

# **SINUMERIK 850**

**Software version 2, 3 and 4  
Interface Description  
Part 2: Connection Conditions**

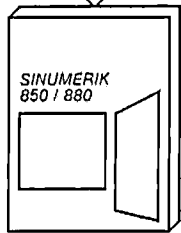
**Planning  
Guide**

# **SINUMERIK**

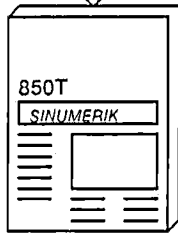
**Manufacturer  
Documentation  
01.90 Edition**

# SINUMERIK 850

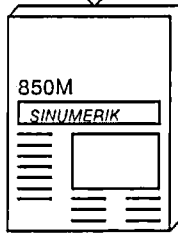
## General Documentation



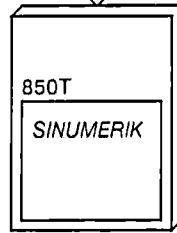
Sales Brochure



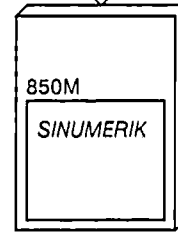
Technical Data



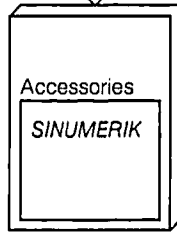
Catalog NC 23



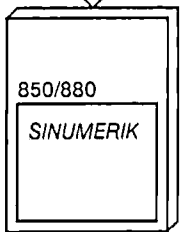
Catalog NC 24



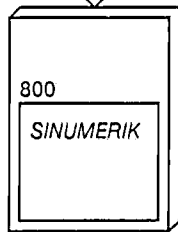
Catalog NC 90



## User Documentation

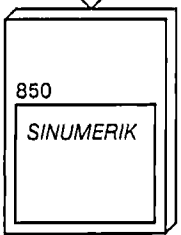


Operator's Guide  
Programming Guide

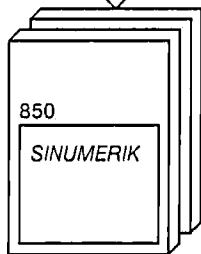


Contour Calculator  
for NC Geometry  
Programs

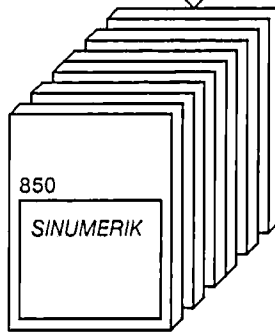
## Manufacturer Documentation



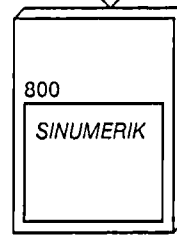
Instructions Manual



Interface:  
- Signals  
- Cables and  
Connections



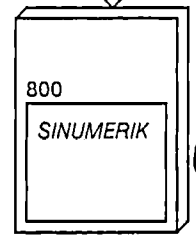
Function Block  
Packages



Universal Interface

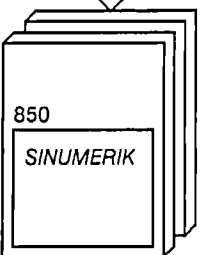


Measuring Cycles:  
- General  
- Turning  
- Milling



SINUMERIK WS 800  
CL 800 Language

## Service Documentation



Installation Guide  
- Instructions  
- Lists



Spare Parts List

# SINUMERIK 850

## Interface Description Part 2: Connection Conditions

### Manufacturer Documentation

#### Planning Guide

Valid for:

*Control*

SINUMERIK 850T/ 850TE  
SINUMERIK 850M/ 850ME

*Software version*

2, 3 and 4  
2, 3 and 4

**Edition 01.90**

# SINUMERIK® documentation

## Printing history

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

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

*Status code in "Remarks" column:*

**A . . .** New documentation      **B . . .** Unrevised reprint with new Order No.  
**C . . .** Revised edition with new status

<b>Edition</b>	<b>Order No.</b>	<b>Remarks</b>
01.88	E80850-D49-X-A1-7600	A
01.89	E80850-D49-X-A2-7600	C
01.90	6ZB5 410-0BG02-0BA1	C

Other functions not described in this documentation might be executable in the control. This does not, however, represent an obligation to supply such functions with a new control or when servicing.

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# Preliminary Remarks

## Guide to use

SINUMERIK documentation comprises three parts:

- User Documentation
- Manufacturer Documentation and
- Service Documentation

The **Manufacturer Documentation** for the **SINUMERIK 850** control is divided into the following sections:

- Operating Manual
- Interface
  - Part 1: Signals
  - Part 2: Cables and Connections
- Function Blocks
  - Package 0: Basic functions
  - Package 1: Tool management for chain magazines
  - Package 3: Serial interface AS 512
  - Package 4: Computer interfacing CP 535 or AS 512
  - Package 5: Interfacing to SINEC H1 bus with CP 535
  - Package 9: Serial interface CP 525-2 or 524
- Computer Interfacing
  - Part 1: Interfaces, protocols and procedures
  - Part 2: Message description

Further SINUMERIK publications apply to all SINUMERIK controls (e. g. universal interface, measuring cycles, CL 800 cycle language).

Consult your local Siemens office for further details.

The **current** documentation is intended for manufacturers of machine tools with SINUMERIK 850.

It describes the installation arrangements and wiring between the control and machine.

## Technical Notes

This documentation describes the maximum scope of functions with software version 4. For software versions 2 and 3, the functions apply, that are described in the relevant catalog and available for order.

Relevant notes are provided on differences between the SINUMERIK 850 T and SINUMERIK 850 M. Inverse signals that are effective at logic zero are marked with an asterisk \* in front of the signal name.

In the timing diagrams, all the described signals are written in upper case. Thick lines represent real signals, thin lines represent symbolic signal paths. The signal meaning refers to the NC-PLC interface.

***This manual is valid for software version 2,3 and 4 !***

System Configuration and Subrack Assignments

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Machine Control Panel

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Coded Selector Switches

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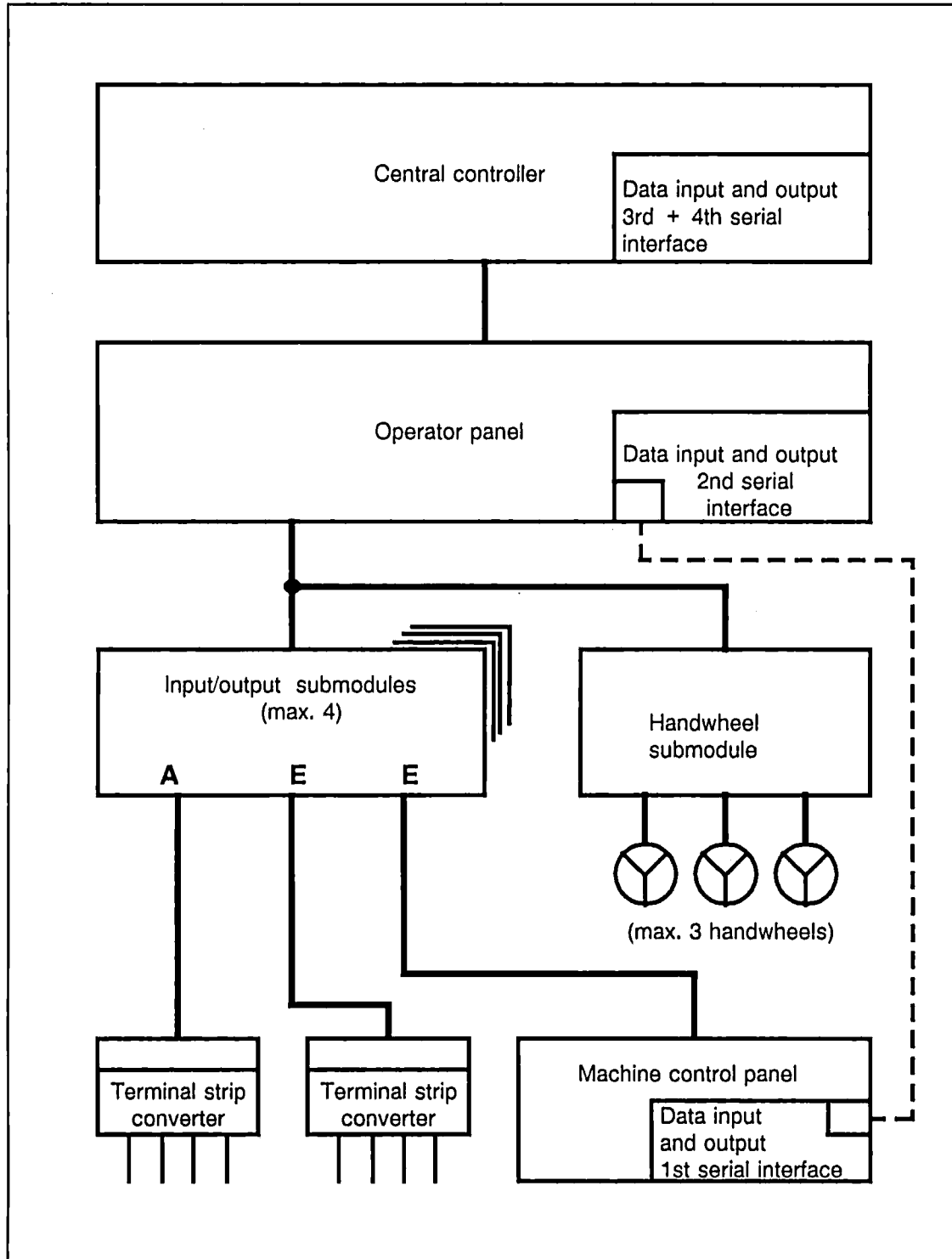
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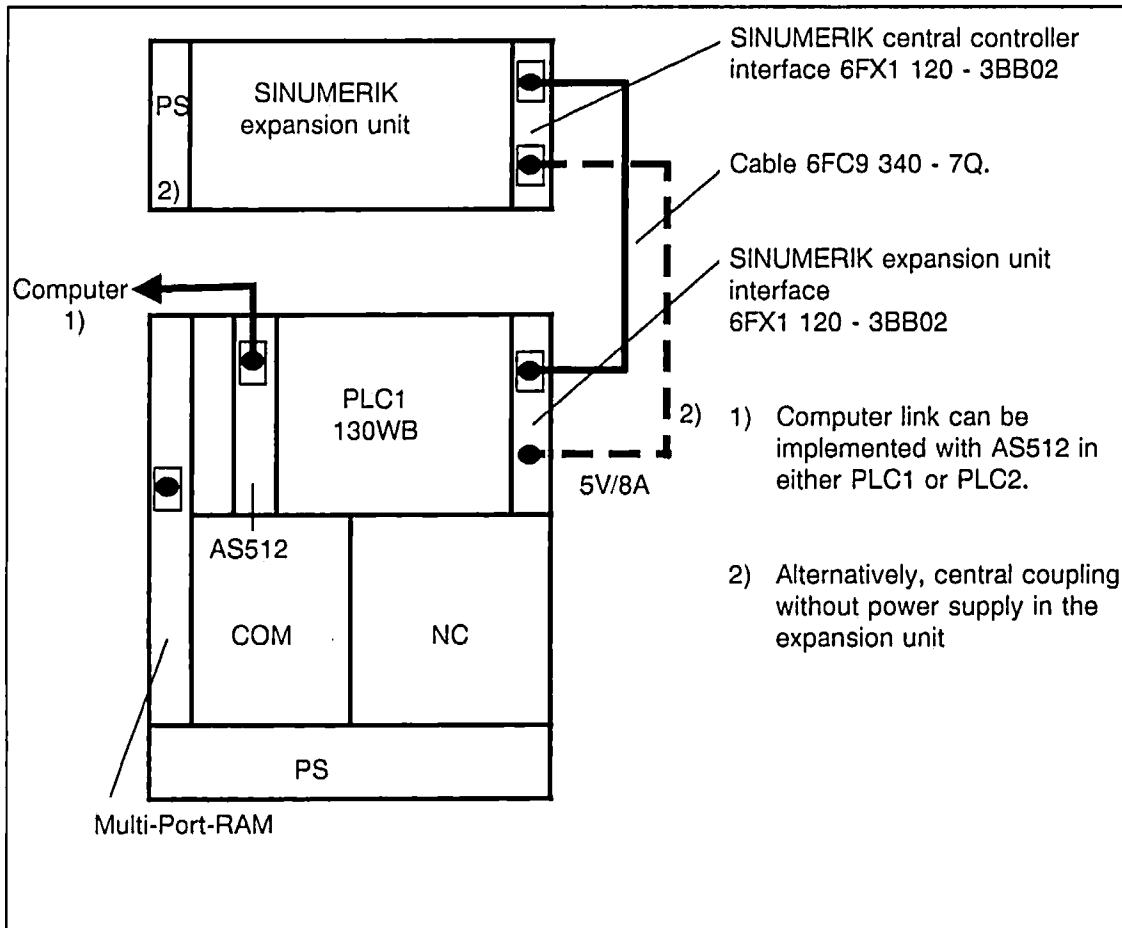
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# 1 System Configuration and Subrack Assignments

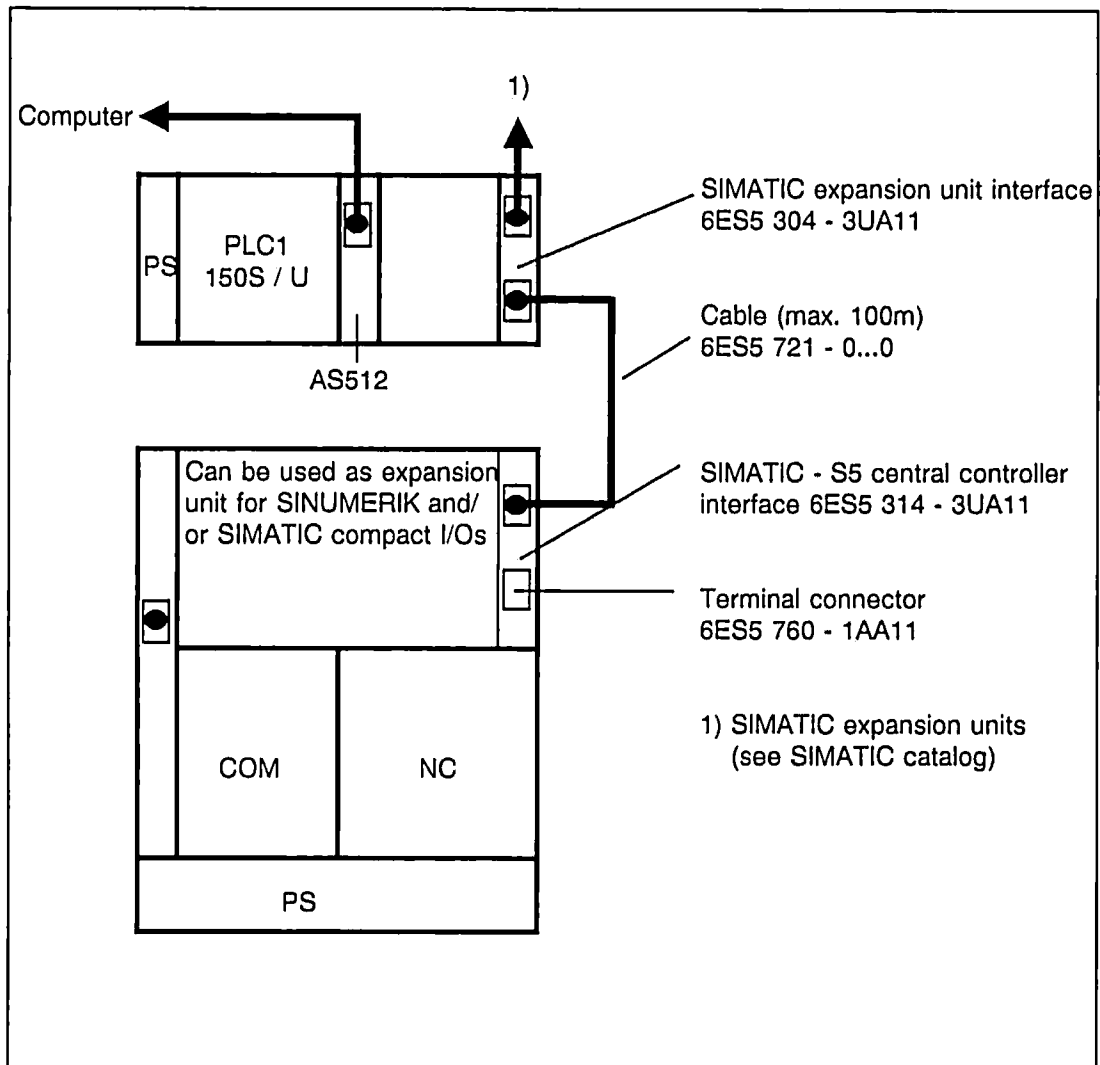
## 1.1 System configuration SINUMERIK 850



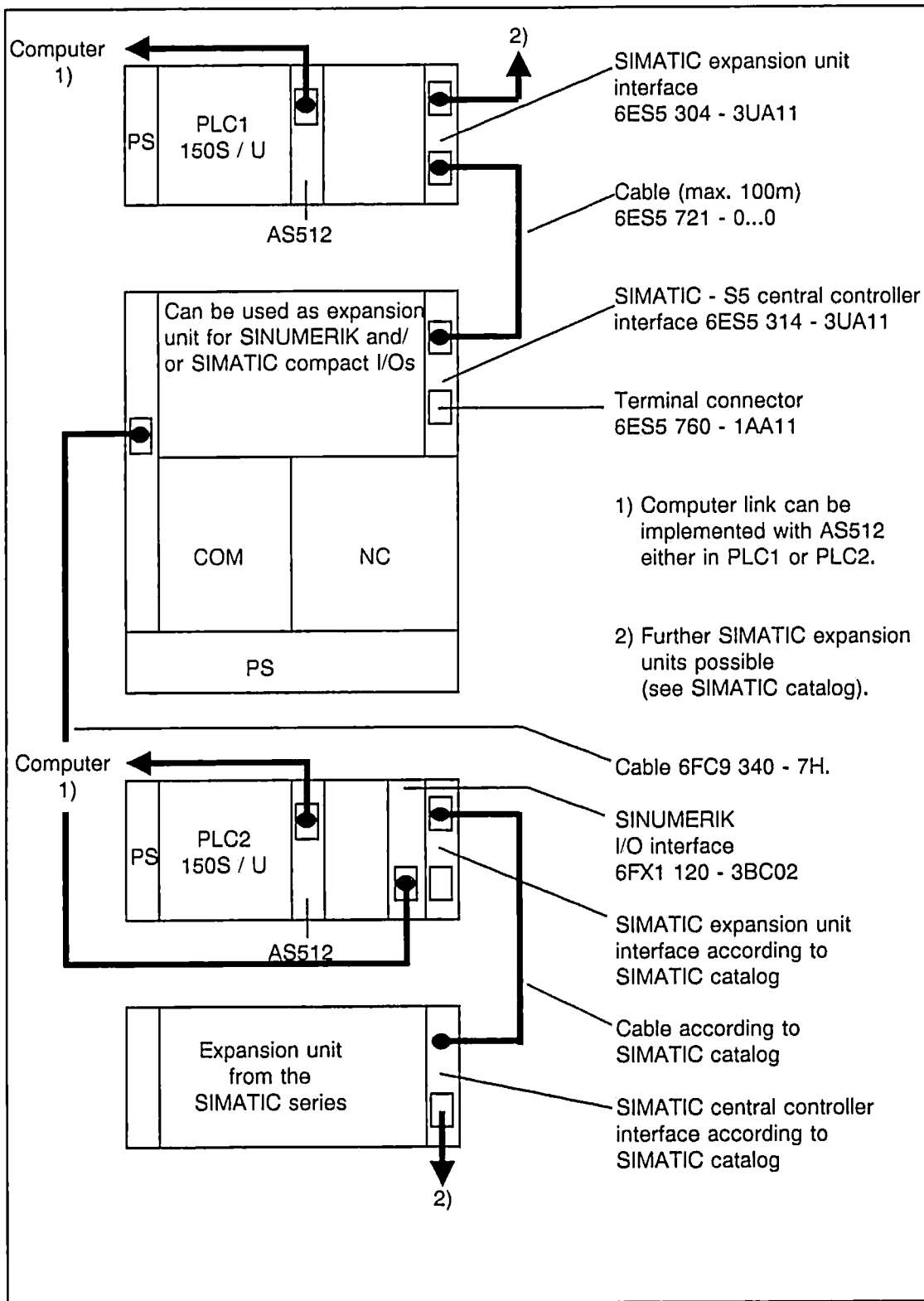
Variant: PLC1 130WB



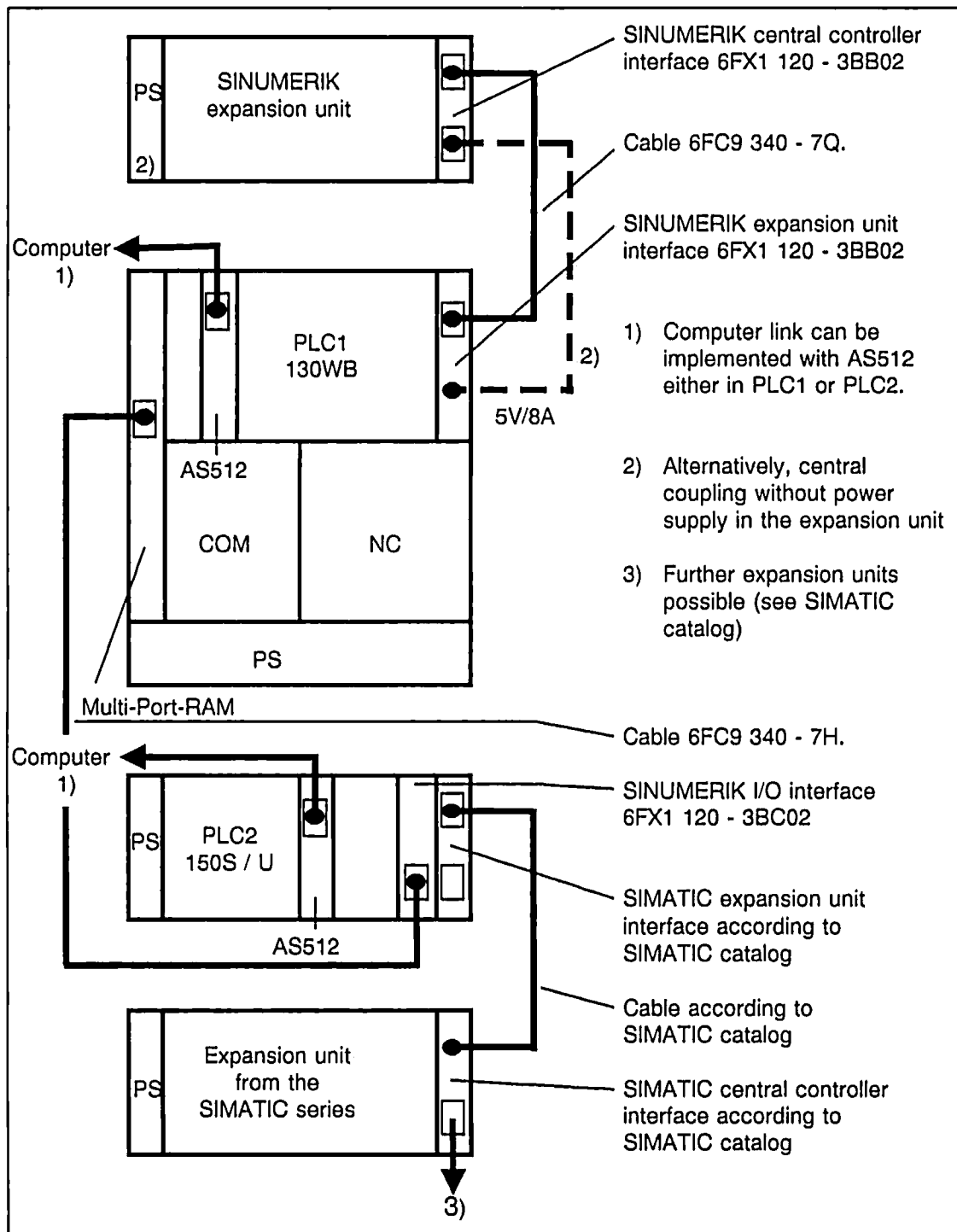
Varlant: PLC1 150S / U



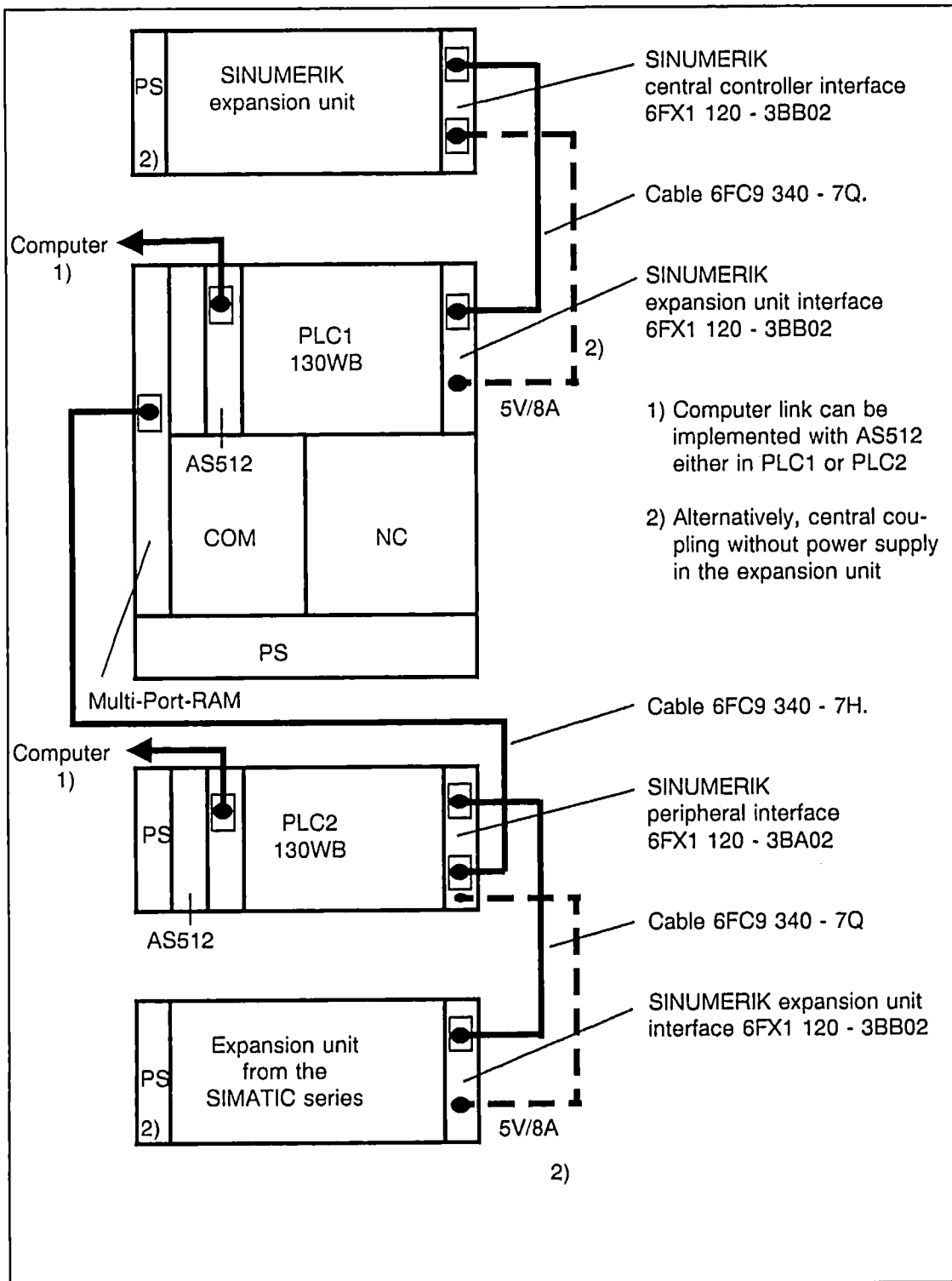
**Variant: PLC1 150S / U,  
 PLC2 150S / U**



Varlant: PLC1 130WB,  
PLC2 150S / U

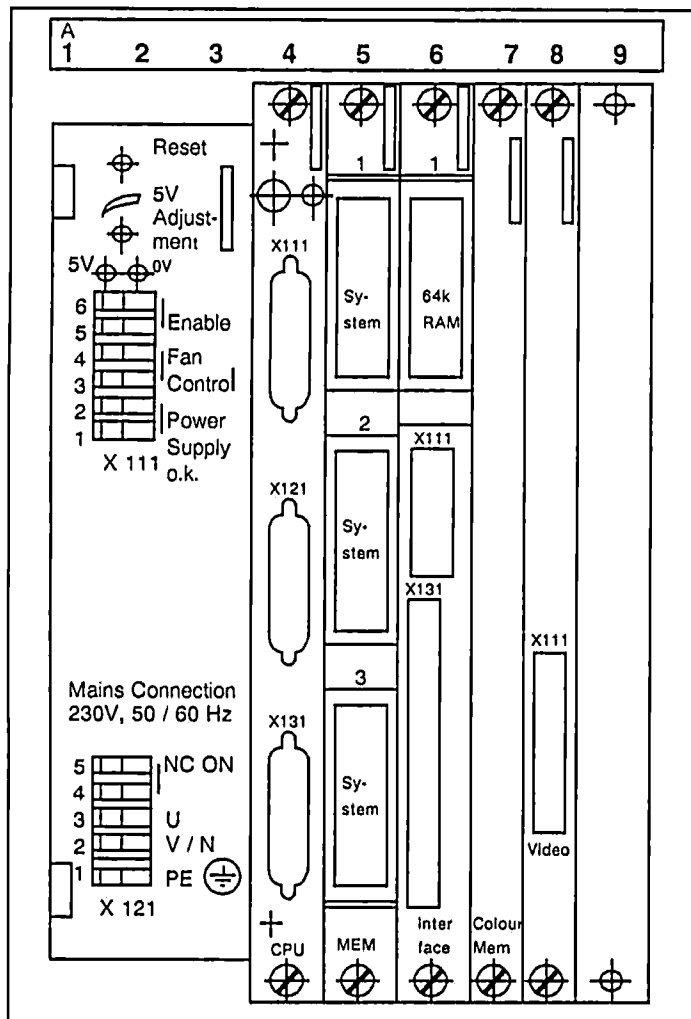


**Variant: PLC1 130WB,  
 PLC2 130WB with SINUMERIK expansion unit**



## 1.2 Subrack assignments SINUMERIK 850

## 1.2.1 Subrack assignments - operator panel

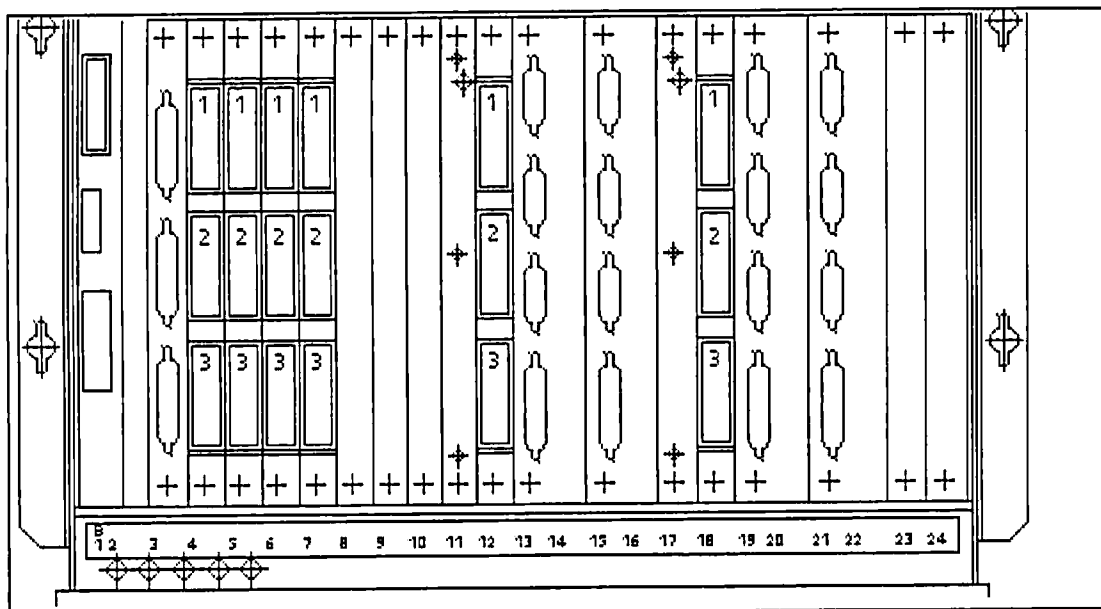


2nd and 3rd  
operator panel  
see section 6.7

Slot	Name	Order No.
A 1/ 2/ 3	Power supply 230V AC	6EW1 861 - 3AA
A 4	Operator panel CPU	6FX1 120 - 4BA
A 5	Memory module	6FX1 120 - 7BB
A 6	Interface module	6FX1 121 - 2BB
A 7	Colour image memory	6FX1 126 - 4AA
A 8	Video graphics module	6FX1 126 - 1AA
A 9	Blanking plate	6FC3 985 - 7AC



### 1.2.2 Subrack assignments - central controller (NC tier)

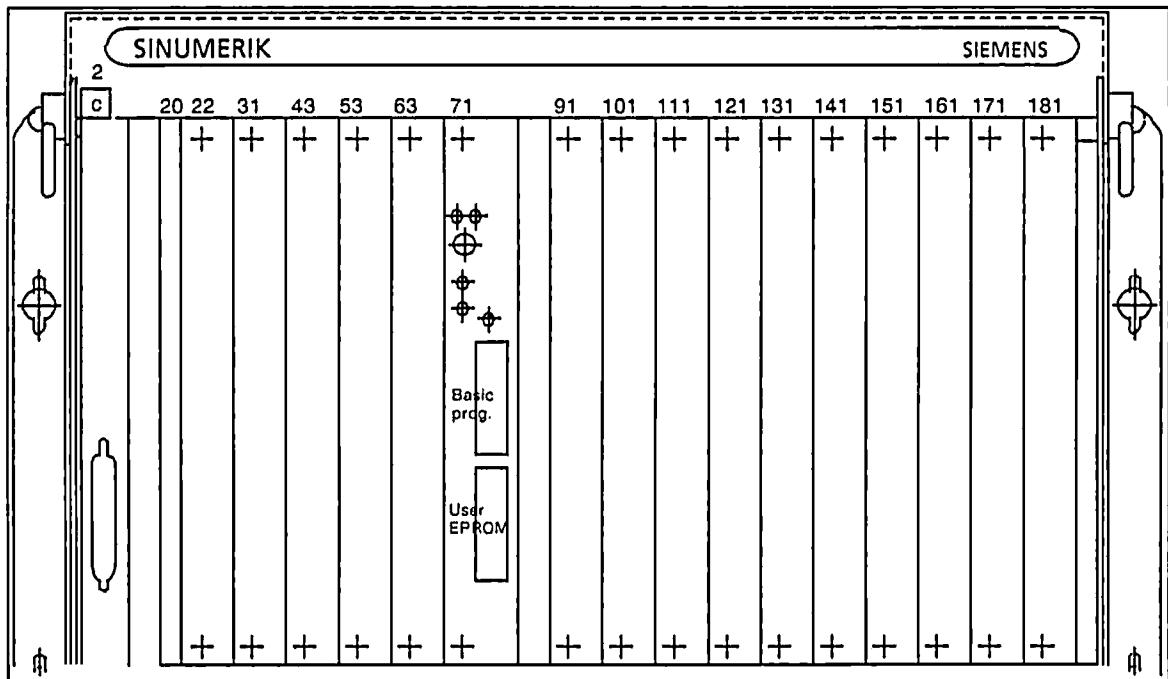


Slot	Name	Order No
B 1/ 2 (C 2)	Multiport	6FX1 121 - 8BB
B 3	CPU / Communic	6FX1 120 - 4BA
B 4	Memory module (System + UMS)	6FX1 128 - 1BB
B 5, B 6, B 7	Memory module (part program)	6FX1 126 - 7BA
B 8	Memory module (from software version 3)	6FX1 128 - 1BB
B 9	Interface module / extension 5 + 6 serial interface	6FX1 122 - 2BA
B 10	Blanking plate	6FC3 985 - 7AC
B 11	CPU / NC 1	6FX1 120 - 5BA
B 12	Memory module (system)	6FX1 120 - 7BA
B 13/ 14	Measuring circuit module	6FX1 126 - 8B. or 6FX1 121-4B.
B 15/ 16	Measuring circuit module	6FX1 126 - 8B. or 6FX1 121-4B.
B 17	CPU / NC 2	6FX1 120 - 5BA
B 18	Memory module (system)	6FX1 120 - 7BA
B 19/ 20	Measuring circuit module	6FX1 126 - 8B. or 6FX1 121-4B.
B 21/ 22	Measuring circuit module	6FX1 126 - 8B. or 6FX1 121-4B.
B 23/ 24	Blanking plate	6FC3 985 - 7AC

Slot	Submodule		
	1	2	3
B4	System program	System program	UMS
B5	128kB part program	128kB part program	128kB part program
B6	128kB part program	128kB part program	128kB part program
B7	128kB part program	128kB part program	128kB part program
B8	Spare	Spare	Spare
B12	System program	System program	64k RAM
B18	System program	System program	64k RAM

UMS ... User memory submodule

## 1.2.3 Subrack assignments - central controller (PLC tier)



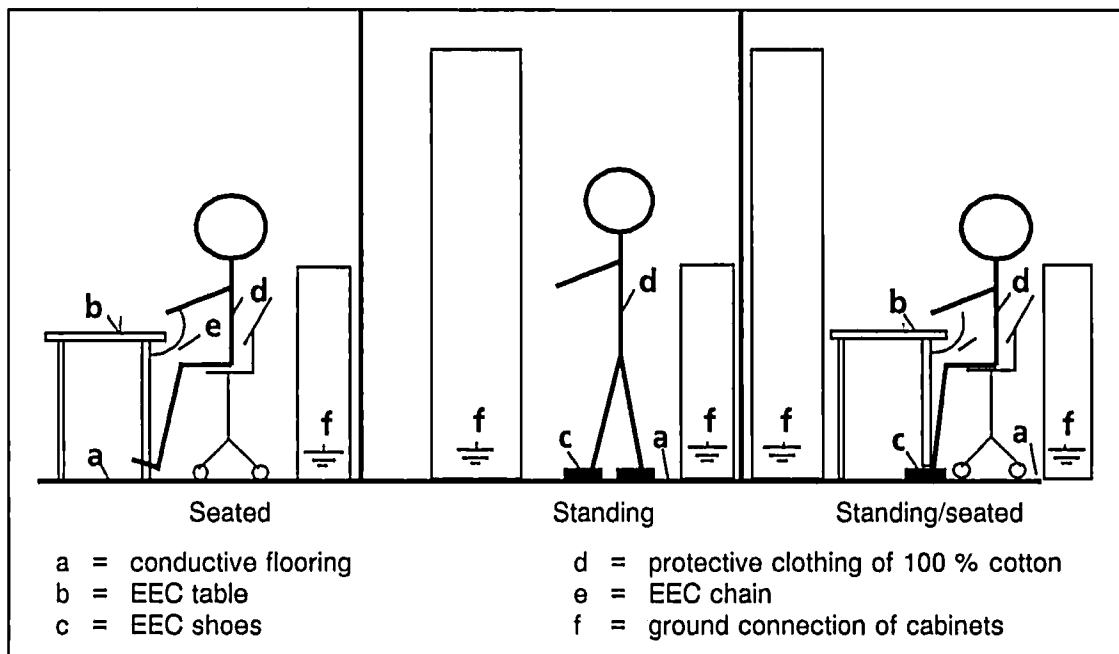
Slot	Name	Order No.
C 2	Multiport	6FX1 121 - 8BB
C 20	Blanking plate	6FX2 002 - 6KB
C 43	Interface module AS 512	
C 53	Interface module AS 512	
C 63	Interface module AS 511	
C 71	PLC 1 (130WB)	6ES5 921 - 3WB
C 89	Blanking plate	6FX2 002 - 6KB
C 181	Link module / CU-EU	6FX1 120 - 3B.
At slots C 22 C 31 C 91 C 101 C 111 C 121 C 131 C 141 C 151 C 161 C 171 C 181 I/O modules can be inserted	Input/output module 48 inputs, 24 outputs Input/output module 32 inputs, 32 outputs Input module 96 inputs Output module 48 outputs Output module 16 outputs Input module 32 inputs Input module 16 inputs Output module 32 outputs Output module 16 outputs	6FX1 118 - 4AA 6FX1 111 - 4AB 6FX1 192 - 4AA 6FX1 130 - 6BA 6FX1 112 - 0AA 6ES5 420 - 3BA11 6ES5 432 - 3BA12 6ES5 445 - 3AA12 6ES5 444 - 3AA

## 2 Connection Conditions

### 2.1 Information on safe handling of the control

#### 2.1.1 Electrostatically endangered components (EEC)

- Electronic modules should not be touched unless this is unavoidable because of work to be performed on them.
- Before touching an electronic module, the human body must be in a discharged state. This can be done by simply touching a conductive grounded object immediately beforehand (e.g. bright metal cabinet parts, electrical socket protective ground contact).
- Modules must not be brought into contact with highly insulating materials such as plastic film, insulating desk tops, items of clothing made of synthetic fibre.
- Modules must be placed only on conductive surfaces.
- Modules must be plugged in or withdrawn only when in a de-energized state.
- Signal voltages must not exist unless the supply voltage is switched on.
- When soldering on modules, the solder iron tip must be grounded.
- Modules and components must always be stored or dispatched in conductive packaging (e.g. metallized plastic boxes, metal bushings).
- If packagings are non-conductive, modules must be enclosed in conductive material before packaging. Conductive foam rubber or household aluminium foil, for example, can be used for this purpose.
- The necessary protective measures for electrostatically endangered components are illustrated below.



## 2.1.2 CRT display

The image on the screen can oscillate if the display unit is subjected to electromagnetic fields. Devices which generate electromagnetic fields such as transformers, fans, electromagnetic switches, cables carrying alternating current etc. must be located at a distance of more than 300 mm from the CRT display unit.

## 2.2 Installation

### 2.2.1 NC units

The SINUMERIK 850 controls consist of the following units:

- central controller with integrated PLC
- operator panel unit with integrated CRT display
- machine control panel

The following options are available for this basic unit:

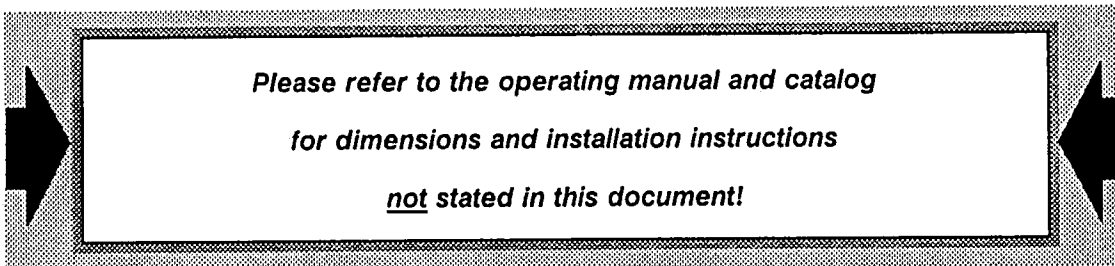
- max. 4 I/O submodules (operator panel extension)
- tape reader
- interface submodule for manual encoders
- manual encoders

For interfacing additional peripheral devices, please refer to Sections 6 and the Interface Description - Universal Interface -.

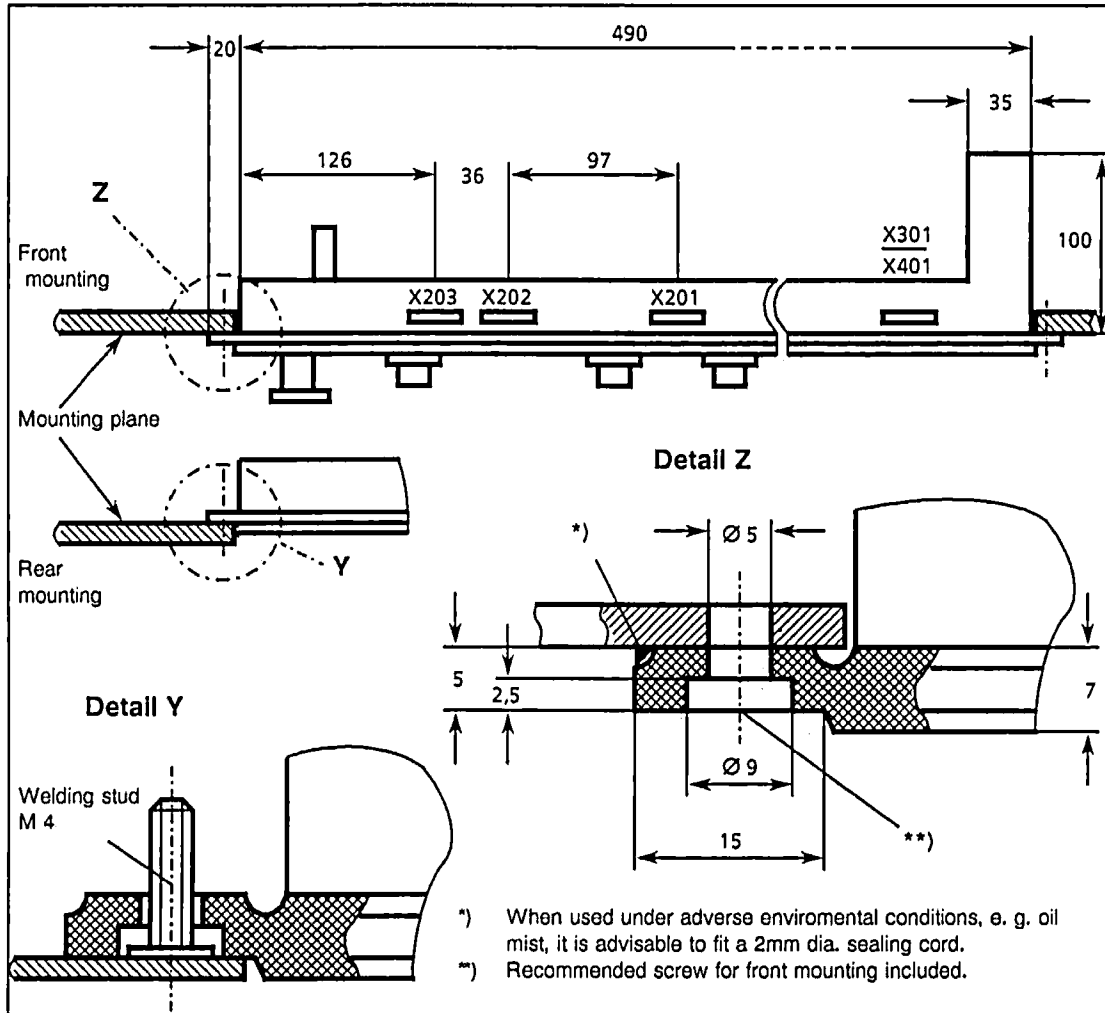
#### 2.2.1.1 Dimension drawings and mounting

Precise installation instructions must be followed for the various SINUMERIK 850 units and the peripheral equipment. Please observe the various instructions for enclosed installation and for open-circuit ventilation (see Section 2.2.1.2).

The maximum admissible temperatures must never be exceeded.



- Machine control panel
- Installation instructions



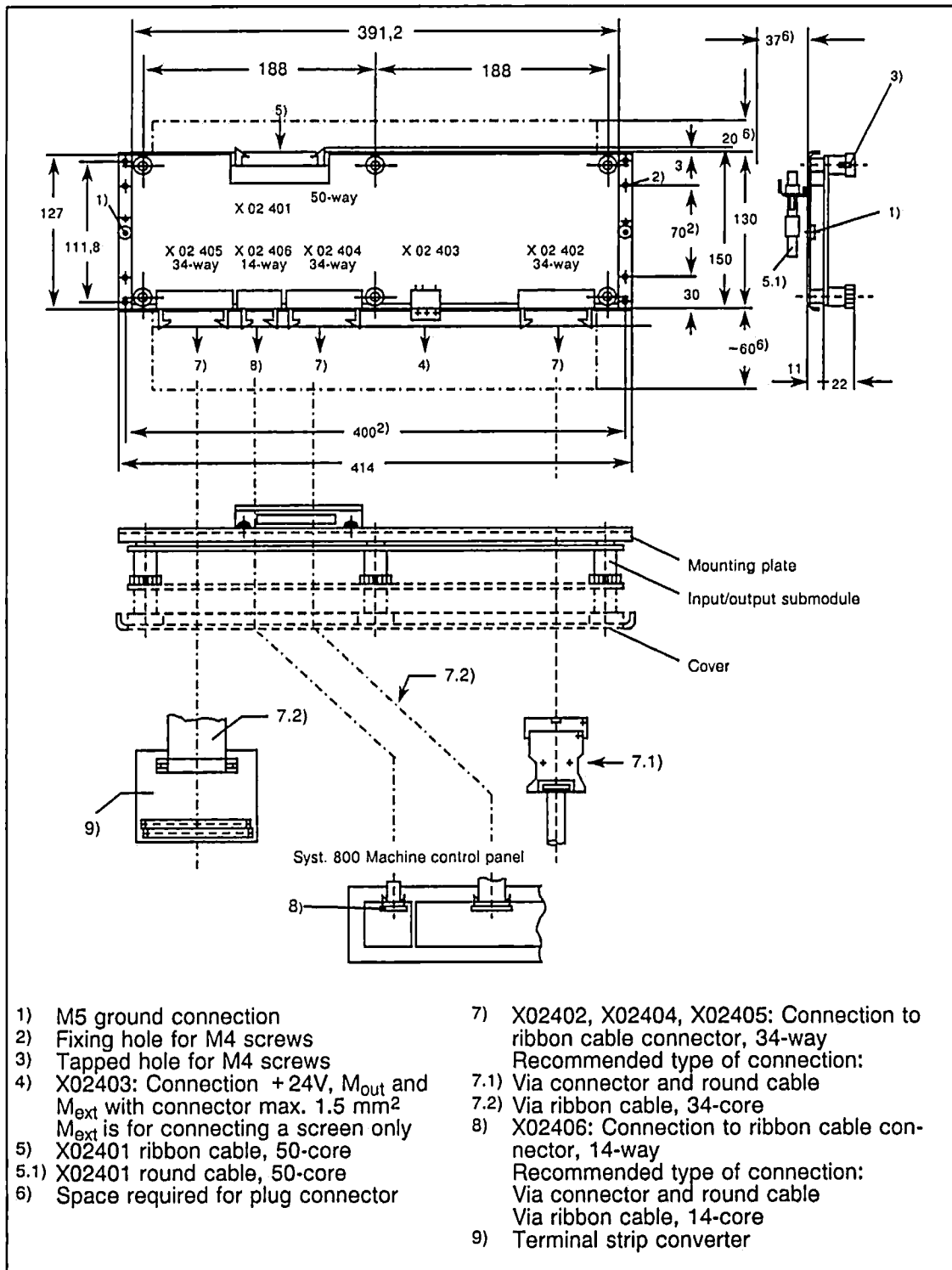
Machine control panel mounting (top view)

• I/O submodules

Order No.: 6FC3 984 - 3R. (M01, M02, M03, M04)

Type: 6FX1 124 - 6A.

