	2	1	0	Data module 9			
No.	Byte									DW		Relative byte addr.	Marker byte
7	0	Operating mode switch				Feedrate/rapid ovveride switch				1	H	0	0
		D	C	B	A	D	C	B	A				
7	1	Key-switch	Dry run	Block delete	Single block	Block search	Spindle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

Basic system 3 ◢

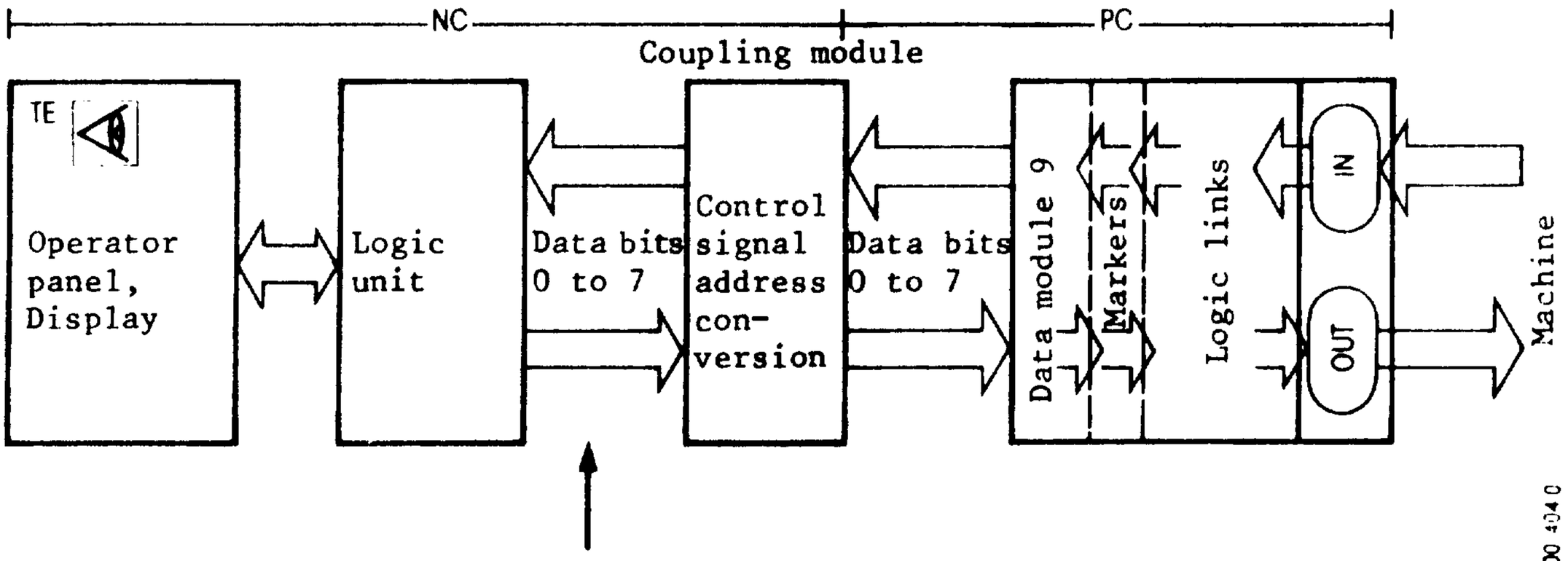
NC		NC - Interface control or PC								PC		
Test No.	Byte	Data bit 7	6	5	4	3	2	1	0	Data module 9 DW	Relative byte addr.	Marker byte
10	0	Mod. signal M	S	T		Motion command 4th axis	Z	Y	X	7 H	12	12
10	1	Program active		NC BB2	NC BB1	Rapid	Thread cutting	MO2/ M30 Reset	Programmed stop MOO	7 L	13	13
10	2	BCD output 10^1 D	10^1 C	10^1 B	10^1 A	10^0 D	10^0 C	10^0 B	10^0 A	8 H	14	15
10	3									8 L	15	16
11	4									9 H	16	17
11	5	BCD output 10^3 D	10^3 C	10^3 B	10^3 A	10^2 D	10^2 C	10^2 B	10^2 A	9 L	17	14

3.3.5 Interface schematic diagrams

Parallel connection to interface control (basic system 0,1)



NC - PC interface (basic system 2 and 3)



3.4 NC output signals

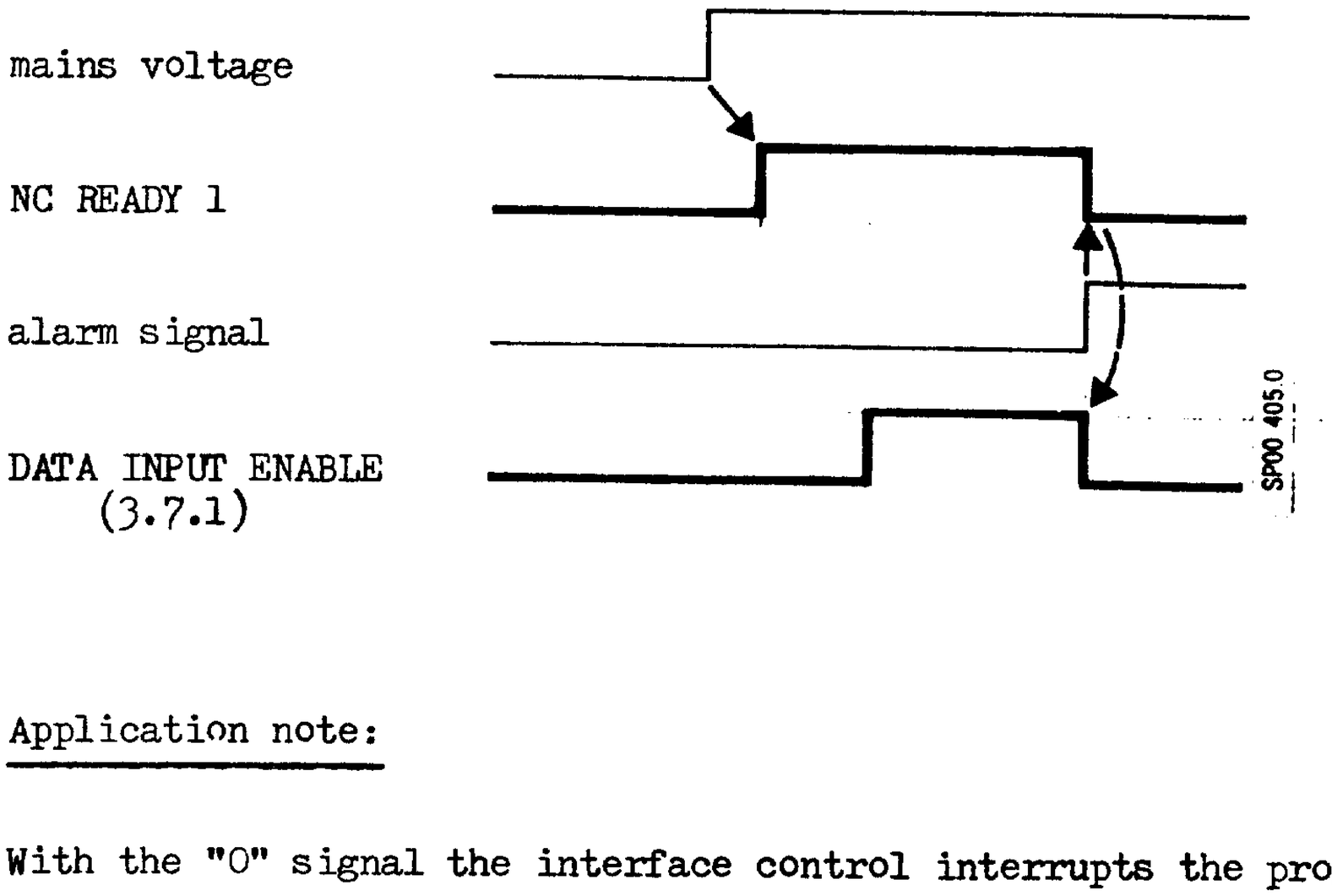
Ready signals to the interface control

3.4.1 NC ready 1

	3T	3M
O/P	1	1

"1" signal: After power on and attainment of correct voltage levels

"0" signal: When temperature limit 1 in the SINUMERIK (alarm signal) is exceeded (alarm light and number displayed on operator panel)



Application note:

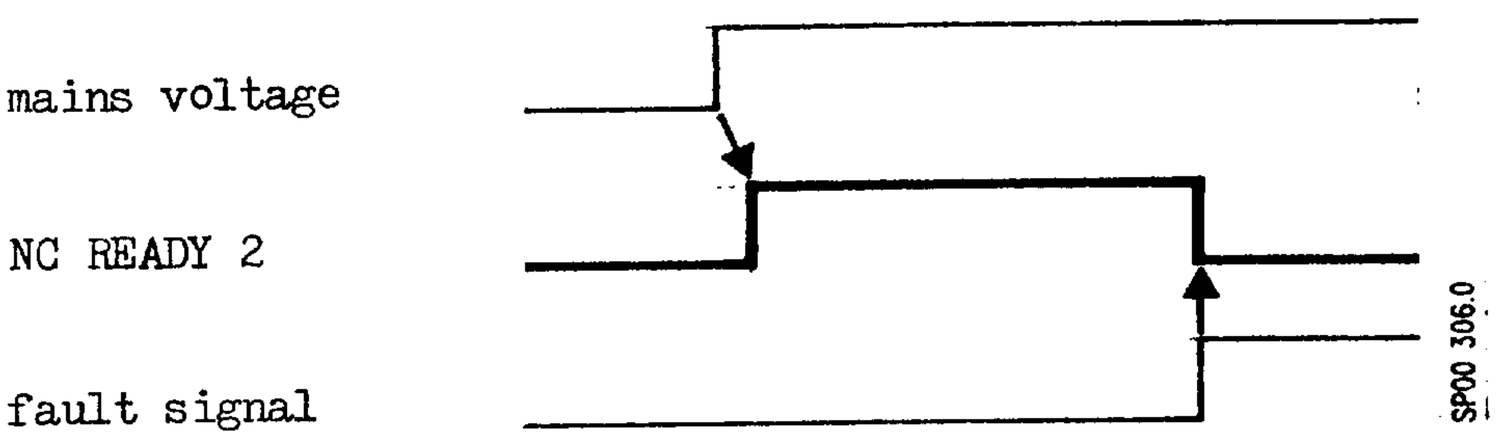
With the "0" signal the interface control interrupts the program by preventing the data input enable, i.e. the block being executed is completed.

3.4.2 NC ready 2

	3T	3M
O/P	1	1

"1" signal: Following power on and attainment of correct voltage levels

"0" signal: a) temperature limit 2 in the SINUMERIK is exceeded (fault signal)
b) actuation of undervoltage monitoring
c) actuation of overvoltage monitoring
d) initiation of measuring circuit monitoring



Application note:

When temperature limit 2 is exceeded or the overvoltage or undervoltage monitoring actuated, the control (including PC) is switched off and thus all functions stored in the active and buffer stores are cancelled.

If the measuring circuit monitoring is initiated the feed drives and main spindle drive are rapidly decelerated. The resulting alarms can be cleared using the reset button. This also clears all functions stored in the active and buffer stores.

Note:

In addition to the NC READY 2 signal to the interface control a similar signal containing the processer monitoring is outputted to the machine interface (5.1.1).

3.4.3 Motion command

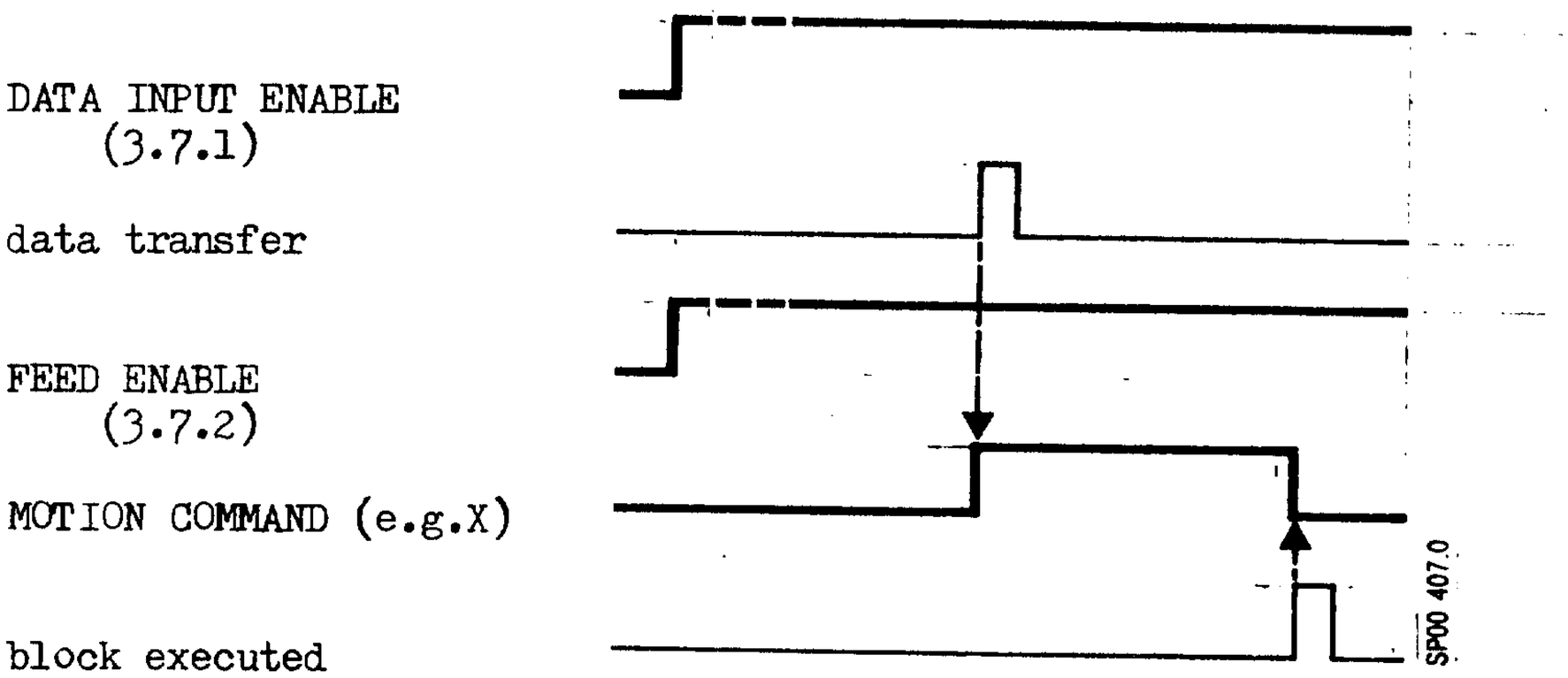
	3T	3M
O/P	2	4

A single signal for both directions is available for each axis

In operating modes automatic AUT, MDA

"1" signal: following successful data transfer of a block into the active store; the block must contain at least one coordinate value

"0" signal: a) when block has been executed
b) with reset
c) for active axis inhibit (2.12.1)



In operating mode setting up

JOG, INC, REF

"1" signal: axis selected and/or direction button pressed.
With REF only following actuation of the button for return to datum.

"0" signal: a) with manual/handwheel JOG, if
- direction button no longer pressed and digital 0
- traverse using handwheel

b) with incremental steps when traverse if complete and measuring circuit is 0

c) for return to datum when datum point is reached and measuring circuit is 0

d) immediately with RESET

Application note:

For machines with axis clamping this can be used to determine which clamps must be released.

Motion command signals:

Case	Programmed or Operating example	with	The same motion command is permanent	Motion command disappears	The same motion command comes
1	subsequent block: same axis in same or opposite direction	G00 G09 G60	-	for approx. 20ms	-
		G64*			
2	M00 single block		-	after position reached following elimination of following error	
3	Limit switches reached in modes AUT, MDA, INC		as long as operating mode is not changed	when operating mode is changed	When traversing away using direction button for other direction
4	Limit switches reached in JOG mode		as long as direction button remains pressed	after release of direction button	
5	Circle	G02 G03	yes	-	-
6	E.STOP during axis traverse		yes	with reset	-
7	Removal of controller enable during axis traverse		yes	with reset	-

* if G00 or G09 is not programmed

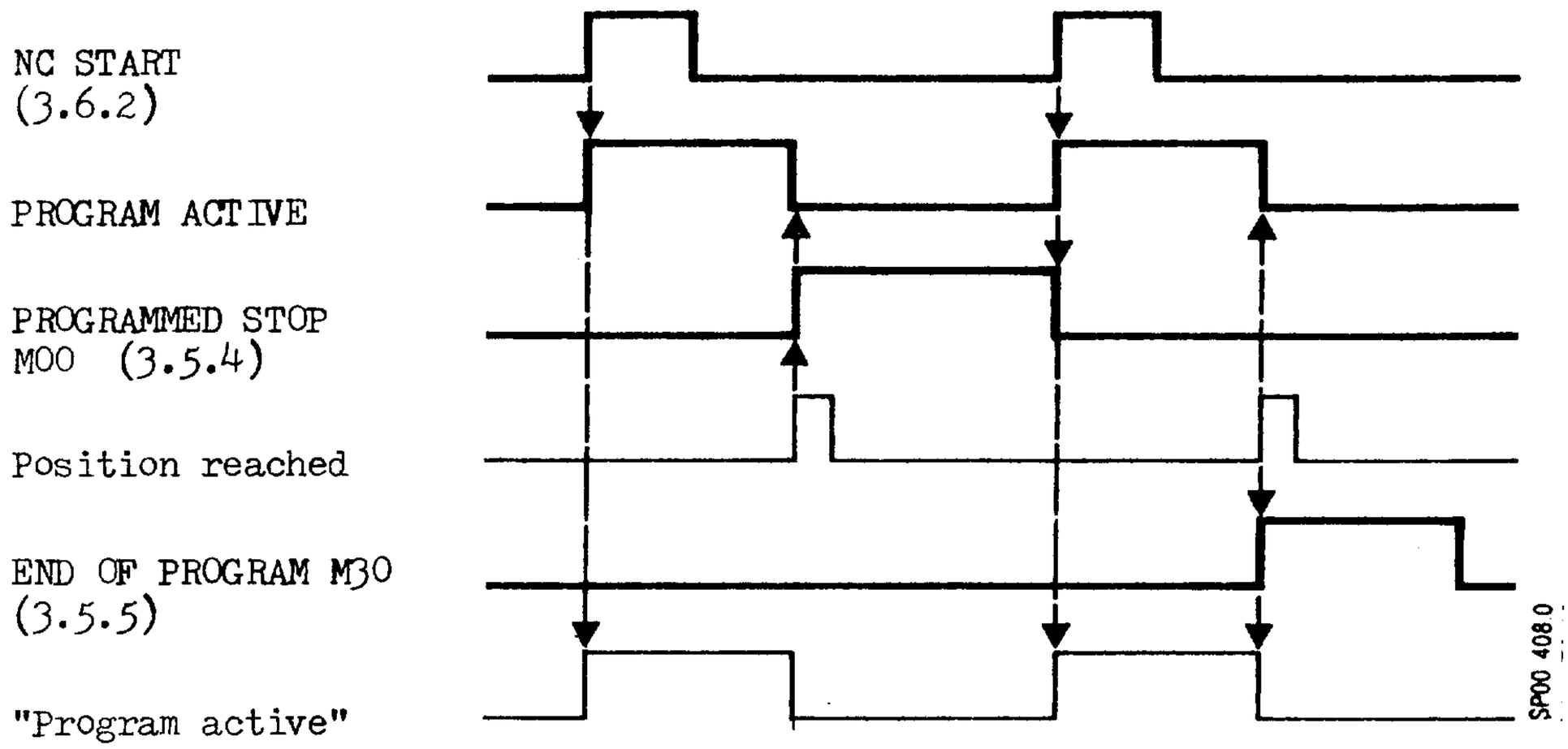
3.4.4 Program active

	3T	3M
O/P	1	1

In automatic modes AUT, MDA

"1" signal: in automatic modes AUT, MDA and signal NC START (3.6.2)

"0" signal: following RESET, block executed in single block, program stop, program end, change of operating mode



Application note:

Control of a time-based printer.

3.5 NC output signals
Program commands to the interface control

3.5.1 General

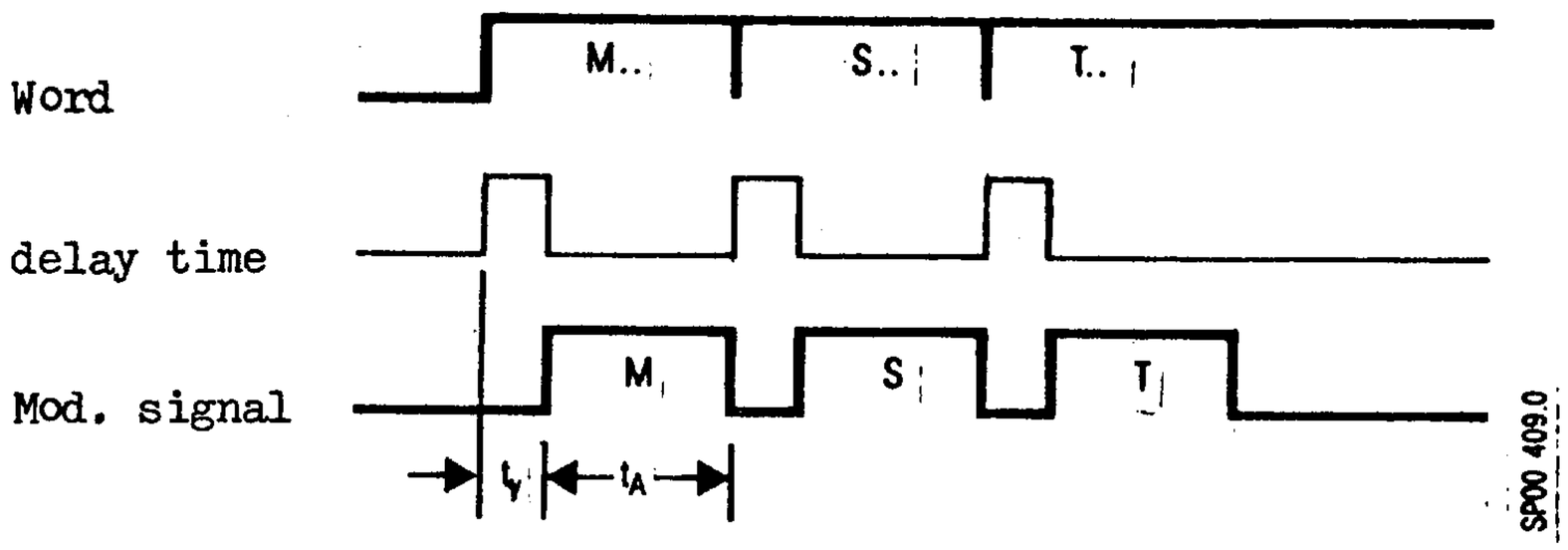
The switching and auxiliary functions M, S, T are outputted consecutively via the same data channels. A mod. signal, which appears after a delay with each datum, serves to identify the data.
When several functions are programmed in one block, the sequence for the output is M, S, T independent of the actual programming in the block.
In any one block only one M function is permitted.

The delay time and mod. signals can be adjusted between 16 and 288 ms in steps of 10ms (common times for all switching and auxiliary functions).
Short times are used for controls with PC and long times for controls with relay interface.

Switching and auxiliary functions must be received in the interface control in separate stores for M, S and T with the rising flank of the mod. signal.

Depending on the machine data the switching and auxiliary functions can be outputted

- before the start of axis traverse
- with the start of axis traverse.



t_V and t_A can be set between 16 and 288ms in steps of 10ms

3 types of output via machine parameters can be selected:

a) during block search the auxiliary functions are not stored and not outputted;

b) during block search the associated switching and auxiliary functions which have been read in are immediately outputted using a mod. signal;

c) during block search the NC stores internally the final switching and auxiliary function of each address; following NC start the stored functions are outputted consecutively using a mod. signal. The sequence is M, S, T.

If the appropriate machine data bit is not set the auxiliary functions can be stored manually (manual data input) when the preselected block is reached (search indicator)

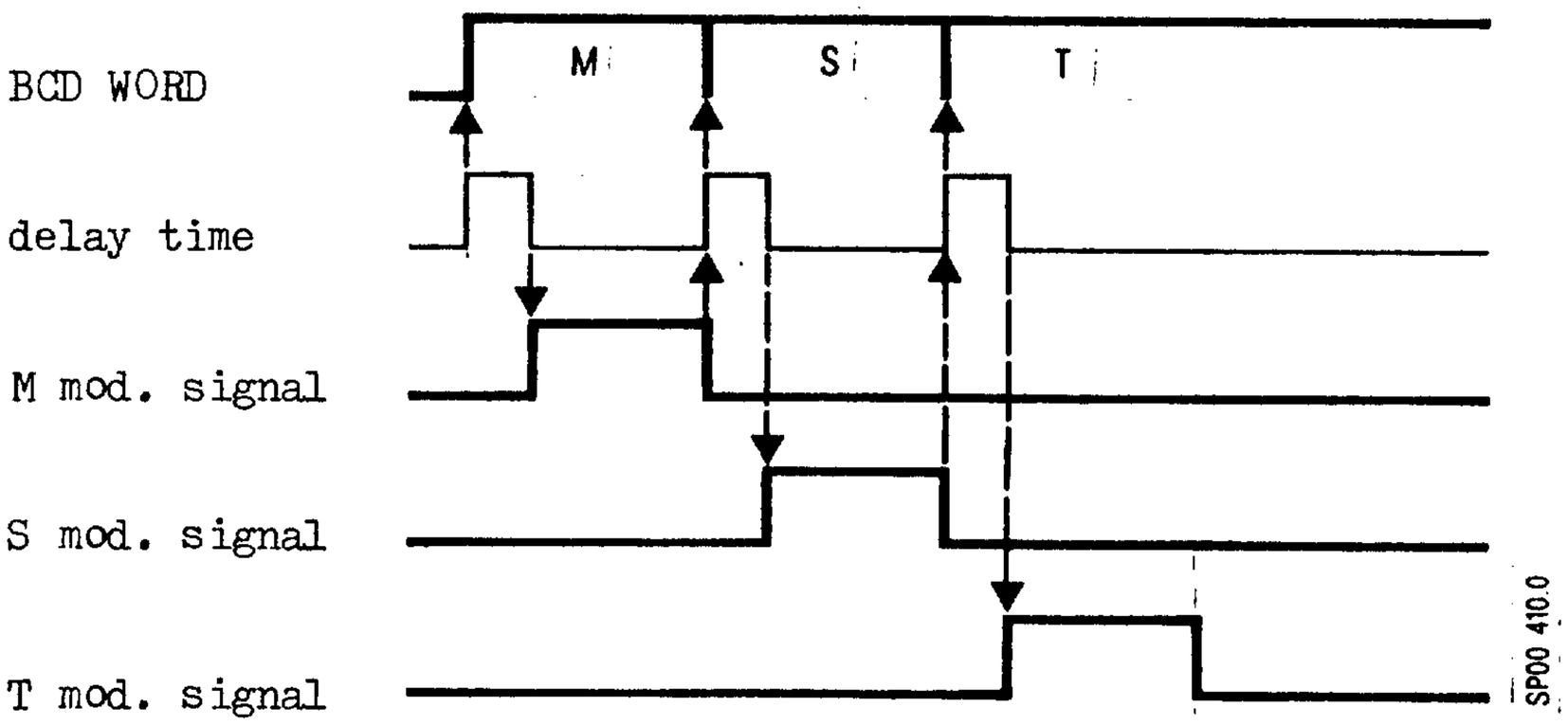
3.5.2 Switching and auxiliary functions M, S, T

Output

	3T	3M
O/P	11	11
O/P	8	8

Signal output: M 2 decades with mod. signal M
S 2 (4) decades with mod. signal S
T 2 (4) decades with mod. signal T

Sequence: a) word, 2(4) decades simultaneously
b) MOD SIGNAL - M
- S
- T



Example for programming a M, S or T word in a block.

M, S, T functions in a machining program
(in automatic modes AUT or MDA)

Following data transfer of the BCD word into the active store the BCD word is active for the period of the associated delay time and mod. time in the sequence M, S, T.

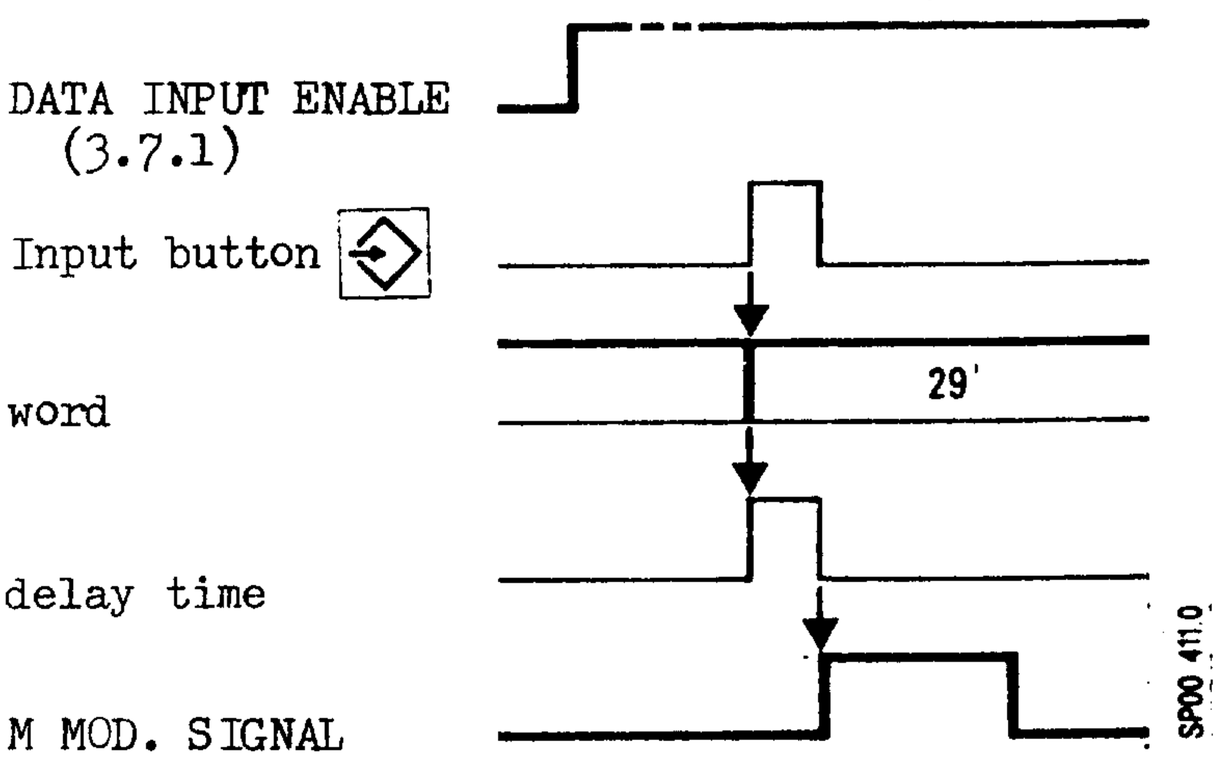
The third (or last) word remains in the active store until data transfer of a new block with M, S, T functions. These functions are cleared using RESET.

The M commands (M00, M02, M03, M04, M05, M17,M19,M30)in the control are contained, together with the mod. signal, in the BCD output.

M, S, T functions inputted manually in feed hold condition
(for AUT, MDA, JOG, INC)

The inputted word is active when data input enable is given and the input button is pressed.

M, S, T functions are cleared with RESET



Example: input word M29

3.5.3 Switching and auxiliary functions M, S, T
Description of functions

Miscellaneous function M

The M commands (M00, M02, M03, M04, M05, M17, M19, M30) in the control are contained, together with the mod. signal, in the BCD output.

Application note:

Control of miscellaneous functions, e.g. spindle rotation, coolant, tool change, gear stages.

Spindle speed S

The speed command value limitation programmed using G92 S... is not outputted to the interface control /PC.

Application note:

Control of the spindle speed

Tool number T

Application note:

Control of tool selection

Tool change:

If the T word is programmed in its own block, execution of the program must be stopped by removing the data input enable (3.7.1); in the case where the block also contains path data the program must be interrupted by removing the feed enable (3.7.2) (only for output before axis traverse).

If the function sequence in the interface control is to be independent from the programming of the T word, data input enable and feed enable must be removed during tool change.

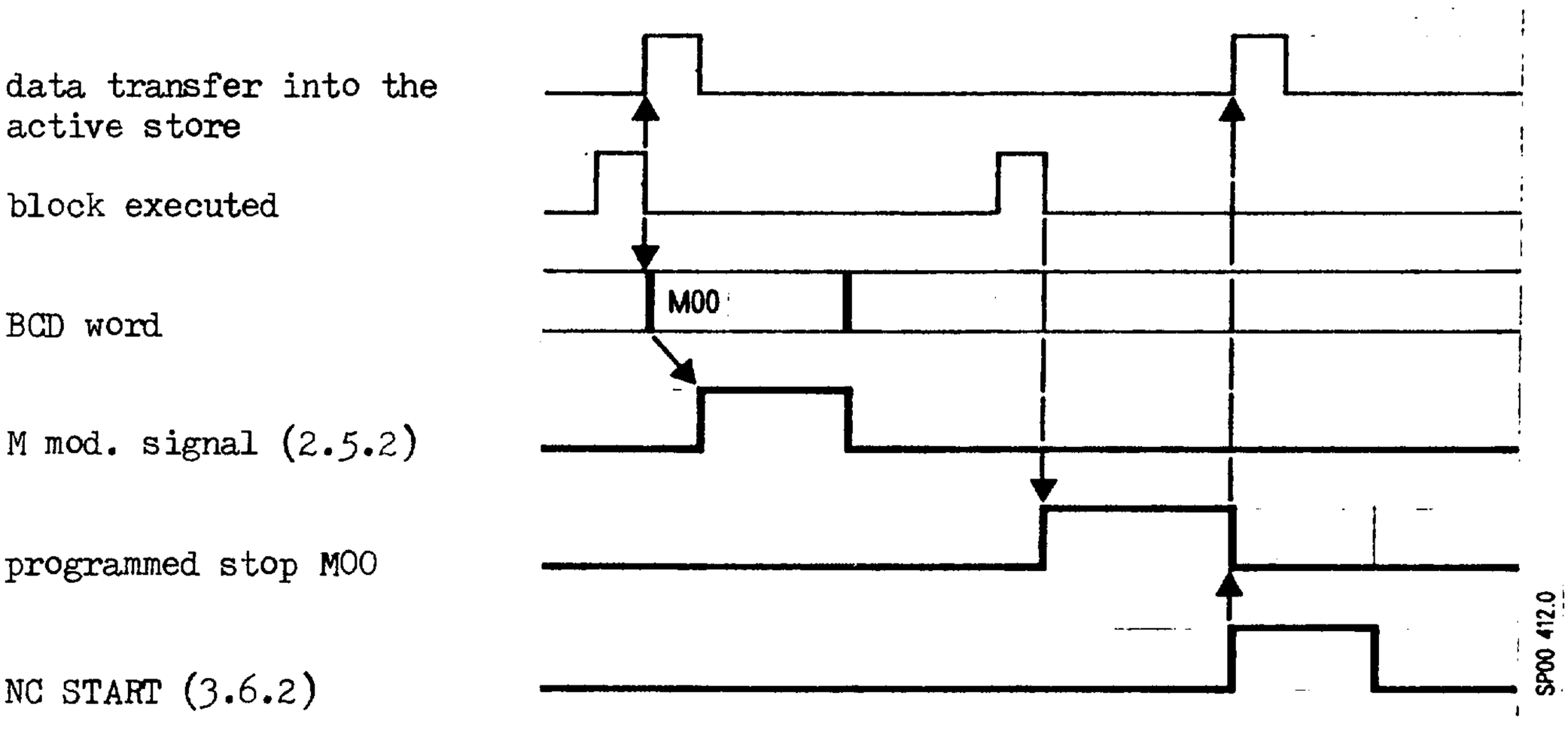
This de-activation of the enable signals must start during the T MOD. SIGNAL and be maintained until tool change is completed.

3.5.4 Programmed stop M00

	3T	3M
O/P	1	1

"1" signal: block executed and auxiliary functions outputted and M00 in the active store

"0" signal: a) with NC START
b) with RESET



Application note:
Stopping the main spindle

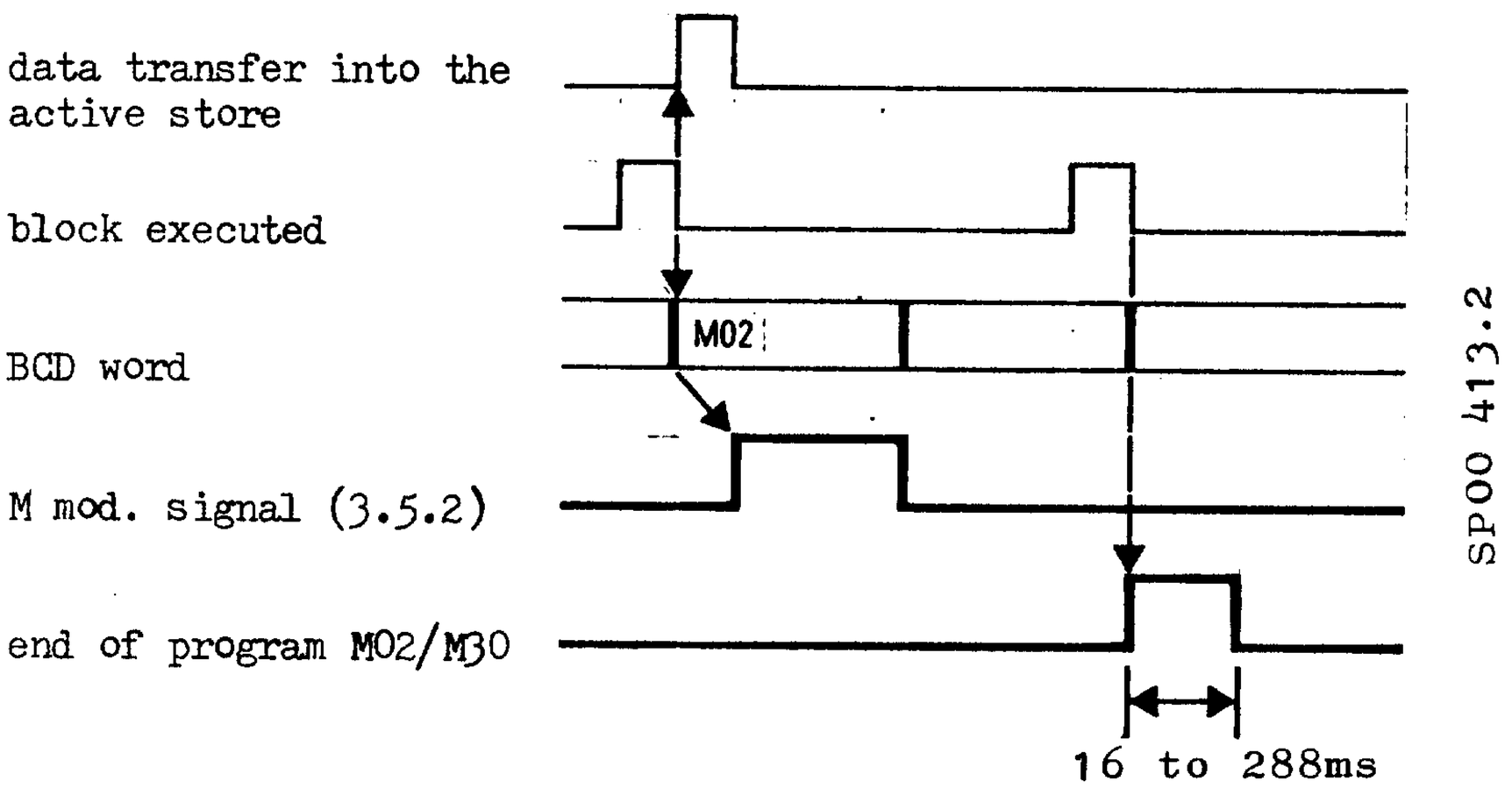
3.5.5 End of program M02/M03

	3T	3M
O/P	1	1

"1" signal: a) block executed and auxiliary functions outputted
and
- M02 in the active store or
- M30 in the active store

b) with RESET

"0" signal: after 16 to 288ms (machine parameter)



The functions M02 and M30 have the same effect; M30 does not initiate reader rewind.

Application note:

e.g. clearing the function store, i.e. clearing the functions stored in the interface control.

This function cannot be directly used for automatic function sequences in the interface such as bar feed, batch counting, opening of protective devices. For these functions the interface, together with the BCD word M02, M30 (section 3.5.2), must be used.

3.5.6 Preparatory functions G

THREAD CUTTING G33/G63

	3T	3M
O/P	1	1

In the automatic modes AUT, MDA

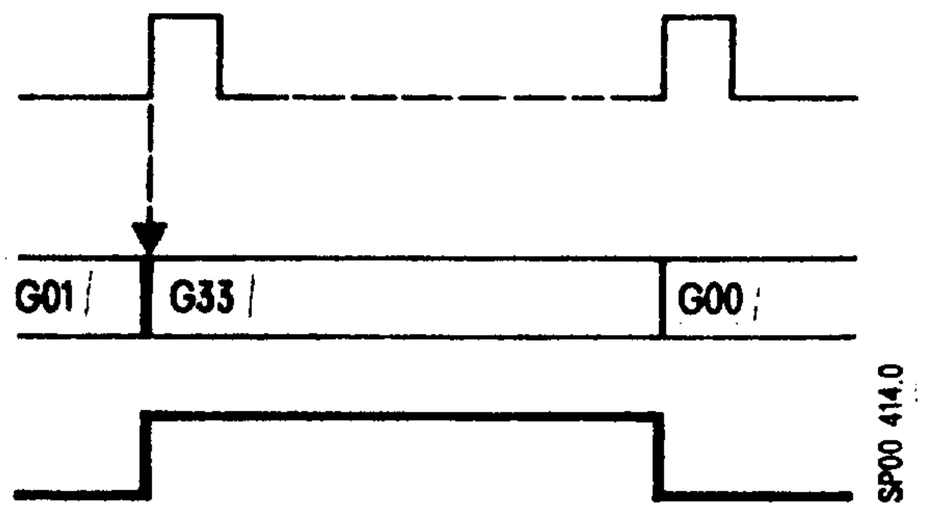
"1" signal: following data transfer of a block in which G33 or G63 is programmed.

"0" signal: a) after data transfer of a block in which another G function from the lst G group or the 10th G group is programmed.

b) with RESET

data transfer into the active store

content of the active store



THREAD CUTTING G33/G63

Effect in the SINUMERIK

The following are inactive:

with G33: a) feedrate override switch
b) feed hold
("Feed enable" is not recognised)
c) spindle speed override switch
d) single block
(stop at end of next block without G33
or G63).

with G63: feedrate override switch

Application note:

With G33 feedhold (4.2.18) can be achieved indirectly using spindle OFF (4.2.17), generated as combination of thread cutting and feed hold. With G63 the spindle must be stopped in parallel with feed hold.

Rapid traverse G00

	3T	3M
o/P	1	1

In automatic modes AUT, MDA

"1" signal: after data transfer of a block in which G00 is programmed.

"0" signal: a) after processing of this block
b) with RESET

In operating mode JOG

"1" signal: during actuation of the rapid traverse button and the direction button.

"0" signal: a) rapid traverse button not pressed
b) direction button (with rapid traverse button actuated) no longer pressed and axis in position.
c) with RESET

In operating mode return to datum REF

"1" signal: after pressing the appropriate direction button for return to datum.

"0" signal: a) when datum is reached
b) with RESET

Application note:

Switching in of pumps

3.5.7 V.24 active

	3T	3M
O/P	1	1

In operating modes Data output DO and Data input DI

"1" signal : Data transfer is active either from or to the control

"0" signal : V.24 is not active

In all other operating modes

"0" signal

3.6 NC input signals

Ready signals to the SINUMERIK

3.6.1 * E. STOP

	3T	3M
I/P	1	1

"1" signal: operating status; emerg. stop buttons not actuated

"0" signal: emerg. stop status; one of the e. stop buttons pressed.

Application note:

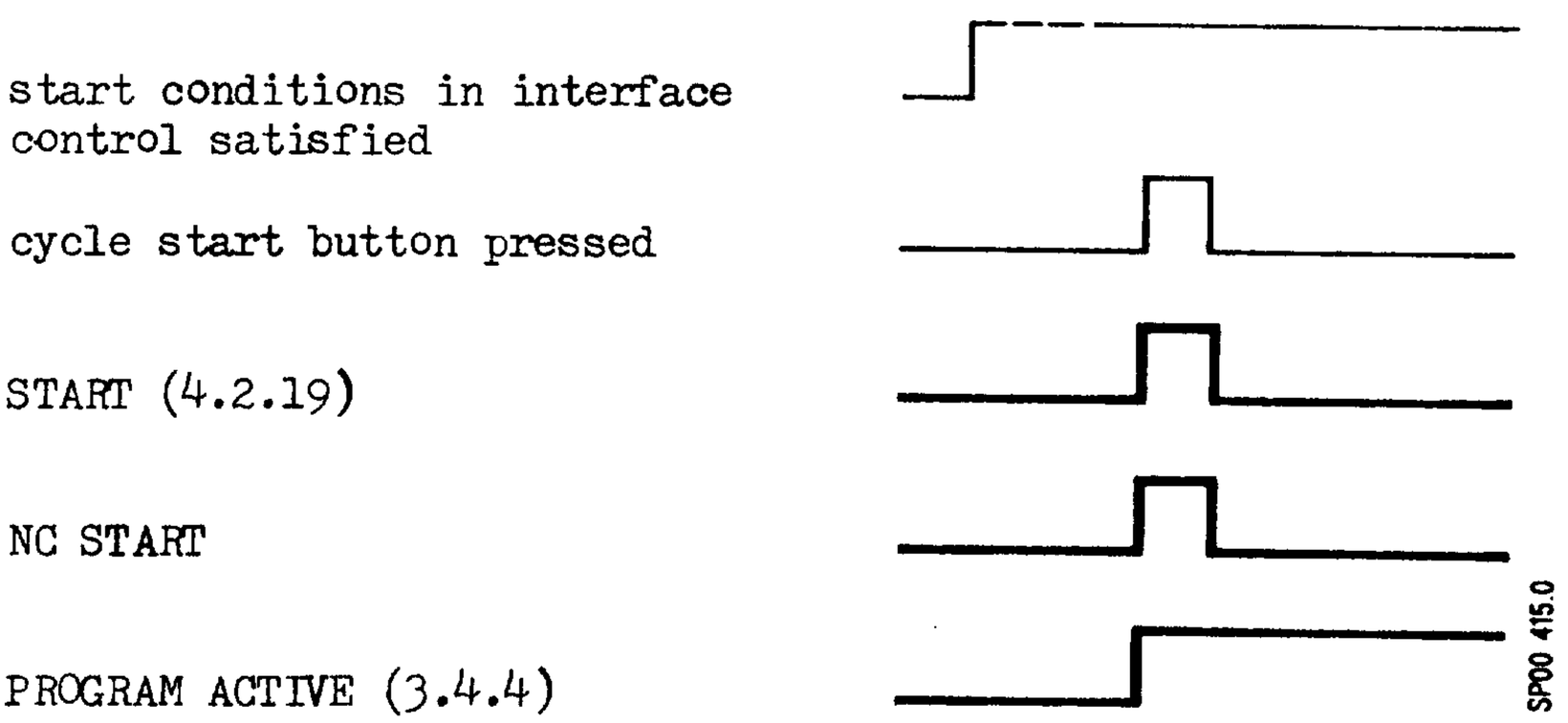
A "0"-signal effects rapid deceleration of the feed drives and spindle drive at full braking current. The position loop is opened and the NC goes into the follow up mode. Once the E-STOP condition has been removed with RESET (follow up mode active) then no re-synchronisation of the axes (return to datum) is required.

3.6.2 NC start

	3T	3M
I/P	1	1

"1" signal: either the cycle start button on the control (4.2.19) or a start button on the machine has been pressed and the start conditions in the interface control are satisfied.

"0" signal: no start button pressed



Effect in the SINUMERIK

In the automatic modes AUT, MDA

If DATA INPUT ENABLE is available the NC START signal has the following effect (3.7.1):

a) starts the program with the lst block of the machining program filed in, and called up, from the program store

b) after completion of block search in the program store, starts the program at the block preselected.

c) following programmed stop M00 restarts the automatic machining sequence

d) processing of the next block following "Block executed" and "Auxiliary functions outputted" in the operating mode AUT.

If no data input enable is available with the NC START signal, no data are transferred into the active store and thus no block is executed. When the data input enable signal appears later, the data are transferred into the active store without another NC START signal and block execution starts.

Necessary start condition: Machine at datum

It is possible to interlock the start of the automatic machining sequence via a machine parameter such that the "Return to datum" condition is monitored.

3.6.3 NC WITHOUT ACTIVE OPERATOR PANEL

	3T	3M
I/P	1	1

The signal NC WITHOUT ACTIVE OPERATOR PANEL enables operation of the control without operator panel (operator panel disconnected). The machine control panel must not be disconnected.

"1" signal: a) no operator panel available
(if necessary disconnect panel)

b) operator panel input is blocked
(e.g. via the key switch for control lock)

"0" signal: with active operator panel
(operator panel connected)

Application note:

For a "1" signal key inputs are ignored. If the operator panel is disconnected when a "0" signal is active alarm indication results.

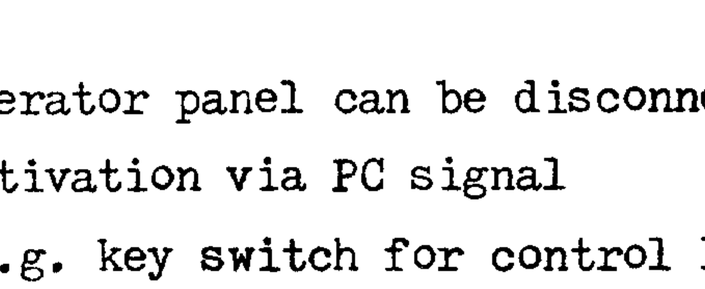
Advantages: a) operator panel can be disconnected
b) activation via PC signal
(e.g. key switch for control lock).

3.6.4 Data start

	3T	3M
I/P	1	1

"1" signal : Start of data input

"0" signal : No data start pressed



Application note:

The data start signal must remain active for at least 6 ms.

3.7 NC input signals

Program sequence control from interface control

3.7.1 DATA INPUT ENABLE

	3T	3M
I/P	1	1

The DATA INPUT ENABLE signal is effective in the automatic modes AUT, MDA and the setting up modes JOG, INC.

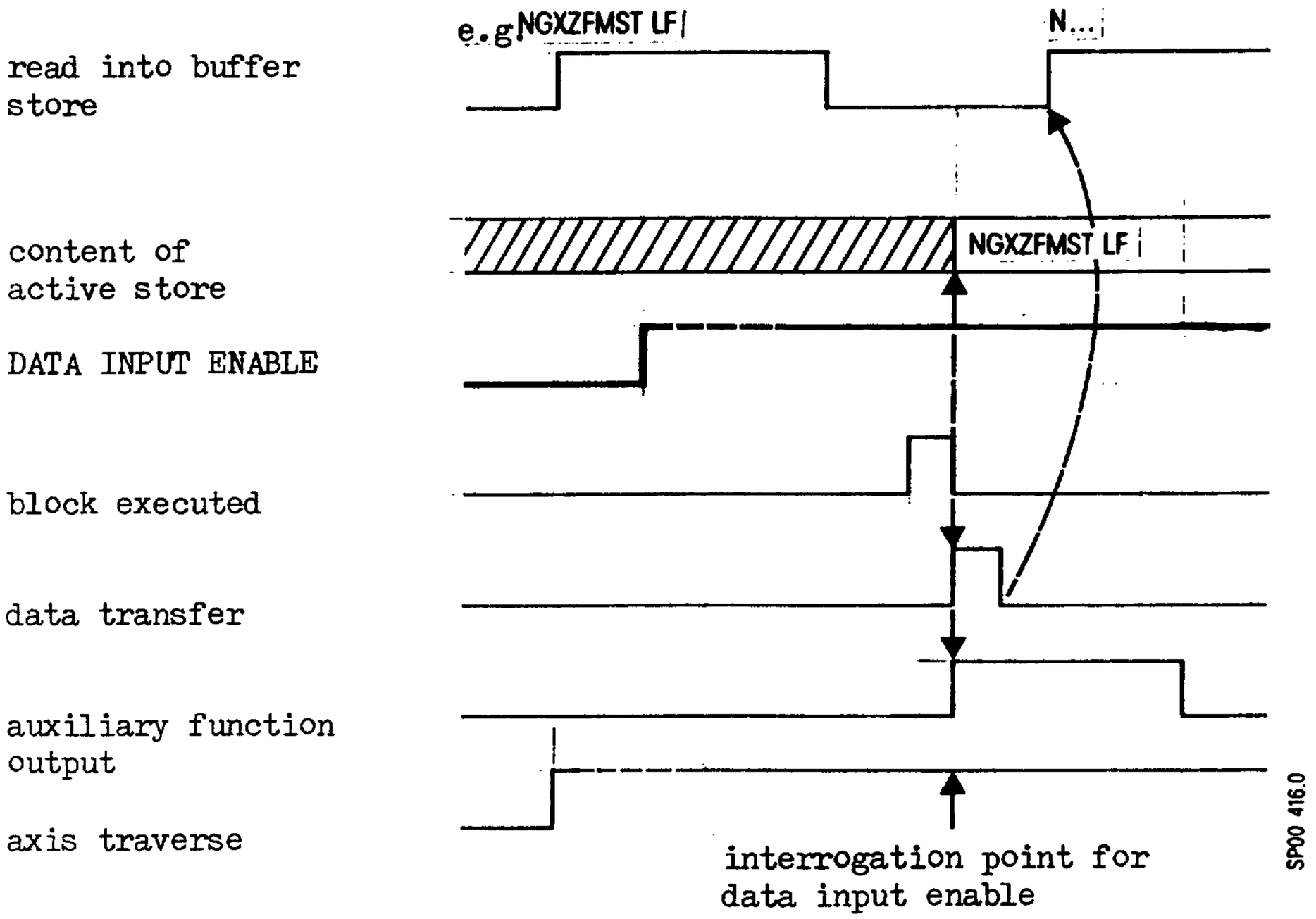
In the operating modes AUT, MDA

"1" signal: enables transfer of the data from the buffer store into the active store

a) if "block executed" and the auxiliary functions of the pre-determined block is outputted.

b) when the next block is read in in the modes automatic or single block or previous M00 after NC start (3.6.2).

"0" signal: interlocks data transfer from the buffer store into the active store.



(Auxiliary function output during axis traverse).

In the setting up modes JOG, INC

The inputted auxiliary functions are active after pressing the input button with DATA INPUT ENABLE applied (3.5.2).

3.7.2 **FEED ENABLE**

	3T	3M
I/P	1	1

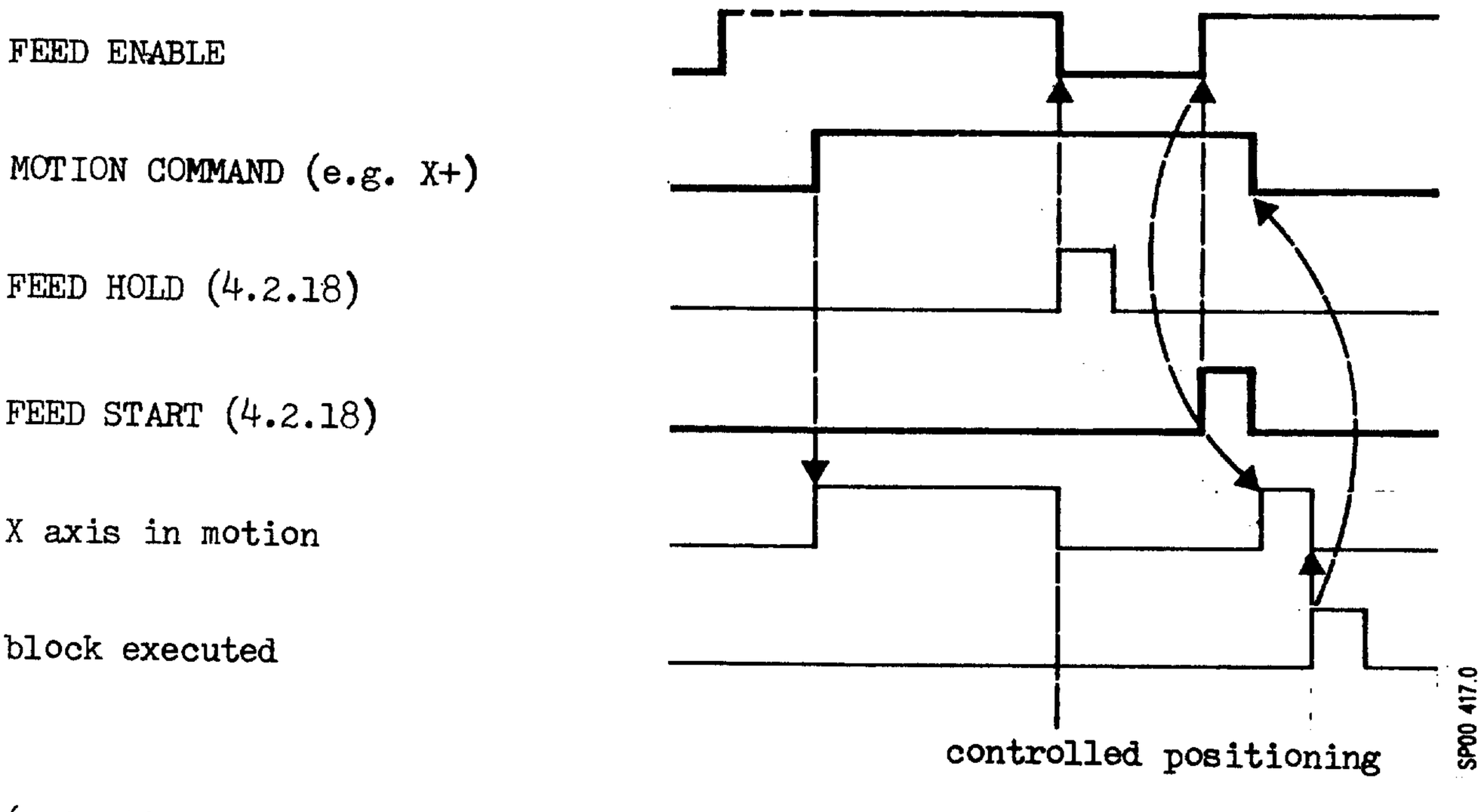
In the automatic modes AUT, MDA and setting-up modes

JOG, INC, REF

"1" signal: effects feed enable for all axes

"0" signal: effects feed hold for all axes, e.g. after actuation of one of the feed hold elements.

