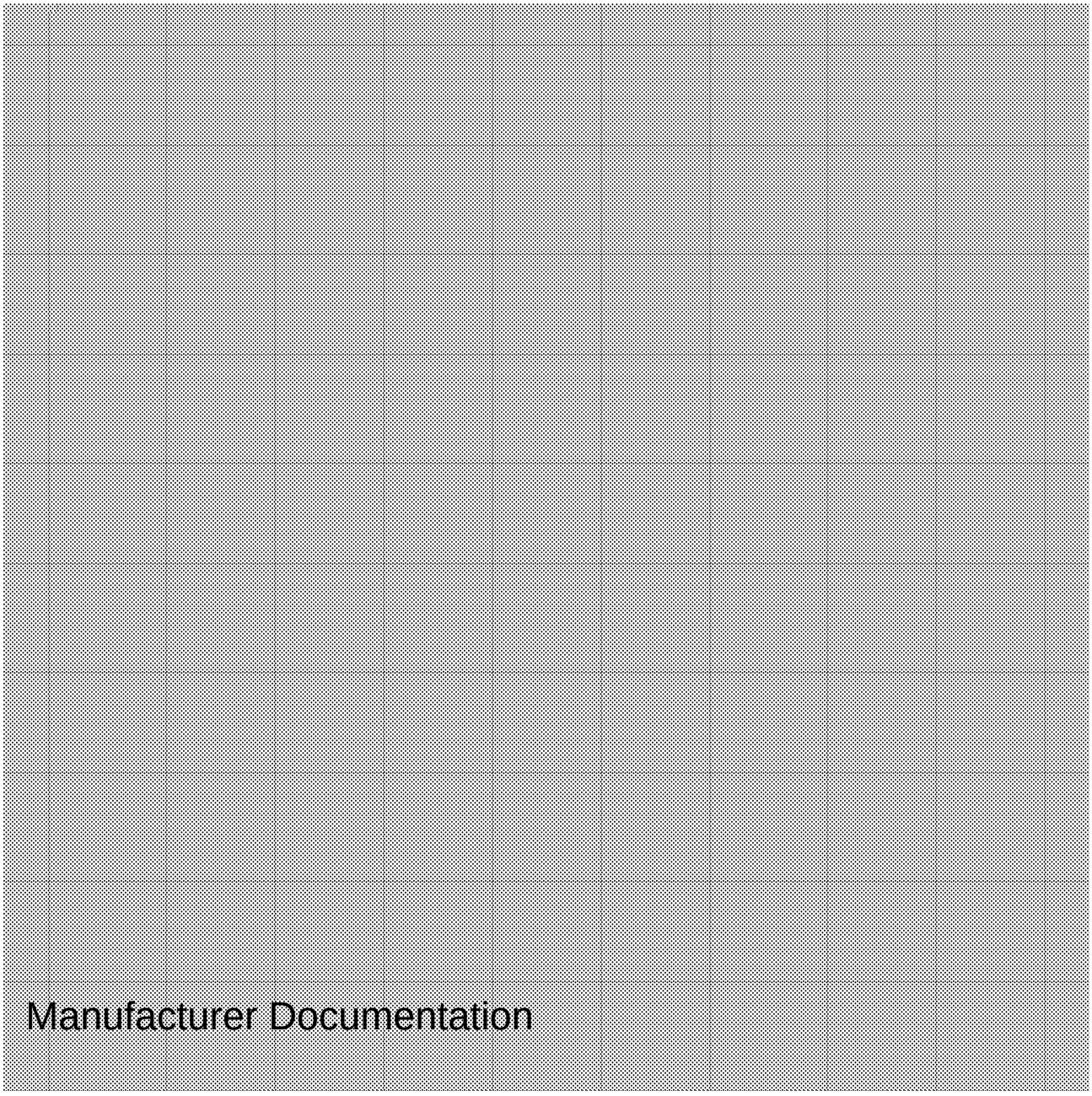
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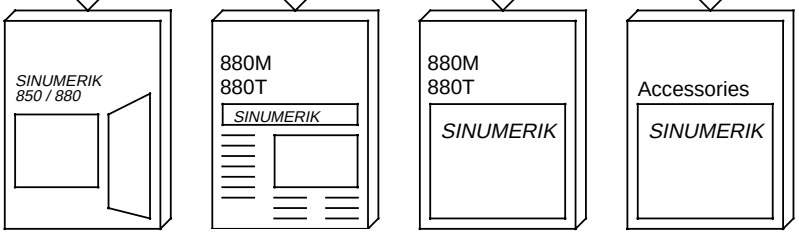
SINUMERIK 880
Software Version 1/2/3/4/5/6
Interface Description
Part 2: Connection Conditions

Planning Guide 05.91 Edition



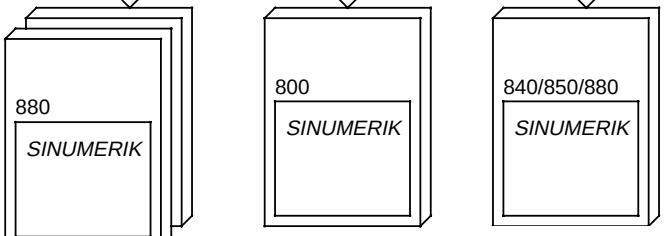
Manufacturer Documentation

General Documentation



Sales Brochure | Technical data | Catalog NC 28 | Catalog NC 90

User Documentation

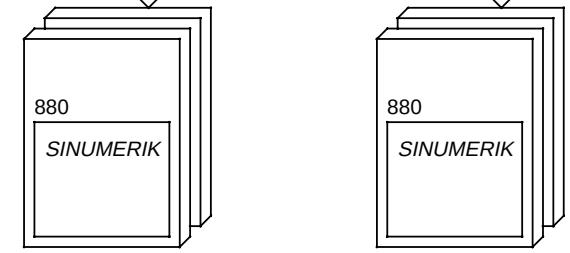


Operator's Guide
Programming Guide

Cycles,
Programming Guide

Measuring Cycles
Version 2

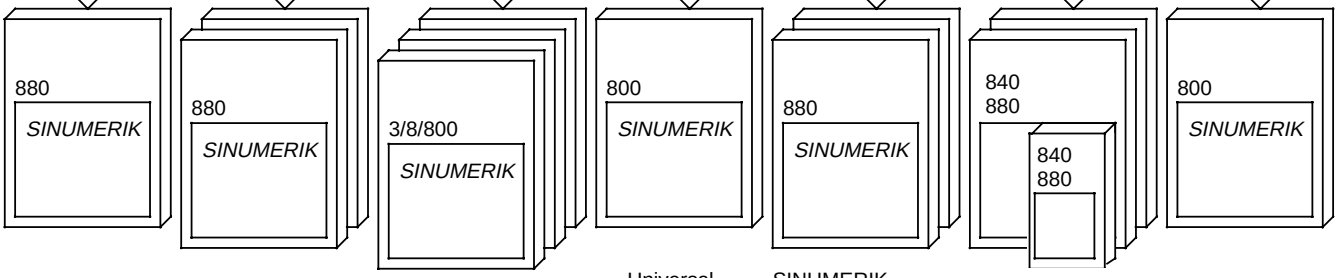
User/Manufacturer/Service Documentation



Function Manual:
- Electronic Gearbox
- Integrated Drive Control

Function Manual:
- Extended Functions for Spindles
- VT340 Terminal Emulator

Manufacturer Documentation



Instruction Manual

Interface:
- Signals
- **Cables and Connections**

Function Block
Packages 0, 1/2, 4/5, 6, 7/8 Function Macros

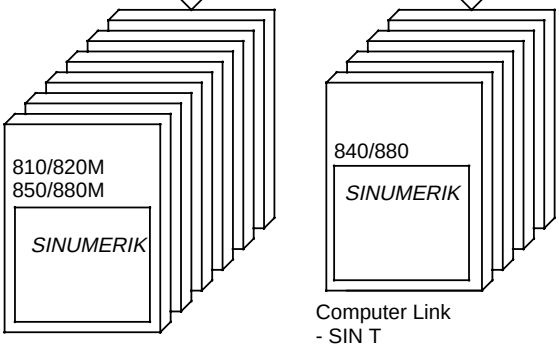
Universal
Interface

SINUMERIK
WS 800
CL 800 Language

PLC 135WB
- Configuring
- Quick Reference
- S5-HLL

Planning Guide
VT340 Terminal
Emulator

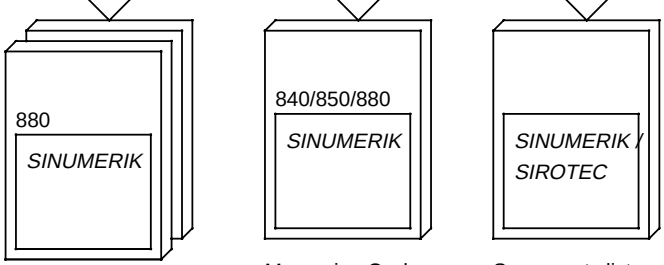
Manufacturer Documentation



Workshop UMS
6 Volumes

Computer Link
- SIN T
- SIN PS 231
- SIN PS 315
- Message Frame Description
- General Description

Service Documentation



Installation Guide
- Instructions
- Lists

Measuring Cycles
Version 20

Spare parts list

Preliminary Remarks

Guide to use

SINUMERIK documentation comprises four parts:

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

The **Manufacturer Documentation** for the **SINUMERIK 880** control is divided into the following sections:

- Instruction Manual
- Interface
  Part 1: Signals
  Part 2: Connection Conditions
- Function Macros
- Function blocks
  Package 0: Basic Functions
  Package 1**/**2: Tool Management
  Package 4**/**5: Computer Link
  Package 6: Loading and Unloading Tools with Code Carriers
  Package 7: Code Carriers
  Package 8: PLC-Controlled Data Input/Output
- PLC 135WB Configuration
- S5-HLL High-Level Language Programming
- Computer Link

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

Consult your local Siemens office for further details.

This documentation is intended for manufacturers of machine tools with SINUMERIK 880. It describes the installation arrangements and wiring between the control and machine. The document describes:

- Which modules can be used in the control in which combination (rack assignment, device connection plan)
- Cables by which the devices of the SINUMERIK 880 are connected
- Switching machine signals to the SINUMERIK 880
- Dimension drawings of the devices that the machine manufacturer has to mount outside the control (operator panel, measured-value encoder).

Technical Notes

Software version 6 is only executable with the PLC 135 WB with ACOP. The differences between the SINUMERIK 880T and 880M are noted. Inverted signals that are effective at logic zero are marked with an asterisk * in front of the signal name.
In the timing diagrams, all the described signals are written in upper case. Thick lines represent real signals, thin lines represent symbolic signal paths. The signal meaning refers to the NC-PLC interface.
This document describes the maximum functional scope with software version 6.
For software versions 1 to 5, the functions that can be ordered are described in the relevant catalog.



System Configuration and Subrack Assignments 1

Connection Conditions 2

Machine Control Panel 3

Coded Selector Switches/Codings 4

Signals NC - Machine 5

External Devices 6

Overview of Cables and Devices 7

Terms and Abbreviations 8

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Software Version 1/2/3/4/5/6
Interface Description
Part 2: Connection Conditions

Planning Guide

Manufacturer Documentation

Valid for:

Control	*Software Version*
SINUMERIK 880 T/M	1/2/3/4/5/6

May 1991 Edition

SINUMERIK® documentation

Printing history

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

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

Status code in "Remarks" column:

A . . . New documentation
B . . . Unrevised reprint with new Order No.
C . . . Revised edition with new status.
If factual changes have been made on a page since the last edition, this is indicated by a new edition coding in the header on that page.

Edition	Order No.	Remarks
05.91	6ZB5 410-0HF02-0AA0	**A**

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.

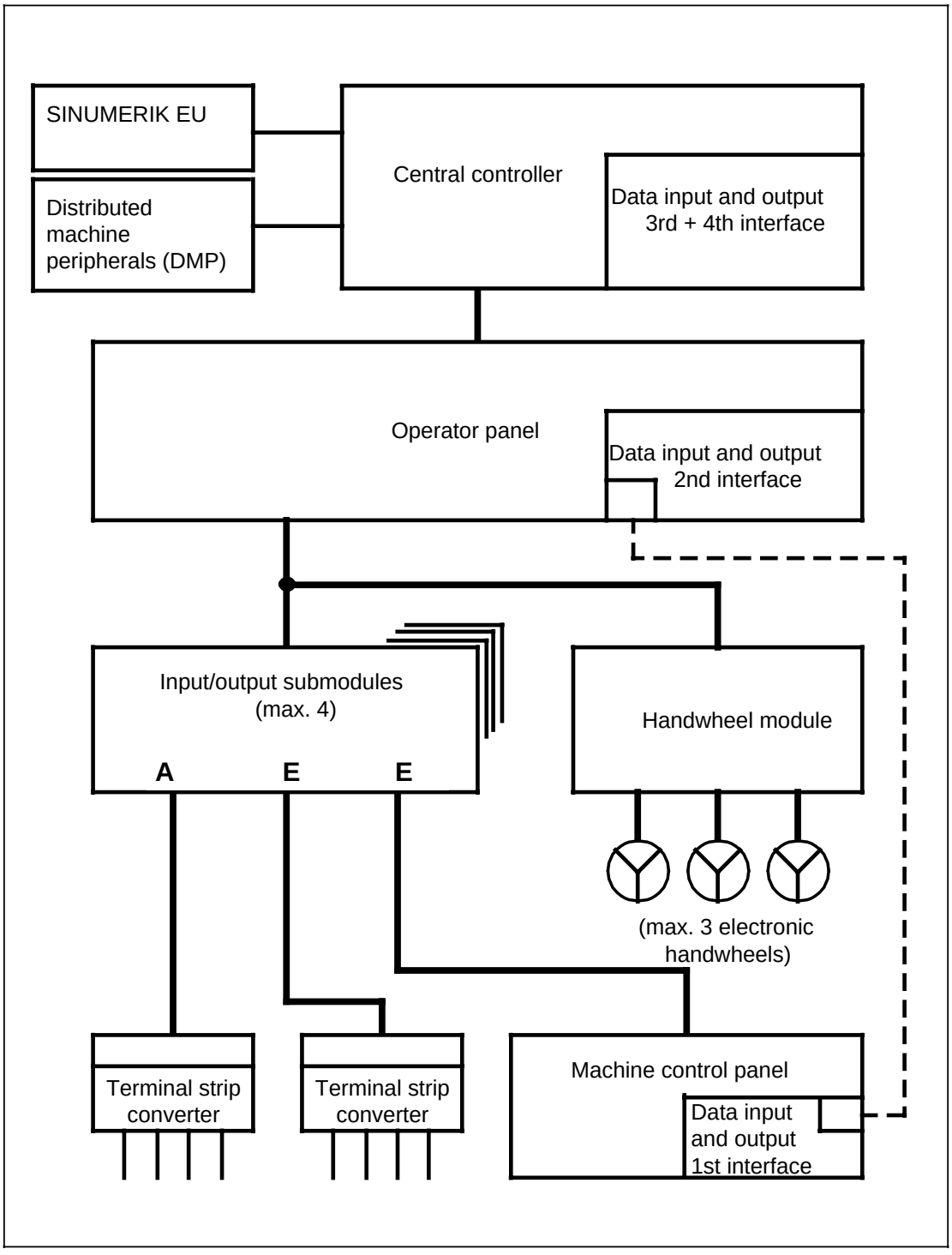
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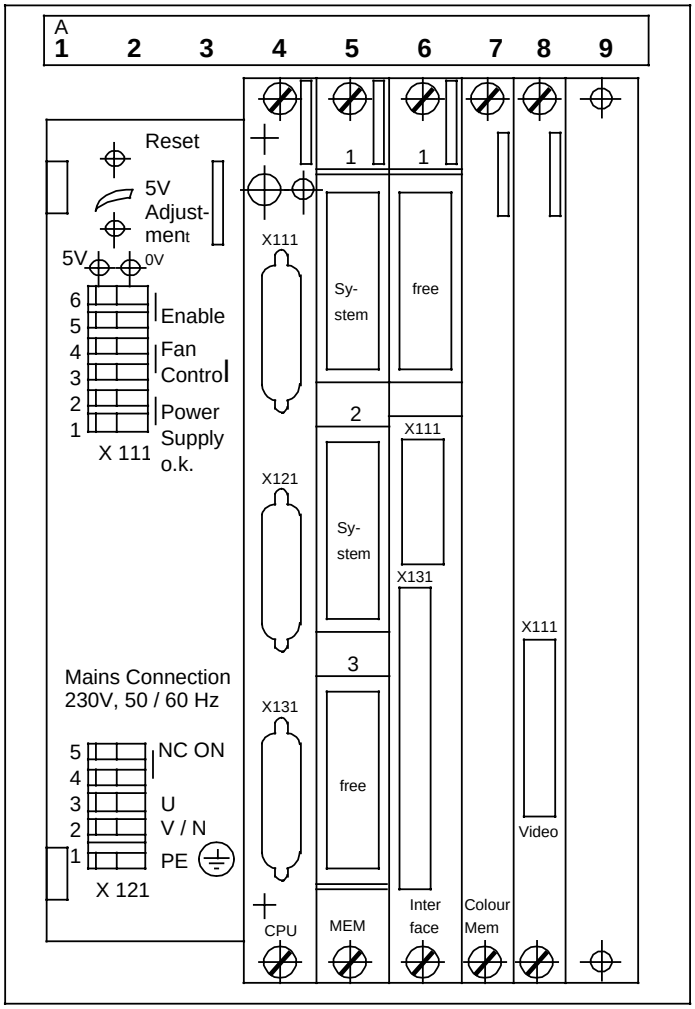
1 System Configuration and Subrack Assignments

1.1 System configuration SINUMERIK 880



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1.2 Subrack assignments - 1st operator panel (see Section 6.7 for 2nd and 3rd operator panels)



Slot	Name	Order No.
A 1/ 2/ 3	Power supply AC 230V	6EW1 861-3AA
A 4	Operator panel-CPU	6FX1 120-4BB
A 5	Memory modle	6FX1 128-1BB
A 6	Interface module	6FX1 121-2BB
A 7	Blanking plate, or	6FC3 985-7AC
A 7	Memory module, colour	6FX1 126-4AA
A 8	Module for video graphics	6FX1 126-1AA
A 9	Blanking plate or	6FC3 985-7AC
A 9	Interface 2nd / 3rd operator panel	6FX1 143-3BA

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1.3 Subrack assignments - central controller (valid only for software version 6)

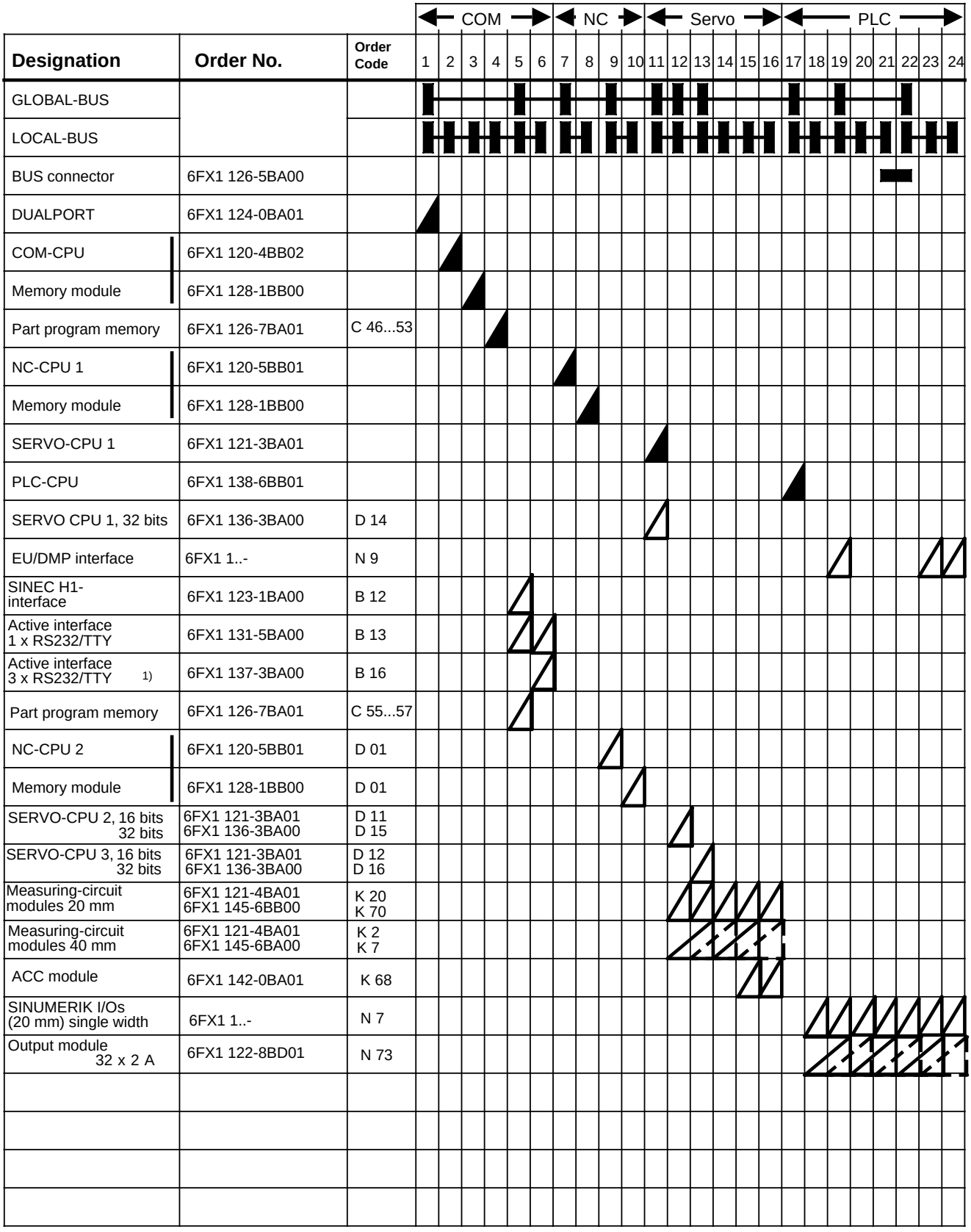
The individual versions of the SINUMERIK 880 have the following principal data:

Central controller version 6FC3 491-1 A 6FC3 191-1 A		COM	Measuring circuit/servo	incl. CPUs	NC CPUs 1)	I/Os in the PLC 1	I/Os in the PLC 2
single-tier	Rack 1	2	5	3	2	7	–
	Rack 2	2	10	3	2	2	–
	Rack 3	2	3	1	1	10	–
Two-tier							
	Rack 4	4	7	3	2	13	7
	Rack 5	4	13	4	4	10	2
	Rack 6	4	10	4	1	21	–
	Rack 7a	3	7	3	1	23 2)	–
	Rack 7b	2	7	3	1	2	23 2)
	Rack 7c	2	7	3	2	23 2)	–

1) The number of CPUs is absolute, including basic version
2) Including 20 slots for enabled SIMATIC I/Os too

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1.3.1 Version 1 Tier B



Designation	Order No.	Order Code
GLOBAL-BUS		
LOCAL-BUS		
BUS connector	6FX1 126-5BA00	
DUALPORT	6FX1 124-0BA01	
COM-CPU	6FX1 120-4BB02	
Memory module	6FX1 128-1BB00	
Part program memory	6FX1 126-7BA01	C 46...53
NC-CPU 1	6FX1 120-5BB01	
Memory module	6FX1 128-1BB00	
SERVO-CPU 1	6FX1 121-3BA01	
PLC-CPU	6FX1 138-6BB01	
SERVO CPU 1, 32 bits	6FX1 136-3BA00	D 14
EU/DMP interface	6FX1 1..-	N 9
SINEC H1-interface	6FX1 123-1BA00	B 12
Active interface 1 x RS232/TTY	6FX1 131-5BA00	B 13
Active interface 3 x RS232/TTY 1)	6FX1 137-3BA00	B 16
Part program memory	6FX1 126-7BA01	C 55...57
NC-CPU 2	6FX1 120-5BB01	D 01
Memory module	6FX1 128-1BB00	D 01
SERVO-CPU 2, 16 bits 32 bits	6FX1 121-3BA01 6FX1 136-3BA00	D 11 D 15
SERVO-CPU 3, 16 bits 32 bits	6FX1 121-3BA01 6FX1 136-3BA00	D 12 D 16
Measuring-circuit modules 20 mm	6FX1 121-4BA01 6FX1 145-6BB00	K 20 K 70
Measuring-circuit modules 40 mm	6FX1 121-4BA01 6FX1 145-6BA00	K 2 K 7
ACC module	6FX1 142-0BA01	K 68
SINUMERIK I/Os (20 mm) single width	6FX1 1..-	N 7
Output module 32 x 2 A	6FX1 122-8BD01	N 73

