

SIEMENS

SINUMERIK Primo S

Interface description

SINUMERIK Primo S

Interface description

Ausgabe 1.86

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SINUMERIK^R Documentation

The Editions listed below have been published prior to the current Edition.

The column headed "Amendments" lists the amended sections with reference to the previous Editions.

<u>Edition</u>	<u>Order No.</u>	<u>Amendments</u>
1/86	E80210-T145-X-A0-7600	1-1, 1-3, 1-11, 1-12, 1-13, 1-18, 1-24, 2-13, 5-4, 5-8, 9-1, 9-7, 9-11, 10-3, 11-1

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(Interface Description)

Functions extending beyond the scope of this Description may be capable of operating in the controller. However, no claims are made with respect to such functions when first delivered or on servicing.

We reserve the right to alter this Description on the basis of technical modifications.

(Interface Description)

The following Description explains the individual interface signals between the control and the interface or machine, and their interaction.

The interface contains the control sequences for switching on and off, E-Stop, overtravel and enabling logic the axes.

The signals conform with VDI 3422, in as far as they are described therein.

The following are contained in this description:

- Installation of the interface
- Description of the connection interface - PRIMO S
- Description of input signals from external operating elements
- Description of the connection PRIMO S - servos
- Description of the connection PRIMO S - measuring devices
- Signal summary
- Connection diagrams
- External equipment and operating elements

We reserve the right to change this description due to technical improvements.

Notes on nomenclature

Inverse signals, which are active for logic '0', are designated with an asterisk (*) in front of the signal name.

In the Appendix, Section 4, there is a fold-out diagram of the operator panel explaining the keys and operating modes.

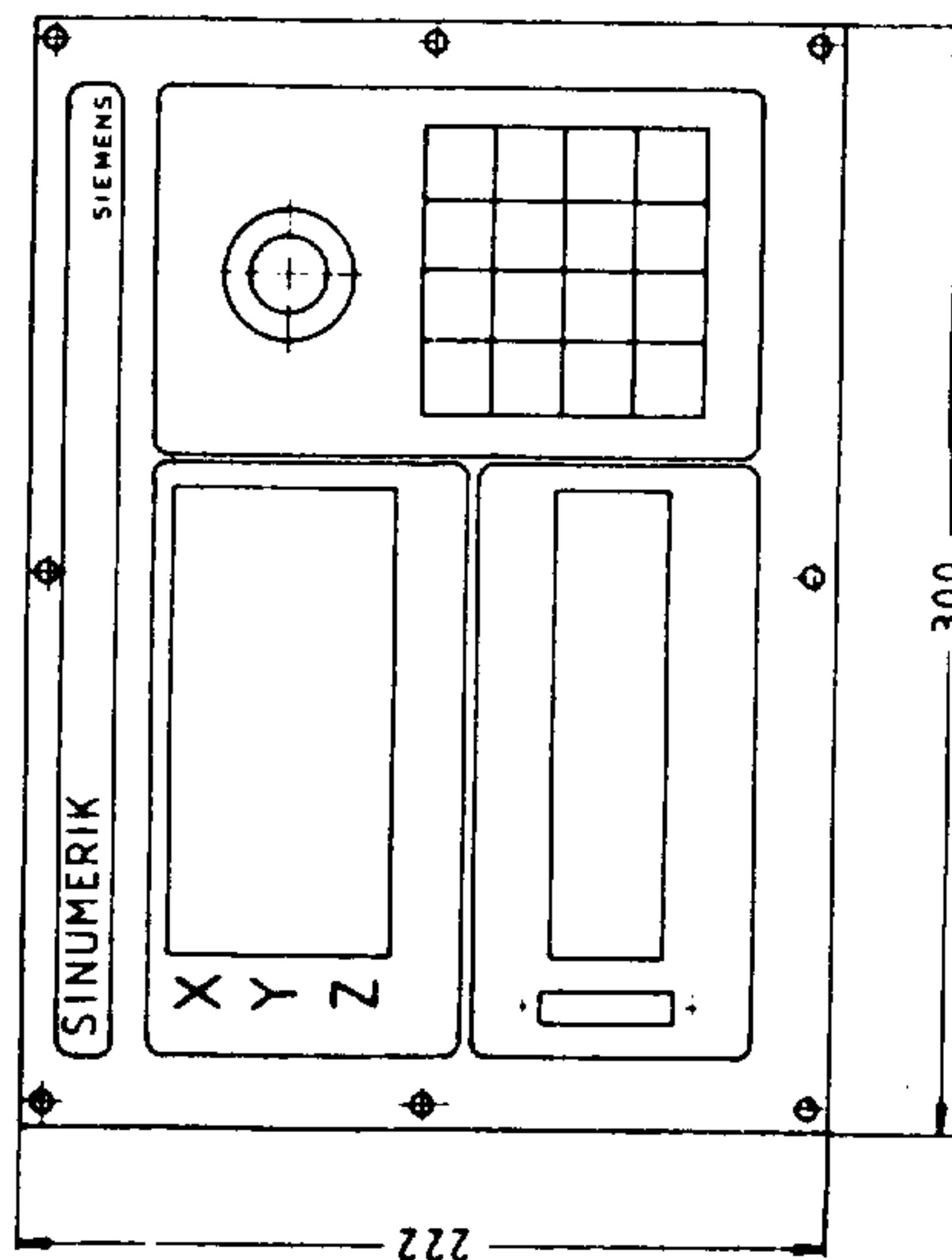
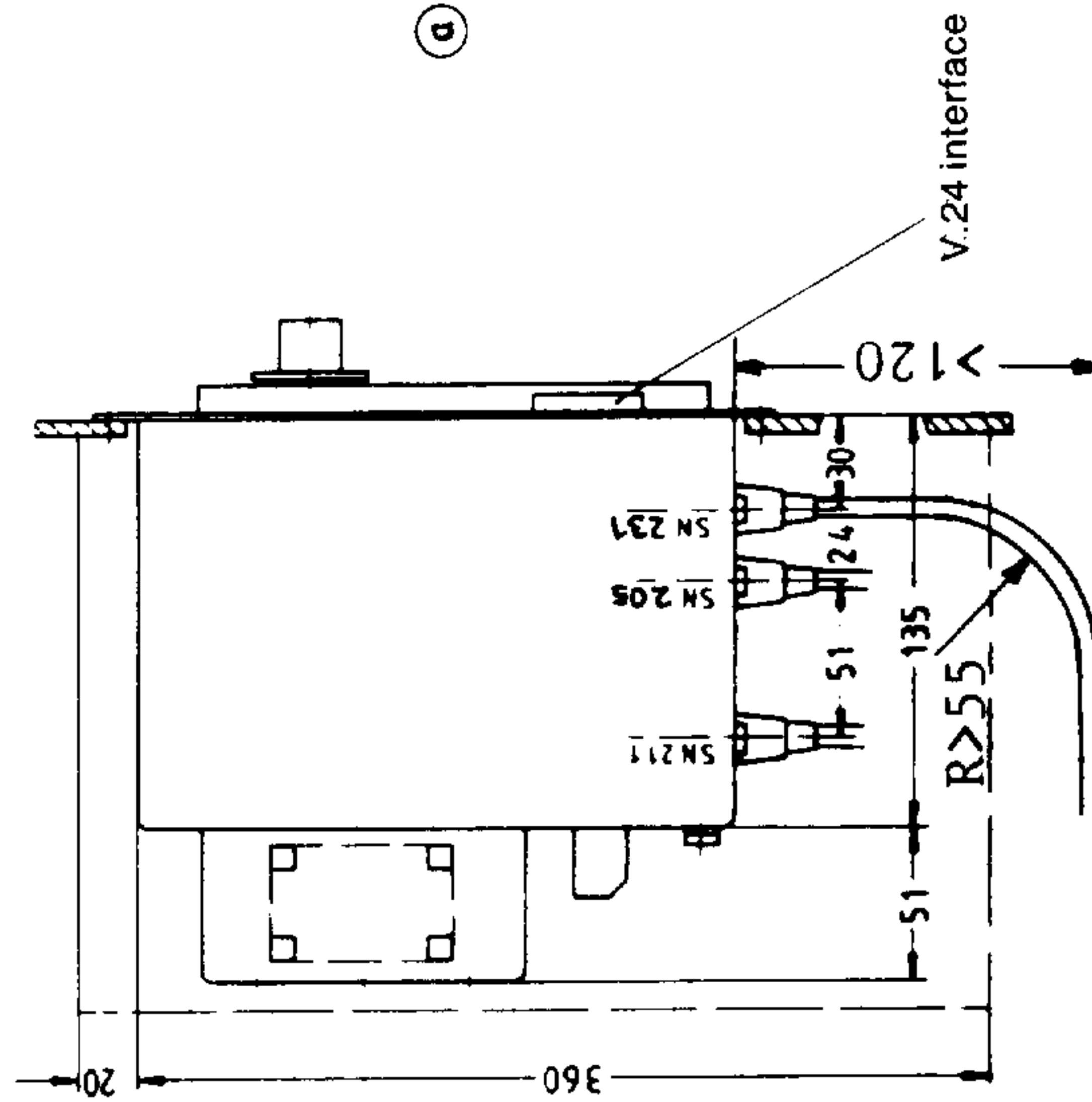
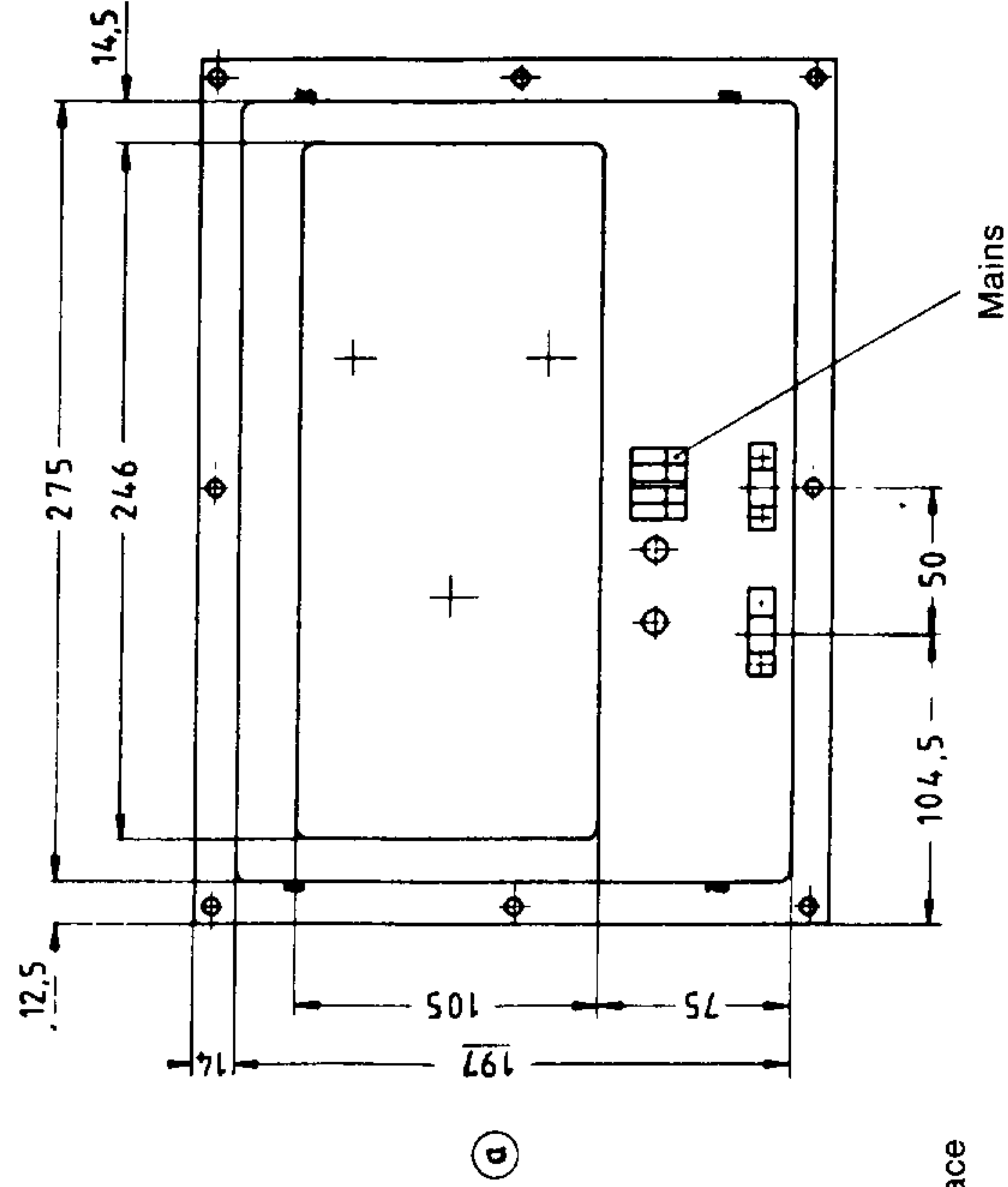
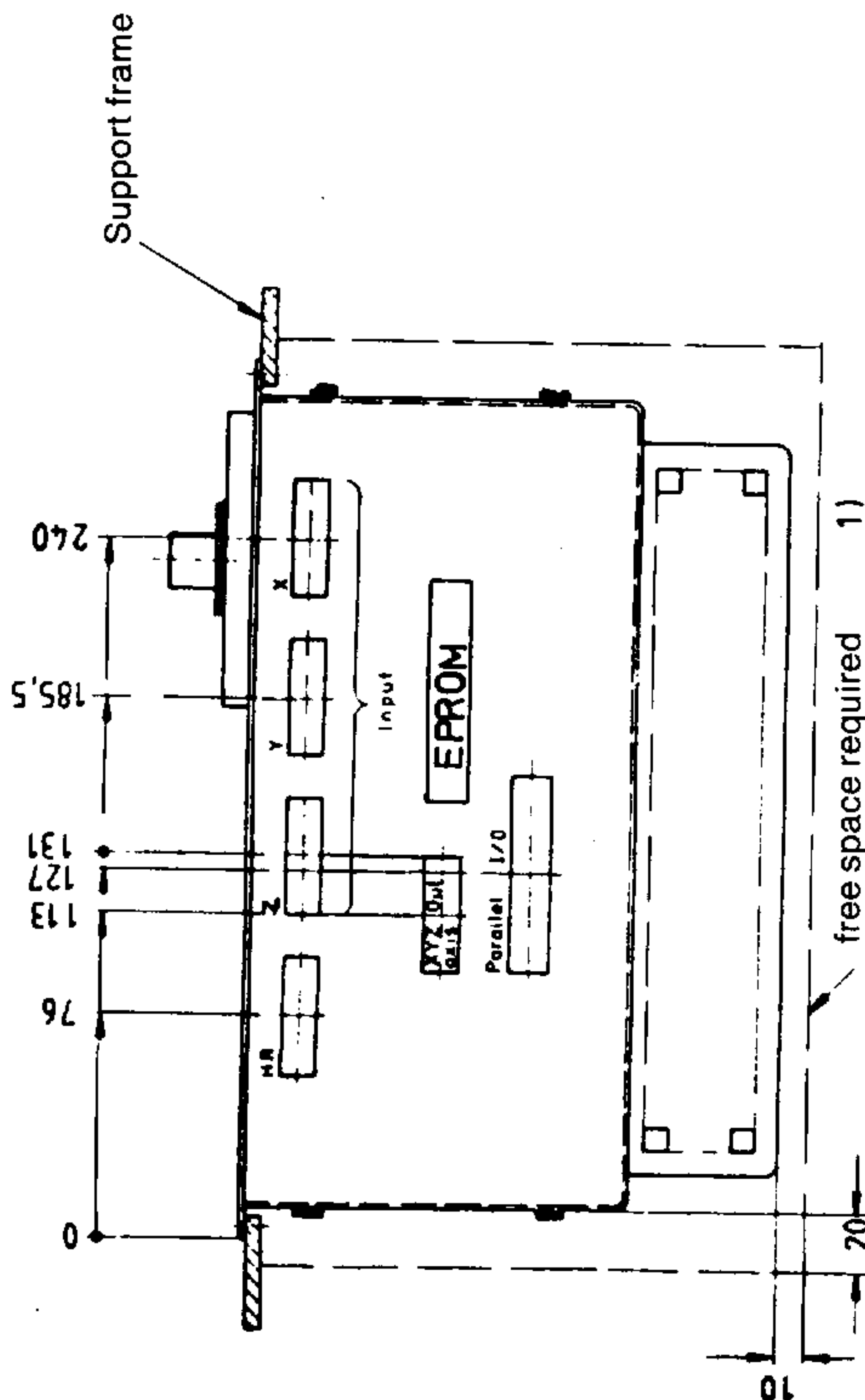
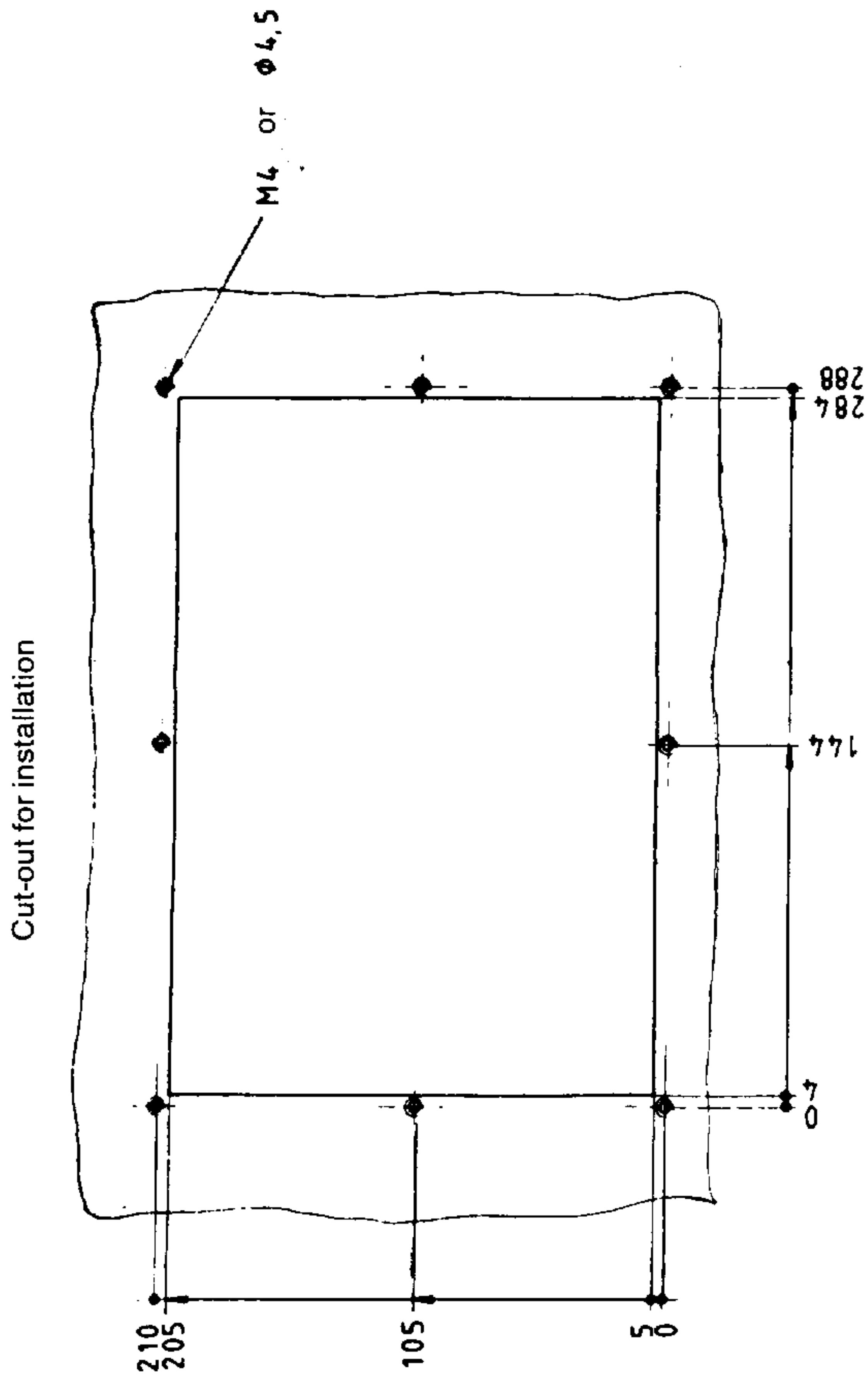
In order to understand the following, it is advisable to unfold this diagram, since the keys and operating mode symbols are referred to by number in the text.

For pulse diagrams, the signals described in the relevant section are written in capitals. Thick lines represent actual signals, thin lines are symbolic operating sequences. An alphabetic list of signals can be found in Section 8, with notes on the relevant points in the text and the connection diagrams.

(Interface Description)

1. Connections

1.1 Installation



- 1) Opening 300 cm²
- Ambient air temp. + 45°C
- Temperature change max. 1.1 K/min
- Permissible humidity, Class F
- in accordance with DIN 40040
- Ambient air free of aggressive gases
- Enclosure protection in accordance with DIN 40040: Front IP 54
- Rear IP 00

(Interface Description)

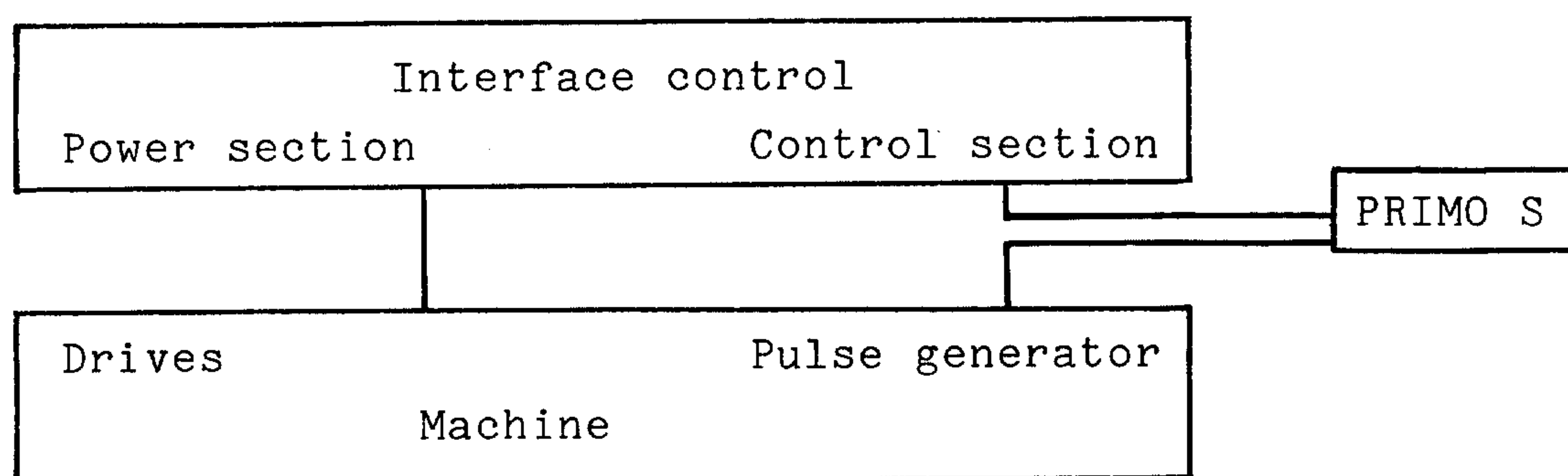
1.2 Cables and connectors

In order to ensure trouble-free operation of the control it is recommended that only the screened cables as mentioned in the cable drawings be used.

The Siemens subminiature connectors should be screwed firmly to the chassis of the control. The connectors transmit the cable screen to the control housing serving as the reference potential.

The cables to the machine and interface control must be mechanically protected (e.g. by enclosure in a cable duct). Ingress of oil, coolant or swarf must be avoided.

Signal cables must not be run parallel to power cables.

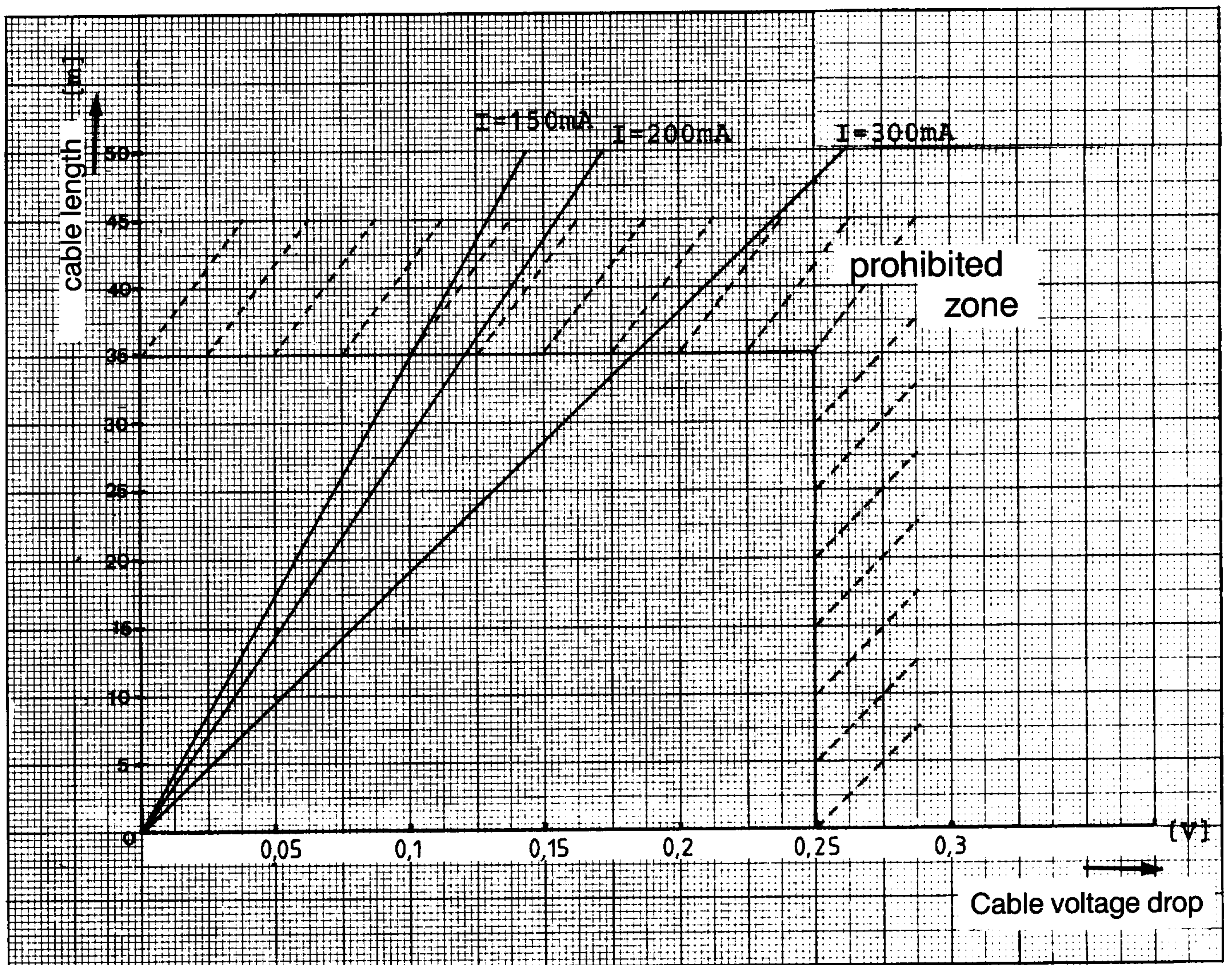


Example of cabling

(Interface Description)

The following diagram shows the maximum possible lengths for the actual value cables.

Diagram for the determination of the maximum cable length dependent on the cable voltage drop and various currents. Power supply cable cross-section: 1 mm^2 .



The cable screen is connected to the subminiature connector - see assembly drawing. The overview of cables and equipment (Section 8) gives the maximum permissible cable lengths.

(Interface Description)

The complete range of cables for Primo S fall into 3 cable types which are adapted to 3 sizes of connector.

1. Cable 8 x 2 x 0.18 \emptyset , external diameter 9.5 mm, with twisted pairs, used in conjunction with 25-pole plugs.
2. Cable 10 x 2 x 0.18 \emptyset , external diameter 10 mm, with twisted pairs, used in conjunction with 15-pole plugs.
3. Cable 50 x 0.18 \emptyset , external diameter 12 mm, with twisted pairs, used in conjunction with 50-pole plugs.

A plug suitable for the external device must be fitted to the second end of the cable.

Cable construction where undertaken by the customer must comply with our specifications with regard to cable construction and diameter.

Plug requirements

1. The 15-, 25- and 50-pole plugs must conform to International Standards and the casings to the SINUMERIK specification.
2. The plugs must be secured by captive screws to the control housing. The faces of the plugs must be in full contact with the module front plates.
3. There must be ground contact between the cable screen and the SINUMERIK electronics ground via the casing-spring in the plug. This obviates the need for the reference bar, cable stripping and cable clips.
4. Strain relief must be provided by the plug itself.

Installation Instructions

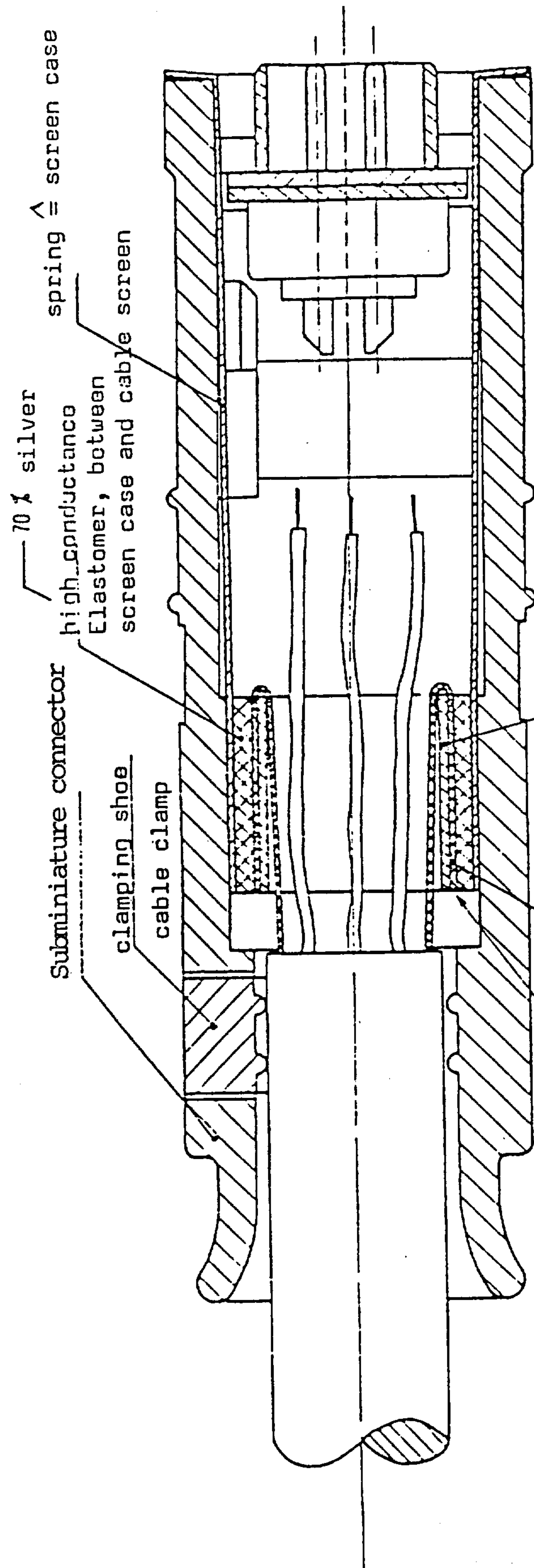
It is imperative to use SIEMENS' subminiature plugs at the SINUMERIK end of the cables as no other suitable alternatives are available.

On pages 1-5 to 1-8 of this Interface Description, there is a section devoted to plugs. If the customer manufactures his own cables he must follow these instructions, in order to ensure satisfactory functioning of the control.

(Interface Description)

Assembly drawing: Cable/subminiature connector

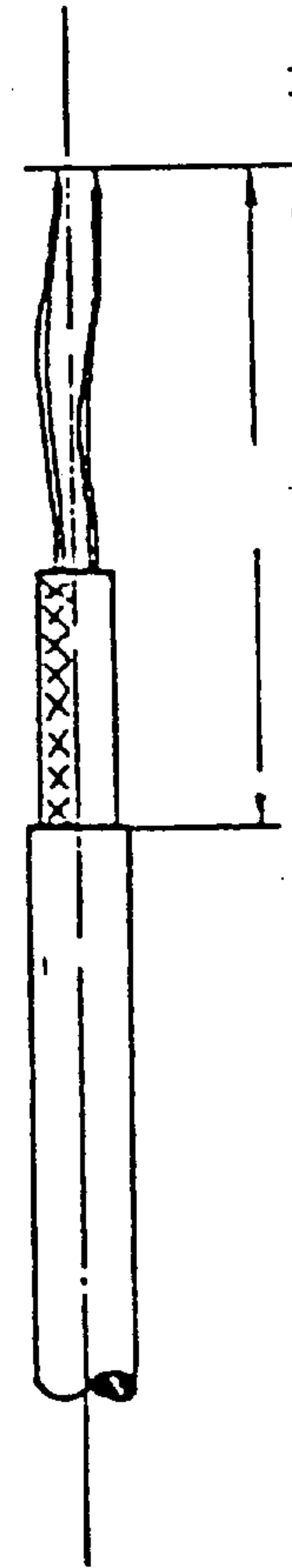
Scale: 4 : 1



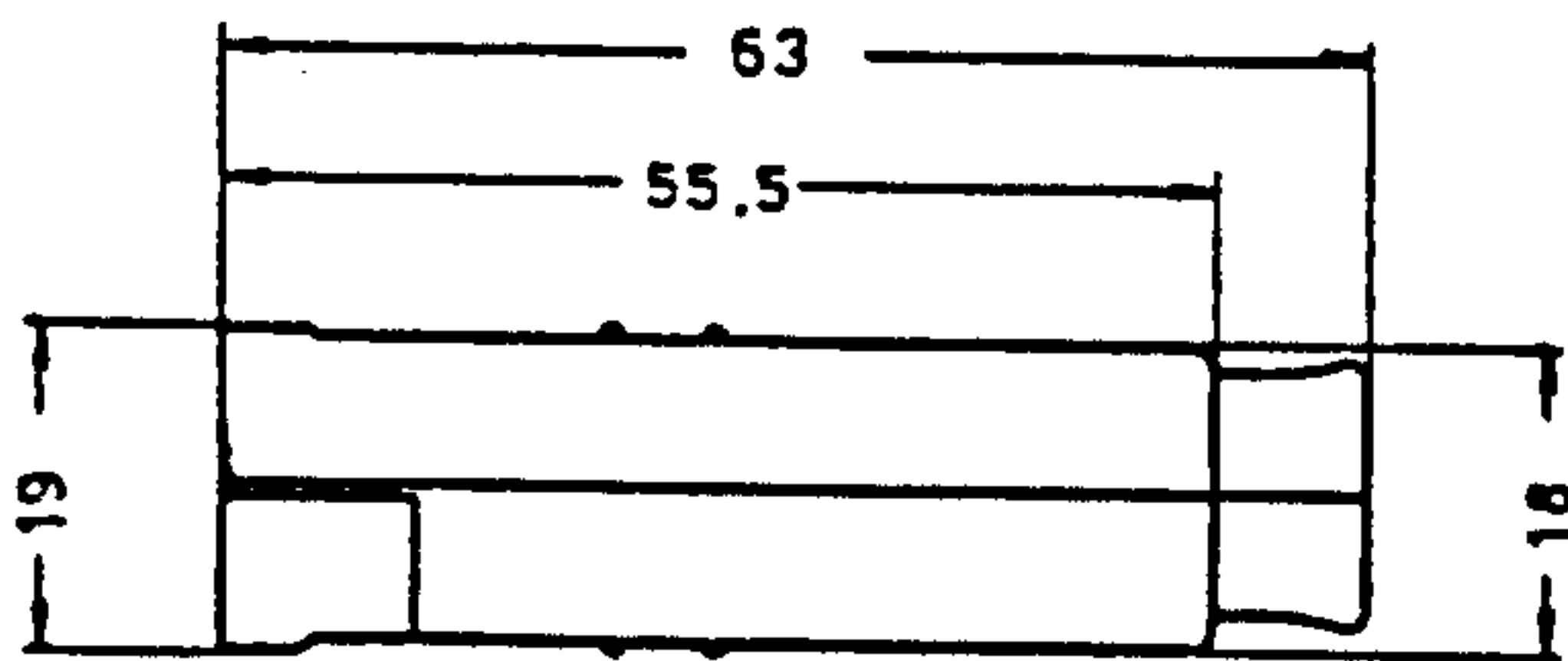
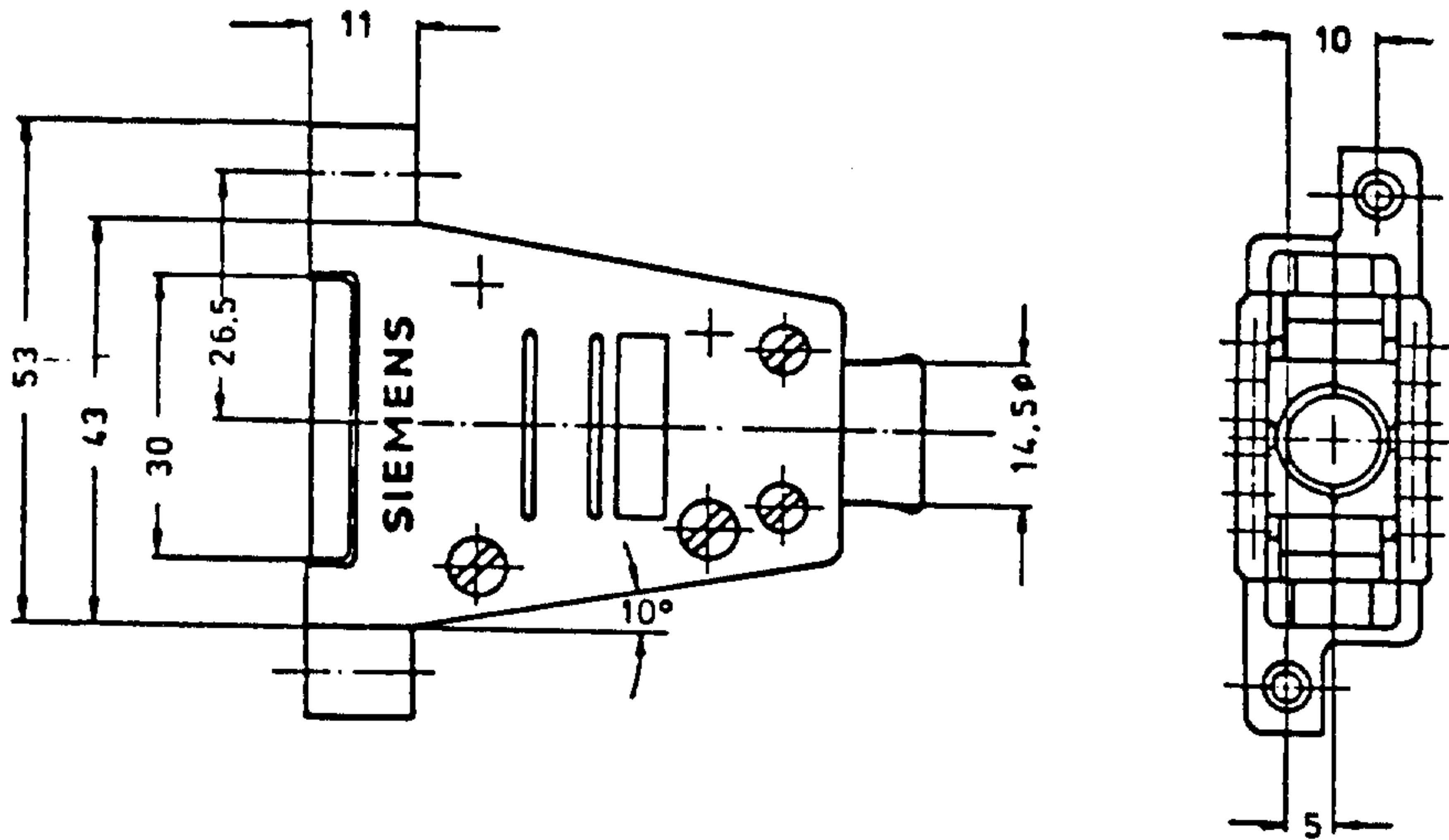
70% silver
 high-conductance Elastomer, between screen case and cable screen
 spring = screen case

Subminiature connector
 clamping shoe
 cable clamp
 Steel tube 10mm long provides uniform diameter for laying on Elastomer. This ensures even pressure of the screen case on the Elastomer and cable screen.

