

SINUMERIK 810 GA3  
SINUMERIK 820 GA3  
Interface Description  
Part 2: Connection Conditions

Planning Guide

07.94 Edition

Manufacturer Documentation

# SINUMERIK 810 GA3 SINUMERIK 820 GA3 Interface Description Part 2: Connection Conditions

**Planning Guide**

**Manufacturer Documentation**

**Applies to:**

<i>Control</i>		<i>Software Version</i>
SINUMERIK 810T/TE	Basic Version 3	1 and higher
SINUMERIK 810M/ME	Basic Version 3	1 and higher
SINUMERIK 820T/TE	Basic Version 3	1 and higher
SINUMERIK 820M/ME	Basic Version 3	1 and higher
SINUMERIK 810G	Basic Version 3	1 and higher
SINUMERIK 820G	Basic Version 3	1 and higher
SINUMERIK 810N	Basic Version 3	1 and higher
SINUMERIK 820N	Basic Version 3	1 and higher

**January 1993 Edition**

## 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.

If factual changes have been made on the page since the last edition, this is indicated by a new edition coding in the header on that page.

<b>Edition</b>	<b>Order No.</b>	<b>Remarks</b>
11.90	6ZB5 410-0DV02-0AA0	<b>A</b>
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01.93	6ZB5 410-0DV02-0AA2	<b>C</b>
07.94	6ZB5 410-0DV02-0AA3	<b>C</b>

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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Overview of Cables and Devices

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Cable Diagrams

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Elements for the Machine Control Panel

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Cables and Connectors

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# Preliminary Remarks

## Notes for the reader

This documentation is intended for manufacturers of machine tools using SINUMERIK 810 or SINUMERIK 820, basic version 3.

The publication describes cabling and configuration of control to machine.

SINUMERIK documentation comprises 4 parts:

- General documentation
- User documentation
- Manufacturer documentation and
- Service documentation

The **manufacturer documentation** for the **SINUMERIK 810/820** control is divided into the following sections:

- Operating Manual
- Interface Description
  - Part 1: Signals
  - Part 2: Cables and Devices
- PLC Programming Guide and
- FB-PLC, Package 1 Tool Management

Further SINUMERIK publications apply to all SINUMERIK controls (e.g. Universal Interface, CL 800 - Cycle Language)

Consult your local Siemens office for further details.

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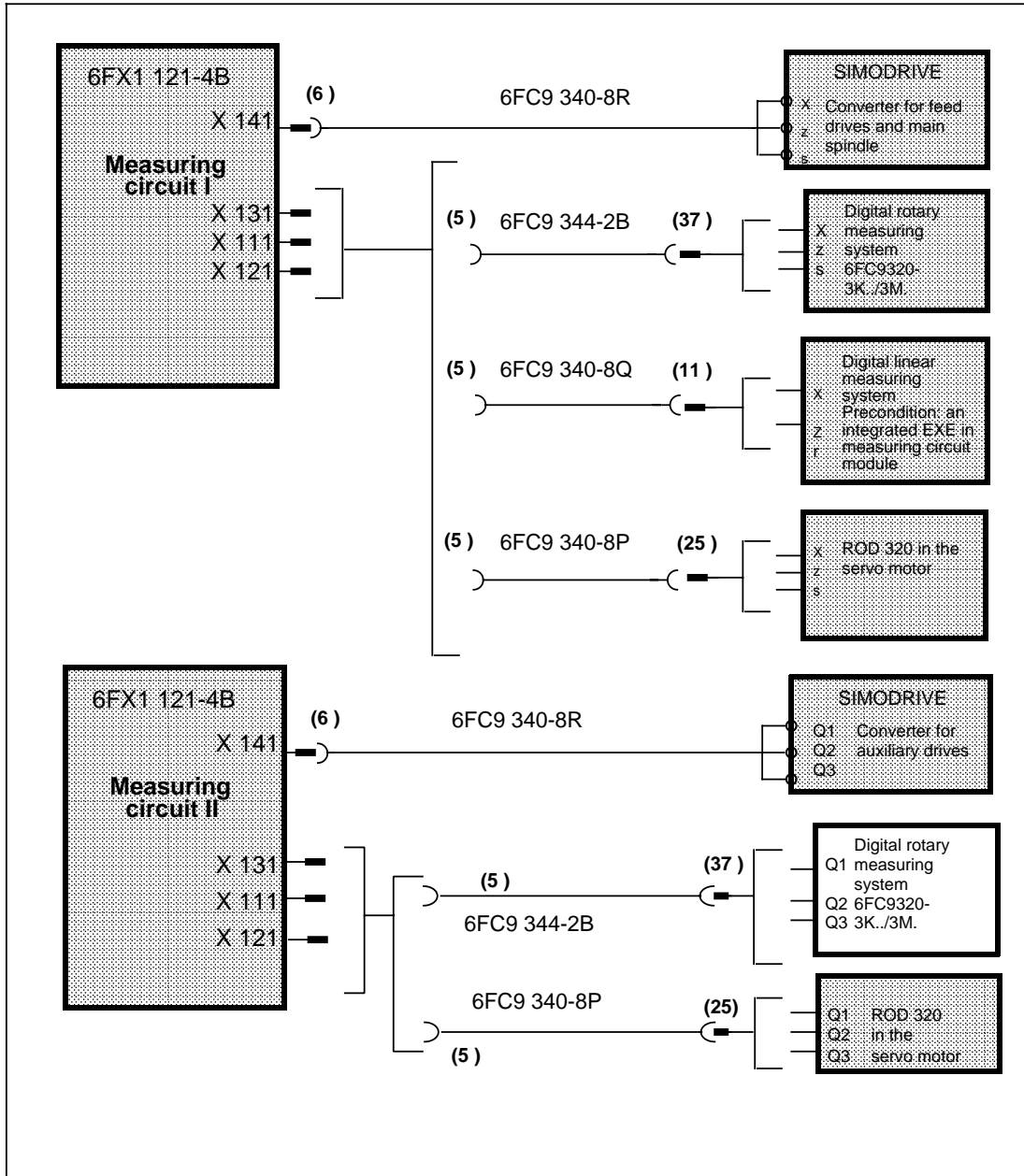
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# 1 Overview of Cables and Devices

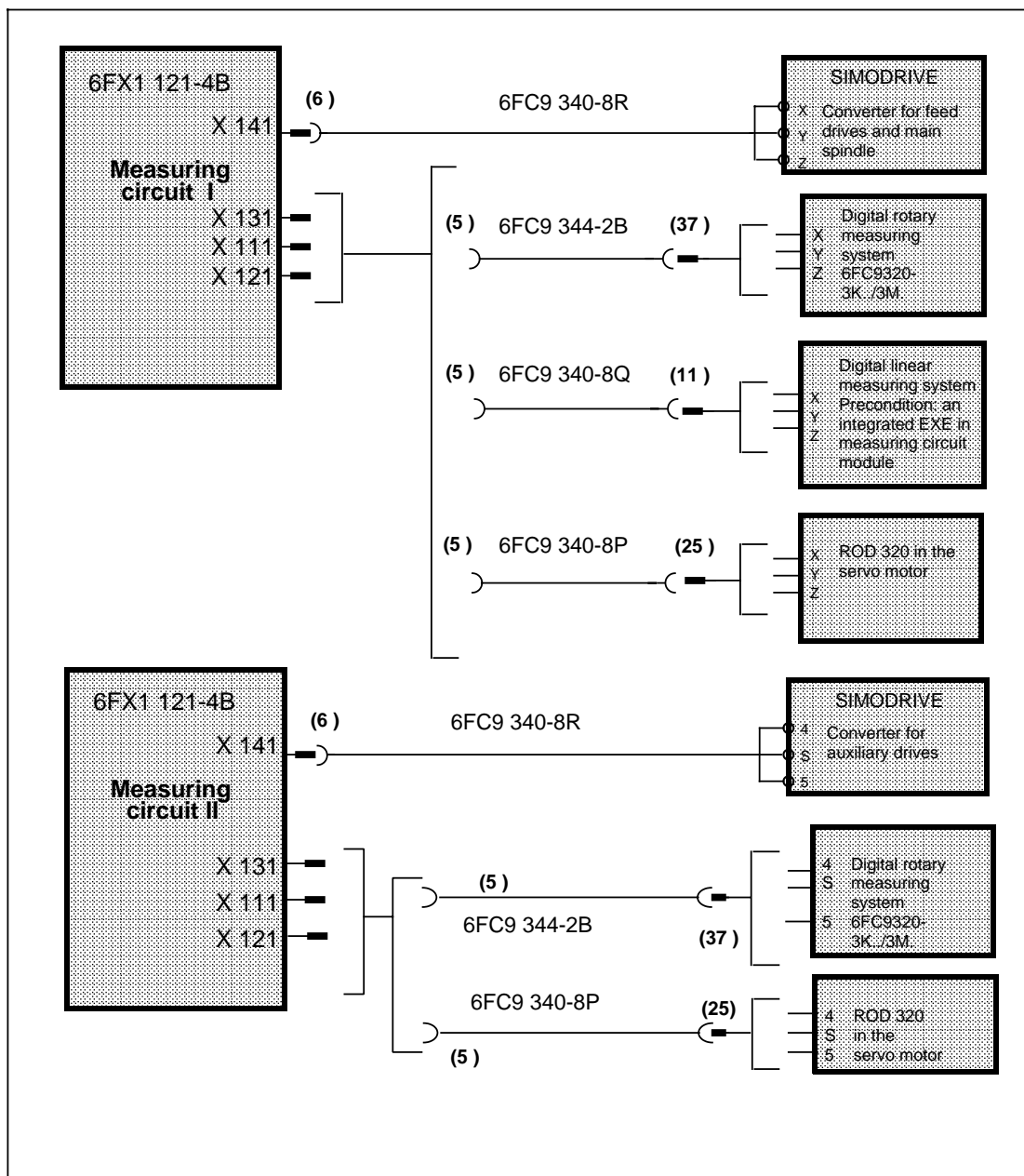
## 1.1 SINUMERIK 810T/820T, Basic Version 3: Connecting measuring circuit modules



Connection of SINUMERIK 810T/820T and G measuring-circuit modules (SPC modules) for a machine constellation as for T

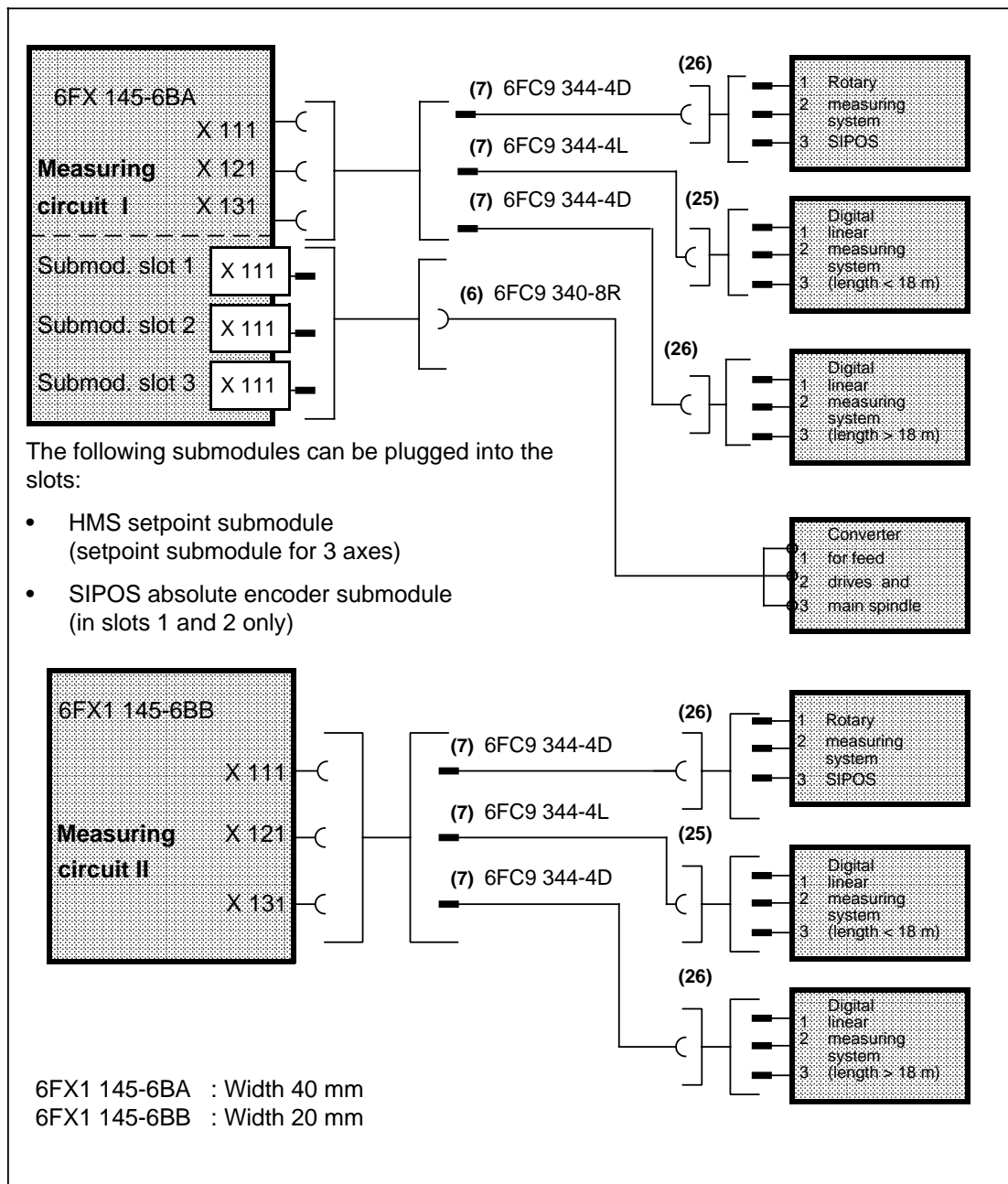
For the connection of the HMS measuring circuit modules, Section 1.2.  
The figures in brackets designate the type of connector (see Section 1.9).

### 1.2 SINUMERIK 810M/820M, Basic Version 3: Connecting measuring circuit modules



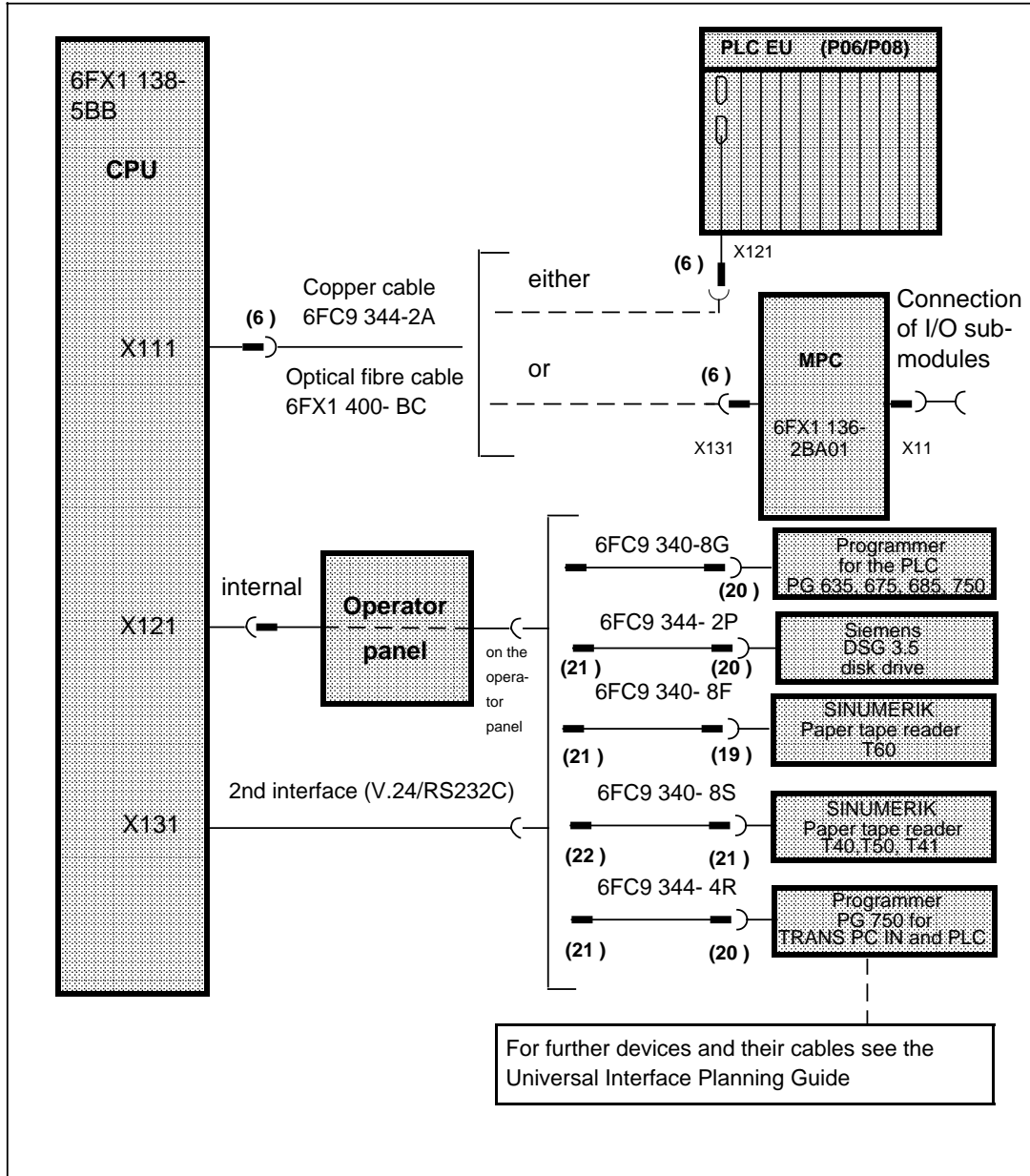
Connection of SINUMERIK 810M/820M and G, N measuring-circuit modules (SPC modules) for a machine constellation as for M

The figures in brackets designate the type of connector (see Section 1.9)



Connection of HMS measuring circuit modules (SW2 and higher and only for T M))

### 1.3 Connection of CPU module

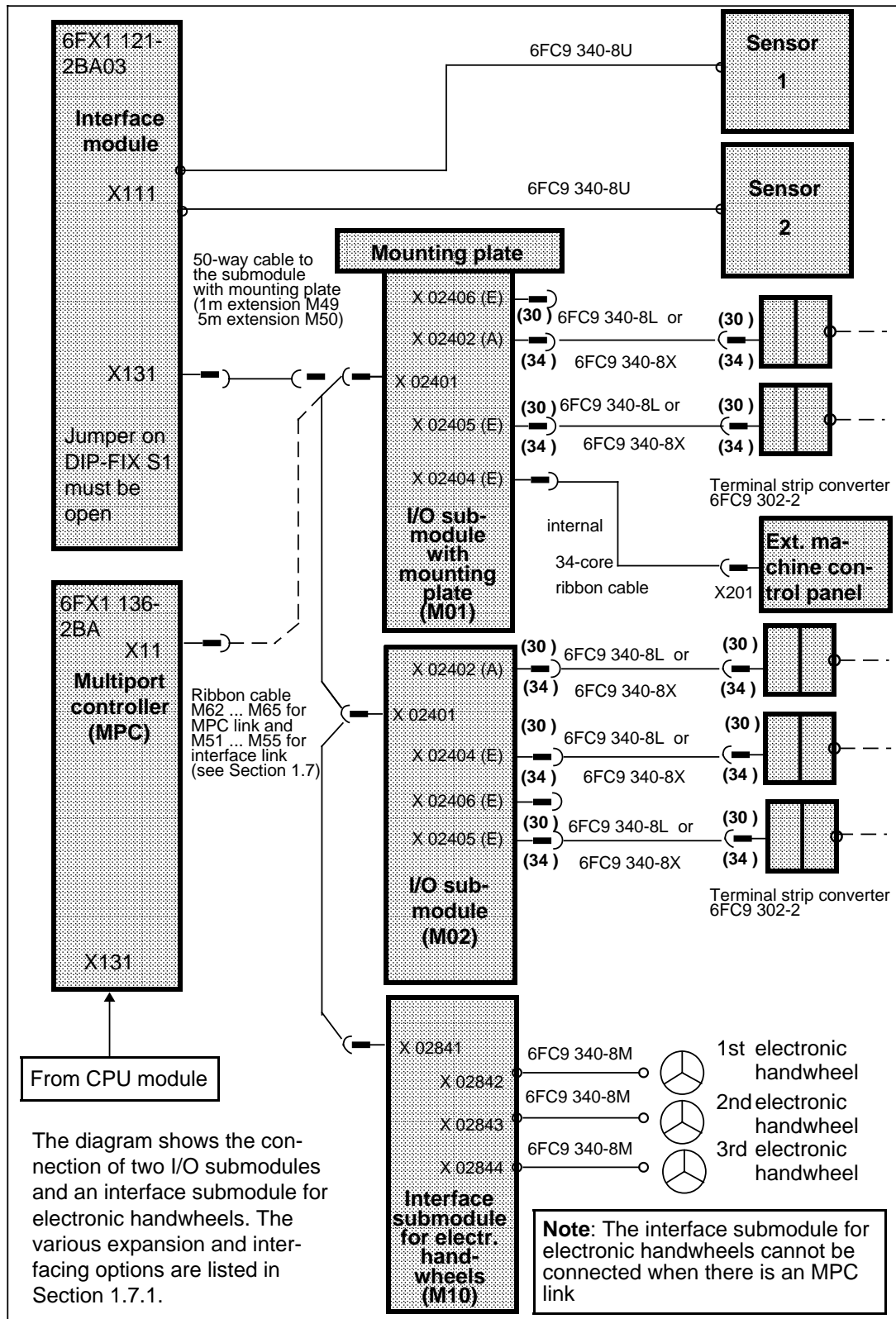


Connection of CPU module

The figures in brackets designate the type of connector (see Section 1.9)

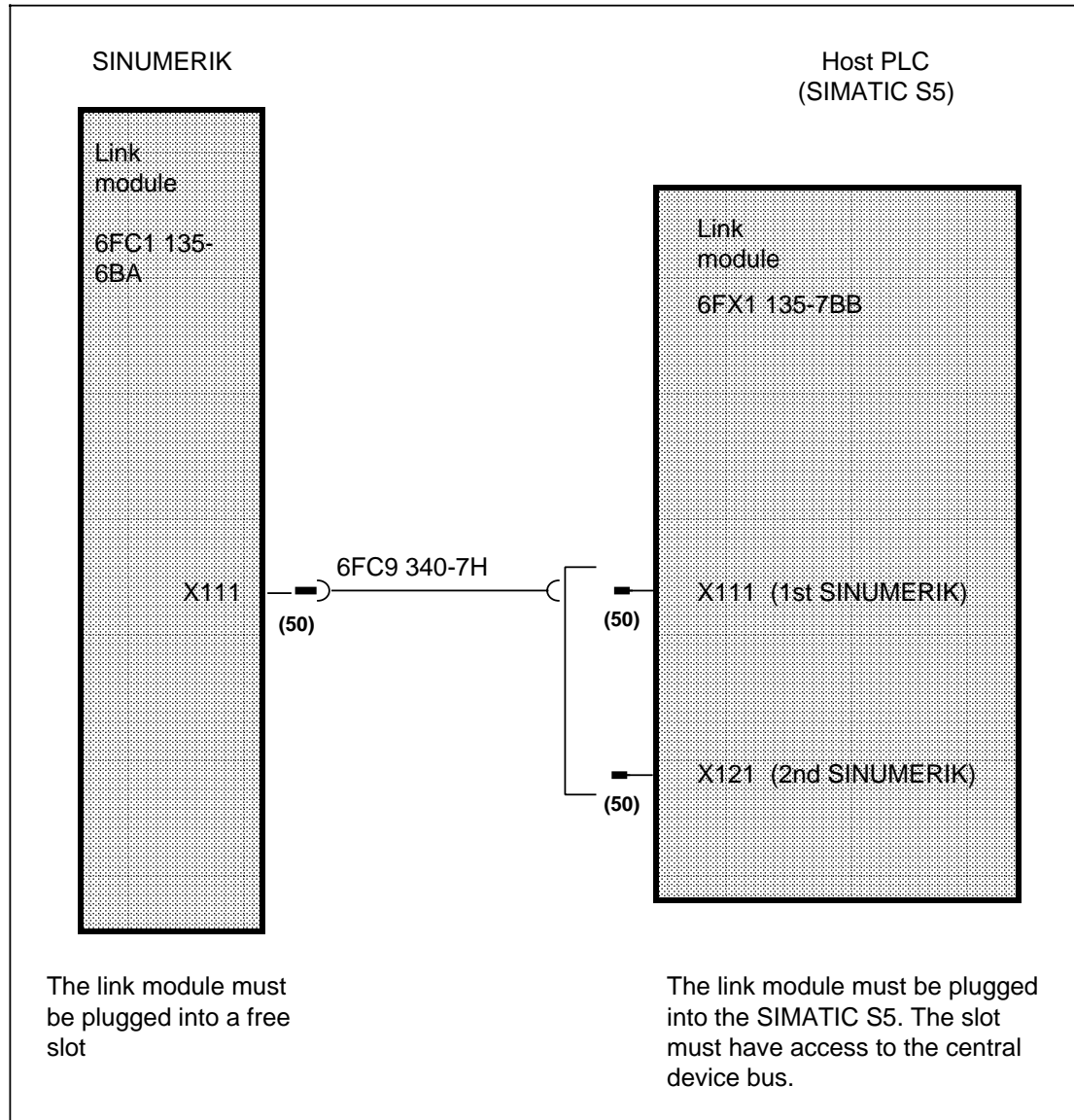
## 1.4 Connecting I/O submodules and the host PLC

### 1.4.1 Connecting I/O modules



Connecting I/O submodules

## 1.4.2 Connecting the host PLC



### Note:

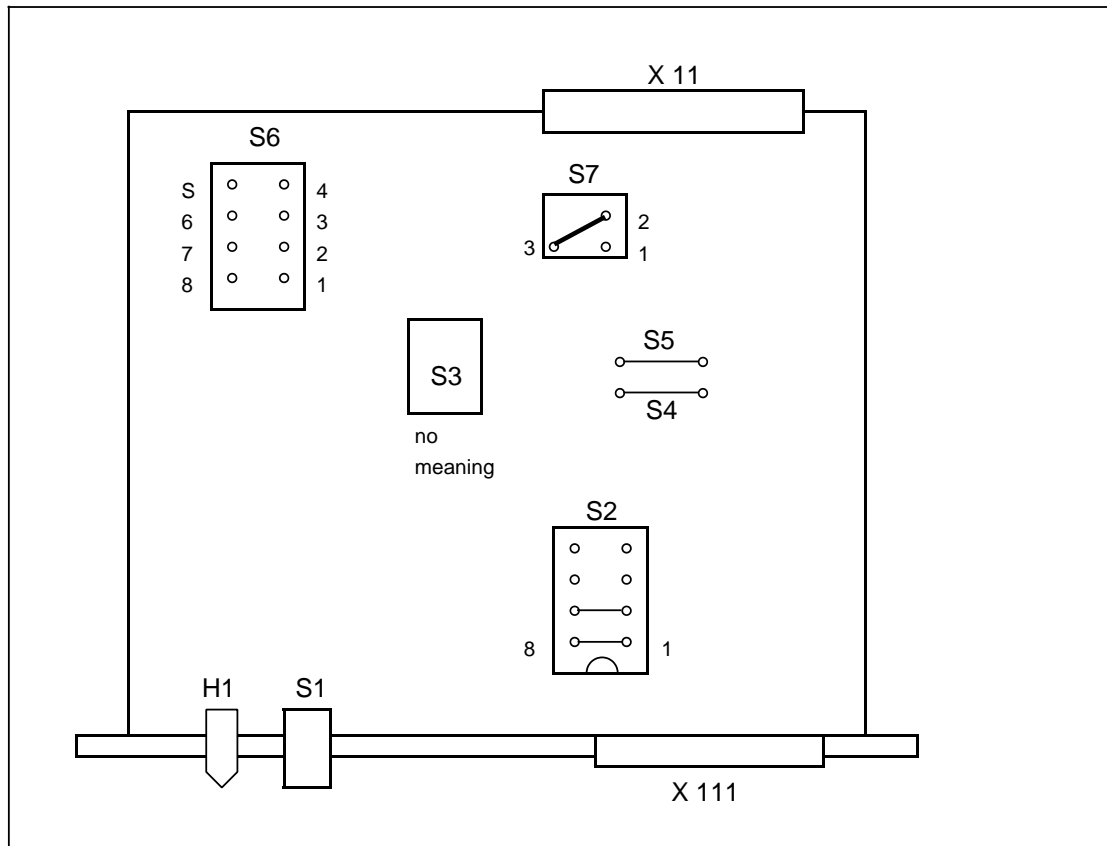
On the front panel of the link module 6FC1 135-6BA there is a rotary switch S1 for setting the size of the link area:

- Position 1 = 127 bytes
- Position 2 = 255 bytes
- Position 3 = 511 bytes
- Position 4 = 1023 bytes

The number of bytes depends on the length of the data block in the SINUMERIK PLC. When the host PLC fails, a red LED (H1) lights up on the front panel of the link module 6FC1 135-6BA.

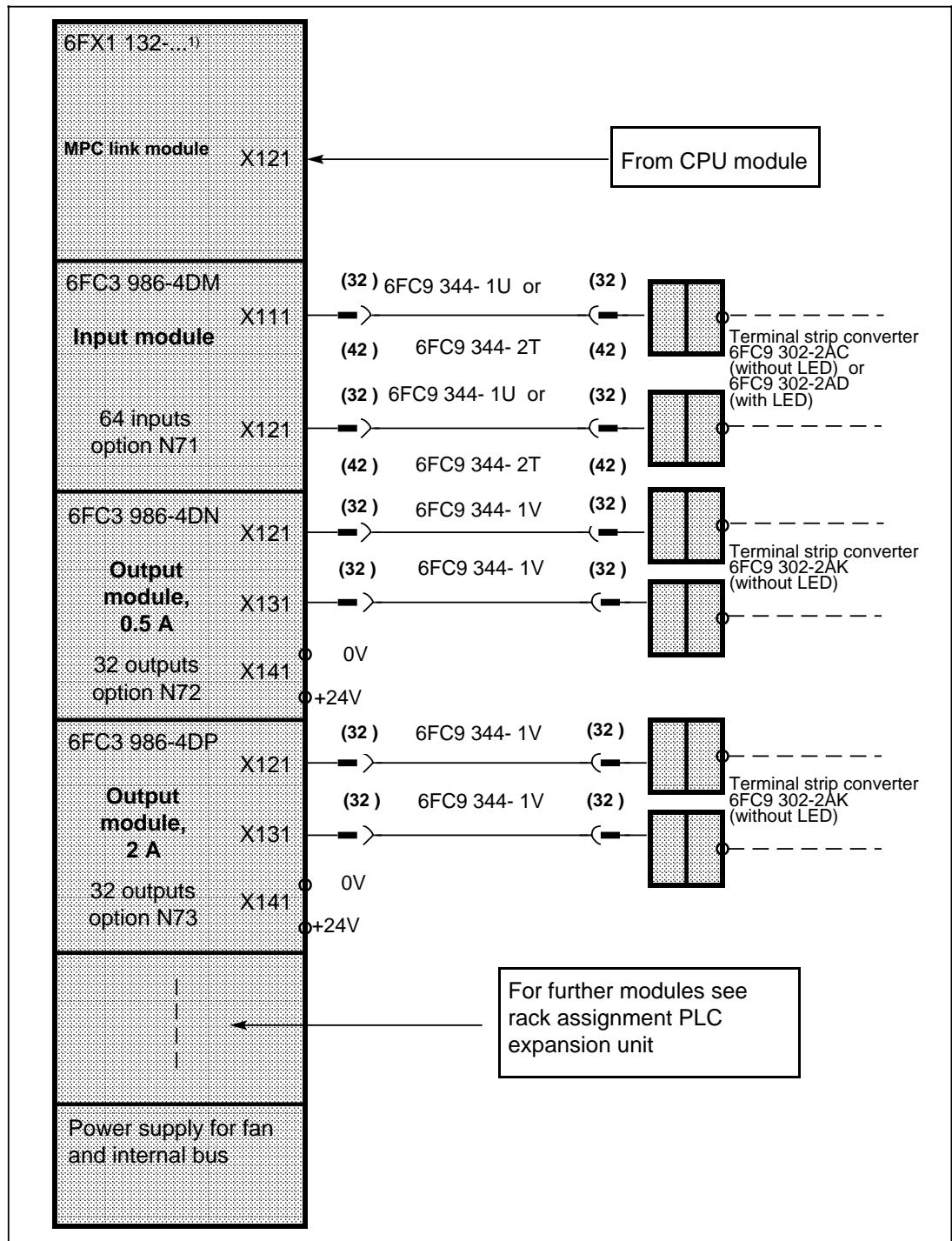
**Jumper settings on the link module**

6FC1 135-6BA

*Front panel***Technical data of the link module 6FC1 135-6BA**

Power supply:	5 V (internal)
Power consumption:	1.2 A
Interference immune to DIN 57 847:	3 kV
Format:	Double-height Eurocard
Mounting width:	1 1/3 standard slot dimension

### 1.5 Connection of the PLC expansion unit



Connecting the PLC expansion unit

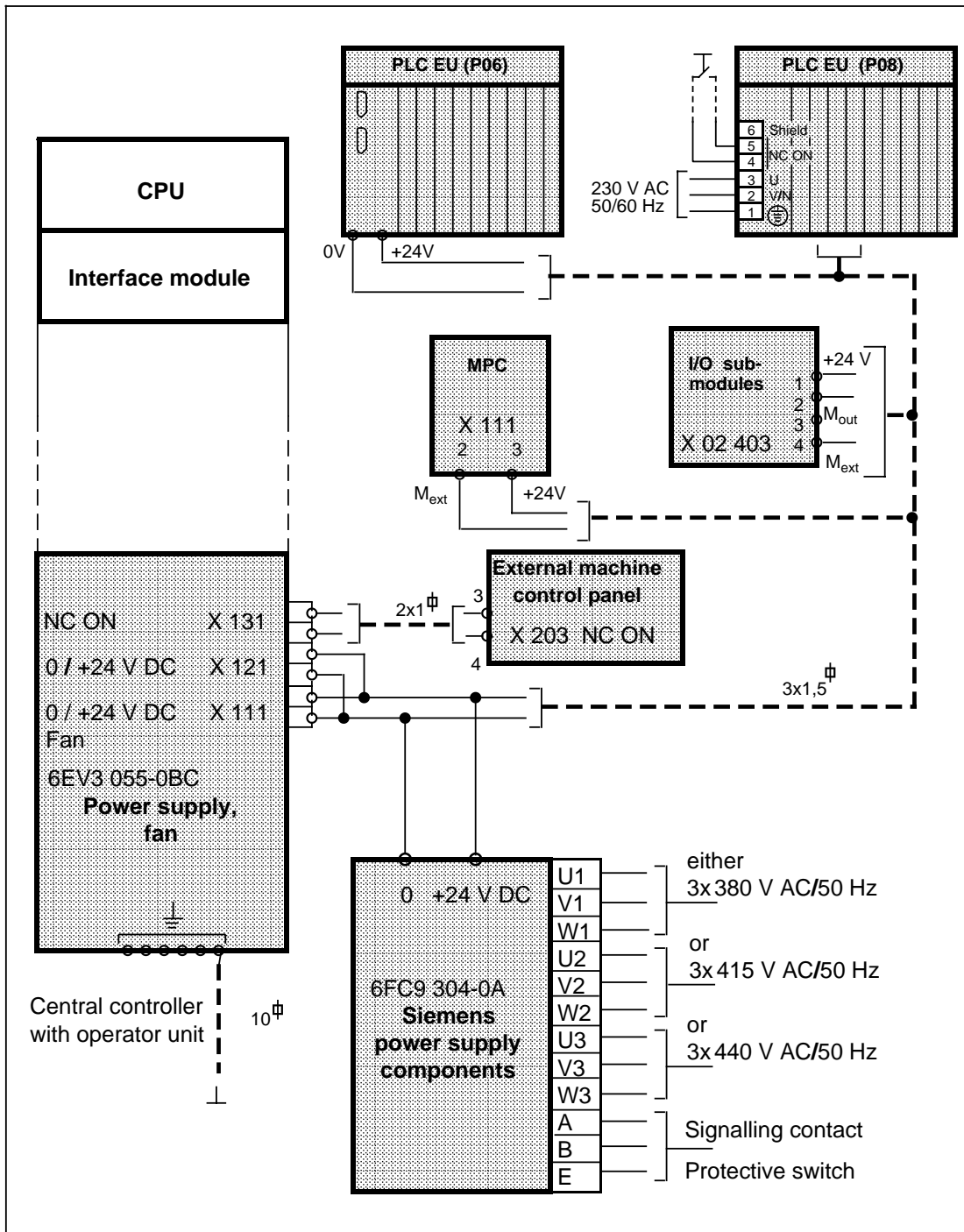
The figures in brackets designate the type of connector (see Section 1.8)

1) For the mini EU: ... = 1BA  
 For the maxi EU: ... = 1BB



## 1.6 Connecting the power supply

### 1.6.1 Connecting the power supply for SINUMERIK 810

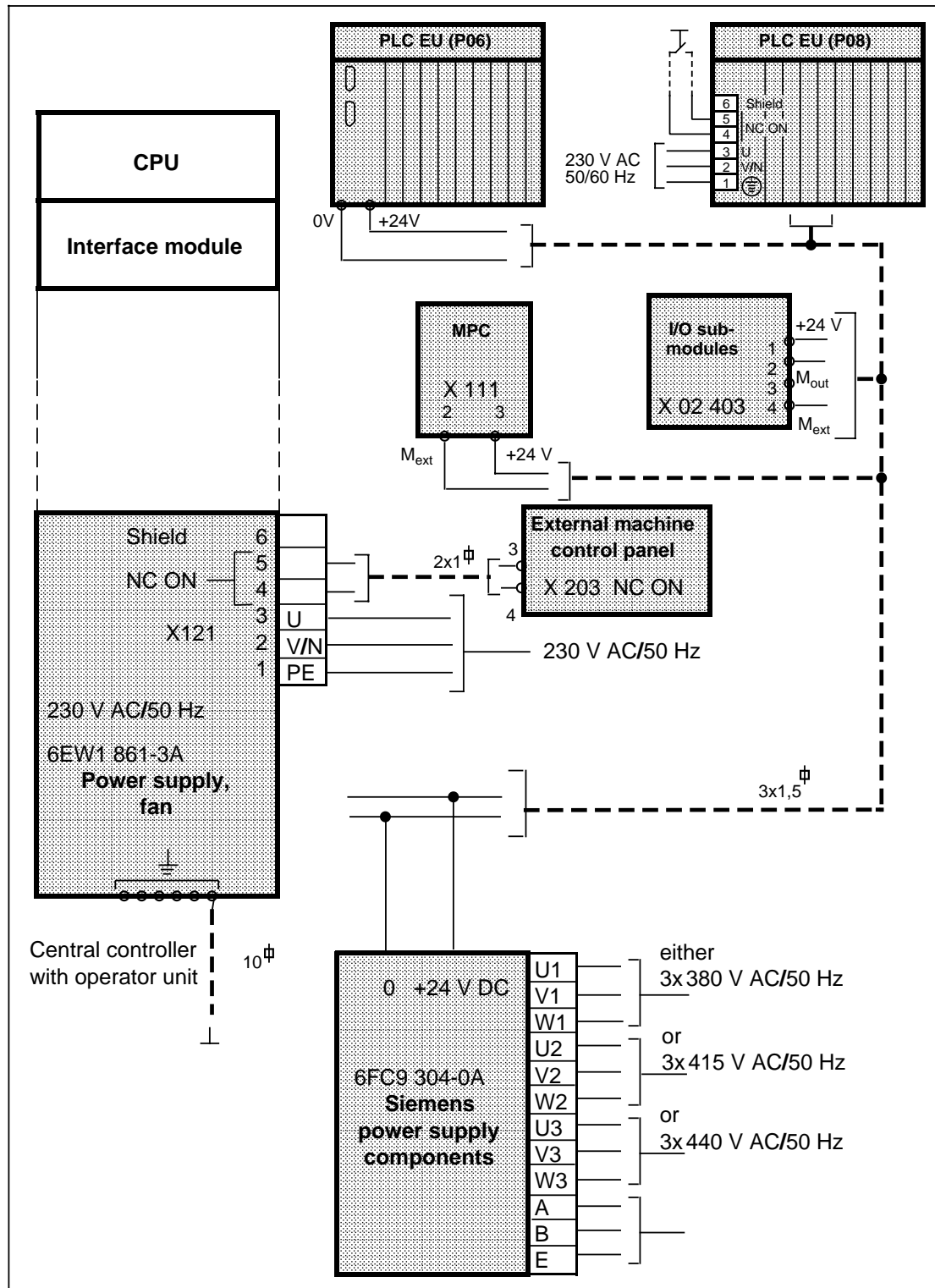


Connecting the power supply and NC ON for SINUMERIK 810

Input fuse of the power supply 6EV3 055-0BC: F118 Type FF 16A 6.3x32mm

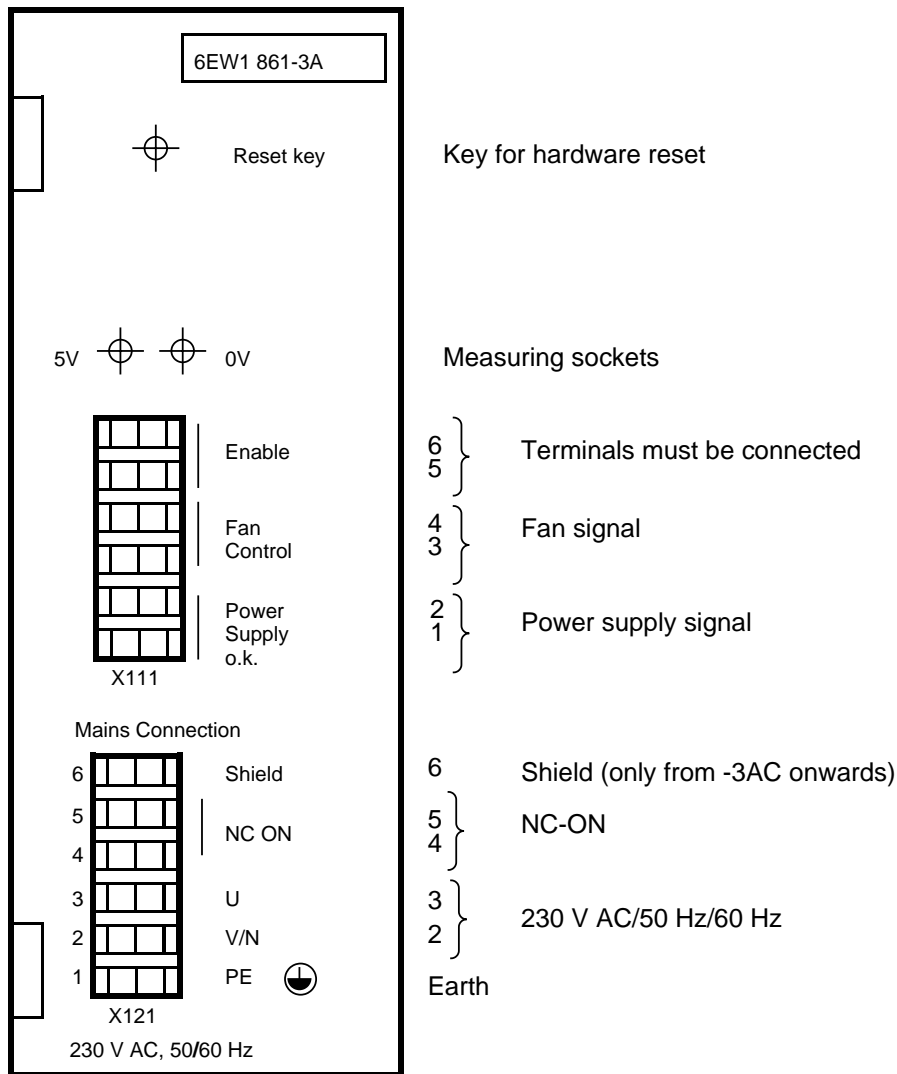
### 1.6.2 Connecting the power supply for SINUMERIK 820

#### 1.6.2.1 Overview



Connecting the power supply and NC ON for SINUMERIK 820

### 1.6.2.2 View of the front panel of the power supply to 6EW1 861-3A 230 V AC/50 Hz/60 Hz



#### Electrical connection data

Voltage 187 ... 235 V AC  
 Frequency 48 ... 63 Hz  
 Power 500 VA

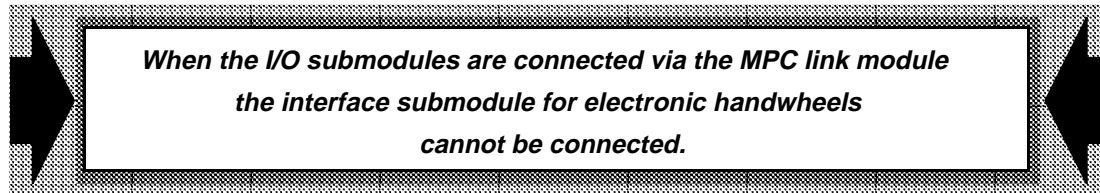
		Design.	Type
Input fuse	(for -3AA: F 101	F 101	mT 4 A 5x20 mm
	-3AB: F 101)		
	(for -3AC: F 131)	F 131	M 3.15 A 5x20 mm

## 1.7 I/O submodules

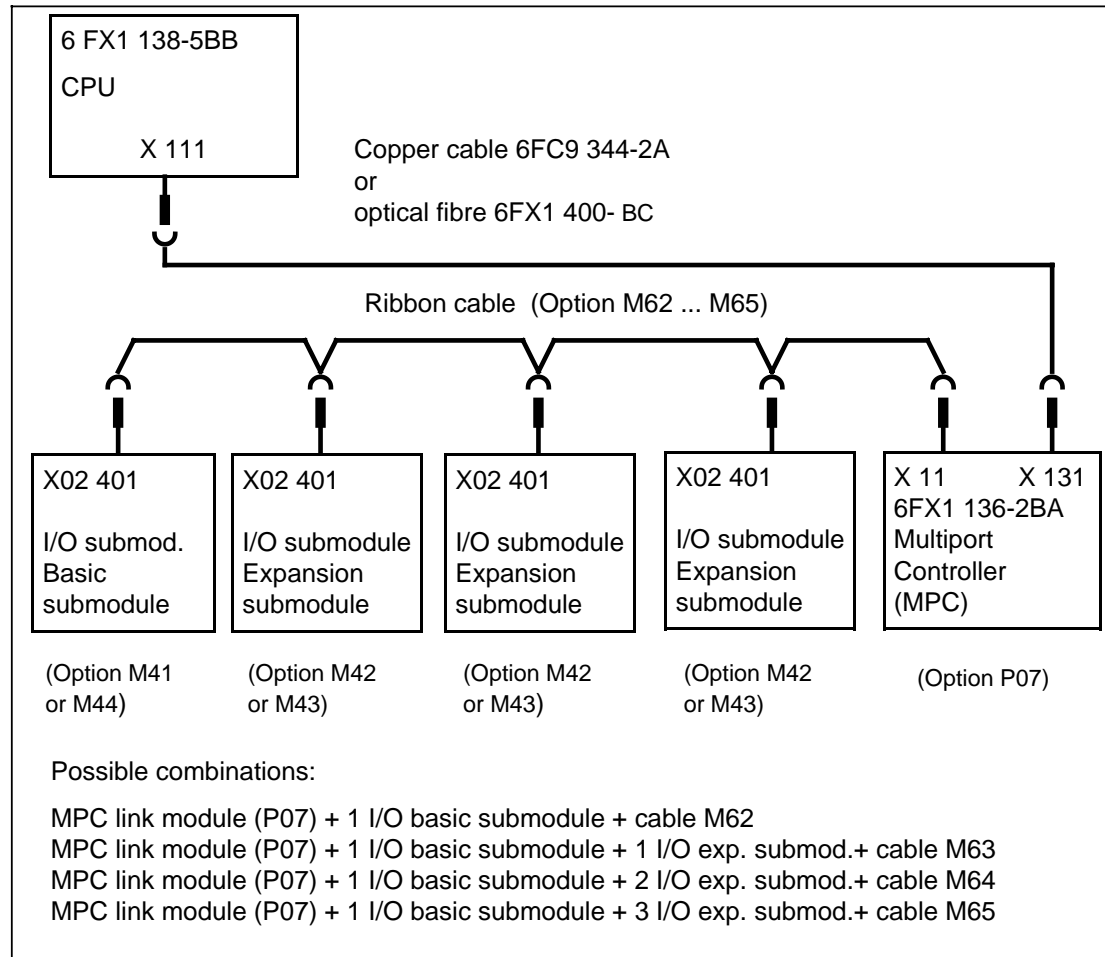
### 1.7.1 Linking the I/O submodules

Up to 4 I/O submodules and an interface submodule for electronic handwheels can be connected to the interface module. Up to 4 I/O submodules can be connected to the MPC link module.