Axes in motion are decelerated to zero along the contour.
Position loop control remains active; i.e. the following error is reduced to zero.



(Actuation of one of the feed hold elements).

3.7.3 CONTROLLER ENABLE

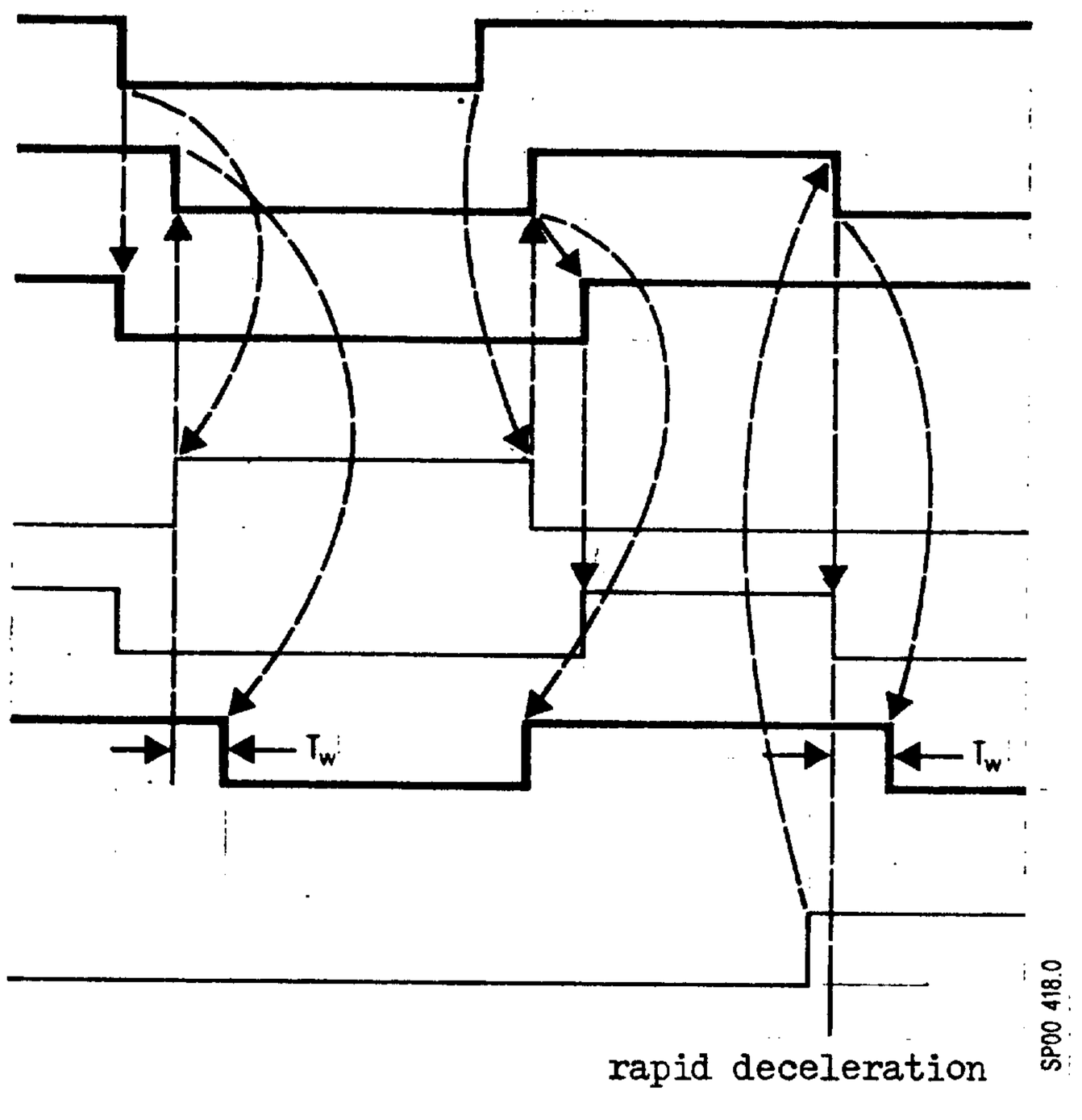
	3T	3M
I/P	2	4

There is a separate CONTROLLER ENABLE signal for each axis.

"1" signal: effects completion of position loop for appropriate axis.

"0" signal: effects rapid deceleration of any axis in motion. In this case the position loop is opened and the axis decelerated with maximum current.

In the modes AUT and MDA all axes which are in motion are stopped. However the axis which still has controller enable is decelerated with digital speed = zero (following error removed via drive).



T_W = 1ms to 32767ms (machine parameter)

Application notes:

Any following error remaining after rapid deceleration is automatically eliminated in the control.

Once the deceleration process has been initiated * CONTROLLER ENABLE to the servo for the associated axis is removed. The controller enables must always be available so that the position loops for the drives always operate at maximum gain.

Exceptions: Axis with clamping or traverse onto a final limit switch.

3.7.4 * DECELERATION (for return to datum)

	3T	3M
I/P	2	4

Digital measuring system

In the operating mode return to datum REF the control recognises a limit switch signal * DECELERATION for each axis. With this signal it is possible to traverse to the datum (reference point) at the preset traverse rate, e.g. rapid traverse.

Both signal flanks are effective:

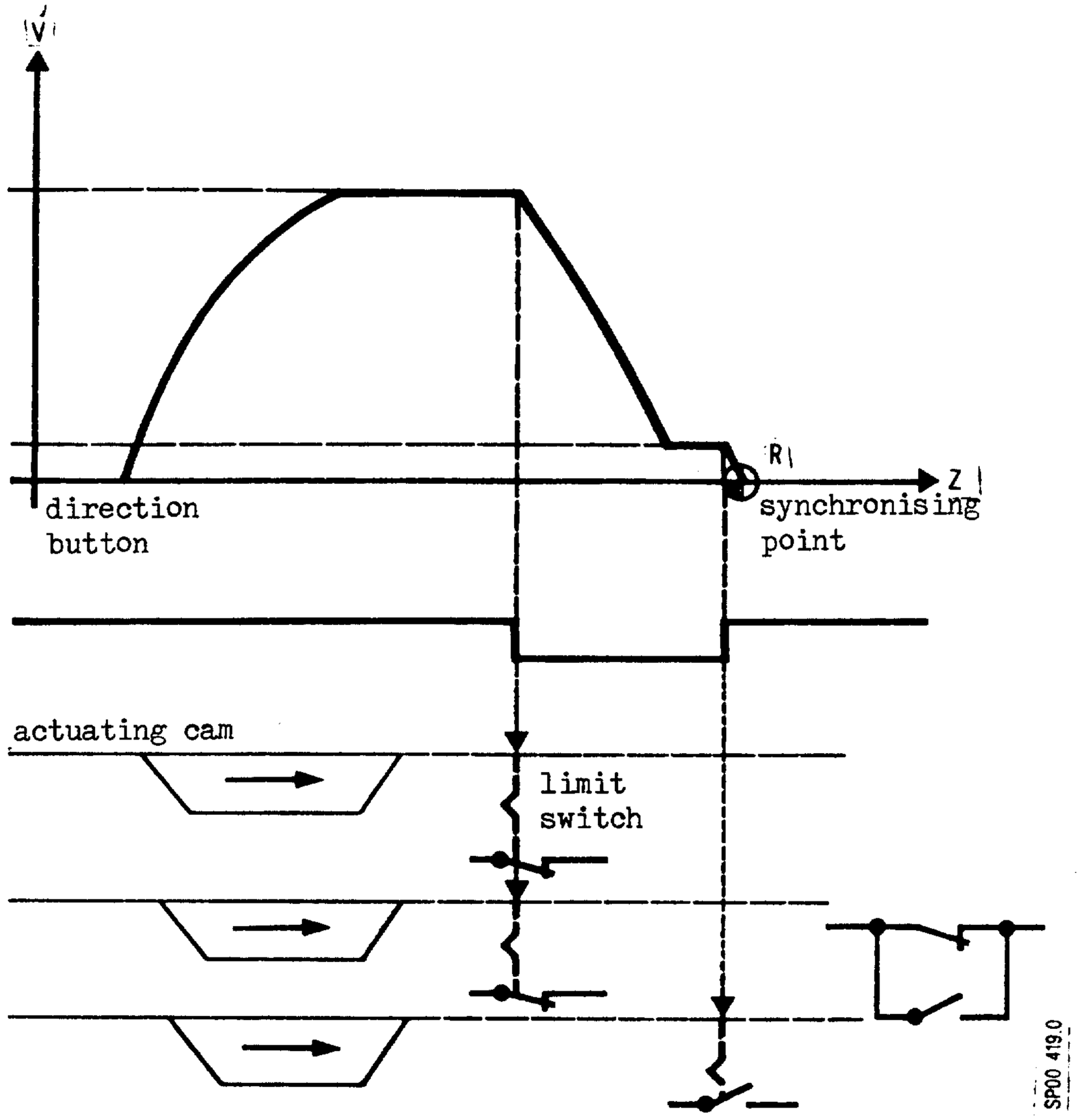
"1"/"0" transition: effects deceleration of the selected axis to the internally preset switch-off speed.

"0"/"1" transition: effects traverse to the zero mark of the measuring system plus 2mm.

Application notes:

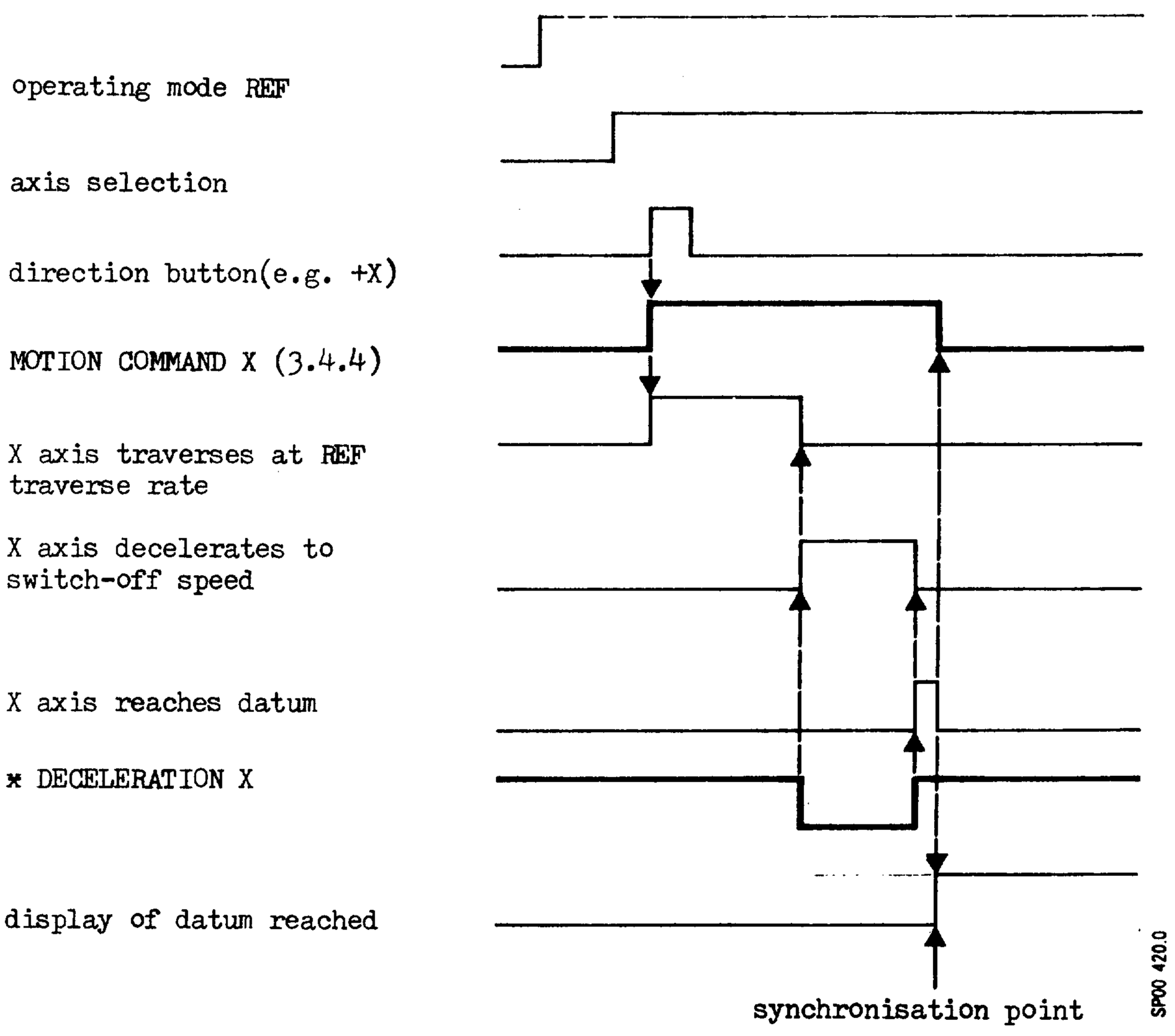
It is possible to realise this function using a cam which actuates a normally closed contact.
If no limit switch is available which closes quickly enough (see adjustments), two cams in different tracks should be used.

Return to datum



Return to reference (datum) is initiated by the appropriate direction button (with the 3M axis select must be used).
At the "1"/"0" transition of the * DECELERATION signal the servo for the appropriate axis is reduced from the return to datum speed to the switch-off speed and after the "0"/"1" transition the axis traverses to the zero mark of the measuring system plus 2mm.
When the axis reaches the datum point this is displayed on the SINUMERIK.

Diagram for return to datum:



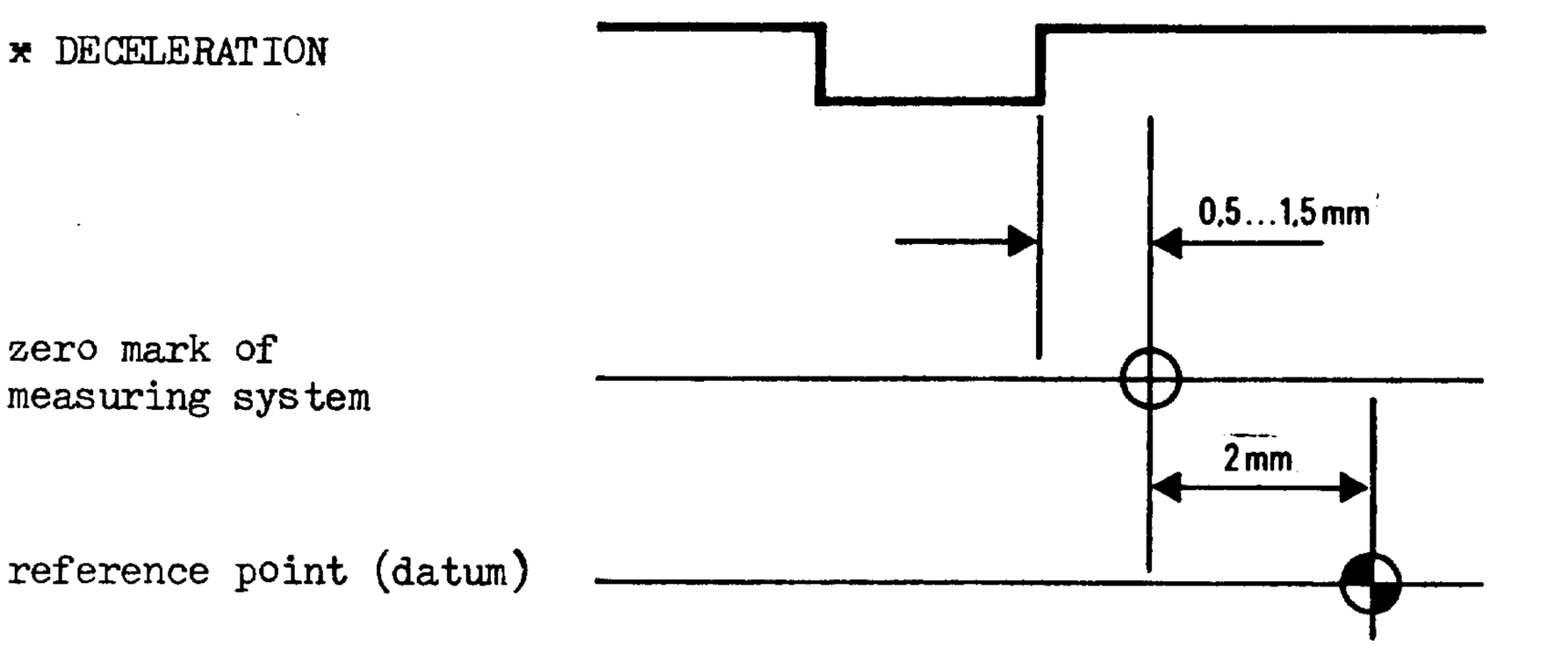
Application notes:

The cam must be so dimensioned that it is possible to decelerate from the return to datum traverse rate to the switch-off speed.

The last edge of the cam should be set to 0.5 to 1.5 mm in front of the zero mark of the measuring system.
With the internally adjustable switch-off speed the datum limit switch must switch within a reproducible range of 0.2. mm.

Datum

Determined by limit switch and zero mark of measuring system:



Application notes:

It is not essential to make a fine mechanical adjustment to the measuring system, it is also possible to realise an electrical displacement using machine parameters.

3.7.5 4th AXIS = MAIN AXIS (3M)

	3T	3M
I/P	-	1

"1" signal: 4th axis = main axis

"0" signal: 4th axis = supplementary axis

Application notes:

With the SINUMERIK 3M it is possible to make the 4th axis the main axis. In a supplementary axis a tool offset will not be taken into account.

Machine parameters are used to determine which axis operates in parallel with the 4th axis and transfers the function of the main axis to the 4th axis whilst the signal is active.

3.7.6 MIRROR IMAGE

	3T	3M
I/P	2	2

a) with SINUMERIK 3T

"1" signal: mirror image in the axes X,Z
(all combinations are possible).

For the X axis:

mirror image of:
- programmed values
- direction of rotation (G02, G03)
- cutter radius comp. (G41, G42)
- tool length comp.
- tool cutter point position

no mirror image of:
- zero offset

For the Z axis:

mirror image of:
- programmed values
- direction of rotation (G02, G03)
- cutter radius comp. (G41, G42)

no mirror image of:
- zero offset
- tool length comp.
- tool cutter point position

"0" signal: no mirror image

Application notes:

With mirror image in the X axis it is always the axis which is reflected. Can be applied to lathes with 2 turrets on the X axis slideway. The workpiece is programmed as if the complete machining process is to be executed by the main turret. The distance between the reference points for turret 1 and 2 is taken into account in the program by G59 X... when calling up the 2nd turret (programmeable zero offset)

With mirror image in the Z axis it is always the workpiece which is reflected.

b) with SINUMERIK 3M

"1" signal: mirror image in the main axes X, Y
(all combinations possible)

For the main axes X, Y:

mirror image of:
- programmed values
- direction of rotation (G02, G03)
- cutter radius comp. (G41, G42)

no mirror image of:
- zero offset
- tool length comp.

"0" signal: no mirror image

Application note:

For mirror image of the main axes X, Y, it is always the workpiece which is reflected.

3.8 NC input signals

Inhibit signals to the SINUMERIK

3.8.1 Axis inhibit

	3T	3M
I/P	1	1

Application note:

For commissioning or program sequence test.
Axis movement is inhibited

"1" signal: no speed command signal is given to the axes
(axes inhibited)
The position loop remains closed.

"0" signal: normal status

Application note:

The inhibited axes are maintained at command value = 0.

3.9 NC input signals
Spindle control signals to the SINUMERIK

3.9.1 Spindle control with basic systems 0,1,2

3.9.1.1 Types of spindle control

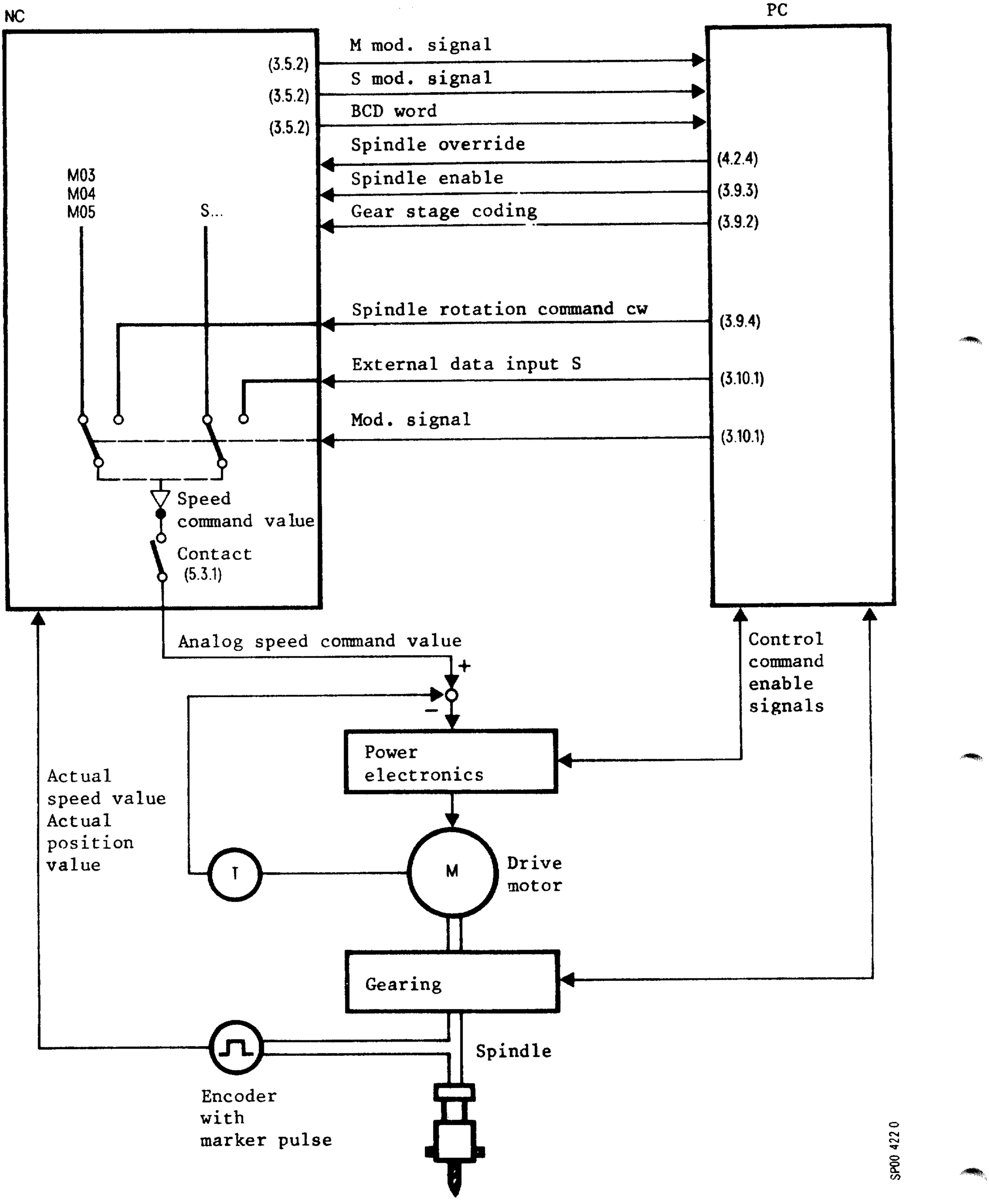
There are two methods of spindle control using S analog:

a) Direct spindle control from the NC

with recognition of the direction of rotation M03, M04, M05, and the programmed speed/cutting speed S in the control.
It is also possible in this mode to transfer via "External data input" from the interface control/PC the speed/cutting speed as well as the direction of rotation.
Data thus transferred into memory are active until "RESET".
If S data are inputted externally during program operation, the programmed data are suppressed until the end of program (RESET).
The signal "Spindle commanded direction clockwise" is interrogated cyclically from the first "external data input S"until RESET.

Block diagram

Direct spindle control from the NC



There is no feedback from the spindle data provided from the NC with the external data input.

b) Spindle control via the interface control/PC

The BCD data for spindle speed/cutting speed and direction of rotation are decoded in the PC and fed back to the NC via the "External data input".
For special functions such as oscillation for gear meshing or chip breaking, PC-specific spindle data can be transferred to the NC in place of the spindle data normally outputted from the NC.

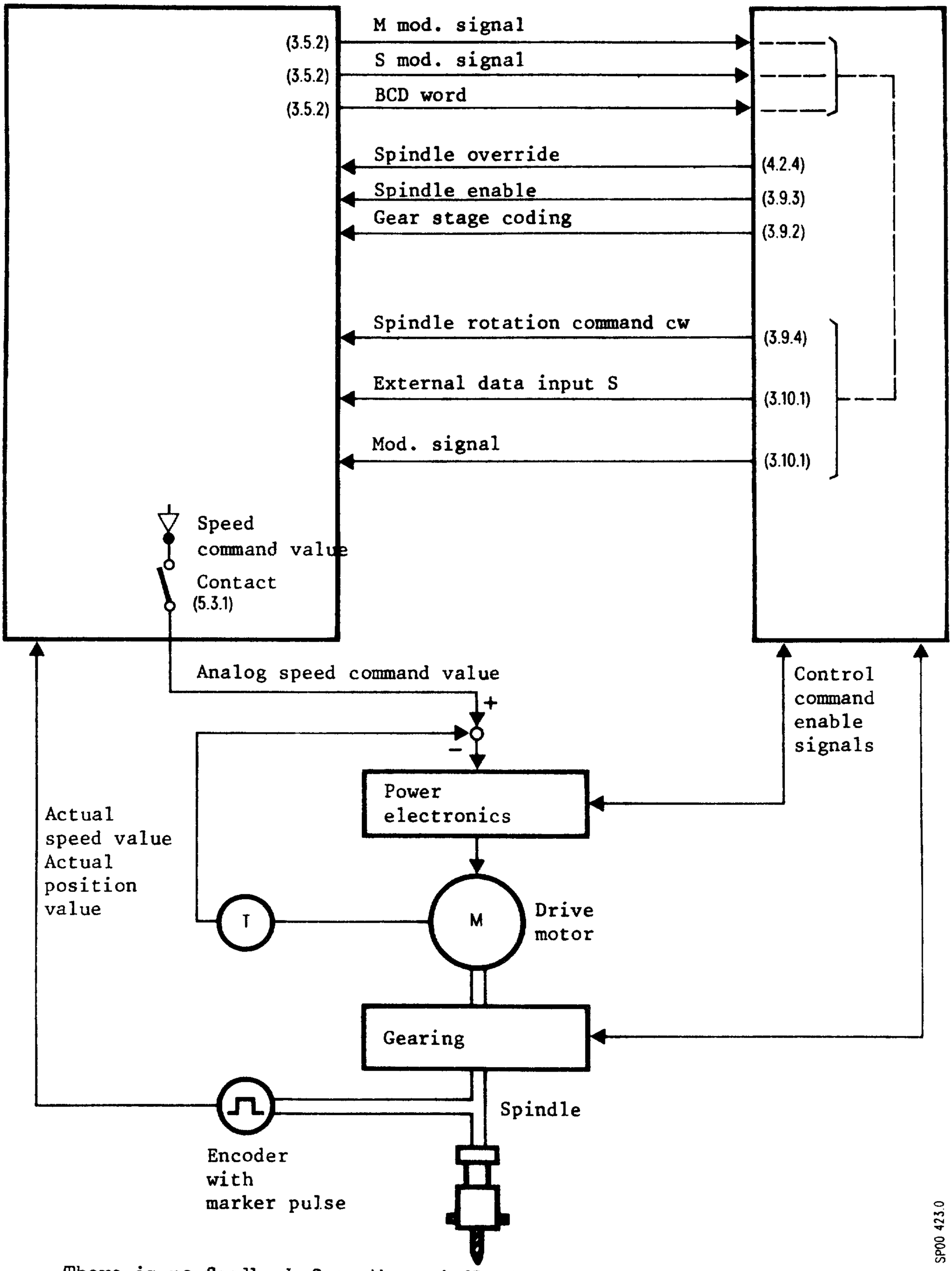
Recognition of the spindle rotation direction M03, M04, M05 and the speed/cutting speed S in the control is inactive.

The signal "Spindle command direction clockwise" is continuously and cyclically interrogated.

Which type of spindle control is to be used is defined by a machine parameter.

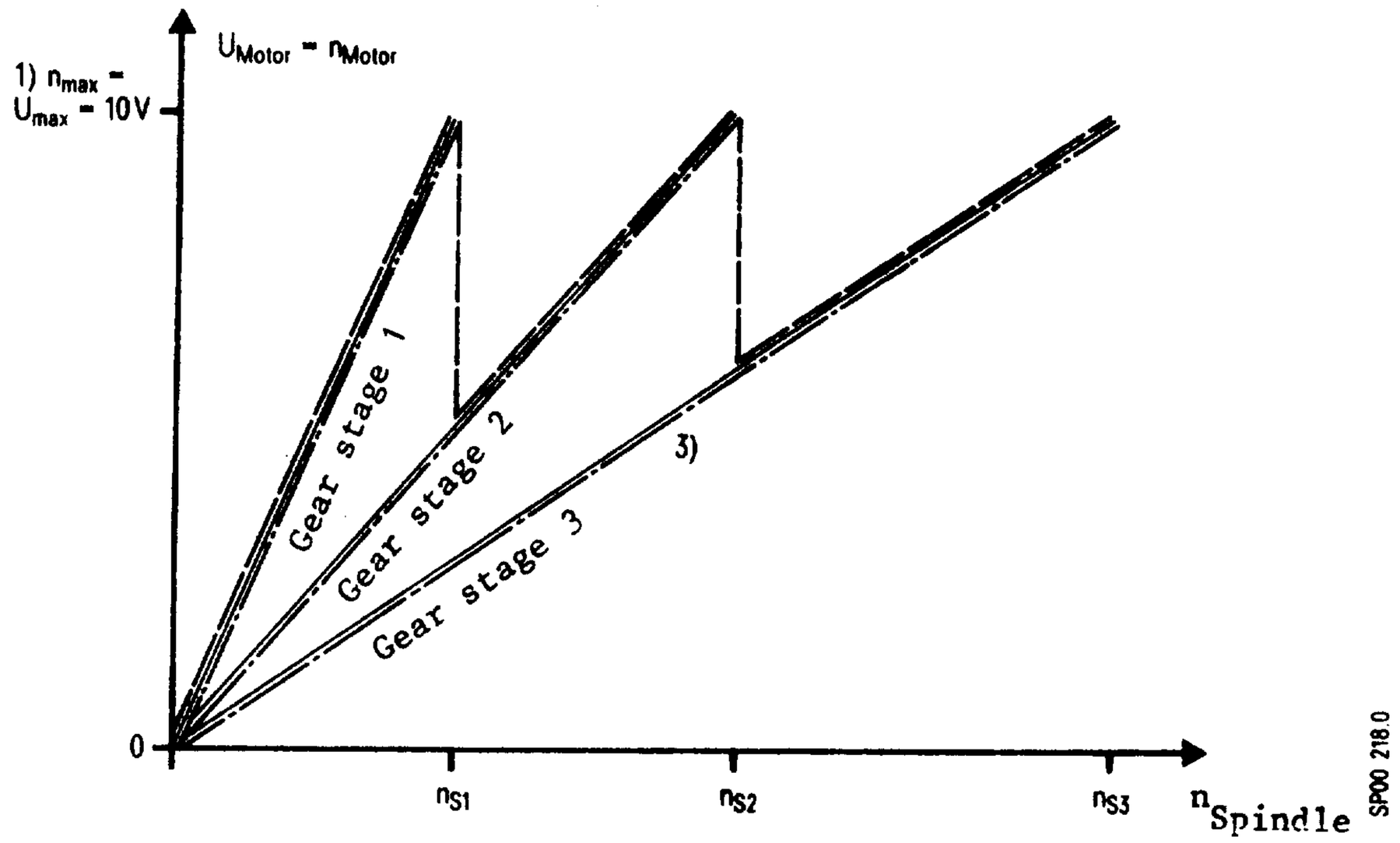
Block diagram

Spindle control via the interface control/PC



There is no feedback from the spindle data provided from the NC with the external data input.

Gear stages



Variable speed main spindle drive

(e.g. D.C. motor with electromagnetic clutch)

The total spindle speed range is achieved using different gear stages.

---- Normally for milling machines the gear stage is derived directly from the programmed S word (there is no switchover of the M functions). In this case there is no overlap between stages (see diagram).

-.-.- For lathes the gear change is normally controlled by the M function. In this case there is overlap in the different stages.

Description

1) 10V correspond to maximum motor speed (value permanently stored in the NC);

2) Maximum spindle speed corresponding to the gear stages and the 10V for maximum motor speed (values as NC machine parameter);

3) Each change in the speed signal is followed by a step change in the command value voltage.
A ramp characteristic can be generated in the servo controller;

4) Minimum motor speed for smooth rotation. This is the minimum control speed. (Value as machine parameter);

5) Limitation of spindle speed by the program (e.g. G92 S...).
This is the maximum control speed. The command value is limited.

Note on v = constant for SINUMERIK 3 T

For constant cutting speed the spindle is controlled from the NC such that the actual turning diameter is taken into account. For v = constant the S value (directly from NC or from PC) is not interpreted as a rotational speed but rather as a cutting speed. As before the PC controls selection of the gear stage. Normally gear change does not occur during machining.

When using the "Spindle control via the interface control/PC" feature it is necessary to switch to G94/G95 in the program before calling for special speeds (e.g. oscillating speed). as otherwise the rotational speed value will be interpreted as a cutting speed.

Note on E.STOP and switching system on

In the event of E. STOP a command value voltage corresponding to speed = 0 is outputted in the same way as for normal stop. After a delay the * CONTROLLER INHIBIT signal is removed from the servo controller and 0 V outputted. If a certain braking characteristic or armature short circuit is required this must be provided by the appropriate external circuitry.

The interface signal SPEED CONTROLLER (5.1.2) is also important for S analog. Following power on there can be no S analog output until this signal appears.
When the ready signal appears the NC closes the speed command value contact and generates a "1" signal (* CONTROLLER INHIBIT 5.3.2). If the SPEED CONTROLLER READY signal disappears during machining the NC reacts as for E. STOP.

3.9.1.2 SPINDLE ENABLE

	3T	3M
I/P	1	1

In the automatic modes AUT, MDA and setting up modes JOG, IND

"1" signal: effects main spindle drive enable
(with spindle rotation direction and speed available)

"0" signal: effects deceleration of the spindle to standstill by generation of speed command value zero (step function). After completion of the deceleration process (characteristic of drive controller), the signal * CONTROLLER INHIBIT (5.3.2) is removed from the drive controller. The time can be set between 1 and 32767 ms using machine parameters.

Application notes:

Has a similar effect as the controller inhibit for the feed axes.
Used to generate the spindle enable signal from the operating elements SPINDLE OFF and SPINDLE ON (4.2.17) taking machine conditions into account.

3.9.2 Spindle control with basic system 3

(supply from 4.83)

The NC accepts the task of determining the analog command variable for the spindle circuit. A ramp generator is provided per gear stage in the NC for this purpose. Spindle orientation (M19) is realised solely through the NC by machine parameter. Spindle positioning can be in either direction and in any gear range.

3.9.2.1 Types of spindle control

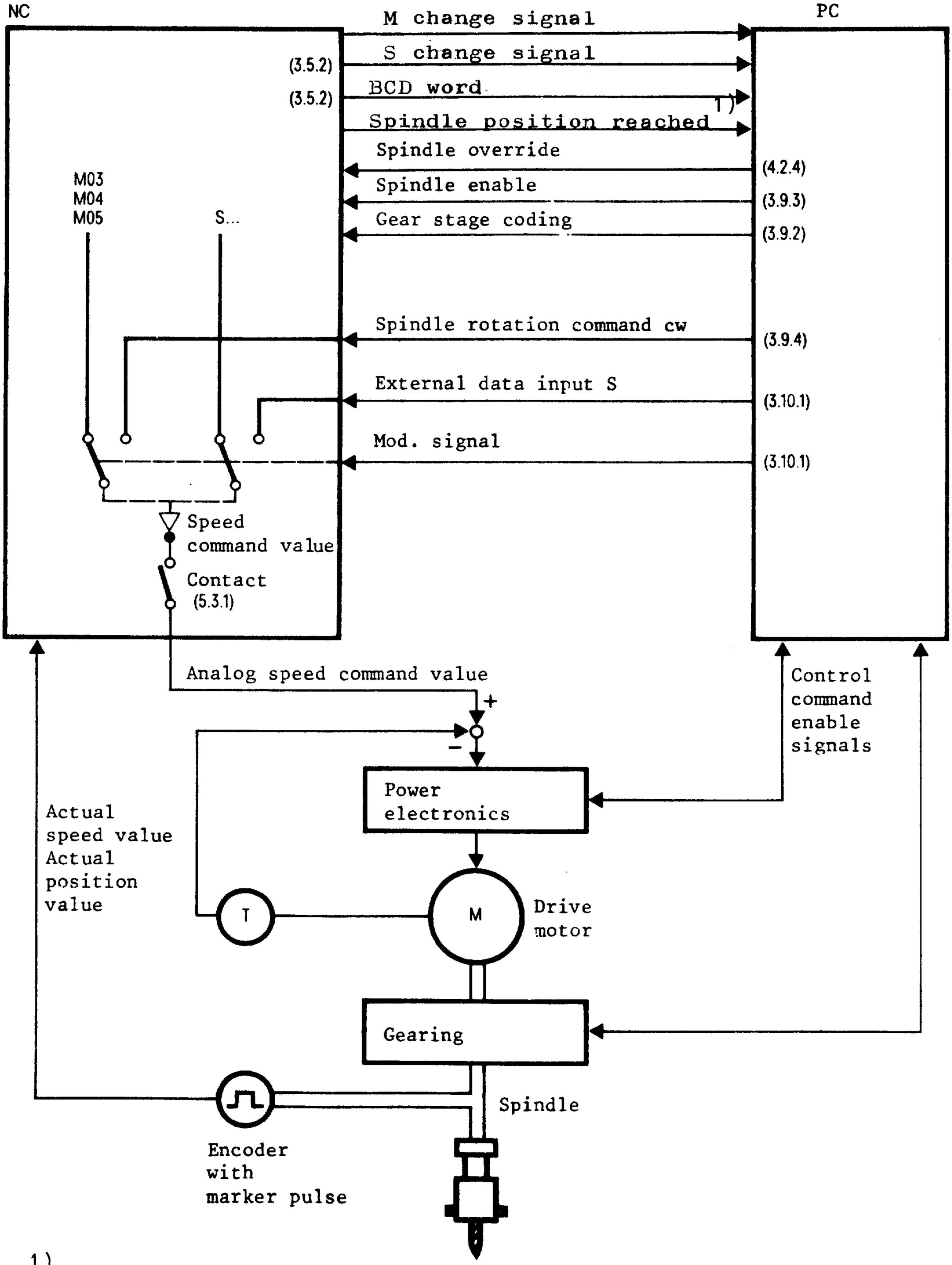
There are two methods of spindle control using S analog:

a) Direct spindle control from the NC

with recognition of the direction of rotation M03, M04, M05, and the programmed speed/cutting speed S in the control.
It is also possible in this mode to transfer via "External data input" from the interface control/PC the speed/cutting speed as well as the direction of rotation.
Data thus transferred into memory are active until "RESET".
If S data are inputted externally during program operation, the programmed data are suppressed until the end of program (RESET).
The signal "Spindle commanded direction clockwise" is interrogated cyclically from the first "external data input S"until RESET.

Block diagram

Direct spindle control from the NC



SPCO 422.1a

1) There is no feedback from the spindle data provided from the NC with the external data input.

b) Spindle control via the PC

The BCD data for spindle speed/cutting speed and direction of rotation are decoded in the PC and fed back to the NC via the "External data input".
For special functions such as oscillation for gear meshing or chip breaking, PC-specific spindle data can be transferred to the NC in place of the spindle data normally outputted from the NC.

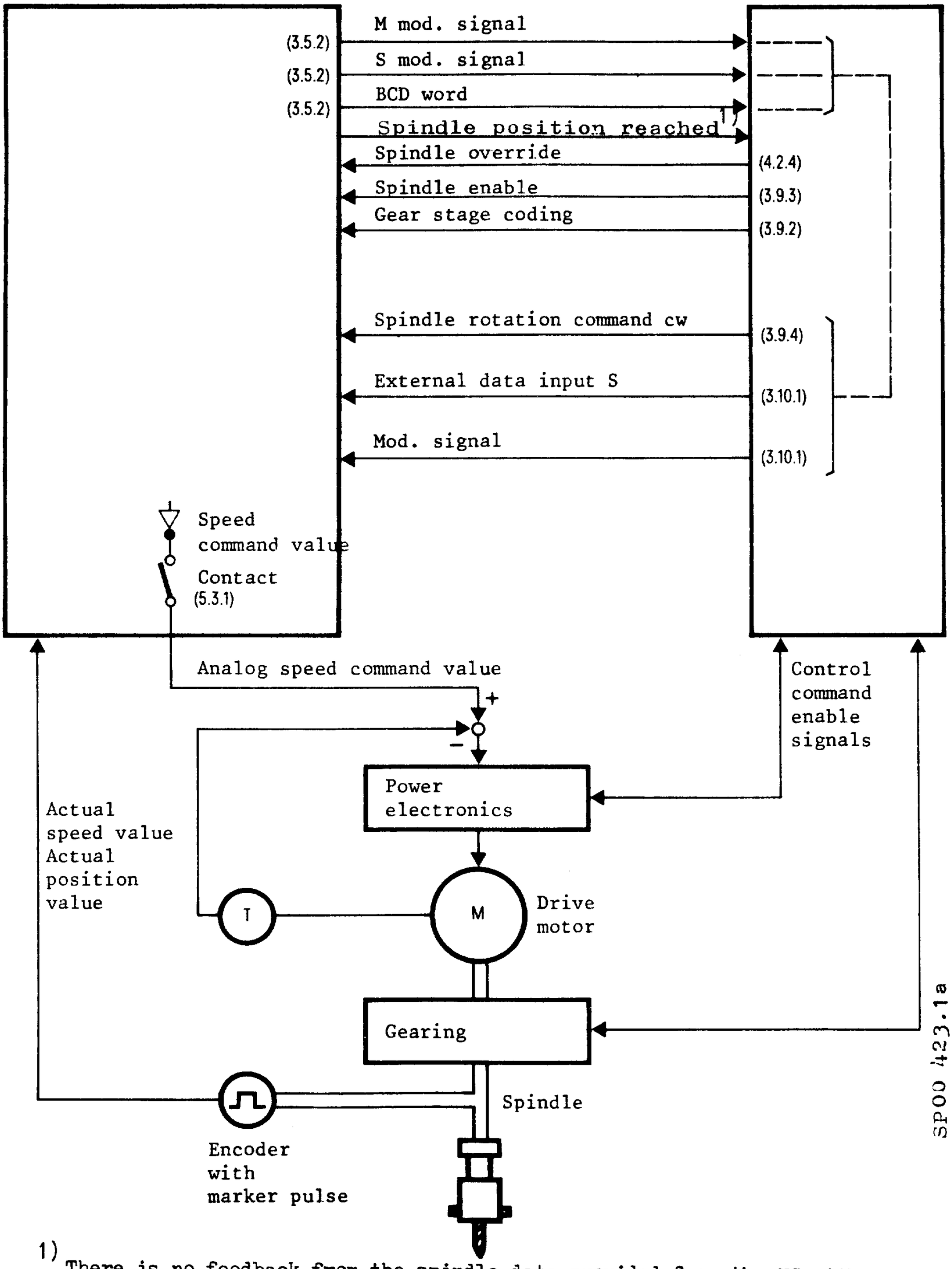
Recognition of the spindle rotation direction M03, M04, M05 and the speed/cutting speed S in the control is inactive.

The signal "Spindle command direction clockwise" is continuously and cyclically interrogated.

Which type of spindle control is to be used is defined by a machine parameter.

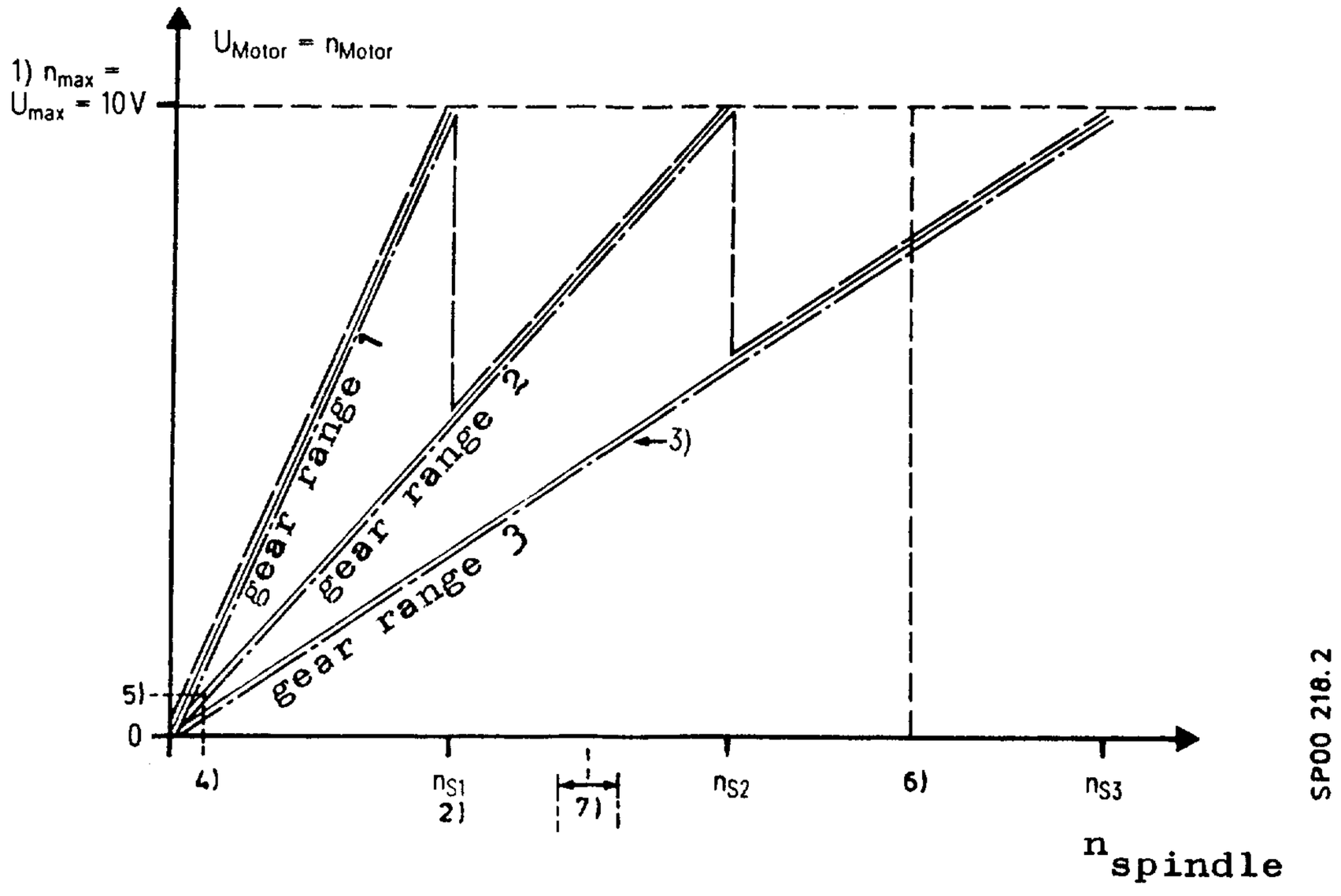
Block diagram

Spindle control via the interface control/PC



1) There is no feedback from the spindle data provided from the NC with the external data input.

Ramp characteristics (Spindle-speed-diagram)



Variable speed main spindle drive

(e.g. D.C. motor with electromagnetic clutch)

The total spindle speed range is achieved using different gear stages.

---- Normally for milling machines the gear stage is derived directly from the programmed S word (there is no switchover of the M functions). In this case there is no overlap between stages (see diagram).

-.-.- For lathes the gear change is normally controlled by the M function. In this case there is overlap in the different stages.

to 1) Voltage level of 10 V corresponds to maximum motor speed. (this value is stored permanently in the NC)

to 2) Maximum values of the spindle speed relating to the gear range and representing the 10 V for maximum motor speed (enterable value range in NC-machine data: 16 - 999 rpm or 1.6 - 999 rpm) dependant upon machine parameter.

to 3) Ramp time for spindle motor - n_o to n_{max} is taken into account for each speed change; also for immediate stop and V-constant;
(1 value per gear range. Time settable :
0 to 1 min for 0 to n_{max})

to 4) Creep speed is introduced with M19 , prior to engaging the position control.

to 5) Minimum motor speed for stable operation. Normally the motor is not allowed below this speed; the exception is M19, the value is entered as machine parameter.

to 6) Maximum spindle speed for V-constant. Value is stored in the NC and may be modified through G92 S... at the control or by using tape.

to 7) Command-actual value comparison of the spindle speed. This comparison is referred to the spindle and operates within a tolerance window. The window size is set by machine parameter.

Note: The maximum spindle speed for the 3T/M is 9999 rpm.

Special features with M19

If M19 is not activated internally by the NC (machine parameter) it is handled in the same way as any other miscellaneous function. On activation by the PC (the spindle is a closed NC position loop) the following sequence applies (see drawing):

- The spindle is decelerated to the creep speed through the deceleration characteristic (1)

- The spindle continues to move in the same direction with the same speed (2)

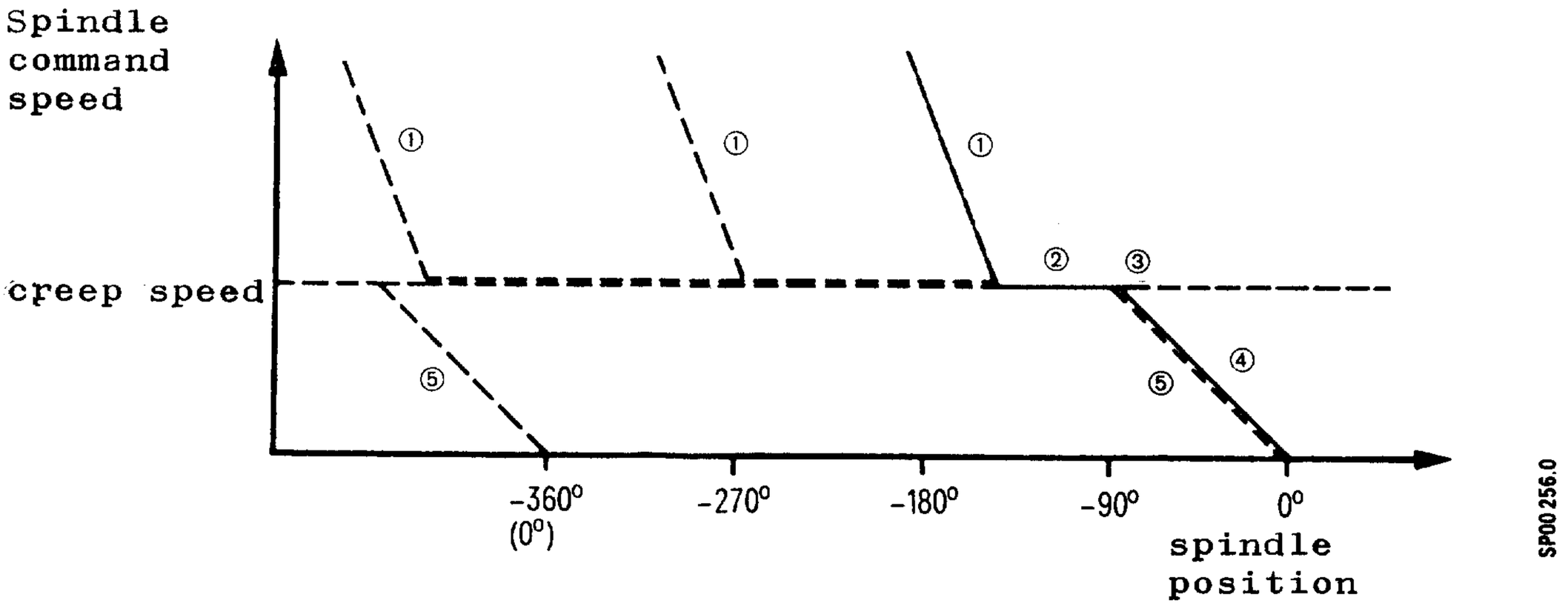
- At the intersection (3) of the deceleration characteristic (5) with the creep speed : switch on the position control and move into the spindle stop position (4) (distance less than 1 $^{1}/_{2}$ revolutions)

- Holding position under position loop control

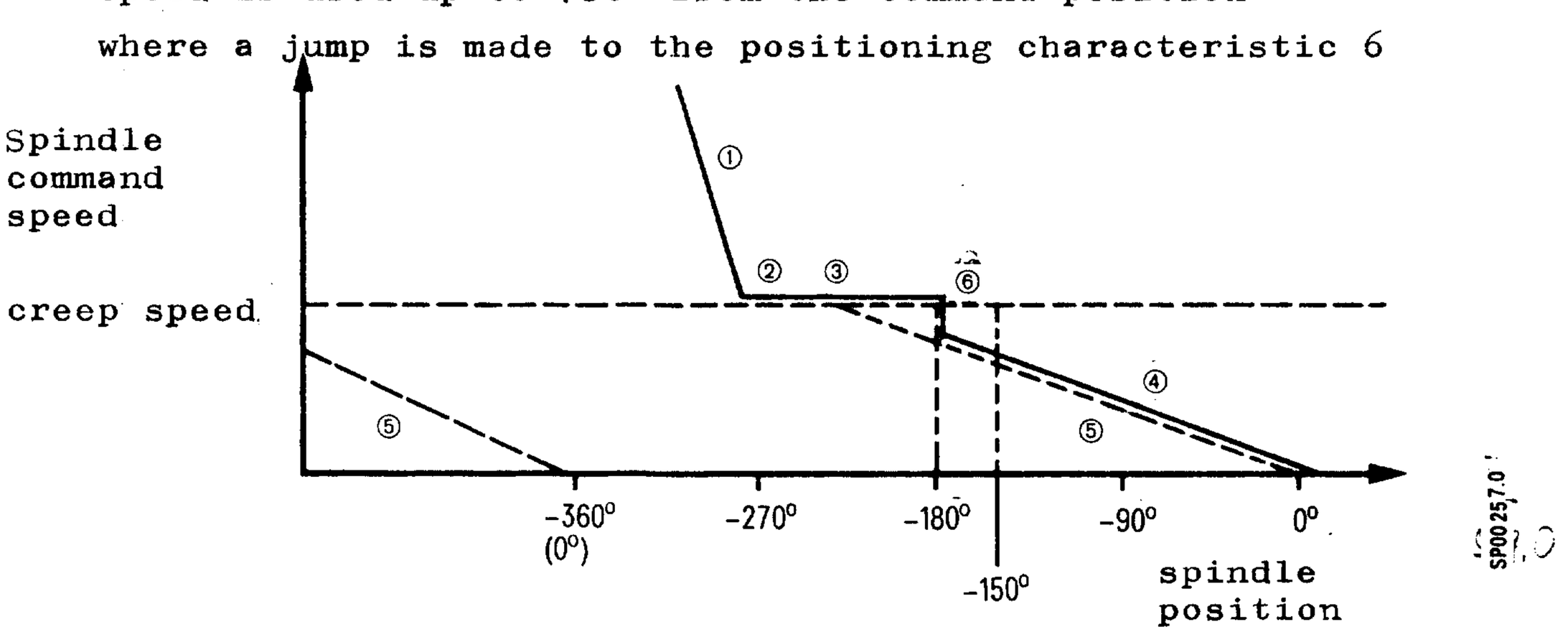
- SPINDLE POSITION REACHED (3.9.5.6) is transferred to the PC

- As soon as the PC removes the SPINDLE ENABLE (pulse length larger or equal to 32 ms, 3.9.5.7) the NC switches off the position loop control, outputs a zero command variable (opens the spindle speed = 0 contacts), removes the drive enable (*CONTROLLER INHIBIT 5.3.2) and automatically reads and executes the next block.

- Reset does not interrupt the spindle positioning if machine data (TE 407 bit 6=1) is set.
If this machine data bit is not set (TE 407 bit 6=0) the spindle is decelerated according to the deceleration characteristic and then stopped ; i.e. the required spindle position is not reached.
Machine data (TE 407 bit 6=1) is only active together with machine data (TE 407 bit 5=1)



If the gain is set low enough, that the intersection of the deceleration ramp characteristic and the creep speed lies more than 150° from the command position, then the same speed is used up to 180° from the command position where a jump is made to the positioning characteristic 6



With M19 from rest, positioning results always from the shortest path and is independant of the command direction.

Special feature with V-constant for SINUMERIK 3T

For constant cutting speed the spindle is controlled from the NC such that the actual turning diameter is taken into account. For v = constant the S value (directly from NC or from PC) is not interpreted as a rotational speed but rather as a cutting speed. As before the PC controls selection of the gear stage. Normally gear change does not occur during machining.

When using the "Spindle control via the interface control/PC" feature it is necessary to switch to G94/G95 in the program before calling for special speeds (e.g. oscillating speed). as otherwise the rotational speed value will be interpreted as a cutting speed.