Screen bent back 180° over steel tube and trimmed off level with end of steel tube

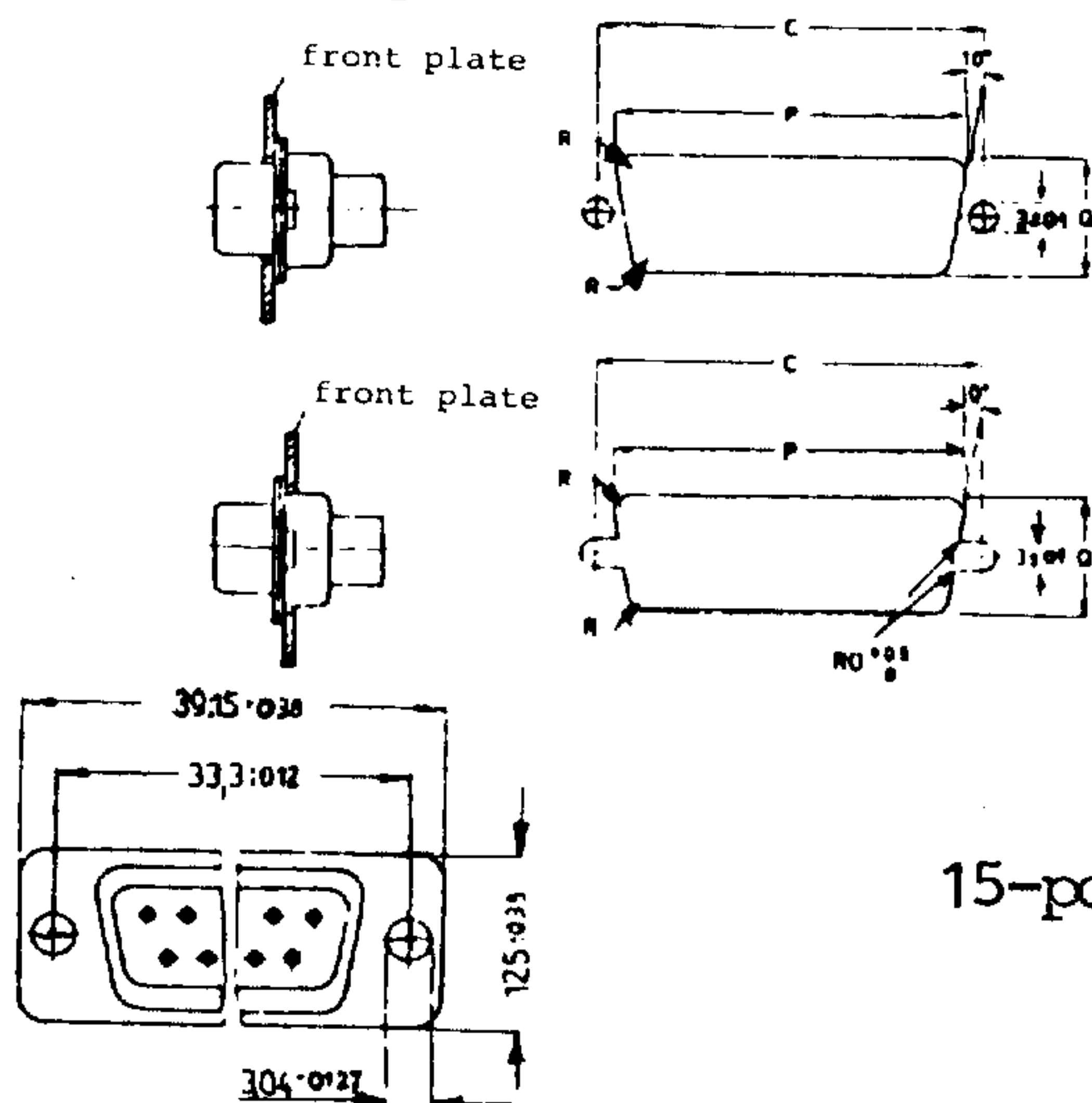


total cable strip length
 15-pole: 37 mm
 25-pole: 37 mm
 50-pole: 45 mm



Scale : 1:1

Installation diagram



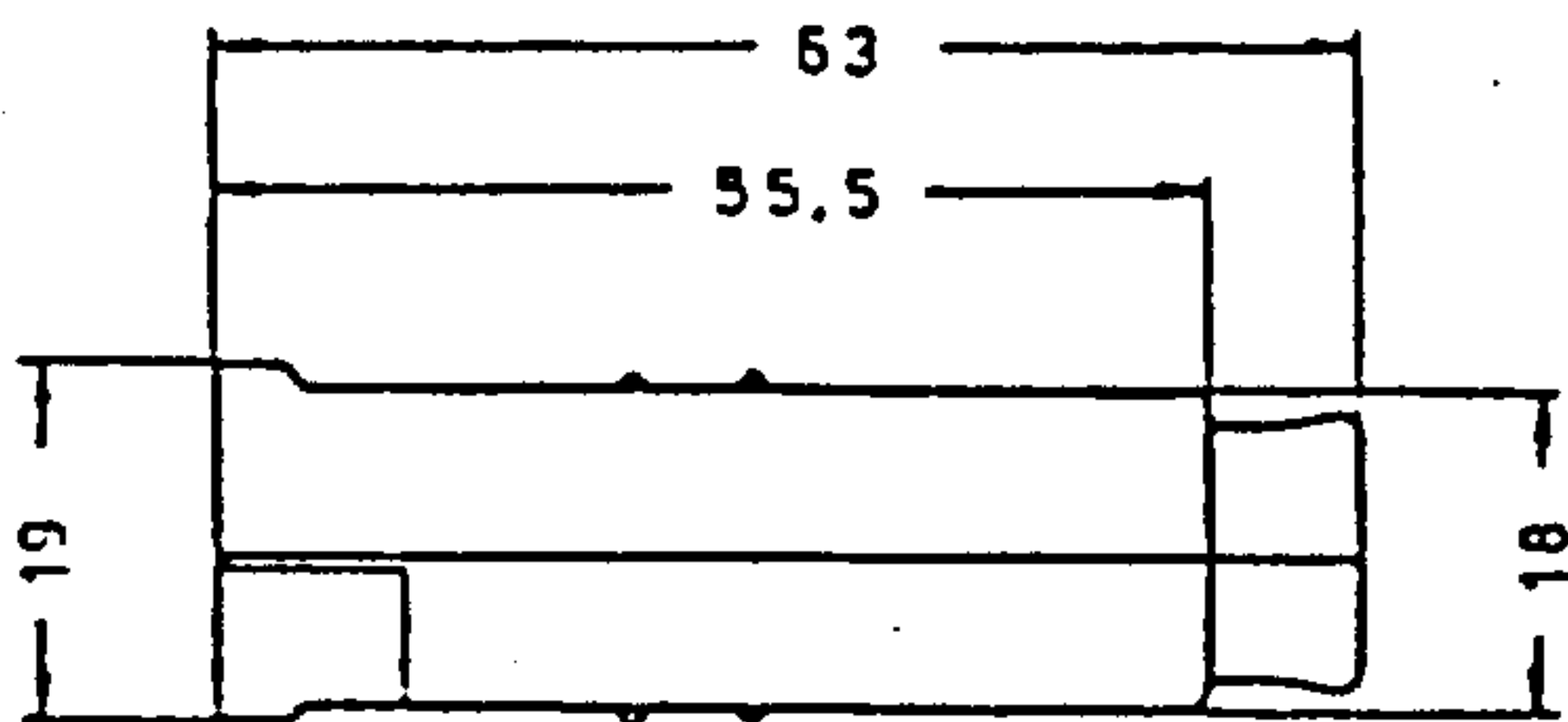
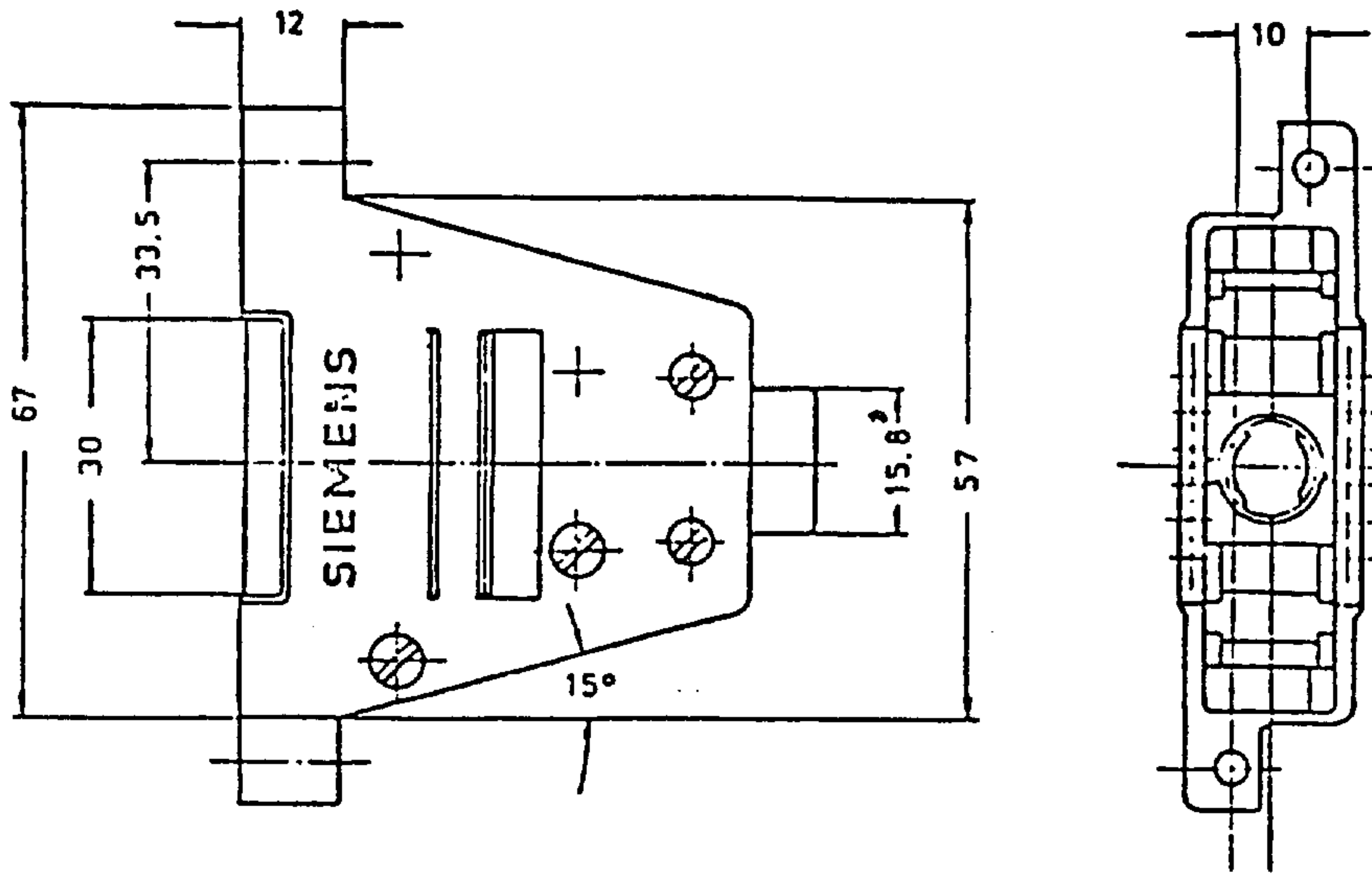
Pohlzahl	C(±0,2)	P(±0,2)	Q(±0,2)	R(±0,2)
15	33,3	28,8	11,4	3,4
15	33,3	30,5	12,3	2,1

15-pole socket (dimensions same for plug)

Subminiature 15-pole socket

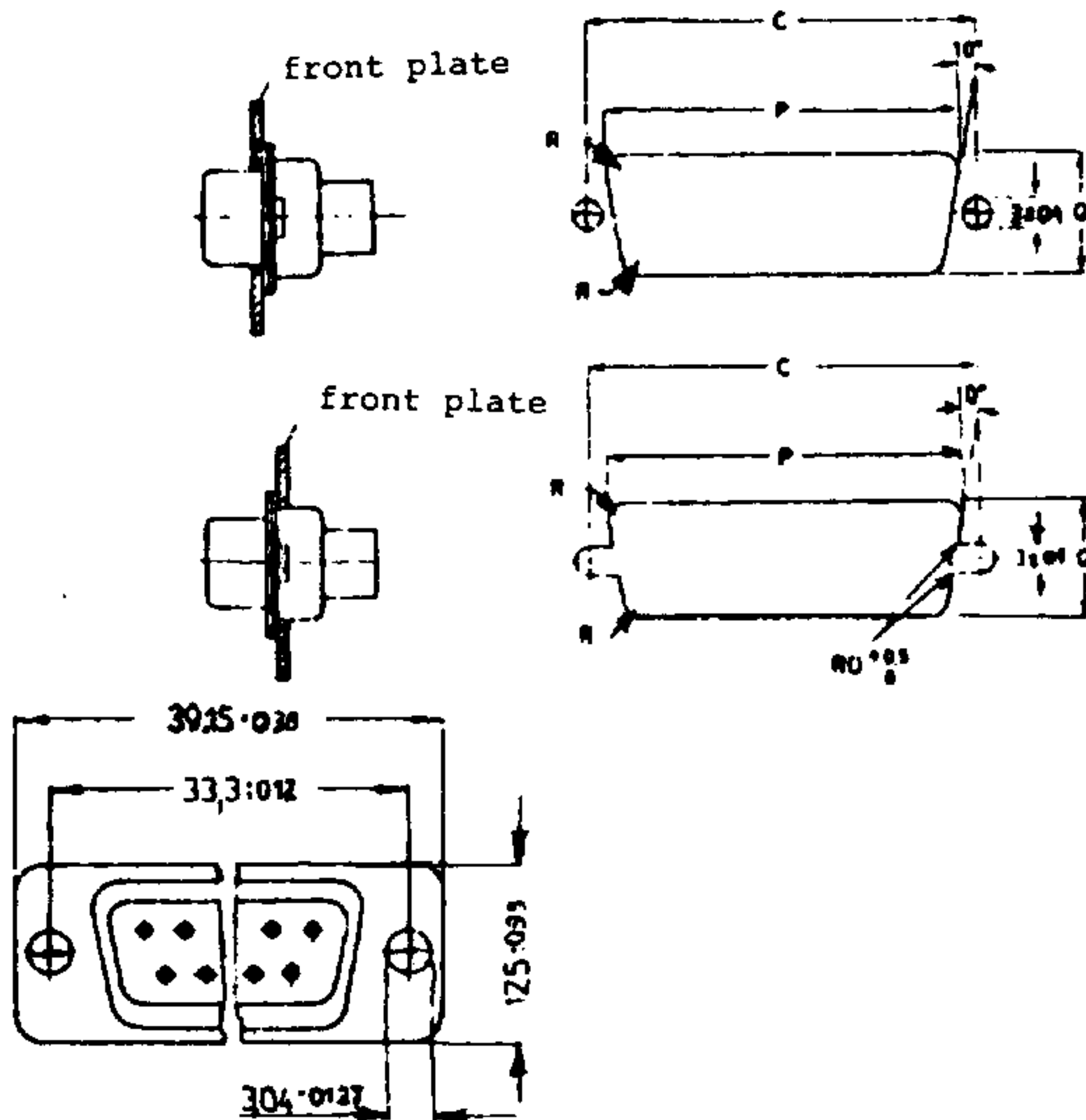
(complete with housing): Order No. 6FC9 341-1EC

Subminiature 15-pole housing: Ident No. 400 90 802



Scale : 1:1

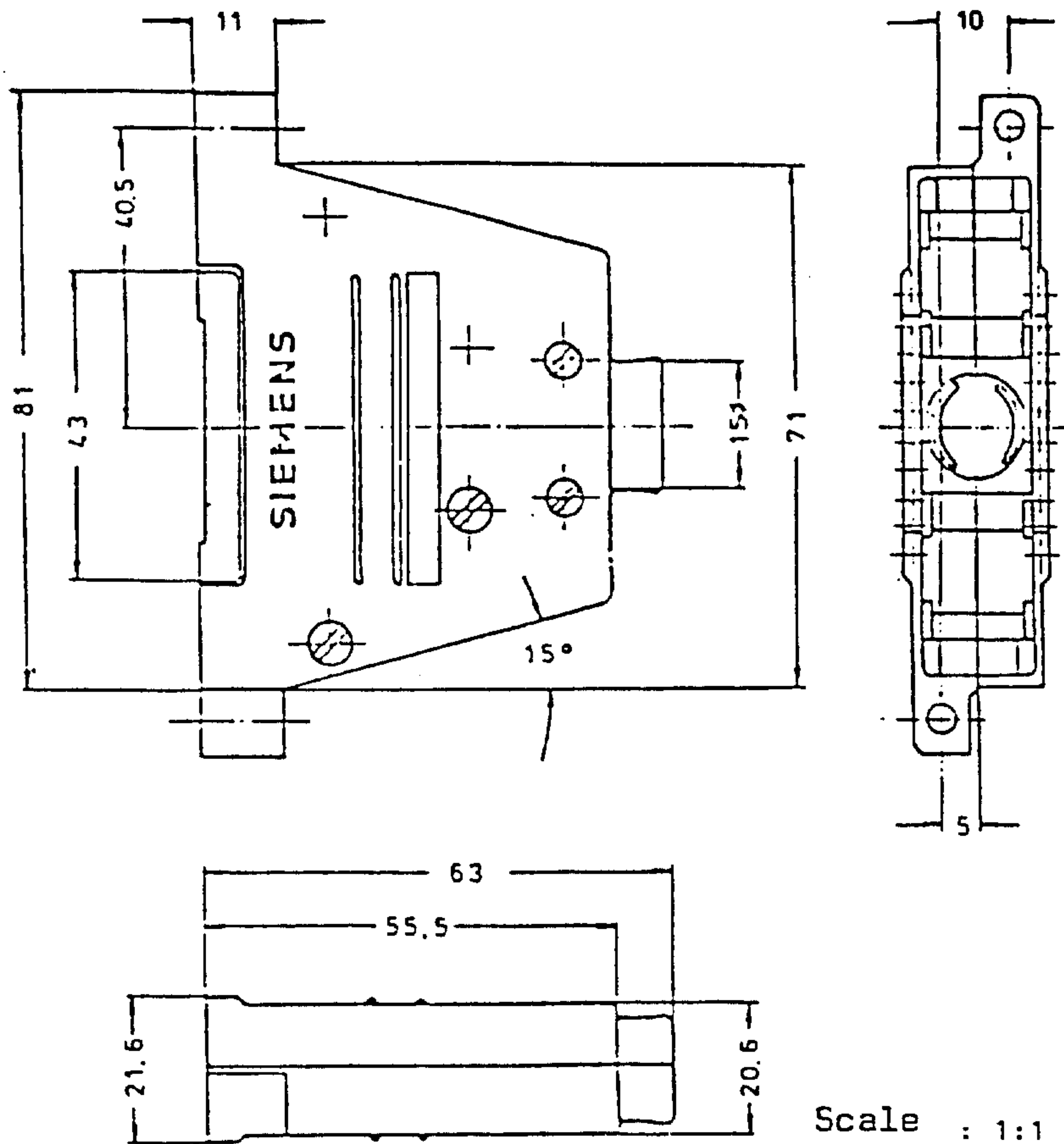
Installation diagram



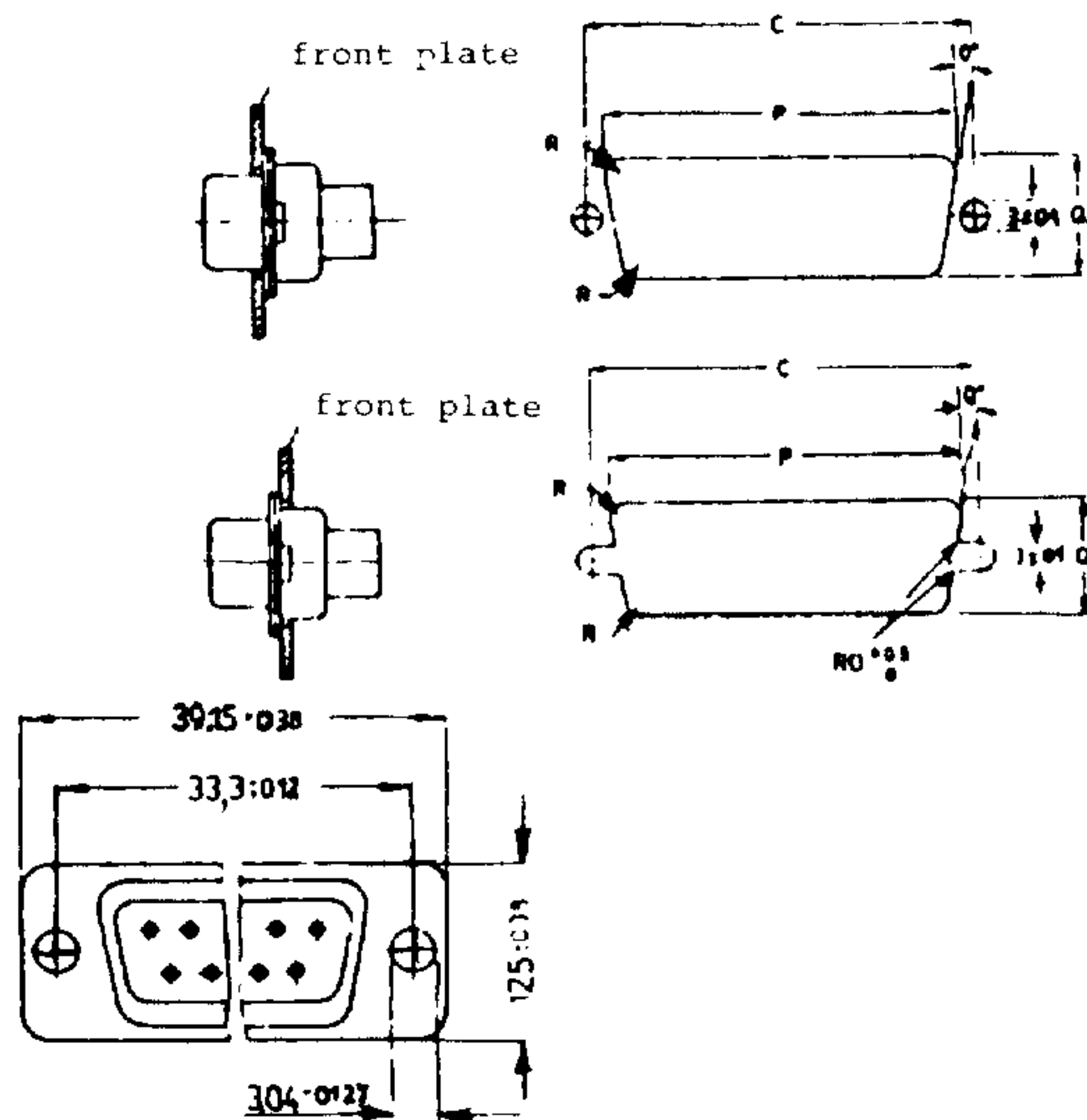
Cores	C(±0.2)	P(±0.2)	Q(±0.2)	R(±0.2)
25	47.0	42.5	11.4	3.4
25	47.0	44.3	12.3	2.1

25-pole socket
(dimensions same for plug)

Subminiature 25-pole socket
(complete with housing): Order No. 6FC9 341-1ED
Subminiature 25-pole housing: Ident No. 400 90 851



Installation diagram



Cores	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
(dimensions same for plug)

Subminiature 50-pole socket
(complete with housing): Order No. 6FC9 341-1EE
Subminiature 50-pole housing: Ident No. 400 90 908

(Interface Description)

1.3 Permissible climatic and mechanical conditions

(Precise standards and norms: VDE 0160 and DIN 40040)

Ambient temperature:

in operation 0 °C to +45 °C

during transport or storage -40 °C to +70 °C

Maximum permissible temperature change: 1.1 K/min

Humidity:

Permissible relative humidity 20 to 75 %, momentarily 95 %
(see above)

Concentration of aggressive gases and airborne dust:

MAK values * (maximum concentration at place of work).

Mechanical stress:

brief shock forces up to max. 2.5 g are permissible (see above).

* (MAK lists are available from the Federal Government,
Ministry of Labour).

(Interface Description)

1.4 Mains and earth connectionsSupply system conditions

Mains voltage: 220 V, + 10% - 15%, single phase
Frequency: 50/60 Hz \pm 3 %
Power consumption: 80 W
Fusing of interface control: 2 A slow-response, 220 V

Permissible voltage interruptions:

8 ms for nominal voltage U_n 3 ms for nominal voltage $U_n - 15%$

Permissible mains voltage harmonics:

Sum of 2nd to 5th harmonic: 0.1 U_n Sum of 6th to 30th harmonic: 0.02 U_n Mains connection

Mains connection is to the terminals L1-N/12 at the back of the control.

The mains cable is 3 x 1.5 and no free cores are permitted, i.e. for cables with more than 3 cores the extra cores must be run in parallel.

Earth connection

The housing of the Primo S serves as the reference potential and is important for the functioning of the control. The earth connections from the control housing to the other components are achieved through the subminiature plugs and the cable screens.

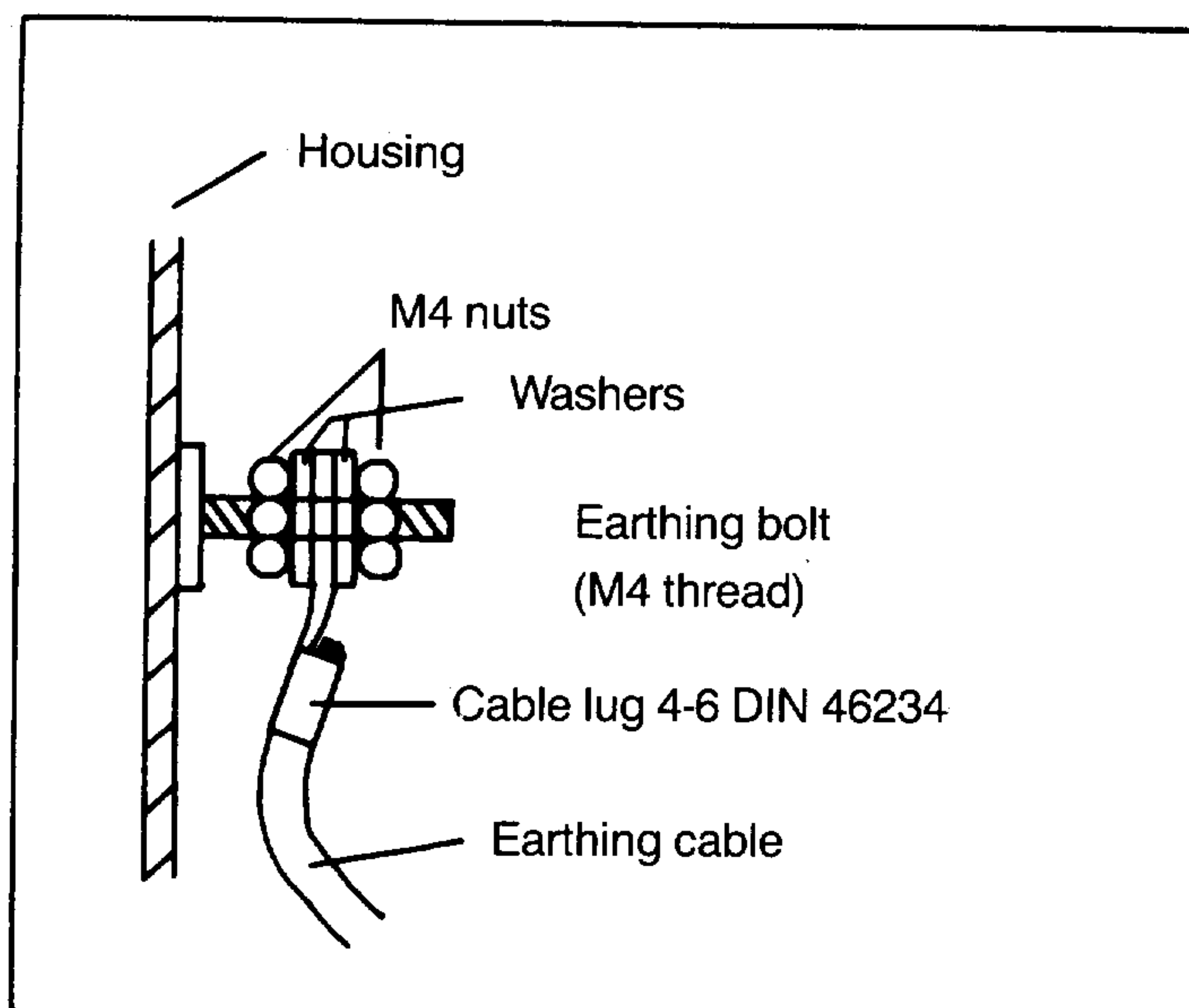
The earthing connection to the control must have a cross-sectional area of at least 6 mm².

No loops or intermediate connections are permitted and the conductors must be kept to the minimum possible length. It should be connected as shown in the diagram below (1) to the earthing bolt or the rear panel of the control.

NC-ON pushbutton

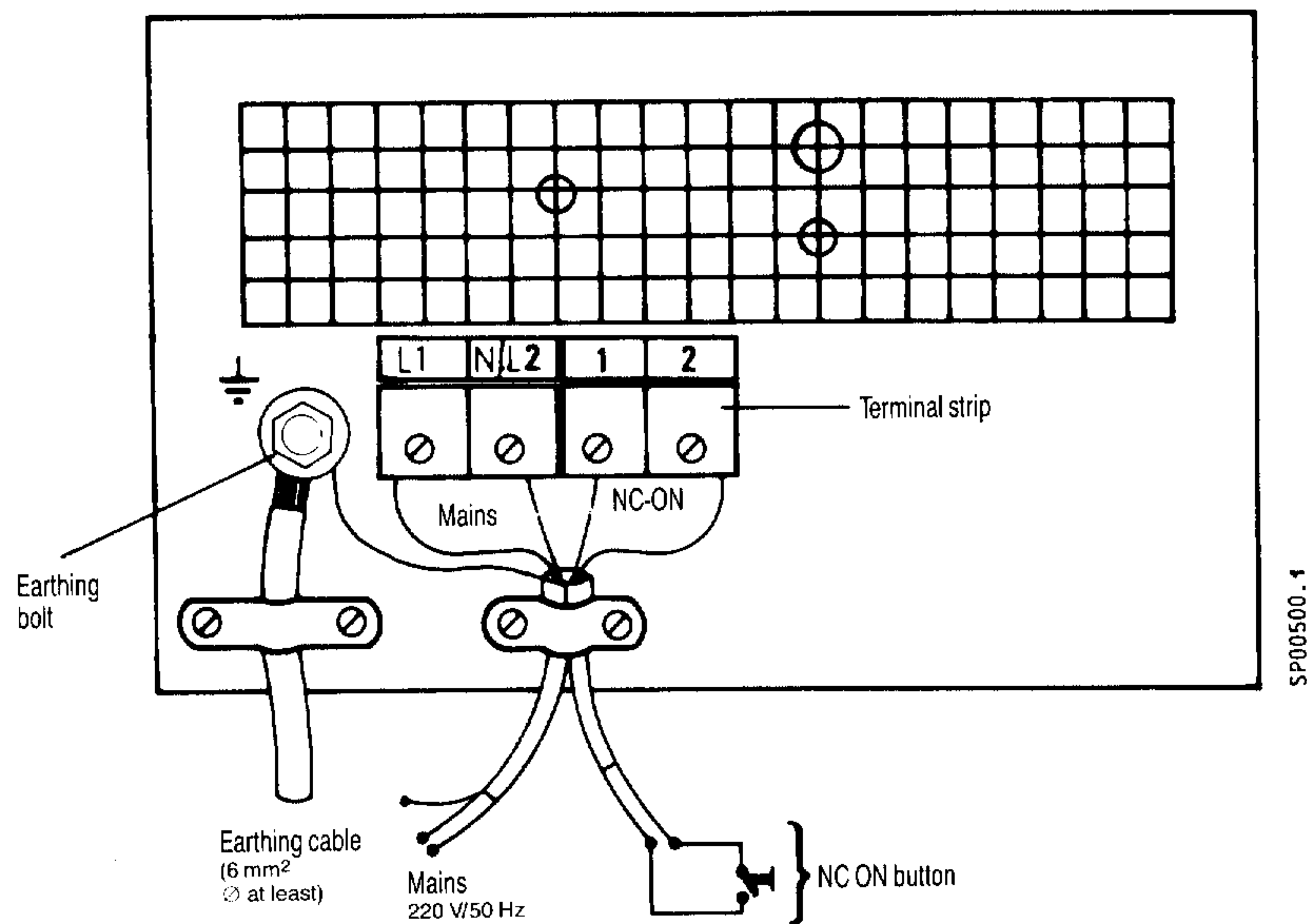
A button is required for switching the control on and this is connected to the "NC ON" terminals. Do not use a latching button or switch because, in the event that the voltage monitoring is activated, the control cannot be switched off.

(1)



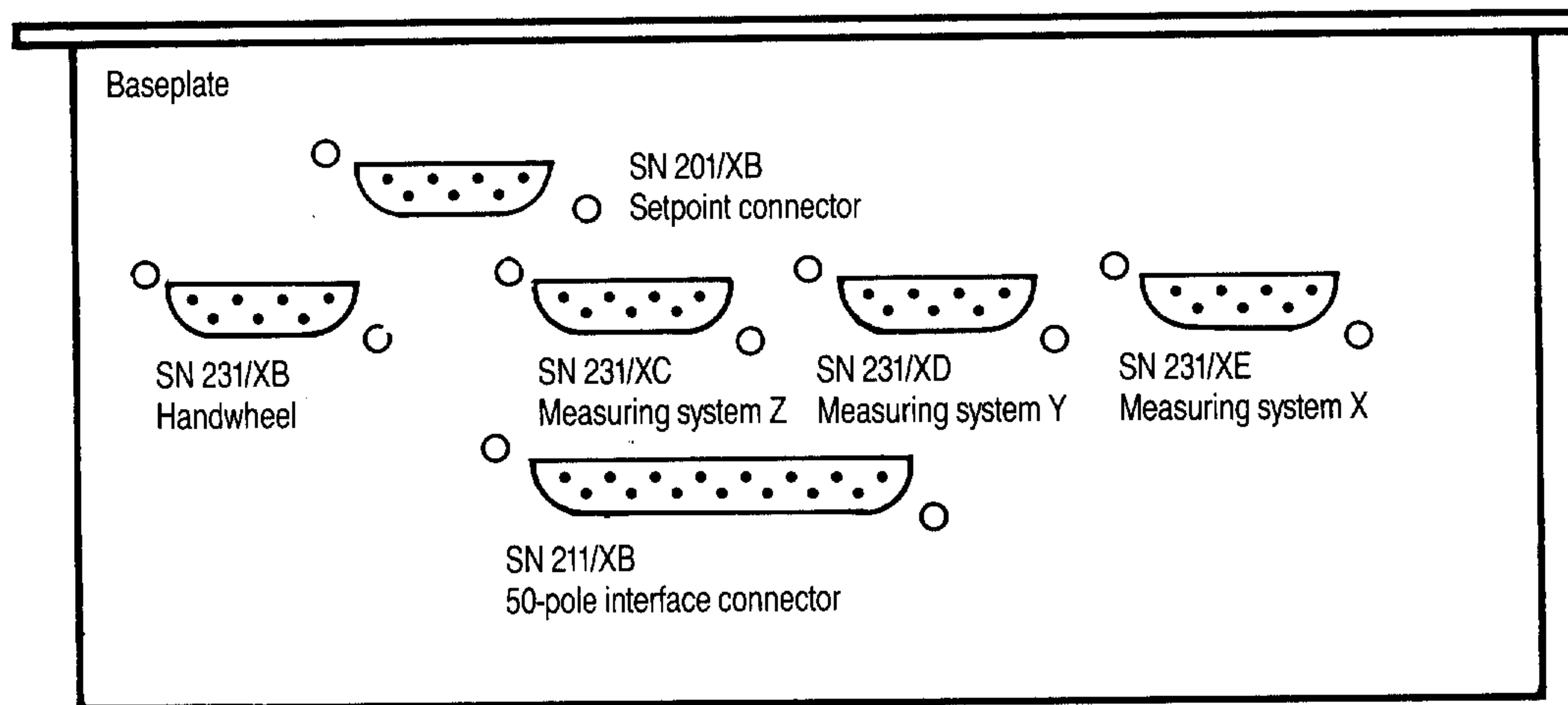
Connection drawing

Rear panel



Identification of connectors

Front panel



(Interface Description)

1.5 Definition of input and output signals

The +24 V DC supply for the input/output interface must be taken from an external power supply with rectification and smoothing, and the following signal levels must be taken into account:

"1" - signal: 24 V (min. 14 V, max. 30 V)

"0" - signal: 0 V (min. -3 V, max. 5 V)

Max. ripple 500 mV

The "0-signal" must be connected to earthing bolt on cabinet rear plate. Otherwise, the input signals may not be recognized. This can cause setpoint variations, setpoint restrictions, rapid traverse not being possible, external modes not being recognized, no response, clocking of output signals, etc.