Basic version

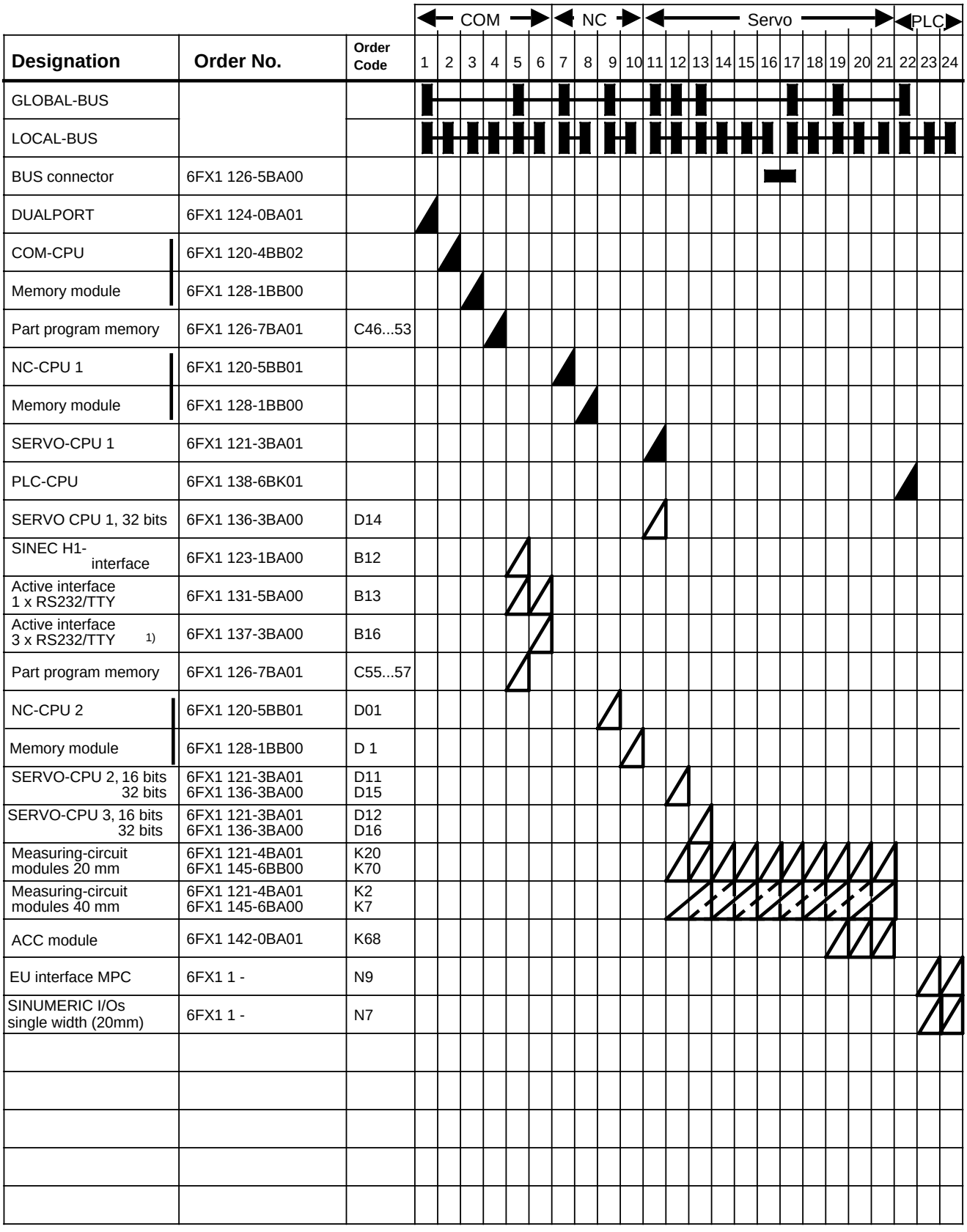
Option

Alternative

1) Can only be used with (6FX 1131-5BA00) (B13)

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1.3.2 Version 2 Tier B



Designation	Order No.	Order Code
GLOBAL-BUS		
LOCAL-BUS		
BUS connector	6FX1 126-5BA00	
DUALPORT	6FX1 124-0BA01	
COM-CPU	6FX1 120-4BB02	
Memory module	6FX1 128-1BB00	
Part program memory	6FX1 126-7BA01	C46...53
NC-CPU 1	6FX1 120-5BB01	
Memory module	6FX1 128-1BB00	
SERVO-CPU 1	6FX1 121-3BA01	
PLC-CPU	6FX1 138-6BK01	
SERVO CPU 1, 32 bits	6FX1 136-3BA00	D14
SINEC H1-interface	6FX1 123-1BA00	B12
Active interface 1 x RS232/TTY	6FX1 131-5BA00	B13
Active interface 3 x RS232/TTY 1)	6FX1 137-3BA00	B16
Part program memory	6FX1 126-7BA01	C55...57
NC-CPU 2	6FX1 120-5BB01	D01
Memory module	6FX1 128-1BB00	D 1
SERVO-CPU 2, 16 bits 32 bits	6FX1 121-3BA01 6FX1 136-3BA00	D11 D15
SERVO-CPU 3, 16 bits 32 bits	6FX1 121-3BA01 6FX1 136-3BA00	D12 D16
Measuring-circuit modules 20 mm	6FX1 121-4BA01 6FX1 145-6BB00	K20 K70
Measuring-circuit modules 40 mm	6FX1 121-4BA01 6FX1 145-6BA00	K2 K7
ACC module	6FX1 142-0BA01	K68
EU interface MPC	6FX1 1 -	N9
SINUMERIC I/Os single width (20mm)	6FX1 1 -	N7

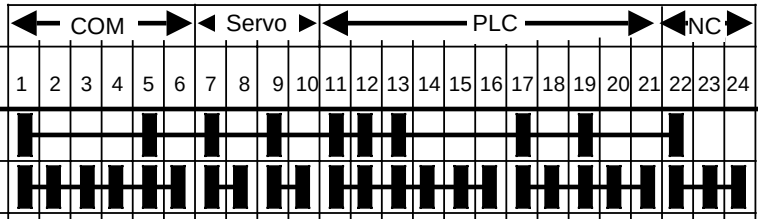
Basic version Option Alternative

1) For use only in conjunction with 6FX1131-5BA00 (B13)

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1.3.3 Version 3 Tier B

Designation	Order No.	Order Code
GLOBAL-BUS		
LOCAL-BUS		
BUS connector	6FX1 126-5BA00	
DUALPORT	6FX1 124-0BA01	
COM-CPU	6FX1 120-4BB02	
Memory module	6FX1 128-1BB00	
Part program memory 1	6FX1 126-7BA01	C46...53
NC-CPU	6FX1 120-5BB01	
Memory module	6FX1 128-1BB00	
SERVO-CPU 1	6FX1 121-3BA01	
PLC-CPU	6FX1 138-6BK01	
SERVO-CPU 1, 32 bits	6FX1 136-3BA00	D14
SINEC H1-interface	6FX1 123-1BA00	B12
Active interface 1 x RS232/TTY	6FX1 131-5BA00	B13
Active interface 3 x RS232/TTY 1)	6FX1 137-3BA00	B16
Part program memory 2	6FX1 126-7BA01	C55...57
Measuring-circuit modules 20 mm	6FX1 121-4BA01 6FX1 145-6BB00	K20 K70
Measuring-circuit modules 40 mm	6FX1 121-4BA01 6FX1 145-6BA00	K2 K7
ACC module	6FX1 142-0BA01	K68
SINUMERIK I/Os single width (20mm)	6FX1 1..-	N7
Output module 32 x 2 A	6FX1 122-8BD01	N73
EU/DMP interface	6FX1 1..-	N9



Basic version

Option

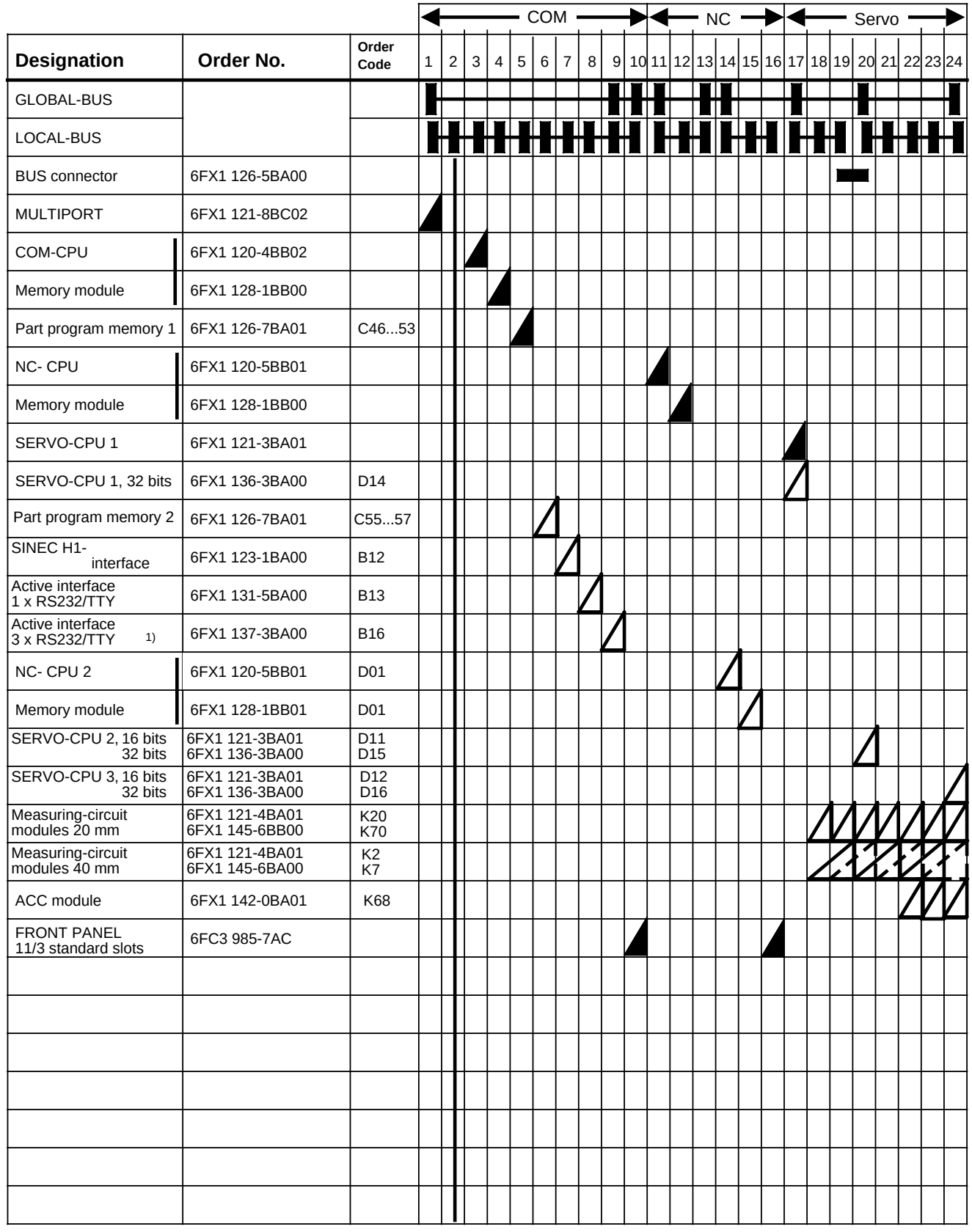
Alternative

1) For use only in conjunction with 6FX1131-5BA00 (B13)

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1.3.4 Version 4 Tier B

Designation	Order No.	Order Code
GLOBAL-BUS		
LOCAL-BUS		
BUS connector	6FX1 126-5BA00	
MULTIPORT	6FX1 121-8BC02	
COM-CPU	6FX1 120-4BB02	
Memory module	6FX1 128-1BB00	
Part program memory 1	6FX1 126-7BA01	C46...53
NC- CPU	6FX1 120-5BB01	
Memory module	6FX1 128-1BB00	
SERVO-CPU 1	6FX1 121-3BA01	
SERVO-CPU 1, 32 bits	6FX1 136-3BA00	D14
Part program memory 2	6FX1 126-7BA01	C55...57
SINEC H1-interface	6FX1 123-1BA00	B12
Active interface 1 x RS232/TTY	6FX1 131-5BA00	B13
Active interface 3 x RS232/TTY 1)	6FX1 137-3BA00	B16
NC- CPU 2	6FX1 120-5BB01	D01
Memory module	6FX1 128-1BB01	D01
SERVO-CPU 2, 16 bits 32 bits	6FX1 121-3BA01 6FX1 136-3BA00	D11 D15
SERVO-CPU 3, 16 bits 32 bits	6FX1 121-3BA01 6FX1 136-3BA00	D12 D16
Measuring-circuit modules 20 mm	6FX1 121-4BA01 6FX1 145-6BB00	K20 K70
Measuring-circuit modules 40 mm	6FX1 121-4BA01 6FX1 145-6BA00	K2 K7
ACC module	6FX1 142-0BA01	K68
FRONT PANEL 11/3 standard slots	6FC3 985-7AC	

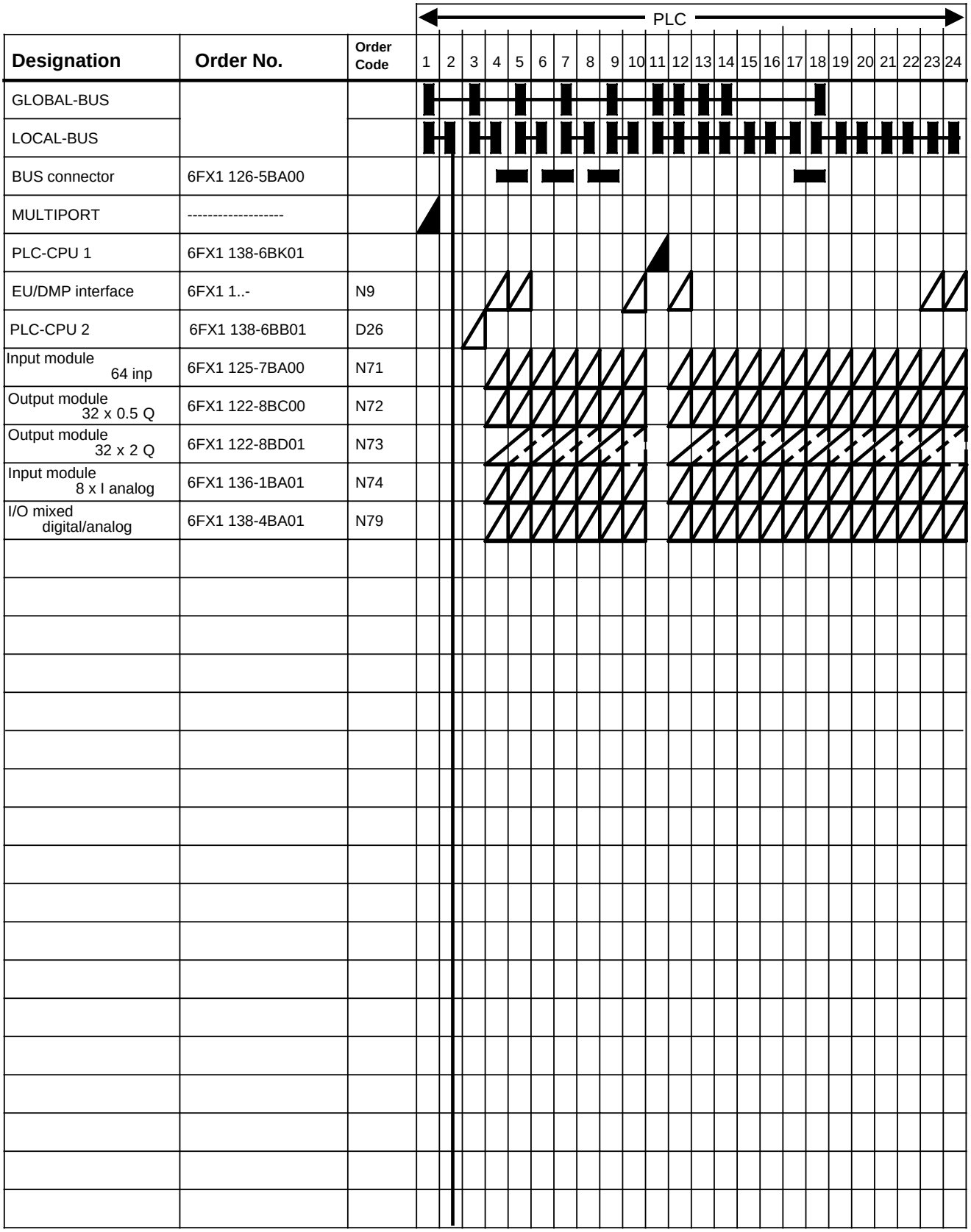


Basic version Option Alternative

1) Can only be used with (6FX 1131-5BA00) (B13)

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1.3.5 Version 4 Tier C



Designation	Order No.	Order Code
GLOBAL-BUS		
LOCAL-BUS		
BUS connector	6FX1 126-5BA00	
MULTIPORT	----------	
PLC-CPU 1	6FX1 138-6BK01	
EU/DMP interface	6FX1 1..-	N9
PLC-CPU 2	6FX1 138-6BB01	D26
Input module 64 inp	6FX1 125-7BA00	N71
Output module 32 x 0.5 Q	6FX1 122-8BC00	N72
Output module 32 x 2 Q	6FX1 122-8BD01	N73
Input module 8 x I analog	6FX1 136-1BA01	N74
I/O mixed digital/analog	6FX1 138-4BA01	N79

Basic version

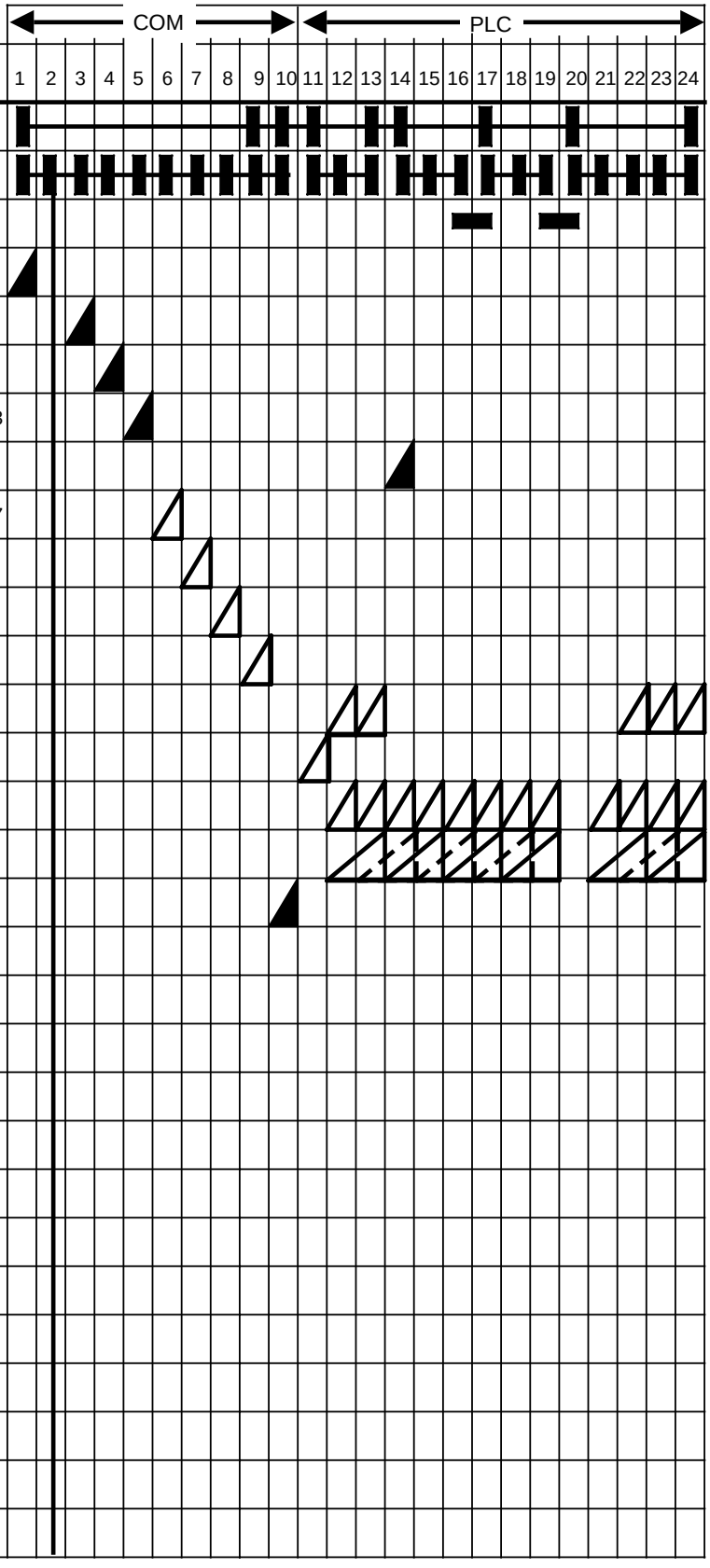
Option

Alternative

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1.3.6 Version 5 Tier B

Designation	Order No.	Order Code
GLOBAL-BUS		
LOCAL-BUS		
BUS connector	6FX1 126-5BA00	
MULTIPORT	6FX1 121-8BC02	
COM-CPU	6FX1 120-4BB02	
Memory module	6FX1 128-1BB00	
Part program memory 1	6FX1 126-7BA01	C46...53
PLC-CPU	6FX1 120-6BK01	
Part program memory 2	6FX1 126-7BA01	C55...57
SINEC H1 interface	6FX1 123-1BA00	B12
Active interface 1 x RS232/TTY	6FX1 131-5BA00	B13
Active interface 3 x RS232/TTY 1)	6FX1 137-3BA00	B16
EU/DMP interface	6FX1 1 -	N9
PLC-CPU 2	6FX1 138-6BB01	D26
SINUMERIK I/Os single width (20mm)	6FX1 1 -	N7
Output module 32 x 2 O	6FX1 122-8BD01	N73
FRONT PANEL 1 1/3 standard slots	6FC3 985-7AC	