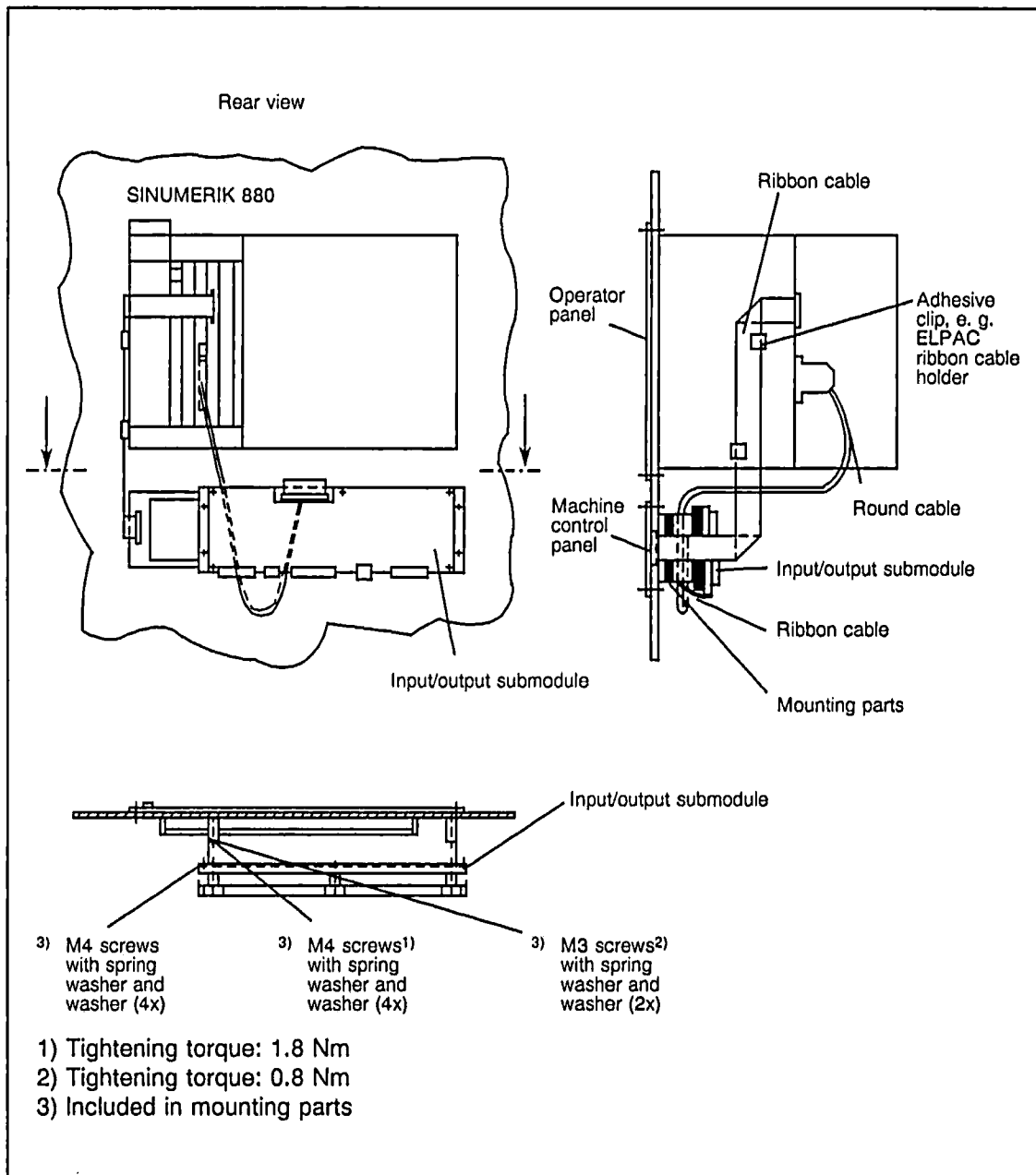
- Dimension drawings



- 1) M5 ground connection
- 2) Fixing hole for M4 screws
- 3) Tapped hole for M4 screws
- 4) X02403: Connection +24V, M<sub>out</sub> and M<sub>ext</sub> with connector max. 1.5 mm<sup>2</sup>  
M<sub>ext</sub> is for connecting a screen only
- 5) X02401 ribbon cable, 50-core
- 5.1) X02401 round cable, 50-core
- 6) Space required for plug connector

- 7) X02402, X02404, X02405: Connection to ribbon cable connector, 34-way  
Recommended type of connection:
- 7.1) Via connector and round cable
- 7.2) Via ribbon cable, 34-core
- 8) X02406: Connection to ribbon cable connector, 14-way  
Recommended type of connection:
- Via connector and round cable
- Via ribbon cable, 14-core
- 9) Terminal strip converter

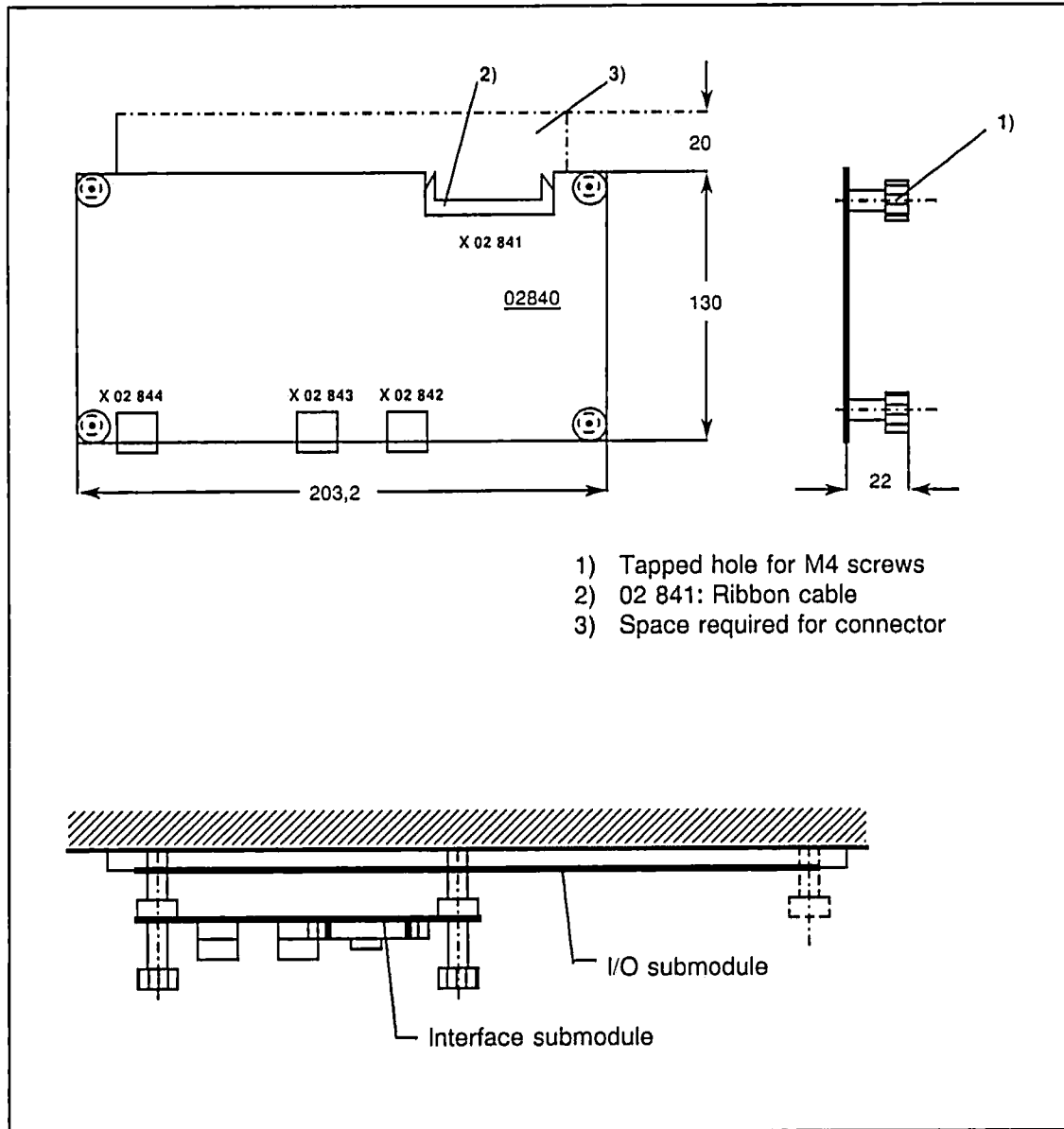
## - Installation instructions



• **Interface submodule for electronic handwheels**

Order No.: 6FC3 984 - 3RJ  
Type: 6FX1 126 - 5AA

Three electronic handwheels can be connected to the interface submodule for simultaneous operation.

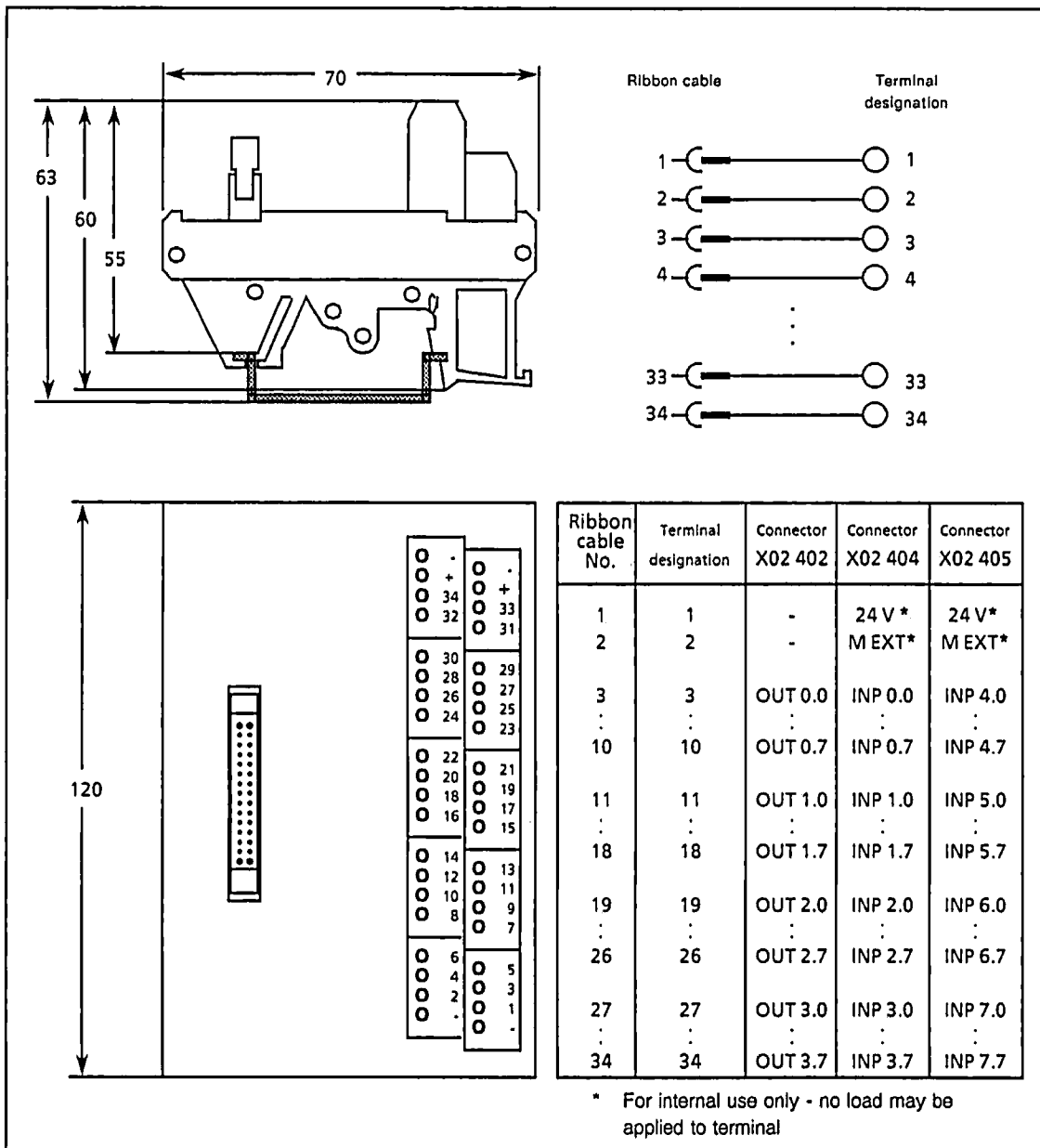




• Terminal strip converter without LEDs, for I/O submodule

Order No.: 6FC9 302-2AA

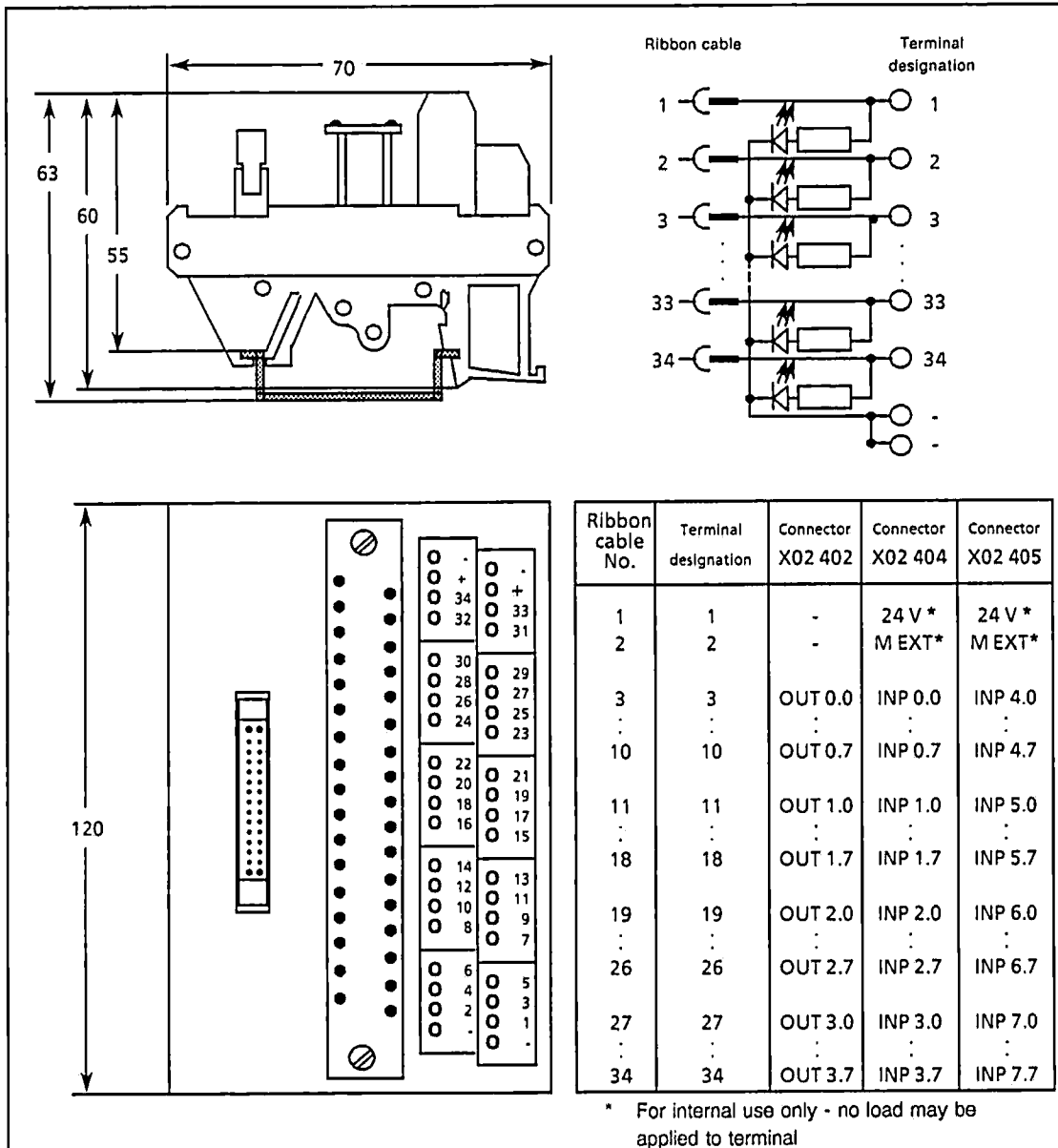
Nominal voltage: 24 V DC  
 No. of transmitted signals: 34  
 Nominal current: 0.5 A (x 34 terminals)  
 Connection type: 34-core ribbon cable/screw terminal  
 Nominal cross-section: 1.5 mm<sup>2</sup> (screw terminal)  
 Designation: SIEMENS 6FC 9302 AA  
 Locating socket: TS 32/TS 35  
 Colour: RAL 7032



• Terminal strip converter with LEDs, for I/O submodule

Order No.: 6FC9 302-2AB

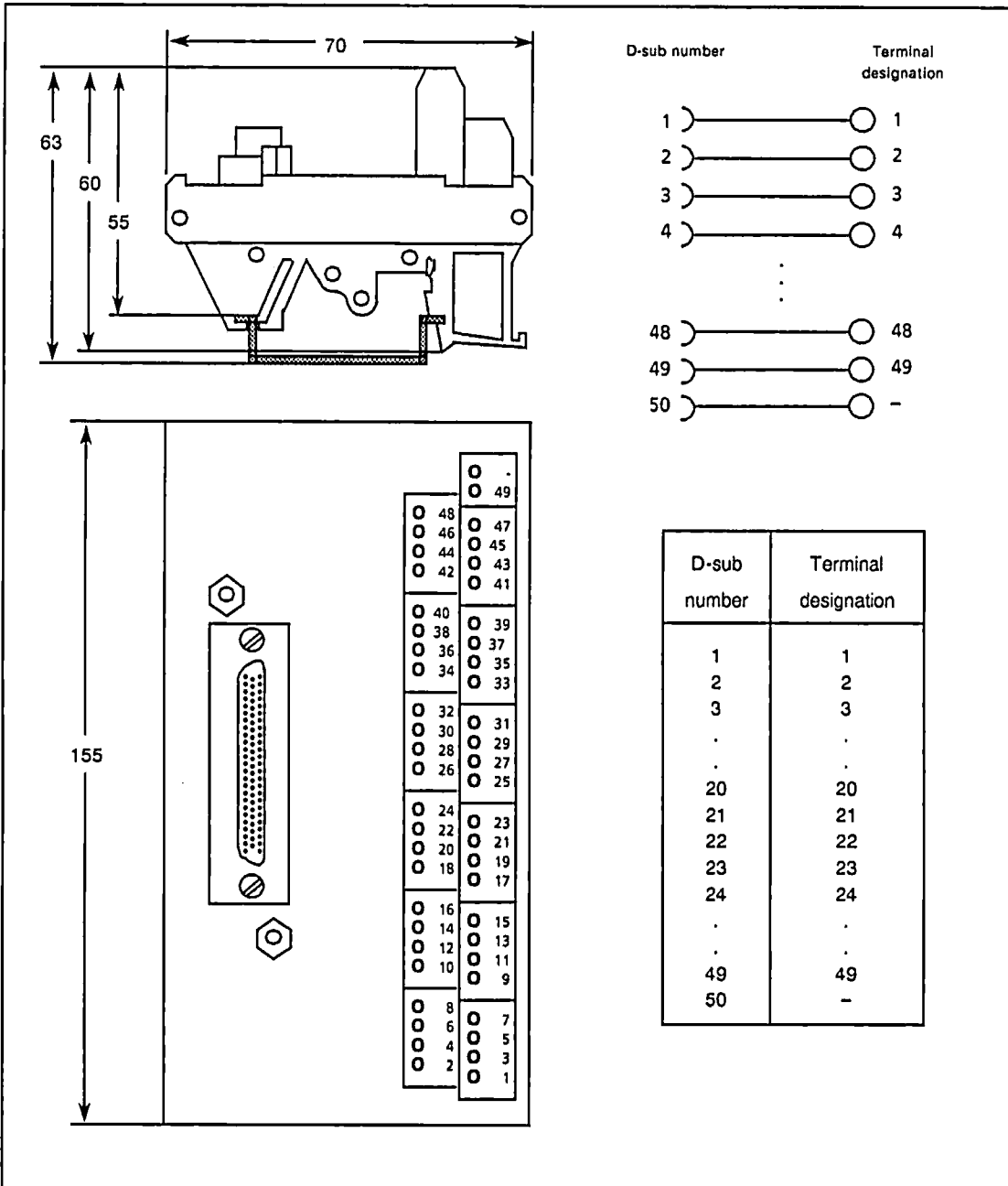
Nominal voltage:	24 V DC
No. of transmitted signals:	34
Nominal current:	0.5 A (x 34 terminals)
LEDs, red:	34x (plug-type, renewable)
LED current:	approx. 5 mA
Connection type:	34-core ribbon cable/screw terminal
Nominal cross-section:	1.5 mm <sup>2</sup> (screw terminal)
Designation:	SIEMENS 6FC 9302 AB
Locating socket:	TS 32/TS 35
Colour:	RAL 7032



• Terminal strip converter without LEDs, for output submodule

Order No.: 6FC9 302-2AF

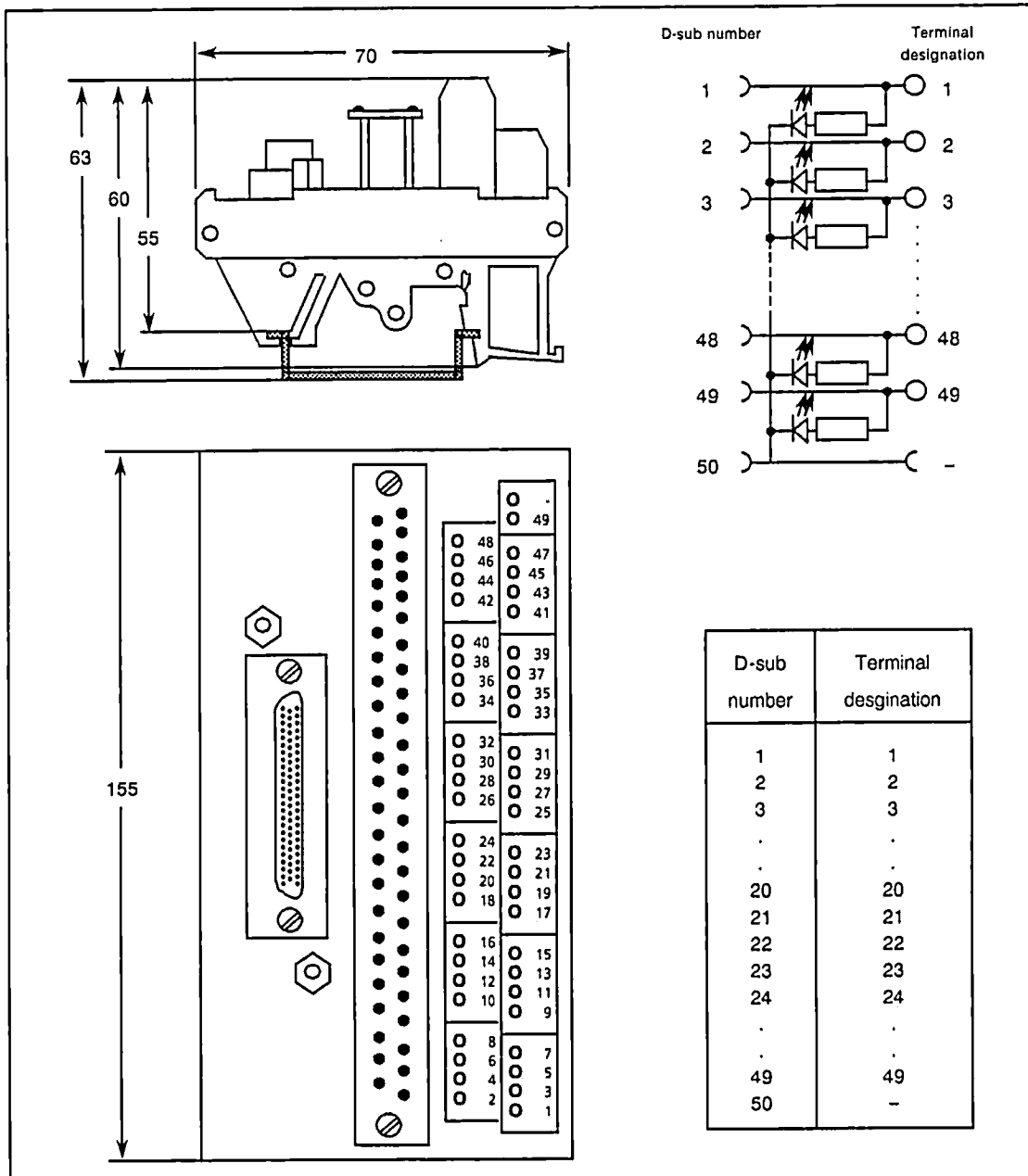
Nominal voltage: 24 V DC  
 No. of transmitted signals: 49  
 Nominal current: 0.5 A (x 49 terminals)  
 Connection type: 50-way D-sub female connector/screw terminal  
 Nominal cross-section: 1.5 mm<sup>2</sup> (screw terminal)  
 Designation: SIEMENS 6FC 9302-2AF  
 Locating socket: TS 32/TS 35  
 Colour: RAL 7032



• Terminal strip converter with LEDs, for I/O submodule

Order No.: 6FC9 302-2AG

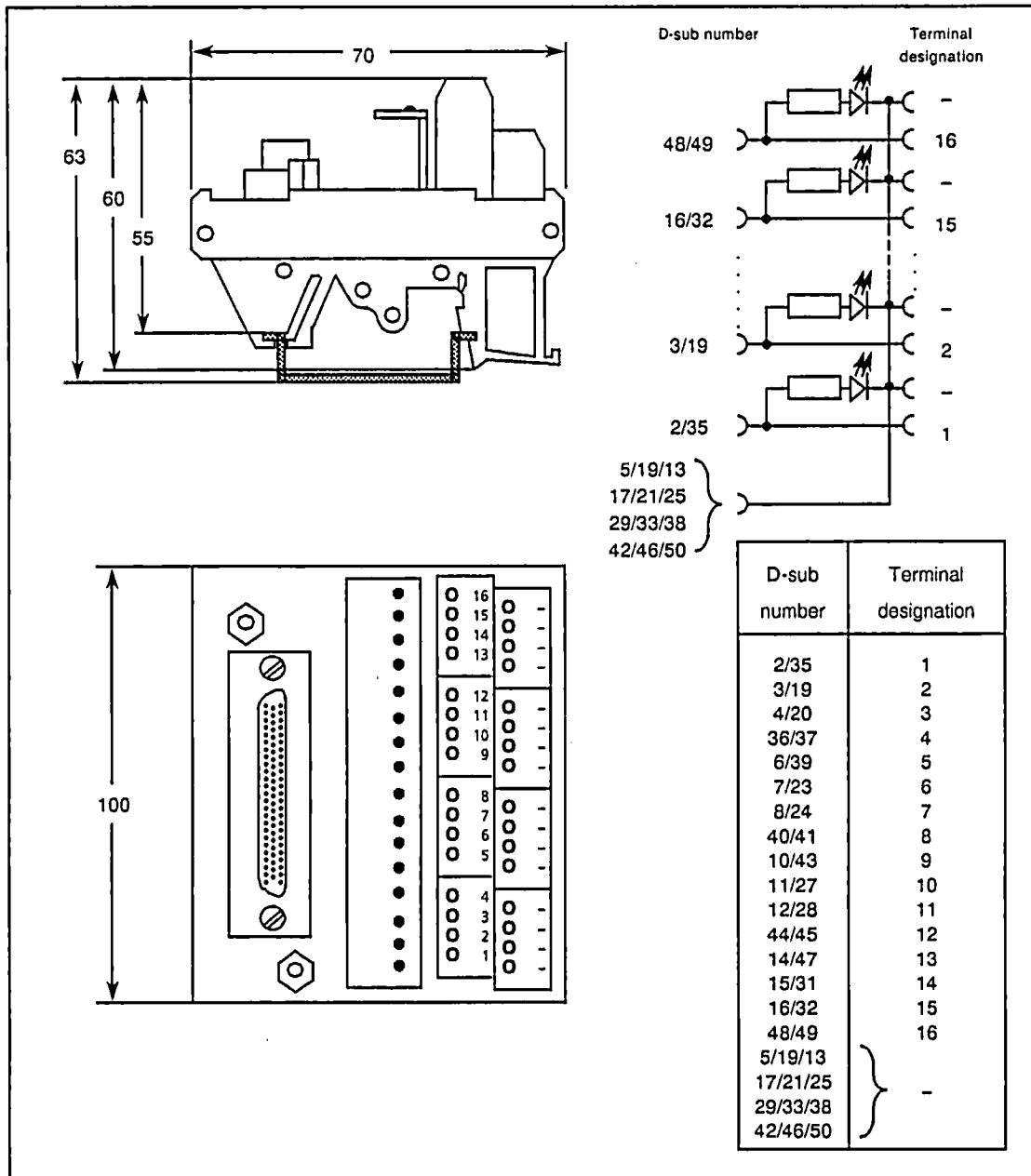
Nominal voltage:	24 V DC
No. of transmitted signals:	49
Nominal current:	0.5 A (x 49 terminals)
LEDs, red:	49 (soldered)
LED current:	approx. 5 mA
Connection type:	50-way D-sub female connector/screw terminal
Nominal cross-section:	1.5 mm <sup>2</sup> (screw terminal)
Designation:	SIEMENS 6FC 9302-2AG
Locating socket:	TS 32/TS 35
Colour:	RAL 7032



• Terminal strip converter with LEDs, for output submodule

Order No.: 6FC9 302-2AH

Nominal voltage:	24 V DC
No. of transmitted signals:	16
Nominal current:	2 A (x 16 terminals)
LEDs, red:	16 (soldered)
LED current:	5 mA
Connection type:	50-way D-sub female connector/screw terminal
Nominal cross-section:	1.5 mm <sup>2</sup> (screw terminal)
Designation:	SIEMENS 6FC 9302-2AH
Locating socket:	TS 32/TS 35
Colour:	RAL 7032



### 2.2.1.2 Installation conditions

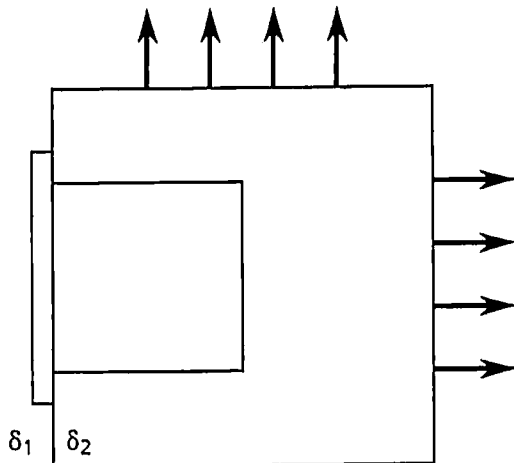
- Electrical and mechanical installation conditions

Device \ Conditions	Nominal voltage and tolerance	Max. power loss	Degree of protection (to DIN 40050)	Dimensions width height depth	Weight approx.
Central controller	220 V AC +/- 15%	240 W	IP 00	544 mm 816 mm 310 mm	80 kg
Operator panel	220 V AC +/- 15%	150 W	Front IP 54 Rear IP 00	530 mm 350 mm 370 mm	20 kg
I/O submodule M01 (6FC3 984 - 3RA)	24 V DC (20...30V including ripple)	7.5 W	IP 00	414 mm 150 mm 33 mm	1.3 kg
I/O submodule M02 (6FC3 984 - 3RB) and input submodule M03 (6FC3 984 - 3RC)	24 V DC (20...30V including ripple)	7.5 W	IP 00	391 mm 150 mm 22 mm	1.0 kg
Interface submodule for manual encoder M10 (6FC3 984 - 3RJ)	Internal voltage	7.5 W	IP 00	203 mm 150 mm 22 mm	0.5 kg
Machine control panel J85 (6FC3 188 - 3EF)	Internal voltage		Front IP 54 Rear IP 00	530 mm 144 mm 135 mm	1.2 kg
Control cabinet with heat exchanger		725 W at 10 K 1450 W at 20 K	IP 54	720 mm 1802 mm 852 mm	160 kg
DUO PLC P04 6FC3 985 - 4FE	24 V DC	75 W	IP 00		
PLC - EU P03 6FC3 981 - 4FD			IP 00	547 mm 440 mm 267 mm	20 kg
Power supply for PLC-EU P23 / 6FC3 981 - 4GD	24 V DC	75 W	IP 00		
Terminal strip converter 6FC3 302 - 2A.			IP 00	see dimension drawings	

- Climatic installation conditions

Device \ Conditions	Inlet air and ambient temperature in operation	Maximum temperature change	Permissible air humidity (to DIN 40040)
Central device	0 to 55° C	1,1 K / min	F
Operator panel	0 to 55° C	1,1 K / min	F
Input submodule M01 (6FC3 984 - 3RA)			
Input submodule M02 (6FC3 984 - 3RB) and input submodule M03 (6FC3 984 - 3RC)			
Interface submodule for manual encoder M10 (6FC3 984 - 3RJ)			
Machine control panel J85 (6FC3 188 - 3EF)	0 to 55° C	1,1 K / min	F
Control cabinet with heat exchanger	≤ 45 °C	1,1 K / min	F
DUO PLC P04 6FC3 985 - 4FE			
PLC - EU P03 6FC3 981 - 4FD	0 to 55° C	1,1 K / min	F
Power supply for PLC-EU P23 / 6FC3 981 - 4GD			
Terminal strip converter 6FC3 302 - 2A.			

• Heat removal (operator panel)



1) By convection

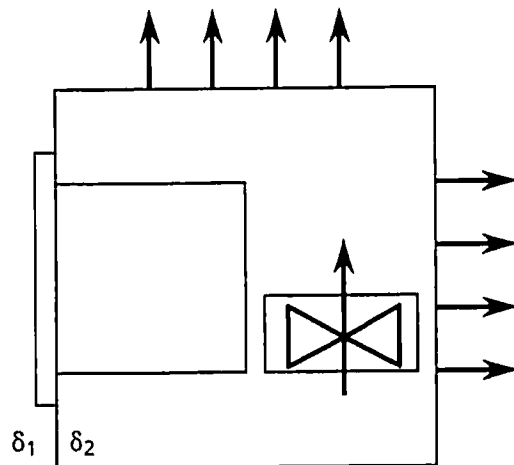
The housing surface of the surrounding space (steel or aluminium sheet 1.5 mm thick) is determined by the equation

$$A[\text{m}^2] = \frac{P_V [\text{W}]}{5 \times (\delta_2 - \delta_1) [\text{K}]}$$

$P_V$  is the sum of the power losses of the devices built into the housing (power loss  $\approx$  nominal power consumption)

$\delta_2$  is the temperature in the housing  
 $\delta_1$  is the ambient temperature

The above equation applies approximately for  $\delta_2 - \delta_1 \geq 10 \text{ K}$ . The front and underside of the housing are not taken into account in the surface calculation.



2) By forced air circulation in housing and convection

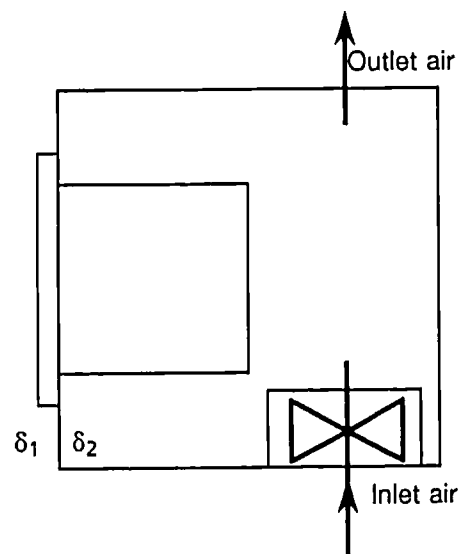
The following equation applies:

$$A[\text{m}^2] = \frac{P_V [\text{W}]}{10 \times (\delta_2 - \delta_1) [\text{K}]}$$

Prerequisites see 1)

Air flow through fan:

100 to 165 m<sup>3</sup> / h



3) Open-circuit ventilation

The air flow for removing the lost heat is determined by the equation

$$V[\text{m}^3 / \text{h}] = \frac{3,5 \times P_V [\text{W}]}{(\delta_2 - \delta_1) [\text{K}]}$$

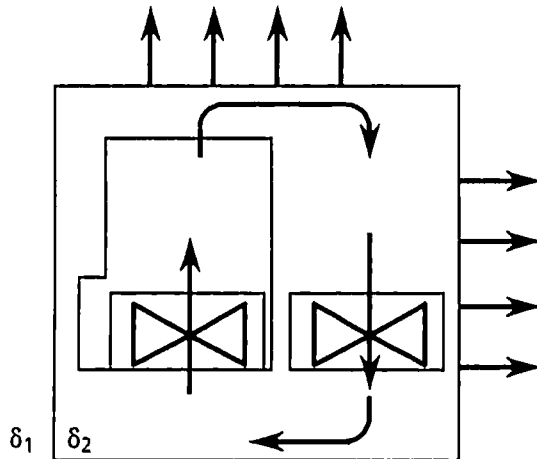
Prerequisites see 1)

Inlet air temperature  $\leq 55 \text{ }^\circ\text{C}$

(For determination of power loss  $P_V$  see Section 2.3.2)



- Heat removal (central controller)

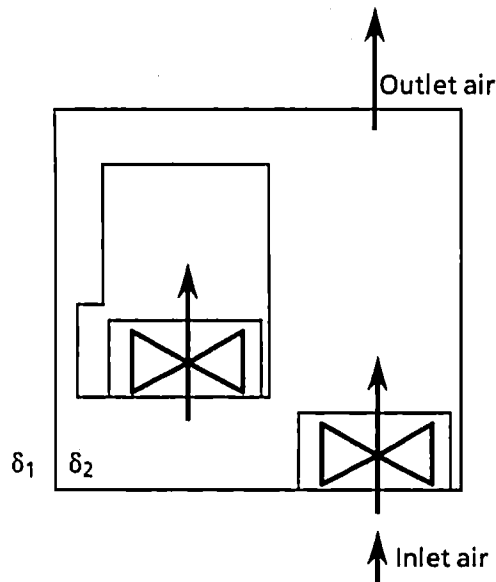


1) Heat removal by natural convection and internal turbulence of the air:

The necessary free convection surface of the surrounding space (steel or aluminium sheet 1.5 thick) is calculated approximately from the following equation, referred to a temperature difference  $\delta_2 - \delta_1 \geq 10\text{K}$ :

$$A[\text{m}^2] = \frac{P_V [\text{W}]}{10 \times (\delta_2 - \delta_1) [\text{K}]}$$

The surfaces of the front and underside are not allowed for in the calculation of convection surface.

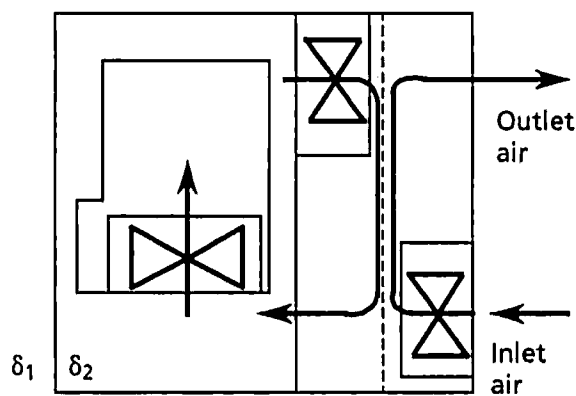


2) Heat removal by open-circuit ventilation

Inlet air temperature:  $\leq 55^\circ\text{C}$

The air flow required here for removing the lost heat is calculated from:

$$V[\text{m}^3/\text{h}] = \frac{3,5 P_V [\text{W}]}{(\delta_2 - \delta_1) [\text{K}]}$$



3) Heat removal by means of heat exchanger

The heat exchanger to be selected depends on the power loss to be removed.

Maximal temperature in cabinet:  
+55 °C

(For determination of power loss  $P_V$  see Section 2.3.2)

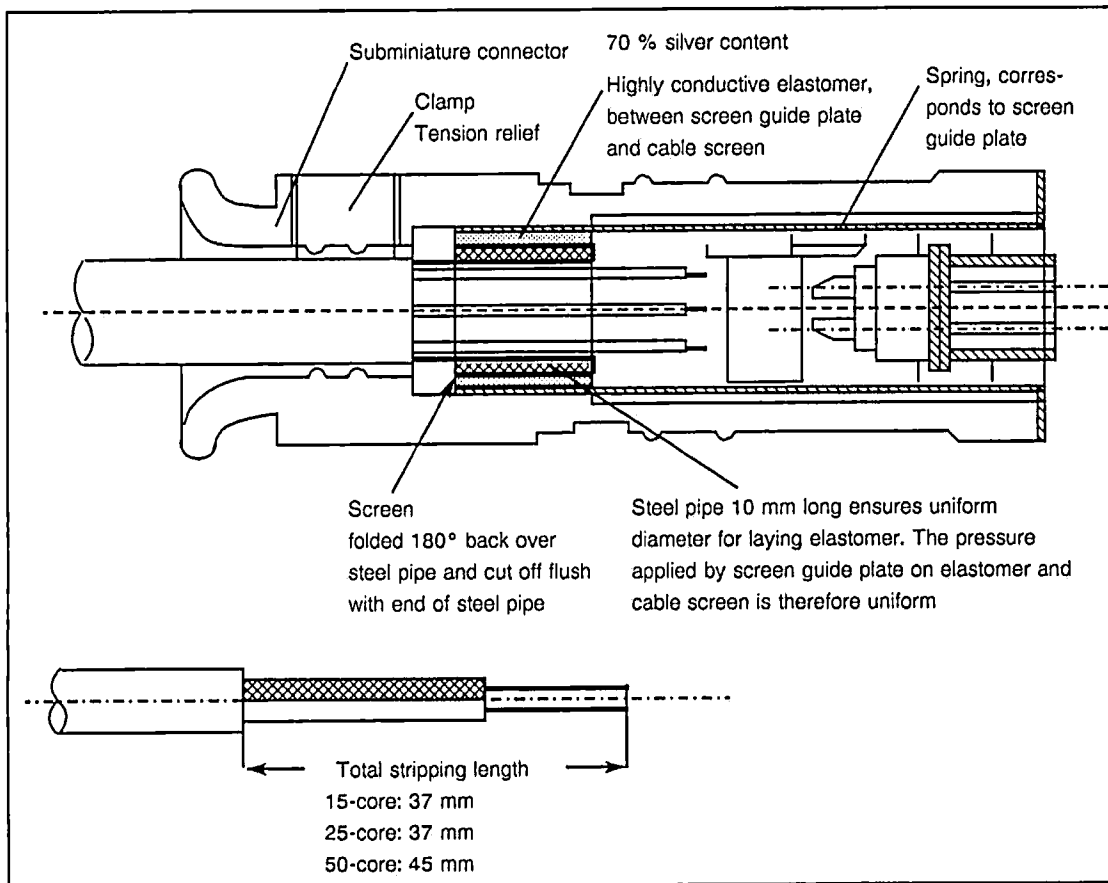
### 2.2.1.3 Cables and connectors

The units must be connected only with the prescribed types of cable in accordance with the overview of cables and devices (Section 7.5).

In the overview of cables and devices and in the lists of accessories (Section 7.1) the maximum possible cable lengths are given. The cable screen is connected to the subminiature connector as shown in the installation scheme.

The cables must be protected against mechanical damage, for example by means of cable channels or sheet metal covers. Penetration of oil, coolant or chips must be avoided. Communications cables must not be run in parallel to power cables. Cables not belonging to the control must not be taken through the central controller.

The connectors must be securely screwed onto the front panels of the modules.



#### Connector features

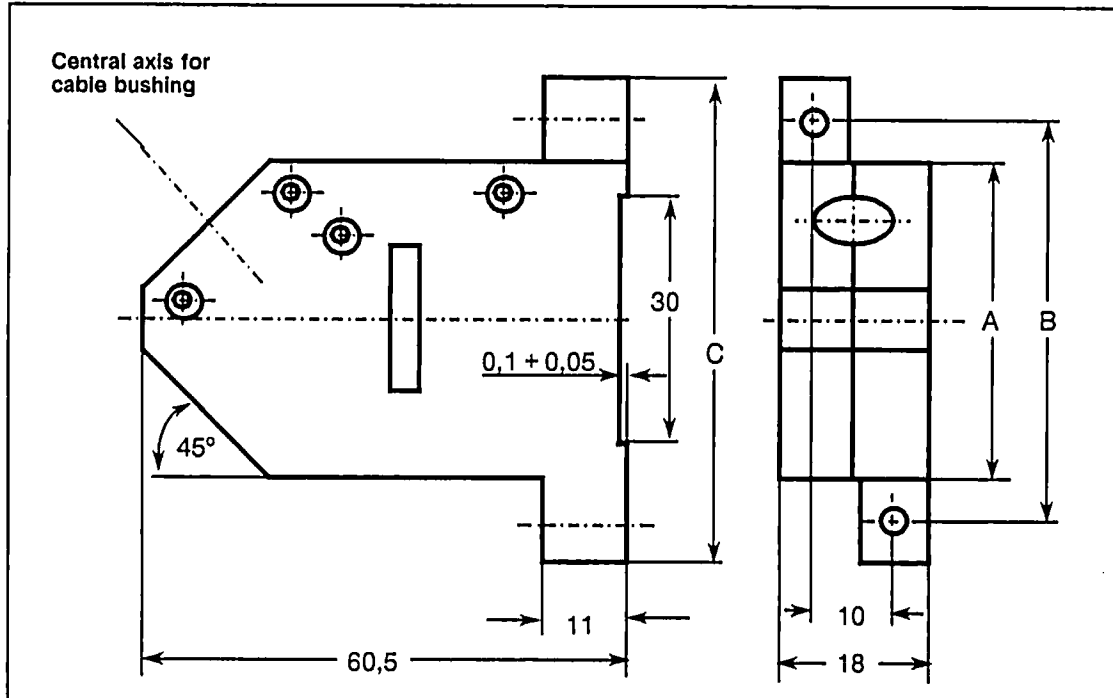
1. Uniform international standard connector as 15, 25 and 50-way version with special SINUMERIK housing.
2. Securing of the connector by means of captive screws on the front panels of the printed circuit boards.
3. Cable strain relief in the connector.
4. Plug-in coding for unmistakable connection of the cable connector.
5. Perfect connection to frame between cable outside screen and in electronics of the SINUMERIK by means of springs fitted in the connector.

## Installation rules

On the NC side, this Siemens subminiature connector must be used because no commercially available connector housing has these features. If the customer makes his own cable, the installation rules must definitely be followed, otherwise proper functioning cannot be guaranteed.

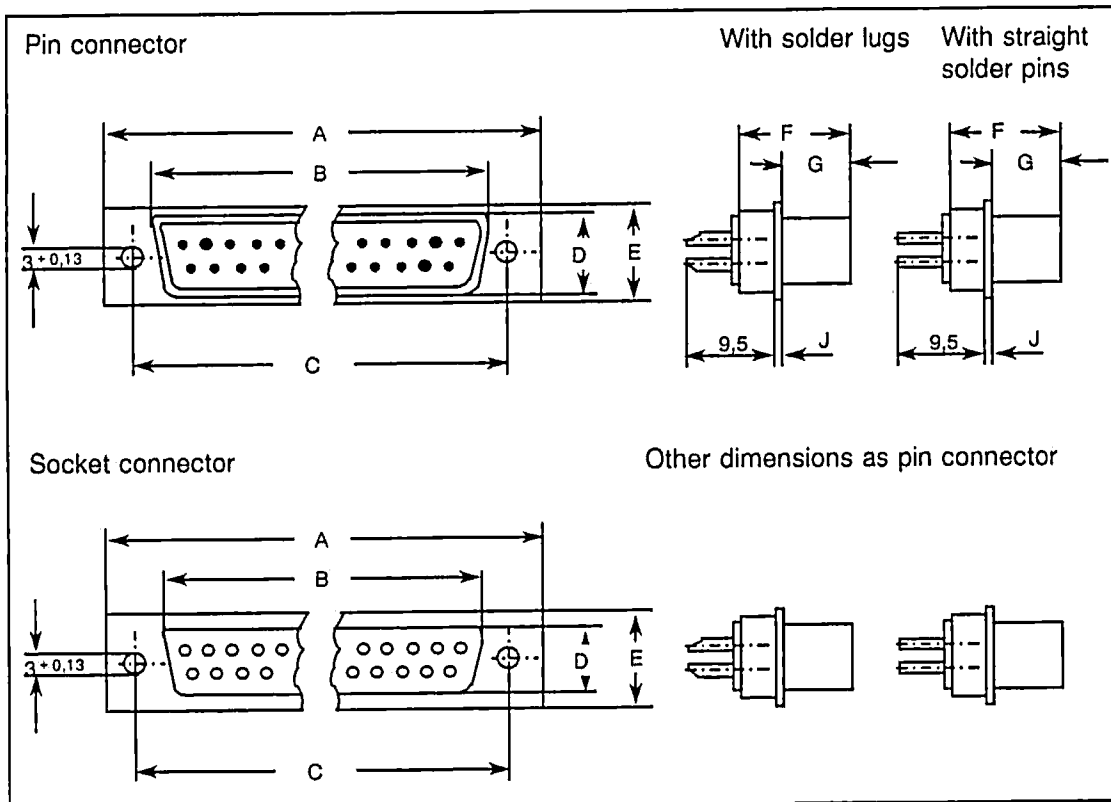
## Subminiature connector with SINUMERIK housing

## Dimension drawing



Submin. connector	Dim. A	Dim. B	Dim. C	Order No.: (complete with housing)
15-way female	43	53	63	6FC9 341 - 1EC
25-way female	57	67	77	6FC9 341 - 1ED
37-way female	71	81	91	6FC9 341 - 1FH
50-way female	71	81	91	6FC9 341 - 1EE
15-way male	43	53	63	6FC9 341 - 1EU
25-way male	57	67	77	6FC9 341 - 2AB
50-way male	71	81	91	6FC9 341 - 1EH

Installation data

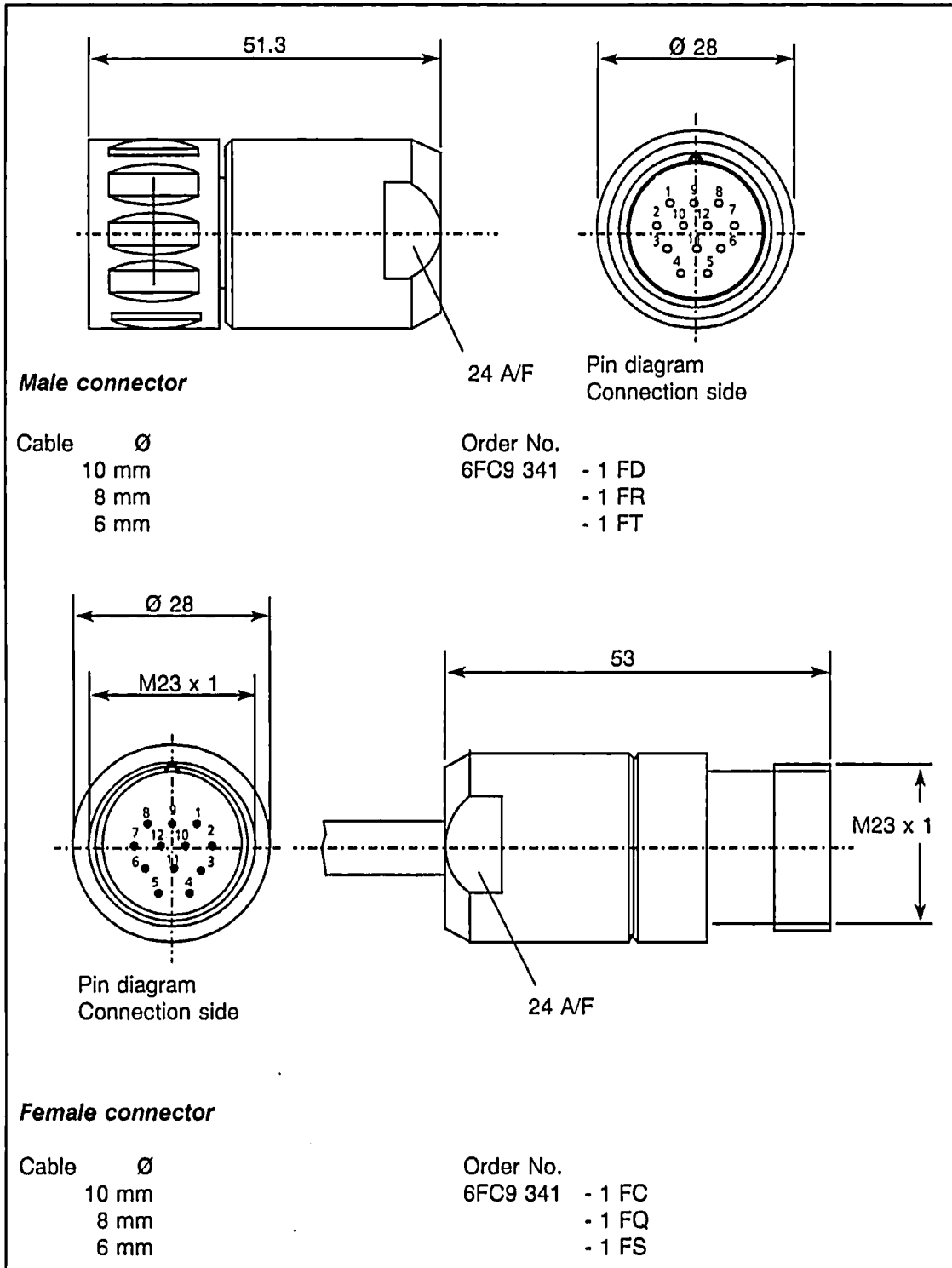


Number of pins	Con- nector	A in mm	B 1) in mm	C in mm	D 1) in mm	E in mm	F in mm	G in mm	J in mm
15	Pin	39.1	25.2	33.3	8.4	12.5	10.8	5.9	1.0
15	Socket	39.1	24.6	33.3	7.8	12.5	10.8	6.2	0.9
25	Pin	53.0	38.9	47.0	8.4	12.5	10.8	5.9	1.0
25	Socket	53.0	38.3	47.0	7.8	12.5	10.8	6.2	0.9
37	Pin	66.9	52.8	61.1	11.1	15.4	10.8	5.9	1.0
37	Socket	66.9	52.4	61.1	10.7	15.4	10.8	6.2	0.9
50 2)	Pin	66.9	52.8	61.1	11.1	15.4	10.8	5.9	1.0
50 2)	Socket	66.9	52.4	61.1	10.7	15.4	10.8	6.2	0.9

1) Dimensions are inside for pin connector and outside for socket connector

2) Three rows of pins/sockets

**Siemens connector for rotary encoder**

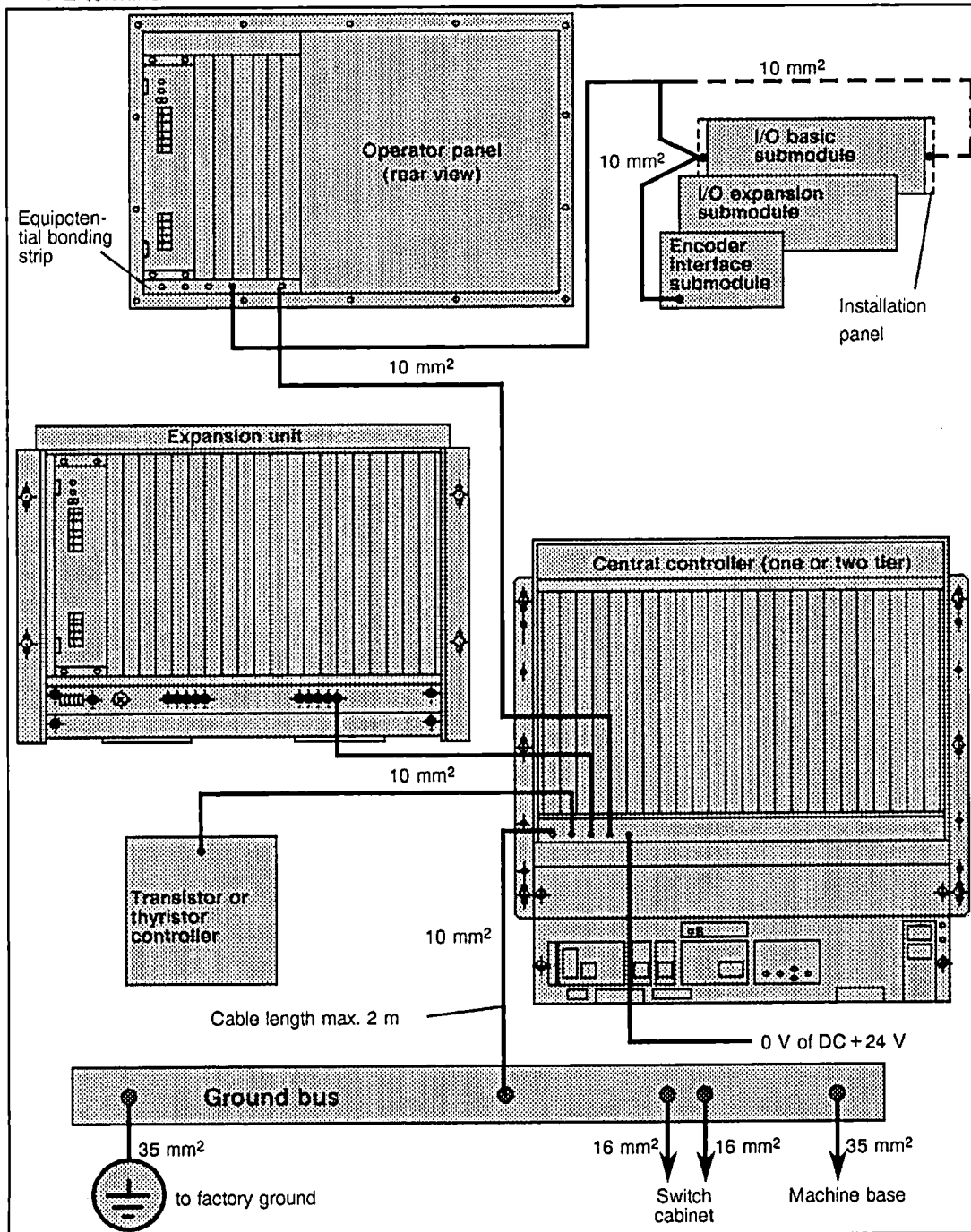


### 2.2.1.4 Grounding concept

Proper grounding, to discharge external interference, is essential for troublefree operation. Ground lines must be without loops and have the required cross-section (also see commissioning instructions and operating manual).