Output signals

Output of signals to the interface control is effected by relays (+24V, switching to positive). The expected life varies according to the loading of the relays.

Voltage (V)	Current (mA)	Number of switching cycles
24	400	500,000
24	200	10,000,000
24	less than	greater than
	200	10,000,000

The receivers in the interface control may be either relays or electronic limit value comparators.

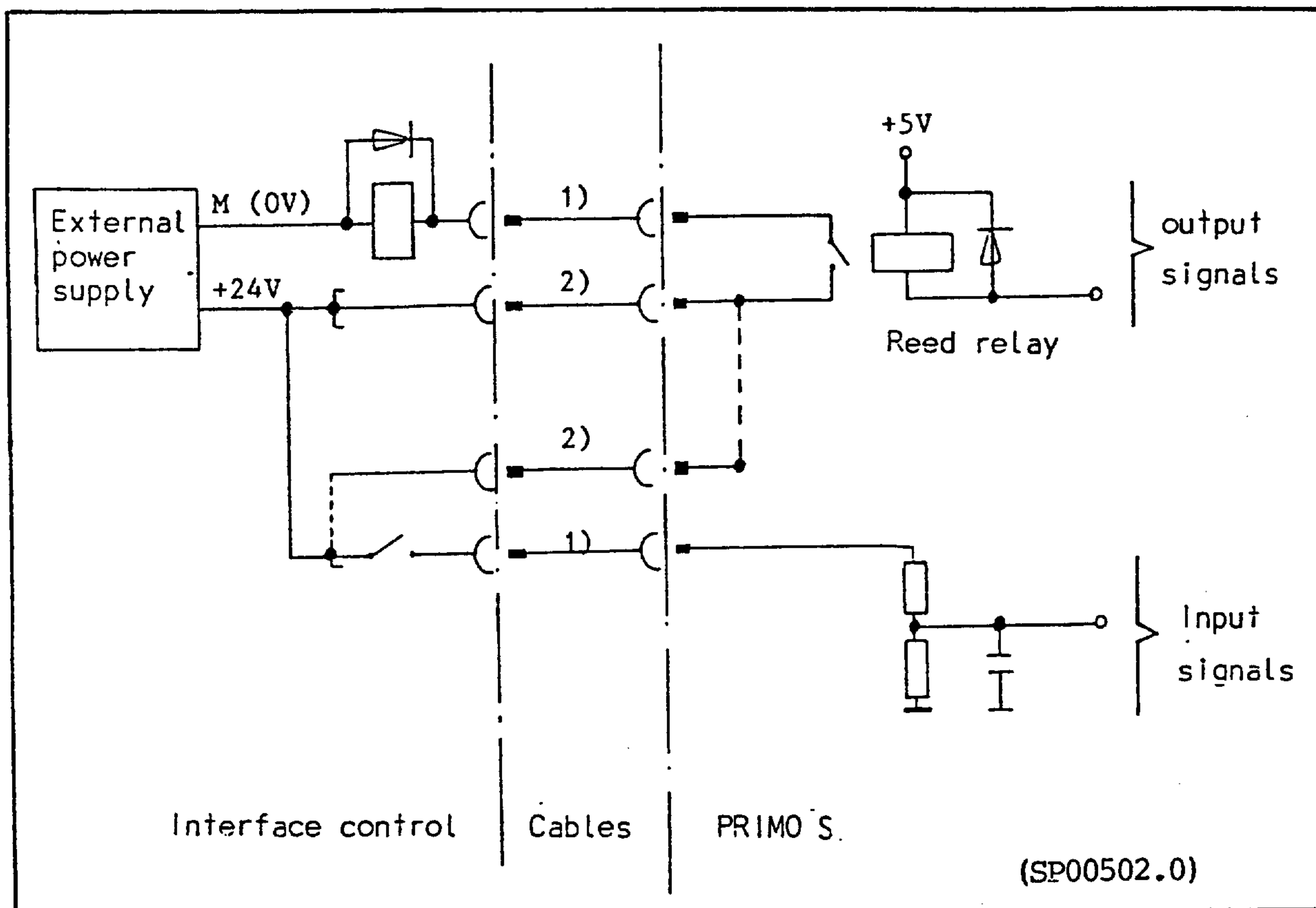
Input signals:

The signals from the interface control to the PRIMO S are connected via an RC element for matching the voltage level and filtering. Either contacts or electronic switches can be used in the interface control for transmitting the signals.

These signals must be at least 16 ms long to ensure reliable transfer.

The input resistance is approximately 4.5 kOhm.

Signal flow and cable connections:



- 1) Single core representation of cable PRIMO S - Interface control
- 2) Common +24 V input leads.

Note: For switching example, decoding of 'M' miscellaneous functions, see Section 2.1.5

Selection of receiver relays for the interface control

The following data are recommended for the relays:

Nominal voltage	UN	=	24 V
Maximum voltage	Umax	=	30 V
Energizing voltage	UAn	=	16 V (10 V UAn 10 V)
Drop-out voltage	UAb	=	2...4 V (10 V)

Also to be taken into consideration when selecting the relays is a voltage drop of 0.75 V, which is generated by a 16 m cable with total current 1.5 A (Primo SG-interface).

Recommended relays

for low voltages: Type N cradle relay, coil data max. 31 V
max. 60 mA

dust-tight version	hermetically sealed version
V23154 - D07020 - C110	V231162 - B0720 - C110 silver
V23154 - D07020 - C410	V231162 - B0720 - C410 gold

Contact leading: double spring contact, 4 reversing 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)

(Interface Description)

for 220 V: Type N cradle relay, coil data, max. 31 V, max. 60 mA
V23154 - D0720 - F104 V231162 - B0720 - F104 silver

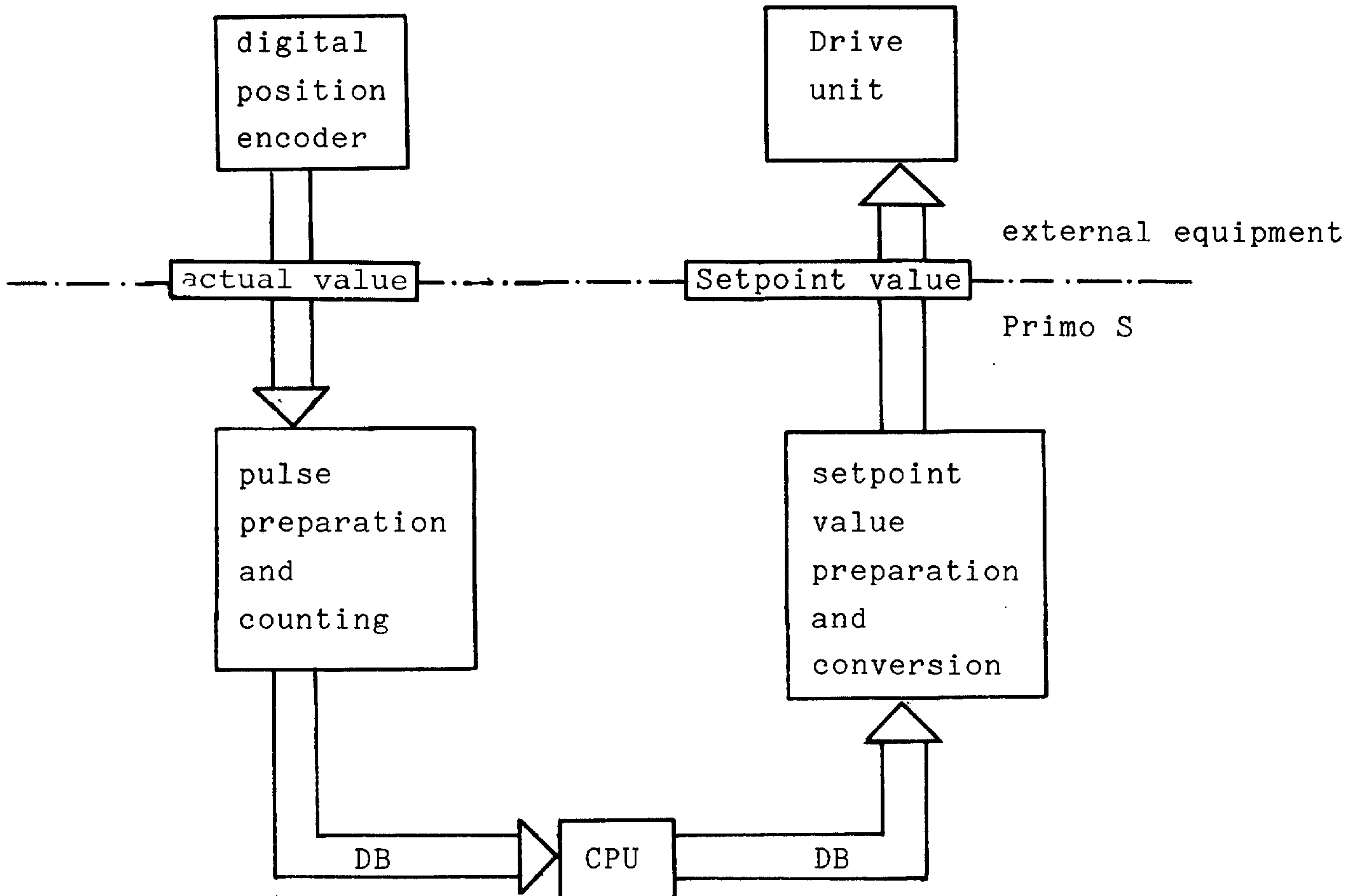
Contact loading: spring contact, 2 reversing contacts
Switching voltage max. 220 V
Switching current max. 5 A
Switching power max. up to 30 V....100 W, 30-50 V ... 80 W

Recommended suppression diodes

The inductive voltage generated during switch off must be reduced to 20 V or less at the relay coil 20 ns after switching by diode suppression. The recommended suppression diode is Type TS4 (Souriau).

1.6 Definition of the actual and setpoint value signals

Schematic



This specification defines the actual value and setpoint value interface between the Primo S and the external equipment. Basically any item of external equipment may be connected to the Primo S provided that it fulfils all the named prerequisites.

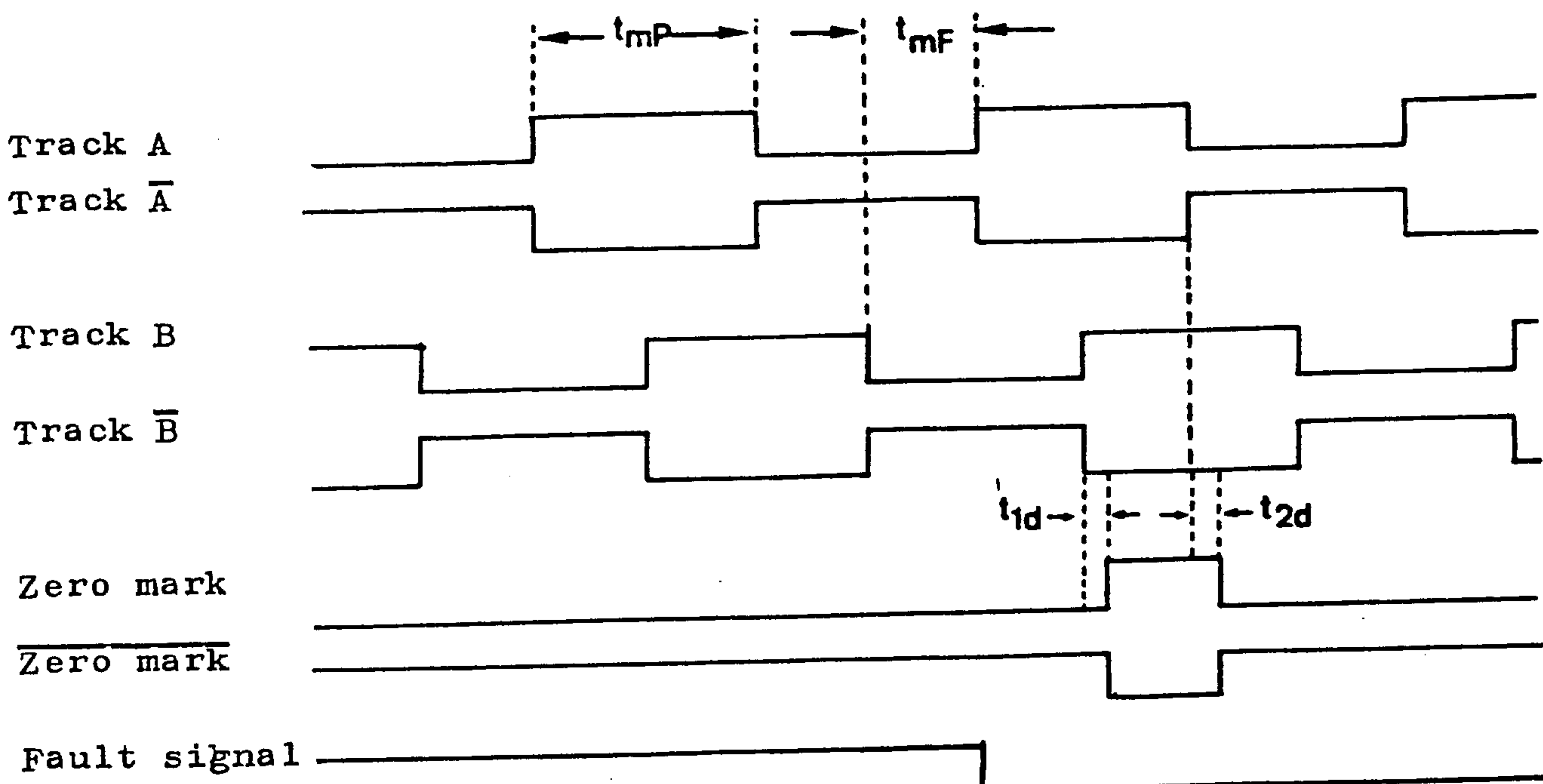
1.6.1 Actual value

The actual value pulses are conveyed to the control through the 15-pole connector screwed down on the rear panel of the Primo S.

Connection possibilities:

- Pulse generator with integral pulse shaping electronics and TTL-compatible output signals (line driver or TTL-outputs)
- Pulse generator without integral pulse shaping electronics with pulse shaping and/or multiplication with TTL-compatible output signals somewhere en route to the control.

Input signals to the control



Unless otherwise stated the following values in the table opposite apply for the following encoder signals:

- A and \bar{A}
- B and \bar{B}
- Zero mark and Zero mark

The handwheel connection only requires tracks A and B.

(Interface Description)

Technical specification	
Measurement encoder supply voltage (also for handwheel)	$5 \text{ V} \pm 5 \%$
Basic supply voltage ripple (also for handwheel)	$\leq 100 \text{ mV}_{\text{SS}}$
Current per measurement system (also for handwheel)	$\leq 300 \text{ mA}$
Resistive input load	$560 \ \Omega$
Differential input voltage	$\geq 1 \text{ V}$
Maximum allowable differential input voltage	10.5 V
Allowable DC switched mode referred to 0 V	$0 / . 4 \text{ V}_{\text{typ}}$
Maximum input frequency with 90° electrical phase shift between the A and B track pulses	500 kHz
Minimum pulse width t_{mP}	$1 \ \mu\text{s}$
Minimum separation between two following edges t_{mF}	500 ns

Technical specification	
Edge gradient	$\geq 5 \text{ V}/\mu\text{s}$
Delay between the rising edge of the zero mark and the rising edge of the respective A- or B-track pulse t_{1d}	$\leq 300 \text{ ns}$
Delay between the falling edge of the zero mark and the falling edge of the respective A- or B-track pulse t_{2d}	$\leq 200 \text{ ns}$
Fault signal, low activation	$\leq 0.4 \text{ V}$ with -5mA_{typ}
High level of the fault signal	$\geq 2.2 \text{ V}$ with -3mA_{typ}
DC voltage difference between the cable screen (= module front plate) and 0 V	$\leq 100 \text{ mV}$
AC voltage component of the DC voltage difference without allowing for any possible interference that is picked up externally	$\leq 250 \text{ mV}_{\text{ss}}$

(Interface Description)

Technical specification

Edge gradient of the AC component (without any picked up interference)	$\leq 5 \text{ V}/\mu\text{s}$
Maximum handwheel input frequency	750 Hz
Shift between the handwheel A- and B-tracks	$90^\circ \pm 10^\circ \text{el.}$
High signal level for handwheel pulses	$\geq 3 \text{ V}$
Low signal level for handwheel pulses	$\leq 2 \text{ V}$
Current at handwheel input	$\leq 1.5 \text{ mA}$
Resistive load of the handwheel inputs	$> 3.4 \text{ k}\Omega$
Handwheel speed with handwheels with 100 pulses/revolution	$\leq 300 \text{ rpm}$

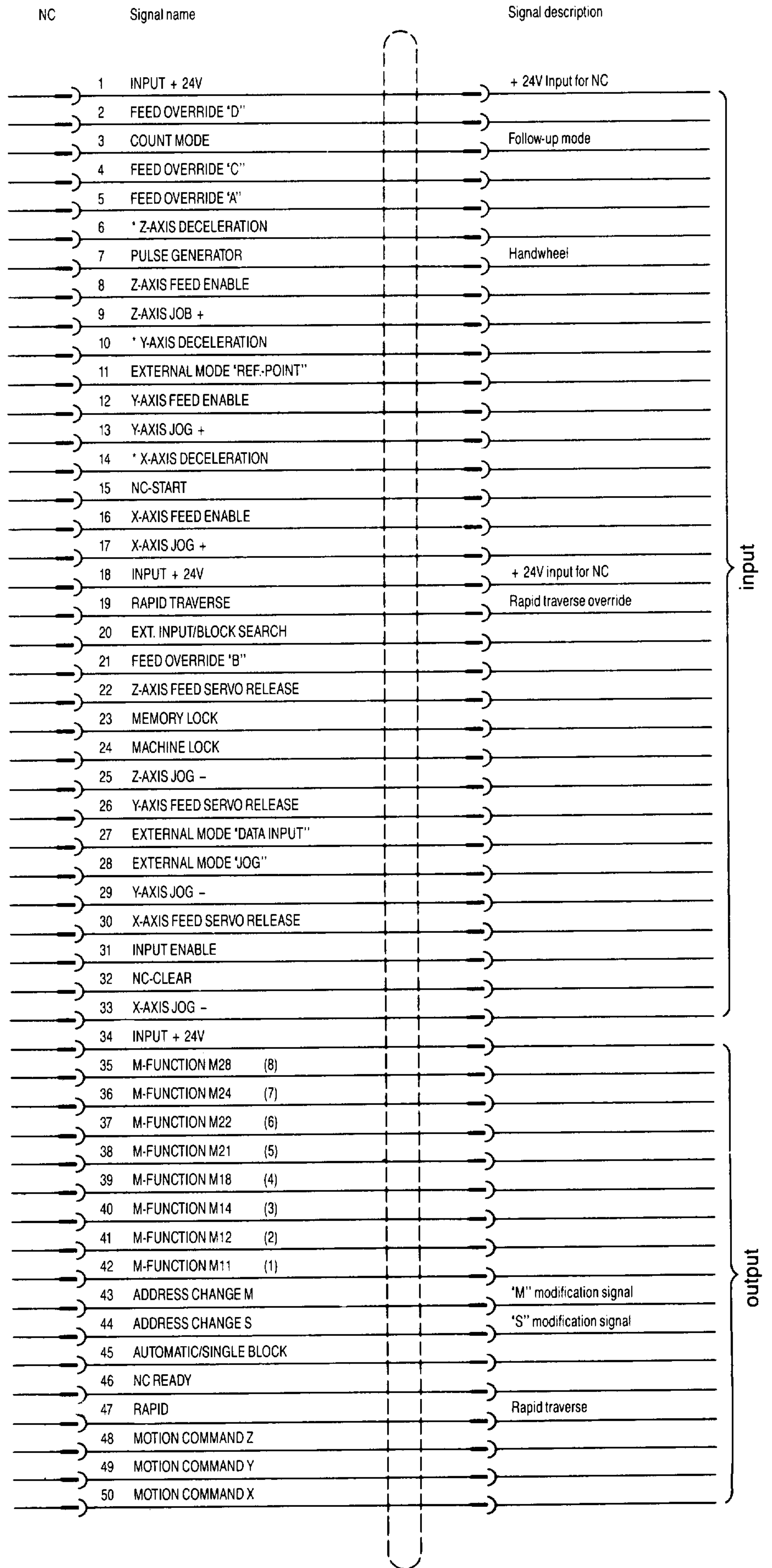
1.6.2 Setpoint values

The setpoint values may be accessed through the Siemens 15-pole connector screwed down to the baseplate of the PRIMO S housing. In addition, a floating relay contact for switching the + controller inhibit is brought out to this connector.

Technical specification	
Setpoint voltage	± 10 V
Current	2 mA
Routed voltage for the controller inhibits and NC-ready	≤ 30 V
Maximum current for the controller inhibits and NC-ready	400 mA
Maximum switching power for the controller inhibits and NC-ready	10 W

2. Description of the interface Primo S - interface control

The adjacent diagram shows the connections to the interface control and machine. The interface control contains the control sequences for switching on and off, E-Stop, overtravel and enabling the axes. The + 24V DC supply for the input/output signals must be taken from an external power supply with rectification and smoothing, and the following signal levels must be taken into account:
 "1"-signal 24V (min. 14V, max. 30 V)
 "0"-signal 0V (min. -3V, max. 5 V)
 max. ripple 500 mV
 Chassis connected to earthing bolt on cabinet rear plate.



2.1 Output signals

2.1.1 NC ready for operation (pin 46)

- 1 output signal -

Output to control a lamp or send a message to the interface control.

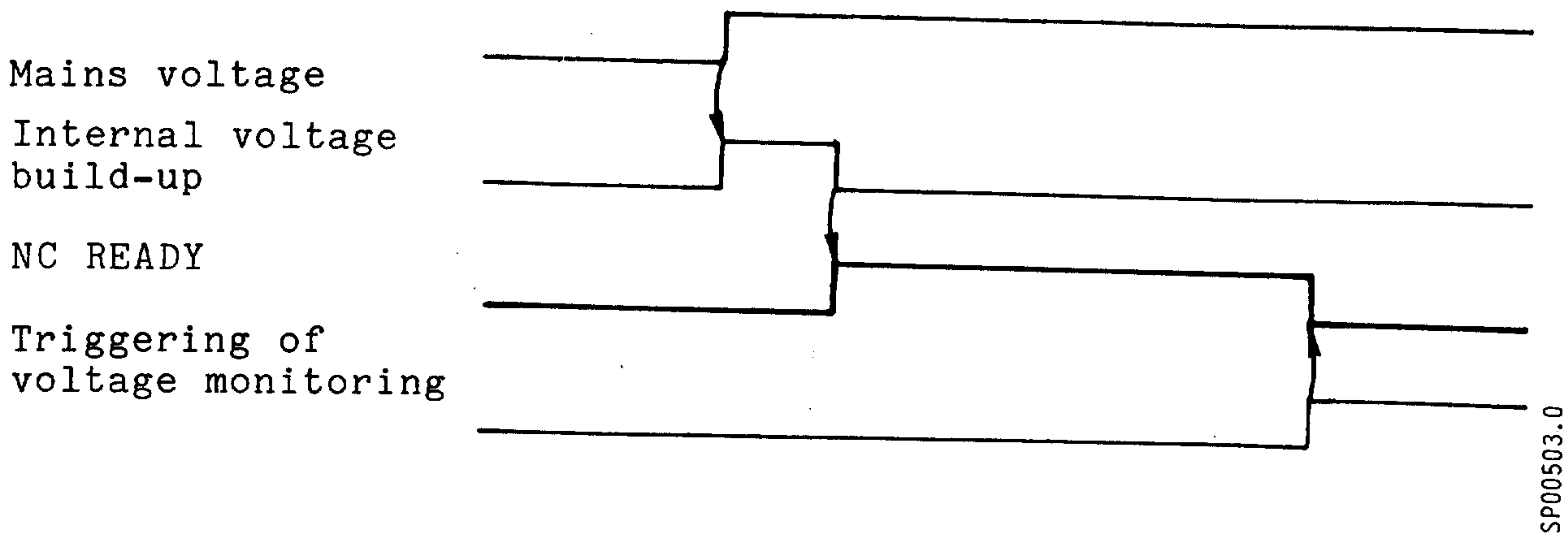
"1" signal: Following switch on of mains and voltage build-up.

"0" signal: a) Actuation of undervoltage monitoring
b) Actuation of overvoltage monitoring

Effect: When the voltage monitoring is actuated, the control is switched off and all functions stored in the buffer and main memories are reset.

The interface control must be set in the emergency off position.

The control is only ready for operation when the mains supply is switched on again.



(Interface Description)

2.1.2 Traversing commands (pins 48, 49, 50) - 3 output signals -

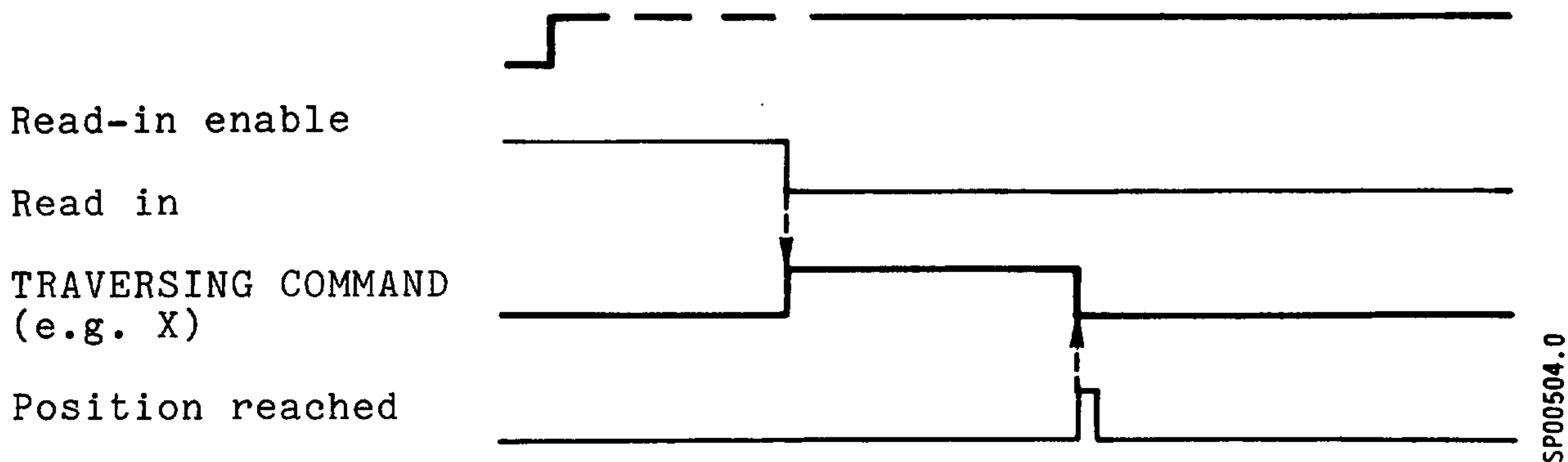
Separate traversing commands for each axis. The signals are used for axis clamping or for switching axes.

Automatic mode (No. 5) and single block (no. 4)

"1" signal: After a block with at least one coordinate value has been read in, provided the read-in enable signal is present at the interface control.

"0" signal: On reaching position

Note: No traversing command is output for a trailing axis.



Jog mode (No. 6) and Reference point approach (No. 7)

"1" signal: Axis selected and/or direction key pressed. With "Reference point approach" (No. 7) press only the key for the direction in which the return is to be made.

"0" signal: a) direction key released and position reached.
b) reference point reached.

"Teach in" mode (No. 9)

- "1" signal: a) with traversing block entered and NC start
 b) with direction key pressed
- "0" signal: a) for position reached
 b) direction key released

Note for all operating modes:

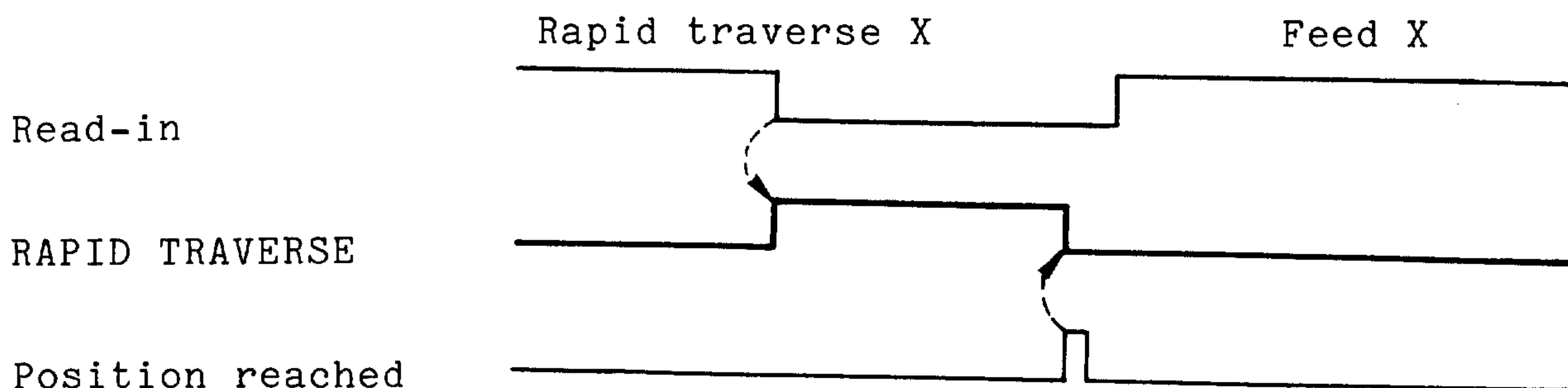
After NC-reset, or after releasing the direction key or reaching the displayed position, traversing commands remain set until the following error is equal to or less than the exact stop limit given in the machine parameters.

2.1.3 RAPID TRAVERSE (pin 47)
 - 1 output signal -

Output signal for actuating mechanical aids to rapid traverse.

Automatic mode (No. 5) and single block (No. 4)

- "1" signal: After transfer of a block with a programmed rapid traverse.
- "0" signal: After the block has been executed or the position reached.

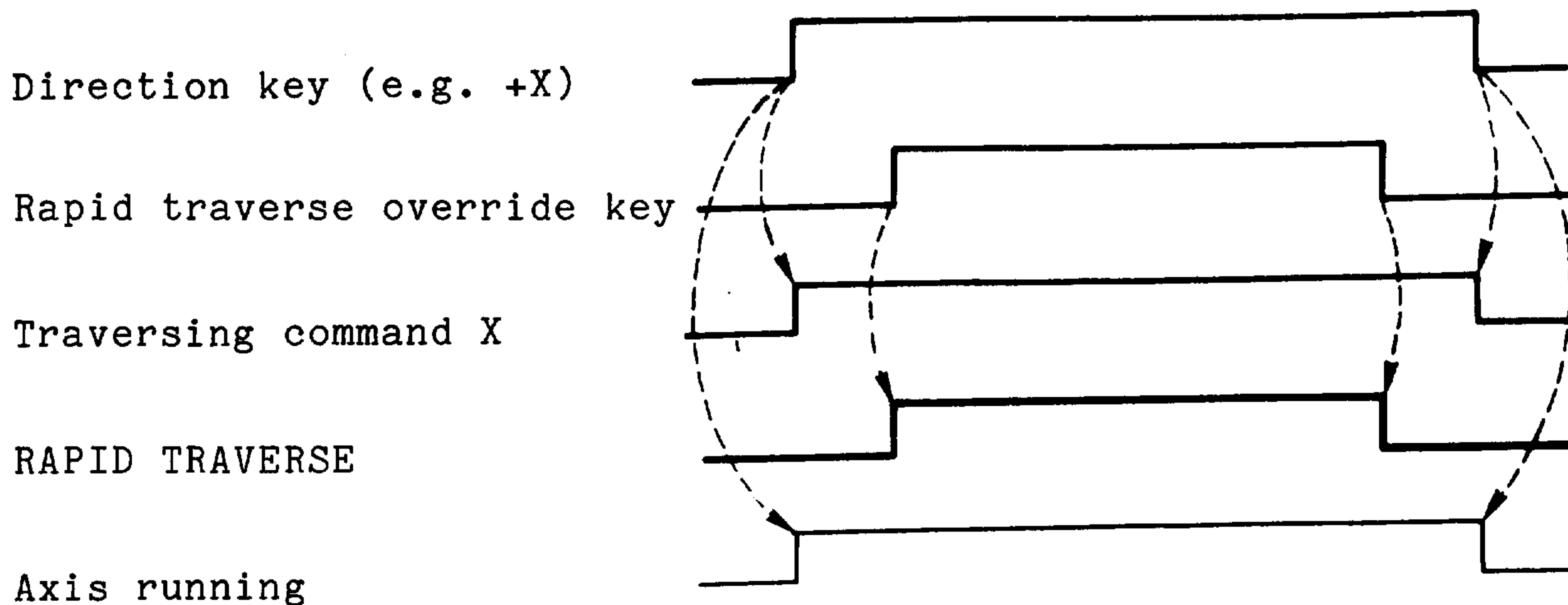


(Interface Description)

Jog mode (No. 6)

"1" signal: Rapid traverse override key and direction key pressed.

"0" signal: Rapid traverse override key or direction key not pressed.



SP00506.0

"Reference point approach" mode (No. 7)

"1" signal: by pressing the direction key bringing the axis towards the reference point

"0" signal: when the axis reaches the deceleration cam (with the negative edge of the * deceleration signal).

"Teach in" mode (No. 9)

"1" signal: a) with a traversing block input containing programmed rapid traverse following NC start
b) with rapid traverse override key and direction keys pressed

"0" signal: a) for position reached
b) direction or rapid traverse keys no longer pressed.

(Interface Description)

2.1.4 AUTOMATIC or SINGLE BLOCK mode (pin 45)

- 1 output signal -

Output signal to differentiate between jog and automatic modes.

"1" signal: In 'automatic' (No. 5) and 'automatic single block' (No. 4) modes

"0" signal: In all other modes.

2.1.5 Auxiliary functions M and S (pins 35-449)

- 10 output signals -

Signal output: 2 decade BCD-coded (M00 to M99) with M and S modification signal or 8 individual M signals (M01 to M18) with M modification signal (selected using machine parameters).

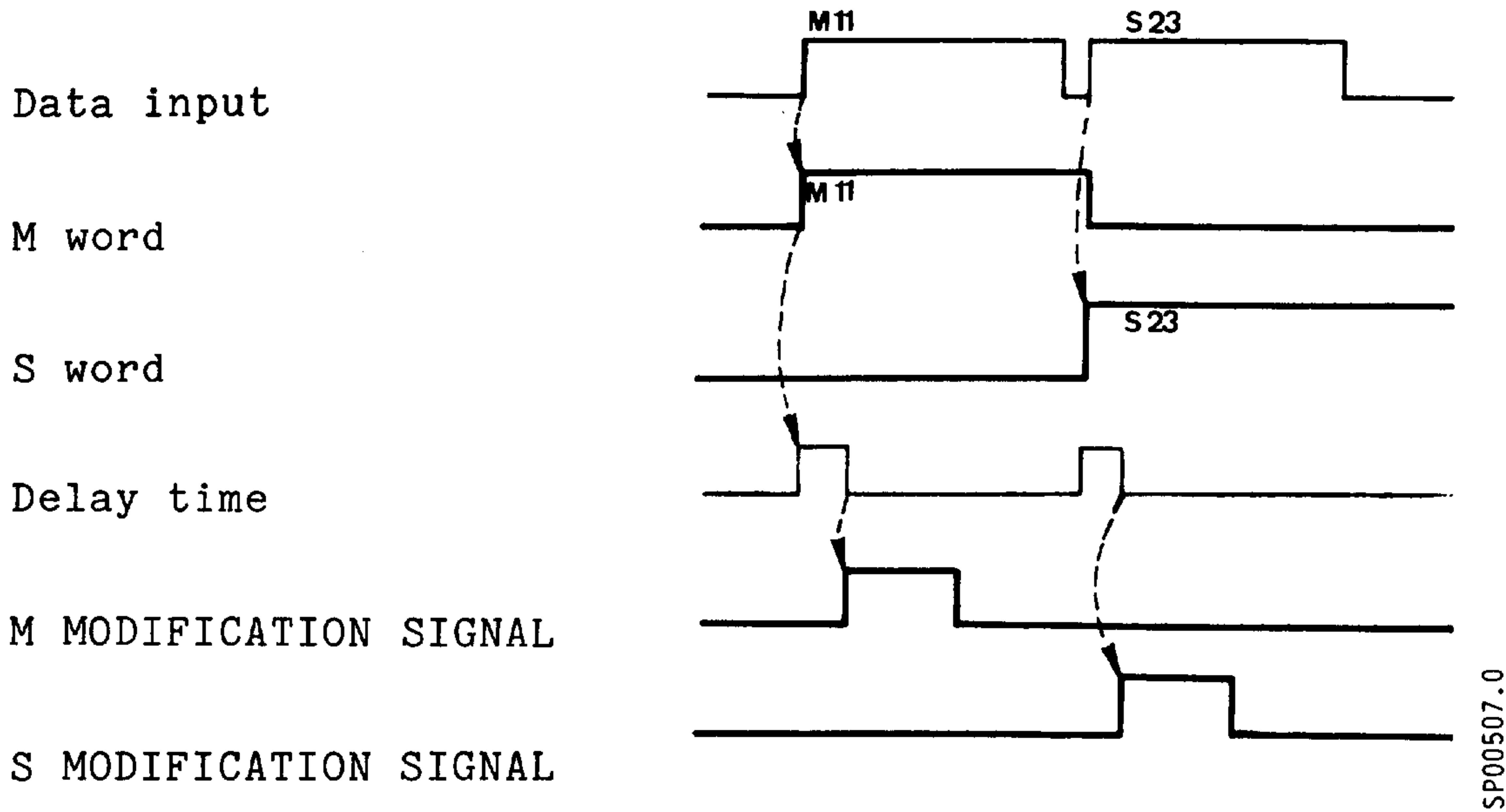
Sequence: a) M or S word
b) delay time
c) M or S modification signal

Automatic (No. 5) and single block (No. 4) modes

Information changes following data transfer of a new M or S word into the main memory.

Information is deleted with NC-RESET.