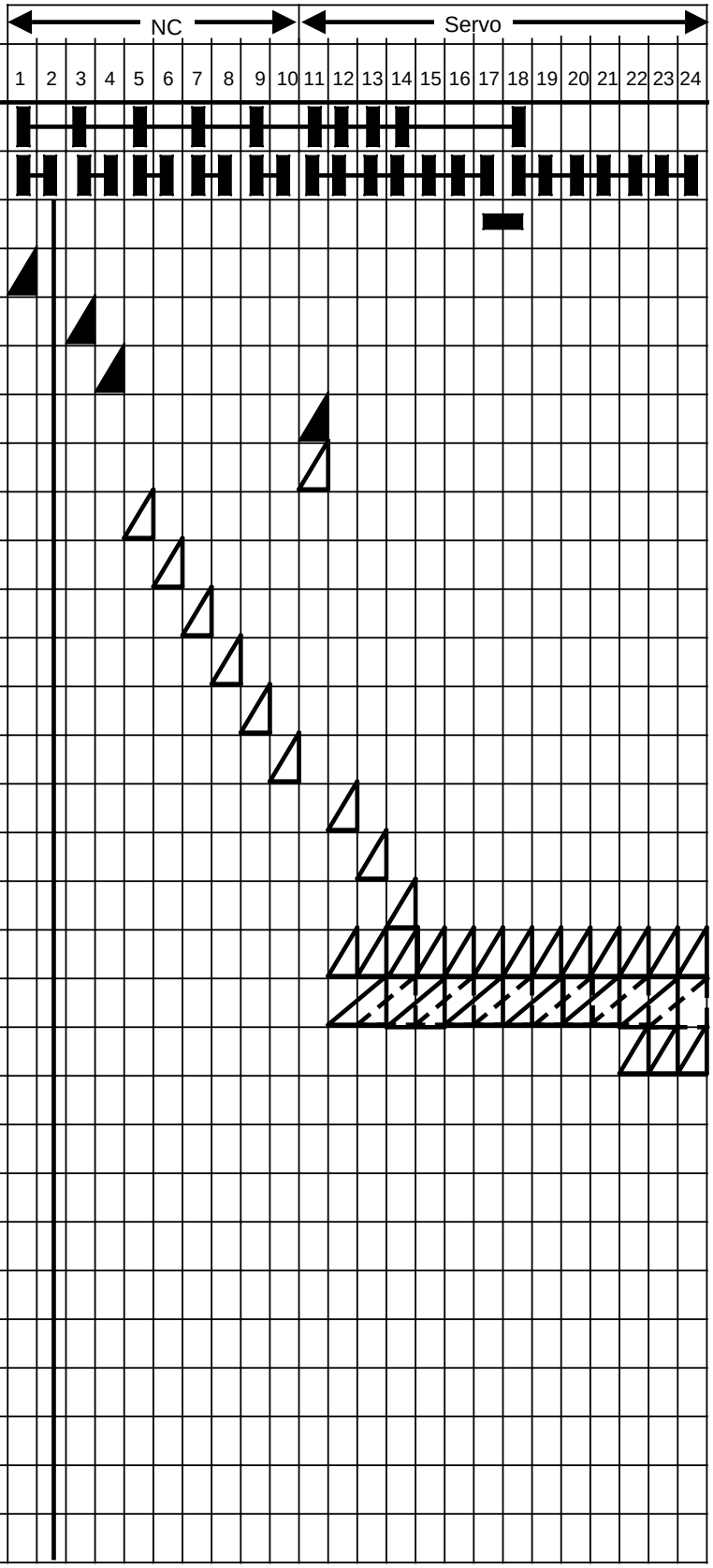
Basic version Option Alternative

1) For use only in conjunction with 6FX1131-5BA00 (B13)

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1.3.7 Version 5 Tier C

Designation	Order No.	Order Code
GLOBAL-BUS		
LOCAL-BUS		
BUS connector	6FX1126-5BA00	
MULTIPORT	----------	
NC-CPU 1	6FX1 120-5BB01	
Memory module	6FX1 128-1BB00	
SERVO-CPU 1	6FX1 121-3BA01	
SERVO-CPU 1, 32 bits	6FX1 136-3BA00	D14
NC-CPU 2	6FX1 120-5BB01	D01
Memory module	6FX1 128-1BB00	D01
NC-CPU 3	6FX1 120-5BB01	D02
Memory module	6FX1 128-1BB00	D02
NC-CPU 4	6FX1 120-5BB01	D03
Memory module	6FX1 128-1BB00	D03
SERVO-CPU 2, 16 bits 32 bits	6FX1 121-3BA01 6FX1 136-3BA00	D11 D15
SERVO-CPU 3, 16 bits 32 bits	6FX1 121-3BA01 6FX1 136-3BA00	D12 D16
SERVO-CPU 4	6FX1 121-3BA01	D13
Measuring-circuit modules 20 mm	6FX1 121-4BA01 6FX1 145-6BB00	K20 K70
Measuring-circuit modules 40 mm	6FX1 121-4B.01 6FX1 145-6BB00	K2 K7
ACC module	6FX1 142-0BA01	K68



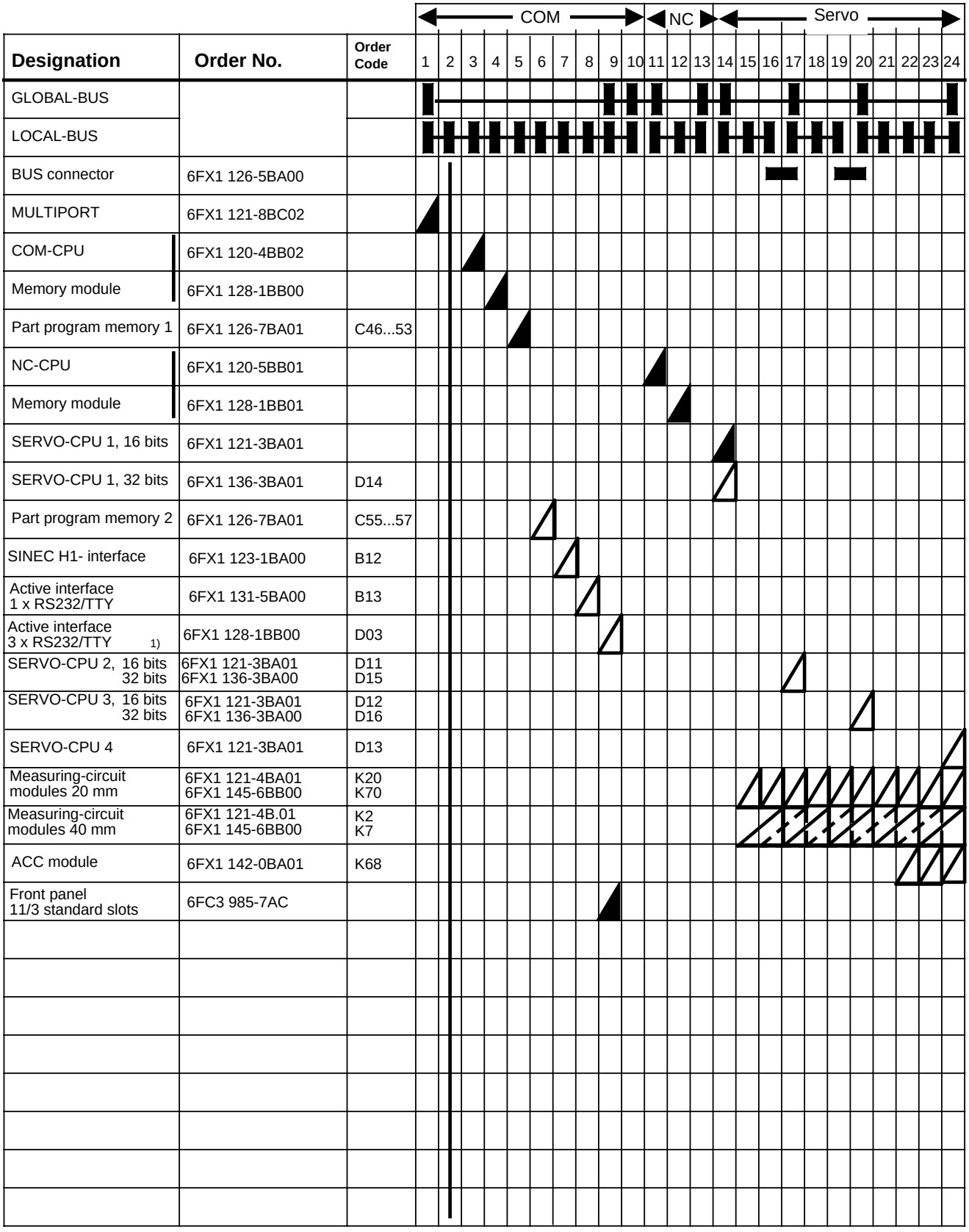
Basic version Option Alternative

1) use only in conjunction with 6FX1131-5BA00 (B13)

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1.3.8 Version 6 Tier B

Designation	Order No.	Order Code
GLOBAL-BUS		
LOCAL-BUS		
BUS connector	6FX1 126-5BA00	
MULTIPORT	6FX1 121-8BC02	
COM-CPU	6FX1 120-4BB02	
Memory module	6FX1 128-1BB00	
Part program memory 1	6FX1 126-7BA01	C46...53
NC-CPU	6FX1 120-5BB01	
Memory module	6FX1 128-1BB01	
SERVO-CPU 1, 16 bits	6FX1 121-3BA01	
SERVO-CPU 1, 32 bits	6FX1 136-3BA01	D14
Part program memory 2	6FX1 126-7BA01	C55...57
SINEC H1- interface	6FX1 123-1BA00	B12
Active interface 1 x RS232/TTY	6FX1 131-5BA00	B13
Active interface 3 x RS232/TTY 1)	6FX1 128-1BB00	D03
SERVO-CPU 2, 16 bits 32 bits	6FX1 121-3BA01 6FX1 136-3BA00	D11 D15
SERVO-CPU 3, 16 bits 32 bits	6FX1 121-3BA01 6FX1 136-3BA00	D12 D16
SERVO-CPU 4	6FX1 121-3BA01	D13
Measuring-circuit modules 20 mm	6FX1 121-4BA01 6FX1 145-6BB00	K20 K70
Measuring-circuit modules 40 mm	6FX1 121-4B.01 6FX1 145-6BB00	K2 K7
ACC module	6FX1 142-0BA01	K68
Front panel 11/3 standard slots	6FC3 985-7AC	



Grundaus-führung

Option

Alternativ-bestückung

1) For use only in conjunction with 6FX1131-5BA00 (B13)

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1.3.9 Version 6 Tier C

Designation	Order No.	Order Code	PLC 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
GLOBAL-BUS																										
LOCAL-BUS																										
BUS connector	6FX1 126-5BA00																									
MULTIPORT	----------																									
EU/DMP interface	6FX1 1 -	N9																								
PLC-CPU	6FX1 138-6BK01																									
Input module 64 inp	6FX1 125-7BA00	N71																								
Output module 32 x 0.5 Q	6FX1 122-8BC00	N72																								
Output module 32 x 2 Q	6FX1 122-8BD01	N73																								
Input module 9 x I analog	6FX1 136-1BA01	N74																								
I/O mixed digital/analog	6FX1 138-4BA01	N79																								

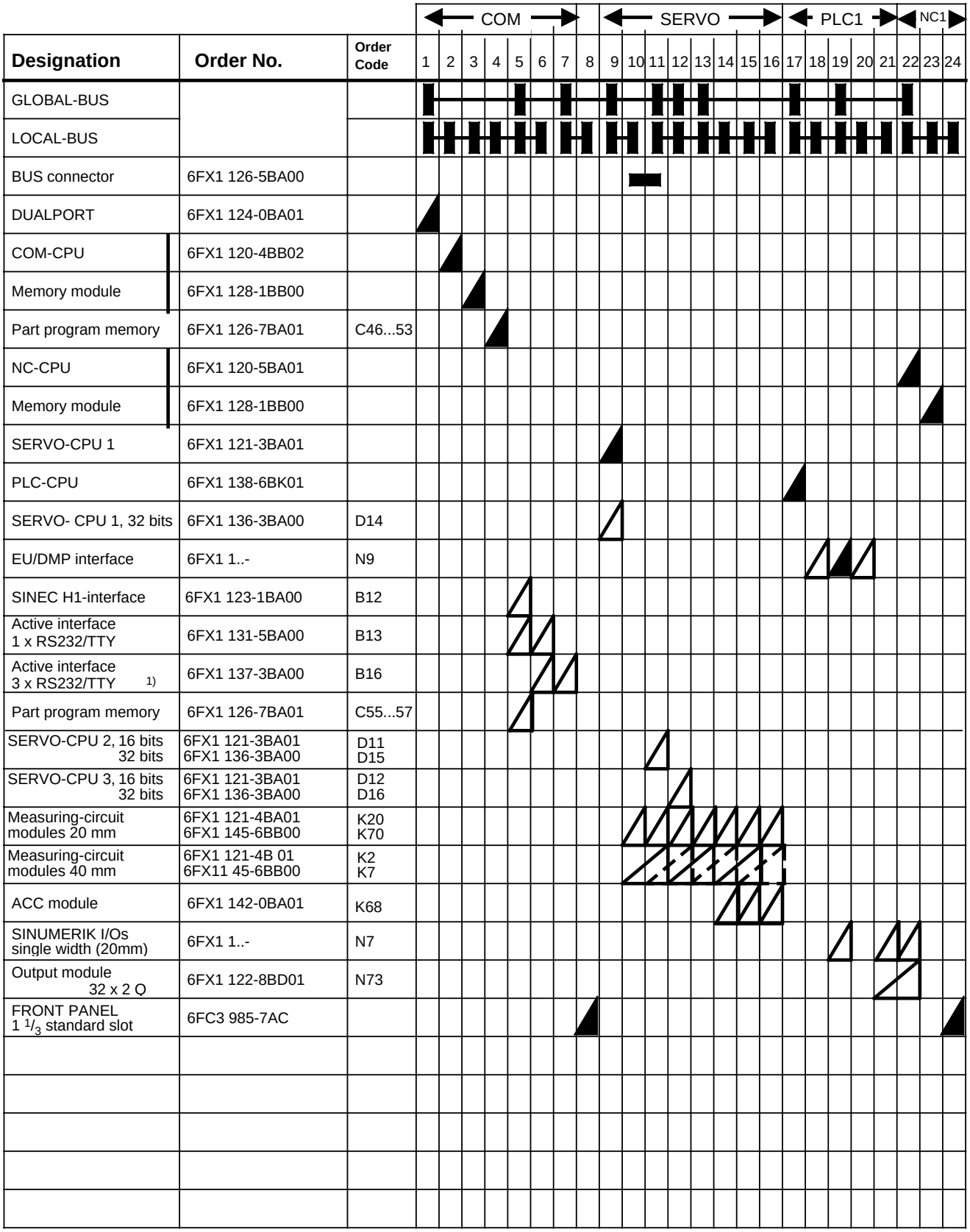
Basic version

Option

Alternative

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SINUMERIK 880, (PJ)

1.3.10 Version 7A Tier B



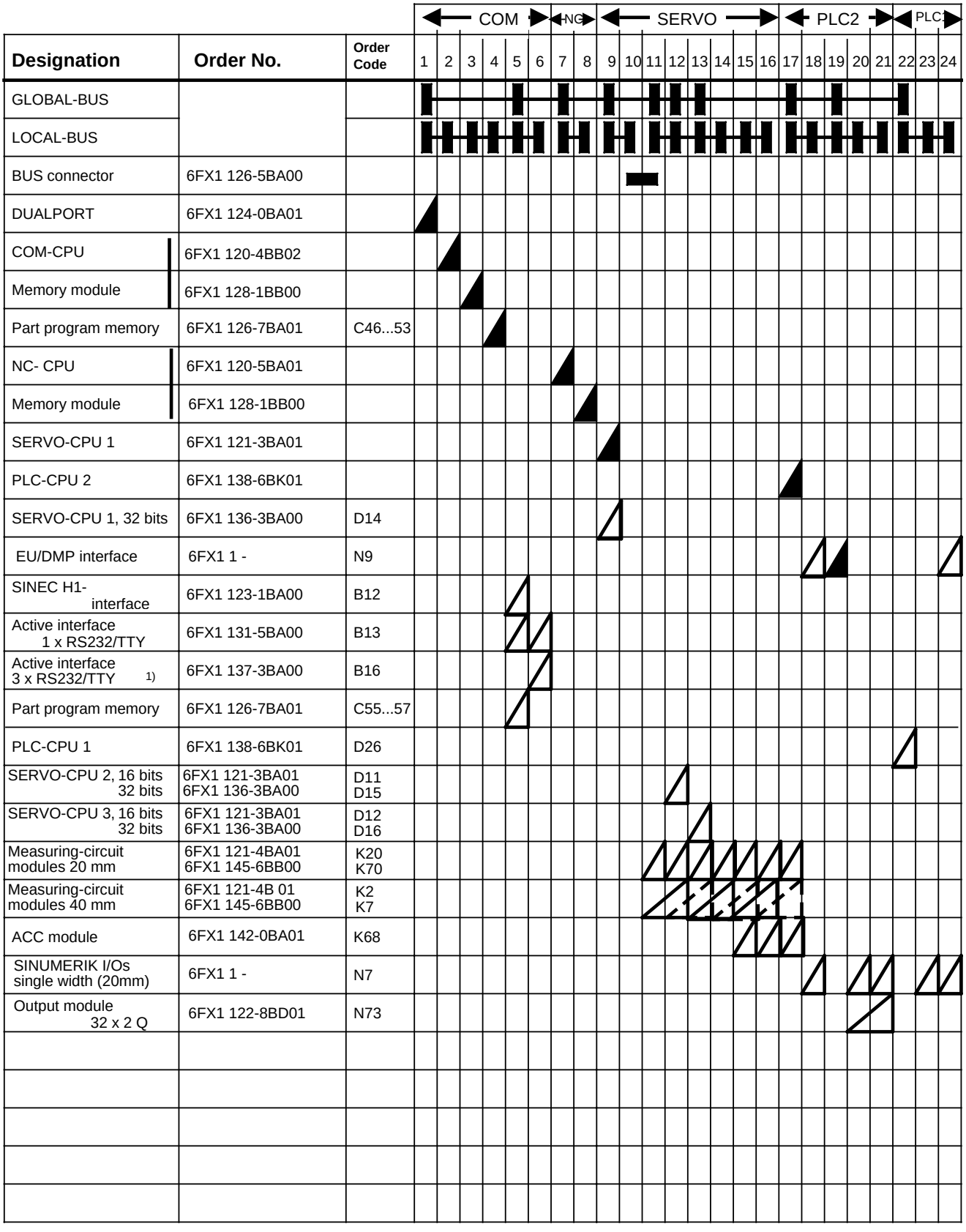
Designation	Order No.	Order Code
GLOBAL-BUS		
LOCAL-BUS		
BUS connector	6FX1 126-5BA00	
DUALPORT	6FX1 124-0BA01	
COM-CPU	6FX1 120-4BB02	
Memory module	6FX1 128-1BB00	
Part program memory	6FX1 126-7BA01	C46...53
NC-CPU	6FX1 120-5BA01	
Memory module	6FX1 128-1BB00	
SERVO-CPU 1	6FX1 121-3BA01	
PLC-CPU	6FX1 138-6BK01	
SERVO- CPU 1, 32 bits	6FX1 136-3BA00	D14
EU/DMP interface	6FX1 1..-	N9
SINEC H1-interface	6FX1 123-1BA00	B12
Active interface 1 x RS232/TTY	6FX1 131-5BA00	B13
Active interface 3 x RS232/TTY 1)	6FX1 137-3BA00	B16
Part program memory	6FX1 126-7BA01	C55...57
SERVO-CPU 2, 16 bits 32 bits	6FX1 121-3BA01 6FX1 136-3BA00	D11 D15
SERVO-CPU 3, 16 bits 32 bits	6FX1 121-3BA01 6FX1 136-3BA00	D12 D16
Measuring-circuit modules 20 mm	6FX1 121-4BA01 6FX1 145-6BB00	K20 K70
Measuring-circuit modules 40 mm	6FX1 121-4B 01 6FX11 45-6BB00	K2 K7
ACC module	6FX1 142-0BA01	K68
SINUMERIK I/Os single width (20mm)	6FX1 1..-	N7
Output module 32 x 2 Q	6FX1 122-8BD01	N73
FRONT PANEL 1 1/3 standard slot	6FC3 985-7AC	

Basic version Option Alternative

1) For use only in conjunction with 6FX1131-5BA00 (B13)

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1.3.11 Version 7B Tier B



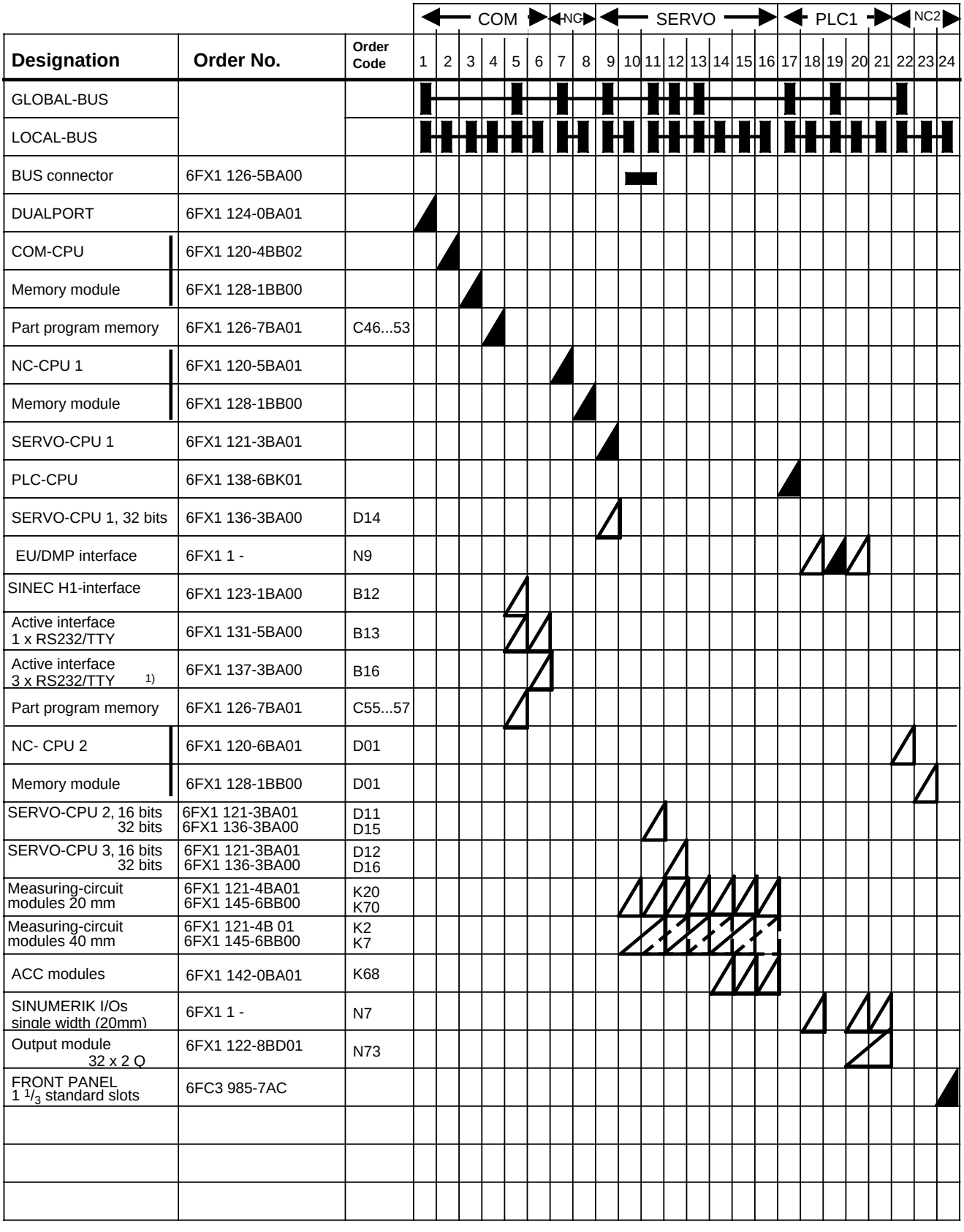
Designation	Order No.	Order Code
GLOBAL-BUS		
LOCAL-BUS		
BUS connector	6FX1 126-5BA00	
DUALPORT	6FX1 124-0BA01	
COM-CPU	6FX1 120-4BB02	
Memory module	6FX1 128-1BB00	
Part program memory	6FX1 126-7BA01	C46...53
NC- CPU	6FX1 120-5BA01	
Memory module	6FX1 128-1BB00	
SERVO-CPU 1	6FX1 121-3BA01	
PLC-CPU 2	6FX1 138-6BK01	
SERVO-CPU 1, 32 bits	6FX1 136-3BA00	D14
EU/DMP interface	6FX1 1 -	N9
SINEC H1-interface	6FX1 123-1BA00	B12
Active interface 1 x RS232/TTY	6FX1 131-5BA00	B13
Active interface 3 x RS232/TTY 1)	6FX1 137-3BA00	B16
Part program memory	6FX1 126-7BA01	C55...57
PLC-CPU 1	6FX1 138-6BK01	D26
SERVO-CPU 2, 16 bits 32 bits	6FX1 121-3BA01 6FX1 136-3BA00	D11 D15
SERVO-CPU 3, 16 bits 32 bits	6FX1 121-3BA01 6FX1 136-3BA00	D12 D16
Measuring-circuit modules 20 mm	6FX1 121-4BA01 6FX1 145-6BB00	K20 K70
Measuring-circuit modules 40 mm	6FX1 121-4B 01 6FX1 145-6BB00	K2 K7
ACC module	6FX1 142-0BA01	K68
SINUMERIK I/Os single width (20mm)	6FX1 1 -	N7
Output module 32 x 2 Q	6FX1 122-8BD01	N73

Basic version Option Alternative

1) For use only in conjunction with 6FX1131-5BA00 (B13)

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1.3.12 Version 7C Tier B



Designation	Order No.	Order Code
GLOBAL-BUS		
LOCAL-BUS		
BUS connector	6FX1 126-5BA00	
DUALPORT	6FX1 124-0BA01	
COM-CPU	6FX1 120-4BB02	
Memory module	6FX1 128-1BB00	
Part program memory	6FX1 126-7BA01	C46...53
NC-CPU 1	6FX1 120-5BA01	
Memory module	6FX1 128-1BB00	
SERVO-CPU 1	6FX1 121-3BA01	
PLC-CPU	6FX1 138-6BK01	
SERVO-CPU 1, 32 bits	6FX1 136-3BA00	D14
EU/DMP interface	6FX1 1 -	N9
SINEC H1-interface	6FX1 123-1BA00	B12
Active interface 1 x RS232/TTY	6FX1 131-5BA00	B13
Active interface 3 x RS232/TTY 1)	6FX1 137-3BA00	B16
Part program memory	6FX1 126-7BA01	C55...57
NC- CPU 2	6FX1 120-6BA01	D01
Memory module	6FX1 128-1BB00	D01
SERVO-CPU 2, 16 bits 32 bits	6FX1 121-3BA01 6FX1 136-3BA00	D11 D15
SERVO-CPU 3, 16 bits 32 bits	6FX1 121-3BA01 6FX1 136-3BA00	D12 D16
Measuring-circuit modules 20 mm	6FX1 121-4BA01 6FX1 145-6BB00	K20 K70
Measuring-circuit modules 40 mm	6FX1 121-4B 01 6FX1 145-6BB00	K2 K7
ACC modules	6FX1 142-0BA01	K68
SINUMERIK I/Os single width (20mm)	6FX1 1 -	N7
Output module 32 x 2 Q	6FX1 122-8BD01	N73
FRONT PANEL $1\ ^1/_3$ standard slots	6FC3 985-7AC	

Basic version

Option

Alternative

1) For use only in conjunction with 6FX1131-5BA00 (B13)

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1.3.13 Version 7A, B, C Tier C

Designation	Order No.	Order Code	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																										
CC interface MPC	6FX1 132-1BB01																									
SINUMERIK I/Os single width (20mm)	6FX1 1..-	N7																								
Output module 32 x 2 Q	6FX1 122-8BB01	N73																								
SIMATIC I/Os single width (20mm)		N **																								
SIMATIC I/O double width (40mm)		N **																								

Basic version

Option

Alternative

** Global and local

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1.4 Subrack assignments expansion units

The SINUMERIK and SIMATIK I/O modules can be inserted in the SINUMERIK EUs (P06 and P08) at the same time.