Special features with E.STOP and switching on the system

As for normal stop the speed is reduced in accordance with a preset characteristic in the event of E.STOP. After the motor speed has reached 0, and after the settable waiting time (machine data) has elapsed , 0 Volt(speed command relay contacts are opened) and controller inhibit (*CONTROLLER INHIBIT 5.2.2) are output.
(If some other characteristic is required , e.g. deceleration without the characteristic or deceleration using armature short circuiting, then this must be realised using appropriate external circuitry.)
The PC speed command is cancelled with E.STOP.

The input signal SPEED CONTROLLER READY (5.1.2) is also important with S-analog. Following power on the S-analog output is not switched on until this signal appears.
The NC only closes the speed command contacts and outputs (*CONTROLLER INHIBIT 5.3.2) 1-signal, if it is commanded to move through M19 or though some external command.
If the SPEED CONTROLLER READY is removed during machining then the NC reacts as if it were E.STOP.

3.9.2.2 SPINDLE ENABLE

	3T	3M
I/P	1	1

"0" signal: effects stopping of the spindle, the spindle is decelerated through the deceleration characteristic, termination of the M19 function, spindle position reached

"1" signal: effects main spindle drive enable (with active spindle rotation direction and spindle speed)

Pulse length greater than or equal to 26 ms.

Application note:
As with E.STOP and programmed S=0, when the SPINDLE ENABLE is removed the spindle is decelerated via the ramp characteristic. After reaching a commanded speed of zero and expiry of a settable waiting time (machine data), 0 V (speed command contacts are opened) and controller inhibit (*CONTROLLER INHIBIT 5.3.2) are output.
If SPINDLE ENABLE is re-established then the previous spindle speed command value is active and the spindle ramps back up to this speed.

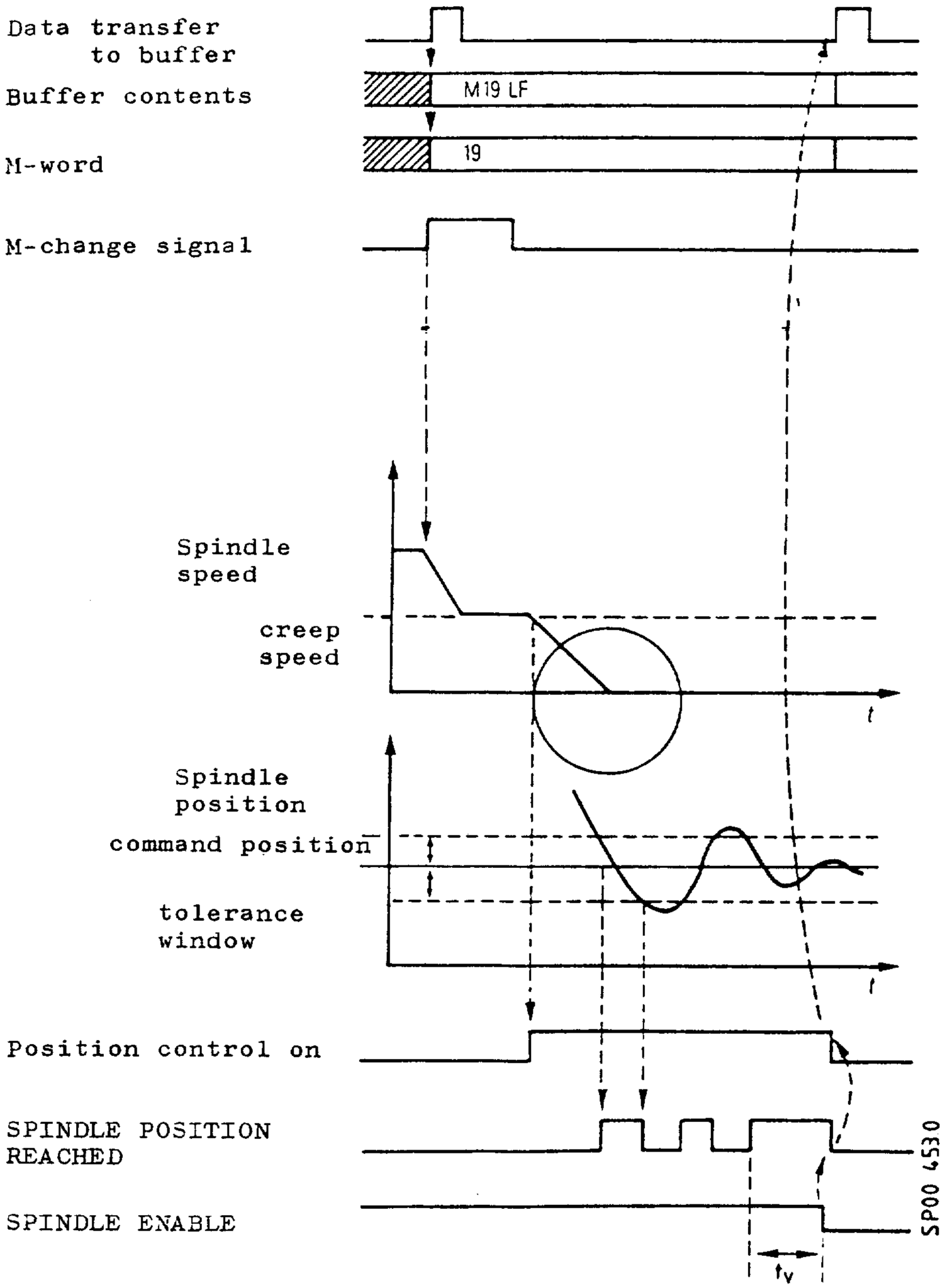
If M19 is active and SPINDLE ENABLE is removed then the position control is switched off. If the spindle is already in position (signal: SPINDLE POSITION REACHED 3.9.5.6) then if SPINDLE ENABLE is removed , 0V and controller inhibit are output . The block transfer is then active according to machine data TE 407 bit 5.

3.9.2.3 SPINDLE POSITION REACHED

	3T	3M
O/P	1	1

"1" signal: - with spindle position reached

"0" signal: - with spindle position not reached
- with spindle hold



SPINDLE POSITION REACHED is always output in conjunction with M19 when the actual postion lies within the in position zone (machine data). If the spindle overshoots this zone then it will be pulled back into the zone.This may occur with an incorrect optimisation of the spindle position control loop or too small an in position zone. SPINDLE ENABLE should only be reset by the PC when the spindle has fully come into position.

With marked overshooting it is recommended to remove SPINDLE ENABLE after a delay when the spindle has finally come into position and hence establish a time t_v.

3.9.3 GEAR STAGE CODING

	3T	3M
I/P	3	3

A gearbox connected to the output shaft of the motor provides a larger speed range at the spindle. The S programming refers to the speed of the main spindle and not the DC motor and it is necessary to take the gear stage into account when calculating speed command values.

The gear stages are programmed using address M and, following decoding in the interface control, selected in the machine control.

Confirmation is given in coded form:

Gear stages		1	2	3	4	5	6
Input signals	A	0	1	0	1	0	1
	B	0	0	1	1	0	0
	C	0	0	0	0	1	1

The NC control takes the gear stage into account such that the analog spindle speed output results in the programmed speed at the main spindle.

Gear stage 1 is associated with the lowest spindle speed range. If there are less than 6 stages the non-assigned stages must not be provided to the NC.
The input signals are continuously interrogated, i.e. a change of code effects immediately (approx. 32ms delay) a corresponding change in speed.

3.9.4 SPINDLE ROTATION CLOCKWISE COMMAND

	3T	3M
I/P	1	1

"1" signal: PLUS command value voltage
(rotation clockwise = M03)

"0" signal: MINUS command value voltage
(rotation anti-clockwise = M04)

a) Direct spindle control from the NC:
Operating modes: automatic AUT, MDA
setting up JOG, INC

The signal is only active in combination with the external data input (3.10.1).
It is interrogated after the first "external data input S" continuously and cyclically until RESET.

If an S value is inputted from the external data input during execution of a program, the programmed spindle data active in the NC are blocked until the end of the program or RESET.

Application note:

Input of spindle speeds and rotation direction from the interface control/PC in the automatic and setting up modes.

b) Spindle control from the interface control/PC
In the operating modes: automatic AUT, MDA
setting up JOG, INC

Normally the signal confirms the commanded direction of rotation M03/M04.
The signal is interrogated continuously and cyclically.

It is possible to change the programmed direction at any time from the interface control/PC for special functions (e.g. oscillation for gear engagement). After the special function has been completed the PC must transfer the originally programmed direction and speed back to the NC.

Application note:

Spindle control via the interface control/PC.

3.10 External data transfer to the SINUMERIK

3.10.1 EXTERNAL DATA INPUT

	3T	3M
I/P	22	22

Data word: 2 bytes

The following inputs are possible via the external data input:

- Additive tool offset ± 7.999 mm
  The value is added to the length of the internally active tool offset store value.

- Additive zero offset ± 7.999 mm
  (supplementary conpensation)
  The value is stored in its own store "External zero offset" and in the block for block calculation of zero offset it is added.
  The additive zero offset can only be changed or cancelled by a new input via the external data input.

- 4 decade S word
  a) Direct spindle control by the NC (3.9)
  The inputted S value suppresses the programmed S value until RESET.
  Following the first S input, the "Spindle command direction clockwise" signal is activated and cyclically interrogated (3.9.4).

b) Spindle control via the interface control/PC (3.9)
The S value output from the NC is acknowledged via the external data input.
PC specific spindle data can be given to the NC in place of the spindle data outputted from the NC itself.

The S word from the "External data input" is cleared in the NC using RESET.

- 4 decade F word mm/min.
  In the setting up mode JOG the feed rates can be inputted using the direction buttons. In this case the jog feed rate set by machine parameter is suppressed.
  The F word from the external data input is cleared in the NC using RESET.

- 4 decade program number call-up
  Instead of calling up the program number to be executed using the NC control it can also be called up via the external data input.

- PC alarm message [1] (2 ASCII - characters)
  The PC alarm message consists of 2 alphanumeric characters generated by the PC (e.g. OT = Over Travel). It may be used to give information directly or alternatively indirectly using a code(protected). The PC alarm message is cleared with the two ASCII characters 2020 HEX (Blank).

The inputs described above apply for operating modes AUT, MDA, JOG and INC.

1) only with Basic system 3.

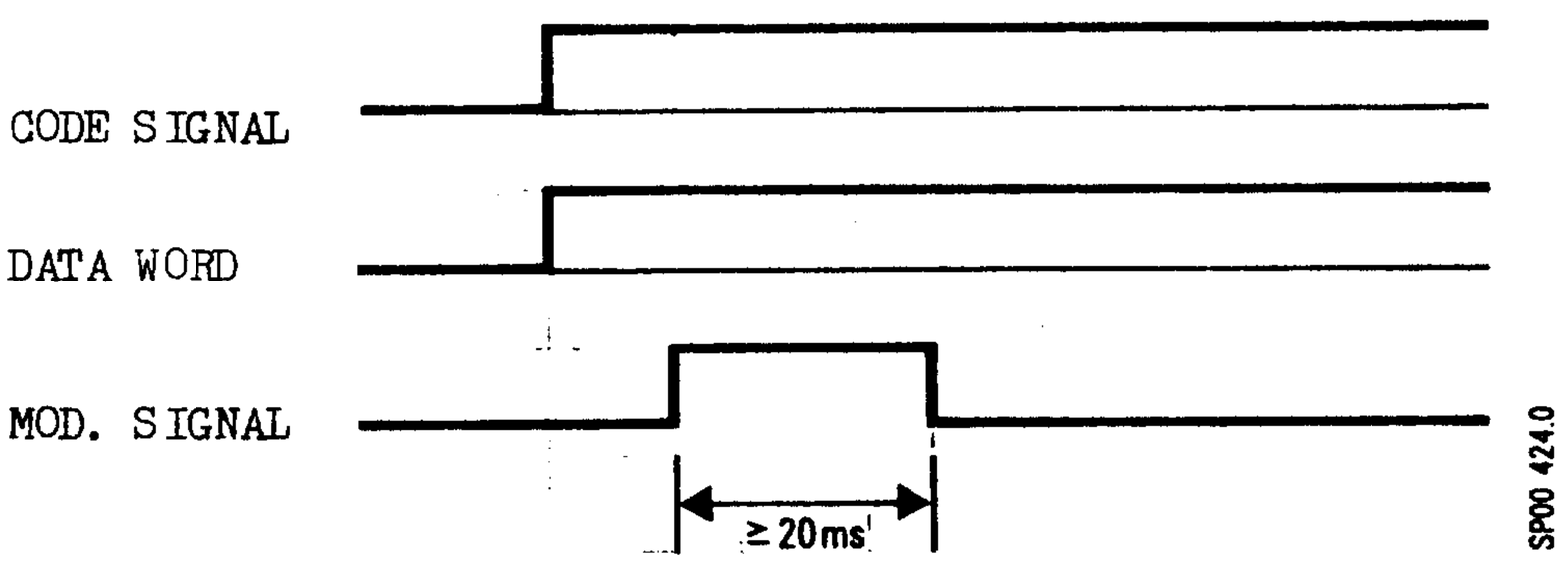
Function sequence

The EXTERNAL DATA INPUT consists of:

- 2 bytes data word
- 5 bits code signal
- 1 bit mod. signal for data transfer

The data word contains the actual data, the code signal determines the type of data and the mod. signal controls the data transfer.

With the "0"/"1" transition of the "Mod. signal for data transfer" the code signal and data word are transferred to the NC. The "1" status of the mod. signal must last at least 20 ms.



Both code signal and data word must be available at the time of the "0"/"1" transition.

The transfer cycle lasts at least 20 ms.

Bit datum	3T Code Signal 4 3 2 1 0 E D C B A		3M Code Signal 4 3 2 1 0 E D C B A		Data word - BCD - 7 6 5 4 Q P O N	3 2 1 0 M L K I	7 6 5 4 H G F E	3 2 1 0 D C B A
Function	Axis		Axis		- ≙1			
Additiv tool offset	X	0 0 0 0 1	X	0 0 0 0 1	±	7	9	9	9
	Z	0 0 0 1 0	Y	0 0 0 1 0	±	7	9	9	9
		-	Z	0 0 0 1 1	±	7	9	9	9
		-	4.	0 0 1 0 0	±	7	9	9	9
Additive zero offset	X	0 1 0 0 1	X	0 1 0 0 1	±	7	9	9	9
	Z	0 1 0 1 0	Y	0 1 0 1 0	±	7	9	9	9
		-	Z	0 1 0 1 1	±	7	9	9	9
		-	4.	0 1 1 0 0	±	7	9	9	9
S rev./min; m/min		1 1 0 0 0		1 1 0 0 0		9	9	9	9
F mm/min		1 1 0 0 1		1 1 0 0 1		9	9	9	9
% Program no.		1 1 0 1 0		1 1 0 1 0		9	9	9	9
PC-alarm message 1)		1 0 0 0 0		1 0 0 0 0	0	-ASCII- 7 bit ASCII code		0	7 bit ASCII code

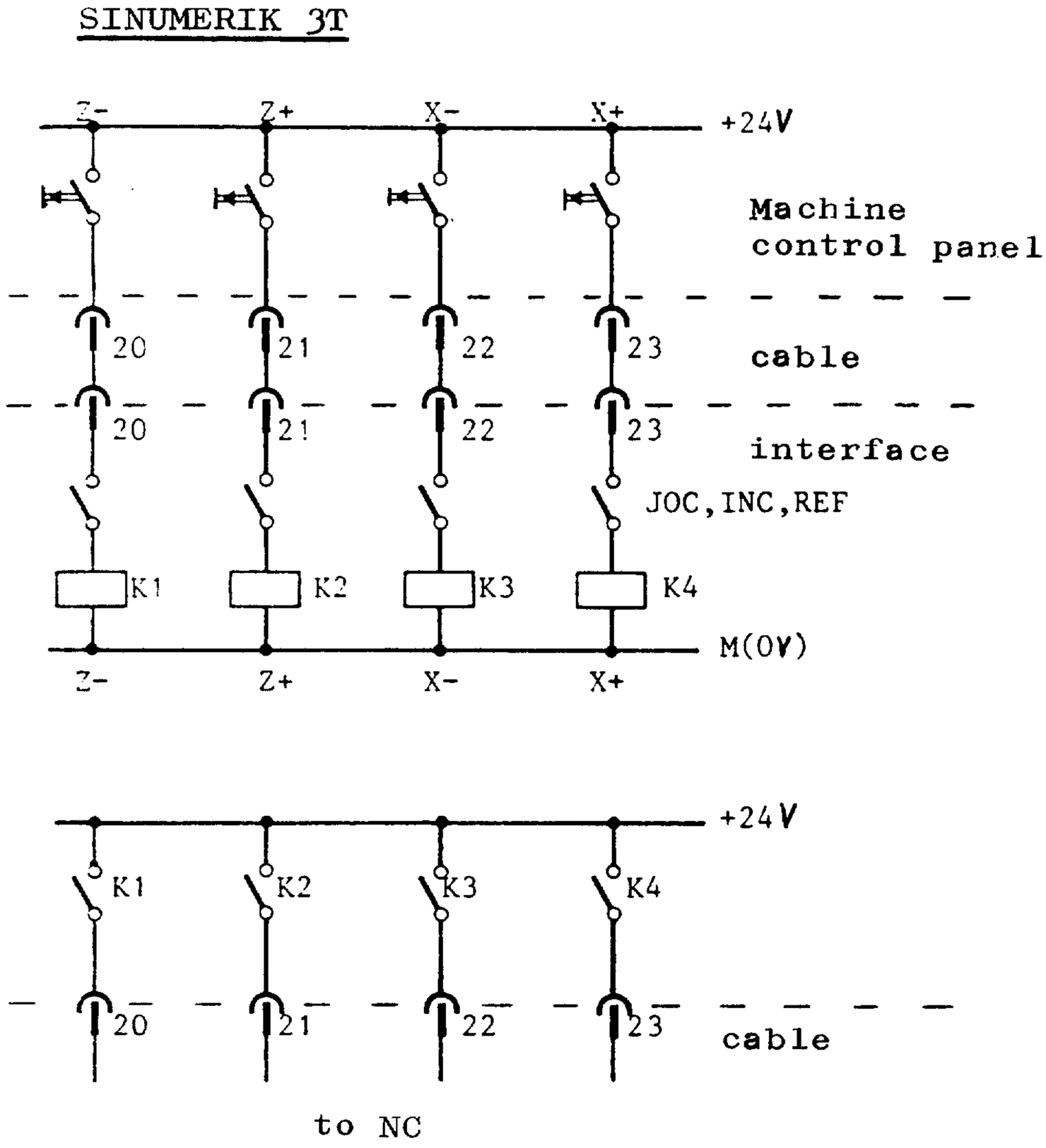
Maximum value for tool offset and zero offset:

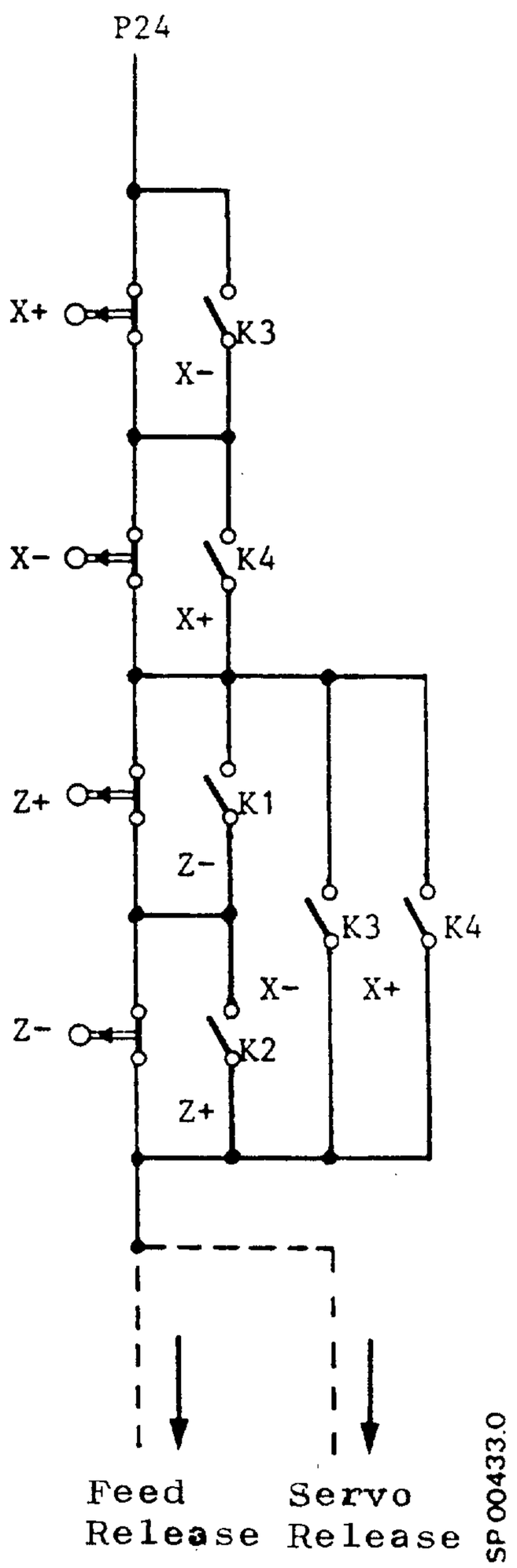
± 7,999 mm ; 0,7999"

1) only with Basic system 3

3.11 Examples of axis limiting and jog off limit logic

SINUMERIK 3T





Controlled braking:

Removal of feed release

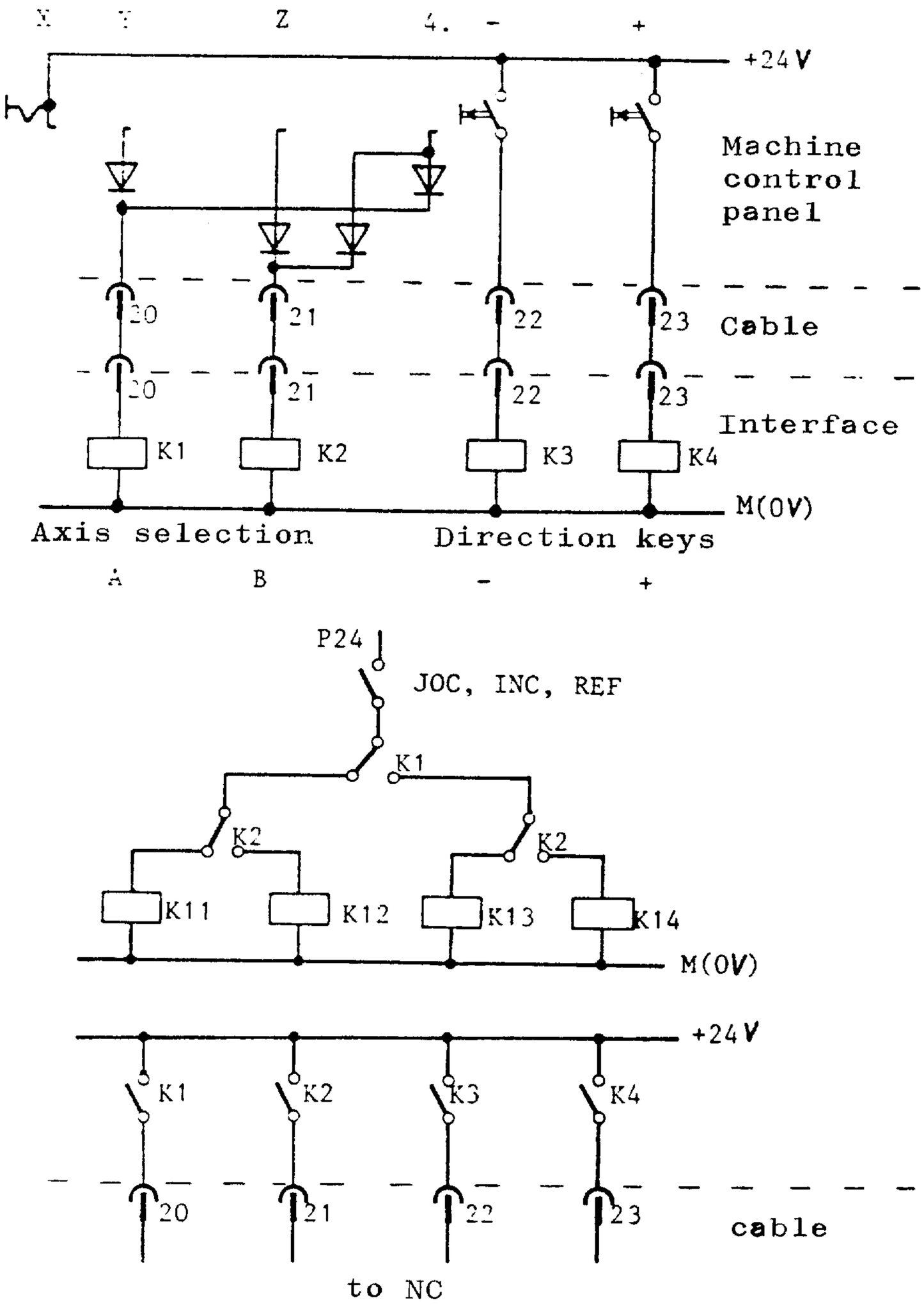
Fast braking:

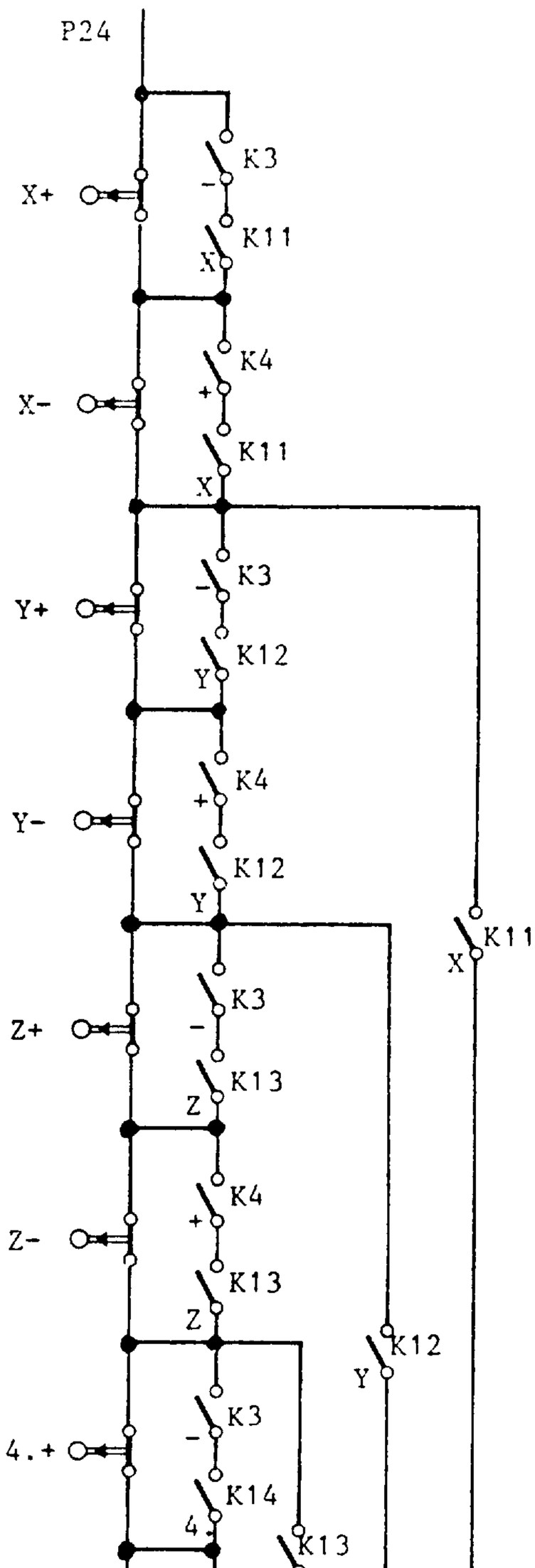
Removal of servo release

Jog off sequence:

X,Z if 2 limits are made at
the same time.

Note: The limit switches take over the role of ultimate ESTOP switches. The individual axis limitation is achieved through the use of software limits.





Controlled braking:

Removal of feed release

Fast braking:

Removal of servo release

Jog off sequence:

X,Y,Z,4 if more than one switch is made at the same time

Note: The limit switches take over the role of ultimate ESTOP switches. The individual axis limitation is achieved through the use of software limits.

4. Signal description for the machine control panel

4.1 General

4.2 Machine control panel signals

4. Signal description for the machine control panel

4.1 General

Version 1 (without PC)

The machine control panel is connected to the interface control via a standard input/output cable and from there signal processing occurs or direct transfer of the signals via a standard input/output cable to the input socket IN of the 1st input/output module.

Using the coupling module 03630 in the machine control panel 18 additional operating signals can be connected via solder tags to the machine control panel. They will then also be transferred to the interface control in the same cable. The number of the solder tag corresponds to the socket point.

Version 2 (with integral PC)

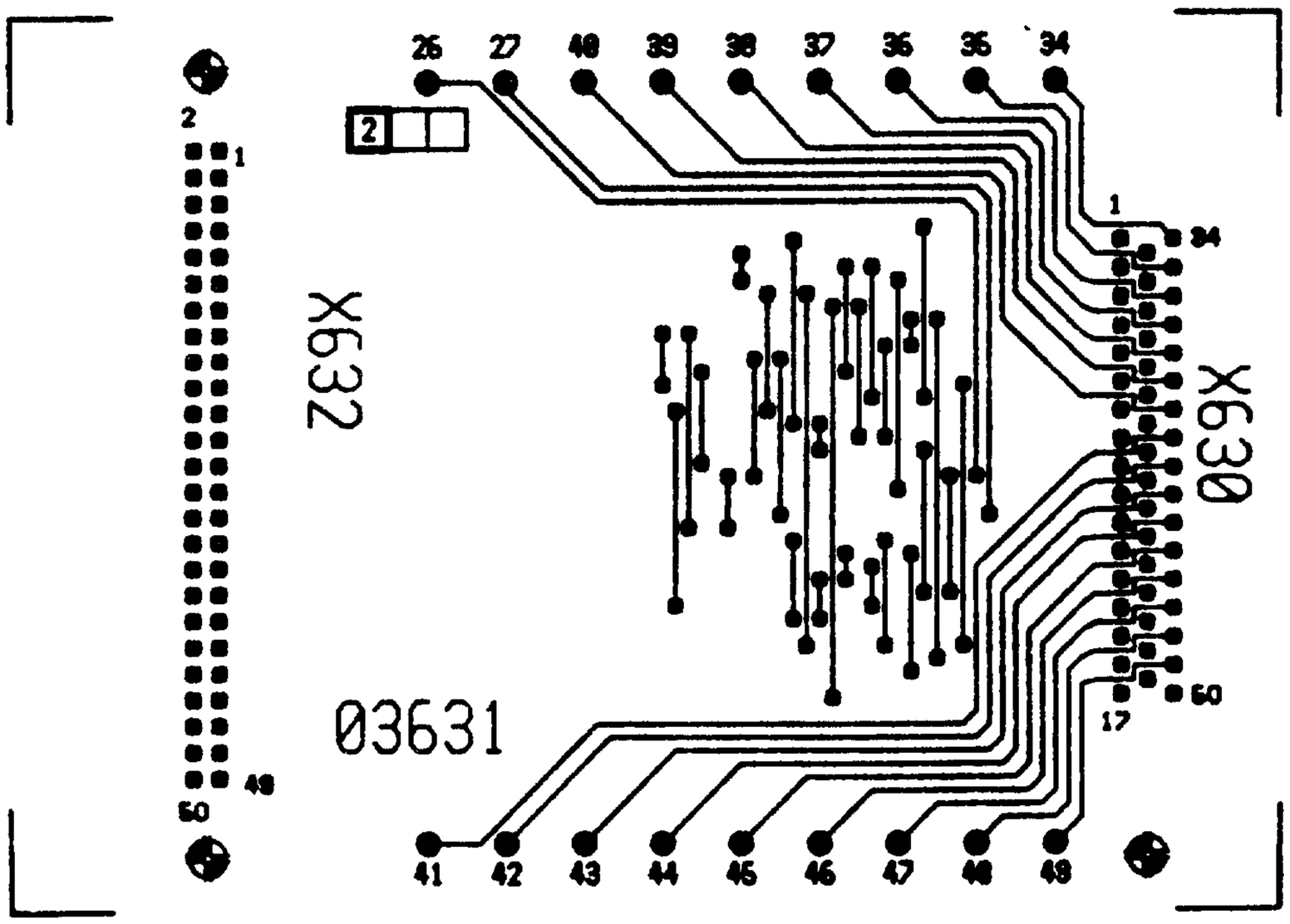
The machine control panel is connected via a standard input/output cable directly to the input socket IN of the input/output module no. 2. A copy of the PC address assignments is generated which corresponds largely to the copy of the NC - PC interface section. Connection to module no. 1 is not permitted because byte 0 is reserved for the alarm inputs.

The 18 bits still available on the input module can be utilized by connecting additional operating signals from the machine control panel to the solder tags of the coupling module 03630 in the machine control panel. The number of the solder tag and the number in the data bit list on the following 2 pages correspond to the socket point.

Connection of the machine control panel (3T) to the PC

PC inputs Byte addr.	PC Data bit 7	6	5	4	3	2	1	0
8	Operating mode switch D 8	C 7	B 6	A 5	Feedrate/rapid override switch D 4	C 3	B 2	A 1
9	Key switch 76	Dry run 15	Block delete 14	Single block 13	Block search 12	Spindle override switch C 11	B 10	A 9
10	Rapid override active 25	Rapid override 24	Direction buttons X+ 23	X- 22	Z+ 21	Z- 20	X 19	X 18
11	* Spindle OFF 33	Spindle ON 32	* Feed hold 31	Feed start 30	Handwheel X 29	Cycle Start 28	Unassigned 27	Unassigned 26
12	Unassigned 41	Unassigned 40	Unassigned 39	Unassigned 38	Unassigned 37	Unassigned 36	Unassigned 35	Unassigned 34
13	Unassigned 49	Unassigned 48	Unassigned 47	Unassigned 46	Unassigned 45	Unassigned 44	Unassigned 43	Unassigned 42

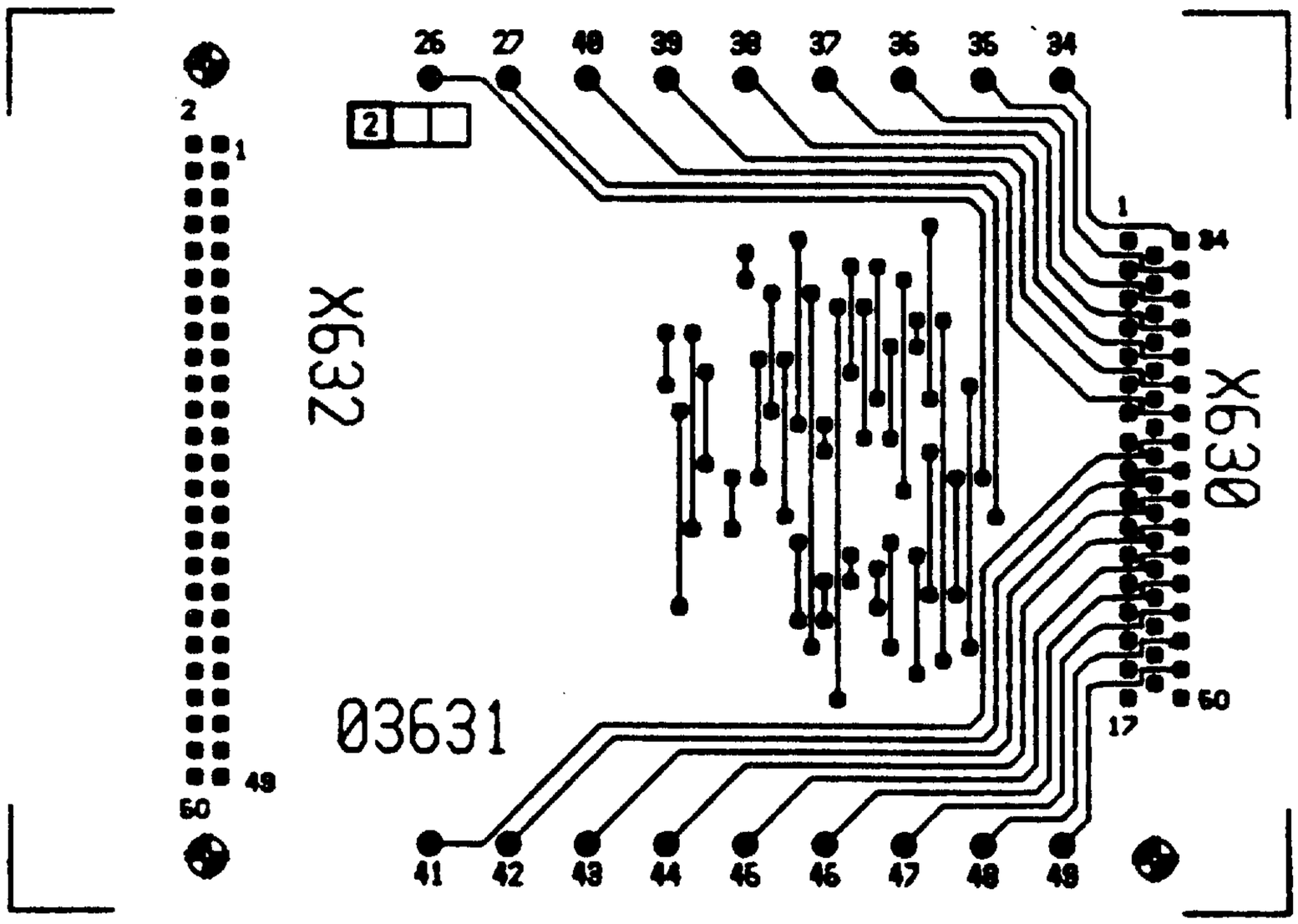
Coupling module for additional machine panel controls



Connection of the machine control panel (3M) to the NC

PC inputs Byte addr.	PC Data bit 7	6	5	4	3	2	1	0
8	Operating mode switch D 8	C 7	B 6	A 5	Feedrate/rapid override switch D 4	C 3	B 2	A 1
9	Key switch 76	Dry run 15	Block delete 14	Single block 13	Block search 12	Spindle override switch C 11	B 10	A 9
10	Rapid override active 25	Rapid override 24	Direction buttons + 23	- 22	Axis selector switch - B 21	A 20	19	18
11	* Spindle OFF 33	Spindle ON 32	* Feed hold 31	Feed start 30	29	Cycle Start 28	Unassigned 27	Unassigned 26
12	Unassigned 41	Unassigned 40	Unassigned 39	Unassigned 38	Unassigned 37	Unassigned 36	Unassigned 35	Unassigned 34
13	Unassigned 49	Unassigned 48	Unassigned 47	Unassigned 46	Unassigned 45	Unassigned 44	Unassigned 43	Unassigned 42

Coupling module for additional machine panel controls



Construction of the machine control panel from individual elements

The machine control panel operates at 24V.
It contains no electronic circuits. The operating element signals are connected directly to the inputs of the input/output module.

The machine control panel can also be built and wired from individual elements. In this case the selector switch coded via a diode matrix can be installed as a single element including the diode board.

These coded selector switches are shown in Section 8 in the circuit diagram and in their mechanical construction.

4.2 Machine control panel signals

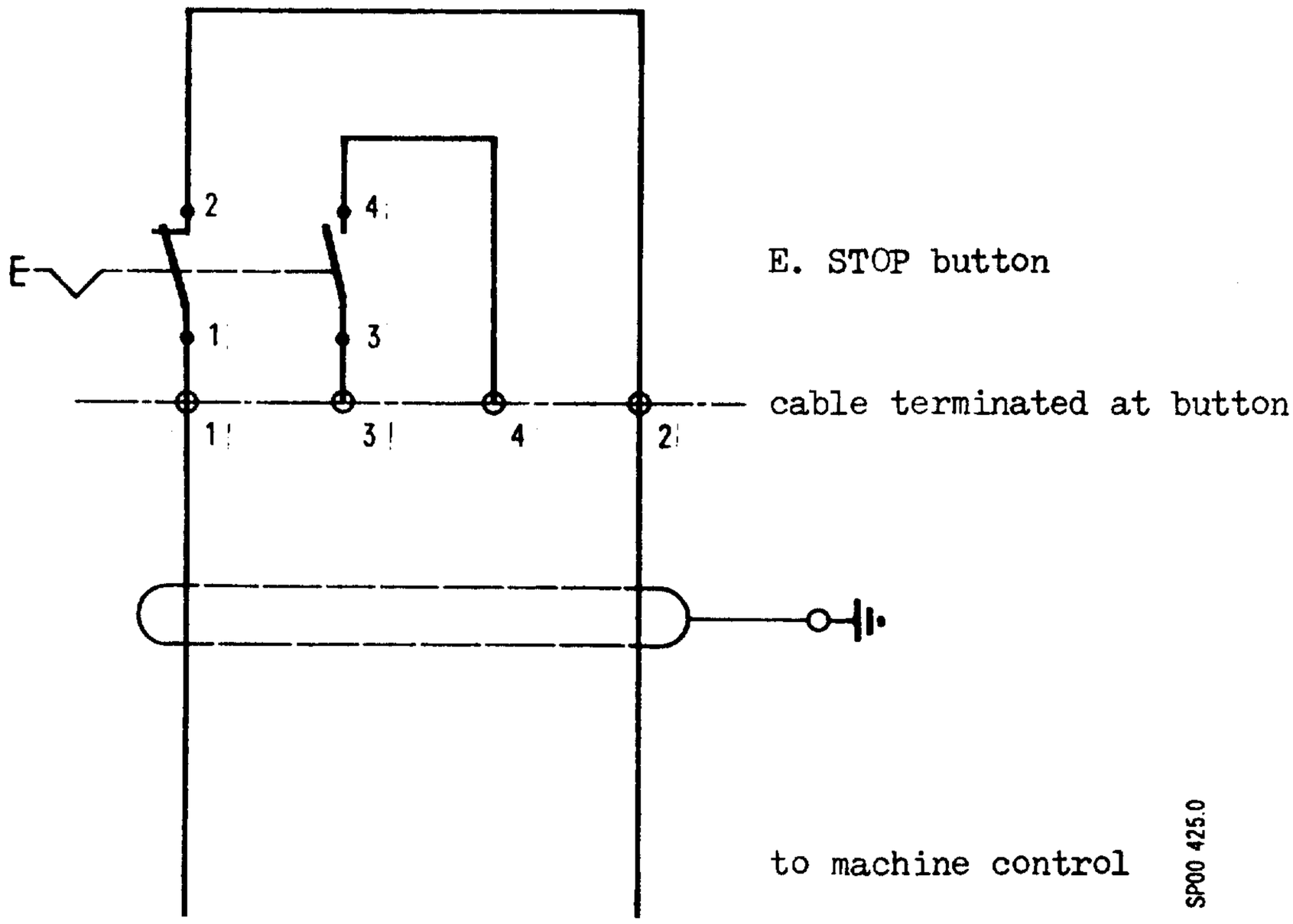
4.2.1 EMERGENCY STOP - separate cable 4(2) signals -

E. STOP BUTTON (mushroom head button with twist release)
Switching voltage max. 220 V.

Connection via screened cable direct to the E. STOP button.
Screen connected at one end only in machine control.

Application note:

Effective in machine E. STOP circuitry.



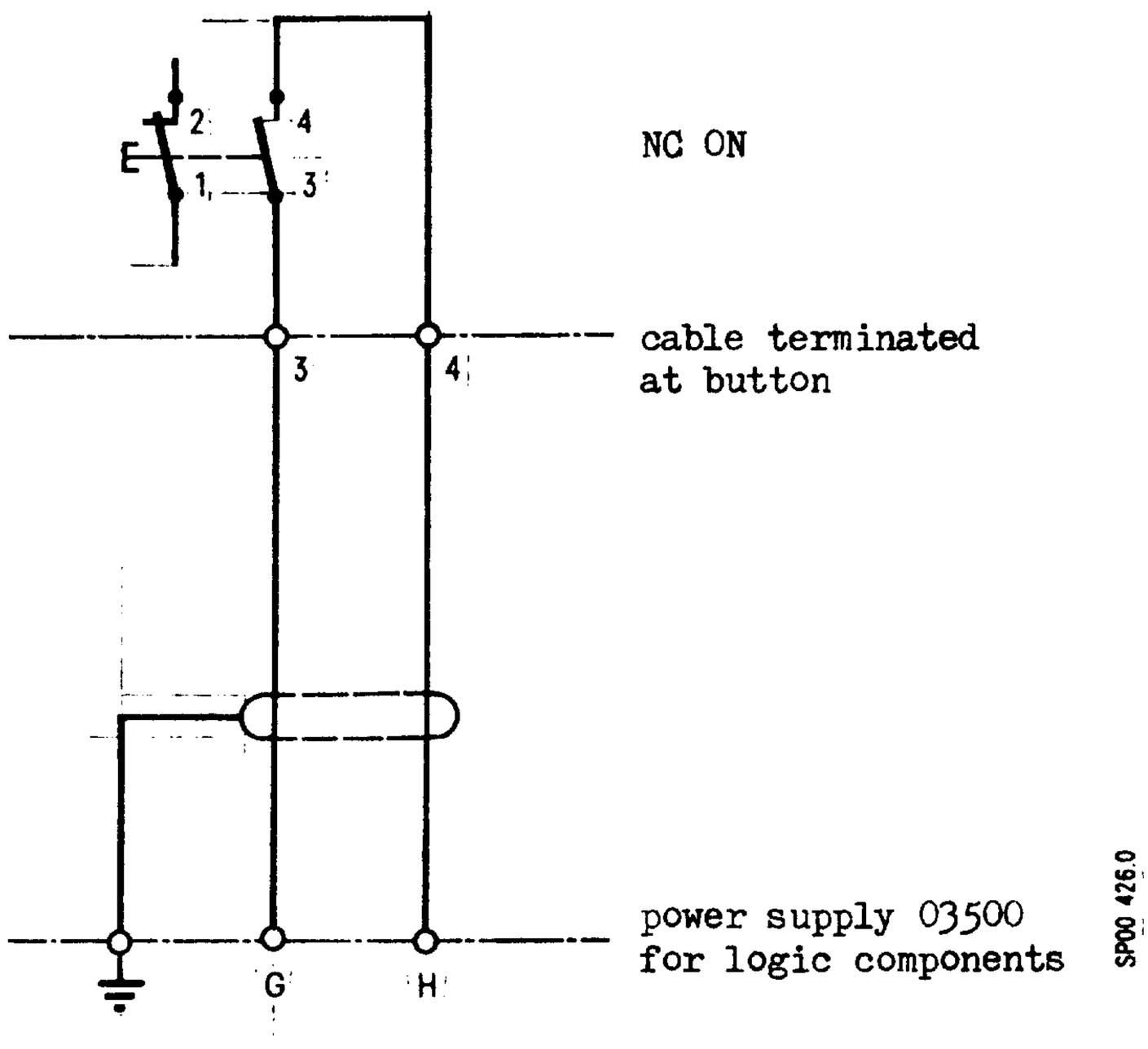
4.2.2 NC ON - separate cable 2 signals -

POWER ON button
Switching voltage 24 d.c.

Connection via screened cable directly to button.
Screen connected at one end only to NC logic components.

Application note:

Switching on the NC logic components after connection of 24 V d.c. power supply.



The connections for power supply 03500 are shown in more detail in Section 1.1.7.

4.2.3 OPERATING MODE SWITCH - 4 input signals -

Selector switch with 16 positions, coded.
Overlapping contact arrangement.
The various operating modes are selected on this switch.
An explanation of the operating modes is given in SECTION 2.3.

Code table

Position	Connection	Symbol	Code D	C	B	A
1	1		0	0	0	1
2	3					
3	5		0	0	1	1
4	7					
5	9		0	0	1	0
6	11		1	0	1	0
7	13	1	1	0	1	1
8	15	10	1	0	0	1
9	17	100	1	0	0	0
10	19	1000	1	1	0	0
11	21	10000	1	1	0	1
12	23		0	1	0	1
13	25		0	1	0	0
14	27		0	1	1	0
15	29					
16	31		1	1	1	0

Software function:

general clear of incremental store

clear incremental store when switching through

4.2.4 SPINDLE SPEED OVERRIDE SWITCH - 3 input signals-

Selector switch with 8 positions, coded.
Overlapping contact arrangement.

The switch enables spindle speed changes in steps between 50% and 120%.

For rotational feedrate and constant cutting speed the spindle speed override effects automatic matching with the feed drives.

The switch is de-activated for thread cutting.

Code table

Position	Connection	Symbol S ↻ %	Code C B A
1	1	50	1 1 1
2	3	60	1 1 0
3	5	70	0 1 0
4	7	80	0 1 1
5	9	90	0 0 1
6	11	100	0 0 0
7	13	110	1 0 0
8	15	120	1 0 1

4.2.5 FEEDRATE OVERRIDE SWITCH - 4 input signals -

Selector switch with 16 positions, coded.
Overlapping contact arrangement.

The switch enables changes in the feed rate in steps between 0 and 120%.
The rapid traverse rate can also be changed between 0% and 100% with the switch in the "Rapid override active" position. For thread cutting the switch is de-activated.

Code table

Position	Connection	Symbol F [~] %	Code D	C	B	A
1	1	0	0	0	0	0
2	3	1	0	0	0	1
3	5	2	0	0	1	1
4	7	4	0	0	1	0
5	9	6	0	1	1	0
6	11	8	0	1	1	1
7	13	10	0	1	0	1
8	15	20	0	1	0	0
9	17	40	1	1	0	0
10	19	60	1	1	0	1
11	21	70	1	1	1	1
12	23	80	1	1	1	0
13	25	90	1	0	1	0
14	27	100	1	0	1	1
15	29	110	1	0	0	1
16	31	120	1	0	0	0

4.2.6 AXIS SELECTOR SWITCH (3M) - 2 input signals -

Selector switch with 4 positions, coded.
Overlapping contact arrangement.

In the setting up modes JOG, INC, REF this switch is used to select the axis to be traversed.
Traverse is initiated by the direction buttons + or -.

Code table

Position	Connection	Symbol	Code B A
1	1	X	0 0
2	3	Y	0 1
3	5	Z	1 0
4	7	4	1 1

4.2.7 DIRECTION BUTTONS PLUS, MINUS (3M) - 2 input signals -

Button, 1 normally open contact

The direction buttons initiate traverse of the axes selected on the axis selector switch.

4.2.8 DIRECTION BUTTONS (3T) - 4 input signals -

Button, 1 normally open contact.

In the setting up modes JOG, INC, REF an axis is traversed using the direction buttons.

4.2.9 RAPID OVERRIDE

Button, 1 normally open contact.

In the setting up modes JOG, INC, REF the axis can be traversed in rapid by pressing this button at the same time as the direction buttons.

4.2.10 HANDWHEEL ACTIVE IN X AXIS (3T) - 1 input signal -

Toggle switch, 1 normally open contact.

The switch is used to select the axis which is to be traversed using the handwheel in the operating mode JOG.

"1" signal: X axis

"0" signal: Z axis

In the case of the 3M the axis is determined by the axis selector switch.

4.2.11 RAPID TRAVERSE OVERRIDE ACTIVE - 1 input signal -

Toggle switch, 1 normally open contact.

This signal enables the feedrate override switch to be used for rapid traverse in the range 0 to 100%.
The position 0% on the feedrate override switch is always active even when the signal "Rapid traverse override active" is not available.

4.2.12 DRY RUN - 1 input signal -

Toggle switch, 1 normally open contact.

For tests on the workpiece this signal is used to provide a dry run feedrate (set using machine parameter) instead of the programmed feedrate. This also applies to rotational feedrate and feedrate for threadcutting.

4.2.13 BLOCK DELETE - 1 input signal -

Toggle switch, 1 normally open contact.

When this signal is active blocks designated with "/" in the program are skipped. If there is a series of deleted blocks (measuring loop), the signal must be available before the first "/" block is read or otherwise the whole measuring loop will be executed.

4.2.14 SINGLE BLOCK - 1 input signal -

Toggle switch, 1 normally open contact.

In the AUT mode this signal effects execution of the program in single blocks.

4.2.15 SEARCH - 1 input signal -

Button, 1 normally open contact

This signal determines the search routine for re-entering the program at a predetermined point.

4.2.16 KEY SWITCH - 1 input signal -

Key switch, 1 normally open contact

"0" signal: key removed.

This signal enables input of data into the program store as well as editing and input of tool offset and zero offset data.

4.2.17 SPINDLE OFF - SPINDLE ON - 2 input signals -

OFF: button, 1 normally closed contact

ON: button, 1 normally open contact

The two signals spindle OFF and spindle ON are linked as logic signals in the interface control/PC and generate, depending on machine conditions, the spindle enable signal (Section 3.9.3).

Additional, external spindle ON/OFF switches can also be integrated in the logic.

4.2.18 FEED HOLD - FEED START - 2 input signals -

Hold: button, 1 normally closed contact

Start: button, 1 normally open contact

The two signals feed hold and feed start are linked as logic signals in the interface control/PC and generate, depending on machine conditions, the feed enable signal (Section 3.7.2).

Additional, external feed hold/start switches can also be integrated in the logic.

4.2.19 CYCLE START - 1 input signal -

Button, 1 normally open contact

Providing the start conditions on the machine are satisfied the signal Cycle Start generates the NC start signal (Section 3.6.2) in the interface control/PC.

NC start effects program start in automatic modes AUT, MDA.

Additional, external start buttons can be integrated in the logic (operate in parallel).

5. Description of NC - Machine signals

5.1 READY SIGNALS

5.2 Feed drives

5.3 Spindle drive

5. Description of NC - Machine signals

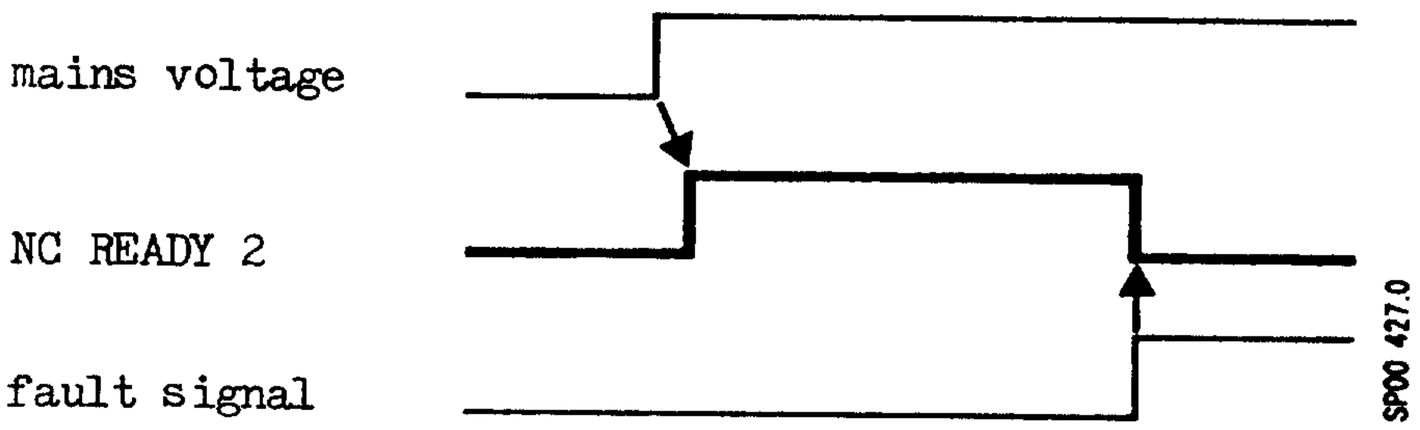
5.1 READY SIGNALS

5.1.1 NC READY 2

	3T	3M
O/P	1	1

"1" signal: following power on and correct voltage levels

"0" signal: a) following temperature increase beyond temperature limit 2 in the SINUMERIK (fault signal)
b) actuation of undervoltage monitoring
c) actuation of overvoltage monitoring
d) actuation of measuring circuit monitoring
e) actuation of processor monitoring



Attention:

The output signal NC READY 2, which also contains the processor monitoring, is output via the first command value cable on the measuring circuit board 03320.
The signal must be used to stop all movements influenced by the NC immediately (signal processing via relays and contactors, fault = 0-signal).

Application notes:

When temperature limit 2 is exceeded or the undervoltage or overvoltage monitoring circuits are actuated the control is switched off and thus all functions in the buffer and active stores are cancelled.

The NC is ready for operation only when power is switched on again. Actuation of the measuring circuit monitoring effects rapid deceleration of the feed drives and the spindle with S analog. The resulting alarms are cleared using RESET. At the same time all functions in the buffer and active stores are cancelled.

In addition to this NC READY 2 signal outputted to the interface section NC - Machine, a similar signal (without processor monitoring) is outputted to the interface section interface control/PC.

5.1.2 VELOCITY CONTROLLER READY

	3T	3M
I/P	1	1

The input signal applies to all axes and the spindle (for S analog) and monitors all drive controllers.

It is transmitted by the 1st command value cable and is received by the measuring circuit module 03320.

"1" signal: velocity controller is ready

"0" signal: effects rapid deceleration of all drives.
Alarm no. 222 is registered.

If the VELOCITY CONTROLLER READY signal is not used, the appropriate input must be permanently switched to 24 V.

5.2 Feed drives

5.2.1 VELOCITY COMMAND VALUE

	3T	3M
O/P	2	4

Polarity of command value voltage:

PLUS (positive) voltage: effects traverse in direction of increasing coordinate values PLUS

MINUS (negative) voltage: effects traverse in direction of decreasing coordinate values MINUS

The velocity command value is a pure d.c. voltage. Normally no additional circuitry is necessary.

Note: The speed command value is switched to 0 V when the processor monitoring is activated.

5.2.2 * CONTROLLER INHIBIT

	3T	3M
O/P	2	4

The axis dependent enable signals (3.7.3) from the interface control are processed logically in the NC and outputted to the servo controllers.