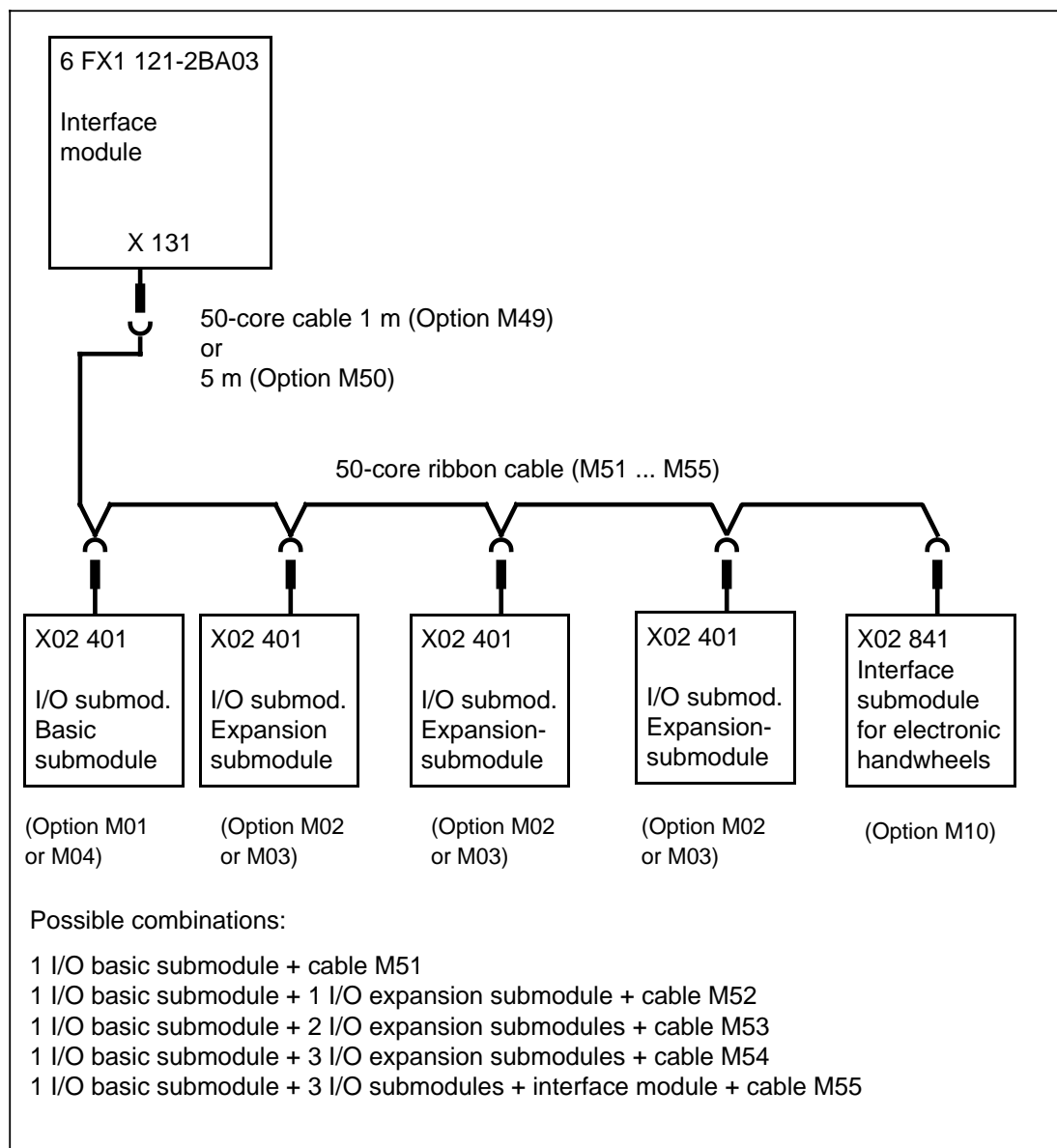
The I/O modules can be connected both via the Multiport controller (MPC) and via the interface module. Mixed operation, in which some of I/O submodules are connected to the interface module and the rest to the MPC, is permitted.



### 1.7.2 Configuration of the cable to the I/O submodules

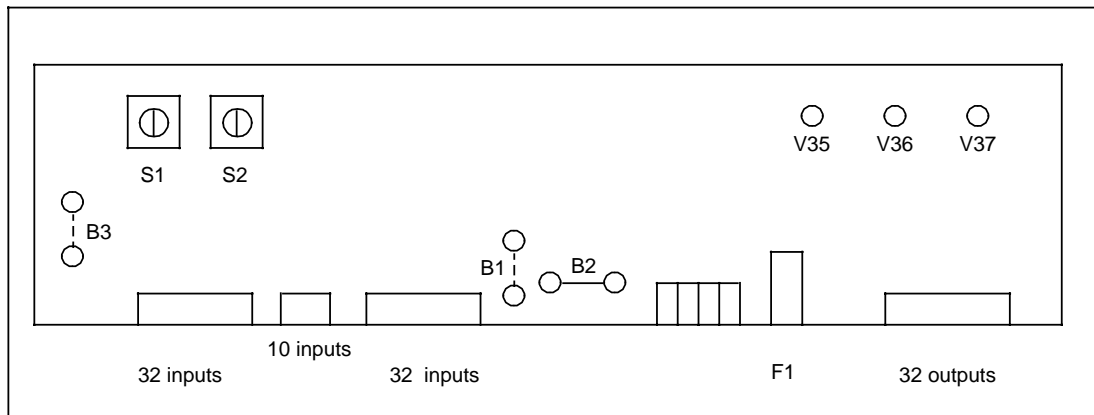


Connecting the I/O submodules to the MPC link module



Connecting the I/O submodules to the interface module

### 1.7.3 Addressing the I/O submodules



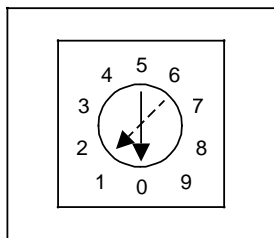
#### State of the jumpers:

B1 open  
B2 closed  
B3 open

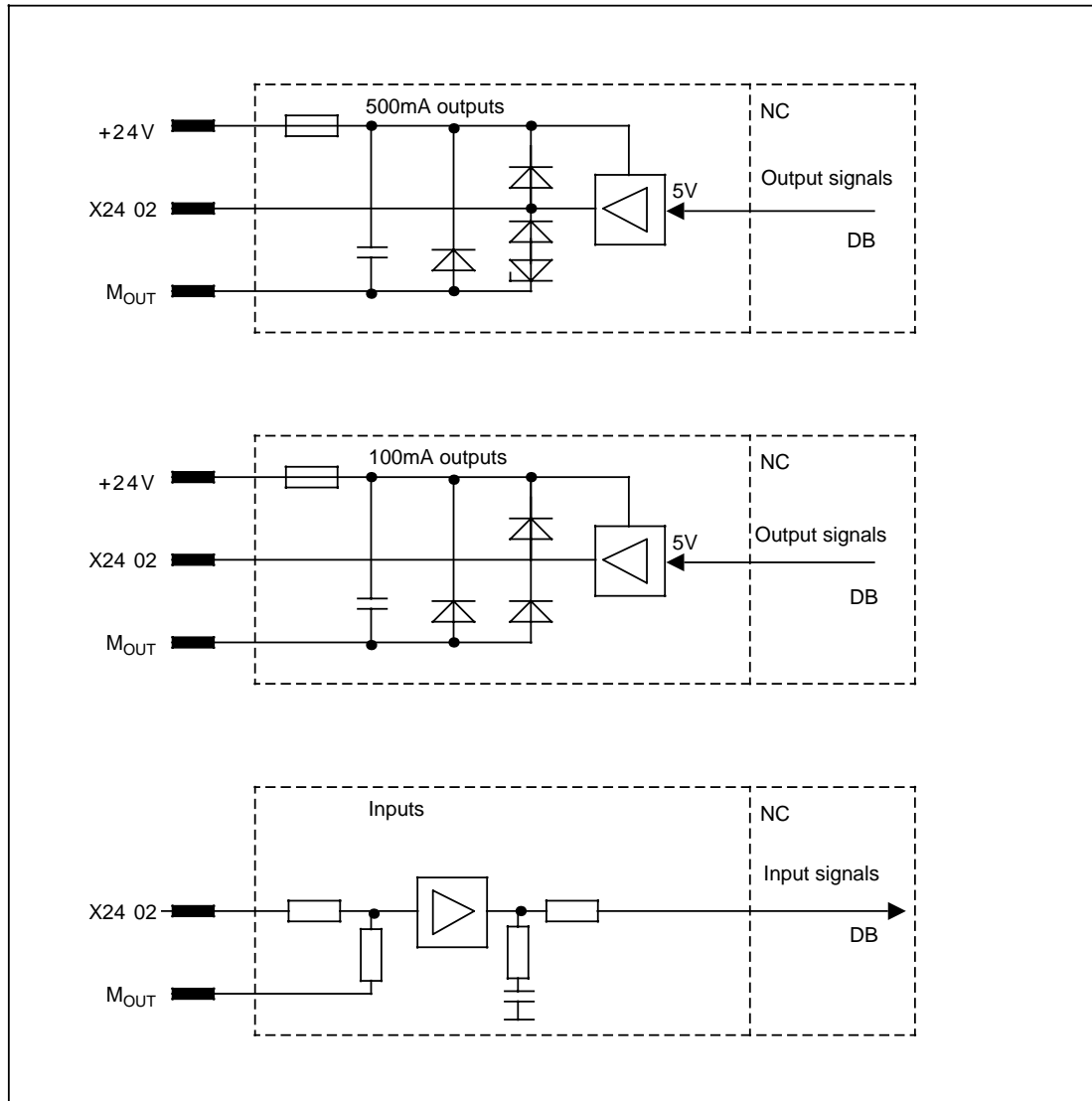
S1 . . . addressing the inputs  
S2 . . . addressing the outputs

(Setting of the switches S1, S2 see section 1.7.6)

F1 ... fuse 6.3 A for the outputs and the external machine control panel



### 1.7.4 Signal flow and conductor routing in the I/O submodules



*M<sub>out</sub>/24 V are routed via the terminal block X02 403*

### 1.7.5 Electrical characteristics of the I/O submodules

6FX1 124-6AA/6FX1 124-6AB		6FX1 124-6AA	
Number of inputs	64	Number of outputs	32 (8+24)
Floating	no	Floating	no
Input voltage (Rated value)	24V-	Supply voltage $U_P$	
Input voltage - for signal "0"	-3V to +5V or input open	- rated value	24V-
- for signal "1"	+13V to +30V	- ripple $U_{PP}$ max.	3.6V
Input current at signal "1" typ.	6 mA	- permissible range (including ripple)	20V to 30V
Delay		Output current with signal "1"	
- for tpLH	2.5...4.3 ms	- rated value 100 mA/0.5A	
- for tpHL	2.5...4.3 ms	Short circuit protection	
Cable length	50 m	for 100mA output	without electronic
		for 0.5A output	
		Limitation of inductive cutoff voltage to make break capacity for lamps	-11V
		at 100mA outputmax.	--- 3)
		at 0.5A outputmax.	14W
		Switching frequency	
		- ohmic load max.	500Hz
		- lamps max.	500Hz
		- inductive load 1) max.	10Hz
		Total load capacity 2)	
		at 55°C	50%
		Signal level of the outputs	
		- with signal "0" max.	output open
		- with signal "1"	
		at 0.5mA output min.	$U_P$ -1.1V
		at 0.5A output min.	$U_P$ -1.7V
		Cable length max.	50m
		Insulation voltage external connections against housing	
		- to VDE 0160	---
		- tested with	---
		Current consumption	
		- internal (at 5V)	0.1 A
		- internal (at 24V)	0.05A
		Space requirement	391x127x15mm
		Weight	M01 approx. 1.3 kp
			M02/M03 approx. 1.0 kp

only outputs

1) At rated loading. At a lesser load higher values are permissible.

2) In relation to the sum of the rated current of all outputs.

3) Maximum making current 350mA.  
 For signal lamp control:  
 12V - lamps with series resistance or  
 24V - lamps with preheating



## 1.7.6 Terminal assignment of the I/O submodules

The inputs are connected via 2 connectors and the outputs via 1 connector.

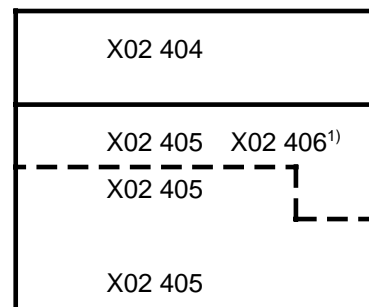
### Assignment of the inputs

No. of the 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 pin No.							
	10	9	8	7	6	5	4	3
IB m+5	Connector X02 405 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

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

Switch position S1	Address m
0	0
1	8
2	16
3	24

IB m to  
IB m+3  
IB m+4  
IB m+5  
IB m+6  
IB m+7



1) On the connector X02 406 on pin No. 3 to 12 the input byte m+4 (bit 0 to 7) and the input byte m+5 (bits 0 and 1) are led out. As these 10 input bits are also led out on connector X02 405 double assignment is not permissible.

### Assignment of the outputs

No. of the 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

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

Switch position S2	Address m
0	0
1	4
2	8
3	12

### 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

## 1.8 Measuring circuit modules

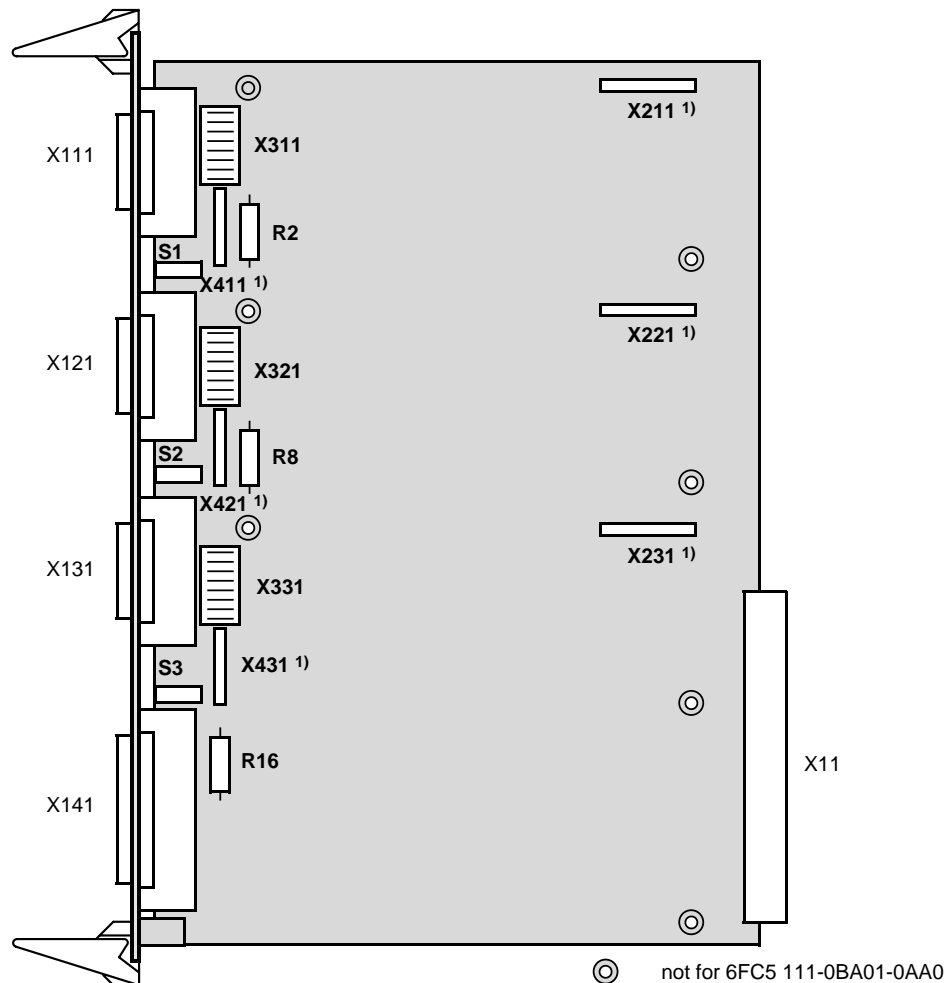
### 1.8.1 SPC measuring circuit module with/without EXEs 6FX1 121-4B

This module is used for the output of analog setpoints (speed setpoints) and the acquisition of actual values (incremental actual positions) of 3 axes. It can also process sinusoidal signals as actual values of linear measuring scales. They are amplified and multiplied by electronic pulse shaping systems (EXEs).

#### Function blocks:

- Controller enable
- Wire break monitoring
- Contamination monitoring
- EXE 5/10-fold (**not** 6FX1 121-4BA02)
- Address routing by software
- 3 measuring circuit/actual value inputs for connecting 3 axes with incremental position encoders)
- 1 measuring circuit actual value output for 3 axes with analog speed setpoints

#### Position of interfaces, jumpering sockets and jumpers



1) not for 6FX1 121-4BA02

## 1.8.1 SPC measuring circuit module with/without EXEs 6FX1 121-4B

X11	– SS to local bus
X111	– Actual value axis 2
X121	– Actual value axis 3
X131	– Actual value axis 1
X141	– Setpoint/controller enable axis 1 to 3
X311, X321, X331	– Customer jumpering – Encoder and EXE adjustment
X211, X221, X231	– Customer jumpering – Output of integrated EXEs
X411, X421, X431	– Customer jumpering – Input of integrated EXEs
S1 to S3	– to position 1

Assignment of switches and connectors to the individual module axis numbers

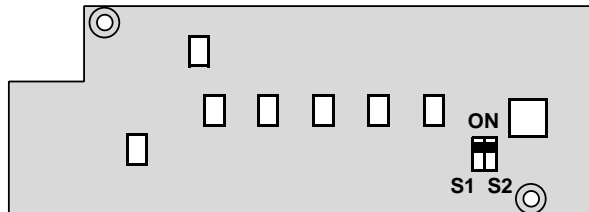
Axis	Switch	Connector			
1	S3	X131	X231	X431	X331
2	S1	X111	X211	X411	X311
3	S2	X121	X221	X421	X321

Current balance	+5 V	+15 V	–15 V	V <sub>CC</sub>
typical	0.65 A	0.05 A	0.05 A	—
integrated EXEs (typical)	0.06 A	—	—	—
X111 to X131	1.5 A	—	—	—
per encoder supply	0.5 A <sup>1)</sup>	—	—	—

1) Current may only be picked off at pin 14! Mind the power drop at the encoder cable!

**EXE 5/10-fold**

The EXE 5/10-fold module converts analog input signals into digital output signals and at the same time multiplies the pulses (by 5/by 10).



- S1 – Input frequency switch
- S2 – Division factor

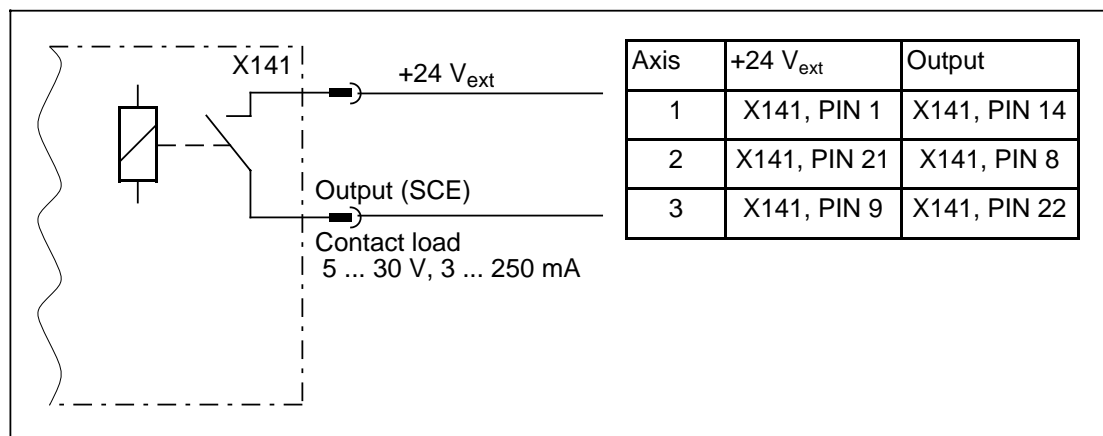
**Choosing the function**

- max. input frequency  $f_{max}=50$  kHz: S1 – ON position
- max. input frequency  $f_{max}=25$  kHz: S1 – OFF position
- Division factor 10: S2 – OFF position
- Division factor 5: S2 – ON position

***The frequencies 25 kHz and 50 kHz are strict limits that must on no account be exceeded!***

***Pulses can get lost position errors!***

On delivery, the EXE is set to position 50 kHz/5-fold (S1, S2 ON position).



## Characteristics of the measuring system input

Data sheet for the interface on the SPC measuring circuit module

Connector No. Signal type Encoder supply – Short-circuit protection: no	Differential driver				
	BEZ	MIN	TYP	MAX	EINH.
Encoder supply – Voltage – Ripple – Current per encoder		+4.75	+5.0	+5.25 100 300	V mV <sub>SS</sub> mA
Input voltage – Voltage positive (TTL) – Voltage negative (TTL) – Difference – Permissible common range mode		– – 1.0 –2.0		– – 10.0 +5.0	V V V V
Input current – "H" current – "L" current		– –	– –	21 21	mA mA
Inputs – Frequency with 90° el A-B – Pulse width – Rate of change – Edge interval – Edge interval for reference signal – Edge interval (change) – Edge offset	1/T t <sub>mP</sub>  t <sub>mF</sub> t <sub>1d</sub> t <sub>2d</sub> t <sub>3d</sub>	 1.0 5.0 0.45 – 0.9		1 – 0.2 0.05	MHz μs V/μs μs μs μs
Interference immunity (DIN 57847) Width of interference signal Interference energy				3 – –	kV μs μWs
Length of encoder cable when using SINUMERIK cables				35	m

Data sheet for the interface on the SPC measuring circuit module with integrated EXEs

Connector No. Signal type Encoder supply – Short-circuit protection: no	Sinusoidal current				
	BEZ	MIN	TYP	MAX	EINH.
Encoder supply – Voltage – Ripple – Current per encoder		+4.75	+5.0	+5.25 100 300	V mV <sub>SS</sub> mA
Input current – Track A and B – Reference mark – Zero-frequency quantity – Amplitude difference		0.007 0.002		0.016 0.009 6.5 20	mA mA % %
Inputs – Frequency with 90° el A-B – Phase shift between A and B – Phase shift between ref. mark and A				25 (12) 100 405	kHz °el °el
Interference immunity (DIN 57847)				3	kV
Cable length from EXE to encoder when using SINUMERIK cables				20	m

The actual values are feed into the SINUMERIK via 15-pole connectors.

The encoders connected are either incremental rotary encoders for linear and round axes or incremental linear encoders with external electronic pulse shaping systems.

The 6FX1 121-4B. module is also available with integrated EXE. In this case, the signals from the pick-up are fed directly into the measuring circuit modules and converted into A, B or reference signals.

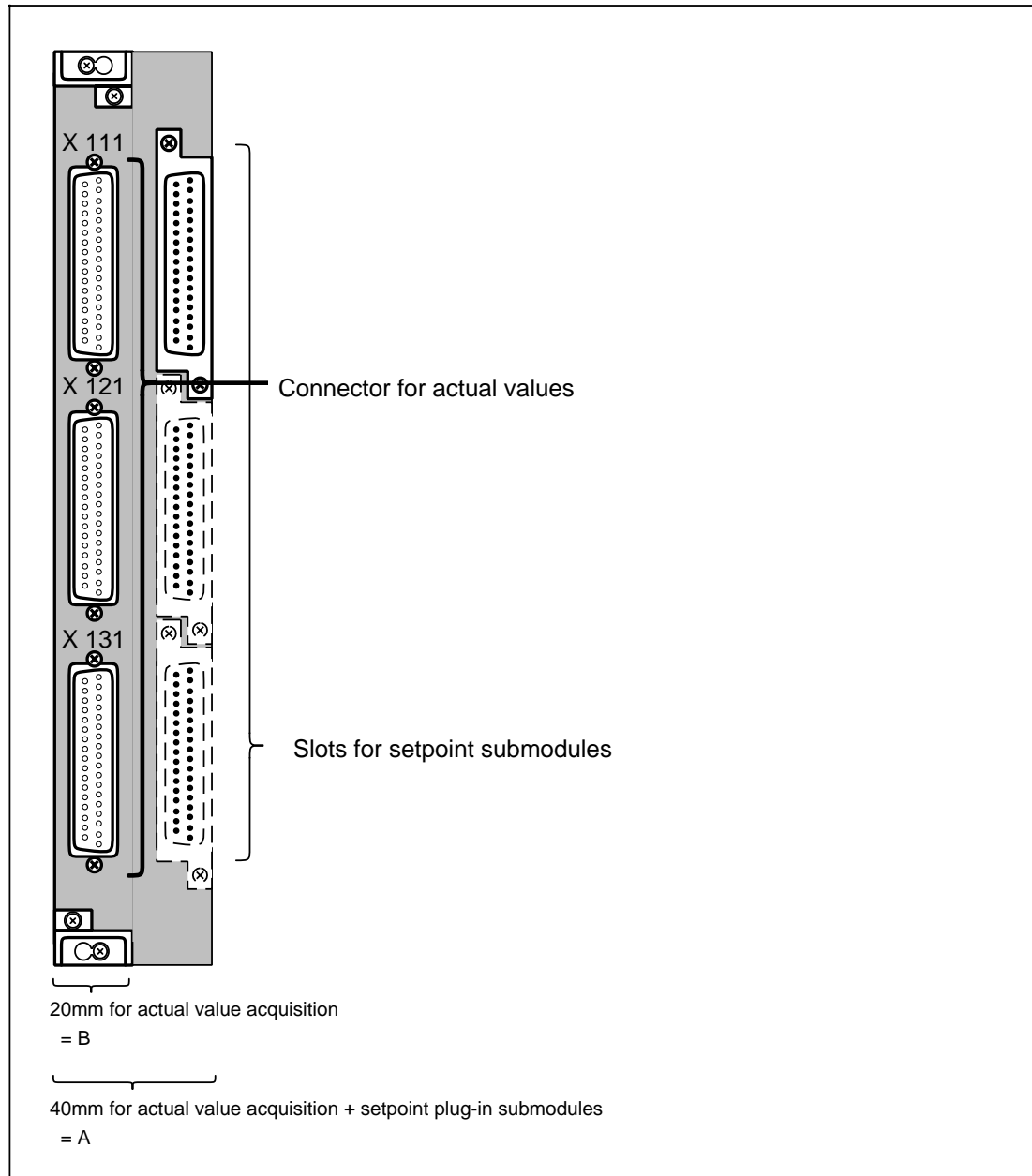
## 1.8.2 HMS measuring circuit module 6FX1 145-6B 00

### The module comprises:

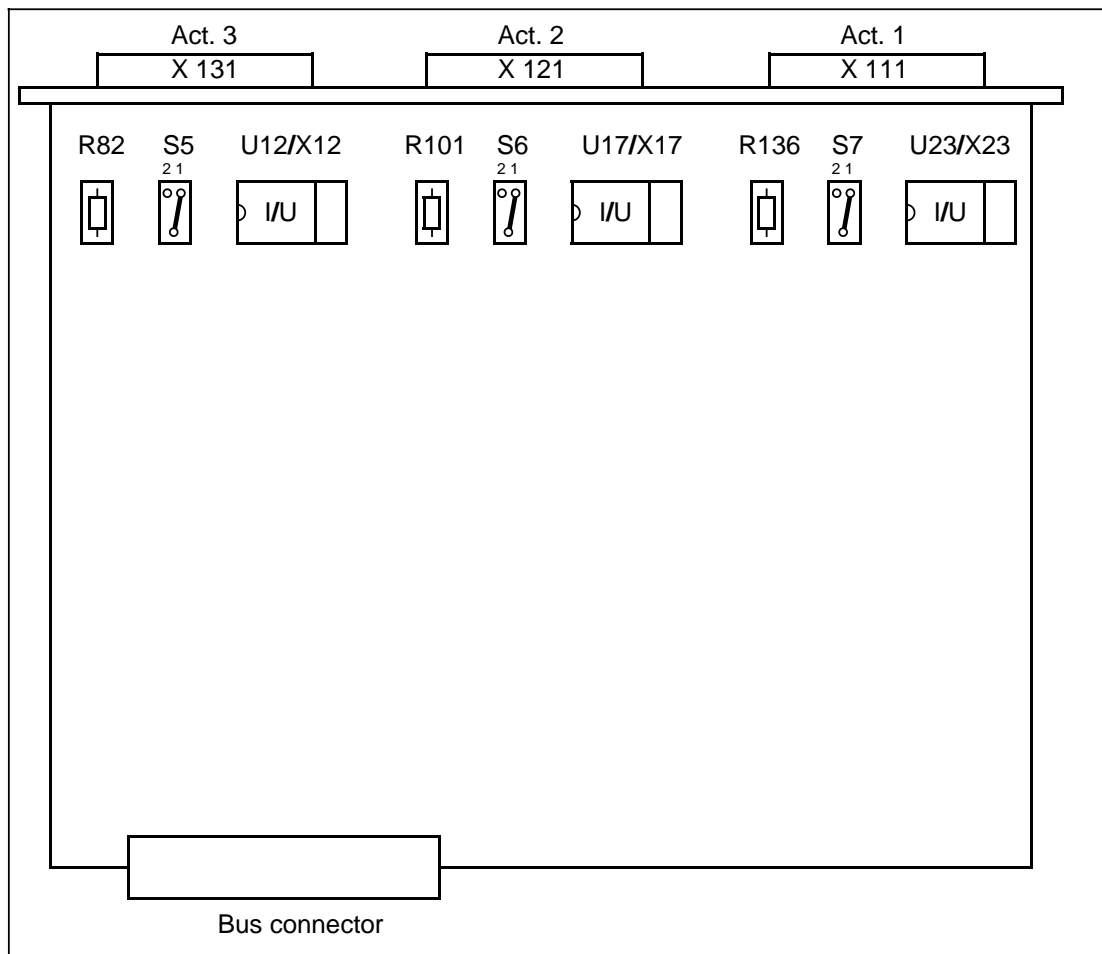
- 3 measuring-circuit/actual-value inputs as interfaces for 3 axes with incremental position encoders.
- 3 analog measuring circuit and setpoint submodule slots (only 6FX1 145-6BA00).

The two upper setpoint submodule slots are also used to plug in the absolute submodule for three SIPOS absolute encoders. In this case only one setpoint submodule can be installed in the free slot at the bottom.

A setpoint submodule has the setpoint outputs for 3 axes/spindles.

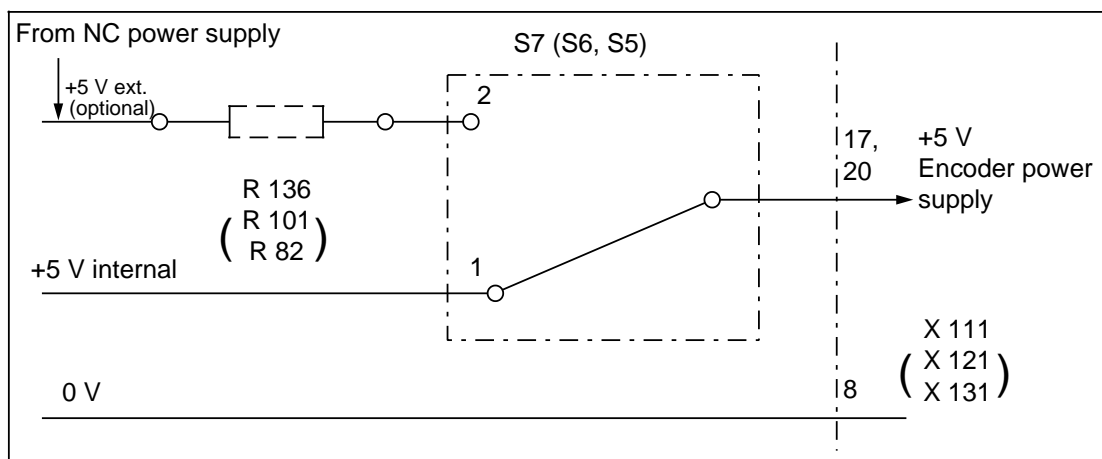






Jumper assignments on the HMS measuring circuit modules

Encoder power supply:



Module side

There are 3 measuring-circuit/actual-value inputs as interfaces for 3 axes with incremental position encoders on both HMS measuring circuit modules. The double-width module has 3 additional submodule slots, into each of which one analog measuring-circuit setpoint submodule (HMS setpoint submodule) or 1 SIPOS absolute encoder submodule + 1 measuring-circuit setpoint submodule can be plugged. The two modules can be combined in such a way that the double-width HMS measuring circuit module contains the measuring-circuit setpoint submodules for all 6 axes/spindles (but then no SIPOS absolute encoder submodule can be inserted).

**Note:**

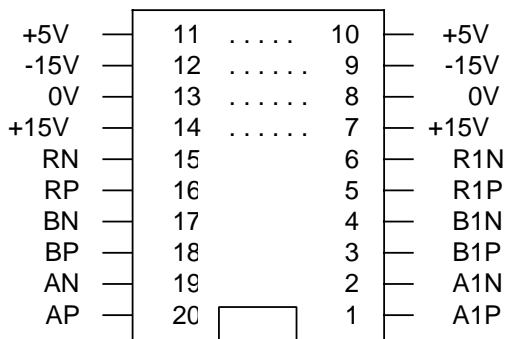
- The SIPOS absolute encoder submodule can only be plugged into the 2 upper submodule slots of the HMS measuring circuit module.
- An I/V hybrid plugged onto the module makes it possible to connect linear measuring scales with unconditioned current signals to the HMS module. Each of the 3 measuring system outputs can be equipped with an I/V hybrid.

**Encoder-signal jumpering interface**

Connector designations U12 (X12), U17 (X17), U23 (X23).

20-way IC socket (DIL 20) for insertion of one current-voltage converter hybrid user together with encoders with unconditioned current signals (optional).

Order No.: 6FC3 988-7CN



A1P	Encoder signal	A	(Unconditioned voltage or current signal)
A1N	Encoder signal	*A	(Unconditioned voltage or current signal)
B1P	Encoder signal	B	(Unconditioned voltage or current signal)
B1N	Encoder signal	*B	(Unconditioned voltage or current signal)
R1P	Encoder signal	R	(Unconditioned voltage or current signal)
R1N	Encoder signal	*R	(Unconditioned voltage or current signal)
AP	Encoder signal	A	(Unconditioned voltage signal)
AN	Encoder signal	*A	(Unconditioned voltage signal)
BP	Encoder signal	B	(Unconditioned voltage signal)
BN	Encoder signal	*B	(Unconditioned voltage signal)
RP	Encoder signal	R	(Unconditioned voltage signal)
RN	Encoder signal	*R	(Unconditioned voltage signal)

For encoders sending an unconditioned voltage signal (standard; SIPOS encoder) the interfaces are equipped with short-circuit coding connectors (X12, X17, X23) that connect opposite pins (1-20, 2-19, 3-18, ...). The pins for the supply voltage are already connected together on the module.

### HMS setpoint submodule 6FX1 132-5BA00

The submodule is plugged into the appropriate interface in the HMS measuring circuit module 6FX1 145-6BA00 (double-width with submodule interface). Setpoint values for up to 3 axes/spindles can be output via one submodule. A maximum of 2 HMS setpoint submodules can be plugged into the HMS measuring circuit module 6FX1 145-6BB00 (single-width without submodule interface). The resulting maximum configuration for the SINUMERIK 810 is therefore as follows (the SINUMERIK 820 provides more space on the subrack):

- 1 HMS measuring circuit module with submodule interface
- 1 HMS measuring circuit module without submodule interface
- 2 HMS setpoint submodules

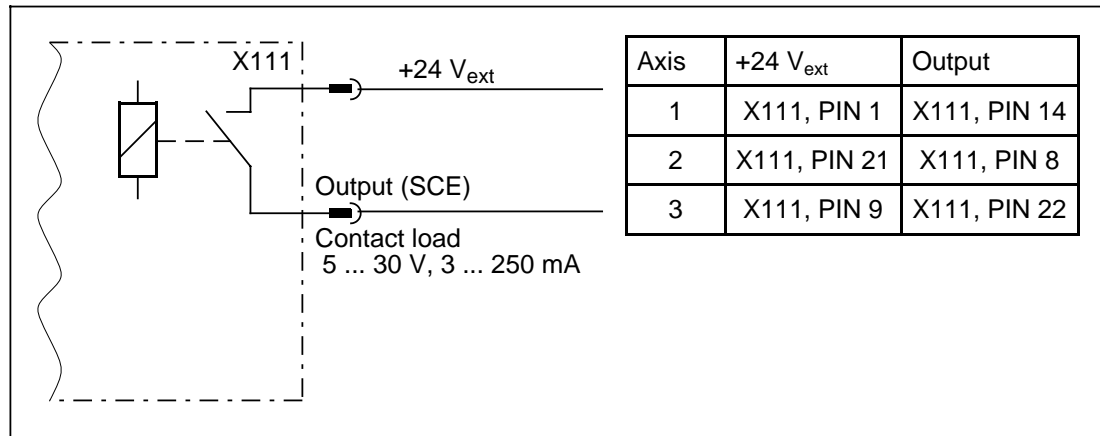
and the minimum configuration when using HMS is:

- 1 HMS measuring circuit module with submodule interface
- 1 HMS setpoint submodule

#### Restrictions:

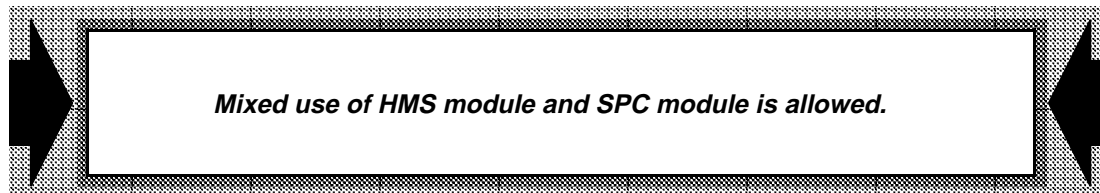
If an absolute-value auxiliary submodule is plugged into the HMS measuring circuit module, no more than one HMS setpoint submodule can then be plugged into this module.

Output for controller enable



### SIPOS absolute encoder submodule G33961-A3729-L1

A SIPOS absolute encoder submodule can be plugged into the two upper submodule slots of the double-width HMS measuring circuit module. Absolute measured values can thus be simulated for all 3 inputs. No more than one additional HMS setpoint submodule can, however, be plugged in at the same time. For saving the absolute values in case of a failure of the supply voltage, a battery submodule can be plugged onto the SIPOS absolute encoder submodule.



## 1.9 Accessories, ordering data

### 1.9.1 Devices

Devices	Order Code	Order No.
<b>Electronic handwheel</b>		<b>6FC9 320-5DA</b>
<b>Incremental rotary encoder<sup>1)</sup></b> and main spindle encoder with axial cable output 1024 pulses/rev. 2000 pulses/rev. 2500 pulses/rev. 5000 pulses/rev.		<b>6FC9 320-3KB00</b> <b>6FC9 320-3KK00</b> <b>6FC9 320-3KN00</b> <b>6FC9 320-3KS00</b>
<b>Incremental rotary encoder<sup>1)</sup></b> and main spindle encoder with radial cable output 1024 pulses/rev. 2000 pulses/rev. 2500 pulses/rev. 5000 pulses/rev.		<b>6FC9 320-3MB00</b> <b>6FC9 320-3MK00</b> <b>6FC9 320-3MN00</b> <b>6FC9 320-3MS00</b>
<b>Combined rotary encoder</b> for spindles and C axes 1024/9000 pulses/rev.		<b>6FC9 320-1KT00</b>
<b>Incremental rotary encoder for rotary axes</b> ROD 250 RON 255		<b>6FC9 320-3CM00</b> <b>6FC9 320-3CN00</b>
<b>Clamp<sup>2)</sup></b> <b>Springdisk coupling</b>		<b>6FC9 320-4GA</b> <b>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 submodule)</b>	<b>M01</b>	<b>6FC3 984-3RA</b>
<b>I/O submodule (expansion 1)</b>	<b>M02/M42</b>	<b>6FC3 984-3RB</b>
<b>I/O submodule (expansion 2)</b>	<b>M03/M43</b>	<b>6FC3 984-3RC</b>
<b>I/O submodule (basic submodule for link to MPC module)</b>	<b>M41</b> <b>M44</b>	<b>6FC3 984-3RF</b> <b>6FC3 984-3TE</b>
<b>Interface submodule for electronic handwheel</b>	<b>M10</b>	<b>6FC3 984-3RL</b>
<b>Power supply unit,</b> Input 3x380 V AC/Output 24 V DC 20A Input 3x380 V AC/Output 24 V DC 40A	- -	<b>6FC9 304-0AC</b> <b>6FC3 304-0AD</b>
<b>Terminal strip converter, 34-way, ribbon cable</b> without LEDs with LEDs	- -	<b>6FC9 302-2AA</b> <b>6FC9 302-2AB</b>
<b>Terminal strip converter, 37-way for input module</b> without LEDs with LEDs	- -	<b>6FC9 302-2AC</b> <b>6FC9 302-2AD</b>
<b>Terminal strip converter, 37-way for output module</b> with LEDs	-	<b>6FC9 302-2AK</b>

1) Without spring disk coupling and clamps

2) Three clamps are required per encoder

**1.9.2 Connectors**

Connector complete	Order No.	Connector type
<b>12-way round female connector (Siemens)</b> 10 mm cable 8 mm cable 6 mm cable	<b>6FC9 341-1FD</b> <b>6FC9 341-1FR</b> <b>6FC9 341-1FT</b>	37
<b>9-way round female connector coupling (Siemens)</b> 8 mm cable	<b>6FC9 341-1EW</b>	25
<b>17-way round female connector (Siemens)</b> 8 mm cable	<b>6FC9 341-1HA</b>	26
<b>12-way round male connector (Souriau)</b>	<b>6FC9 341-1AB</b>	2
<b>17-way round female connector (Tuchel)</b>	<b>6FC9 341-1AC</b>	11
<b>15-way female D subconnector (Siemens)</b> with SINUMERIK casing	<b>6FC9 341-1EC</b>	5
<b>25-way female D subconnector (Siemens)</b> with SINUMERIK casing	<b>6FC9 341-1ED</b>	6
<b>25-way male D subconnector (Siemens)</b> with SINUMERIK casing	<b>6FC9 341-1AB</b>	7
<b>37-way female D subconnector (Siemens)</b> with SINUMERIK casing	<b>6FC9 341-1FH</b>	32
<b>37-way female D subconnector (Siemens)</b> with SINUMERIK casing (ribbon cable)	<b>6FC9 341-1FX</b>	42
<b>25-way male D subconnector</b> Casing with push latch	<b>6FC9 341-2AA</b>	21
<b>25-way male D subconnector (Siemens)</b> Post office casing	<b>6FC9 341-1ES</b>	20
<b>25-way female D subconnector (Siemens)</b> Post office casing	<b>6FC9 341-1ER</b>	19
<b>34-way female ribbon cable connector</b> for ribbon cable	<b>6FC9 341-1FE</b>	30
<b>34-way female connector (Honda)</b> for round cables with ribbon cable connector insert	<b>6FC9 341-2AD</b>	34
<b>50-way male D subconnector (Hartung)</b>	<b>6FC9 341-1EE</b>	50

### 1.9.3 Cables

Cable, complete	Max. possible length	Order No.
SINUMERIK-SIMATIC S5 link Length <b>1 m</b> Length <b>2 m</b> Length <b>3 m</b> Length <b>5 m</b> Length <b>10 m</b> Length <b>15 m</b> Length <b>18 m</b> Length <b>25 m</b> Length <b>50 m</b> Special lengths up to 150 m	150 m	<b>6FC9 340-7HL</b> <b>6FC9 340-7HM</b> <b>6FC9 340-7HN</b> <b>6FC9 340-7HB</b> <b>6FC9 340-7HC</b> <b>6FC9 340-7HD</b> <b>6FC9 340-7HE</b> <b>6FC9 340-7HF</b> <b>6FC9 340-7HG</b> <b>6FC9 340-7HZ</b>
To Siemens PT 88 printer (V.24) Length <b>5 m</b> Length <b>10 m</b> Length <b>18 m</b>	30 m	<b>6FC9 340-8DB</b> <b>6FC9 340-8DC</b> <b>6FC9 340-8DE</b>
To Siemens PG 635, PG 675, PG 685, PG 750 (PLC) programmer Length <b>5 m</b> Length <b>10 m</b>	30 m	<b>6FC9 340-8GB</b> <b>6FC9 340-8GC</b>
To Siemens PG 615 programmer Length <b>5 m</b> Length <b>10 m</b>	10 m	<b>6FC9 340-8HB</b> <b>6FC9 340-8HC</b>
To Facit 4070 with MI 77 Length <b>5 m</b>	30 m	<b>6FC9 340-8JB</b>
Between I/O submodule and terminal strip converter ribbon cable Length <b>0.5 m</b> Length <b>1 m</b> Length <b>2 m</b>	2.5 m	<b>6FC9 340-8LA</b> <b>6FC9 340-8LL</b> <b>6FC9 340-8LM</b>
To electronic handwheel Length <b>1 m</b> Length <b>5 m</b> Length <b>10 m</b> Length <b>18 m</b> Length <b>25 m</b>	25 m	<b>6FC9 340-8MA</b> <b>6FC9 340-8MB</b> <b>6FC9 340-8MC</b> <b>6FC9 340-8ME</b> <b>6FC9 340-8MF</b>
To digital rotary encoders and to main spindle encoder (old version) Length <b>10 m</b> Length <b>18 m</b> Length <b>25 m</b>	35 m	<b>6FC9 340-8NC</b> <b>6FC9 340-8NE</b> <b>6FC9 340-8NF</b>
To digital rotary encoders in servo drives (ROD 320) Length <b>5 m</b> Length <b>10 m</b> Length <b>18 m</b> Length <b>25 m</b>	35 m	<b>6FC9 340-8PB</b> <b>6FC9 340-8PC</b> <b>6FC9 340-8PE</b> <b>6FC9 340-8PF</b>

Cable, complete	Max. possible length	Order No.
To digital linear measuring system (integrated EXE) Length <b>5 m</b> Length <b>10 m</b> Length <b>18 m</b> Length <b>25 m</b>	18 m	<b>6FC9 340-8QB</b> <b>6FC9 340-8QC</b> <b>6FC9 340-8QE</b> <b>6FC9 340-8QF</b>
To servo drives and main spindle drives Length <b>5 m</b> Length <b>10 m</b> Length <b>18 m</b> Length <b>25 m</b>	50 m	<b>6FC9 340-8RB</b> <b>6FC9 340-8RC</b> <b>6FC9 340-8RE</b> <b>6FC9 340-8RF</b>
To T 40/T 50/T 41 tape reader Length <b>5 m</b> Length <b>10 m</b> Length <b>18 m</b> Length <b>25 m</b>	30 m	<b>6FC9 340-8SB</b> <b>6FC9 340-8SC</b> <b>6FC9 340-8SE</b> <b>6FC9 340-8SF</b>
To probe Length <b>5 m</b> Length <b>10 m</b> Length <b>18 m</b> Length <b>25 m</b>	35 m	<b>6FC9 340-8UB</b> <b>6FC9 340-8UC</b> <b>6FC9 340-8UE</b> <b>6FC9 340-8UF</b>
Between I/O submodule and terminal strip converter round cable Length <b>5 m</b> Length <b>10 m</b> Length <b>18 m</b> Length <b>25 m</b>	25 m	<b>6FC9 340-8XB</b> <b>6FC9 340-8XC</b> <b>6FC9 340-8XE</b> <b>6FC9 340-8XF</b>
To Siemens programmer PG 635, PG 675, PG 685 (PGIN) Length <b>5 m</b> Length <b>10 m</b>	30 m	<b>6FC9 344-1AB</b> <b>6FC9 344-1AC</b>
To programming workstation WS 800A (RS 232 C) (with 25-way pin adapter - e.g. for PC 32-05 PG 750) Length <b>10 m</b>	30 m	<b>6FC9 344-1BC</b>
Between PLC I/O modules and machine control, input Length <b>5 m</b> Length <b>10 m</b> Length <b>18 m</b> Length <b>25 m</b>	50 m	<b>6FC9 344-1UB</b> <b>6FC9 344-1UC</b> <b>6FC9 344-1UE</b> <b>6FC9 344-1UF</b>
Between PLC I/O modules and machine control, output Length <b>5 m</b> Length <b>10 m</b> Length <b>18 m</b> Length <b>25 m</b>	50 m	<b>6FC9 344-1VB</b> <b>6FC9 344-1VC</b> <b>6FC9 344-1VE</b> <b>6FC9 344-1VF</b>

Cable, complete	Max. possible length	Order No.
Between CPU and PLC expansion unit (MPC interface) copper cable Length <b>2 m</b> Length <b>5 m</b> Length <b>10 m</b> Length <b>18 m</b> Length <b>25 m</b> Length <b>50 m</b>	50 m	<b>6FC9 344-2AM</b> <b>6FC9 344-2AB</b> <b>6FC9 344-2AC</b> <b>6FC9 344-2AE</b> <b>6FC9 344-2AF</b> <b>6FC9 344-2AG</b>
To digital rotary encoders and to main spindle encoder (new version) Length <b>10 m</b> Length <b>18 m</b> Length <b>25 m</b>	35 m	<b>6FC9 344-2BC</b> <b>6FC9 344-2BE</b> <b>6FC9 344-2BF</b>
To portable tape reader T60 Length <b>5 m</b>	30 m	<b>6FC9 344-2CB</b>
To DSG 3.5 disk drive unit Length <b>2 m</b> Length <b>5 m</b> Length <b>10 m</b> Length <b>18 m</b> Length <b>25 m</b>	30 m	<b>6FC9 344-2PM</b> <b>6FC9 344-2PB</b> <b>6FC9 344-2PC</b> <b>6FC9 344-2PE</b> <b>6FC9 344-2PF</b>
Between PLC I/O modules and machine control, input, ribbon cable Length <b>0.5 m</b> Length <b>1 m</b> Length <b>2 m</b> Length <b>3 m</b>	5 m	<b>6FC9 344-2TA</b> <b>6FC9 344-2TL</b> <b>6FC9 344-2TM</b> <b>6FC9 344-2TN</b>
To configuring workstation WS 800A (RS 232 C) for AT computers with 9-way interface (e.g. PCD-3T) Length <b>10 m</b>	30 m	<b>6FC9 344-4HC</b>
Between CPU and PLC expansion unit (MPC interface), special fibre cable Length <b>10 m</b> (plastic) Length <b>18 m</b> (glass) Length <b>50 m</b> (glass) Length <b>75 m</b> (glass)	100 m	<b>6FX1 400-2BC10</b> <b>6FX1 400-1BC18</b> <b>6FX1 400-1BC50</b> <b>6FX1 400-1BC75</b>
Cable to DSG 2S disk drive unit for remote operation Length <b>2 m</b> Length <b>5 m</b> Length <b>10 m</b> Length <b>18 m</b>	30 m	<b>6FM1 590-7AA00</b> <b>6FM1 590-7AB00</b> <b>6FM1 590-7AC00</b> <b>6FM1 590-7AD00</b>
Cable to DSG 2S disk drive unit Length <b>2 m</b> Length <b>5 m</b> Length <b>10 m</b> Length <b>18 m</b>	30 m	<b>6FM1 590-7BA00</b> <b>6FM1 590-7BB00</b> <b>6FM1 590-7BC00</b> <b>6FM1 590-7BD00</b>



## 1.10 Technical data

The SINUMERIK 810 control and the SINUMERIK 820 control has been made in accordance with the requirements of DIN VDE 0160 concerning the construction of equipment.