1.4.1 Expansion unit (P08)

Designation	Order No.	Order Code	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 pack	6EW1861-3A.																									
CC interface MPC	6FX1132-1BB01	N 95																								
SINUMERIK I/Os single width (20mm)	6FX11..-	N 7. [1]																								
SINUMERIC I/Os 32 x 2 A	6FX1122-8BB01	N 73																								
SIMATIC I/Os single width (20mm)		N 6. [2]																								
SIMATIC I/Os double width (40mm)		N 6. [3]																								

1.4.2 Mini expansion unit (P06)

Designation	Order No.	Order Code	1	2	3	4	5	6	7	8	9	10	11	12
BUS / Mini-EU														
CC interface MPC	6FX1132-1BA01													
SINUMERIK I/Os single width (20mm)	6FX11..-	N 7. [4]												
SINUMERIK I/Os 32 x 2 A	6FX1122-8BB01	N 73												
SIMATIC I/Os single width (20mm)		N 6. [2]												
SIMATIC I/Os double width (40mm)		N 6. [3]												

Basic version

Option

Alternative

[1] N71, N72, N74, N79

[2] N61, N66, N69

[3] N68

[4] N71, N72, N74

No other SINUMERIK and SIMATIK modules can be used.

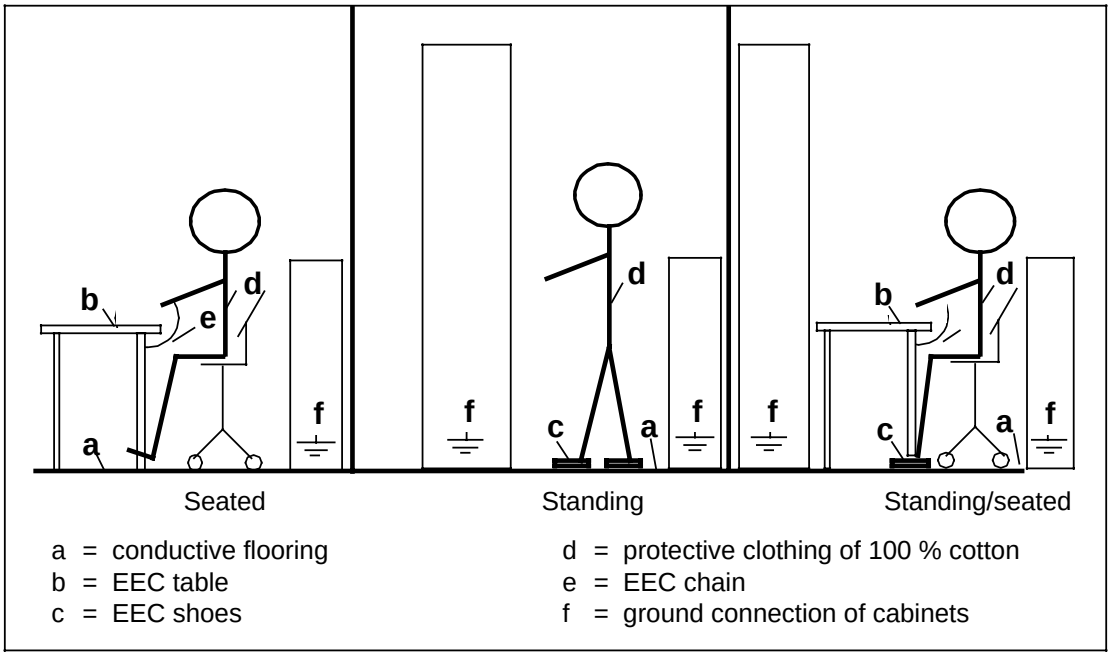
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2 Connection Conditions

2.1 Information on safe handling of the control

2.1.1 Electrostatically endangered components (EEC)

- The "EMC Guidelines for SINUMERIK and SIROTEC controls" apply: document order No. 6TC3987-7DA from GWE.
- Electronic modules should not be touched unless this is unavoidable because of work to be performed on them.
- Before touching an electronic module, the human body must be in a discharged state. This can be done by simply touching a conductive grounded object immediately beforehand (e.g. bright metal cabinet parts, electrical socket protective ground contact).
- Modules must not be brought into contact with highly insulating materials such as plastic film, insulating desk tops, items of clothing made of synthetic fibre.
- Modules must be placed only on conductive surfaces.
- Modules must be plugged in or withdrawn only when in a de-energized state.
- Signal voltages must not exist unless the supply voltage is switched on.
- When soldering on modules, the solder iron tip must be grounded.
- Modules and components must always be stored or dispatched in conductive packaging (e.g. metallized plastic boxes, metal bushings).
- If packagings are non-conductive, modules must be enclosed in conductive material before packaging. Conductive foam rubber or household aluminium foil, for example, can be used for this purpose.
- The necessary protective measures for electrostatically endangered components are illustrated below.



Seated Standing Standing/seated

a = conductive flooring
b = EEC table
c = EEC shoes
d = protective clothing of 100 % cotton
e = EEC chain
f = ground connection of cabinets

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2.1.2 CRT display

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

2.2 Installation

2.2.1 NC units

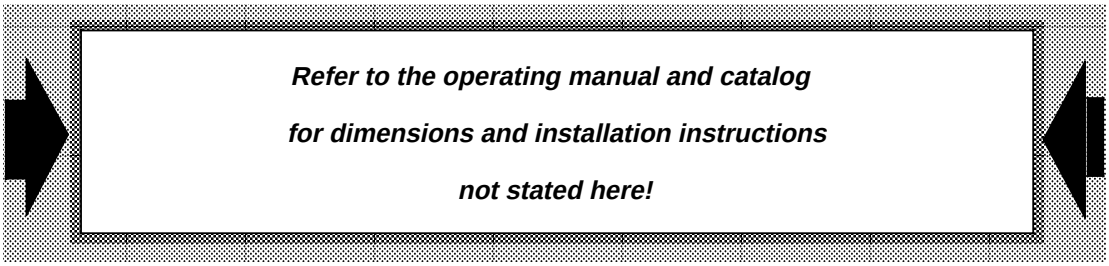
The SINUMERIK 880 controls consist of the following units:
- Central controller with integrated PLC
- Operator panel unit with integrated CRT display

The following options are available for this basic unit:
- Machine control panel
- Max. 4 I/O submodules (operator panel extension)
- Tape reader
- Interface submodule for electronic handwheels
- Electronic handwheels
- Expansion units for PLC modules
- Mini expansion units for PLC modules
- 2nd and 3rd operator panel units with integrated CRT display
- DMP submodules for PLC I/O devices

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

2.2.1.1 Dimension drawings and mounting

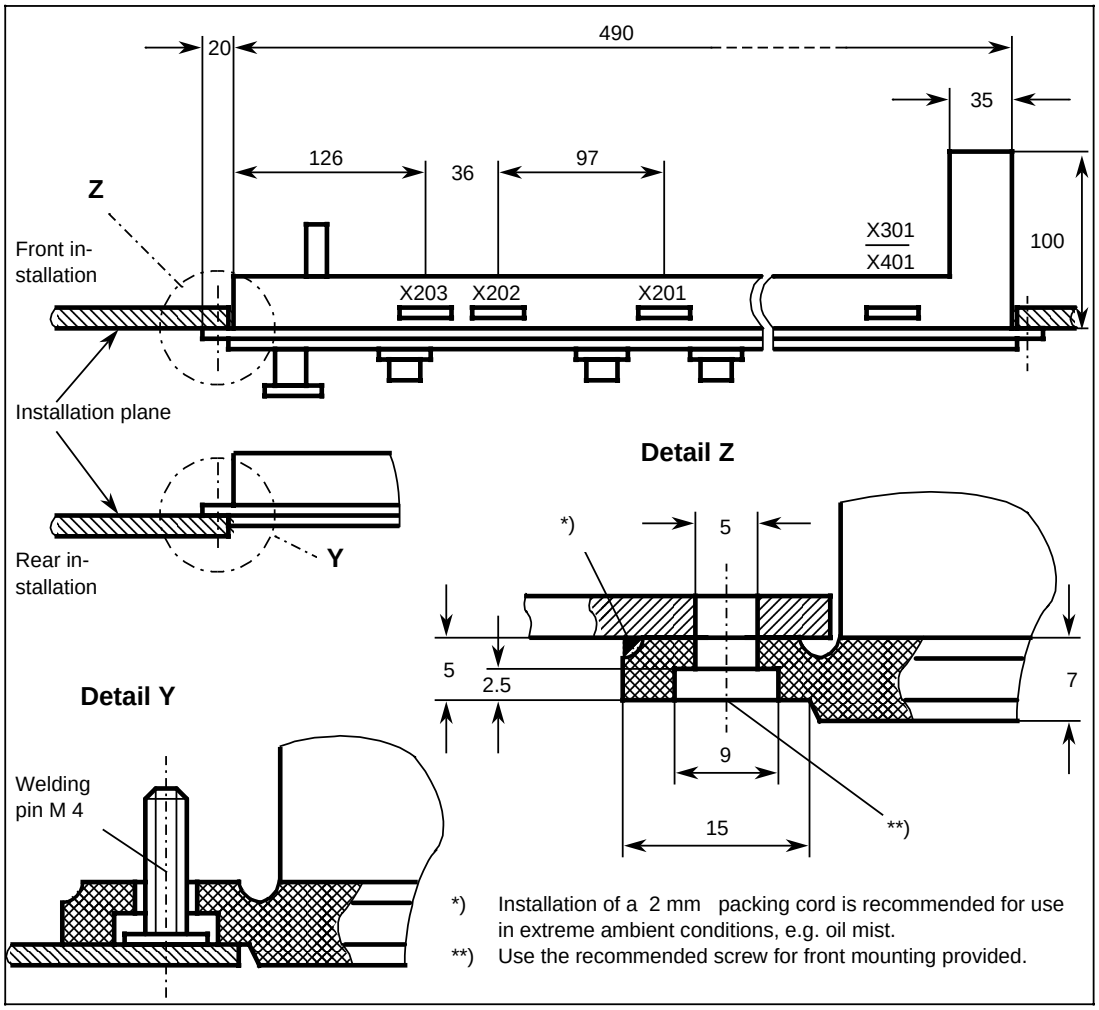
Precise installation instructions must be followed for the various SINUMERIK 880 units and the peripheral equipment. Please observe the various instructions for enclosed installation and for open-circuit ventilation (see Section 2.2.1.2).
The maximum admissible temperatures must never be exceeded.



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- **Machine control panel**

- Installation instructions

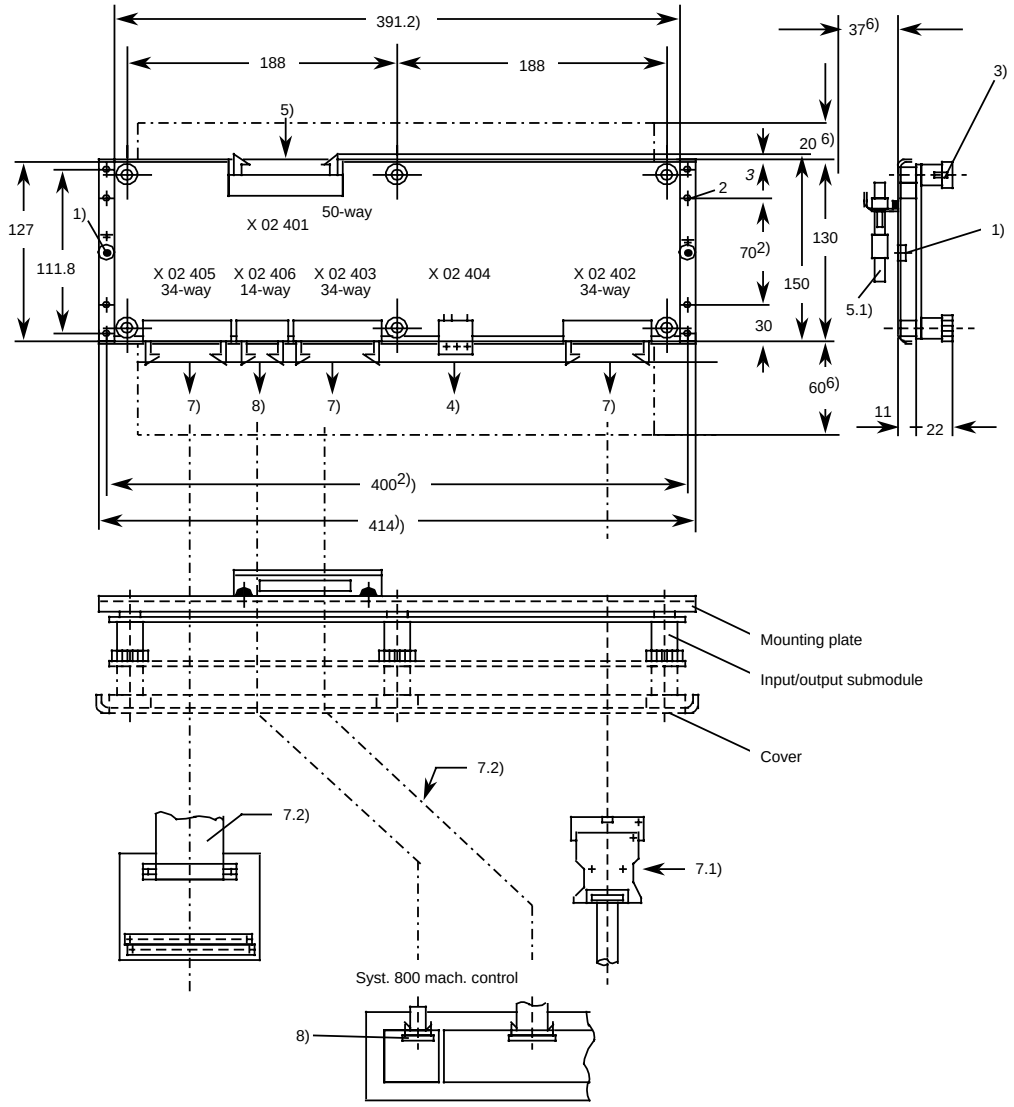


Installation of the machine control panel (front view)

- **I/O submodules**

  Order No.: 6FC3 984 - 3R. (M01, M02, M03, M04)
  Type: 6FX1 124 - 6A.

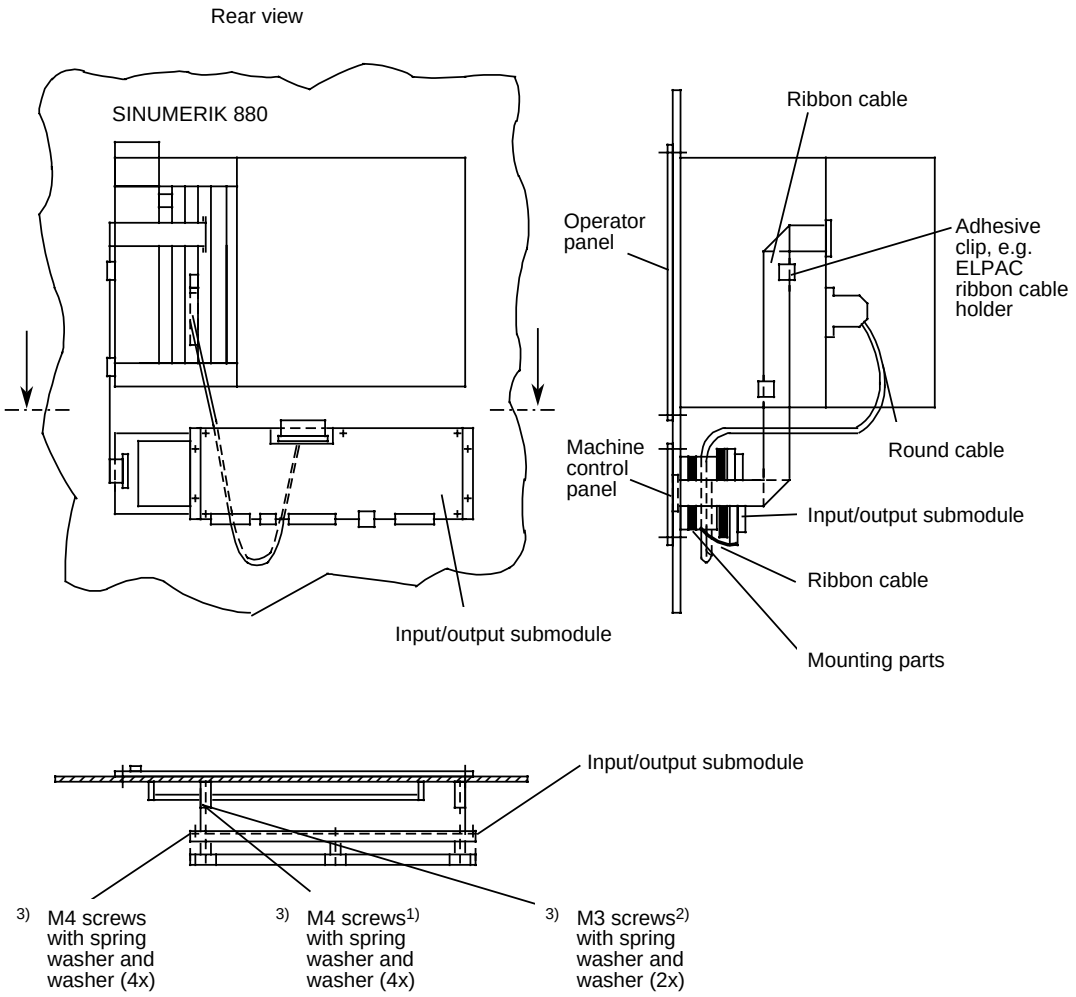
  - Dimension drawings



1) M5 ground connection
2) Fixing hole for M4 screws
3) Tapped hole for M4 screws
4) X02403: Connection +24V, M_{out} and M_{ext} with connector max. 1.5 mm^2
   M_{ext} is for connecting screen only
5) X02401 ribbon cable, 50-core
5.1) X02401 round cable, 50-core
6) Space required for plug connector
7) X02402, X02404, X02405: Connection to ribbon cable connector, 34-way
   Recommended type of connection:
7.1) Via connector and round cable
7.2) Via 34-core ribbon cable
8) X02406: connect to 14-way ribbon cable connector.
   Recommended type of connection:
   Via connector and round cable
   Via 14-core ribbon cable
9) Terminal strip converter

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- Installation instructions



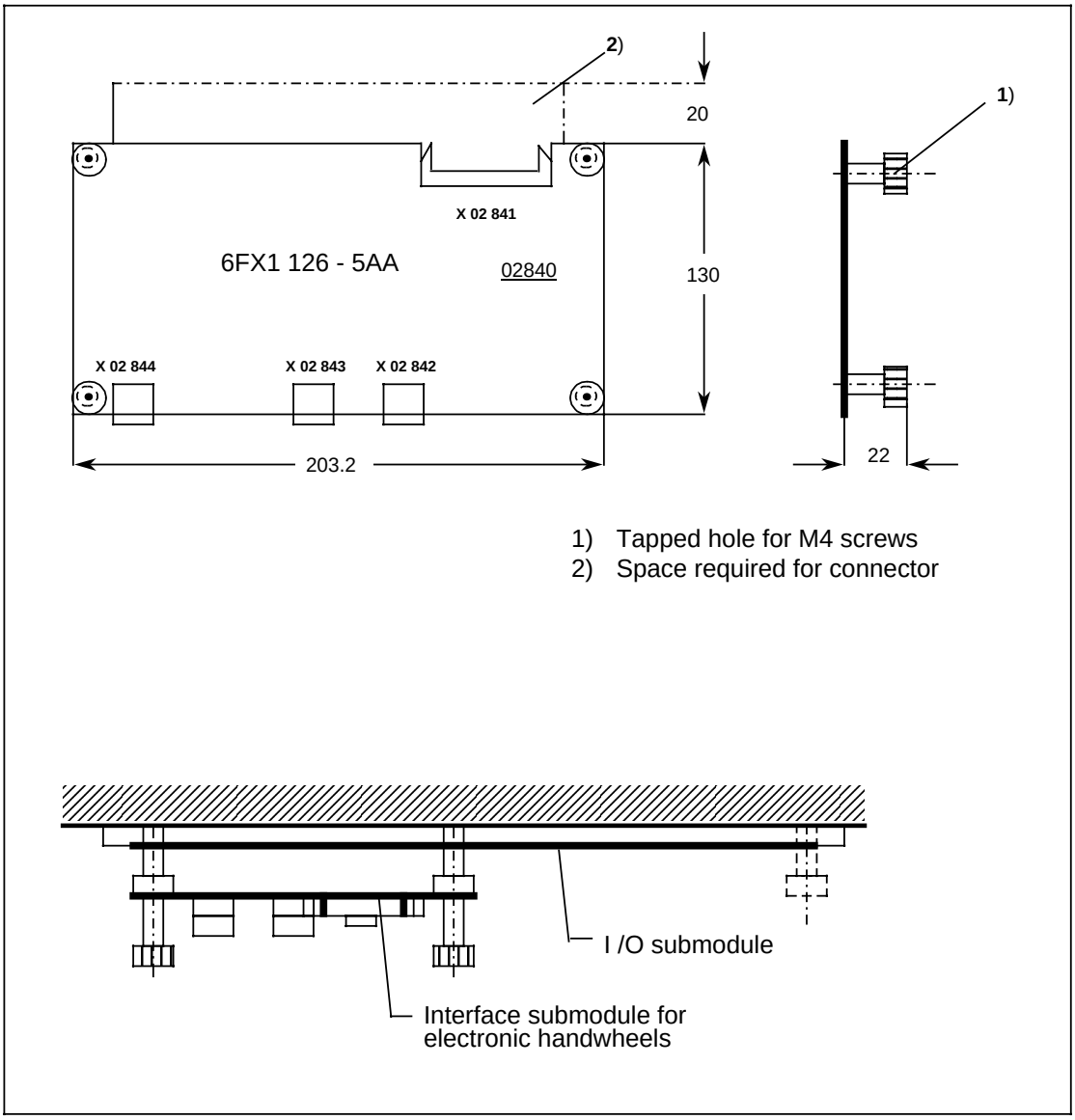
1) Tightening torque: 1.8 Nm
2) Tightening torque: 0.8 Nm
3) Included in mounting parts