"0" signal: thyristor pulses blocked

"1" signal: thyristor pulses enabled

In the case of machines with no mechanical clamps the controller enable signals must be normally permanently available.

Permitted exception:

Traverse onto a final limit switch (3.11).

Note: CONTROLLER INHIBIT is not removed when the processor monitoring is activated.

In the case of machines with axis clamping the controller enable signal for the clamped axis is removed for the duration of clamping.

E. STOP (3.6.1) or actuation of the measuring circuit monitoring for the associated axis causes immediate stopping of the feed drives using max. braking current. The axes not involved in the measuring circuit actuation are braked in the normal way. 1ms to 32767 ms after initiation of the braking process all "0" signals to the drive controller for the associated axis become active. For as long as the E. STOP situation applies the axes cannot be traversed.

When controller enable (3.7.3) is removed from an axis in motion this is interpreted as E. STOP and causes immediate braking of the drive for this axis at maximum braking current. All other axes are braked in the normal way.
1 ms to 36767 ms after initiation of the braking process the "0" signal to the servo controller of the appropriate axis, i.e. the axis whose enable was removed by the interface control, becomes active.
All other axes can be traversed once the braking process has been completed.

Deceleration distances and following error are detected in the control in such a way that the actual position data store contains the machine position data after the braking process. Re-synchronising the axes (return to datum) is not necessary.

5.3 Spindle drive

5.3.1 SPEED COMMAND VALUE

	3T	3M
O/P	1	1

Control of the main spindle rotation direction results directly from the NC using the programming functions M03, M04;

or for spindle control via the interface control/PC from the signal "Spindle rotation clockwise command" (3.9.4).

The speed command value is a pure d.c. voltage.
Normally no extra circuitry is required.

The following polarity assignment is recommended for the command value voltage:

PLUS (positive) voltage: clockwise M03

MINUS (negative) voltage: anti-clockwise M04

5.3.2 * CONTROLLER INHIBIT

	3T	3M
O/P	1	1

"O" signal: thyristor pulses blocked
comes when Spindle enable (3.9.3) removed;
Programmed spindle stop M05;
E. STOP (3.6.1);
Actuation of measuring circuit monitoring

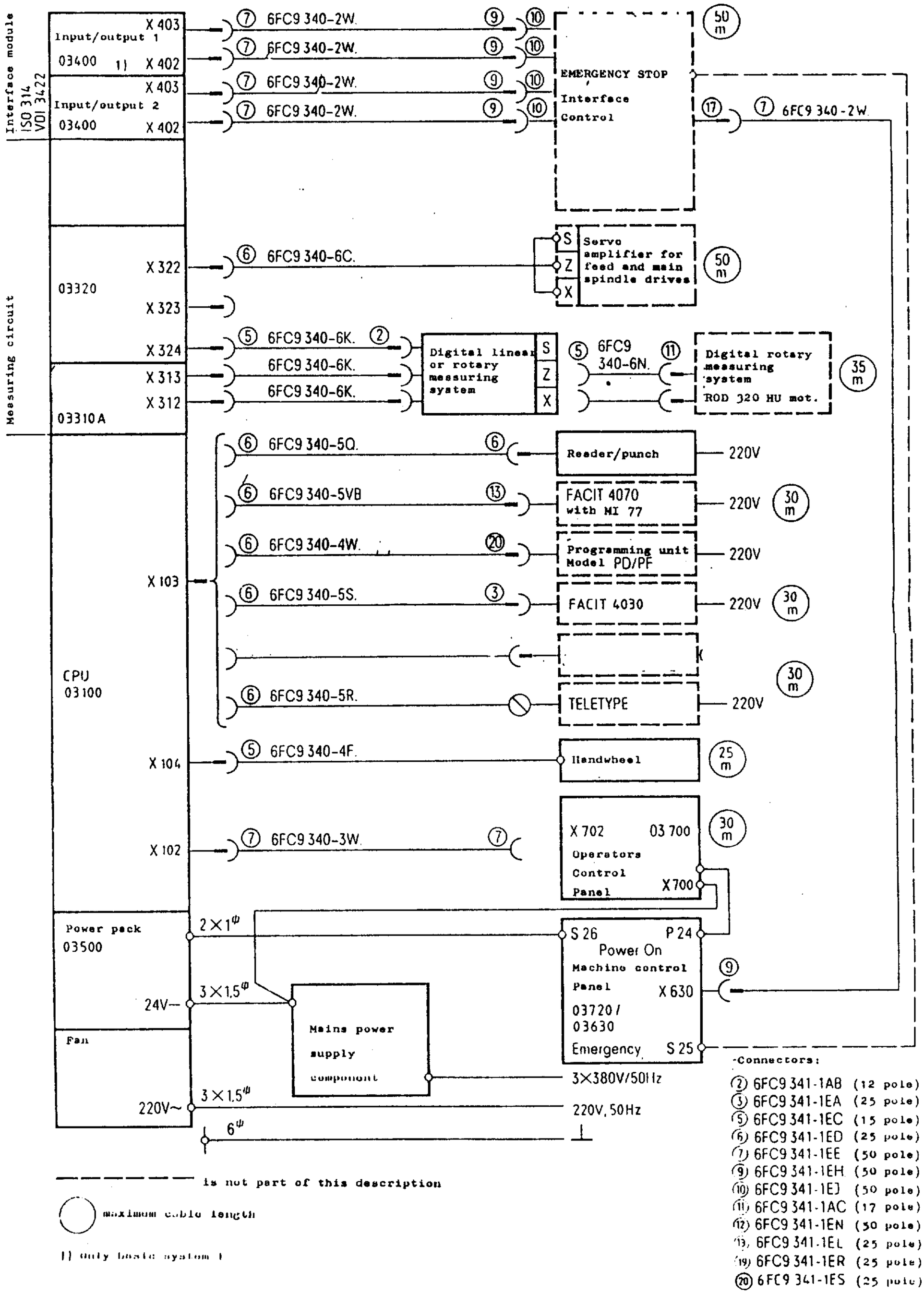
Following output of a command value voltage corresponding to speed = 0 and a delay time adjustable between 1 ms and 32767 ms.
At the same time a command value voltage of 0 V is outputted.

"1" signal: thyristor pulses enabled
comes when Main spindle drive is enabled.

6. Summary of equipment and cables

6. Summary of equipment and cables

6.1 SINUMERIK 3T - Basic systems 0,1



———— is not part of this description

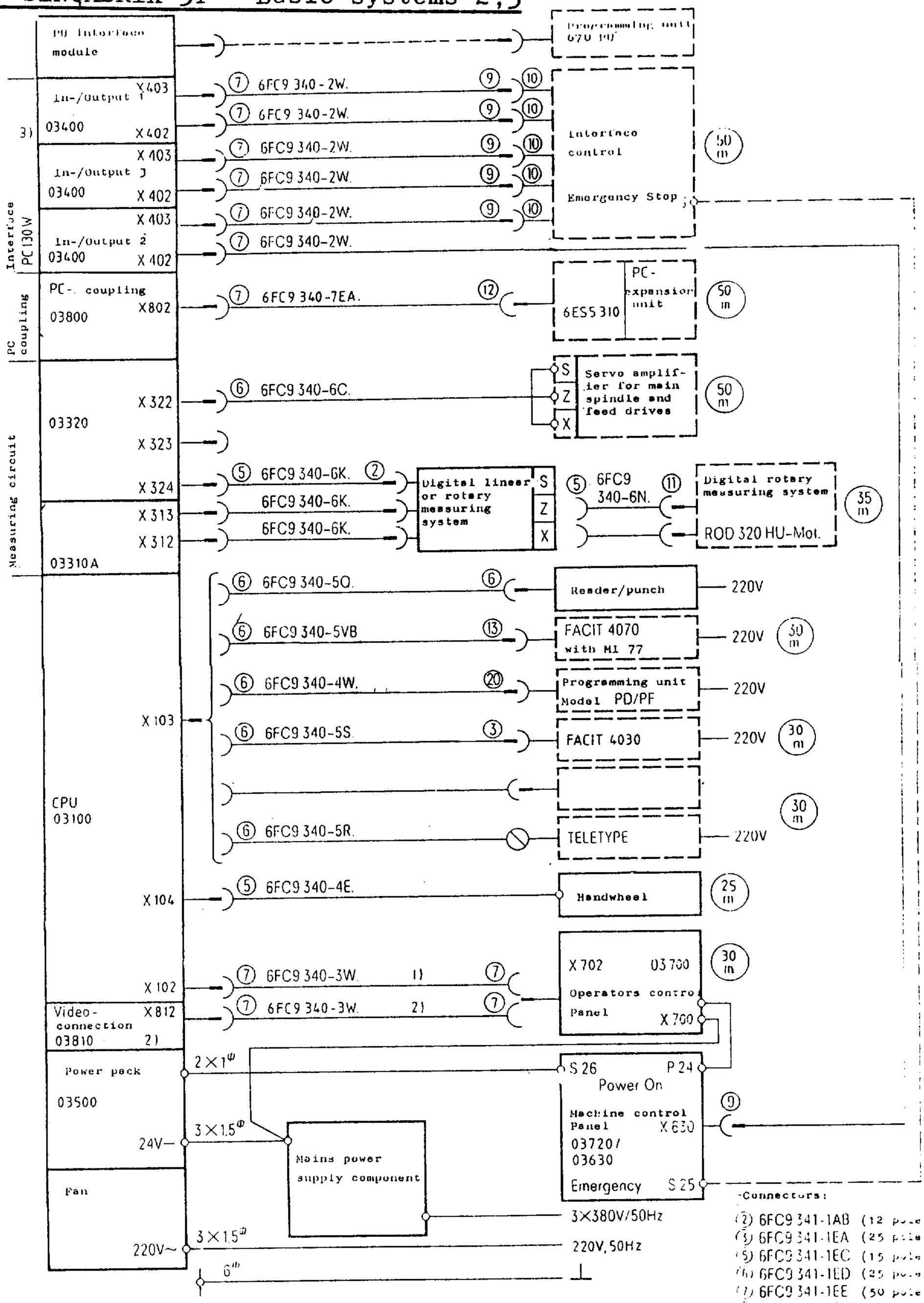
◯ maximum cable length

1) only basic system 1

-Connectors:

② 6FC9 341-1AB (12 pole)
③ 6FC9 341-1EA (25 pole)
⑤ 6FC9 341-1EC (15 pole)
⑥ 6FC9 341-1ED (25 pole)
⑦ 6FC9 341-1EE (50 pole)
⑨ 6FC9 341-1EH (50 pole)
⑩ 6FC9 341-1EJ (50 pole)
⑪ 6FC9 341-1AC (17 pole)
⑫ 6FC9 341-1EN (50 pole)
⑬ 6FC9 341-1EL (25 pole)
⑲ 6FC9 341-1ER (25 pole)
⑳ 6FC9 341-1ES (25 pole)

6.2 SINUMERIK 3T - Basic systems 2,3



——— is not part of this description

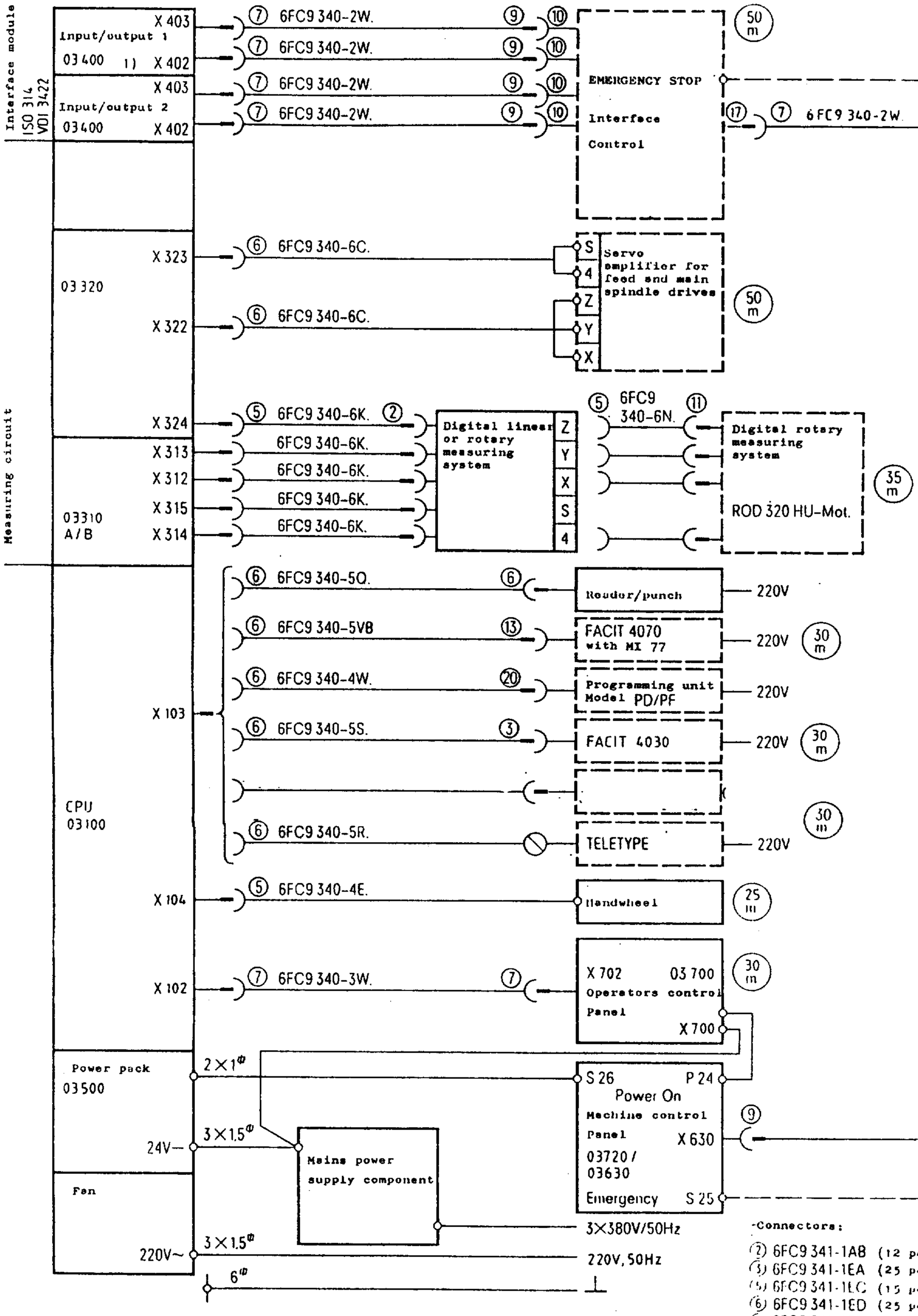
( ) maximum cable length

1) Only with basic system 2
2) Only with basic system 3
3) Maximum of 4 in-/output boards possible; see section 1.2

-Connectors:

(2) 6FC9 341-1AB (12 pole)
(3) 6FC9 341-1EA (25 pole)
(5) 6FC9 341-1EC (15 pole)
(6) 6FC9 341-1ED (25 pole)
(7) 6FC9 341-1EE (50 pole)
(9) 6FC9 341-1EH (50 pole)
(10) 6FC9 341-1EJ (50 pole)
(11) 6FC9 341-1AC (17 pole)
(12) 6FC9 341-1EN (50 pole)
(13) 6FC9 341-1EL (25 pole)
(19) 6FC9 341-1ER (25 pole)
(20) 6FC9 341-1ES (25 pole)

6.3 SINUMERIK 3M - Basic systems 0,1



- - - - - - - - is not part of this description

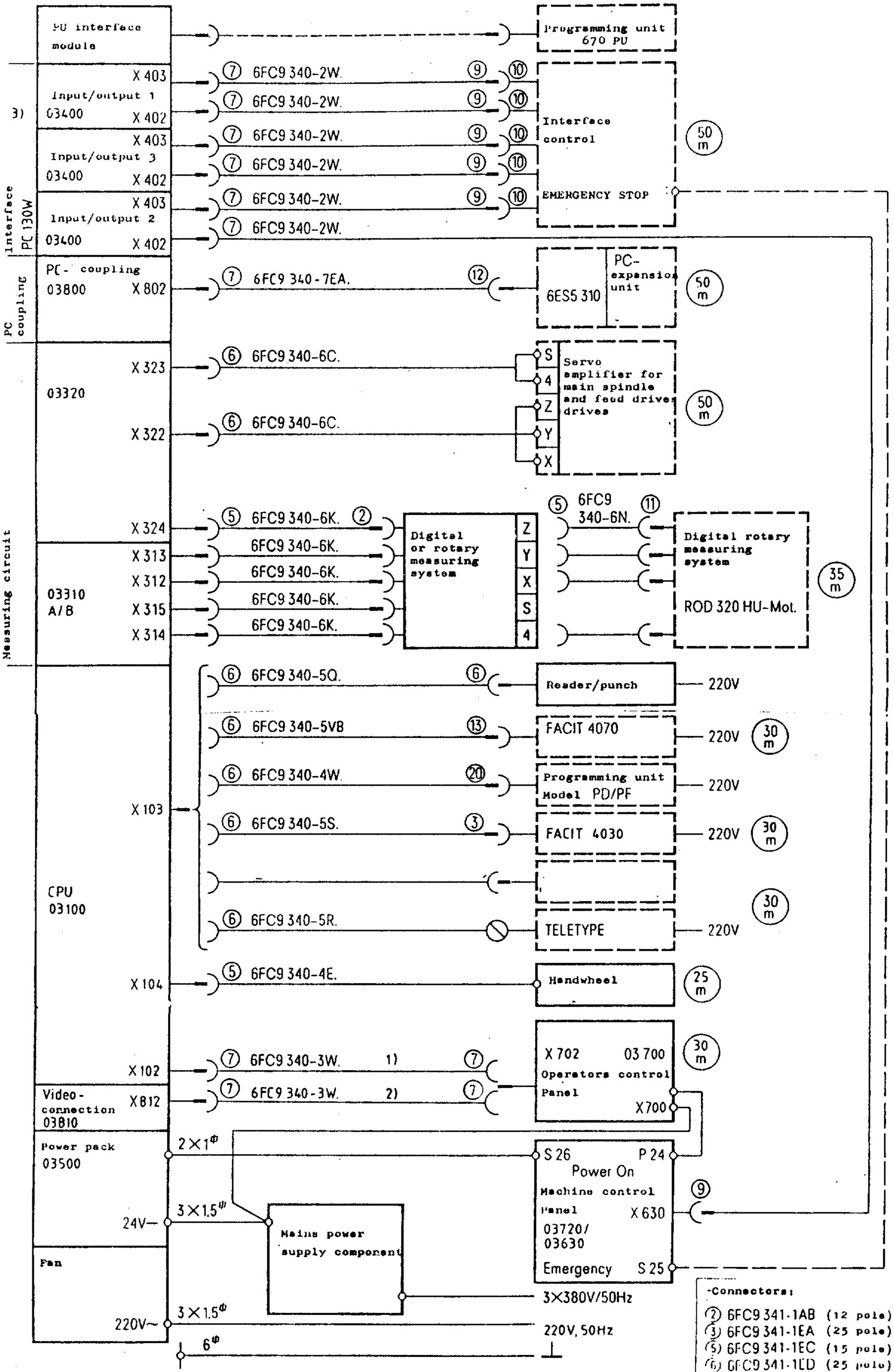
○ maximum cable length

1) Only basic system 1

-Connectors:

(2) 6FC9 341-1AB (12 pole)
(3) 6FC9 341-1EA (25 pole)
(5) 6FC9 341-1EC (15 pole)
(6) 6FC9 341-1ED (25 pole)
(7) 6FC9 341-1EE (50 pole)
(9) 6FC9 341-1EH (50 pole)
(10) 6FC9 341-1EJ (50 pole)
(11) 6FC9 341-1AC (17 pole)
(12) 6FC9 341-1EN (50 pole)
(13) 6FC9 341-1EL (25 pole)
(19) 6FC9 341-1ER (25 pole)
(20) 6FC9 341-1ES (25 pole)

6.4 SINUMERIK 3M -- Basic systems 2,3



-Connectors:

(2) 6FC9 341-1AB (12 pole)
(3) 6FC9 341-1EA (25 pole)
(5) 6FC9 341-1EC (15 pole)
(6) 6FC9 341-1ED (25 pole)
(7) 6FC9 341-1EE (50 pole)
(9) 6FC9 341-1EH (50 pole)
(10) 6FC9 341-1EJ (50 pole)
(11) 6FC9 341-1AC (17 pole)
(12) 6FC9 341-1EN (50 pole)
(13) 6FC9 341-1EL (25 pole)
(19) 6FC9 341-1ER (25 pole)
(20) 6FC9 341-1ES (25 pole)

---------- is not part of this description

○ maximum cable length

1) Only with basic system 2
2) Only with basic system 3
3) Maximum of 4 in-/output boards possible; see section 7.2

6.5 Accessories - Cables

Required accessories	max. permissible length	Order no.
Complete cables		
For handwheel length 5 m length 10 m	15 m	 6FC9 340-4FB 6FC9 340-4FC
To reader/punch SIEMENS PT80 length 5 m length 10 m	30 m	 6FC9 340-5QB 6FC9 340-5QC
To Teletype length 5 m length 10 m	30 m	 6FC9 340-5RB 6FC9 340-5RC
To FACIT 4030 length 5 m	30 m	 6FC9 340-5SB
To FACIT - punch length 5 m	30 m	 6FC9 340-5VB
To operators panel (CRT or display) length 5 m length 10 m	25 m	 6FC9 340-3WB 6FC9 340-3WC
To servo controllers and thyristor controller for main spindle length 5 m length 10 m	50 m	 6FC9 340-6CB 6FC9 340-6CC

Required accessories	max. permissible length	Order no.
Complete cables		
<u>To digital measuring system e.g. ROD 426.009</u>	35 m	6FC9 340-6KB
Length 5 m		6FC9 340-6KB
Length 10 m		6FC9 340-6KC
Length 18 m		6FC9 340-6KE
Length 25 m		6FC9 340-6KF
<u>To interface control</u>	50 m	
Length 5 m		6FC9 340-2WB
Length 10 m		6FC9 340-2WC
Length 18 m		6FC9 340-2WE
Length 25 m		6FC9 340-2WF
<u>To digital rotary measuring system ROD 320</u>	35 m	
Length 5 m		6FC9 340-6NB
Length 10 m		6FC9 340-6NC
Length 18 m		6FC9 340-6NE
Length 25 m		6FC9 340-6NF
<u>To extension unit</u>	50 m	
Length 1 m		6FC9 340-7EA
<u>To programming unit</u>	30 m	
PD/PF (3T) PD (3M)		
Length 5 m		6FC9 340-4WB
Length 10 m		6FC9 340-4WC
<u>To portable tape-reader</u>	30 m	
Length 5 m		6FC9 340-4VB
Length 10 m		6FC9 340-4VC

6.6 Accessories - Cable plugs

Required accessories	Type or supplier	Order no.
Plug		
12 pole plug consisting of: - 6FC9 198-4BF00 plug - 6FC9 198-4FB10 end housing	②	6FC9 341-1AB
Subminiature plug 25 pole	③	6FC9 341-1EA
Subminiature socket -15 pole (complete with housing)	⑤	6FC9 341-1EC
Subminiature socket 25 pole (complete with housing)	⑥	6FC9 341-1ED
Subminiature socket -50 pole (Complete with housing)	⑦	6FC9 341-1EE
Subminiature plug -50 pole (Complete with housing)	⑨	6FC9 341-1EH
Subminiature socket -50 pole (mating plug, solder connection)	⑩	6FC9 341-1EJ
17 pole socket	⑪	6FC9 341-1AC
50 pole socket (complete with housing and positive lock connection)	⑫	6FC9 341-1EN
Subminiature socket -50 pole (mating plug, solder connection)	⑰	6FC9 341-1EQ

6.7 Accessories - Electrical equipment

Required equipment	Type or supplier	Order no.
Equipment		
Pulse generator 1024 p.p. rev. 1)	ROD 426	6FC9 320-1DA
Handwheel	HR 100	6FC9 320-5DA
Encoder 2000 p.p. rev. 1) Encoder 2500 p.p. rev. 1) Encoder 5000 p.p. rev. 1)	ROD 426.009 ROD 426.009 ROD 426.009	6FC9 320-3CA 6FC9 320-3CB 6FC9 320-3CC
Power supply components Primary 3 x 380/415 V 50/60 Hz Secondary + 24 V d.c. 20A or 40A		
supplementary connections: - 20A power supply components: logic/operator panel components parallel interface section or all inputs/outputs for basic system 2		6FC9 304-0AC
- 40A power supply components: supplementary extension equipment		6FC9 304-0AD
Portable tape reader without reels		6FC9 310-0BA
Test board		6FC9 384-0BA

1) Including spring coupling (6MM) and 3 tensioning screws.

7. Cable diagrams 3T/3M

7.1 Cable diagrams 3T

Cable name : PC Extension rack

Order number: 6FC9 340 7EA

Module : 03 800

SINUMERIK 3

		Core Colour	
PADB4	2	1 red/blue	2
*PADB4	3	1 red/red	3
PADB5	4	2 red/green	4
*PADB5	5	2 red/yellow	5
PADB6	6	2 green/blue	6
*PADB6	7	2 green/red	7
PADB7	8	2 green/green	8
*PADB7	9	2 green/yellow	9
PDB6	10	3 white/green	10
*PDB6	11	3 white/yellow	11
PDB7	12	4 white/green	12
*PDB7	13	4 white/yellow	13
PEU+	14	6 red/green	14
PEU-	15	6 red/yellow	15
PADBØ	18	1 red/green	18
*PADBØ	19	1 red/pink	19
PADB1	20	1 red/white	20
*PADB1	21	1 red/brown	21
PADB2	22	2 green/	22
*PADB2	23	2 green/pink	23
PADB3	24	2 green/white	24
*PADB3	25	2 green/brown	25
PDB3	26	3 white/white	26
*PDB3	27	3 white/brown	27
PDB4	28	4 white/white	28
*PDB4	29	4 white/brown	29
PDB5	30	4 white/blue	30
*PDB5	31	4 white/red	31
ZGU+	32	6 red/green	32
ZGU-	33	6 red/pink	33
*PMEMR	34	5 white/white	34
PMEMR	35	5 white/brown	35
*PMEMW	36	5 white/green	36
PMEMW	37	5 white/yellow	37
PESP	38	5 white/grey	38
*PESP	39	5 white/pink	39
BASP	40	5 white/blue	40
*BASP	41	5 white/red	41
PDBØ	42	3 white/grey	42
*PDBØ	43	3 white/pink	43
PDB1	44	3 white/blue	44
*PDB1	45	3 white/red	45
PDB2	46	4 white/grey	46
*PDB2	47	4 white/pink	47
*PRDY	48	6 red/white	48
PRDY	49	6 red/brown	49
			1
			17

Cable with twisted pairs,
screened
$23 \times 2 \times 0{,}09^2$

50 way Submin. Spcket

Casing screen
Socket casing

PC Port X802

Soldering side

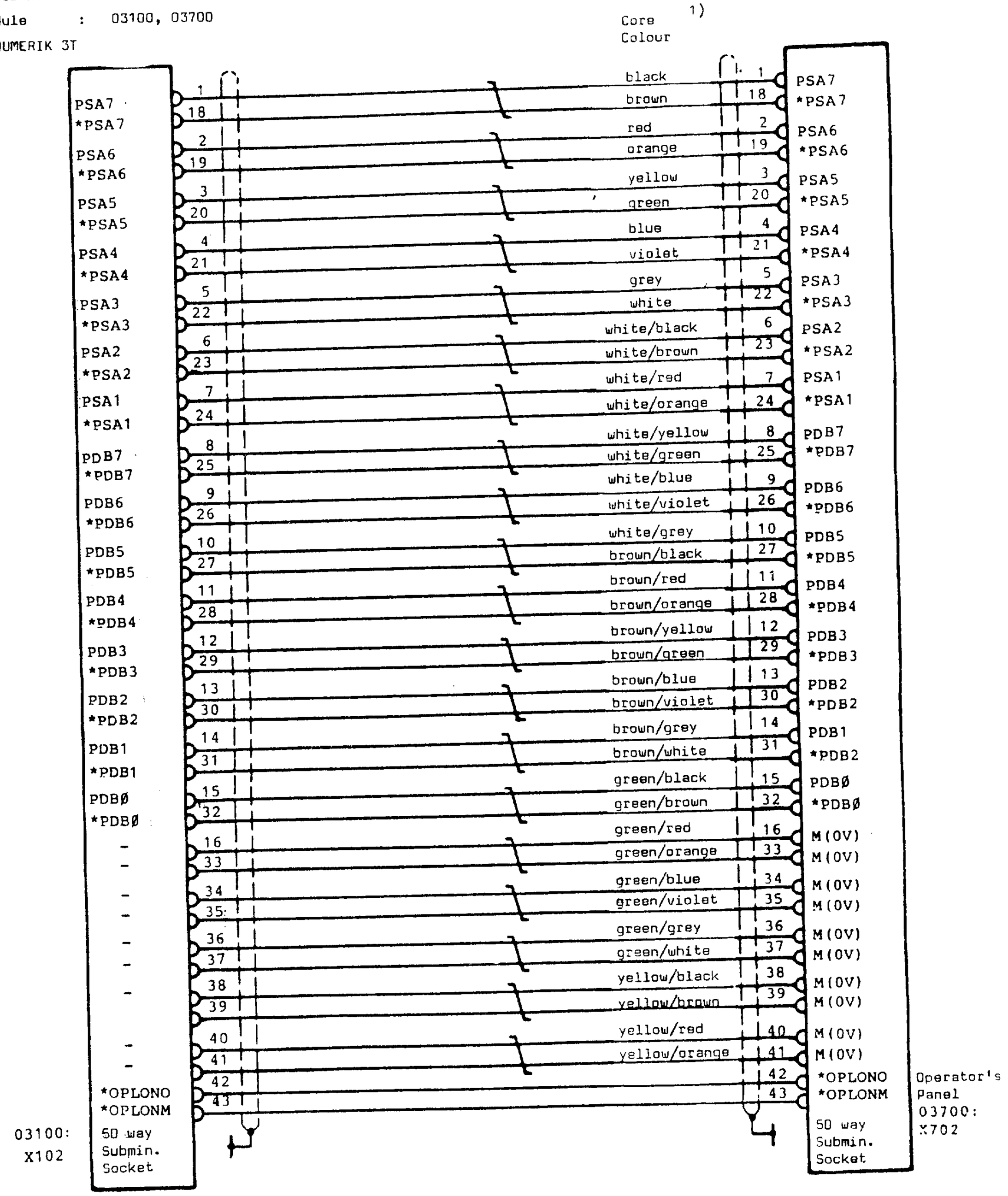
50 way Submin. Socket

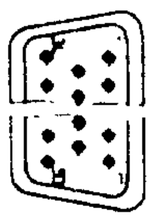
PC Extension rack coupling 6ES5 310

Soldering side

with retaining clip

Cable name : Operator's Panel
Order number: 6FC9 340 3W
Module : 03100, 03700
SINUMERIK 3T

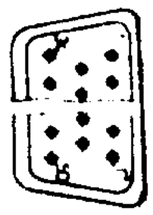




42 Core cable
twisted pairs
screened
21 x 2 x 0,18²

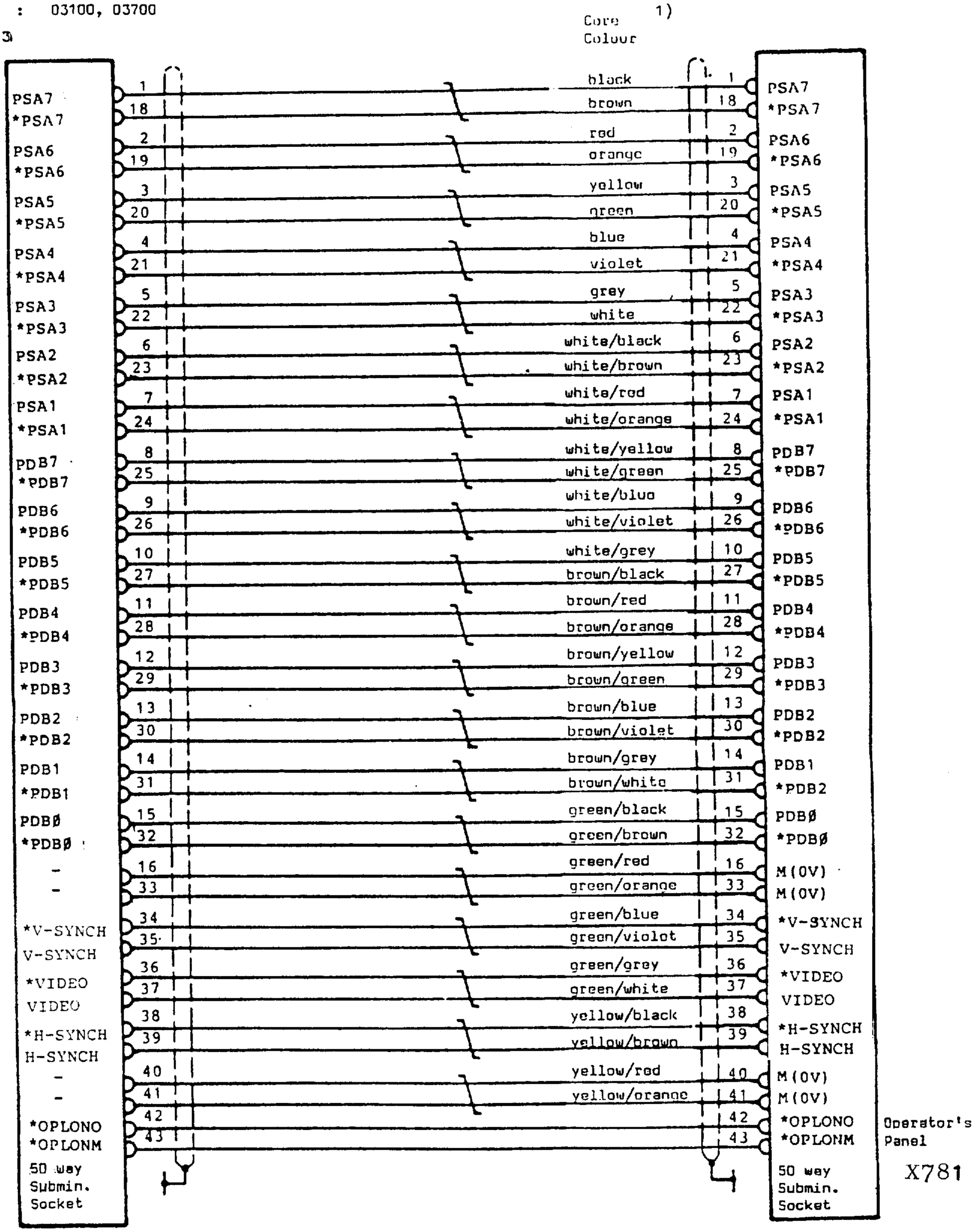
Soldering side

Soldering side



1) See comparison chart page 7 - 40

Cable name : Operator's Panel
Order number: 6FC9 340 3W
Module : 03100, 03700
SINUMERIK 3



42 Core cable
twisted pairs
screened
$21 \times 2 \times 0{,}10^2$

Soldering side

Soldering side

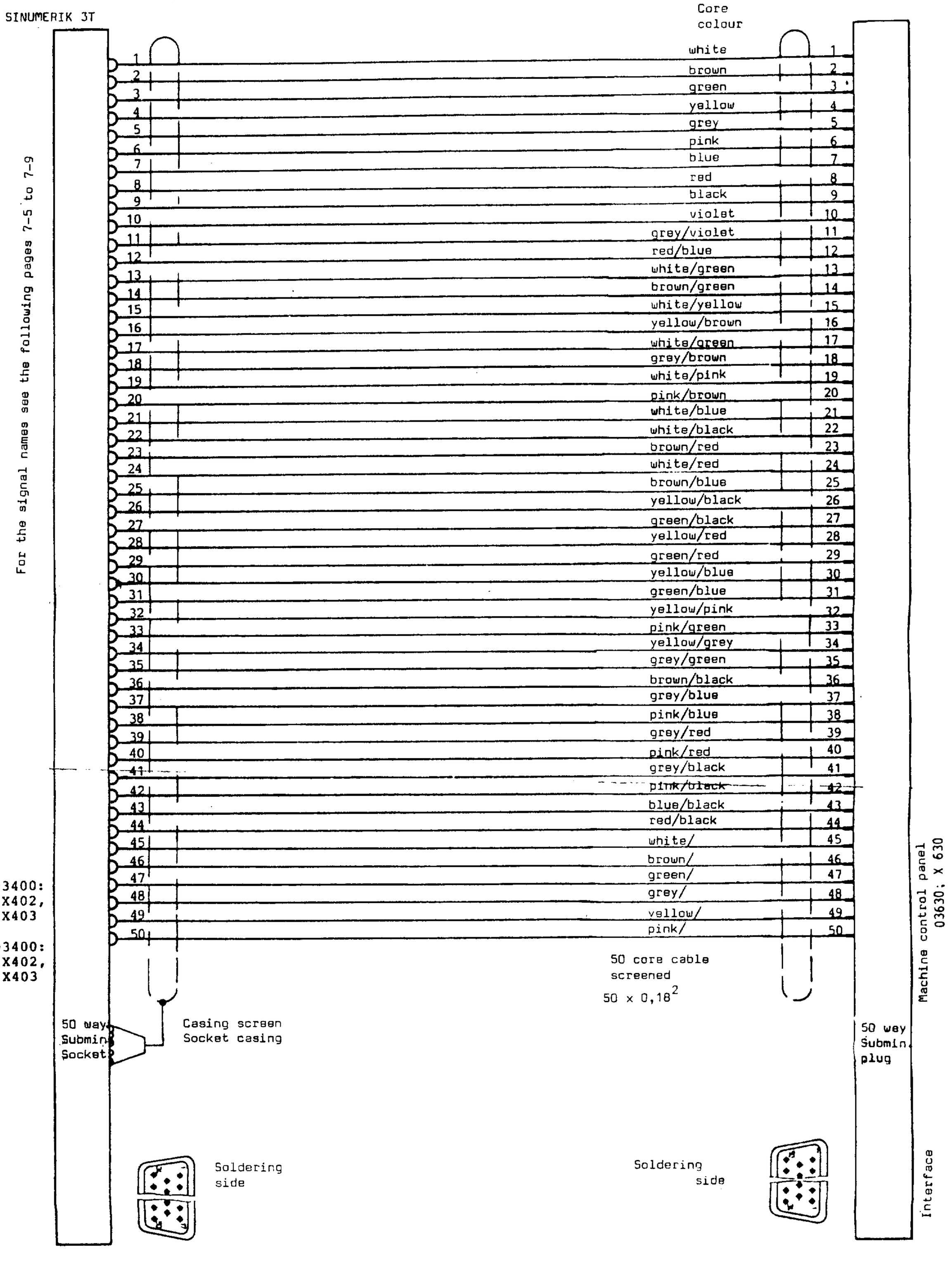
1) See comparison chart page 7 - 40

Cable name ; Interface (Relay)

Order number : 6FC9 340 2W

Module: : 03 630, 03 400

SINUMERIK 3T



Input Port SINUMERIK 3T

Plug connections: X 630

Module: 03 630

Cable: 6FC9 340-2W

Pin					
1	Feed/Rapid traverse Override switch A (4.2.5)			34	
2	Feed/Rapid traverse Override switch B (4.2.5)	18		35	
3	Feed/Rapid traverse Override switch C (4.2.5)	19		36	
4	Feed/Rapid traverse Override switch D (4.2.5)	20	Axis Selector switch A (4.2.6)	37	
5	Mode Select switch A (4.2.3)	21	Axis Selector switch B (4.2.6)	38	
6	Mode Select switch B (4.2.3)	22	Direction Push Button - (4.2.7)	39	
7	Mode Select switch C (4.2.3)	23	Direction Push Button + (4.2.7)	40	
8	Mode Select switch D (4.2.3)	24	Rapid Traverse (4.2.9)	41	
9	Spindle Speed Override switch A (4.2.4)	25	Rapid Traverse Override active (4.2.11)	42	
10	Spindle Speed Override switch B (4.2.4)	26		43	
11	Spindle Speed Override switch C (4.2.4)	27		44	
12	Block Search (4.2.15)	28	Cycle Start (4.2.19)	45	
13	Single Block (4.2.14)	29		46	
14	Block Delete (4.2.13)	30	Feed Enable (4.2.10)	47	
15	Dry Run (4.2.12)	31	* Feed Hold (4.2.18)	48	
16	Key Switch (4.2.16)	32	Spindle Start (4.2.17)	49	
17		33	* Spindle Stop (4.2.17)	50	

Input Port SINUMERIK 3T

Plug Connections: X402

Module: 1.03400 Cable: 6FC9 340-2W

Pin					
1	Feed/Rapid Traverse Override switch A (4.2.5)			34	
2	Feed/Rapid Traverse Override switch B (4.2.5)	18	Controller Enable X (3.7.3)	35	
3	Feed/Rapid Traverse Override switch C (4.2.5)	19	*Creep X (3.7.4)	36	Feed Enable (3.7.2)
4	Feed/Rapid Traverse Override switch D (4.2.5)	20	Direction Push Button Z-	37	Spindle Enable (3.9.3)
5	Mode Select switch A (4.2.3)	21	Direction Push Button Z+	38	Spindle Command C.W. (3.9.4)
6	Mode Select switch B (4.2.3)	22	Direction Push Button X- (4.2.7)	39	Gear Range A (3.9.2)
7	Mode Select switch C (4.2.3)	23	Direction Push Button X+ (4.2.7)	40	Gear Range B (3.9.2)
8	Mode Select switch D (4.2.3)	24	Rapid Traverse (4.2.9)	41	Gear Range C (3.9.2)
9	Spindle Speed Override switch A (4.2.4)	25	Rapid Traverse Override active (4.2.11)	42	
10	Spindle Speed Override switch B (4.2.4)	26	Controller Enable Z (3.7.3)	43	
11	Spindle Speed Override Switch C (4.2.4)	27	*Creep Z (3.7.4)	44	NC without active Operator's Panel (3.6.3)
12	Block Search (4.2.15)	28	NC Start (3.6.2)	45	Axis Lock (3.8.1)
13	Single block (4.2.14)	29	Handwheel Active (4.2.10)	46	Mirror X (3.7.6)
14	Block Delete (4.2.13)	30		47	Mirror Z (3.7.6)
15	Dry Run (4.2.12)	31		48	Read Enable (3.7.1)
16	Key Switch (4.2.16)	32		49	*EM Stop (3.6.1)
17		33		50	

Input Port SINUMERIK 3T

Plug Connections: X402

Module: 2.03400 Cable: 6FC9 340-2W

Pin					
1	External Data Input Code Signal for Mod Signal A (3.10.1)			34	
2	External Data Input Code Signal for Mod Signal B (3.10.1)	18	External Data Input Bit Datum 2nd Byte I (3.10.1)	35	
3	External Data Input Code Signal for Mod Signal C (3.10.1)	19	External Data Input Bit Datum 2nd Byte K (3.10.1)	36	
4	External Data Input Code Signal for Mod Signal D (3.10.1)	20	External Data Input Bit Datum 2nd Byte L (3.10.1)	37	
5	External Data Input Code Signal for Mod Signal E (3.10.1)	21	External Data Input Bit Datum 2nd Byte M (3.10.1)	38	
6		22	External Data Input Bit Datum 2nd Byte N (3.10.1)	39	
7		23	External Data Input Bit Datum 2nd Byte O (3.10.1)	40	
8	Mod Signal for Data Transfer (3.10.1)	24	External Data Input Bit Datum 2nd Byte P (3.10.1)	41	
9	External Data Input Bit Datum for 1st Byte A (3.10.1)	25	External Data Input Bit Datum 2nd Byte Q (3.10.1)	42	
10	External Data Input Bit Datum for 1st Byte B (3.10.1)	26		43	
11	External Data Input Bit Datum for 1st Byte C (3.10.1)	27		44	
12	External Data Input Bit Datum for 1st Byte D (3.10.1)	28		45	
13	External Data Input Bit Datum for 1st Byte E (3.10.1)	29		46	
14	External Data Input Bit Datum for 1st Byte F (3.10.1)	30		47	
15	External Data Input Bit Datum for 1st Byte G (3.10.1)	31		48	
16	External Data Input Bit Datum for 1st Byte H (3.10.1)	32		49	
17		33		50	

Output Port SINUMERIK 3T

Plug Connections: X403

Module: 1.03400

Cable: GFC9 340-2W

Pin					
1	External 24V			34	M (0V) External
2	External 24V	18	Programmed Stop M00 (3.5.4)	35	M (0V) External
3	External 24V	19	Programmed End M02/M30, Reset (3.5.5)	36	
4		20	Threading G33/G63 (3.5.6)	37	
5		21	Rapid Traverse (3.5.6)	38	
6		22	NC Ready 1 (3.4.1)	39	
7		23	NC Ready 2 2 (3.4.2)	40	
8		24		41	
9	Motion Command X (3.4.3)	25	Programming running (3.4.4)	42	
10	Motion Command $\overline{Z}$ (3.4.3)	26	Switching and Auxillary function output BCD 10^0A (3.5.2)	43	
11		27	Switching and Auxillary function output BCD 10^0B (3.5.2)	44	
12		28	Switching and Auxillary function output BCD 10^0C (3.5.2)	45	
13		29	Switching and Auxillary function output BCD 10^0D (3.5.2)	46	
14	Mod. Signal T (3.5.2)	30	Switching and Auxillary function output BCD 10^1A (3.5.2)	47	
15	Mod. Signal S (3.5.2)	31	Switching and Auxillary function output BCD 10^1B (3.5.2)	48	
16	Mod. Signal M (3.5.2)	32	Switching and Auxillary function output BCD 10^1C (3.5.2)	49	
17		33	Switching and Auxillary function output BCD 10^1D (3.5.2)	50	

Output Port SINUMERIK 3T

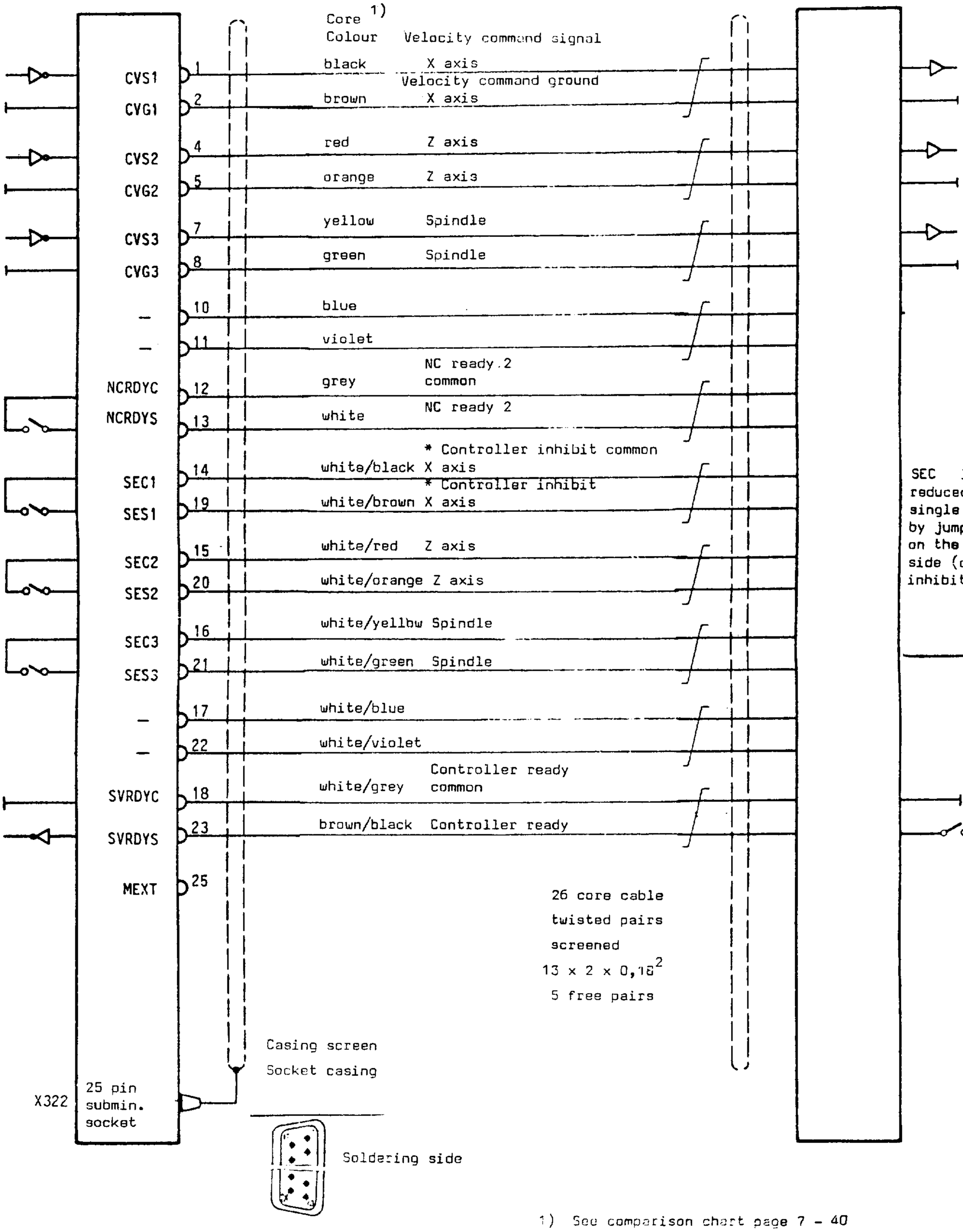
Plug connection: X403

Module: 2.03400

Cable: 6FC9 340-2W

Pin				Pin	
1	External + 24V			34	M (0V) External
2	External + 24V	18		35	M (0V) External
3	External + 24V	19		36	
4		20		37	
5		21		38	
6		22		39	
7		23		40	
8		24		41	
9		25		42	
10		26	Switching and Auxillary function output BCD 10^2A (3.5.2)	43	
11		27	Switching and Auxillary function output BCD 10^2B (3.5.2)	44	
12		28	Switching and Auxillary function output BCD 10^2C (3.5.2)	45	
13		29	Switching and Auxillary function output BCD 10^2D (3.5.2)	46	
14		30	Switching and Auxillary function output BCD 10^3A (3.5.2)	47	
15		31	Switching and Auxillary function output BCD 10^3B (3.5.2)	48	
16		32	Switching and Auxillary function output BCD 10^3C (3.5.2)	49	
17		33	Switching and Auxillary function output BCD 10^3D (3.5.2)	50	

Cable name : Axis/Spindle Drives
Order number: 6FC9 340 6C
Module : 03 320
SINUMERIK 3T



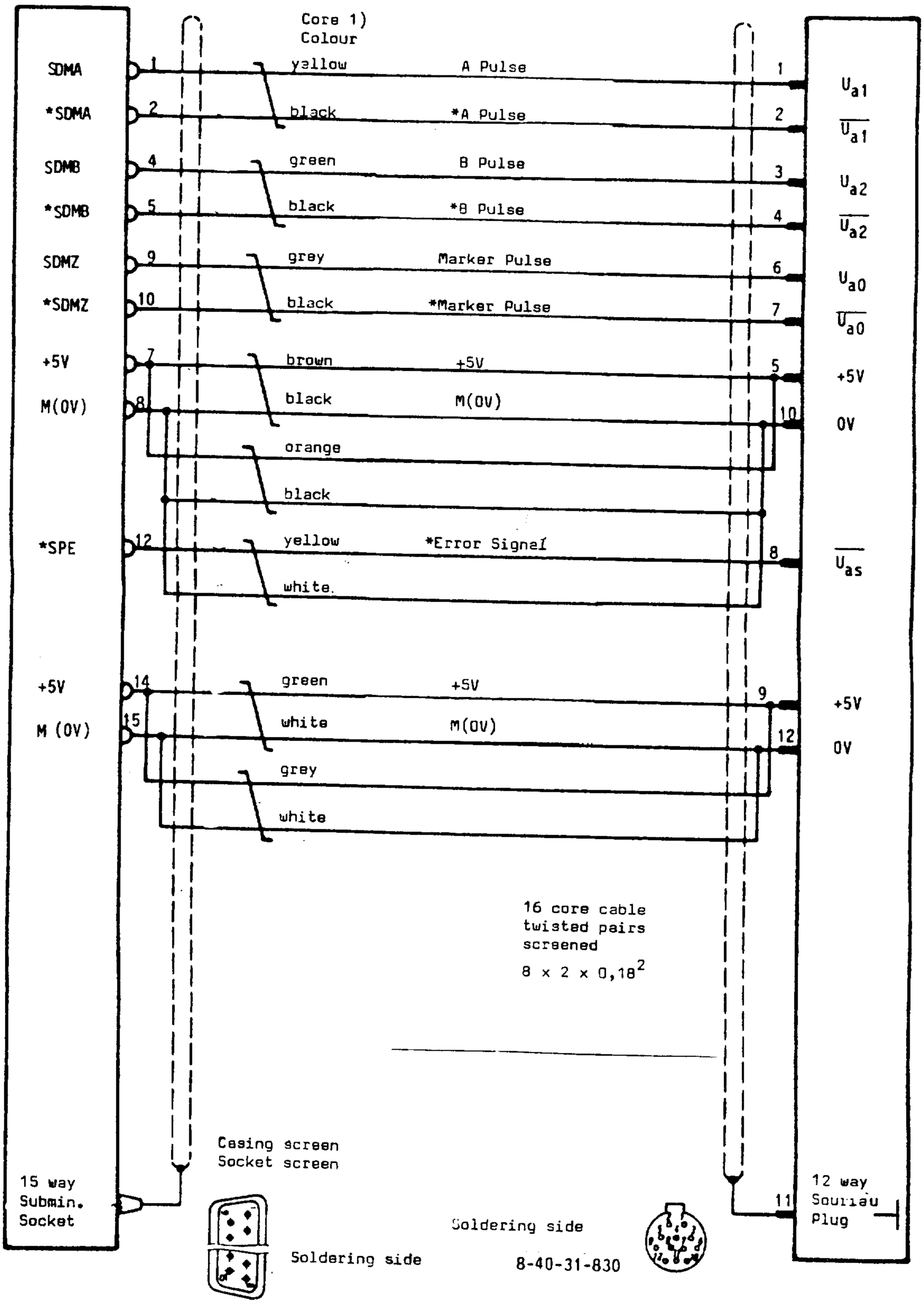
1) See comparison chart page 7 - 40

Cable name : Main spindle encoder/Digital linear or rotary measuring device (as shown up to ca. the end of 1981)

Order number: 6FC9 340 6K

Module : 03 310 320

SINUMERIK 3T



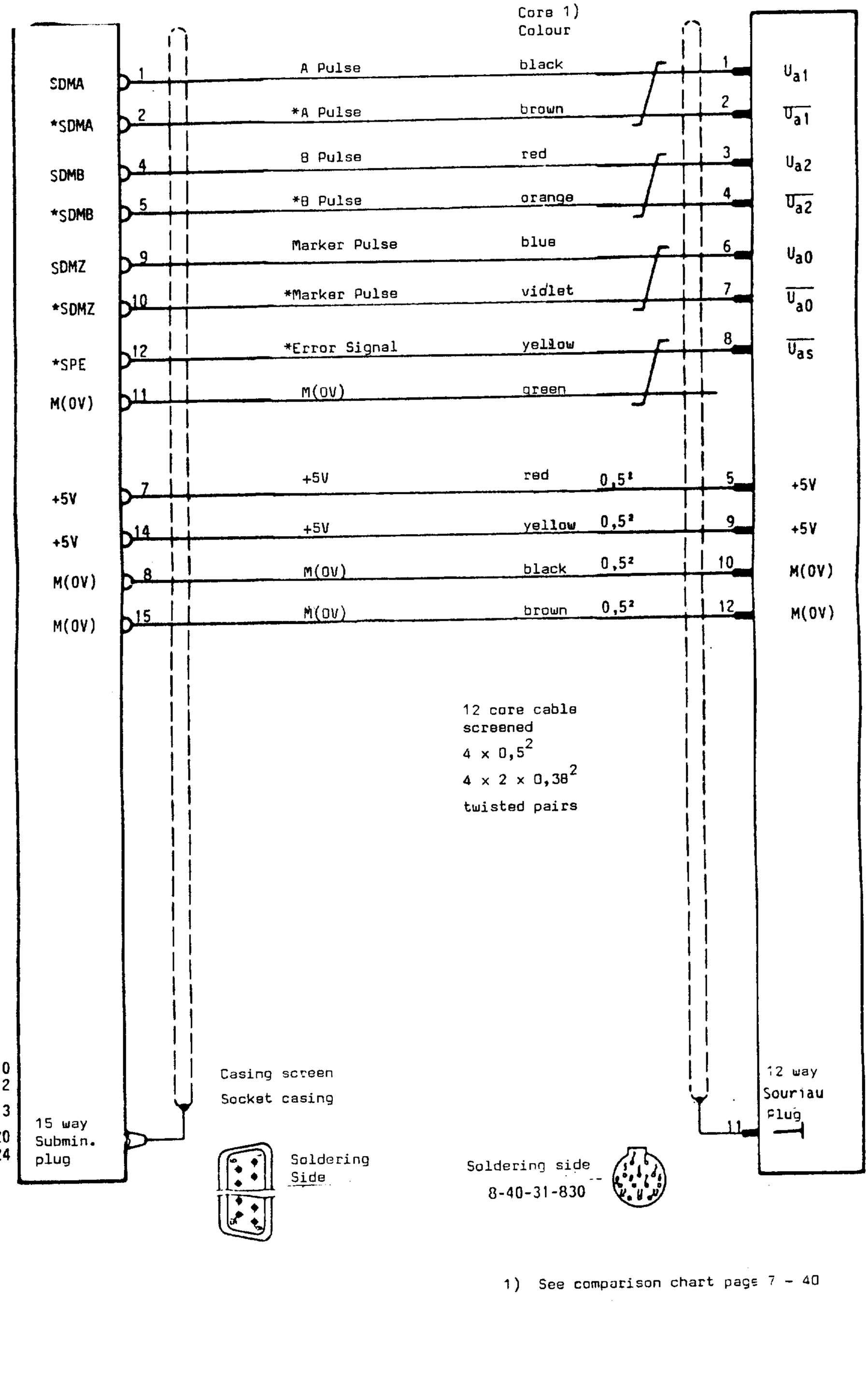
1) See comparison chart page 7 - 40

Cable name : Main spindle encoder /Digital linear or rotary measuring devices (as shown after ca. the beginning of 1982)