Output of two consecutive M and S functions:

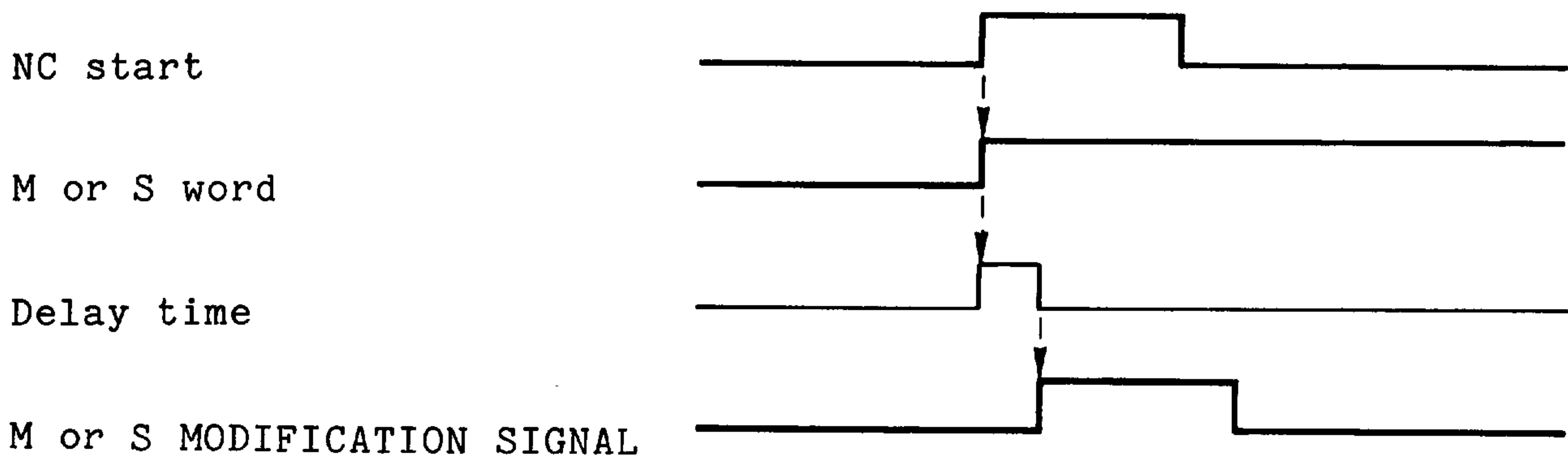


Internal commands M00, M30, M91.....M96 are also output.

Jog (No. 6) and Teach in (No. 9) modes

Information changes after an M or S word is entered and NC start.

Information is deleted with NC-RESET.



Example:

a) BCD coded: M23, S64 is programmed

Output signal

M/S	28	24	22	21	18	14	12	11
M23	$\underbrace{0 \quad 0 \quad 1 \quad 0}_{\text{2nd decade}}$ Value = 2				$\underbrace{0 \quad 0 \quad 1 \quad 1}_{\text{1st decade}}$ Value = 2+1 = 3			
S64	$\underbrace{0 \quad 1 \quad 1 \quad 0}_{\text{2nd decade}}$ Value = 4+2 = 6				$\underbrace{0 \quad 1 \quad 0 \quad 0}_{\text{1st decade}}$ Value = 4			

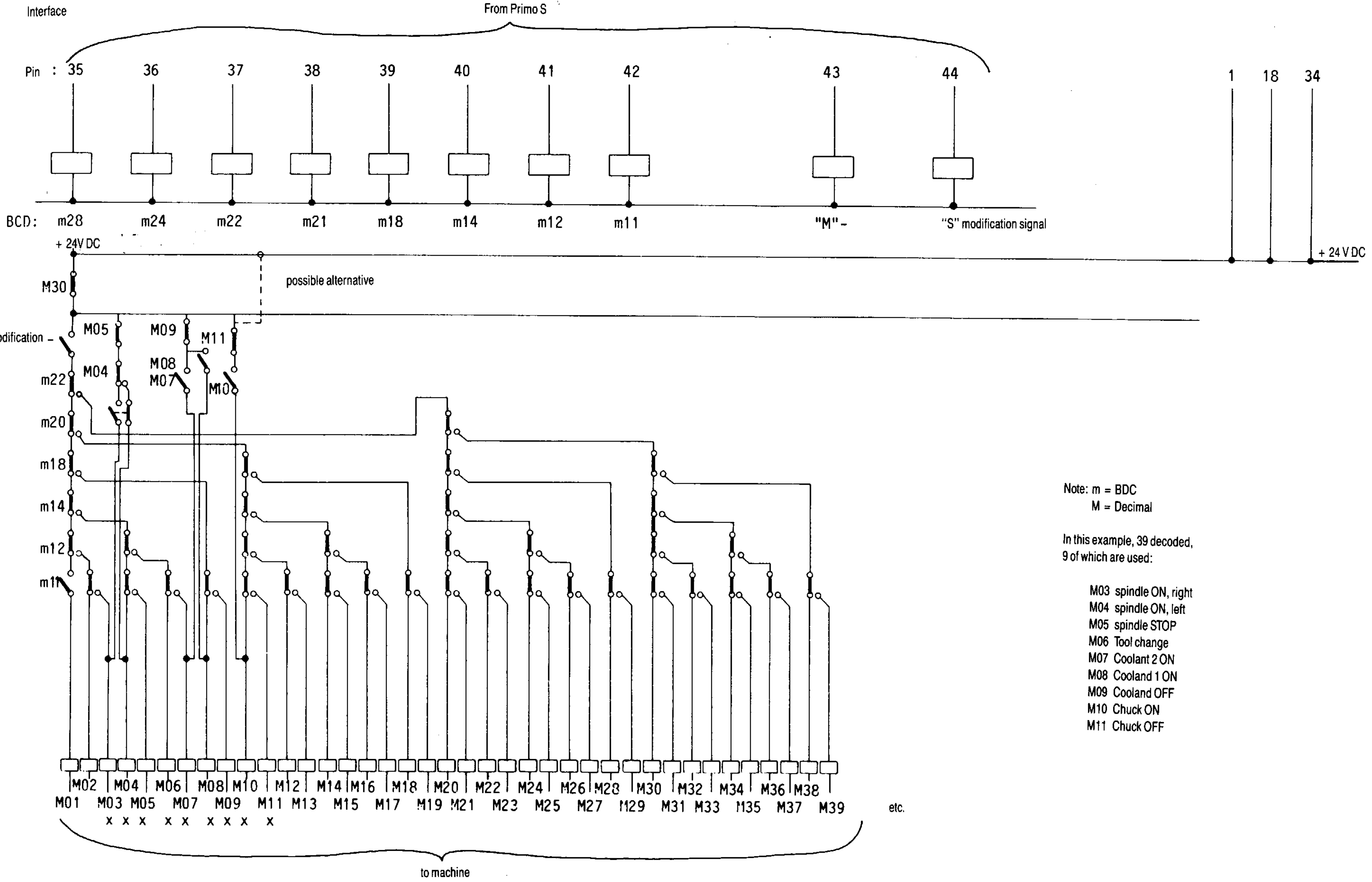
b) Individual signal: e.g. sequence M12, M14, M02, M16 is programmed.

Output signals:

Output No.	8	7	6	5	4	3	2	1
Pin No.	35	36	37	38	39	40	41	42
M12	0	0	0	0	0	0	①	0
M14	0	0	0	0	①	0	1	0
M02	0	0	0	0	1	0	①	0
M16	0	0	①	0	1	0	0	0

i.e. M12 sets +24V at output 2
 M14 sets +24V at output 4
 M02 clears output 2
 M16 sets +24V at output 6

(Interface Description)
Example for M decoding
(max. 99 switching and auxiliary functions)



Remarks:

Delay time and modification signal can be adjusted between 8 - 2040 ms in steps of 8 ms.

Short times are selected by electronic switching and long times by contact switching in the interface control.

The transfer of the auxiliary functions into the interface control using BCD-coded output must be initiated by the rising flank of the modification signal. Using single signal output the M functions do not have to be stored because the outputs are static. In this case the modification signal is unimportant.

Care:

For single signal and programmed

- M00, output 1 is reset
- M30, output 1 is set
- M91, output 1 is set
- M92, output 2 is set
- M93, output 3 is set
- M94, output 4 is set
- M95, output 5 is set
- M96, output 6 is set

The output of single M signals and the output of S functions are mutually exclusive.

S function output is only possible in BCD code.

2.2 Input signals

2.2.1 Feed enable (pins 8, 12, 16)

- 3 input signals -

In addition to controller enable, a "1" signal at the relevant feed enable input is required for axis motion. If a "0" signal is applied when the relevant axis is moving, the control causes the drive to brake, and brings it to standstill.

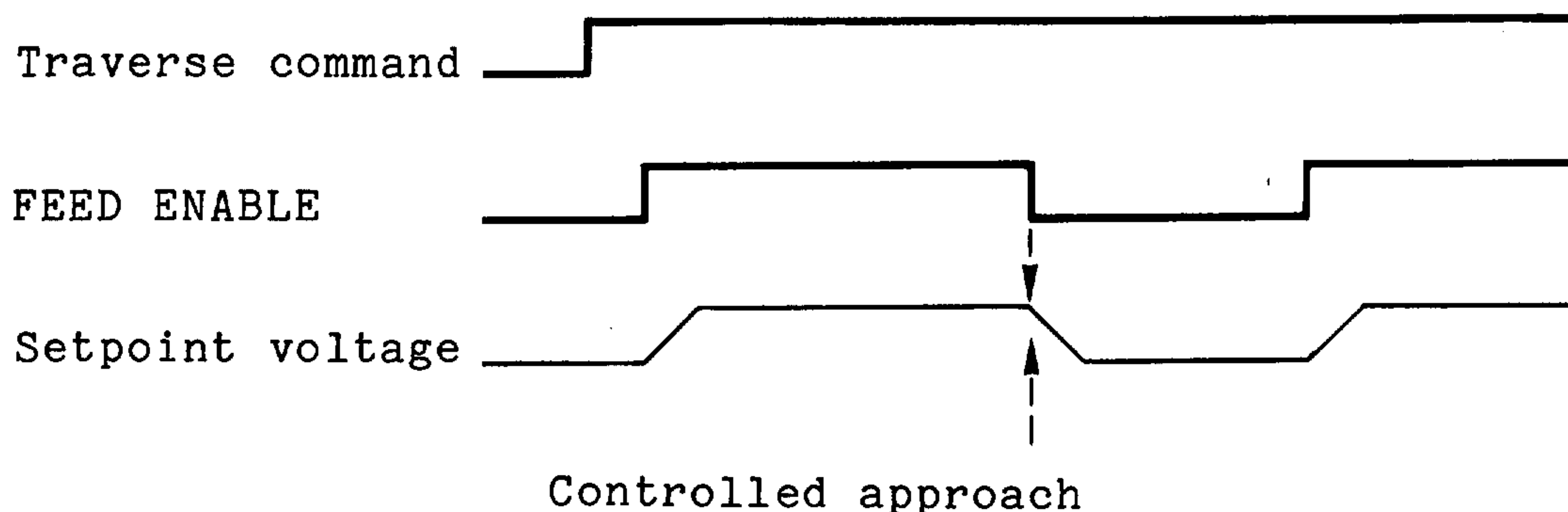
The position loop remains active, i.e. any following error is reduced to zero.

Note: The "FEED START", "FEED HOLD" and "OVERTRAVEL LIMIT SWITCH" signals must be combined as required in the interface control, to produce "0" or "1" signals at these inputs.

Automatic (No. 5), Single block (No. 4), Jog (No. 6), Tech-in (No 9), Approach reference point (No. 7) modes

"1" signal: acts as feed enable for the relevant axis

"0" signal: acts as feed hold for the axis, but only if it is removed from an axis which is in motion. When the "1" signal is given again the motion restarts.



(Interface Description)

2.2.2 CONTROLLER ENABLE (pins 22, 26, 30= - 3 input signals -

"1" signal: effects completion of the position control loop for the required axis.

"0" signal: effects rapid deceleration of an axis only when the controller enable is removed from an axis in motion. In this case, the position loop is decoupled and the motor stopped with maximum braking current.

Following rapid deceleration any following error remaining is not accounted for in the control! In this case, the control has to be switched on again.

8 ms to 2040 ms after initiation of the braking process (set by machine data N621), *Controller disable for the servos of all axes is removed.

If controller enable is removed from axes not in motion, the *controller disable signals to the servo controllers are passed on without delay in accordance with the controller enable inputs. The controller enable signals must be permanently available so that the position loops and the drives function.

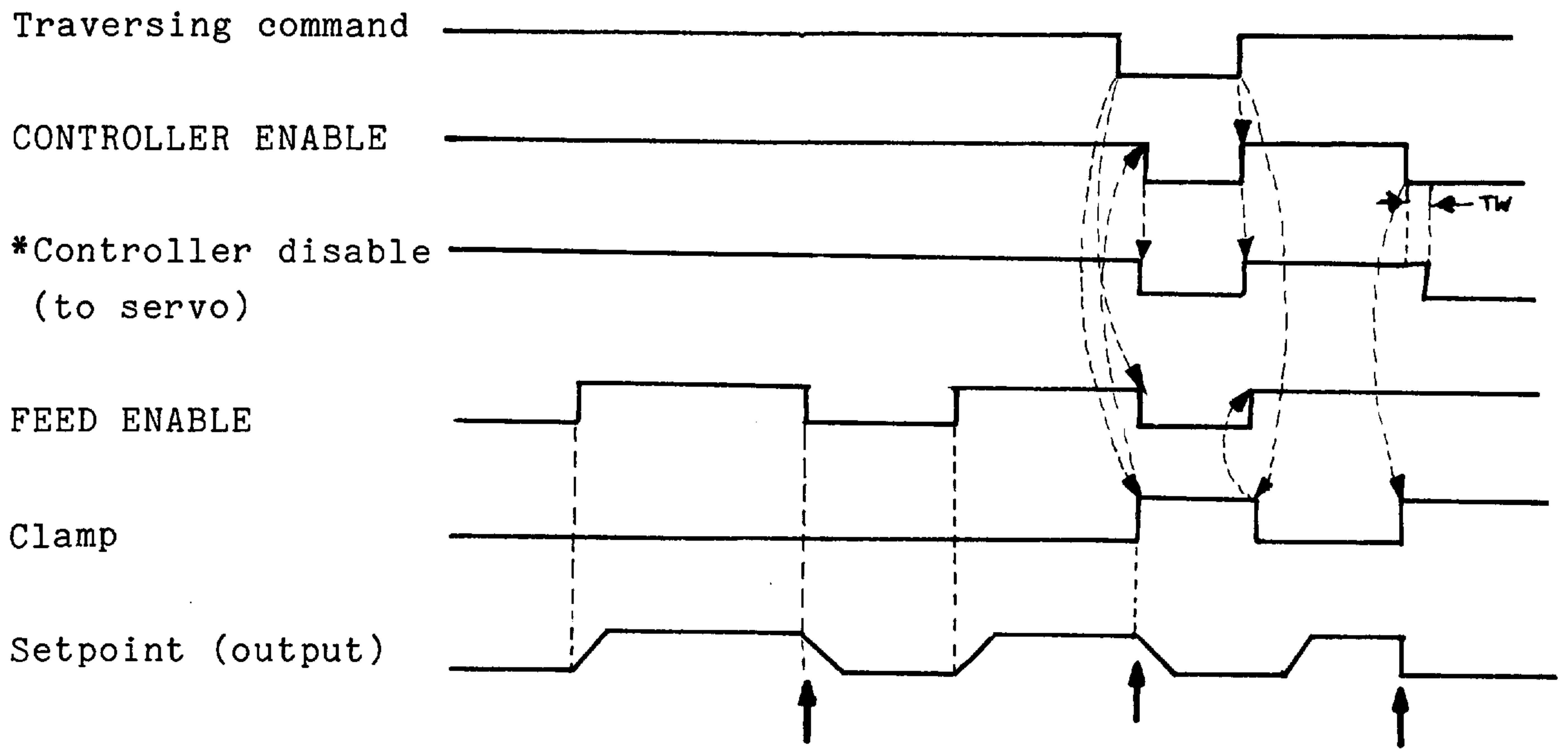
Exceptions:

For machines with axis clamps, the controller enable must be rejected by the interface for the duration of clamping.

On reaching the E-STOP limit switch, or on pressing the E-STOP, the controller enables must be removed.

Diagram for controller- and feed enable

Set speed output, response when individual signals are removed
 (application example):



<p>Stopped by removal of FEED ENABLE (feed hold, overtravel switch, change of operating mode, NC-reset)</p>	<p>Position reached</p>	<p>Stopped by removal of CONTROLLER ENABLE ERR29 (E-Stop limit switch, E-Stop)</p>
--	--------------------------------------	---

TW: Settable from 8 ms to 2040 ms via machine data N621.

(Interface Description)

2.2.3 *DECELERATION (pins 6, 10, 14)
- 3 input signals -

Signal description

In the "Reference point approach" mode (No. 7) the control evaluates for each axis a *DECELERATION limit switch signal. This signal is used to return to the reference point at rapid traverse.

Both signal edges are effective:

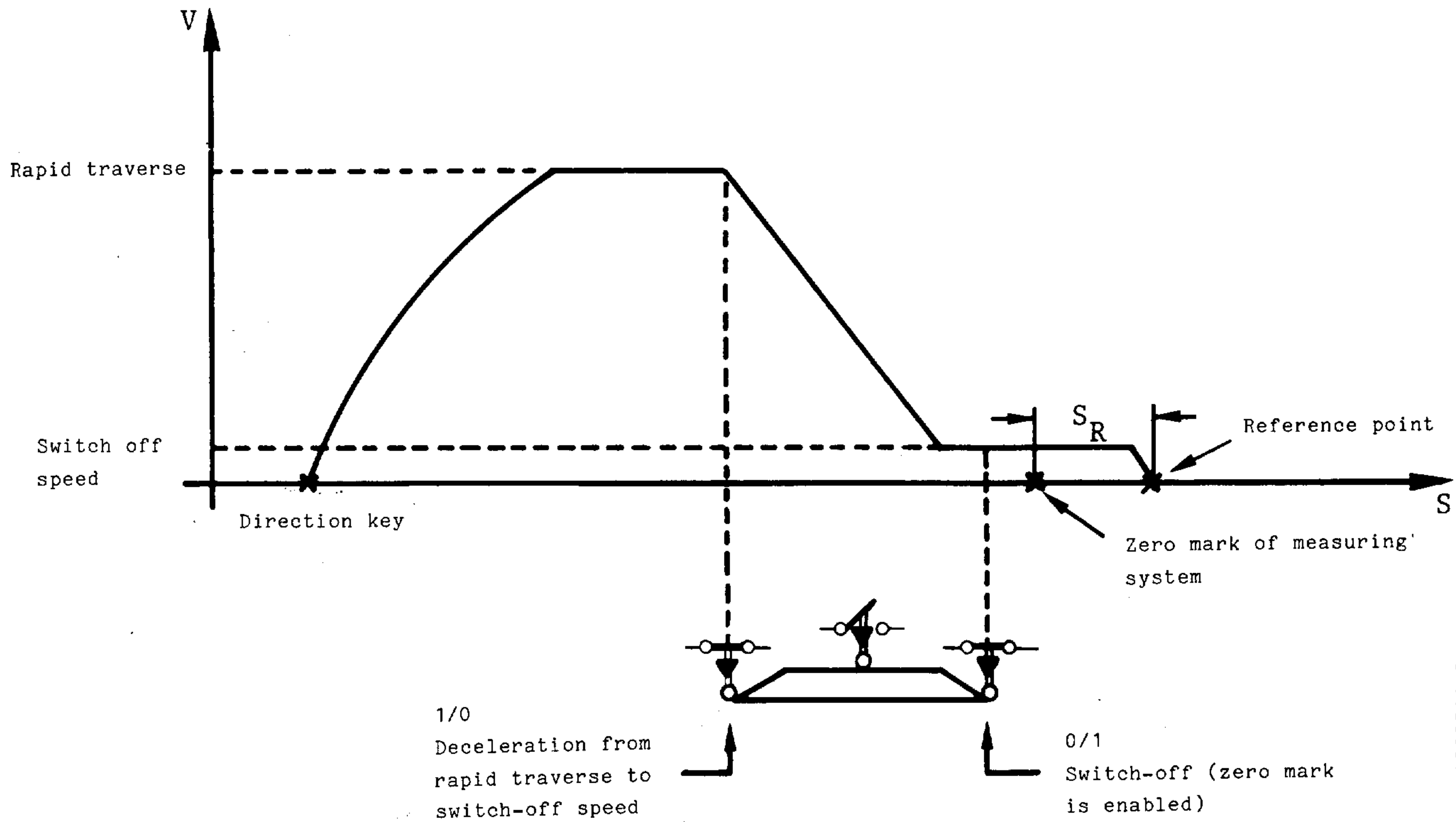
Transition from "1" to "0": effects deceleration of the selected axis from rapid traverse to a switch off speed set internally (via machine data).

Transition from "0" to "1": enables recognition of a measuring system zero mark.

This function is best achieved using a cam controlling an NC contact.

Reference point approach

Characteristic:



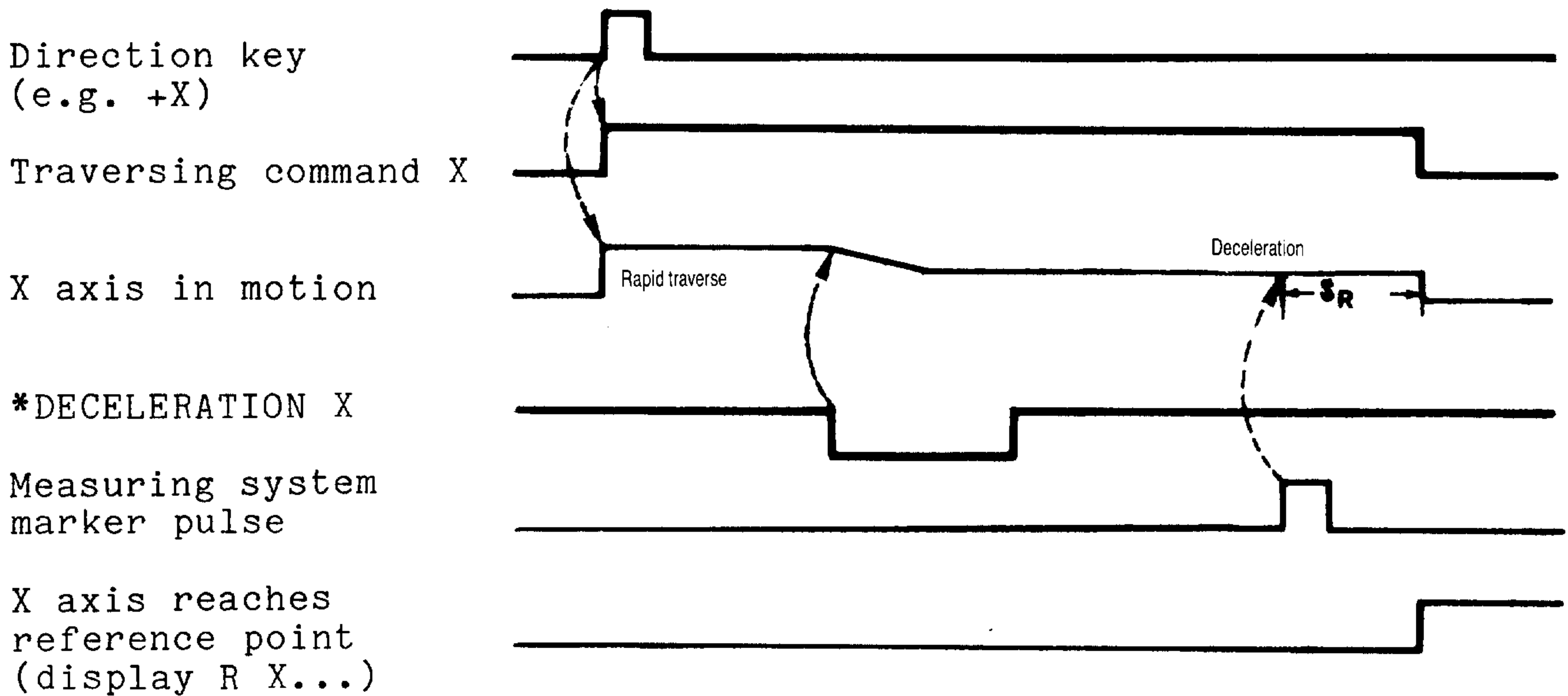
The reference point approach is initiated by the associated direction key.

When the *DECELERATION signal changes from "1" to "0" the drive of the associated axis is reduced from rapid traverse to the switch-off speed.

During the subsequent "0" to "1" transition the control waits for the next marker pulse from the measuring system. The path S_R is traversed and RX.., RXY., RXYZ for the associated axis shown on the universal display.

* S_R = 1000 increments for linear measuring systems
= 1/2 revolution for ROD transducers, if the number of pulses per ROD transducer revolution is stored in machine data N630, N631, N632.

Diagram - Reference point approach:



SP00512.0

The length of the cam must be such as to allow deceleration from rapid traverse to switch off speed.

It is necessary to adjust the last edge of the reference point cam so that it is at least 4 mm in front of the associated zero reference (marker) of the measuring system.

Note: If the *DECELERATION signal is already zero at the start of the reference point approach (e.g. if the axis is already on the cam), the axis traverses at switch off speed from the start to the reference point.

Caution: If the direction key continues to be pressed when the reference point is reached, reference point approach is initiated once more.

The reference point may not coincide with a zero reference (marker) of the measuring system.

2.2.4 READ IN ENABLE (pin 31)

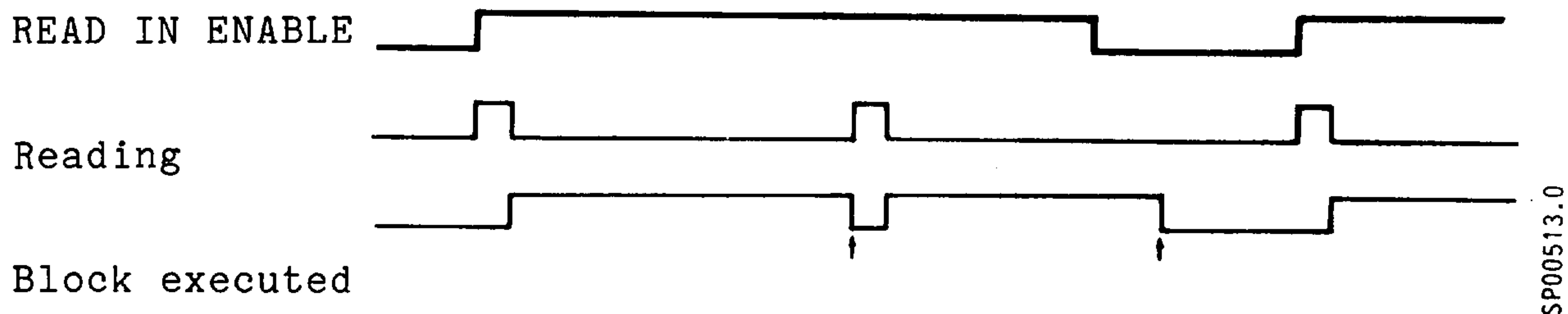
- 1 input signal -

The READ IN ENABLE signal is effective in Automatic (No. 5) and Single Block (No. 4) modes.

After reaching the position, or after a block has been completed, the READ IN ENABLE signal is required for the next block to be read and executed.

"1" signal: enables the transfer of information from the buffer store to the main memory.

"0" signal: prevents the reading and execution of the next program block. Should the read in enable signal be removed during the execution of a block it has no effect on that block.



(Position reached or execution complete)
Point at which read in enable is scanned.

SP00513.0

Application: During the execution of auxiliary functions, such as tool change, gear change, etc., the reading and execution of the next block is prevented by a "0" signal at this input, until the auxiliary function is completed and the read in enable is restored to the system.

2.2.5 EXTERNAL OPERATING MODES (pins 27, 28, 11)
- 3 input signals -

The three signals

- External mode "data input" (pin 27)
- External mode "jog" (pin 28)
- External mode "approach reference point" (pin 11)

are used, when the interface control is used to override the operating mode set on the mode selector switch of the control. A change in the external operating mode has the same effect as a change in the internal operating mode, i.e. if necessary the axes are adjusted under control.

Data input: "1" signal: control goes into "data input" mode;
display "DATA"

Jog: "1" signal: control goes into "jog" mode;
display "CONV"

Return to datum: "1" signal: control goes into "reference point approach" mode; display "R.."

Only one of the 3 inputs may be "1"!

All 3 signals = 0: internal operating mode is active

(Interface Description)

Application: e.g. using the PRIMO S as a subordinate control for external supply of programs.

Example:

- 'External operating mode data input' = 1
- 'Transferring programs via V.24 (RS232)
- 'Data input' = 0
- 'Reference point approach' = 1, direction keys = 1
- 'Reference point approach' = 0
- NC reset
- NC start

2.2.6 +24V DC input voltage (pins 1, 18, 34)

- 3 inputs -

The output signals, pins 35 to 50, are supplied with +24V DC via these inputs.

(Interface Description)

3. Input signals from external operating elementsOperating elements:

Switches: Feedrate override switch
 Key-operated switch for memory lock

Switches or
latching keys for: Machine lock
 Handwheel
 Follow-up operation

Keys for: NC reset
 NC start
 Direction keys
 Rapid traverse override
 Input or block search

3.1 Feedrate override switch (pins 2,4,5,21)

- 4 input signals -

With this switch, feedrates and rapid traverse can be modified from 0 to 120 %, in steps.

This switch is not effective in "Reference point approach" (No. 7) and in "Automatic" (No. 5) modes for blocks with programmed rapid traverse.

The signal combinations are in Gray code.

They must overlap when the switch position is altered.

Siemens type: 6FC9 130-0AC00

	0	3	6	10	15	20	30	40	50	60	70	80	90	100	110	120
A	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0
B	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0
C	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0
D	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

3.2 Key-operated switch for memory lock (pin 23)

- 1 input signal -

With the memory lock signal, all methods of inputting data into the control memory can be disabled.

- Part program
- Tool offsets
- Drift compensation and jog feedrate
- Machine data

Effect: "1" signal: no input possible
"0" signal: input is enabled

3.3 Machine lock (pin 24)
- 1 input signal -

The signal is effective in "Automatic" (No. 5), "Single block" (No. 4) and "Teach-in" (No. 9) modes and allows programs to be tested.

It results in no machine movement, i.e. no set speed is given.

The program is executed only within the control. Traverse commands and auxiliary functions are output.

"1" signal: All axes are processed within the control. "1" signal is only accepted with axes stationary.

"0" signal: Machine lock is ineffective. The removal of machine lock is likewise only possible with stationary axes.

Note: Those movements shown in the display during machine lock are taken into account for the actual position calculation.

3.4 Handwheel (pin 7)
- 1 input signal -

The handwheel signal is effective in the "Jog" (No. 6) and "Teach-in" (No. 9) modes.

Handwheel pulses represent 5,10,20,40,80 or 160 um (can be selected with data).

The correlation of the handwheel to an axis is given by pressing a direction key for that axis.

"1" signal: Handwheel pulses are evaluated according to the multiplier given in the machine parameters, and given as a command value to the chosen axis.

"0" signal: The handwheel has no function.

(Interface Description)

3.5 Follow-up mode (pin 3)

- 1 input signal -

The control works as a position display, the position loops are open. The signal is effective in all operating modes. Follow-up mode may be selected or aborted only if axes are stationary.

"1" signal: Follow-up mode is effective, the control works as a position display.

"0" signal: All other cases

Note:

If, before the selection of follow-up mode, a moving axis was interrupted by mode change or feed hold, then the remaining distance will be travelled with feed enabled and, if required, NC-START (with mode change and M00).

With 2.5 μm measuring resolution double the distance; with 1 μm measuring resolution five times the distance, is displayed.

3.6 NC-reset (pin 32)
- 1 input signal -

With this the control is reset to a defined state, and returned to the program start. All signals except "NC ready" are reset in all operating modes.

Automatic (No. 5) and Single block (No. 4) modes

"1" signal: Must be given once before starting the first block of a program and before block search.

Teach-in (No. 9) mode

"1" signal: Must be given once before the start of programming. Executed blocks which should not be stored can be deleted with NC-reset.

Defined basic state caused by NC-reset:

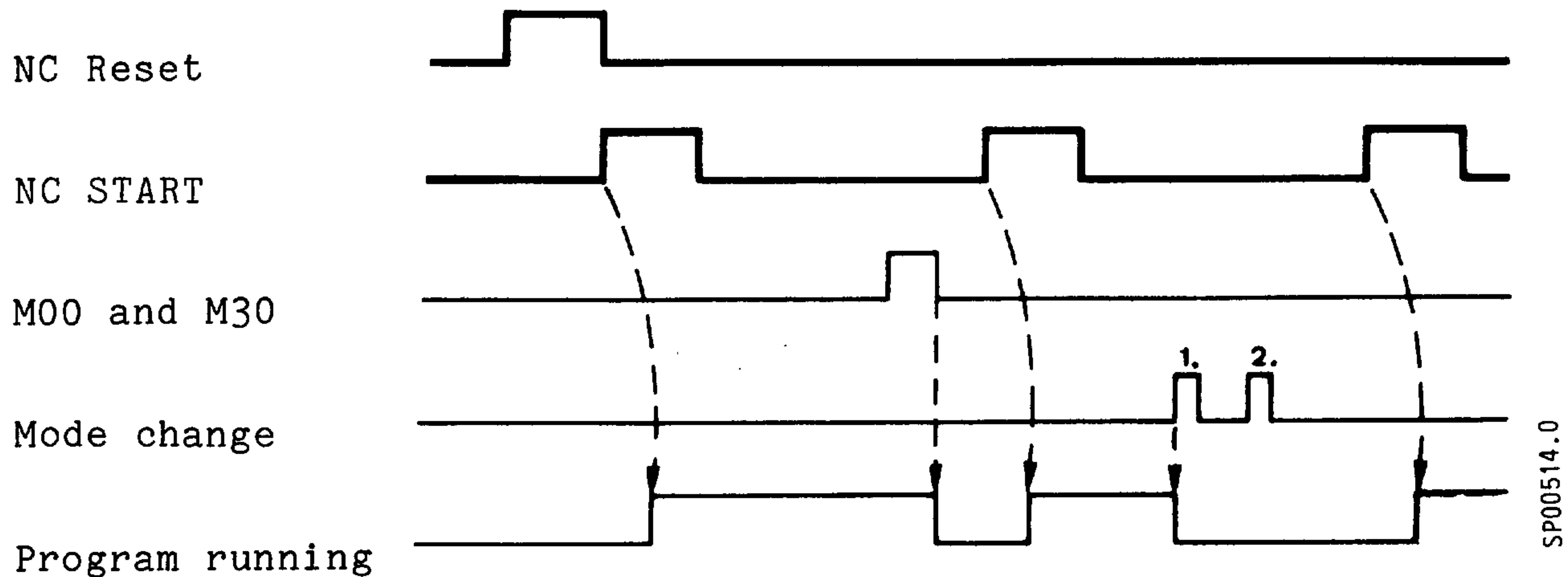
- Moving axes are brought to a standstill by the deceleration.
- Program pointer is put on block 1.
- Output signals apart from "NC-ready" are cancelled (traversing command when the exact stop is reached).
- The prepared block is cancelled in the intermediate memory.
- Calculated compensations are cancelled.

3.7 NC start (pin 15)
- 1 input signal -

"Automatic" (No. 5) mode

"1" signal: a) After NC reset or M30 to start the program
b) Starting the program after M00
c) Starting the program following change of operation mode

"0" signal: All other conditions



Single block (No. 4) and Teach-in (No. 9) modes

"1" signal: a) Starting a block
b) Starting a block following change of operating mode

"0" signal: All other conditions

"Jog" (No. 6) mode

"1" signal: For output of M and S functions (see page 2-7)

"0" signal: All other conditions

Data output (No. 12) mode

"1" signal: to start data transfer via V.24 (RS232)/20 mA interface.

- a) Unprotected program memory
- b) Protected program memory
- c) Setting data memory
- d) Machine data memory

"0" signal: All other conditions

3.8 Direction keys (pins 9,13,17,25,29,33)
- 6 input signals -

The direction keys +X, -X, +Y, -Y, +Z, -Z simultaneously determine axis and direction, and initiate axis motion in the jog (No. 6), reference point approach (No. 7) and teach-in (No. 9) modes.

"1" signal: Key pressed

3.9 Rapid traverse override (pin 19)
- 1 input signal -

If this key is pressed in addition to the direction key, then the control moves at the rapid jog speed given in the machine data, instead of at jog feedrate.

The key is only effective in the jog (No. 6) and teach-in (No. 9) modes.

"1" signal: Key pressed

3.10 External input key or external block search (pin 20)
- 1 input signal -

The function of this input can be defined as follows by means of machine data:

Machine data N611 bit 3 = 0: Input key
 (only effective for teach-in
 (No. 9) mode)
 = 1: Block search
 (only effective for automatic
 (No. 5) and single block (No. 4)
 modes)

The external input key has the same function as the input key (No. 21) on the control for "teach-in" (No. 9): Transfer of an executed block into memory.

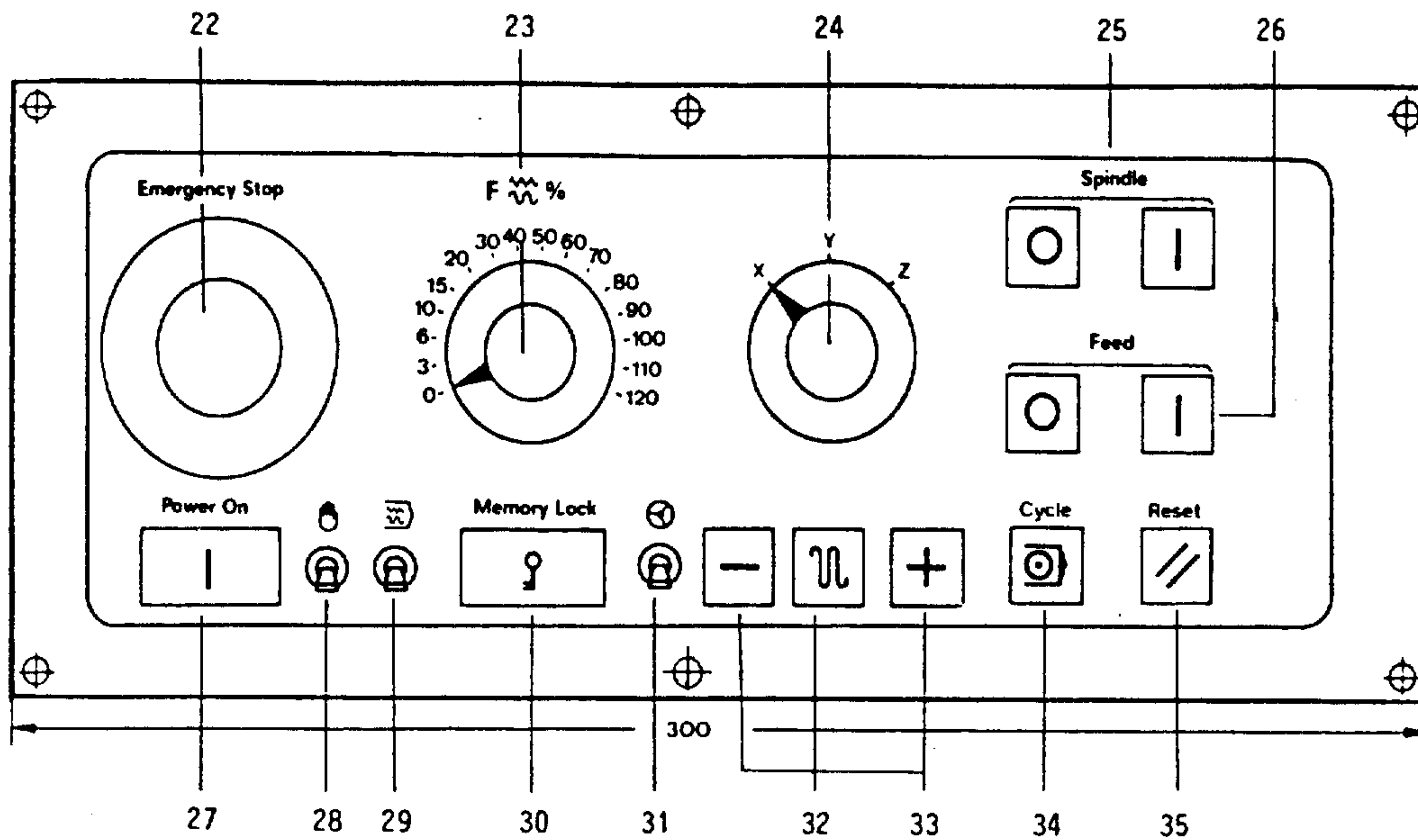
External block search: After NC Reset M00 or M30 the block number is increased by 1 for each input pulse.
The program can be started or continued from the preselected point using NC Start.