#### Grounding concept:

- Grounding is in accordance with the requirements of DIN VDE 0160.
- The same grounding concept applies to NCs, PLCs, drives and machines.
- Ground connections are run point-to-point to a central grounding location.
- Equipotential bonding of the external components is effected by means of a bonding jumper.
- PE terminal



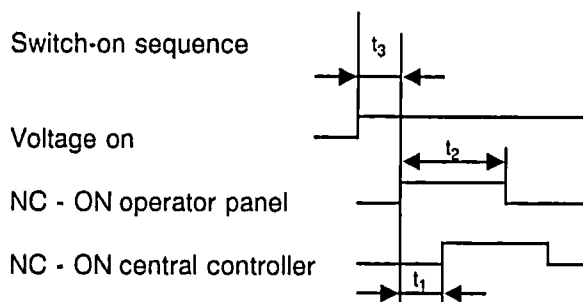
Typical configuration of equipotential bonding conductors

### 2.2.1.5 Power supply connection and switch-on conditions

- **General**

- The NC-ON of the operator panel power supply and the central controller power supply must not be connected together.  
The enable inputs of the two power supplies must not be connected to each other.
- The NC-ON must be screened (see Section 3.3.8).
- The NC - ON must be provided as a momentary contact pushbutton with two normally open contacts (no switch).  
With the power supplies central controller 6EW1 861-1AC (25 A, 850 only), central controller 6EW1 861-2AC (40 A) and operator panel 6EW1 861-3AB, the NC-ON can also be a **switch** or jumper.

- Switch-on sequence



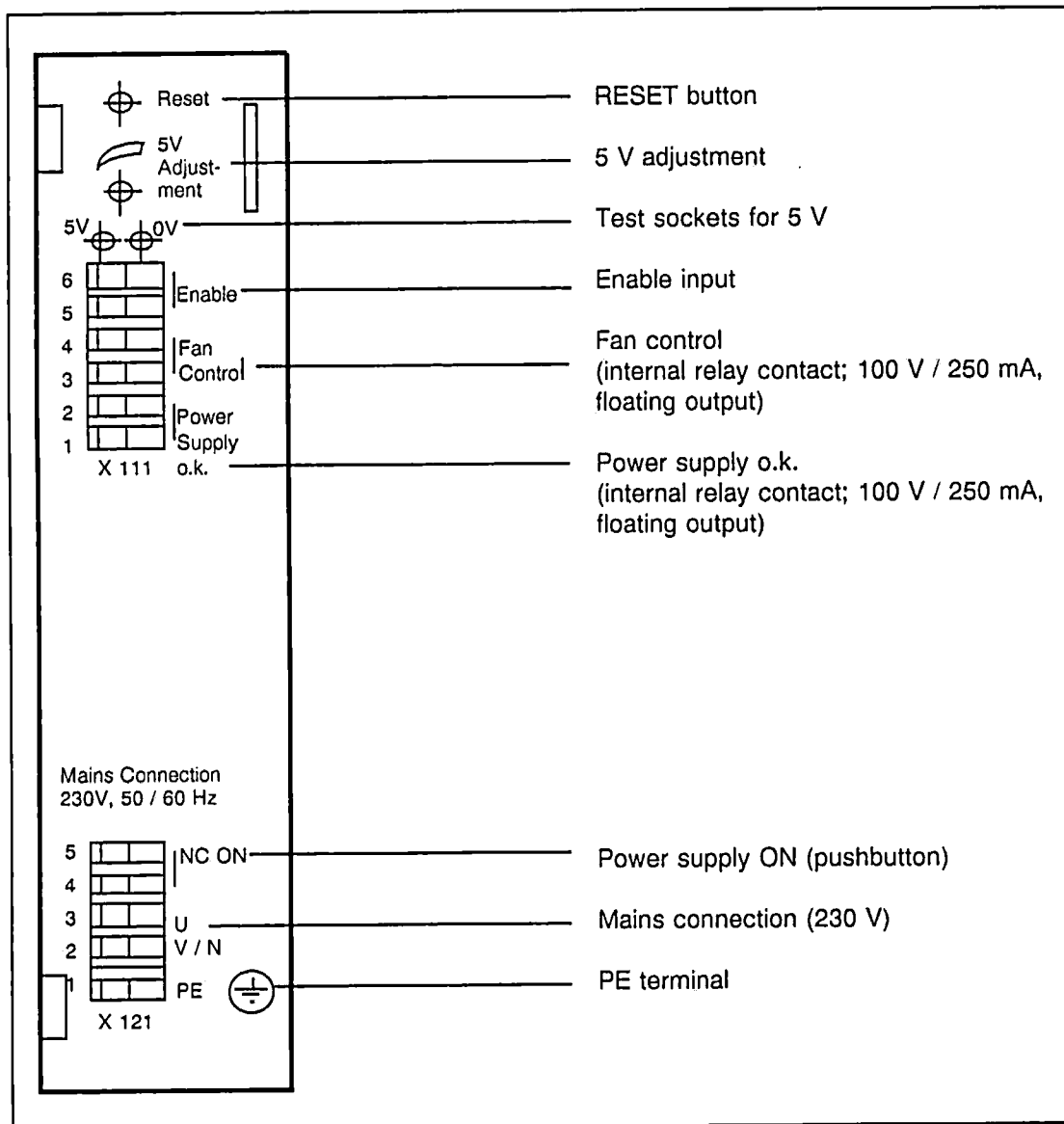
The time  $t_3 \geq 500$  ms must have elapsed before NC-ON is operated (except with power supplies stated above).

The time  $t_1$  must be  $\geq 0$  seconds, i.e. the NC-ON of the operator panel must be pressed before (or at the same time as) the NC-ON of the central controller. The pushbutton must be operated at least for a time of  $t_2 = 500$  ms ( $t_2 = \infty$  if NC-ON is a switch with the appropriate power supplies).

The power supplies of the external PLCs and/or expansion units must be switched on before (or at the same time as) the control.

- The operator panel can be switched on again only after a period of 10 seconds, as otherwise the screen can be damaged or the synchronization will not be correct (display moves across the screen or does not appear at all).
- The supply of the I/O submodules is designed for 20-30 V including ripple. The supply voltage must be generated from the mains voltage by means of an additional power supply unit.
- When connecting the input voltage to the power supplies, all relevant standards and rules (VDE 0160, EC 550) must be followed.

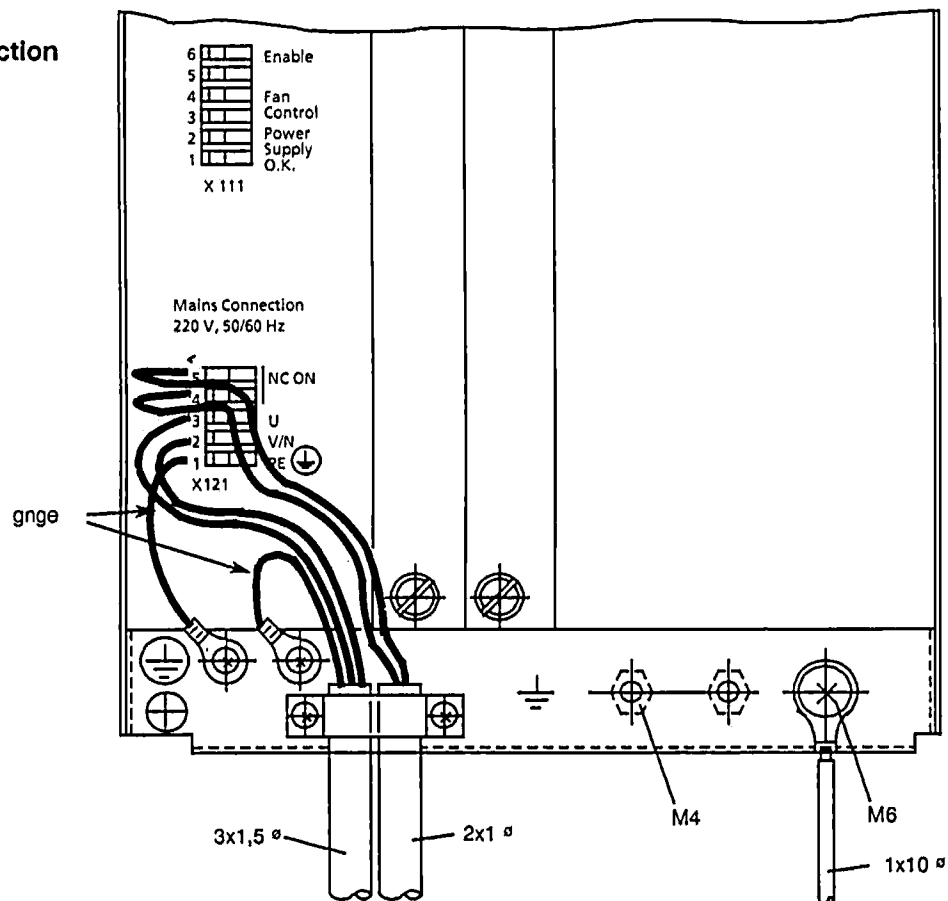
• Power supply operator panel





**- Technical data**

Input voltage	220 V + 6 % / -10 %	Operating temperature	0 to + 55° C
	Single phase / neutral with loadable neutral	Storage and trans- portation temp.	- 40 to + 70° C
Other voltages to be matched by means of auto- transformer	Two-phase phase / phase without loadable neutral	Humidity rating (DIN 40040)	F
		Degree of pro- tection	IP 00 IP 20 (built-in)
Frequency	48 to 63 Hz	Vibration and impact load (DIN 20010)	
		stationary	12
		transportation	22
Power consumption for operator panel	215 VA + fan + CRT display		
Permissible voltage interrupt with:			
- nominal voltage	UN	max 10 ms	
-	UN - 15 %	max. 3 ms	

**- Mains connection**

• **ON/OFF conditions**

(Prerequisite: jumpered ENABLE inputs)

The NC ON button must be pressed to switch on.

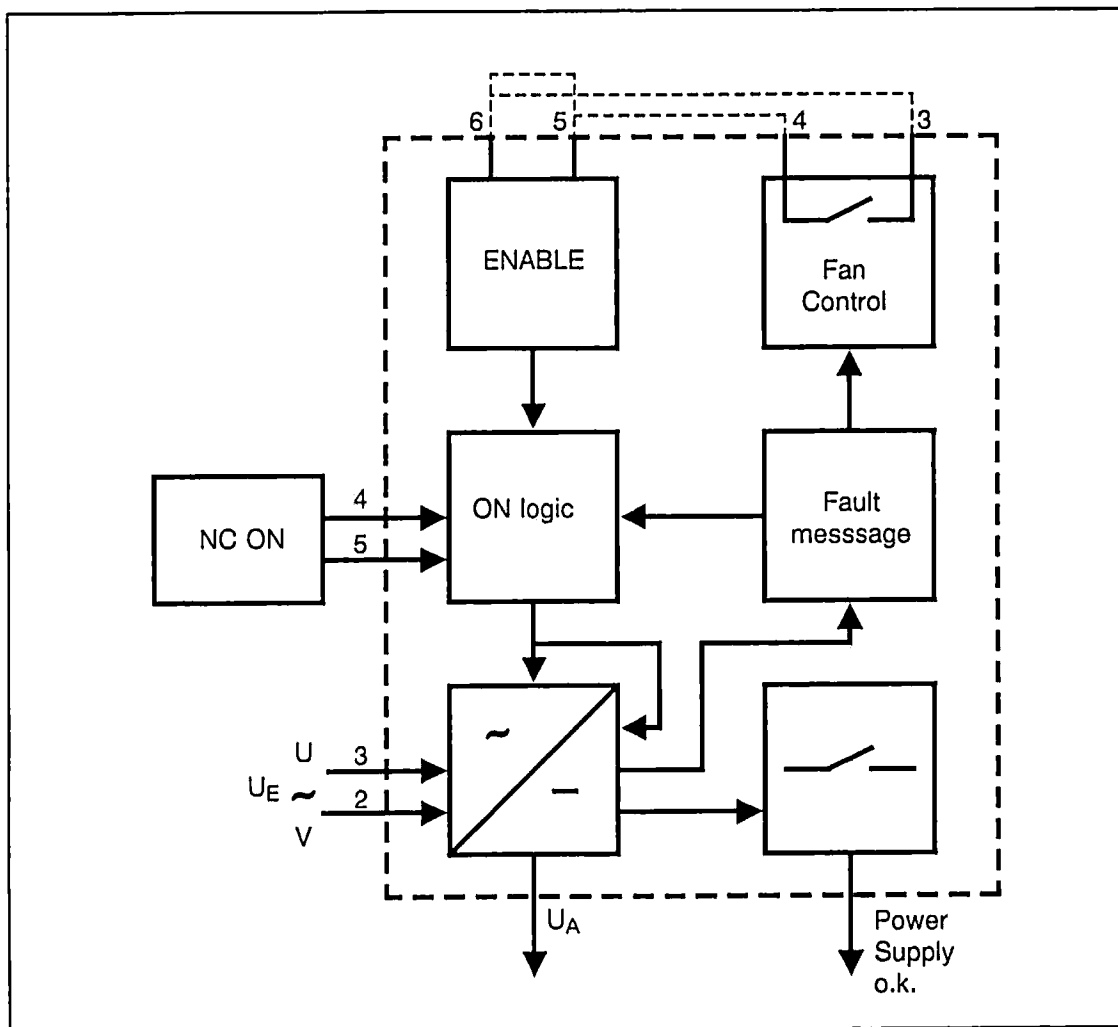
If the output voltage has not been reached after 500 ms, the power supply switches off.

The power supply also switches off if the monitoring system responds.

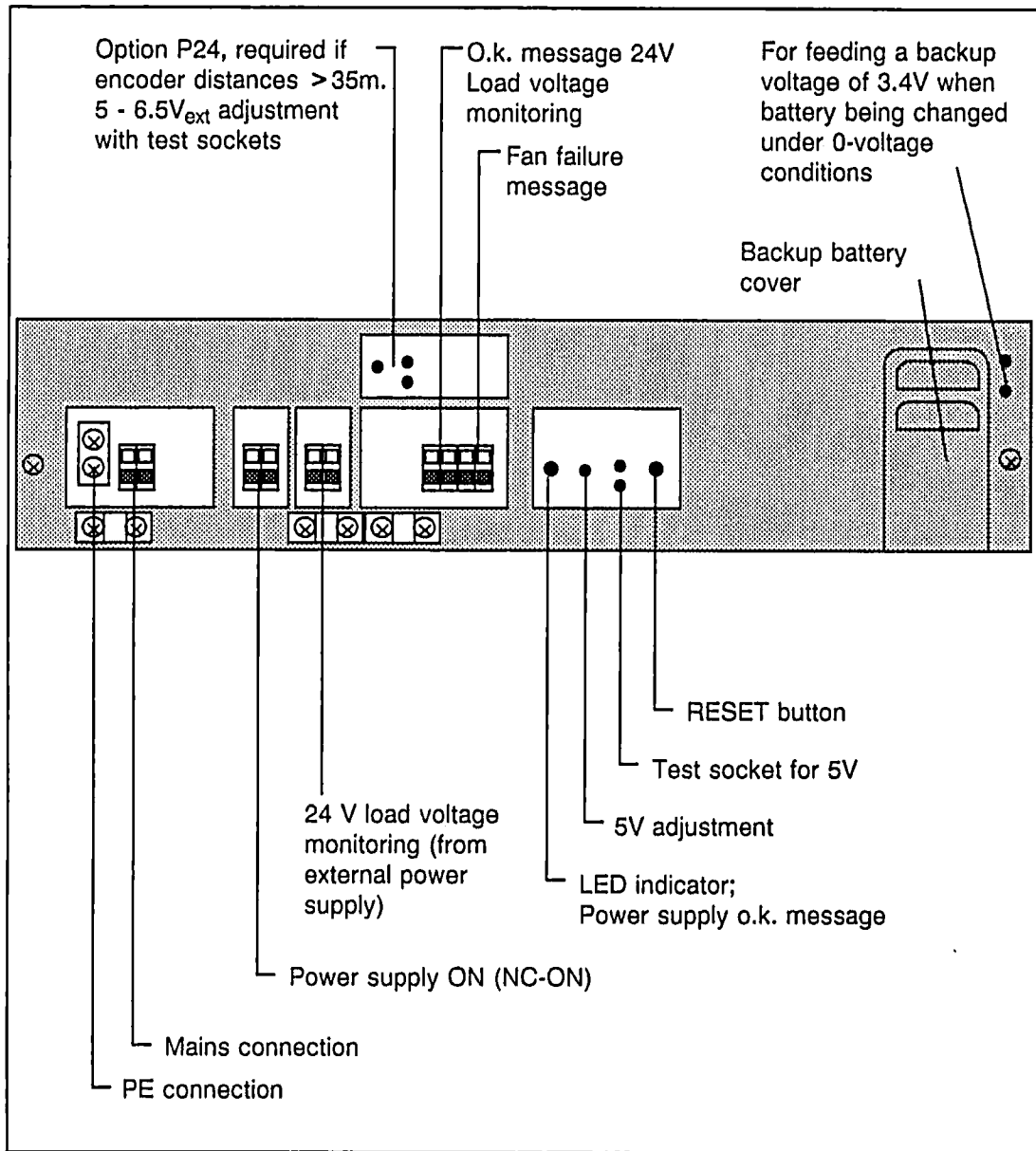
The power supply switches on again by operating the NC ON button (the fault must no longer exist).

• **Outline diagram for ON/OFF logic**

- Only ENABLE jumpered (jumper 5-6):  
 Fan failure is signalled as FAN CONTROL (connection 4-3) and can be evaluated by the customer.
- FAN CONTROL jumpered with ENABLE (jumpers 5-4; 6-3):  
 The power supply switches off in the event of fan failure.



• Power supply central controller

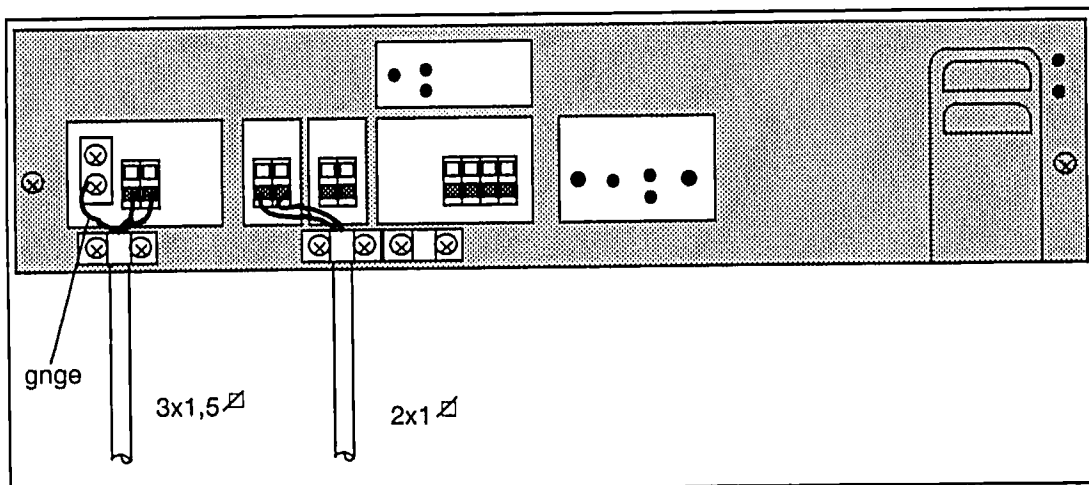


- **Technical data**

Input voltage	220 V - 10%/ + 6% Single-phase phase/neutral with loadable neutral Two-phase phase/phase without loadable neutral Other voltages must be matched by means of autotransformer
Frequency	48 to 63 Hz
Power consumption for central controller	700 VA + fan
Permissible voltage interrupt with:	
- nominal voltage $U_N$	max. 10 ms
- $U_N - 15\%$	max. 3 ms
Permissible noise voltage	to VDE 10 D
Operating temperature	0 bis 55 ° C
Storage and transportation temperature	- 40 to + 70 ° C
Humidity rating (DIN 40040)	F
Degree of protection	IP 00 IP 20 (built-in)
Vibration and impact load (DIN 20010)	
stationary	12
transportation	22

- **Mains connection**

When connecting the input voltage to the power supply, all relevant standards and rules must be observed (DIN VDE 0160)



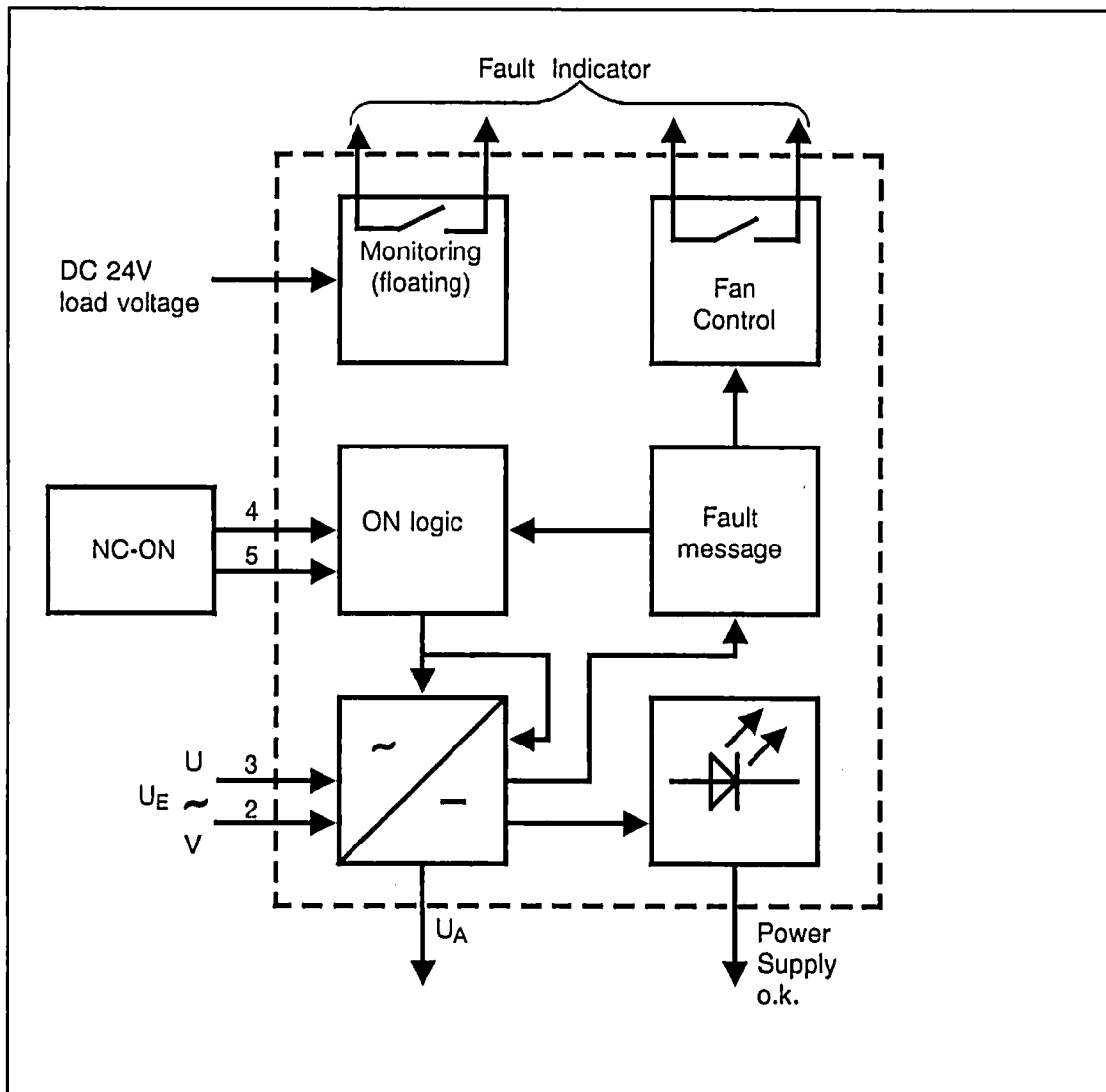
- **ON/OFF conditions**

The NC ON button must be pressed to switch on.

If the output voltage has not been reached after 500 ms, the power supply switches off. The power supply also switches off if the monitoring system responds.

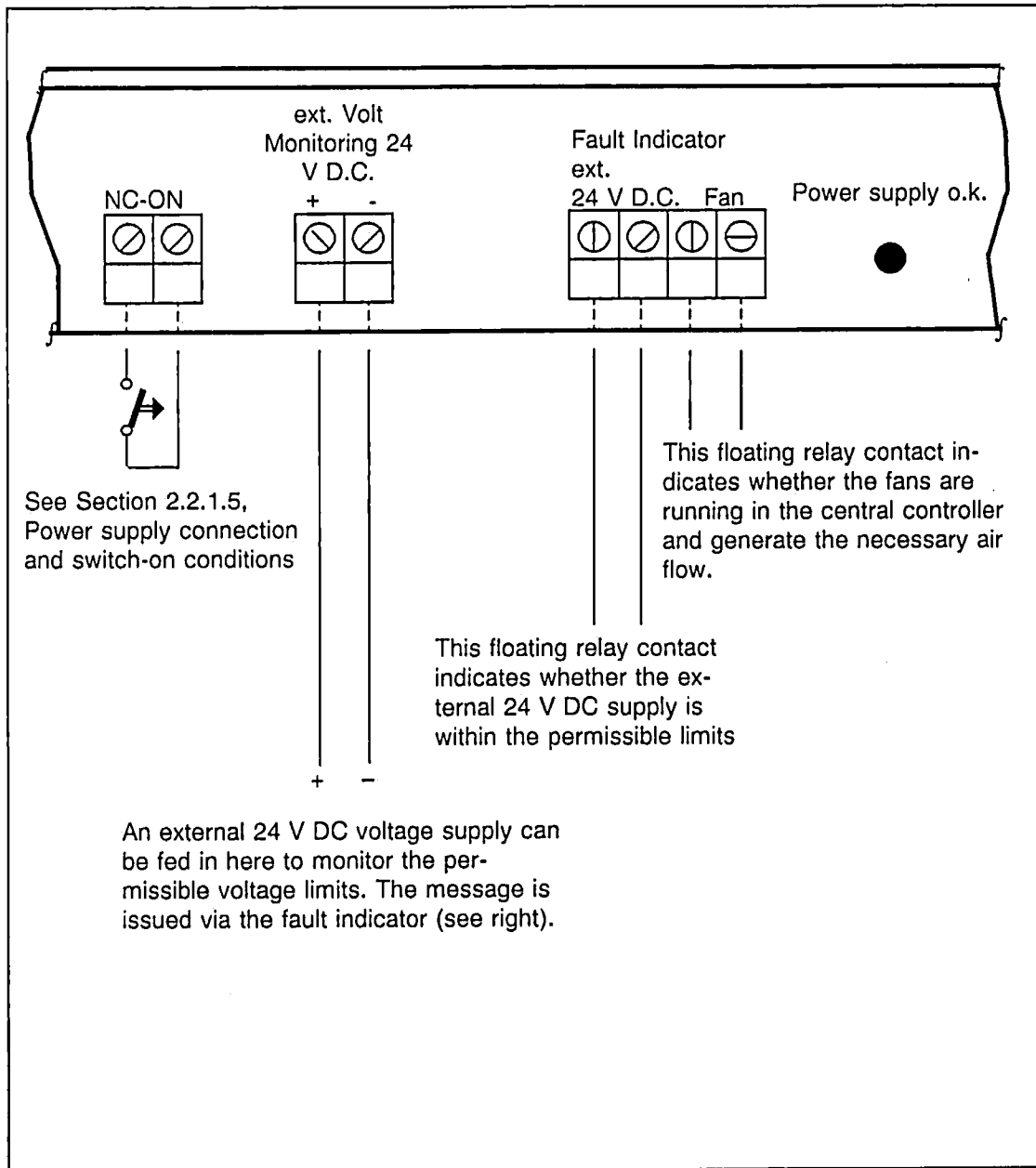
The power supply switches on again by operating the NC ON button (the fault must no longer exist).

- **Outline diagram for ON/OFF logic**



- Monitoring logic

Power supply central controller



2.2.1.6 Interference suppression

Beside the protective grounding of the system components in accordance with VDE specifications, special measures are necessary to ensure safe and interference-free operation of the system. These measures include screened signal cables as well as special equipotential bonding and frame connections.

### Screened signal cables

To ensure that the installation operates safely and without disturbance, screened cables must be used in accordance with the various drawings. The only cable connectors which are approved are those specified in Section 2.2.1.3 (cables and connectors). The Siemens special connectors guide the cable screen over a wide area and positively to the housing of the unit and thus to reference potential. All units of the control having their own power supply connect the internal reference potential to the housing of the unit.

The reference potentials of the housings of the units with their own power supply are connected together via the cable screens. The screens are therefore connected on both sides. If, for design reasons, the screen cannot be connected on both sides, 4 equipotential bonding conductors are required in order to limit the current in the cable screens.

These must be connected on both sides to the respective housings.

In the case of units without their own power supply but with 5 V power supply from the associated component unit of the control (e.g. incremental encoder), the screen on the device itself remains unconnected because these devices cannot be of insulated construction. No equipotential bonding conductors are used. The reference potential M of these devices must not be connected with the housing. It is connected to the reference potential of the associated components units of the control only via the signal cables.

Cables for transmitting low frequency signals (e.g. relay interface) are laid with screening in the cabinet up to the jumper board (one-sided screen connection on the central controller).

If signals cannot be grouped together in the cable, e.g. single connection of command devices (digital input / output of the PLC), unscreened single wires are laid. These signal lines must be placed in their own channels, separate from power cables.

## 2.2.2 Input/output modules

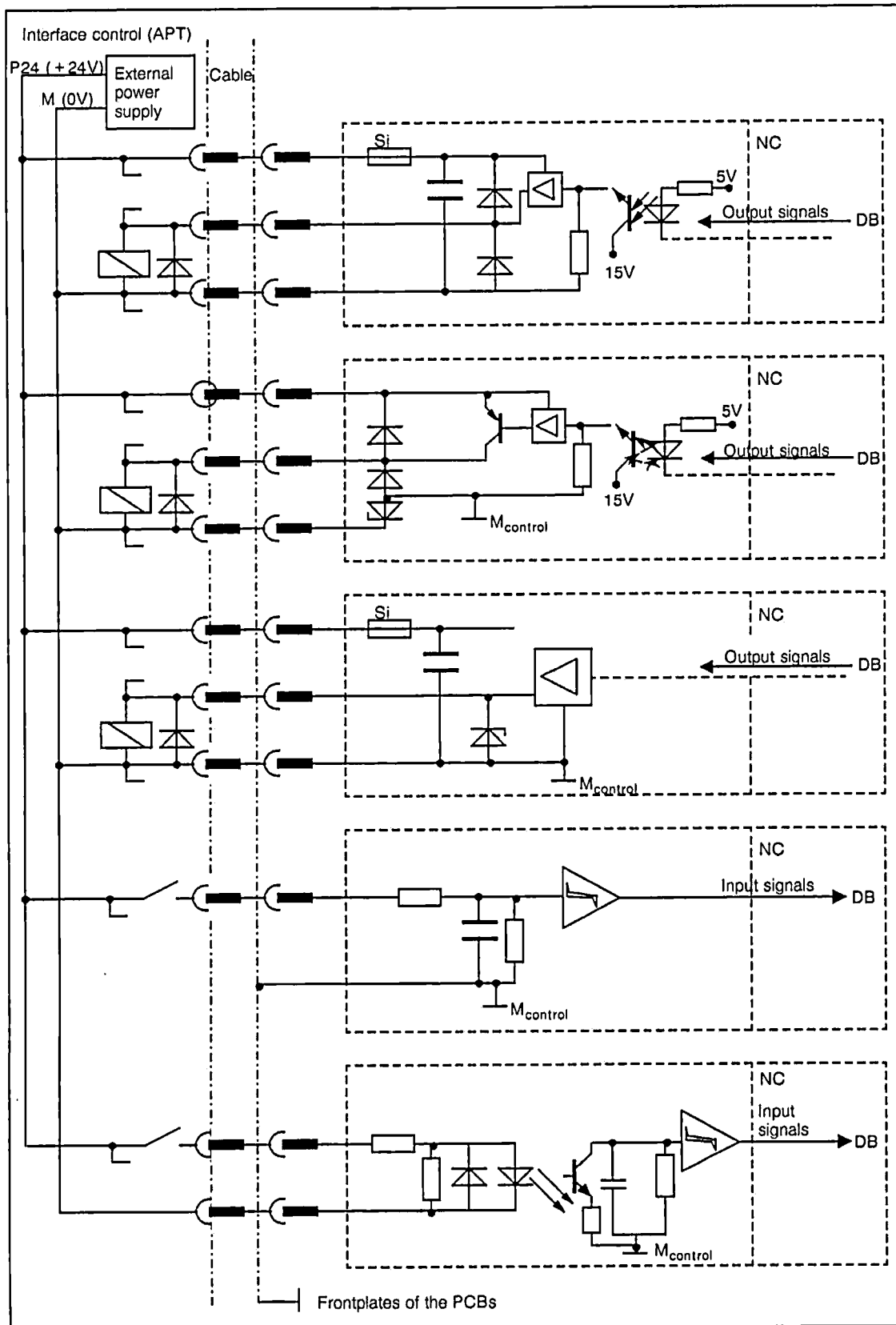
The input/output modules are specific to the SINUMERIK system. They can be used universally as I/O modules in the integrated PLC or in the SINUMERIK expansion units.

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

### 2.2.2.1 Overview of the available SINUMERIK I/O modules

Module	In-puts	Out-puts	Output current (nom. value)
6FX1 118 - 4AA (N81)	48	24	100 mA
6FX1 192 - 4AA (N83)	96	-	-
6FX1 130 - 6BA (N84)	-	48	500 mA
6FX1 111 - 4AB (N85)	32	32	100 mA
6FX1 112 - 0AA (N82)	-	16	2 A

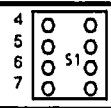
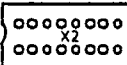
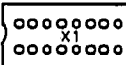
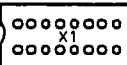
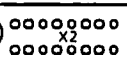
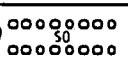
### 2.2.2.2 Signal flow and wiring arrangements







### 2.2.2.3 Addressing of the I/O modules

The PCBs can be plugged-in in any order in the frame.

Byte addr.	6FX1 118 - 4AA 48INP (6 bytes) 24OUT (3 bytes)	6FX1 192 - 4AA 96INP (2x6 bytes)	6FX1 130 - 6BA 24OUT (6 bytes) 24OUT (6 bytes)		6FX1 111 - 4AB* 32INP (4 bytes) 32OUT (4 bytes)	6FX1 112-0AA** 16OUT (2 bytes)
						
0						
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
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27						
28						
29						
30						
31						

\* In modules as from version AC, jumper 3-14 is omitted 

\*\* In modules as from version AC, jumper 8-9 is omitted 

Every module is provided with a number by jumpering; this also defines the address area.


Byte addr.	6FX1 118 - 4AA 48INP (6 bytes) 24OUT (3 bytes)	6FX1 192 - 4AA 96INP (2x6 bytes)	6FX1 130 - 6BA 24OUT (6 bytes)   24OUT (6 bytes)		6FX1 111 - 4AB 32INP (4 bytes) 32OUT (4 bytes)	6FX1 112 - 0AA 16OUT (2 bytes)
32						
33						
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Addresses cannot be allocated

Addresses can be assigned to other modules

## 2.2.2.4 Electrical specifications

	6FX1 118 - 4AA / N81	6FX1 192 - 4AA / N83	6FX1 130 - 6BA / N84	6FX1 111 - 4AB / N85	6FX1 112 - 0AA / N82
Number of inputs Electrical isolation	48 no	96 no	5.2 mA	32 yes	6.4 mA
Input voltage (nominal value)	24V DC	24V DC		24V DC	
Input voltage - for signal "0"  - for signal "1"	-3V to +5V or input open  +14V to +30V	-3V to +5V or input open  +14V to + 30V		-2.1V to +5V   +15V to +30V	
Input current with signal "1"	typ.	5.2 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	
Line length for cable	50 m	50 m		50 m	
Number of outputs Electrical isolation	24 no	3.6V      --- 3)  100Hz 11Hz 2Hz		48 no	
Supply voltage $U_p$ - nominal value - ripple $U_{pp}$ - permissible range (including ripple)	24V DC max.  20V to 30V		24V DC  18V to 32V	24V DC 3.6V  20V to 30V	24V DC 3.6V  20V to 30V
Output current with signal "1" - nominal value	100 mA		500 mA	100 mA	2 A
Short-circuit protection	none		electronic	none	electronic
Limitation of inductive cut- out voltage to the switch- ing capacity for lamps	-0.7V max.		-0.7V  10W	-0.7V  10W	-13VS --- 3) 10W
Switching frequency with - ohmic load - lamps - inductive load 1)	max. max. max.		100Hz 11Hz 2Hz	100Hz 11Hz 2Hz	100Hz 11Hz 2Hz
Overall loading capacity 2) at 55°C	50%		50%	50%	50%

	6FX1 118-4AA / N81	6FX1 192-4AA / N83	6FX1 130-6BA / N84	6FX1 111-4AB / N85	6FX1 112-0AA / N82
Signal level of output - with signal "0" max. - with signal "1" min.	output open U <sub>P</sub> -1.7V		output open U <sub>P</sub> -1.5V	output open U <sub>P</sub> -1.7V	output open U <sub>P</sub> -1.7V
Line length for cable max.	50m		50m	50m	50m
Insulation voltage external connections against housing - to VDE 0160 - tested with	125 V DC 125 V AC	---	---	125 V DC 125 V AC	125 V DC 125 V AC
Current input - internal (with 5V) - internal (with 24V) Space required (1 standard slot = 15.24 mm) Weight approx.	0.6 A 0.15A 1 2/3 std. slot 0.4 kg	0.52 A --- 1 2/3 std. slot 0.4 kg	0.25 A 0.12A 1 2/3 std. slot 0.3 kg	0.8 A 0.12A 1 2/3 std. slot 0.4 kg	0.5 A 0.34A 1 2/3 std. slot 0.6 kg
<p> <b>Outputs only</b></p> <p>1) For nominal loading. With lower loading, higher values are permissible.</p> <p>2) Referred to the sum of the nominal current for all outputs.</p> <p>3) Maximum switch-on current 350mA. With signal lamp control: 12V lamps with series resistance or 24V lamps with preheating</p>					

### 2.2.2.5 Pin assignments of inputs/outputs

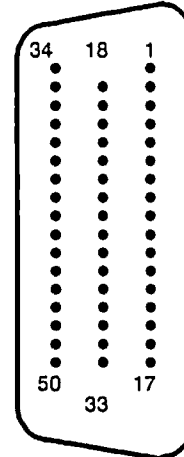
● **Module 6FX1 118 - 4AA / N81**

Connection is separate for inputs and outputs, on a 50-way subminiature pin connector in each case.

Connector X402, X403, IN, OUT

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

Input connector X402, IN



Byte	Connector pin							
	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	10	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

Pin  
View on PCB frontplate

Output connector X403, OUT

Byte	Connector pin							
	7	6	5	4	3	2	1	0
0	16	15	14	13	12	11	10	9
1	25	24	23	22	21	10	19	18
2	33	32	31	30	29	28	27	26
P24 (+24V)            1 2 3 inputs M <sub>ext</sub> (0V)            34 35 inputs								

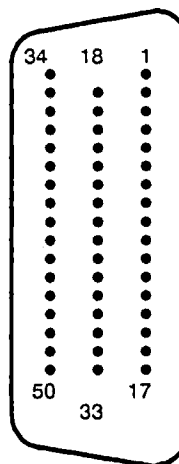
● **Module 6FX1 192 - 4AA / N83**

Connection is for 48 inputs in each case on a 50-way subminiature pin connector.

Connector X412, X413, IN

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

Input connector X412, IN



Byte	Connector 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	10	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

Pin  
 View on PCB frontplate

Input connector X413, IN

Byte	Connector 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	10	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

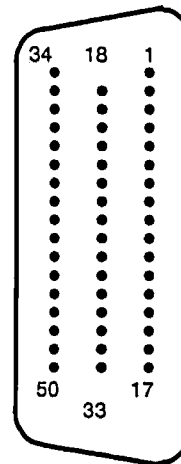
● Module 6FX1 130 - 6BA / N84

Connection is for 24 outputs in each case on a 50-way subminiature pin connector.

Connector X423, X424, OUT

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

Output connector X423, OUT



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

Pin  
View on PCB frontplate

Output connector X424, OUT

Connector X422

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

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

● **Module 6FX1 111 - 4AB / N85**

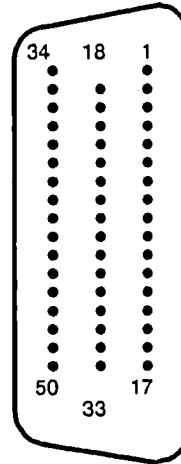
Connection for inputs and outputs is separate on a 50-way subminiature pin connector in each case.

Connector X454, X453, IN, OUT

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

Input connector X454, IN

Byte	Connector 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	10	19	18
2	33	32	31	30	29	28	27	26



Pin  
 View on PCB frontplate

Output connector X453, OUT

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

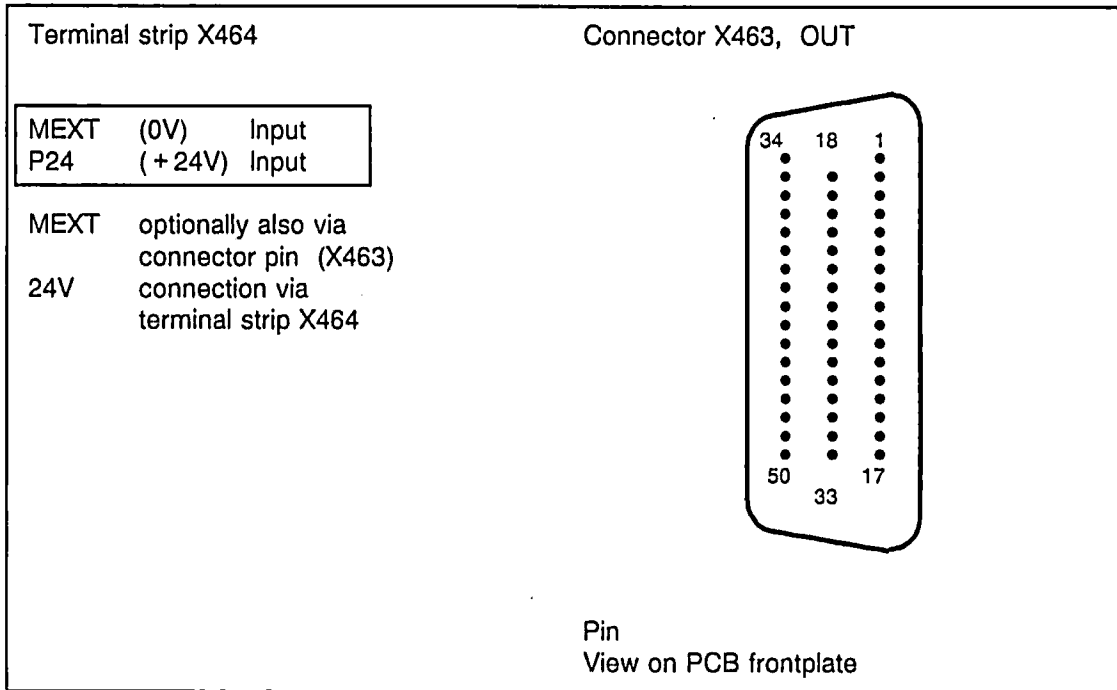


- Module 6FX1 112 - 0AA / N82

Connection is to a 50-way subminiature pin connector.

Cable:

SINUMERIK standard cable 6FC9 340 - 2W.



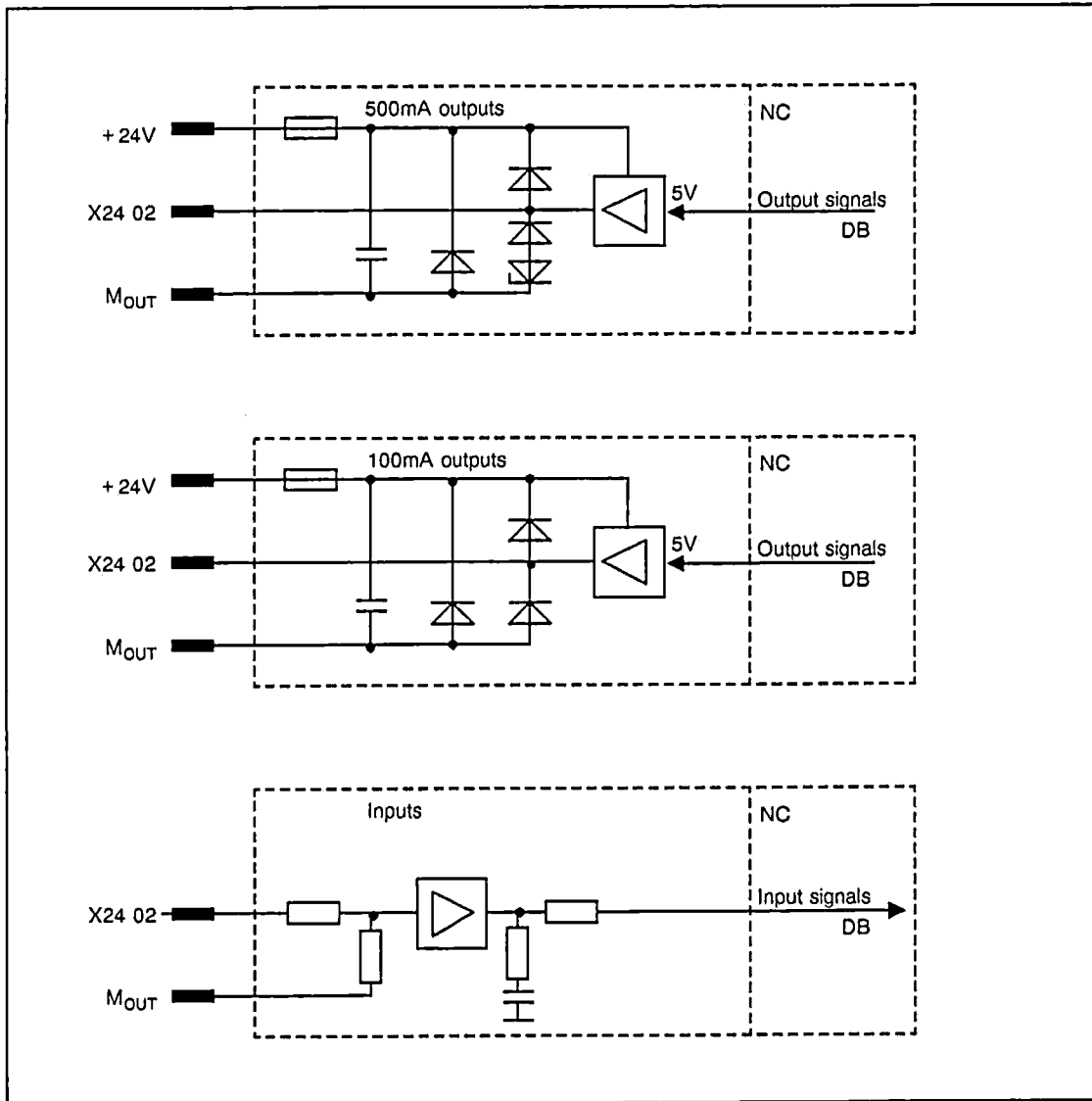
Output connector X463, OUT

Byte	Connector pin														Connector pin Inputs MEXT (0V)				
	Bit																		
	7		6		5		4		3		2		1		0				
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

### 2.2.3 I/O submodules

With the I/O submodules, the standard machine control panel signals as well as up to 224 additional inputs and 128 outputs can be connected. These are transmitted via the optical fibre cable to the NC and from there to the PLC. Up to 4 logic submodules can be linked to the operator panel.