Order number: 6FC9 340 6K

Module : 03 310, 03 320

SINUMERIK 3T



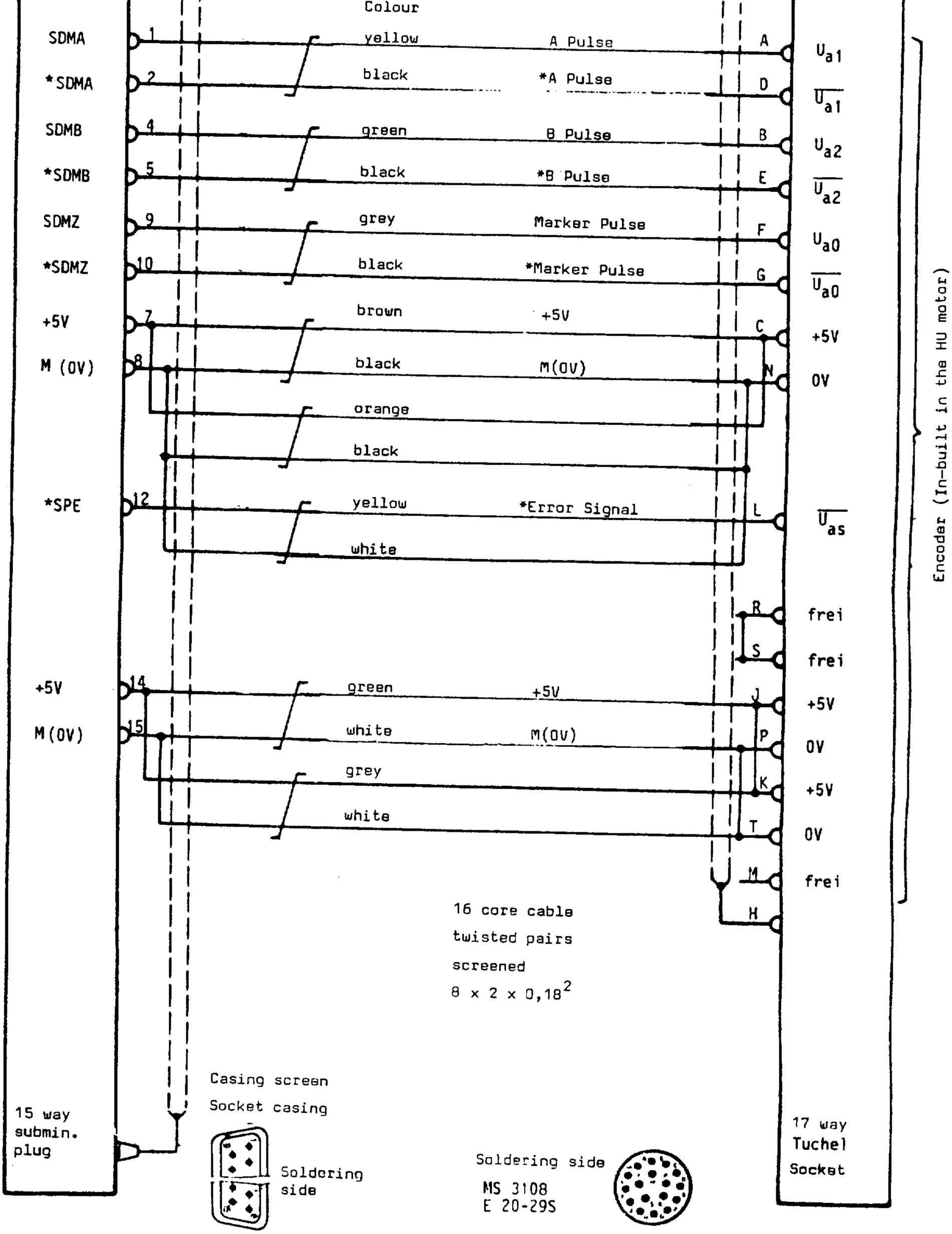
1) See comparison chart page 7 - 40

Cable anme: Digital rotary measuring system (ROD 320) As shown up to ca. the end of 1981

Order number: 6FC9 340 6N

Module: 03 310

SINUMERIK 3T



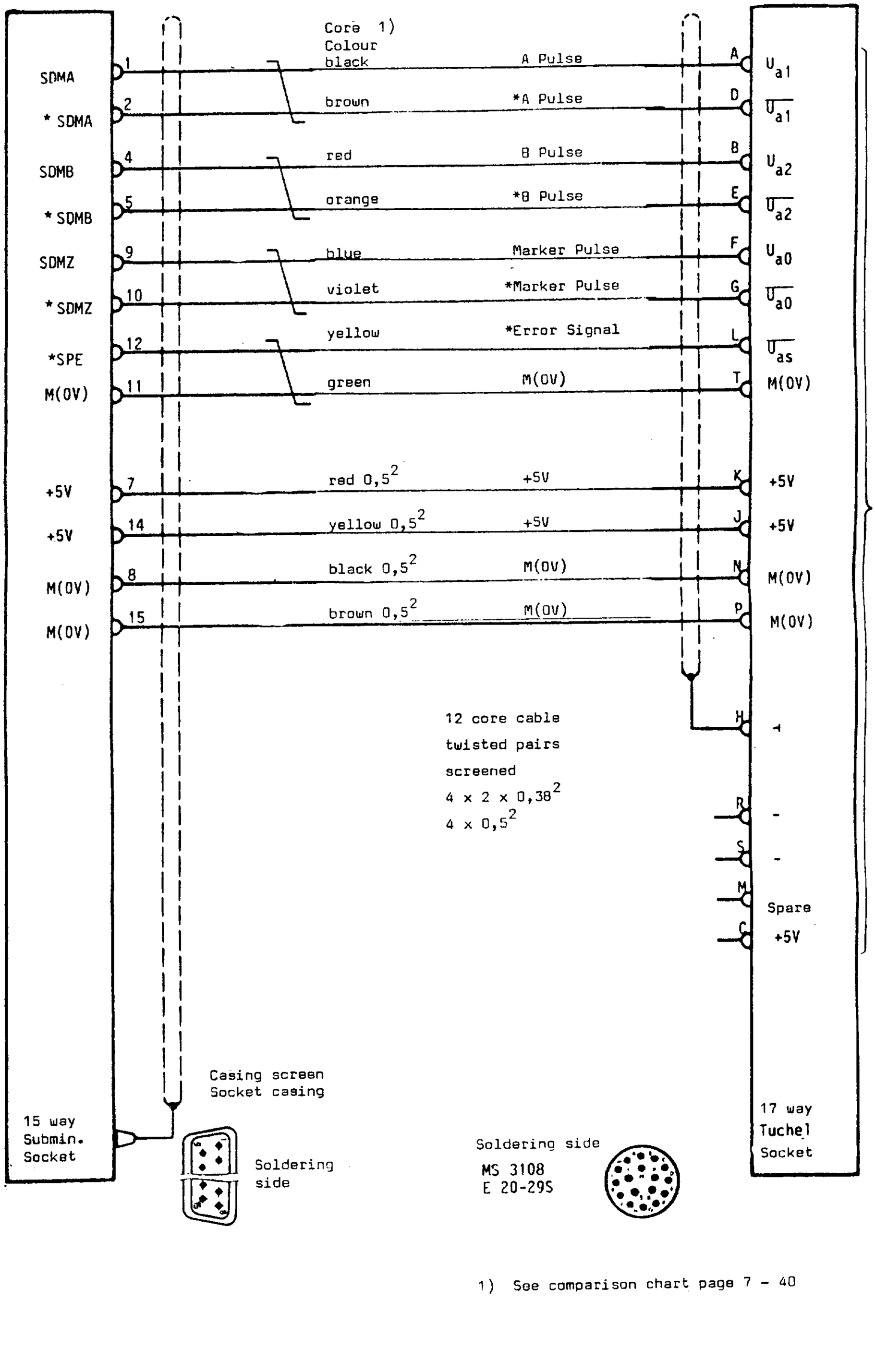
1) See comparison chart page 7 - 40

Cable name : Digital rotary measuring system (ROD 320) (As shown after ca. the beginning of 1982)

Order number: 6FC9 340 6N

Module : 03 310

SINUMERIK 3T



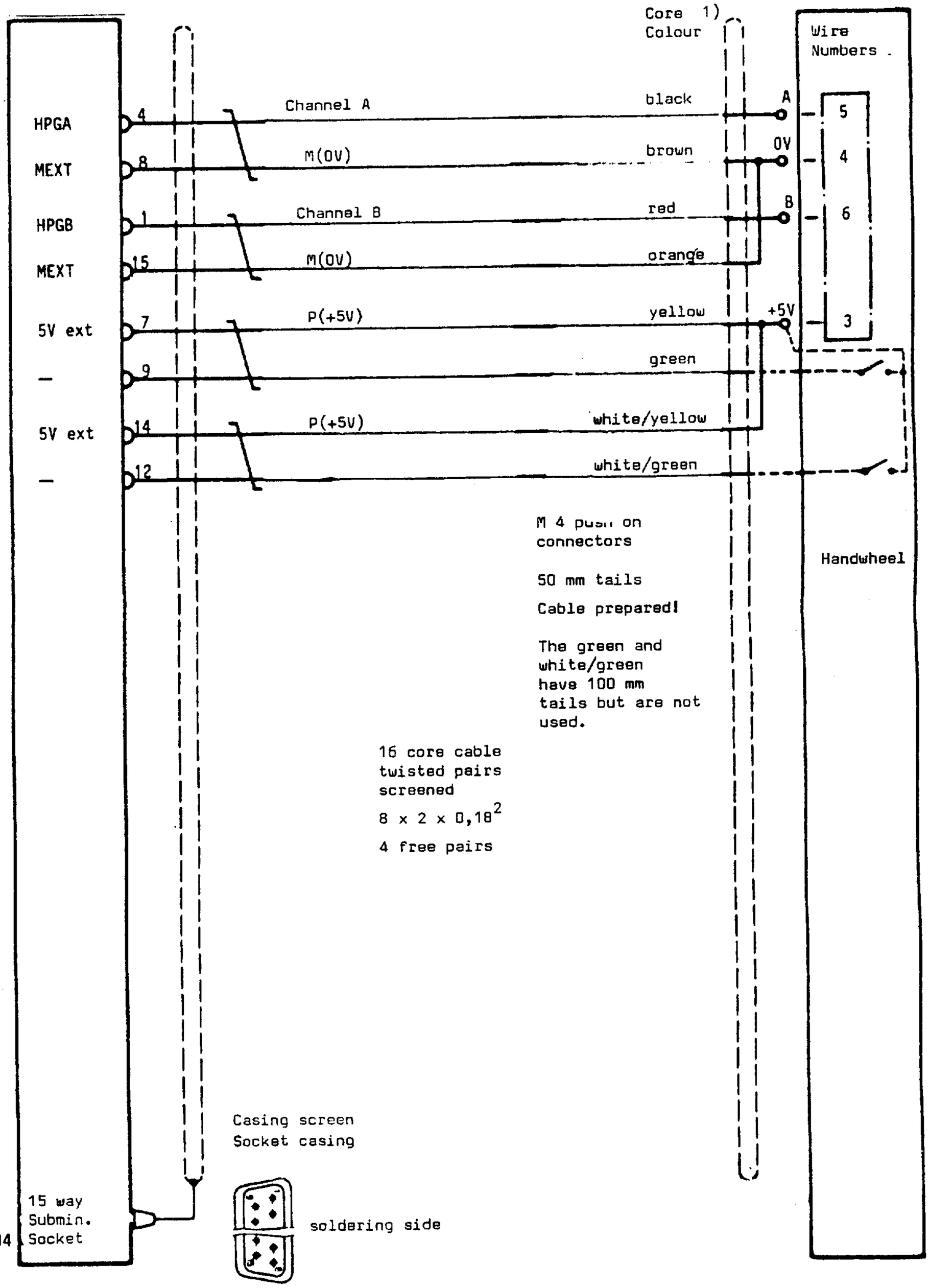
1) See comparison chart page 7 - 40

Cable name: Handwheel

Order number: 6FC9 340 4E

Module : 031 00

SINUMERIK 3T



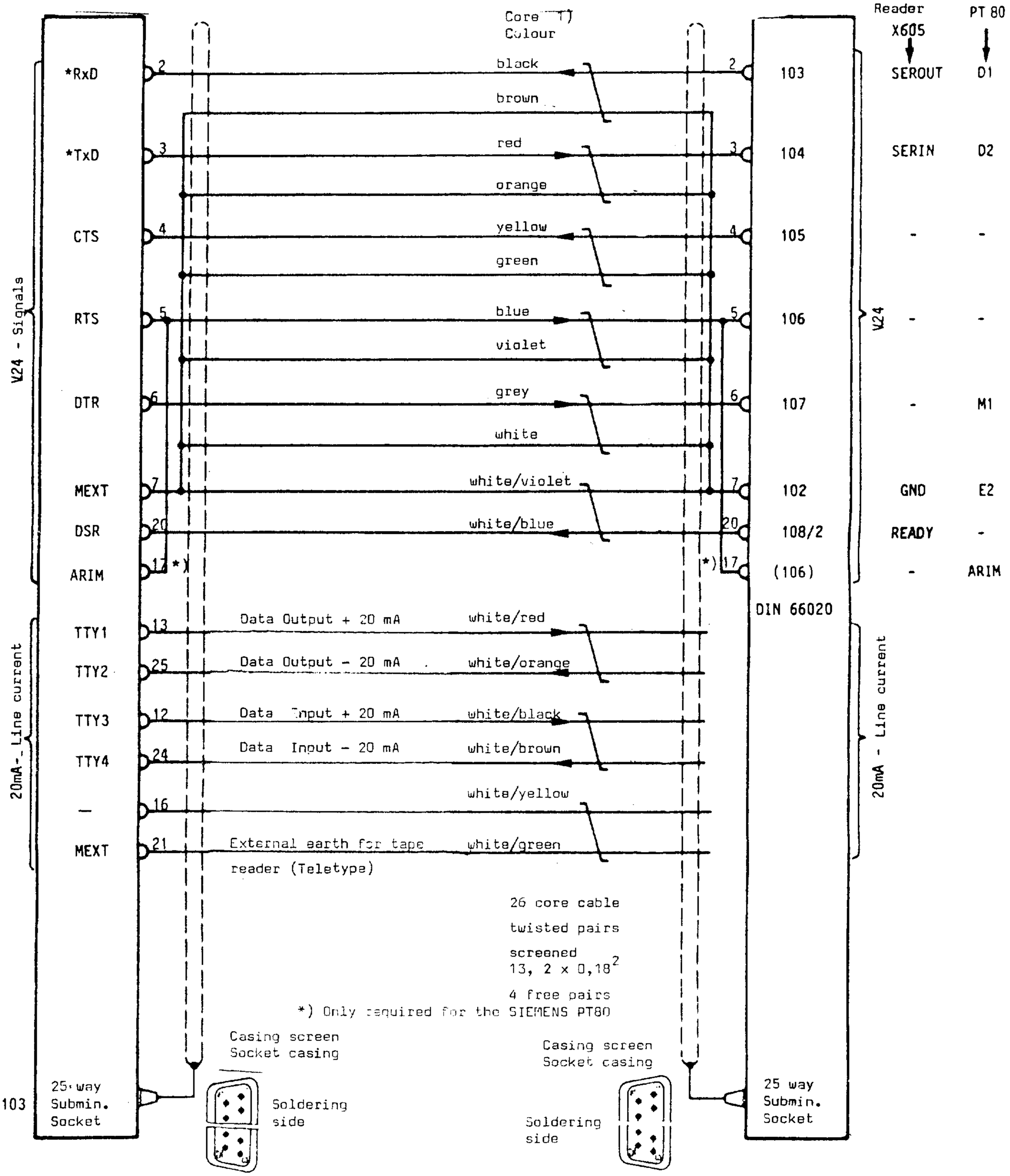
1) see comparison chart page 7 - 40

Cable name : Serial data transfer (V24, 20 mA line current)

Order number: 6FC9 340 5Q

Module : 0 3 100

SINUMERIK 3T

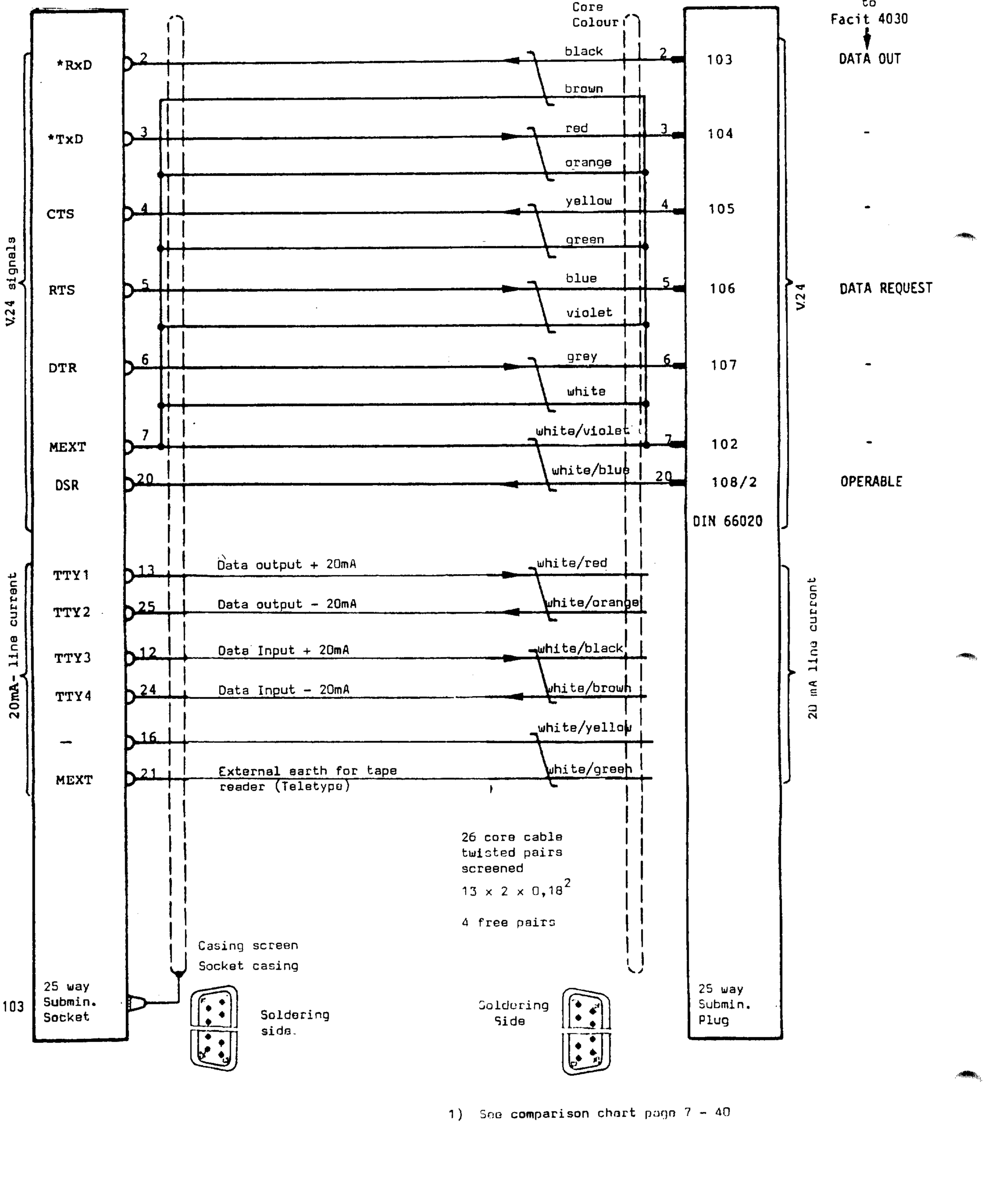


1) See comparison chart page 7 - 40

Cable name: Serial data transfer

Order number: 6FC9 340-5S

Module: 03 100
SINUMERIK 3T



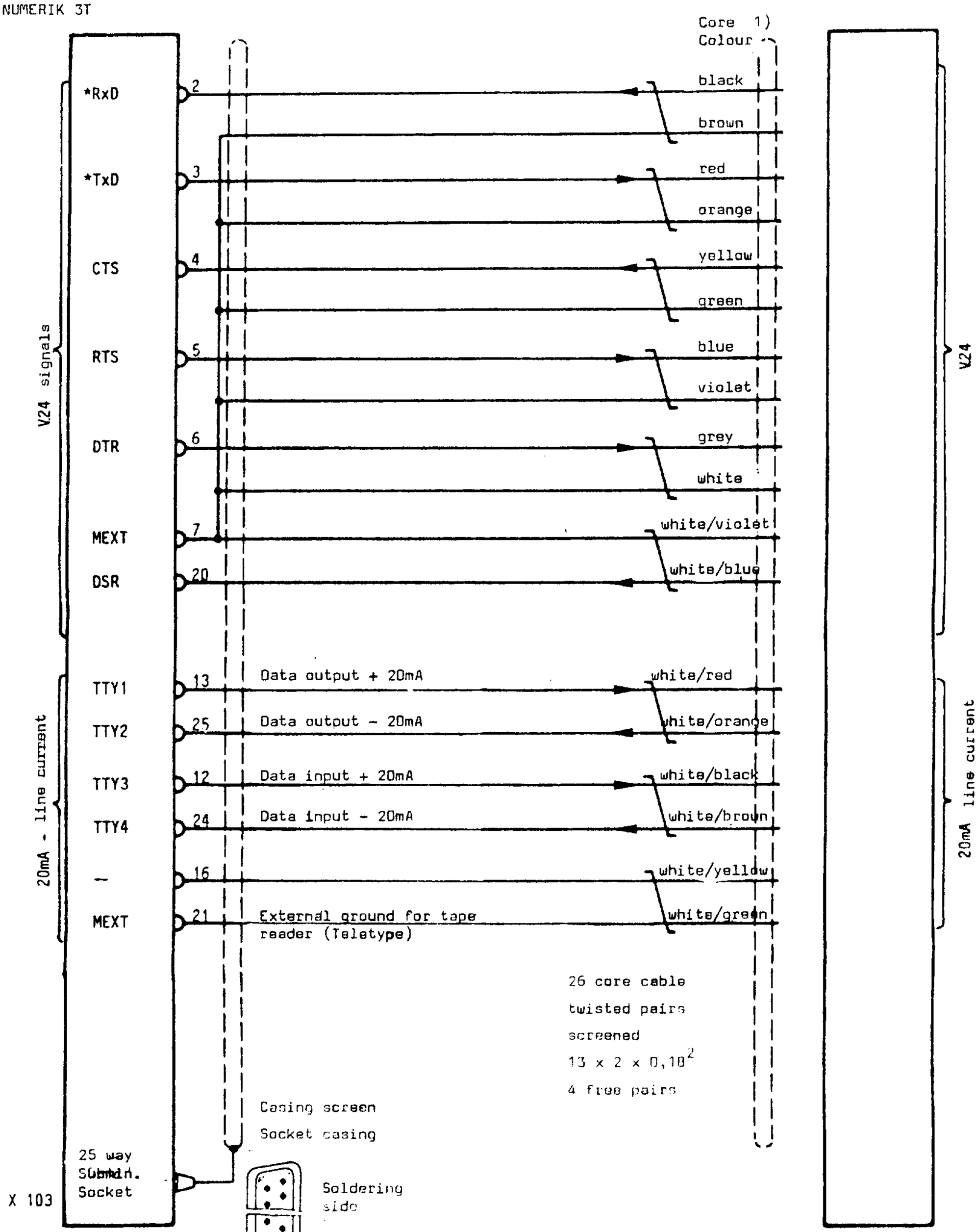
1) See comparison chart page 7 - 40

Cable name : Serial data transfer (V24, 20mA line current)

Order number: 6FC9 340-5R

Module: 03 100

SINUMERIK 3T



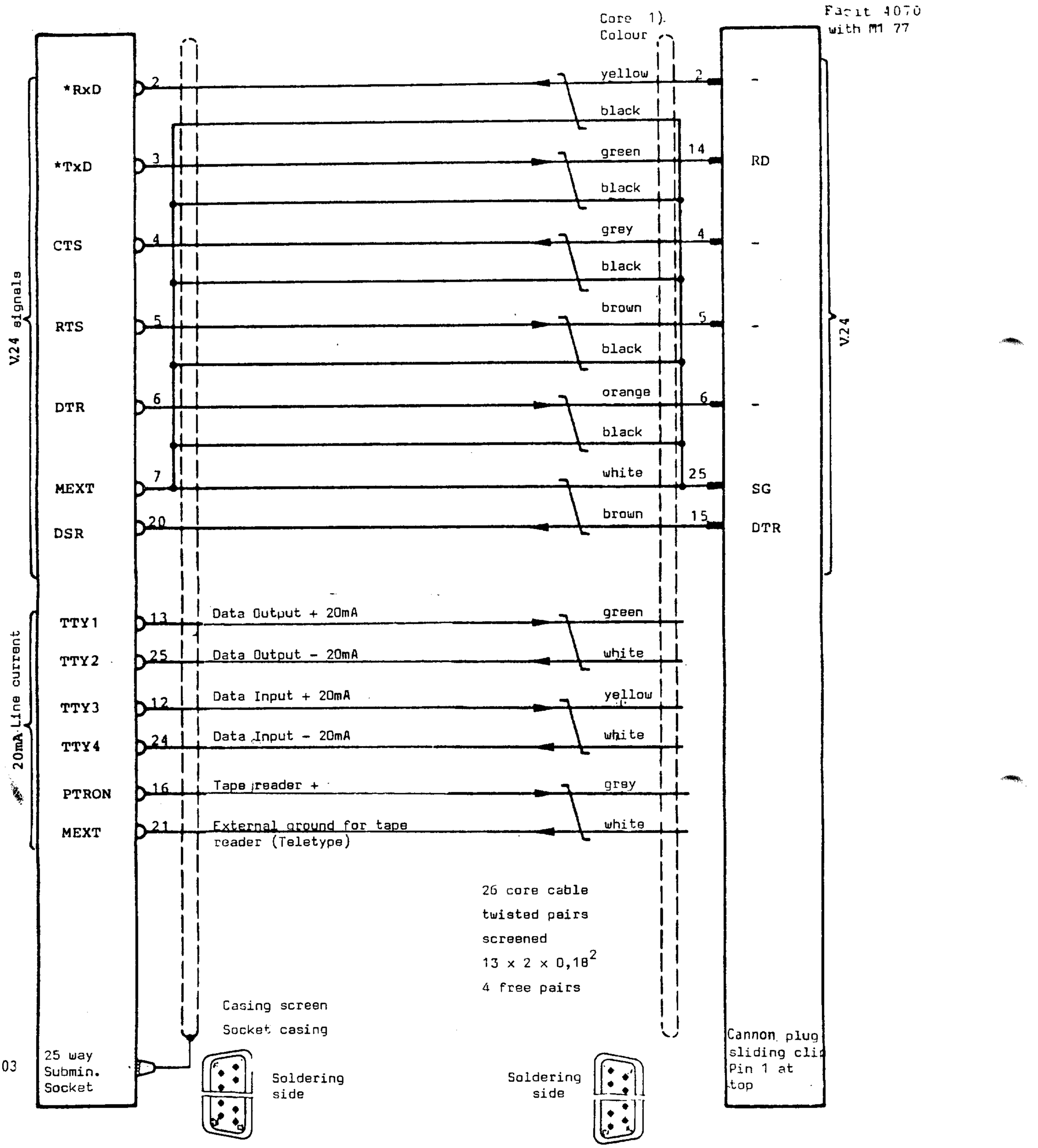
1) See comparison chart page 7 - 40

Cable name: Serial data transfer

Order number: 6FC9 340-5V8

Module:

SIEMENS AT



1) See comparison chart page 7 - 40

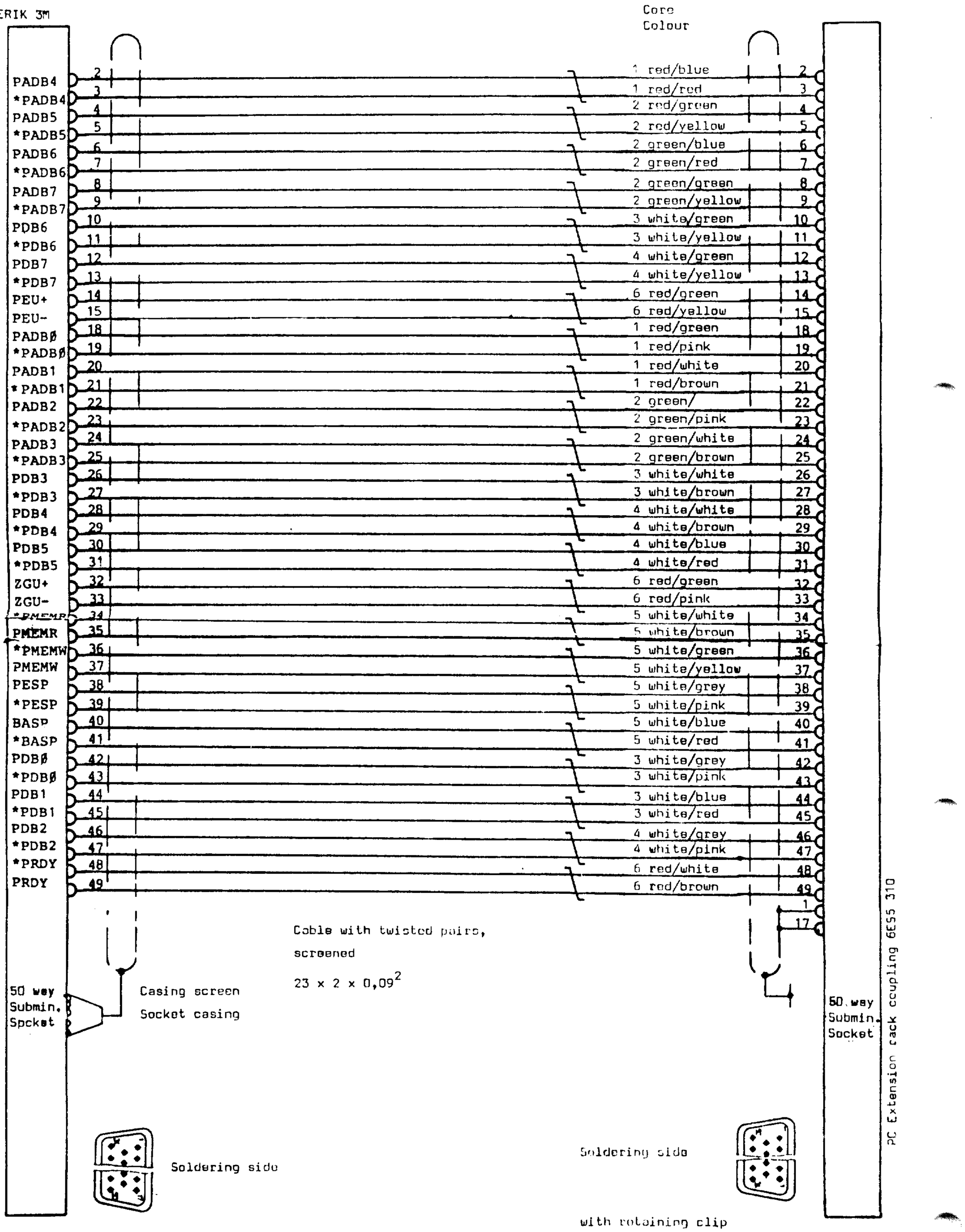
7.2 Cable diagrams 3 M

Cable name : PC Extension rack

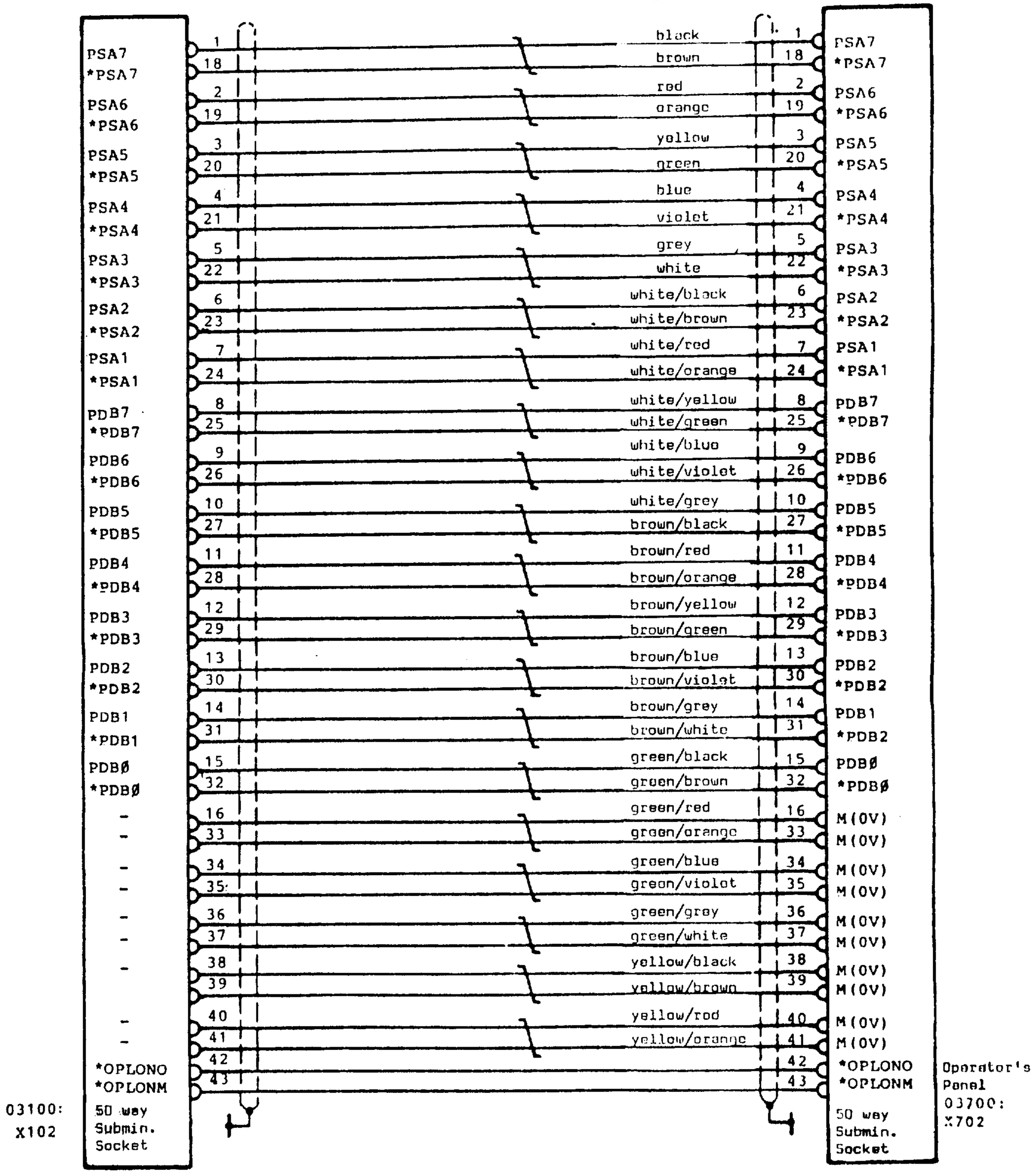
Order number: 6FC9 340 7EA

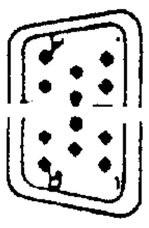
Module : 03 800

SINUMERIK 3M



Cable name : Operator's Panel
Order number: 6FC9 340 3W
Module : 03100, 03700
SINUMERIK 3M

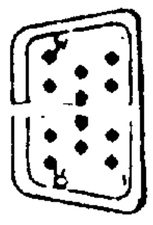




42 Core cable
twisted pairs
screened
$21 \times 2 \times 0{,}18^2$

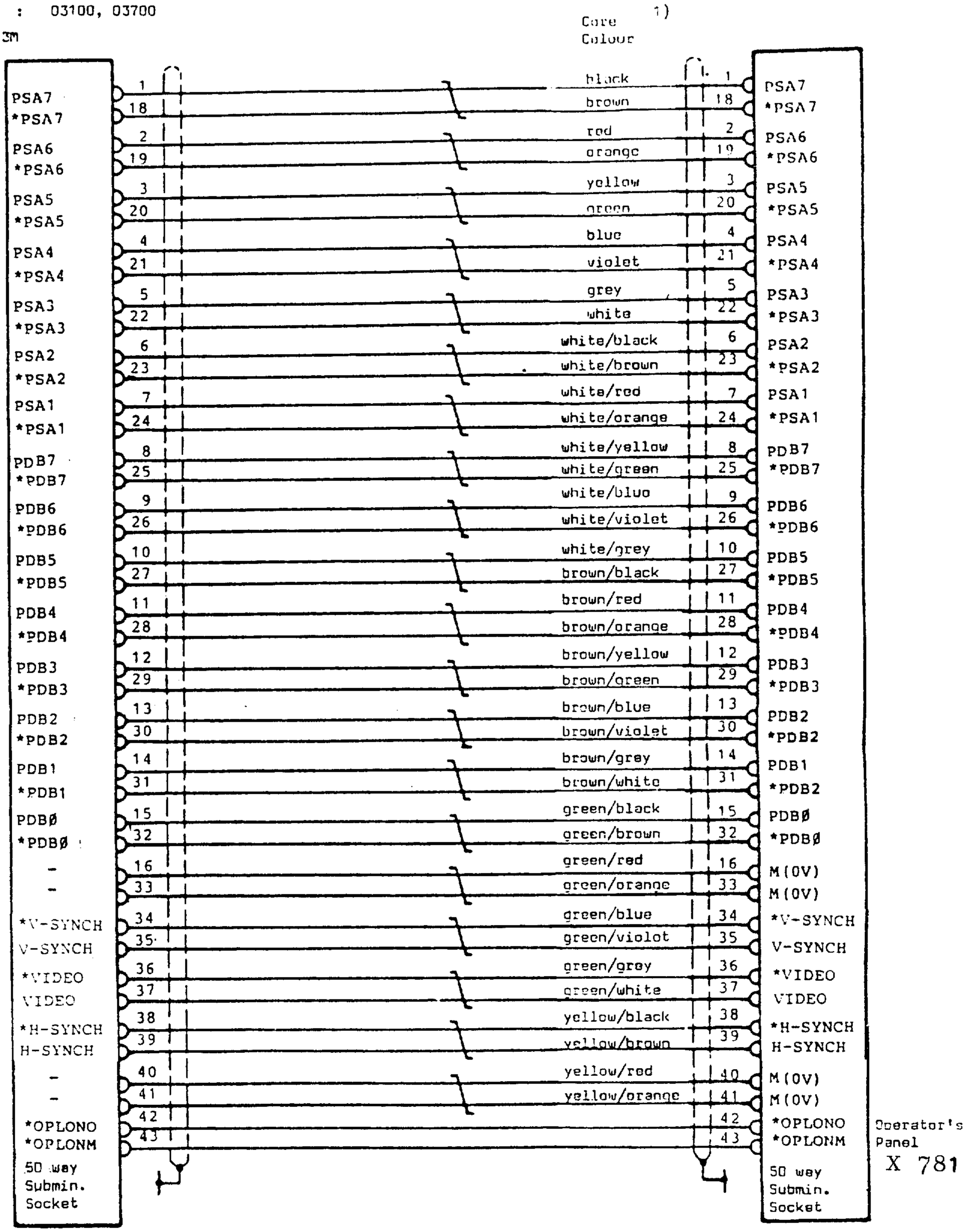
Soldering side

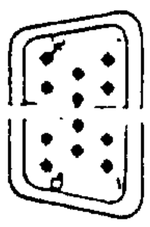
Soldering side



1) See comparison chart page 7 - 40

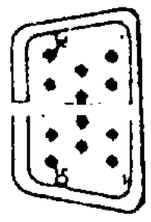
Cable name : Operator's Panel
Order number: 6FC9 340 3W
Module : 03100, 03700
SINUMERIK 3M





42 Core cable
twisted pairs
screened
$21 \times 2 \times 0{,}10^2$

Soldering side

Soldering side 

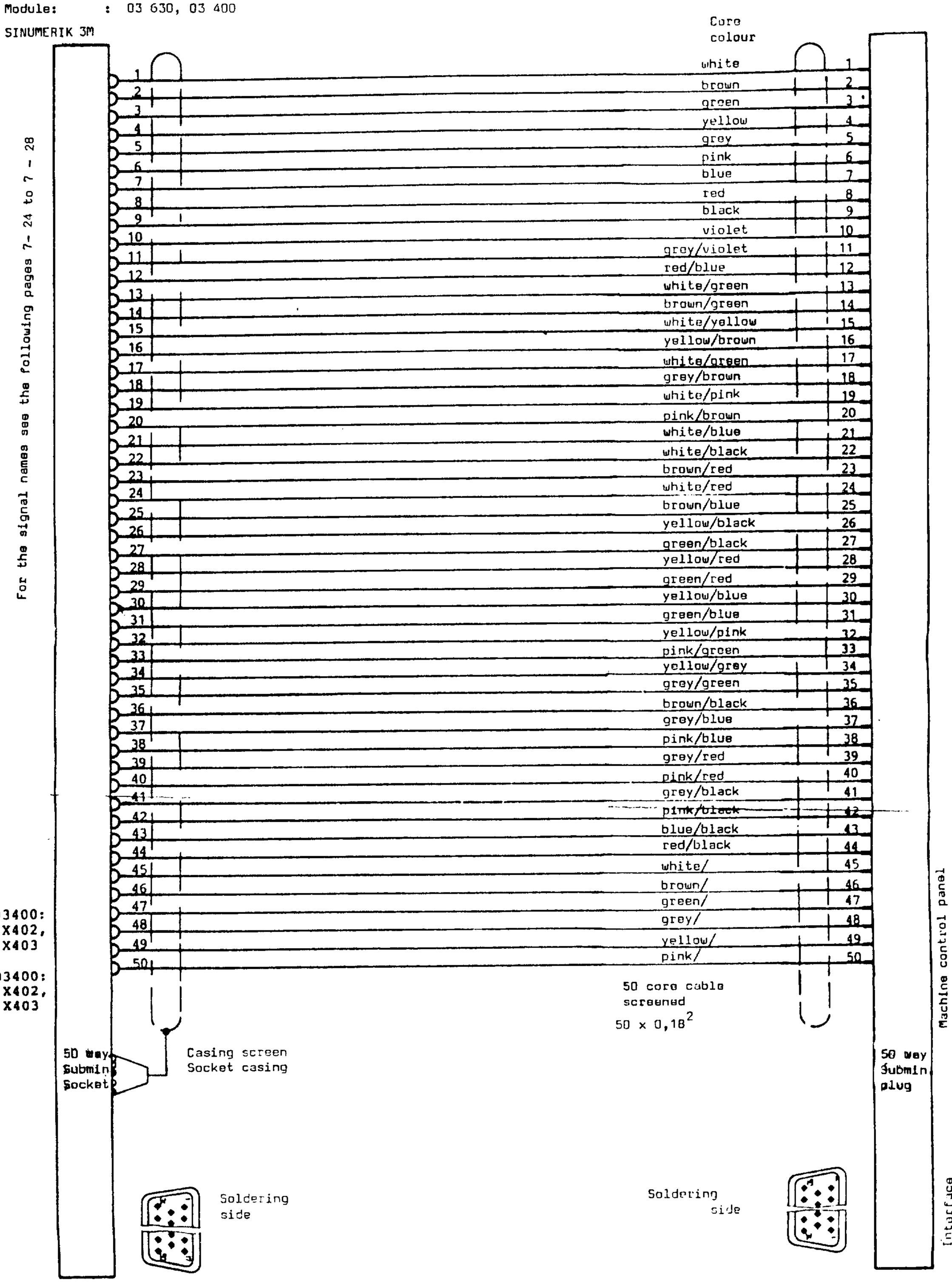
1) See comparison chart page 7 - 40

Cable name ; Interface (Relay)

Order number : 6FC9 340 2W

Module: : 03 630, 03 400

SINUMERIK 3M



Input Port SINUMERIK 3M

Plug connections: X 630

Cable: 6FC9 340-2W

Module: 03 630

Pin				Pin	
1	Feed/Rapid traverse Override switch A (4.2.5)			34	
2	Feed/Rapid traverse Override switch B (4.2.5)	18		35	
3	Feed/Rapid traverse Override switch C (4.2.5)	19		36	
4	Feed/Rapid traverse Override switch D (4.2.5)	20	Axis Selector switch A (4.2.6)	37	
5	Mode Select switch A (4.2.3)	21	Axis Selector switch B (4.2.6)	38	
6	Mode Select switch B (4.2.3)	22	Direction Push Button - (4.2.7)	39	
7	Mode Select switch C (4.2.3)	23	Direction Push Button + (4.2.7)	40	
8	Mode Select switch D (4.2.3)	24	Rapid Traverse (4.2.9)	41	
9	Spindle Speed Override switch A (4.2.4)	25	Rapid Traverse Override active (4.2.11)	42	
10	Spindle Speed Override switch B (4.2.4)	26		43	
11	Spindle Speed Override switch C (4.2.4)	27		44	
12	Block Search (4.2.15)	28	Cycle Start (4.2.19)	45	
13	Single Block (4.2.14)	29		46	
14	Block Delete (4.2.13)	30	Feed Enable (4.2.18)	47	
15	Dry Run (4.2.12)	31	* Feed Hold (4.2.18)	48	
16	Key Switch (4.2.16)	32	Spindle Start (4.2.17)	49	
17		33	* Spindle Stop (4.2.17)	50	

Input Port SINUMERIK 3M

Plug Connections: X402

Module: 1.03400

Cable: 6FC9 340-2W

Pin		Pin		Pin	
1	Feed/Rapid Traverse Override switch A (4.2.5)			34	Controller Enable (3.7.3)
2	Feed/Rapid Traverse Override switch B (4.2.5)	18	Controller Enable X (3.7.3)	35	*Creep (3.7.4)
3	Feed/Rapid Traverse Override switch C (4.2.5)	19	*Creep X (3.7.4)	36	Feed Enable (3.7.2)
4	Feed/Rapid Traverse Override switch D (4.2.5)	20	Axis Selector switch A (4.2.6)	37	Spindle Enable (3.9.3)
5	Mode Select switch A (4.2.3)	21	Axis Selector switch B (4.2.6)	38	Spindle Command C.W. (3.9.4)
6	Mode Select switch B (4.2.3)	22	Direction Push Button - (4.2.7)	39	Gear Range A (3.9.2)
7	Mode Select switch C (4.2.3)	23	Direction Push Button + (4.2.7)	40	Gear Range B (3.9.2)
8	Mode Select switch D (4.2.3)	24	Rapid Traverse (4.2.9)	41	Gear Range C (3.9.2)
9	Spindle Speed Override switch A (4.2.4)	25	Rapid Traverse Override active (4.2.11)	42	Controller Enable 4th (3.7.3)
10	Spindle Speed Override switch B (4.2.4)	26	Controller Enable Y (3.7.3)	43	*Creep 4th (3.7.4)
11	Spindle Speed Override Switch C (4.2.4)	27	*Creep Y (3.7.4)	44	NC without active Operator's Panel (3.6.3)
12	Block Search (4.2.15)	28	NC Start (3.6.2)	45	Axis Lock (3.8.1)
13	Single block (4.2.14)	29		46	Mirror X (3.7.5)
14	Block Delete (4.2.13)	30		47	Mirror Y (3.7.5)
15	Dry Run (4.2.12)	31		48	Read Enable (3.7.1)
16	Key Switch (4.2.16)	32		49	(3.6.1)
17		33		50	

Input Port SINUMERIK 3M
Plug Connections: X402
Module: 2.03400

Cable: 6FC9 340-2W

Plug					
1	External Data Input Code Signal for Mod Signal A (3.10.1)			34	
2	External Data Input Code Signal for Mod Signal B (3.10.1)	18	External Data Input Bit Datum 2nd Byte I (3.10.1)	35	
3	External Data Input Code Signal for Mod Signal C (3.10.1)	19	External Data Input Bit Datum 2nd Byte K (3.10.1)	36	
4	External Data Input Code Signal for Mod Signal D (3.10.1)	20	External Data Input Bit Datum 2nd Byte L (3.10.1)	37	
5	External Data Input Code Signal for Mod Signal E (3.10.1)	21	External Data Input Bit Datum 2nd Byte M (3.10.1)	38	
6		22	External Data Input Bit Datum 2nd Byte N (3.10.1)	39	
7		23	External Data Input Bit Datum 2nd Byte O (3.10.1)	40	
8	Mod Signal for Data Transfer (3.10.1)	24	External Data Input Bit Datum 2nd Byte P (3.10.1)	41	
9	External Data Input Bit Datum for 1st Byte A (3.10.1)	25	External Data Input Bit Datum 2nd Byte Q (3.10.1)	42	
10	External Data Input Bit Datum for 1st Byte B (3.10.1)	26		43	
11	External Data Input Bit Datum for 1st Byte C (3.10.1)	27		44	
12	External Data Input Bit Datum for 1st Byte D (3.10.1)	28		45	
13	External Data Input Bit Datum for 1st Byte E (3.10.1)	29		46	
14	External Data Input Bit Datum for 1st Byte F (3.10.1)	30		47	
15	External Data Input Bit Datum for 1st Byte G (3.10.1)	31		48	
16	External Data Input Bit Datum for 1st Byte H (3.10.1)	32		49	
17		33		50	

Output Port SINUMERIK 3M

Plug Connections: X403

Module: 1.03400

Cable: 6FC9 340-2W

Pin				Pin	
1	External 24V			34	M (0V) External
2	External 24V	18	Programmed Stop M00 (3.5.4)	35	M (0V) External
3	External 24V	19	Programmed End M02/M30, Reset (3.5.5)	36	
4		20	Threading G33/G63 (3.5.6)	37	
5		21	Rapid Traverse (3.5.6)	38	
6		22	NC Ready 1 (3.4.1)	39	
7		23	NC Ready 2 2 (3.4.2)	40	
8		24		41	
9	Motion Command X (3.4.3)	25	Programming running (3.4.4)	42	
10	Motion Command Y (3.4.3)	26	Switching and Auxillary function output BCD 10^0A (3.5.2)	43	
11	Motion Command Z (3.4.3)	27	Switching and Auxillary function output BCD 10^0B (3.5.2)	44	
12	Motion Command 4th (3.4.3)	28	Switching and Auxillary function output BCD 10^0C (3.5.2)	45	
13		29	Switching and Auxillary function output BCD 10^0D (3.5.2)	46	
14	Mod. Signal T (3.5.2)	30	Switching and Auxillary function output BCD 10^1A (3.5.2)	47	
15	Mod. Signal S (3.5.2)	31	Switching and Auxillary function output BCD 10^1B (3.5.2)	48	
16	Mod. Signal M (3.5.2)	32	Switching and Auxillary function output BCD 10^1C (3.5.2)	49	
17		33	Switching and Auxillary function output BCD 10^1D (3.5.2)	50	

Output Port SINUMERIK 3M

Plug connection: X403

Module: 2.D3400

Cable: 6FC9 340-2W

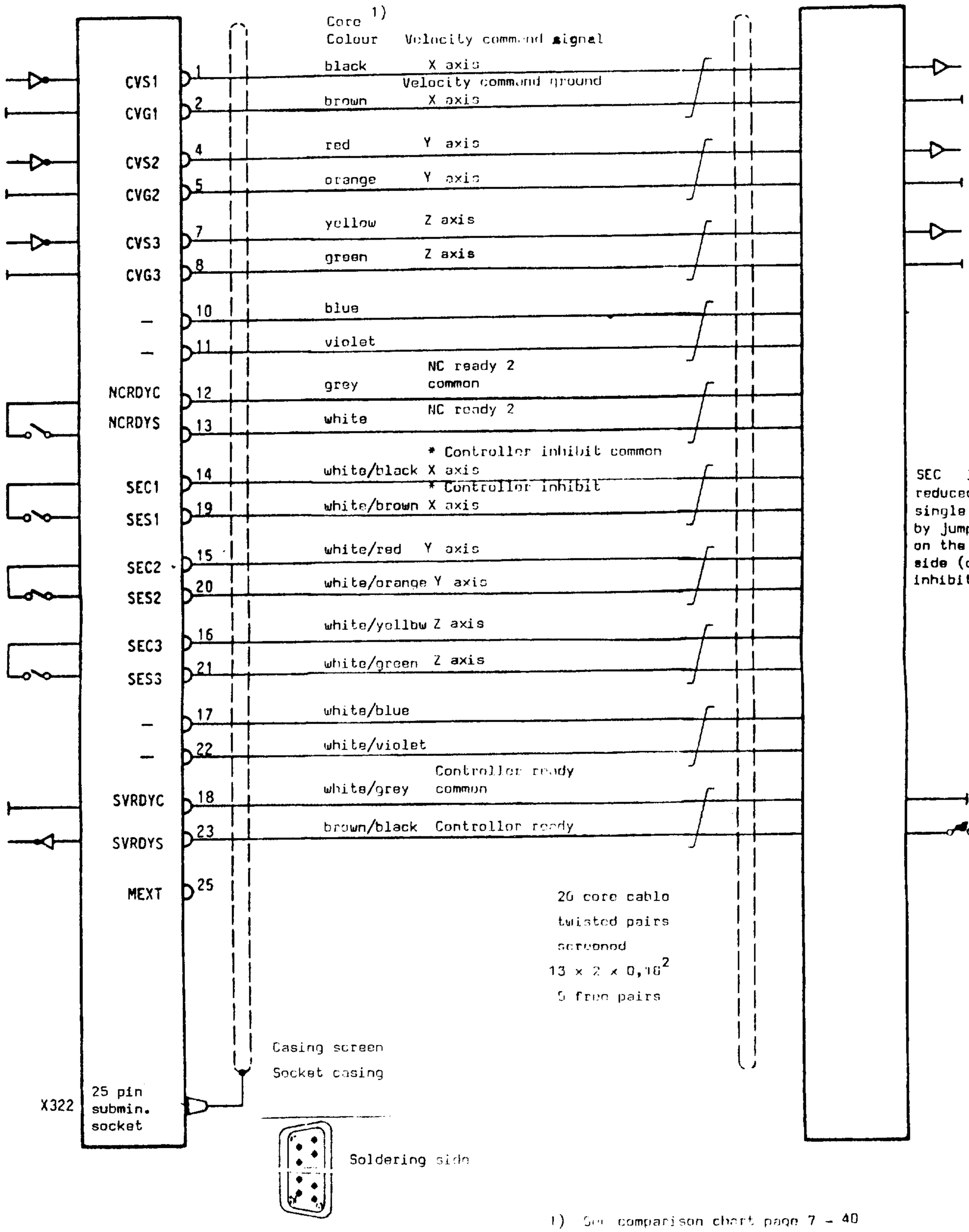
Pin		Pin		Pin	
1	External + 24V			34	M (0V) External
2	External + 24V	18		35	M (0V) External
3	External + 24V	19		36	
4		20		37	
5		21		38	
6		22		39	
7		23		40	
8		24		41	
9		25		42	
10		26	Switching and Auxillary function output BCD 10^2A (3.5.2)	43	
11		27	Switching and Auxillary function output BCD 10^2B (3.5.2)	44	
12		28	Switching and Auxillary function output BCD 10^2C (3.5.2)	45	
13		29	Switching and Auxillary function output BCD 10^2D (3.5.2)	46	
14		30	Switching and Auxillary function output BCD 10^3A (3.5.2)	47	
15		31	Switching and Auxillary function output BCD 10^3B (3.5.2)	48	
16		32	Switching and Auxillary function output BCD 10^3C (3.5.2)	49	
17		33	Switching and Auxillary function output BCD 10^3D (3.5.2)	50	