### 1.10.1 Electrical data

#### 1.10.1.1 Overview

Device	Conditions	Nominal voltage and tolerance	Nominal frequency	Max. connected load at nominal voltage	Max. power loss at nominal voltage	Max. starting current
Compact control SINUMERIK 820		230 V AC +10 % - 20 %	50/60 Hz ±5 Hz	340 VA *)	195 W *)	20×I <sub>N</sub> for 10 ms
Compact control SINUMERIK 810		24 V DC 20 - 30 V DC	—	145 VA *)	145 W *)	20×I <sub>N</sub> for 10 ms
Siemens machine control panel		Supply via I/O submodule	—	Supply via I/O submodule	0 W	—
Customer machine control panel	Customer machine control panels must not be supplied via I/O submodules					
Input/output submodule 6FX1124-6AA... (1 off) central and distributed	24 V DC (20 to 30 V incl. ripple)		—	130 VA 24 V DC	16 W	20×I <sub>N</sub> for 10 ms
Input submodule 6FX1124-6AB/AC.. (1 off) central and distributed				5 VA 24 V DC	10 W	
Electronic handwheel submodule 6FX1126-5AA...		Supply via compact control	—	Supply via compact control	1 W	—
Video encoder		Supply via compact control	—	Supply via compact control	1 W	—

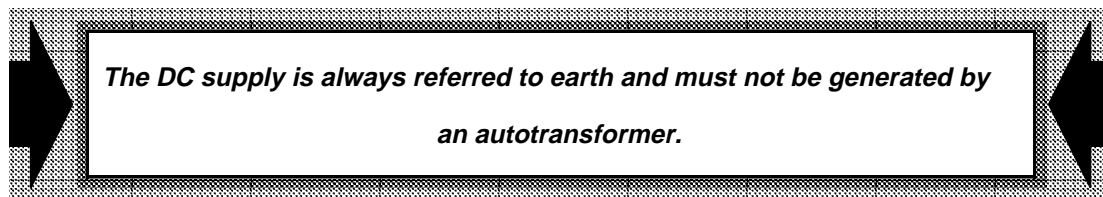
Electrical data, overview

\*) It may be necessary to calculate the actual connected load and the power loss.

### 1.10.1.2 Requirements for AC supply

- **Nominal voltage** 1 AC 230 V
  - Tolerance – 20 %, +10 %
  - Frequency 50/60 Hz ±5 Hz
  - Ramp-up time at power up 100 ms
  
- **Harmonic content** 10 %  
 in accordance with DIN VDE 0160, section 5.3.1.2
  
- **Short voltage dips** 10 ms  
 in accordance with DIN VDE 0160, section 5.3.1.1
  - Voltage interrupts at nominal voltage and current 10 s
  - Restoration time 10
  - Events per hour 10

### 1.10.1.3 Requirements for DC supply



- **Nominal voltage** 24 V DC
  - Voltage range including ripple 20 V DC to 30 V DC
  - Voltage ripple at nominal voltage and current peak to peak 3.6 V
  - Ramp-up time at power up 100 ms
  
- **Harmonic content** 10 %  
 in accordance with DIN VDE 0160, section 5.3.1.2
  
- **Non-periodic overvoltages** 35 V
  - Duration of overvoltage 500 ms
  - Restoration time 50 s
  - Events per hour 10
  
- **Short voltage dips** 14.25 V  
 Referred to 24 V DC nominal voltage
  - Duration of voltage dips 5 ms
  - Restoration time 10 s
  - Events per hour 10

### 1.10.1.4 Connected load and power loss calculation

The maximum values for the connected load (compact control or central controller) in table "Electrical data, overview" are based on a power supply unit capacity utilization of  $A = 100\%$ . The values stated for maximum power loss (central controller, operator panel) are based on the following conditions:

- power supply unit capacity utilization  $A = 100\%$
- no power output from the power supply unit to external components (e.g. encoders)
- switching power losses from output modules in the compact control or central controller are taken into account for a maximum I/O device configuration.

The following tables can be used to determine the actual connected load and power loss. This is primarily necessary when the maximum power loss demands an unrealistic convection surface area for heat removal.

If the electrical connection and heat removal are designed for the maximum values, the connected load and power loss do not have to be calculated.

The power supply unit capacity utilization must be calculated if it is to be expected that the maximum permissible power supply unit capacity utilization will be exceeded by the planned inclusion of a large number of hardware options (mainly in the case of large controls) and external components.

#### Notes on calculation table:

- **Power supply unit capacity utilization  $A_n$**

Enter all required modules, additional and external components along with the required currents. Check power supply unit capacity utilizations  $A_n$  for individual power supply output voltages.

- **Power supply unit connected load  $P_S$**

For the calculation of the connected load, the efficiency  $\eta$ , which depends on the power supply unit capacity utilization  $A$ , is taken from the following table:

<b>A</b>	
20 %	0.6
20 % to 30 %	0.64
30 % to 40 %	0.69
40 % to 50 %	0.72
50 % to 60 %	0.74
60 %	0.76

*Efficiency*

- **Power loss  $P$**

When calculating power loss  $P$ , note that:

- the power loss of the external components  $P_{\text{ext}}$  is not included in the power loss of the compact control or central controller.
- the switching power losses of the output modules  $P_{E/A}$  in the compact control or central controller increase the power loss in the latter.

Power supply unit capacity utilization $A_n = I_{An} / I_{Amn} \times 100 \%$										
Modules (mod.) MRPD (machine-readable product designation)	U <sub>A1</sub> = +5 V			U <sub>A2</sub> = +15 V			U <sub>A3</sub> = - 15 V			Comments
	A	No. of mod.	A	A	No. of mod.	A	A	No. of mod.	A	
6FX1121-2B . 02	0,47	1	0,47							
6FX1121-4B . 01	0,65			0,05			0,05			
6FX1124-6A . 02	0,10									
6FX1126-1AA03	2,15	1	2,15							
6FX1126-4AA . .	2,15	1	2,15							
6FX1126-4B . 00										
6FX1126-5AA01	0,10									
6FX1128-1B . 00	0,24	1	0,24							
6FX1128-2BA00				0,07						
6FX1128-4B . 00	0,08									
6FX1132-5BA02	0,10			0,05			0,05			
6FX1132-8BB01	1,77			0,06			0,03			
6FX1134-2B . 01	0,02									
6FX1135-6BA01	1,18									
6FX1138-5BA01	1,5	1		0,06			0,03			5V/1A additionally for serial interface
6FX1138-5BB03										
6FX1145-6B . . .	1,1			0,12			0,1			5V/2A for encoder, +15V/0.5A for modules
6ES5445-3AA int. EXEn 5fold	0,02			0,01						
6ES5444-3AA int. EXEn 10fold	0,04			0,02						
Mod. currents	—	—		—	—		—	—		
Encoder										
Handwheels										
external EXEn										
Currents (ext. components)										I <sub>extn</sub>
Currents to										I <sub>An</sub>
Max. power supply unit output currents			I <sub>Am1</sub> =15 A			I <sub>Am2</sub> =0,5 A			I <sub>Am3</sub> =0,5 A	I <sub>Amn</sub>
Power supply unit capacity utilization A <sub>n</sub>										max. perm.: 100 %

Calculation table for power supply unit capacity utilization

Power supply unit connected load $P_S = 1 / \times P_A + P_L$				
Currents $I_{An}$				transferred fr.
Voltages $U_{An}$	+5 V	+15 V	- 15 V	
Power supply unit outputs $P_{An}$	VA	VA	VA	$P_{An} = I_{An} \times  U_{An} $
Actual power supply unit output $P_A$				$P_A = P_{An}$
Max. power supply unit output $P_{Am}$	at 810 105 VA / at 820 90 VA			
Power supply unit capacity utilization A				$A = P_A / P_{Am}$
Power factor	0,55			See table efficiency
Efficiency				
Connected load of fan $P_L$	30 VA			
Connected load of monitor $P_M$	Monochrom: 50 VA; colour: 70 VA			
Power supply unit connected load $P_S$				

Calculation table for power supply unit connected load

Power loss $P = 1 / \times P_A + P_L - P_{ext} + P_{E/A}$				
Current $I_{extn}$ (ext. components)				transferred fr.
Power losses $P_{extn}$ (ext. comp.)				$P_{extn} =  U_{An}  \times I_{extn}$
Power losses $P_{ext}$ (ext. comp.)				$P_{ext} = P_{extn}$
Power loss $P_{E/A}$ (logic submodules)				see Note
Power loss P				

Calculation table for power loss

**Note:**

When determining the total power loss  $P$ , note that the logic submodules 6FX1124-6A.02 can be installed together with or separately from the compact control. See Section 2.4.4 for determining the power loss of logic submodules.

## 1.10.2 Mechanical data

### 1.10.2.1 Overview

Device	Conditions	Dimensions		Weight		Degree of protection acc. to DIN 40050	Shock protection, safety class acc. to DIN VDE 0160
		SIN 820	SIN 810	SIN 820	SIN 810		
Compact control SINUMERIK 820/810		530 mm	420 mm	Monochrome: 19.5 kg   12 kg		Front IP 54 Rear IP 00	I
		350 mm	350 mm	Colour: 23.5 kg			
Siemens machine control panel		530 mm	420 mm	1.2 kg	1 kg	Front IP 54 Rear IP 00	I
		144 mm	144 mm				
		135 mm	90 mm				
Customer machine control panel							
I/O and I submodule 6FX1124-6AA/AB/AC ... with mounting plate (Options M01 and M04)		414 mm		1.5 kg		IP 00	I
		150 mm					
		33 mm					
I/O and I submodule 6FX1124-6AA/AB/AC ... without mounting plate (Options M02 and M03)		391 mm		1.0 kg		IP 00	I
		150 mm					
		22 mm					
Electronic handwheel submodule 6FX1126- 5AA ... without mounting plate (Option M10)		203 mm		0.5 kg		IP 00	I
		150 mm					
		22 mm					
Video-encoder		164 mm		0.5 kg		IP 00	I
		104 mm					
		33 mm					

Mechanical data, overview

### 1.10.2.2 Resistance to vibration

- **Vibratory load**

- In operation Severity 12 in accordance with  
SN 29010, Part 1 \*)  
for all components
- When transported in original packaging Severity 22 in accordance with  
SN 29010, Part 2 \*)  
for all components

- **Shock load**

Test group E, test Ea in accordance with DIN 40046, Part 7

- Acceleration 15 g (1 g = 9,81 m/s<sup>2</sup>)
- Duration of nominal shock 11 ms

### 1.10.3 Climatic environmental conditions

#### General requirements

- The packaging must be selected to suit the climatic conditions likely to be encountered on the shipping route and at the destination.
  - Register of destinations according to SN 69154 \*)
  - Climatic overview map with sea routes according to SN 29080 \*)
  - Climatic conditions before start-up according to SN 29081 \*).
- If the specified limiting values cannot be maintained, a heat exchanger or an air conditioning unit must be provided.

#### 1.10.3.1 Installation and operation

- **Temperature range**

- Lower limit temperature 0 °C
  - Upper limit temperature +45 °C /+55 °C
- For calculation of the cooling  
see Operating Instructions

- **Dew point temperature  $t_d$  and relative air humidity U**

- Annual average U = 75 %  
 $t_d$  = 17 °C
  - On 30 days (24 hours) per year U = 95 %  
 $t_d$  = 24 °C
- These days should be distributed naturally over the year.
- On the remaining days (<24 hours)  
observing the annual average U = 85 %  
 $t_d$  = 20 °C

- **Condensation** not allowed

\*) SN = Siemens Standard

- **Temperatur variation**
  - Within one hour 10 K
  - Within three minutes 1 K
- **Atmospheric pressure** 860 mbar to 1080 mbar  
(860 hPa to 1080 hPa)

The values specified apply to operation at an altitude of 1500 m above mean sea level. For greater altitudes, the upper limit temperature must be reduced by 3.5 °C / 500 m.

### 1.10.3.2 Transportation and storage

- **Temperature range**
  - Lower limit temperature – 40 °C
  - Upper limit temperature +70 °C
- **Dew point temperature  $t_d$  and relative air humidity U**
  - Annual average U = 75 %  
 $t_d = 17$  °C
  - On 30 (24 hours) per year U = 95 %  
 $t_d = 24$  °C

These days should be distributed naturally over the year.

  - On the remaining days (< 24 hours) U = 85 %  
observing the annual average  $t_d = 20$  °C


- **Condensation** rare, brief, light

Rare, brief and light condensation covers situations where the following conditions also apply:

- Max. duration of a single condensat. event 3 hours
- Frequency of occurrence: Annual average 3  
Maximum 10
- Shortest sequence of condensation cycles 1 day

- **Temperature variation**
  - Within 1 hour 20 K
- **Atmospheric pressure** 660 mbar to 1080 mbar  
(660 hPa to 1080 hPa)

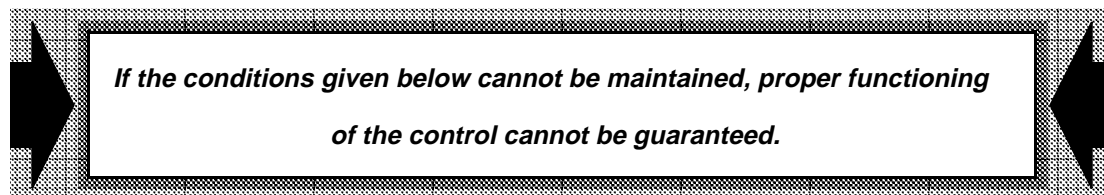
The values specified apply to a transportation altitude of up to 3500 m above mean sea level.

	<p><b>CAUTION</b></p> <p>In line with legislation, the lithium batteries <sup>1)</sup> installed in the control must be treated as dangerous goods when transporting by land, sea and air (explosion hazard).</p>
---	---

1) old types



## 1.10.4 Exposure to contaminants



Applicable standards

DIN 40046, Parts 36 and 37  
DIN 40050

### 1.10.4.1 Hazardous gases

- **Sulphur dioxide (SO<sub>2</sub>)**

Test conditions:

Severity	1 cm <sup>3</sup> /m <sup>3</sup> , ± 0.3 cm <sup>3</sup> /m <sup>3</sup>
Temperature	25 °C, ± 2 °C
Relative air humidity	75 %, ± 5 %

- **Hydrogen sulphide (H<sub>2</sub>S)**

Test conditions:

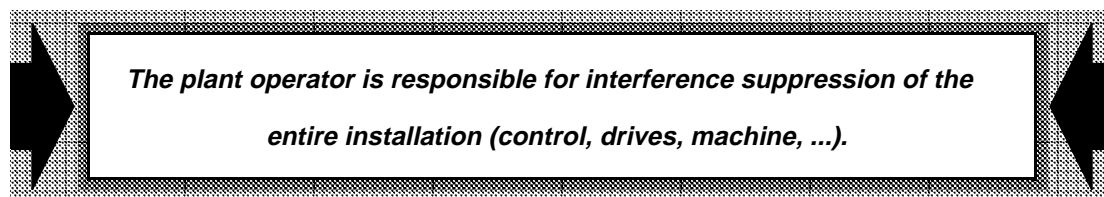
Severity	1 cm <sup>3</sup> /m <sup>3</sup> , ± 0.3 cm <sup>3</sup> /m <sup>3</sup>
Temperature	25 °C, ± 2 °C
Relative air humidity	75 %, ± 5 %

### 1.10.4.2 Hazardous dust

When working in areas where there is an unacceptably high dust burden, the control must be operated in a cabinet with heat exchanger or in a cabinet with suitable air intake. In addition, an air filter must be used when performing service work with the cabinet door open.

## 1.10.5 Electromagnetic compatibility (EMC)

### 1.10.5.1 Interference suppression



The SINUMERIK 820 control complies with limiting values class A (DIN VDE 0871, Parts 1 and 2) at the mains power supply (230 V AC). The SINUMERIK 810 control complies with limiting values class A (DIN VDE 0871, Parts 1 and 2) at the mains power supply (DC 24 V).

### 1.10.5.2 Immunity to noise

Relevant standards IEC 801-2, 3 and 4

- **Immunity to noise carried in cables**

Test in accordance with IEC 801-4, 65

– Power supply cables:

Test voltage	3 kV
Test duration	10 s

– Signal cables:

Test voltage	2.5 kV
Test duration	10 s

- **Immunity to static discharging**

Test in accordance with IEC 801-2

Test voltage	10 kV
Test duration	10 discharges at 1 discharge/s

- **Immunity to high frequency irradiation**

Test in accordance with IEC 801-3

Test field strength	10 V/m
Test duration	11 min/frequency decade

### 1.10.5.3 Protection against X-rays

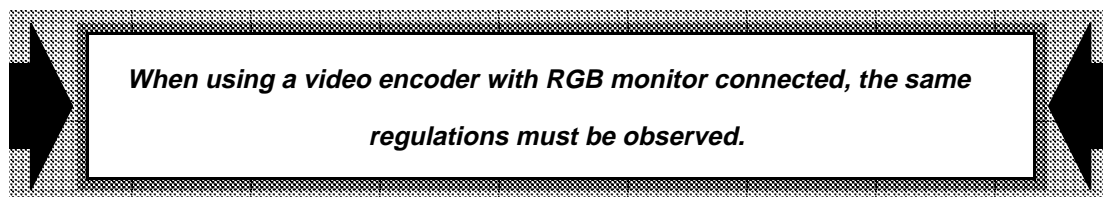
- **Extract from RÖV §5:**

In many countries there are regulations concerning the use of equipment emitting X-rays. Approval must generally be obtained.

- In the case of the SINUMERIK 810 control or SINUMERIK 820 control, routine tests ensure that such regulations are complied with. The X-rays generated are shielded adequately.

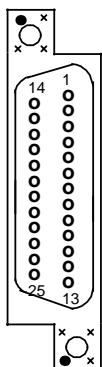
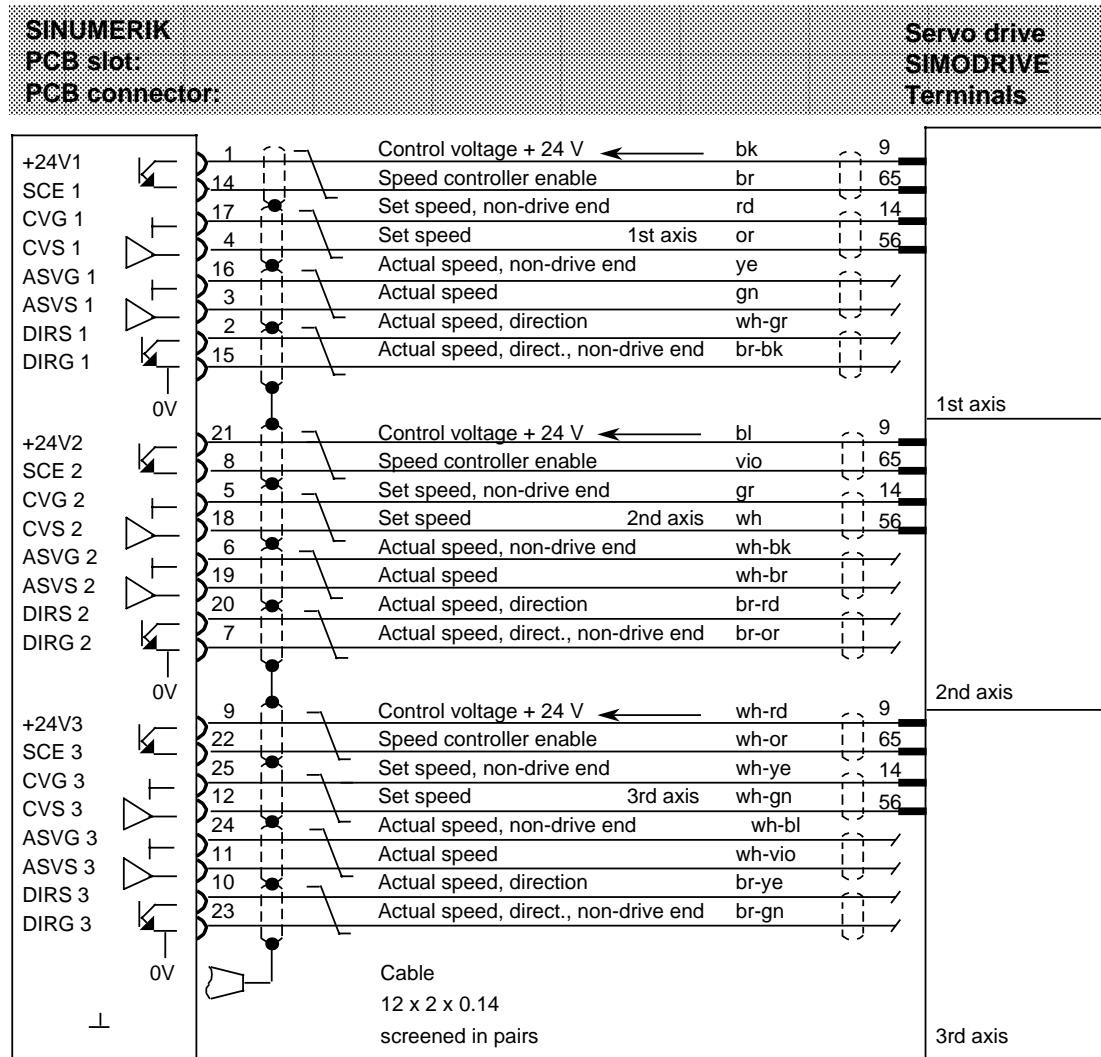
Acceleration voltage (typical) 22.8 kV

RÖV approval number By 367/86/Rö



# 2 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

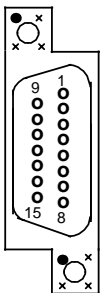
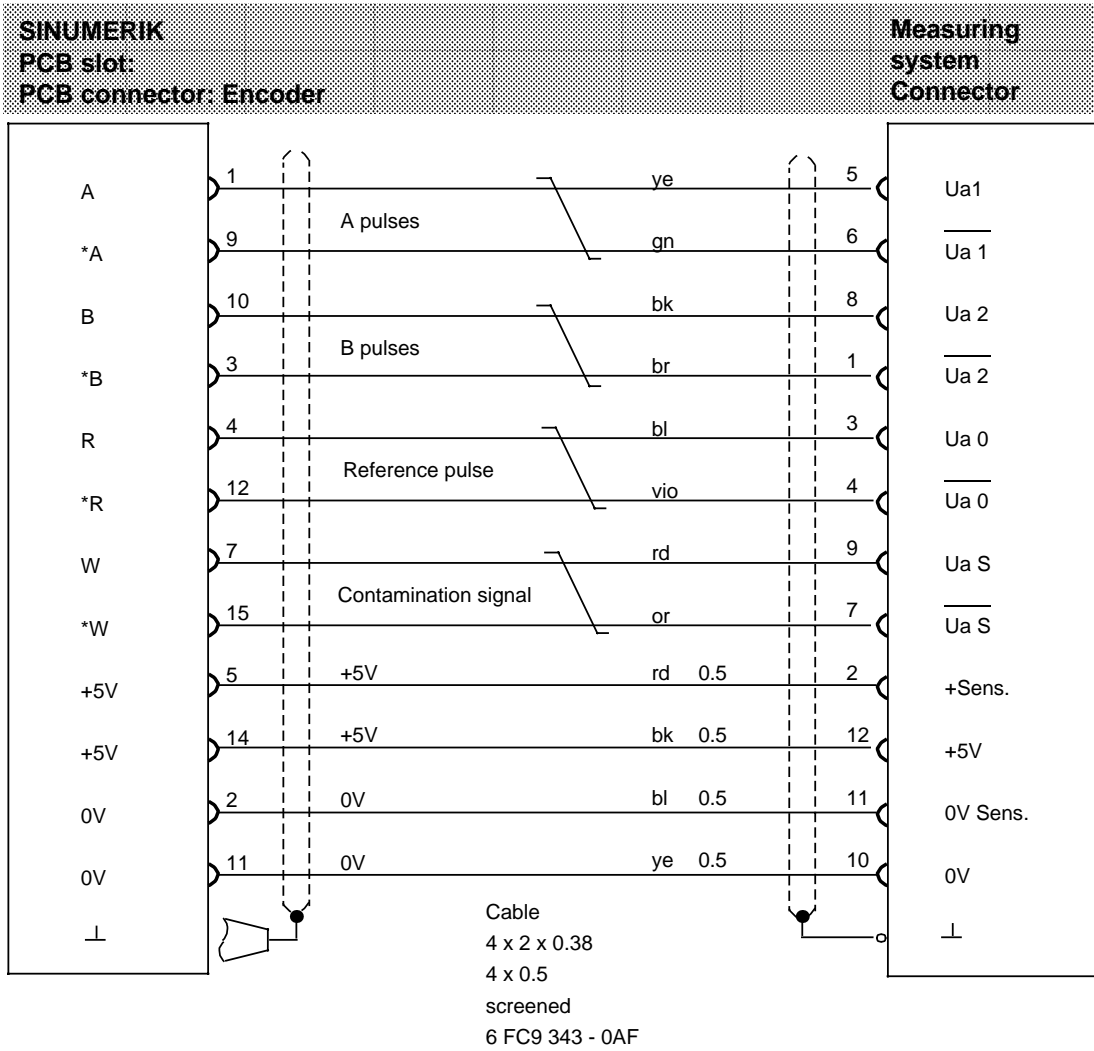
Cable end prepared for connection

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**



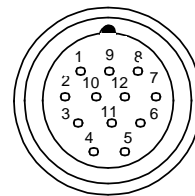
**Connector**  
 Position: 1 top  
 D-Sub  
 15-way, socket  
 Connection side  
 SINUMERIK housing  
 6FC9 341-1EC

**Connector code**

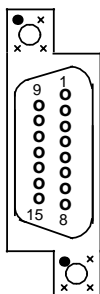
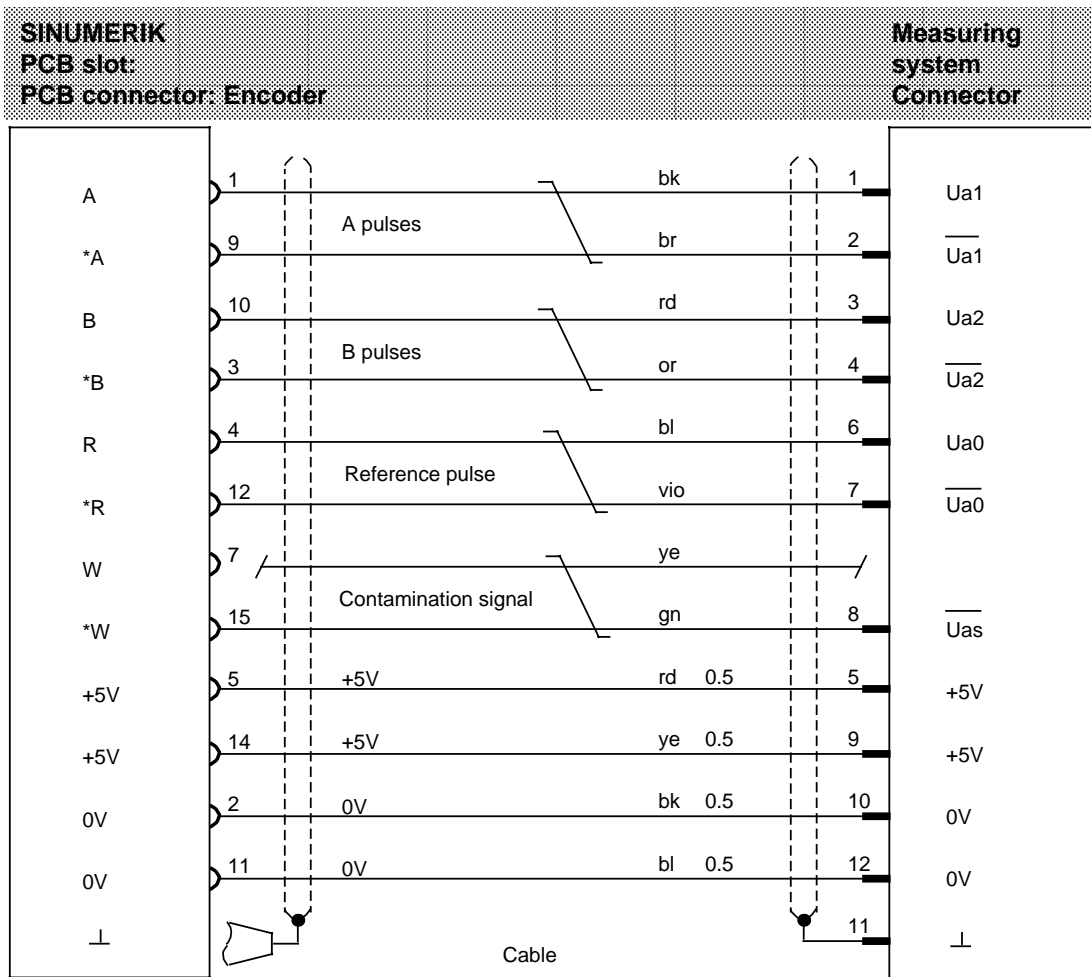
- coding pin
- x no coding pin

**Connector**  
 12-way socket  
 Siemens  
 10 mm cable  
 Connection side

6 FC9 341 - 1FD



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



**Connector**

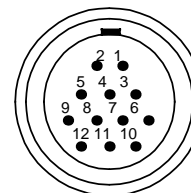
Position: 1 top  
 D-Sub  
 15-way, socket  
 Connection side  
 SINUMERIK housing  
 6FC9 341-1EC

**Connector code**

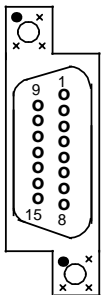
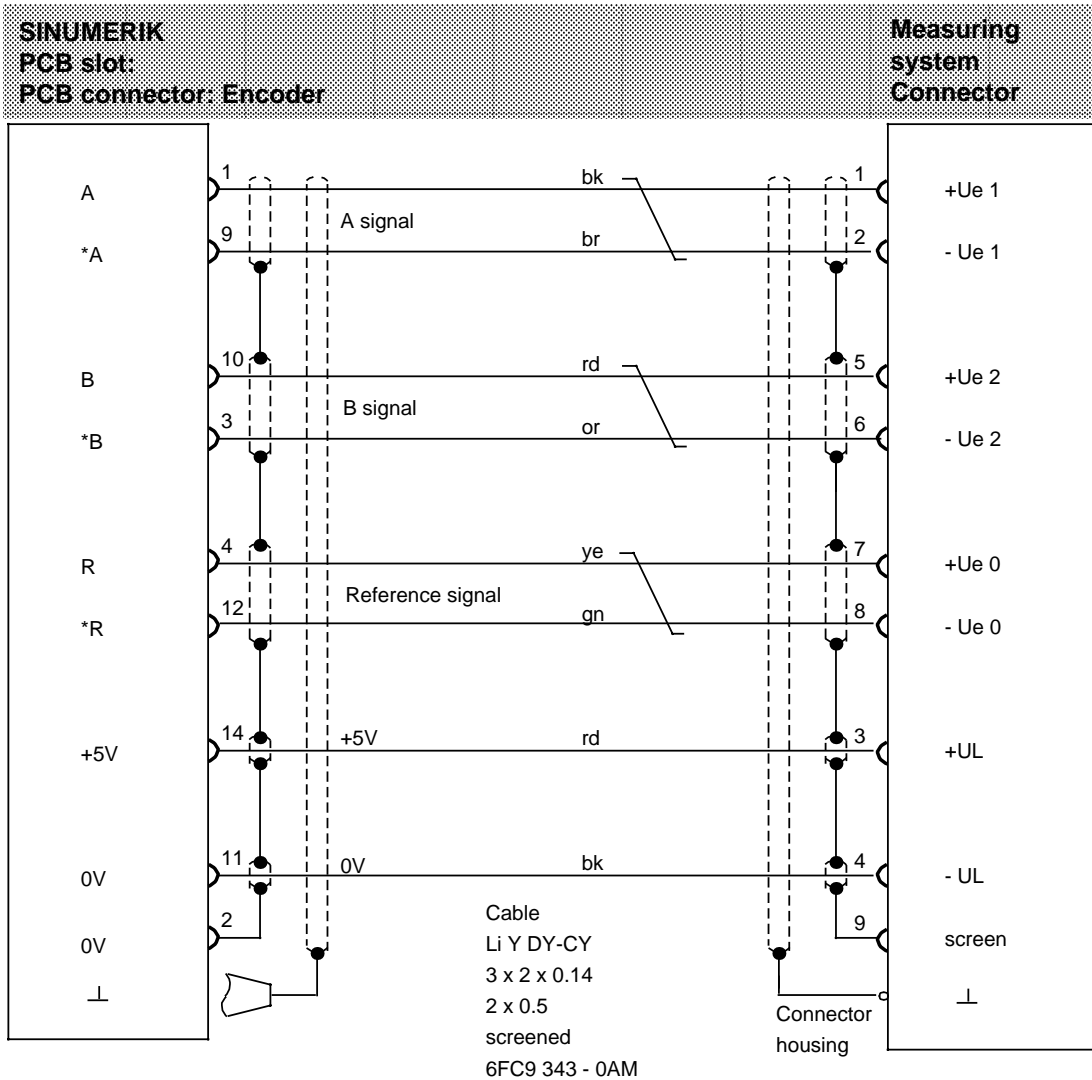
- coding pin
- x no coding pin

**Connector**

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



Cable name: Digital linear 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

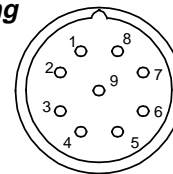
**Connector code**

- coding pin
- x no coding pin

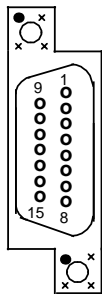
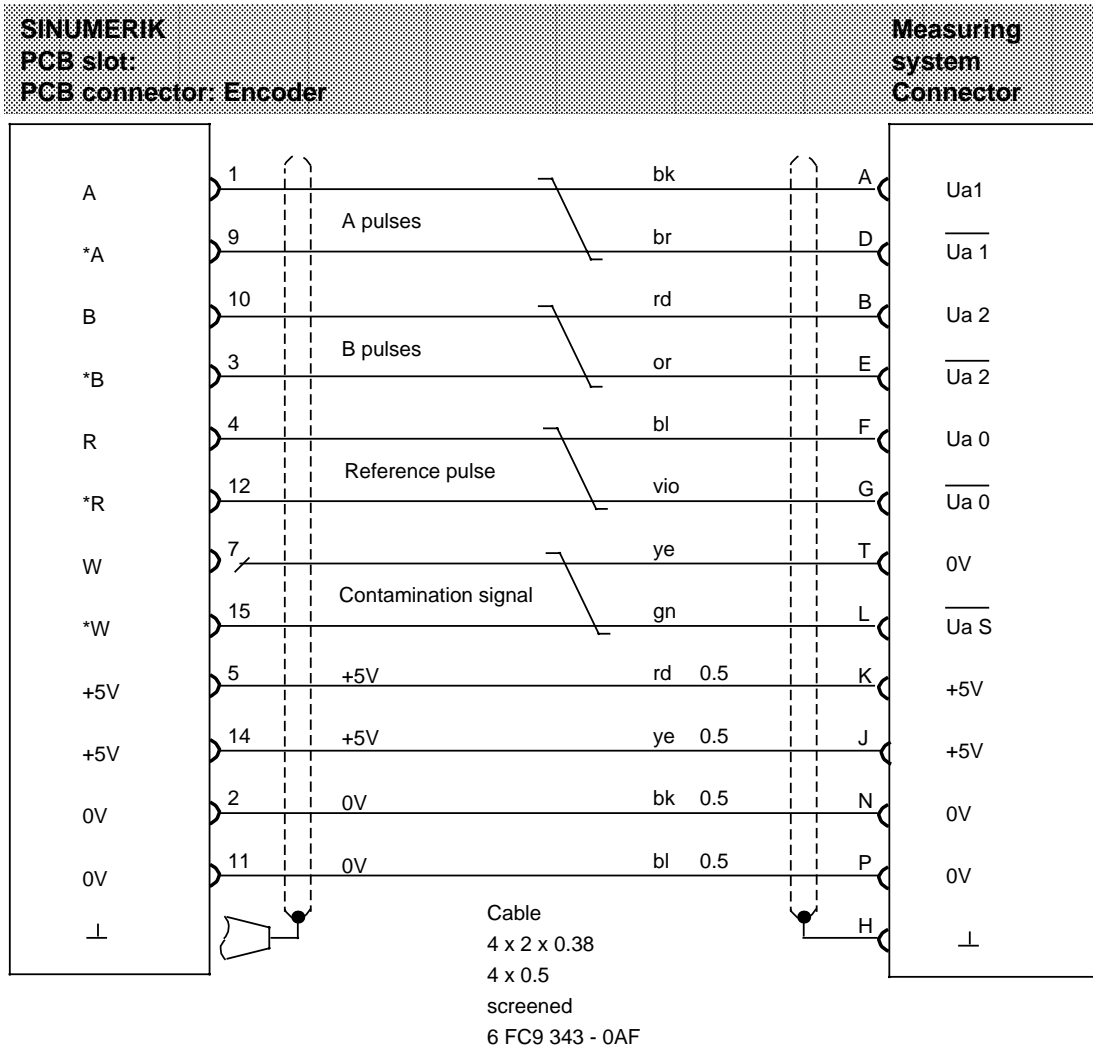
**Connector coupling**

9-way, socket  
 Siemens  
 8 mm cable  
 Connection side

6 FC9 341 - 1EW



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



**Connector**

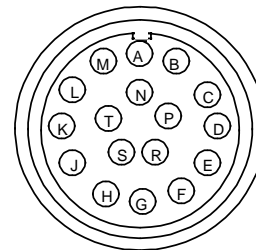
Position: 1 top  
 D-Sub  
 15-way, socket  
 Connection side  
 SINUMERIK housing  
 6FC9 341-1EC

**Connector code**

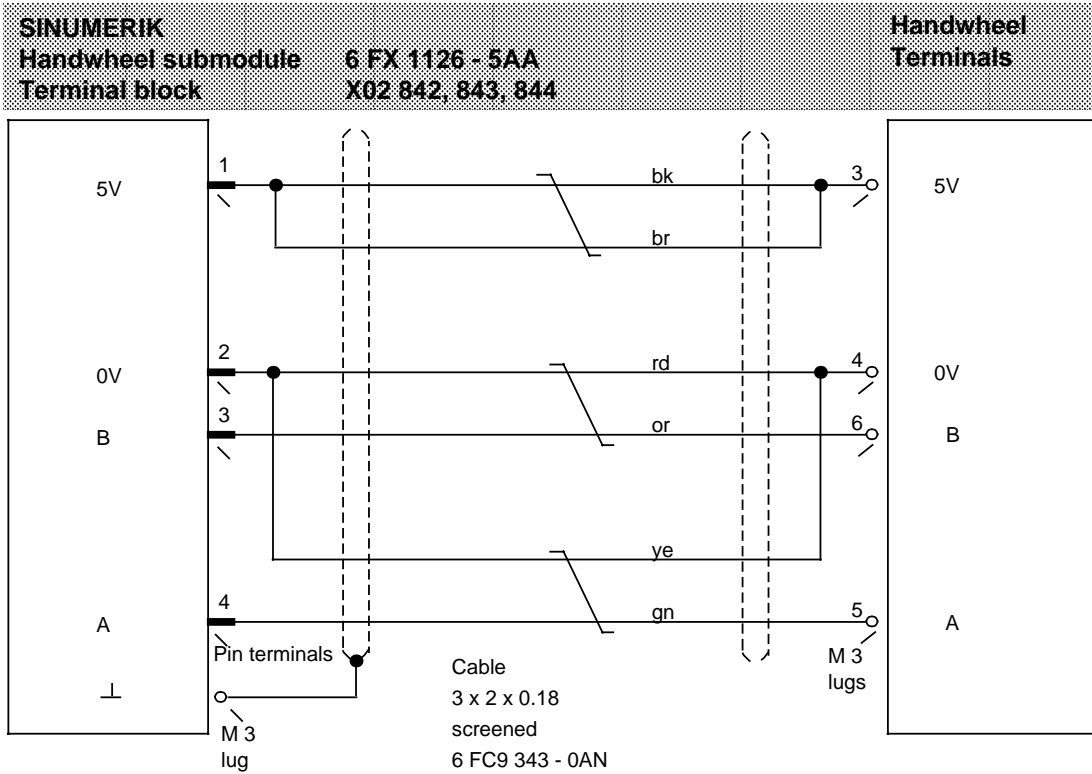
- coding pin
- x no coding pin

**Connector**

17-way, socket  
 Tuchel  
 CA 08-20-295  
 Connection side  
 6 FC9 341 - 1AC



Cable name: Electronic handwheel  
 Order No.: **6FC9 340-8M**



Cable end prepared for connection

Cable end prepared for connection

Bare wire ends 50 mm

Bare wire ends 50 mm

Pin terminal +  
terminal marking  
on designated wires

M3 lugs +  
terminal marking  
on designated wires

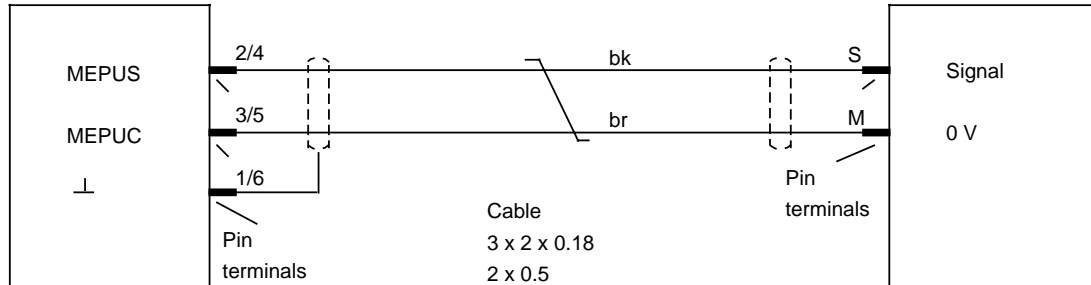
Screen end with M3 lug

Designation: NC



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

**SINUMERIK PCB slot:**  
**Terminal block on the interface module** **Sensor Terminals**



Cable end prepared for connection

Bare wire ends 30 mm

Pin terminal + terminal marking on designated wires

Designation: NC interface (6FX1 121-2B ...)