#### 2.2.3.1 Signal flow and wiring arrangement of the I/O submodules



M<sub>out</sub> / 24 V are supplied via the terminal block X02 403 (see also 2.2.3.4)

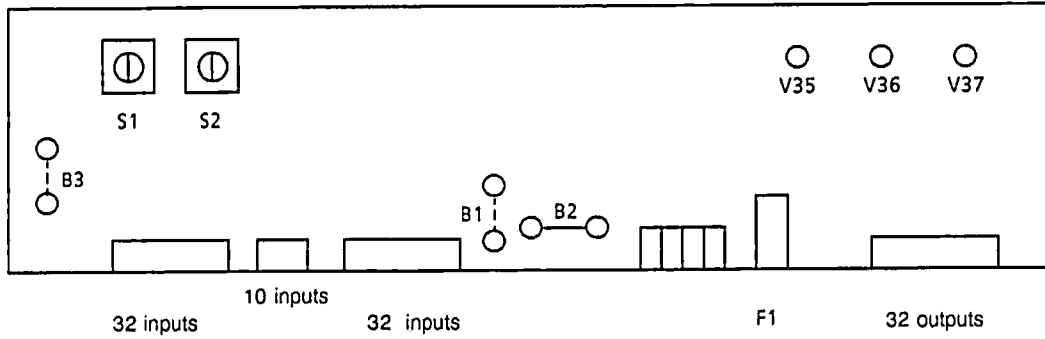
## 2.2.3.2 Electrical specifications for the I/O submodules

6FX1 124-6AA / 6FX1 124-6AB		6FX1 124-6AA	
Number of inputs	64	Number of outputs	32 (8 + 24)
Electrical isolation	no	Electrical isolation	no
Input voltage (nominal value)	24V DC	Supply voltage $U_P$	
Input voltage		- nominal value	24V DC
- for signal "0"	-3V to +5V or input open	- ripple $U_{SS}$ max.	3.6V
- for signal "1"	+13V to +30V	- permissible range (including ripple)	20V to 30V
Input current with signal "1" typ.	6 mA	Output current with signal "1"	
Delay time		- nominal value	100 mA / 0,5A
- for tpLH	2.5...4.3 ms	Short-circuit protection	
- for tpHL	2.5...4.3 ms	with 100mA output	none
Line length for cable	50 m	with 0.5A output	electronic
		Limitation of the inductive cut-out voltage to	-11V
		Switching capacity for lamps	
		with 100mA output max.	--- 3)
		with 0.5A output max.	14W
		Switching frequency with	
		- ohmic load max.	500Hz
		- lamps max.	500Hz
		- inductive load 1) max.	10Hz
		Total loadability 2)	
		at 55°C	50%
		Signal level of the output	
		- with signal "0" max.	output open
		- with signal "1"	
		with 0.5mA output min.	$U_P$ -1.1V
		with 0.5A output min.	$U_P$ -1.7V
		Line length for cable max.	50m
		Insulation voltage external connection against housing	
		- to VDE 0160	---
		- tested with	---
		Current input	
		- internal (with 5V)	0.1 A
		- internal (with 24V)	0.05A
		Space required	391x127x15mm
		Weight	M01 approx. 1.3kp
			M02/M03 approx. 1.0kp

 Outputs only

1) For nominal loading. With lower loading, higher values are permissible.  
 2) Referred to the sum of the nominal currents for all outputs  
 3) Maximum switch-on 350mA.  
 With signal lamp control:  
 12V lamps with serial resistance or  
 24V lamps with preheating

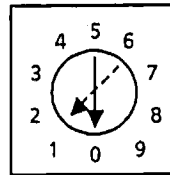
### 2.2.3.3 Addressing of the I/O submodules



Jumper status:

- B1 open
- B2 closed
- B3 open

F1 ... Fuse 6.3 A  
for outputs and external  
machine control panel



- S1 ... Addressing of inputs
- S2 ... Addressing of outputs

### 2.2.3.4 Pin assignments for the I/O submodules

Connection for the inputs is on two connectors and for the outputs on one connector.

Cable: see cable and hardware wiring diagrams in Section 7.5

#### Pin assignments for Inputs

No. of Input signal								
Byte-No.	Bit: 7	6	5	4	3	2	1	0
IB m	Connector X02 404 Pin No.							
	10	9	8	7	6	5	4	3
IB m + 1	Connector X02 404 Pin No.							
	18	17	16	15	14	13	12	11
IB m + 2	Connector X02 404 Pin No.							
	26	25	24	23	22	21	20	19
IB m + 3	Connector X02 404 Pin No.							
	34	33	32	31	30	29	28	27
IB m + 4	Connector X02 405/406 Pin No.							
	10	9	8	7	6	5	4	3
IB m + 5	Connector X02 405/406 Pin No.							
	18	17	16	15	14	13	12	11
IB m + 6	Connector X02 405 Pin No.							
	26	25	24	23	22	21	20	19
IB m + 7	Connector X02 405 Pin No.							
	34	33	32	31	30	29	28	27

Address M results from the position of the selector switch on the I/O submodule:

Selector switch position S1	Address m
0	64
1	72
2	80
3	88

IB m -	X02 404
IB m + 3	
IB m + 4	X02 405/X02 406
IB m + 5	X02 405
IB m + 6	
IB m + 7	X02 405

### Pin assignments for outputs

No. of output signal								
Byte-No.	Bit: 7	6	5	4	3	2	1	0
QB m	Connector X02 402 Pin No.							
	10	9	8	7	6	5	4	3
QB m + 1	Connector X02 402 Pin No.							
	18	17	16	15	14	13	12	11
QB m + 2	Connector X02 402 Pin No.							
	26	25	24	23	22	21	20	19
QB m + 3	Connector X02 402 Pin No.							
	34	33	32	31	30	29	28	27

Address m results from the position of the selector switch on the I/O submodule:

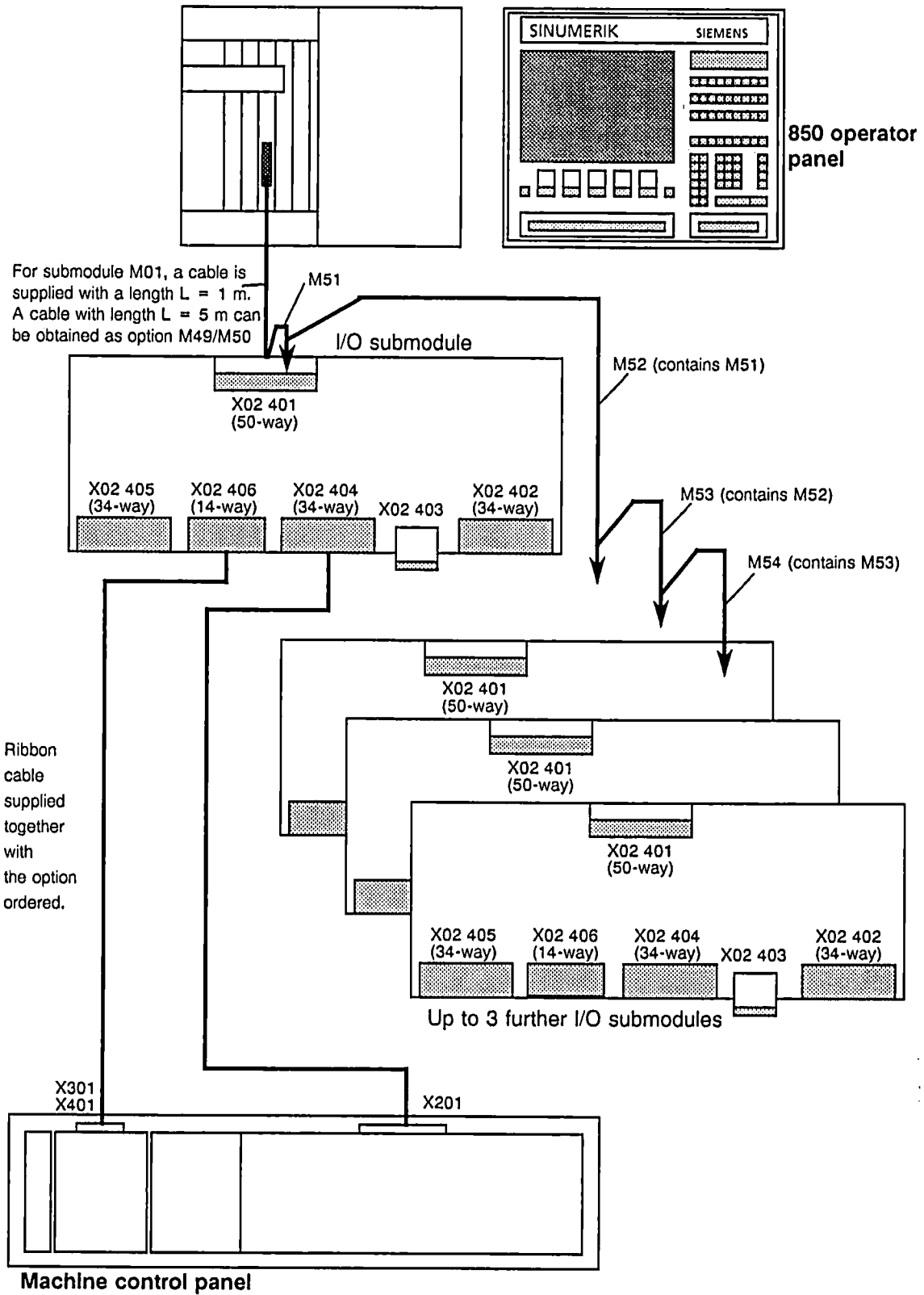
Selector switch position S2	Address m
0	64
1	68
2	72
3	76

### Output load

Byte No. QB m  
 QB m + 1  
 QB m + 2 ] 24V; 0.5A short-circuit proof

Byte No. QB m + 3 24V; 0.1A

### 2.2.3.5 Interfacing the I/O submodules



## 2.3 Power schedule and total power loss

### 2.3.1 Power schedule for central controller

Since the individual versions of the SINUMERIK 850 are equipped to match specific machine tools, it is essential to compile a power schedule at the planning stage. Two different power packs are available for the SINUMERIK 850 (25 A basic version, 40 A Option); the maximum current in the schedule must not exceed the permissible value of the power pack in **any range** (+ 5 V, + 15 V, - 15 V, Vcc).

The following table lists all the modules, with typical current consumptions, that can be connected to the central controller. A power schedule is **not** required for the operator panel unit.

Modules in central controller	6FX11...	+ 5V [A]			+ 15V [mA]			- 15V [mA]			V <sub>cc</sub> [μA]		
		+ 5V [A]	No. of modu-les.	Total [A]	+ 15V [mA]	No. of modu-les.	Total [mA]	- 15V [mA]	No. of modu-les.	Total [mA]	V <sub>cc</sub> [μA]	No. of modu-les.	Total [μA]
Multiport	368		1	1.2								1	115
COM-CPU	204		1	2.3		1	70		1	70		1	20
Memory module	281		2	1.0								2	20
Part program memory module	267	0.5											
128 Kbyte RAM submod.	266	0.08										32	
256 Kbyte RAM submod.	353	0.2										24	
active serial interface module <sup>1)</sup>	315	0,02			50			50				8	
active serial interface module <sup>1)</sup>	373				145			35					
SINEC-H1- interface module <sup>1)</sup>	231	2,5			350			5				10	
NC-CPU	205	1.6										16	
Memory module	281	0.5										10	
64 Kbyte RAM submod.													
Measuring circuit module	214	1.5			60			60					
Measuring circuit module	268												
ExE 5 x	354	0.02			12								
ExE 10 x	355	0.035			17								
Digital encoder		< 0.3											
PLC-CPU 130WB	6ES5921-3WB14	3.5											
SIMATIC S5- central controller connection	6ES5314-3UA11	1											
Connection module AS 511	6ES5511-5AA14	1,7											
Connection module AS 512	6ES5511-5BC12	1,6											
Input module N60	6ES5420-3BA11	0.15											
Output module N65	6ES5445-3AA12	0.3											
Output module N70	6ES5444-3AA	0.24											

1) from software version 4  
 2) from software version 3



Modules in central controller	6FX11...-	+ 5V [A]			+ 15V [mA]			- 15V [mA]			V <sub>CC</sub> [μA]		
		+ 5V [A]	No. of modules.	Total [A]	+ 15V [mA]	No. of modules.	Total [mA]	- 15V [mA]	No. of modules.	Total [mA]	V <sub>CC</sub> [μA]	No. of modules.	Total [μA]
I/O module N81	184	0.55											
Output module N82	120	0.5											
Input module N83	924	0.52											
Output module N84	306	0.3											
I/O module N85	114	0.8											
Input module N90	323	0,27											
<b>Net current of central controller</b>		/	/		/	/		/	/		/	/	
<b>Power pack 6EW1861-1AC</b>		/	/	25	/	/	2500	/	/	2000	/	/	600
<b>Power pack 6EW1861-2AC (Option)</b>		/	/	40	/	/	2500	/	/	2000	/	/	600

## 2.3.2 Total power loss

Calculation of total power loss to determine required heat dissipation:

$$P_V = \left( \frac{U_{A1} \cdot I_{A1} + U_{A2} \cdot I_{A2} + U_{An} \cdot I_{An}}{\eta} \right) \cdot K + P_{VL} + P_{VM} + P_{VS} \quad [W]$$

- $P_V$  = Power loss (converted to heat)  
 $P_{VL}$  = Power loss of fans  
 $P_{VM}$  = Power loss of monitor  
 $P_{VS}$  = Circuit and switching losses of 24 V outputs

$$P_{VS} = U_{ext} \cdot I_{ext} + U_S \cdot I_S \cdot T \cdot B \cdot F \quad [W]$$

- $P_S$  = Device connected load

$$P_S = \frac{P_V - P_{VS}}{\lambda} \quad [VA]$$

- $U_{A1} \dots A_n$  = Power supply unit output voltages (max)  
 $I_{A1} \dots A_n$  = Power supply unit output currents (max)  
 $\eta$  = Efficiency of power supply unit; between 60 and 70 % for switched-mode supply units  
 $K$  = Factor for power supply unit utilization; generally  $\leq 0.9$   
 $U_{ext}$  = Supply voltage of output modules; 30 V must be assumed here  
 $I_{ext}$  = Current consumption of output modules with 30 V DC  
 $U_S$  = Voltage drop at switching element of output modules  
 $I_S$  = Nominal load of outputs (0.4 A/2.0 A)  
 $T$  = Number of outputs on one module  
 $B$  = Number of output modules  
 $F$  = Load factor of output modules = 0.5  
 $\lambda$  = Power factor with AC voltage input, generally between 0.5 and 0.6, with DC voltage input = 1.0

## 3 Machine Control Panel

### 3.1 General

The machine control panel is interfaced to the operator panel through an I/O submodule. Apart from the machine control panel signals, other input/output signals can be transferred to the PLC via the I/O submodule. A maximum of 4 I/O submodules can be attached. The pin assignments are given Section 2.2.3.3.

There are two possibilities for transferring the machine control panel signals to the NC link RAM:

**Possibility 1:**

The signals of the machine control panel are transferred unchanged from the input byte IB48 to IB50 from FB22 into the NC link area.

**Possibility 2:**

If an input byte other than IB48 is jumpered, the user PLC program must transfer the machine control panel signals to the relevant flag areas (see machine control panel signals to NC). The FB22 transfers the signals from that to the NC link area. Jumpering of IB0 is assigned for alarm inputs and must therefore not be used for the machine control panel signal.

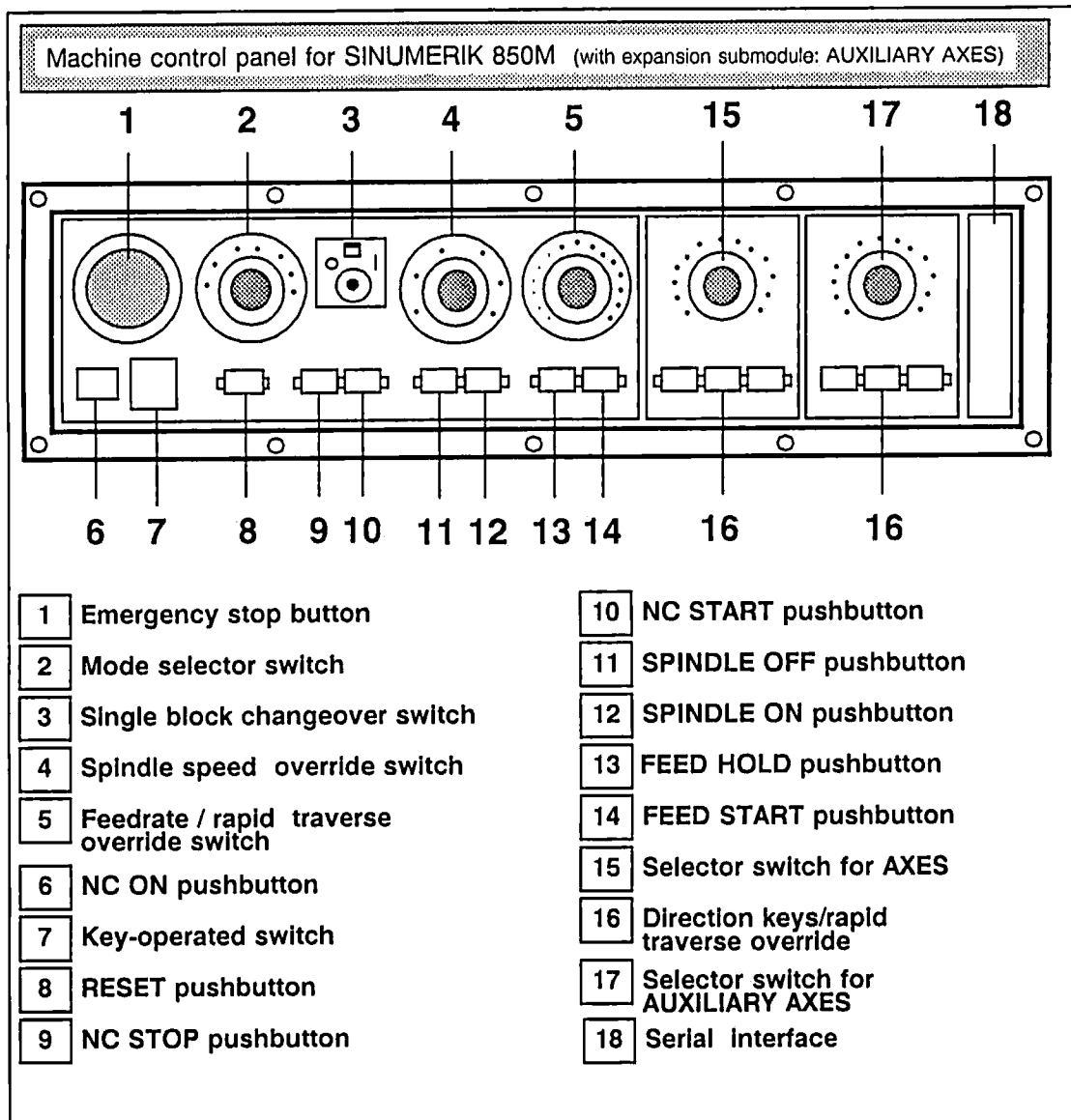
### 3.2 Arrangement of the machine control panel

The machine control panel operates at 24 V level. It does not contain any electrical circuits. The signals from the operator control elements are taken direct to the inputs of the input/output printed-circuit board.

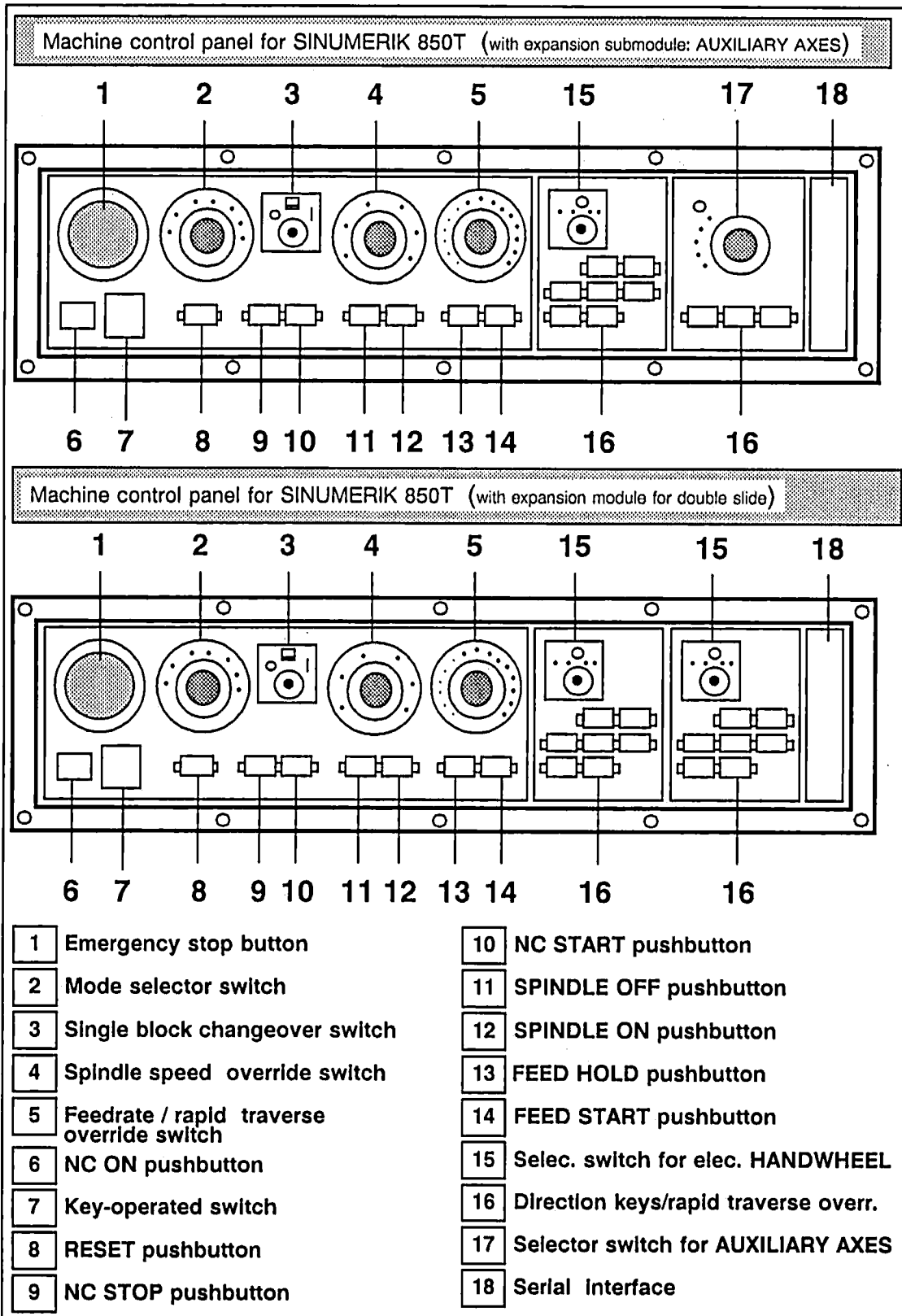
## 3.2 Arrangement of the machine control panel

The machine control panel can also be made up and wired from single elements. The coded selector switches can be used as single elements.

These coded selector switches are described in Section 4.



*SINUMERIK 850M machine control panel*



SINUMERIK 850 machine control panel

## 3.2 Arrangement of the machine control panel

## Assignment of inputs by machine control panel

Machine control panel 880 T (turning)								
Byte No.	Bit: 7	6	5	4	3	2	1	0
IB 64	Spindle override switch				Mode selector switch			
	D 10	C 9	B 8	A 7	D 6	C 5	B 4	A 3
IB 65	Direction keys		Rapid traverse	Direction keys		13	00 handwheel X 01 handwheel C 10 handwheel Z	
	X+ 18	X- 17	16	C+ 15	C- 14		12	11
IB 66	Direction keys		Spindle		Feed		NC START	NC STOP
	Z+ 26	Z- 25	ON 24	OFF 23	ON 22	OFF 21	20	19
IB 67	Reset	Key- operated switch	Single block	Feedrate override switch				
	34	33	32	E 31	D 30	C 29	B 28	A 27

All pins, connector X02 404

Machine control panel 880 M (milling)								
Byte No.	Bit: 7	6	5	4	3	2	1	0
IB 64	Spindle override switch				Operating mode switch			
	D 10	C 9	B 8	A 7	D 6	C 5	B 4	A 3
IB 65	Direction keys 1		Rapid traverse1	Selector switch 1				
	+ 18	- 17	16	E 15	D 14	C 13	B 12	A 11
IB 66			Spindle		Feed		NC START	NC STOP
	26	25	ON 24	OFF 23	ON 22	OFF 21	20	19
IB 67	Reset	Key- operated switch	Single block	Feedrate override switch				
	34	33	32	E 31	D 30	C 29	B 28	A 27

All pins, connector X02 404

Assignment of inputs by machine control panel

Expansion assemblies of the machine control panel

<b>Double slide assembly 850 T</b> (Connector X 02 406 I/O submodule)								
Byte No.	Bit: 7	6	5	4	3	2	1	0
IB 68	Handwheel Bit 1 10	Direction keys X+ 9	Direction keys X- 8	Direction keys Z+ 7	Direction keys Z- 6	Rapid traverse 5	Direction keys C+ 4	Direction keys C- 3
IB 69	18	17	16	15	14	13	12	Handwheel Bit 2 11

<b>Auxiliary axes assembly 850 T / 850 M</b> (Connector X 02 406 I/O submodule)								
Byte No.	Bit: 7	6	5	4	3	2	1	0
IB 68	Direction keys + 10	Direction keys - 9	Rapid traverse 8	E 7	D 6	Axis selector switch C 5	B 4	A 3
IB 69	18	17	16	15	14	13	12	Spare auxiliary axes assembly 11

<b>Rapid traverse override assembly 850 T / 850 M</b> (Connector X 02 406 I/O submodule)								
Byte No.	Bit: 7	6	5	4	3	2	1	0
IB 68	10	9	8	7	6	C 5	Rapid traverse overr. B A A 4 0 3	
IB 69	18	17	16	15	14	13	12	11

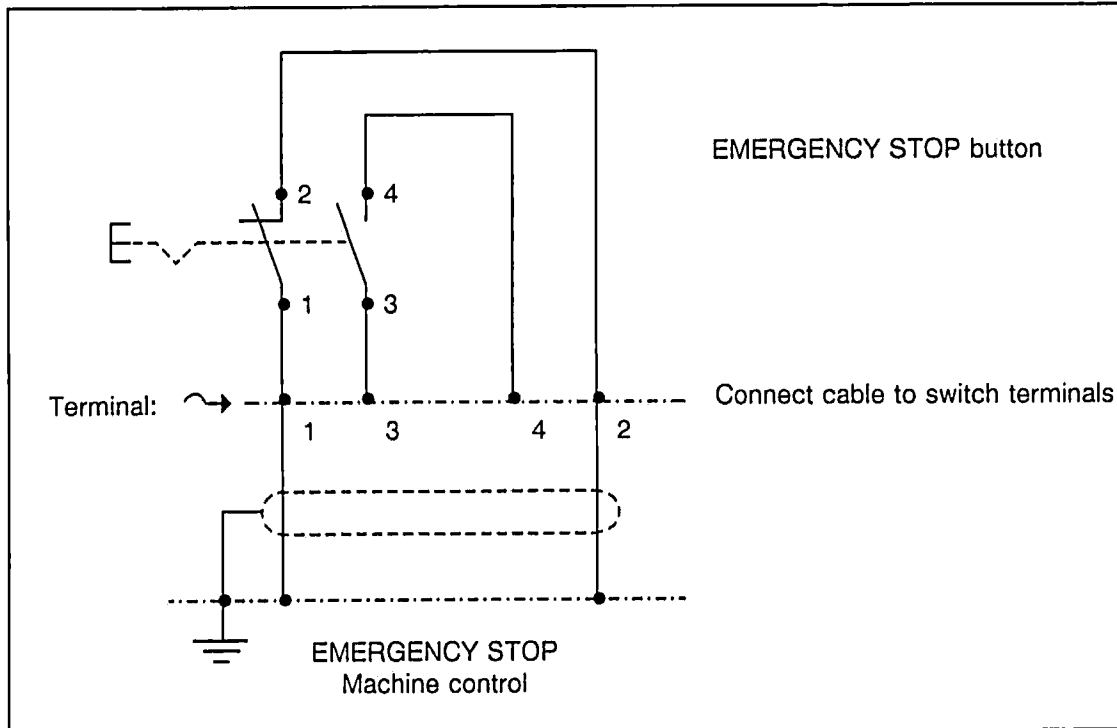
### 3.3 Description of machine control panel signals

#### 3.3.1 EMERGENCY STOP

EMERGENCY STOP button (with turn-to-reset feature) switching voltage 220V max.

Connection is via a screened cable direct on the EMERGENCY STOP button. The screen is placed on one side on the machine control.

Suggested wiring for EMERGENCY STOP system:











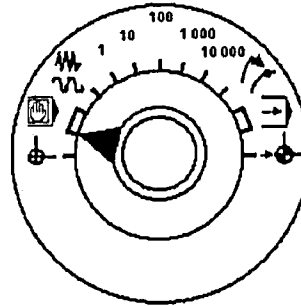
**3.3.2 Mode switch**

Order No.: 6FC9 301 - 0AE

Selector switch, 13 positions, Gray-coded, overlapping contact arrangement.

The operating modes are selected with the mode switch.

Position	Mode	Symbol
1	Preset	
2	Manual data input MDA	
3	Manual data input MDA	
4	JOG	
5	Incr. 1	1
6	Incr. 10	10
7	Incr. 100	100
8	Incr. 1000	1000
9	Incr. 10000	10000
10	Reposition REPOS	
11	Automatic AUT	
12	Automatic AUT	
13	Approach reference point REF	



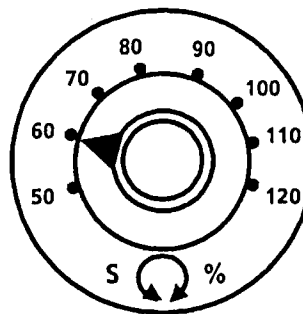
### 3.3.3 Spindle speed override switch

Order No.: 6FC9 301 - 0EC

Selector switch, 16 positions, Gray-coded, overlapping contact arrangement. The switch allows the spindle speed to be changed in steps between 50 % and 120 %. Each switch position is assigned a fixed override value via machine data.

In the case of rotary feed and constant cutting speed, spindle speed override causes the feed drives to adapt automatically. In thread cutting, the switch is inactive.

Position	Override value in %
1	50
2	55
3	60
4	65
5	70
6	75
7	80
8	85
9	90
10	95
11	100
12	105
13	110
14	115
15	120
16	120



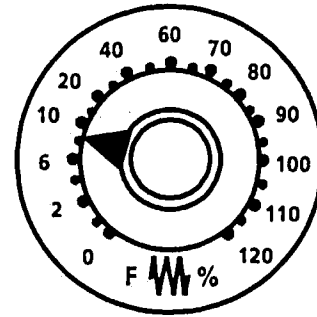
**3.3.4 Feedrate / rapid traverse override switch**

Order No.: 6FC9 301 - 0BC

Selector switch, 23 positions, Gray-coded, overlapping contact arrangement. The switch allows the feedrate to be modified in steps between 0 % and 120 %. Each switch position is assigned a fixed override value via machine data.

The position 0 % of the feedrate override switch is always active, even for rapid traverse. In thread cutting, the switch is inactive.

Position	Override value in %
1	0
2	1
3	2
4	4
5	6
6	8
7	10
8	20
9	30
10	40
11	50
12	60
13	70
14	75
15	80
16	85
17	90
18	95
19	100
20	105
21	110
22	115
23	120



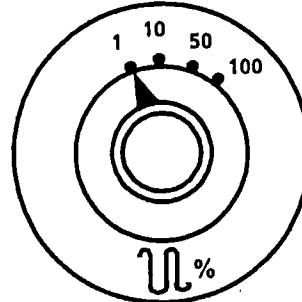
3.3.5 Rapid traverse override switch

**3.3.5 Rapid traverse override switch**

Order No.: 6FC9 301- 0CD

Selector switch, 4 positions, Gray-coded, overlapping contact arrangement.  
The switch allows the rapid traverse rate to be modified in four steps up to 100 %. Every switch position is assigned a fixed override value by machine data. In thread cutting, the switch is inactive.

Position	Override value in %
1	1
2	10
3	50
4	100

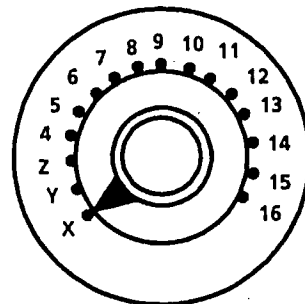


**3.3.6 Axis selector switch**

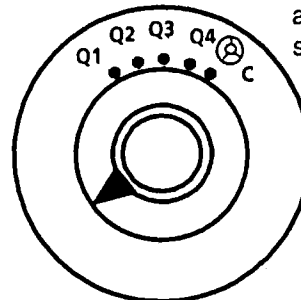
Order No.: 6FC9 301- 0DE (auxiliary axis selector switch)  
6FC9 301- 0DD (axis selector switch)

Selector switch, 16 positions, Gray-coded, overlapping contact arrangement.  
In the JOG, INC, REF and REPOS setup modes, the axis to be traversed is preselected by means of the axis selector switch. Travel is performed by means of the ± direction keys.

Position	Axes	
	850 M	850 T
1	X	Q1
2	Y	Q2
3	Z	Q3
4	4	Q4
5	5	C
6	6	
7	7	
8	8	
9	9	
10	10	
11	11	
12	12	
13	13	
14	14	
15	15	
16	15	



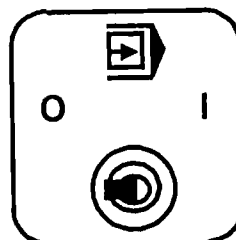
Axis selector switch



Auxiliary axis selector switch

**3.3.7 Single block**

Toggle switch, 1 normally open contact  
1 signal: SINGLE BLOCK switch in position 1

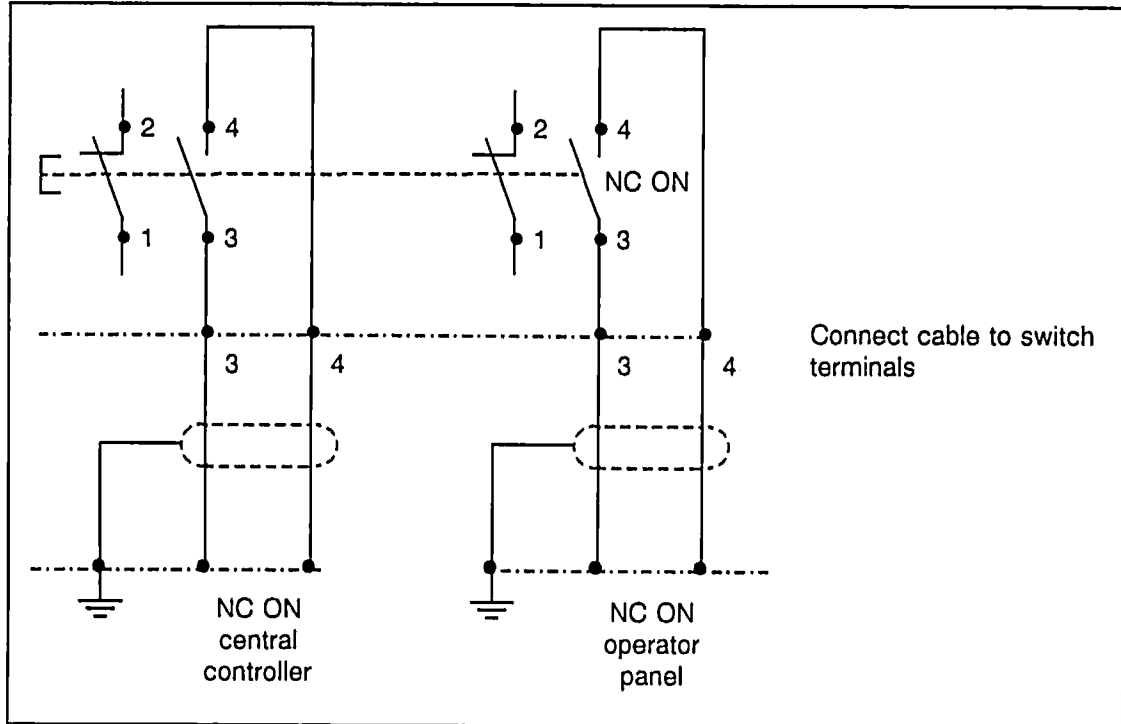


## 3.3.8 NC ON

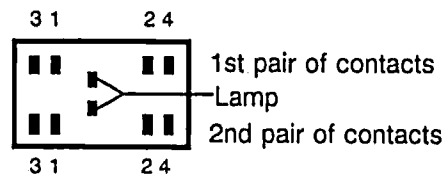


Connection via screened cable direct on pushbutton. The screen is placed on one side on the power supply of the central controller and of the operator panel.

The central controller is switched on after the mains voltage has been applied.



Pushbutton connection diagram:



The NC ON of the operator panel and central controller must not be connected to the same pushbutton (NO contact). Two separate NO contacts are required in each case.

### 3.3.9 Key-operated switch



Key-operated switch, 1 normally open contact  
0 signal: Key removed

This signal allows data input into the program memory, editing, and data input of tool offsets and zero offsets.

### 3.3.10 RESET



Pushbutton, 1 normally open contact.  
1 signal: RESET button pressed

### 3.3.11 NC Stop



Pushbutton, 1 normally closed contact  
0 signal: NC STOP button pressed

### 3.3.12 NC Start



Pushbutton, 1 normally open contact  
1 signal: NC START button pressed

### 3.3.13 SPINDLE OFF



Pushbutton, 1 normally closed contact  
0 signal: SPINDLE OFF button pressed

**3.3.14 SPINDLE ON**

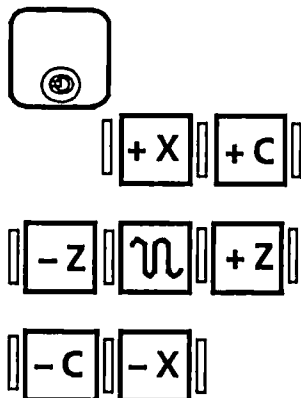
Pushbutton, 1 normally open contact  
1 signal: SPINDLE ON button pressed

**3.3.15 FEED HOLD**

Pushbutton, 1 normally closed contact  
0 signal: FEED HOLD button pressed

**3.3.16 FEED START**

Pushbutton, 1 normally open contact  
1 signal: FEED START button pressed

**3.3.17 Direction keys**

One normally open contact per pushbutton  
1 signal: Direction key pressed

**3.3.18 PLUS / MINUS direction keys**

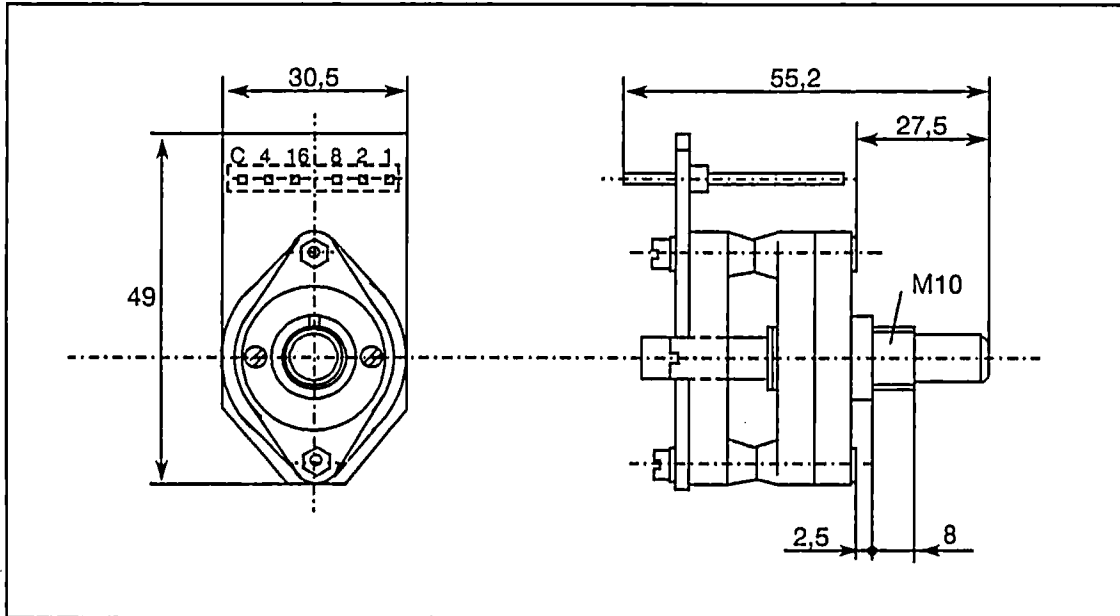
1 normally open contact per pushbutton  
1 signal: + or - direction key pressed

**3.3.19 Rapid traverse override**

1 normally open contact per pushbutton  
1 signal: RAPID TRAVERSE OVERRIDE button

## 4 Coded Selector Switches / Codings

### 4.1 Coded selector switches



Used in the machine control panel as ...	Switch positions		Switching angle	Order No.
	available	in use		
Mode switch	16	13	15°	6FC9 301 - 0AE
Spindle speed override switch	16	15	15°	6FC9 301 - OEC
Feedrate override switch	23	23	11.25°	6FC9 301 - 0BC
Rapid traverse override switch	16	4	15°	6FC9 301 - 0CD
Rapid traverse override switch	8	4	30°	6FC9 301 - 0CC
Axis selector switch 850 M	16	16	15°	6FC9 301 - 0DD
Axis selector switch 850T	16	5	15°	6FC9 301 - 0DE



## 4.2 Mode switch coding

**4.2 Mode switch coding**

Order No.: 6FC9 301-OAE

The mode switch on the machine control panel transfers the following code (Gray-Code) to the input byte in accordance with the position that has been set:

Position	Code			
	8	4	2	1
1	0	0	0	1
2	0	0	1	1
3	0	0	1	0
4	0	1	1	0
5	0	1	1	1
6	0	1	0	1
7	0	1	0	0
8	1	1	0	0
9	1	1	0	1
10	1	1	1	1
11	1	1	1	0
12	1	0	1	0
13	1	0	1	1

**4.3 Spindle override switch coding**

Order No.: 6FC9 301-0EC

The spindle override switch on the machine control panel transfers the following code (Gray-code) to the input byte in accordance with the position that has been set:

Position	Code			
	8	4	2	1
1	0	0	0	1
2	0	0	1	1
3	0	0	1	0
4	0	1	1	0
5	0	1	1	1
6	0	1	0	1
7	0	1	0	0
8	1	1	0	0
9	1	1	0	1
10	1	1	1	1
11	1	1	1	0
12	1	0	1	0
13	1	0	1	1
14	1	0	0	1
15	1	0	0	0

**4.4 Feedrate override switch coding**

Order No.: 6FC9 301-0BC

The feedrate override switch on the machine control panel transfers the following code (Gray code) to the input byte in accordance with the position that has been set:

Position	Code				
	16	8	4	2	1
1	0	0	0	0	1
2	0	0	0	1	1
3	0	0	0	1	0
4	0	0	1	1	0
5	0	0	1	1	1
6	0	0	1	0	1
7	0	0	1	0	0
8	0	1	1	0	0
9	0	1	1	0	1
10	0	1	1	1	1
11	0	1	1	1	0
12	0	1	0	1	0
13	0	1	0	1	1
14	0	1	0	0	1
15	0	1	0	0	0
16	1	1	0	0	0
17	1	1	0	0	1
18	1	1	0	1	1
19	1	1	0	1	0
20	1	1	1	1	0
21	1	1	1	1	1
22	1	1	1	0	1
23	1	1	1	0	0

**4.5 Rapid traverse override switch coding**

Order No.: 6FC9 301-0CD

The rapid traverse override switch delivers the following code (Gray code) in accordance with the position that has been set:

Position	Code		
	4	2	1
1	0	0	1
2	0	1	1
3	0	1	0
4	1	1	0

### 4.6 Rapid traverse override switch coding

Order No.: 6FC9 301-0CC

The rapid traverse override switch delivers the following code (Gray code) in accordance with the position that has been set:

Position	Code			
	8	4	2	1
1	0	0	1	1
(Z)	0	0	1	0
2	0	1	1	0
(Z)	0	1	1	1
3	0	1	0	1
(Z)	0	1	0	0
4	1	1	0	0

When this switch is installed, code conversion to the NC-PLC user interface is required in the PLC user program.

### 4.7 Axis and auxiliary axis selector switch coding

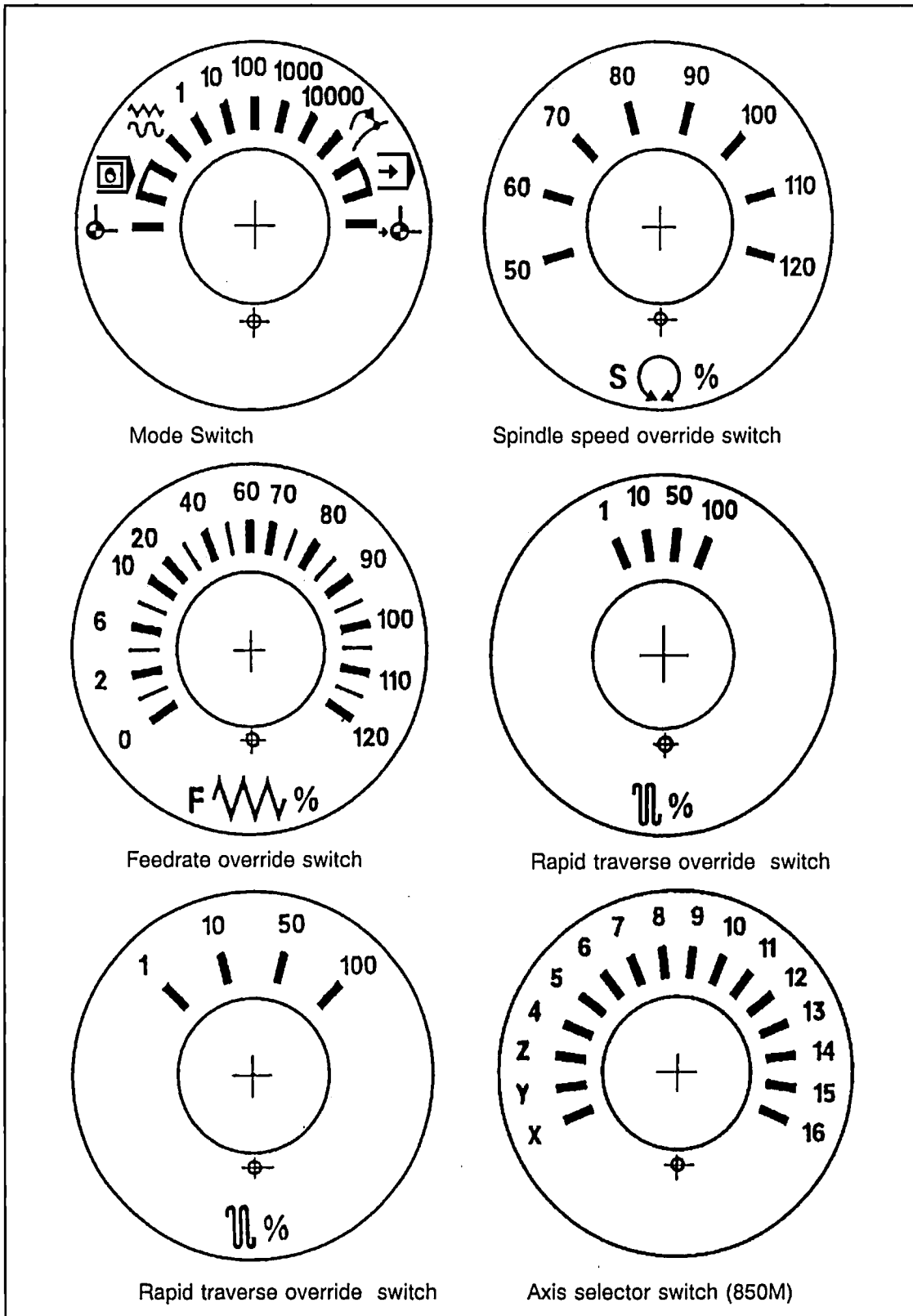
Order No.: 6FC9 301-0DD

6FC9 301-0DE

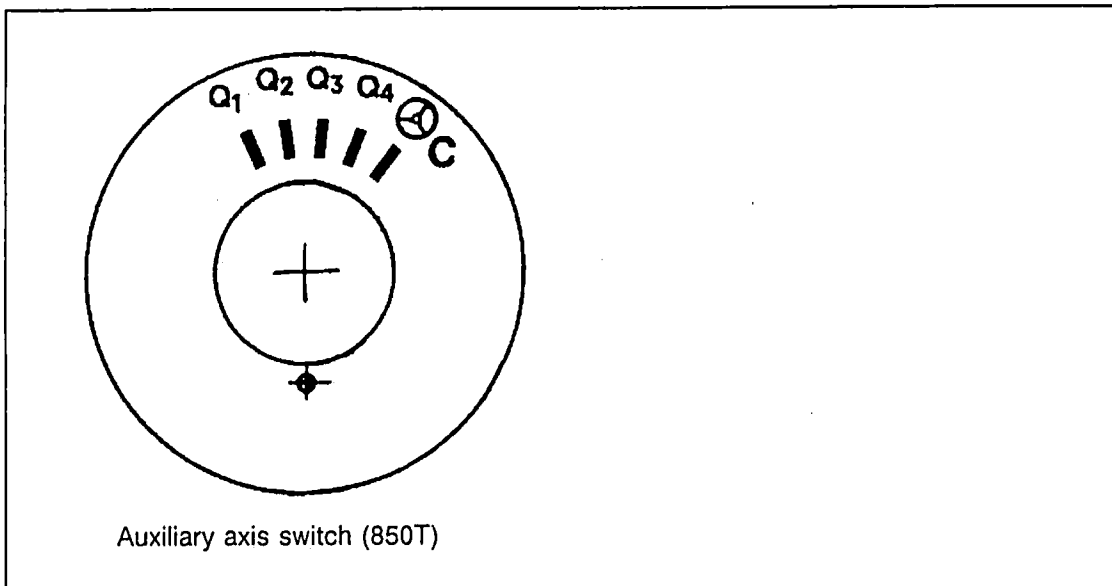
The axis selector switch delivers the following code (Gray code) in accordance with the position that has been set:

Position	Code			
	8	4	2	1
1	0	0	0	1
2	0	0	1	1
3	0	0	1	0
4	0	1	1	0
5	0	1	1	1
6	0	1	0	1
7	0	1	0	0
8	1	1	0	0
9	1	1	0	1
10	1	1	1	1
11	1	1	1	0
12	1	0	1	0
13	1	0	1	1
14	1	0	0	1
15	1	0	0	0
16	1	0	0	0

### 4.8 Engravings



4.8 Engravings

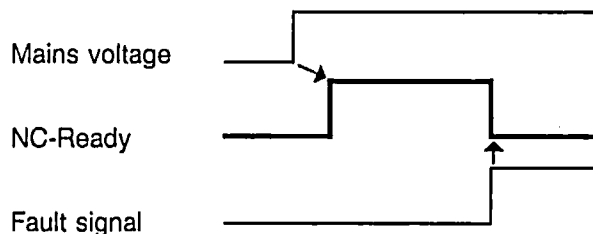


## 5 NC - Machine Signals

### 5.1 NC-Ready

The NC-Ready signal is supplied as a floating relay on multipoint 6FX1 121-8BA or -8BB at connector X151 pins 3 and 4.