Cable name : Axis drives, X, Y and Z

Order number: 6FC9 340 6C

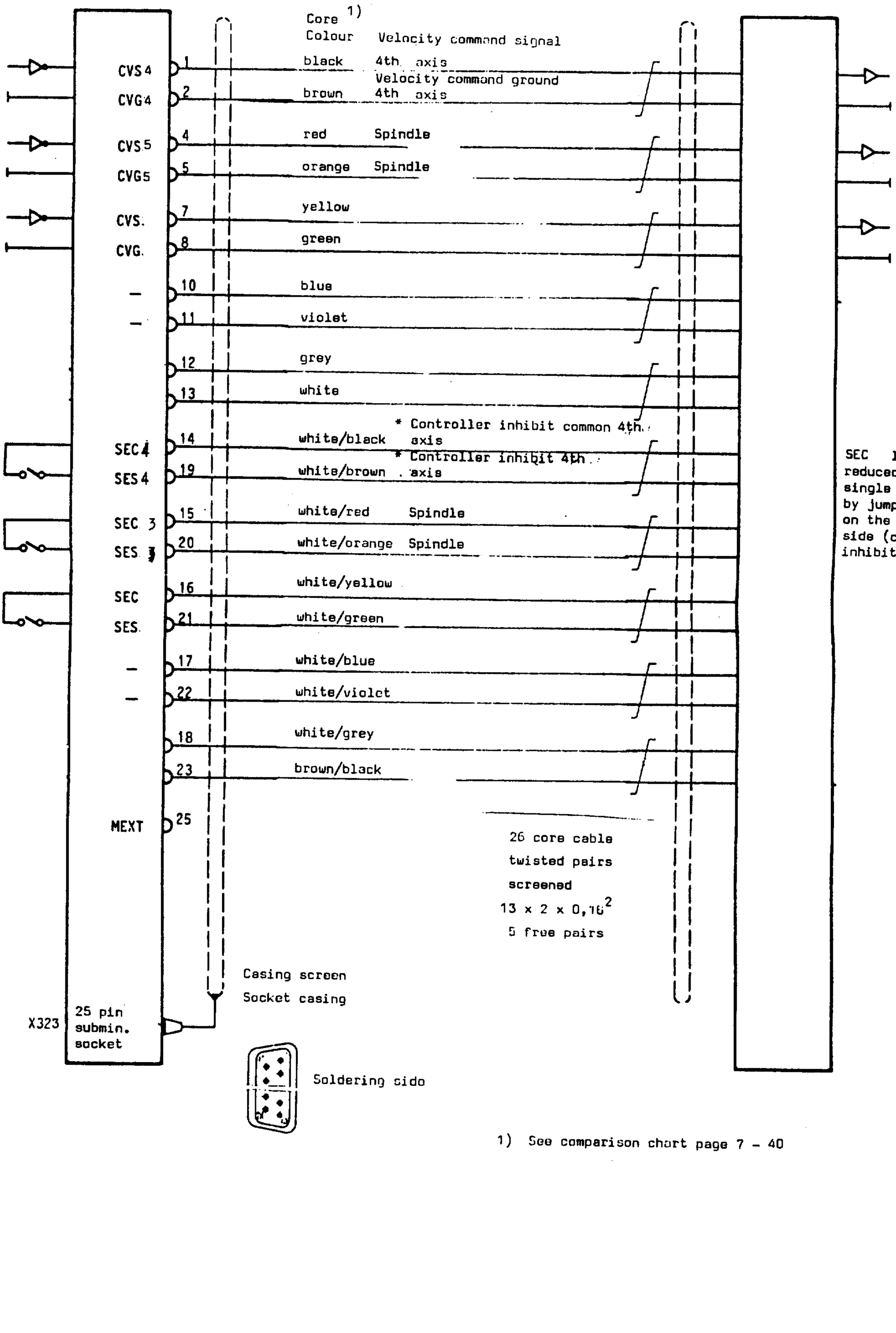
Module : 03 320

SINUMERIK 3M



1) See comparison chart page 7 - 40

Cable name : Axis/Spindle Drives
Order number: 6FC9 340 6C
Module : 03 320
SINUMERIK 3M



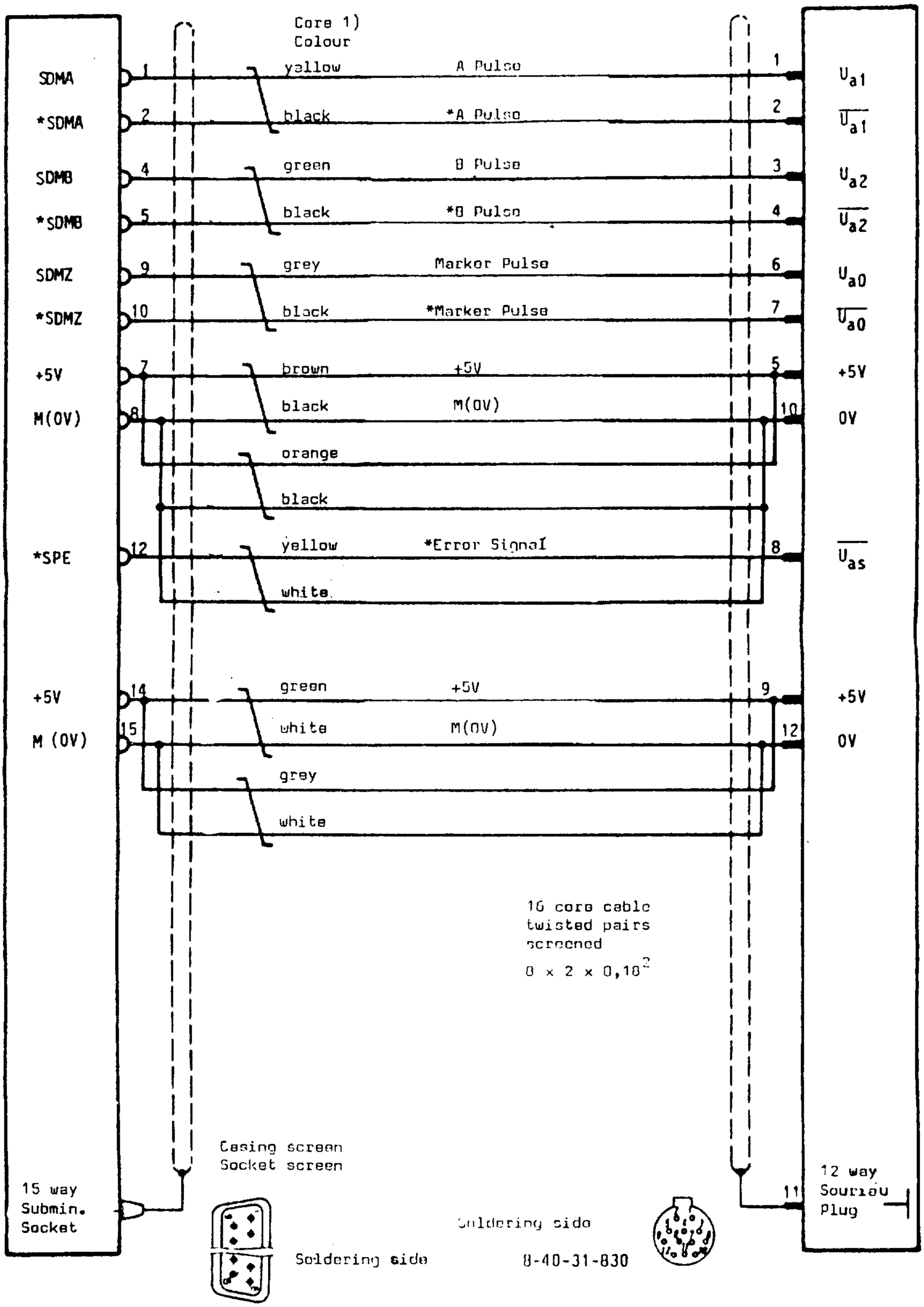
1) See comparison chart page 7 - 40

Cable name : Main spindle encoder/Digital linear or rotary measuring device (as shown up to ca. the end of 1981)

Order number: 6FC9 340 6K

Module : 03 310 320

SINUMERIK 3M



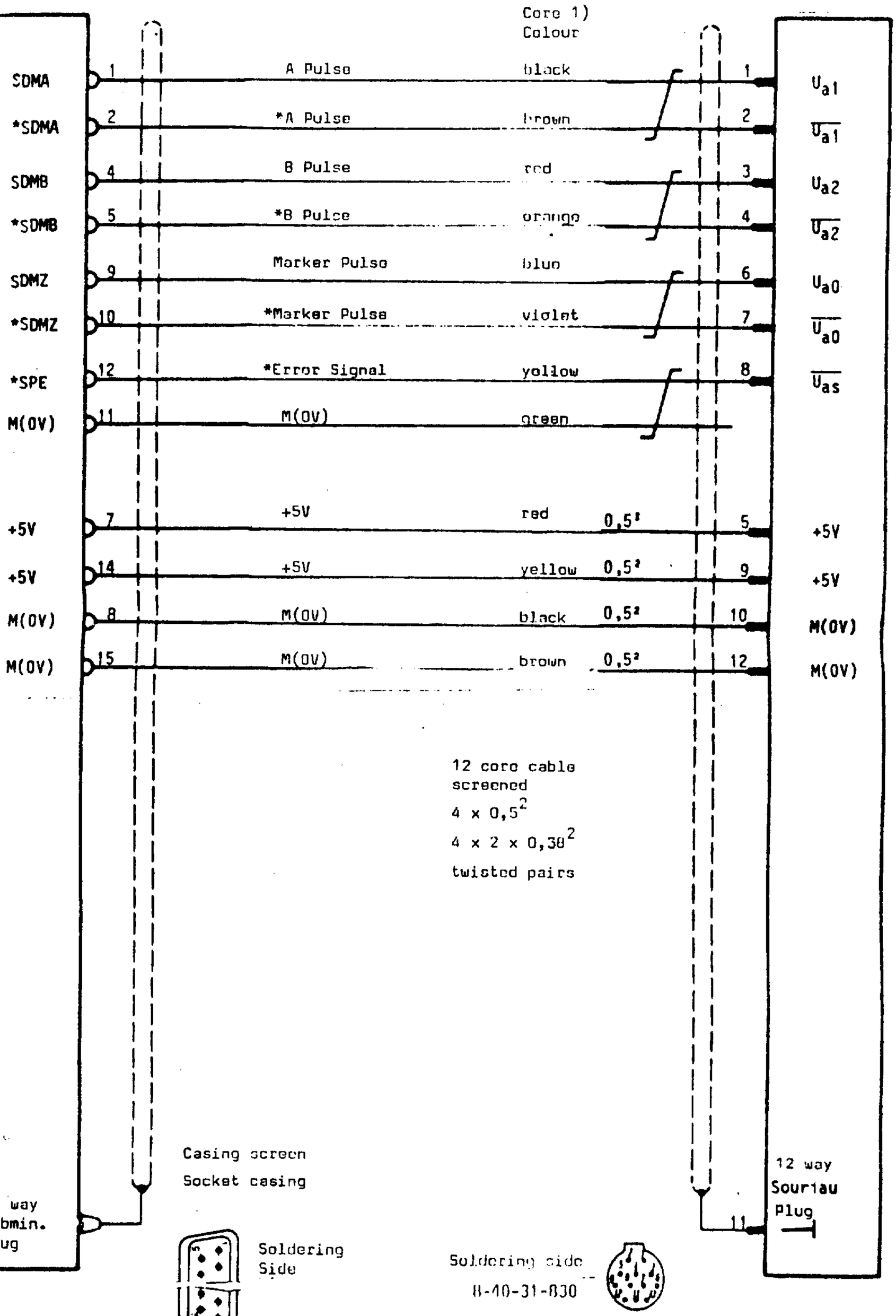
1) See comparison chart page 7 - 40

Cable name : Main spindle encoder /Digital linear or rotary measuring devices (as shown after ca. the beginning of 1982)

Order number: 6FC9 340 6K

Module : 03 310, 03 320

SINUMERIK 3M



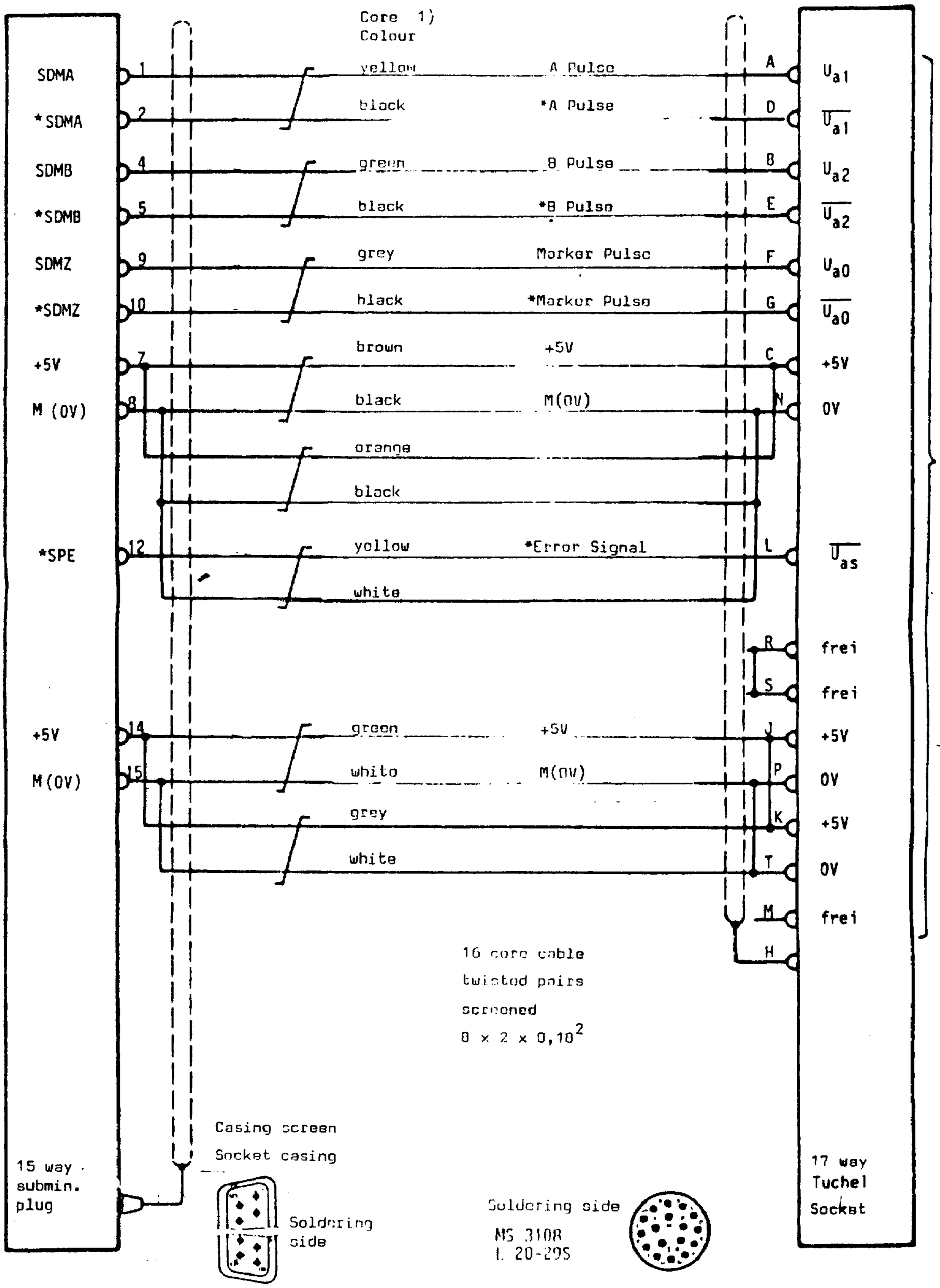
1) See comparison chart page 7 - 40

Cable anmo: Digital rotary measuring system (ROD 320) As shown up to rev. the end of 1981

Order number: 6FC9 340 6N

Module: 03 310

SINUMERIK 3M



X Axis 03 310
X 312
Y Axis X 313
Z Axis 03 320
X 324
4th Axis 03 310
X 314

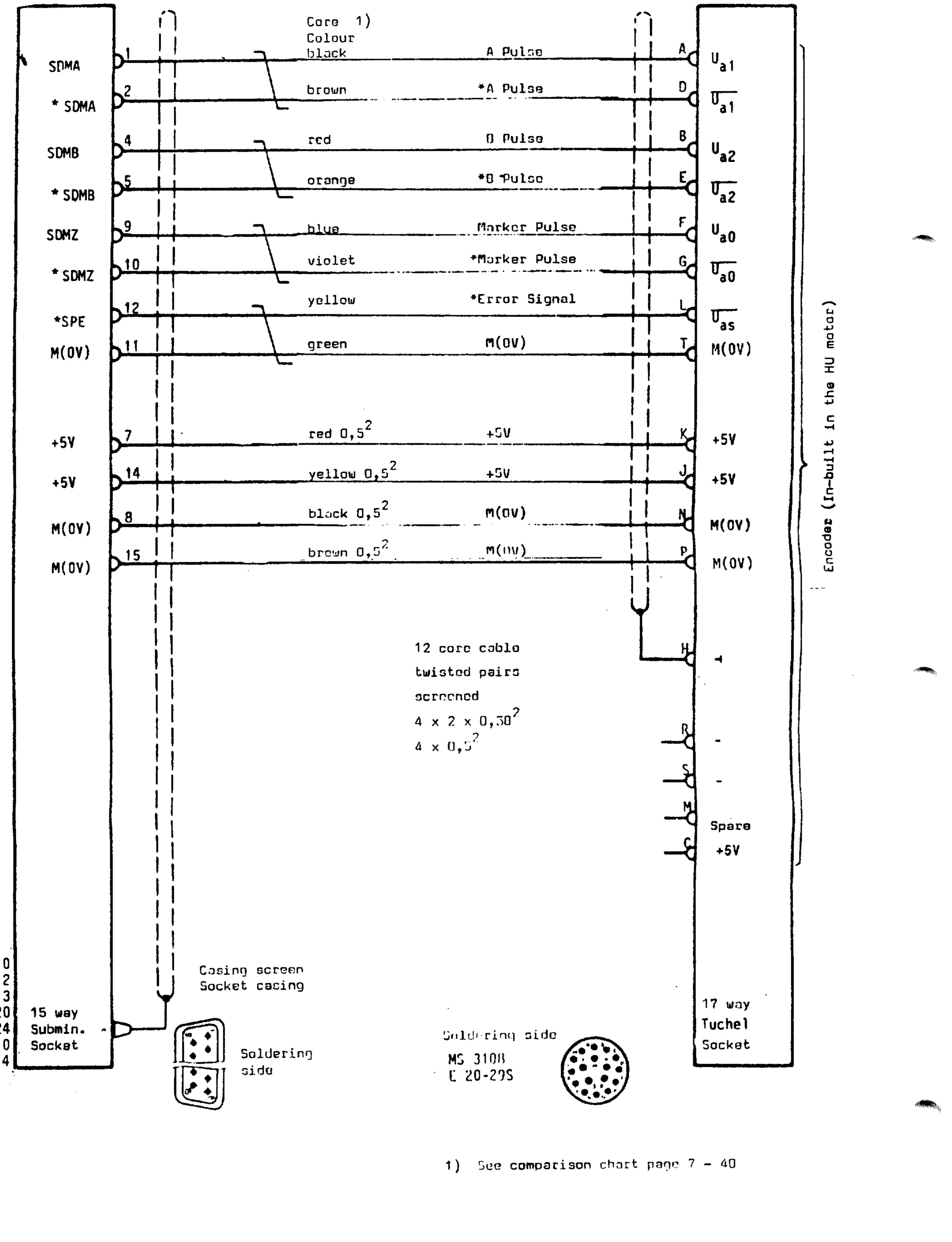
1) See comparison chart page 7 - 40

Cable name : Digital rotary measuring system (ROD 320) (As shown after ca. the beginning of 1982)

Order number: 6FC9 340 6N

Module : 03 310

SINUMERIK 3M



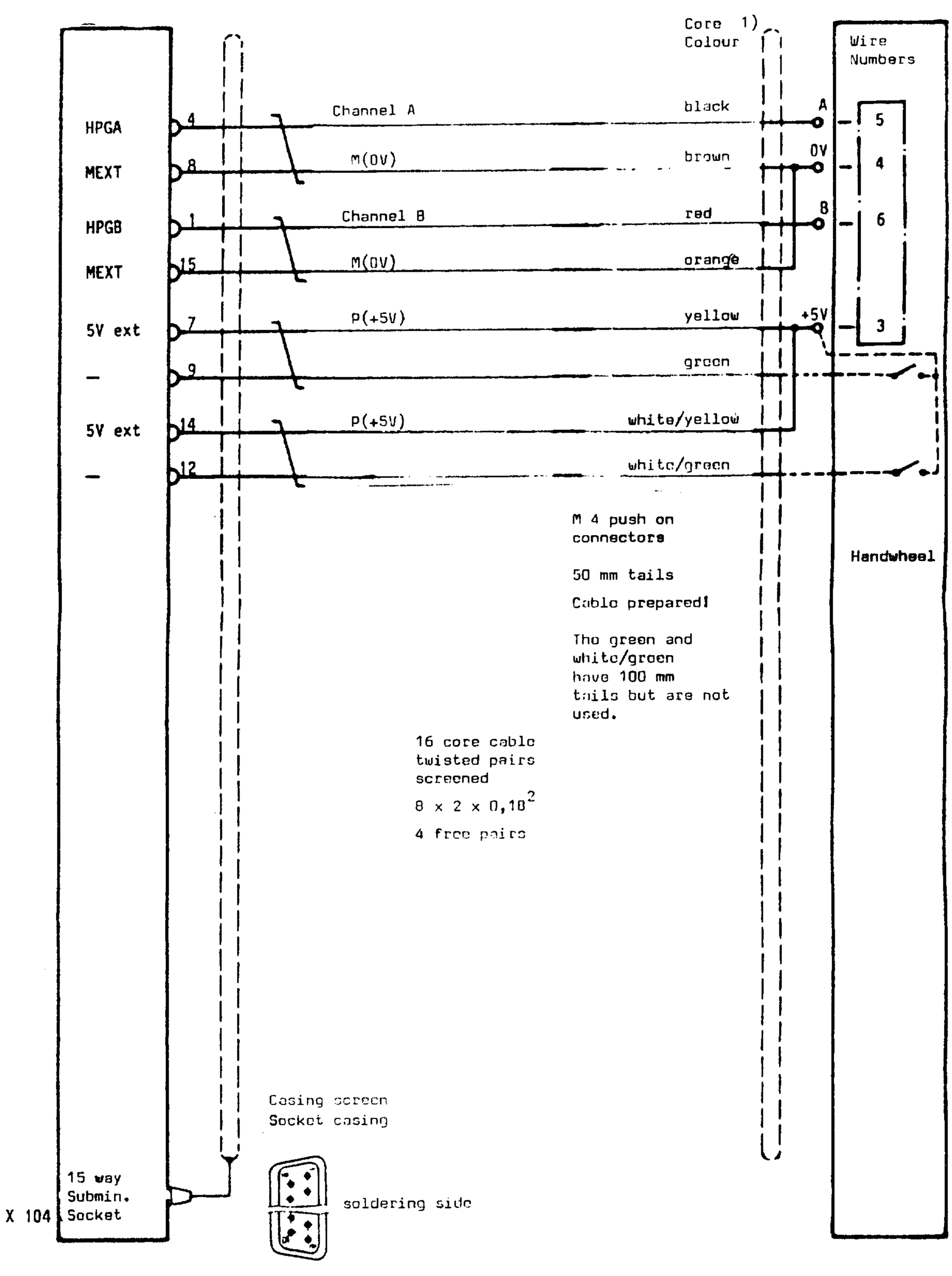
1) See comparison chart page 7 - 40

Cable name: Handwheel

Order number: 6FC9 340 4E

Module : 031 00

SINUMERIK 3M



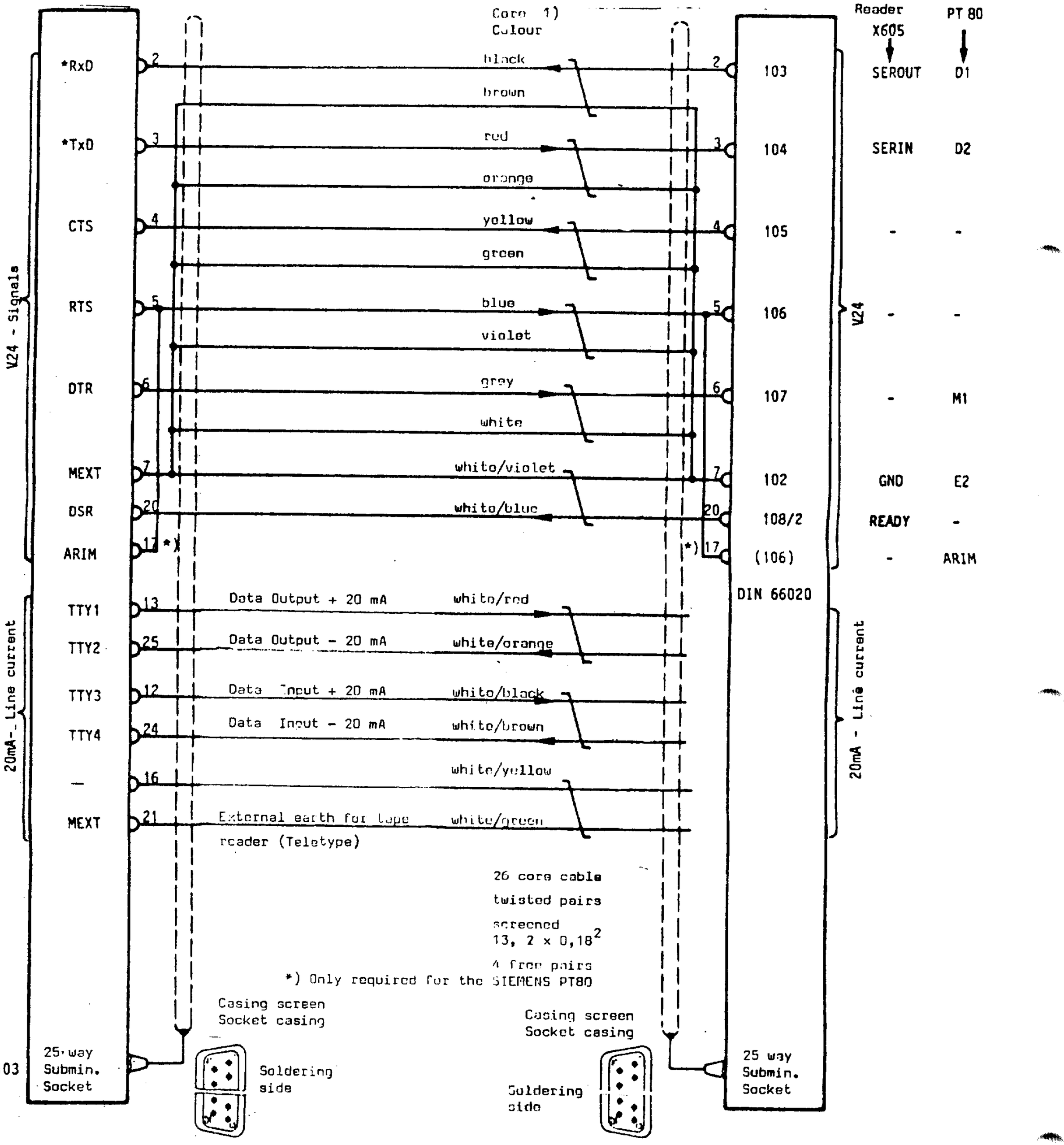
1) see comparison chart page 7 - 40

Cable name : Serial data transfer (V24, 20 mA line current)

Order number: 6FC9 340 5Q

Module : O 3 100

SINUMERIK 3M

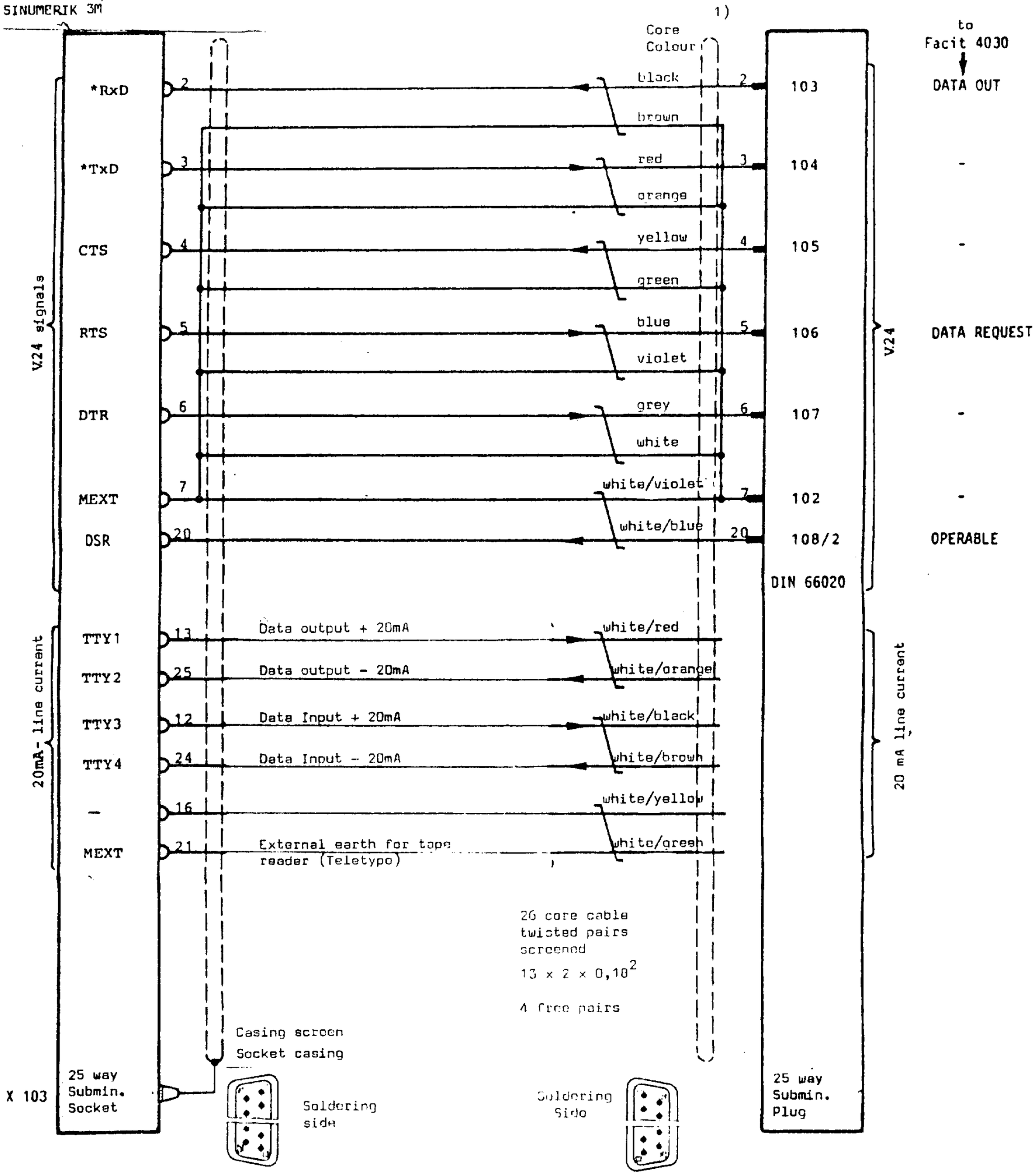


1) See comparison chart page 7 - 40

Cable name: Serial data transfer

Order number: 6FC9 340-5S

Module: 03 100
SINUMERIK 3M



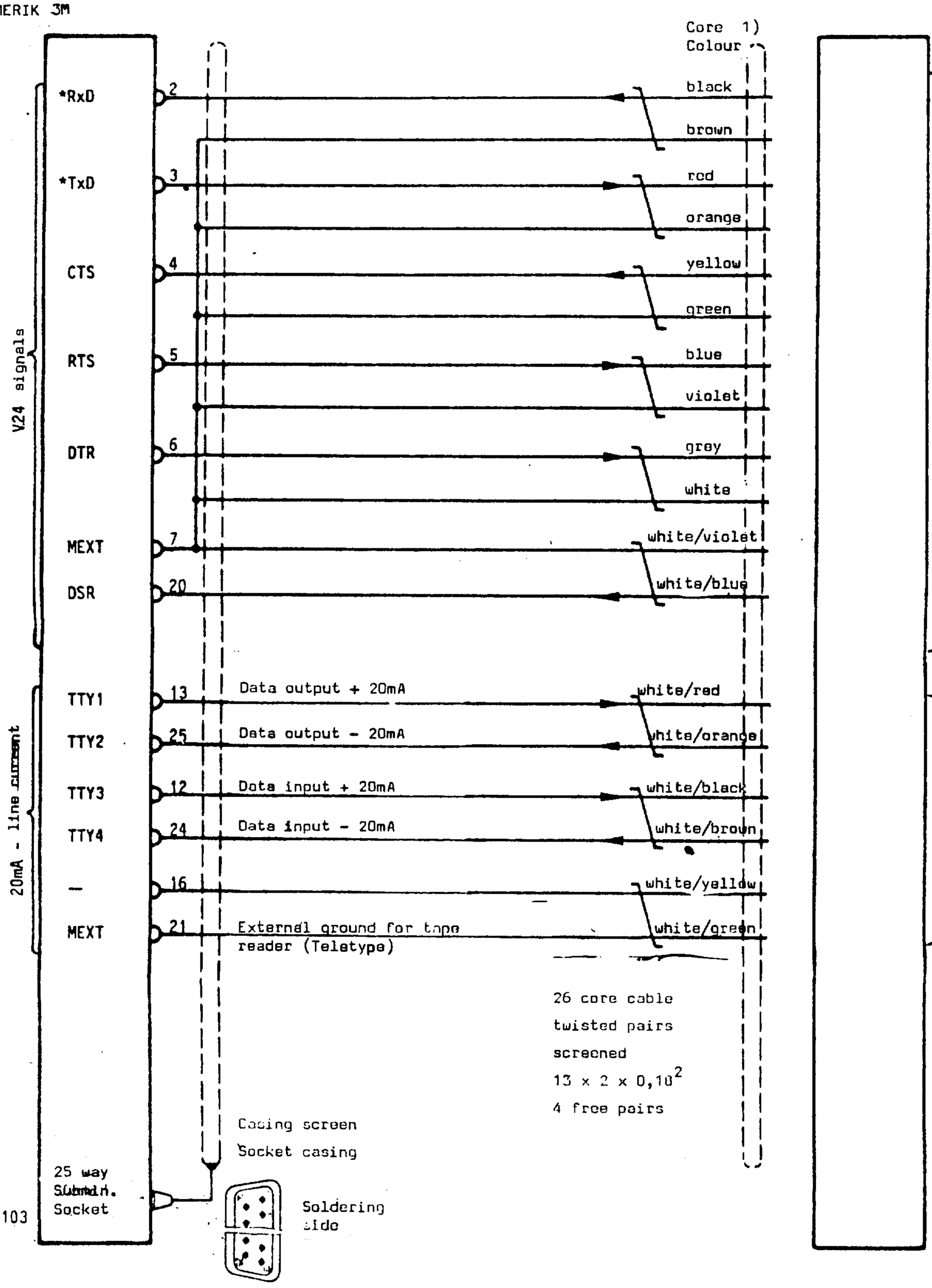
1) See comparison chart page 7 - 40

Cable name : Serial data transfer (V24, 20mA line current)

Order number: GFC9 340-5R

Module: 03 100

SINUMERIK 3M



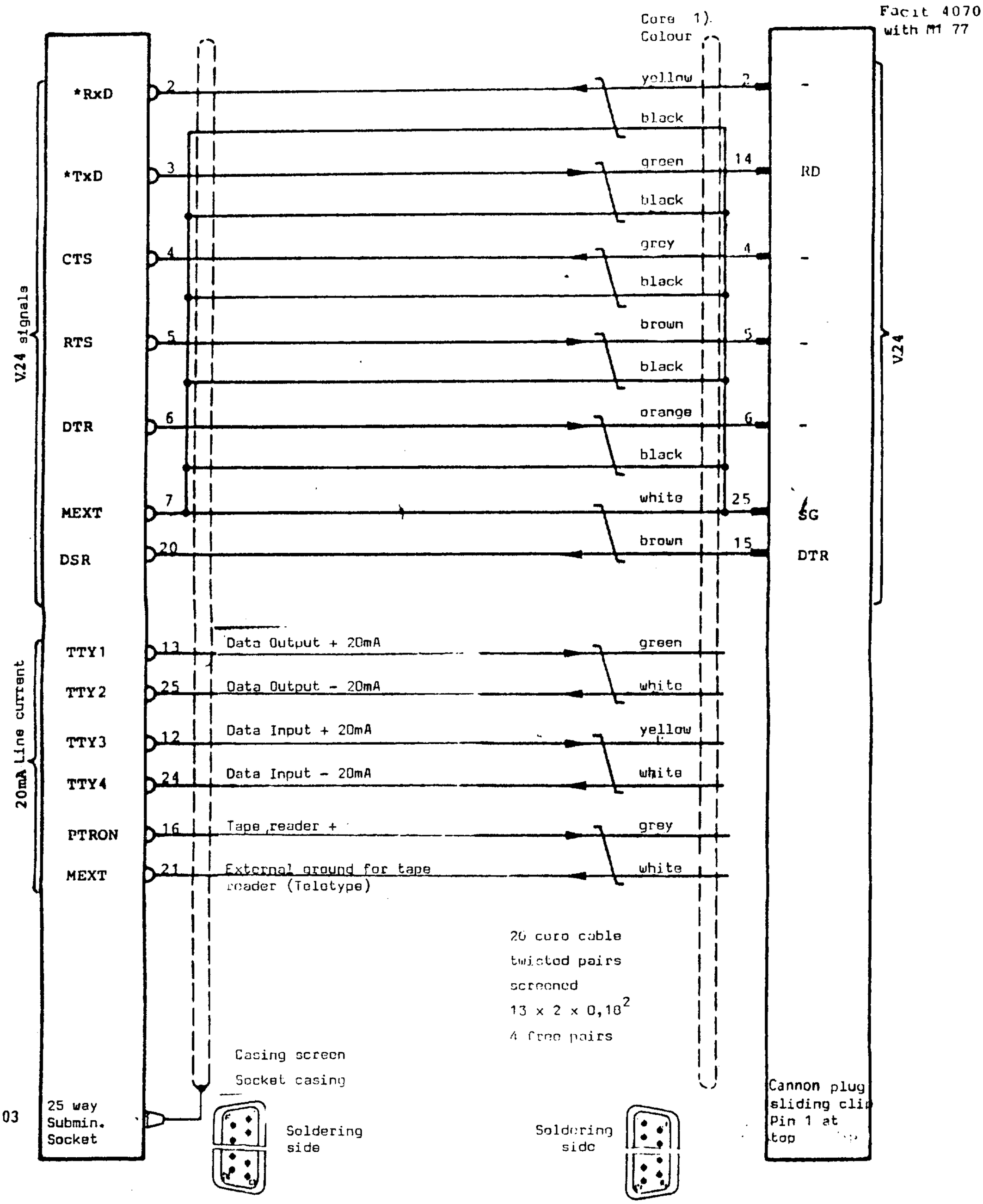
1) See comparison chart page 7 - 40

Cable name: Serial data transfer

Order number: 6FC9 340-5VB

Module: 03 100

SINUMERIK 3M



1) See comparison chart page 7 - 40

Comparison Chart - Colour Coding

	A Core		B Core	
PAIR NUMBER	Old	New	Old	New
1	yellow	black	black	brown
2	green	red	black	orange
3	grey	yellow	black	green
4	brown	blue	black	violet
5	orange	grey	black	white
6	yellow	white/black	white	white/brown
7	green	white/red	white	white/orange
8	grey	white/yellow	white	white/green
9	brown	white/blue	white	white/violet
10	orange	white/grey	white	brown/black
11	yellow	brown/red	red	brown/orange
12	green	brown/yellow	red	brown/green
13	grey	brown/blue	red	brown/violet
14	brown	brown/grey	red	brown/white
15	orange	green/black	red	green/brown
16	yellow	green/red	blue	green/orange
17	green	green/blue	blue	green/violet
18	grey	green/grey	blue	green/white
19	brown	yellow/black	blue	yellow/brown
20	orange	yellow/red	blue	yellow/orange
21	-	yellow/blue	-	yellow/violet

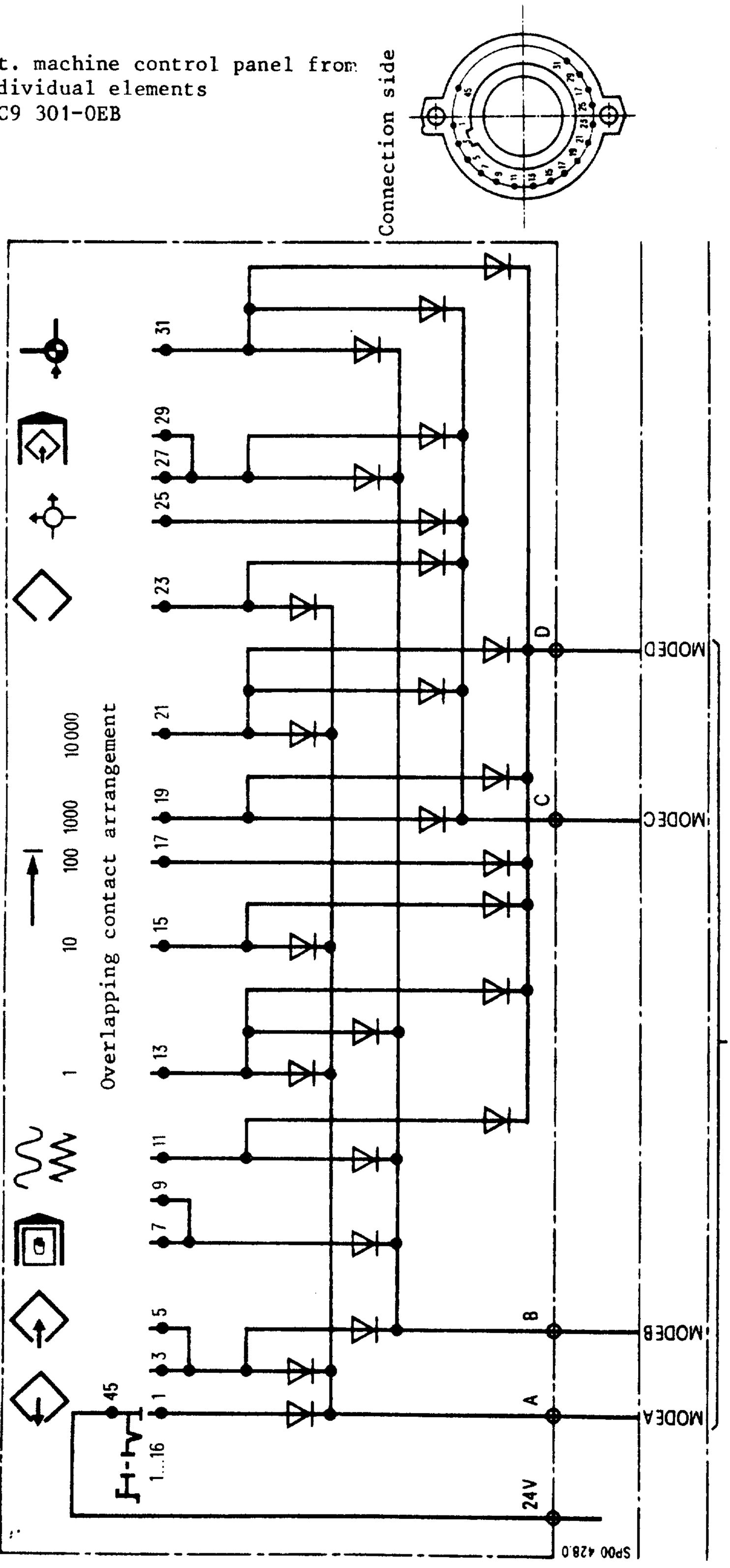
8. External machine control panel

Layout of individual elements

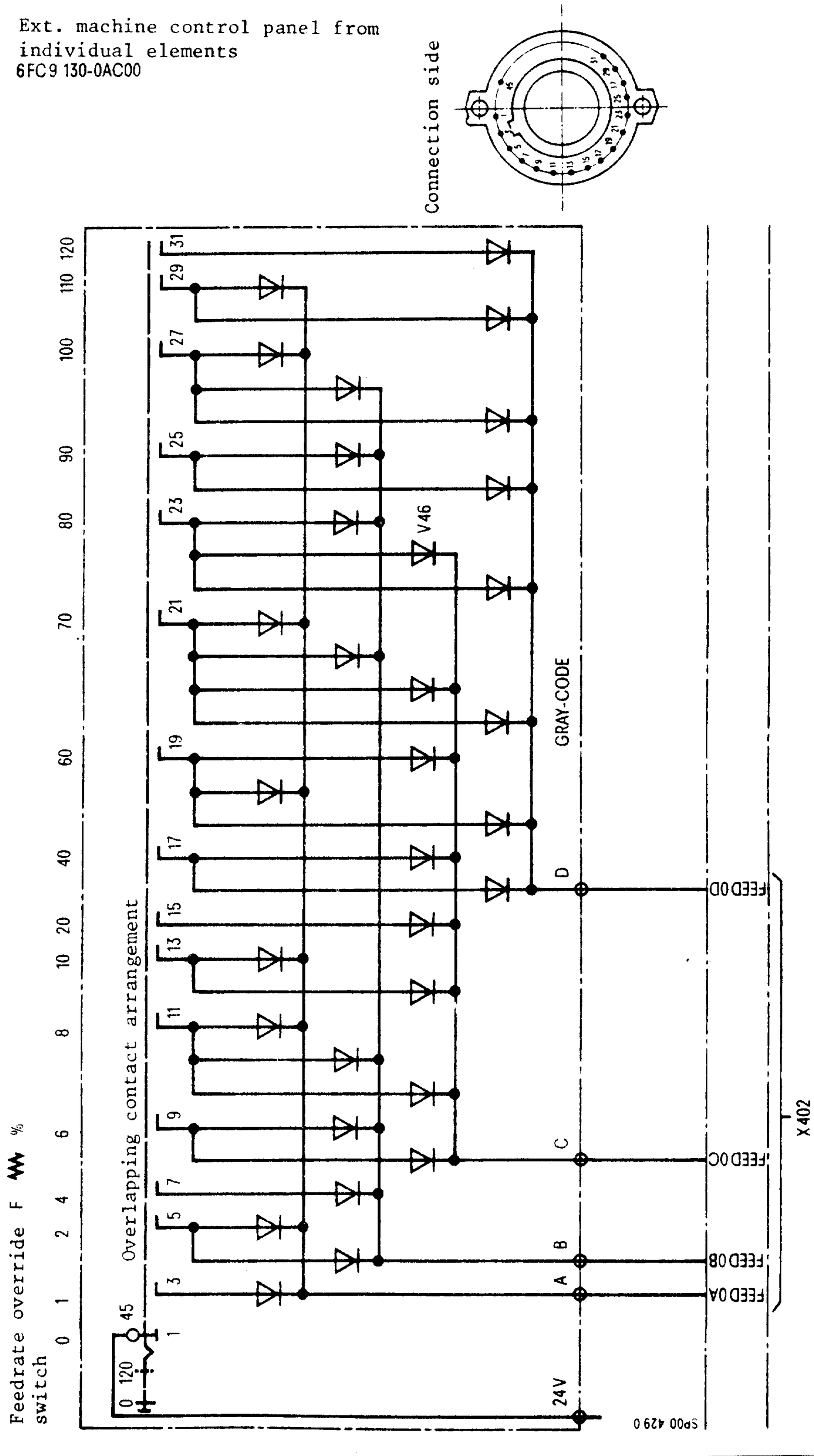
The machine control panel can be supplied as a complete unit (dimension drawings Section 1, description Section 4) or constructed by the machine tool builder from individual elements.

For this latter version the coded selector switches are available as single elements including integral diode board.

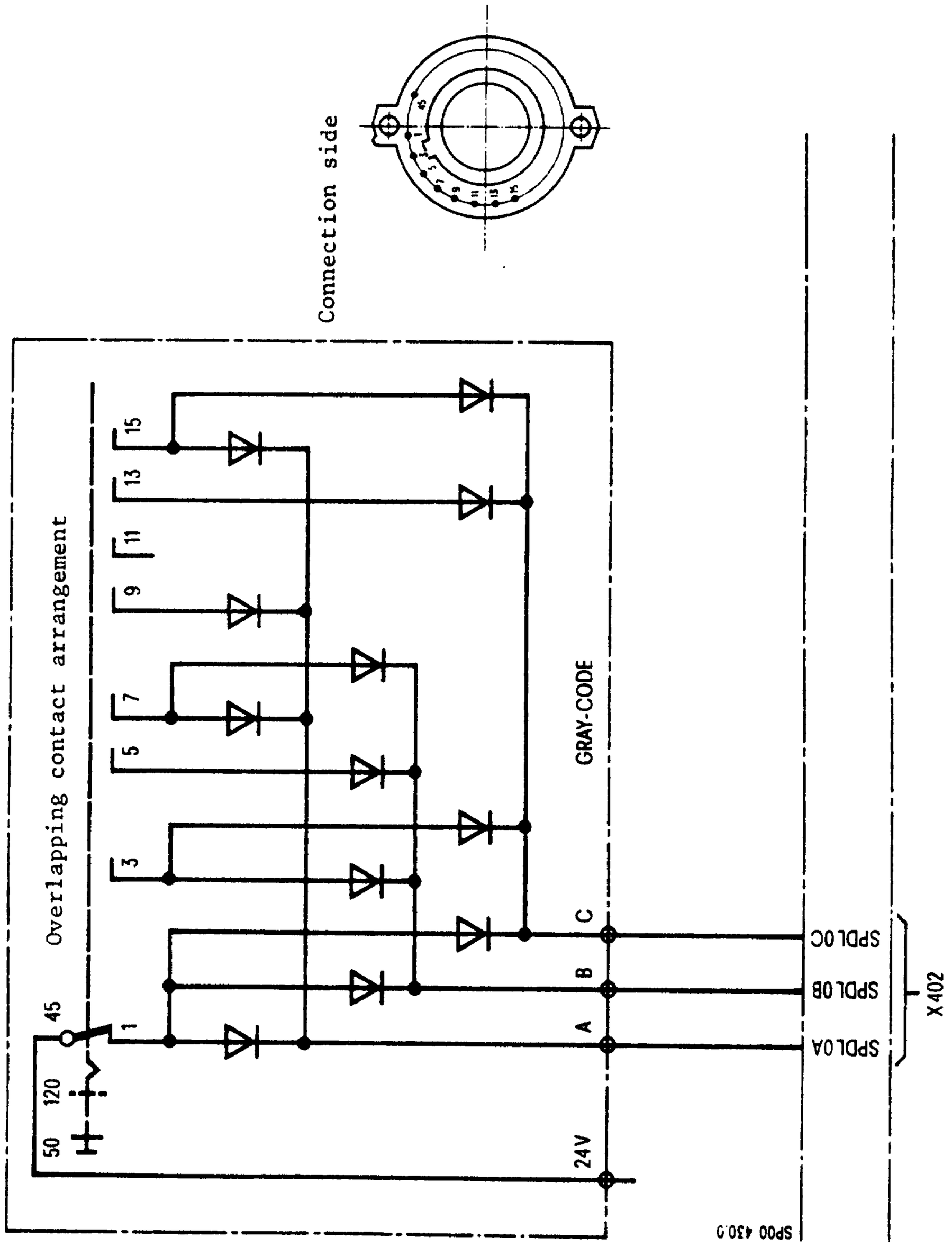
Ext. machine control panel from individual elements
6FC9 301-0EB



Ext. machine control panel from individual elements
6FC9 130-0AC00

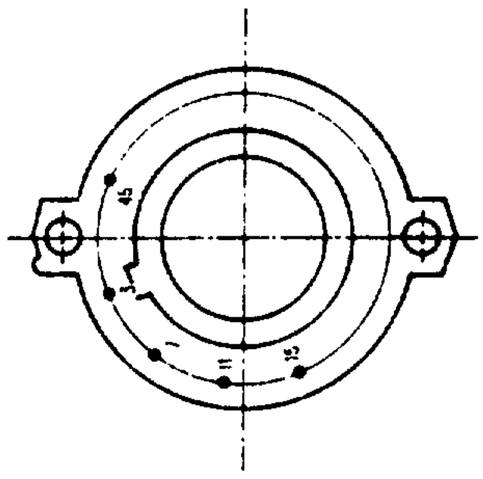


Ext. machine control panel from individual elements
6FC9 301-0EA

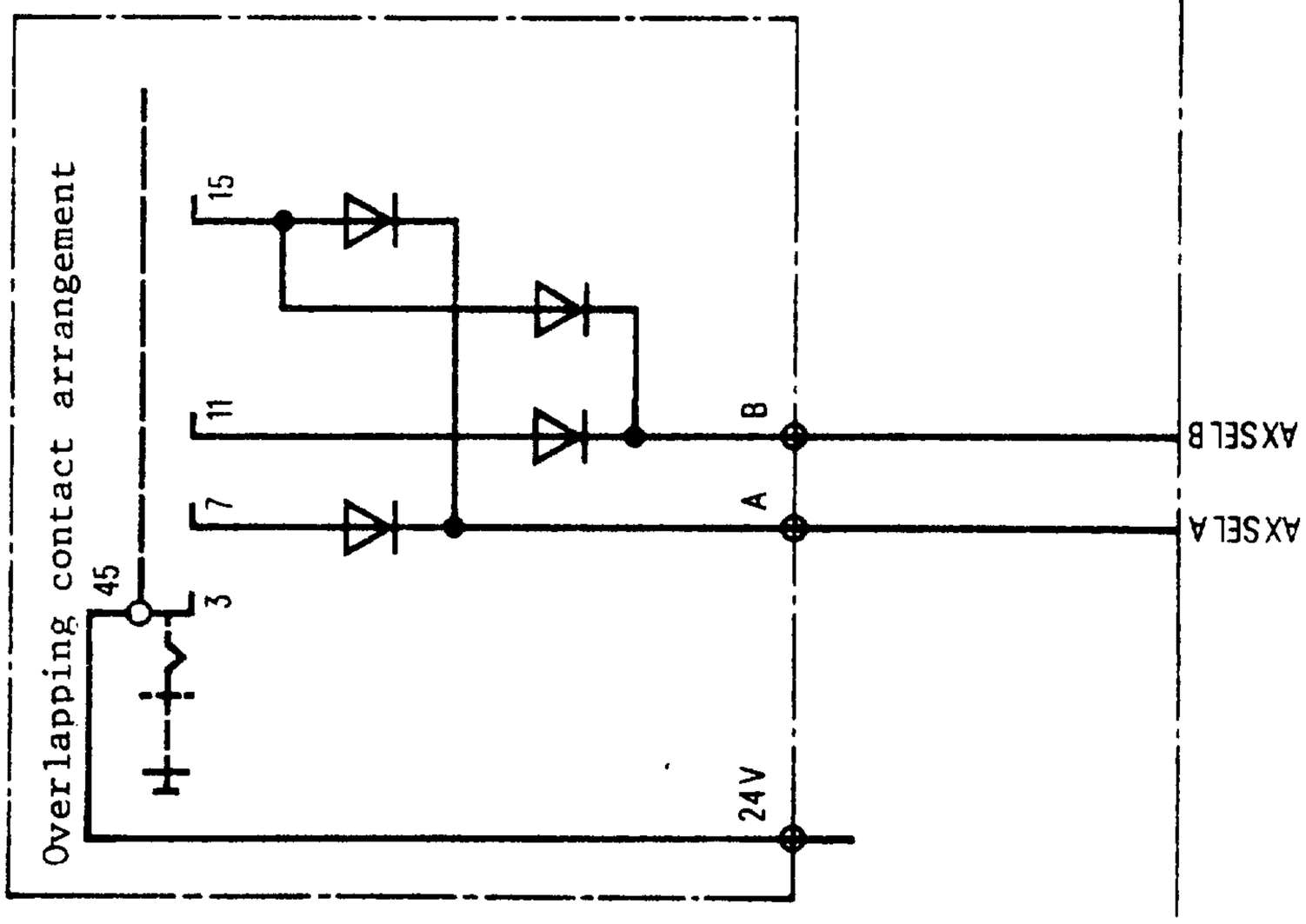


Ext. machine control panel from
individual elements
6FC9 130-0AB

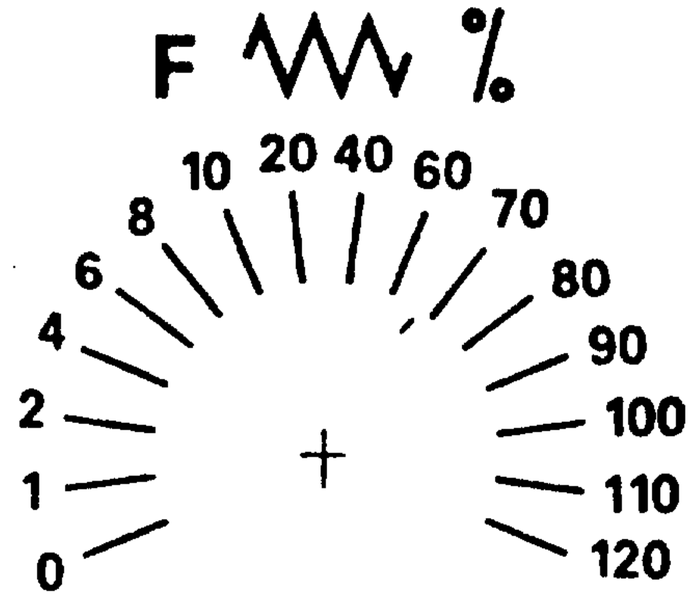
Connection side



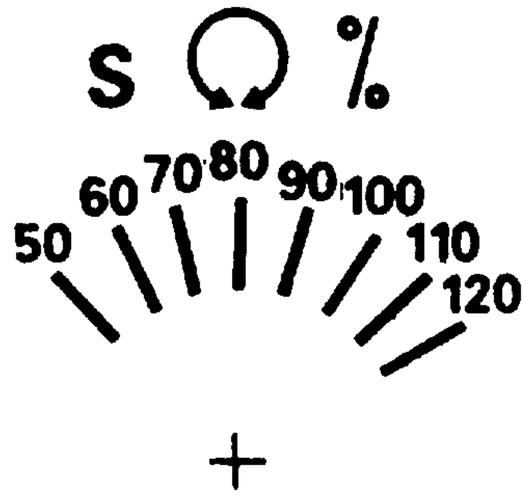
Axis selector switch (3M)



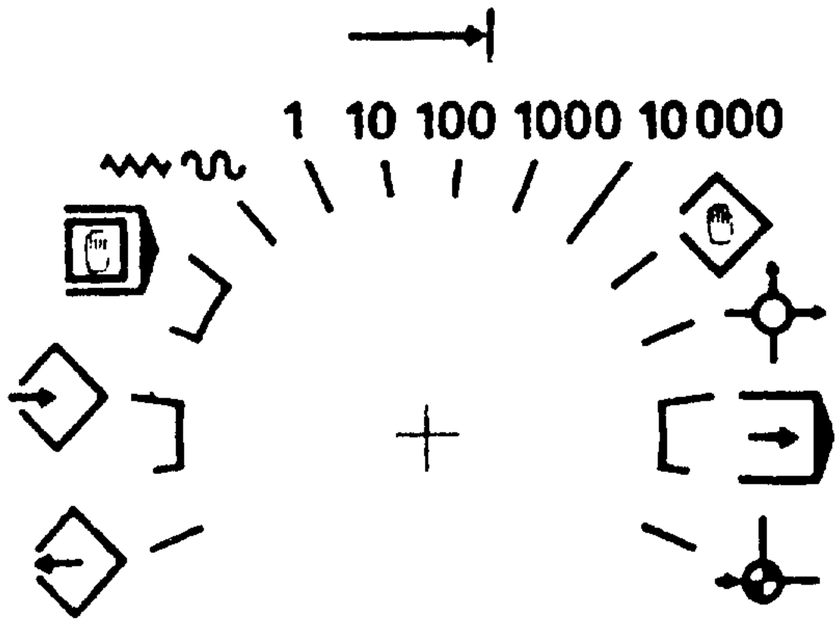
Selector switch markings



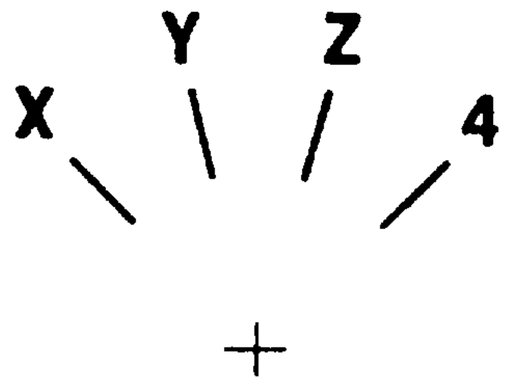
Feedrate override switch
Latch 15°
3T/3M



Spindle speed
override switch
Latch 15°
3T/3M

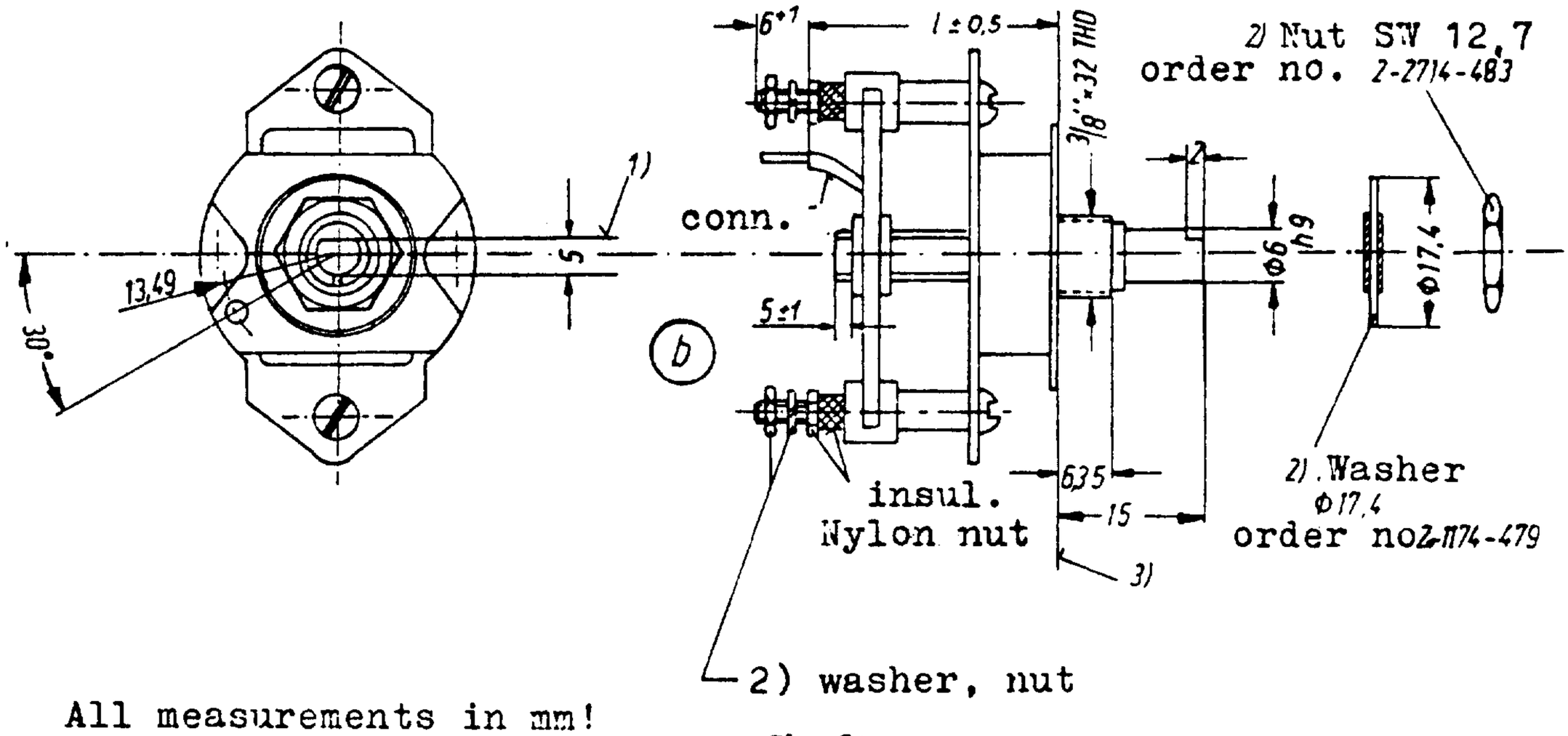


Operating mode switch
Latch 15°
3T/3M



Axis selector switch
Latch 30°
3M

Dimension drawing of selector switch (30°) without diode board



2) washer, nut

All measurements in mm!