Cable  
 3 x 2 x 0.18  
 2 x 0.5  
 screened  
 2 pairs unassigned  
 6 FC9 343 - 0AN

Cable end prepared for connection

Bare wire ends 30 mm

Pin terminal + terminal marking on designated wires

Terminal marking on the NC:

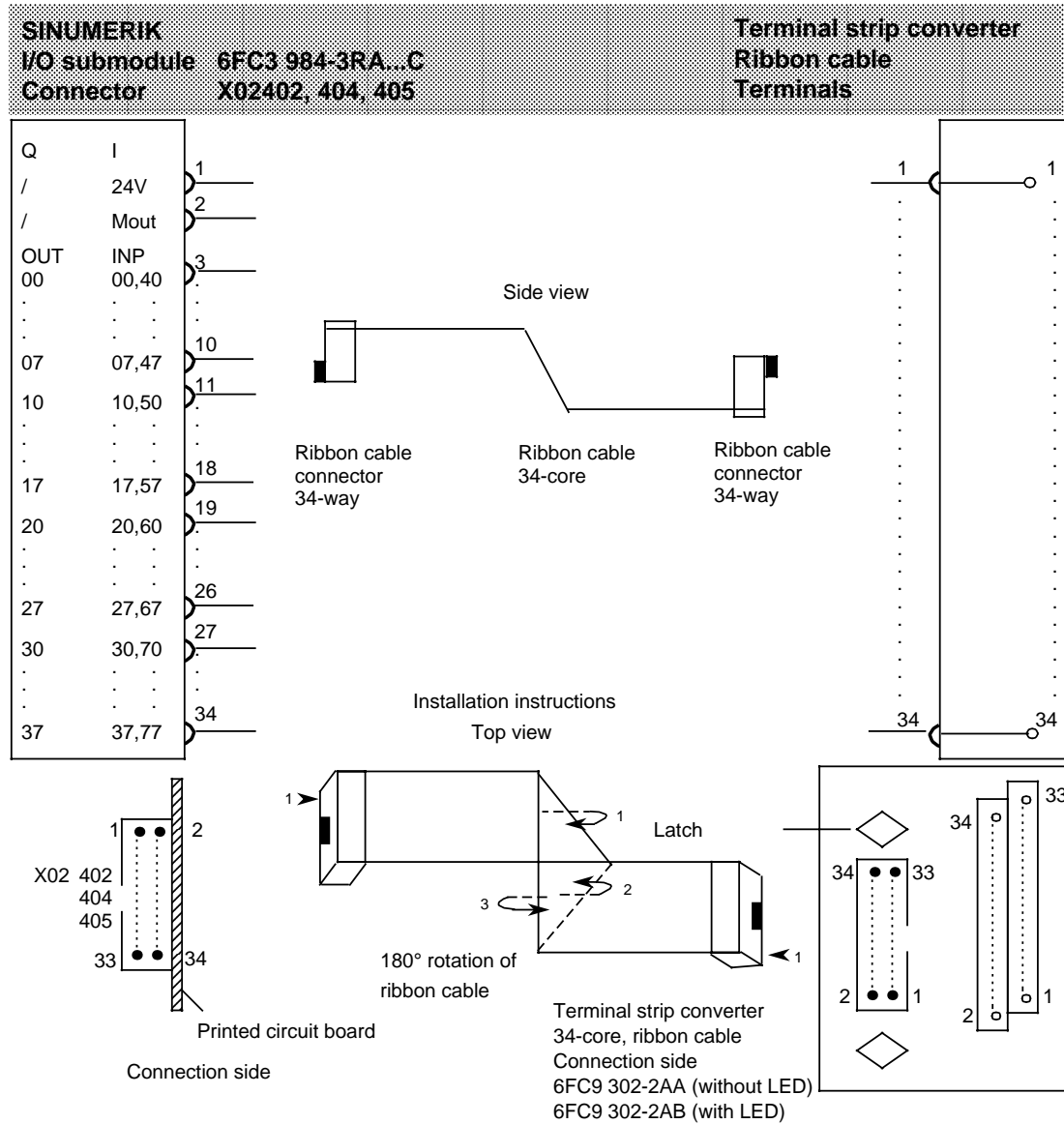
Terminals 1, 2, 3: Sensor 1, terminals 6, 4, 5: Sensor 2

Measuring with 2 sensors requires two cables

**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 (5 V)		+5V	*		*	*	*		*	*
		0V		*	*	*		*	*	*
24 V		+24V	*				*			
		0V		*				*		
* Dip-Fix closed										

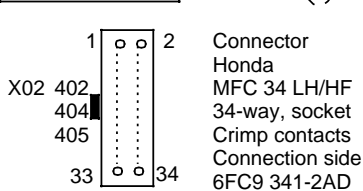
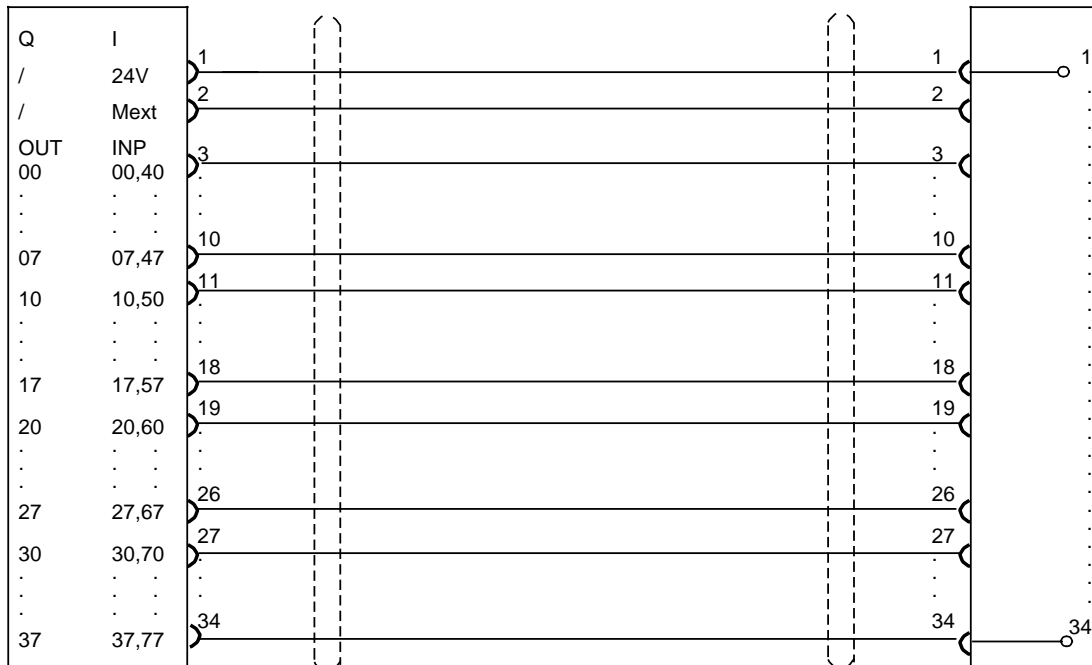
Cable name: Terminal strip converter for I/O submodule, ribbon cable  
 Order No.: **6FC9 340-8L**



I/O sub-module 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	O0.0 ... 3.7	I0.0 ... 3.7	I4.0 ... 7.7	I4.0 ... 5.1
2	1	1	O4.0 ... 7.7	I8.0 ... 11.7	I12.0 ... 15.7	I12.0 ... 13.1
3	2	2	O8.0 ... 11.7	I16.0 ... 19.7	I20.0 ... 23.7	I20.0 ... 21.1
4	3	3	O12.0 ... 15.7	I24.0 ... 27.7	I28.0 ... 31.7	I28.0 ... 29.1

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

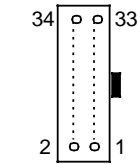
<b>SINUMERIK</b>		<b>Terminal strip converter</b>
<b>I/O submodule</b>	<b>6FC3 984-3RA... C</b>	<b>Ribbon cable</b>
<b>Connector</b>	<b>X02402, 404, 405</b>	<b>Terminals</b>



Connector  
 Honda  
 MFC 34 LH/HF  
 34-way, socket  
 Crimp contacts  
 Connection side  
 6FC9 341-2AD

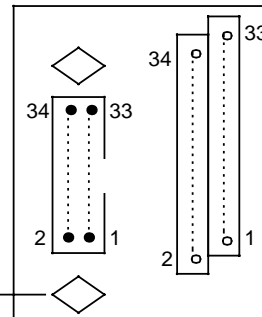
Cable  
 21 x 2 x 0.18  
 (screened)  
 4 pairs unassigned

Connector  
 Honda  
 MFC 34 LH/HF  
 34-way, socket  
 Crimp contacts  
 Connection side  
 6FC9 341-2AD



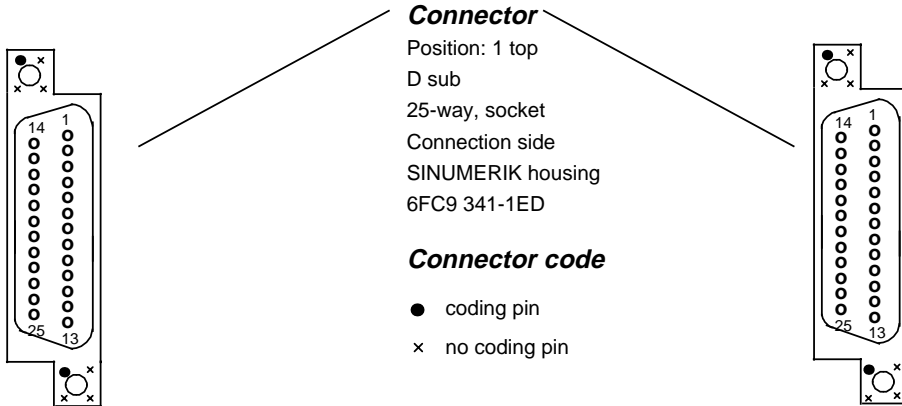
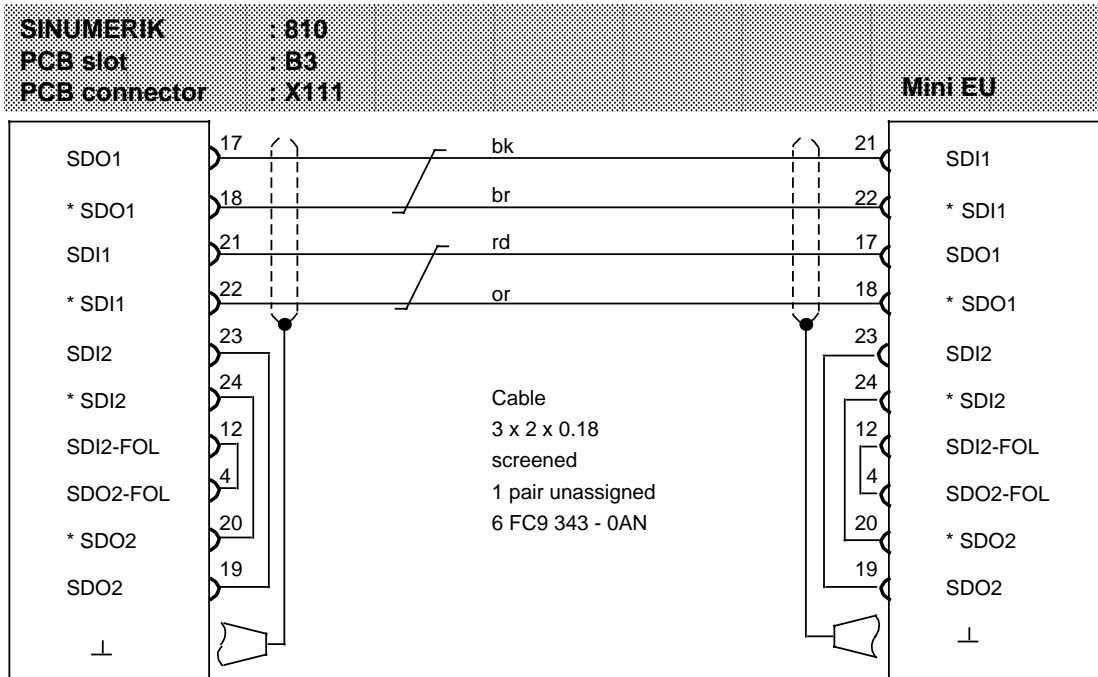
Wire colours							
1	bk	11	wh-bk	21	br-rd	31	gn-rd
2	br	12	wh-br	22	br-or	32	gn-or
3	rd	13	wh-rd	23	br-ye	33	gn-bl
4	or	14	wh-or	24	br-gn	34	gn-vio
5	ye	15	wh-ye	25	br-bl		
6	gn	16	wh-gn	26	br-vio		
7	bl	17	wh-bl	27	br-gr		
8	vio	18	wh-vio	28	br-wh		
9	gr	19	wh-gr	29	gn-bk		
10	wh	20	br-bk	30	gn-br		

Terminal strip converter  
 34-core ribbon cable  
 Connection side  
 6FC9 302-2AA (without LED)  
 6FC9 302-2AB (with LED)

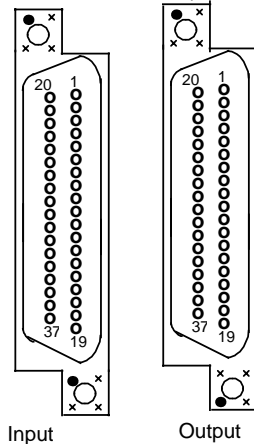
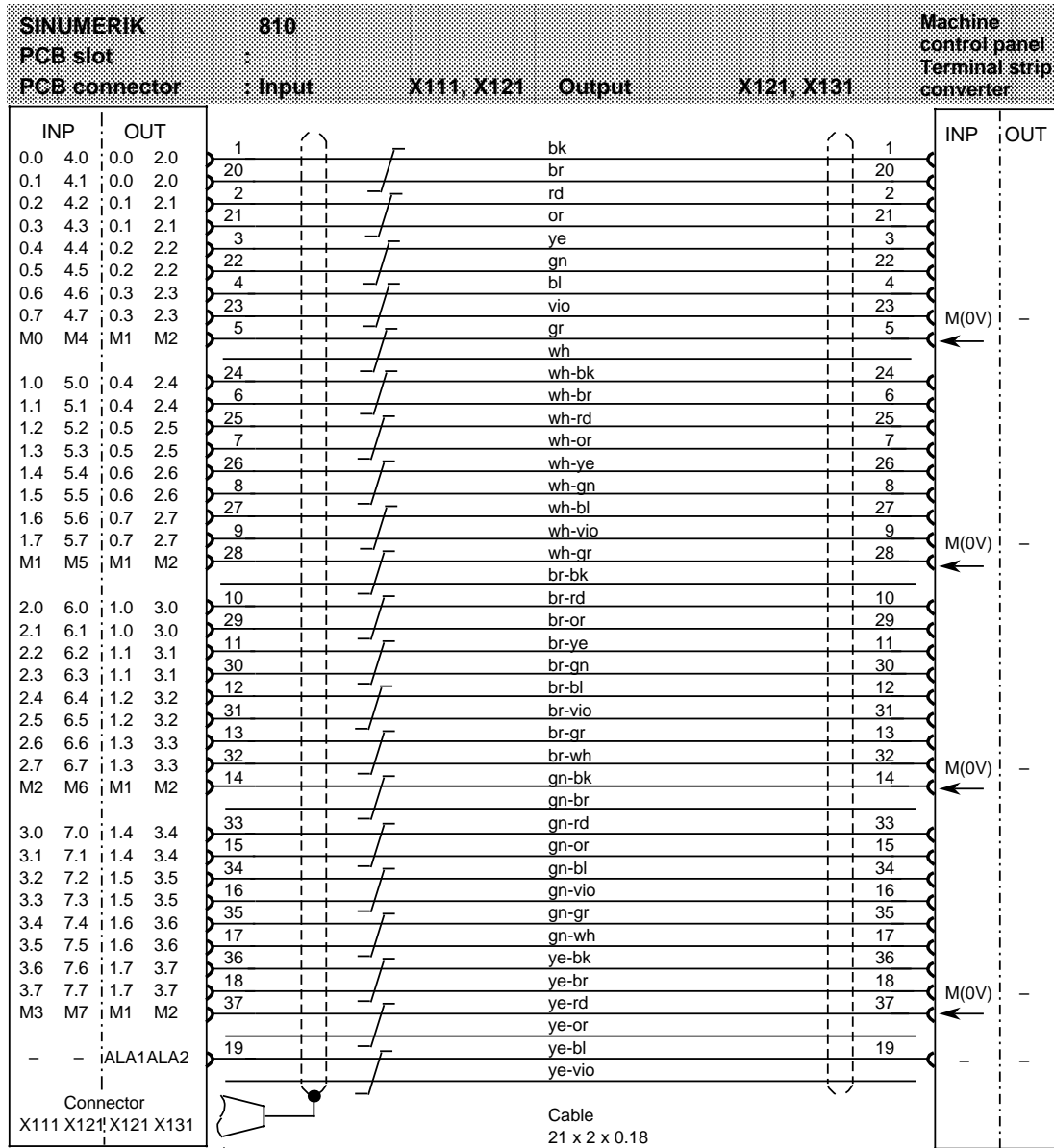


I/O sub-module No.	Rot. switch position		PLC outputs connector X02 402 OUT 00 ... 37	PLC inputs connector X02 404 INP 00 ... 37	PLC inputs connector X02 405 INP 40 ... 77	PLC inputs connector X02 406 INP 40 ... 51
	S1	S2				
1	0	0	O0.0 ... 3.7	I0.0 ... 3.7	I4.0 ... 7.7	I4.0 ... 5.1
2	1	1	O4.0 ... 7.7	I8.0 ... 11.7	I12.0 ... 15.7	I12.0 ... 13.1
3	2	2	O8.0 ... 11.7	I16.0 ... 19.7	I20.0 ... 23.7	I20.0 ... 21.1
4	3	3	O12.0 ... 15.7	I24.0 ... 27.7	I28.0 ... 31.7	I28.0 ... 29.1

Cable name: MPC interface (Cu-L)  
 Order No.: 6FC9 344-2A



Cable name: Machine control  
 Order No.: 6FC9 344-1U  
 6FC9 344-1V  
 Input/output  
 Input  
 Output



**Connector**

Position: 1 at top  
 D sub  
 37-way, socket  
 Connection side  
 SINUMERIK housing  
 6FC9 341-1FH

Designation: NC

**Connector code**

● coding pin  
 x no coding pin

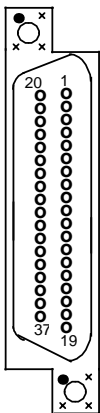
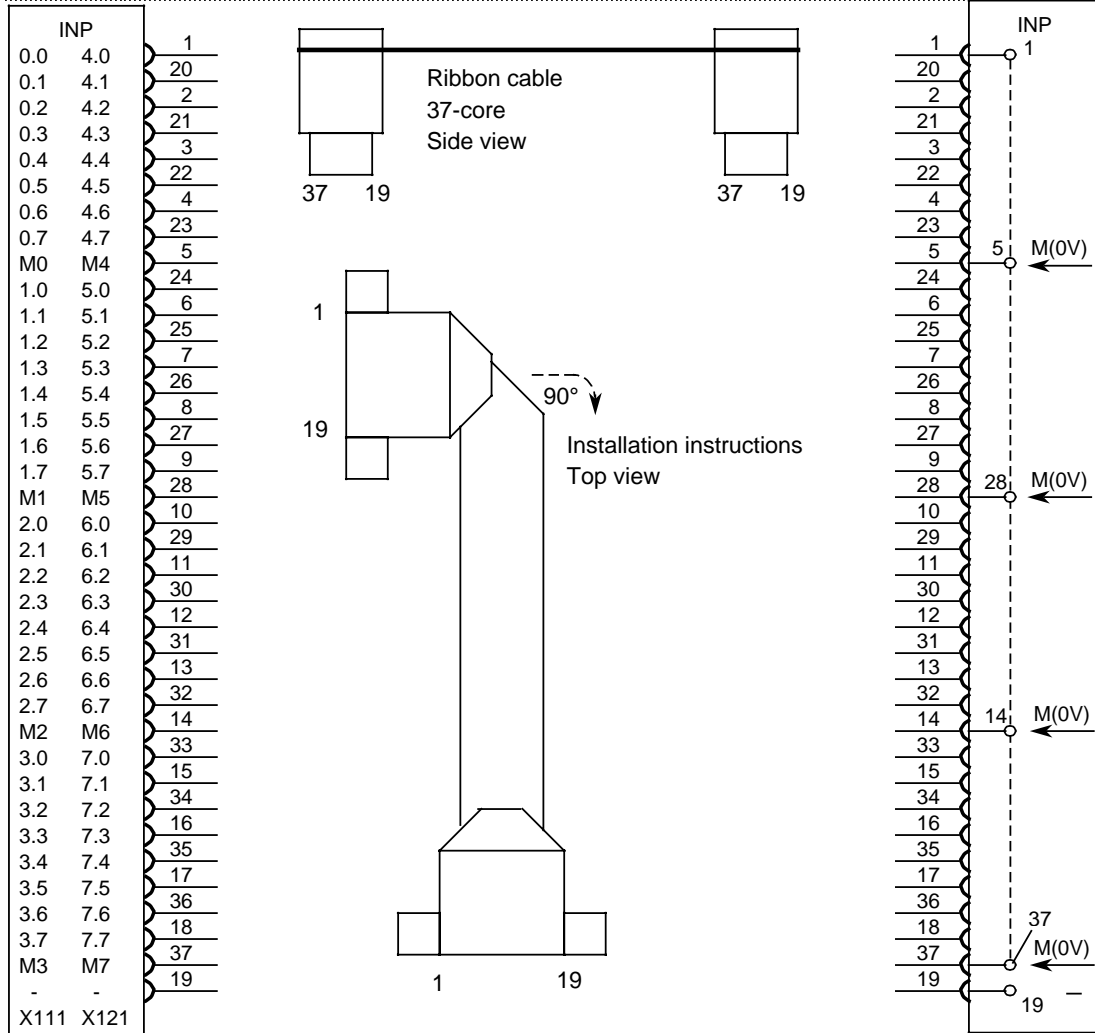
**Connector**

Position: 1 at top  
 D sub  
 37-way, socket  
 Connection side  
 SINUMERIK housing  
 6FC9 341-1FH

Designation: KLU

Cable name: Machine control input (ribbon cable)  
 Order No.: 6FC9 344-2T

**SINUMERIK 810** Terminal strip converter, 37-way  
 PCB slot : D sub/terminals  
 PCB connector : Input 6FC9 302-2AC / AD



**Ribbon cable connector**

Position: 1 at top  
 D sub  
 37-way, socket  
 Connection side  
 SINUMERIK housing  
 6FC9 341-1FX

Designation: NC

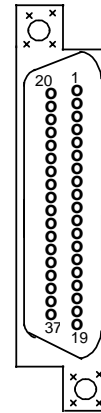
**Connector code**

- coding pin
- x no coding pin

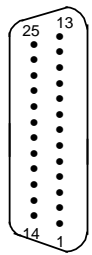
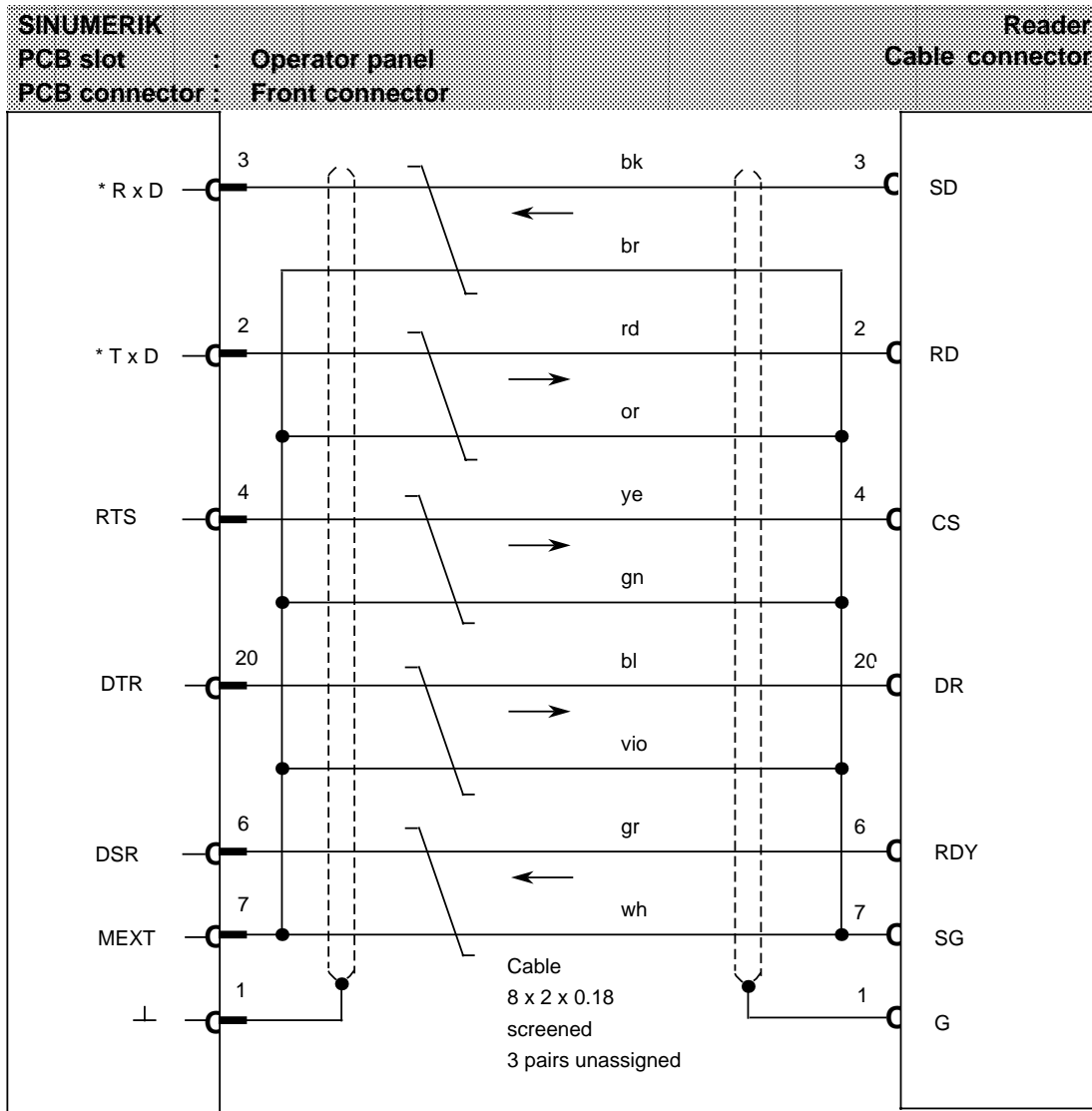
**Ribbon cable connector**

Position: 1 at top  
 D sub  
 37-way, socket  
 Connection side  
 SINUMERIK housing  
 6FC9 341-1FX

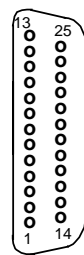
Designation: KLU



Cable name : SINUMERIK reader T60 (portable unit)  
 Order No. : 6FC9 340-8F

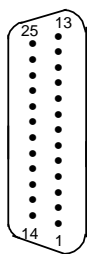
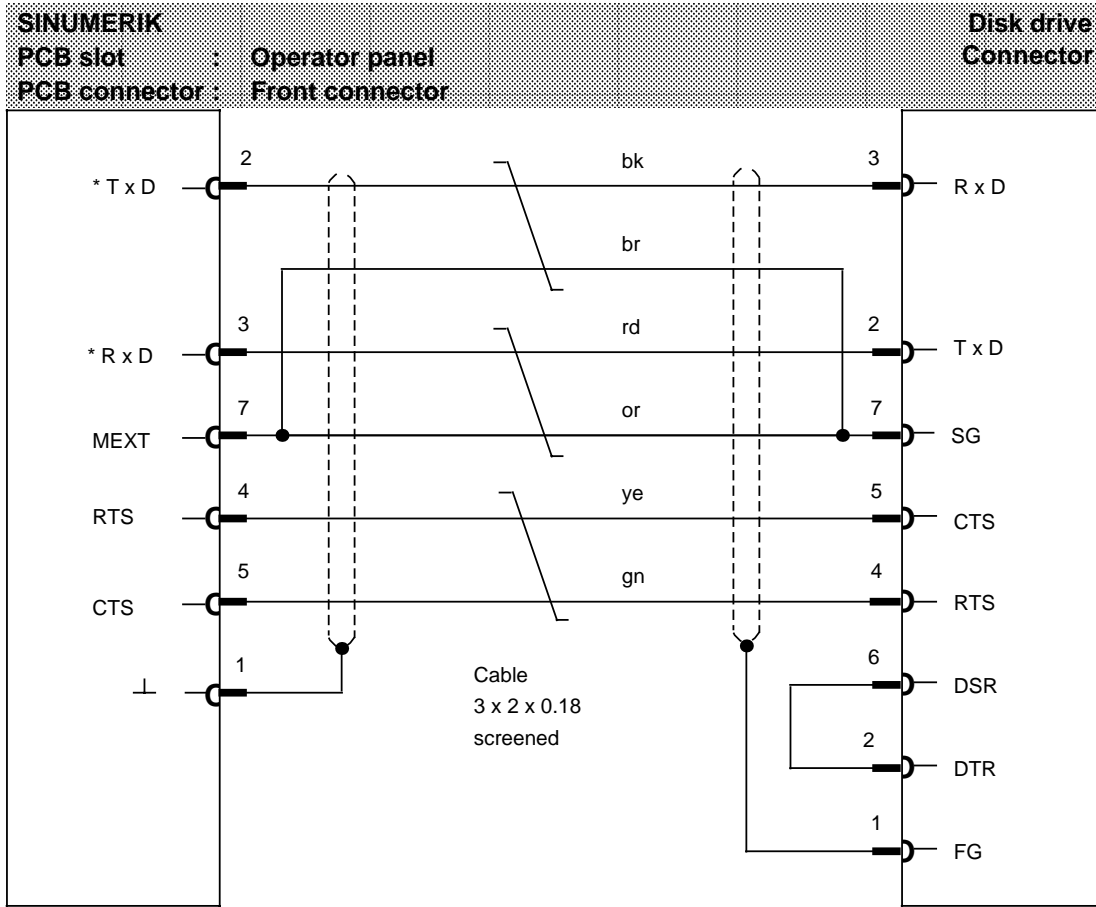


**Connector**  
 Position 1 bottom  
 D sub  
 25-way, pin  
 Connection side  
 Housing with  
 push latch  
 6FC 9 341 - 2AA  
 Designation: NC

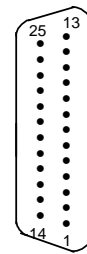


**Connector**  
 Position 1 bottom  
 D sub  
 25-way, socket  
 Connection side  
 Post office housing  
 with spacer  
 6FC 9 341 - 1ER  
 Designation: PTR

Cable name : Siemens DSG 3.5 disk drives  
 CAN NC recorder FD/FH  
 Order No. : **6FC9 344-2P**



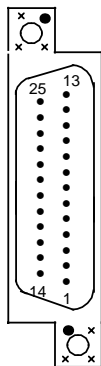
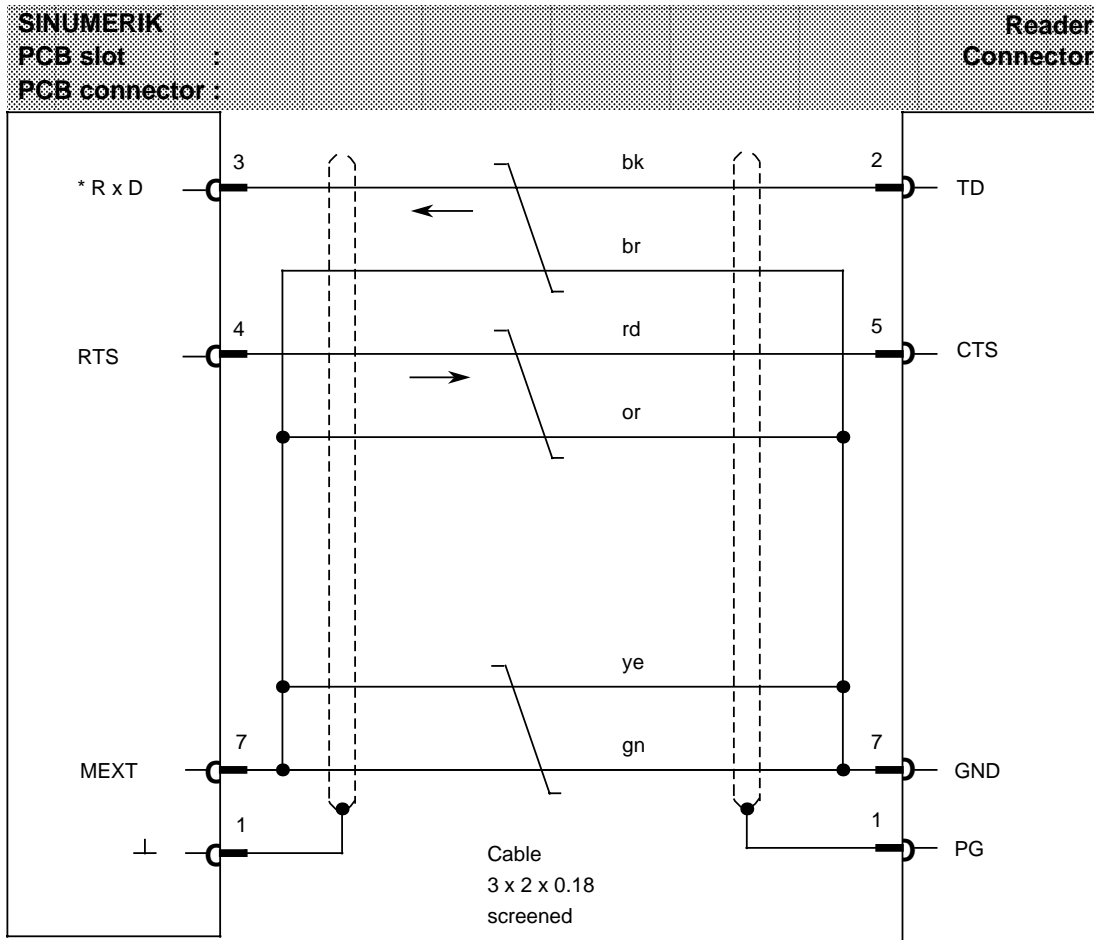
**Connector**  
 Position 1 bottom  
 D sub  
 25-way, pin  
 Connection side  
 Housing with  
 push latch  
 6FC 9 341 - 2AA  
 Designation: NC



**Connector**  
 Position 1 bottom  
 D sub  
 25-way, pin  
 Connection side  
 Post office housing  
 6FC 9 341 - 1ES  
 Designation: CAN



Cable name : SINUMERIK T40 and T50 readers  
 Order No. : **6FC9 340-8S**

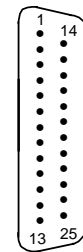


**Connector**  
 Position 1 bottom  
 D sub  
 25-way, pin  
 Connection side  
 SINUMERIK housing  
 6FC9 341-2AB  
 Designation: NC

**Connector code**

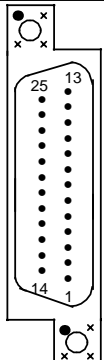
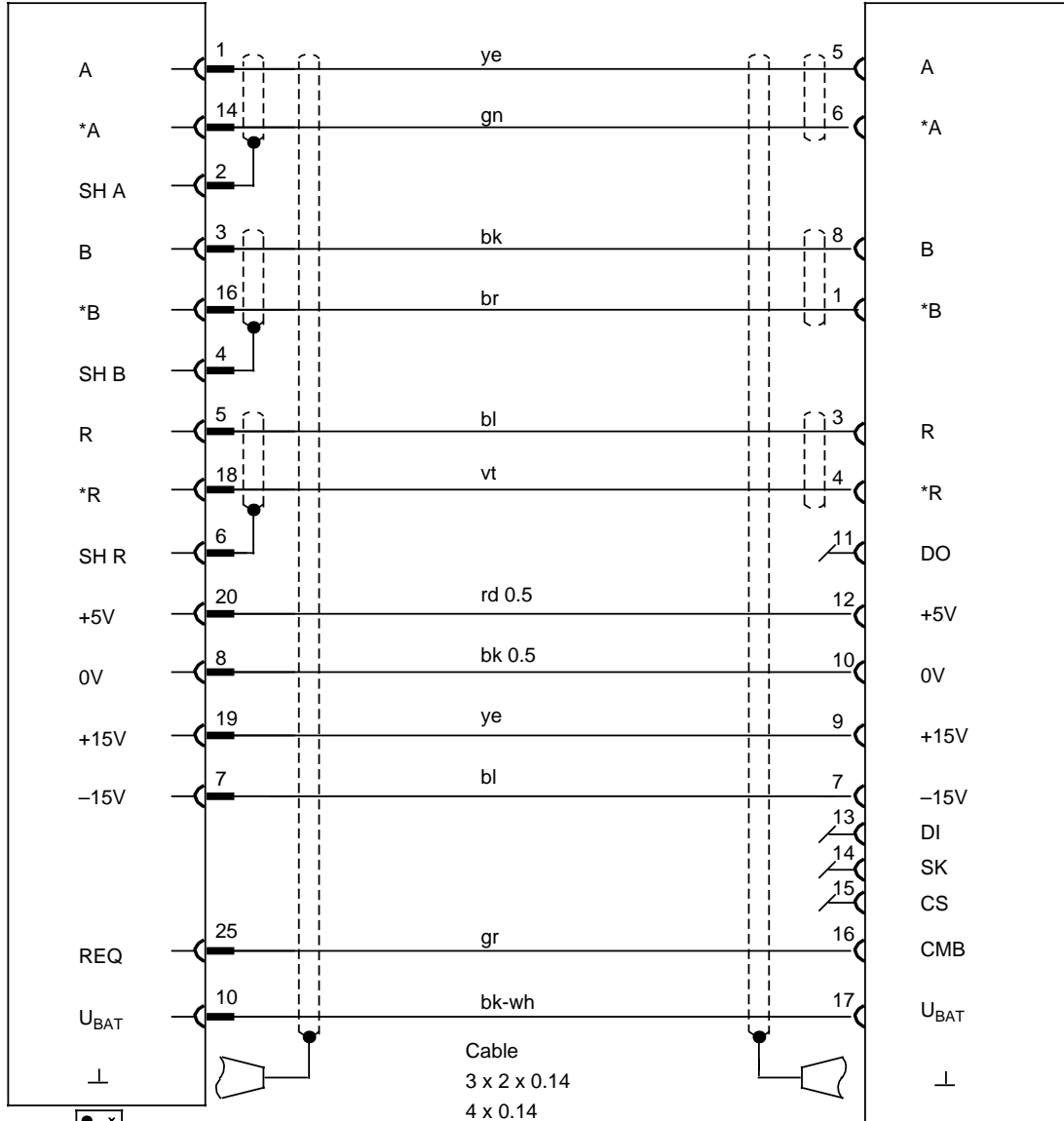
- coding pin
- x no coding pin

**Connector**  
 Position 1 bottom  
 D sub  
 25-way, pin  
 Connection side  
 Housing with  
 push latch  
 6FC 9 341 - 2AA  
 Designation: PTR



Cable name: SIPOS rotary measuring system  
 Order No.: 6FC9 344-4D

<b>SINUMERIK</b>	<b>SIPOS</b>
PCB slot : 6FX1 145-6BA	Meas. system
PCB connector : X 111, X 121	Connector



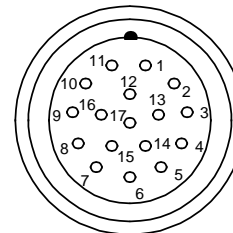
**Connector**  
 Position: 1 at bottom  
 D sub  
 25-way pin  
 Connection side  
 SINUMERIK housing  
 6FC9 341-2AB  
 Designation: NC

Cable  
 3 x 2 x 0.14  
 4 x 0.14  
 2 x 0.5  
 Screened  
 6FC9 343-0AP

**Connector code**

- Coding pin
- x No coding pin

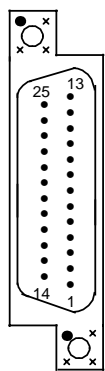
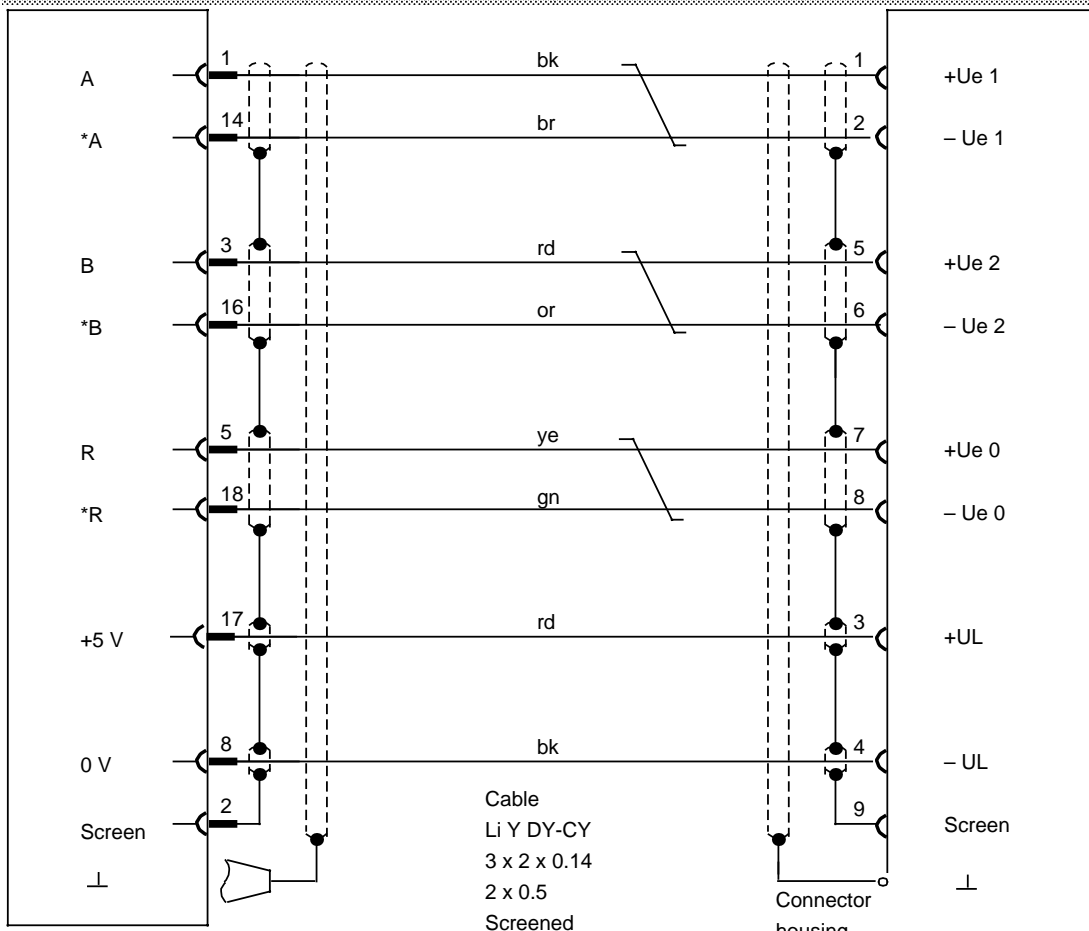
**Connector**  
 17-way, socket  
 SIEMENS  
 Cable dia.: 8 mm  
 Connection side



6FC9 341-1HA  
 Designation: SIPOS

Cable name: Digital linear measuring system (HMS)  
 Order No.: 6FC9 344-4L

<b>SINUMERIK</b>		<b>Measuring system</b>
<b>PCB</b>	: 6FX1 145-6BA	<b>Connector</b>
<b>PCB connector</b>	: X 111, X 121, X 131	

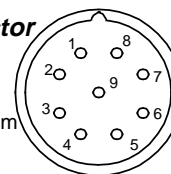


**Connector**

Position: 1 at bottom  
 D sub  
 25-way, pin  
 Connection side  
 SINUMERIK housing  
 6FC9 341-2AB  
 Designation: NC

**Plug-in connector**

9-way, socket  
 SIEMENS  
 Cable diameter: 8 mm  
 Connection side



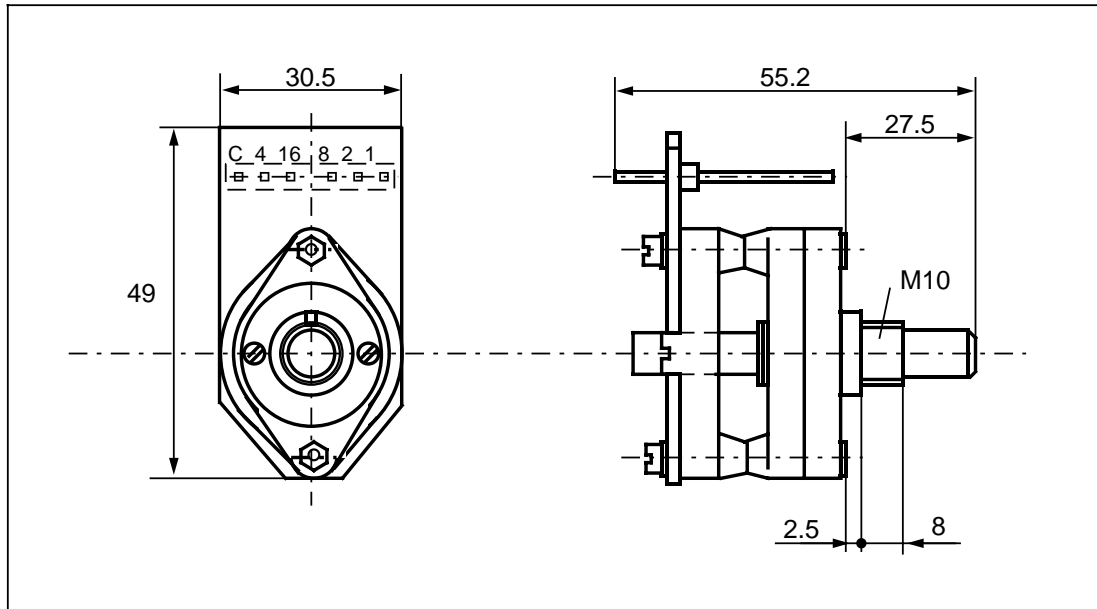
**Connectorcode**

- Coding pin
- x No coding pin

6FC9 341-1EW  
 Designation: LINEAL

## 3 Elements for the Machine Control Panel

### 3.1 Coded selection switch



Used in the machine control panel as ...	Switch position		Switching angle	Order No.
	total	used		
Mode selection switch	16	13	15°	6FC9 301 - 0AE
Spindle speed override switch	16	15	15°	6FC9 301 - 0EC
Feed override switch	23	23	11.25°	6FC9 301 - 0BC
Rapid traverse override switch	16	4	15°	6FC9 301 - 0CD
Rapid traverse override switch <sup>1)</sup>	8	4	30°	6FC9 301 - 0CC
Axis selection switch 810/820M	8	5	30°	6FC9 301 - 0DC

1) If this switch is used, code conversion is required in the PLC user program for the NC/PLC user interface.

### 3.2 Coding of the mode selection switch

Order No.: 6FC9 301-0AE

The mode selection switch of the machine control panel passes the following code (Gray code) to the input byte according to the position 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

### 3.3 Coding of the spindle speed override switch

Order No.: 6FC9 301-0EC

The spindle override switch of the machine control panel passes the following code (Gray code) to the input byte according to the position 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

### 3.4 Coding of the feed and rapid traverse override switches

Order No.: 6FC9 301-0BC

The feed and rapid traverse override switches of the machine control panel pass the following code (Gray code) to the input byte according to the position 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

### 3.5 Coding of the rapid traverse override switch

Order No.: 6FC9 301-0CD

The rapid traverse override switch provides the following code (Gray code) according to the position set:

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

### 3.6 Coding of the rapid traverse override switch

Order No.: 6FC9 301-0CC

The rapid reverse override switch provides the following code (Gray code) according to the position 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 used, code conversion is required in the PLC user program for the NC/PLC user interface.

### 3.7 Coding of the axis selection switch 810/820M

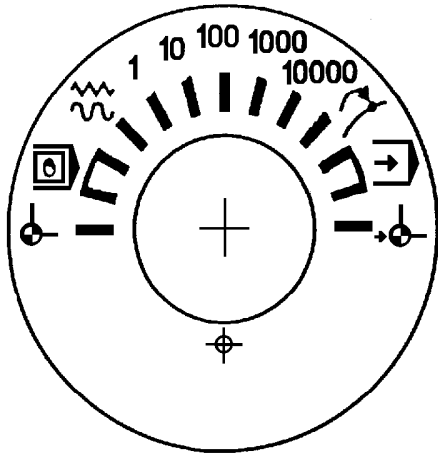
Order No.: 6FC9 301-0DC

The axis selection switch provides the following code (Gray code) according to the position set:

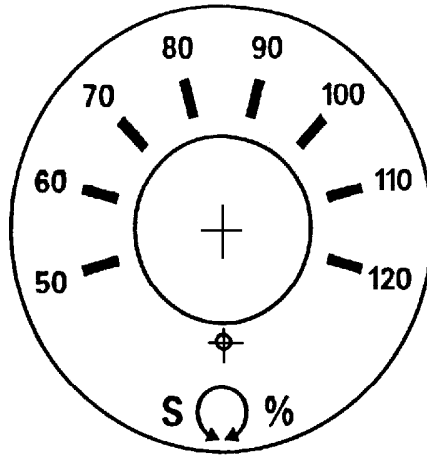
Position	Code				
	E	D	C	B	A
1	0	0	0	1	1
(Z)	0	0	0	1	0
2	0	0	1	1	0
(Z)	0	0	1	1	1
3	0	0	1	0	1
(Z)	0	0	1	0	0
4	0	1	1	0	0
(Z)	0	1	1	0	1
5	0	1	1	1	1
(Z)	0	1	1	1	0
6	0	1	0	1	0
(Z)	0	1	0	1	1
7	0	1	0	0	1

(Z): Intermediate position of the selection switch on the external standard machine control panel. These positions exist electrically but the switch does not click into these positions. The intermediate positions are not evaluated.