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- **Interface submodule for electronic handwheels**

Order No.: 6FC3 984 - 3RJ (M10)
Type: 6FX1 126 - 5AA

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



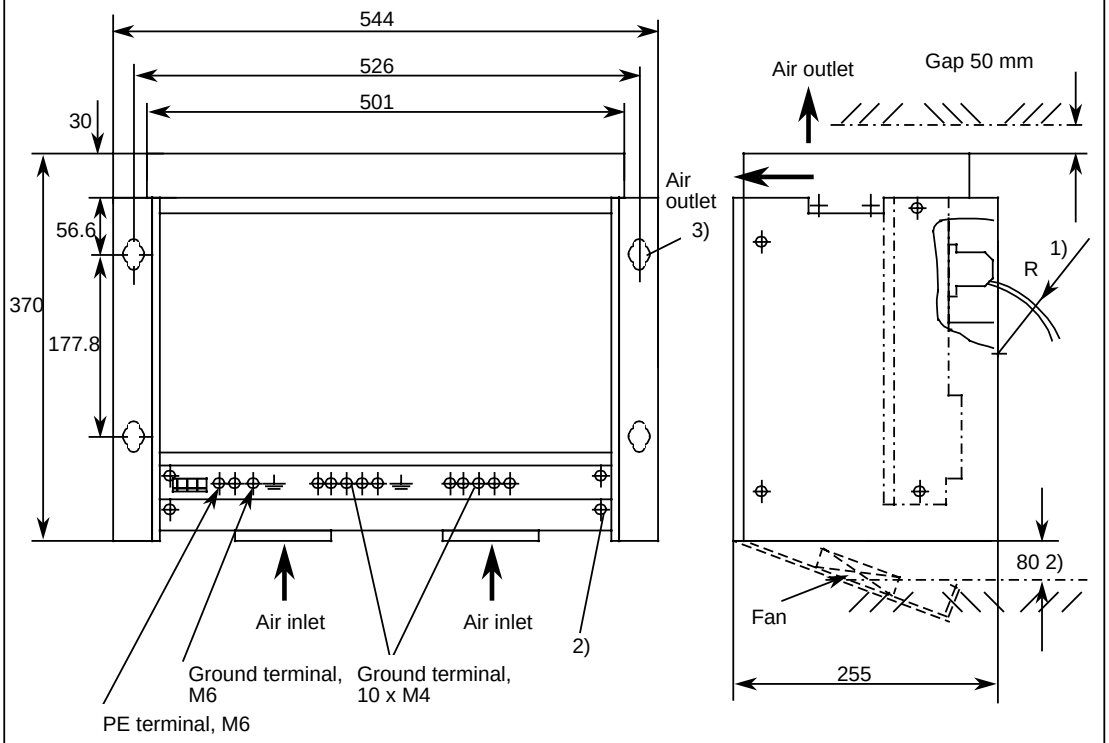
Note:

The interface submodule for electronic handwheels is screwed on top of the I/O submodules.

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- **Expansion unit (P08)**

The expansion unit (P08) permits operation of both SINUMERIK standard I/O modules and of the SIMATIC modules approved for use in the SINUMERIK 880.



1) Depending on cable type. With Siemens cable: R 100

2) Base panel can be hinged and removed after slackening off the retaining screws

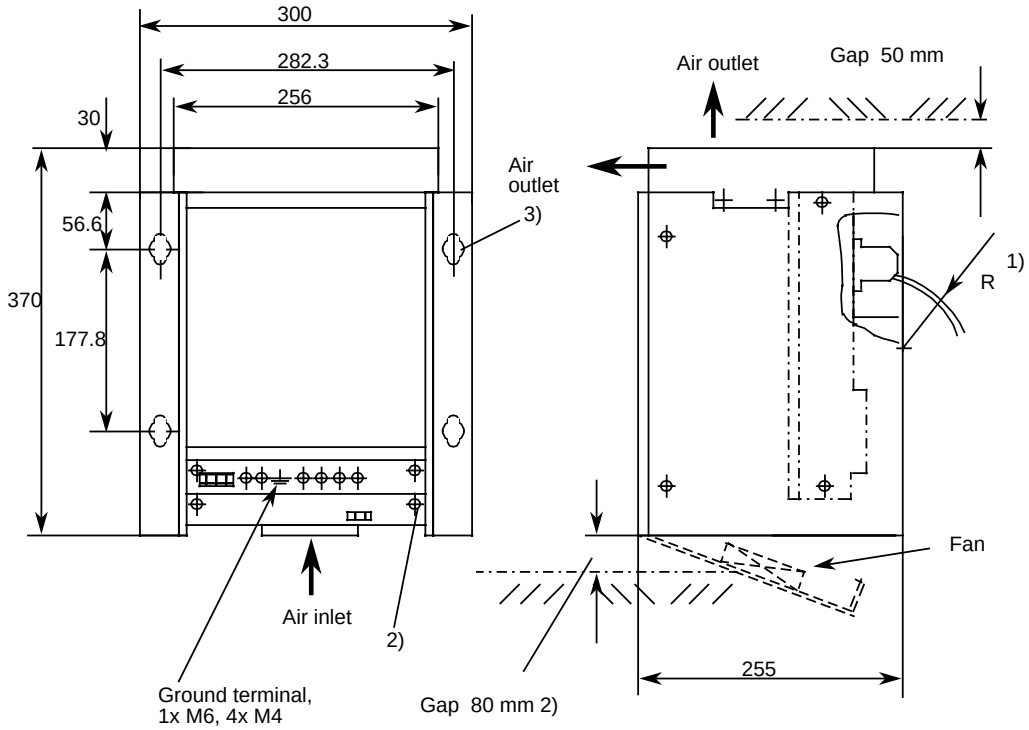
3) M6 retaining screw.

4) Two additional brackets can be attached if required (Order No. 226 104. 0362.01)

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- **Mini expansion unit (P06)**

The mini expansion unit (P06) permits operation of both SINUMERIK standard I/O modules and of the SIMATIC modules approved for use in the SINUMERIK 880. Since no power supply (±15V) is available, analog modules (N74, N79) cannot be operated.



1) Depending on cable type . With Siemens cable: R 100

2) Base panel can be hinged and removed after slackening off the retaining screws

3) M6 retaining screw.

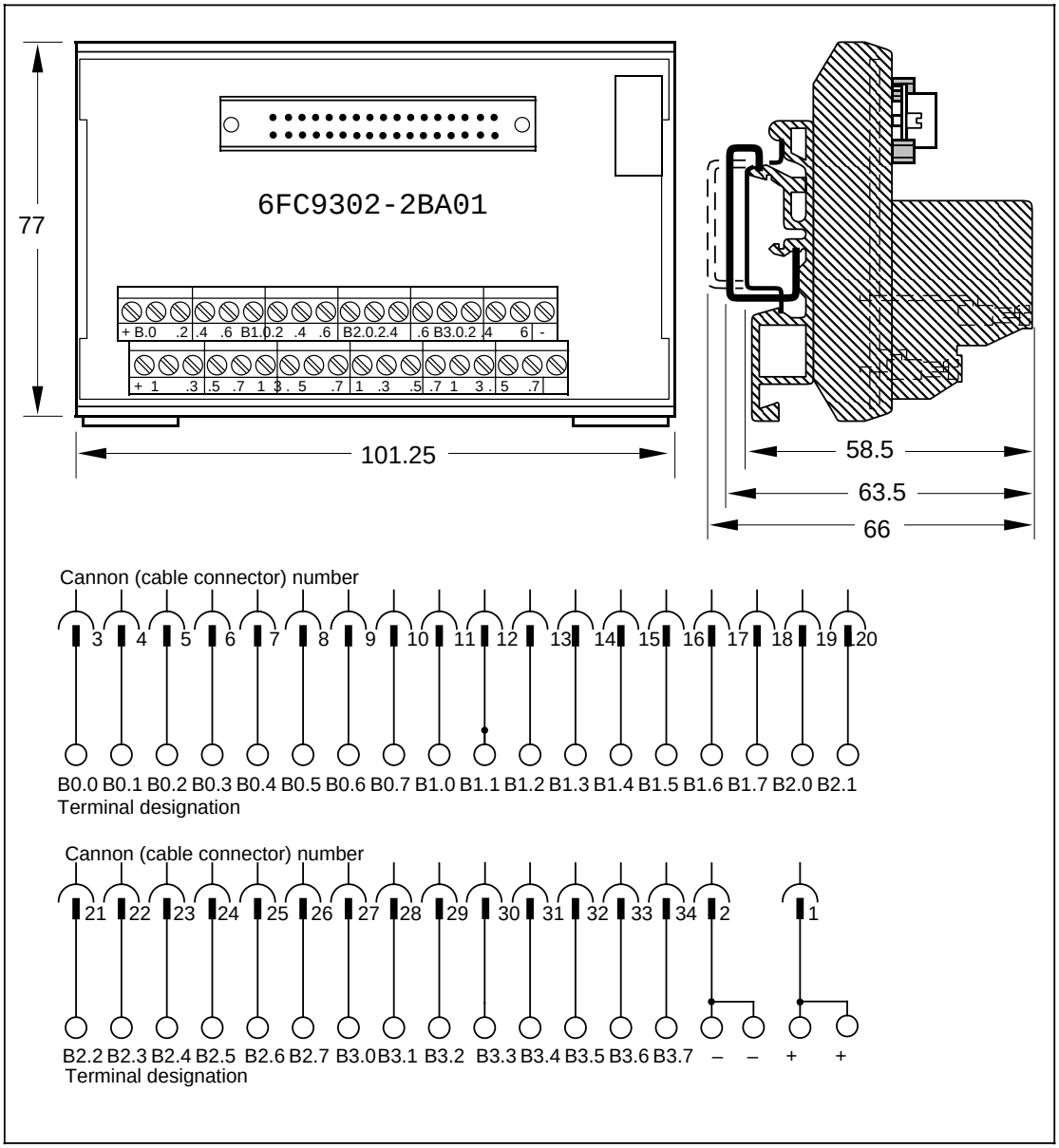
4) Two additional brackets can be attached if required (Order No. 226 104. 0362.01)

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

Order No.: **6FC9 302-2BA01**

Nominal voltage:	24 V DC
No. of transmitted signals:	34
Nominal current:	0.5 A (x 34 connections)
Connection type:	34-way ribbon cable/screw terminal
Nominal cross-section:	1.5 mm² (screw terminal)
Designation:	SIEMENS 6FC 9302 2BA
Locating socket:	TS 32/TS 35
Colour:	RAL 7032

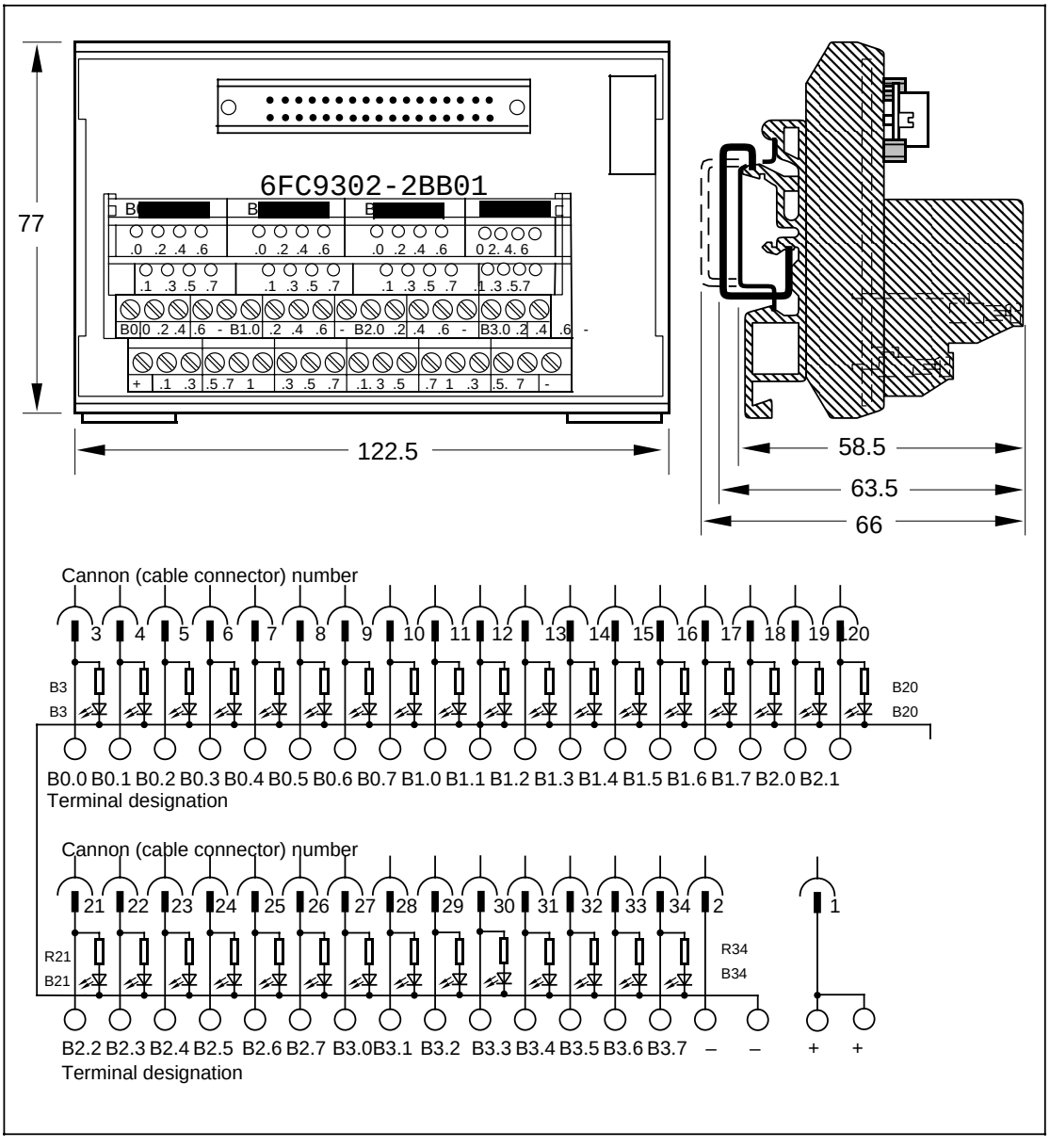


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• Terminal strip converter without LEDs, for I/O submodule (M01 . . . M04)

Order No: **6FC9 302-2BB01**

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

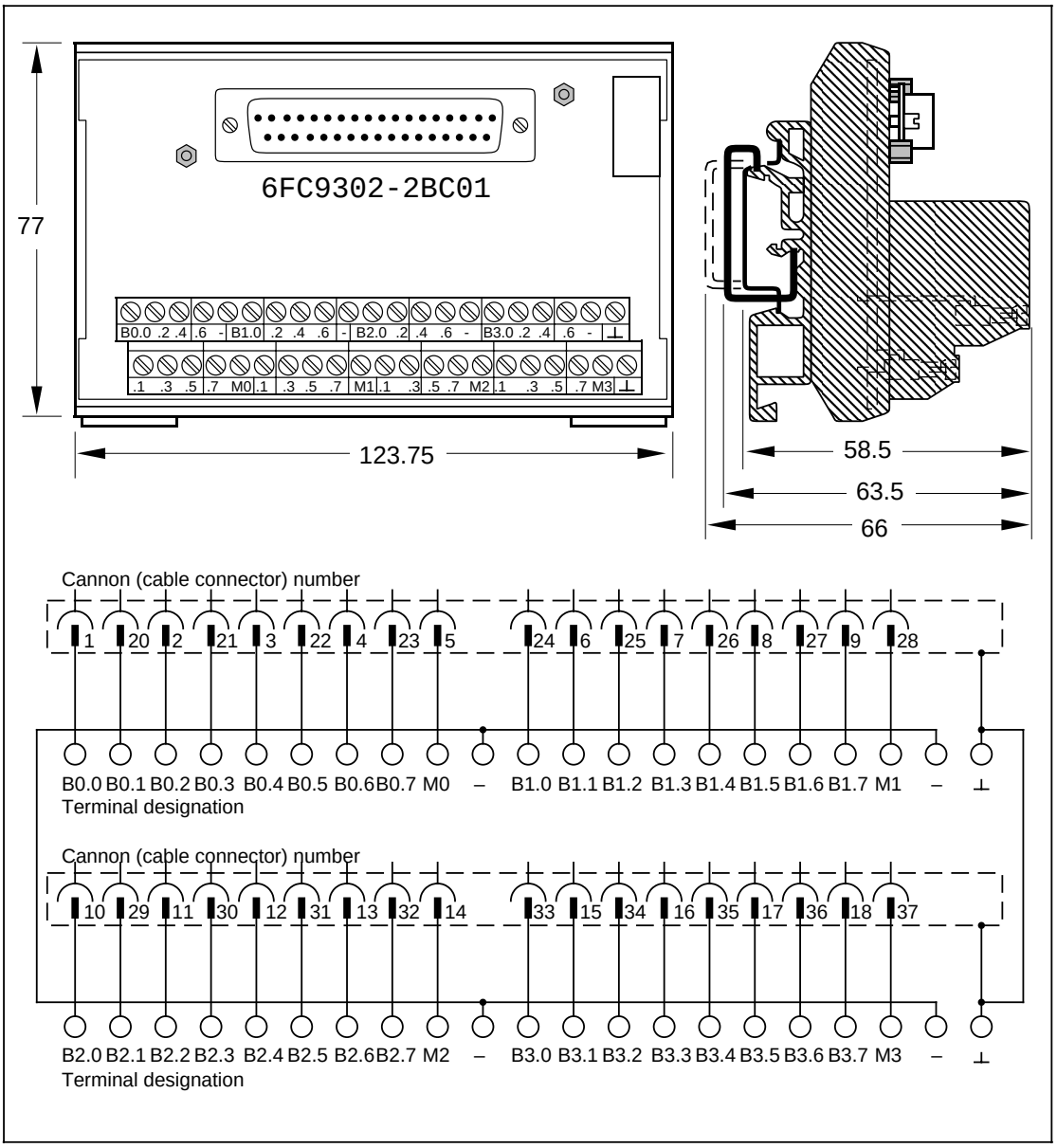


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- **Terminal strip converter without LEDs, for input module (N71) and mixed input/ output module (N79)**

Order No: **6FC 9302-2BC01**

Nominal voltage:	24 V DC
No. of transmitted signals:	37
Nominal current:	0.5 A (x 37 connections)
Connection type:	37-way D-sub male connector/screw terminal
Nominal cross-section:	1.5 mm^2 (screw terminal)
Designation:	SIEMENS 6FC 9302 2BC
Locating socket:	TS 32/TS 35
Colour:	RAL 7032

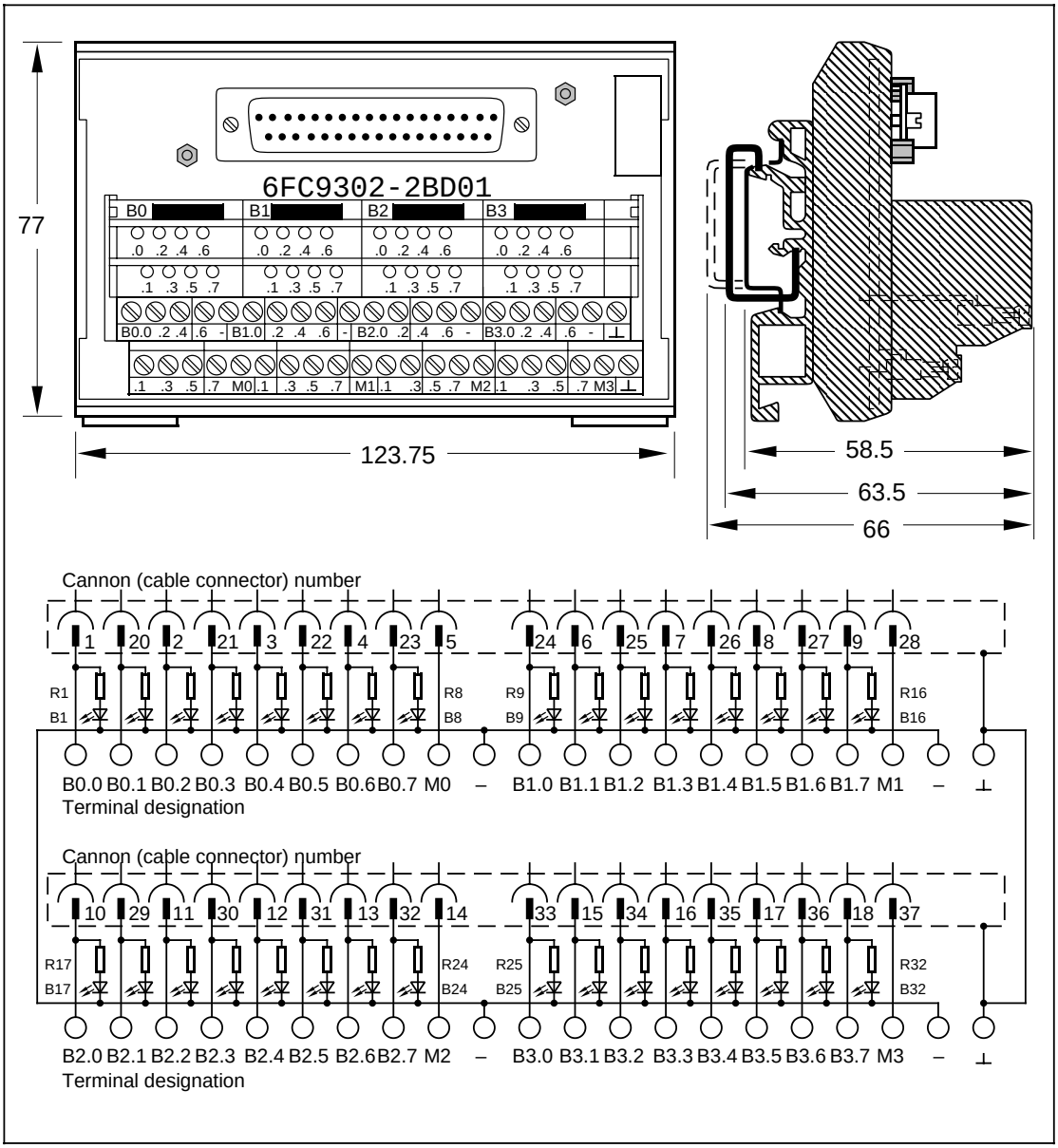


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- **Terminal strip converter with LEDs, for input module (N71) and mixed input/ output module (N79)**

Order No: **6FC 9302-2BD01**

Nominal voltage:	24 V DC
No. of transmitted signals:	37
Nominal current:	0.5 A (x 37 connections)
LEDs, green:	37 (plug-type, renewable)
LED current:	approx. 5 mA
Connection type:	37-way D-sub male connector/screw terminal
Nominal cross-section:	1.5 mm^2 (screw terminal)
Designation:	SIEMENS 6FC 9302 2BD
Locating socket:	TS 32/TS 35
Colour:	RAL 7032