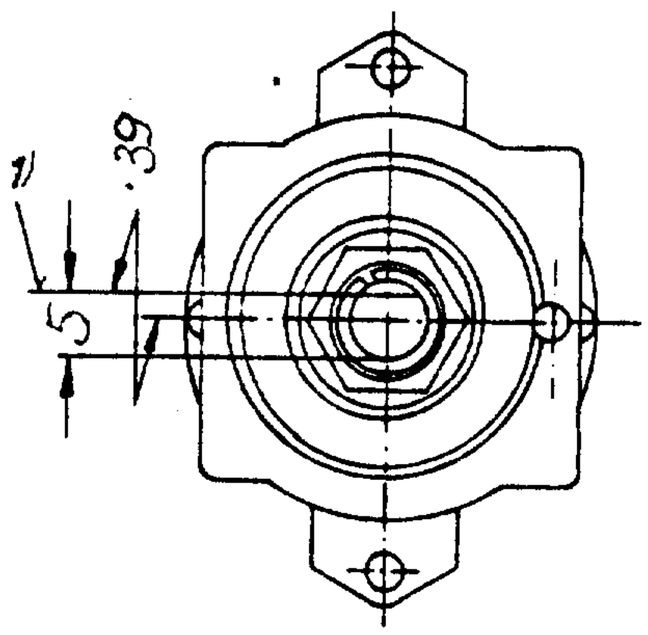
PBC is not shown!

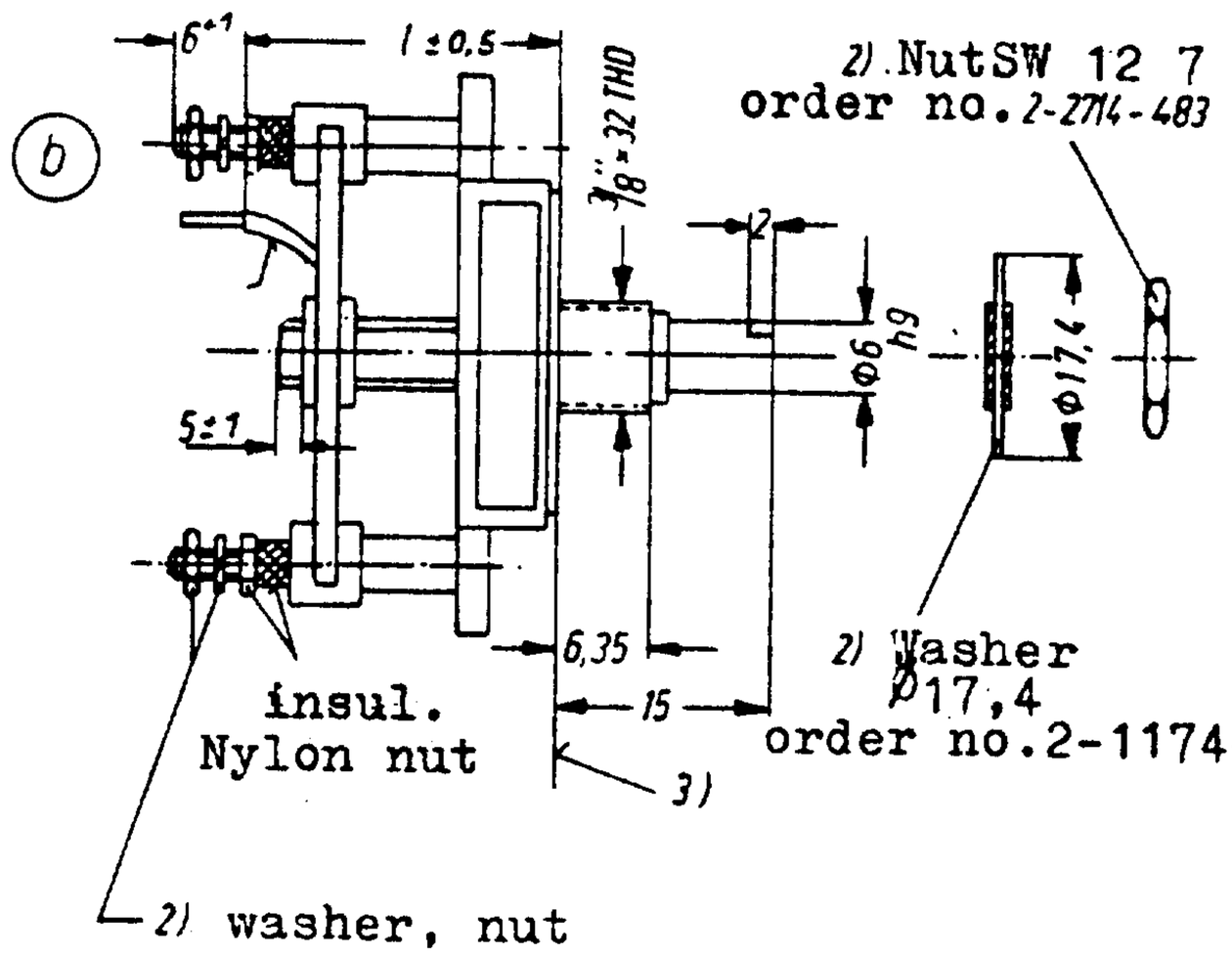
Shaft: flatted
throw-torque: 0,063 cmkp
tightening torque for nut: 0,12 cmkp

	Axis selector switch 3M
Extreme position	3 and 15
Latching angle	30°
Dimension l	21

All switches with overlapping contact arrangement.

Dimension drawing of selector switch (15°) without diode board





All measurements in mm !

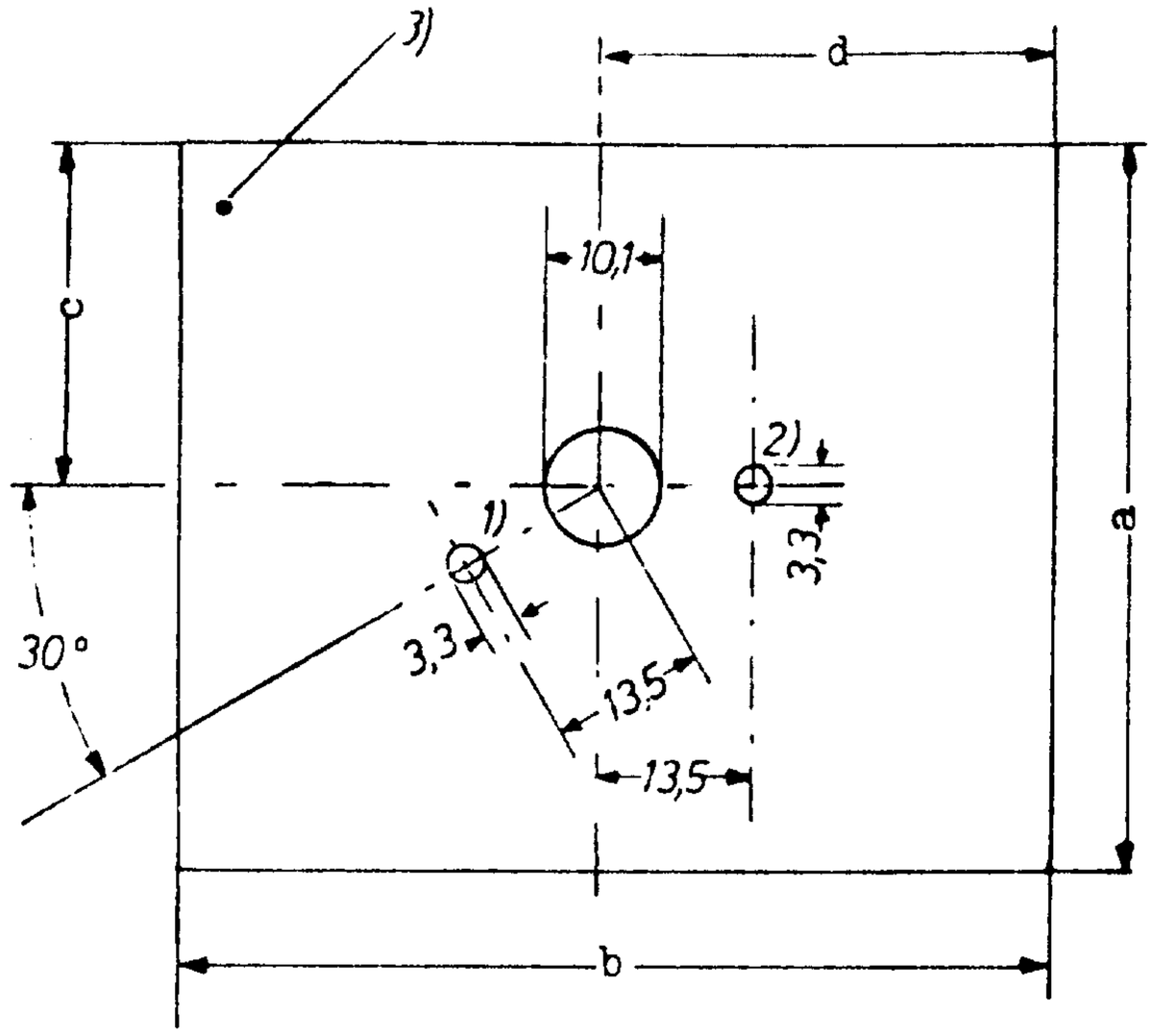
PBC is not shown !

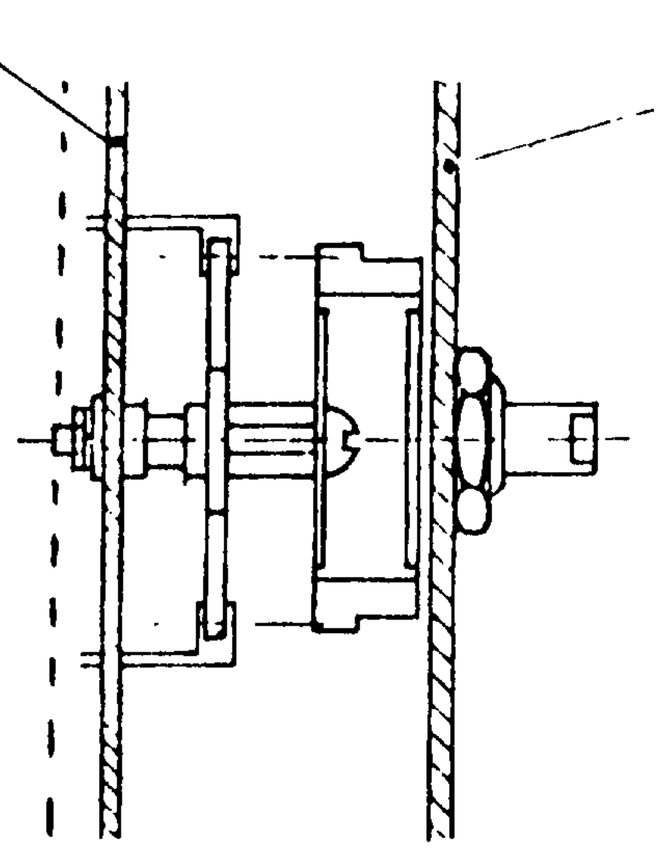
Shaft: flatted
throw-torque: 0,063 cmkp
tightening torque for
nut: 0,12 cmkp

	Feedrate override switch	Operating mode selector switch	Spindle speed override switch
Extreme position	1 and 31	1 and 31	1 and 15
Latching angle	15°	15°	15°
Dimension 1	21	21	21

All switches with overlapping contact arrangement.

Dimension drawing of selector switch with diode board





1) Drill hole for rotation limitation. Switch 30° latch
2) Drill hole for rotation limitation. Switch 15° latch
3) Printed circuit board with diodes. The switch is delivered complete with board.
4) Control panel front element

Printed circuit board dimensions

Dimension in mm	Operating mode switch	Axis selector switch (3M)	Feedrate override switch	Spindle speed override switch
a	65	51	65	65
b	80	71	80	80
c	32	25	32	32
d	42	41	42	42

9. External equipment

Power supply components

Encoders

Encoder selection

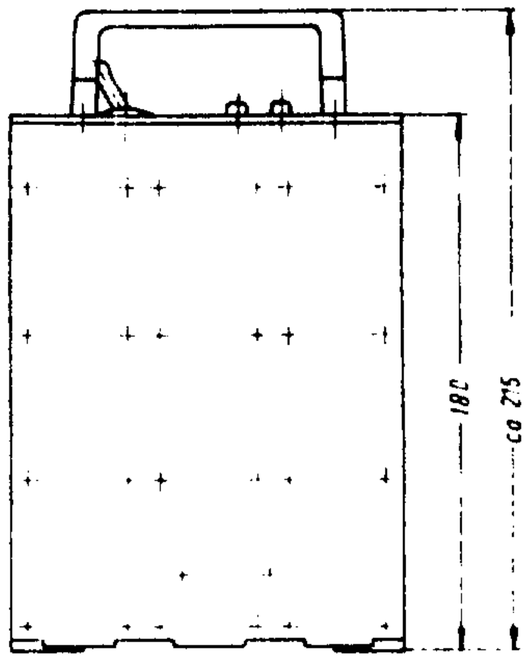
Handwheel

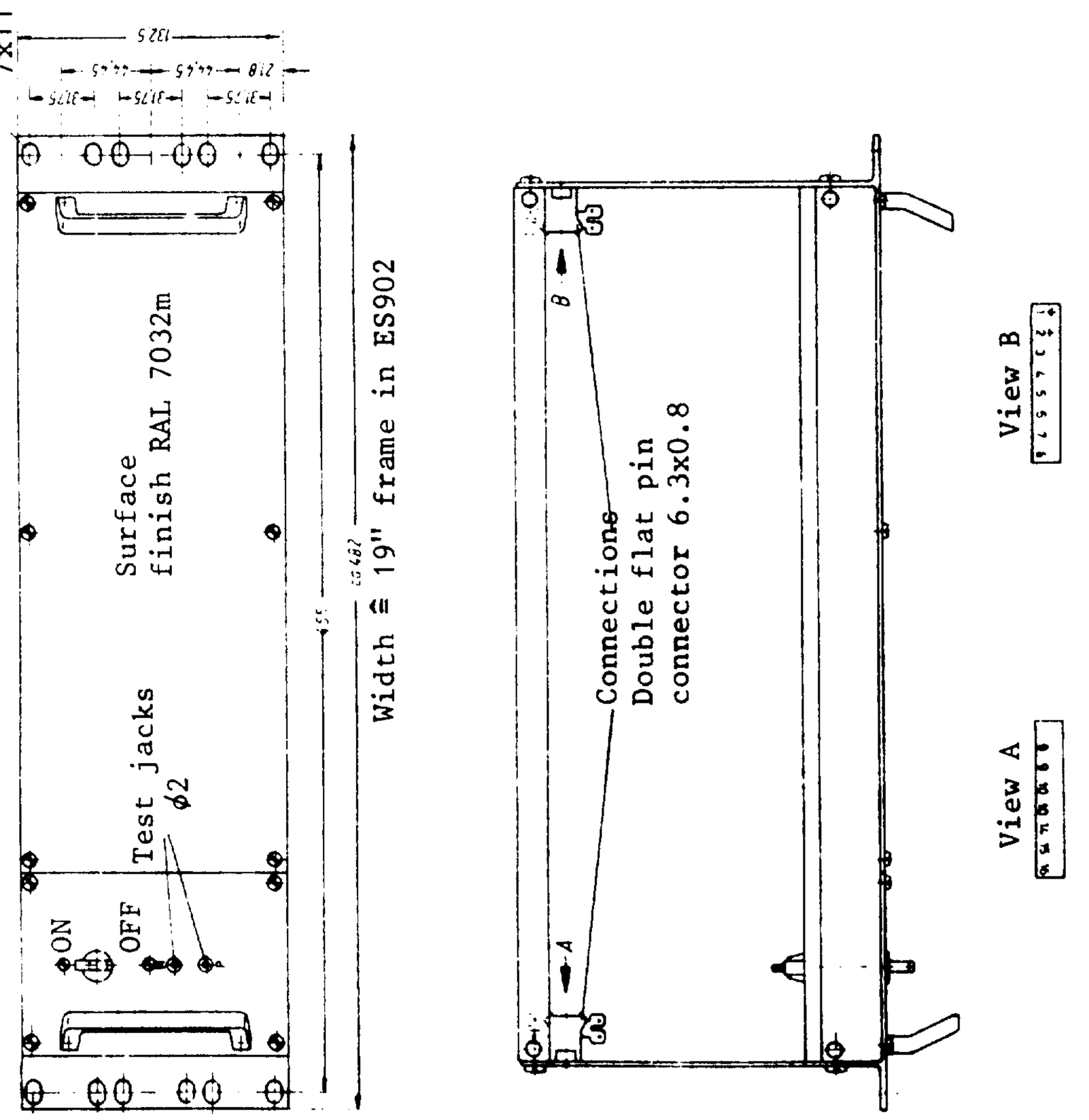
Reader components

Power supply components
Type: 6EV 1350-5AK
Order no. 6FC9 304-0AC
Models up to 8/81

Input: 220 V Δ/380 V Y
Output: 24 V d.c./20A

Dimensions in mm





Power supply components

Type: 6EV 1360-5AK

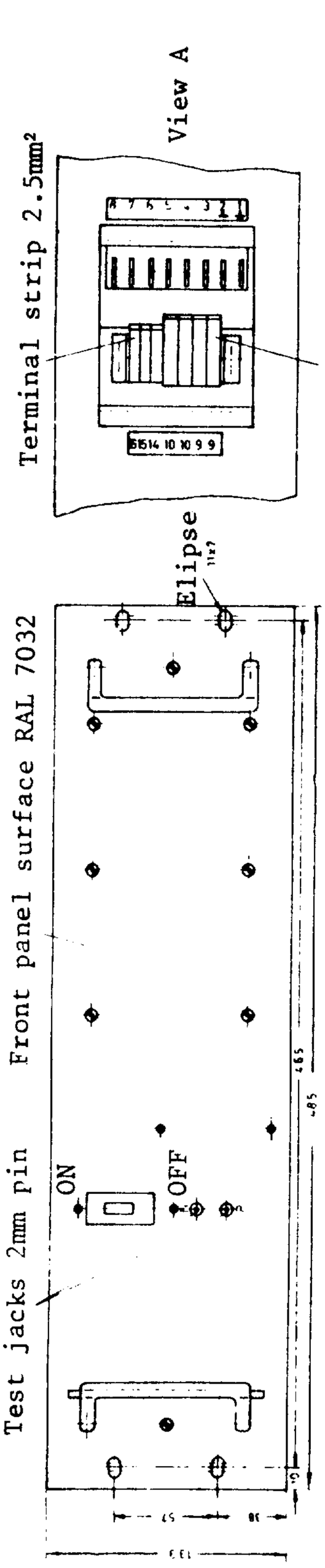
Order no. 6FC9 304-0AD

Models up to 8/81

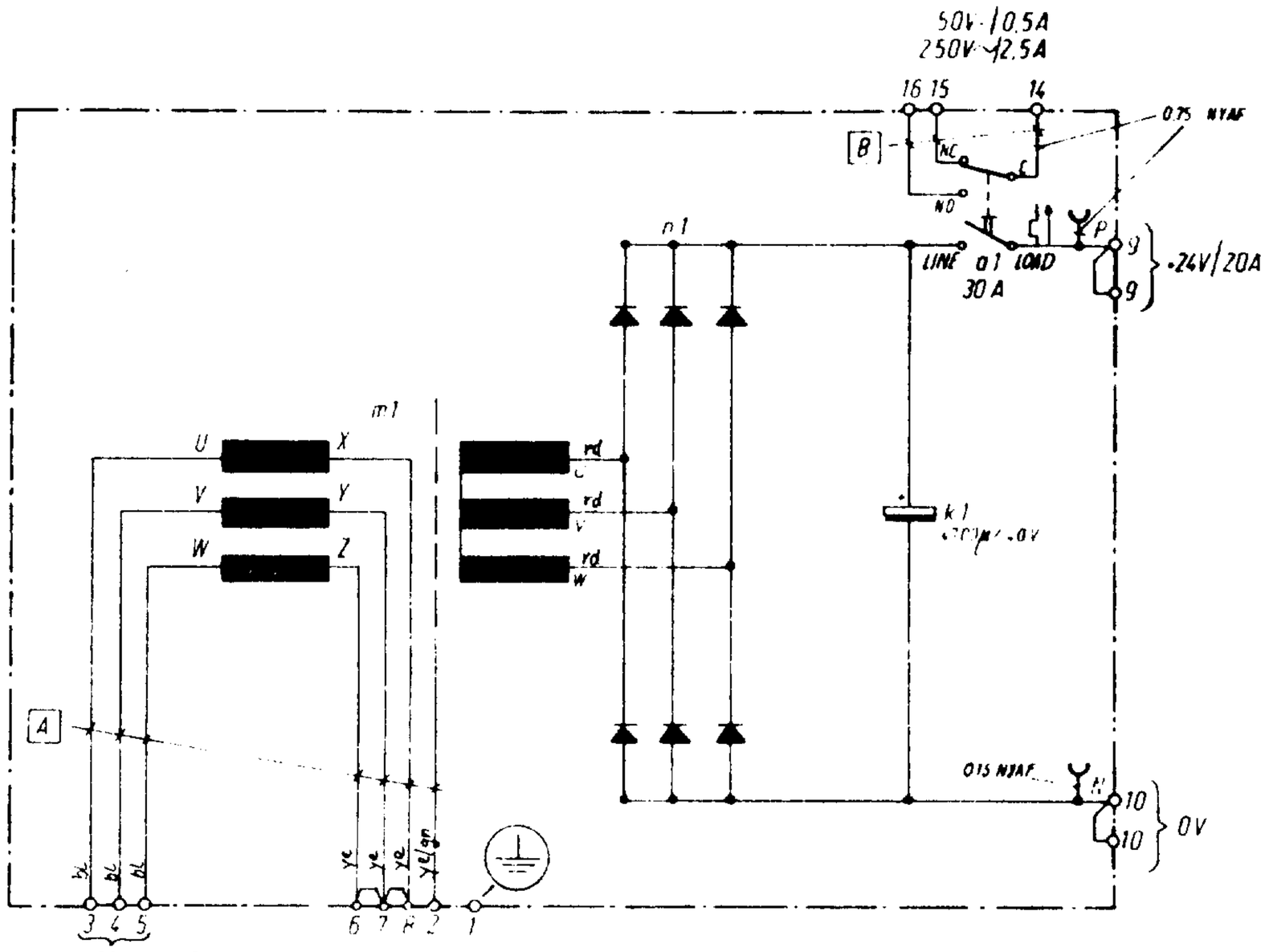
Input: 220 V Δ/380 V Y

Output: 24 V d.c./40A

Dimensions in mm



Connection of power supply components 380 V a.c./24 V d.c.
Rated output currents 20 A and 40 A
Models up to 8/81

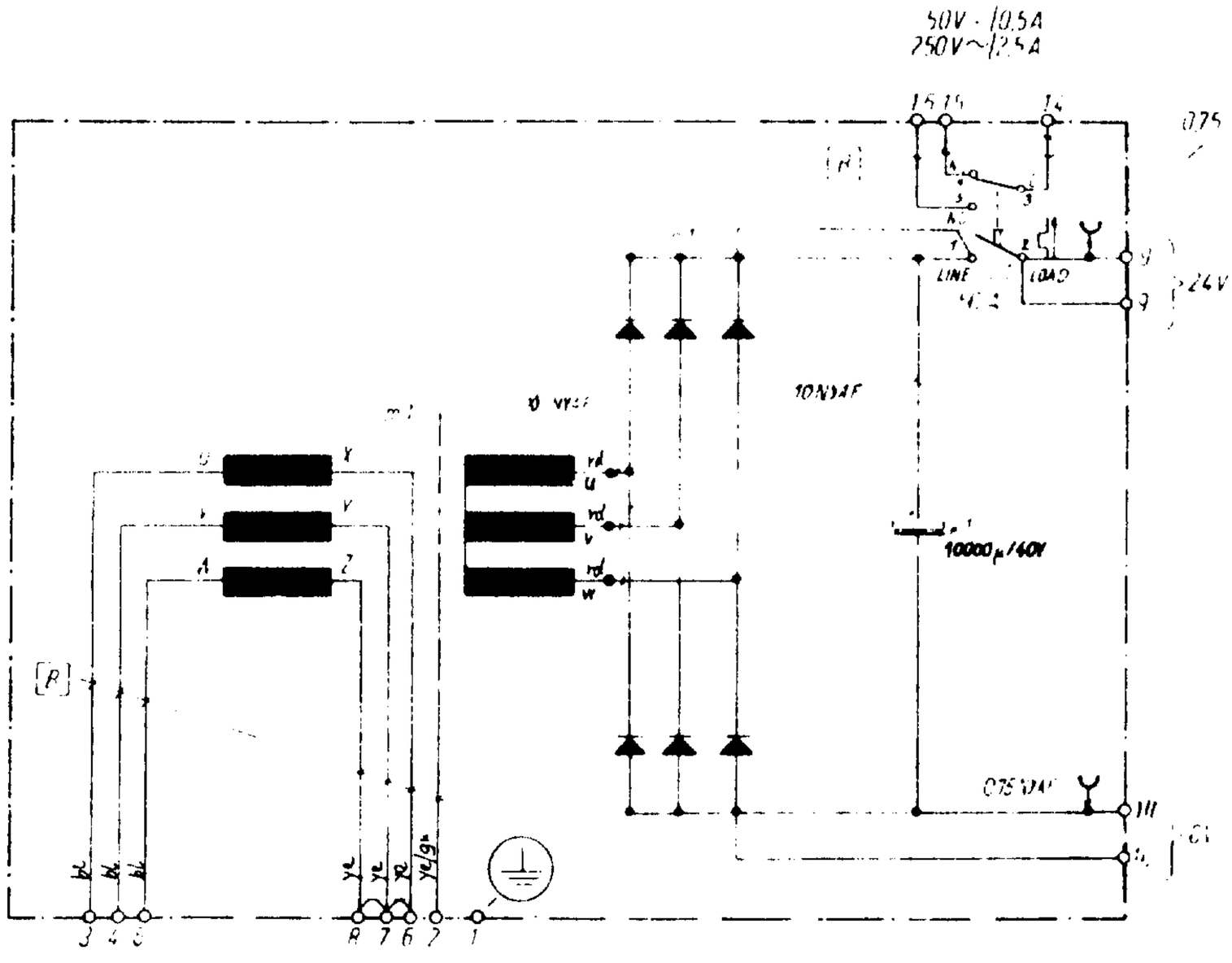


Power supply unit
+24V/20A
6EV 1350 - 5AK

All non-designated cables are 6NYAF

220V Δ / 380V Y / 50 Hz

Cable tree:
- [A] Mains cable
- [B] Signal cable
- [C] all other non-designated



Power supply unit
+24V/40A
6EV 1360 - 5AK

If power supply unit output is loaded above 20A external connection must be made to the terminals 9-9, 10-10 which are connected in parallel

All non-designated cables are 6NYAF

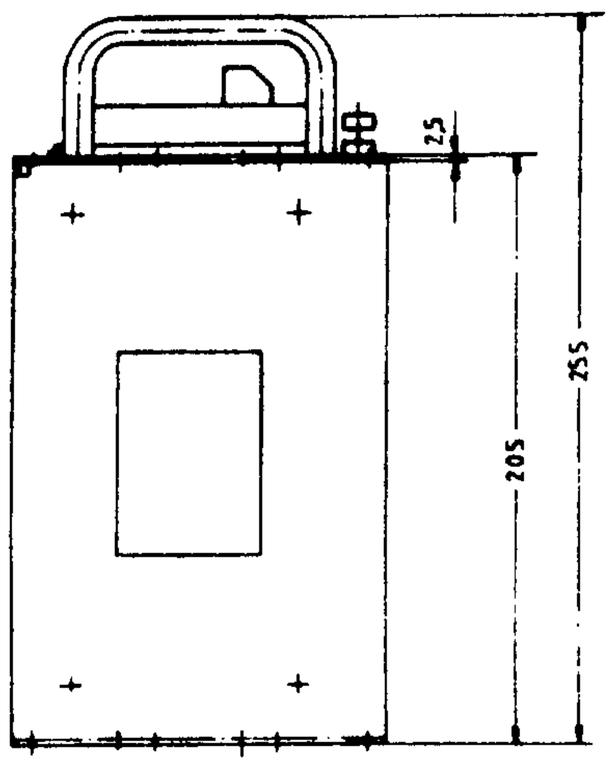
220V Δ / 380V Y / 50 Hz

Cable tree:
- [A] Mains cable
- [B] Signal cable
- [C] all other non-designated

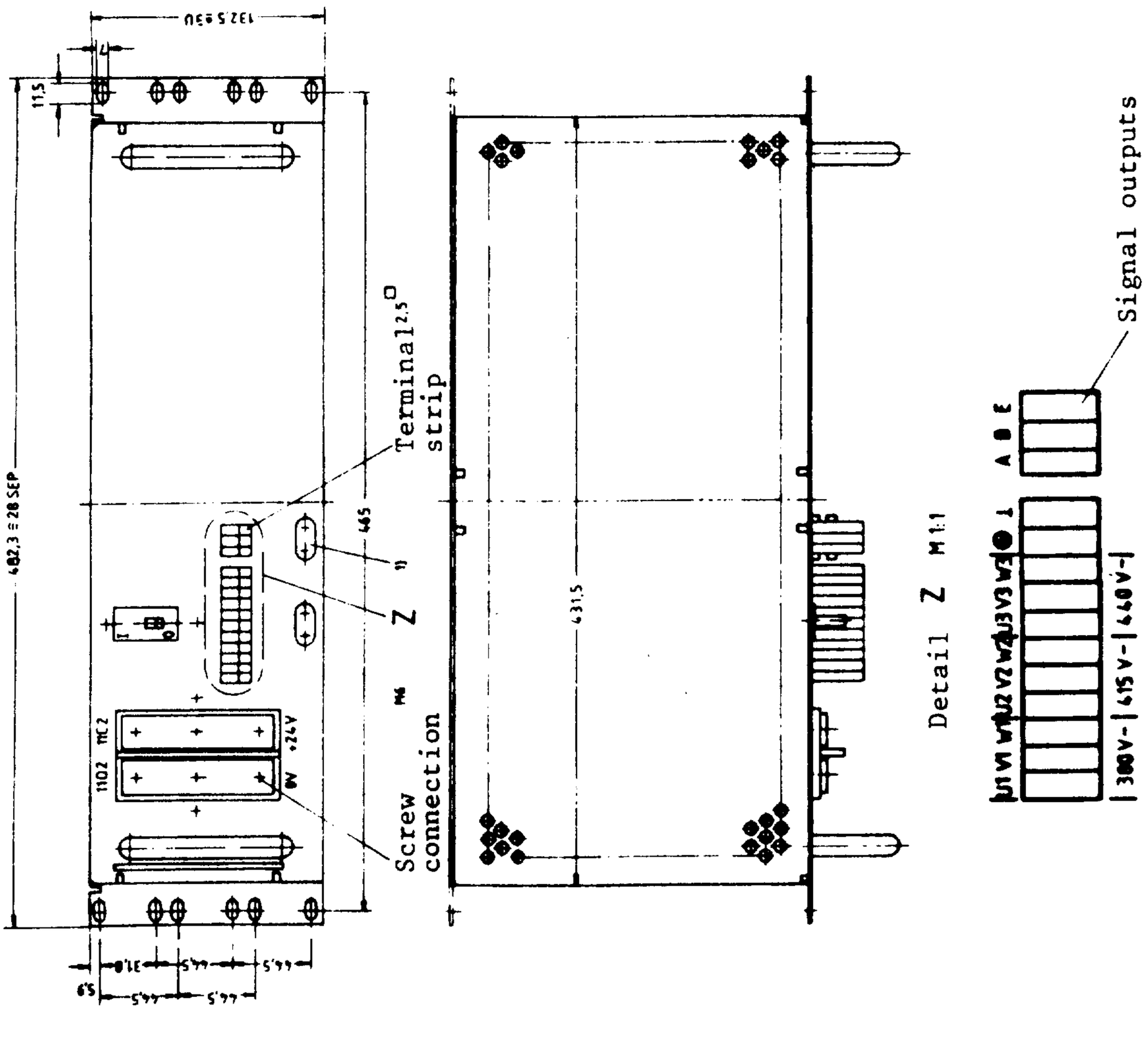
Power supply components
Type: 6EV 1352-5AK
Type: 6EV 1362-5AK
Order no. 6FC9 304-0AC for 20 A
Order no. 6FC9 304-0AD for 40 A
Models after 9/81

Input: 380 V a.c./415 V a.c./440 V a.c.
Output: 24 V d.c./20 A
24 V d.c./40 A

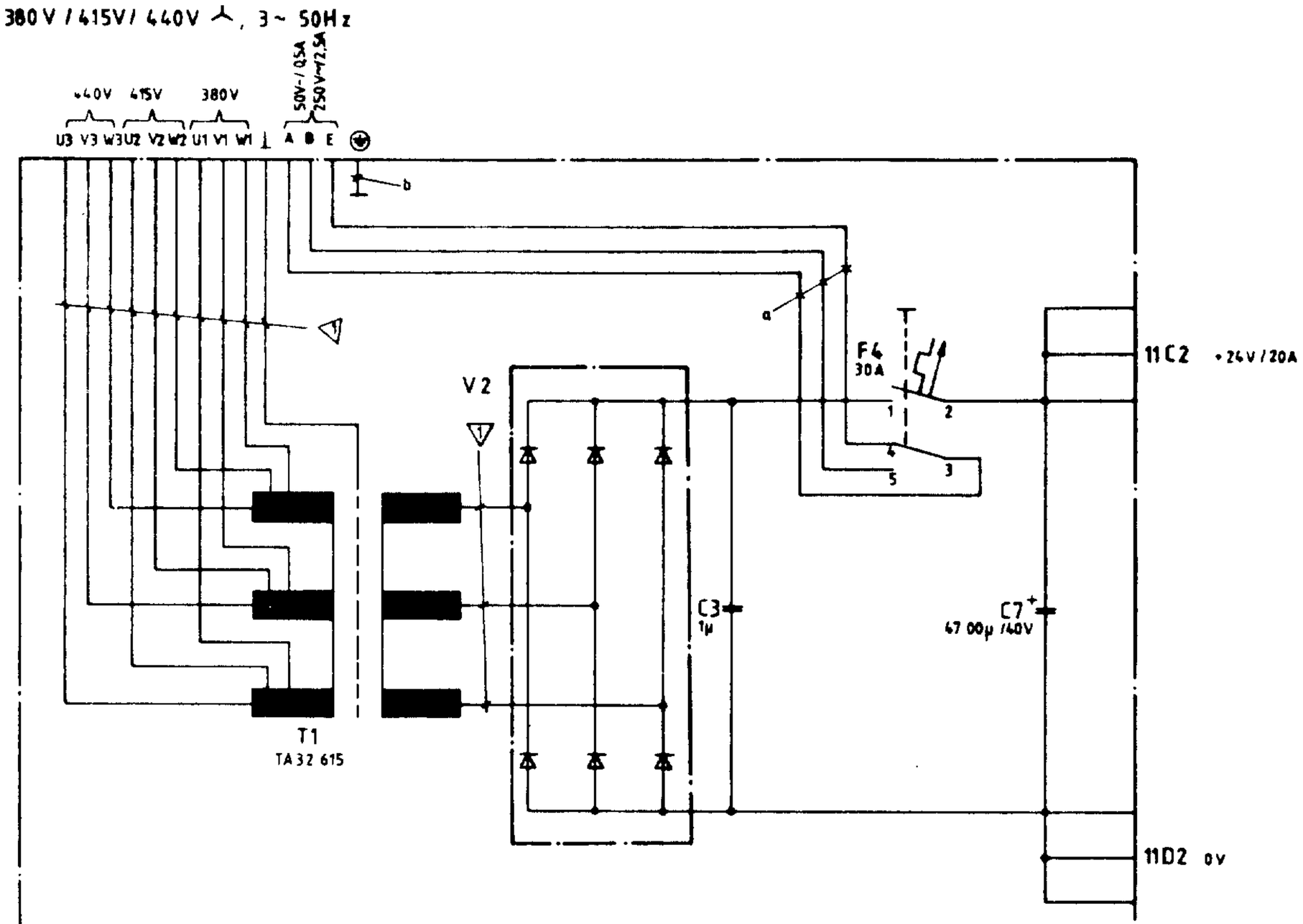
Dimensions in mm

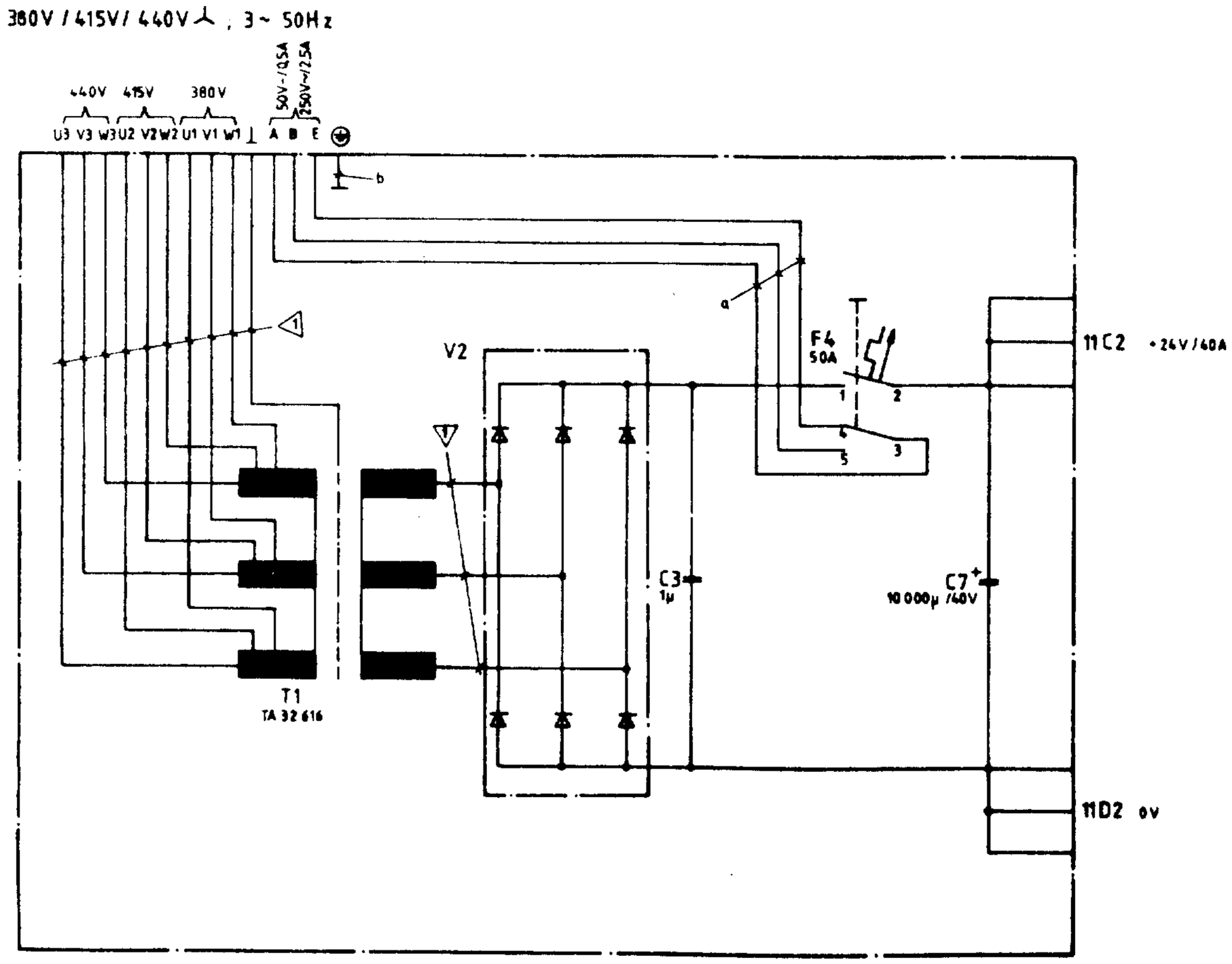


The equipment can be installed flush or on the wall by changing the top section of the casing
Cable grips for ϕ2...8



Connection of power supply components 380 V a.c./24 V d.c.
Rated output currents 20 A and 40 A
Models after 9/81

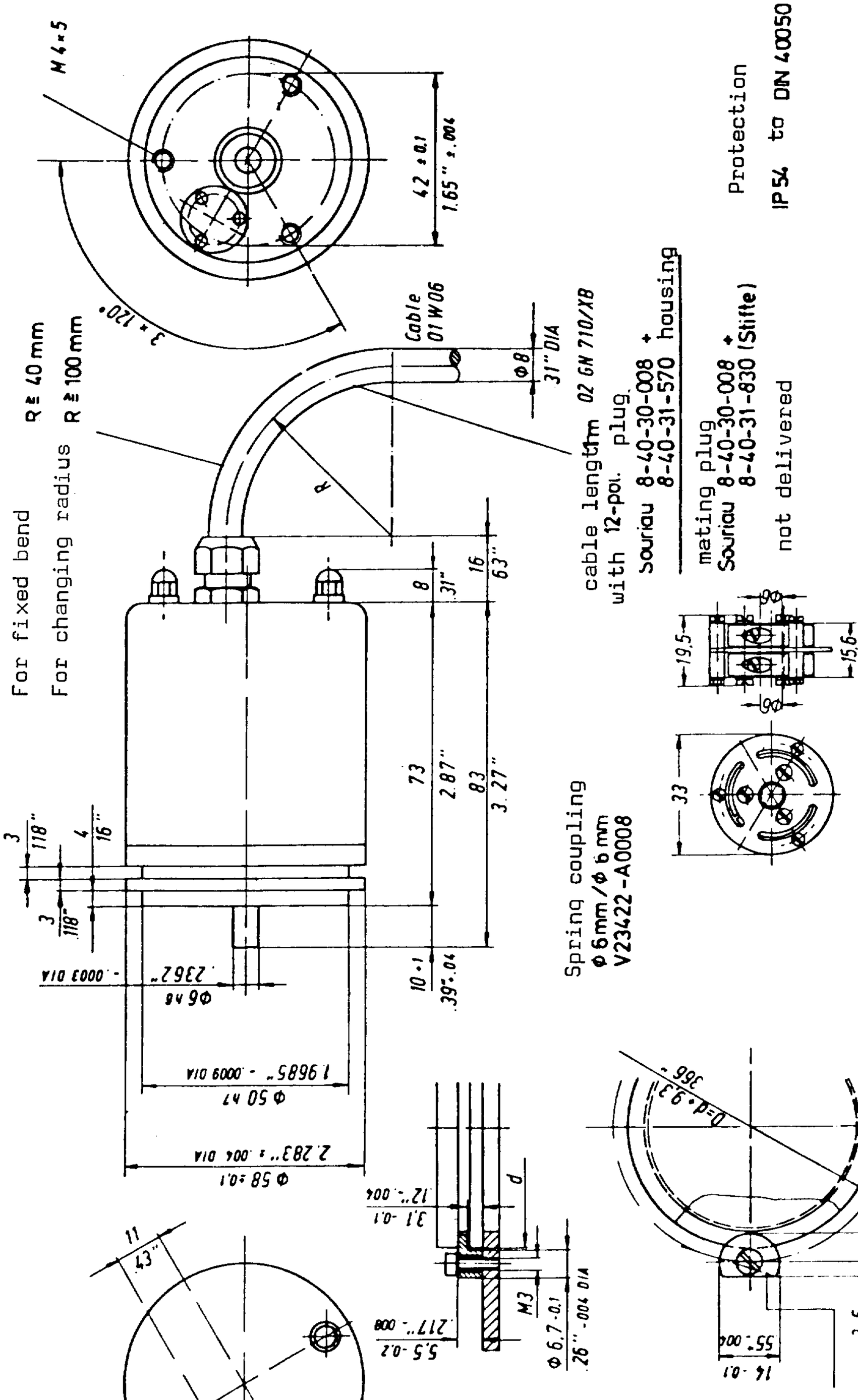




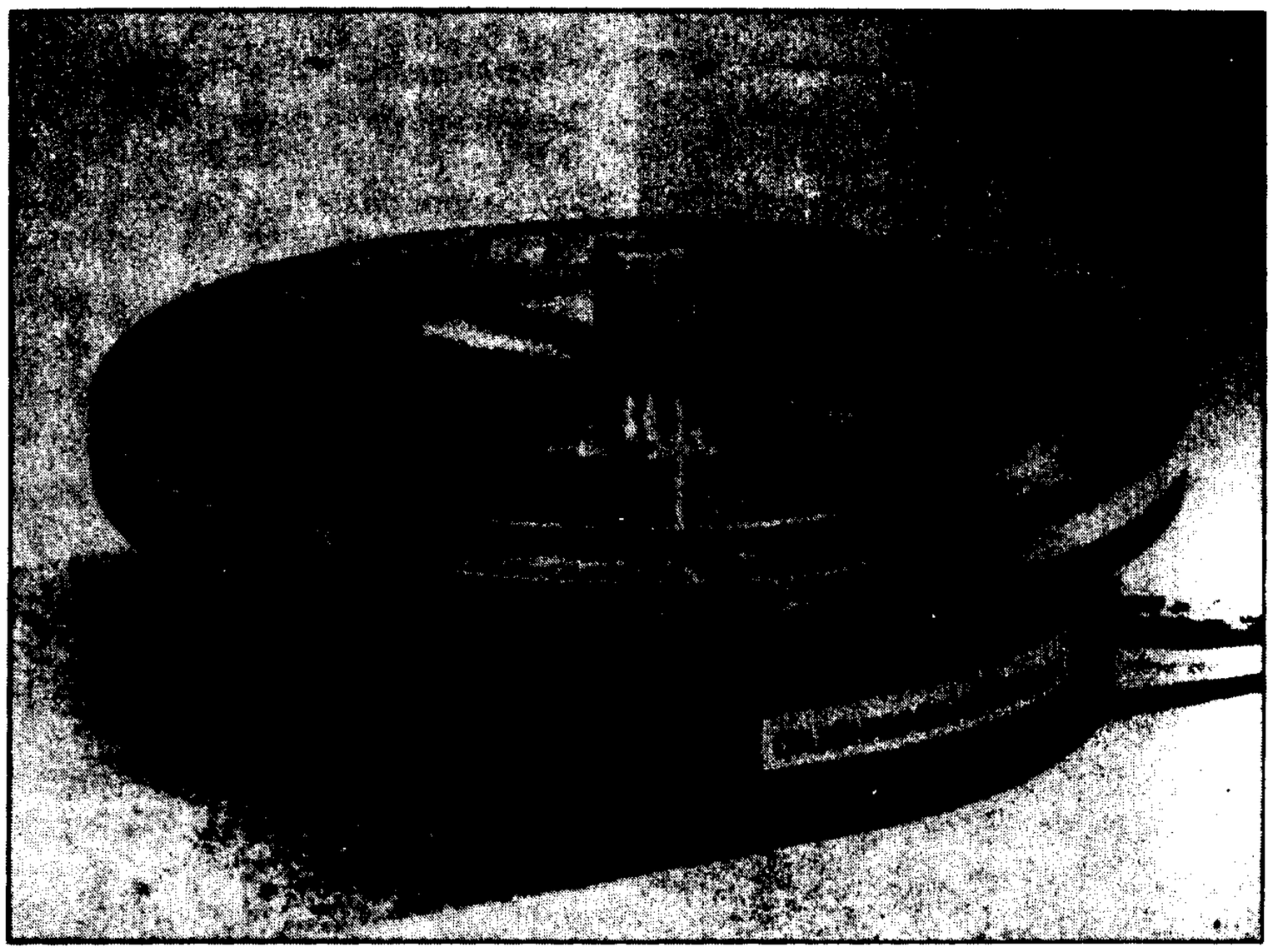
Incremental encoder ROD 426

Dimensional drawing

Dimensions in mm



ROD 700



Resolution
max. 0.0001° (0.36") for 36,000 strokes,
25 times interpolation and
quadruple evaluation

Power supply
+ 5V

Output signals
sine-shaped

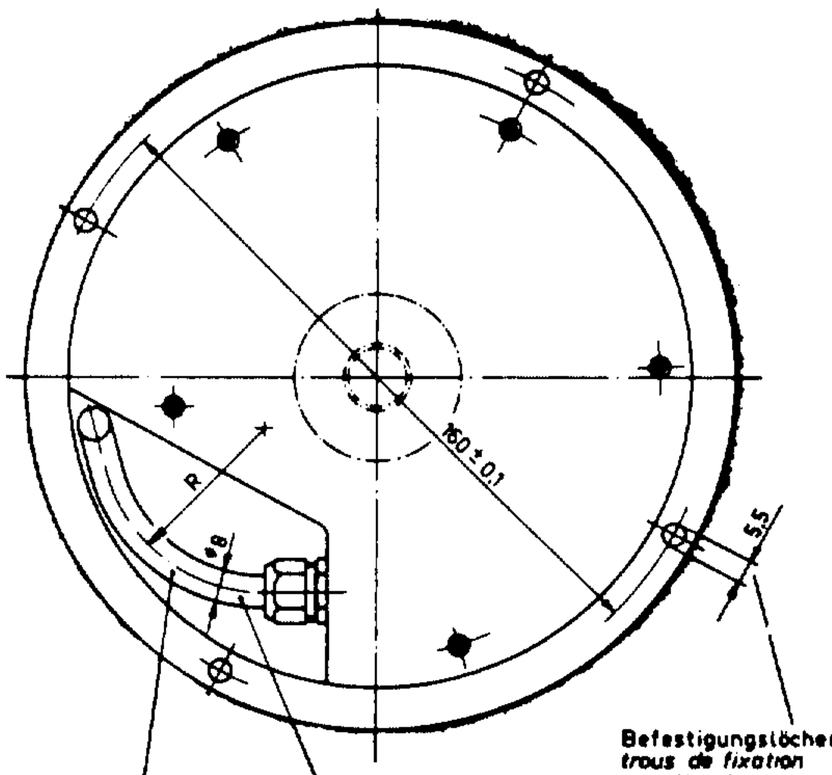
Reference signal
standard

Pulse former electronic
externally (see counter or EXE)

Mechanical design
flat construction,
high wave capacity,
upon request permanent wave,
cable exit radial or axial

High precision

Dimension drawings (mm)



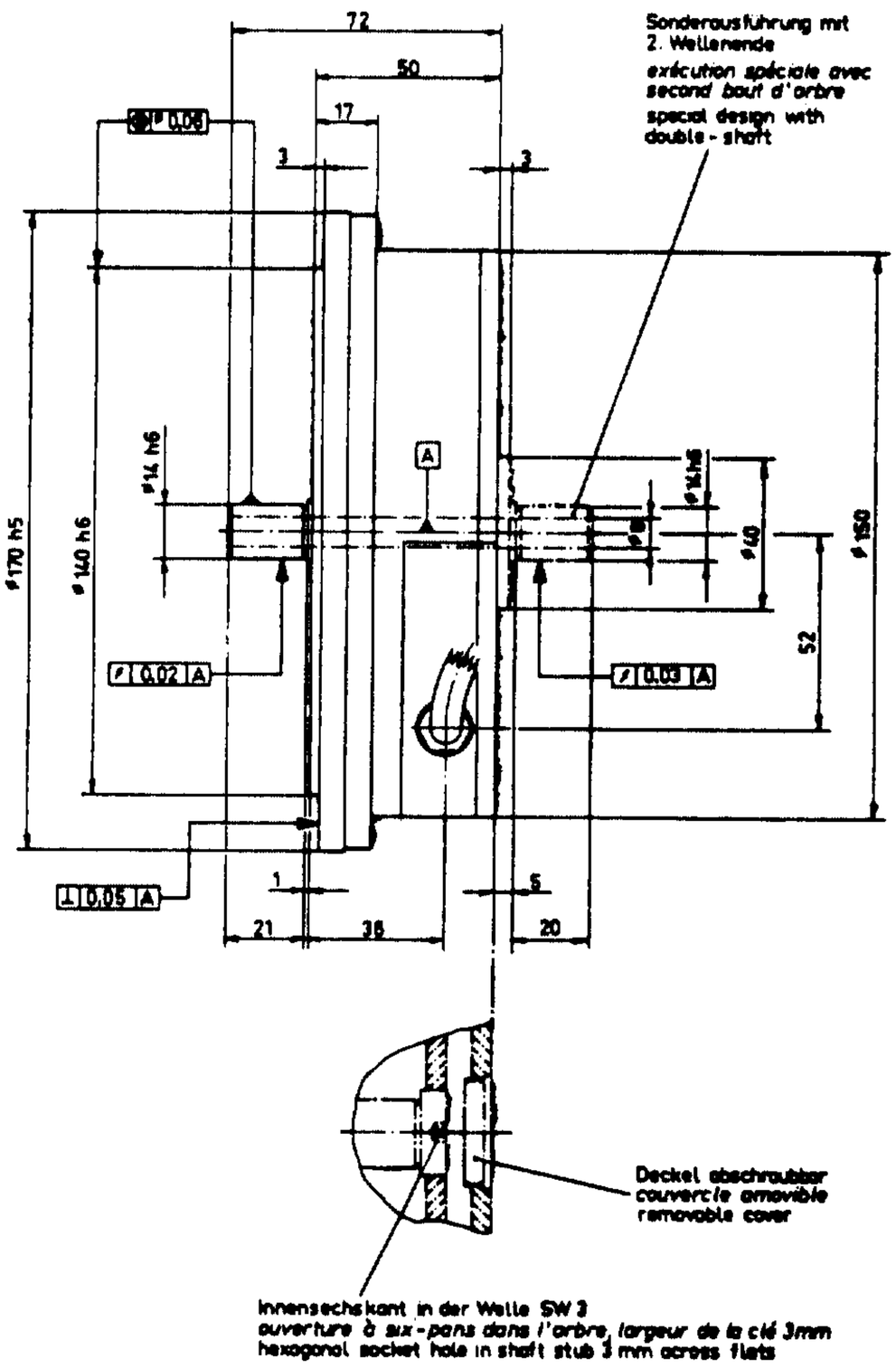


Table for encoder selection

Encoder assignment	ballscrew					rotary axis
Interpolator - unit	0.5 µ					$0.5 \cdot 10^{-3}$°
Factor (machine parameter)	2	1		$\frac{1}{2}$		2
Resolution	1 µm	0.5 µm		0.25 µm		10^{-3}°
Encoder pulse count/rev.	2500	5000	2500	5000	2500	18000
EXE	-	-	-	-	-	5 fold
Pulses position controller input x 4 per rev.	10000	20000	10000	20000	10000	360000
Max. generator frequency per channel	100 KHz	100 KHz	100 KHz	100 KHz	100 KHz	25 KHz
Spindle pitch (pulse count position controller x resolution)	10 mm	10 mm	5 mm	5 mm	2.5 mm	direct
V_{max} axis	24 m/min	12 m/min	12 m/min	6 m/min	6 m/min	29880 °/min
Max. spindle/generator speed	2400 RPM	1200 RPM	2400 RPM	1200 RPM	2400 RPM	83 RPM