- 1 signal: The relay contact is closed after switching on when all voltages have built up and the complete control is in the cyclic mode.
- 0 signal: The relay contact is open when
- undervoltage monitoring responds
  - overvoltage monitoring responds
  - computer monitoring responds
  - control configuration (NC-MD) has been input incorrectly
  - PLC goes to STOP



#### Application note:

The NC-Ready signal is one of the safety signals on the control. It indicates that a fault of such seriousness affecting several mode groups has occurred on the control that all axes and spindles have to be shut down. If the NC-Ready signal becomes 0, all speed controller enable signals are also removed by the hardware. The control is again ready for operation only after POWER ON.

#### Caution:

The relay output can be loaded with 20 ... 30 V/400 mA, max. 10 VA ohmic load. The NC-Ready signal must be used for stopping all motions on the machine.

### 5.2 Feed drives

#### 5.2.1 Set speed (axes)

Analog set speed  $\pm 10$  V/2 mA for the feed motor. The maximum voltage can also be limited via software (via NC-MD). The set speed value is a pure DC voltage.

#### Comment:

When axis faults respond (e.g. monitoring for standstill), 0 V is suddenly output as the set value. The feed motor is braked with maximum current.

## 5.2.2 Speed controller enable (axes)

The speed controller enable signal is supplied as a floating relay on measuring circuit 6FX1 126-8B. (Option K4.) (setpoint connector, 25-way). The relay output can be loaded with 20...30 V/400 mA.

The speed controller enable signal is supplied as a non-floating switching transistor on measuring circuit 6FX 1 121-4B (Option K2.) (setpoint connector, 25-way). The output can be loaded with 20...30 V DC/100 mA.

1 signal: The relay contact is closed when all axes have successfully adopted the position control in the relevant BAG (operating mode group).

0 signal: The relay contact is open when

- a) NC-Ready signal = 0
- b) measuring circuit monitors respond
- c) the control is not able to hold the axes in the position control
- d) the controller enable interface signal from the PLC becomes 0

The contact of the speed controller enable relay always opens 5 to 1000 ms (NC-MD 156) after the fault has been recognized. The drive is thus given the possibility of braking the motor under control (with maximum current) and to disable the pulses for the thyristors/transistors after the motor has stopped.

The braking path and following error are recorded within the control in such a way that the actual value memory contains the machine position following the braking operation. It is not necessary to resynchronize the axes (approach the reference points). The speed control enable signal can be used to disable the speed controller but also to disable the pulses for the thyristors/transistors.

The EMERGENCY STOP interface signal does not cause the speed controller enable to be removed within the control. If this is required, the controller disable interface signal must be set by the PLC.

## 5.3 Spindle drives

### 5.3.1 Set speed (spindles)

Analog set speed  $\pm 10$  V/2 mA for the spindle motor. The spindle is controlled by the NC via the M functions M3 (clockwise), M4 (counterclockwise) and M5 (spindle stop).

The following polarity allocation of setpoint voltage is recommended:

- |                |                      |
|----------------|----------------------|
| PLUS voltage:  | Clockwise M03        |
| MINUS voltage: | Counterclockwise M04 |

The set speed is a pure DC voltage.

#### Comment:

When spindle errors occur (e.g. spindle speed too high) 0 V is output instantaneously as setpoint value. The spindle motor is braked with maximum current.

### 5.3.2 Speed controller enable (spindles)

The speed controller enable signal is supplied at measuring circuit 6FX1 125-8B. (Option K4.) (setpoint connector, 25-way) as a floating relay. The relay output can be loaded with 20...30 V/400 mA.

The speed controller enable signal is supplied as a non-floating switching transistor on measuring circuit 6FX1 121-4B. (Option K2.) (setpoint connector, 25-way). The output can be loaded with 20...30 V DC/100 mA.

1 signal: The relay contact is closed when all axes have successfully adopted the position control in the relevant BAG (operating mode group).

0 signal: The relay contact is open when

- a) NC-Ready signal = 0
- b) spindle or measuring circuit monitors respond
- c) the control is not able to keep a check on the spindles
- d) the spindle controller enable interface signal from the PLC becomes 0

The contact of the speed controller enable relay always opens 5 to 10000 ms (NC-MD 447 \*) after the fault has been recognized. The drive is thus given the possibility of braking the motor under control (with maximum current) and to disable the pulses for the thyristors/transistors after the motor has stopped.

The speed control enable signal can be used to disable the speed controller but also to disable the pulses for the thyristors/transistors. Synchronization of the spindles is not lost when the speed controller enable is removed.

The EMERGENCY STOP interface signal does not cause the speed controller enable to be removed within the control. If this is required, the spindle controller enable interface signal must be reset by the PLC.



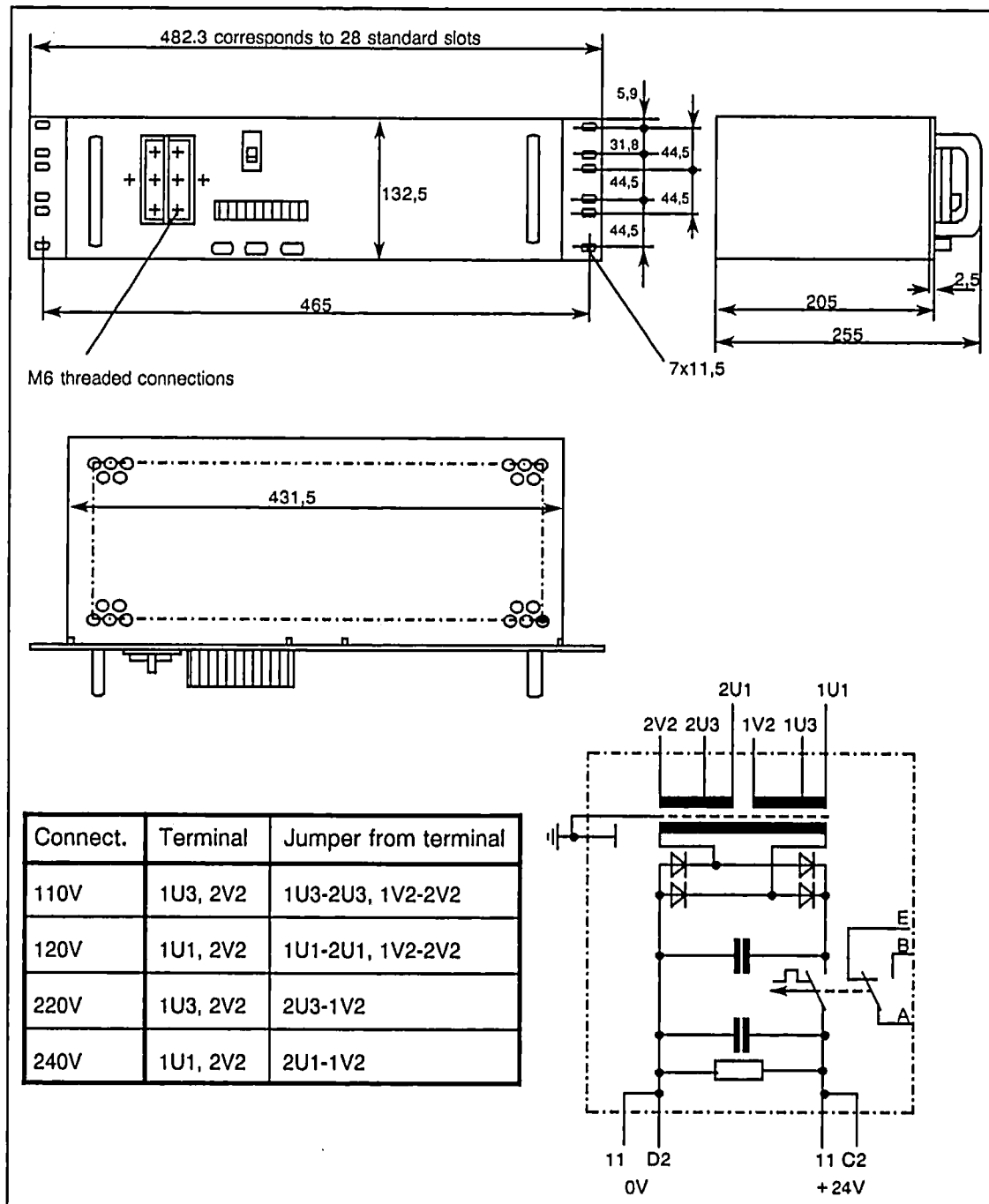
## 6 External Devices

### 6.1 Power supplies

#### 6.1.1 Power supply unit (110V/220V)

Type: 6EV1 334 - 4AK00

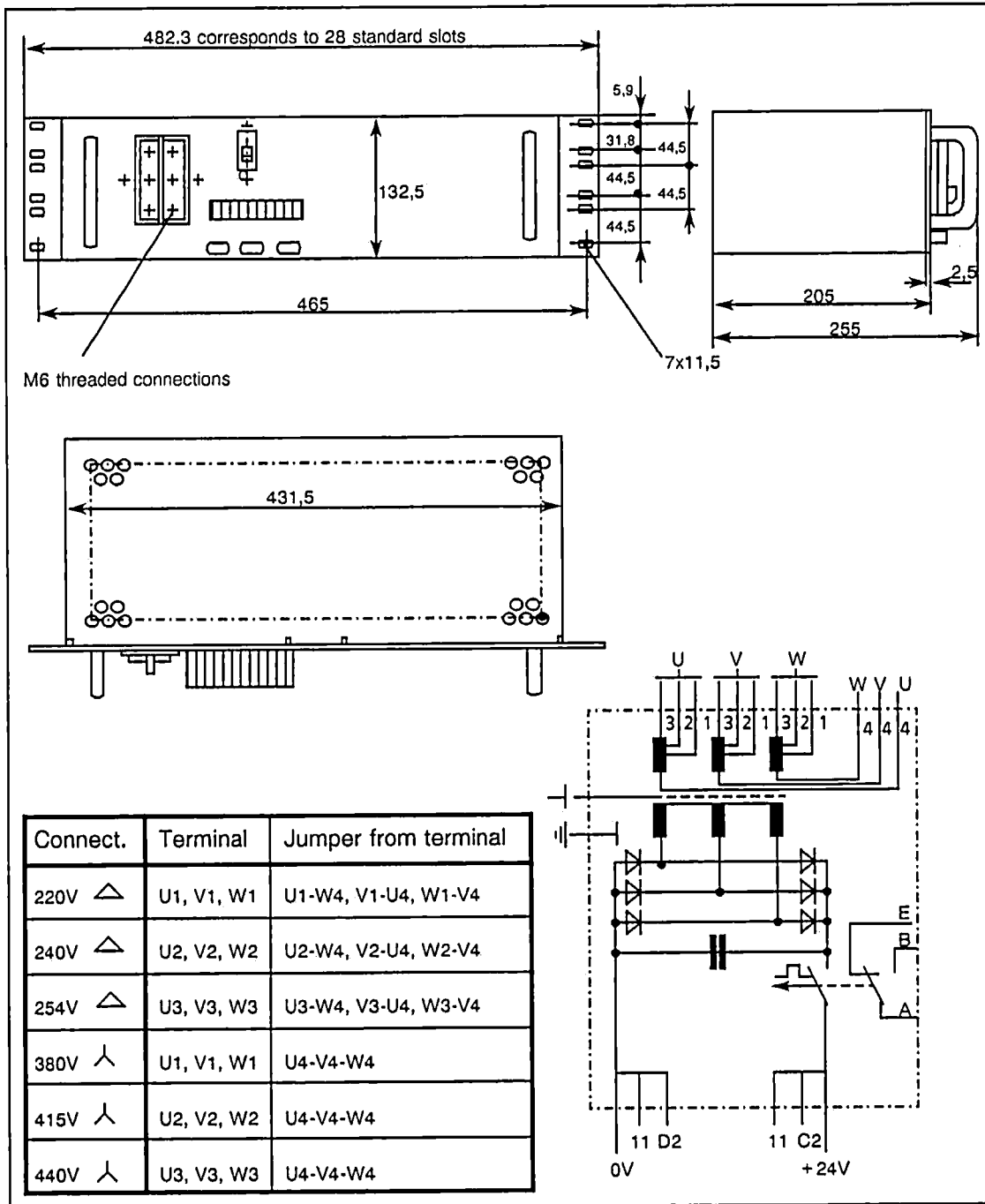
For 220V AC and 110V AC mains connection



### 6.1.2 Power supply unit (220V/380V)

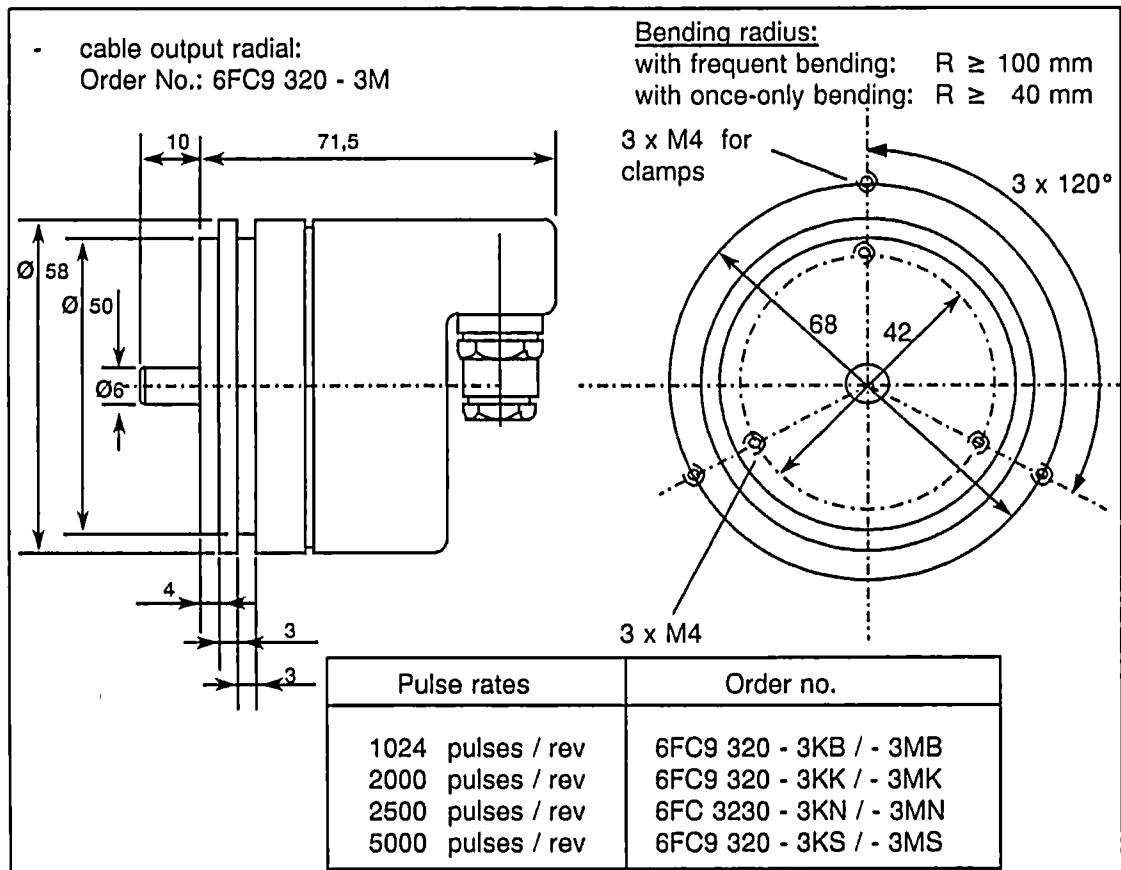
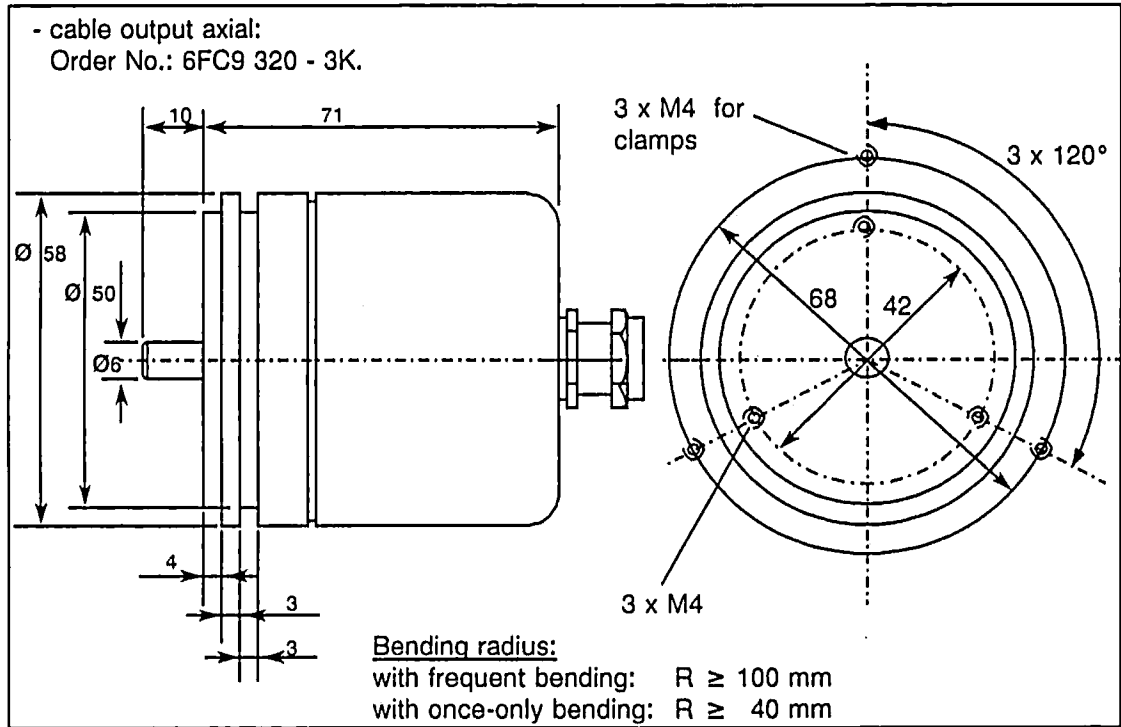
- 20A: Type : 6EV1 352 - 5BK00  
 Order No. : 6FC9 304 - 0AC  
 40A: Type : 6EV1 362 - 5BK00  
 Order No. : 6FC9 304 - 0AD

For 380V AC mains connection



6.2 Incremental encoders

6.2.1 Rotary encoder and main spindle encoder

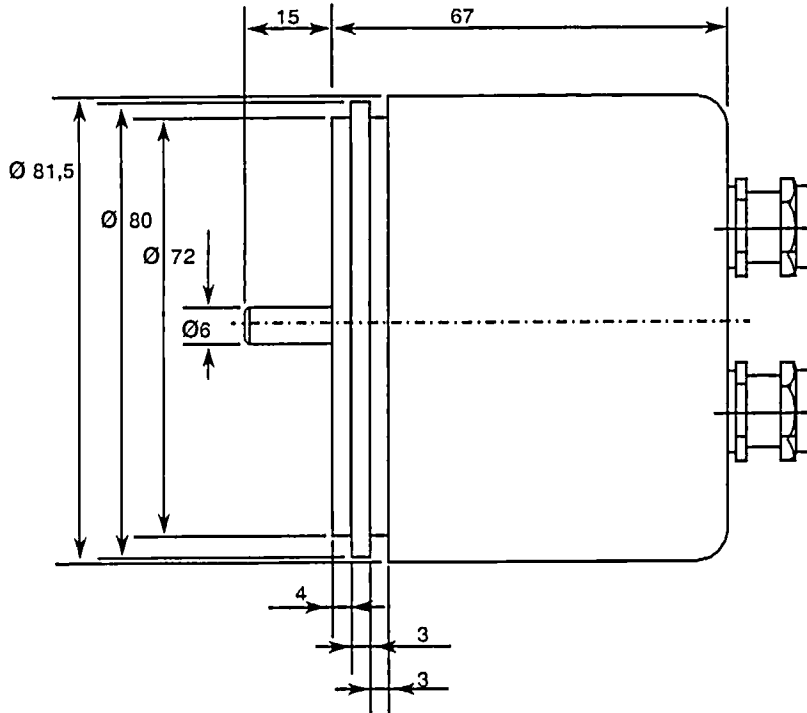


### 6.2.2 Combined rotary encoder for spindle and C axis

Order No.: 6FC9 320 - 3KT00

Pulse rate - spindle: 1024 pulses / rev

Pulse rate - C axis : 9000 pulses / rev

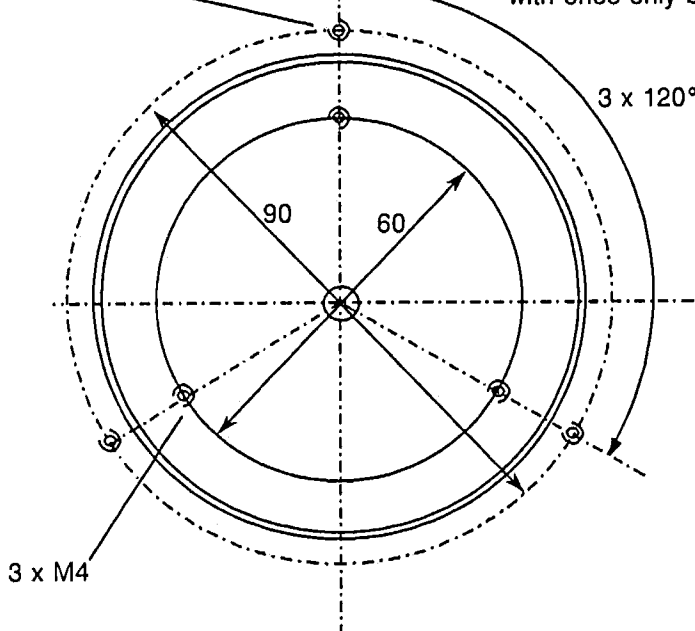


3 x M4 for clamps

Bending radius:

with frequent bending:  $R \geq 100$  mm

with once-only bending:  $R \geq 40$  mm

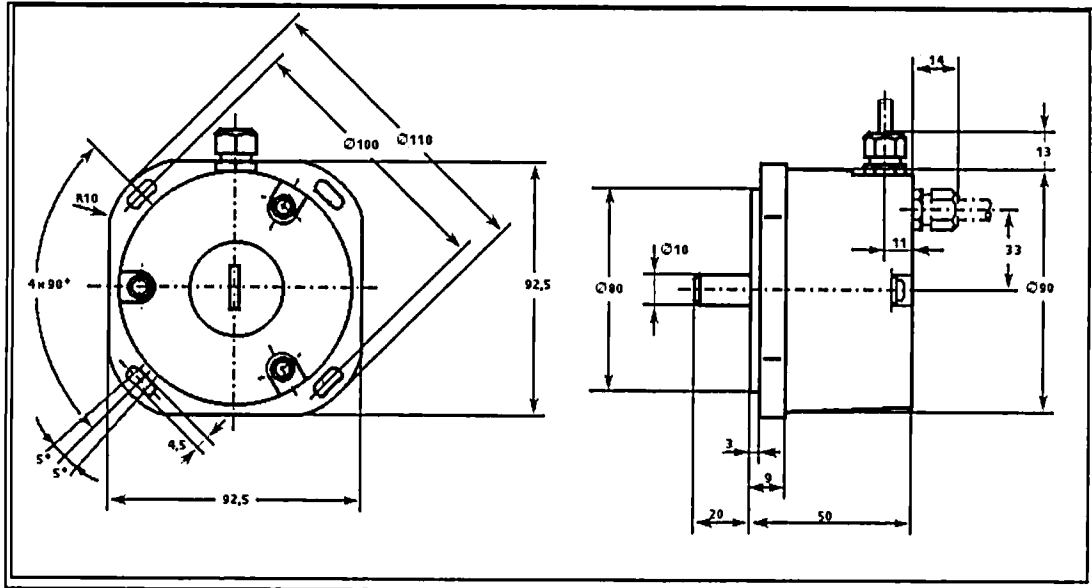


3 x M4

### 6.2.3 High-resolution rotary encoder for rotary axes

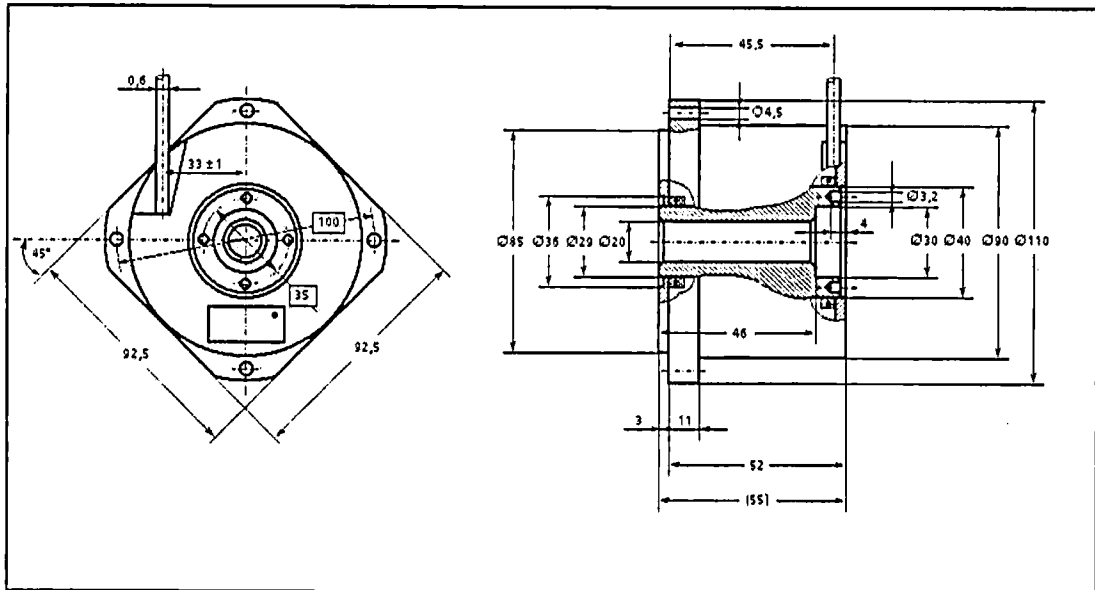
ROD 250

Order No.: 6FC9 320 - 3C M00



RON 255

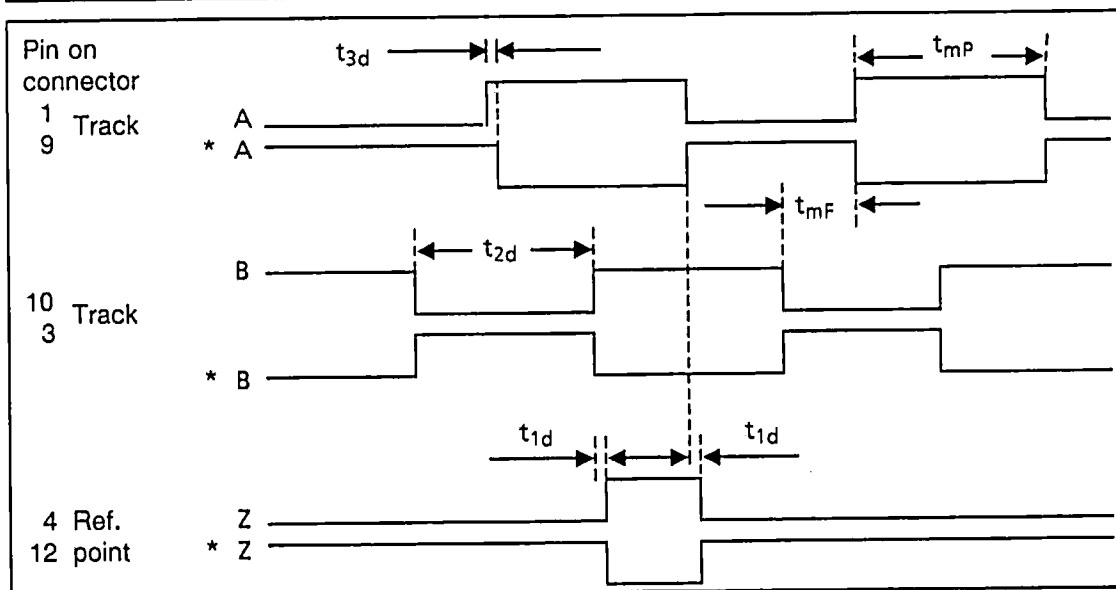
Order No.: 6FC9 320 - 3C N00



### 6.2.4 Characteristic data for measuring system input

Data sheet for measuring circuit interface  
 Actual value digital (measuring circuit module 6FX1 126-8B.)

Connector no. Type of signal (DIN ...) Encoder supply - short-circuit protection	Differential driver				
	no DESIG	MIN	TYPE	MAX	UNIT
Encoder supply - Voltage - Ripple - Current per encoder		+ 4.75	+ 5.0	+ 5.25 100 300	V mVpp mA
Input voltage - Voltage positive (TTL) - Voltage negative (TTL) - Difference - Permissible common mode range		- - 1.0 -2.0		- - 10.0 + 5.0	V V V V
Input current - Current "H" - Current "L"		- -	- -	21 21	mA mA
Inputs - Frequency with 90° el A-B - Pulse width - Edge steepness - Time interval - Time interval ref. signal - Time interval (signal change) - Edge offset	1/T tmP  tmF t1d t2d t3d	1.0 5.0 0.45 - 0.9		500 - 0.2 0.2	KHz μs V/μs μs μs μs
Noise immunity (DIN 57847) Noise signal width Noise energy				3 - -	KV μs μWs
Length of cable to the encoder when using SINUMERIK cables				35	m



Data sheet for measuring circuit interface  
Actual value with integrated EXE

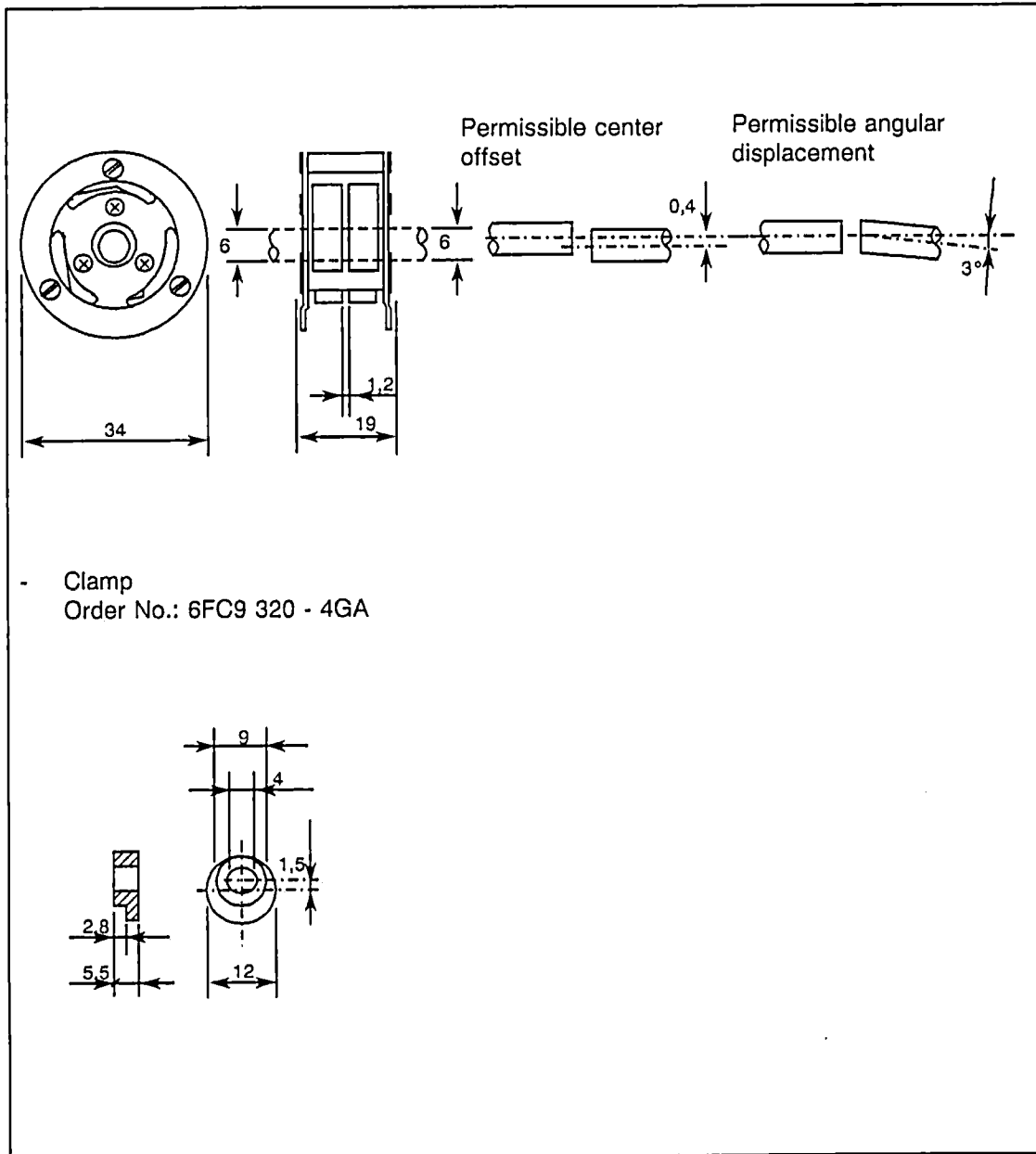
Connector No. Type of signal (DIN ...) Encoder supply - Short-circuit protection	Sinusoidal current				
	no DESIG	MIN	TYPE	MAX	UNIT
Encoder supply - Voltage - Ripple - Current per encoder		+ 4.75	+ 5.0	+ 5.25 100 300	V mV <sub>pp</sub> mA
Input current - Tracks A and B - Ref. mark - Direct component - Amplitude difference		0.007 0.002		0.016 0.009 6.5 20	mA mA % %
Inputs - Frequency with 90° eIA-B - Phase shift A to B - Phase shift ref. mark to A		80 45	90 135	25(12) 100 405	KHz °el °el
Noise immunity (DIN 57847)				3	KV
Cable length from EXE to encoder when using SINUMERIK cables				20	m

The actual values are supplied through 15-way connectors of the SINUMERIK. Incremental rotary encoders for linear and rotary axes are connected, or incremental linear encoders with external pulse shaping electronics.

The 6FX1 126-8BA module can also be delivered with integrated EXE. In this case, the signals from the measuring head are taken direct to measuring circuit modules and converted on the module into the A, B and reference signals. The 6FX1 126-8BA module is 40 mm wide.

### 6.2.5 Spring disk coupling / clamp

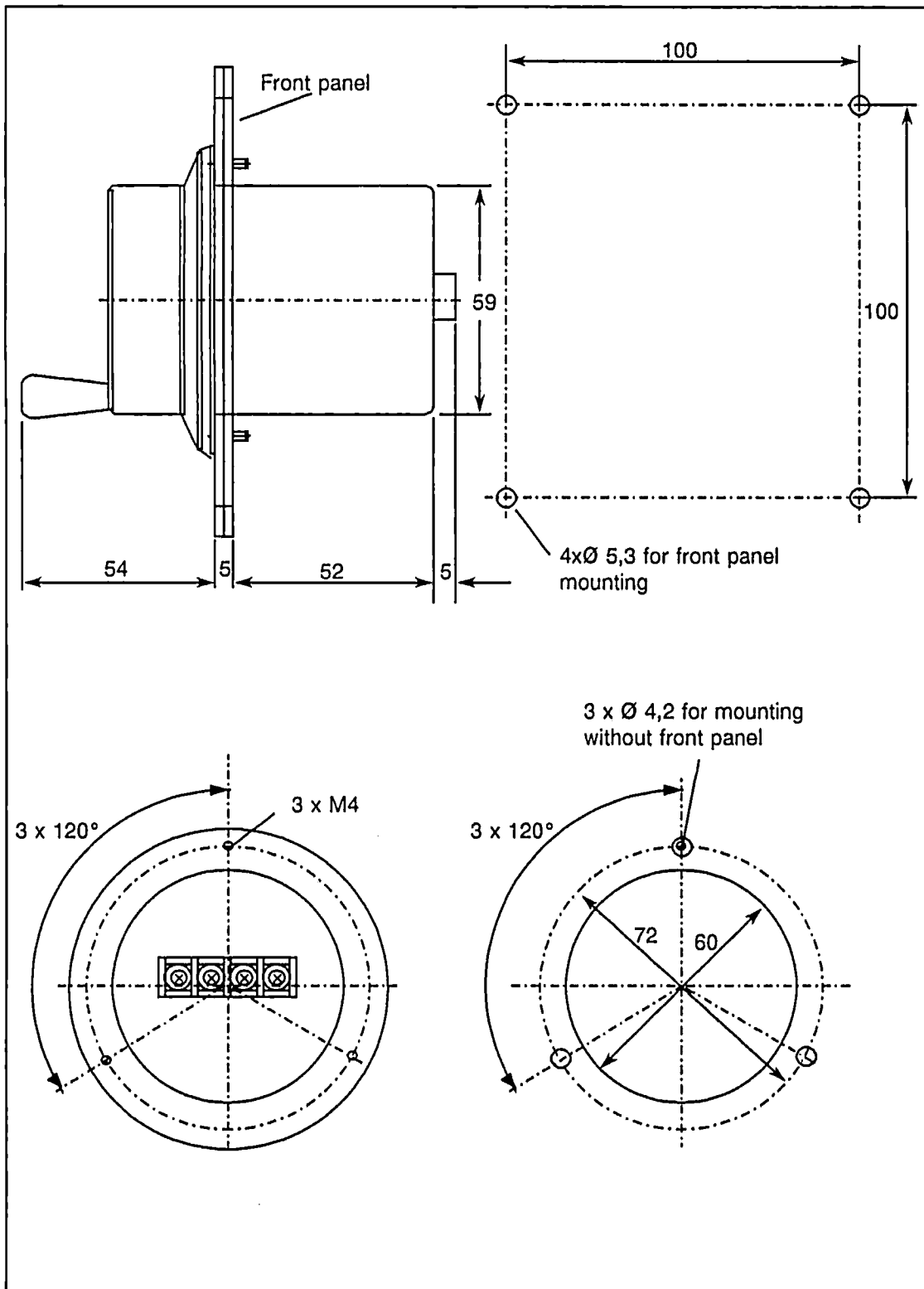
- Spring disk coupling  
Order No.: 6FC9 320 - 4GB





## 6.3 Electronic handwheel

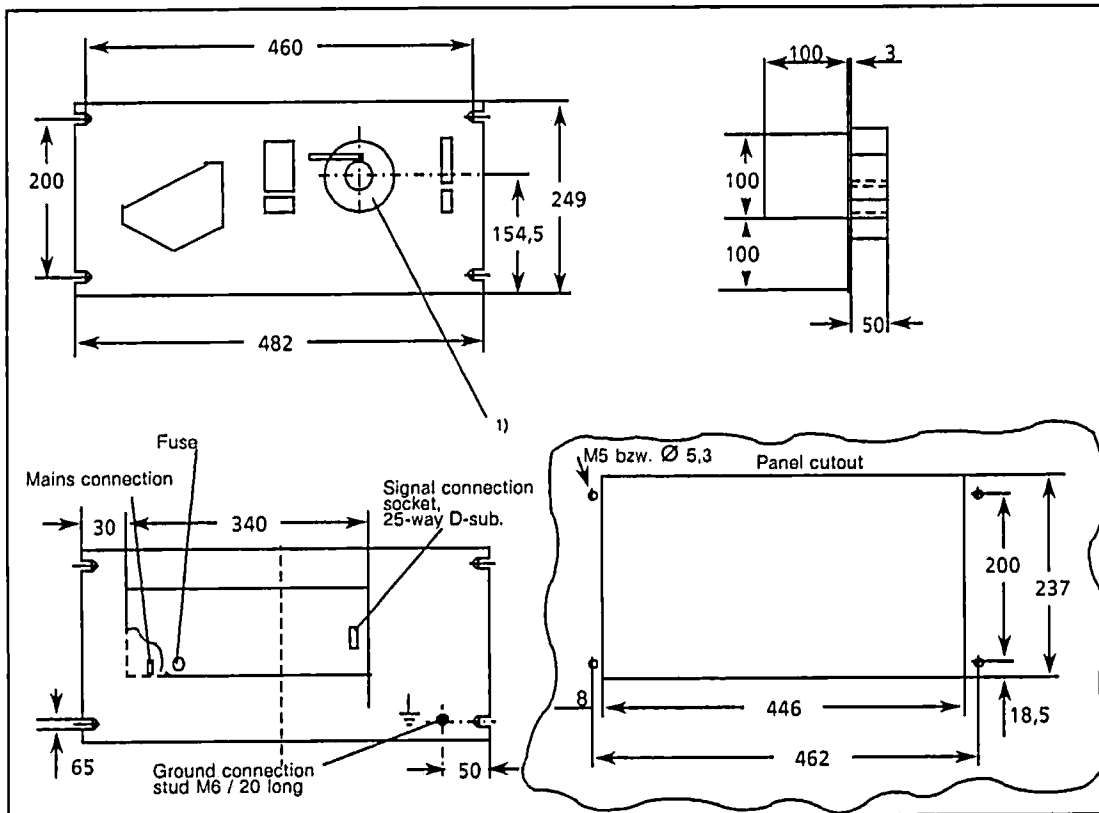
Order No. : 6FC9 320-5DA



## 6.4 Tape reader

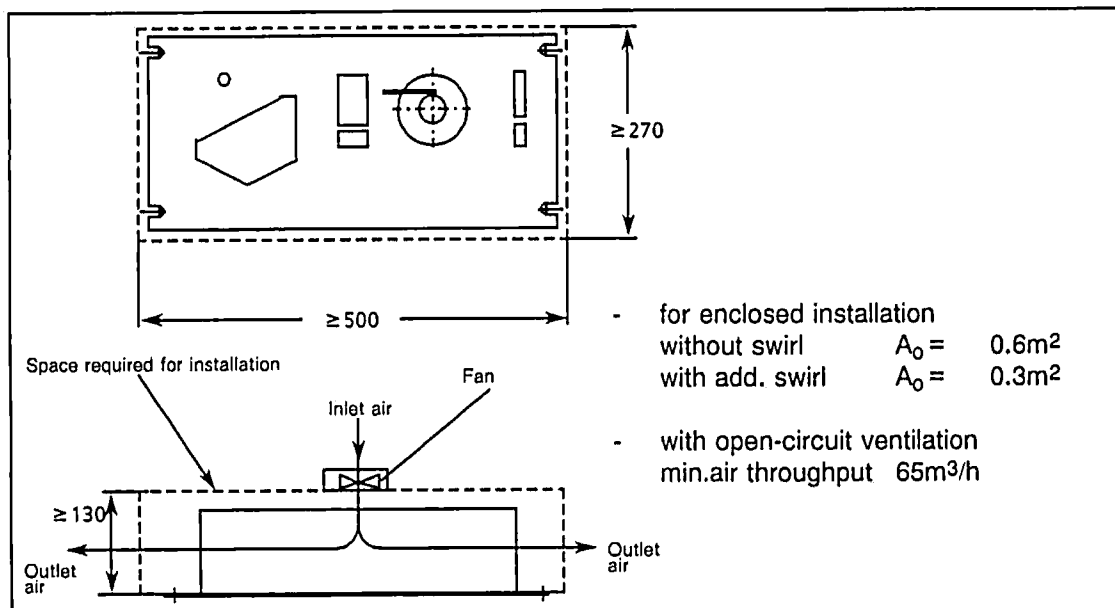
### 6.4.1 Reader T40, with take-up reel

Order No.: 6FC3 984 - 1FC



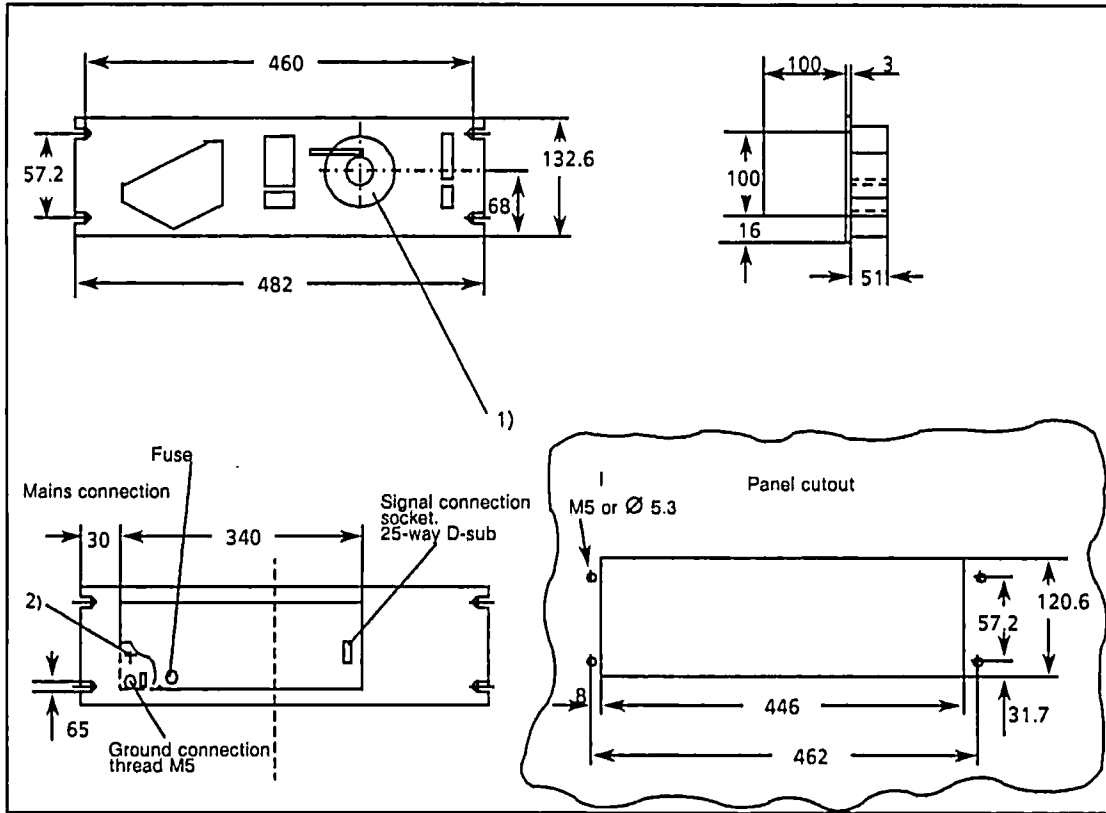
- 1) Rubber ring enclosed for endless looping
- 2) Mains cable 1.5 m long, free wires with sleeves
- 3) Ground symbol DIN 30600 in accordance with DIN 40011-E8

Suggested installation:



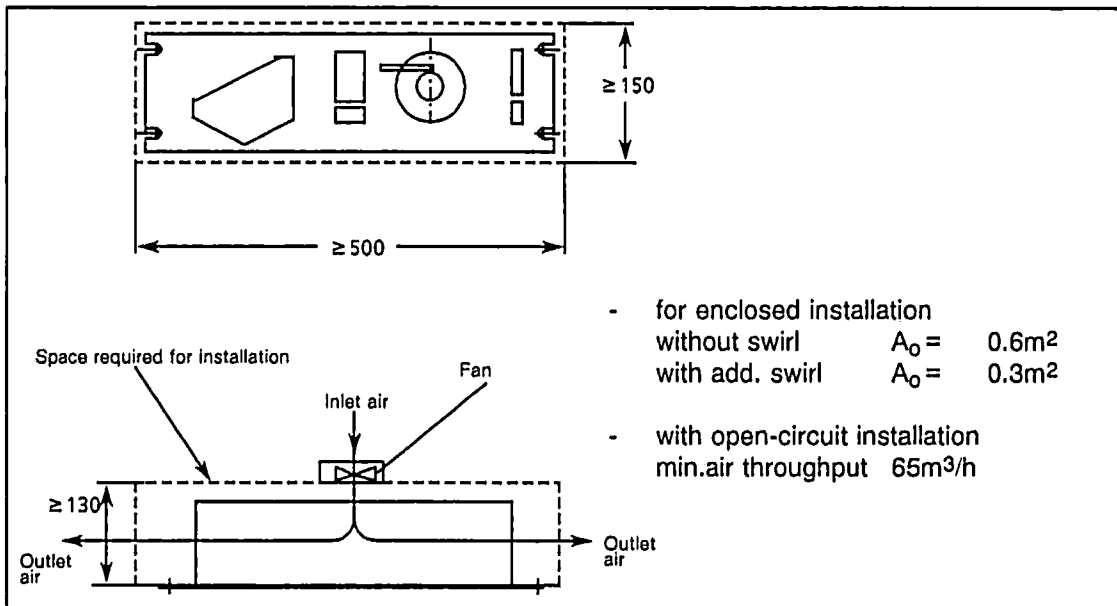
### 6.4.2 Reader T41, with take-up reel and smaller front panel

Order No.: 6FC3 984 - 1GB



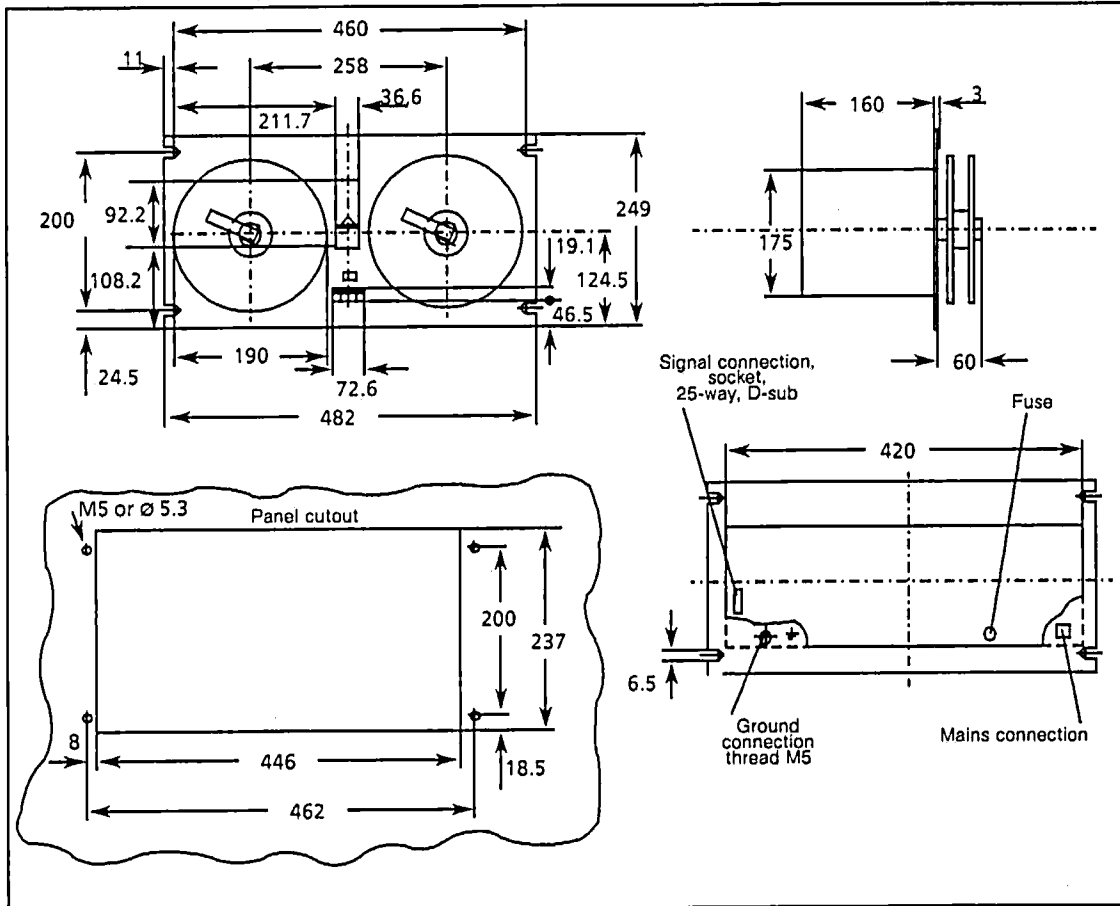
- 1) Rubber ring enclosed for endless looping
- 2) Ground symbol DIN 30600 in accordance with DIN 40011-E8