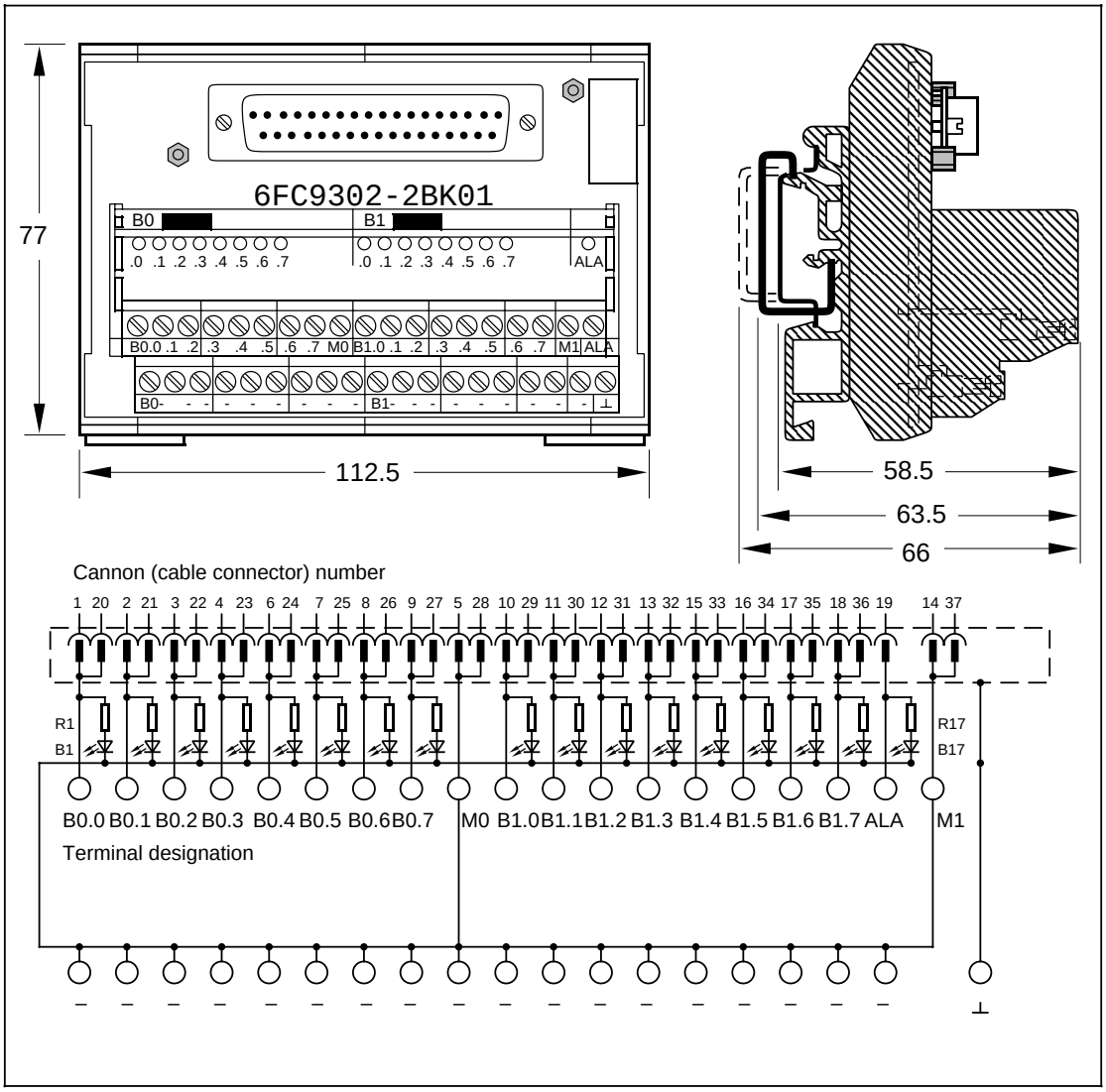


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- **Terminal strip converter with LEDs, for I/O submodule (N72, N73)**

Order No.: **6FC9 302-2BK01**

Nominal voltage:	24 V DC
No. of transmitted signals:	16
Nominal current:	2 A (x 16 connections)
LEDs, green:	16
LED current:	5 mA
Connection type:	37-way D-sub male connector/screw terminal
Nominal cross-section:	1.5 mm^2 (screw terminal)
Designation:	SIEMENS 6FC 9302 2BK
Locating socket:	TS 32/TS 35
Colour:	RAL 7032



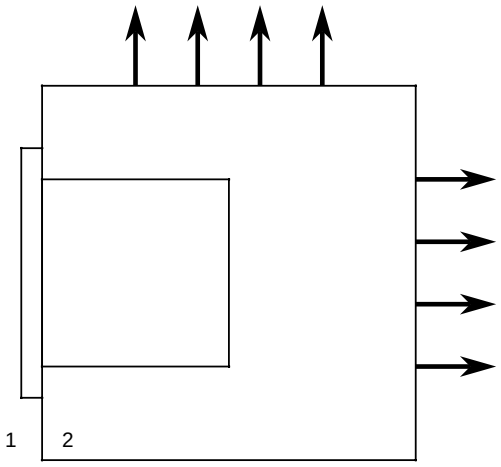
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2.2.1.2 Installation conditions

Device	Electrical and mechanical installation conditions					Climatic installation conditions		
	Nominal voltage and tolerance	Max. power loss	Degree of protection (to DIN 40050)	Dimen-sions (Width Height Depth)	Weight (approx.)	Inlet air and ambient temperature in operation	Max. temperature change	Permissible air humidity (to DIN 40040)
Central controller	230V AC ± 15%	240 W	IP 00	544 mm 816 mm 310 mm	80 kg	0 to 55° C	1.1 K/min	F
Operator panel	230V AC ± 15%	150 W	Front IP 54 Rear IP 00	530 mm 350 mm 370 mm	20 kg	0 to 55° C	1.1 K/min	F
I/O submodule M01 (6FC3 984-3RA) I submodule M 04 (6FC3 984-3RC)	24V DC (20...30V including ripple)	7.5 W	IP 00	414 mm 150 mm 33 mm	1.3 kg			
I/O submodule M02 (6FC3 984-3RB) I submodule M03 (6FC3 984-3RC)	24V DC (20...30V including ripple)	7.5 W	IP 00	391 mm 150 mm 22 mm	1.0 kg			
Interface submodule for electronic hand-wheels M10 (6FC3 984-3RJ)	Internal voltage	7.5 W	IP 00	203 mm 150 mm 22 mm	0.5 kg			
Machine control panel J85 (6FC3 188-3EF)	Internal voltage		Front IP 54 Rear IP 00	530 mm 144 mm 135 mm	1.2 kg	0 to 55° C	1.1 K/min	F
Control cabinet with heat exchanger		725 W at 10 K 1450 W bei 20 K	IP 54	720 mm 1802 mm 852 mm	160 kg	45° C	1.1 K/min	F
Mini EU (PLC) P06 (6FC3 984-4FG)	24V DC		IP 00			0 to 55° C	1.1 K/min	F
EU (PLC) P08 (6FC3 984-4FJ)			IP 00			0 to 55° C	1.1 K/min	F
Terminal strip con-verter (6FC3 302-2A.)			IP 00	See dim. drgs.		0 to 55° C		

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- **Heat removal (operator panel)**



1) By convection

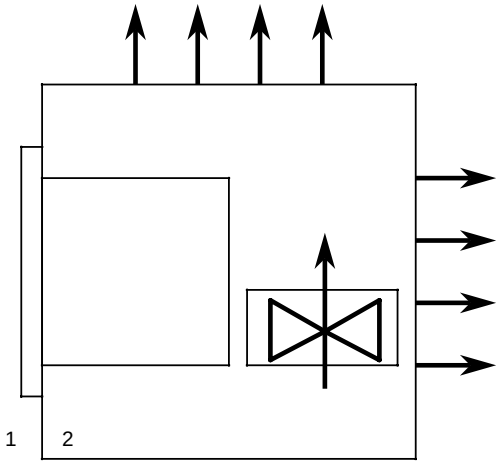
The housing surface of the surrounding space (steel or aluminium sheet 1.5 mm thick) is determined by the equation

$$A[m^2] = \frac{P_V\,[W]}{5 \times (\vartheta_2 - \vartheta_1)\,[K]}$$

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

ϑ_2 is the temperature in the housing
ϑ_1 is the ambient temperature

The above equation applies approximately for $\vartheta_2 - \vartheta_1$ 10 K. The front and underside of the housing are not taken into account in the surface calculation.



2) By forced air circulation in housing and convection

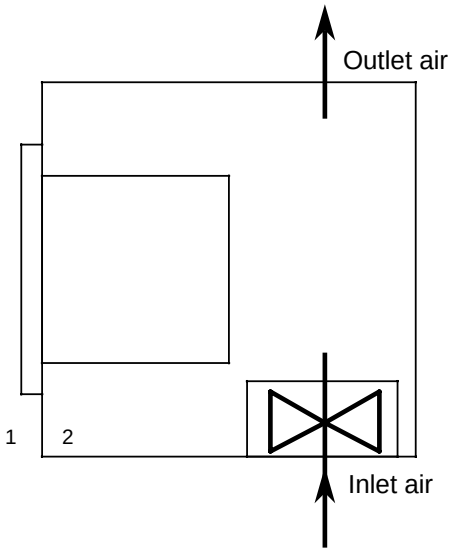
The following equation applies:

$$A[m^2] = \frac{P_V\,[W]}{10 \times (\vartheta_2 - \vartheta_1)\,[K]}$$

Prerequisites see 1)

Air flow through fan:

100 to 165 m^3 / h



3) Open-circuit ventilation

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

$$V[m^3/h] = \frac{3{,}5 \times P_V\,[W]}{(\vartheta_2 - \vartheta_1)\,[K]}$$

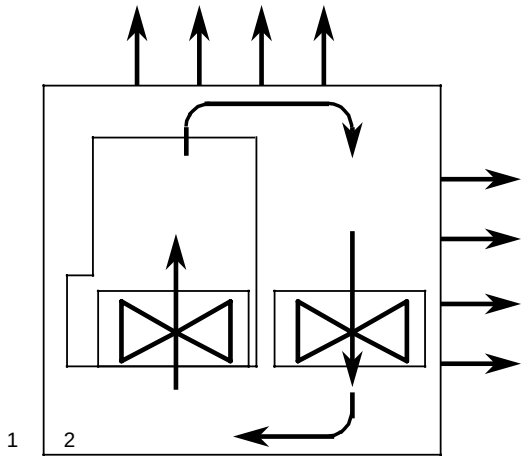
Prerequisites see 1)

Inlet air temperature 55 °C

(For determination of **power loss P_V** see Section 2.4)

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- **Heat removal (central controller)**

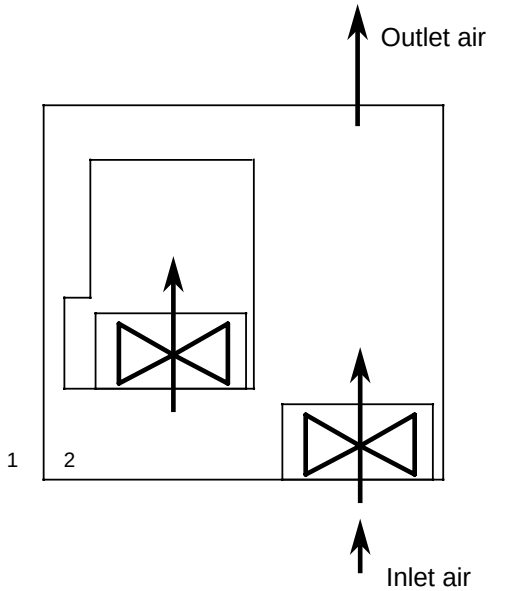


1) Heat removal by natural convection and internal turbulence of the air:

The necessary free convection surface of the surrounding space (steel or aluminium sheet 1.5 thick) is calculated approximately from the following equation, referred to a temperature difference $_2$ - $_1$ 10K:

$$A[m^2] = \frac{P_V\,[W]}{10 \times (\ _2 - \ _1)\ [K]}$$

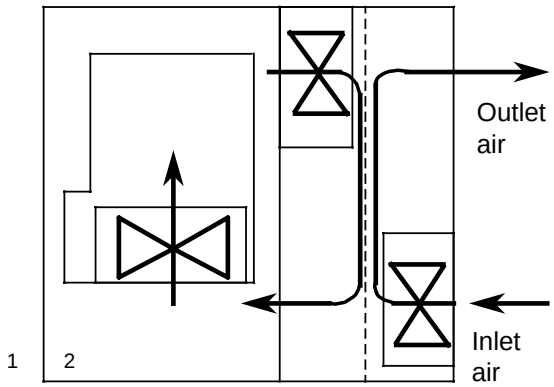
The surfaces of the front and underside are not allowed for in the calculation of convection surface.



2) Heat removal by open-circuit ventilation

Inlet air temperature: 55 °C
The air flow required here for removing the lost heat is calculated from:

$$V[m^3/h] = \frac{3.5\ P_V\,[W]}{(\ _2 - \ _1)\,[K]}$$



3) Heat removal by means of heat exchanger

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

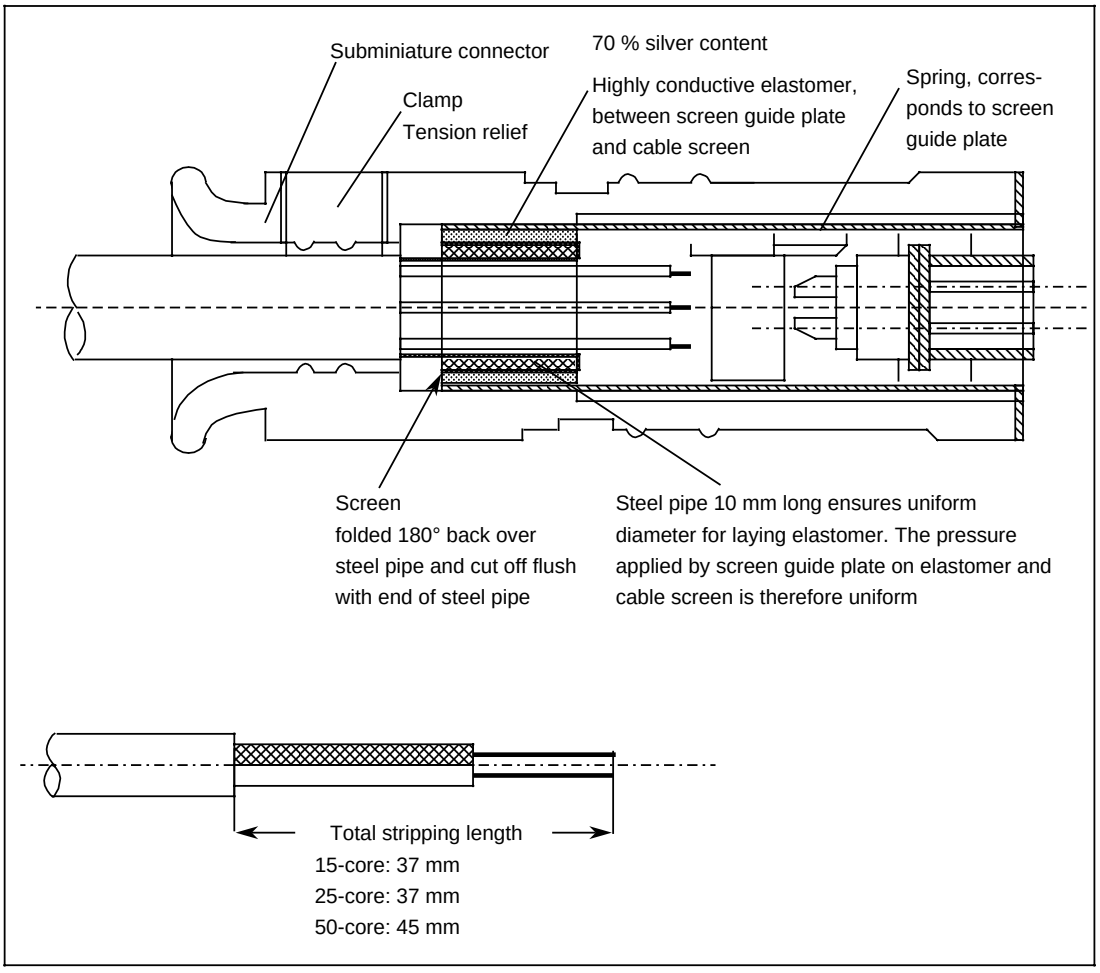
Maximal temperature in cabinet:+55 °C

(For determination of **power loss P_V** see Section 2.4)

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2.2.1.3 Cables and connectors

The units must be connected only with the prescribed types of cable in accordance with the overview of cables and devices (Section 7.5).
In the overview of cables and devices and in the lists of accessories (7.1) the maximum possible cable lengths are given. The cable screen is connected to the subminiature connector as shown in the installation scheme.
The cables must be protected against mechanical damage, for example by means of cable channels or sheet metal covers. Penetration of oil, coolant or chips must be avoided.
Communications cables must not be run in parallel to power cables. Cables not belonging to the control must not be taken through the central controller. The connectors must be securely screwed onto the front panels of the modules.



Connector features

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

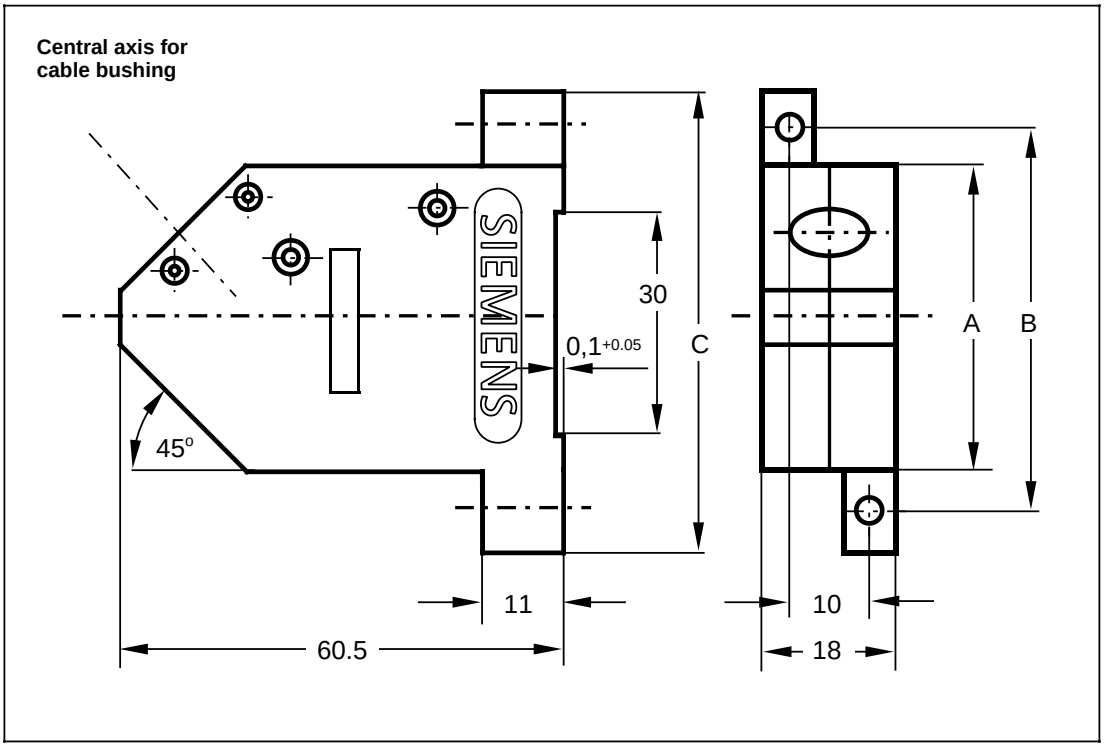
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Installation rules

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

Subminiature connector with SINUMERIK housing

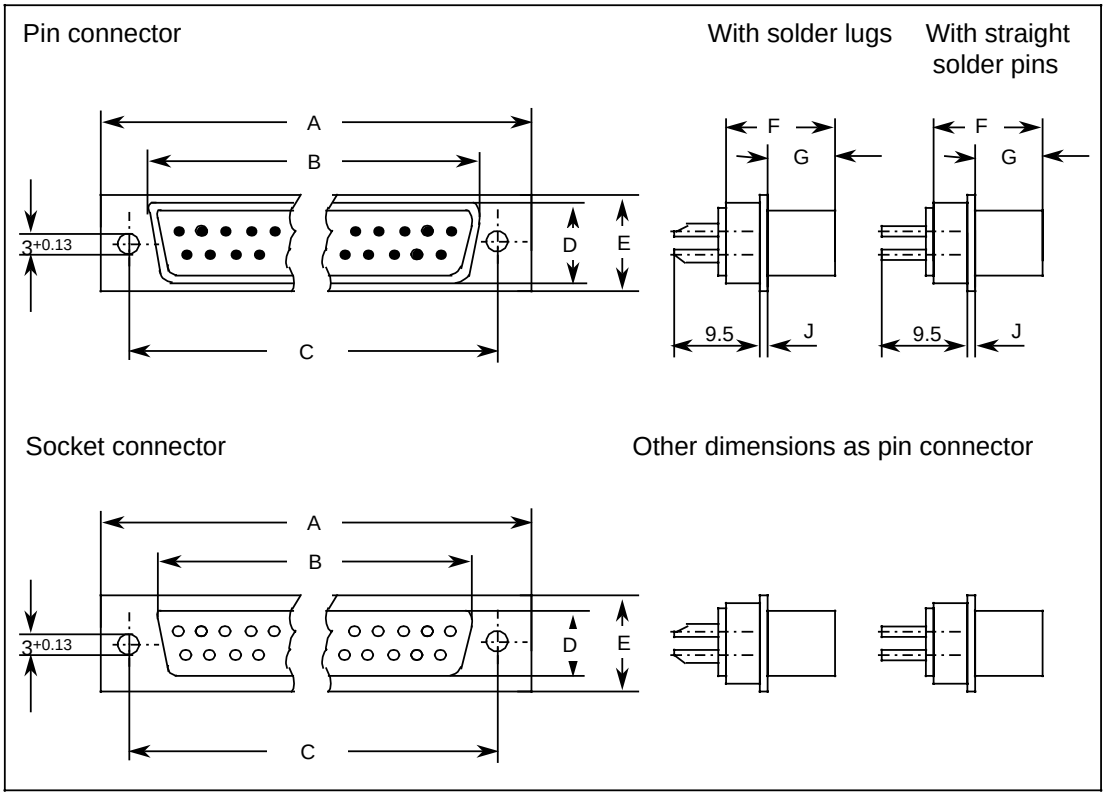
Dimension drawing



Submin.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
50-way female	**71**	**81**	**91**	6FC9 341-1EE
15-way male	**43**	**53**	**63**	6FC9 341-1EU
25-way male	**57**	**67**	**77**	6FC9 341-2AB
50-way male	**71**	**81**	**91**	6FC9 341-1EH

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Installation data



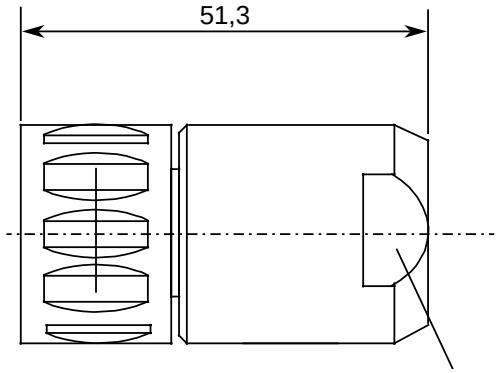
Number of pins	Con-nector	A in mm	B 1) in mm	C in mm	D 1) in mm	E in mm	F in mm	G in mm	J in mm
15	Pin	39.1	25.2	33.3	8.4	12.5	10.8	5.9	1.0
15	Socket	39.1	24.6	33.3	7.8	12.5	10.8	6.2	0.9
25	Pin	53.0	38.9	47.0	8.4	12.5	10.8	5.9	1.0
25	Socket	53.0	38.3	47.0	7.8	12.5	10.8	6.2	0.9
37	Pin	66.9	52.8	61.1	11.1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

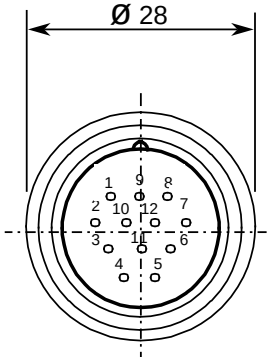
1) Dimensions are inside for pin connector and outside for socket connector