Application: e.g. to select programs when a number of programs are stored, or to skip program blocks after M00.

Note: Modal functions such as feedrates (F blocks) and tool offset selection (D blocks) are not stored during block search, i.e. the chosen program must start with an F and D block as appropriate.

(Interface Description)

3.11 Recommended layout for external operator panel



- 22 Emergency Stop
- 23 Override
- 24 Axis selector
- 25 Spindle on/off
- 26 Feed start/stop
- 27 Power on
- 28 Follow-up mode
- 29 Machine disable
- 30 Memory disable
- 31 Handwheel
- 32 Rapid traverse override
- 33 Direction keys
- 34 NC Start
- 35 NC Reset

Direction keys: effective for jog (No. 6),
reference point approach (No. 7),
teach-in (No. 9), data output

NC-Start: effective for single block (No. 4),
automatic (No. 5), jog (No. 6),
teach-in (No. 9)

NC-Reset: effective for all operating modes

Feedrate override switch: effective for single block (No. 4),
automatic (No. 5), jog (No. 6),
teach-in (No. 9)

Machine disable: effective for single block (No. 4),
automatic (No. 5)

Handwheel: effective for jog (No. 6),
teach-in (No. 9)

Follow-up mode: effective for all operating modes

Memory disable: effective for data input (No. 11)

External input key: effective for teach-in (No. 9)

External block search: effective for single block (No. 4),
automatic (No. 5)

Rapid traverse override: effective for jog (No. 6),
teach-in (No. 9)

Externally selected operating modes always take priority over
internal operating modes.

(Interface Description)

4. Interface PRIMO S - Servos4.1 Set speed (+ 10 V max., loadable with 2 mA)
- 6 conductors -

Polarity of setpoint voltage:

PLUS voltage: effects movement in direction of
increasing coordinates PLUSMINUS voltage: effects movement in direction of
decreasing coordinates MINUS4.2 *Controller disable
- 3 output signals -

The axis-dependent controller enable signals (2.2.2) from the interface control are converted to logic conditions in the control and from there used as outputs to the servos.

"1" signal: Acts as the enable for drives, provided the interface gives the feed servo release signal and the control has no internal monitor triggered.

"0" signal: Disable the drives, on removal of the feed servo release signal, or on triggering one of the alarms ERR 21,22,23,25,26,27,29.

Any actuation of the measuring circuit or standstill monitoring immediately initiates stopping of the feed drives using maximum braking current.

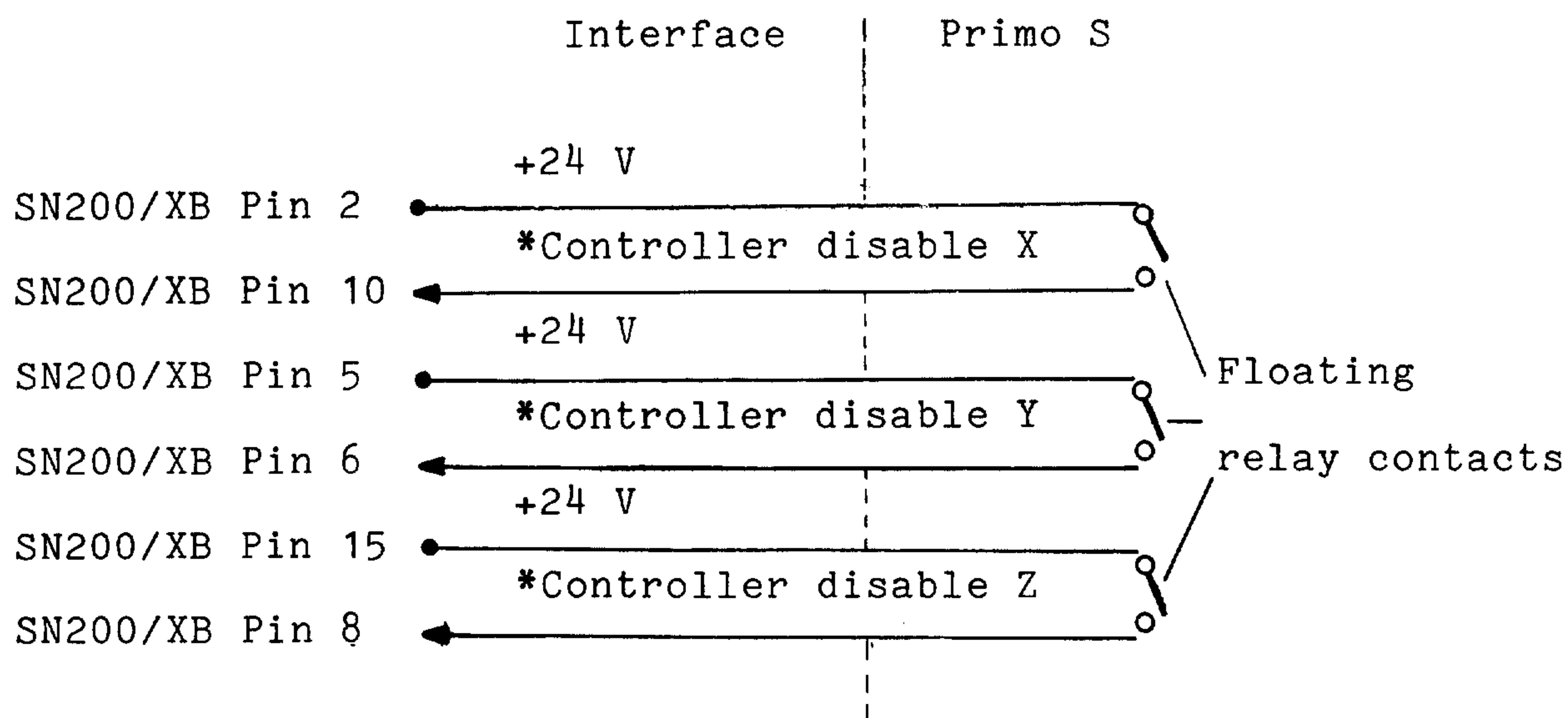
8 ms to 2040 ms after the start of the braking process all *controller disable signals are removed from the servo controllers. For as long as the emergency stop conditions apply the axes cannot be moved.

Removal of controller enable (2.2.2) during motion of the associated axis also initiates immediate braking of the feed drives to standstill.

Resynchronization of the axes is only possible after switching the control on/off and reference point approach.

4.3 +24 V
- 3 conductors -

+24 V DC input acting as power supply for *controller disable outputs:



(Interface Description)

5. Interface PRIMO S - data input/output device
V.24 (RS232)/20 mA interface

The serial interface used here is so arranged that it can be selected to operate with either a V.24 (RS232) signal level or 20 mA current loop. A 25-pole connector (Cannon) on the front panel is provided to connect data peripherals such as tape reader, punch, magnetic tape device etc., to the control.

5.1 V.24 (RS232) interface

For this interface the signals, their significance, signal levels etc., are standardized in accordance with DIN 66020 (CCITT V24) or EIA- RS-232-C.

These standards are valid for the interface between a data transmission device (here the Primo S) and a data terminal (peripheral devices such as reader, punch, magnetic tape device etc.).

5.1.1 Interface signals for V.24 (RS232)Earth line

Next: Signal ground

This conductor is the common return for all interface connectors.

Data lines

- * TxD: Transmitted data
Data from peripheral device to Primo S are transferred via this conductor.
Quiescent state, logic "1".

- * RxD: Received data
Data from Primo S to peripheral device are transferred via this conductor.
Quiescent state, logic "1".

Control lines

- DTR: Data terminal ready
The peripheral device indicates to the Primo S its readiness to transfer data.

- RTS: Request to send
The peripheral device controls transmission from the Primo S.

Status lines

- DSR: Data set ready
The Primo S indicates to the peripheral device whether or not it is in the correct state to transfer data.

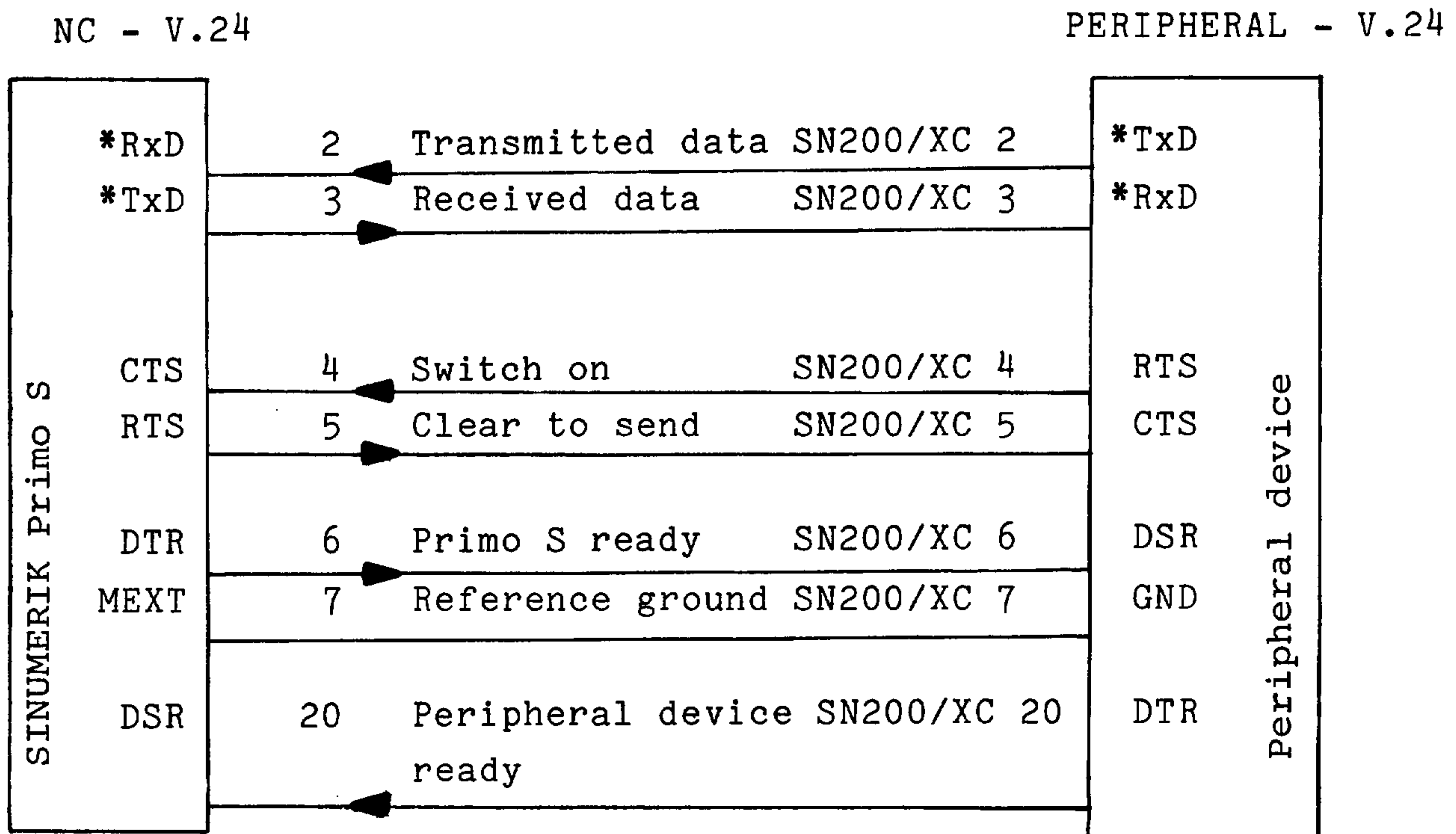
- CTS: Clear to send
The Primo S indicates to the peripheral device whether or not it is ready to send data.

The signal names are shown according to the standards for peripheral equipment. The abbreviations at the data transmitter (Primo S) are the opposite of these, since they represent the NC-internal significance.

Control and message lines are not evaluated by PRIMO S.

5.1.2 Connection schematic V.24 (RS232)

Signal names referred to peripheral device



PERIPHERAL e.g. reader, punch, printer
magnetic tape device (Facit 4040, PT80)

Which of the control and status lines are used depends upon the peripheral device.

In the simplest case, the following suffice:

Mext (pin 7), *TxD (pin 2) data input device
or Mext (pin 7), *RxD (pin 3) data output device

Example: Connecting a FACIT 4040/4070

FACIT links: Module 5148
 PS1 switch 8 on
 PS2 -
 PS3 switch 4 on
 PS4 switch 1 on
 PS5 switches 3 + 4 on
 PS6 switch 5 on

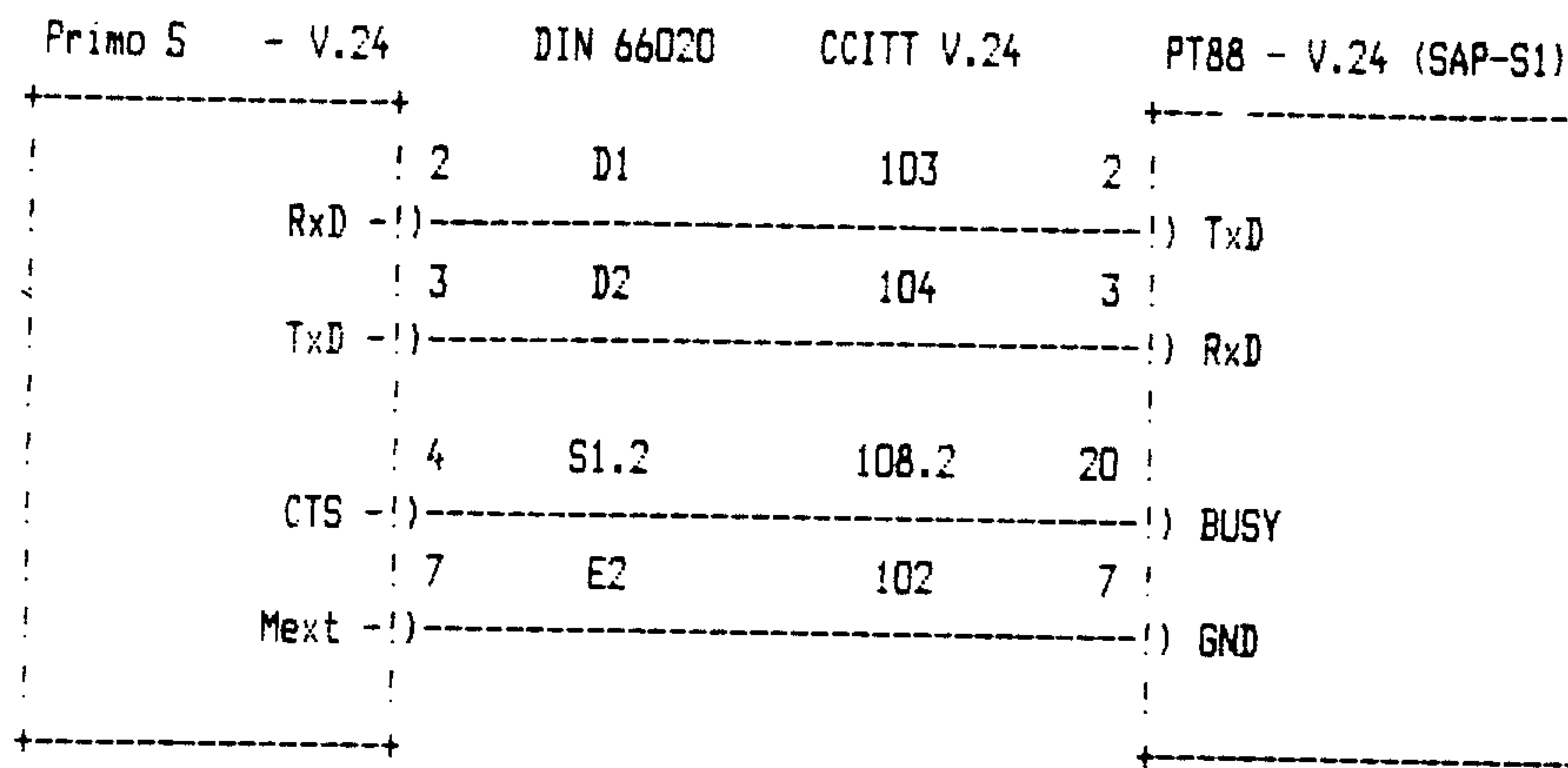
Setting on Primo S: machine data N608: 11110100

Leads connected: 2, 3 and 7

5.1.3 Connecting a PT88 printer

The PT88 printer can be connected to the Primo S via the RS232 (V.24) interface. The following conditions should be fulfilled:

Pin assignment:



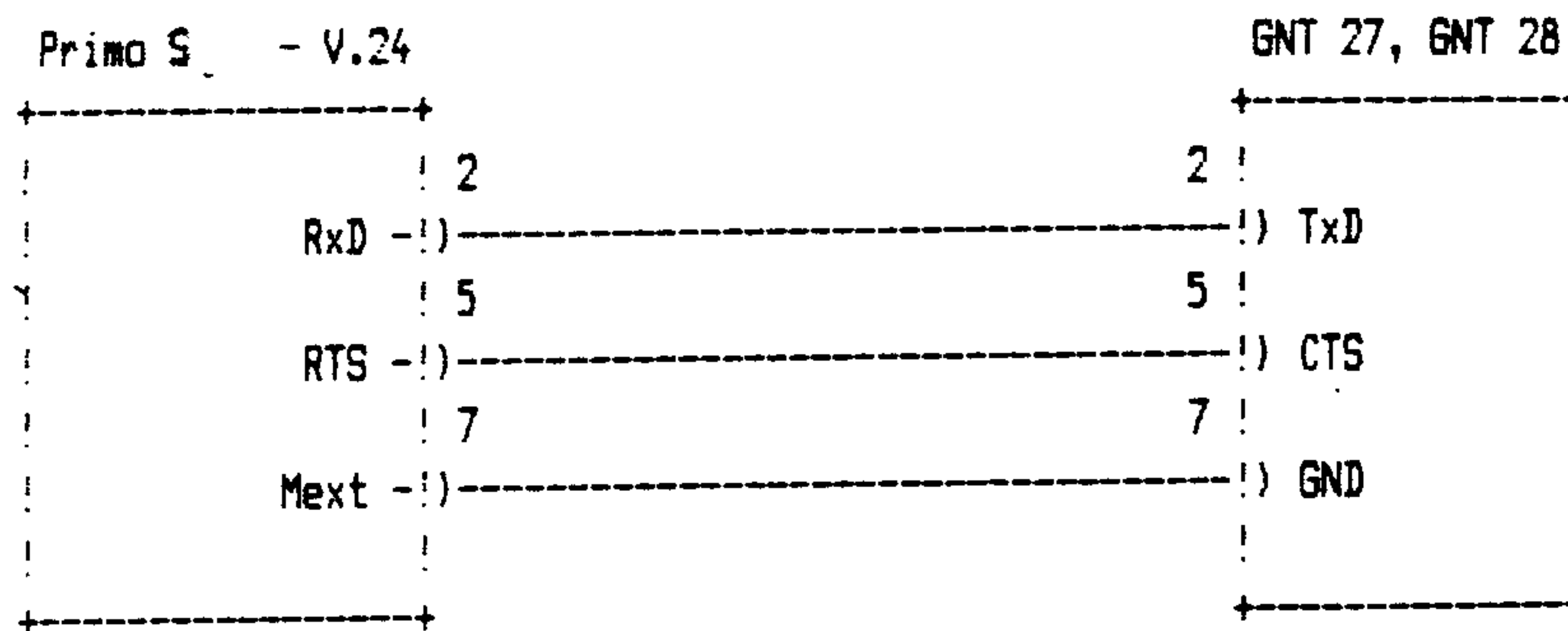
(Interface Description)

Mode	Switch S1						Switch S2					
	1	2	3	4	5	6	1	2	3	4	5	6
Transmission speed (baud)	110	OFF	OFF	OFF	:	:	:	:	:	:	:	:
	300	OFF	ON	OFF	:	:	:	:	:	:	:	:
	600	ON	ON	OFF	:	:	:	:	:	:	:	:
	1200	OFF	OFF	ON	:	:	:	:	:	:	:	:
Operation with BUSY signal				OFF	OFF	OFF						
BUSY 2.10 line switched to line	1.20						ON	OFF	OFF	ON		
BUSY signal X1.20 negative potential										OFF	ON	

5.1.4 Connecting the GNT27 and GNT28 tape readers

The GNT27 (tape-reader with spooler) and GNT28 (tape-reader without spooler) can be connected to the Primo S provided the following conditions are fulfilled:

Pin assignments:



The following settings must be made for 120 baud:

Primo S: Machine data M608 = 11110000

Reader: Switch block A:	SWA - 1 closed
	SWA - 2 closed
	SWA - 3 vacant
	SWA - 4 open
	SWA - 5 open
	SWA - 6 open
	SWA - 7 open
	SWA - 8 open
Switch block B:	SWB - 1 open
	SWB - 2 open
	SWB - 3 open
	SWB - 4 closed (1200 baud)
	SWB - 5 open
	SWB - 6 open
	SWB - 7 open
	SWB - 8 open

In switch block B only one switch may be closed!

5.2 20 mA interface

This interface is not standardized. Because it is widely used, it represents a standard application (TTY interface). The interface is jumpered for full duplex operation only. It is normally an "active" interface, i.e. it delivers the 20 mA line current.

WARNING: The interface of the connected device must therefore be "passive".

5.2.1 Interface signals for 20 mA current loop (referred to the peripheral device)

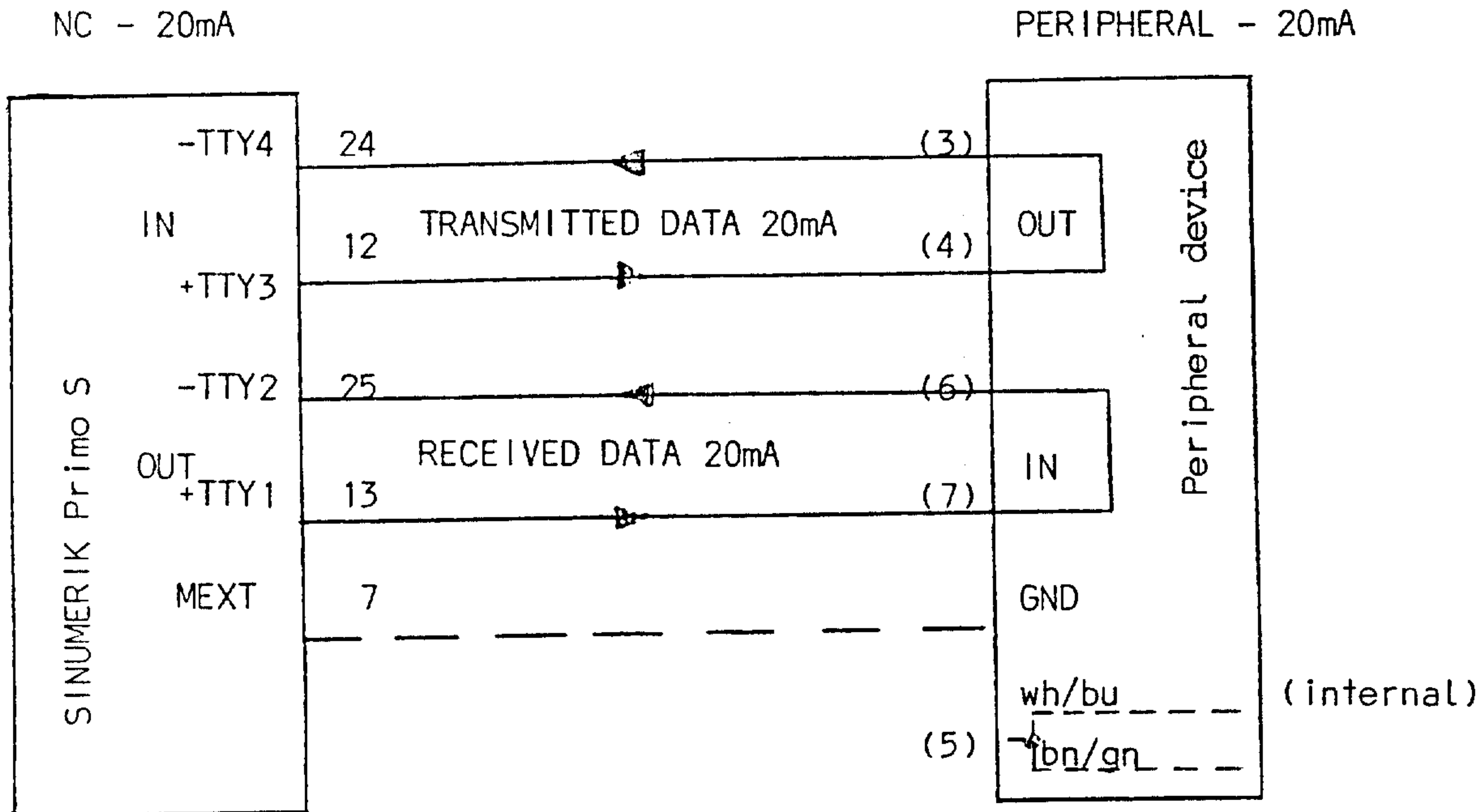
Data lines:

TTY1 (13)		+20 mA
	Received data	
TTY2 (25)		-20 mA
TTY3 (12)		+20 mA
	Transmitted data	
TTY4 (24)		-20 mA

(Interface Description)

5.2.2 Connection scheme for full duplex operation, 20 mA interface

Signal names referred to peripheral device



PERIPHERAL: e.g. TELETYPE; terminal strip pins ()

WARNING: A V.24 transmitter terminal and a 20 mA transmitter may not be simultaneously connected to a serial interface.

Since the control pins 12,13,24 and 25 are always assigned for the 20 mA interface, then it is essential to ensure that, in V.24 operation, they are not connected to the peripheral device.

The choice of V.24 or 20 mA interface is not a matter of setting, but simply based on the assignment of pins in the connector.

(Interface Description)

5.3 Input/output formats
(symbols explained on next page)

Program and setting data

Block type	Block No.	Prep. function	Address	Numerical value, end of block
D	N _ a a n	_ b w w	_ D _	n n CR CR LF
F	N _ a a n	_ b w w	_ F _	n c c c c CR CR LF
M	N _ a a n	_ b w w	_ M _	n n CR CR LF
N	N _ a a n	_ b w w	_ N _	c c n . n n n . n CR CR LF
S	N _ a a n	_ b w w	_ S _	n n CR CR LF
X	N _ a a n	_ b w w	_ X _	v n c c c c c c CR CR LF
Y	N _ a a n	_ b w w	_ Y _	v n c c c c c c CR CR LF
Z	N _ a a n	_ b w w	_ Z _	v n c c c c c c CR CR LF

Machine data

MD	Block No.	Numerical value, end of block
600-611	N _ n n n _	n n n n n n n n n CR CR LF
612-625	N _ n n n _	n c c CR CR LF
626-632	N _ n n n _	n c c c c CR CR LF
633-636	N _ n n n _	n c c CR CR LF
637-640	N _ n n n _	n c c c c CR CR LF
641-643	N _ n n n _	v n c c c c c c CR CR LF
644-647	N _ n n n _	n c c c c CR CR LF

Operations for start and end of program

	Start	end
Unprotected memory area	LF	% LF
Protected memory area	LF U CR CR LF	% LF
Setting data	LF D CR CR LF	% LF
Machine data	LF	% LF

Explanation of symbols

- Numerical values and letters, freely selectable
 - a Numerical value for block number, if required, otherwise replaced by SPACE () or 0
 - b Letter, as in machine parameter N610
 - c Numerical value, only if required
 - n Numerical value, must be present
 - v - (MINUS) for negative numerical values
 - w Preparatory function as in program key
 - * The last entered number must be either 0 or 5!

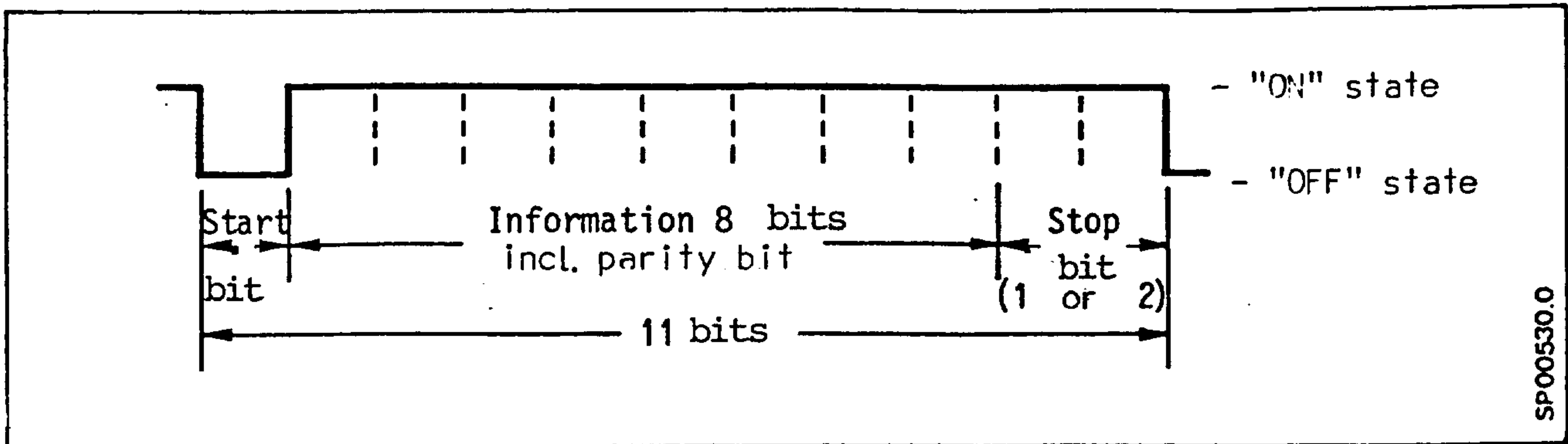
- Fixed letters
 - D Start of setting data
 - D Tool offset
 - F Feedrate
 - M Auxiliary function
 - N Block number
 - N Subroutine call
 - S Auxiliary function
 - U Start of protected memory area
 - X Selection of X axis
 - Y Selection of Y axis
 - Z Selection of Z axis

- Characters
 - SPACE
 - % Percent
 - CR CARRIAGE RETURN
 - LF LINE FEED

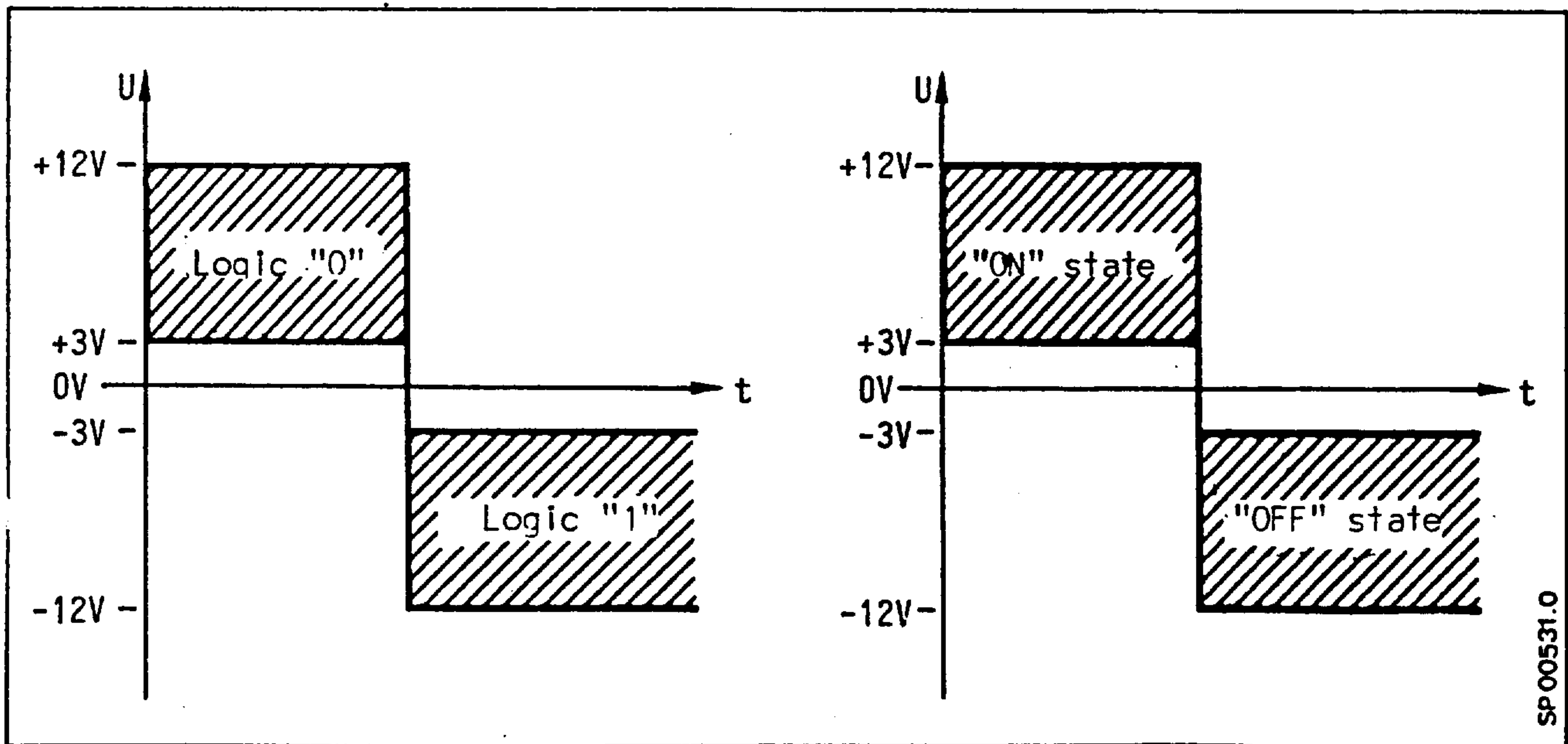
(Interface Description)

5.4 Method of data transfer

Data transfer: serial in full duplex mode



Arrangement of polarity



Data cable

Control cable

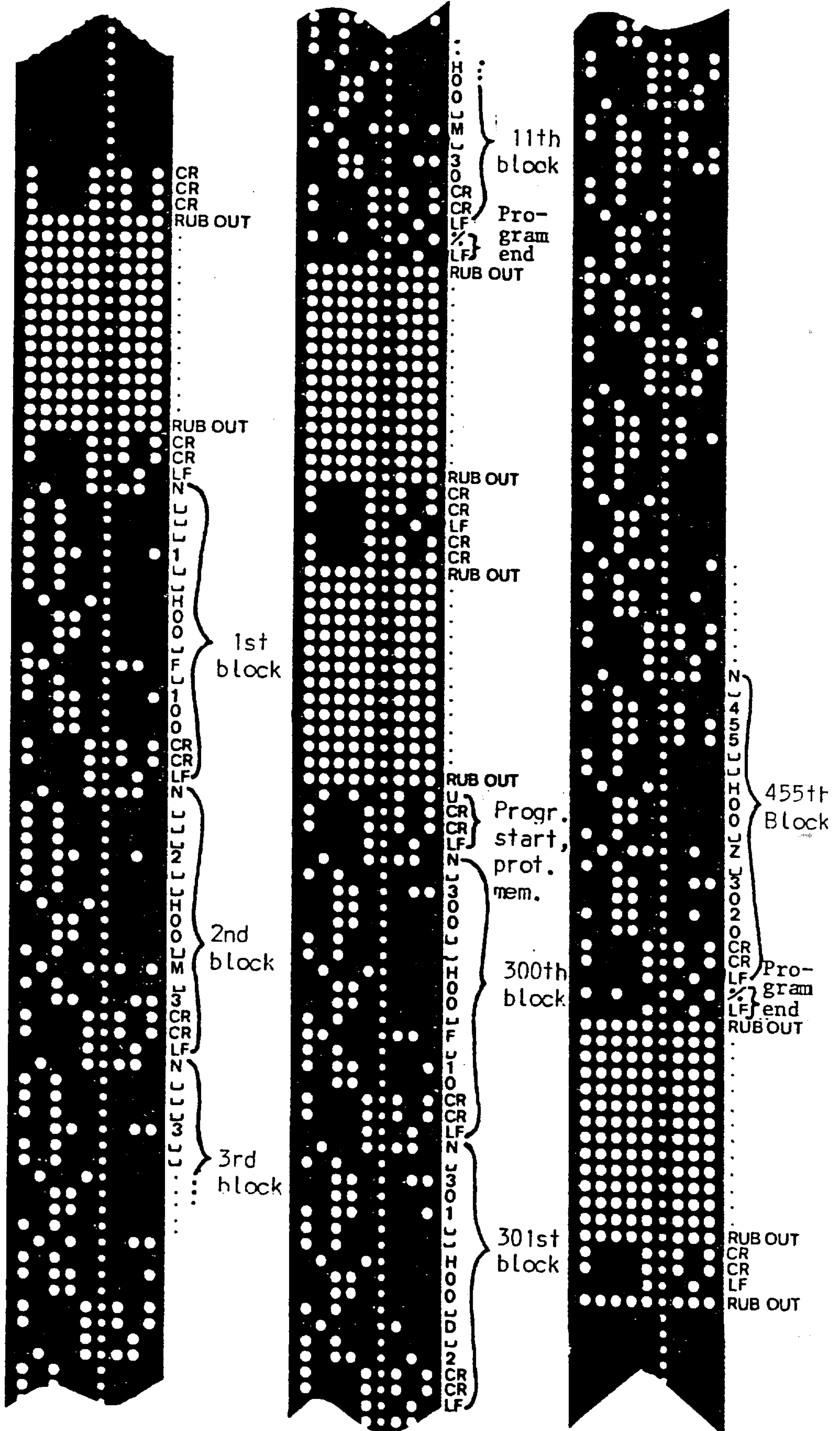
5.5 Input/output formats for program example

```

N 1 H00 F 100
N 2 H00 M 3
N 3 H00 S 10
N 4 H00 D 1
N 5 H00 X 100000
N 6 H41 Y 100000
N 7 H20 X 0
N 8 H21 Y 0
N 9 H10 F 20
N 10 H00 N 300.303.1
N 11 H00 M 30
%

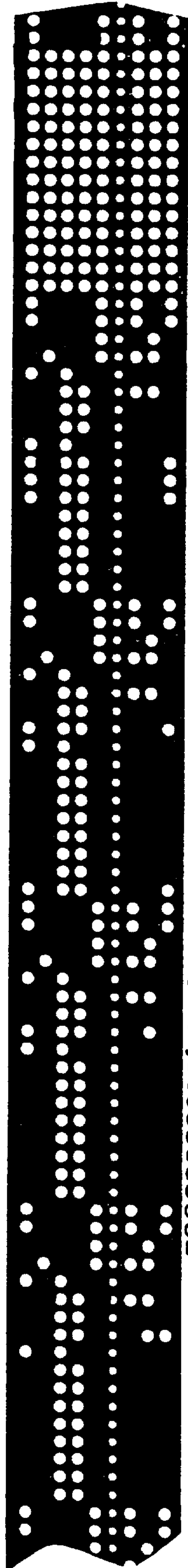
U
N 300 H00 F 10
N 301 H00 D 2
N 302 H44 Z -10000
N 303 H44 Z 10000
%

D
N 450 H00 X 10
N 451 H00 Y 10
N 452 H00 Z 1200
N 453 H00 X 20
N 454 H00 Y 20
N 455 H00 Z 3020
%
    
```



5.6 Machine data tape

N 600 11100000
N 601 00000001
N 602 00000000
N 603 00000000
N 604 10000000
N 605 10000000
N 606 10000000
N 607 00000000
N 608 11110001
N 609 00000000
N 610 01001000
N 611 00000000
N 612 1
N 613 15
N 614 1275
N 615 1275
N 616 1275
N 617 127
N 618 127
N 619 127
N 620 15
N 621 50
N 622 0
N 623 0
N 624 0
N 625 80
N 626 10000
N 627 10000
N 628 10000
N 629 1000
N 630 0
N 631 0
N 632 0
N 633 72
N 634 72
N 635 72
N 636 300
N 637 500
N 638 500
N 639 500
N 640 5000
N 641 0
N 642 0
N 643 0
N 644 250
N 645 5000
N 646 5000
N 647 5000
%



CR
CR
RUB OUT

Leader

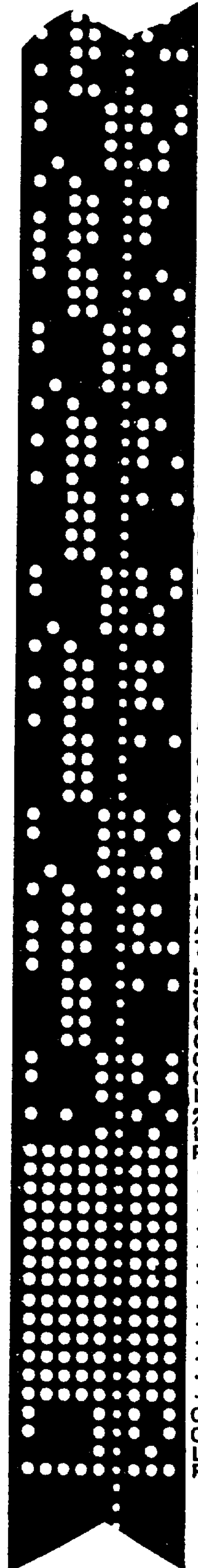
RUB OUT

1st LF

N 600

N 601

etc.