Suggested installation:



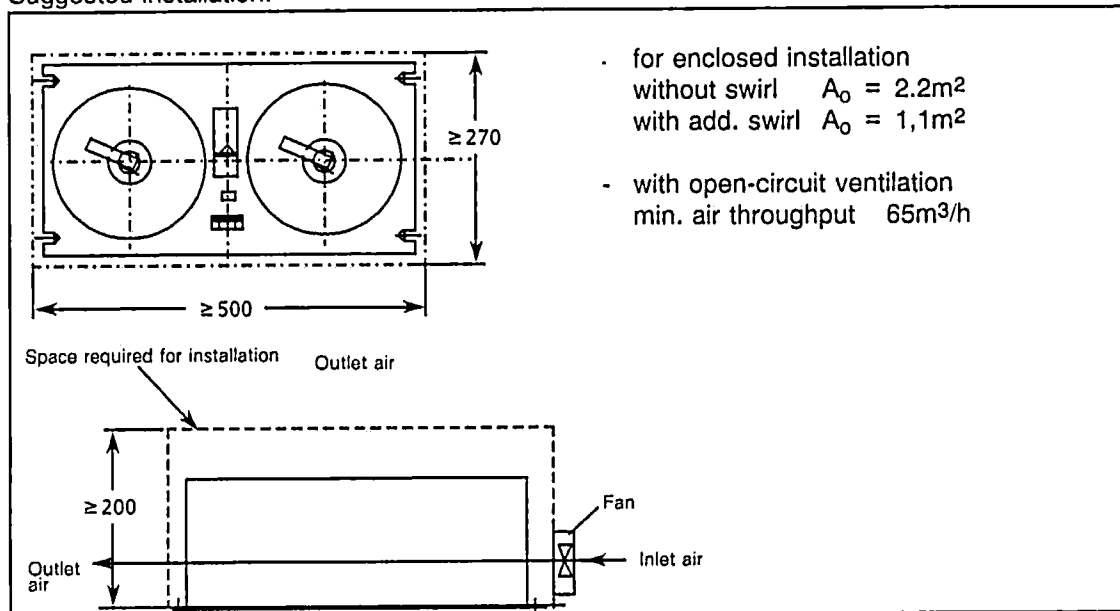
### 6.4.3 Reader T50, with winder

Order No. : 6FC3 984 - 1FD



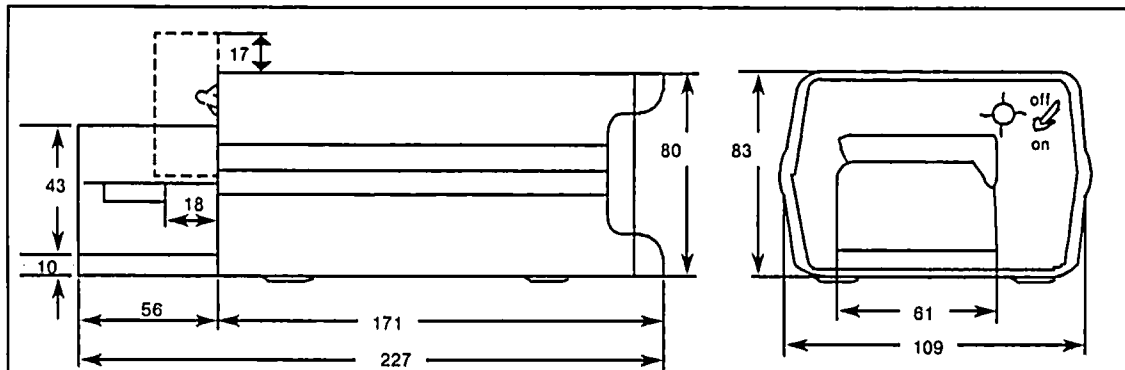
- 1) Power cable 1.1 m long, free wires with sleeves
- 2) Ground symbol DIN 30600 in accordance with DIN 40011-E8

#### Suggested installation:

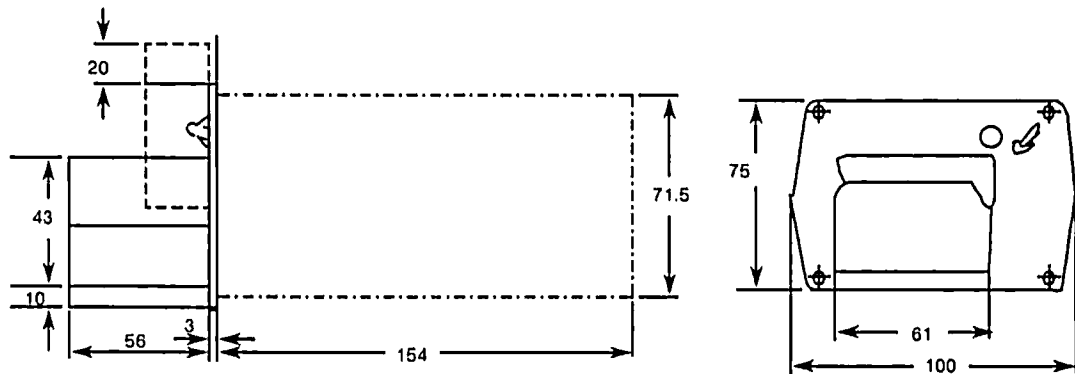


### 6.4.4 Reader T60, portable

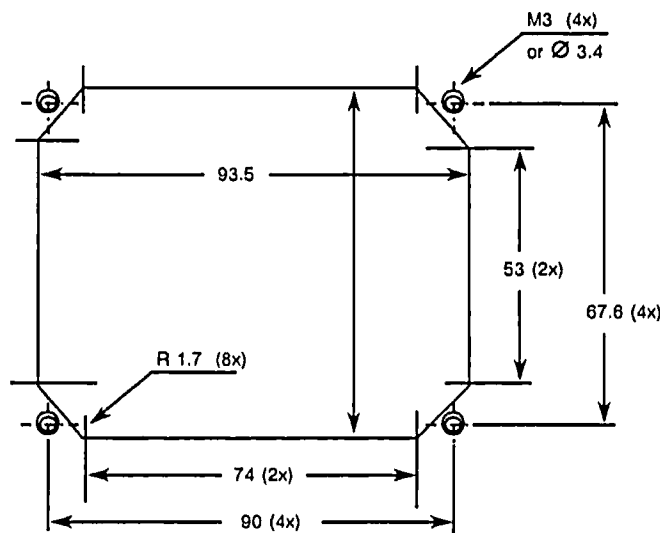
Order No. : 6FC3 984 - 1FB



**Tape reader T60**  
portable version



**Tape reader T60**  
Panel-mounting version, casing removed



**Panel cutout T60**

## 6.5 Video encoder

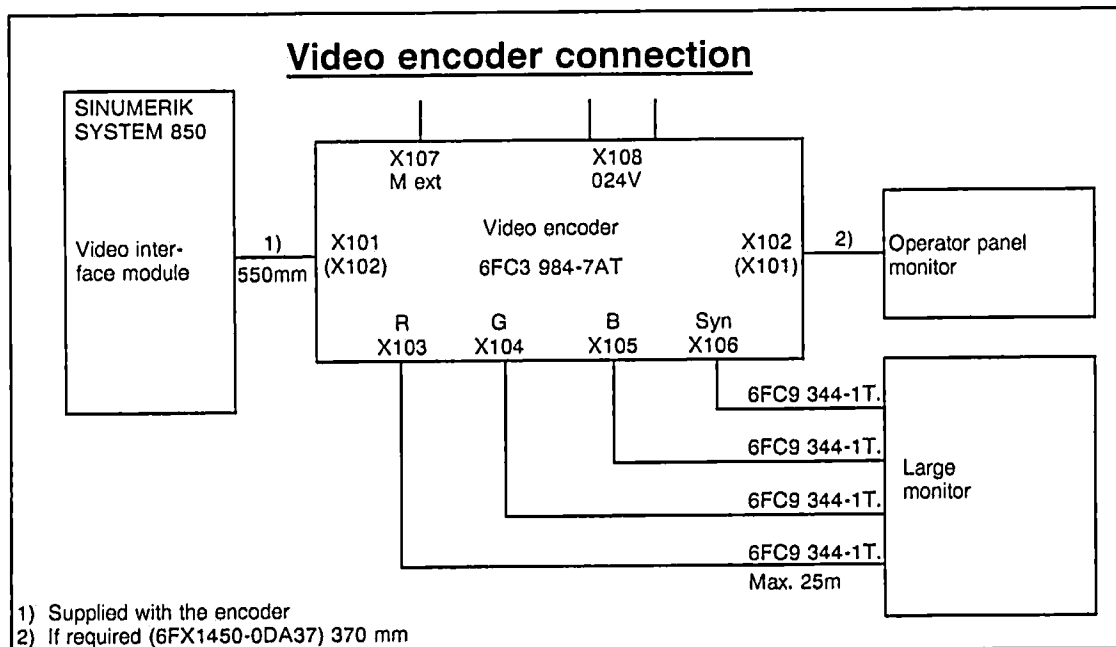
Order No. : 6FC3 984-7AT

By means of the video encoder, a large monitor can be connected to the System 850.

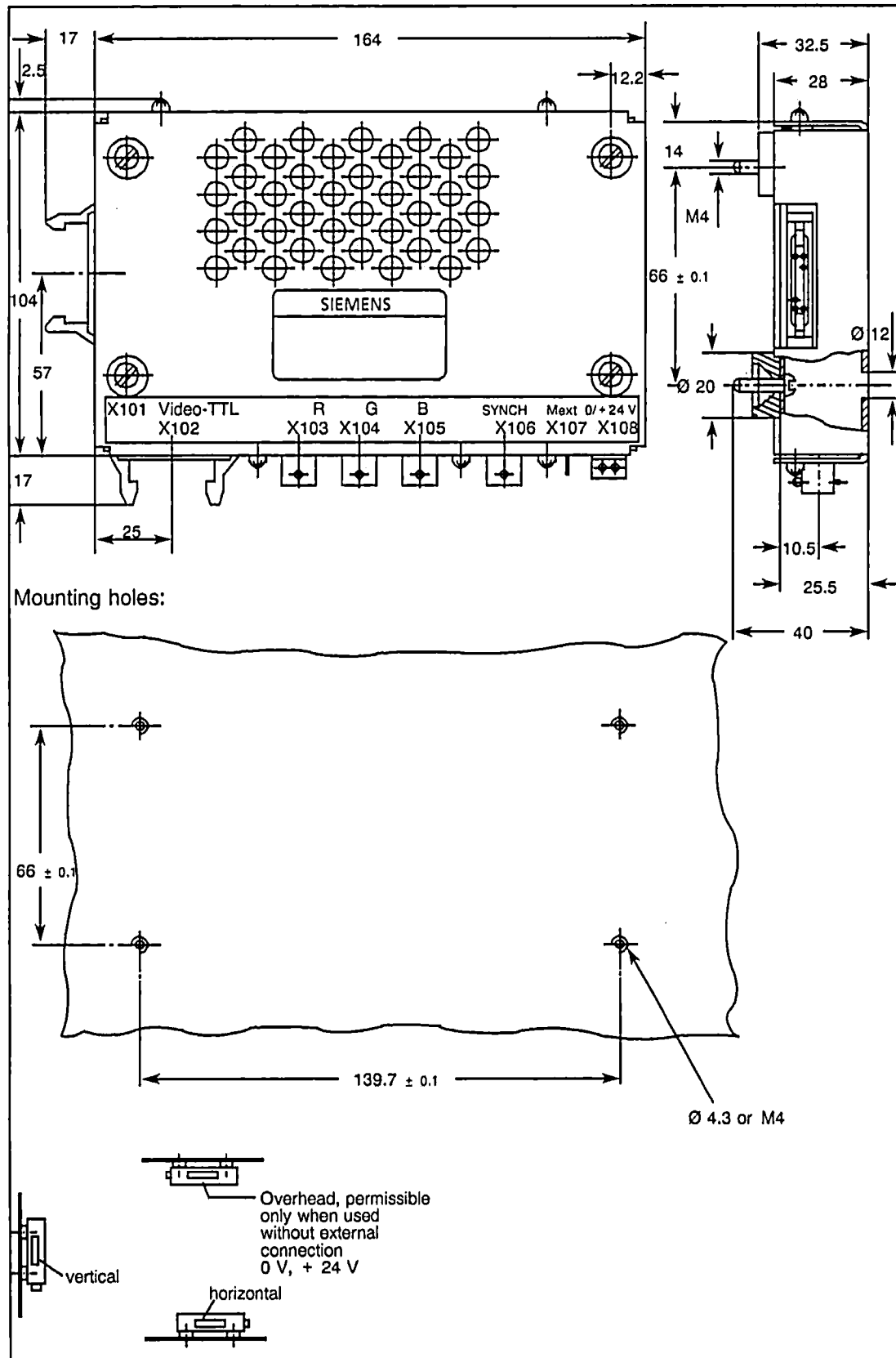
The encoder is connected to the video interface by means of the cable supplied, and the NC display is connected to the encoder with the standard NC cable. If the cable length between NC display and encoder is not sufficient, a ribbon cable can be obtained as an alternative and installed in place of the cable supplied.

The maximum cable length between NC display and video interface must not be greater than 1 m because unshielded ribbon cables are used.

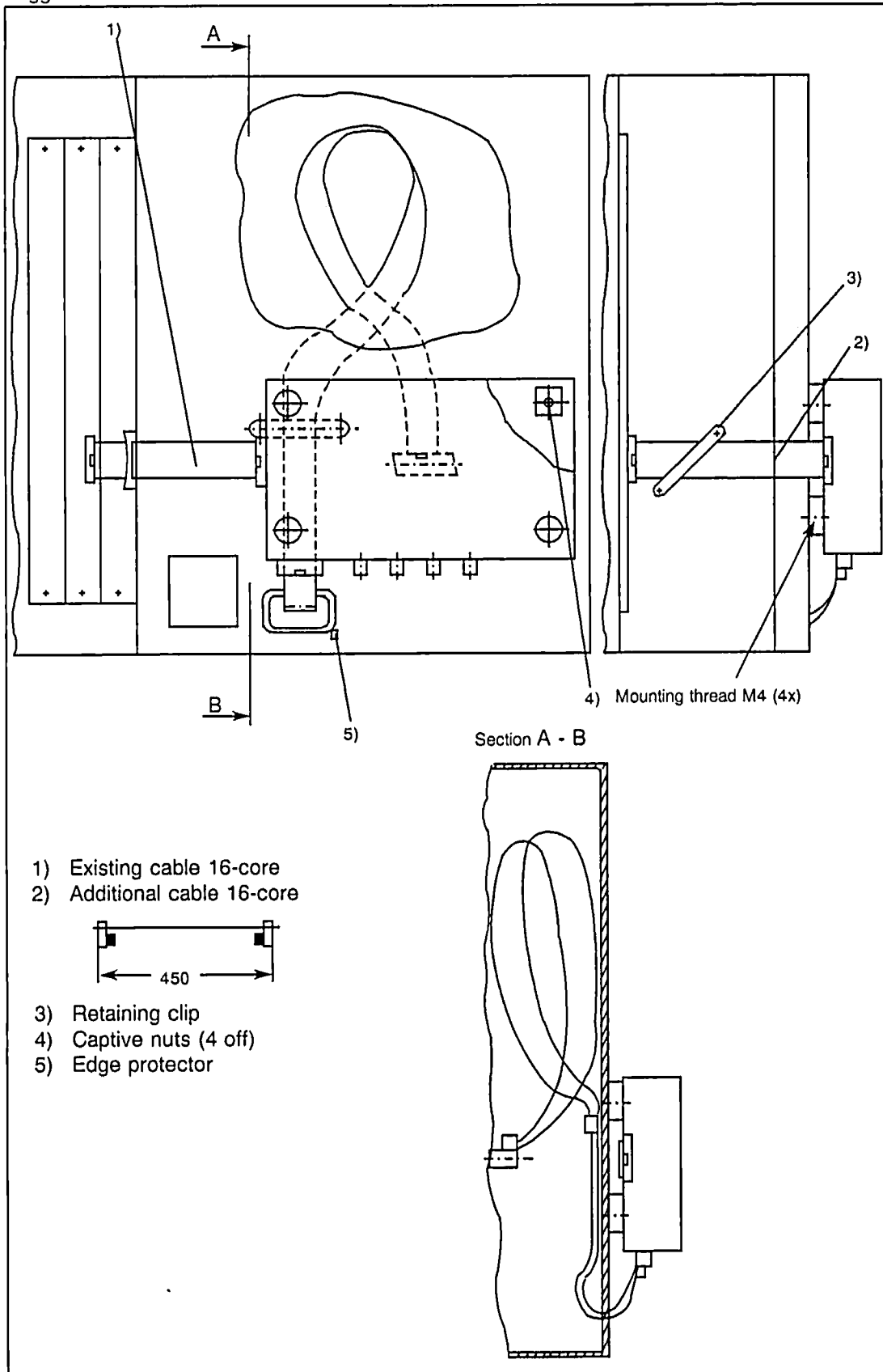
Power is supplied to the encoder through the ribbon cable, a separate source is not necessary. The 6SD3 401-8BH special monitor should be used because the standard type of RGB monitor does not produce satisfactory displays.



Dimension drawings:

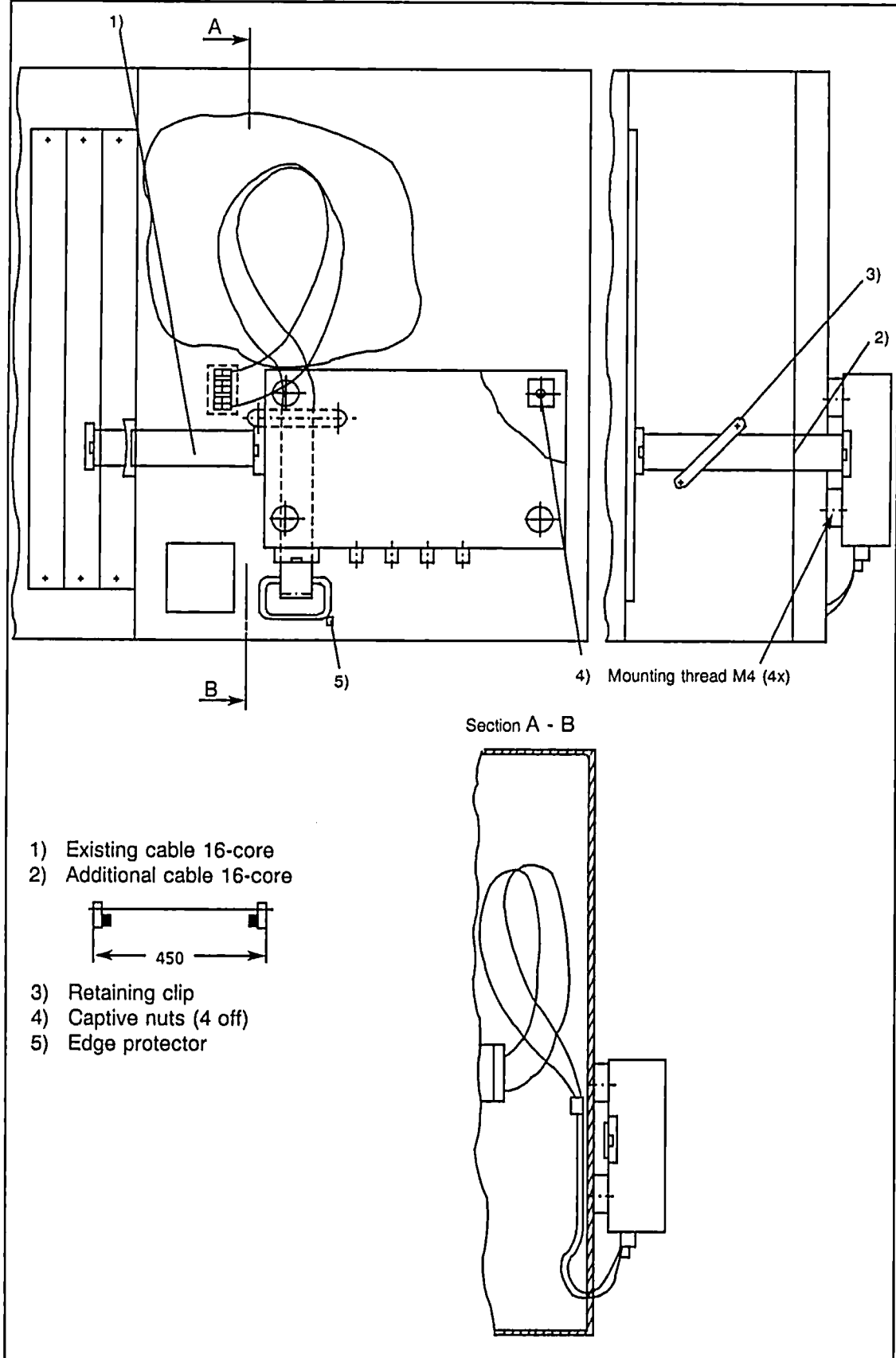


Suggested installation - "monochrome"

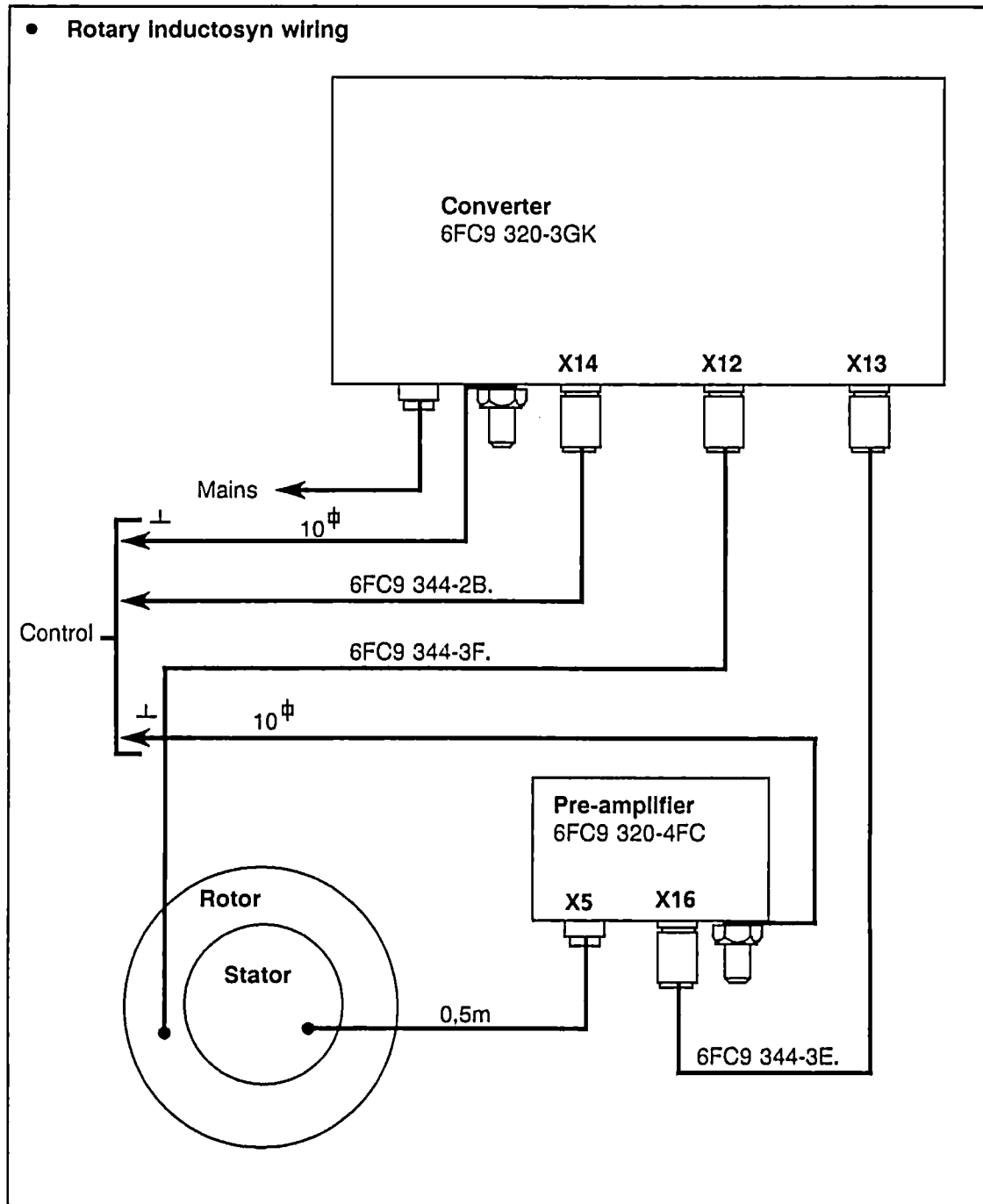




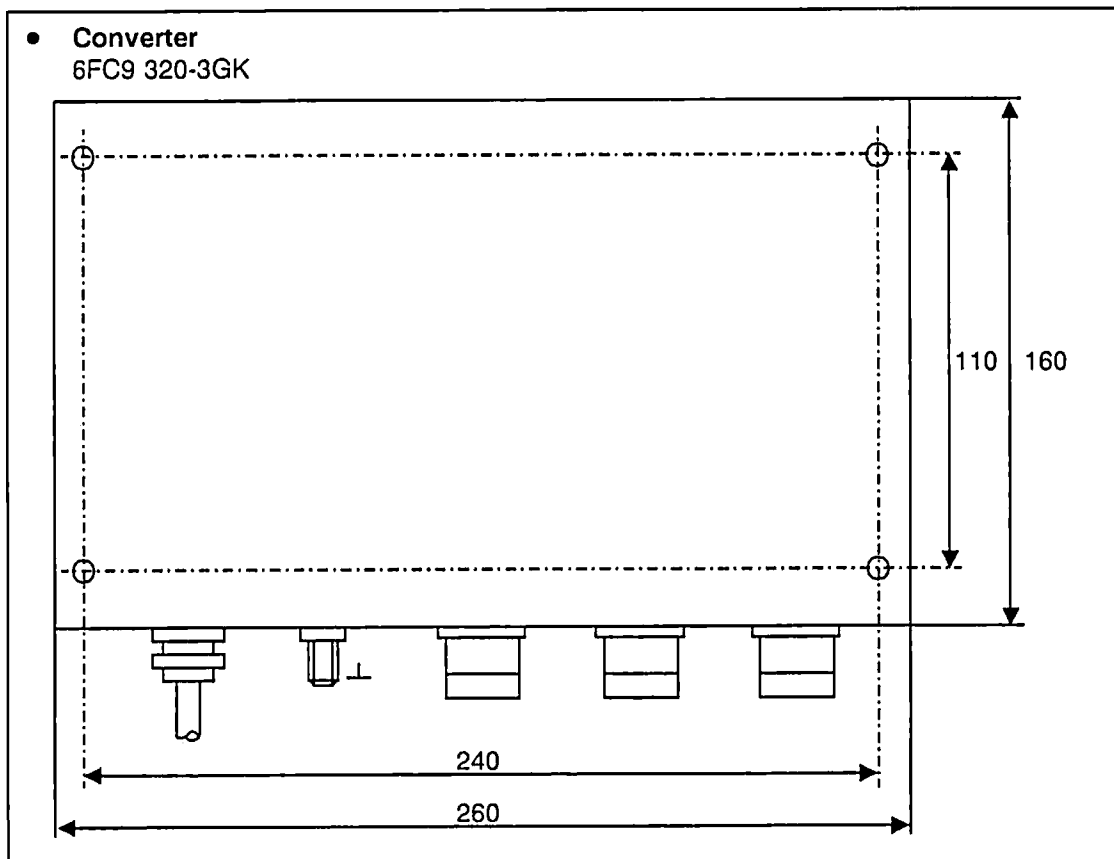
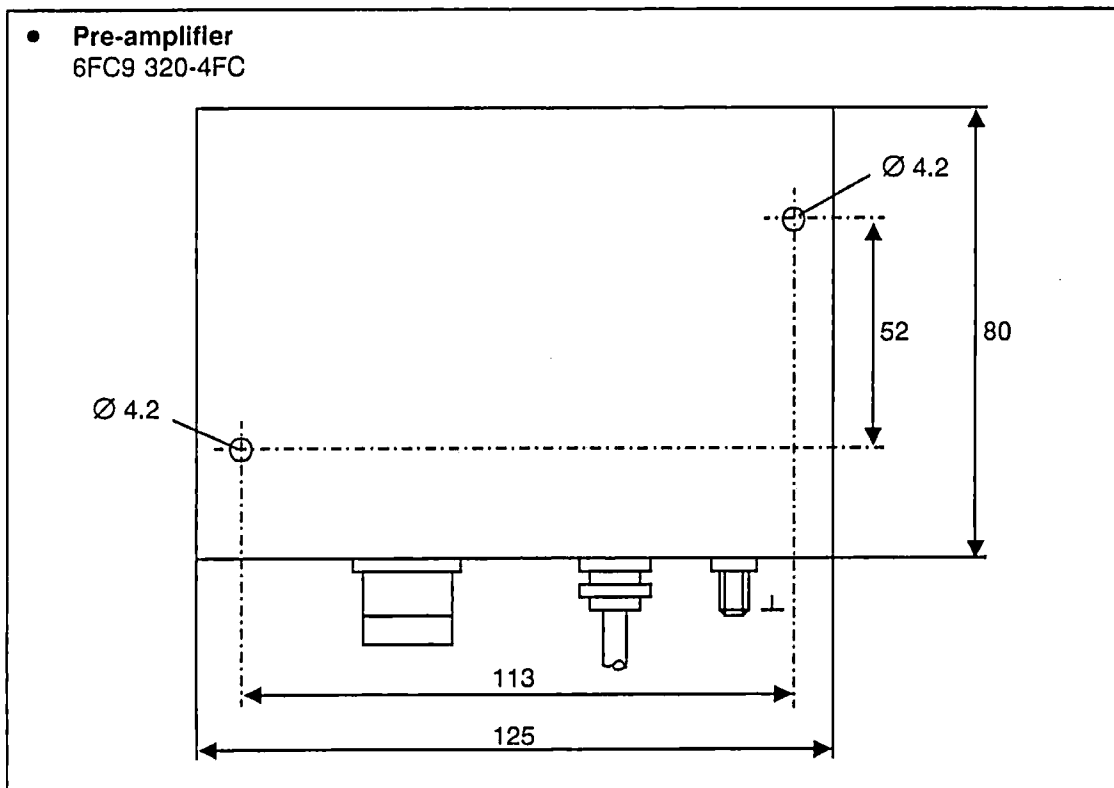
## Suggested installation - "colour"





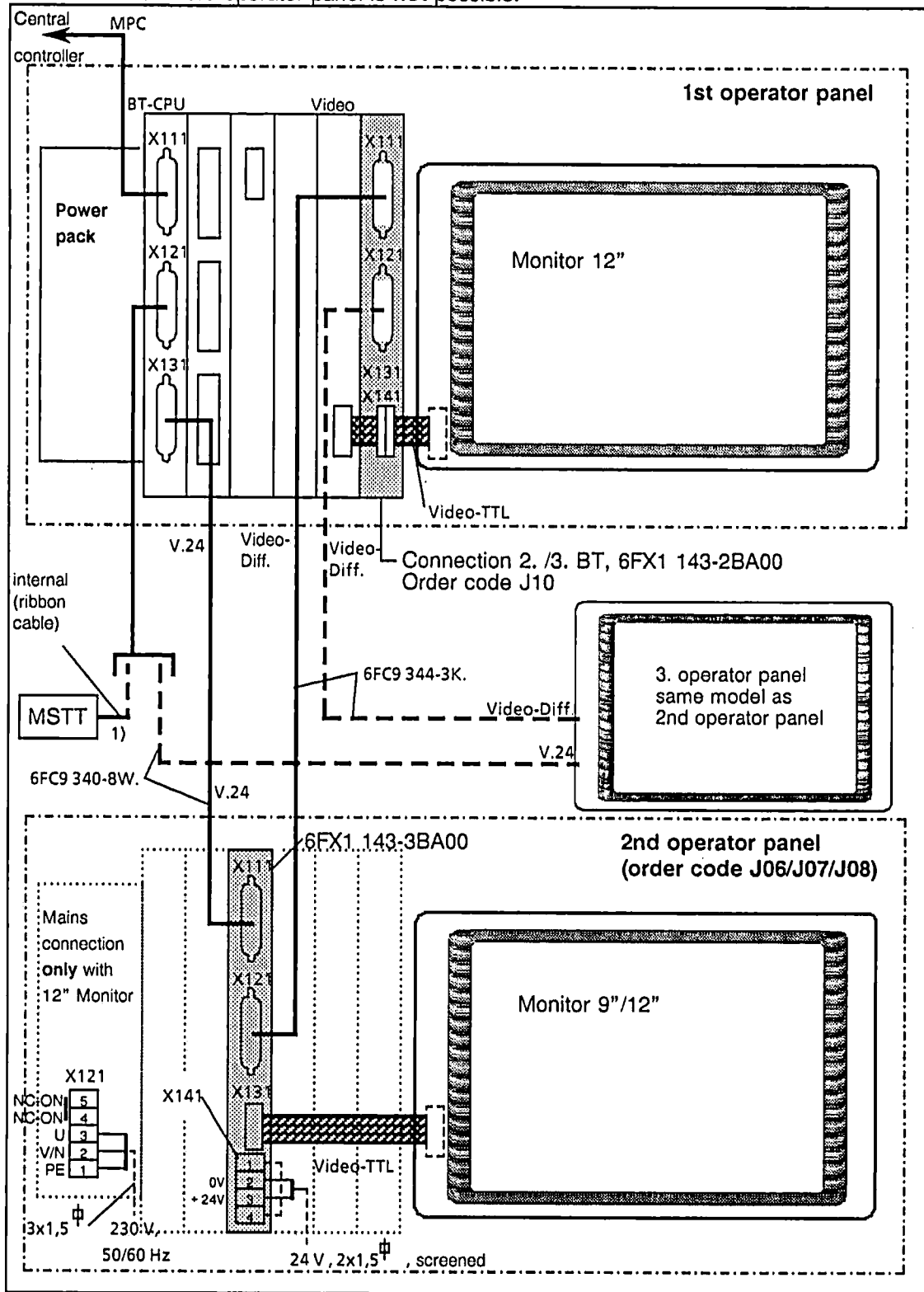


### 6.6.2 Dimension drawings



### 6.7 Interfacing of a 2nd/3rd operator panel (from software version 4)

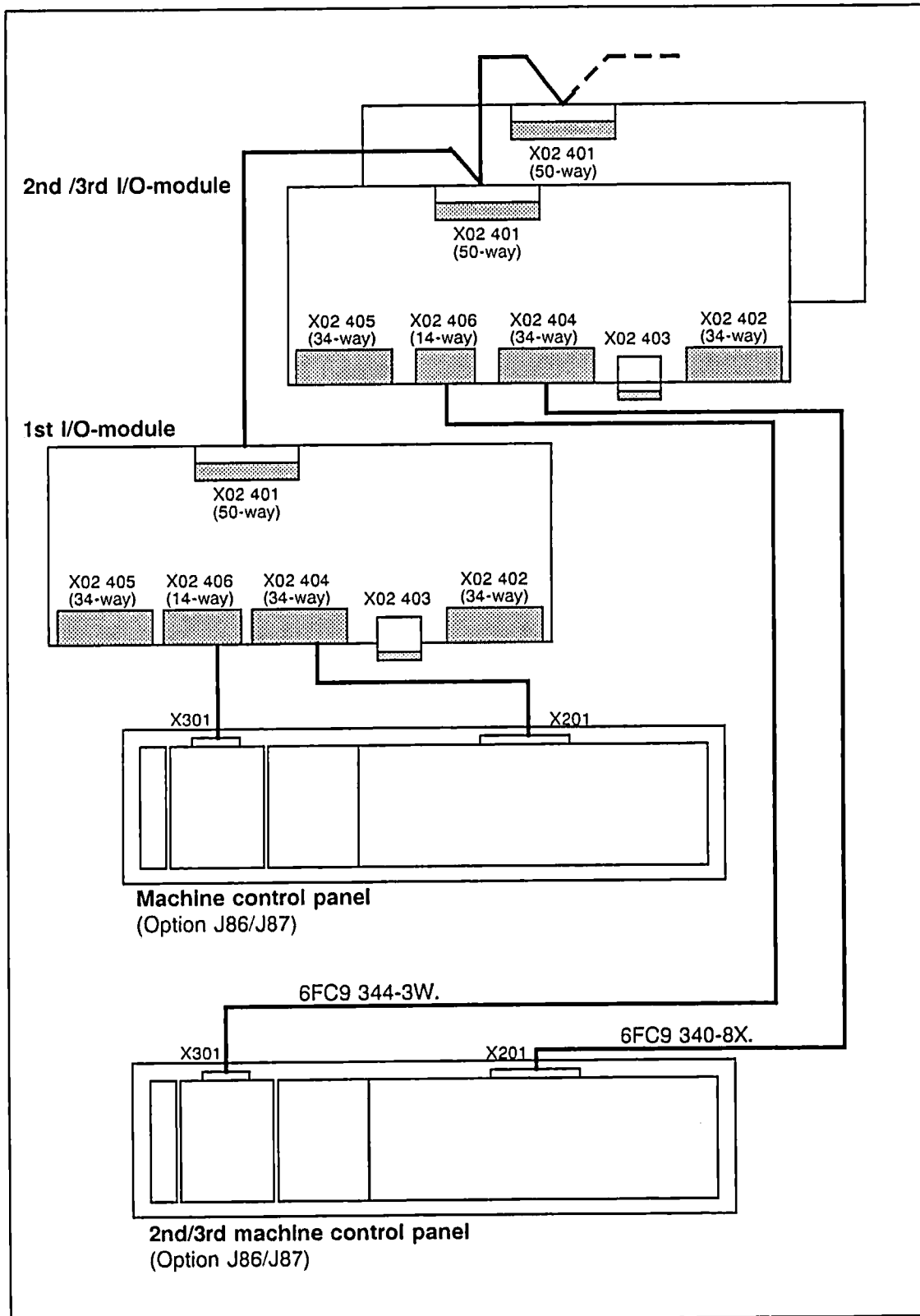
In SINUMERIK 850TE / ME 2nd operator panel has to be connected with the serial interface 1; connection with a 3rd operator panel is not possible.



1) When using a 3rd operator panel the machine control panel's serial interface has to be connected with interface 4 of the central controller by cable 6FC9 344-1F..

6.8 Connection with a 2nd/3rd machine control panel

6.8 Connection with a 2nd/3rd machine control panel



## 6.9 Installation conditions

## 6.9.1 Electrical and mechanical installation conditions

Conditions Device	Nominal voltage $U_N$	Max. power loss $P_V$	Degree of protec- tion (to DIN 40050)	Dimen- sions w h d	Weight
Power supply unit  6FC9 304 - 0AC 6FC9 304 - 0AD  6FC9 304 - 0A	3 x 380 V AC 4 1 5 V AC 4 4 0 V AC 24V / 20A 24V / 40 A 1 x 220 V AC 24V / 10A		IP00	431.5mm 132mm 255mm	
Incremental encoder 6FC9 320 - 3..	Internal voltage 5V DC		IP54	∅58mm 83mm	
Comb. rotary encoder 6FC9 320 - 1EA	Internal voltage 5V DC		IP54		
High-resolution rotary encoder for rotary axes	5V				
Electronic handwheel 6FC9 320 - 5DA	Internal voltage 5V DC	0.5W	Front IP63 Rear IP00	100mm 100mm 106mm	0.7kg
Tape reader T40, with take-up reel B02 6FC9 984 - 1FC	220 V AC + 10% / - 15%	30W	IP00	482mm 249mm 100mm	3.1kg
Tape reader T41, with take-up reel and smaller front panel B21 6FC3 984 - 1GB	220 V AC + 10% / - 15%	30W	IP00	482mm 133mm 100mm	3.1kg
Tape reader T50, with winder B03 6FC9 984 - 1FD	220 V AC + 10% / - 15%	110W	IP00	482mm 249mm 160mm	8.3kg
Tape reader T60, portable B01 6FC3 984 - 1FB	220 V AC + 10% / - 15%	23W	IP00	108mm 85mm 230mm	1.4kg
Video encoder 6FC3 984 - 7AT	5V		IP00	∅170mm 72(92)mm	

### 6.9.2 Climatic conditions for installation

Conditions Device	Air throughput	Inlet and ambient temperature	Maximum temperature change	Permissible air humidity (DIN40040)
Power supply unit  6FC9 304 - 0AC 6FC9 304 - 0AD  6FC9 304 - 0A				
Incremental encoder 6FC9 320 - 3..				
Comb. rotary encoder 6FC9 320 - 1EA				
High-resolution rotary encoder for rotary axes				
Electronic handwheel 6FC9 320 - 5DA				
Tape reader T40, with take-up reel B02 6FC9 984 - 1FC	65m <sup>3</sup> /h	0 to 55°C	1.1 K/min	F
Tape reader T41, with take-up reel and smaller front panel B21 6FC9 984 - 1GB	65m <sup>3</sup> /h	0 to 55°C	1.1 K/min	F
Tape reader T50, with winder B03 6FC9 984 - 1FD	65m <sup>3</sup> /h	0 to 55°C	1.1 K/min	F
Tape reader T60, portable B01 6FC3 984 - 1FB				
Video encoder 6FC3 984 - 7AT				



## 7 Overview of Cables and Devices

### 7.1 Accessories, cables

Cable, complete	Max. possible length	Order No.
To universal interface operating area Length 1 m Length 2 m Length 3 m Length 5 m Length 10 m Length 18 m Length 25 m	30 m	6FC9 344-1FL 6FC9 344-1FM 6FC9 344-1FN 6FC9 344-1FB 6FC9 344-1FC 6FC9 344-1FE 6FC9 344-1FF
To servo drives and main spindle drive Length 5 m Length 10 m Length 18 m Length 25 m	50 m	6FC9 340-8RB 6FC9 340-8RC 6FC9 340-8RE 6FC9 340-8RF
To digital rotary encoders and main spindle encoder (new version) and to inductosyn converter Length 5 m Length 10 m Length 18 m Length 25 m	35 m	6FC9 344-2BB 6FC9 344-2BC 6FC9 344-2BE 6FC9 344-2BF
To digital rotary encoders and main spindle encoder (old version) Length 5 m Length 10 m Length 18 m Length 25 m	35 m	6FC9 340-8NB 6FC9 340-8NC 6FC9 340-8NE 6FC9 340-8NF
Between digital linear measuring system and EXE (extension) Length 17 m	17 m	6FC9 344-3LE
To digital linear measuring system (integrated EXE) Length 5 m Length 10 m Length 17 m	17 m	6FC9 340-8QB 6FC9 340-8QC 6FC9 340-8QE
To digital rotary encoder in servo drive (ROD 320) Length 5 m Length 10 m Length 18 m Length 25 m	35 m	6FC9 340-8PB 6FC9 340-8PC 6FC9 340-8PE 6FC9 340-8PF
To electronic handwheel Length 1 m Length 5 m Length 10 m Length 18 m Length 25 m	25 m	6FC9 340-8MA 6FC9 340-8MB 6FC9 340-8MC 6FC9 340-8ME 6FC9 340-8MF

## 7.1 Accessories, cables

<b>Cable, complete</b>	Max. possible length	Order No.
To probe Length 5 m Length 10 m Length 18 m Length 25 m	35 m	6FC9 340-8UB 6FC9 340-8UC 6FC9 340-8UE 6FC9 340-8UF
Between inductosyn converter and inductosyn scale Length 5 m Length 10 m Length 18 m Length 25 m Length 50 m	50 m	6FC9 344-3FB 6FC9 344-3FC 6FC9 344-3FE 6FC9 344-3FF 6FC9 344-3FG
Between inductosyn converter and inductosyn pre-amplifier Length 5 m Length 10 m Length 18 m Length 25 m Length 50 m	50 m	6FC9 344-3EB 6FC9 344-3EC 6FC9 344-3EE 6FC9 344-3EF 6FC9 344-3EG
Between inductosyn scales Length 0,335 m	-	6FC9 198-4AL
Between I/O submodule and terminal strip converter, ribbon cable, 34-core Length 0,5 m Length 1 m Length 2 m	2,5 m	6FC9 340-8LA 6FC9 340-8LL 6FC9 340-8LM
Between I/O submodule and terminal strip converter and between I/O submodule and machine control panel (larger distance), round cable, 34-core Length 5 m Length 10 m Length 18 m Length 25 m	25 m	6FC9 340-8XB 6FC9 340-8XC 6FC9 340-8XE 6FC9 340-8XF
Between I/O submodule and machine control panel (larger distance), round cable, 14-core Length 5 m Length 10 m Length 18 m Length 25 m	25 m	6FC9 344-3WB 6FC9 344-3WC 6FC9 344-3WE 6FC9 344-3WF
Between PLC I/O modules and machine control Length 5 m Length 10 m Length 18 m Length 25 m	50 m	6FC9 340-2WB 6FC9 340-2WC 6FC9 340-2WE 6FC9 340-2WF

Cable, complete	Max. possible length	Order No.
Between operator panel and central controller (MPC interface), copper cable Length 2 m Length 5 m Length 10 m Length 18 m Length 25 m Length 50 m	50 m	6FC9 344-2AM 6FC9 344-2AB 6FC9 344-2AC 6FC9 344-2AE 6FC9 344-2AF 6FC9 344-2AG
Between operator panel and central controller (MPC interface), optical-fibre cable Length 5 m (plastic) Length 10 m (plastic) Length 18 m (glass) Length 25 m (glass) Length 50 m (glass) Length 75 m (glass) Length 100 m (glass)	300 m	6FX1 400-2BC05 6FX1 400-2BC10 6FX1 400-1BC18 6FX1 400-1BC25 6FX1 400-1BC50 6FX1 400-1BC75 6FX1 401-1BC00
Between operator panel and central controller (MPC interface) Divisible max. 3 times (up to 4 part lengths) Part lengths to order Left part cable . . . m Middle 1st part cable . . . m Middle 2nd part cable . . . m Right part cable . . . m	50 m	6FC9 344-2RZ
To SINUMERIK DUAL PLC Length 1 m Length 2 m Length 3 m	50 m	6FC9 340-7HL 6FC9 340-7HM 6FC9 340-7HN
To SINUMERIK PLC expansion unit (EU interfacing) Length 1 m Length 2 m Length 3 m	50 m	6FC9 340-7QL 6FC9 340-7QM 6FC9 340-7QN
To SINUMERIK S5 PLC expansion unit (EU interfacing) Length 1 m Length 2 m Length 3 m	50 m	6FC9 344-1XL 6FC9 344-1XM 6FC9 344-1XN

**Note:**

The connecting cables for the peripheral devices are described in the Planning Guide - Universal Interface - for the SINUMERIK 800 System.