2) Three rows of pins/sockets

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Siemens connector for rotary encoder

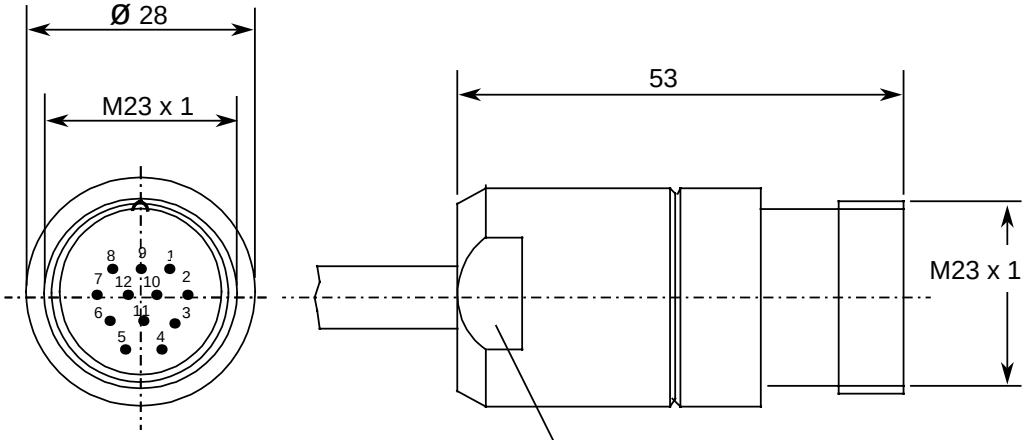




Terminal diagram, connection side

Connector

Cable Ø	Order No.	
10 mm	6FC9 341	- 1 FD
8 mm		- 1 FR
6 mm		- 1 FT



Connector coupling

Cable Ø	Order No.	
10 mm	6FC9 341	- 1 FC
8 mm		- 1 FQ
6 mm		- 1 FS

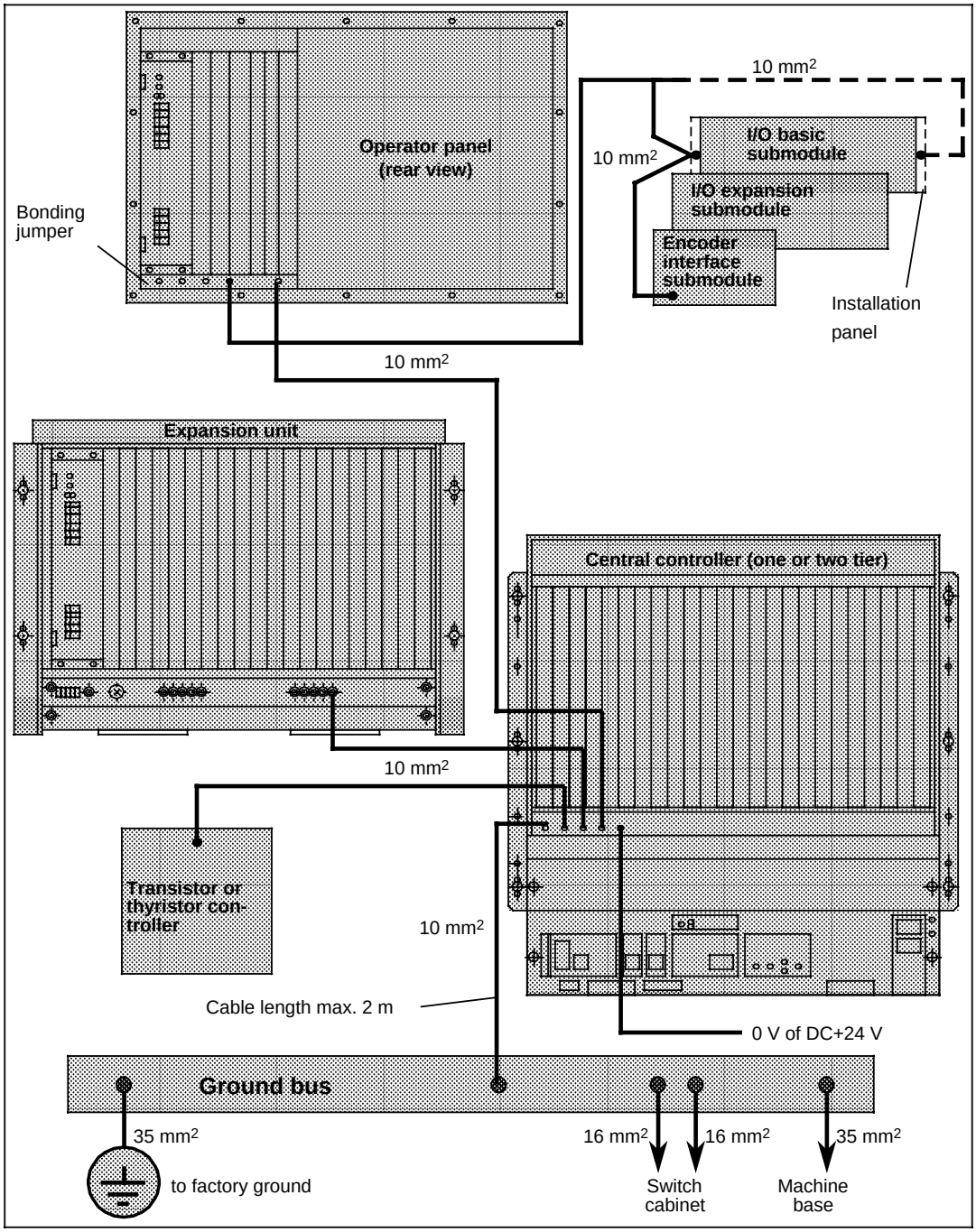
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2.2.1.4 Grounding concept

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

Grounding concept:

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



Typical configuration of equipotential bonding conductors

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2.2.1.5 Power supply connection and switch-on conditions

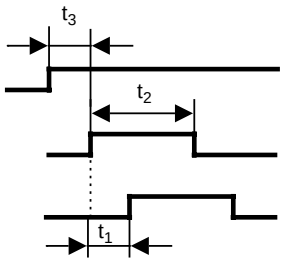
General

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

  Voltage on

  NC - ON operator panel

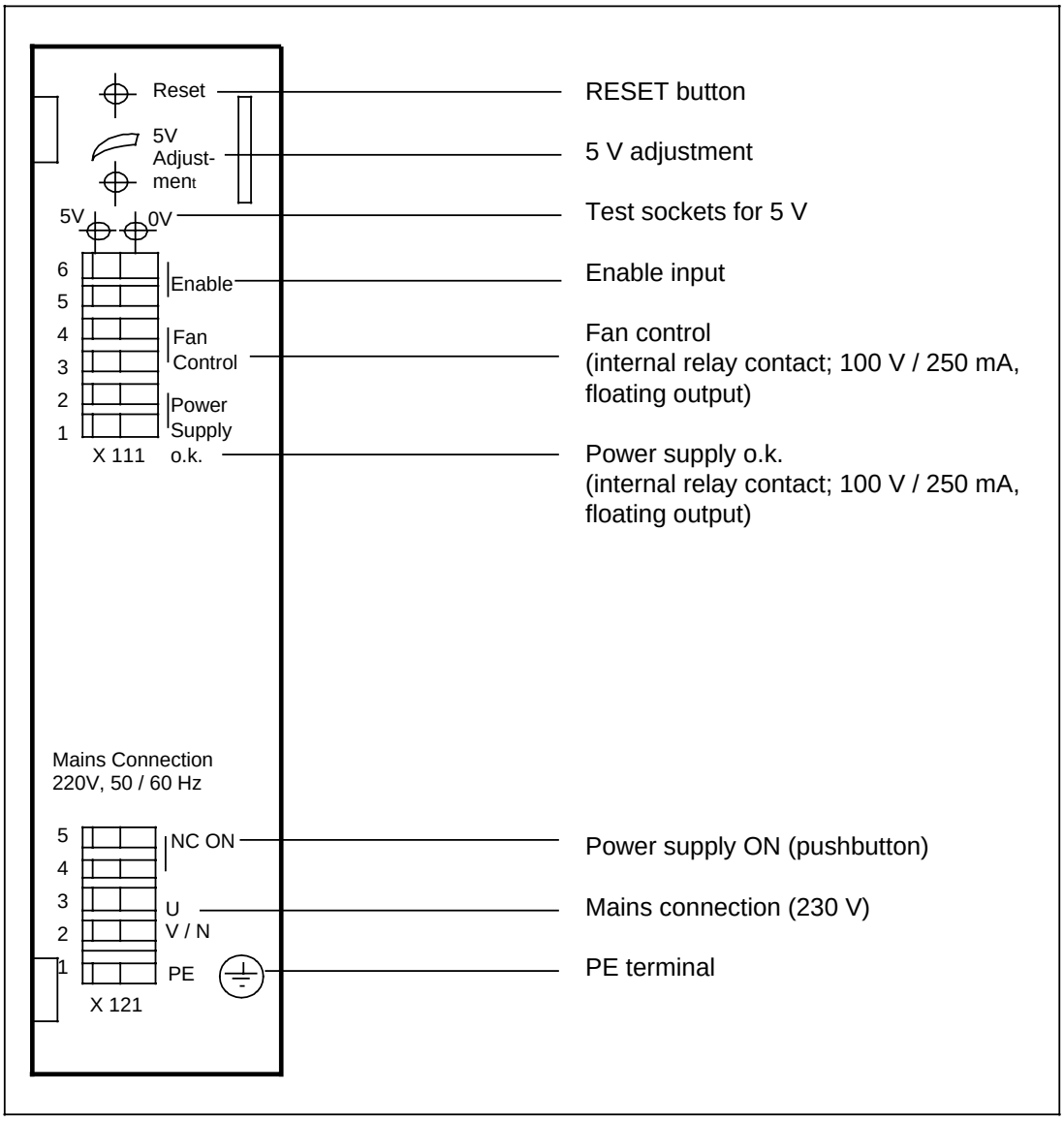
  NC - ON central controller



  The time t_3 500 ms must have elapsed before NC-ON is operated (except with power supplies stated above).
  The time t_1 must be 0 seconds, i.e. the NC-ON of the operator panel must be pressed before (or at the same time as) the NC-ON of the central controller. The pushbutton must be operated at least for a time of t_2 = 500 ms (t_2 = if a switch is used as NC-ON on the relevant power supplies).
- The EU (expansion unit) and Mini EU for PLC I/Os must be switched on before operating the NC-ON of the central controller (simultaneous operation is permitted).
- The operator panel can be switched on again only after a period of 10 seconds , as otherwise the screen can be damaged or the synchronization will not be correct (display moves across the screen or does not appear at all).
- The supply of the I/O submodules is designed for 20-30 V DC including ripple. The supply voltage must be generated from the mains voltage by means of an additional power supply unit.
- When connecting the input voltage to the power supplies, all relevant standards and rules (VDE 0160, EC 550) must be followed.

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Power supply operator panel



View of front panel of the power supply for the operator panel

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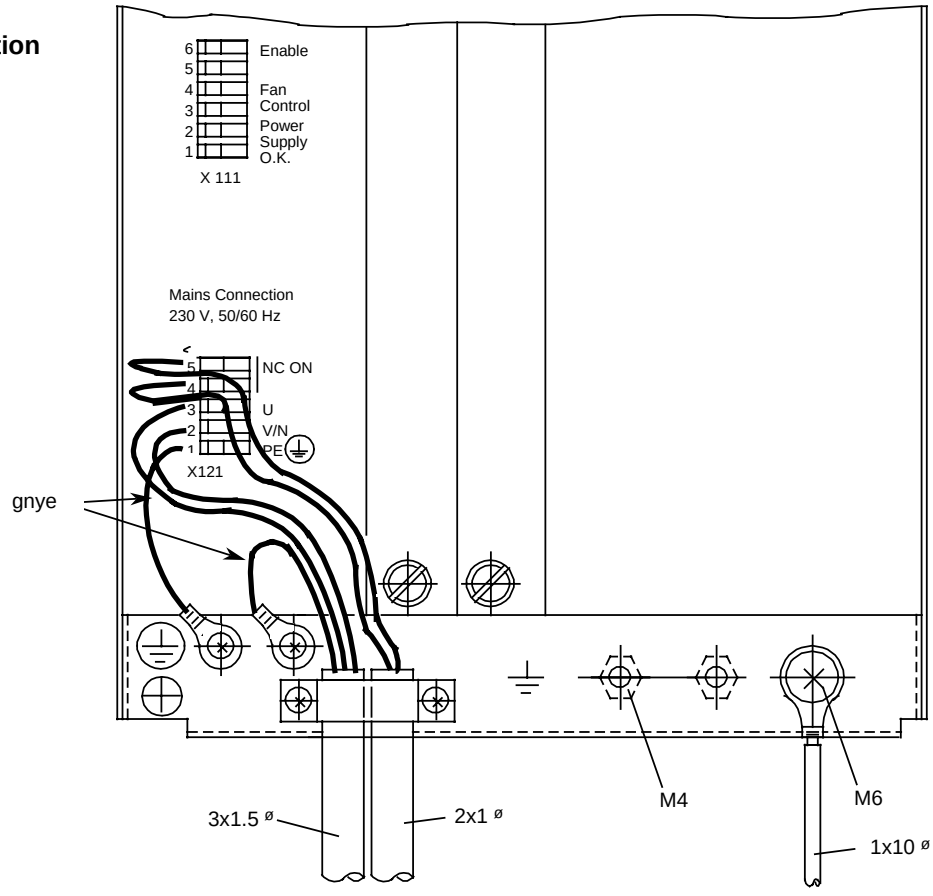
Technical Data (power supply for operator panel)

Input voltage	230 V + 10 % / -20 % Single phase / neutral with loadable neutral Two-phase phase / phase without loadable neutral Other voltages to be matched by means of auto- transformer	Operating temper- ature	0 to + 55° C
		Storage and trans- portation temp.	- 40 to +70° C
		Humidity rating (DIN 40040)	F
		Degree of pro- tection	IP 00 IP 20 (built-in)
Frequency	48 to 63 Hz	Vibration and impact load (DIN 20010) stationary 12 transportation 22	
Power consumption for operator panel	215 VA + fan + CRT display		

Permissible voltage interrupt with:

nominal voltage U_N	max.	10 ms (U_N ... 230 V)
UN - 20 %	max.	3 ms

Mains connection



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ON/OFF conditions (power supply for operator panel)

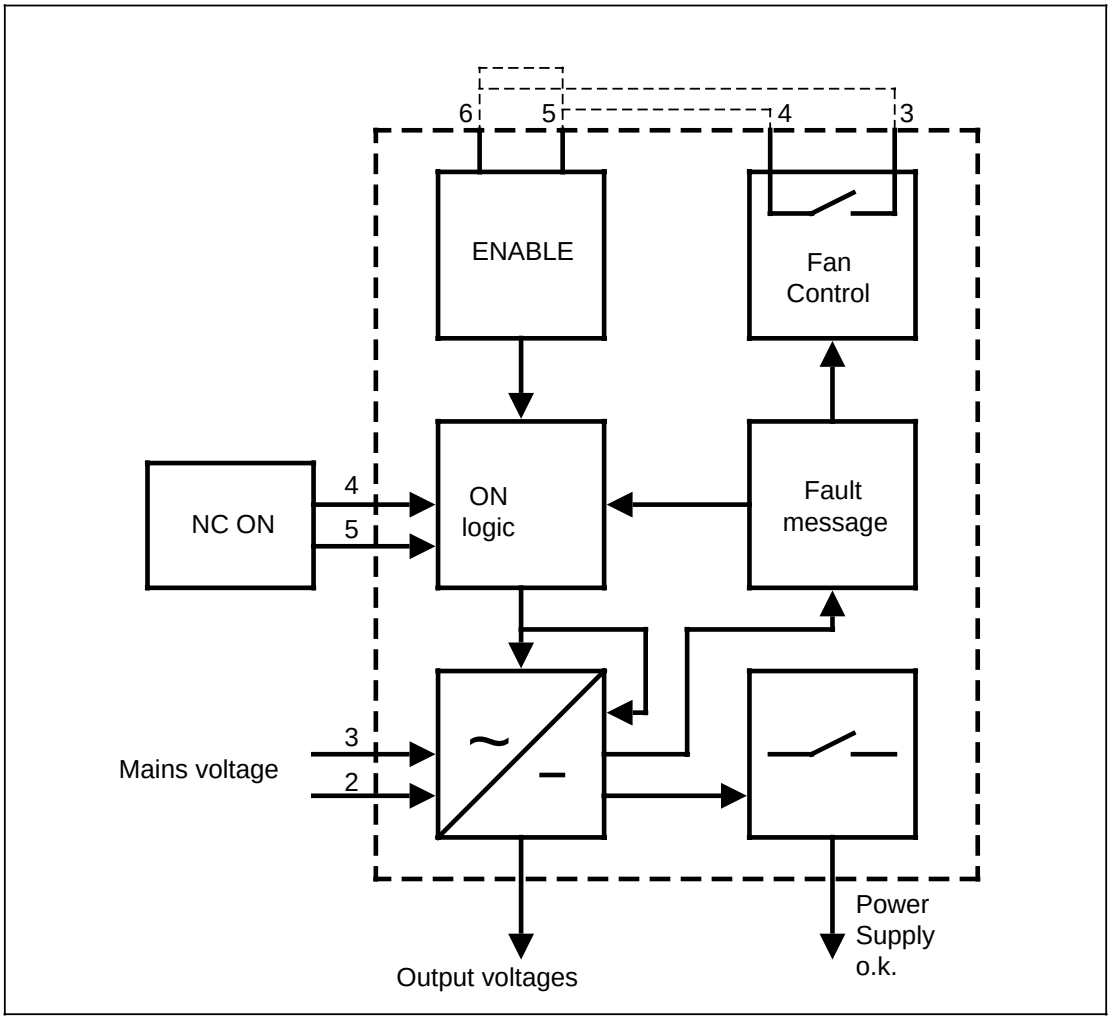
Prerequisite: jumpered ENABLE inputs
The NC ON button must be pressed to switch on.
If the output voltage has not been reached after 500 ms, the power supply switches off. The power supply also switches off if the monitoring system responds.
The power supply switches on again by operating the NC ON button (the fault must no longer exist).

Note:

The operator panel power supply must be connected to the same phase as the power supply in the central controller or other provisions must be made to ensure that both power supplies are switched off and subsequently reconnected in the proper sequence in the event of a power failure.

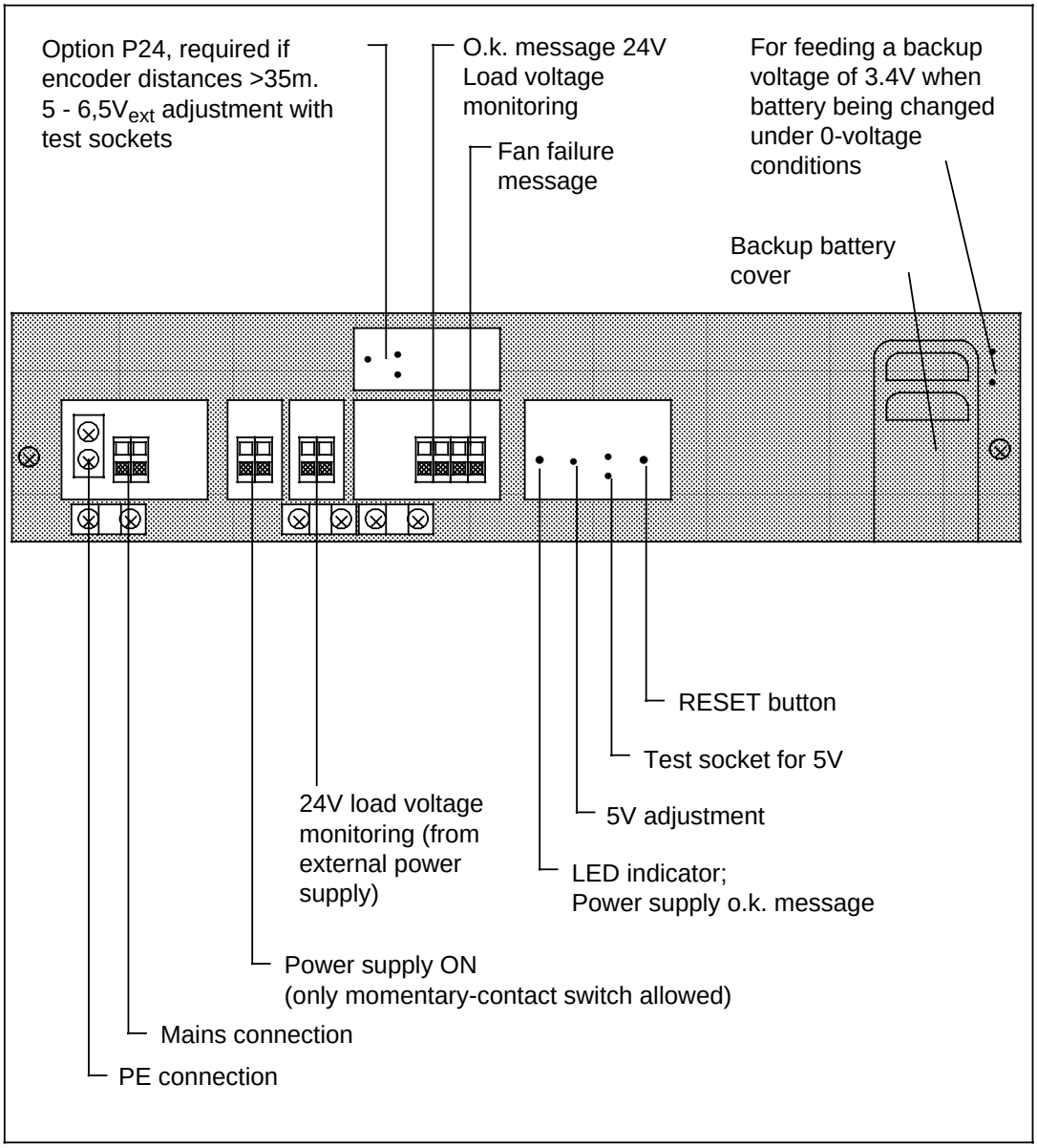
Outline diagram for ON/OFF logic

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



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Power supply central controller



View of front panel of the power supply in the central controller

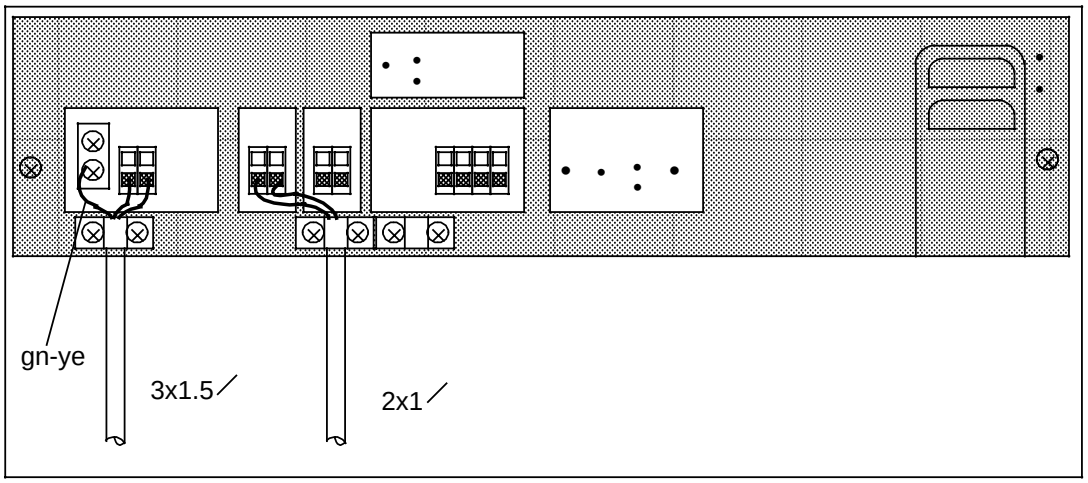
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Technical data (power supply in the central controller)