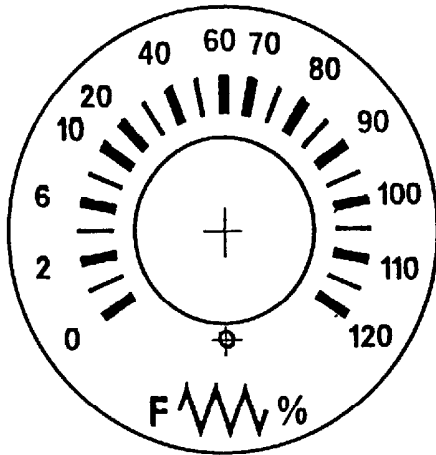
### 3.8 Engravings



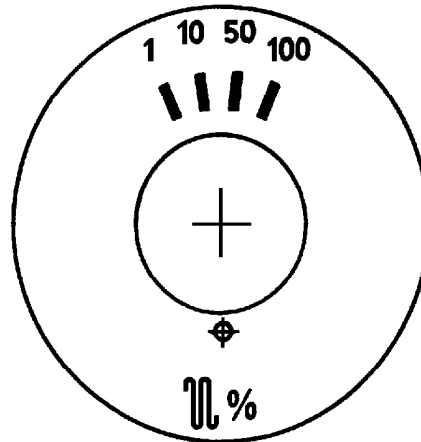
Mode selection switch



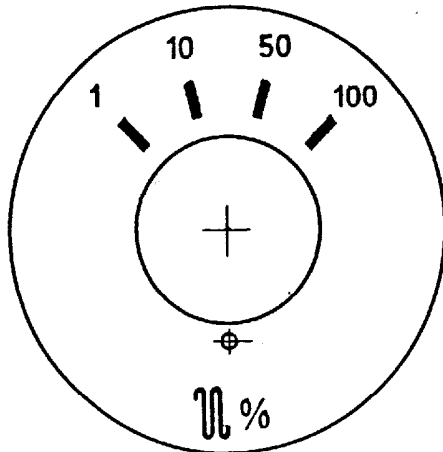
Spindle speed override switch



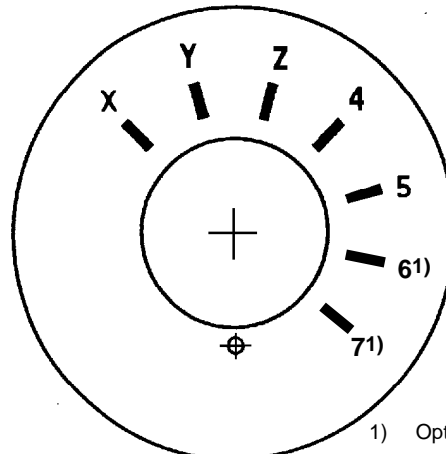
Feed override switch



Rapid traverse override switch



Rapid traverse override switch



Axis selection switch (810/820M)

1) Option J96



## 4 Cables and Connectors

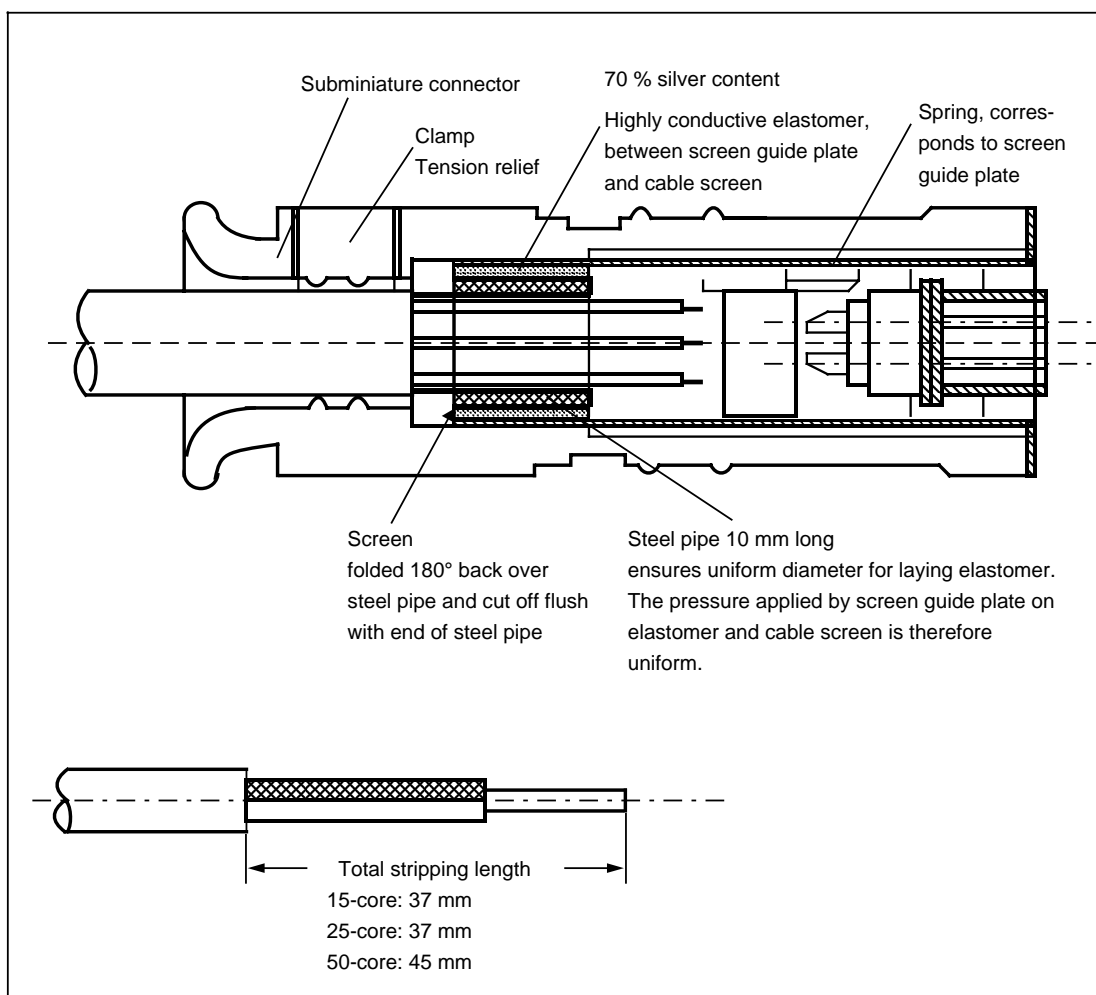
The units must be connected only with the prescribed types of cable in accordance with the overview of cables and devices.

In the overview of cables and devices and in the lists of accessories 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.

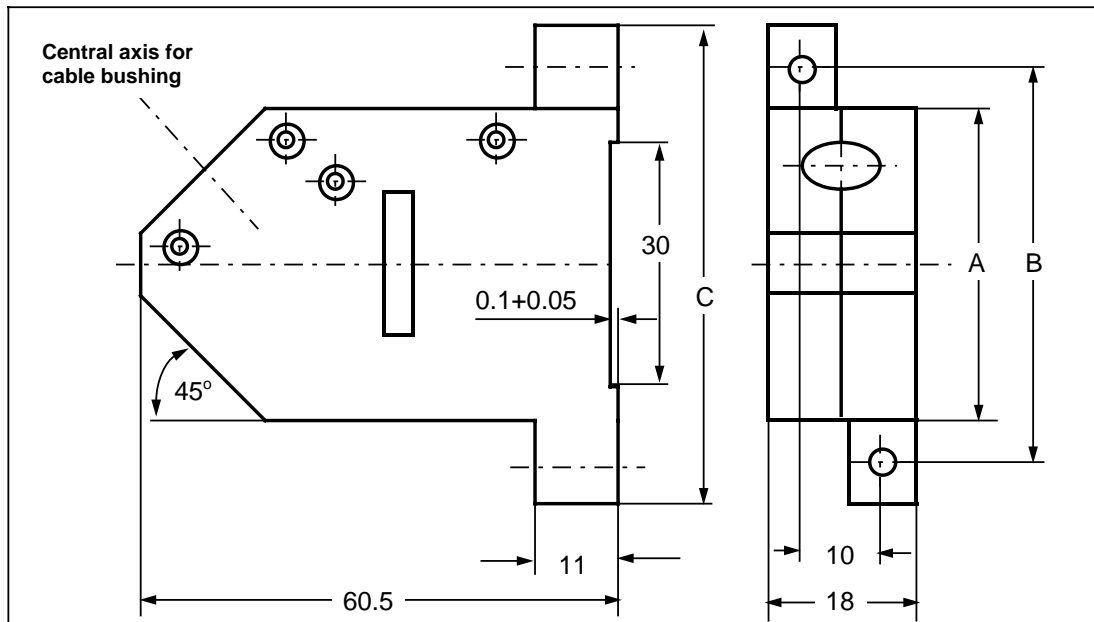
The connectors must be securely screwed onto the front panels of the modules.

### 4.1 Installation scheme: cable/subminiature connector



Cable/subminiature connector

### 4.2 Subminiature connector

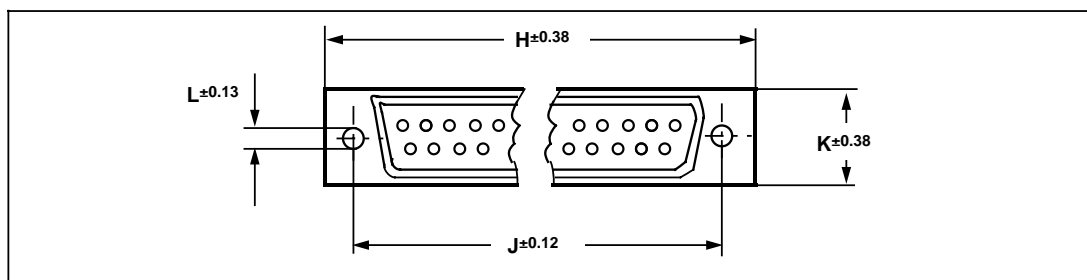


Submin. conn.	Dim. A	Dim. B	Dim. C	Order No.: (complete with housing)
15-way female	43	53	63	6FC9 341 - 1EC
25-way female	57	67	77	6FC9 341 - 1ED
37-way female	71	81	91	6FC9 341 - 1FH
15-way male	43	53	63	6FC9 341 - 1EU
25-way male	57	67	77	6FC9 341 - 2AB

Scale diagram of the subminiature connector, complete with housing

Dimensions in mm

### 4.3 Socket connector

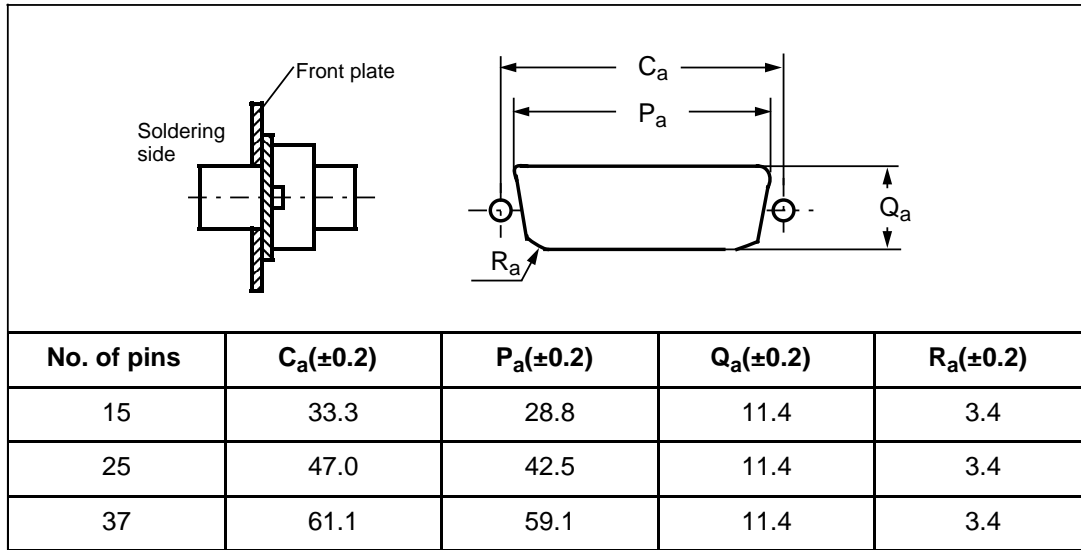


Socket conn.	Dim. H	Dim. J	Dim. K	Dim. L
15-way	39.15	33.30	12.50	3.05
25-way	53.00	47.05	12.50	3.05
37-way	66.90	61.10	15.35	3.05

Scale diagram of the socket connector (dimensions of pin connector the same)

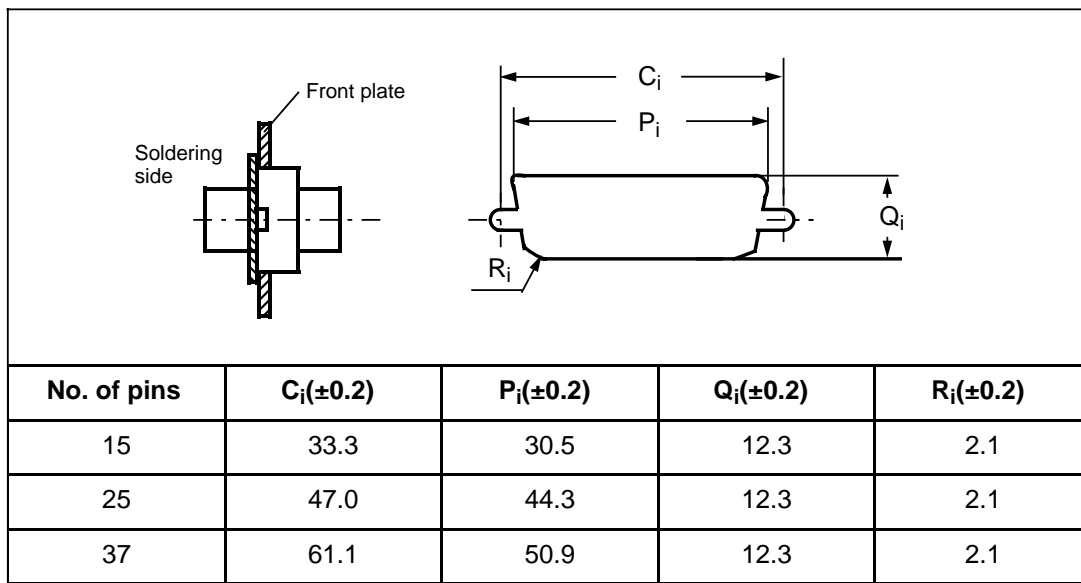
Dimensions in mm

### 4.4 Assembly notes



Scale diagram for external assembly

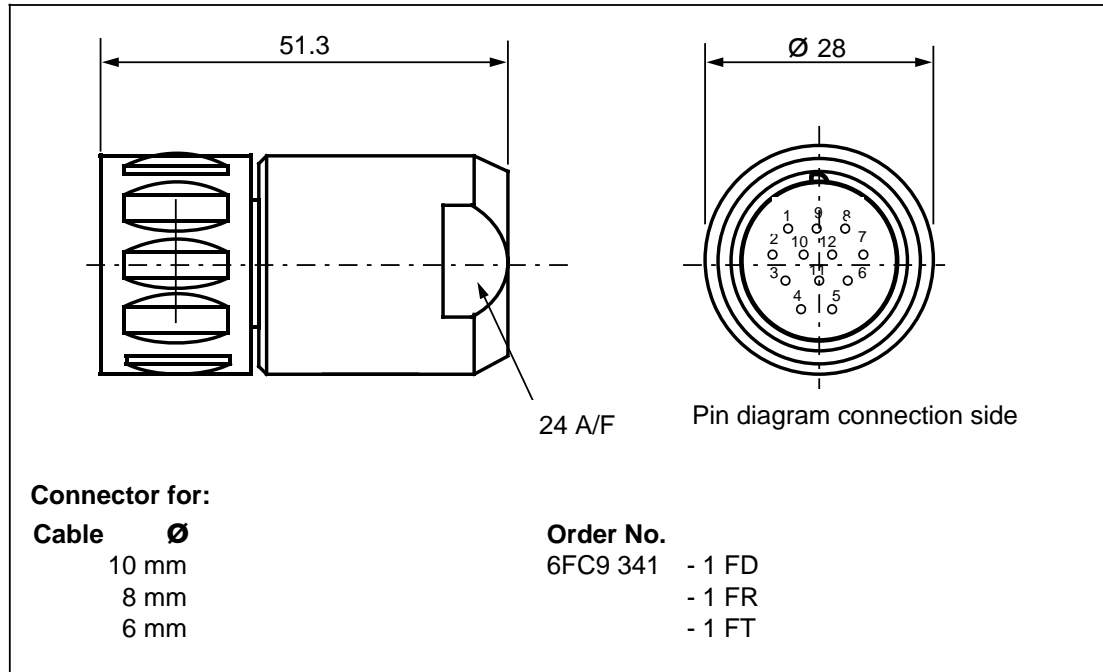
Dimensions in mm



Scale diagram for internal assembly

Dimensions in mm

### 4.5 Round connector

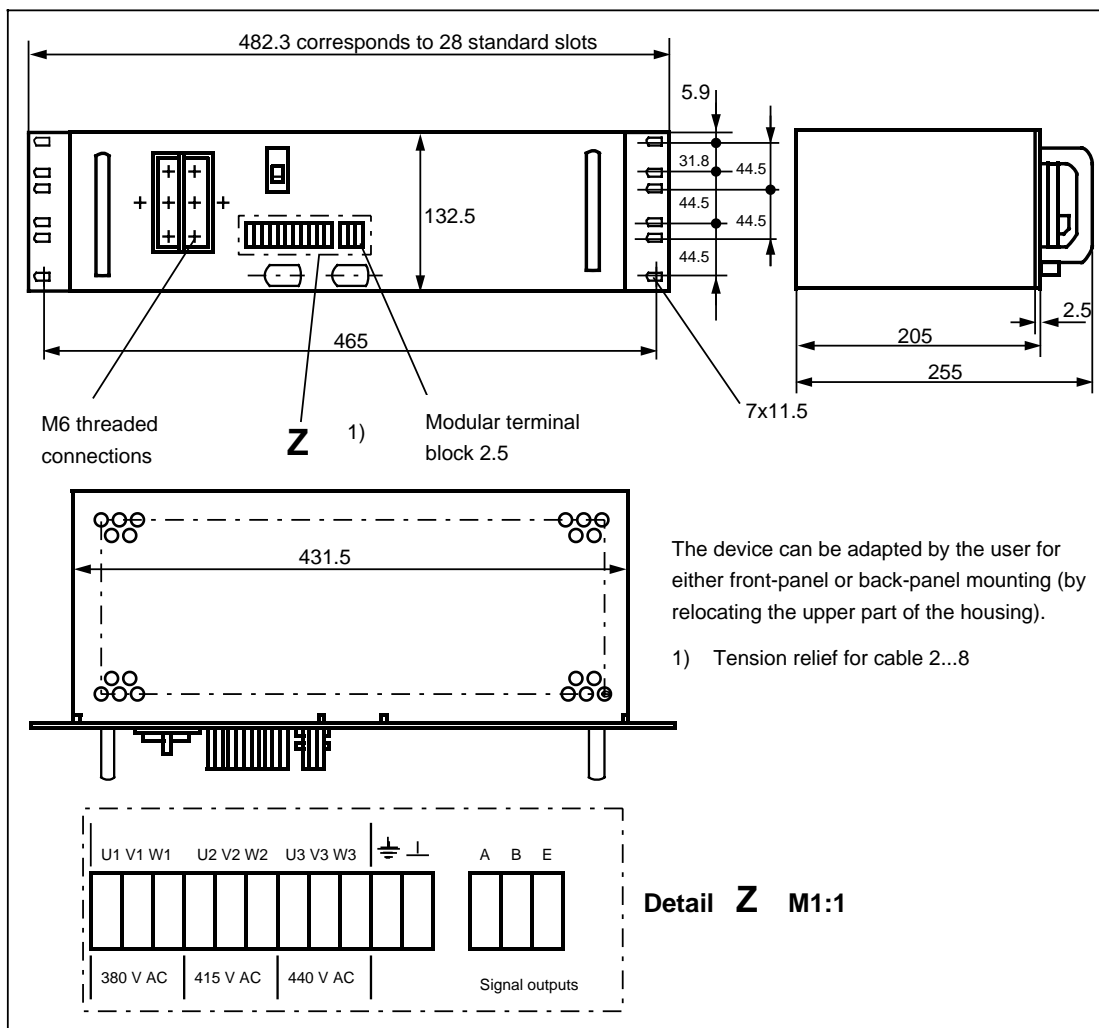


# 5 Devices

## 5.1 Power supplies

Order No. for 20 A: 6FC9 304-0AC  
 Type: 6EV1 352-5BK  
 Input: 380 V AC/415 V AC/440 V AC  
 Output: 24 V DC/20 A

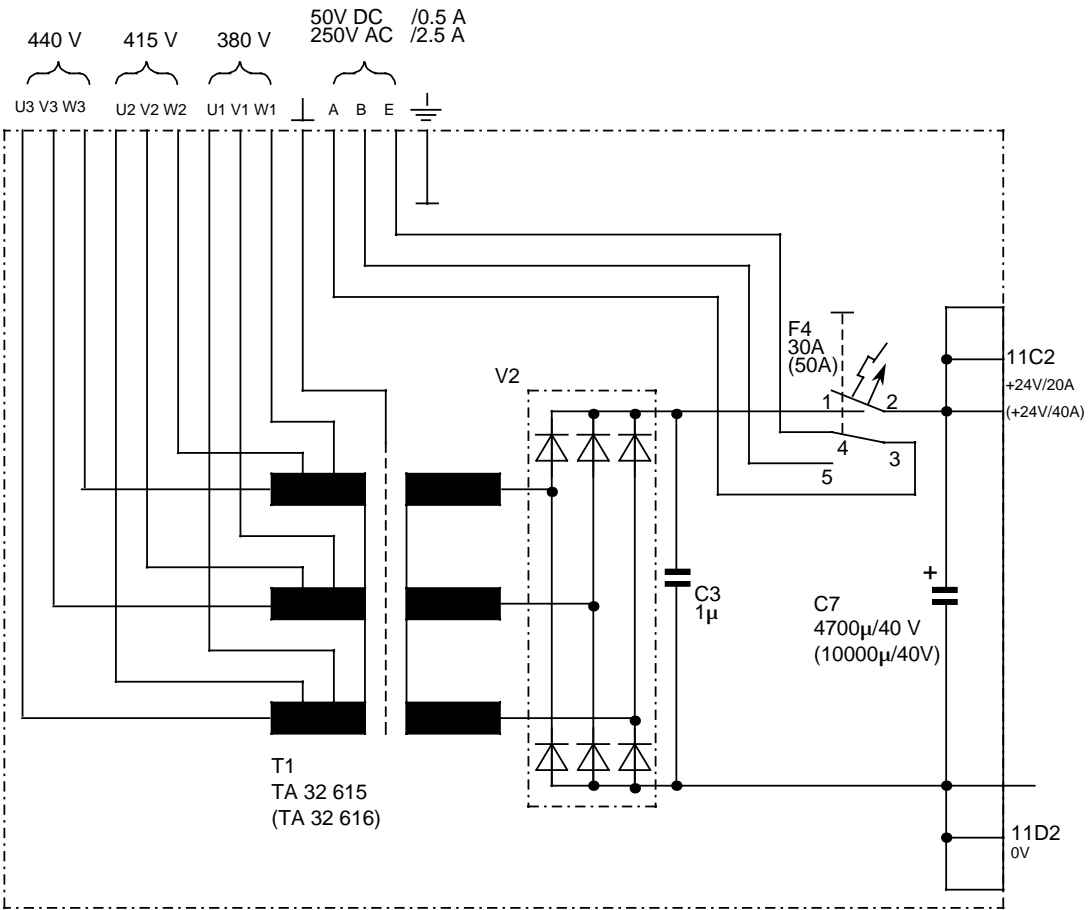
Order No. for 40 A: 6FC9 304-0AD  
 Type: 6EV1 362-5BK  
 Input: 380 V AC/415 V AC/440 V AC  
 Output: 24 V DC/40 A



Connection of the power supply  
380V AC/24V DC  
Rated output currents 20 A and 40 A

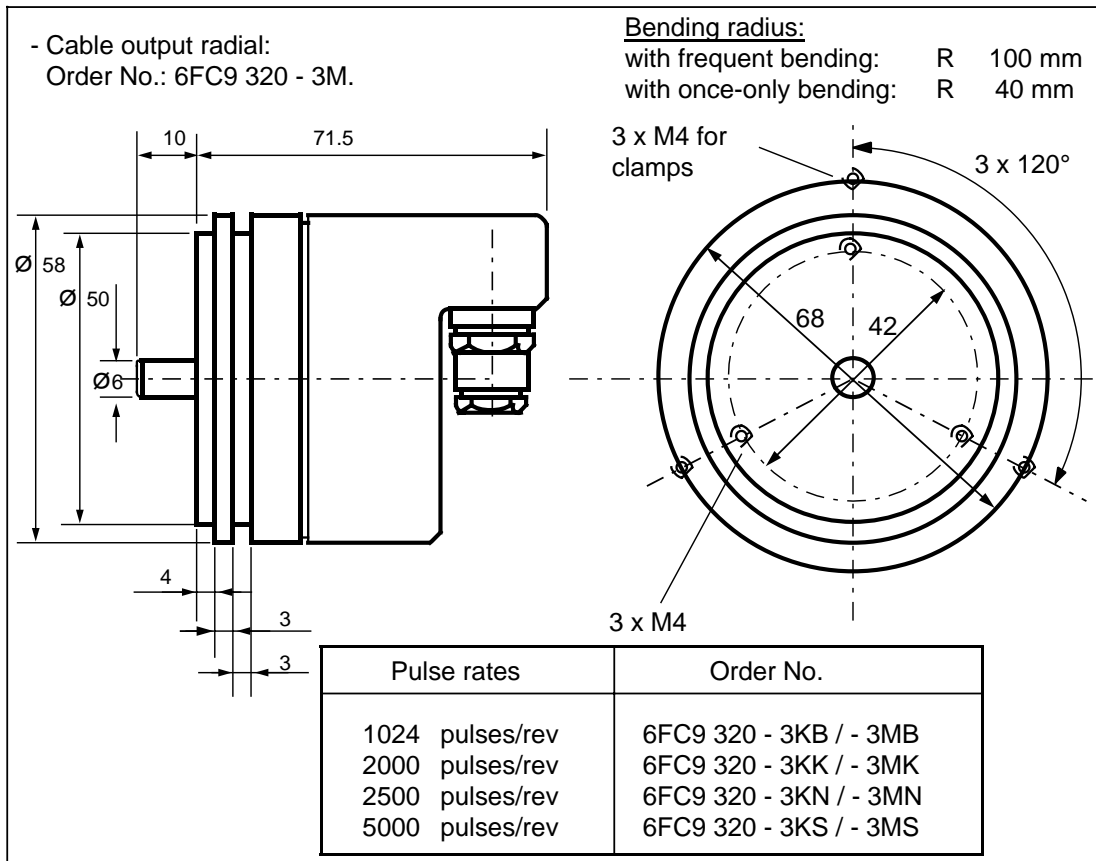
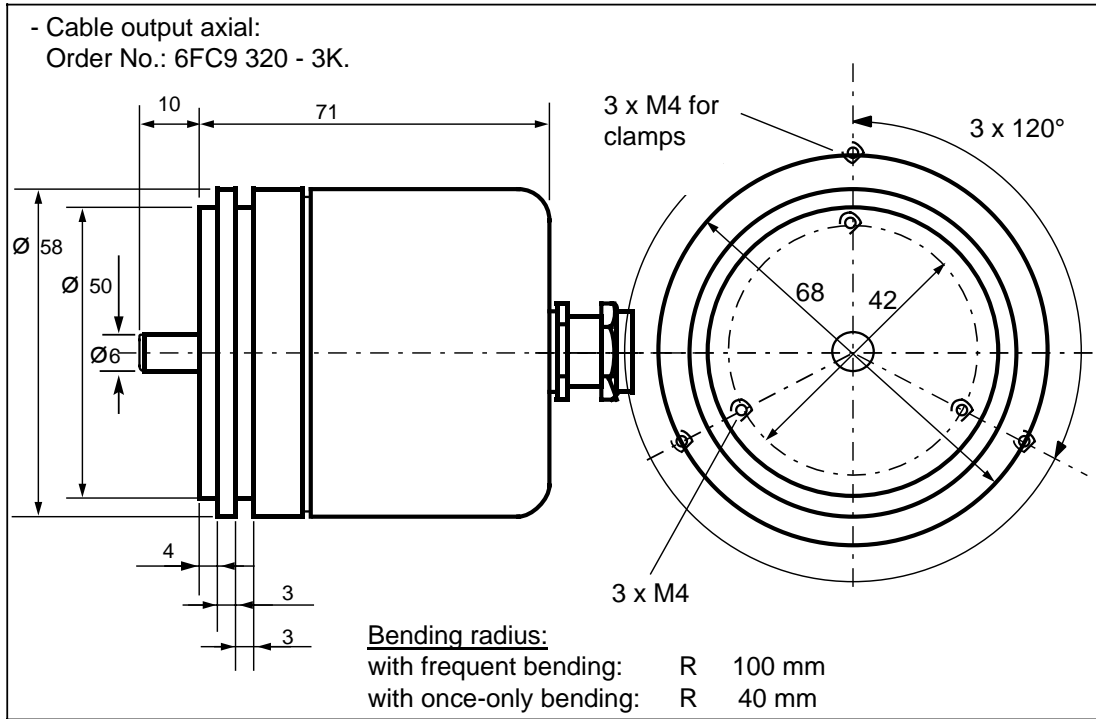
**380 V / 415 V / 440V**    **3 AC 50 Hz**

**Type: 20 A (40A)**

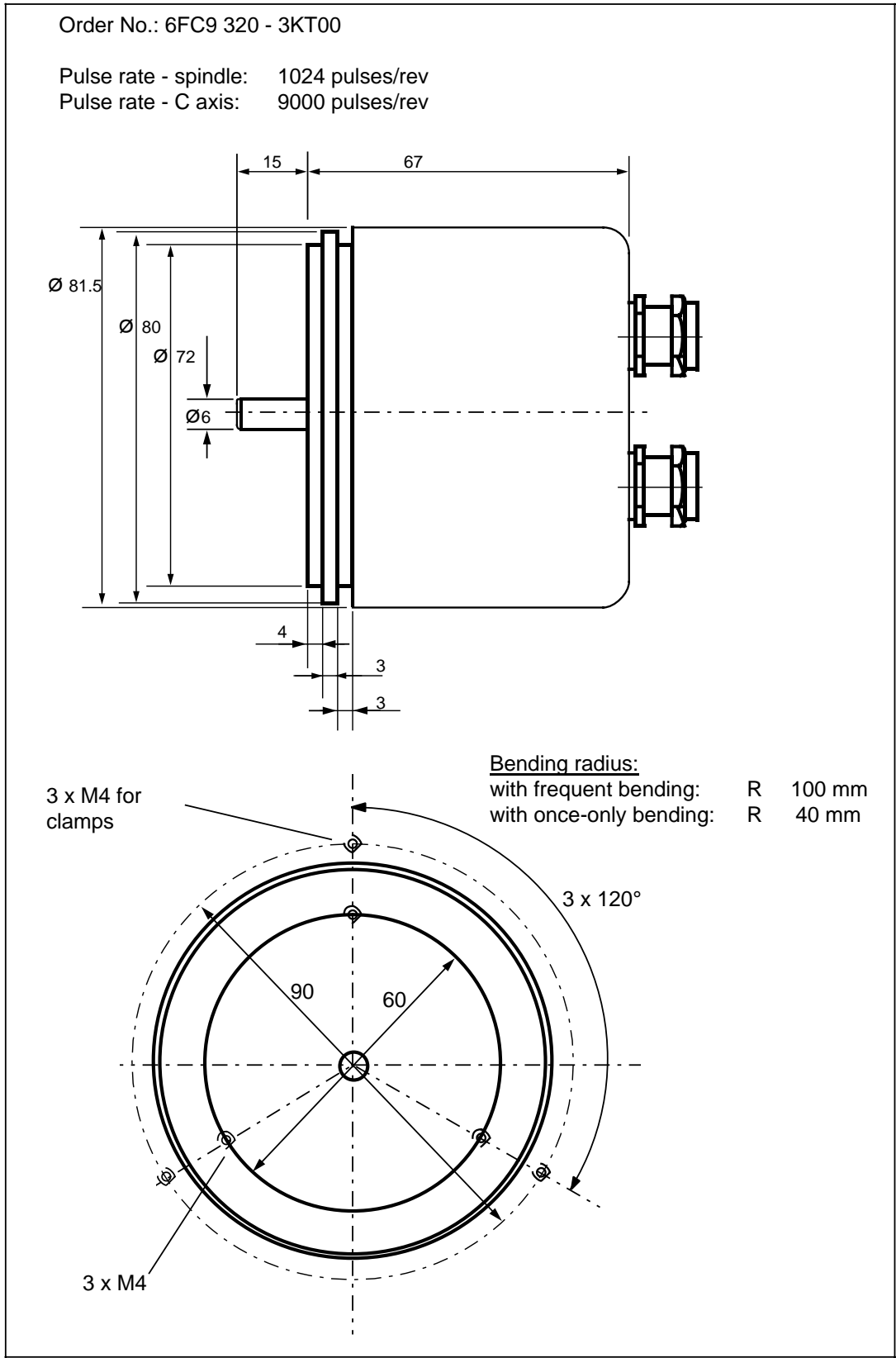


## 5.2 Incremental encoders

### 5.2.1 Rotary encoder and main spindle encoder

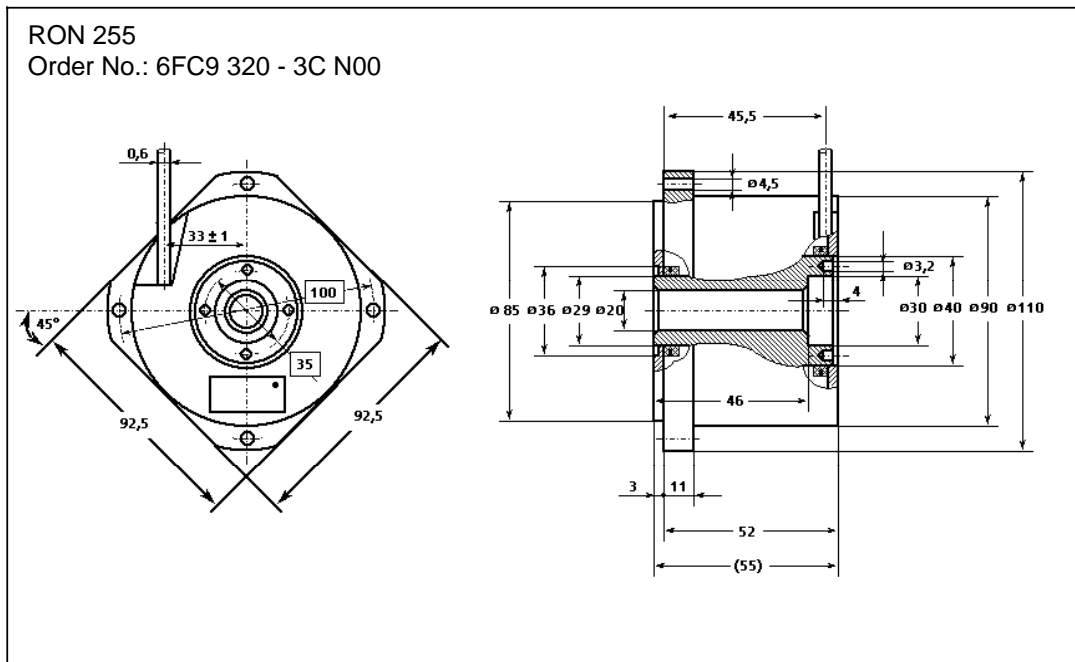
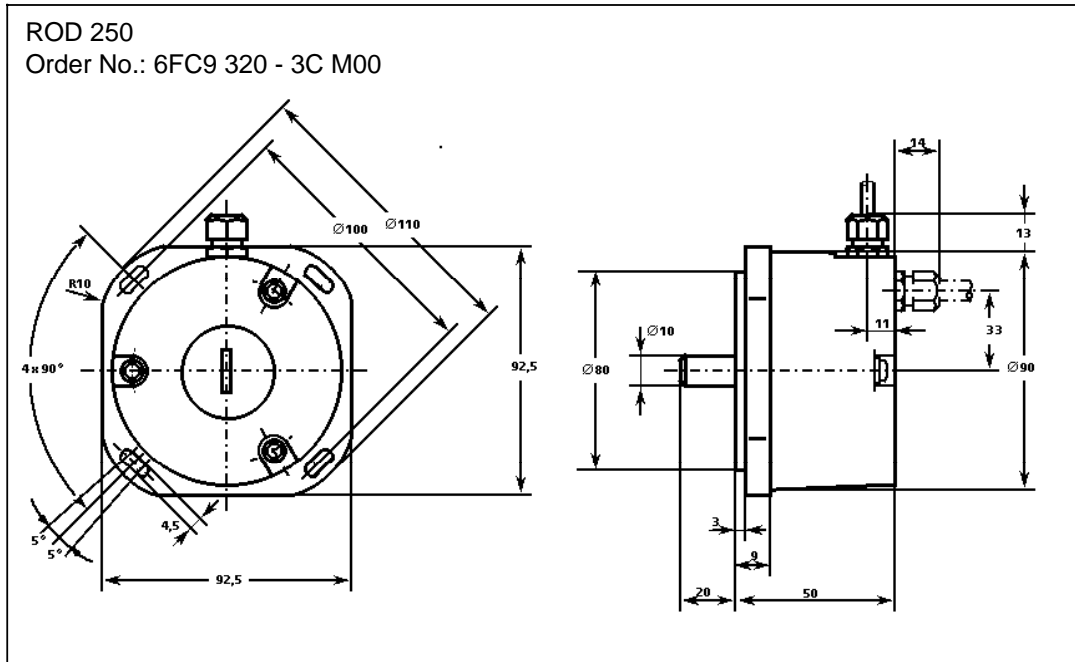


### 5.2.2 Combined rotary encoder for spindle and C axis

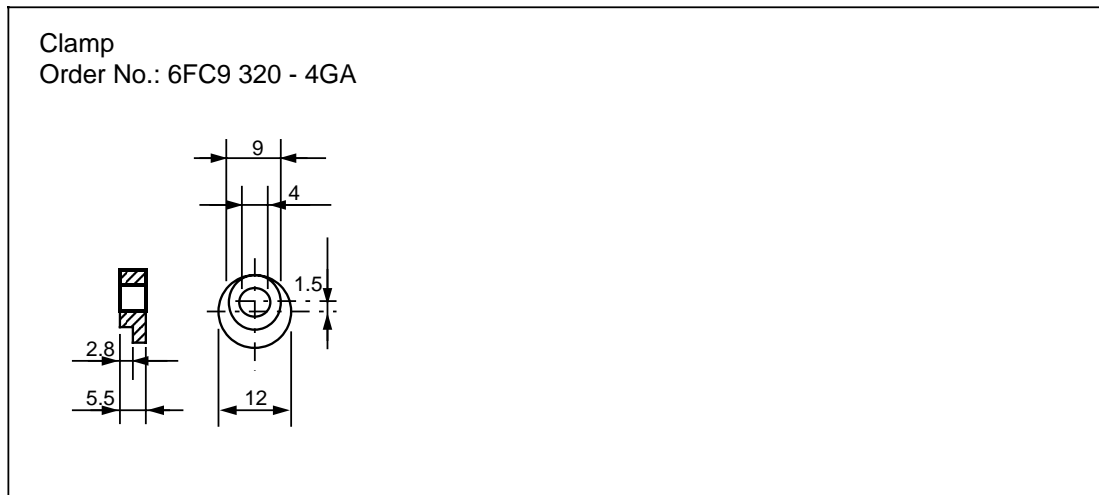
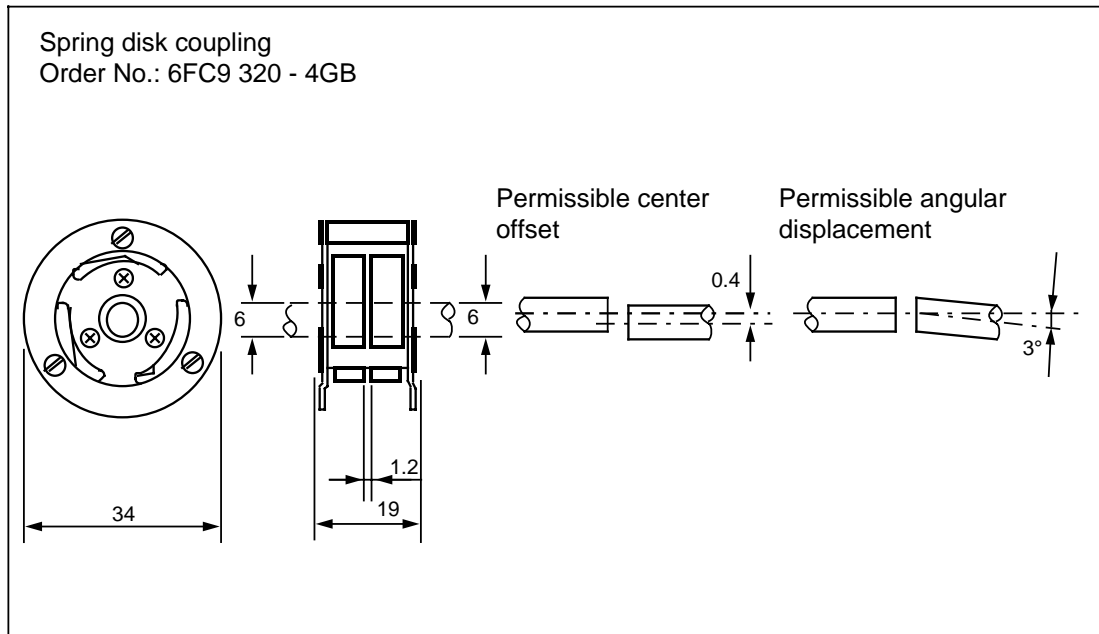




### 5.2.3 High-resolution rotary encoder for rotary axes



### 5.2.4 Spring disk coupling/clamp



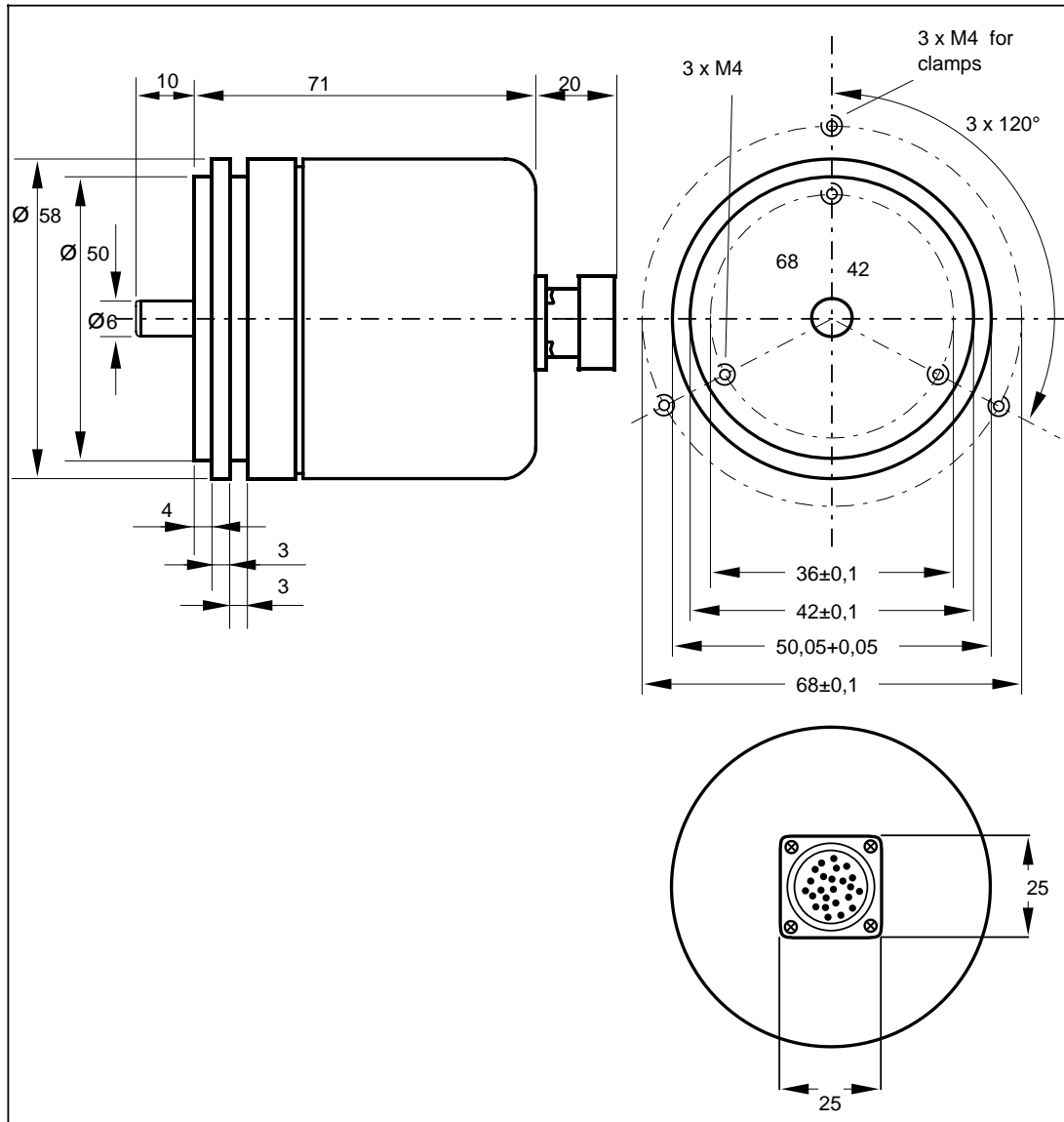
## 5.2.5 SIPOS encoders

	Order No.:
SIPOS incremental encoder (axial outgoing connector)	6FC9 320-3CS
SIPOS incremental encoder (radial outgoing connector)	6FC9 320-3CW
SIPOS incremental encoder (axial outgoing connector)	6FC9 320-3CT
SIPOS incremental encoder (radial outgoing connector)	6FC9 320-3CV

SIPOS encoders are unconditioned signal angular position encoders. The SIPIOS is supplied as a purely incremental encoder or as a multiturn absolute encoder. The absolute encoder sends an absolute value to the NC on power up and then works as an incremental encoder. The sizes and cables of the SIPOS incremental encoders and SIPOS absolute encoders are identical.

SIPOS encoders can only be connected to the HMS measuring circuit module. For the absolute encoder an absolute encoder submodule is required, too.

### SIPOS absolute encoder with axial outgoing connector



Link to motor/leadscrew with set of fixing parts 6FC9 382-1C. When used for pure position measurement (the SIPOS encoder is **not** used for speed measurement) the spring disk coupling 6FC9 320-4GB can also be used.