## 7.2 Accessories, connectors

Connector, complete	Order No.	Description No.
<b>12-way round female connector (Siemens)</b> 10 mm cable Ø 8 mm cable Ø 6 mm cable Ø	6FC9 341-1FD 6FC9 341-1FR 6FC9 341-1FT	37
<b>12-way round male connector coupling (Siemens)</b> 10 mm cable Ø 8 mm cable Ø 6 mm cable Ø	6FC9 341-1FC 6FC9 341-1FQ 6FC9 341-1FS	38
<b>9-way round male connector (Siemens)</b> 8 mm cable Ø	6FC9 341-1AT	40
<b>9-way round female connector (Siemens)</b> 8 mm cable Ø	6FC9 341-1AU	43
<b>9-way round female connec. coupling (Siemens)</b> 8 mm cable Ø	6FC9 341-1EW	25
<b>12-way round male connector (Souriau)</b>	6FC9 341-1AB	2
<b>17-way round female connector (Tuchel)</b>	6FC9 341-1AC	11
<b>15-way female Cannon connector (Siemens)</b> with SINUMERIK casing	6FC9 341-1EC	5
<b>25-way female Cannon connector (Siemens)</b> with SINUMERIK casing	6FC9 341-1ED	6
<b>25-way male Cannon connector (Siemens)</b> with SINUMERIK casing	6FC9 341-2AB	22
<b>50-way female Cannon connector (Siemens)</b> with SINUMERIK casing	6FC9 341-1EE	7
<b>50-way male Cannon connector (Siemens)</b> with SINUMERIK casing	6FC9 341-1EH	9
<b>9-way female Cannon connector</b> Casing with push latch	6FC9 341-1FM	35
<b>25-way male Cannon connector</b> Casing with push latch	6FC9 341-2AA	21
<b>25-way male Cannon cable connector (Siemens)</b> Post-office casing	6FC9 341-1ES	20
<b>50-way female Cannon connector</b> Casing with push latch	6FC9 341-1EN	12
<b>25-way female Cannon connector insert</b> with 2 push latch buttons, solder connection	6FC9 341-1EB	41
<b>50-way female Cannon connector insert</b> with 2 push latch button, solder connection	6FC9 341-1EJ	10
<b>34-way female ribbon connector</b> for ribbon cable	6FC9 341-1FE	30
<b>34-way female connector (Honda)</b> for round cable with ribbon cable connector insert	6FC9 341-2AD	34
<b>14-way female connector (Honda)</b> for round cable with ribbon cable connector insert (special version)	6FC9 341-2HF	44

## 7.3 Accessories, devices

Devices	Abbrev. Order No.	Order No.
<b>Electronic handwheel</b>		<b>6FC9 320-5DA</b>
<b>Incremental rotary encoder<sup>1)</sup> and main spindle encoder with axial cable output 1024 pulses/rev 2000 pulses/rev 2500 pulses/rev 5000 pulses/rev</b>		<b>6FC9 320-3KB00 6FC9 320-3KK00 6FC9 320-3KN00 6FC9 320-3KS00</b>
<b>Incremental rotary encoder<sup>1)</sup> and main spindle encoder with radial cable output 1024 pulses/rev 2000 pulses/rev 2500 pulses/rev 5000 pulses/rev</b>		<b>6FC9 320-3MB00 6FC9 320-3MK00 6FC9 320-3MN00 6FC9 320-3MS00</b>
<b>Combined rotary encoder for spindle and C axis 1024/9000 pulses/rev</b>		<b>6FC9 320-1KT00</b>
<b>Incremental rotary encoder for rotary axes ROD 250 RON 255</b>		<b>6FC9 320-3CM00 6FC9 320-3CN00</b>
<b>Clamp<sup>2)</sup> Spring disk coupling</b>		<b>6FC9 320-4GA 6FC9 320-4GB</b>
<b>Tape reader T40</b>	<b>B02</b>	<b>6FC9 320-1FC</b>
<b>Tape reader T41</b>	<b>B21</b>	<b>6FC9 320-1GB</b>
<b>Tape reader T50</b>	<b>B03</b>	<b>6FC3 984-1FD</b>
<b>Tape reader T60</b>	<b>B01</b>	<b>6FC3 984-1FB</b>
<b>I/O submodule (basic submod.), 64 INP, 32 OUT</b>	<b>M01</b>	<b>6FC3 984-3RA</b>
<b>I/O submodule (expansion 1), 64 INP, 32 OUT</b>	<b>M02</b>	<b>6FC3 984-3RB</b>
<b>I submodule (basic submodule), 64 INP</b>	<b>M04</b>	<b>6FC3 984-3RD</b>
<b>I submodule (expansion 2), 64 INP</b>	<b>M03</b>	<b>6FC3 984-3RC</b>
<b>Interface submod. for electronic handwheel</b>	<b>M10</b>	<b>6FC3 984-3RJ</b>
<b>Power supply unit Input 380 V 3-phase AC/Output 24 V DC 20 A Input 380 V 3-phase AC/Output 24 V DC 40 A Input 230 V AC/Output 24 V DC 10 A</b>	- - -	<b>6FC9 304-0AC 6FC3 304-0AD 6EV1 334-4AK00</b>

1) Without spring disk coupling and clamps

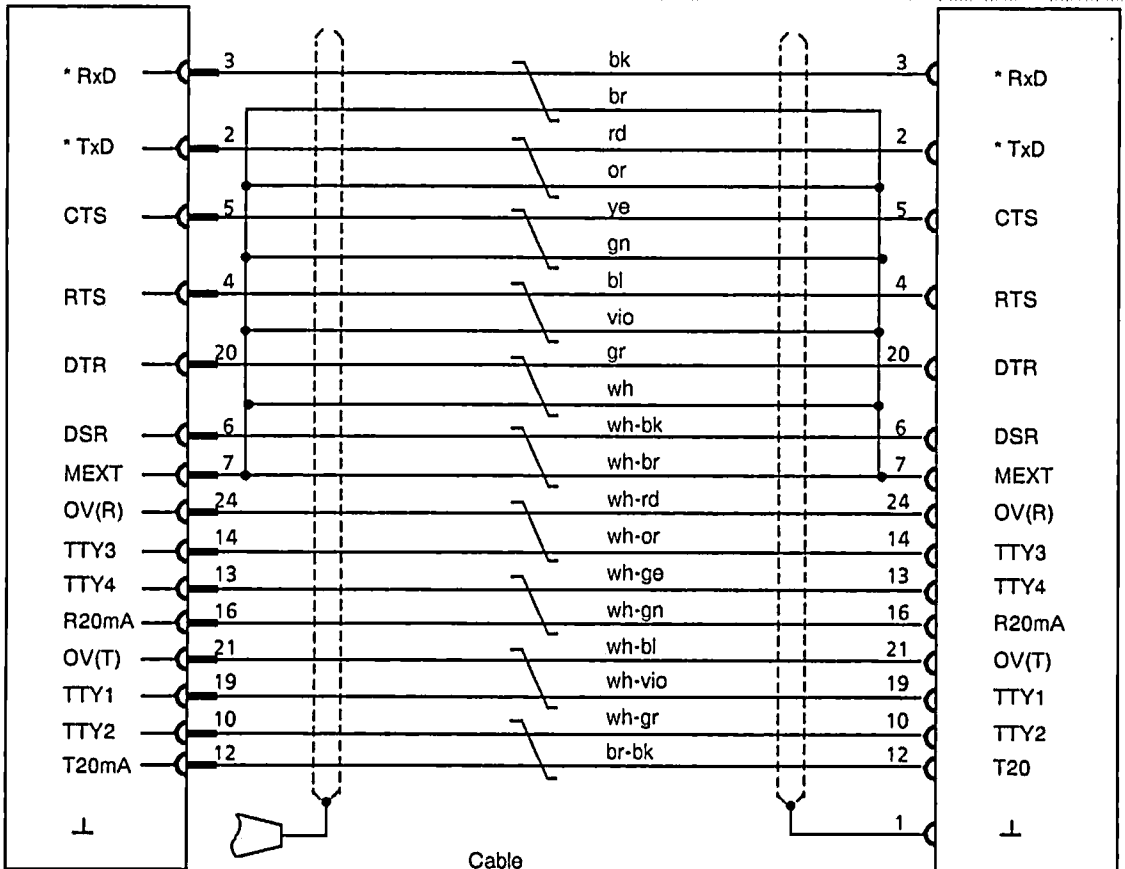
2) 3 clamps are required for each encoder

<b>Devices</b>	<b>Abbrev. Order No.</b>	<b>Order No.</b>
<b>Terminal strip converter, 34-way, ribbon cable</b> without LEDs with LEDs	- -	6FC9 302-2AA 6FC9 302-2AB
<b>Terminal strip converter, 50-way, Cannon type</b> without LEDs with LEDs	- -	6FC9 302-2AF 6FC9 302-2AG
<b>Terminal strip converter, 50-way, for 2A power outputs</b> with LEDs	-	6FC9 302-2AH
<b>External machine control panel</b>	J85	6FC3 488-3EF
<b>Installation components for external machine control panel</b>	-	6FC3 981-7AC
<b>PLC expansion unit</b> without power pack	P03	6FC3 981-4FD
<b>Power pack for expansion unit</b>	P23	6FC3 981-4GD
<b>DUAL PLC</b> with power pack	P04	6FC3 985-4FE

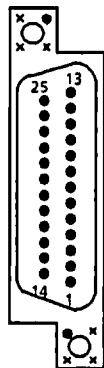
### 7.4 Cable diagrams

Cable name : Universal interface operating area  
Order No. : 6FC9 344-1F

<b>SINUMERIK</b> <b>PCB slot: B 3</b> <b>PCB connector: X 121</b>	<b>Operating area</b> <b>Connector</b> <b>V.24/TTY</b>
---	--



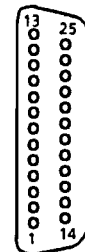
Cable  
10x2x0.18  
screened



**Connector**  
Position 1 bottom  
D - Sub  
25-way pin  
Connection side  
SINUMERIK housing

6FC9 341-2AB  
**Connector code**

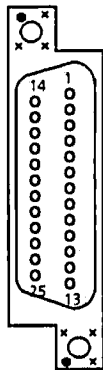
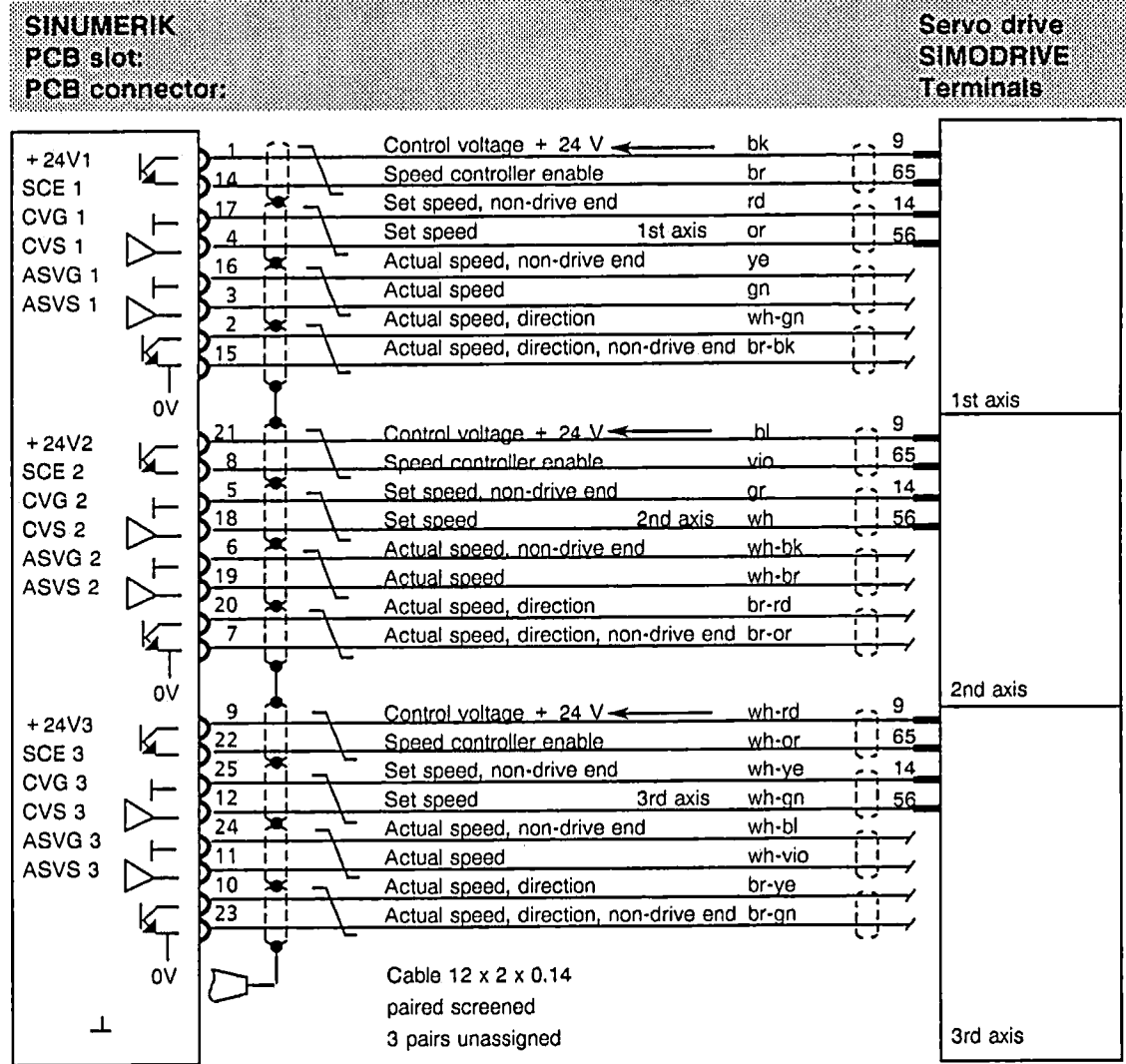
- coding pin
- x no coding pin



**Connector**  
Position 1 bottom  
D - Sub  
25-way socket  
Connection side  
Connector insert and  
2 push latching buttons  
with nuts  
6FC9 341-1EB

7.4 Cable diagrams

Cable name: Servo drive  
 Order No.: 6FC9 340-8R.



**Connector**

Position: 1 top  
 D-Sub  
 25-way, socket  
 Connection side  
 SINUMERIK housing  
 6FC9 341-1ED

**Connector code**

- coding pin
- × no coding pin

Cable end prepared for connection

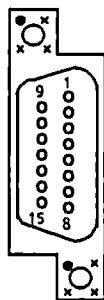
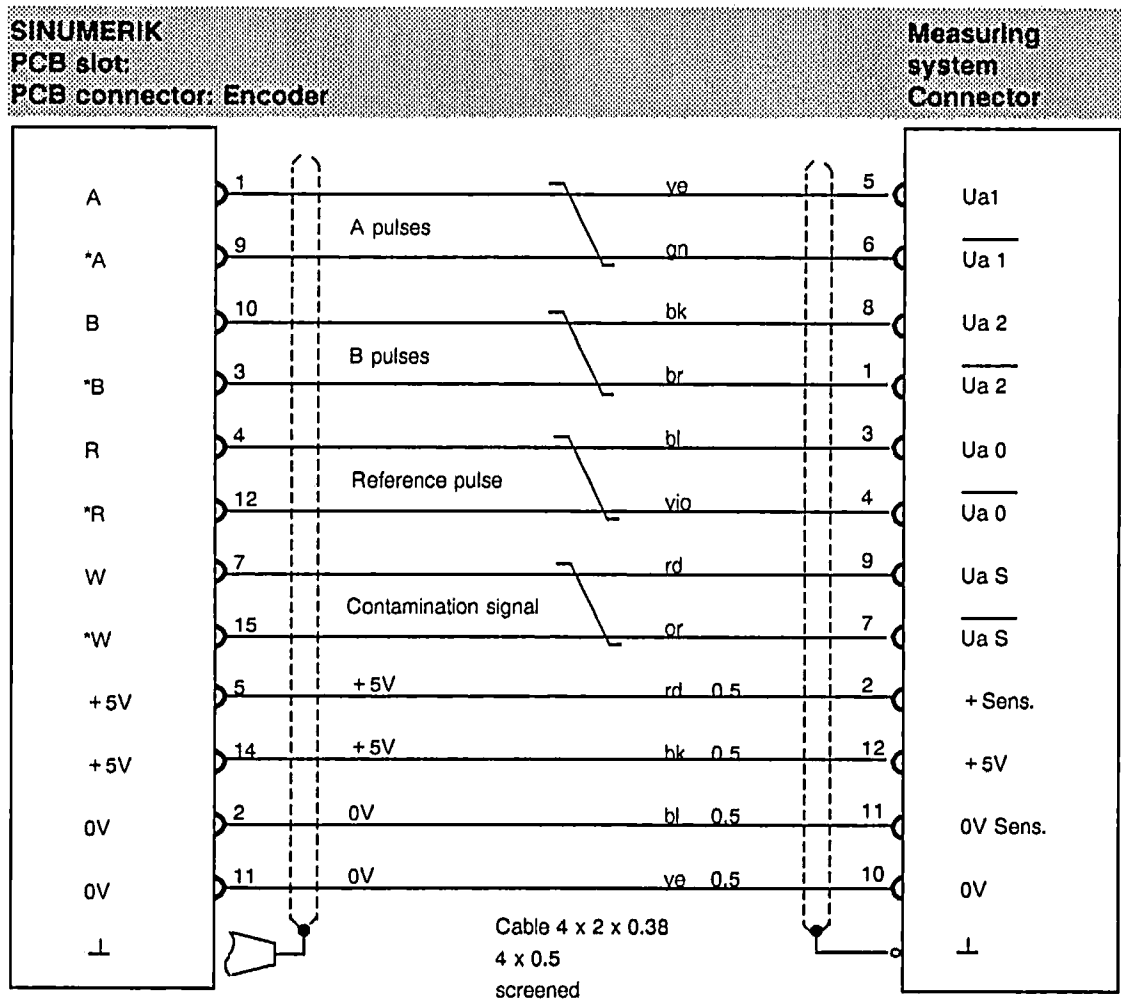
Outer shield 400 mm unshielded

Bare wire ends 30 mm

Pin terminal + terminal marking on designated wires



Cable name: Digital rotary measuring system (new version)  
 Linear measuring system via EXE 60. SI  
 Order No.: 6FC9 344-2B.



**Connector**

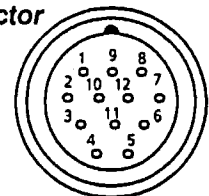
Position: 1 top  
 D-Sub  
 15-way, socket  
 SINUMERIK housing  
 6FC9 341-1EC

**Connector code**

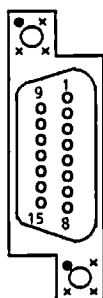
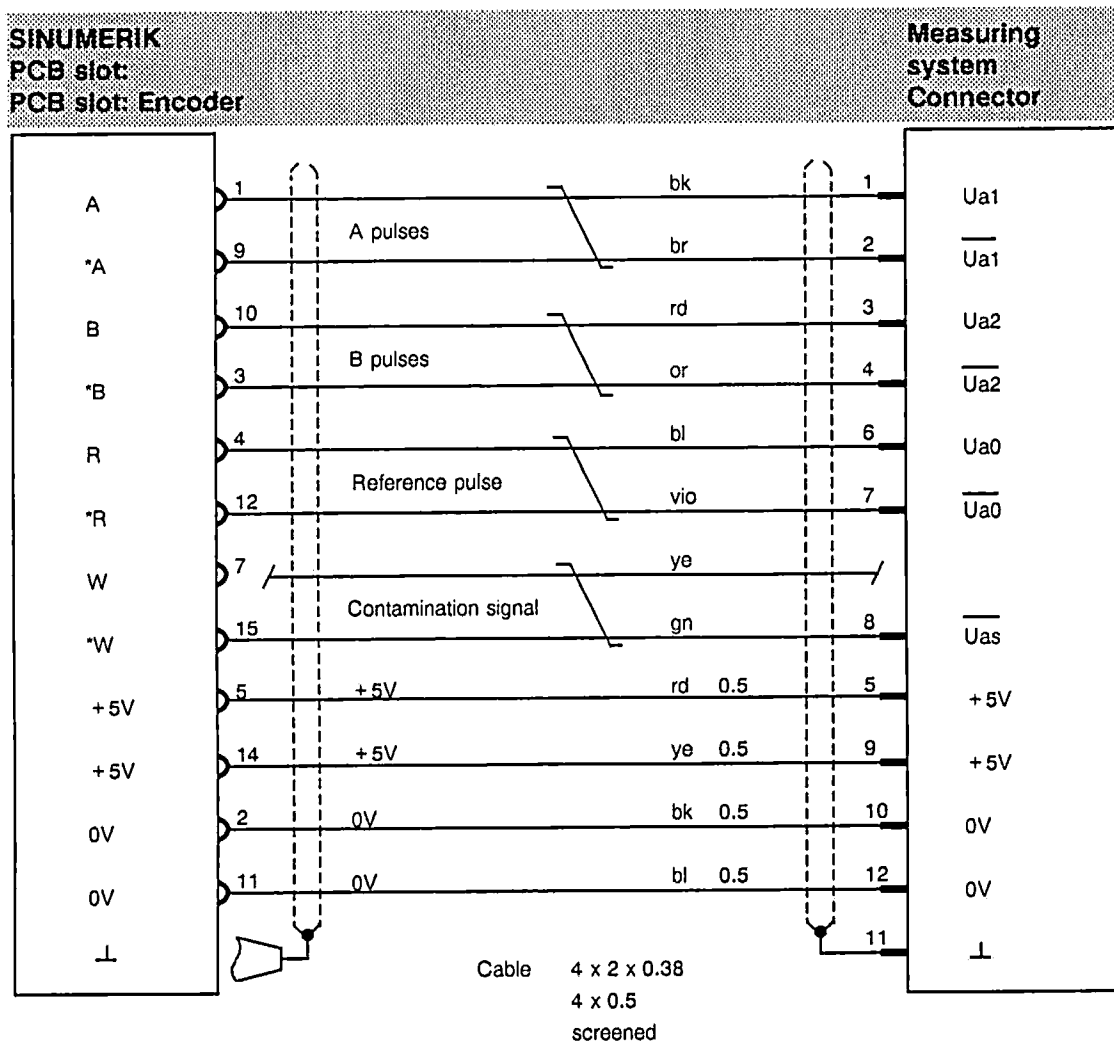
- coding pin
- x no coding pin

**Round connector**

12-way socket  
 Siemens  
 10 mm cable dia.  
 Connection side  
 6 FC9 341 - 1FD



Cable name: Digital rotary measuring system (old version)  
 Linear measuring system EXE 60. S  
 Order No.: 6FC9 340-8N.



**Connector**

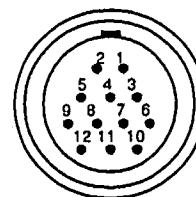
Position: 1 top  
 D-Sub  
 15-way, socket  
 Connection side  
 SINUMERIK housing  
 6FC9 341-1EC

**Connector code**

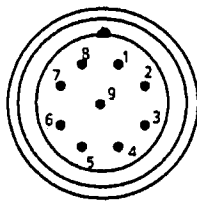
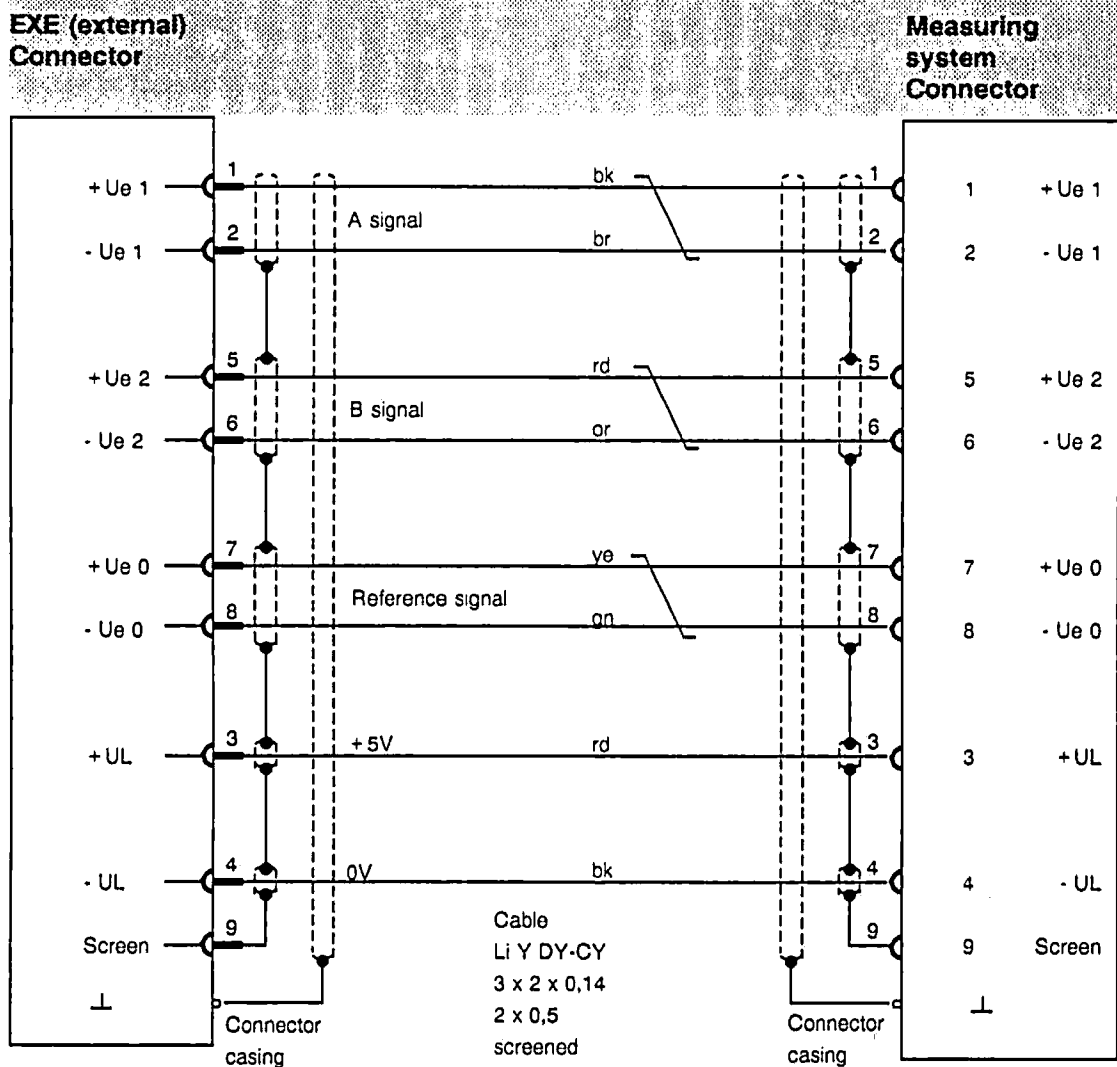
- coding pin
- x no coding pin

**Connector**

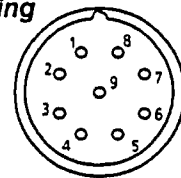
12-way pin  
 Souriau  
 8.40-31-830  
 Connection side  
 6 FC9 341 - 1AB



Cable name: Digital linear measuringsystem (extension)  
Order No.: 6FC9 344-3L.

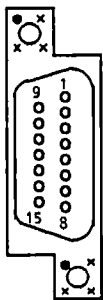
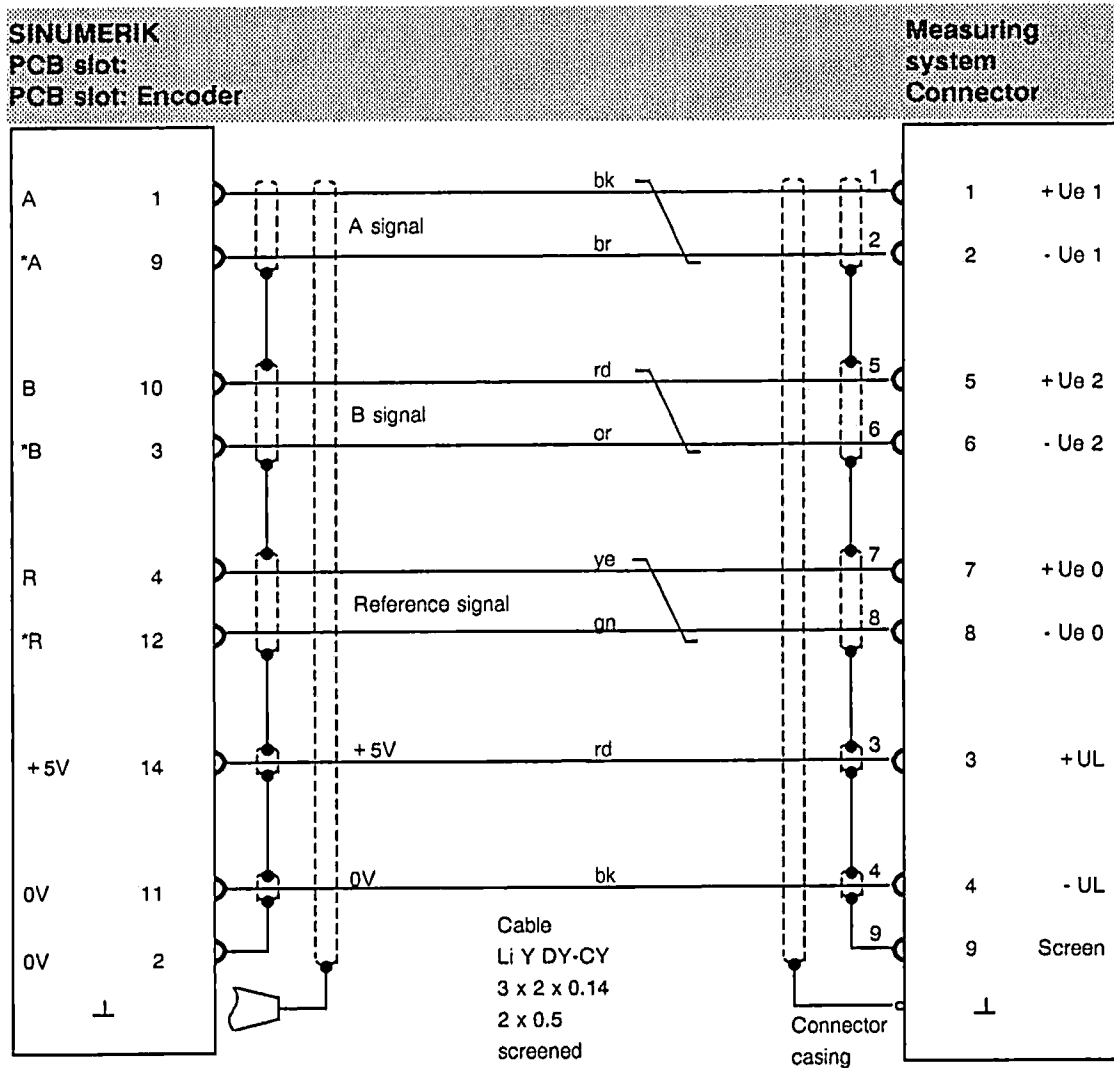


**Connector**  
9-way, pin  
Siemens  
8 mm cable dia.  
Connection side  
  
6 FC9 341 - 1AT  
  
Designation: EXE



**Connector coupling**  
9-way, socket  
Siemens  
8 mm cable dia.  
Connection side  
  
6 FC9 341 - 1EW  
  
Designation: LINEAL

Cable name: Digital linear measuring system (EXE integrated)  
 Order No.: 6FC9 340-8Q.



**Connector**

Position: 1 top  
 D-Sub  
 15-way, socket  
 Connection side  
 SINUMERIK housing  
 6FC9 341-1EC

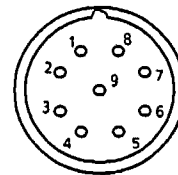
**Connector code**

- coding pin
- x no coding pin

**Connector**

9-way socket  
 Siemens  
 8 mm cable dia.  
 Connection side

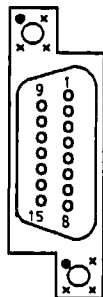
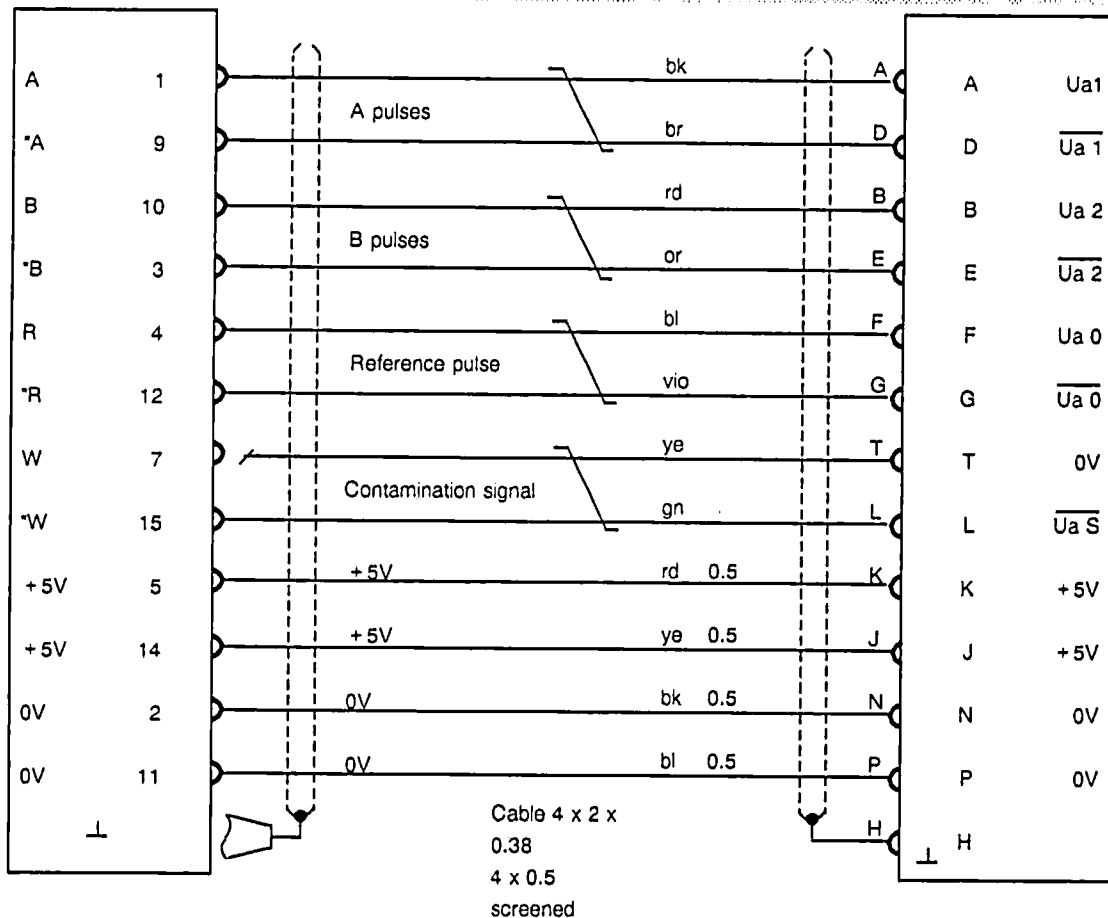
6 FC9 341 - 1EW



Cable name: Digital rotary measuring system in the servo drive  
Order No.: 6FC9 340-8P.

**SINUMERIK**  
PCB slot:  
PCB slot: Encoder

**Measuring system**  
**Connector**



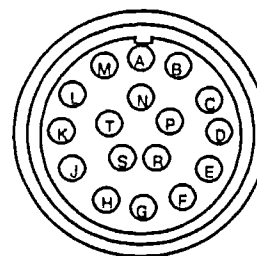
**Connector**  
Position: 1 top  
D-Sub  
15-way, socket  
Connection side  
SINUMERIK housing  
6FC9 341-1EC

**Connector code**

- coding pin
- × no coding pin

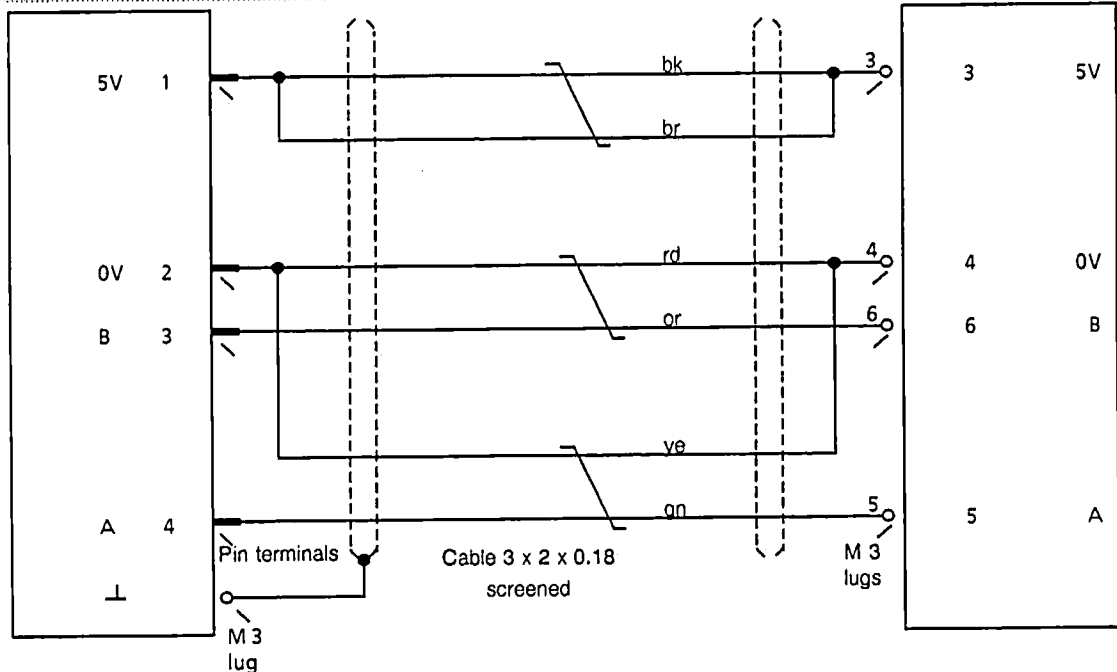
**Connector**  
17-way socket  
Tuchel  
CA 08-20-295  
Connection side

6 FC9 341 - 1AC



Cable name: Electronic encoder  
 (handwheel)  
 Order No.: 6FC9 340-8M.

<b>SINUMERIK</b>		<b>Handwheel</b>
Handwheel submodule	6 FX 1126 - 5AA	Terminals
Terminal block	X02 842, 843, 844	



Cable end prepared for connection

Bare wire ends 50 mm

Pin terminal +  
 terminal marking  
 on designated wires

Screen end with M3 lug

Designation: NC

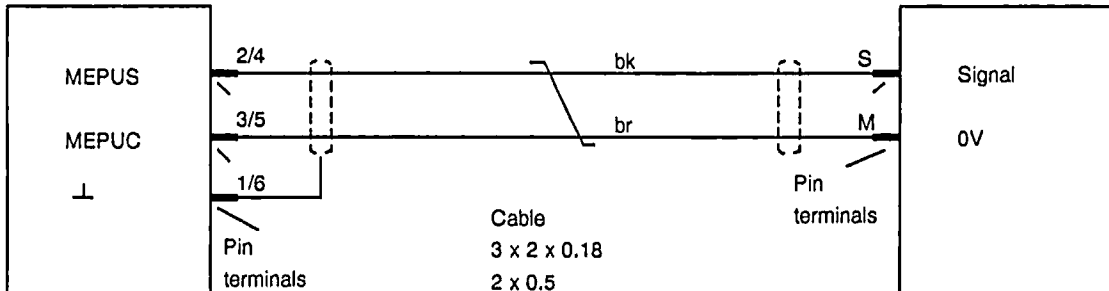
Cable end prepared for  
 connection

Bare wire ends 50 mm

M3 lugs +  
 terminal marking  
 on designated wires

Cable name: Sensor  
Order No.: 6FC9 340-8U.

**SINUMERIK**  
**PCB slot:**  
**Terminal block** **Sensor**  
**Terminals**



Cable end prepared for connection

Bare wire ends 30 mm

Pin terminal +  
terminal marking  
on designated wires

Designation: NC

Terminal marking on the NC:  
Terminals 1, 2, 3: Sensor 1, terminals 6, 4, 5: Sensor 2  
Measuring with 2 sensors requires two cables

Cable end prepared for connection

Bare wire ends 30 mm

Pin terminal +  
terminal marking  
on designated wires

**Wiring of the measurement inputs**

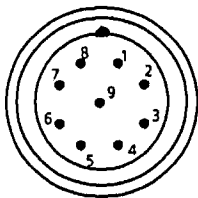
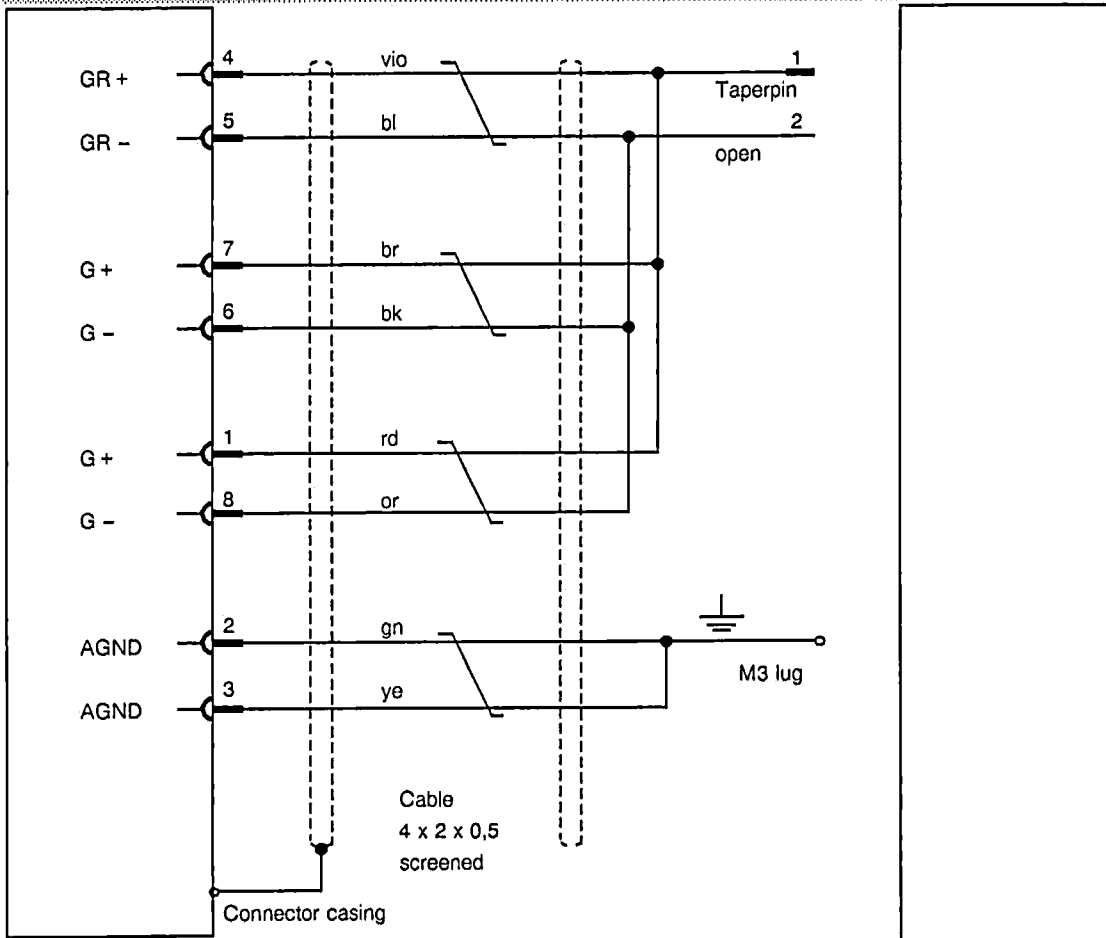
			Sensor 1				Sensor 2			
SINUMERIK 850 / 880			S1.1	S1.2	S2.1	S2.2	S1.3	S1.4	S3.1	S3.2
SINUMERIK 810 / 820			S3.1		S1.1	S2.1	S3.2		S1.2	S2.2
Situation	Edge	Level	N	P			N	P		
▷ Open collector ◀ Relay contact		open (+5V)	*		*	*	*		*	*
		closed (0V)		*	*	*		*	*	*
TTL (5V)		+5V	*		*	*	*		*	*
		0V		*	*	*		*	*	*
24V		+24V	*				*			
		0V		*				*		

\* Dip-Fix closed

Cable name: Inductosyn scale  
 Order No.: 6FC9 344-3F.

**Inductosyn Converter**  
**6FC9 320-3GK**  
**Connector X12**

**Inductosyn**  
**Scale**



**Connector**  
 9-way, pin  
 Siemens  
 8 mm cable dia.  
 Connection side  
 6 FC9 341 - 1AT

Cable end prepared for connection

Bare wire ends

1,2 40 mm

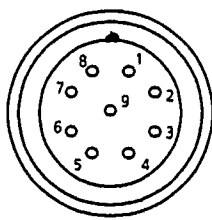
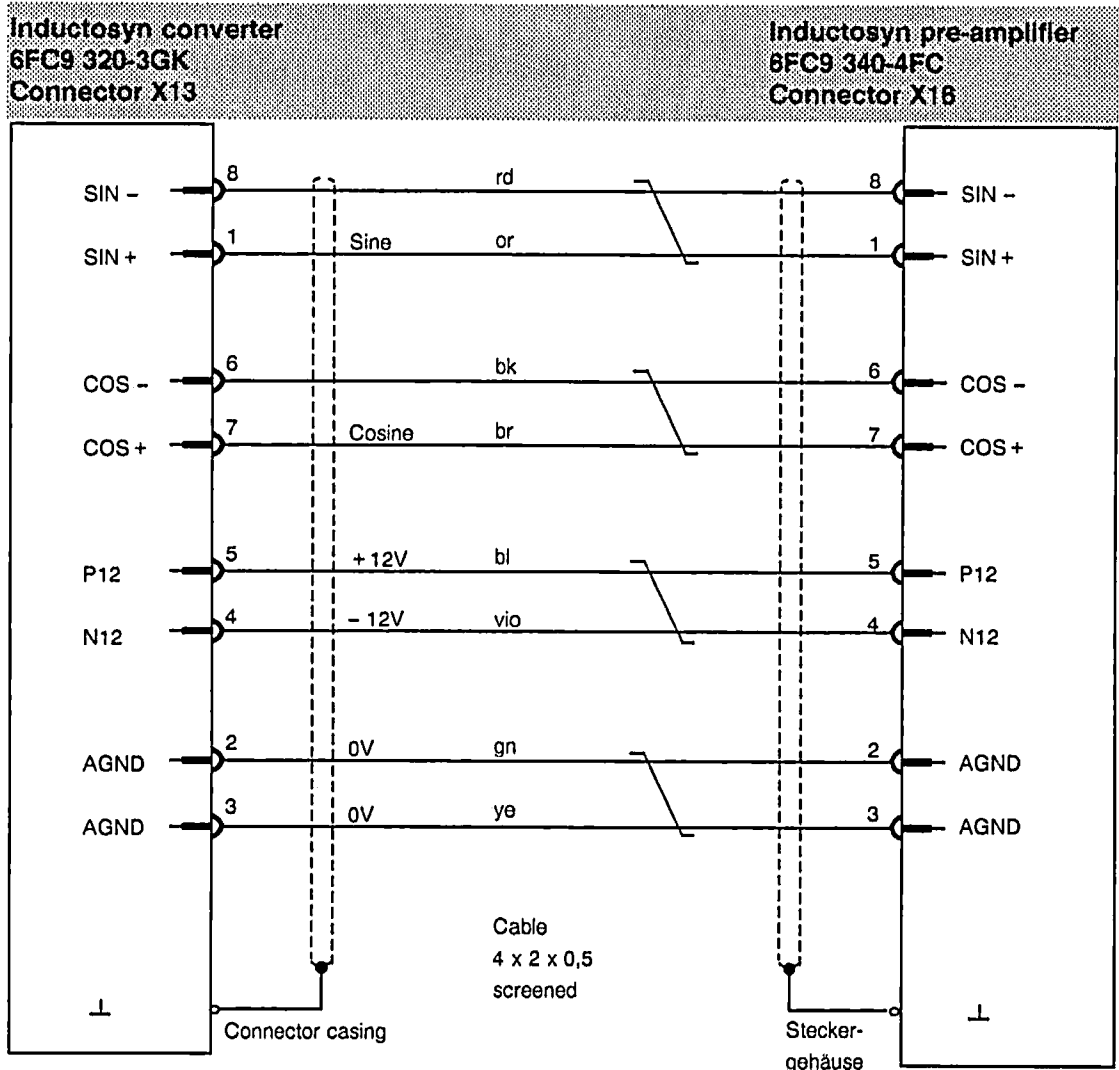
 60 mm

Terminal marking on designated wires

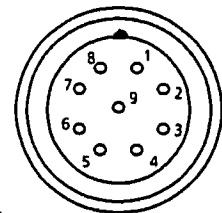
Designation: SCALA



Cable name: Inductosyn pre-amplifier  
Order No.: 6FC9 344-3E.

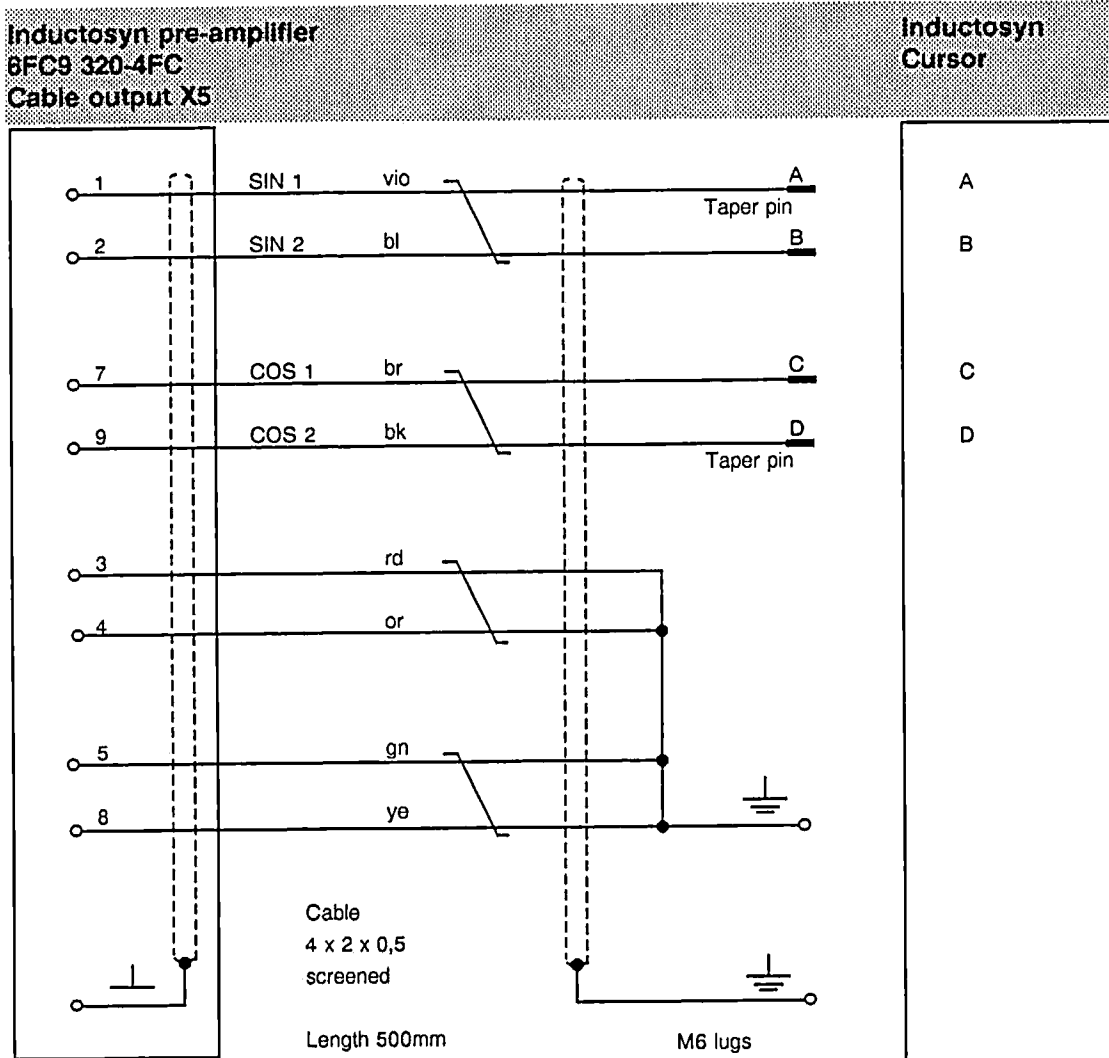


**Connector**  
9-way, socket  
Siemens  
8 mm cable dia.  
Connection side  
6 FC9 341 - 1AU



**Connector**  
9-way, socket  
Siemens  
8 mm cable dia.  
Connection side  
6 FC9 341 - 1AU

Cable name: Inductosyn cursor  
 Order No.: - permanently installed at inductosyn pre-amplifier



Cable connection  
 fixed via gland

Cable end prepared for  
 connection

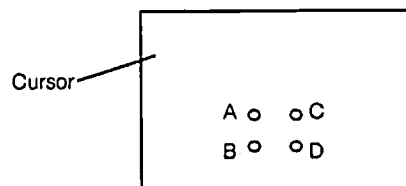
Bare wire ends

A . . . D 40 mm

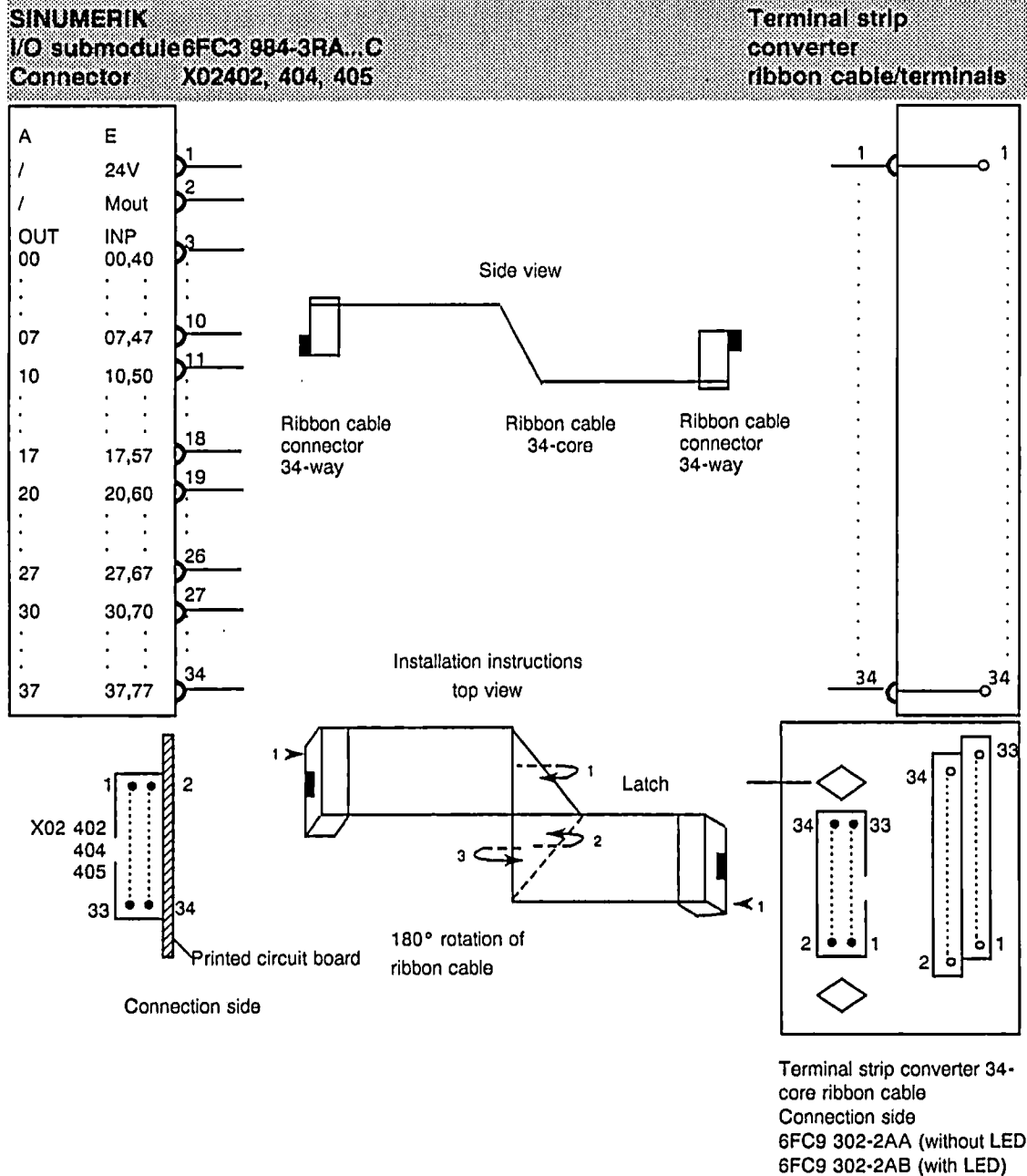
⏏ 60 mm

Terminal marking on  
 designated wires

Designation: SLIDER



Cable name: Terminal strip converter for I/O submodule, ribbon cable  
Order No.: 6FC9 340-8L.