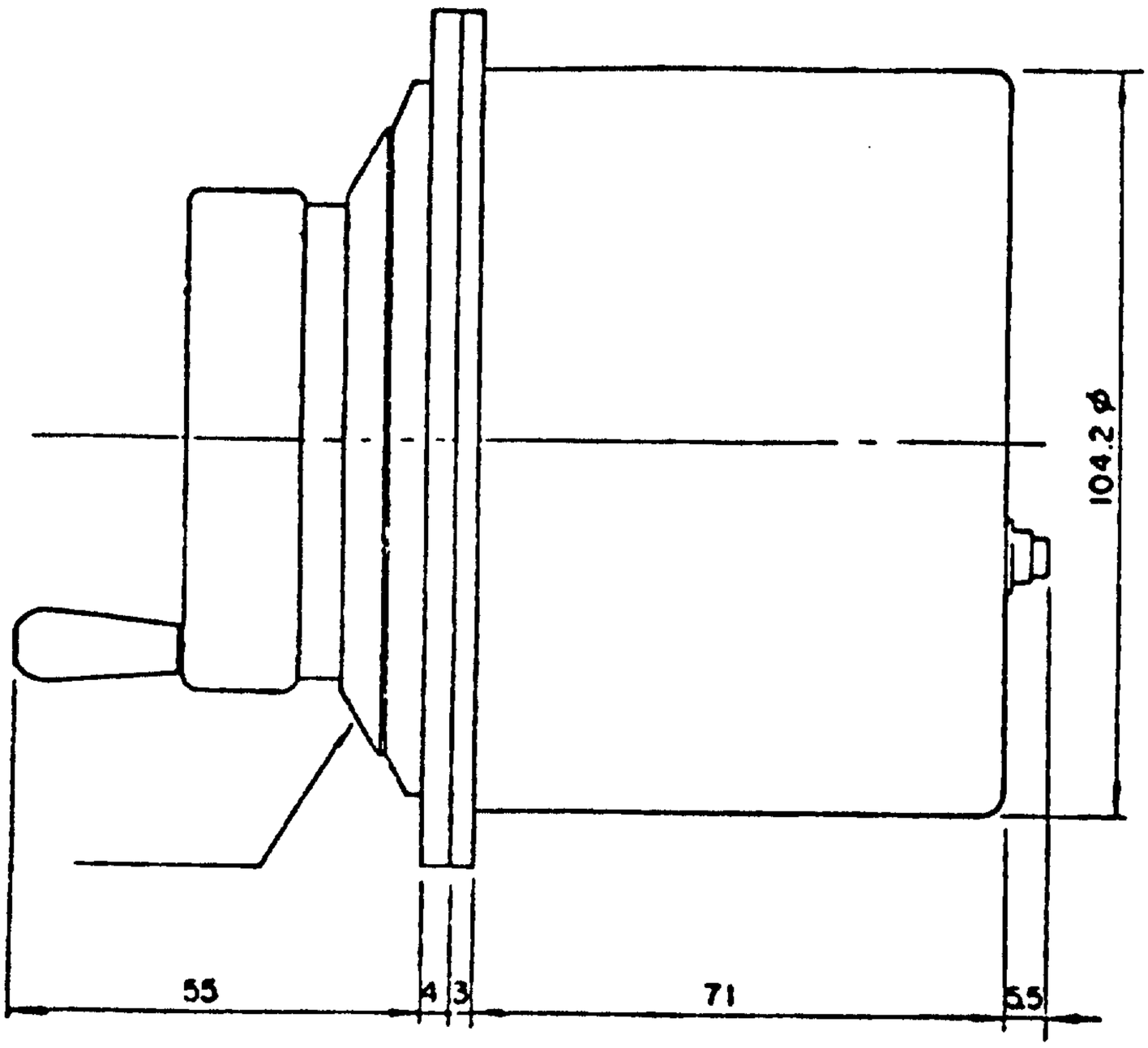
Traverse rate rapid = V_{max} axis, max. 15 m/min

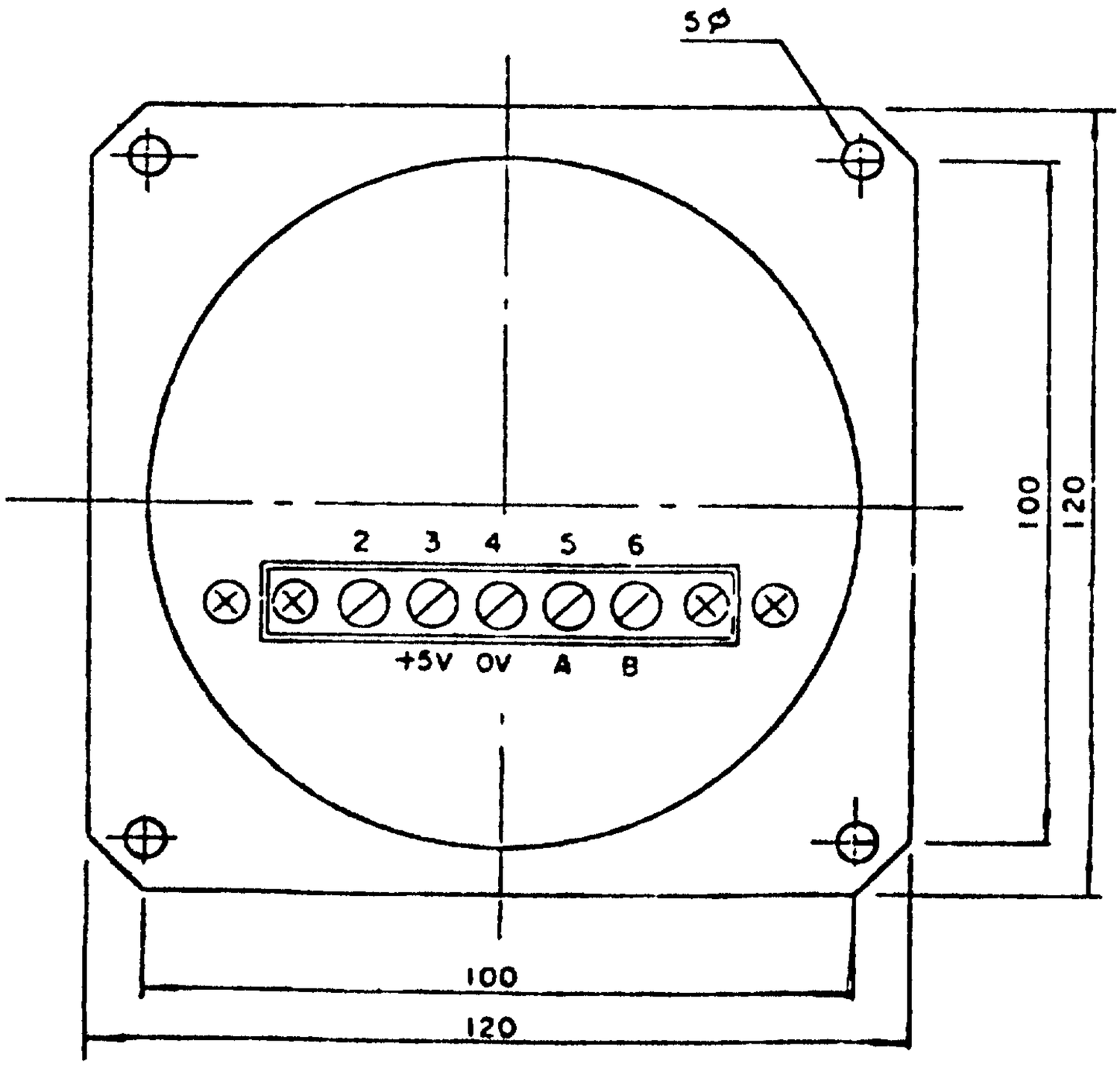
The factor (machine parameter) is settable for specific axes

Encoder for linear axis: 6FC9 320-3C_ ,for rotary axis : 6FC9 320-1DA

Handwheel

Dimensions in mm

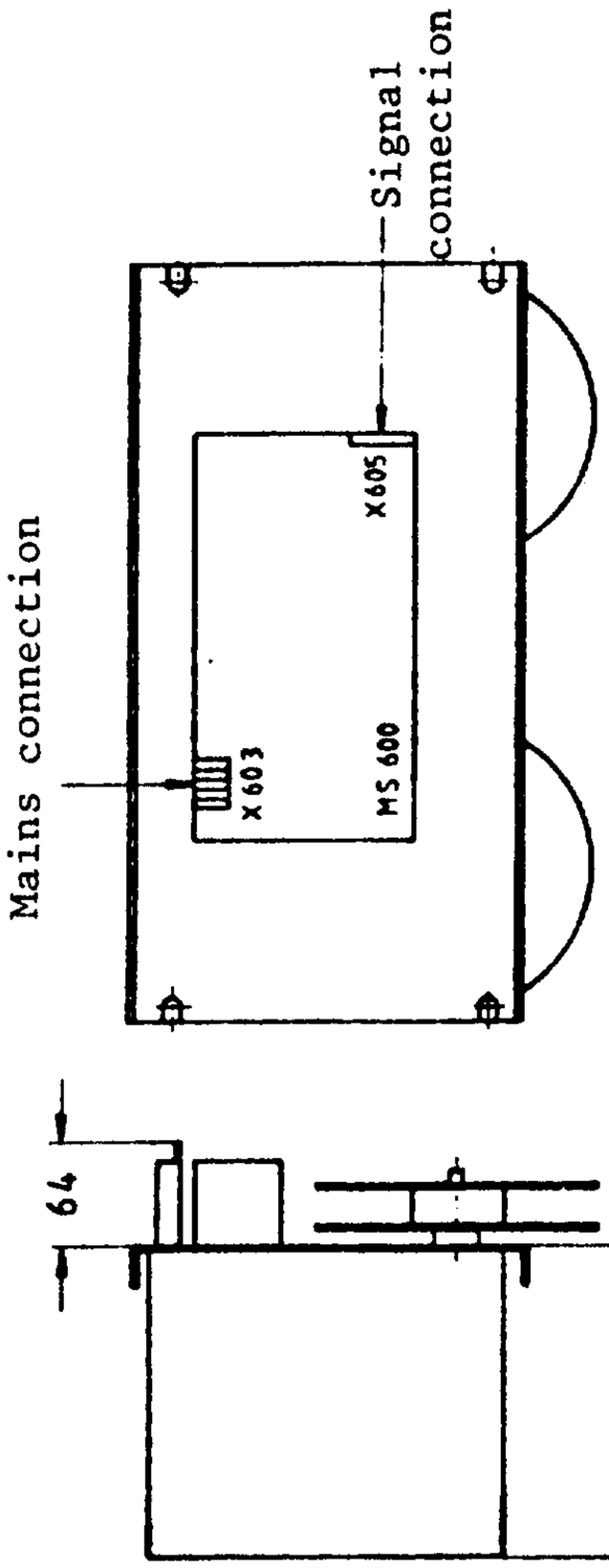


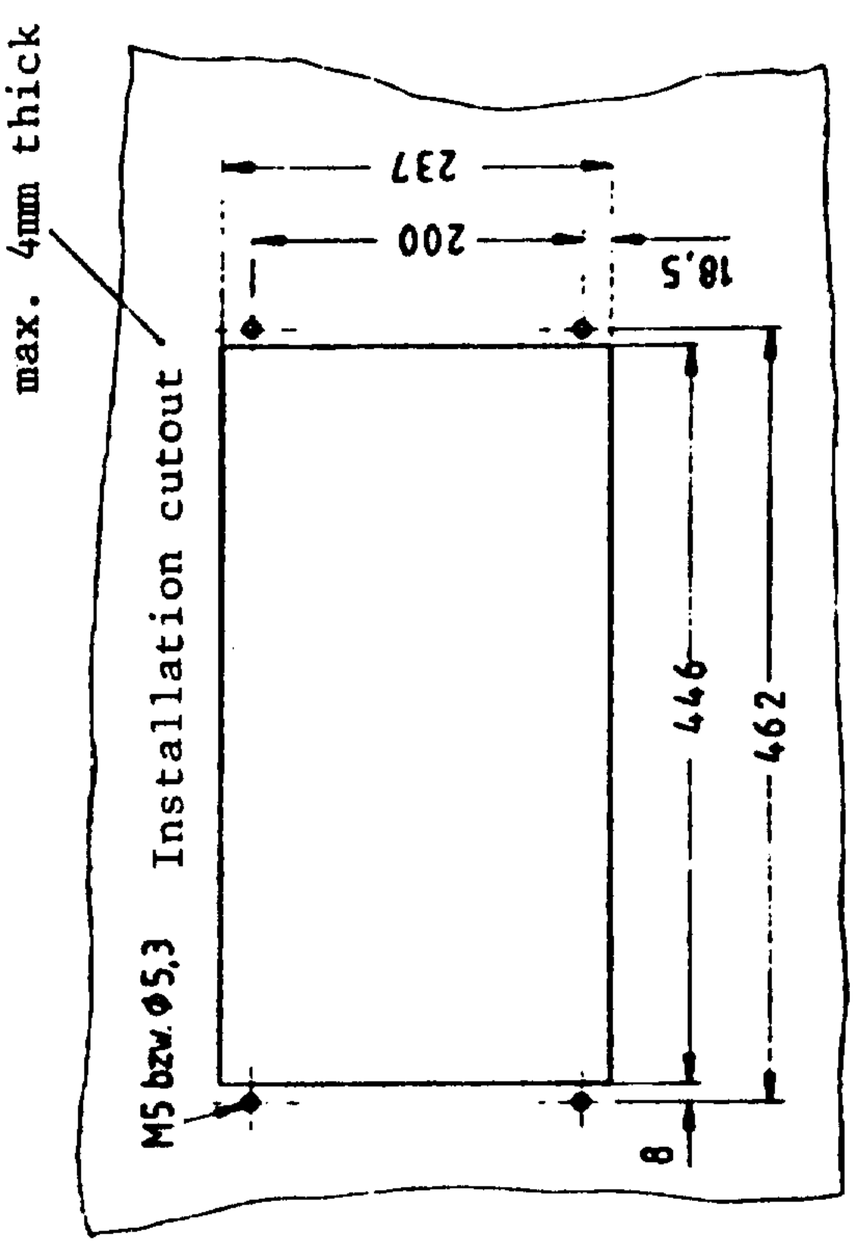


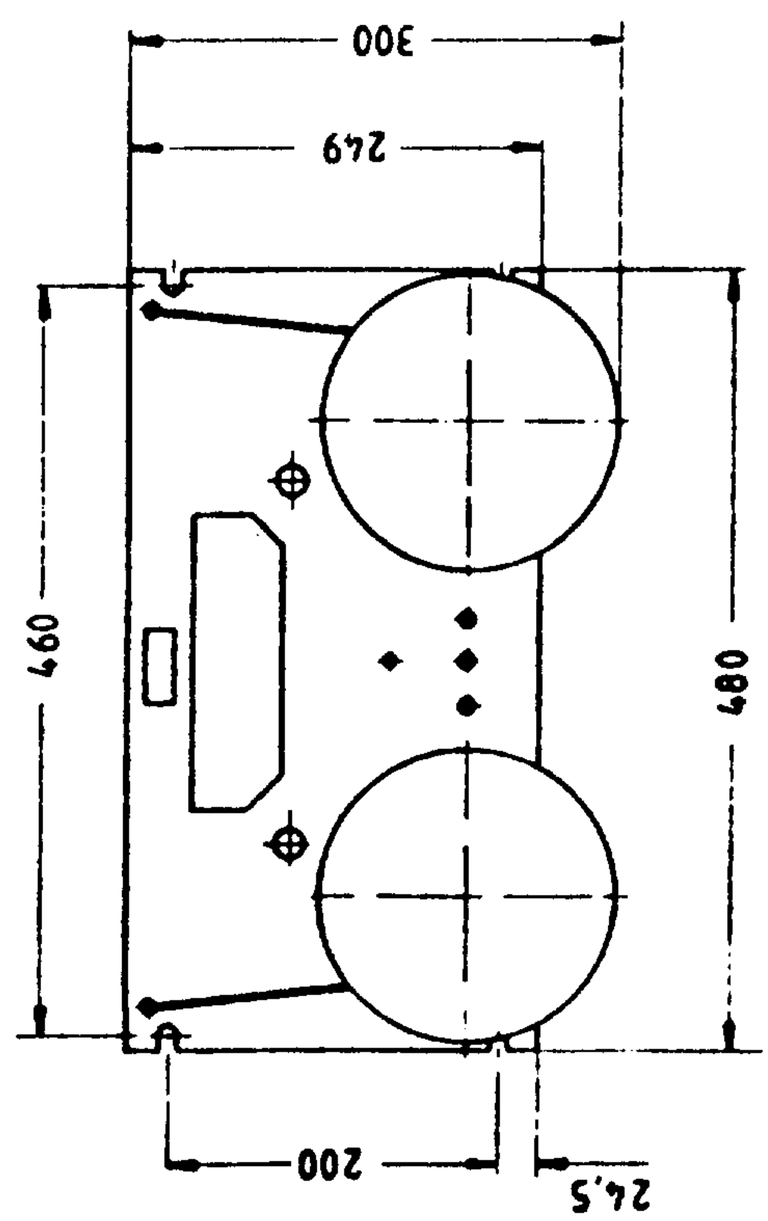
Tape reader

Dimension drawing (with spooler)

Dimensions in mm



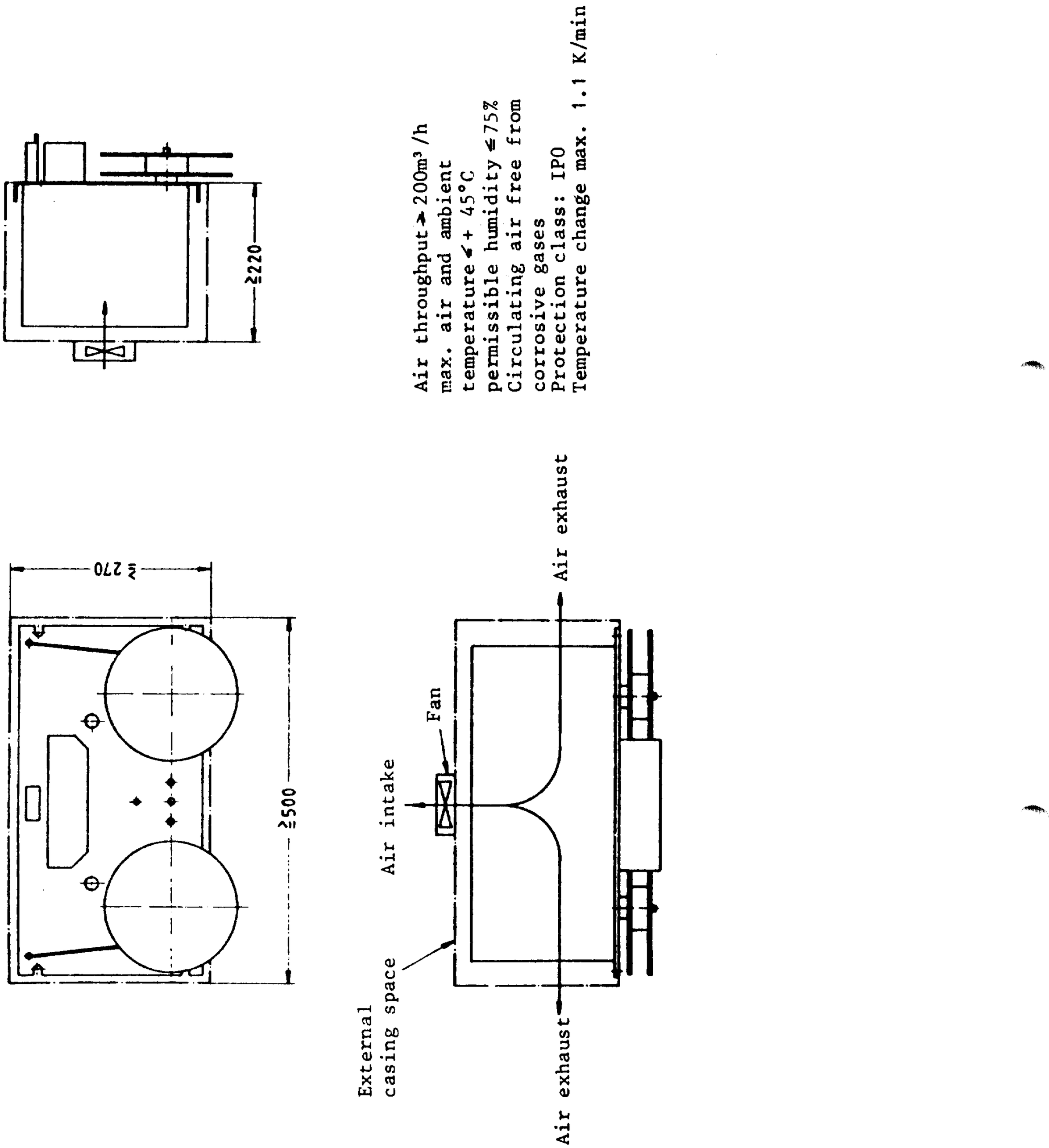




Tape reader

Suggested installation (without spooler)

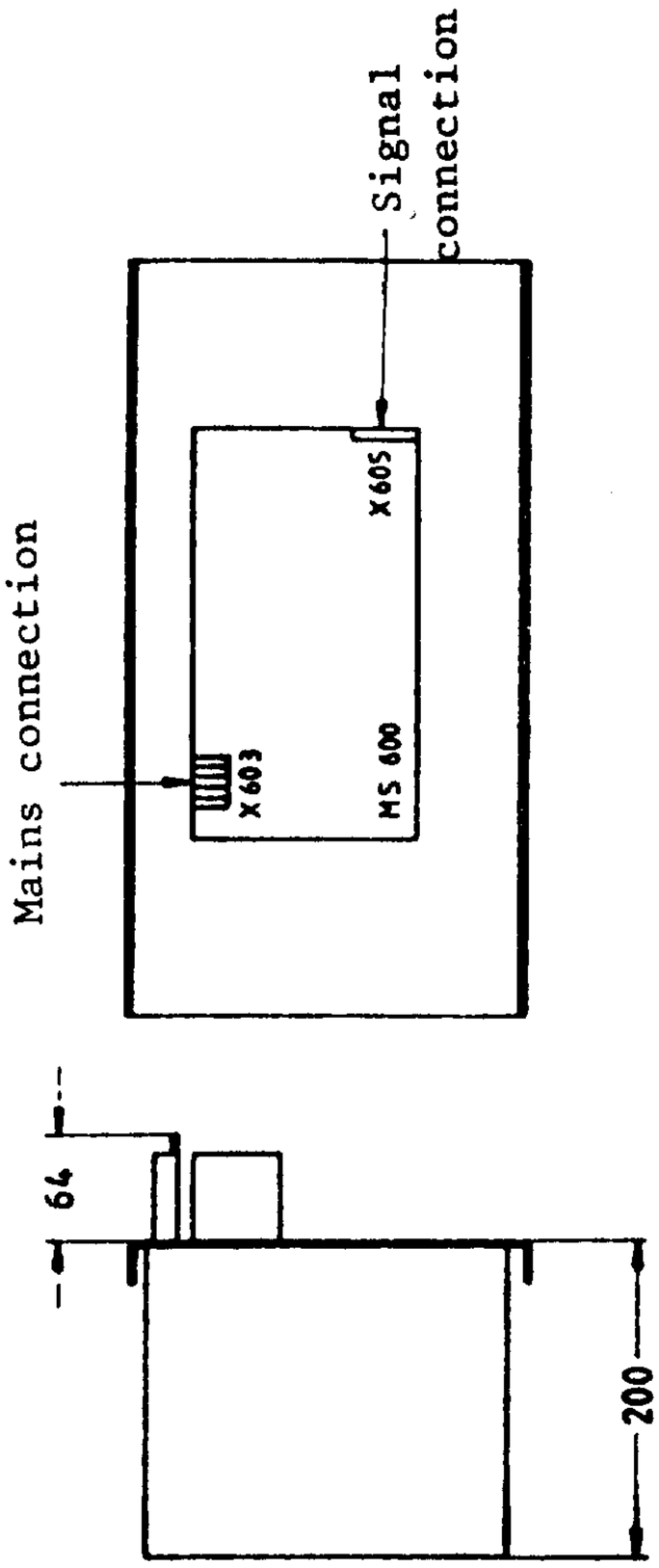
Dimensions in mm

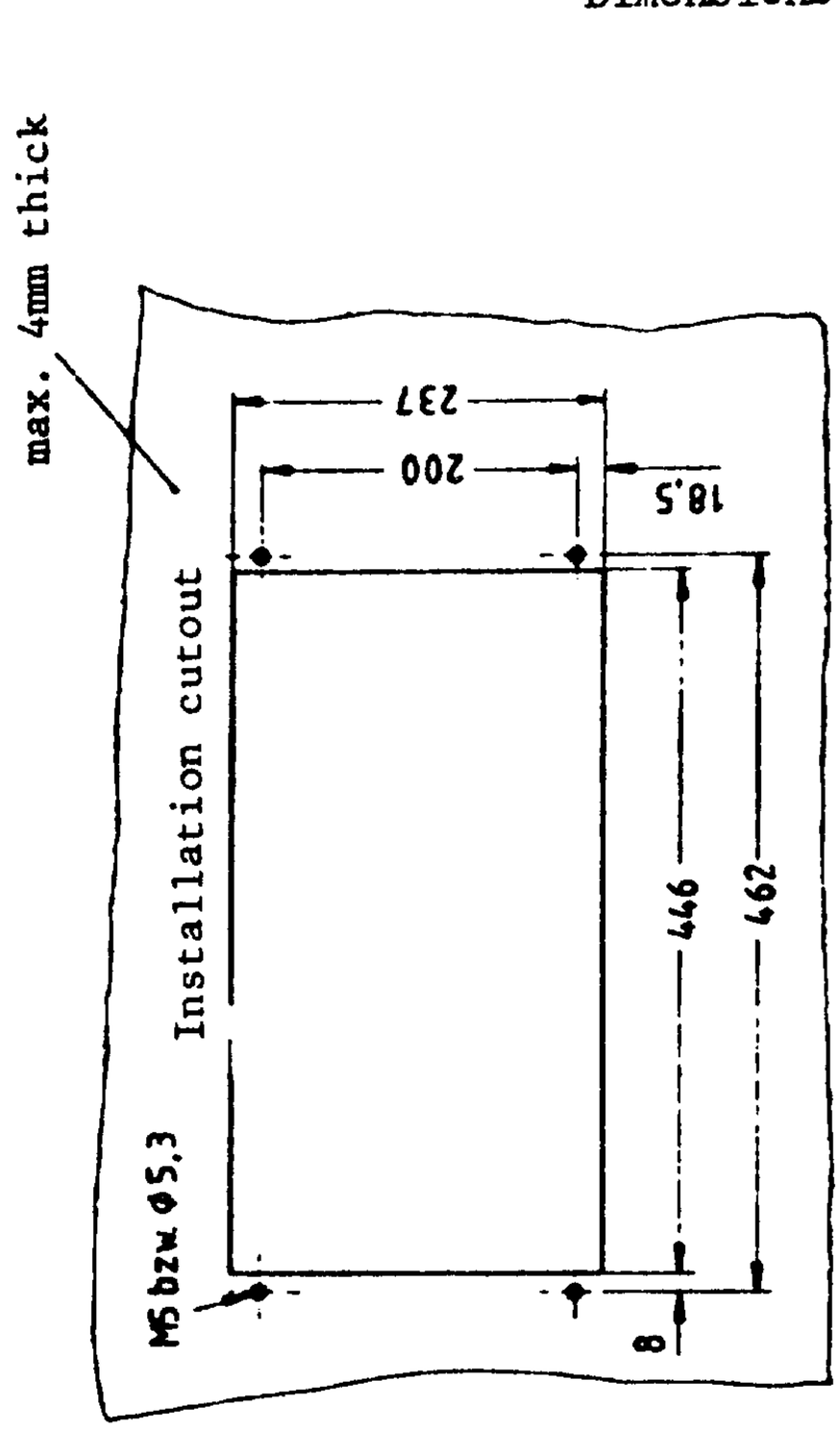


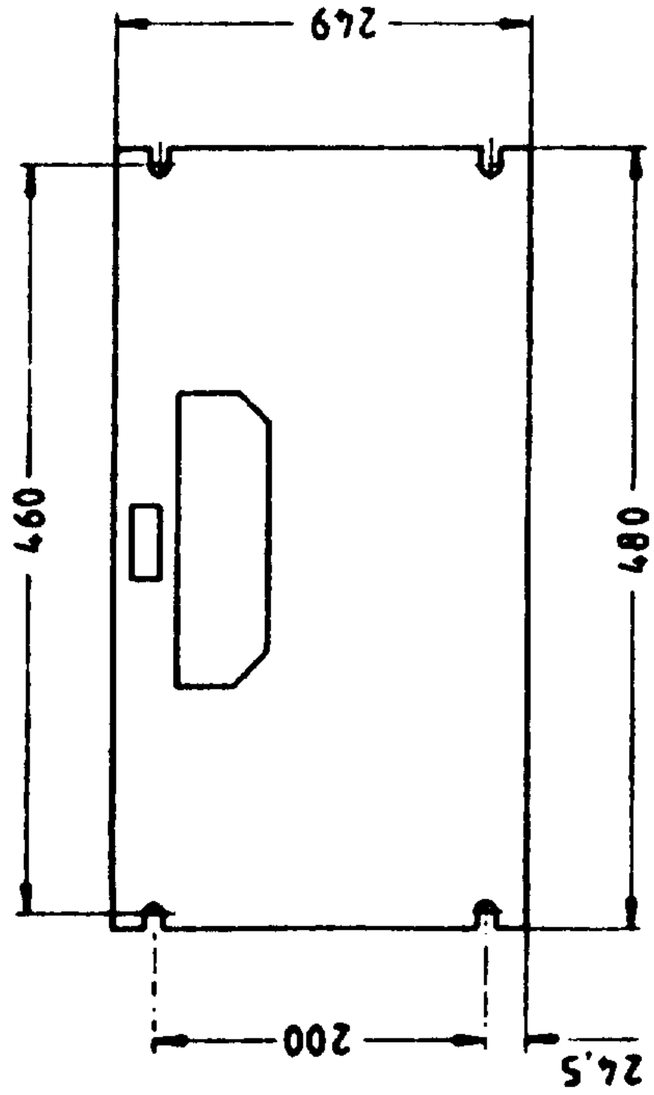
Tape reader

Dimension drawing (without spooler)

Dimensions in mm







Mains connection:

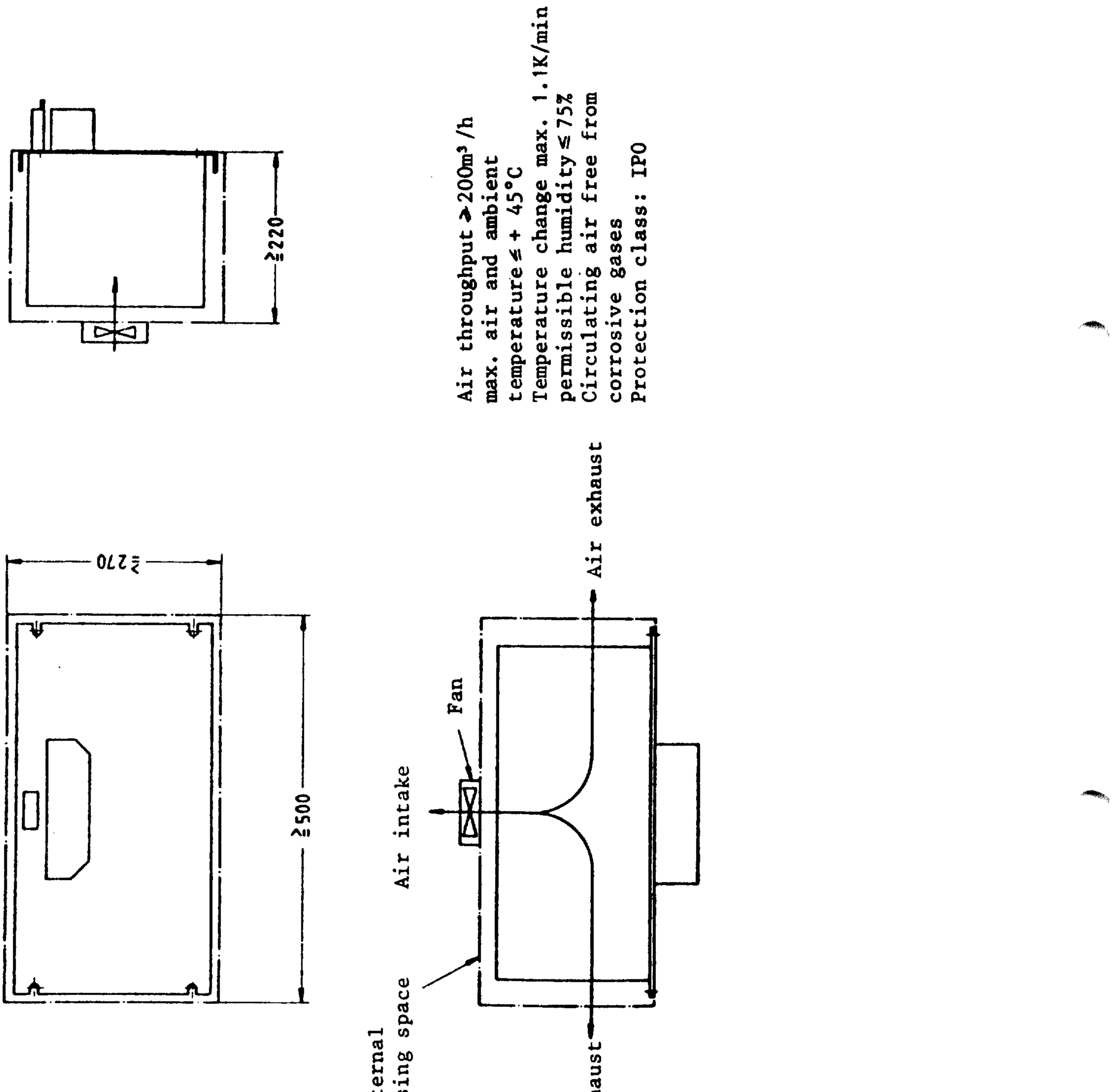
N/L_2	L_1	PE	
o	o	o	o
1	2	3	4
o	o	o	o

X603

Tape reader

Suggested installation (without spooler)

Dimensions in mm



10. Operator's Panel Switching

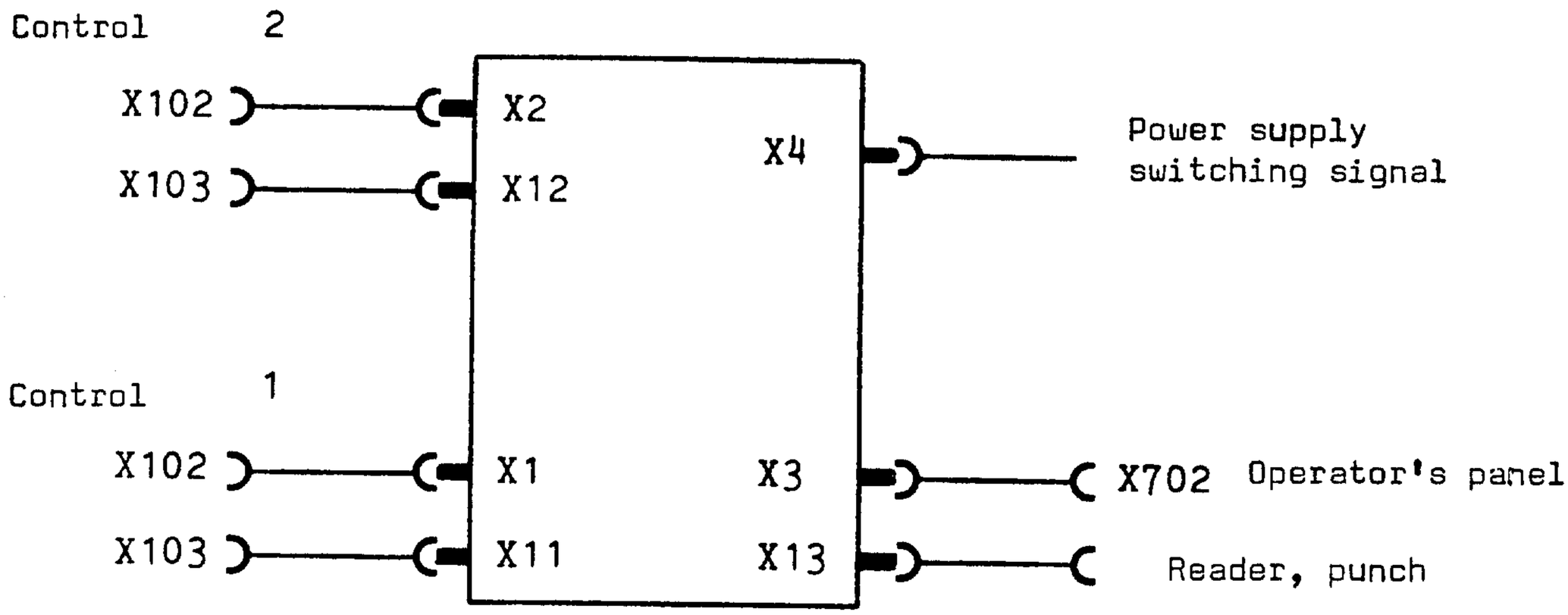
10.1 Switching box connections

10.2 Function description of the switching box

10.3 Dimension drawings

10. Operator's Panel Switching

10.1 Switching box connections



Cable

X102 - X2, X102 - X1, X702 - X3

Operator's panel 6FC9 340-3W.

X103 - X12, X103 - X11

Reader/punch cable 6FC9 340-5Q.

X13 - Reader/Punch

Reader/Punch cable

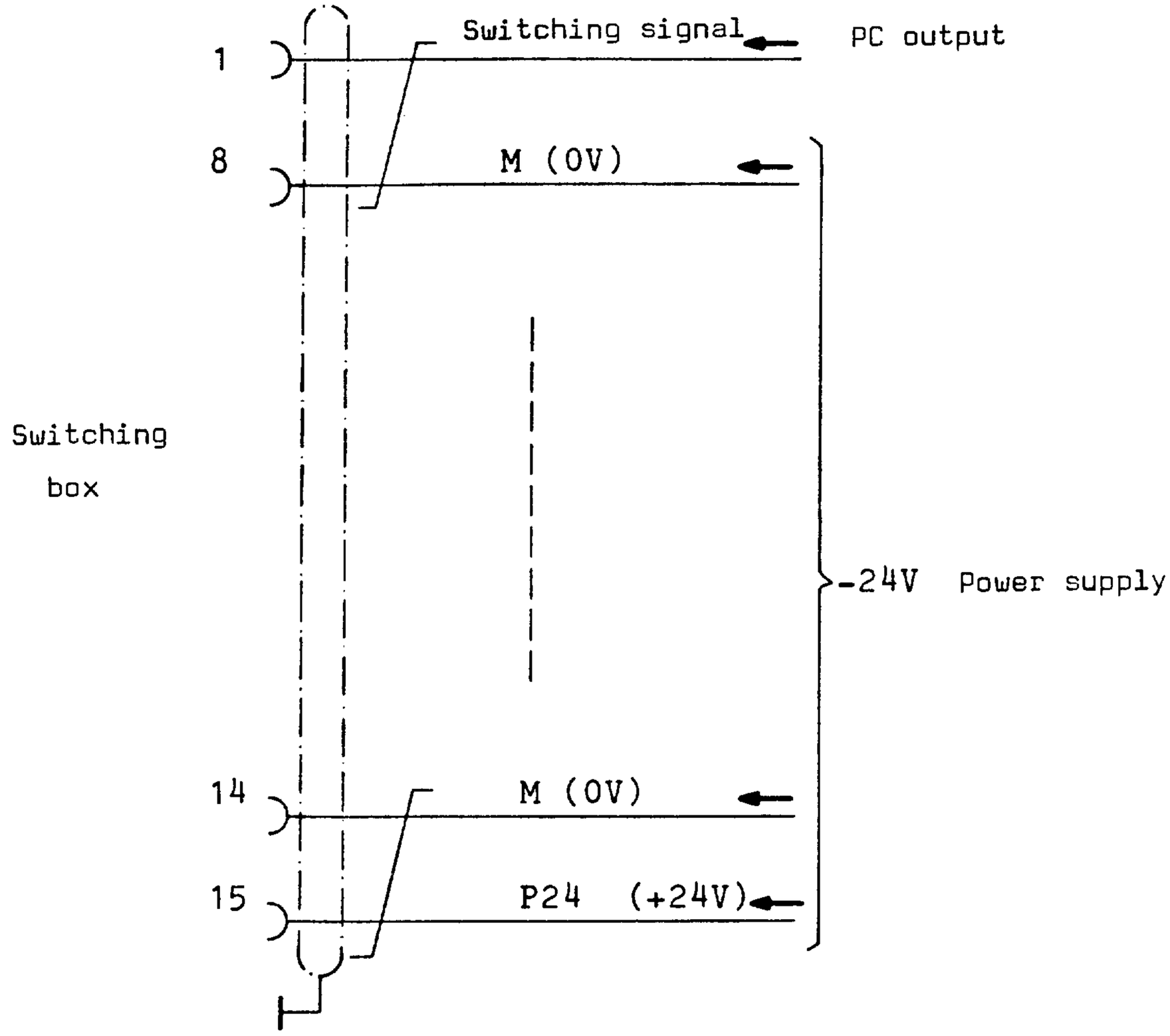
6FC9 340-5Q.	Dependent upon device
6FC9 340-5S.	
6FC9 340-5R.	

X4 - PC + Power supply

6FC9 340-2S.

Cable: 6FC9 340-2S

X4



15 way Subminiature plug

Cable 8 x 2 x 0,18 screened

10.2 Function description of the switching box

The switchbox has the task of switching-over one operator's panel to one of two System 3 controls. The V24 port is also switched.

The switching function only removes the interface signal "Disable Operator's Panel". The switch-over requires a hardwired toggle switch with:

OFF $\hat{=}$ Control 1; Switching signal = 0

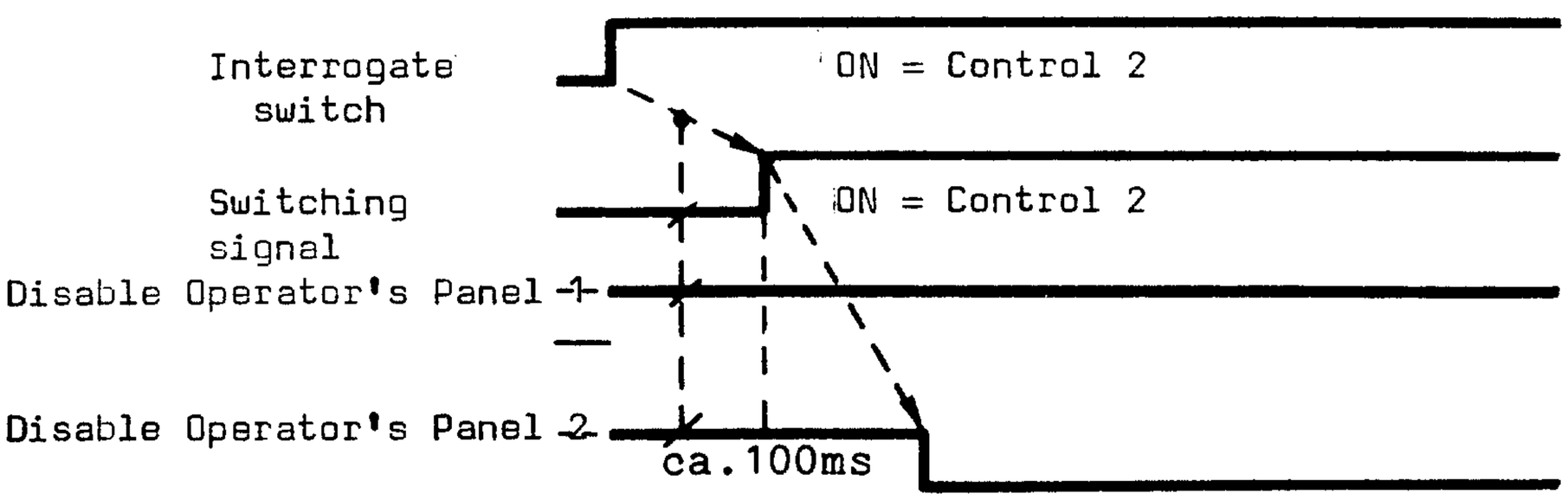
ON $\hat{=}$ Control 2; Switching signal = 24 V

Sequence:

Switching the devices

Dependent upon the position of the switch, the PC controls the switching signals and delays the disable operator's panel signals for the controls.

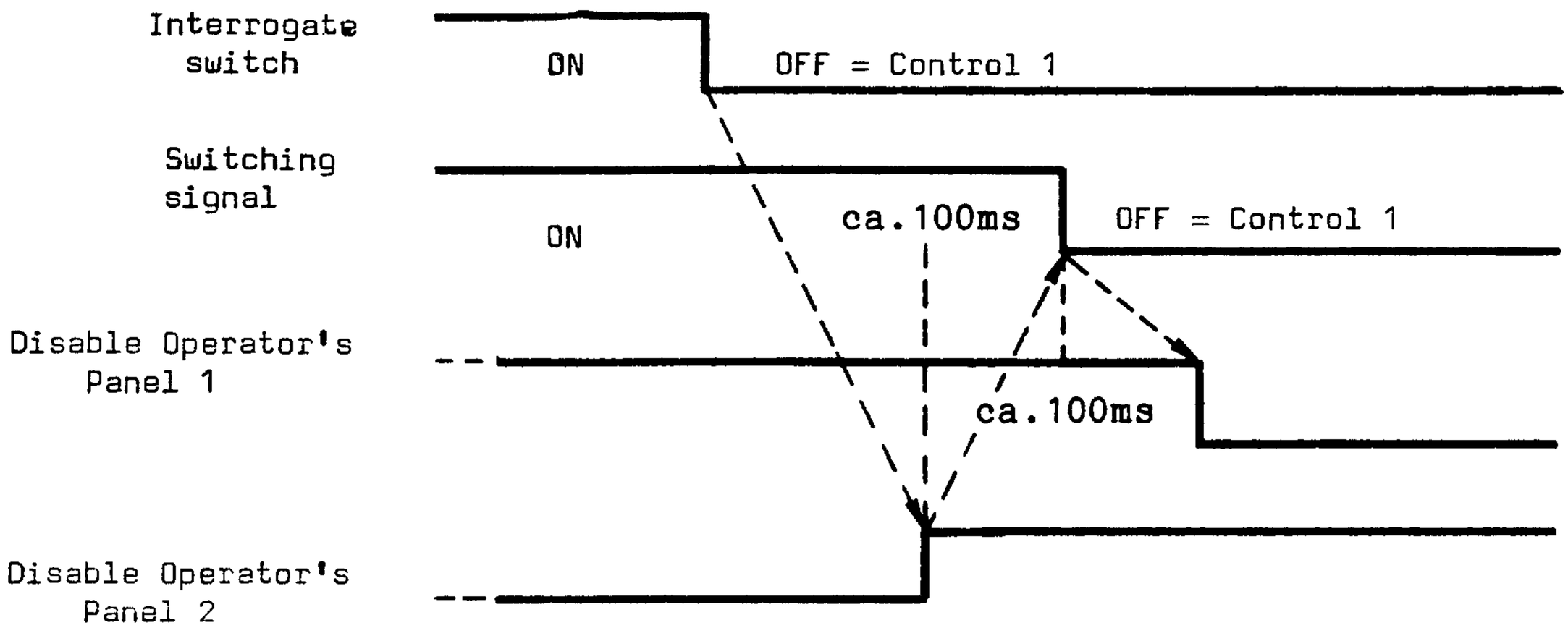
The disable control must have an immediate Operator's Panel Disable signal.



Switch over operation

At the moment of switching over both controls must have "Operator's Panel Disable" signal active.

Subsequently, the "Operator's Panel Disable" signal is removed for the control currently connected.



Both controls require an active machine control panel.

When a control, with a disconnected Operator's panel, which is working, e.g. a program is running (the machine control panel can influence the program), the Operator can set set up, edit, input or output a program via the V24 port, or start a program with the other control.

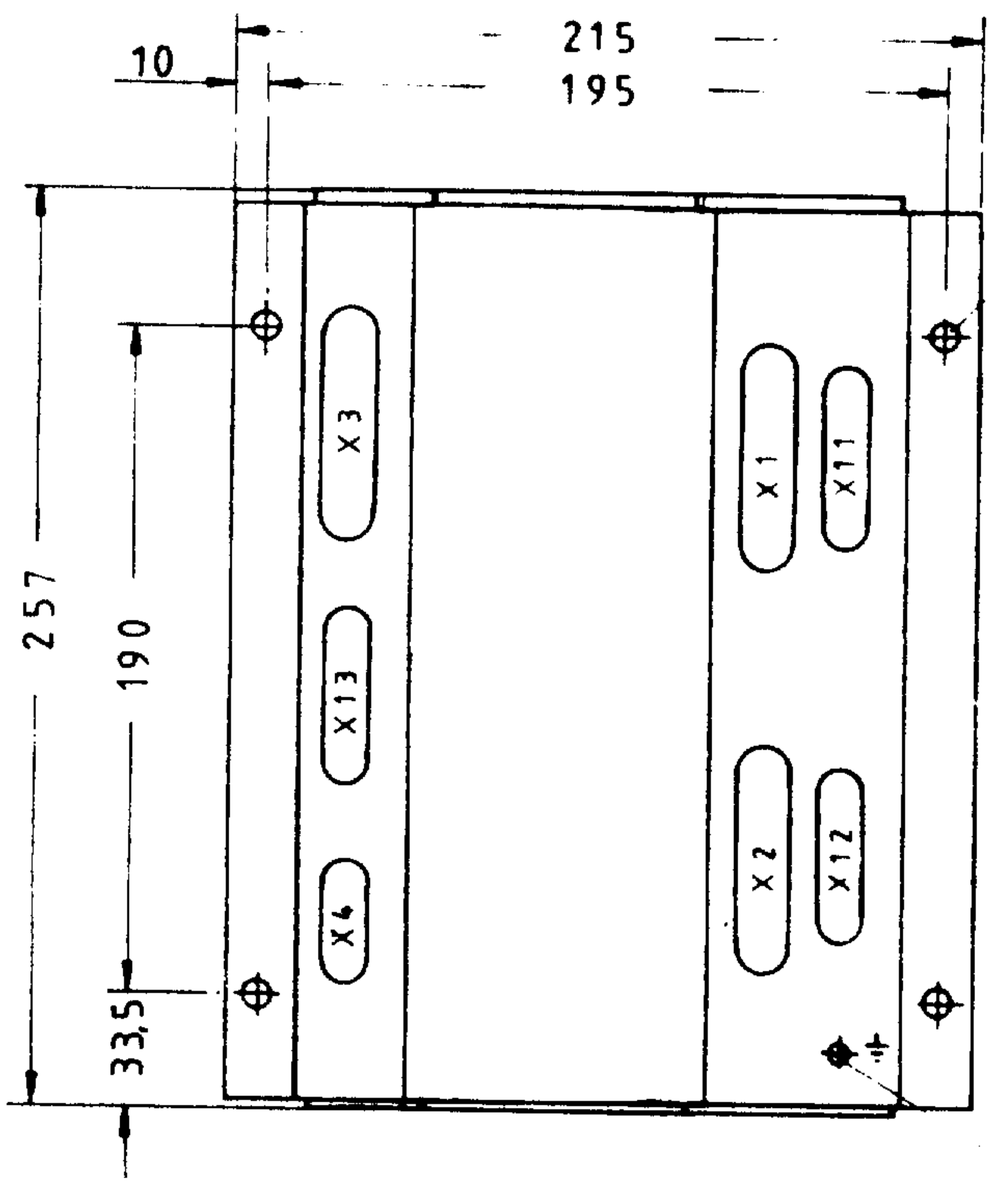
If "Operator's Panel Disable" is generated, the connected control display is active but input is disabled.

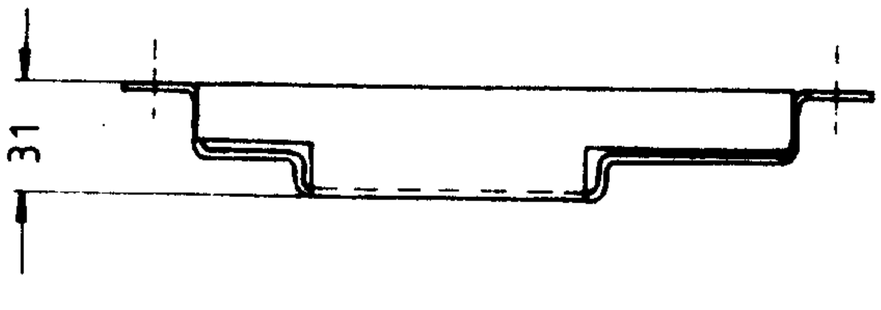
10.3 Dimension drawing

Switch over box

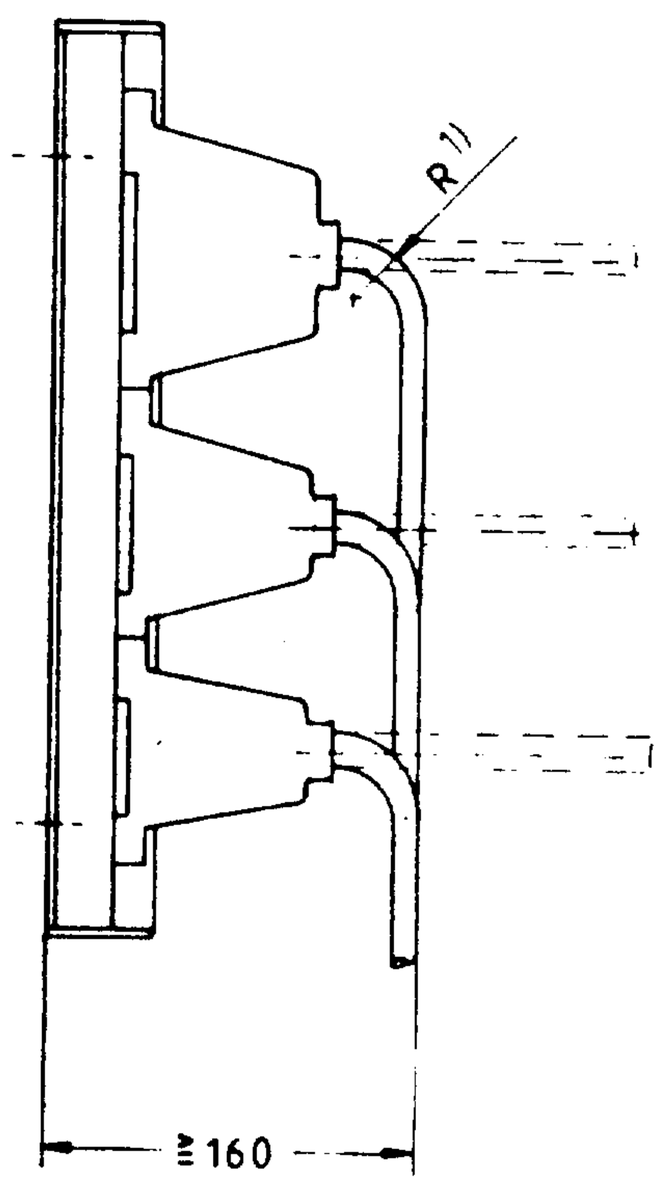
External view

Dimensions in mm





Mounting holes
Φ6,6



1) Required SIEMENS cable type R ≥ 100

2) Ambient temperature ≤ 55°C

Max. temp rate of change

1.1 K/min

Humidity to class F to DIN 40040

Air Quality - non-aggressive

Protection to IP0 to DIN 40050

Siemens Aktiengesellschaft

Subject to change without prior notice

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