**Technical data**

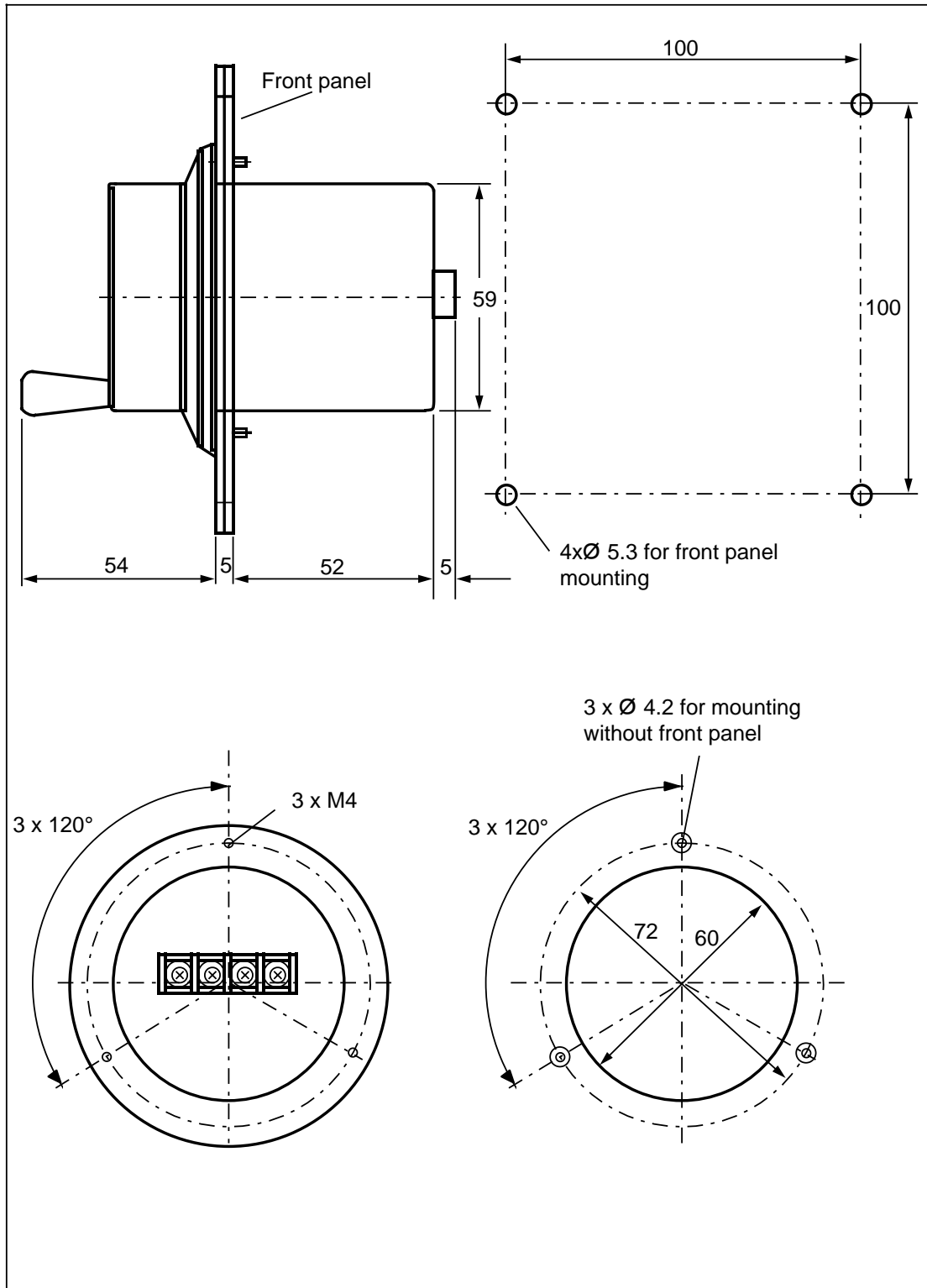
Increments of the disk	Pulses/rev.	2500
Max. sampling frequency	kHz	500
Max. output frequency	kHz	500
Output signals tracks A, B		Sinusoidal, electrical phase shift 90°, differential, amplified photoelectric signals of the incremental track
Output signal zero pulse		Signal peak of the reference mark
Output voltage tracks A, B	volts	+0.8 V/- 0.8 V +0.5 dB/-2 dB (at 100 Hz, terminating resistor: 180 ohms)
Output voltage zero pulse	volts	+0.8 V/- 0.8 V +3 dB/-2 dB (at 100 Hz. terminating: 180 ohms)
Amplitude error track A to track B	%	5 < 25 kHz 10 25 to 500 kHz
Temperature coefficient of the output amplitude from track A, B and N	%K	0.2
Frequency response, tracks A, B and N	dB	-3 (from 0 to 500 kHz, without cable) -6 (from 0 to 500 kHz, with 100 m cable)
Phase angle error (without cable)	degrees	1.5 < 25 kHz 3.0 < 25 to 500 kHz
Offset error tracks A and B	%	2 < 25 kHz 5 < 25 to 500 kHz
Supply voltage		5 volts, ±10 %, approx. 100 mA ±15 volts, ±10 %, approx. 60 mA
System accuracy	Output signals A and B suitable for multiplication by factor 128 for position control and factor 512 for speed control	
Light source	Infrared LED, controlled	
Scan	Photoelectrically using light	
Light receiver	Photodiodes	
Max. cable length	metres	100 (SINUMERIK cable)
Max. speed	rev/min	12000
Life of ball bearings	h	10 <sup>4</sup> at 8000 rev/min and 50 °C
Friction torque	Ncm	1
Shaft loadability axially radially	N N	15 25
Max. permissible angular acceleration	rad/s <sup>2</sup>	105

**Technical data, continued**

Resistance to vibration to DIN 40046 Part 7 3 Hz to 60 Hz: 60 Hz to 600 Hz: 500 Hz to 2 kHz:		$\pm 3 \text{ mm}$ $15 \text{ g}$ $12 \text{ g}$	} $\div 120 \text{ ms}^{-2}$
Shock resistance to DIN 40046 test Fc	$\text{m/s}^2$	300 (30 g)	
Degree of protection to DIN 40050		IP 65 (except for shaft inlet) IP 54 (shaft inlet)	
Temperature range during operation	$^{\circ}\text{C}$	0 to +70	
Temperature range during storage	$^{\circ}\text{C}$	-25 to +80	
Rel. air humidity during operation	%	75	
Rel. air humidity during storage and transport	%	65	
Rel air pressure during operation	HPa	>700	
Rel. air pressure during storage and transport	HPa	>700	
Weight (incl. 1 m cable and connector)	g	approx. 440	

### 5.3 Electronic handwheel

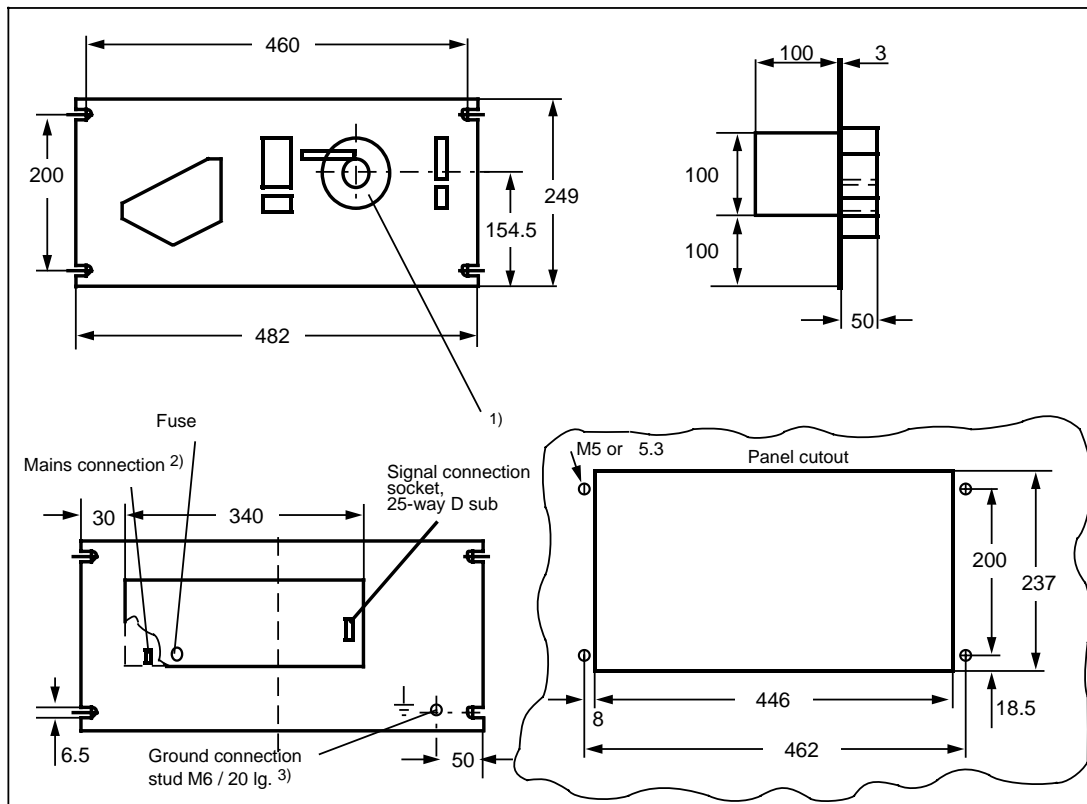
Order No.: 6FC9 320-5DA



## 5.4 Tape readers

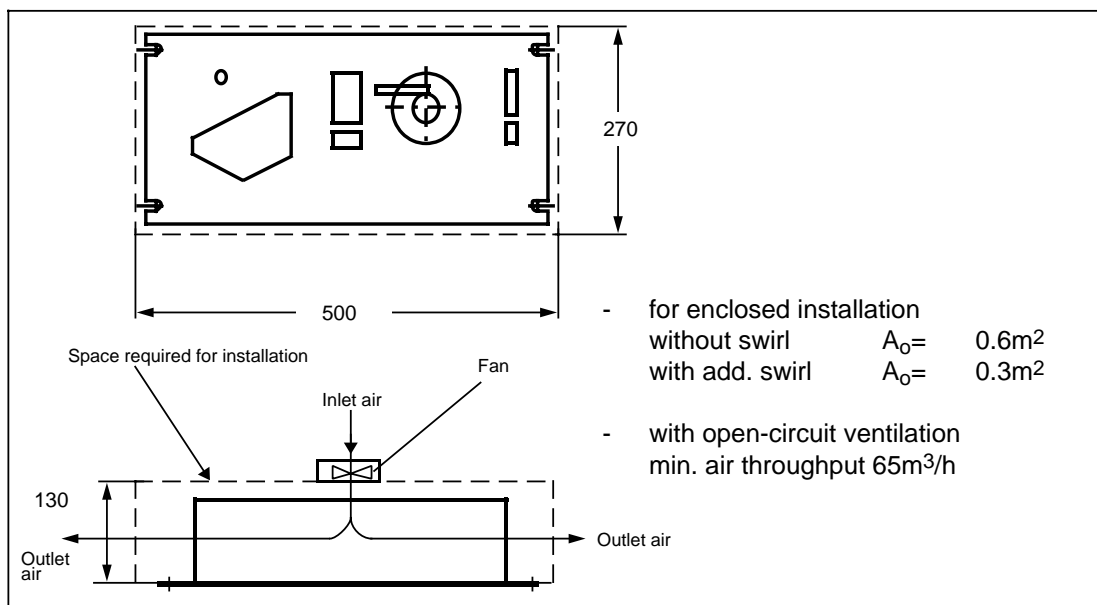
### 5.4.1 Reader T40, with take-up reel

Order No.: 6FC3 984 - 1FC



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

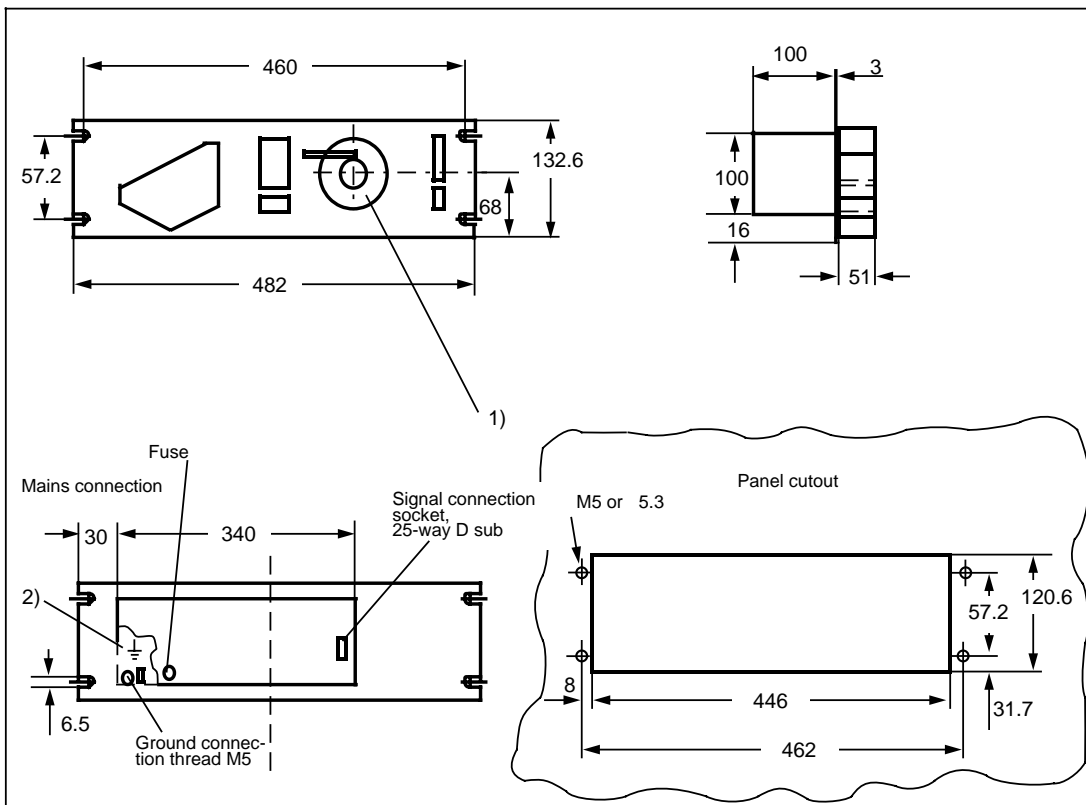
Suggested installation:





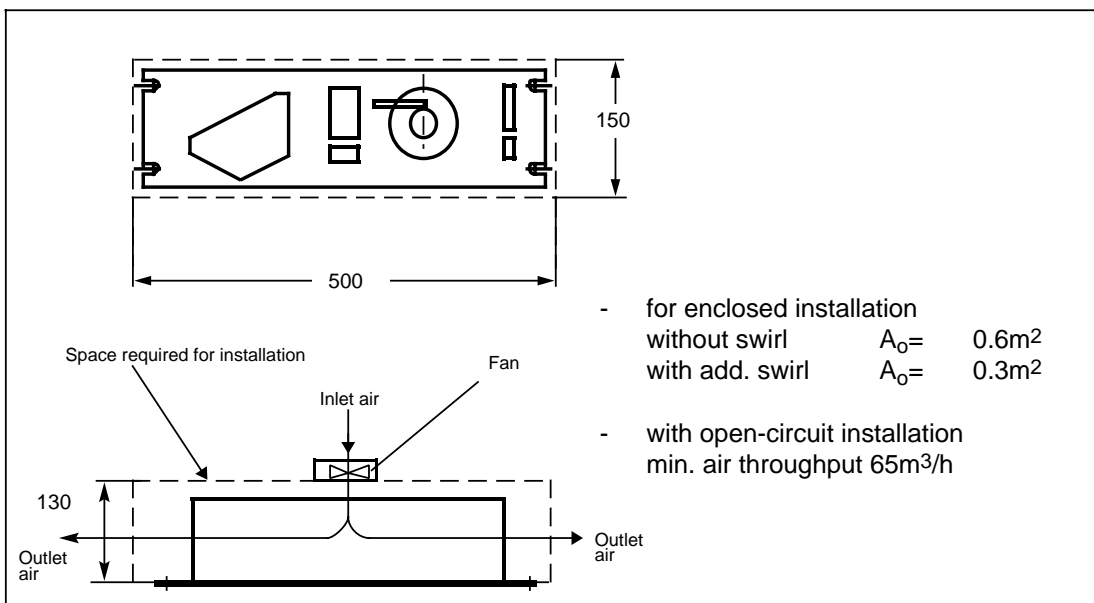
### 5.4.2 Reader T41, with take-up reel and smaller front panel

Order No.: 6FC3 984 - 1GB



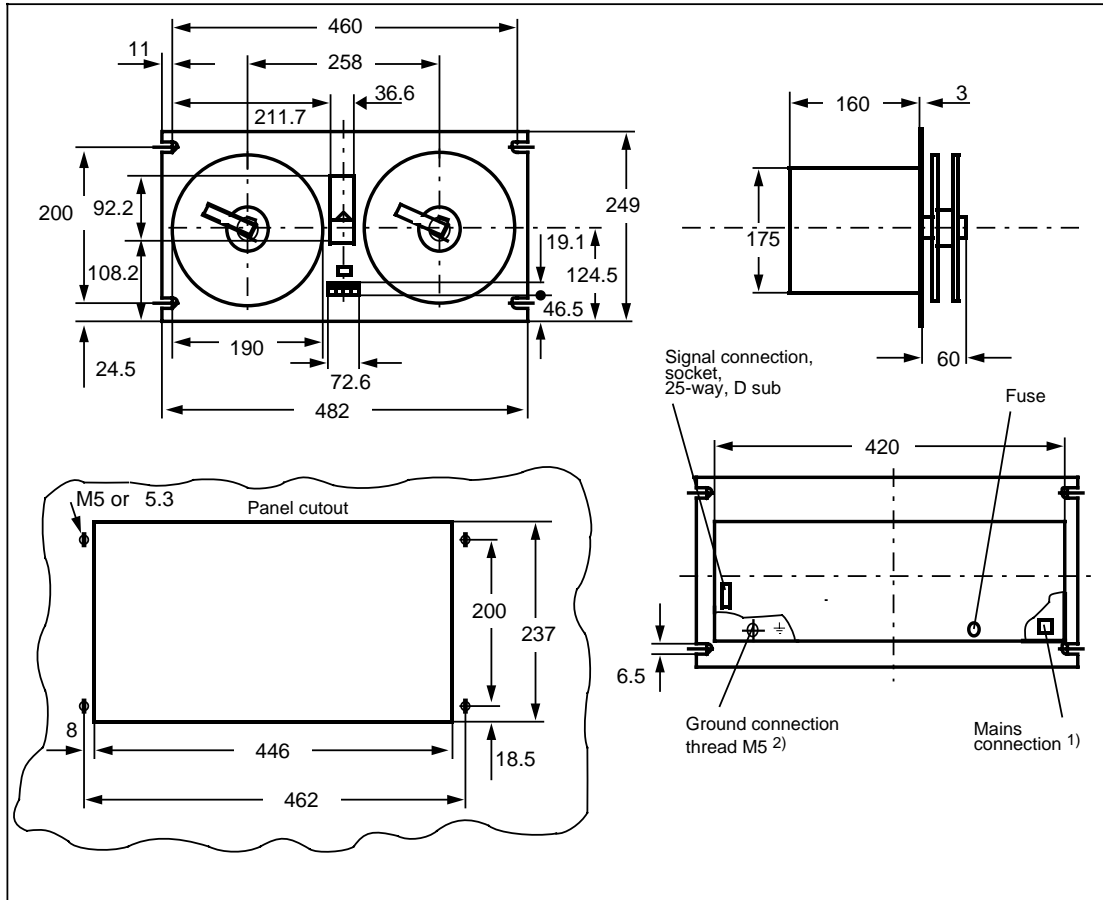
- 1) Rubber ring enclosed for endless looping
- 2) Ground symbol DIN 30600 in accordance with DIN 40011-E8

Suggested installation:



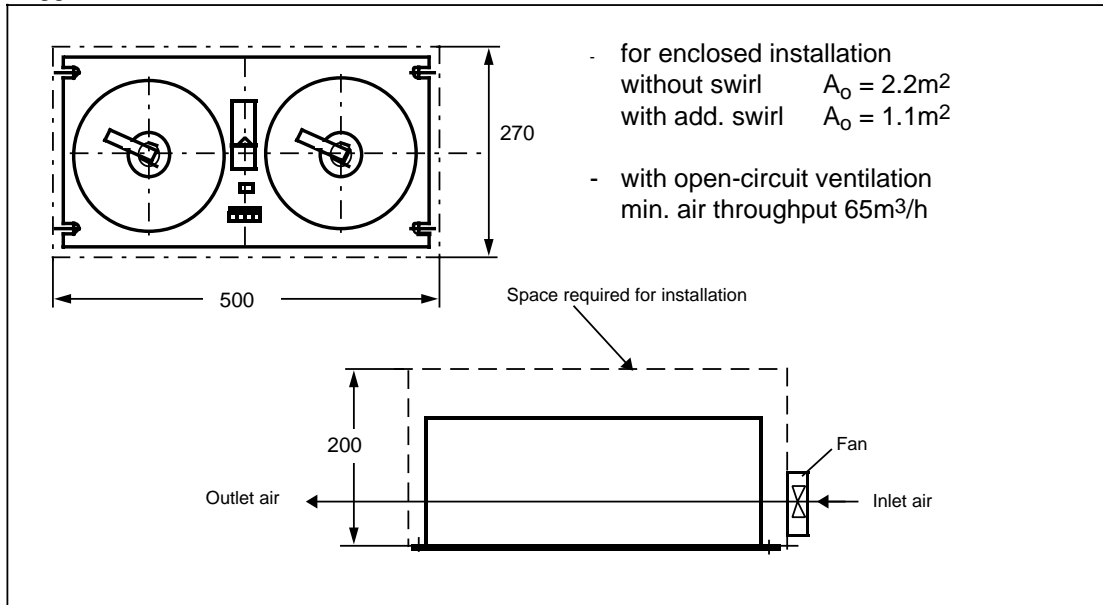
### 5.4.3 Reader T50, with winder

Order No.: 6FC3 984 - 1FD



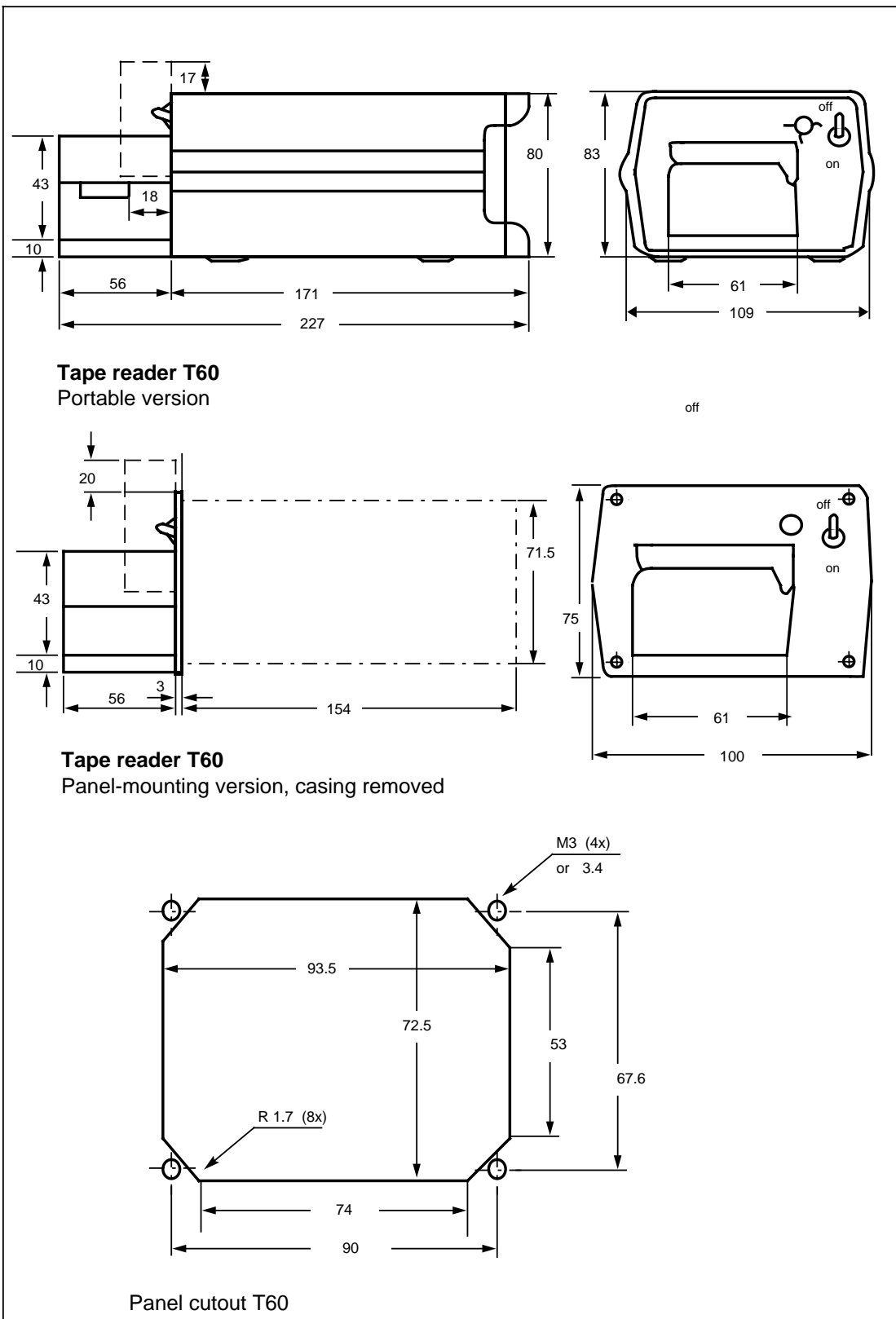
- 1) Power cable 1.1m long, free wires with sleeves
- 2) Ground symbol DIN 30600 in accordance with DIN 40011-E8

Suggested:



### 5.4.4 Reader T60, portable

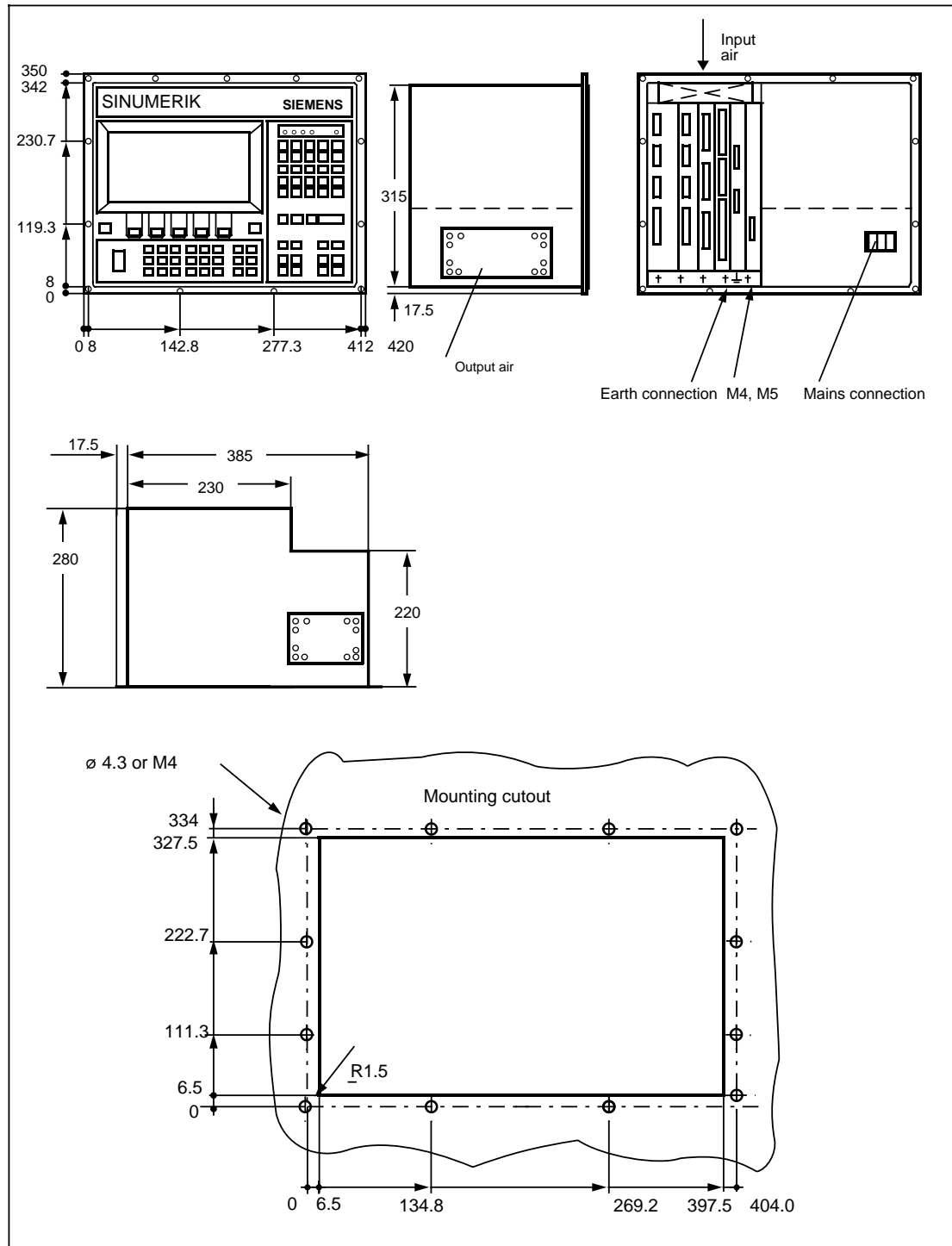
Order No.: 6FC3 984 - 1FB



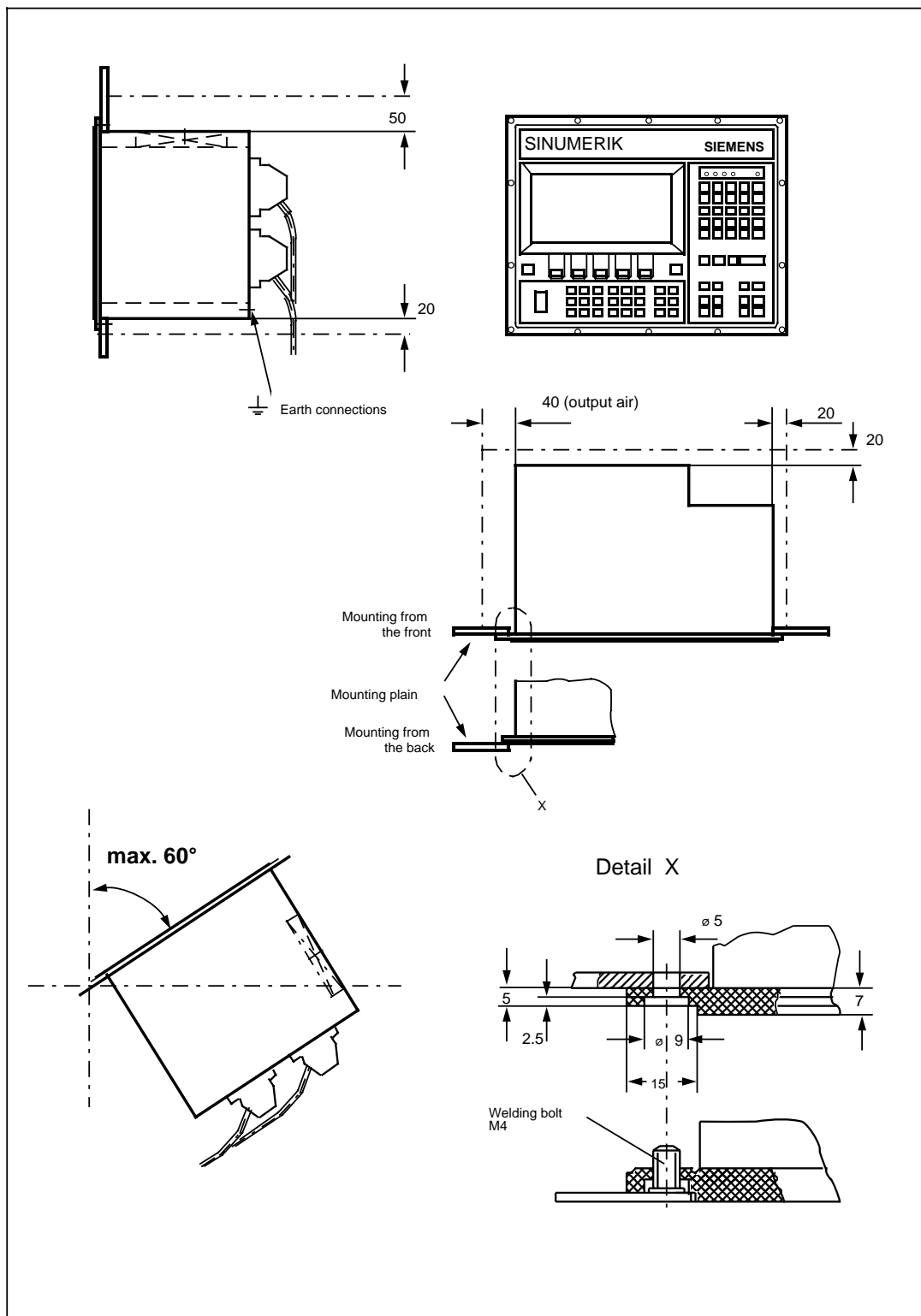
## 5.5 Operator panels

### 5.5.1 SINUMERIK 810 operator panel

- Scale diagrams

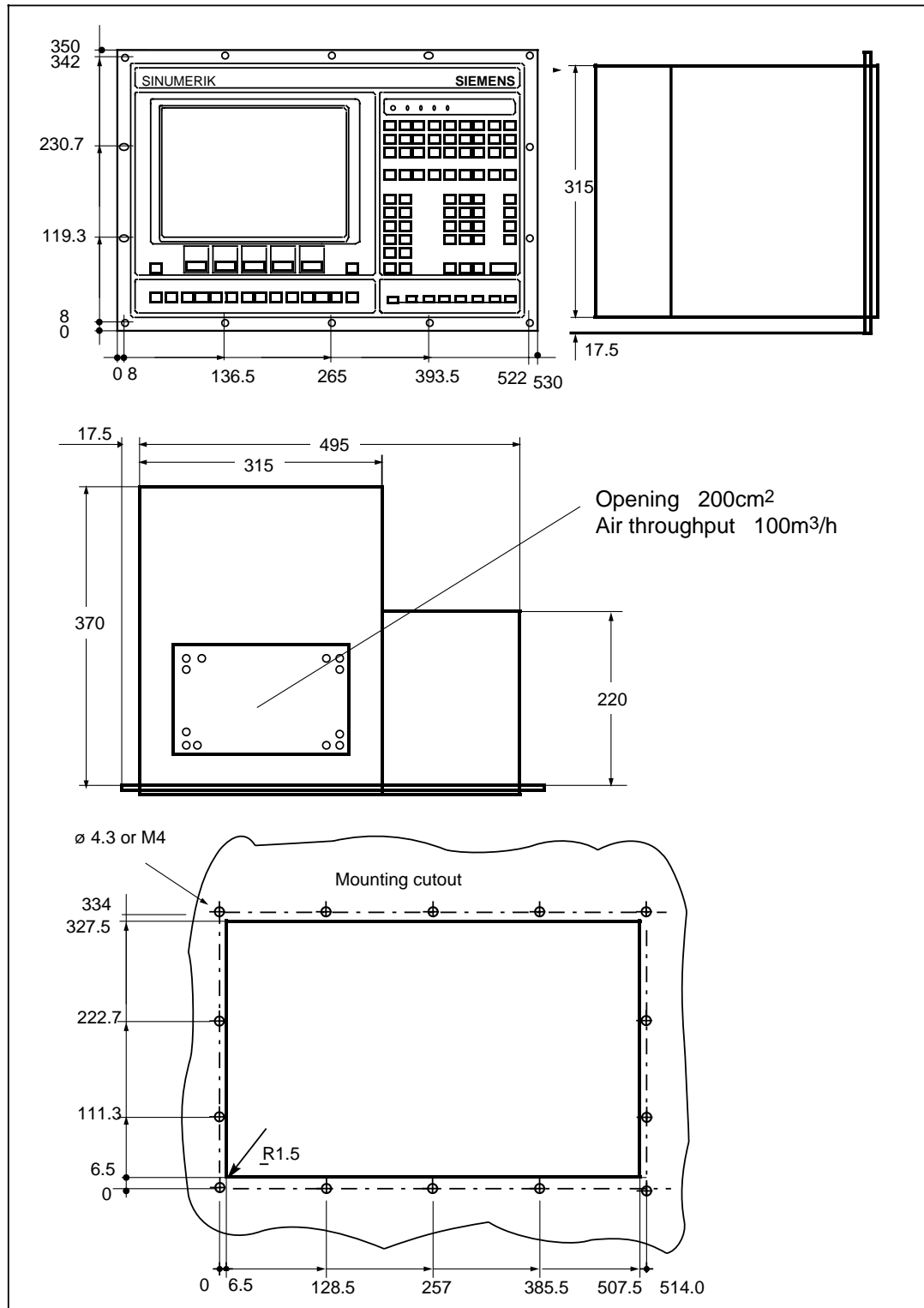


• **Mounting instructions for SINUMERIK 810**

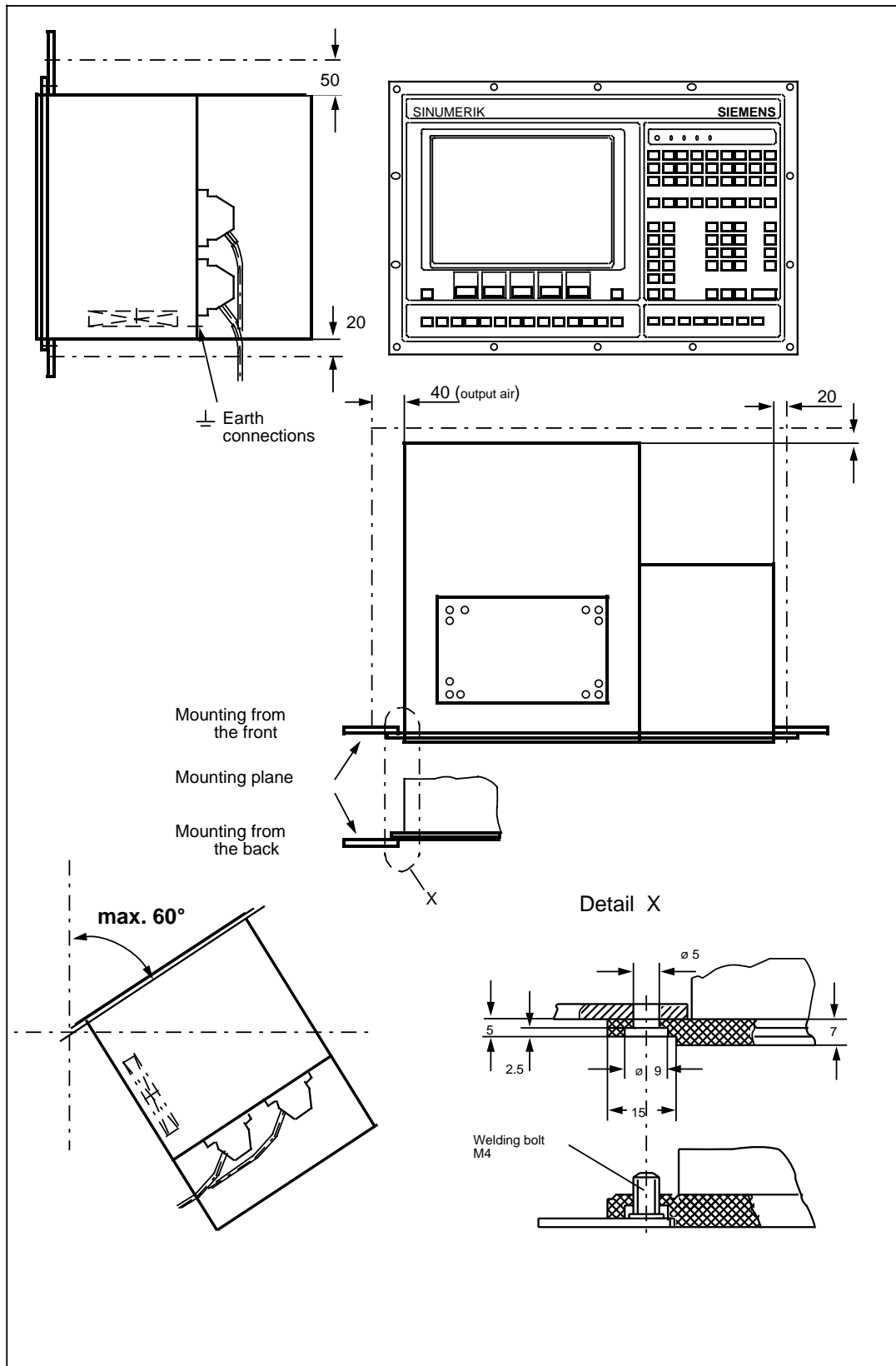


## 5.5.2 SINUMERIK 820 operator panel

- Scale diagrams

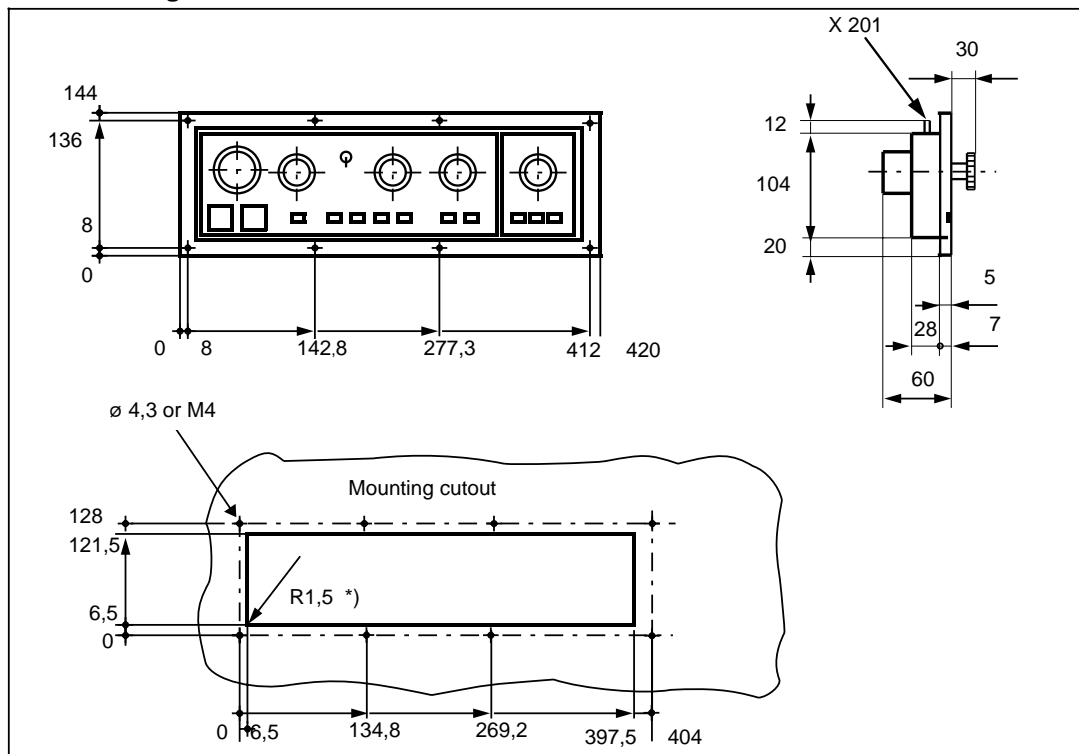


• **Mounting instructions for SINUMERIK 820**

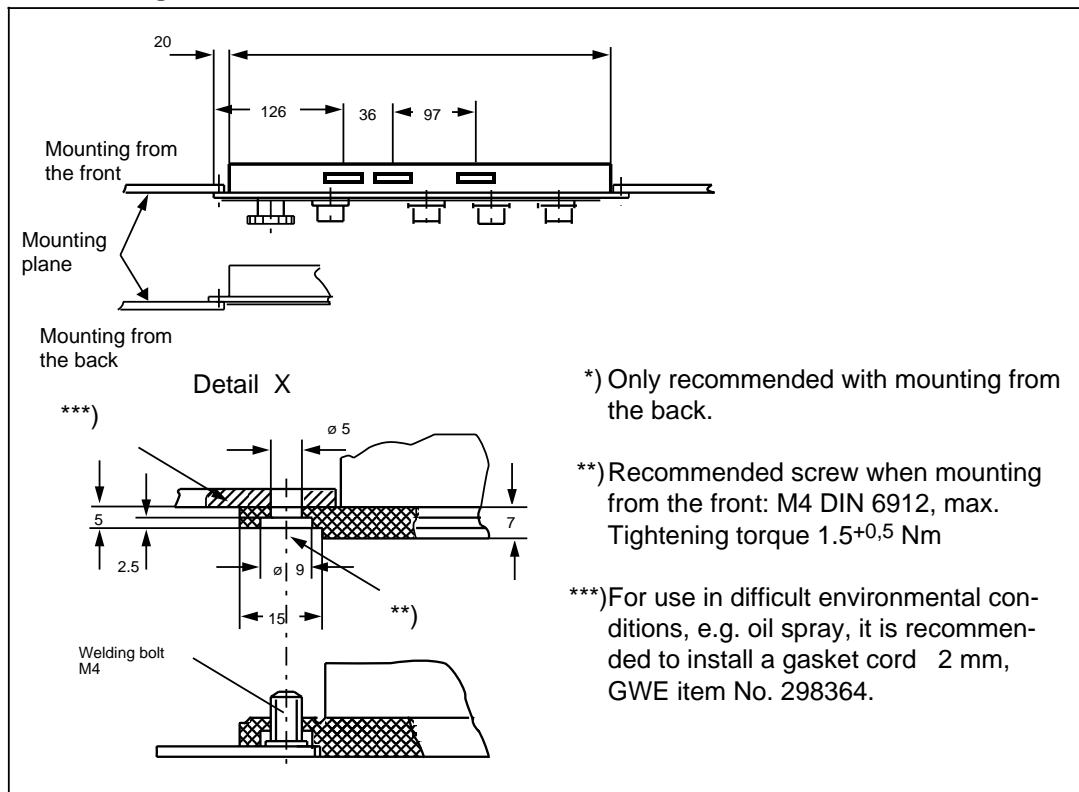


## 5.6 SINUMERIK 810 external machine control panel

### • Scale diagrams



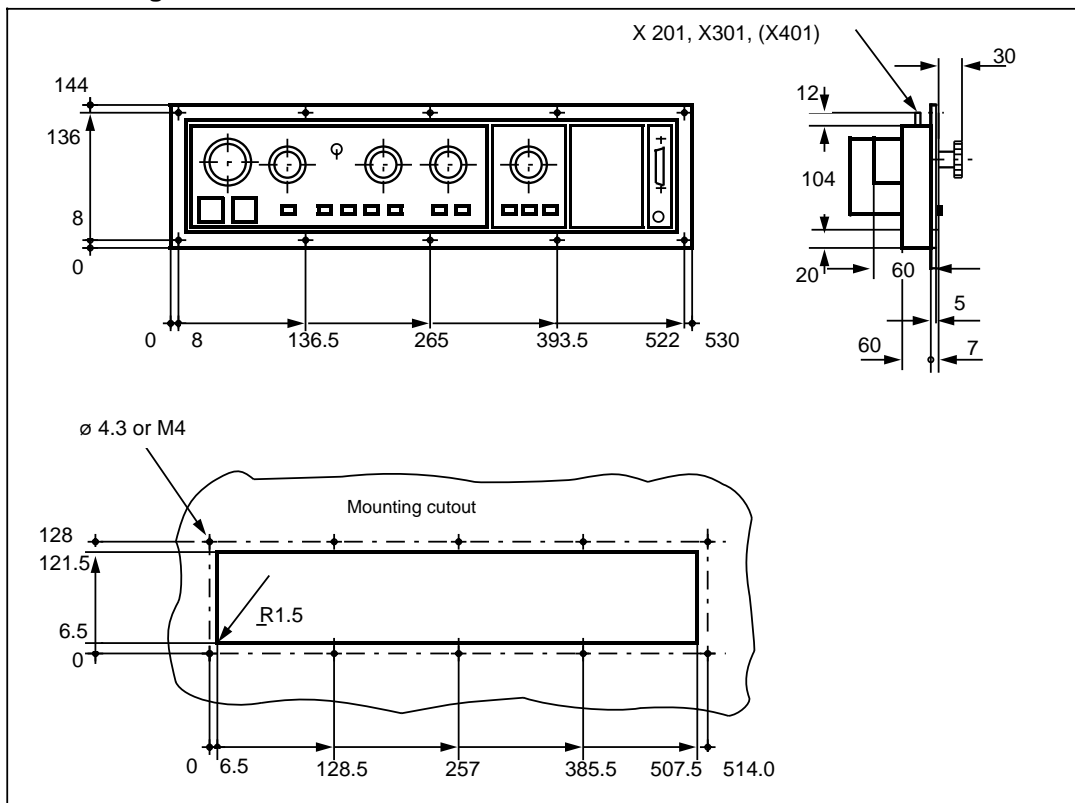
### • Mounting instructions



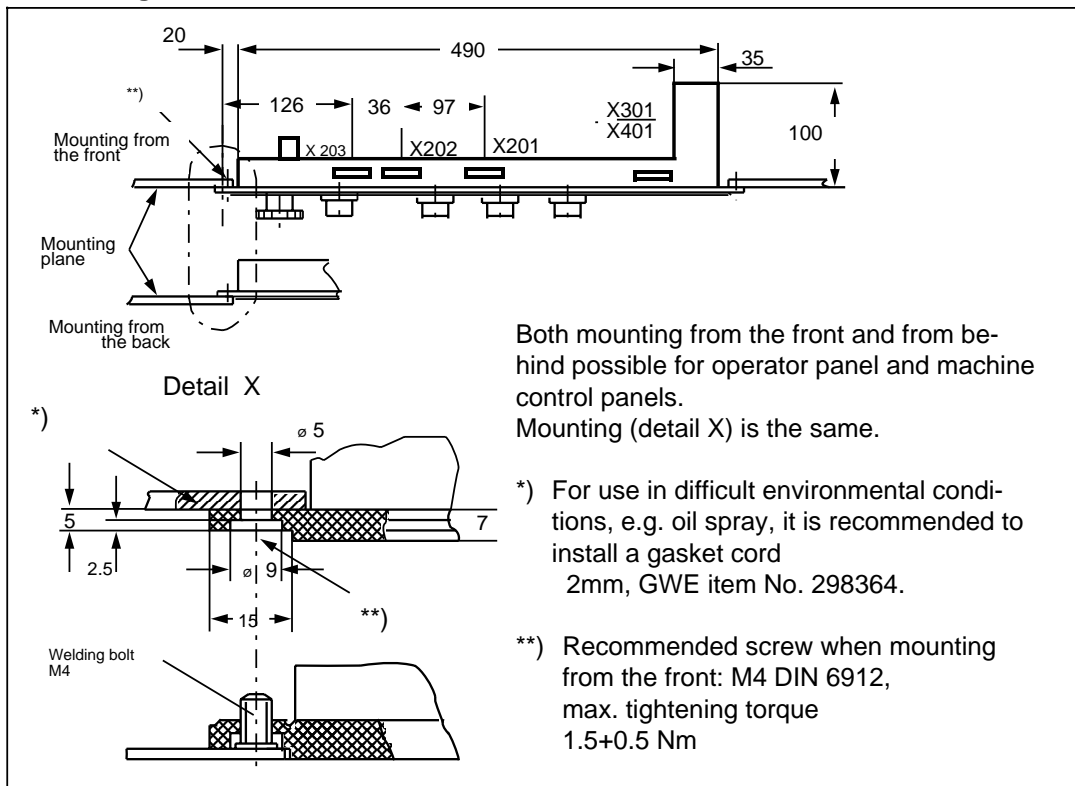


## 5.7 SINUMERIK 820 external machine control panel

### • Scale diagram

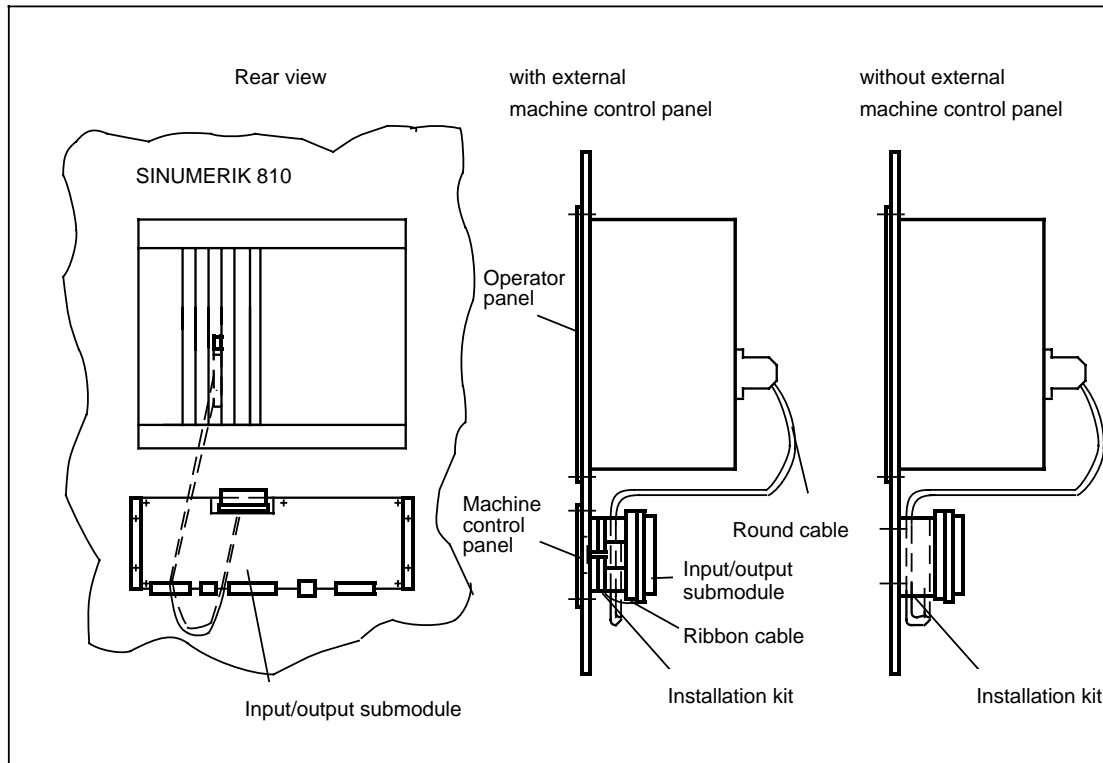


### • Mounting instructions



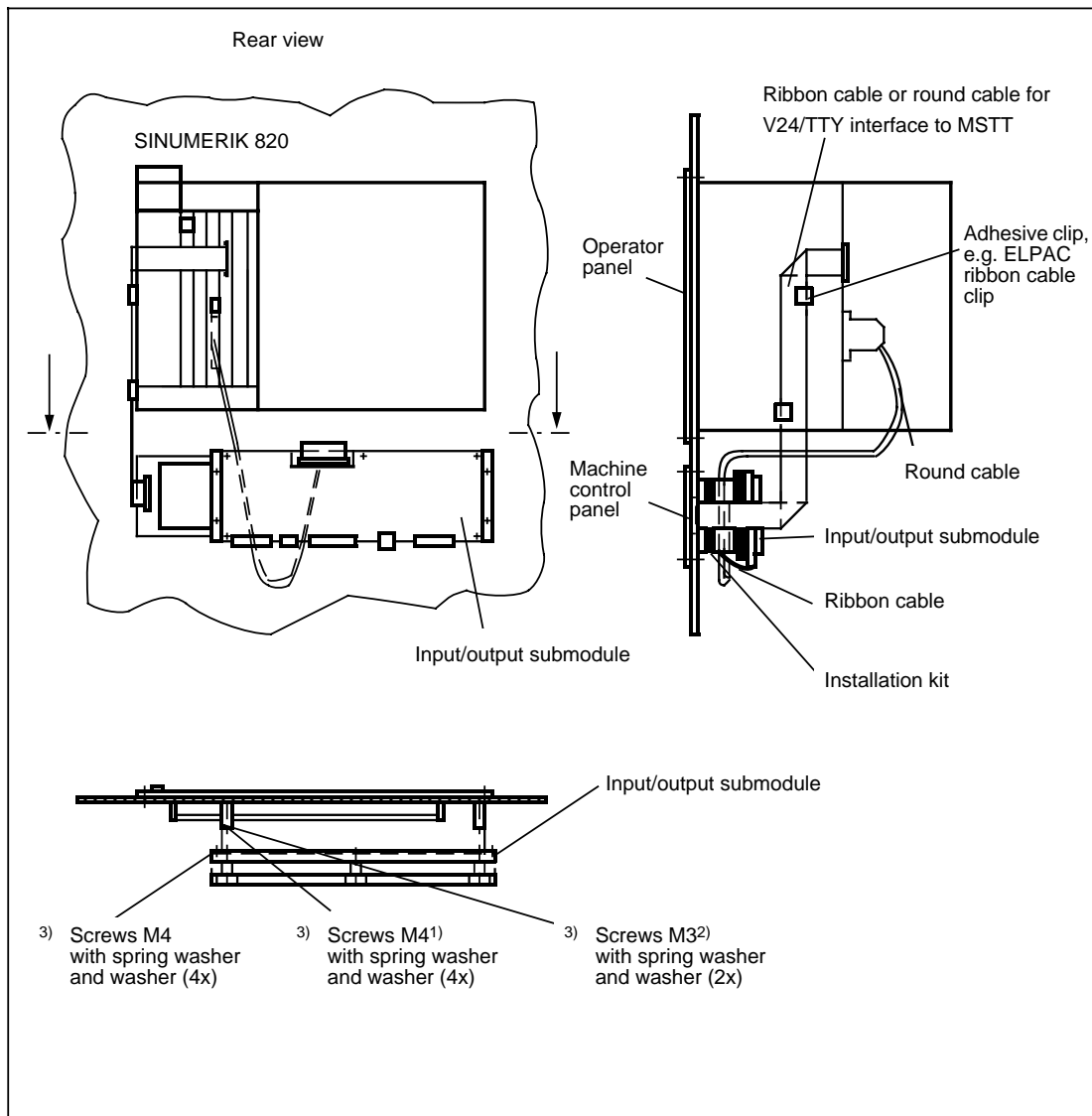
## 5.8 Positioning of I/O submodules

### 5.8.1 Examples of positioning of I/O submodules for SINUMERIK 810



## 5.8.2 Examples of positioning of I/O submodules for SINUMERIK 820

- **Assembly instructions**



1) Tightening torque: 1.8 Nm

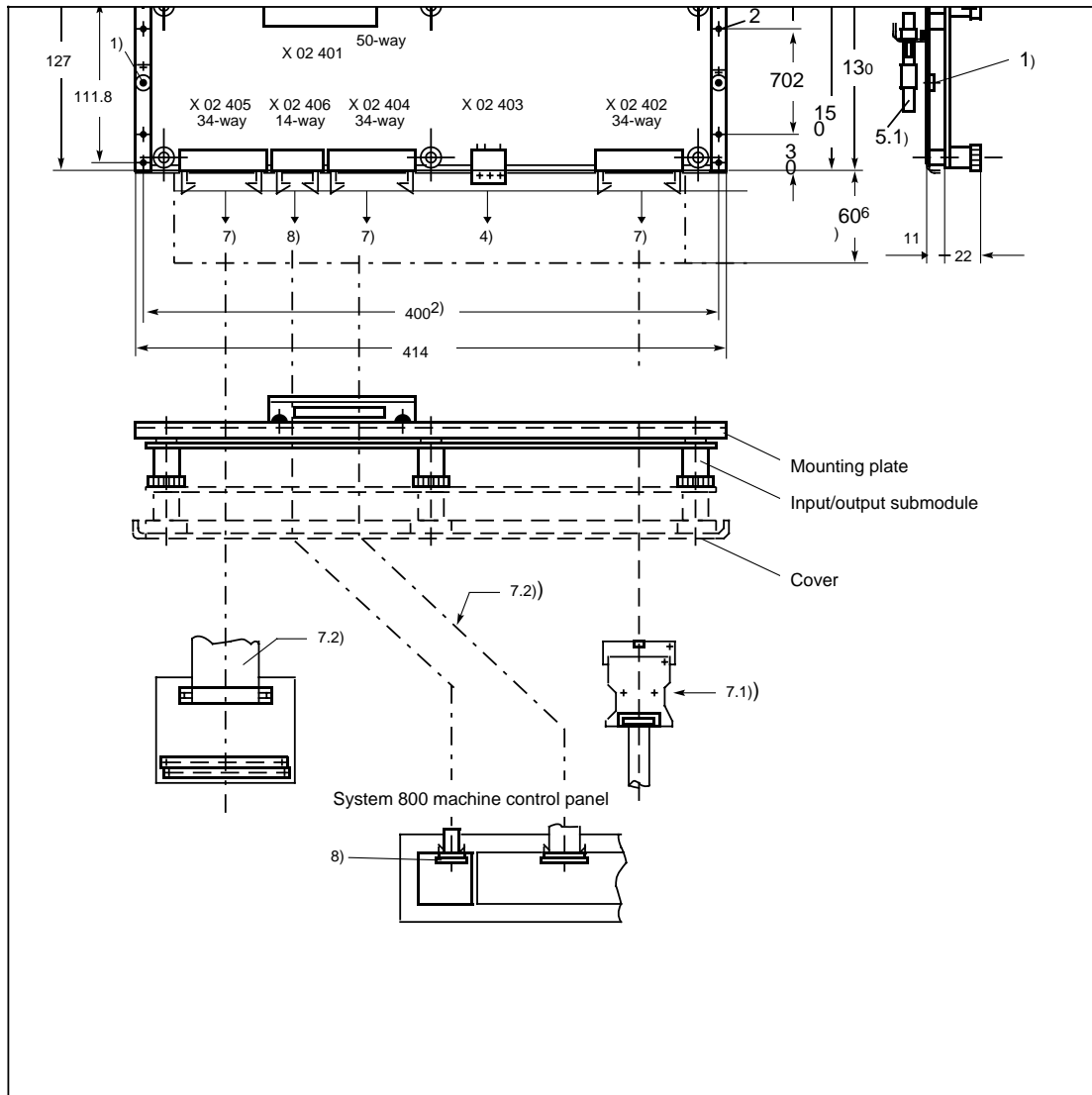
2) Tightening torque: 0.8 Nm

3) Included in the installation kit

## 5.9 I/O submodule

Order No.: 6FC3 984 - 3R  
Type: 6FX1 124 - 6A

### • Scale diagrams



1) Earth connection M5

2) Fixing hole for screws M4

3) Threaded drill hole for screws M4

4) X02403: Connection +24V,  $M_{out}$  and  $M_{ext}$  with connector max. 1.5 mm<sup>2</sup>

5) X02401 Ribbon cable, 50-way

5.1) X02401 Round cable, 50-way

6) Space requirement for connector

7) X02402, X02404, X02405: Connection to ribbon cable connector, 34-way Recommended type of connection:

7.1) Via connector

7.2) Via Siemens ribbon cable, 34-way

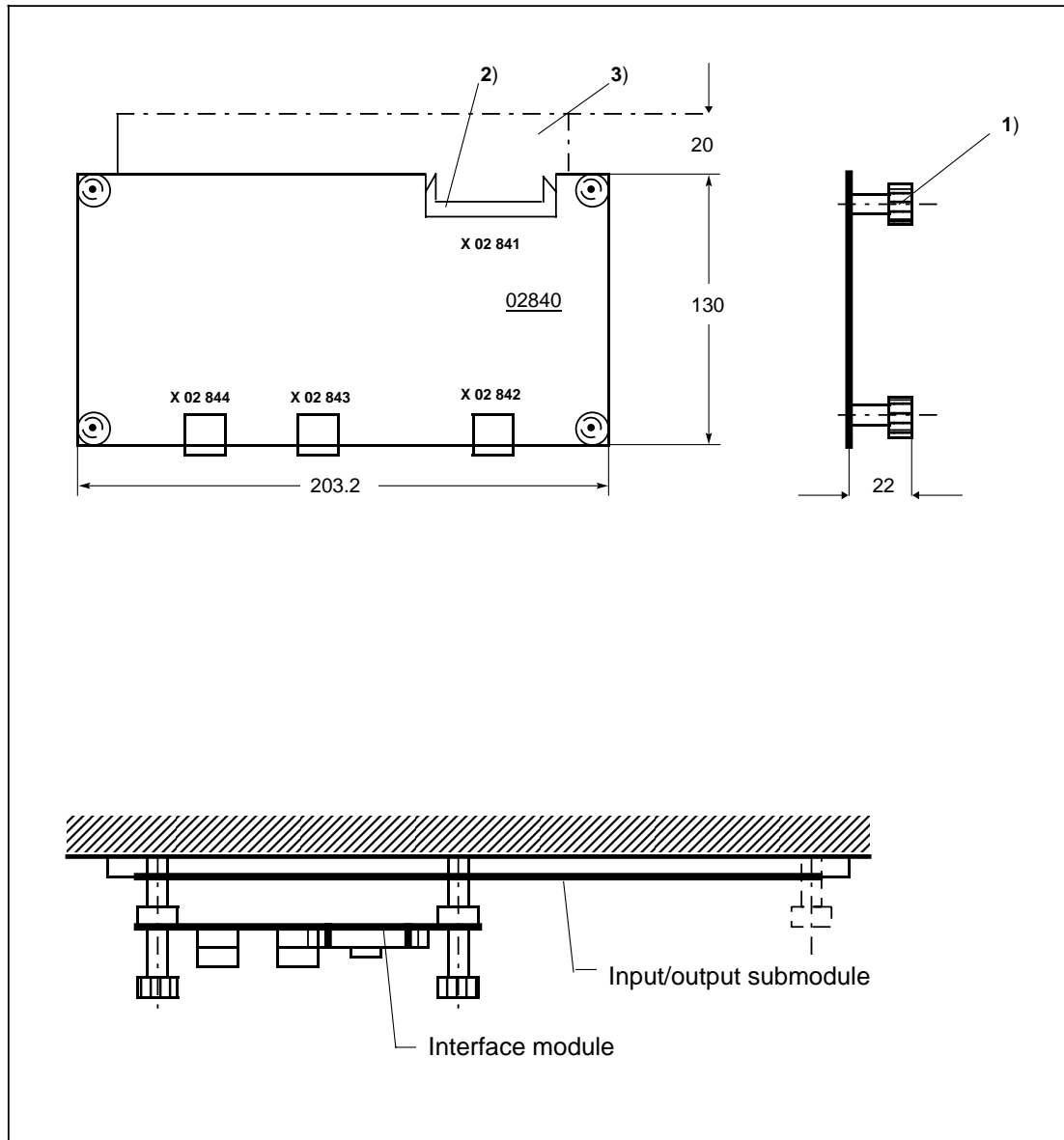
7.3) Via Siemens ribbon cable, 34-way

8) X02406: Connection to ribbon cable connector, 14-way, via Siemens ribbon cable

## 5.10 Interface module for electronic handwheels

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

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

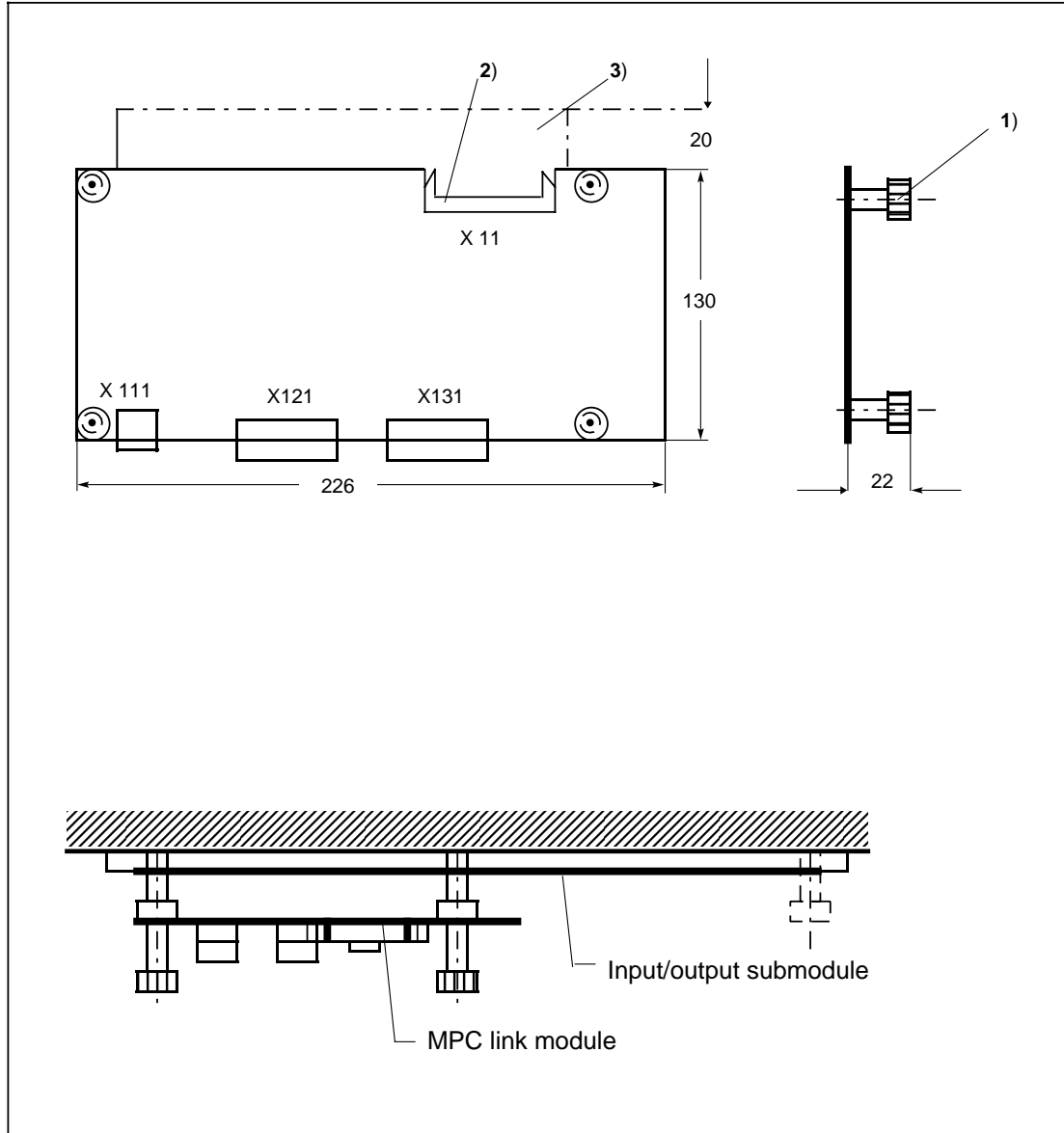


- 1) Threaded drill hole for screws M4
- 2) 02 841: Ribbon cable
- 3) Space requirement for connector

## 5.11 MPC link module for distributed link connection of the I/O submodule

Order No.: 6FC3 984 - 4FH  
 Type: 6FX1 136 - 2BA01

Up to 4 I/O submodules can be connected to the link module.



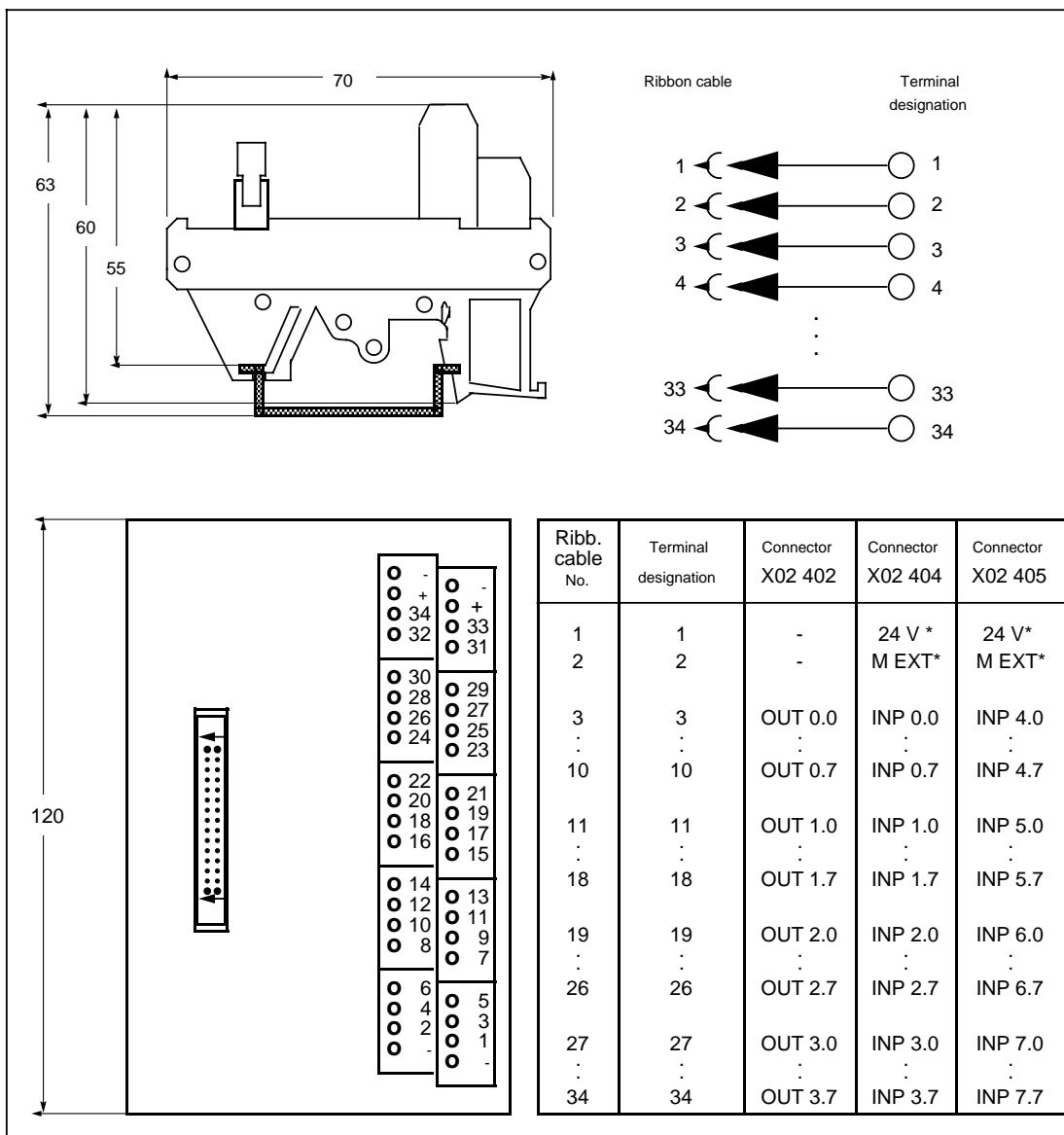
- 1) Threaded drill hole for screws M4
- 2) Ribbon cable: 50-way
- 3) Space requirement for connector

## 5.12 Terminal strip converters

- Terminal strip converters without LEDs, for I/O submodule

Order No.: 6FC9 302-2AA

Rated voltage:	24 V DC
Number of signals led through:	34
Rated current:	0.5 A (x 34 terminals)
Connection technique:	34-way ribbon cable/screw connection
Nominal cross section:	1.5 mm <sup>2</sup> (screw connection)
Printed designation:	SIEMENS 6FC 9302 AA
Latching base:	TS 32/TS 35
Colour:	RAL 7032

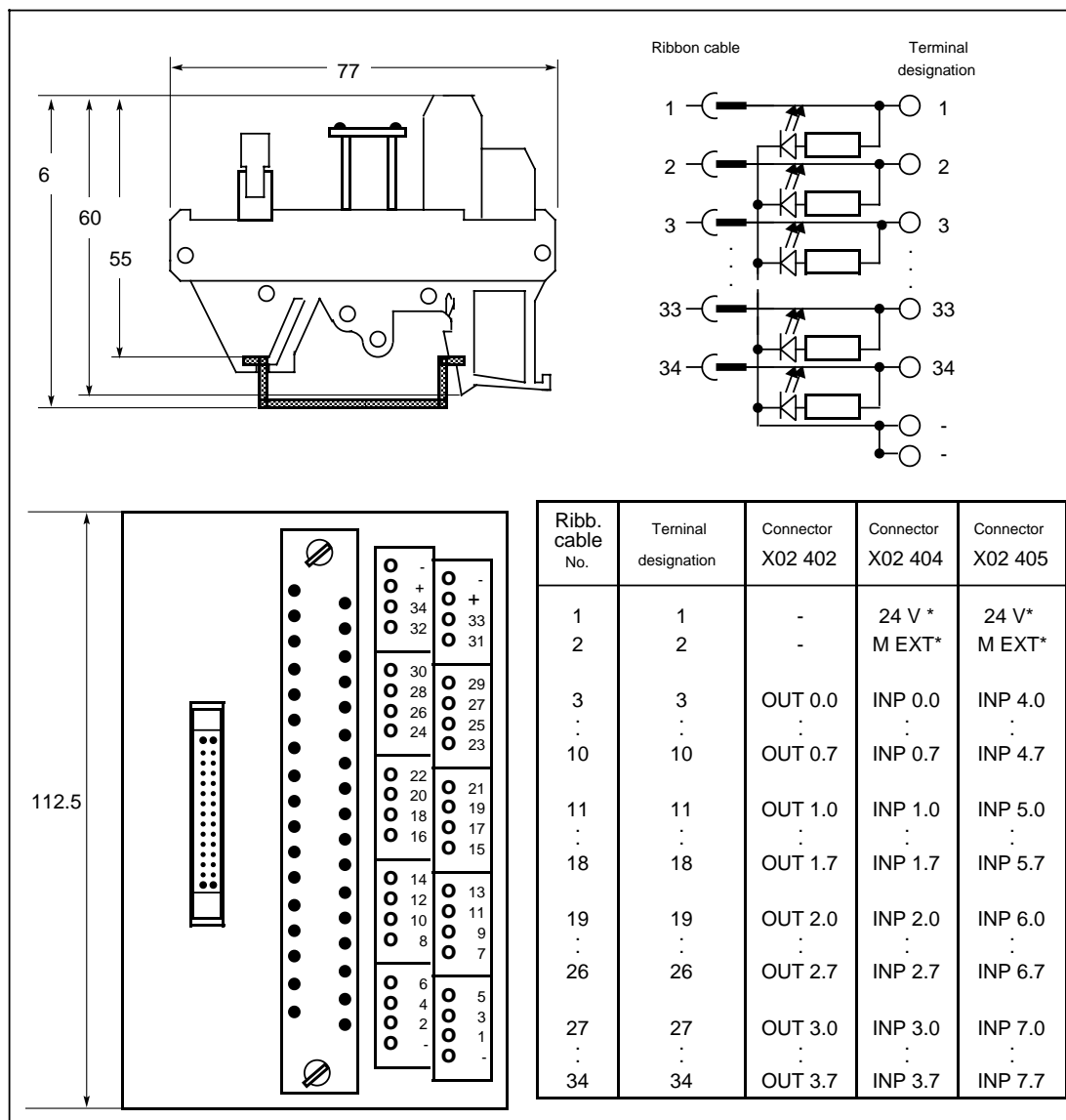


\* only for internal use - terminal must not be loaded

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

Order No.: 6FC9 302-2AB

Rated voltage:	24 V DC
Number of signals led through:	34
Rated current:	0.5 A (x 34 terminals)
LED display, red:	34-fold (plugged in, exchangeable)
LED current:	approx. 5 mA
Connection technique:	34-way ribbon cable/screw connection
Nominal cross section:	1.5 mm <sup>2</sup> (screw connection)
Printed designation:	SIEMENS 6FC 9302 AB
Latching base:	TS 32/TS 35
Colour:	RAL 7032



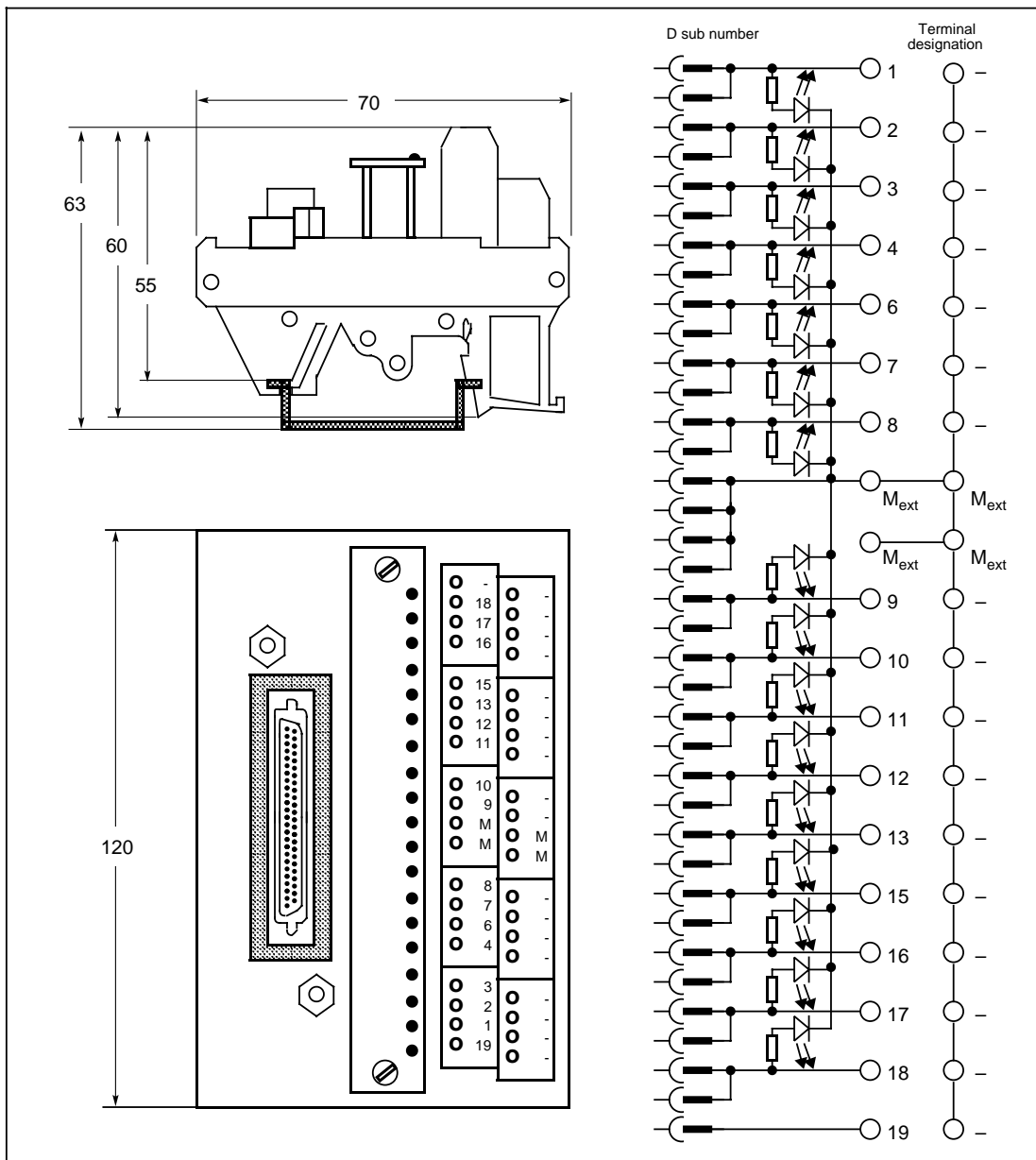
\* only for internal use - terminal must not be loaded



• Terminal strip converters with LEDs, for output board

Order No.: 6FC9 302-2AK

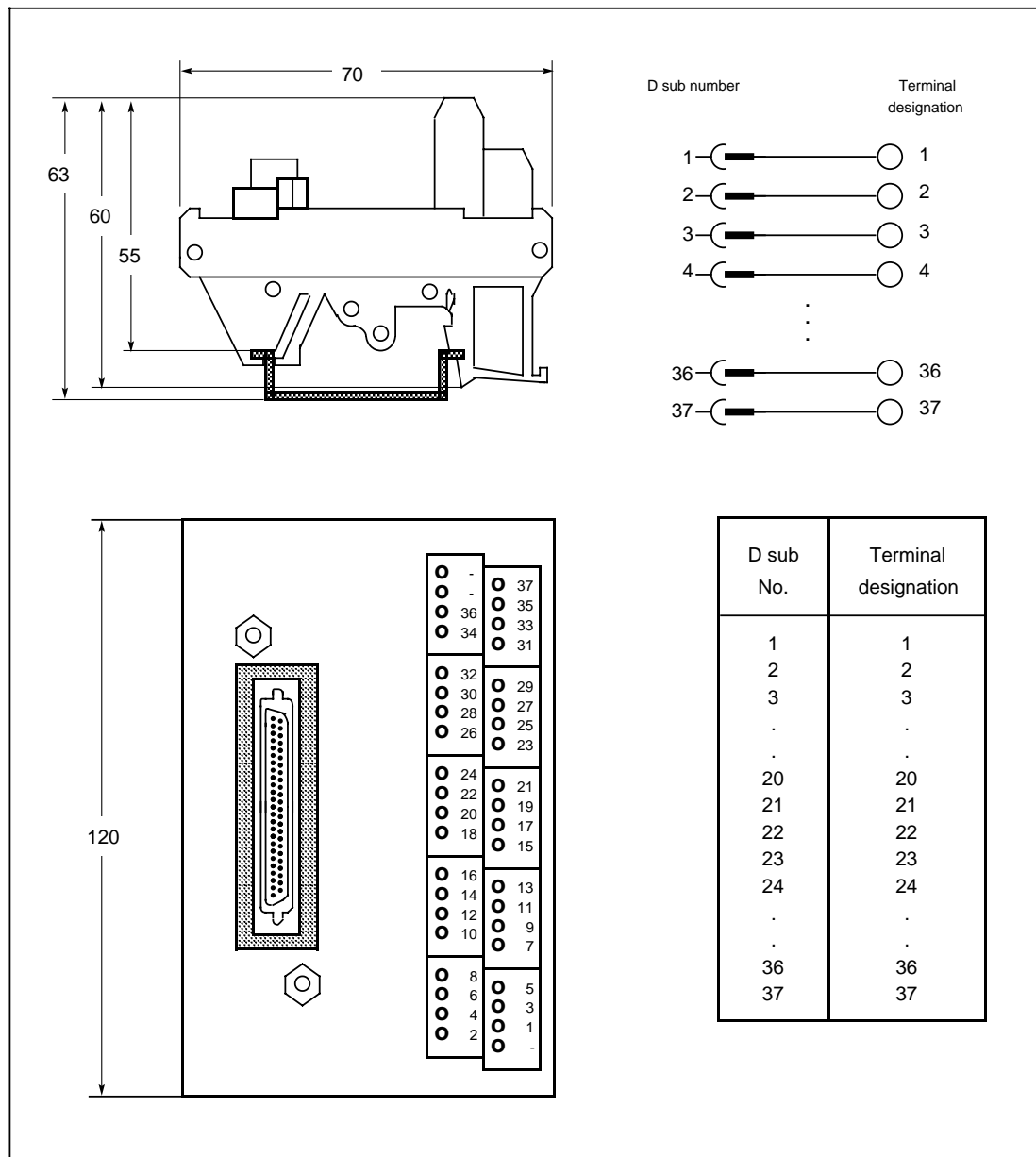
Rated voltage:	24 V DC
Number of signals led through:	16
Rated current:	2 A (x 16 terminals)
LED display, red:	16-fold
LED current:	5 mA
Connection technique:	37-way D sub male/screw connection
Nominal cross section:	1.5 mm <sup>2</sup> (screw connection)
Printed designation:	SIEMENS 6FC 9302 AK
Latching base:	TS 32/TS 35
Colour:	RAL 7032



• **Terminal strip converters without LEDs, for input board**

Order No.: 6FC 9302-2AC

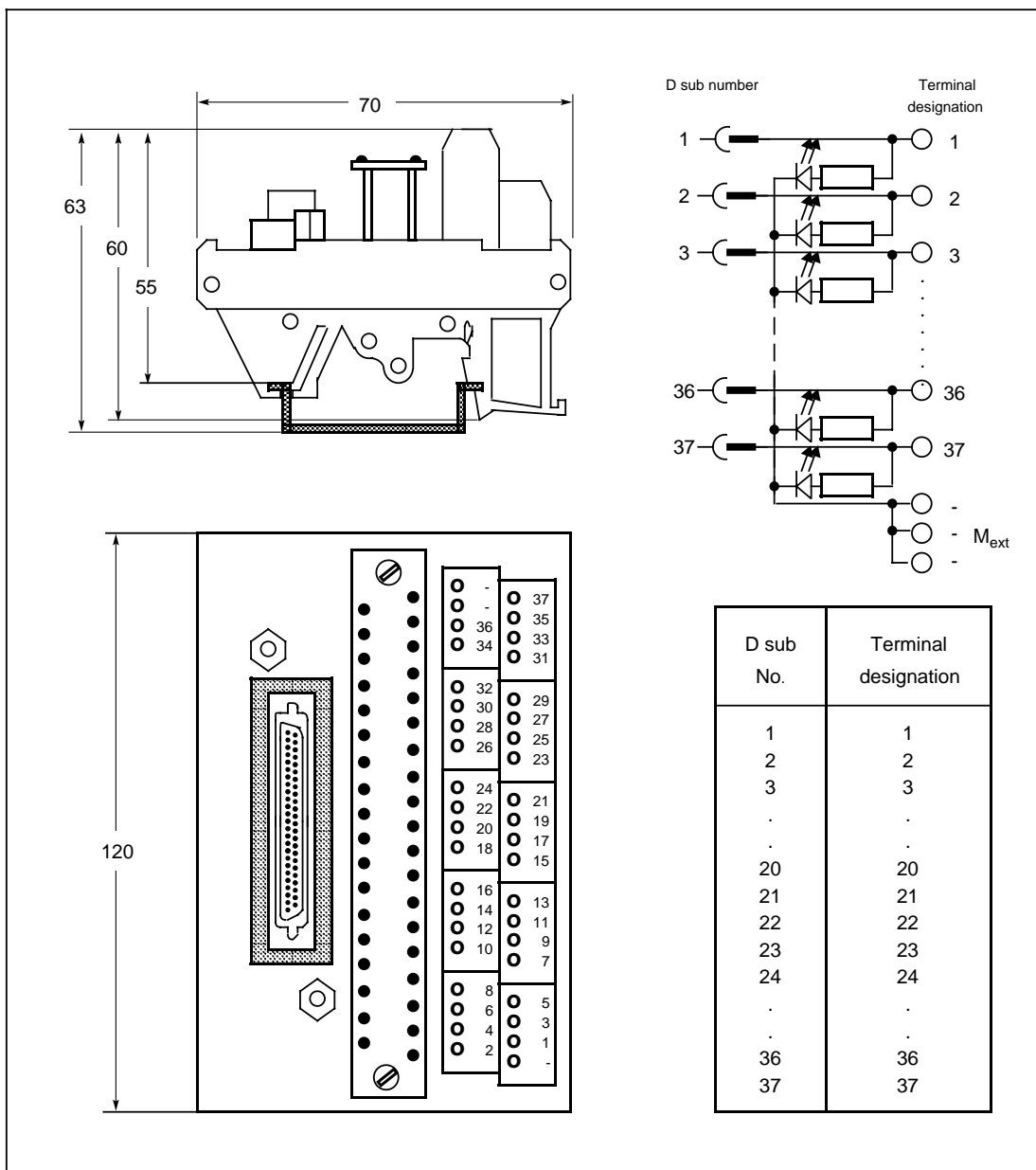
Rated voltage: 24 V DC  
 Number of signals led through: 37  
 Rated current: 0.5 A (x 37 terminals)  
 Connection technique: 37-way D sub male/screw connection  
 Nominal cross section: 1.5 mm<sup>2</sup> (screw connection)  
 Printed designation: SIEMENS 6FC 9302 AC  
 Latching base: TS 32/TS 35  
 Colour: RAL 7032



• **Terminal strip converter with LEDs, for input board**

Order No.: 6FC 9302-2AD

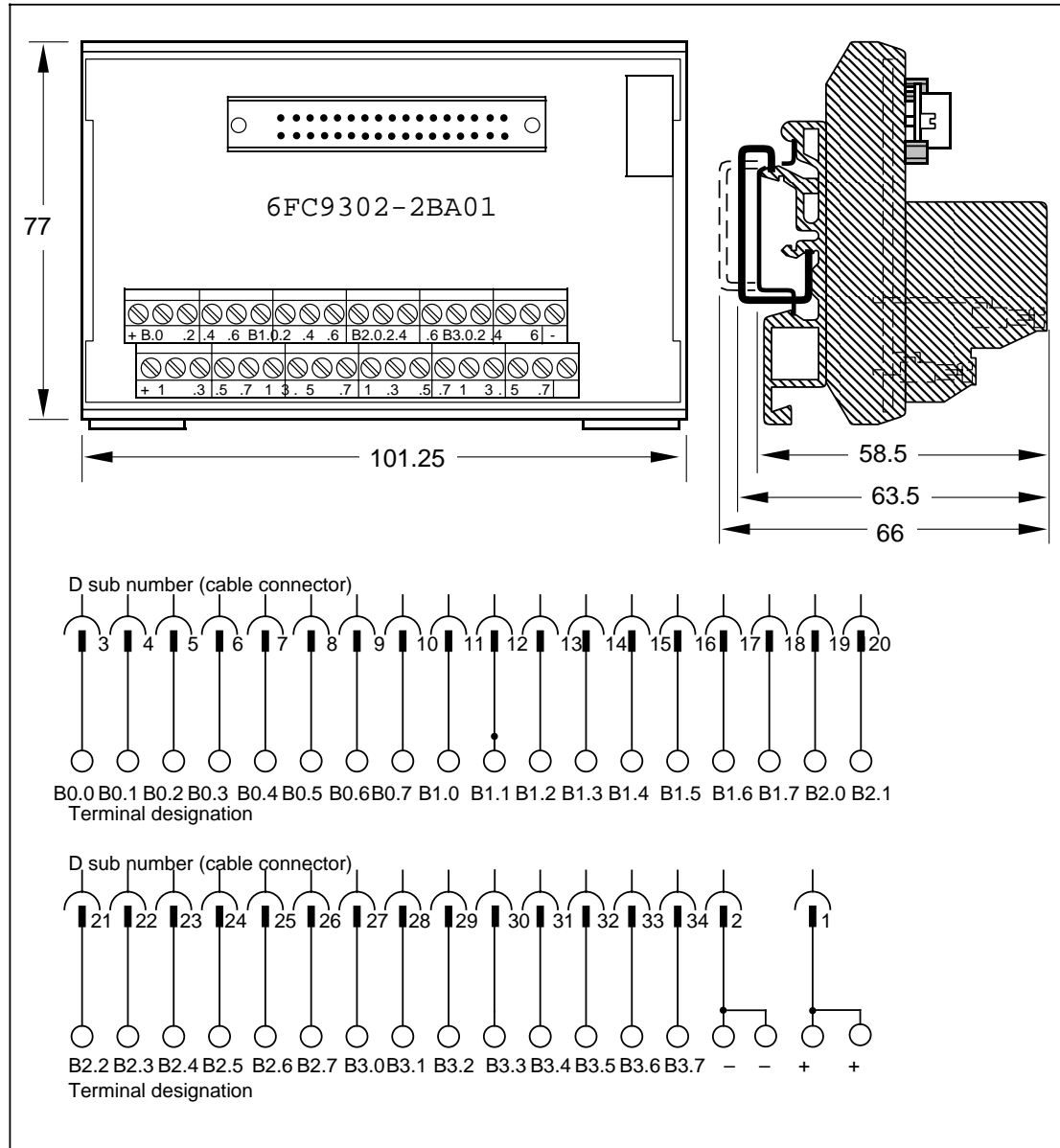
Rated voltage:	24 V DC
Number of signals led through:	37
Rated current:	0.5 A (x 37 terminals)
LED display, red:	37-fold (plugged in, exchangeable)
LED current:	ca. 5 mA
Connection technique:	37-way sub male/screw connection
Nominal cross section:	1.5 mm <sup>2</sup> (screw connection)
Printed designation:	SIEMENS 6FC 9302 AD
Latching base:	TS 32/TS 35
Colour:	RAL 7032



• **Terminal strip converter without LEDs, for I/O submodule (M01 ... M04)**

Order No.: 6FC 9302-2BA01

Rated voltage: 24 V DC  
 Number of signals led through: 34  
 Rated current: 0.5 A (x 34 terminals)  
 Connection technique: 34-way 4-way ribbon cable/screw connection  
 Nominal cross section: 1.5 mm<sup>2</sup> (screw connection)  
 Printed designation: SIEMENS 6FC 9302-2BA  
 Latching base: TS 32/TS 35  
 Colour: RAL 7032



• Terminal strip converter with LEDs, for I/O submodule (M01 ... M04)

Order No.: 6FC 9302-2BB01

Rated voltage: 24 V DC

Number of signals led through: 34

Rated current: 0.5 A (x 34 terminals)

LED display, green: 34-fold (plugged in, exchangeable)

LED current: approx. 5 mA

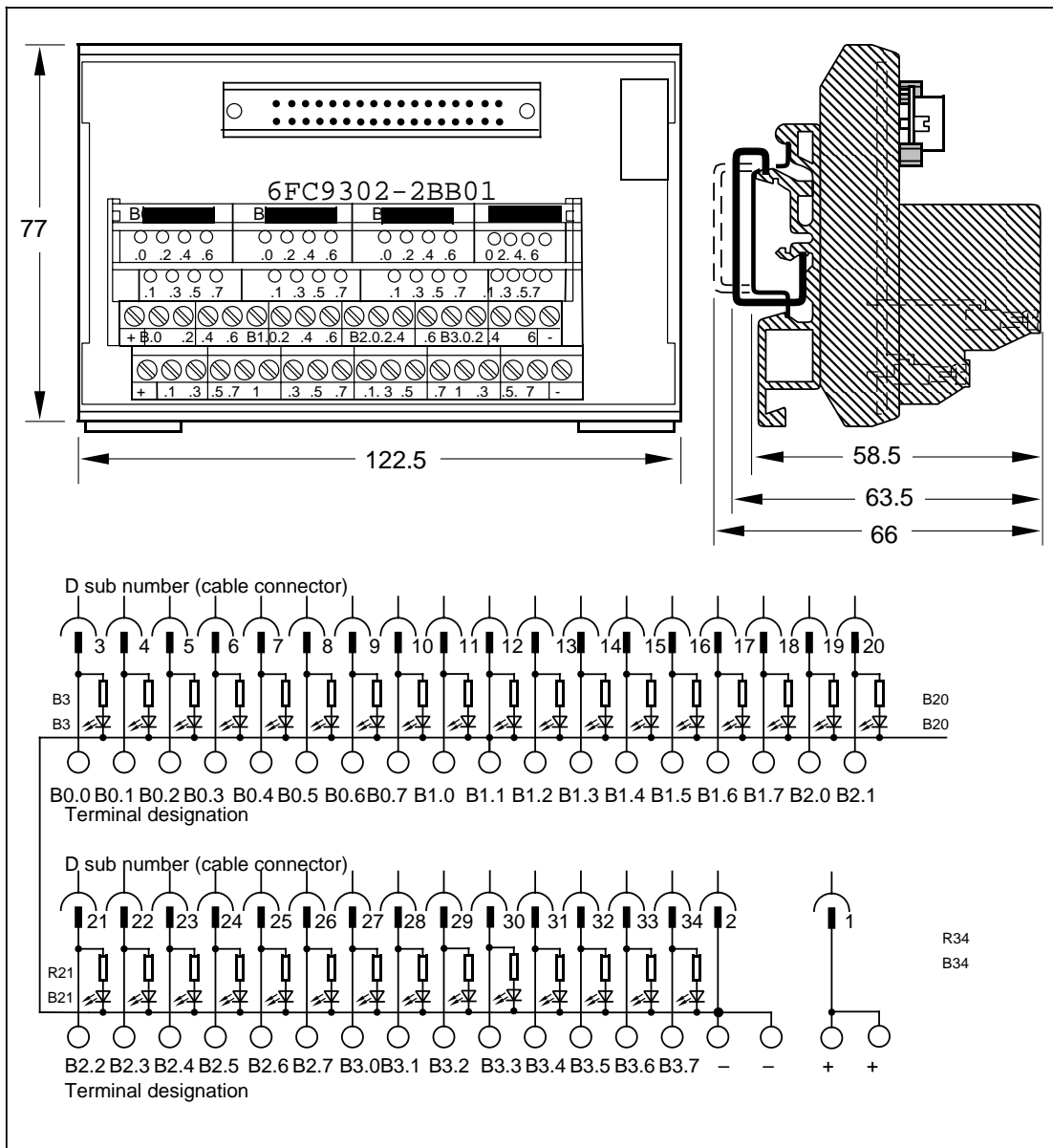
Connection technique: 34-way ribbon cable/screw connection