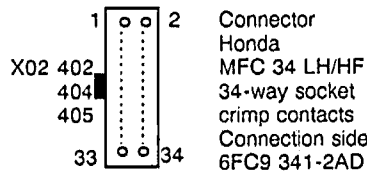
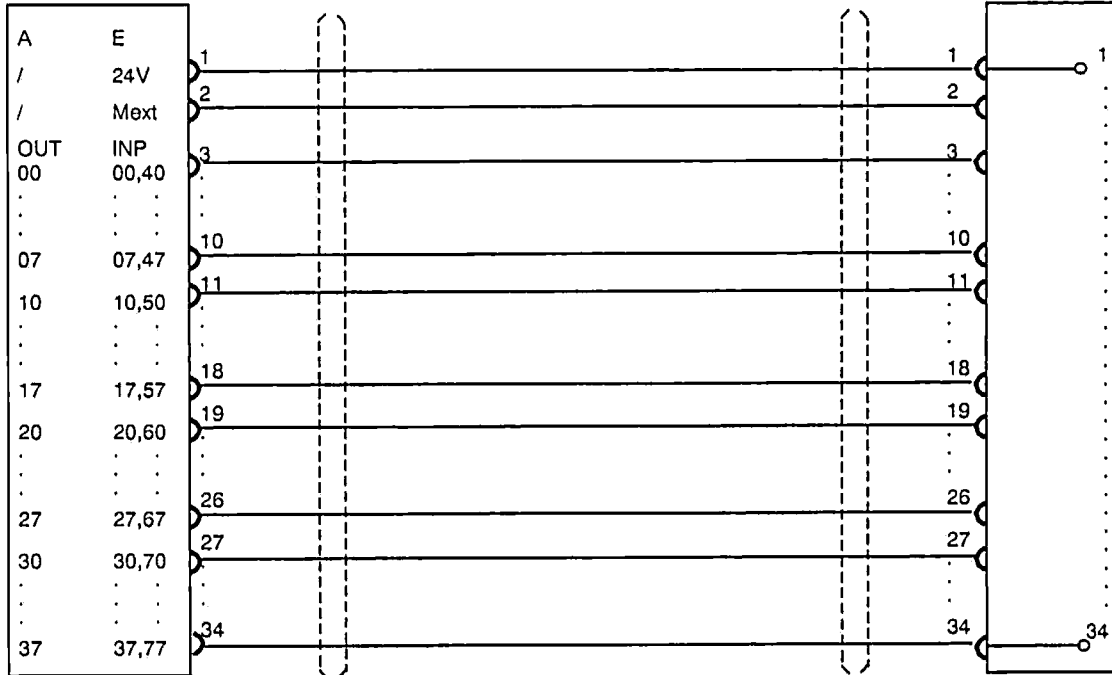


I/O submodule No.	Rot. switch position		PLC outputs connector X02 402	PLC inputs connector X02 404	PLC inputs connector X02 405	PLC inputs connector X02 406
	S1	S2	OUT 00 ... 37	INP 00 ... 37	INP 40 ... 77	INP 40 ... 51
1	0	0	Q64.0 ... 67.7	I64.0 ... 67.7	I68.0 ... 71.7	I68.0 ... 69.1
2	1	1	Q68.0 ... 71.7	I72.0 ... 75.7	I76.0 ... 79.7	I76.0 ... 77.1
3	2	2	Q72.0 ... 75.7	I80.0 ... 83.7	I84.0 ... 87.7	I84.0 ... 85.1
4	3	3	Q76.0 ... 79.7	I88.0 ... 91.7	I92.0 ... 95.7	I92.0 ... 93.1

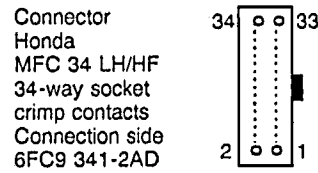
7.4 Cable diagrams

Cable name: Terminal strip converter for I/O submodule, round cable  
 Order No.: 6FC9 340-8X.

**SINUMERIK**  
 I/O submodule 6FC3 984-3RA...C  
 Connector X02402, 404, 405  
 Terminal strip converter ribbon cable/terminals

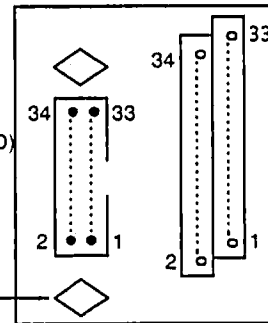


Cable  
 21 x 2 x 0.18  
 (screened)  
 4 pairs unassigned



Wire colours							
1	bk	11	wh-bk	21	br-rd	31	gn-rd
2	br	12	wh-br	22	br-or	32	gn-or
3	rd	13	wh-dt	23	br-ye	33	gn-bl
4	or	14	wh-or	24	br-gn	34	gn-vio
5	ye	15	ws-ye	25	br-bl		
6	gn	16	wh-gn	26	br-vio		
7	bl	17	wh-bl	27	br-gr		
8	vio	18	wh-vio	28	br-wh		
9	gr	19	wh-gr	29	gn-bk		
10	wh	20	br-bk	30	gn-br		

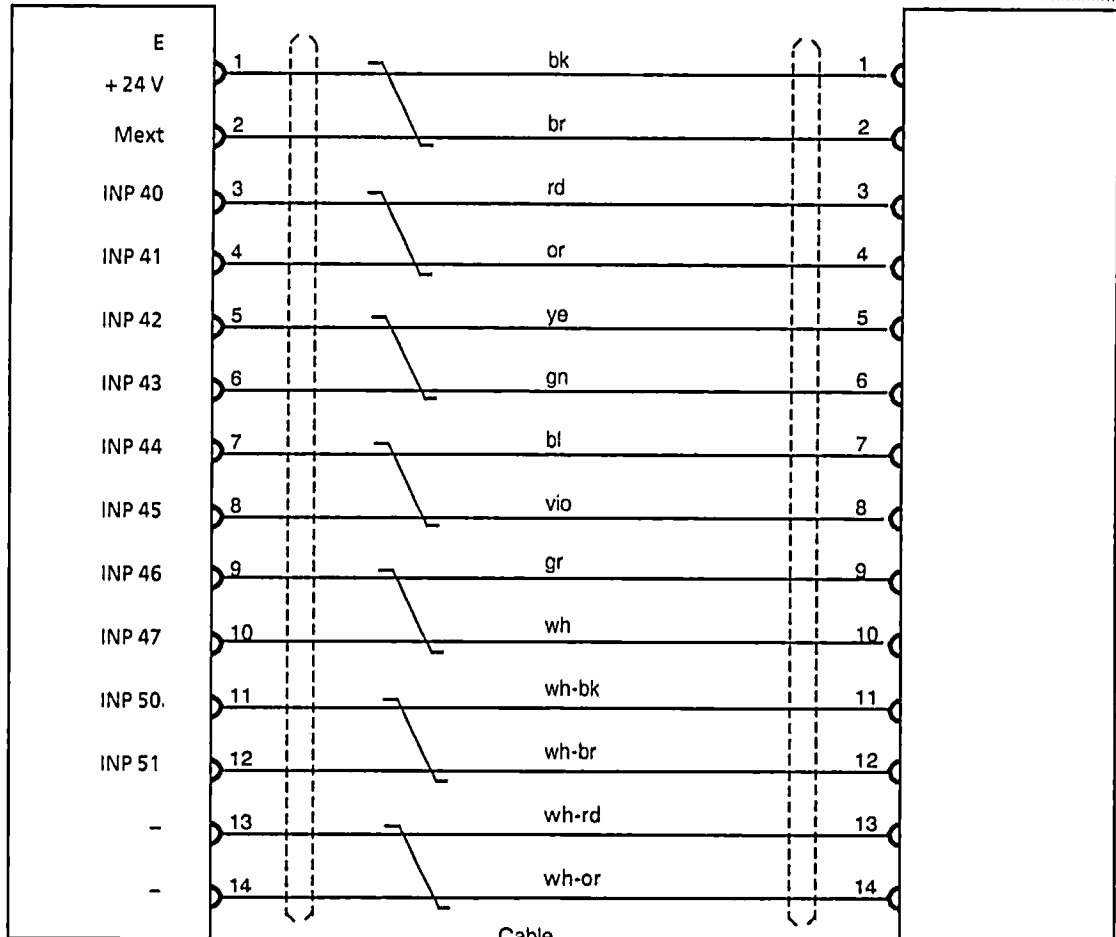
Terminal strip converter  
 34-core ribbon cable  
 Connection side  
 6FC9 302-2AA (withoutLED)  
 6FC9 302-2AB (withLED)



I/O submodule No.	Rot. switch position		PLC outputs connector X02 402	PLC inputs connector X02 404	PLC inputs connector X02 405	PLC inputs connector X02 406
	S1	S2	OUT 00 ... 37	INP 00 ... 37	INP 40 ... 77	INP 40 ... 51
1	0	0	Q64.0 ... 67.7	I64.0 ... 67.7	I68.0 ... 71.7	I68.0 ... 69.1
2	1	1	Q68.0 ... 71.7	I72.0 ... 75.7	I76.0 ... 79.7	I76.0 ... 77.1
3	2	2	Q72.0 ... 75.7	I80.0 ... 83.7	I84.0 ... 87.7	I84.0 ... 85.1
4	3	3	Q76.0 ... 79.7	I88.0 ... 91.7	I92.0 ... 95.7	I92.0 ... 93.1

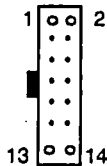
Cable name: Machine control panel I/O submodule, round cable  
 Order No.: 6FC9 344-3W.

**SINUMERIK** Machine control panel  
 I/O submodule: 6FC3 984-3RA...C X301  
 Connector: X02 406

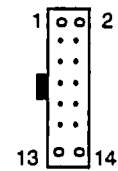


Cable  
 8 x 2 x 0,18  
 screened  
 1 pair  
 unassigned

**Connector**  
 Honda  
 MFC 16 LH/HF mod.  
 14-way, socket  
 Crimp contacts  
 Connection side  
 6FC9 341-1HF

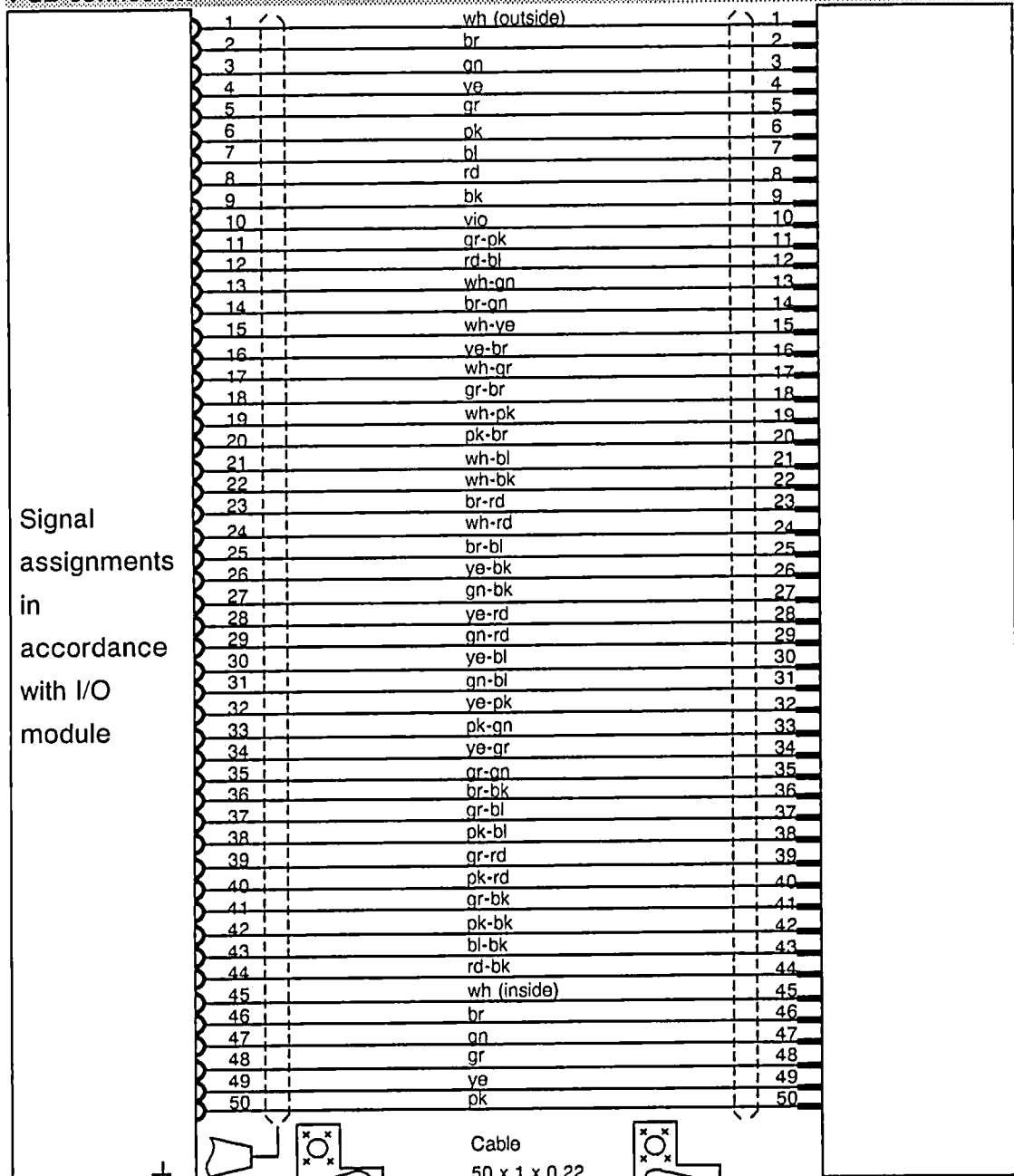


**Connector**  
 Honda  
 MFC 16 LH/HF mod.  
 14-way, socket  
 Crimp contacts  
 Connection side  
 6FC9 341-1HF



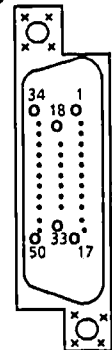
Cable name: Machine control  
 Order No.: 6FC9 340-2W.

**SINUMERIK** **Machine control /**  
**PCB slot:** **terminal strip converter**  
**PCB connector:**

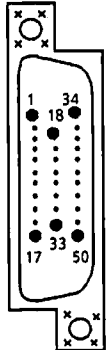


Signal assignments in accordance with I/O module

**Connector**  
 Position: 1 top  
 D - sub  
 50-way socket  
 Connection side  
 SINUMERIK housing  
 6FC9 341-1EE



Cable  
 50 x 1 x 0,22

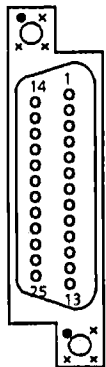
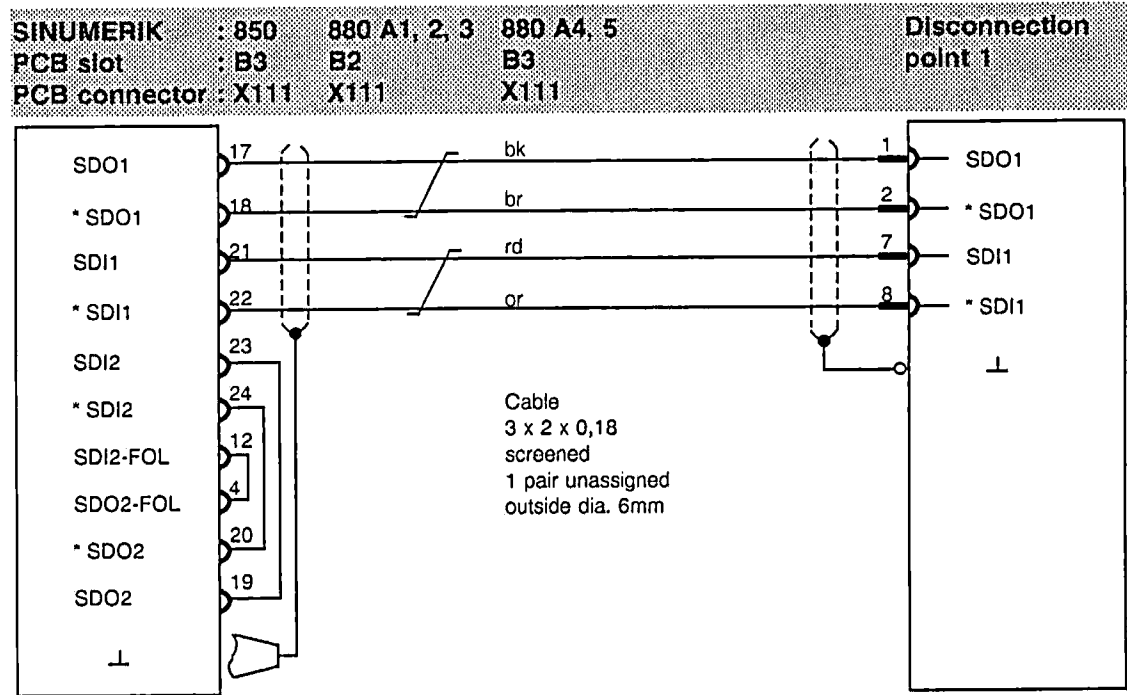


**Connector**  
 Position: 1 top  
 D - sub  
 50-way socket  
 Connection side  
 SINUMERIK housing  
 6FC9 341-1EH



7.4 Cable diagrams

Cable name: MPC interface (Cu-L) with disconnection points, left part cable  
 Order No. : 6FC9 344-2RZ



**Connector**

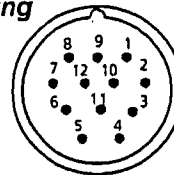
Position: 1 top  
 D - sub  
 25-way socket  
 Connection side  
 SINUMERIK housing  
 6FC9 341-1ED

**Connector code**

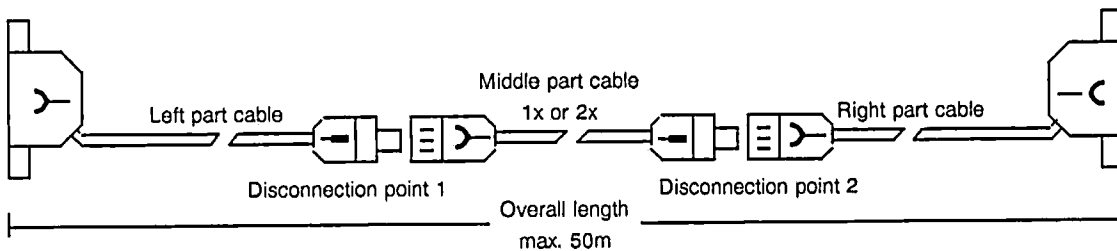
- coding pin
- x no coding pin

**Connector coupling**

12-way pin  
 Siemens  
 6 mm cable dia.  
 Connection side  
 6FC9 341-1FS



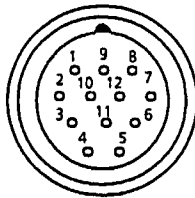
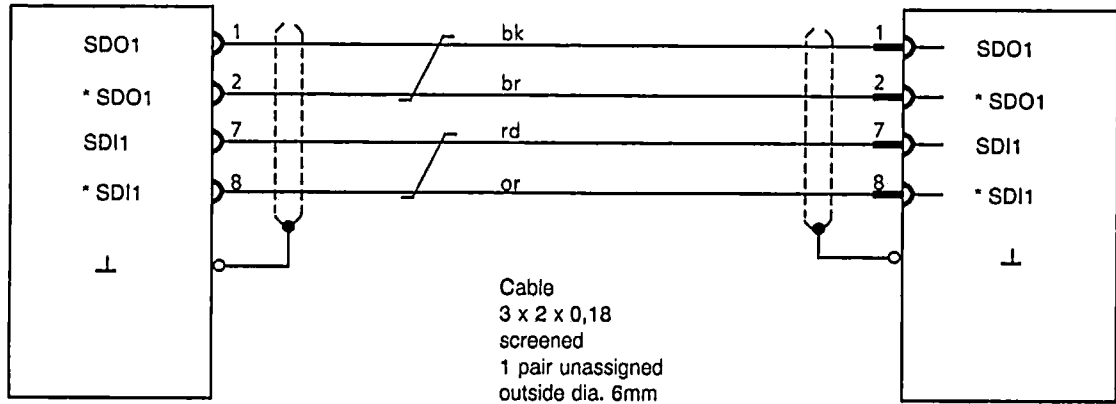
Complete cable configuration



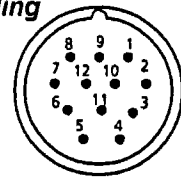


Cable name: MPC interface (Cu-L) with disconnection points, middle part cable  
 Order No. : 6FC9 344-2RZ

**Disconnection point 1** **Disconnection point 2**



**Round connector**  
 12-way socket  
 Siemens  
 6 mm cable dia.  
 Connection side  
 6FC9 341-1FT

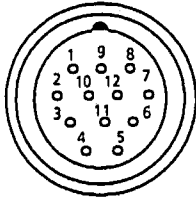
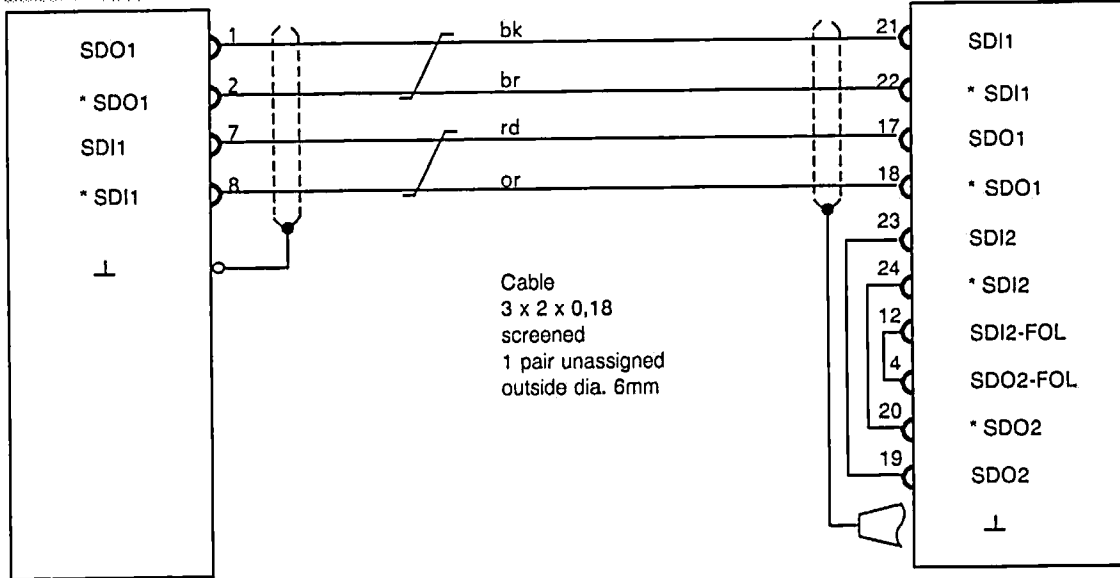


**Connector coupling**  
 12-way pin  
 Siemens  
 6 mm cable dia.  
 Connection side  
 6FC9 341-1FS

Cable name: MPC interface (Cu-L) with disconnection points, right part cable  
 Order No. : 6FC9 344-2RZ

**Disconnection point 2**

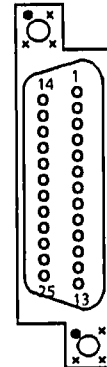
850/880  
 A4 : PCB slot  
 X111: PCB connector



**Round connector**  
 12-way socket  
 Siemens  
 6 mm cable dia.  
 Connection side  
 6FC9 341-1FT

**Connector**

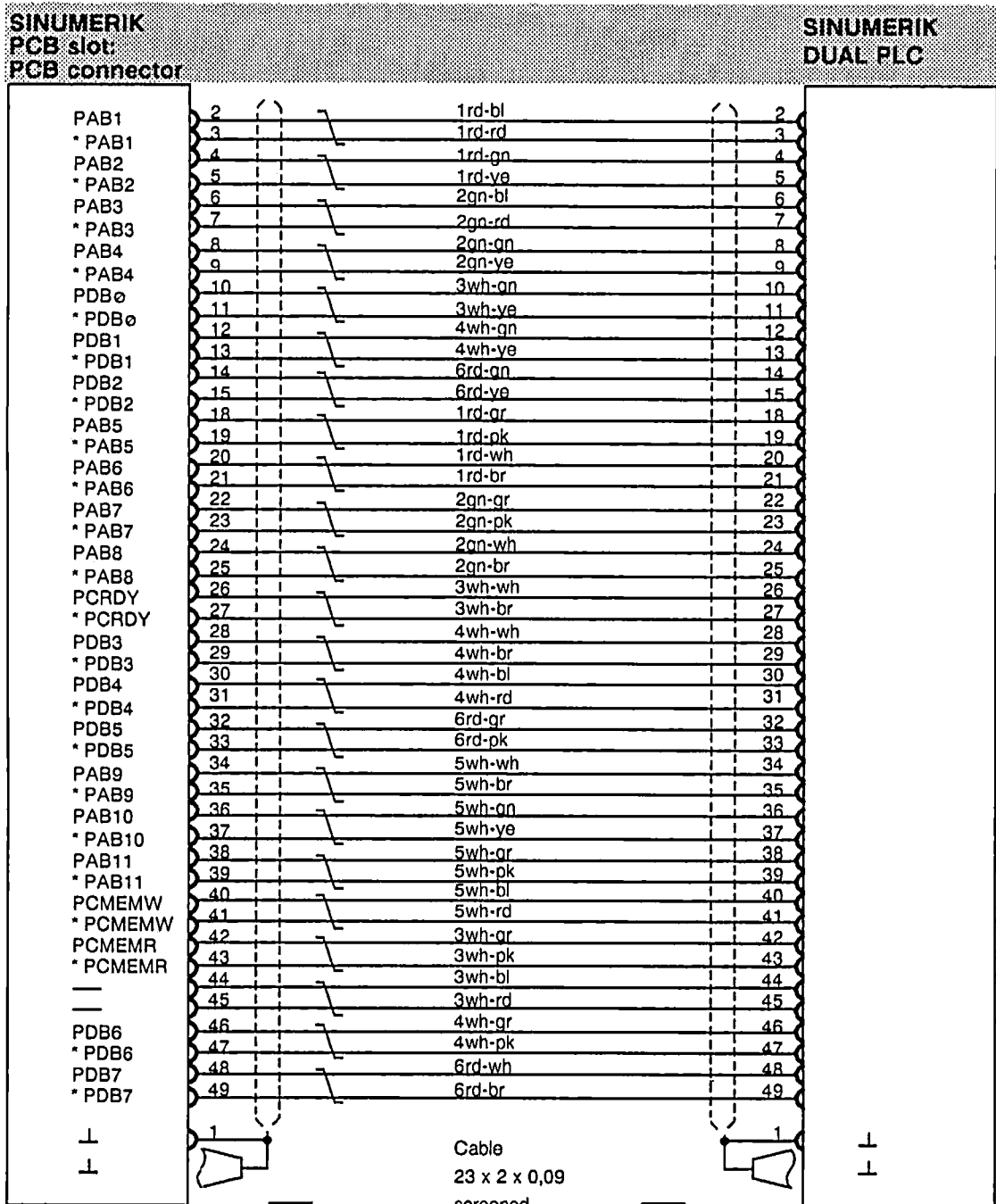
Position: 1 top  
 D-sub  
 25-way socket  
 Connection side  
 SINUMERIK housing  
 6FC9 341-1ED



**Connector code**

- coding pin
- x no coding pin

Cable name: SINUMERIK DUAL PLC  
 Order No.: 6FC9 340-7H.

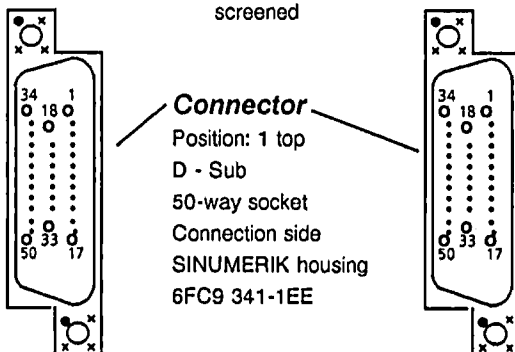


Designation: NC

Designation: PLC

**Connector code**

- coding pin
- x no coding pin

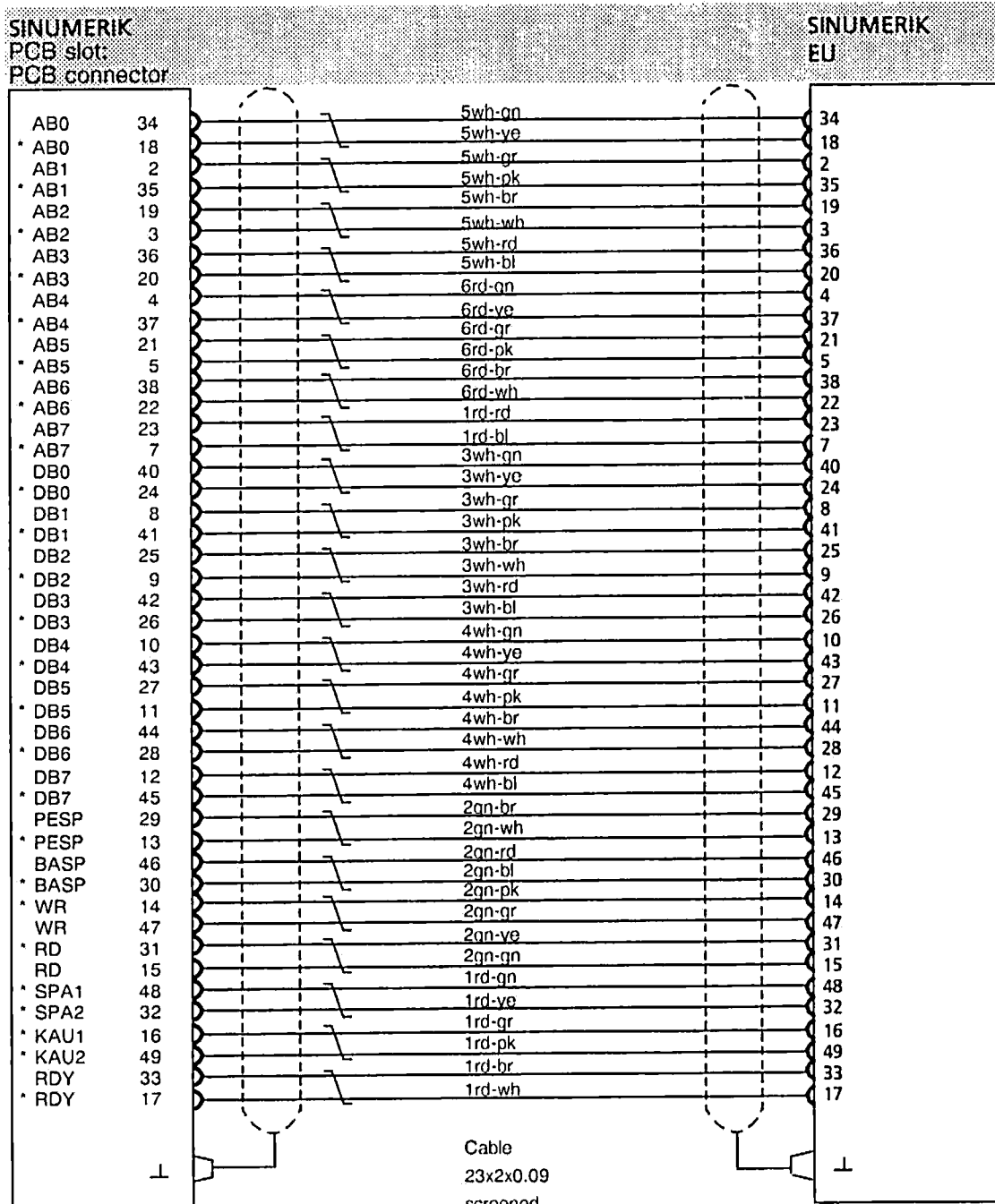


**Connector**

Position: 1 top  
 D - Sub  
 50-way socket  
 Connection side  
 SINUMERIK housing  
 6FC9 341-1EE

7.4 Cable diagrams

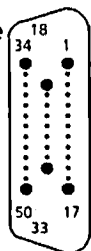
Cable name: SINUMERIK-EU link  
 Order No.: 6FC9 340-7Q.



Cable  
 23x2x0.09  
 screened

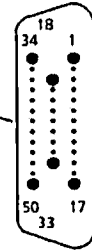
Connector code

- coding pin
- x no coding pin

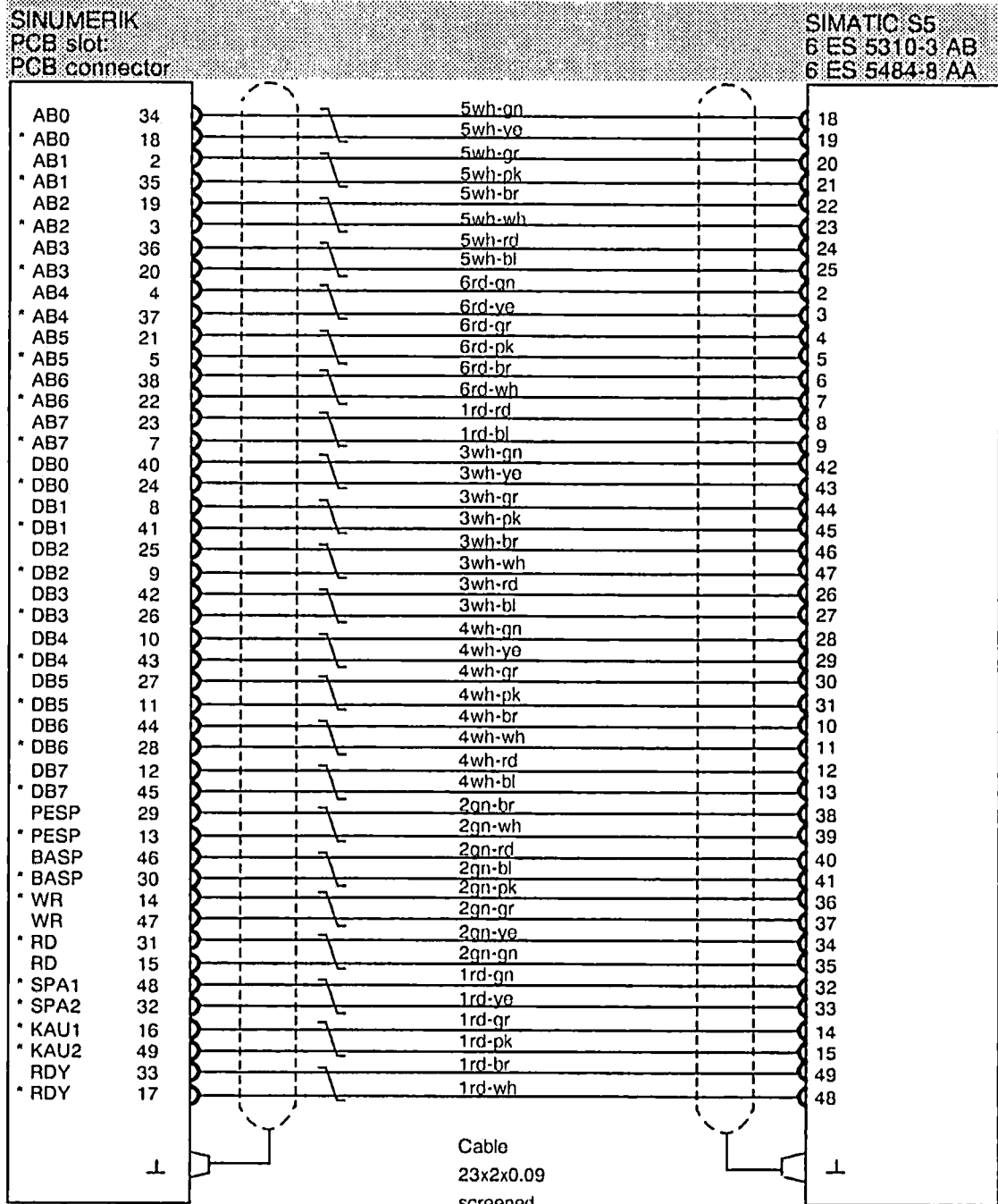


Connector

Position: 1 top  
 D - Sub  
 50-way socket  
 Connection side  
 SINUMERIK housing  
 6FC9 341-1EE



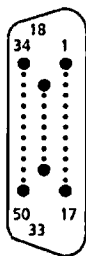
Cable name: SIMATIC S5-EU link  
 Order No.: 6FC9 344-1X.



**Connector**

Position :1 top  
 D - Sub  
 50-way socket  
 Connection side  
 SINUMERIK housing  
 6FC9 341-1EE

Designation: NC



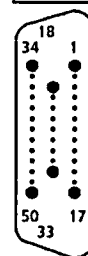
**Connector code**

- coding pin
- x no coding pin

**Connector**

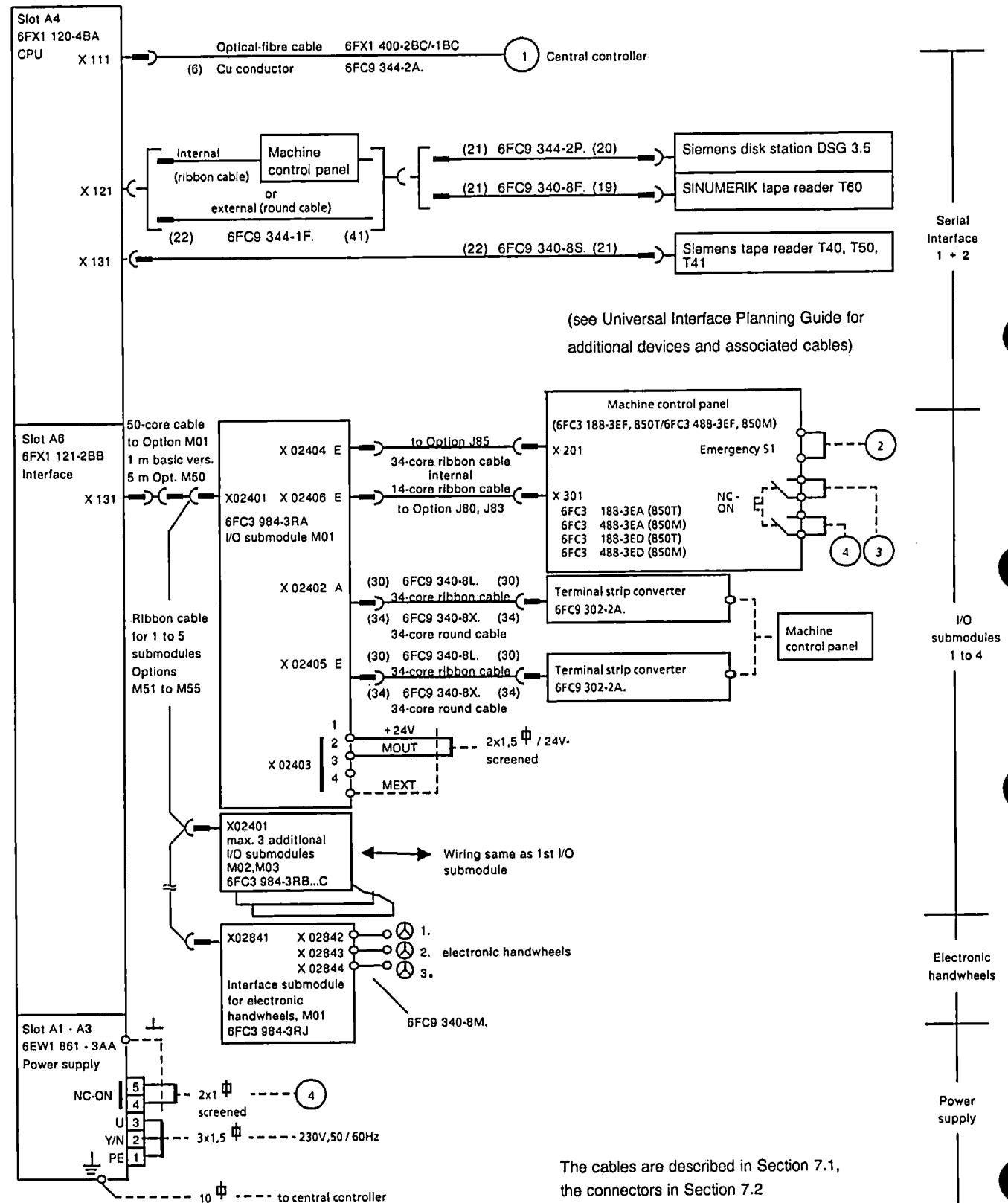
Position: 1 top  
 D - Sub  
 50-way socket  
 Connection side  
 housing with slide latch  
 6FC9 341-1EN

Designation: S5-EU



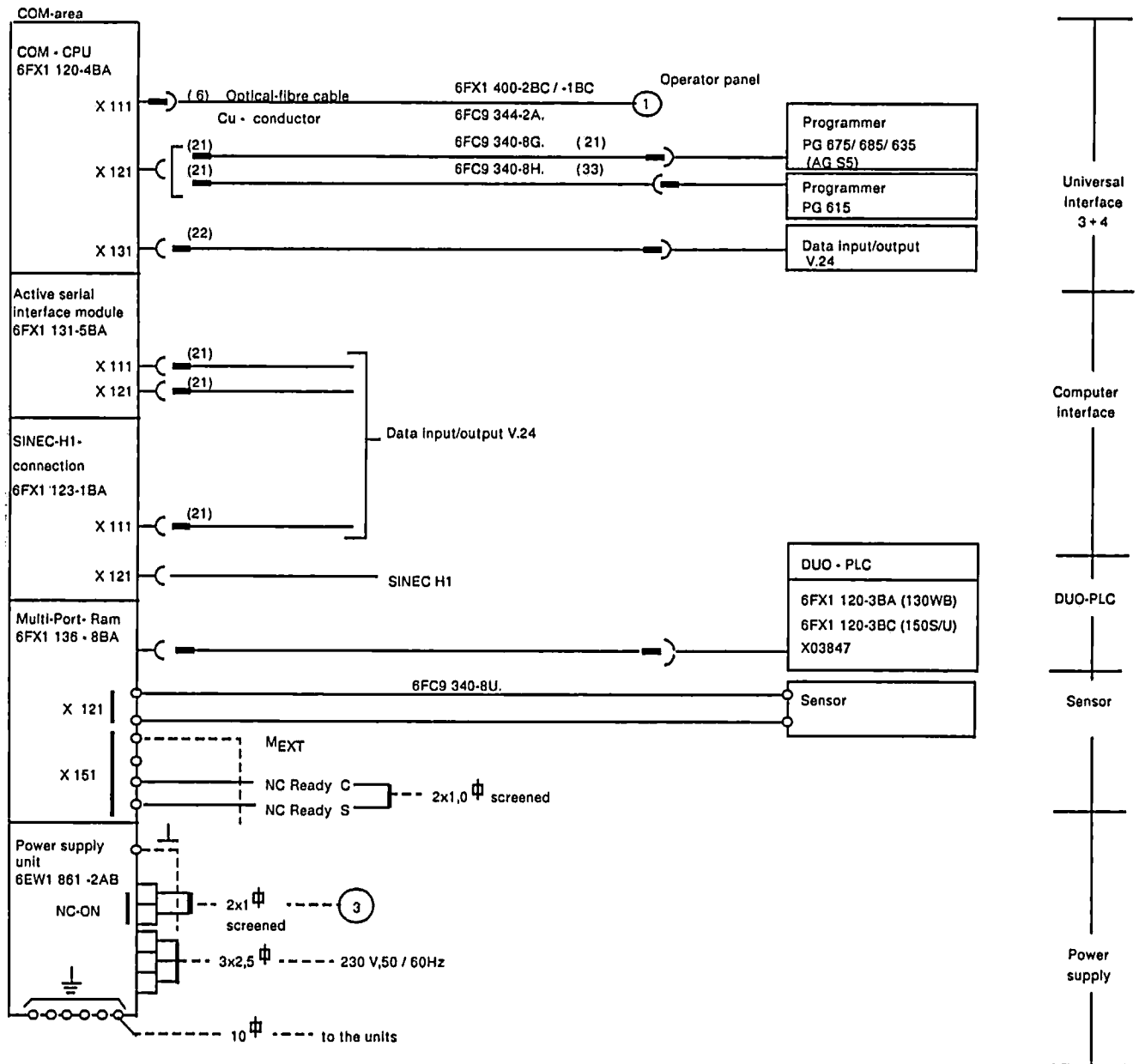
## 7.5 Cable and hardware wiring diagrams

### Operator panel SINUMERIK 850

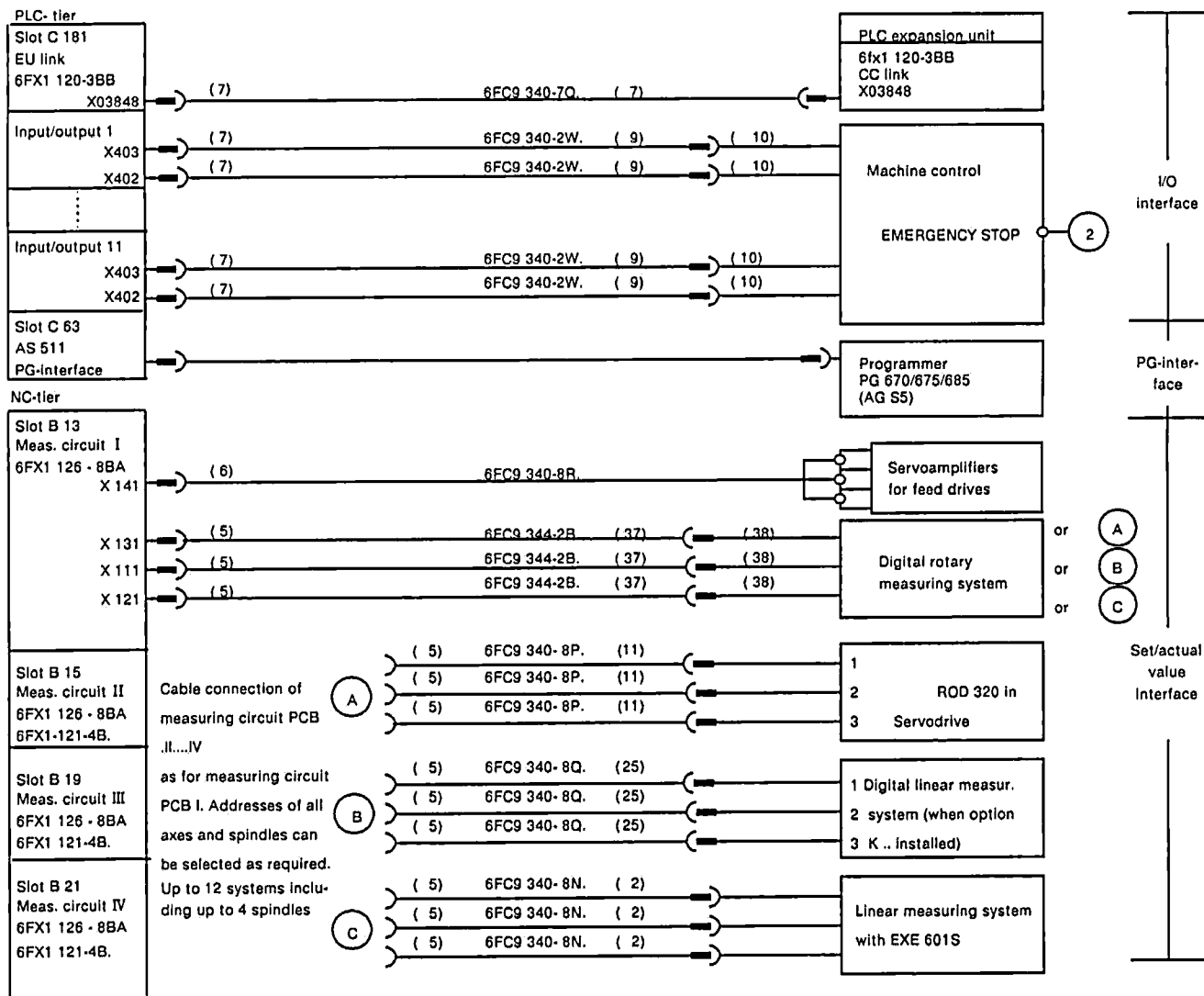


The cables are described in Section 7.1,  
 the connectors in Section 7.2

### Central controller



### Central controller





## 7.6 Terms and abbreviations

**AC**  
Alternating Current

**ASCII**  
American Standard Code for Information Interchange

**Baud**  
Unit of transmission speed; 1 baud = 1 bit per second

**Bit**  
Binary digit; binary unit of information; yes/no signal; binary place; dimensional unit for quantity of information; unit for memory capacity.

**Bus**  
Connecting line, trunk route, rail for transmitting signals, feed voltages, frame potential

**Byte**  
Memory unit, generally with 8 bits, can hold two decimal digits or one alphanumeric character; smallest addressable unit

**CC**  
Central Controller

**CNC**  
Computerized Numerical Control; control with minicomputer, hardware linkage by implementing NC functions by the computer or microprocessor program

**CPU**  
Central Processing Unit; arithmetic and control unit of a computer

**DC**  
Direct Current

**DNC**  
Direct Numerical Control; connection of several numerical controls to a higher-level computer

**EEC**  
Electrostatically endangered component

**EIA**  
Electronic Industries Association

**ENABLE**  
Enable signal or enable input

**Encoder**  
Analog quantity "displacement" or "position" is mapped digitally by the encoder together with electronic counters

**EU**  
Expansion Unit

**FB**  
Function Block

**FMS**

Flexible Manufacturing System; linkage of several machines by automatic materials handling equipment; control of production and transportation by computer

**IB**

Input Byte

**IM**

Interface Module

**Increment**

- a) smallest unit of a digital representation
- b) traversing of a given section with incremental feed

**Incremental**

Information relating to dimensioning or positional measurement referred to a previously defined point; contrasted with absolute dimensional data

**ISO**

International Organization for Standardization

**Jog**

Manual mode of operation with feed or rapid traverse as long as a direction key is operated.

**LCD**

Liquid Crystal Display

**LED**

Light Emitting Diode

**MD**

Machine Data

**Module**

Component, assembly; also software component; modular design: comprising standard compatible units

**NC**

Numerical Control

**Override**

Correction or modification of programmed values by manually operated step switch

**PCB**

Printed Circuit Board

**PLC**

Programmable Logic Control

**PRESET**

Setting of actual value

**PS**

Power Supply

**QB**  
Output Byte

**RAM**  
Random Access Memory

**RESET**  
Reset, delete

**Resolver**  
Electromagnetic position transducer for indirect analog position measurement

**ROM**  
Read Only Memory

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**Suggestions**

**Corrections**

For Publication/Manual:

SINUMERIK 850  
Interface Description  
Part 2: Connection Conditions

**Planning Guide**

Order No.: 6ZB5 410-0BG02-0BA1  
Edition: January 1990

**From:**

Name \_\_\_\_\_

Company/Dept. \_\_\_\_\_

Address \_\_\_\_\_

Telephone / \_\_\_\_\_

Should you come across any printing errors when reading this publication, we would ask you to inform us accordingly, using this form. We would also welcome any suggestions you may have in the way of improvement.

**Suggestions and/or corrections**

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Order No.: 6ZB5 410-0BG02-0BA1  
Printed in the Fed. Rep. of Germany  
251/0152.90 PJ 01900.5