N 645
N 646
N 647

N 645

N 646

N 647

RUB OUT

Run - out

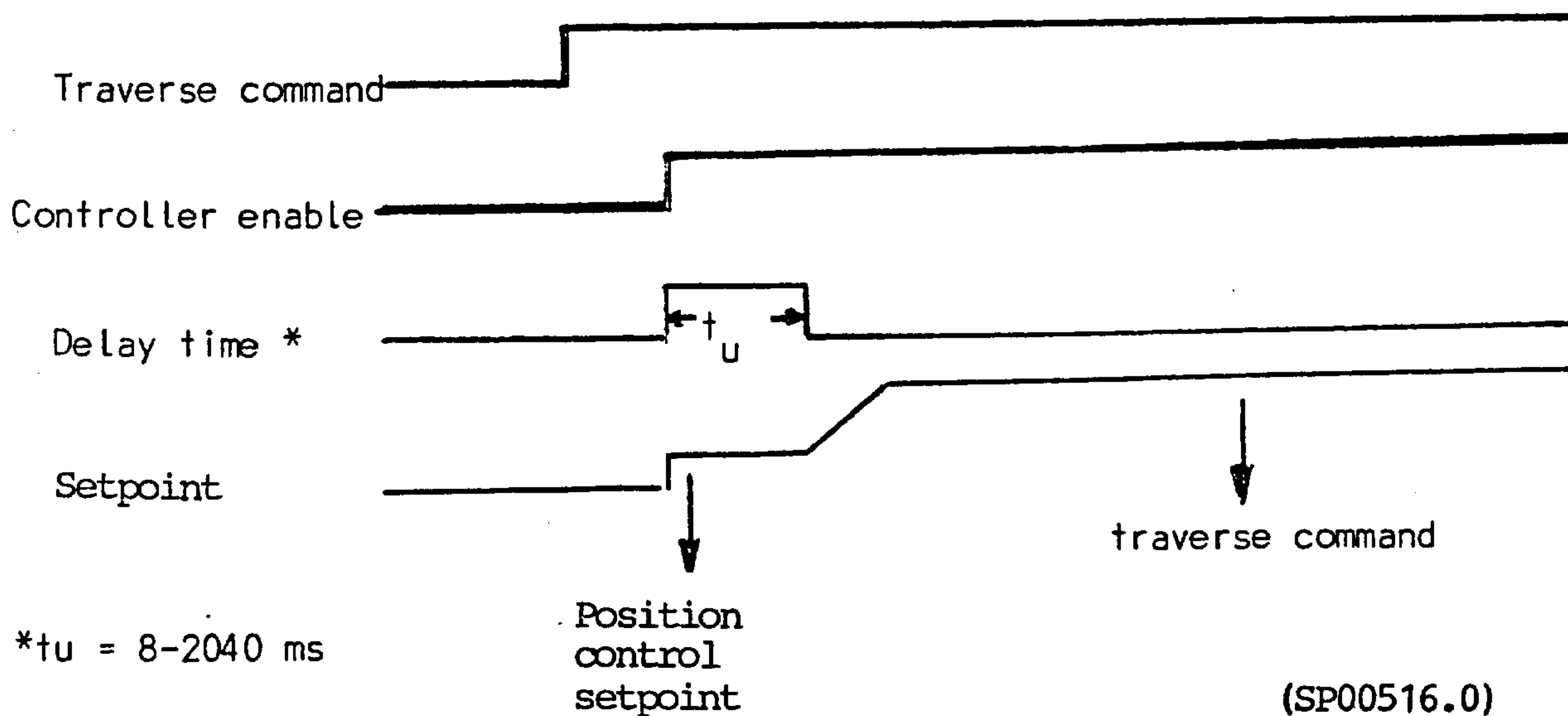
CR
CR
LF
RUB OUT

6. Central drive

6.1 Differences, central drive - individual drives

Central drives differ from individual drives as follows:

- 1) The setpoint for all axes is output via the X channel.
- 2) In addition to "*Controller disable Y" or "*Controller disable Z", "*Controller disable X" is also output when the Y or Z axes are disabled.
- 3) The position loop of an axis is active, in the longest case, only until the "Feed enable" for a new axis is given by the interface in response to a traverse command for that new axis.
- 4) After changing axes, output of the traverse setpoint can be delayed. The time ($t_u = 8 - 2040$ ms) can be set by machine parameter N612. The time starts when, after outputting the traverse command, the interface responds with "Controller enable" for this axis. During the switchover time the position loop is already operational.



6.2 Possibilities for switchover

6.2.1 Acknowledged switchover

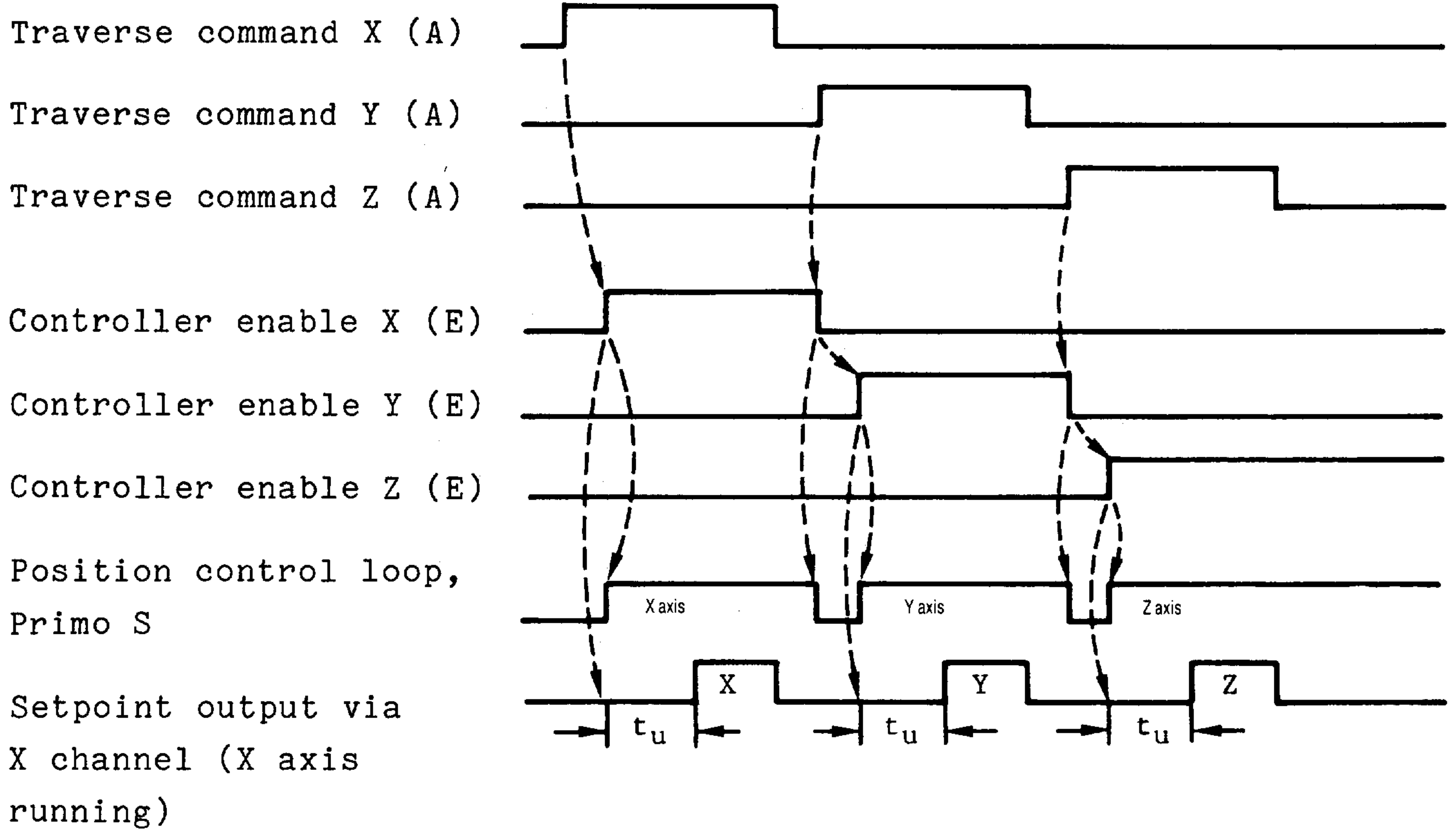
After outputting the new traverse command, the "Controller-" and "Feed enable" are not given by the interface until the new axis is engaged (armature contact energized or mechanical coupling engaged). The setpoint need not then be delayed.

6.2.2 Feed- and controller enable for all axes permanently present

After outputting the new traverse command the traversing setpoint is delayed (machine parameter N612) until the new axis is definitely engaged.

The position control setpoint, which is also output during the switchover period, pulls the axis directly into position on switchover.

Command voltage output and position control with central drive

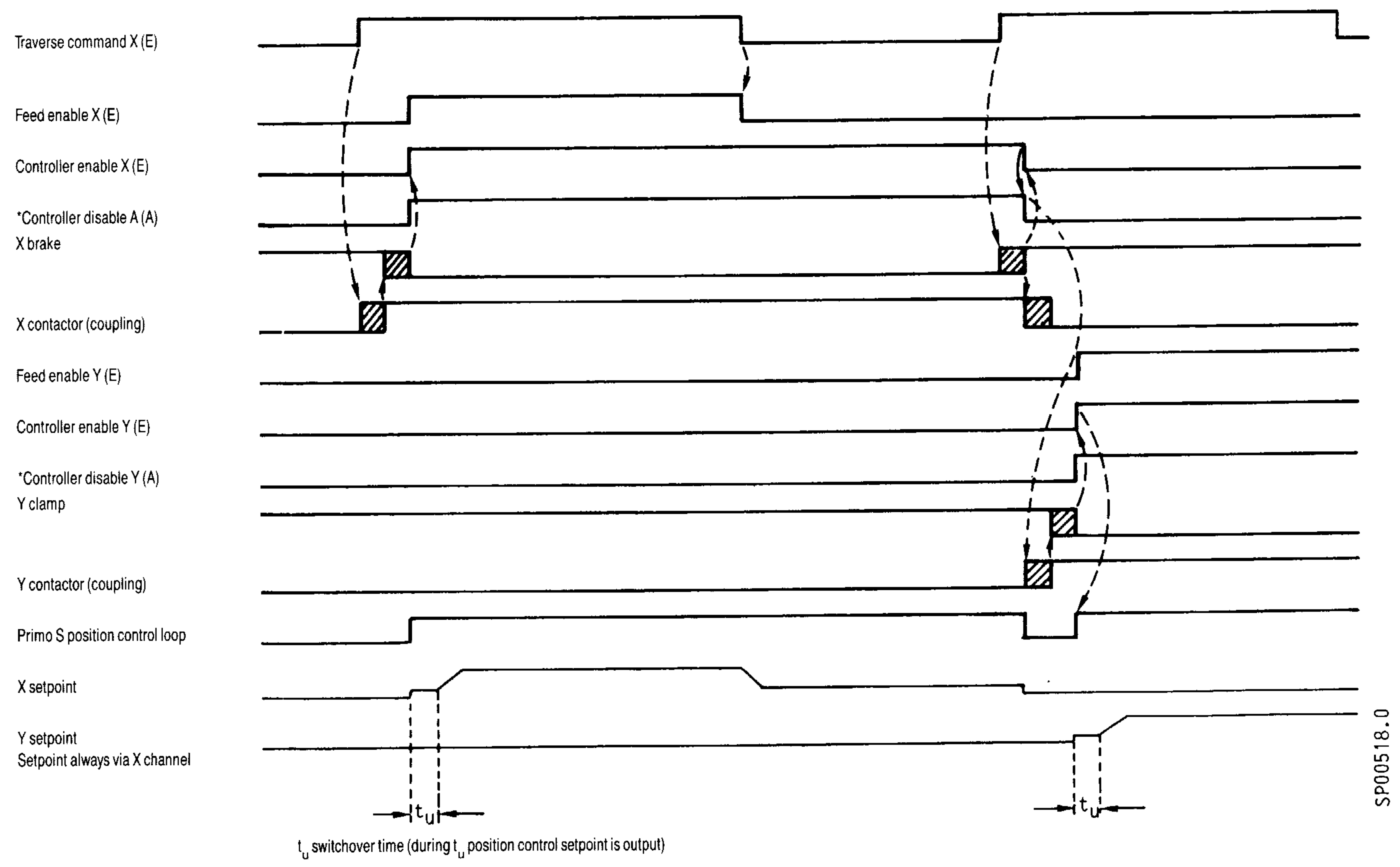


SP00517.0

t_u = switchover time, machine parameter N612

Note: In this case the feed enables of all axes are permanently present.

Example for acknowledged switchover



7. Trailing one axis

7.1 General note on trailing an axis

By internal decoding of the "M" functions M91 - M96, the programmed axis can be trailed by a second axis, in either positive or negative direction.

Both axes traverse at the same rate and reach the end point simultaneously. The trailing occurs at a fixed 45°.

The standstill monitor for the trailing axis is switched off, and no check is made for reaching the exact stop limit. By decoding the relevant "M" functions in the interface, it must be ensured that any clamp for the trailing axis is made to depend on the traverse command for the trailed axis.

Warning!

The trailing axis requires no feed- and controller enables. Thus, on reaching an overtravel limit, the feed- and controller enables for the trailed axis, or all axes, must be removed. The trailing axis must be programmed in absolute dimensions when next called!

(Interface Description)

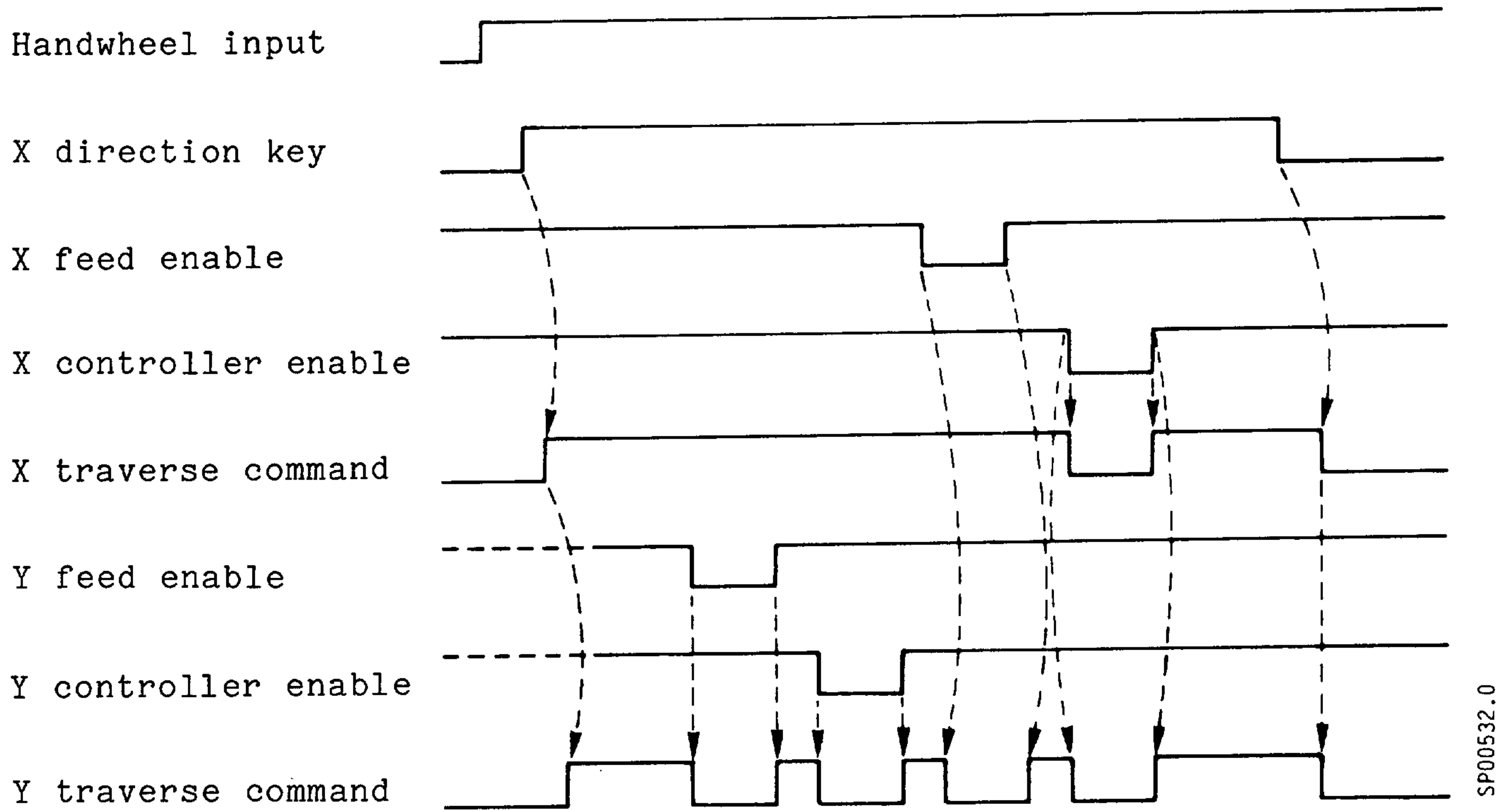
7.2 Additional functions in jog mode2nd axis simultaneous operation

During the motion of one axis by means of direction keys, a second axis can simultaneously be traversed using the handwheel.

Preconditions:

- Individual drives
- Machine parameter N611 bit 7 = 1
- The plane is defined in setting data N449:
 - Input M00: no plane
 - Input M01: XY plane
 - Input M10: XZ plane
 - Input M11: YZ plane(Warning: If machine parameter N611 bit 7=1, then setting data area starts at N449!)
- A "1" is present at the handwheel input.
Operation (N449 = M01):
- Press X direction key
 - o X traverse command is output
 - o If all enables are present for X, then the X setpoint and Y traverse command are output.
 - o If all enables are present for Y, then the Y axis can be moved by the handwheel.
- Press Y direction key
 - o Y traverse command is output
 - o If all enables are present for Y, then the Y setpoint and the X traverse command are output.
 - o If all enables are present for X, then the X axis can be moved by the handwheel.

Example: Manual 2-axis operation in the XY plane



Remarks:

- The 3rd axis is handled as before
- Rapid traverse override as before
- The "jog axis" moves even if the enables for the "handwheel axis" are missing
- Teach-in mode is inoperative if machine parameter N611 bit 7=1 and setting data N449 \neq M00.

(Interface Description)

8. Alphabetical listing of the signals8.1 Interface signals

Signal designation	Description page	Input/Output	Connector pin	Cable diagram page
M modification signal	2 - 5	Output	SN211/XB-43	9 - 9
S modification signal	2 - 5	Output	SN211/XB-44	9 - 9
Automatic single block	2 - 5	Output	SN211/XB-45	9 - 9
Rapid traverse	2 - 3	Output	SN211/XB-47	9 - 9
Rapid traverse override	3 - 8	Input	SN211/XB-49	9 - 9
Read-in enable	2 - 16	Input	SN211/XB-31	9 - 9
Ext. input or block search	3 - 9	Input	SN211/XB-20	9 - 9
Ext. operating mode Data input	2 - 17	Input	SN211/XB-27	9 - 9
Ext. operating mode Jog	2 - 17	Input	SN211/XB-28	9 - 9
Ext. operating mode Reference point approach	2 - 17	Input	SN211/XB-11	9 - 9
Motion command X	2 - 3	Output	SN211/XB-50	9 - 9
Motion command Y	2 - 3	Output	SN211/XB-49	9 - 9
Motion command Z	2 - 3	Output	SN211/XB-48	9 - 9
Handwheel	3 - 4	Input	SN211/XB-7	9 - 9
Aux. function M11	2 - 6	Output	SN211/XB-42	9 - 9
" M12	2 - 6	Output	SN211/XB-41	9 - 9
" M14	2 - 6	Output	SN211/XB-40	9 - 9
" M18	2 - 6	Output	SN211/XB-39	9 - 9
" M21	2 - 6	Output	SN211/XB-38	9 - 9
" M22	2 - 6	Output	SN211/XB-37	9 - 9
" M24	2 - 6	Output	SN211/XB-36	9 - 9
" M28	2 - 6	Output	SN211/XB-35	9 - 9
Machine lock	3 - 3	Input	SN211/SB-24	9 - 9
Follow-up operation	3 - 5	Input	SN211/XB-3	9 - 9

(Interface Description)

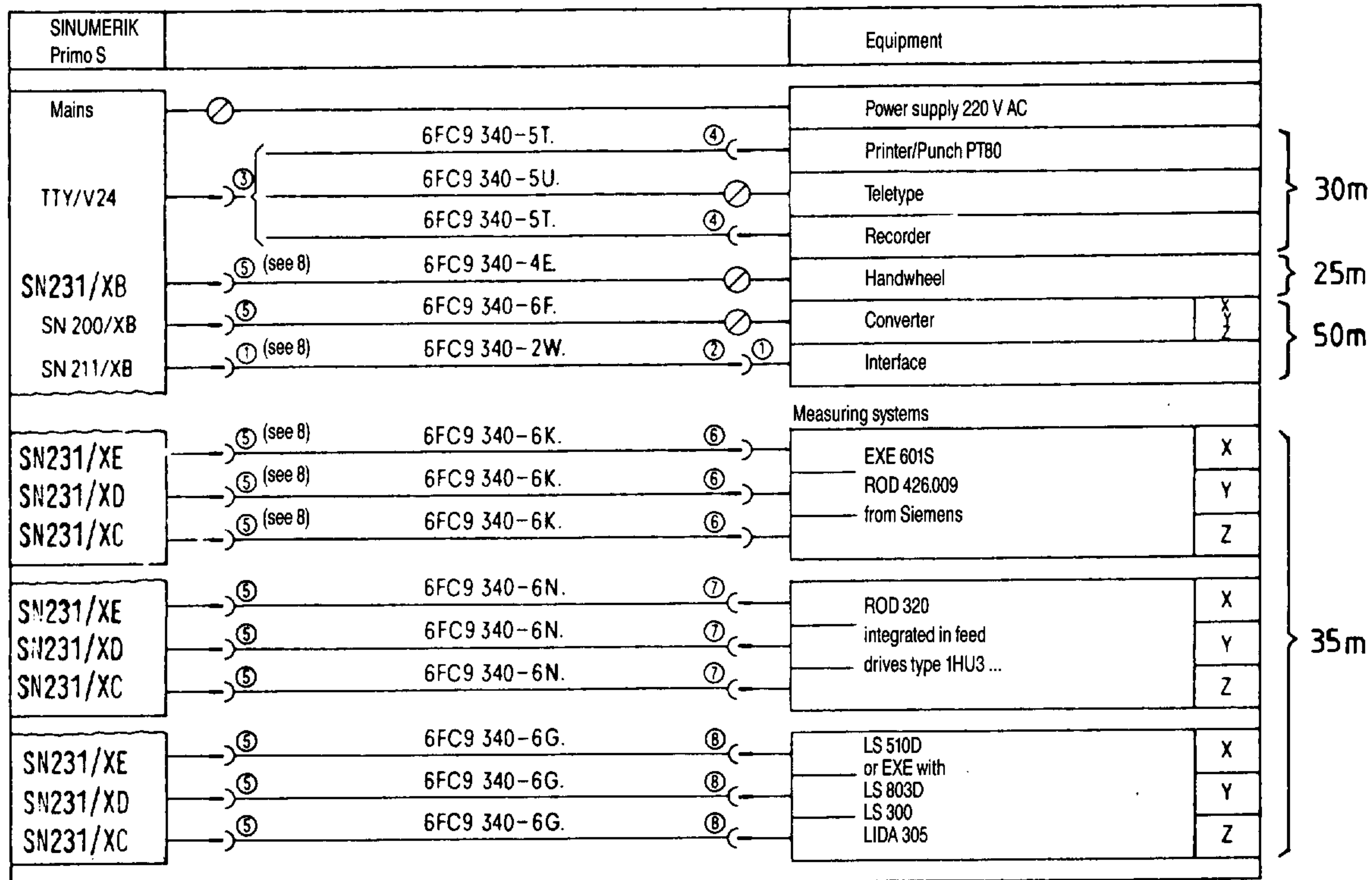
Signal designation	Description page	Input/Output	Connector pin	Cable diagram page
NC ready	2 - 1	Output	SN211/XB-46	9 - 9
NC reset	3 - 6	Input	SN211/XB-32	9 - 9
NC start	3 - 7	Input	SN211/XB-15	9 - 9
Direction key +X	3 - 8	Input	SN211/XB-17	9 - 9
Direction key -X	3 - 8	Input	SN211/XB-33	9 - 9
Direction key +Y	3 - 8	Input	SN211/XB-13	9 - 9
Direction key -Y	3 - 8	Input	SN211/XB-29	9 - 9
Direction key +Z	3 - 8	Input	SN211/XB-9	9 - 9
Direction key -Z	3 - 8	Input	SN211/XB-25	9 - 9
Controller enable X	2 - 11	Input	SN211/XB-30	9 - 9
Controller enable Y	2 - 11	Input	SN211/XB-26	9 - 9
Controller enable Z	2 - 11	Input	SN211/XB-22	9 - 9
Memory lock	3 - 2	Input	SN211/XB-23	9 - 9
*Deceleration X	2 - 13	Input	SN211/XB-14	9 - 9
*Deceleration Y	2 - 13	Input	SN211/XB-10	9 - 9
*Deceleration Z	2 - 13	Input	SN211/XB-6	9 - 9
Feed enable X	2 - 10	Input	SN211/XB-16	9 - 9
Feed enable Y	2 - 10	Input	SN211/XB-12	9 - 9
Feed enable Z	2 - 10	Input	SN211/XB-8	9 - 9
Feedrate override switch A	3 - 2	Input	SN211/XB-5	9 - 9
Feedrate override switch B	3 - 2	Input	SN211/XB-21	9 - 9
Feedrate override switch C	3 - 2	Input	SN211/XB-4	9 - 9
Feedrate override switch D	3 - 2	Input	SN211/XB-2	9 - 9
+24 V	2 - 18	Input	SN211/XB-1	9 - 9
+24 V	2 - 18	Input	SN211/XB-18	9 - 9
+24 V	2 - 18	Input	SN211/XB-34	9 - 9

8.2 Signals to the servos

Signal designation	Description page	Input/output	Connector pin	Cable diagram	
Set speed	X Y Z	4 - 1 4 - 1 4 - 1	Output Output Output	SN200/XB-1 SN200/XB-3 SN200/XB-7	9 - 2 9 - 2 9 - 2
0 V	X	4 - 1	Output	SN200/XB-9	9 - 2
0 V	Y	4 - 1	Output	SN200/XB-4	9 - 2
0 V	Z	4 - 1	Output	SN200/XB-14	9 - 2
*Controller disable	X Y Z	4 - 1 4 - 1 4 - 1	Output Output Output	SN200/XB-10 SN200/XB-6 SN200/XB-8	9 - 2 9 - 2 9 - 2
+24 V		4 - 2	Input	SN200/XB-2	9 - 2
+24 V		4 - 2	Input	SN200/XB-5	9 - 2
+24 V		4 - 2	Input	SN200/XB-15	9 - 2

9. Connection diagrams

9.1 Summary of cables and equipment



- | | |
|---|--|
| 1 Siemens subminiature
50-pole socket with housing,
Order No. 6FC 9341-1EE | 5 Siemens subminiature
15-pole socket with housing,
Order No. 6FC 9341-1EC |
| 2 Siemens subminiature
50-pole plug with housing,
Order No. 6FC 9341-1EH | 6 12-pole round Souriau plug
with housing,
Order No. 6FC 9341-1AB |
| 3 Siemens subminiature
25-pole socket and housing,
cable entry from side,
Order No. 6FC 9341-1EL | 7 17-pole Siemens round
socket with housing,
Order No. 6FC 9341-1AC |
| 4 Siemens subminiature
25-pole socket with housing,
Order No. 6FC 9341-1ED | 8 12-pole Connei round
socket with housing,
Order No. 6FC 9341-1EM |

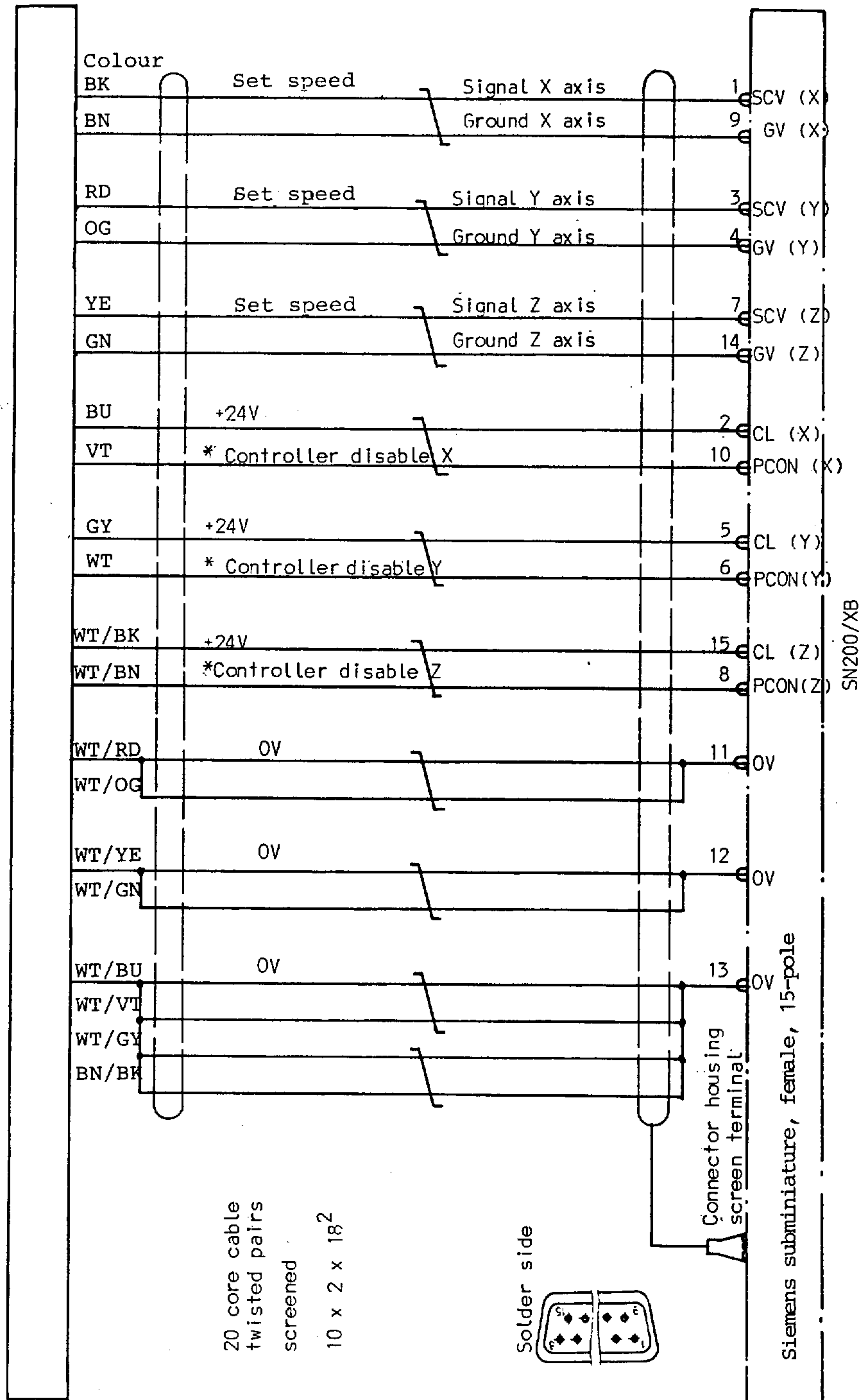
All connectors have cable entry from above except number 3 which has a side entry.