Nominal cross section: 1.5 mm<sup>2</sup> (screw connection)

Printed designation: SIEMENS 6FC 9302 -2BB

Latching base: TS 32/TS 35

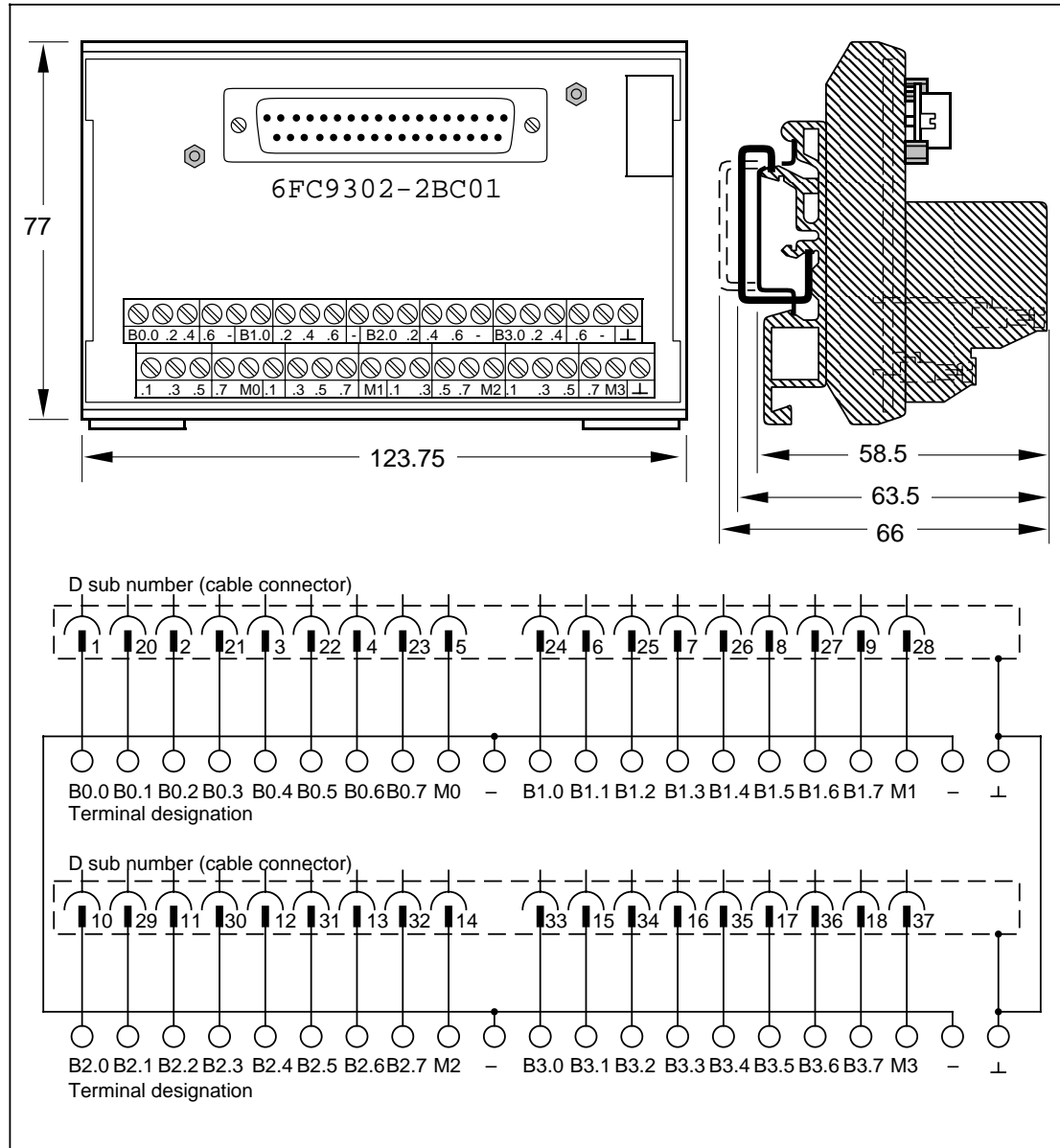
Colour: RAL 7032



• **Terminal strip converters without LEDs, for input board (N71)**

Order No.: 6FC 9302-2BC01

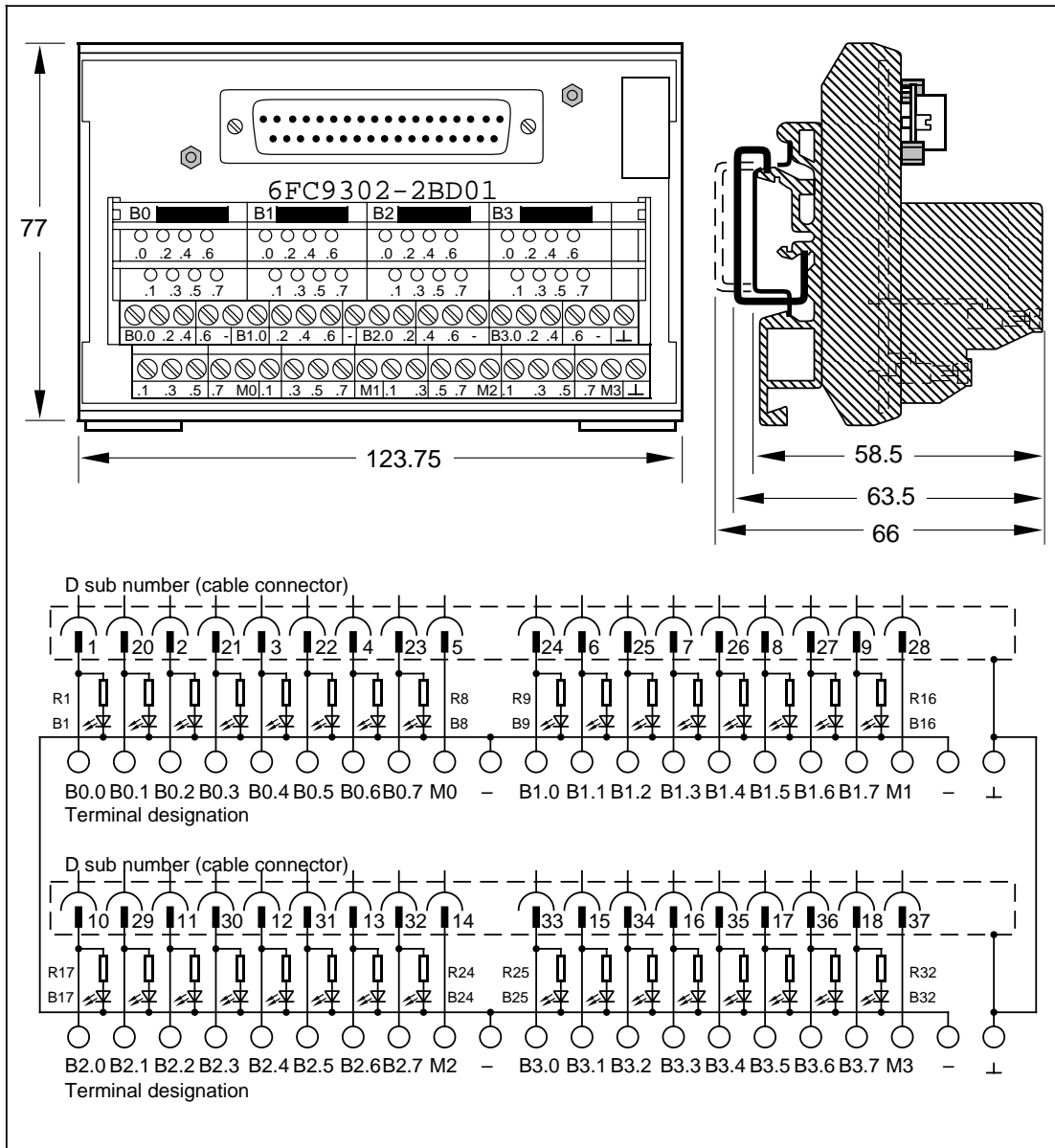
Rated voltage: 24 V DC  
 Number of signals led through: 37  
 Rated current: 0.5 A (x 37 terminals)  
 Connection technique: 37-way D sub male/screw connection  
 Nominal cross section: 1.5 mm<sup>2</sup> (screw connection)  
 Printed designation: SIEMENS 6FC 9302-2BC  
 Latching base: TS 32/TS 35  
 Colour: RAL 7032



• **Terminal strip converter with LEDs, for input board (N71)**

Order No.: 6FC 9302-2BD01

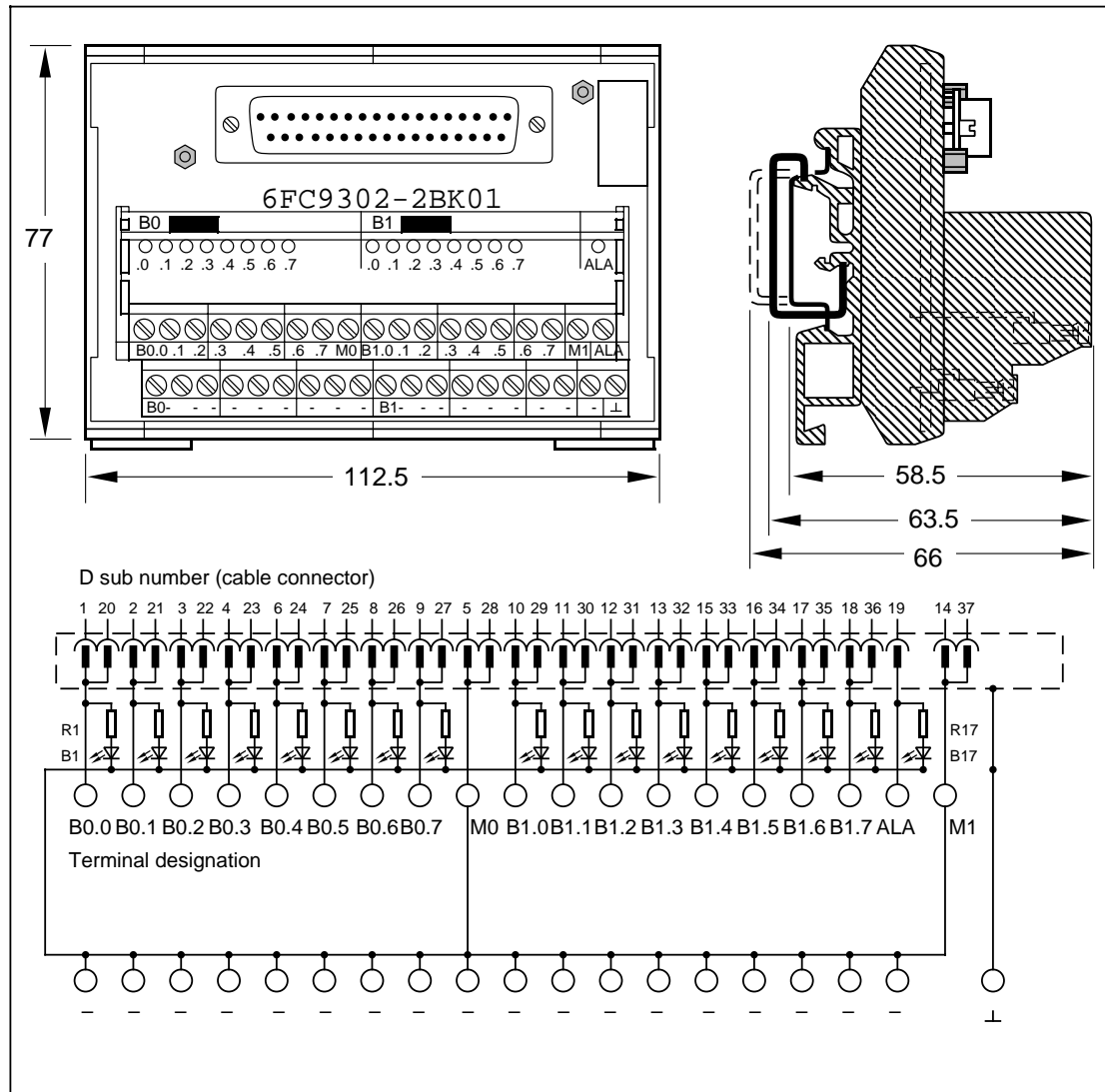
Rated voltage:	24 V DC
Number of signals led through:	37
Rated current:	0,5 A (x 37 terminals)
LED display, green:	37-way (plugged in, exchangeable)
LED current:	approx. 5 mA
Connection technique:	37-way D sub male/screw connection
Nominal cross section:	1.5 mm <sup>2</sup> (screw connection)
Printed designation:	SIEMENS 6FC 9302-2BD
Latching base:	TS 32/TS 35
Colour:	RAL 7032



• **Terminal strip converter with LEDs, for output module (N72, N73)**

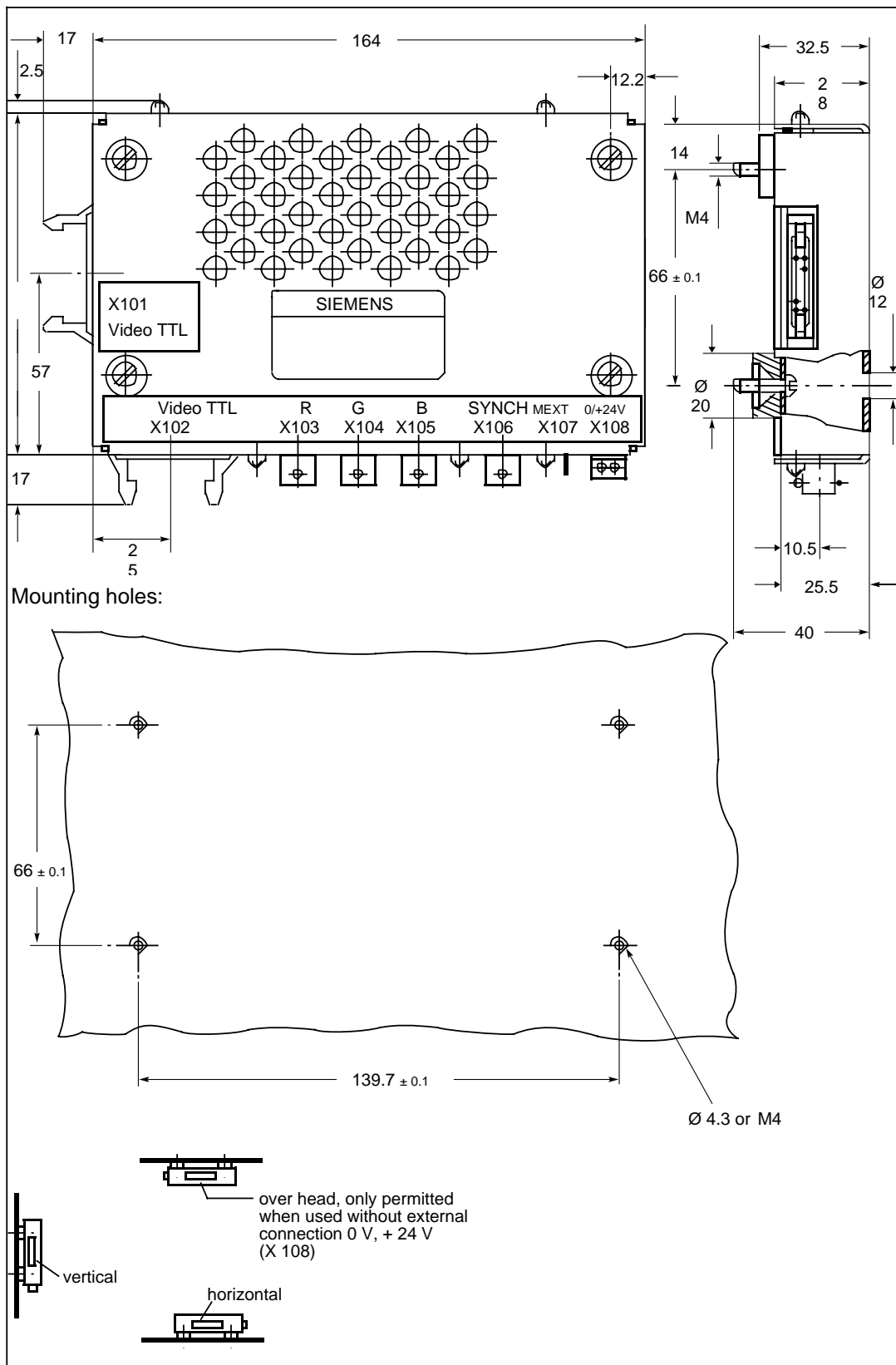
Order No.: 6FC9 302-2BK01

Rated voltage:	24 V DC
Number of signals led through:	16
Rated current:	2 A (x 16 terminals)
LED display, green:	16-fold
LED current:	5 mA
Connection technique:	37-way D sub male/screw connection
Nominal cross section:	1.5 mm <sup>2</sup> (screw connection)
Printed designation:	SIEMENS 6FC 9302-2BK
Latching base:	TS 32/TS 35
Colour:	RAL 7032





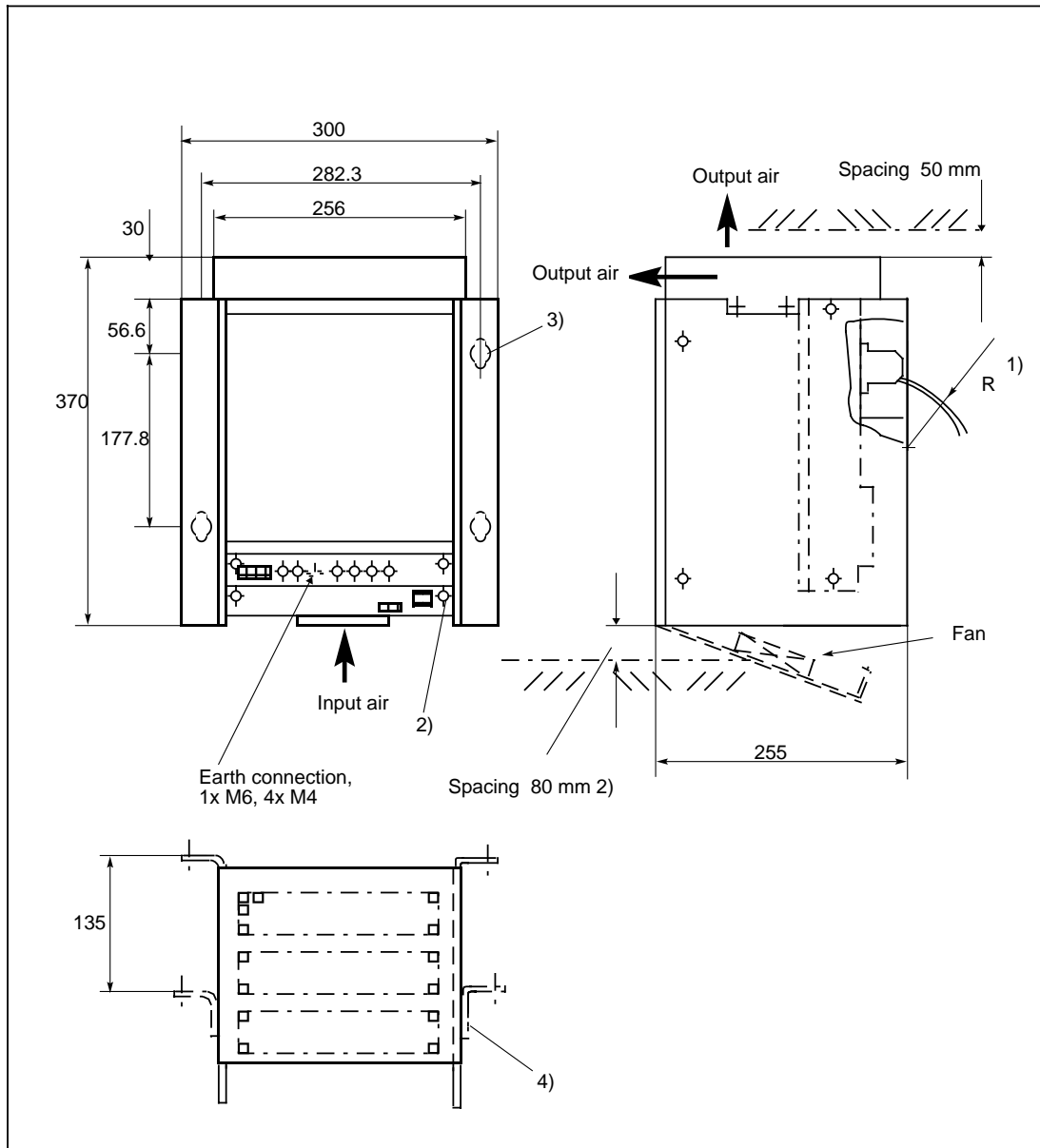
### 5.13 Video encoder



## 5.14 PLC expansion unit

### 5.14.1 PLC expansion unit (Mini EU)

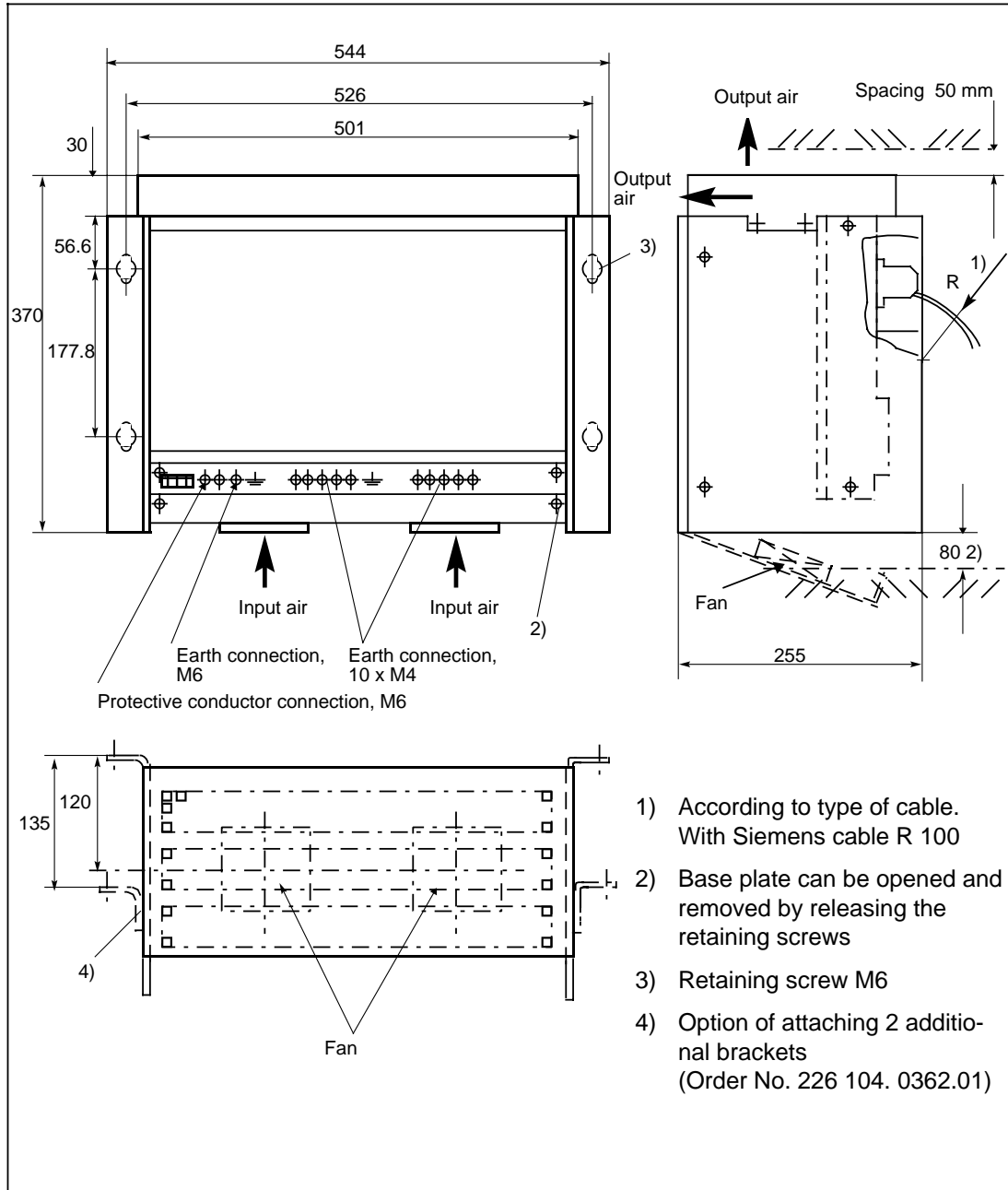
- Scale diagrams



- 1) According to type of cable. With Siemens cable R 100
- 2) Base plate can be opened and removed by releasing the retaining screws
- 3) Retaining screw M6
- 4) Option of attaching 2 additional brackets (Order No. 226 104. 0362.01)

## 5.14.2 PLC expansion unit (Maxi EU)

- Scale diagram



1) According to type of cable. With Siemens cable R 100

2) Base plate can be opened and removed by releasing the retaining screws




3) Retaining screw M6

4) Option of attaching 2 additional brackets (Order No. 226 104. 0362.01)

### 5.14.3 Rack assignment of expansion units

#### 5.14.3.1 Expansion unit (P08)

Designation	MRPD No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SIMATIC BUS connector					▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
SINUMERIK BUS connector		▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
Power supply	6EW1 861-3A	▨																							
CC interface module MPC	6FX1 132-1BB01				▨																				
Digital input module 64 inputs N71	6FX1 125-7BA00				▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
Digital output module 0.5A 32 outputs N72	6FX1 122-8BC01				▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
Digital output module 2A 32 outputs N73	6FX1 122-8BD01				▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
SIMATIC I/Os Single width (20mm)N61, N66					▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
SIMATIC I/Os Double width (40mm)N68, N7					▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨

 Basic version  
  Option  
  Alternative

#### 5.14.3.2 Mini expansion unit (P06)

Designation	MRPD No.	1	2	3	4	5	6	7	8	9	10	11	12
BUS/Mini EU		▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
CC interface module MPC	6FX1 132-1BA01	▨											
Digital input module 64 inputs N71	6FX1 125-7BA00				▨	▨	▨	▨	▨	▨	▨	▨	▨
Digital output module 0.5A 32 outputs N72	6FX1 122-8BC01				▨	▨	▨	▨	▨	▨	▨	▨	▨
Digital output module 2A 32 outputs N73	6FX1 122-8BD01				▨	▨	▨	▨	▨	▨	▨	▨	▨
SIMATIC I/Os Single width(20mm) N61, N66					▨	▨	▨	▨	▨	▨	▨	▨	▨
SIMATIC I/Os Double width (40mm)N68, N7					▨	▨	▨	▨	▨	▨	▨	▨	▨

 Basic version  
  Option  
  Alternative

## 5.15 SINUMERIK input/output modules

The input/output modules are specific to the SINUMERIK systems. They can be used universally as input/output modules in the integrated PLC or in the SINUMERIK expansion unit (not in the SIMATIC expansion unit).

For the input and output signals separate power supplies can be used.

### 5.15.1 Overview of available SINUMERIK I/O modules

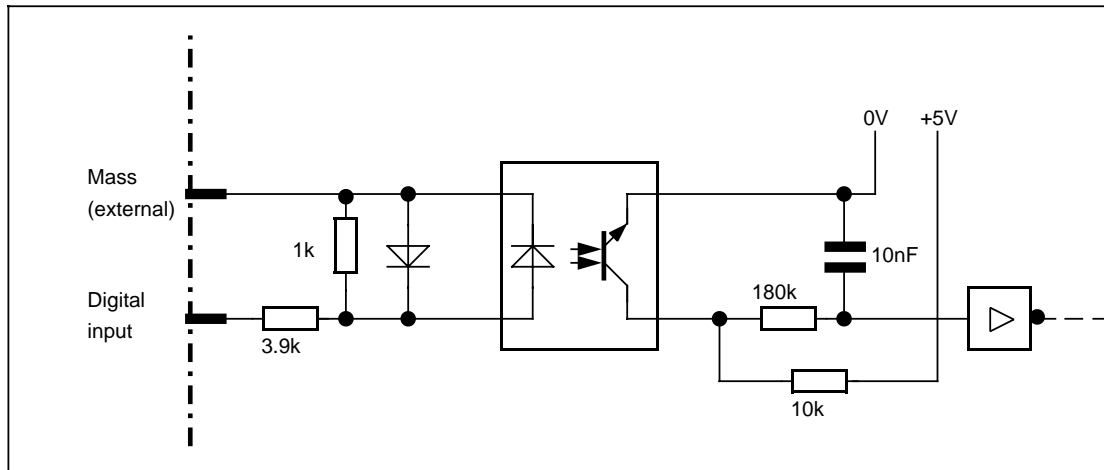
Module designation	Order number	Option	Digital inputs	Digital outputs	Output current <sup>1)</sup>	Analog inputs	Analog outputs
6FX1 125-7BA	6FC3 986-4DM	N71	64	–	–	–	–
6FX1 122-8BC	6FC3 986-4DN	N72	–	32	0.5 A	–	–
6FX1 122-8BD	6FC3 986-4DP	N73	–	32	2 A	–	–

<sup>1)</sup> Output current per output at 50% simultaneity.

### 5.15.2 Input or output circuits of the SINUMERIK modules

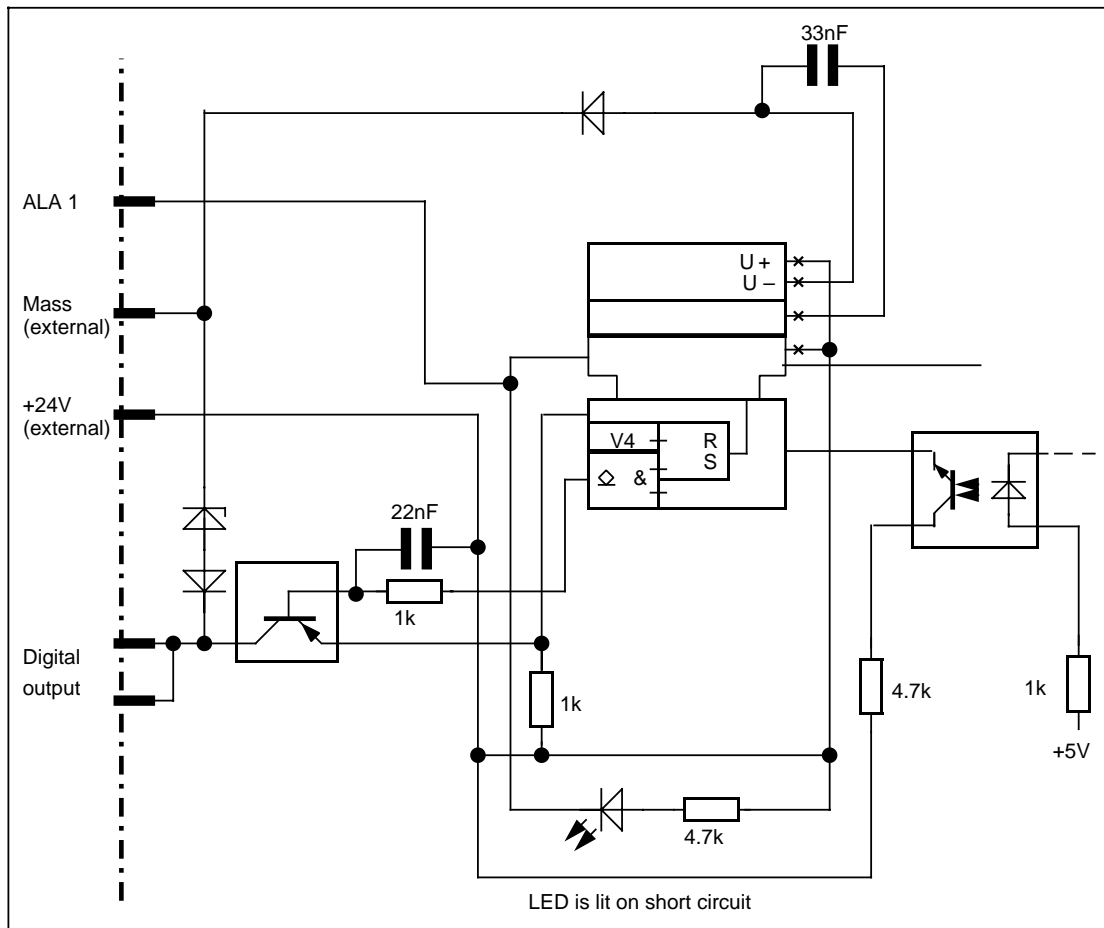
Input module 6FX1 125-7BA (N71)

Digital input circuit



Output module 6FX1 122-8BA/8BB (N72/N73)

Digital output circuit



### 5.15.3 Addressing and terminal assignment of the I/O modules

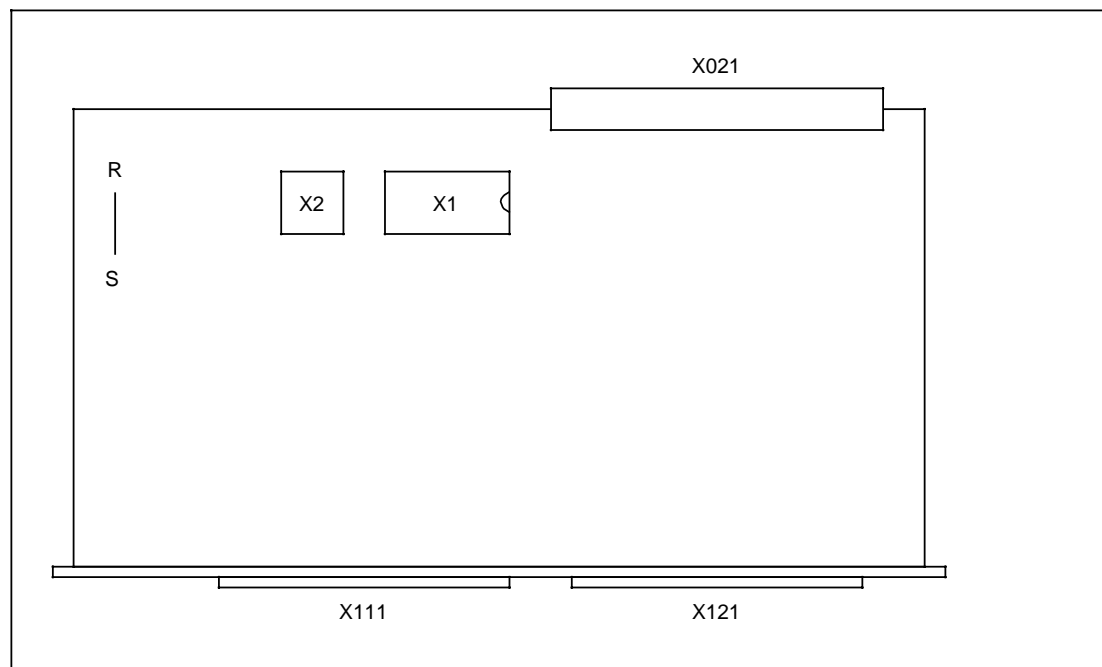
#### Input module 6FX1 125-7BA (N71)

The module 6FX1 125-7BA contains 64 floating inputs. Faults on the mass lines (caused by circulating currents) are suppressed by the optocoupler. In addition, all input signals are filtered on the module by RC elements. In this way, inductively and capacitively coupled interference, which is smaller than 2 ms, is eliminated.

#### Searching the initial address on the input module 6FX1 125-7BA

Initial address (hex.)	Input byte (dec.)	Base X1 (DIP FIX)	Base X2	
00	0 - 7			
08	8 - 15			
10	16 - 23			
18	24 - 31			
20	32 - 39			
28	40 - 47			
30	48 - 55			
38	56 - 63			

### Position of the jumper base and jumpers on the input module 6FX1 125-7BA

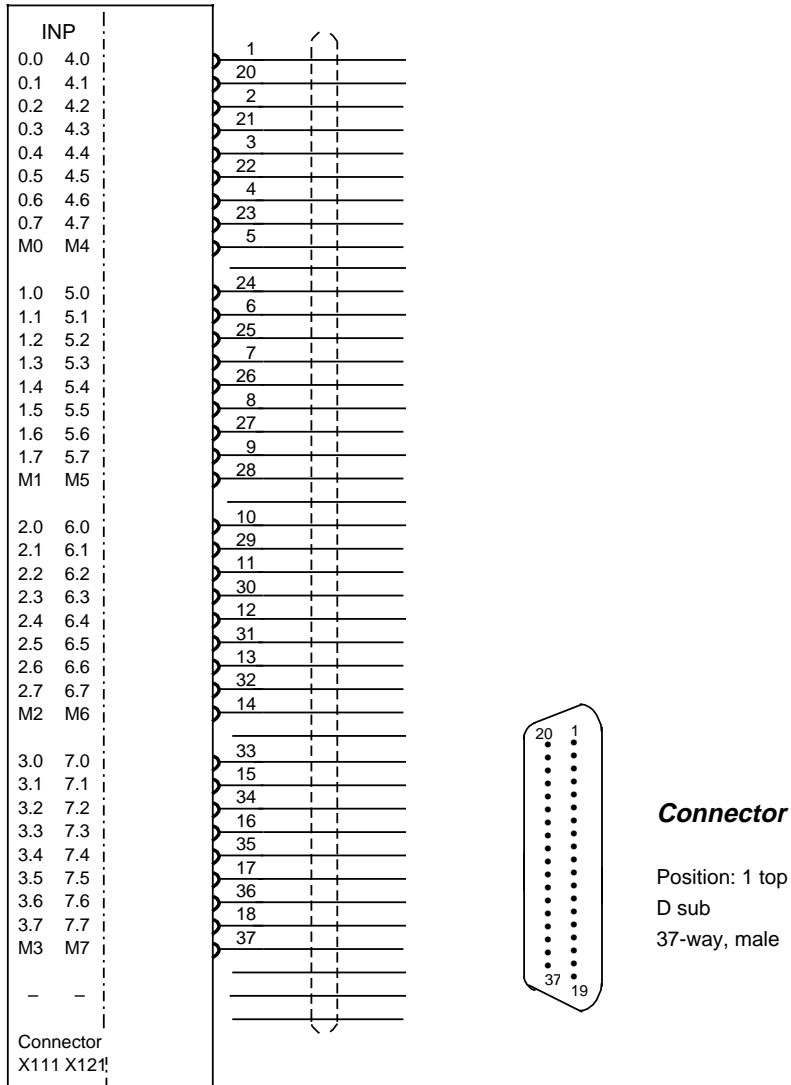


- X1 - setting the initial address
- X2 - as a standard setting, all 3 jumpers (U-P, M-N, K-L) are closed
- Jumper R - S - closed as a standard setting

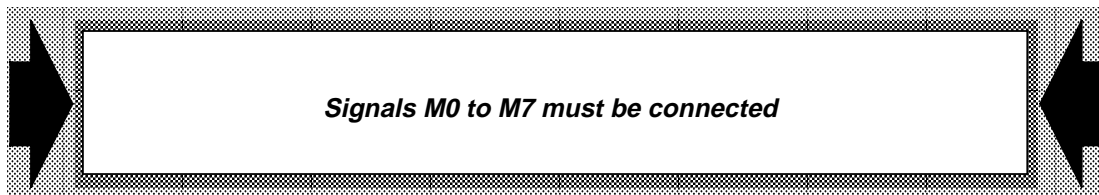


### Terminal assignment of the input module 6FX1 125-7BA (N71)

The connection of the 64 inputs is achieved via two 37-way D sub miniature male connectors for 32 inputs each.



For connection, see Chapter 2 cable plan 6FC9 344-1U and 6FC9 344-2T



**Output module 6FX1 122-8B (N72, N73)**

The outputs are, as is usual for SINUMERIK, supplied with an external+24 V on the fast-on-connector (X111 and X141). The module has a total of 32 floating outputs which are arranged in groups of 16 and are made available via 2 front connectors (X121 and X131) on the interface.

The outputs are short-circuit-proof and can be switched parallel for increased power. Overloading and short circuits of the outputs are indicated by an optical alarm signal (red LED) on the PCB front panel. This monitoring is performed word by word.

**Variants of the output module**

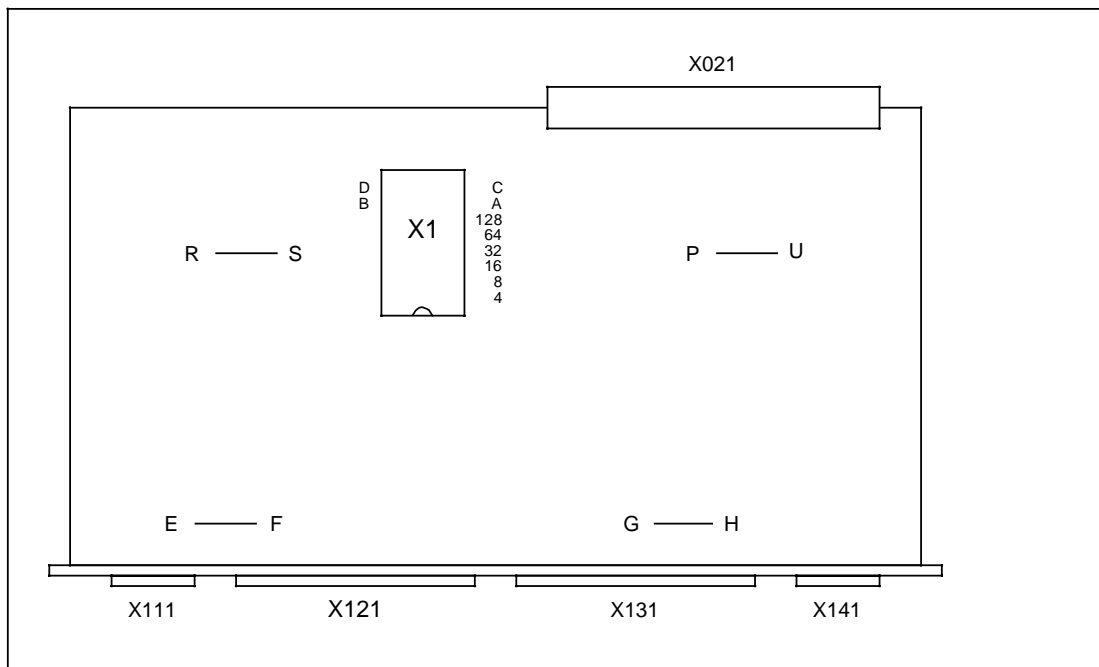
- A 0.5 A version (6FX1 122-8BA/8BC) is constructed with a 20mm front panel. It can be operated with 100% simultaneity factor if it is used in well ventilated plant.
- A 2 A version (6FX1 122-8BB/8BD) is fitted with a 40 mm front panel. It can only be operated with a 50% simultaneity factor.

**Setting the initial address on the output module 6FX1 122-8B**

Initial address (hex.)	Output byte (dec.)	Base X1(DIP FIX)	Jumpers
0	0 - 3		
4	4 - 7		
8	8 - 11		
C	12 - 15		
10	16 - 19		
14	20 - 23		
18	24 - 27		
1C	28 - 31		
20	32 - 35		
24	36 - 39		

Initial address (hex.)	Output byte (dec.)	Base X1(DIP FIX)	Jumpers
			F H S P O O O O O O O O E G R U
28	40 - 43		O O O O O O O O
2C	44 - 47		O O O O O O O O
30	48 - 51		O O O O O O O O
34	52 - 55		O O O O O O O O
38	56 - 59		O O O O O O O O
3C	60 - 63		O O O O O O O O

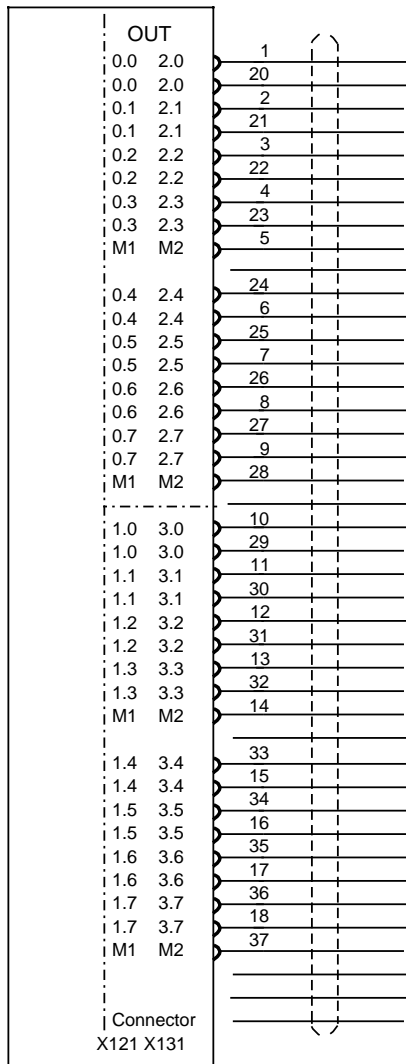
**Position of the jumper base and jumpers on the output module 6FX1 122-8B**



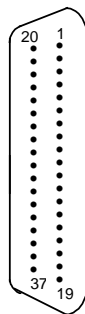
- X1 - setting the initial address
- Jumpers
- E-F, G-H, R-S, U-P - open

### Terminal assignment of the output module 6FX1 122-8B

The connection for the 32 outputs is performed via two 37-way D sub male connectors for 16 outputs each.



Signals M1 and M2 must not be used, they are for test purposes only.



#### Connector

Position: 1 top  
D sub  
37-way, male

For connection see Chapter 2, cable plan 6FC9 344-1V

### 5.15.4 Electrical characteristics

	6FX1125 - 7BA (N71)	6FX1122 - 8BA (N72) 8BC	6FX1122 - 8BB (N73) 8BD
Number of digital inputs Floating	64 yes		
Input voltage (rated value)	24 V DC		
Input voltage <ul style="list-style-type: none"> <li>for signal "0"</li> <li>for signal "1"</li> </ul>	-3V to +5V +14V to +30V		
Input current with signal "1"	3.6 to 7.7 mA		
Delay <ul style="list-style-type: none"> <li>for tpLH</li> <li>for tpHL</li> </ul>	1.8 to 2.2 ms 1.8 to 2.2 ms		
Length of cable max.	50 m		
Number of digital outputs Floating		32 yes	32 yes
Supply voltage $U_P$ <ul style="list-style-type: none"> <li>rated value</li> <li>ripple <math>U_{PP}</math></li> <li>permissible range (including ripple)</li> </ul>		24 V DC 20 V to 30 V	24 V DC 20 V to 30 V
Output current with signal "1" <ul style="list-style-type: none"> <li>rated value</li> </ul>		500 mA	2 A
Short circuit protection		electronic with optical display (LED)	electronic with optical display (LED)
Limitation of the inductive cutoff voltage except for switching power for lamps			
Switching frequency with <ul style="list-style-type: none"> <li>ohmic load</li> <li>lamps</li> <li>inductive load 1)</li> </ul>		100 Hz 11 Hz 2 Hz	100 Hz 11 Hz 2 Hz
Total loadability 2) at 55 C		50 %	50 %
Signal level of the outputs <ul style="list-style-type: none"> <li>for signal "0"</li> <li>for signal "1"</li> </ul>		Output open $U_P -1 V$	Output open $U_P -1 V$

1) At rated load. At a lower load, higher values are permitted.

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

## 5.15.4 Electrical characteristics

	6FX1125 - 7BA (N71)	6FX1122 - 8BA (N72) 8BC	6FX1122 - 8BB (N73) 8BD
Length of cable max.		50 m	50 m
Insulation voltage external terminals against casing			
• to VDE 0160			
• tested with			
Current consumption			
• internal (at 5V) type	120 mA	320 mA	320 mA
• internal (at 24V) type		100 mA	100 mA
Space requirement (1 standard slot=15.24 mm)	20 mm	20 mm	40 mm
Weight approx.	350 g	500 g	1210 g
Degree of protection to DIN 40050	IP00	IP00	IP00
Humidity class to DIN 40040	F	F	F

1) At rated load. At a lower load, higher values are permitted.

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

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**Suggestions**

**Corrections**

For Publication/Manual:  
SINUMERIK 810 GA3  
SINUMERIK 820 GA3  
Interface Description  
Part 2: Connection Conditions

**From:**

Name \_\_\_\_\_

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

Address: \_\_\_\_\_  
\_\_\_\_\_

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

Planning Guide

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Should you come across any printing errors when reading this publication, please notify us on this sheet. Suggestions for improvement are also welcome.

**Suggestions and/or corrections**

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