Primo S
(Interface Description)
Ordering data

Designation	Type	Order No.
Control SINUMERIK Primo S Machine control panel Interface adapter Small parts kits Handwheel (manual encoder) Feedrate override switch Measuring system, rotary Sensor 500 pulse/rev Sensor 1000 pulse/rev Sensor 2000 pulse/rev Sensor 2500 pulse/rev Measuring system, linear Linear device Linear device Linear device Linear device	ROD426.009/500 ROD426.009/1000 ROD426.009/2000 ROD426.009/2500 Note: ROD320 only delivered built into IHU motors LS510 D without EXE LS803 D with EXE LS300 with EXE LIDA305 with EXE	6FC3 360 - OAA 6FC9 303 - OEA 6FC9 330 - OBA 6FC9 382 - 1LA 6FC9 320 - 5DA 6FC9 130 - OAC 6FC9 320-3CD 6FC9 320-3CE 6FC9 320-3CA 6FC9 320-3CB Heidenhain Heidenhain Heidenhain Heidenhain
Cables		
Primo S - Interface control 5m 10m 18m 25m Primo S - machine control panel Primo S - handwheel 5m 10m 18m 25m Primo S - recorder/PT80 5m Primo S - teletype 5m 10m Primo S - converter 5m 10m Primo S - linear measuring device 5m 10m 18m 25m Primo S - encoder ROD426 5m 10m 18m 25m Primo S - encoder ROD320 5m 10m 18m 25m	50 m 50 m 25 m 30 m 30 m 50 m 35 m 35 m	6FC9 340-2WB 6FC9 340-2WC 6FC9 340-2WE 6FC9 340-2WF 6FC9 340-4EB 6FC9 340-4EC 6FC9 340-4EE 6FC9 340-4EF 6FC9 340-5TB 6FC9 340-5UB 6FC9 340-5UC 6FC9 340-5FB 6FC9 340-5FC 6FC9 340-6GB 6FC9 340-6GC 6FC9 340-6GE 6FC9 340-6GF 6FC9 340-6KB 6FC9 340-6KC 6FC9 340-6KE 6FC9 340-6KF 6FC9 340-6NB 6FC9 340-6NC 6FC9 340-6NE 6FC9 340-6NF
Connector, complete with housing		
Surlau, round, 12-pole, male Siemens round, 17-pole, female Siemens subminiature, 25-pole, male Siemens subminiature, 15-pole, female Siemens subminiature, 50-pole, female Siemens subminiature, 50-pole, male Siemens subminiature, 25-pole, female Connel, round 12-pole, female		6FC9 341-1AB 6FC9 341-1AC 6FC9 341-1ED 6FC9 341-1EC 6FC9 341-1EE 6FC9 341-1EH 6FC9 341-1EL 6FC9 341-1EM

9.2 Cable diagrams

Cable name: Feed drive converter
 Order No, 6FC9 340-6F
 Module: SN200/XB

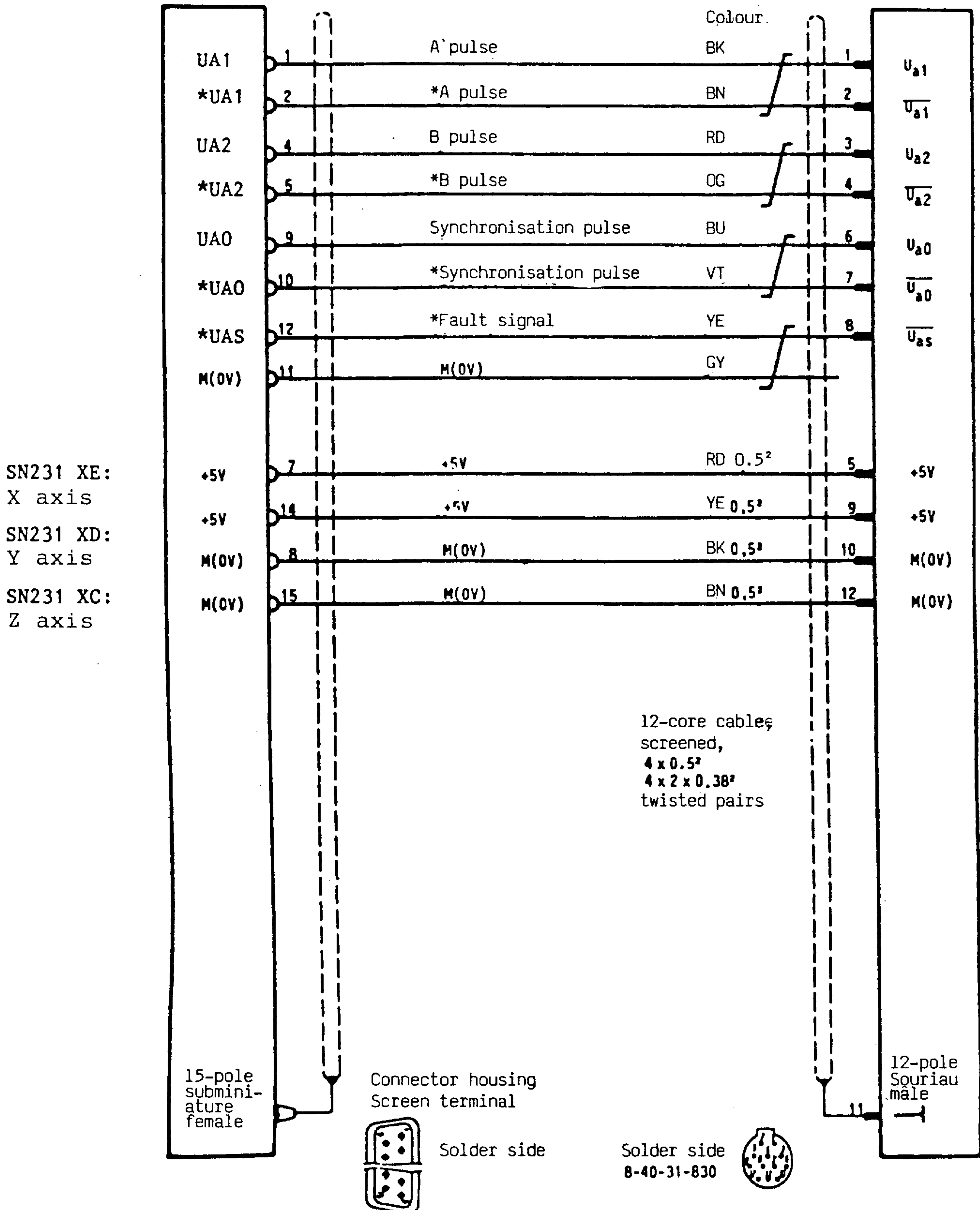


The cable is also available as 16-core, twisted pairs (8x2x0.18) under the same number. Pins 1,9,3,4,7,14,2, 10,5,16,15 and 8 are identical to the above cable. The additional leads are coloured as follows: Pin No. 11 (0V) WT/RD, pin No. 12 (0V) WT/OG and pin No. 13 (0V) WT/BU or WT/GN.

Cable name: Digital linear or rotary measuring device
X, Y or Z axis (ROD 426.009/EXE 601)

Order No.: 6FC9 340-6K.

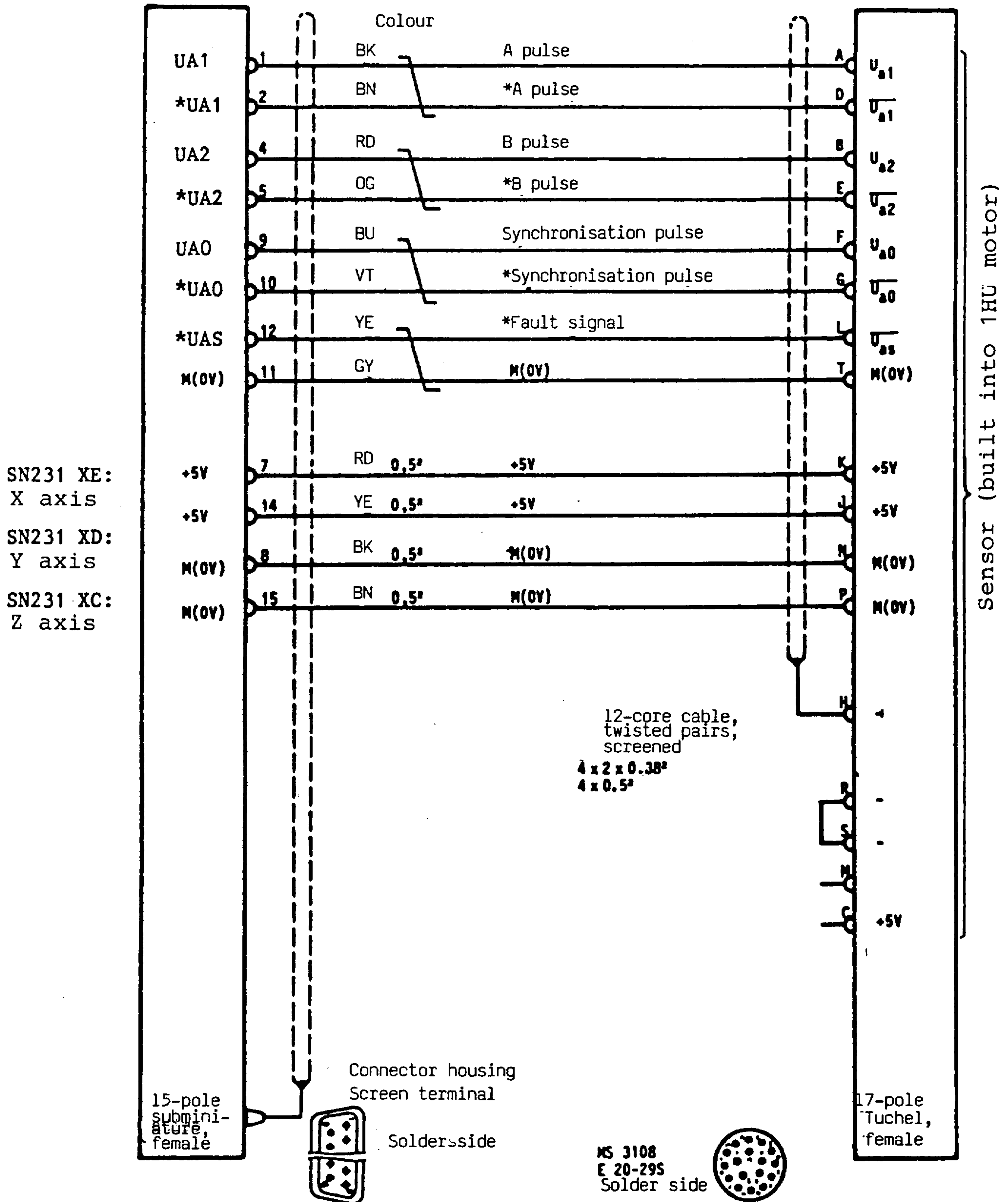
Module: SN 231/X.



Cable name: Digital rotary measuring device
X, Y or Z axis (ROD 320)

Order No.: 6FC9 340-6N.

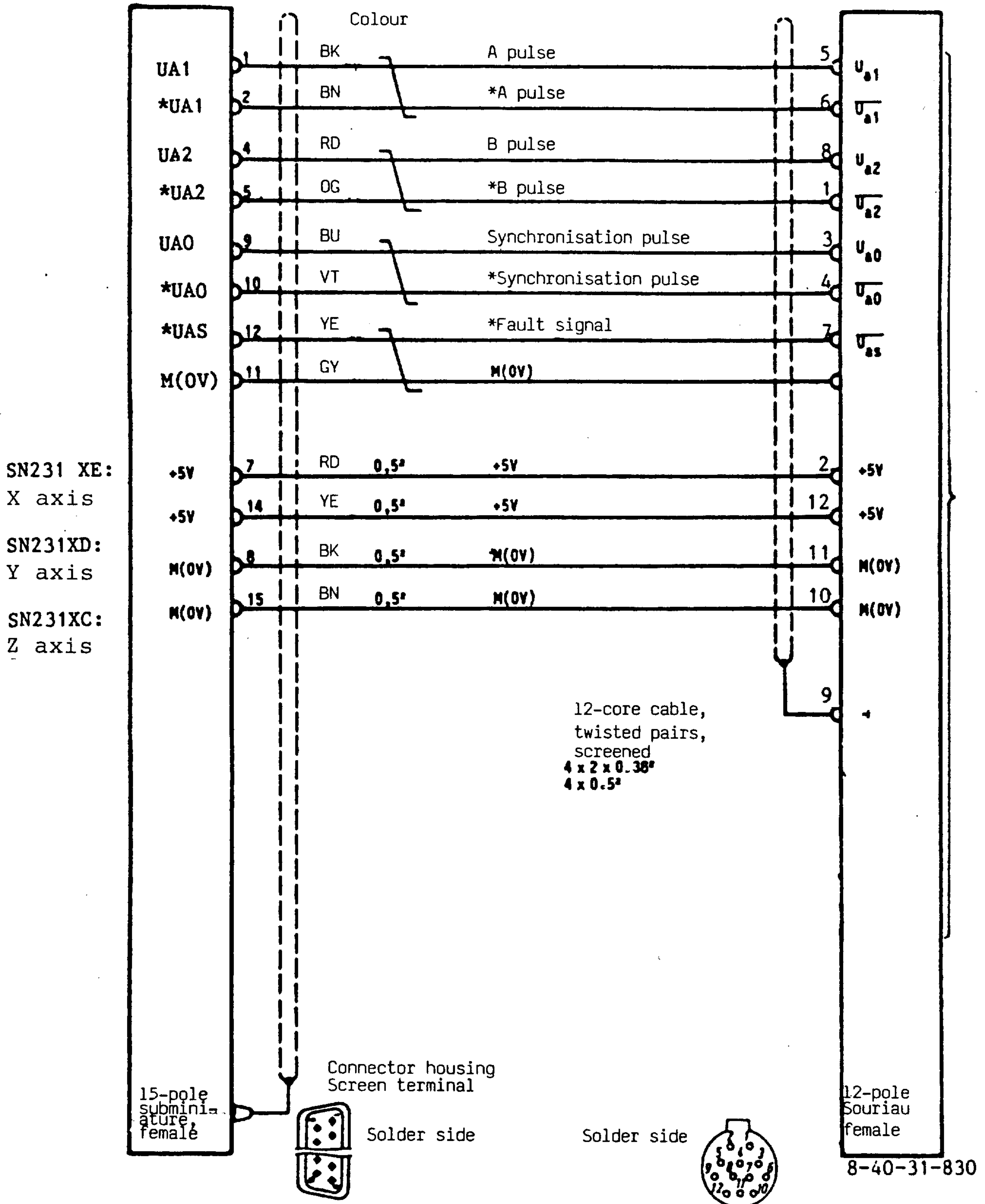
Module: SN 231/X.



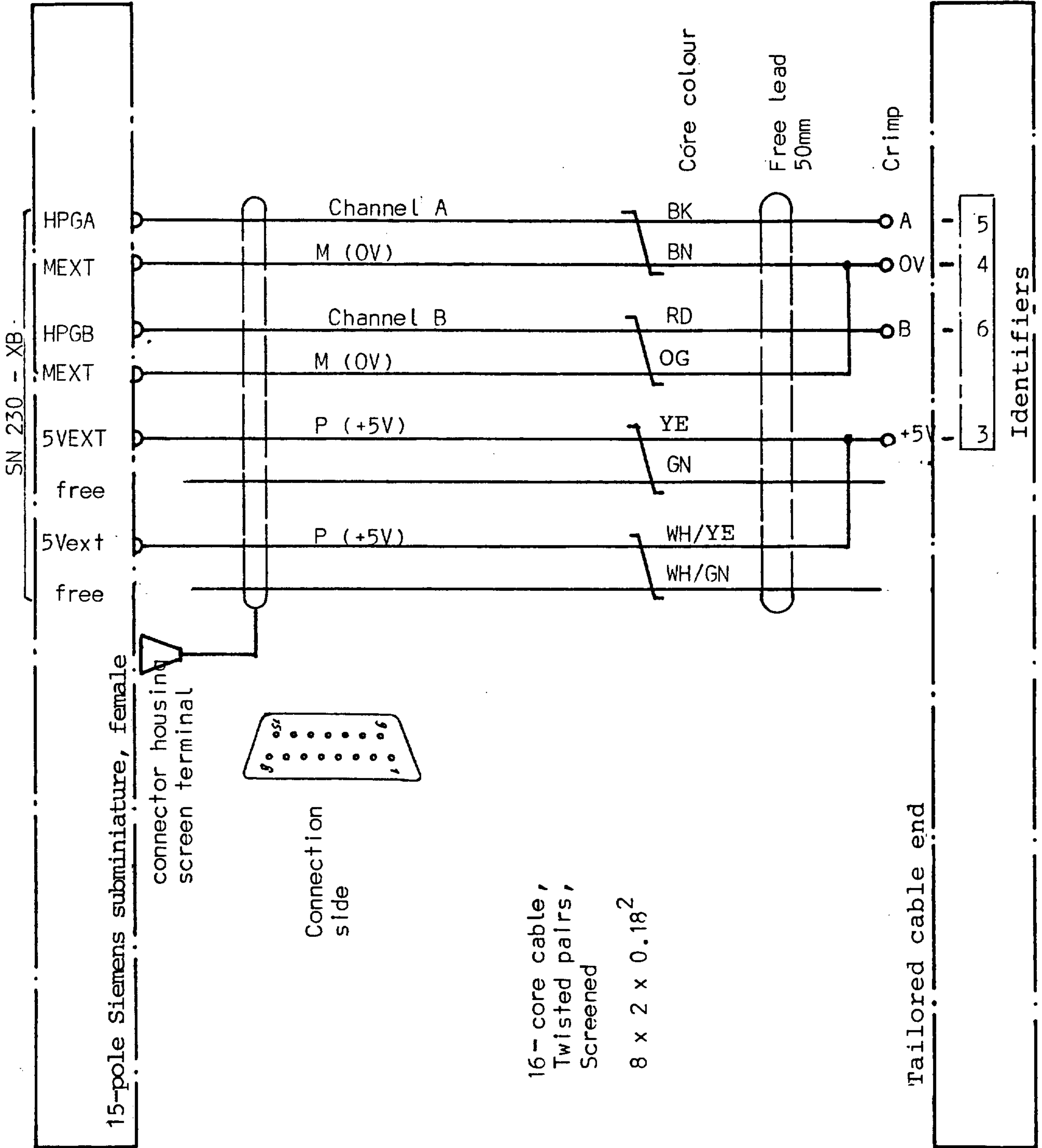
Cable name: Digital linear or rotary measuring device
X, Y or Z axis (LS 510D)

Order No.: 6FC9 340-6G.

Module: SN 231/X.



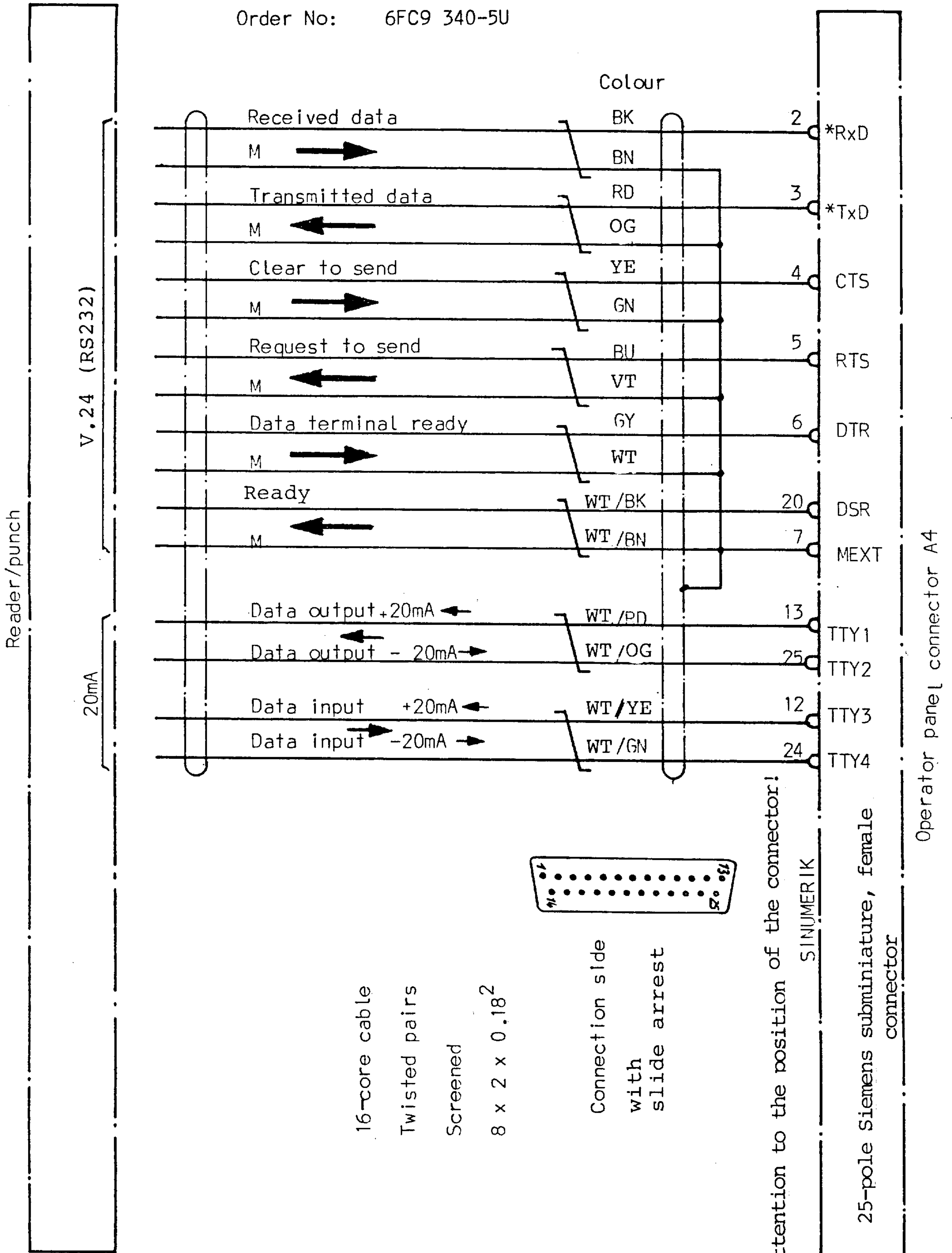
Cable name: Handwheel
 Order No: 6FC9 340-4E
 Module: SN 231-XB



Free lead end 50 mm!
 Tailored cable end!
 The GN and WH-GN
 cores free ends
 100 mm without
 function!

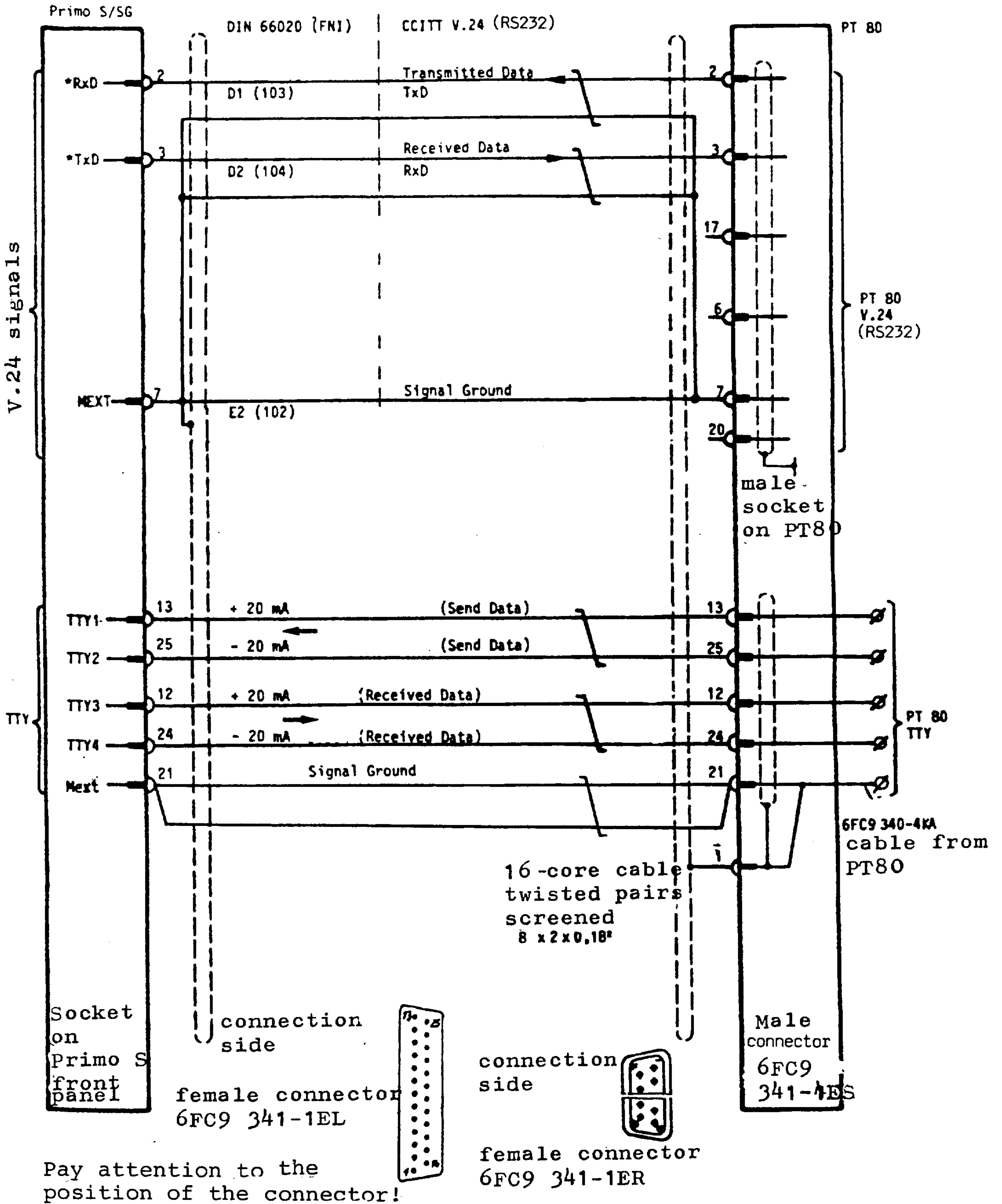
Cable name: V.24 (RS232)/20 mA interface

Order No: 6FC9 340-5U



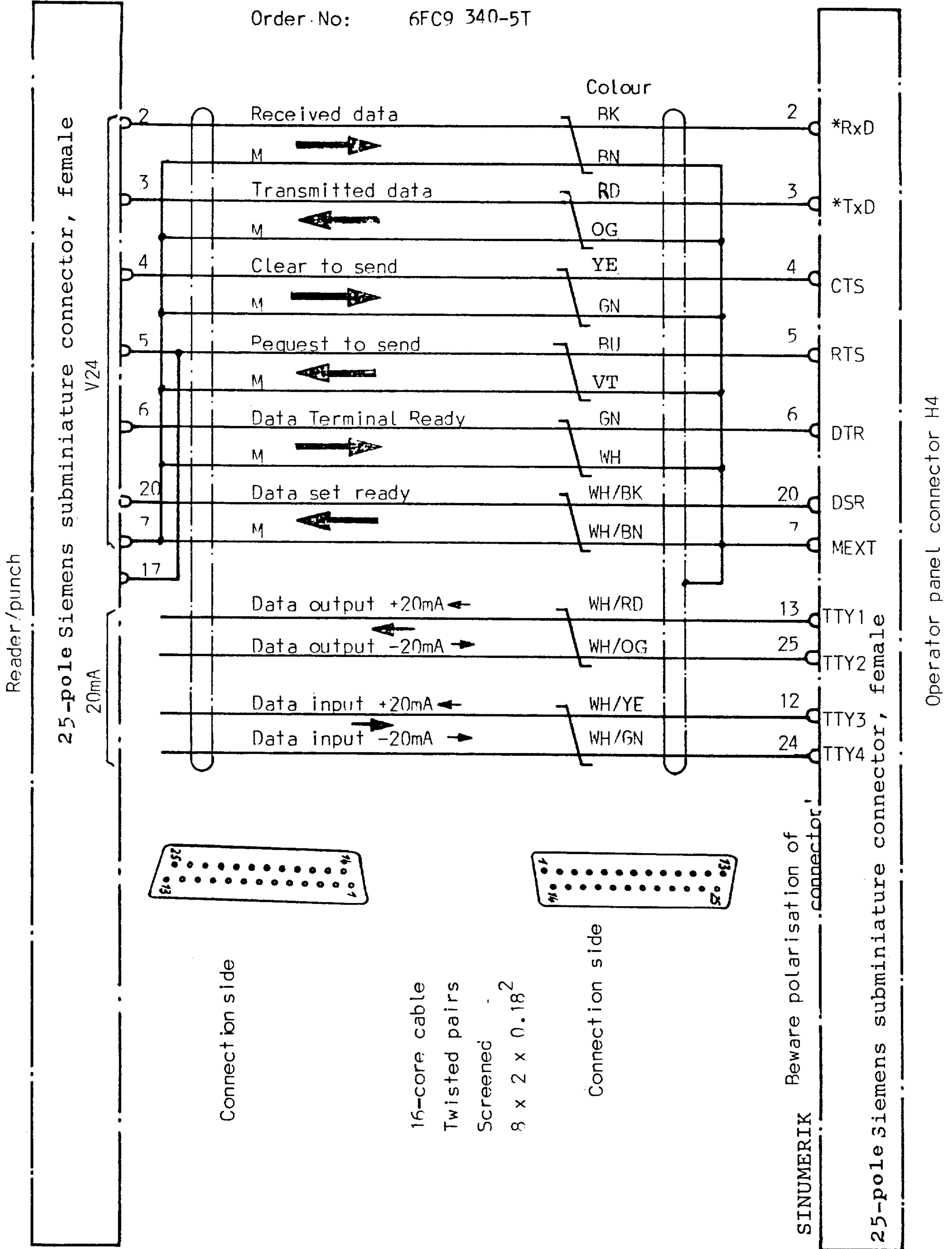
Cable name: Serial data transfer (V.24,RS232), 20 mA current loop)
 Order number: 6FC9 340-4N.

Signal name in accordance with ...

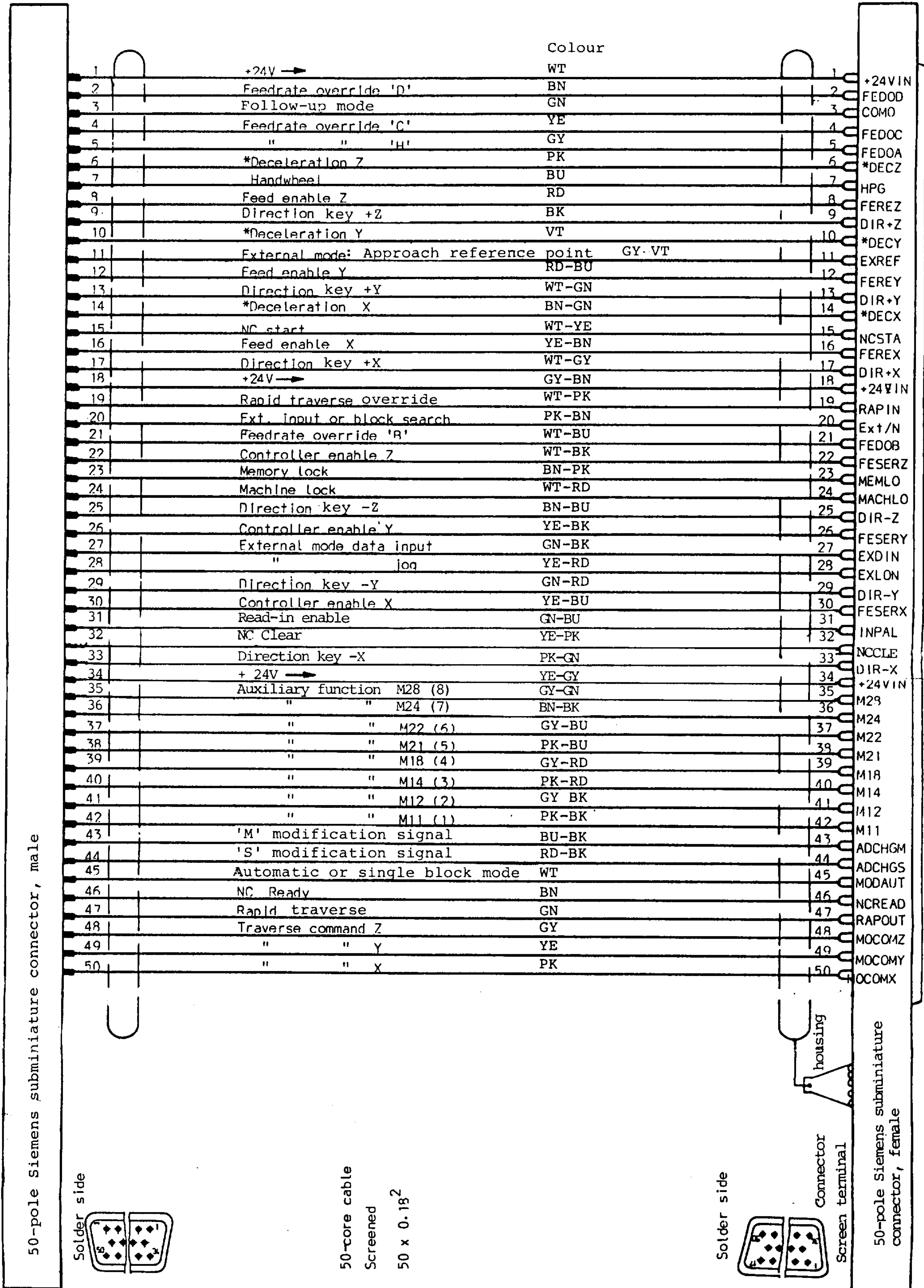


Cable name: Interface V.24/20mA

Order No: 6FC9 340-5T



Cable name: Interface control
 Order-No: AFC9-340-2W
 Module: SN211/XB



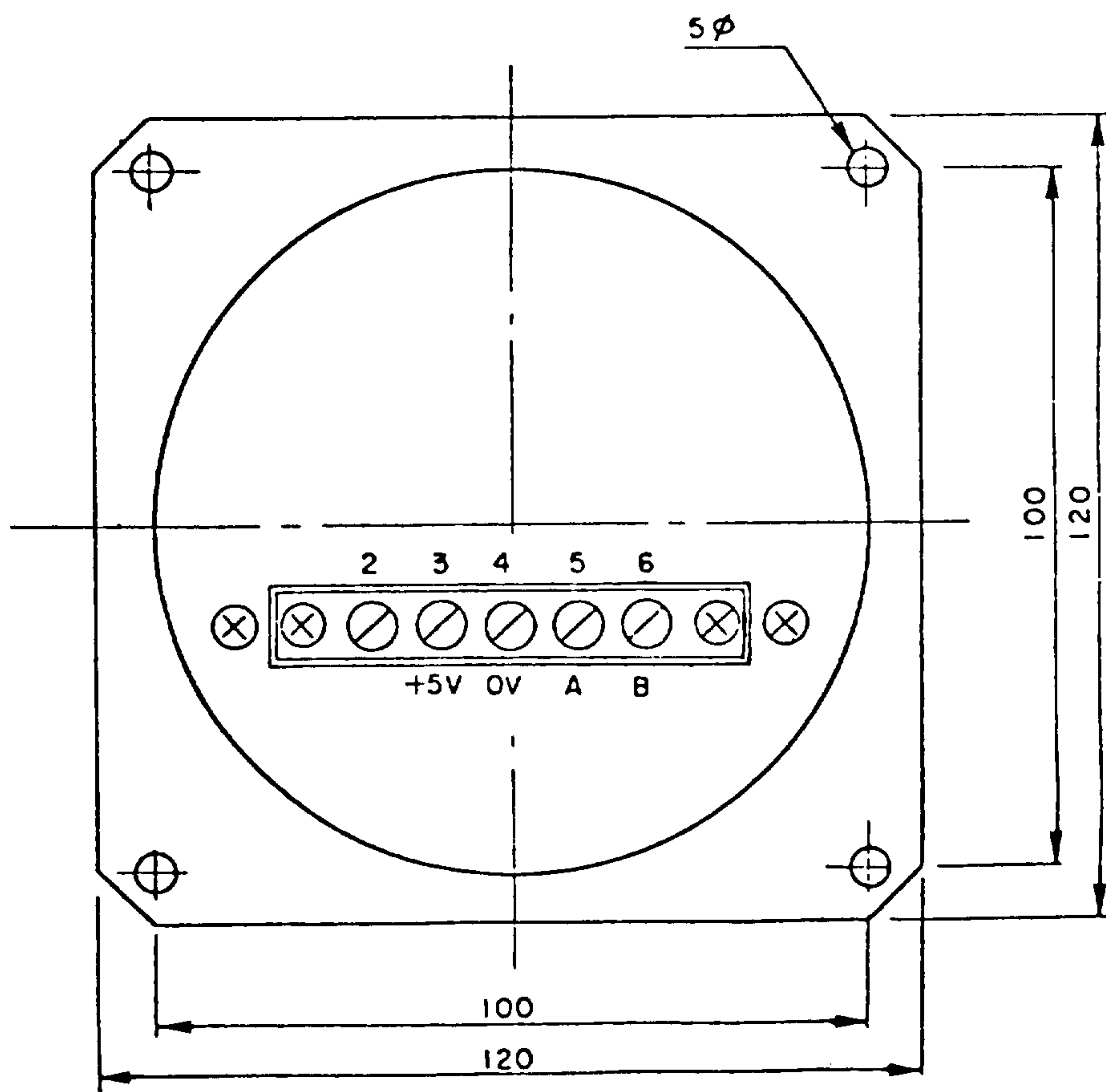
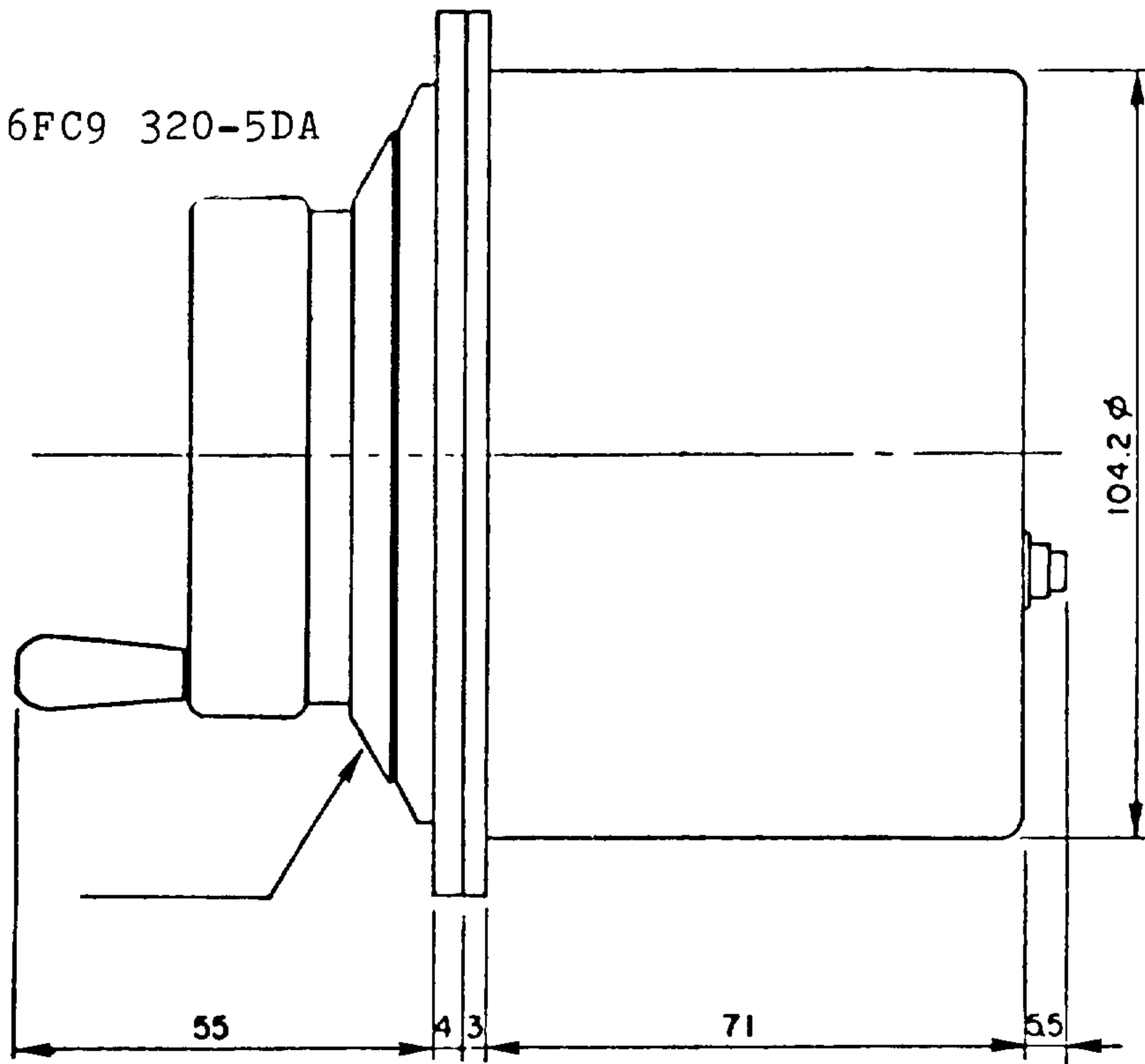
Primo S

(Interface Description)

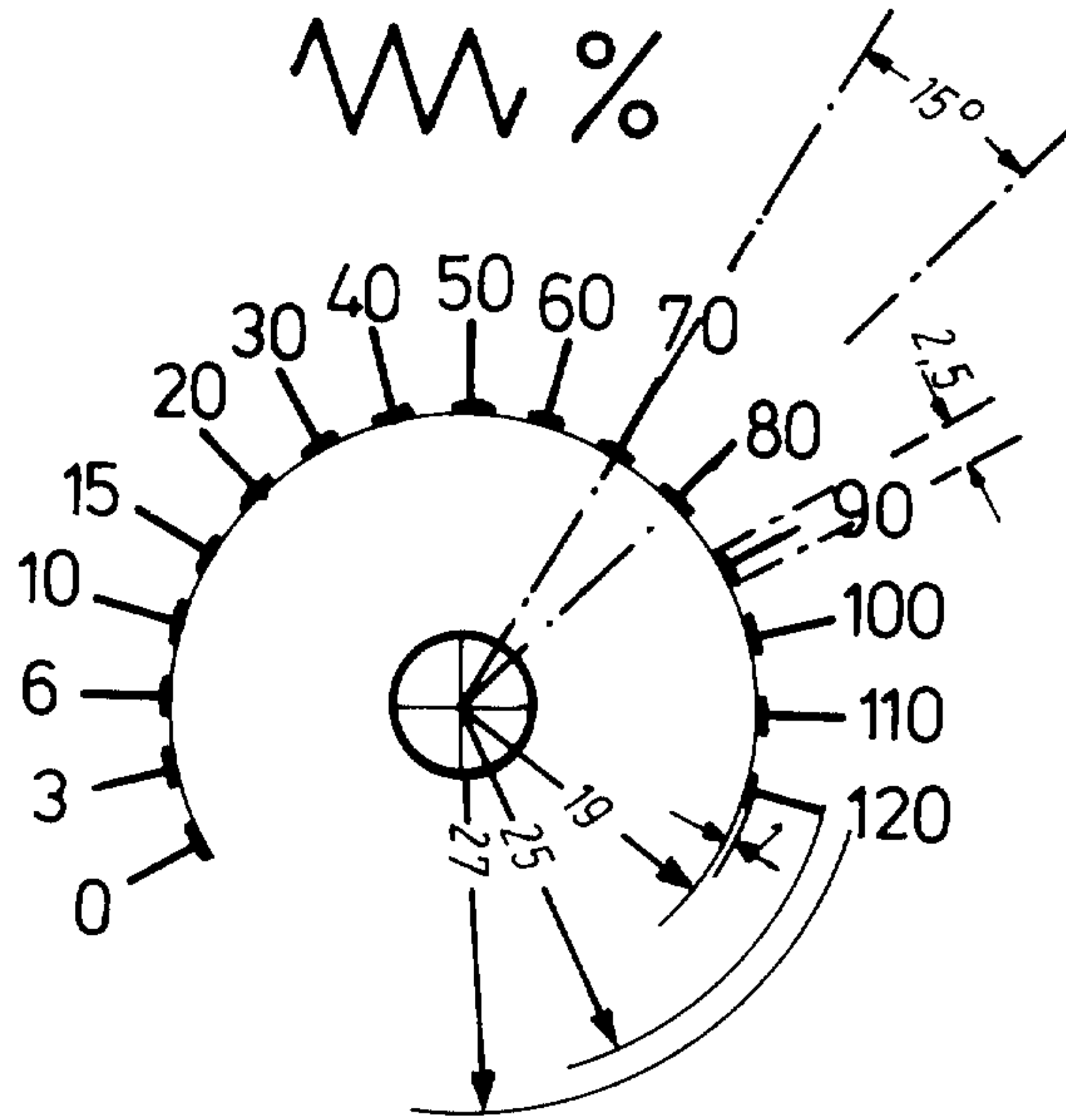
10. External equipment and operating elements

Handwheel

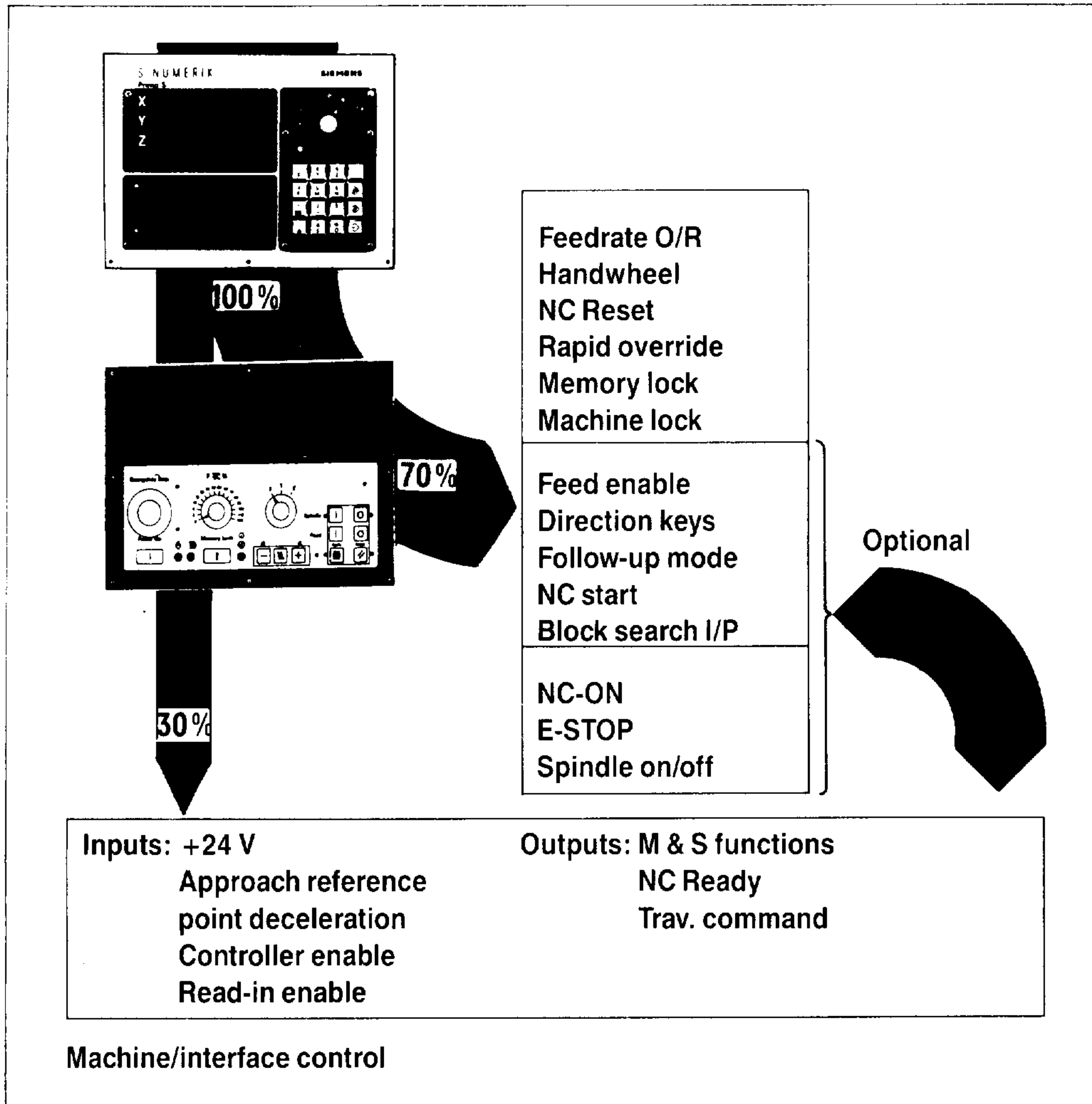
Order No.: 6FC9 320-5DA



Feedrate override switch
Order No.: 6FC9 130-0AC



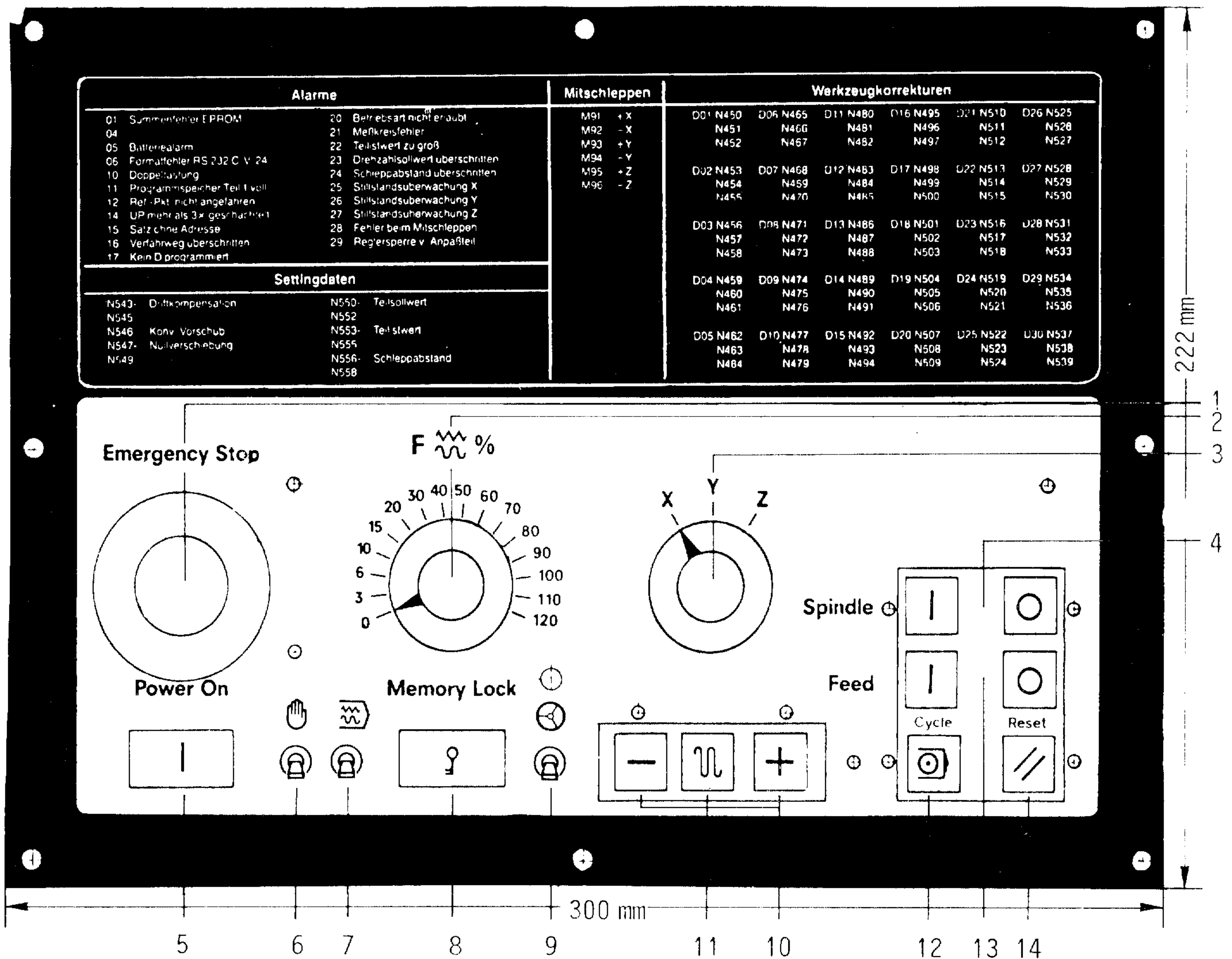
SINUMERIK Primo S Intelligent machine control panel
 Order No.: 6FC9 303-0EA



All interface signals are looped via the control panel. The new machine control panel gives the possibility of addressing about 70% of the interface directly. To cater for the various requirements of different machine tool builders, some signals can additionally be chosen to be handled by the external interface (see sketch above). The interface built into the control panel (relay technology) allows significant reductions in development and building costs, particularly for simpler machines. The control panel is thus "connected in series" with the control, meaning that only the axis and datum limits and +24 V need be further connected. Connecting cable between control and machine control panel about 0.5 m; cable and connector type both for interconnecting cable and continuation cable as before.

(Interface Description)

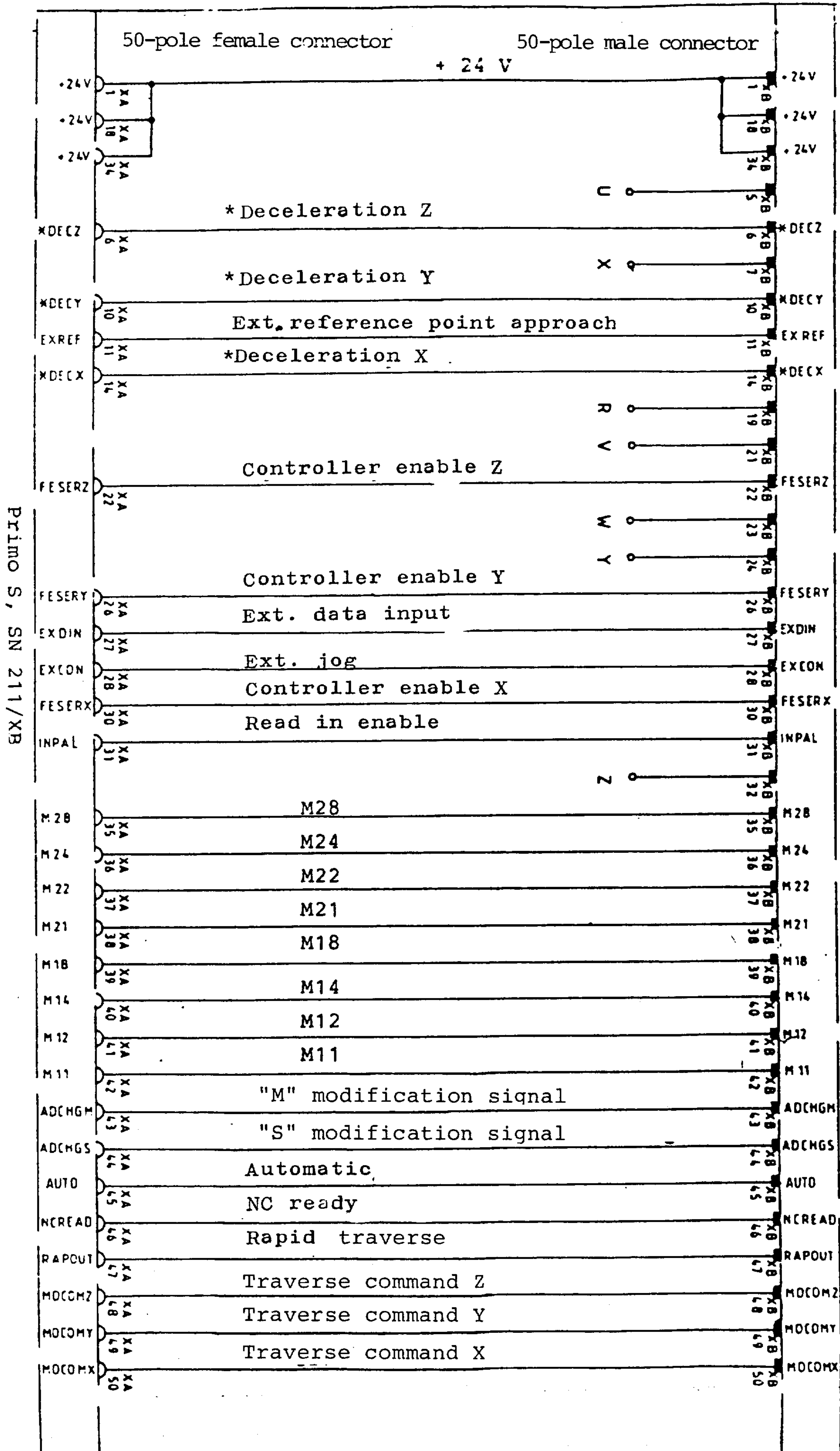
Machine control panel



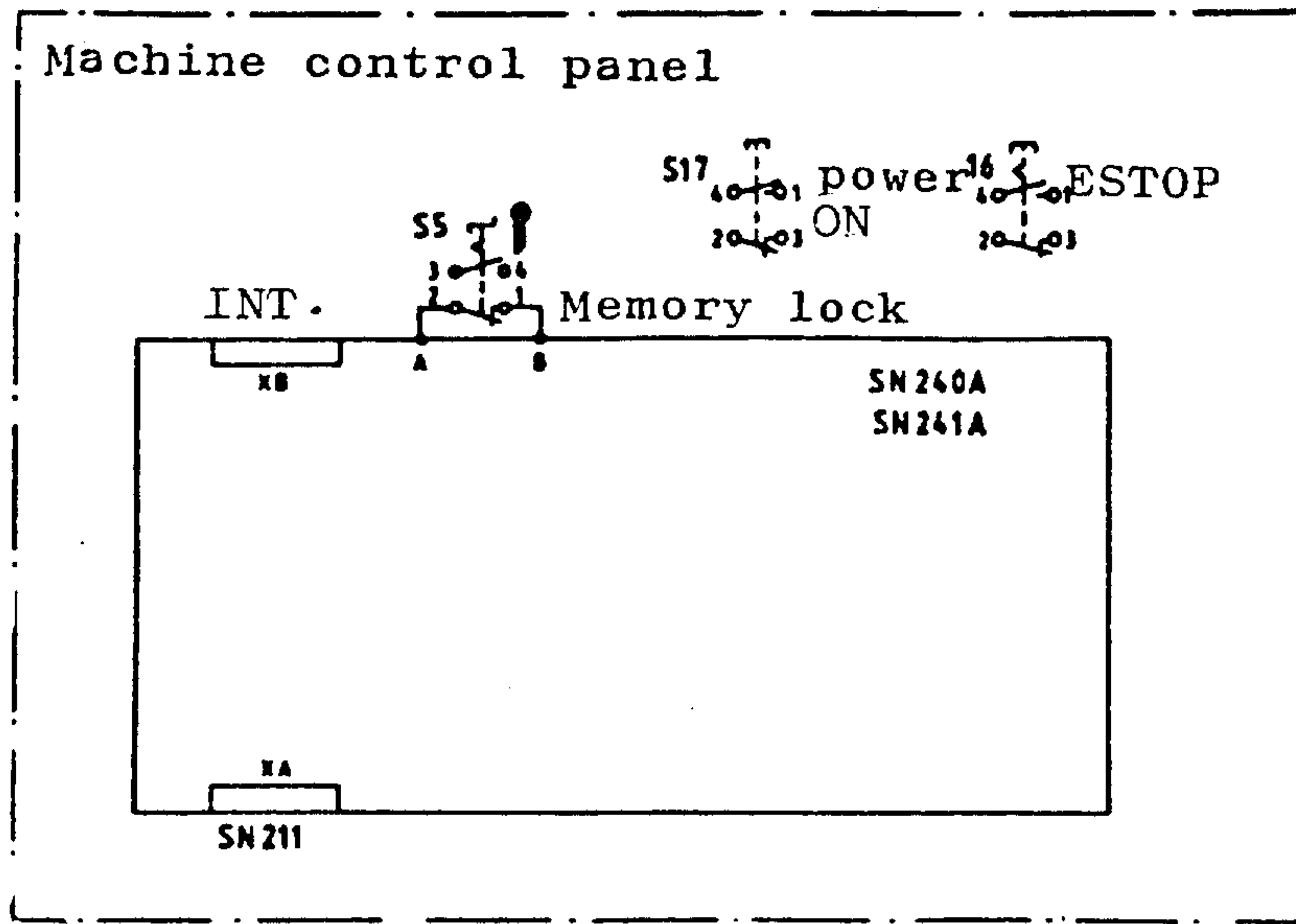
- | | |
|----------------------------|----------------------------|
| 1 Emergency stop | 8 Memory lock |
| 2 Feedrate override switch | 9 Handwheel |
| 3 Axis selector switch | 10 Direction keys |
| 4 Spindle on/off | 11 Rapid traverse override |
| 5 Power on | 12 NC start |
| 6 Follow-up mode | 13 Feed stop/start |
| 7 Machine lock | 14 NC Reset |

See next page for circuit diagrams.

The external dimensions, including fixing holes, are identical to the Primo S. The control panel can thus be mounted below or alongside the control. The tables for the upper section of the control panel are delivered as a separate transfer (E321).

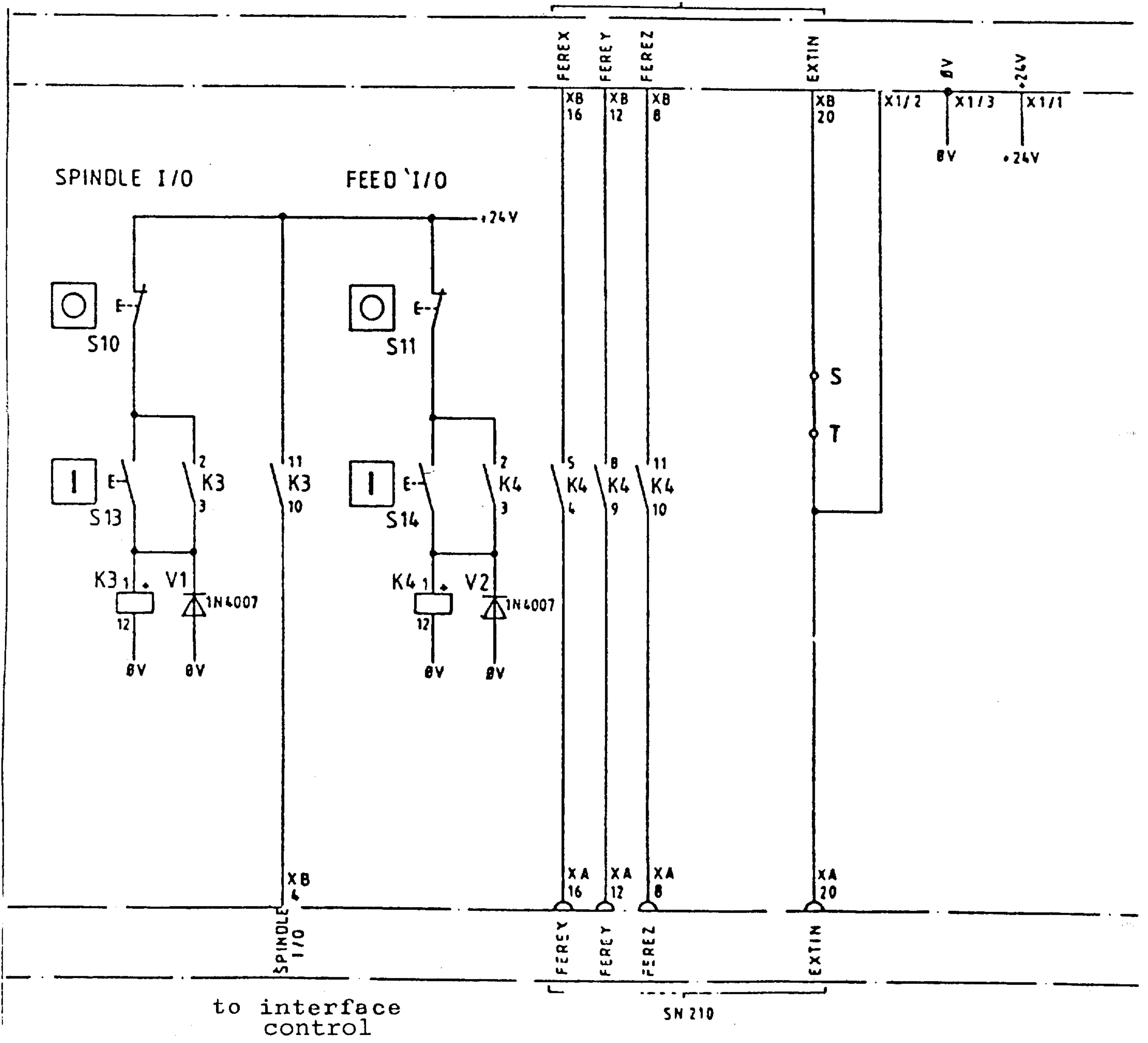


PRIMO S, SN 211/XB

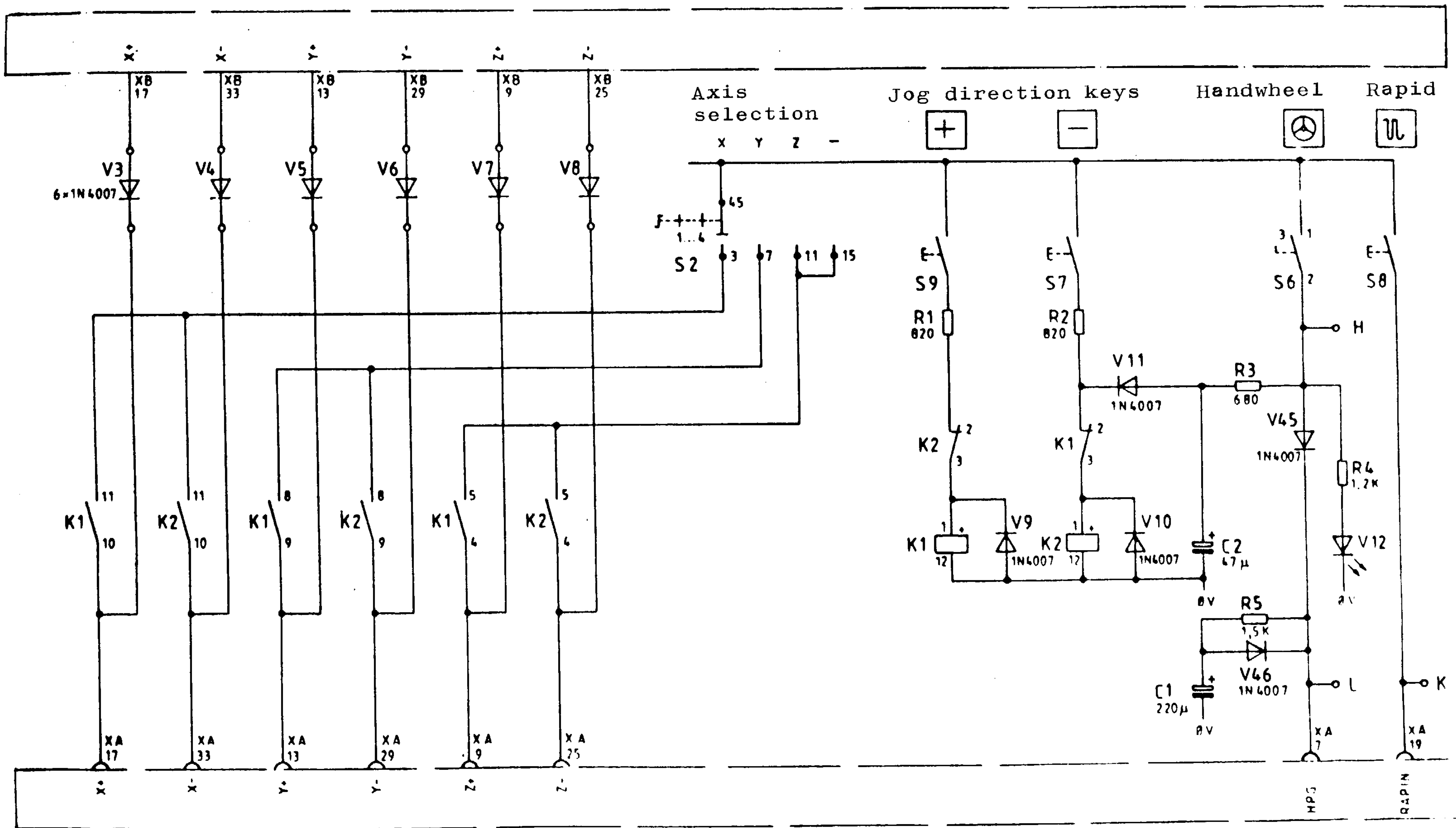


The power ON and ESTOP keys must be connected by the customer

Interface control

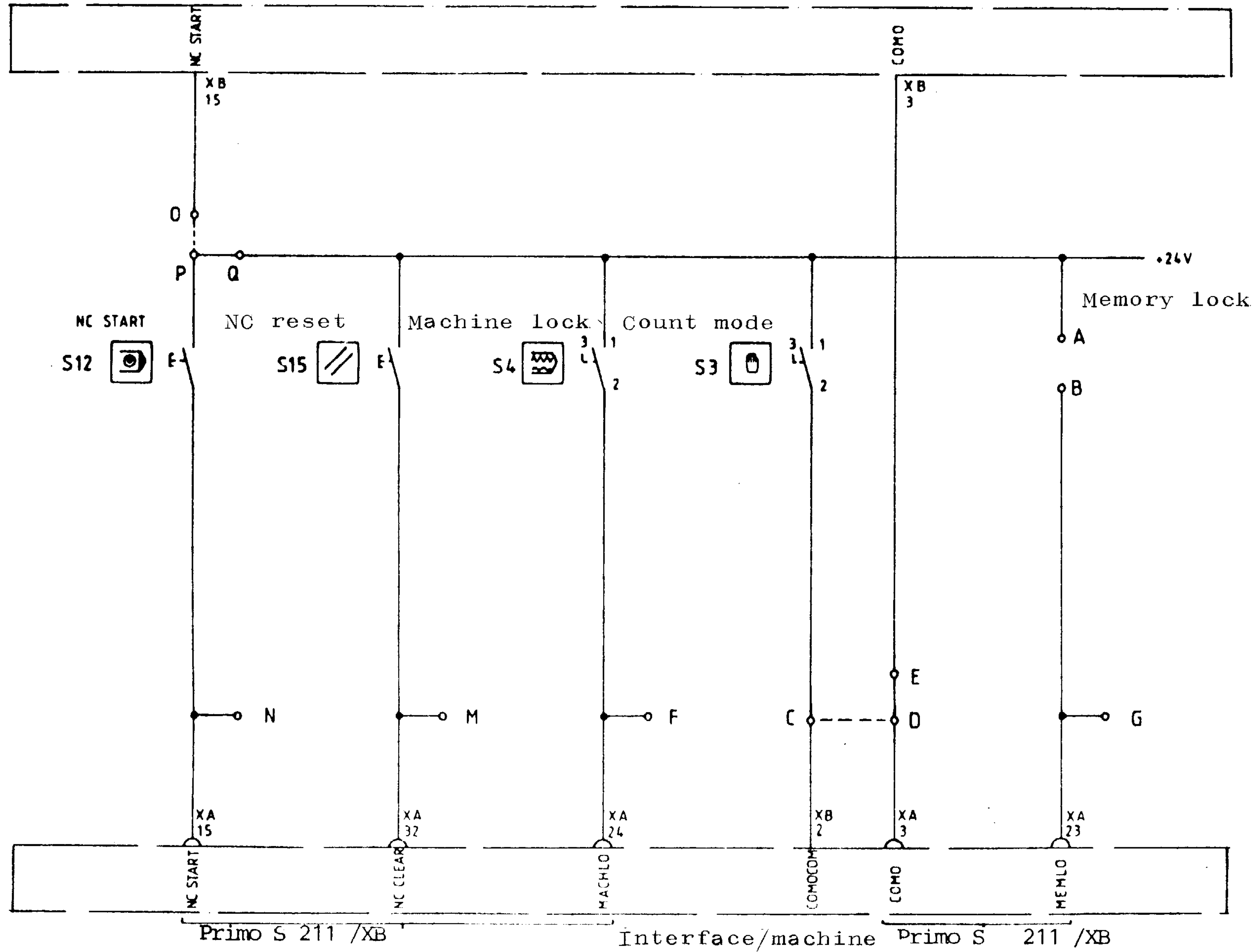


Interface/machine



Primo S plug 211/XB

Interface/machine



Interface/machine

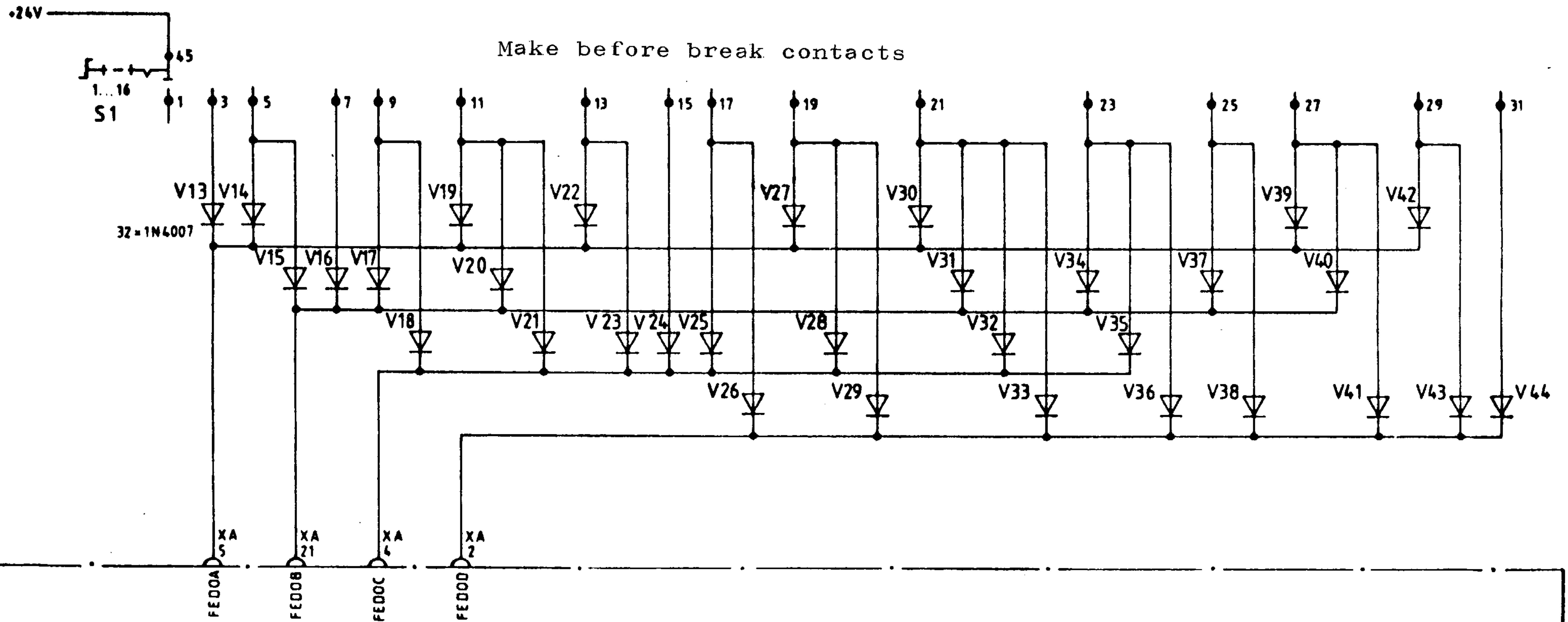
Primo S (Interface)

F %

Feedrate override switch

0 3 4 10 15 20 30 40 50 60 70 80 90 100 110 120

Make before break contacts

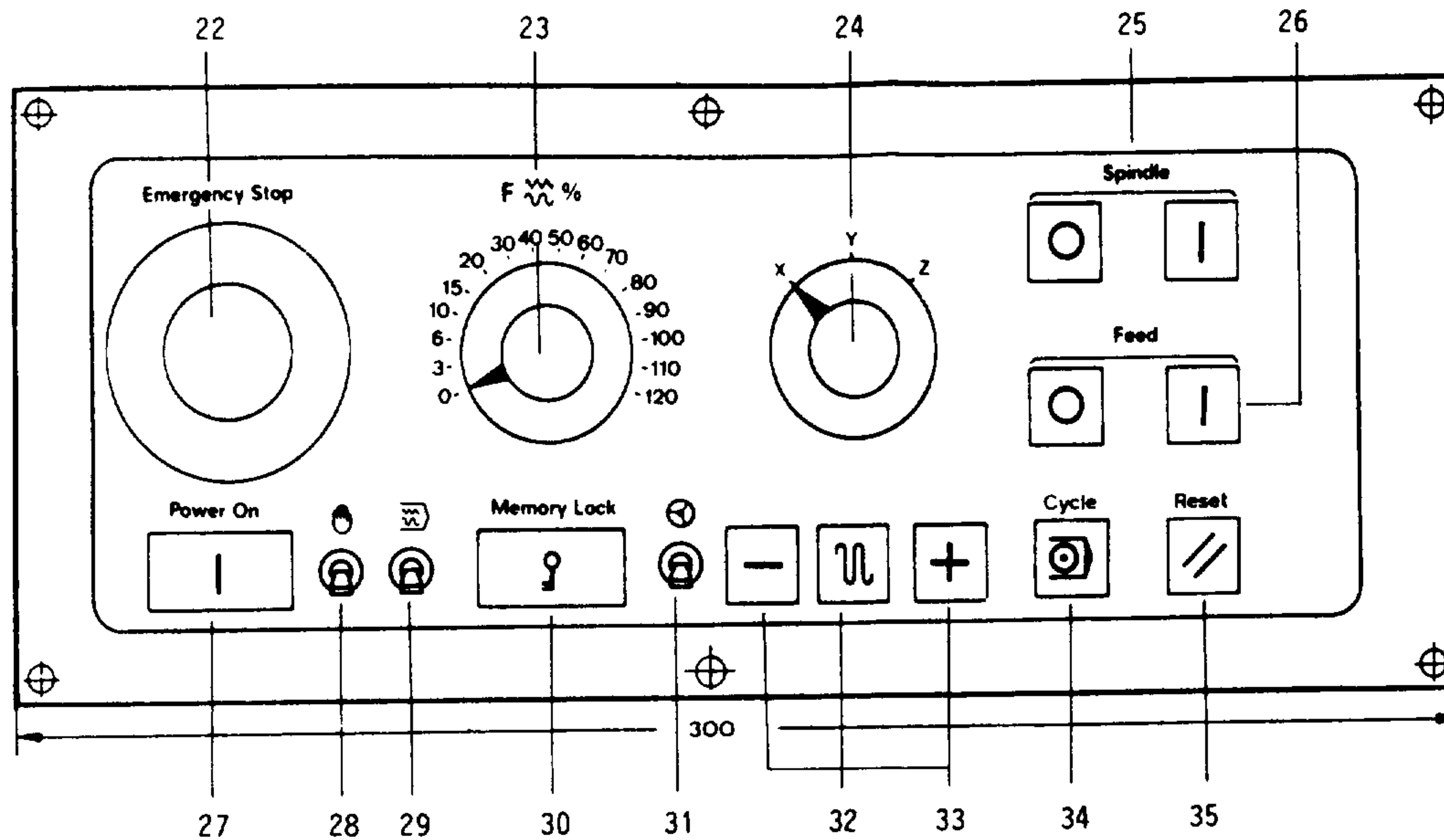


Primo S plug 211 /XB

10 - 9

A.2.83

11. Suggested arrangement of the external operator panel



- | | | | |
|----|----------------------|----|-------------------------|
| 20 | E-STOP | 29 | Machine lock |
| 23 | Override switch | 30 | Memory lock |
| 24 | Axis selector switch | 31 | Handwheel |
| 25 | Spindle on/off | 32 | Rapid traverse override |
| 26 | Feedrate Start/Stop | 33 | Direction keys |
| 27 | Power-ON | 34 | NC start |
| 28 | Follow-up operation | 35 | NC reset |

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Änderungen vorbehalten

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