Input voltage	230 V - 20%/+ 10% Single-phase phase/neutral with loadable neutral Two-phase phase/phase without loadable neutral Other voltages must be matched by means of auto-transformer
Frequency	48 to 63 Hz
Power consumption for central controller	700 VA + fan
Permissible voltage interrupt with:	
nominal voltage U_N	max. 10 ms (U_N=230 V)
U_N - 15 %	max. 3 ms
Operating temperature	0 bis 55 ° C
Storage and transportation temperature	- 40 to + 70 ° C
Humidity rating (DIN 40040)	F
Degree of protection	IP 00 IP 20 (built-in)
Vibration and impact load (DIN 20010)	
stationary	12
transportation	22

Mains connection (power supply in the central controller)

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



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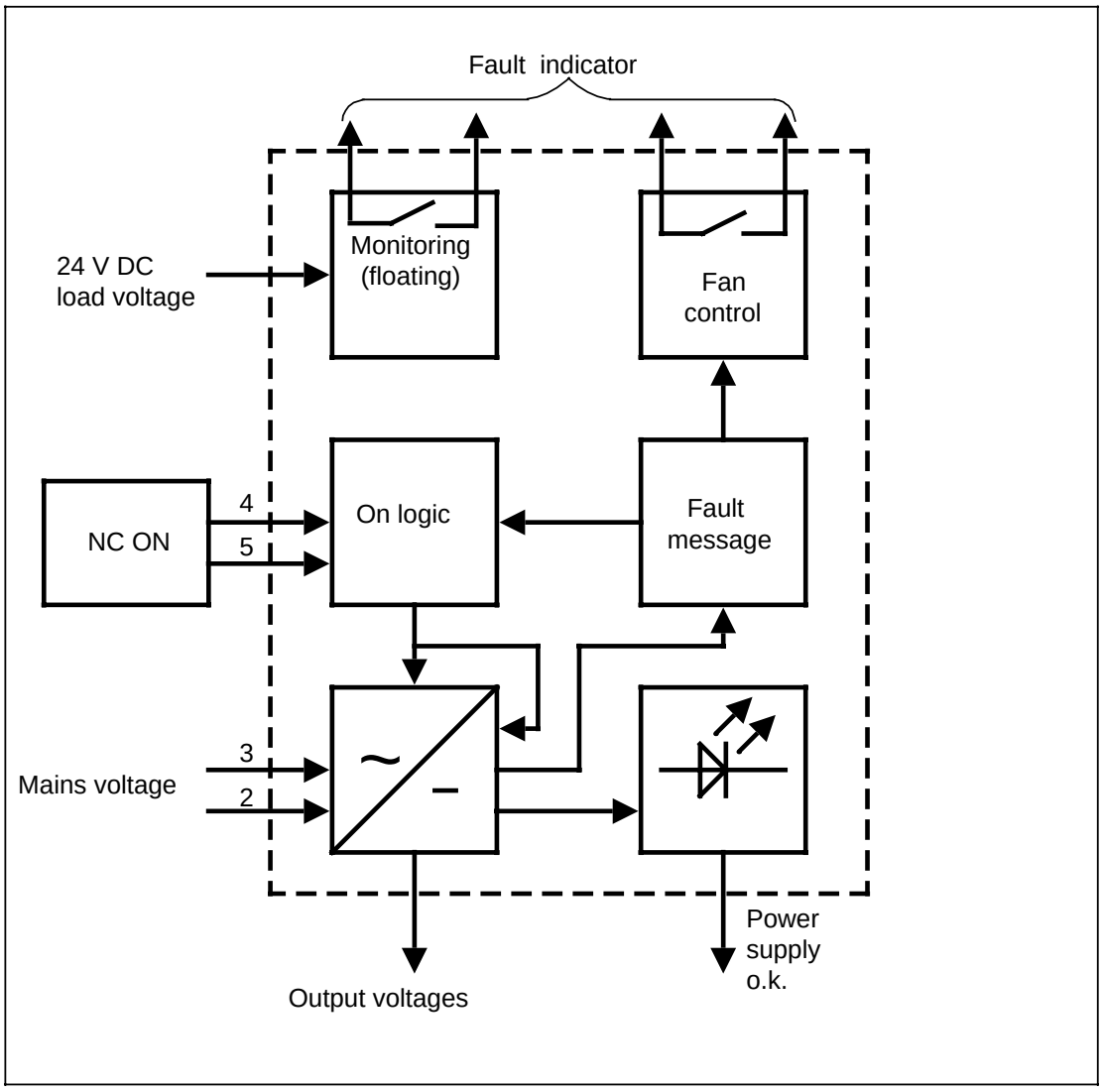
ON/OFF conditions (power supply in the central controller)

The NC ON button must be pressed to switch on.
If the output voltage has not been reached after 500 ms, the power supply switches off. The power supply also switches off if the monitoring system responds.
The power supply switches on again by operating the NC ON button (the fault must no longer exist).

Note:

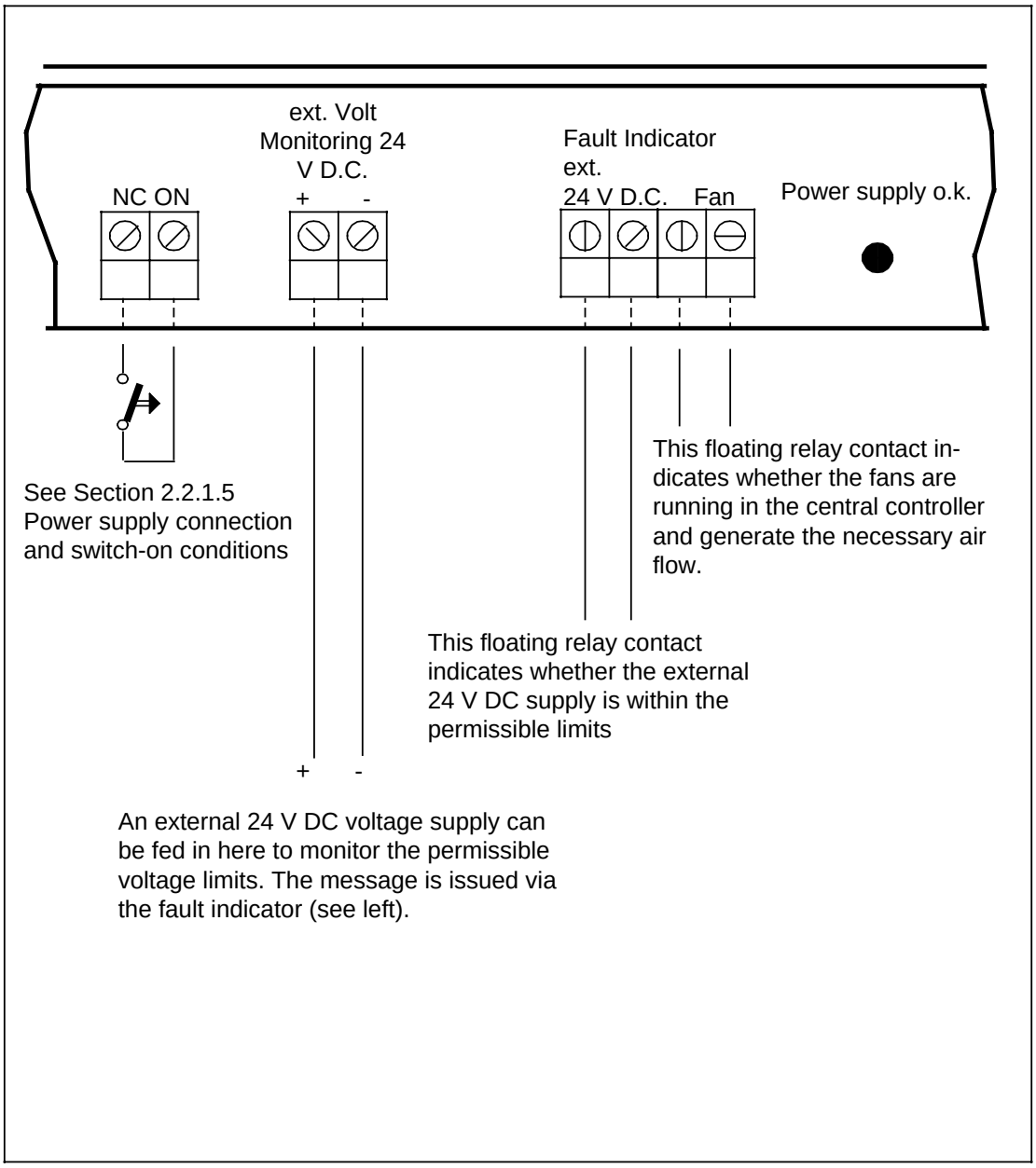
The operator panel power supply must be connected to the same phase as the power supply in the central controller or other provisions must be made to ensure that both power supplies are switched off and subsequently reconnected in the proper sequence in the event of a power failure.

Outline diagram for ON/OFF logic (power supply in the central controller)



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Monitoring logic (power supply in the central controller)



2.2.1.6 Interference suppression

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

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2.2.1.7 Screened signal cables

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

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

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

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

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

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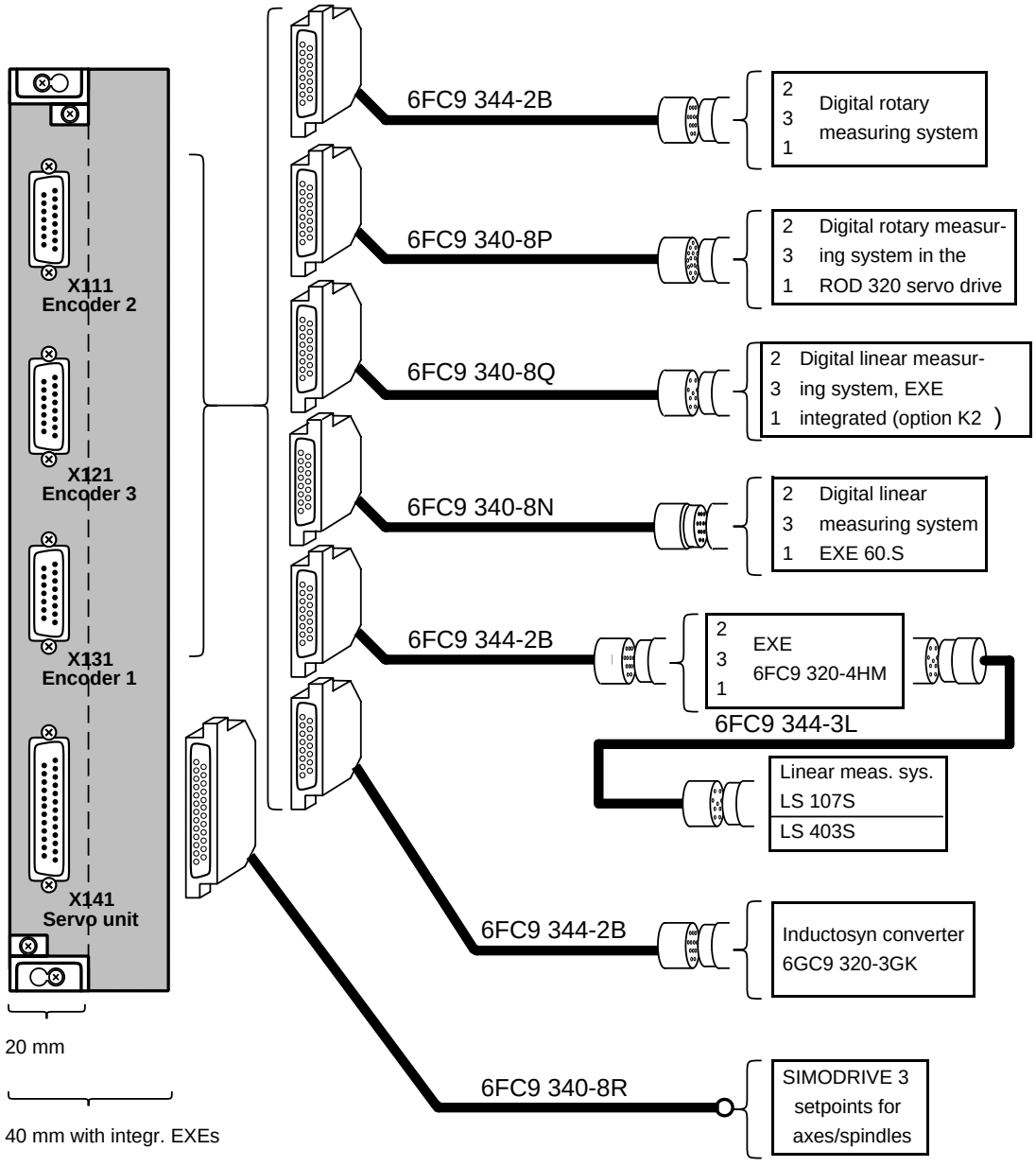
2.3 Connection conditions for modules

2.3.1 Measuring circuits and ACC

2.3.1.1 Measuring-circuit modules (K2) 6FX1 121-4B 01

The module contains:

Three measuring-circuit actual-value inputs for connecting three axes with incremental encoders.
One measuring-circuit setpoint output for three axes with analog speed controllers.



A detailed description of the measuring circuit modules is to be found in the Installation Guide - Instructions

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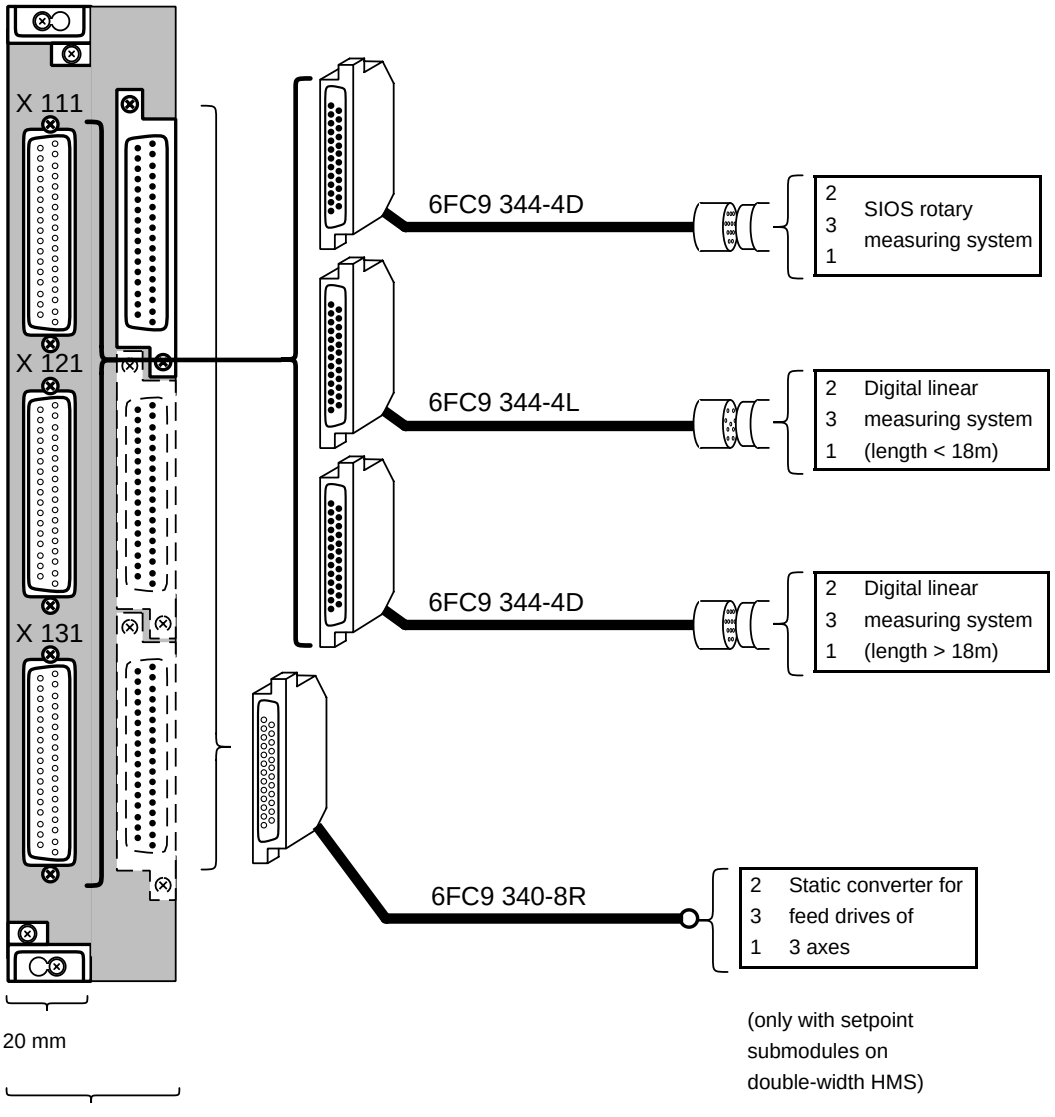
2.3.1.2 HMS measuring-circuit module 6FX1 145-6B 00

The module contains:

Three measuring-circuit actual-value inputs for connecting three axes with incremental encoders.

Three analog measuring-circuit setpoint submodule slots.
The upper two setpoint submodule slots are for the absolute encoder submodule for three SIPOS absolute encoders. In this case only one setpoint submodule can be inserted into the lower slot.

A setpoint submodule contains the setpoint outputs for three drives.



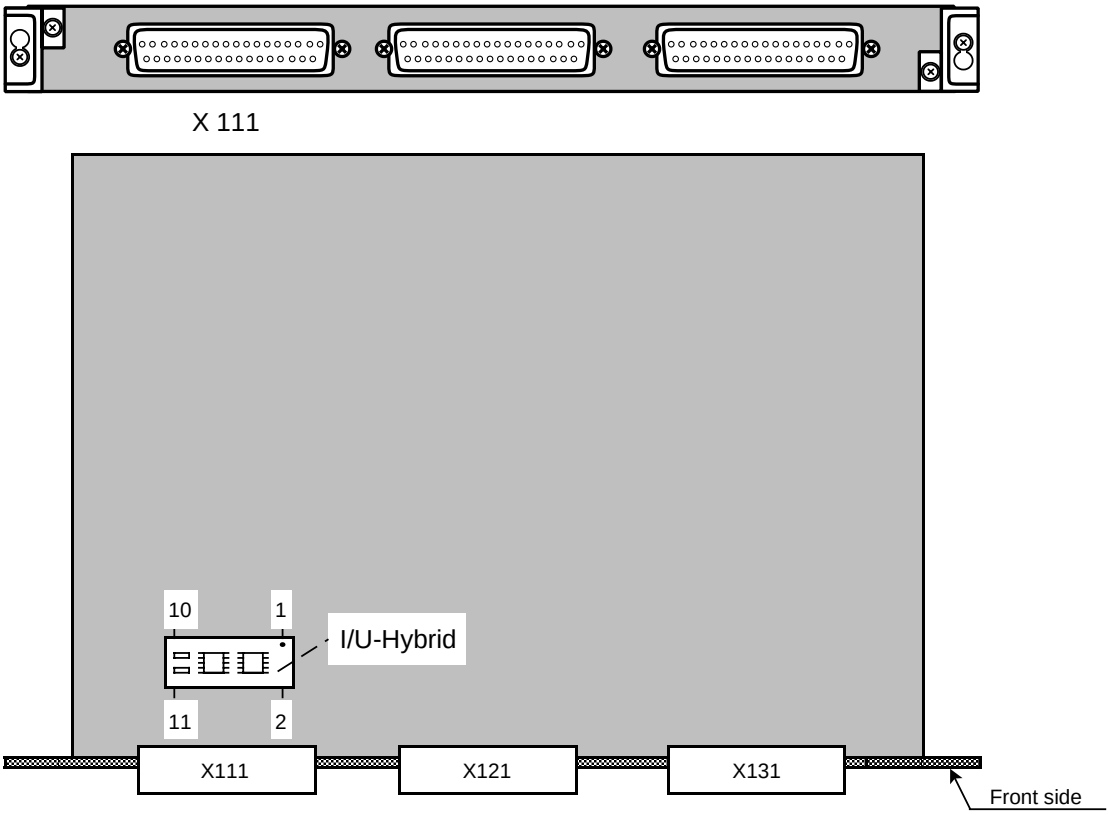
A detailed description of the measuring circuit modules is to be found in the Installation Guide - Instructions

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The HMS module is available in several versions of different dimensions (single width or double width). Setpoint submodules or a SIPOS absolute encoder submodule for three SIPOS absolute encoders can be plugged into a double-width HMS module.

Using a current/voltage converter hybrid, which can be plugged into the module, it is possible to connect linear scales with unconditioned current signals to the HMS module. Any of the three measuring system inputs on the HMS module can be equipped with a current/voltage converter hybrid.

Installation of the current/voltage converter hybrid (on input X111 in this example):



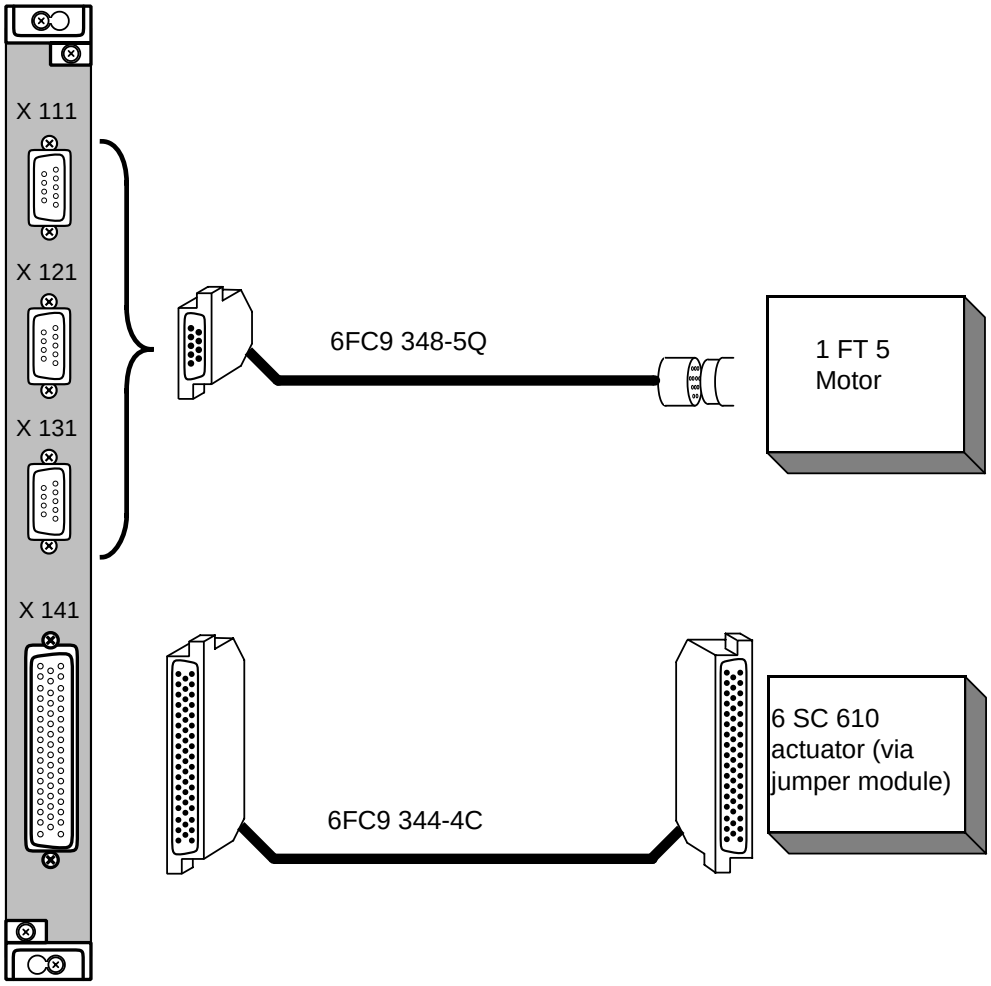
The current/voltage converter hybrid is plugged in as shown here with pins 2 and 11 facing the socket. The coloured spot on the hybrid marks pin 1.

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2.3.1.3 Analog current control (ACC) 6FC3 986-3JJ

The module contains:
Three current control loops with

- digital setpoint input
- control for power transistors (6 SC 610)
- acquisition of the rotor position signals
- evaluation of the PTC thermistor signals for motor temperature monitoring



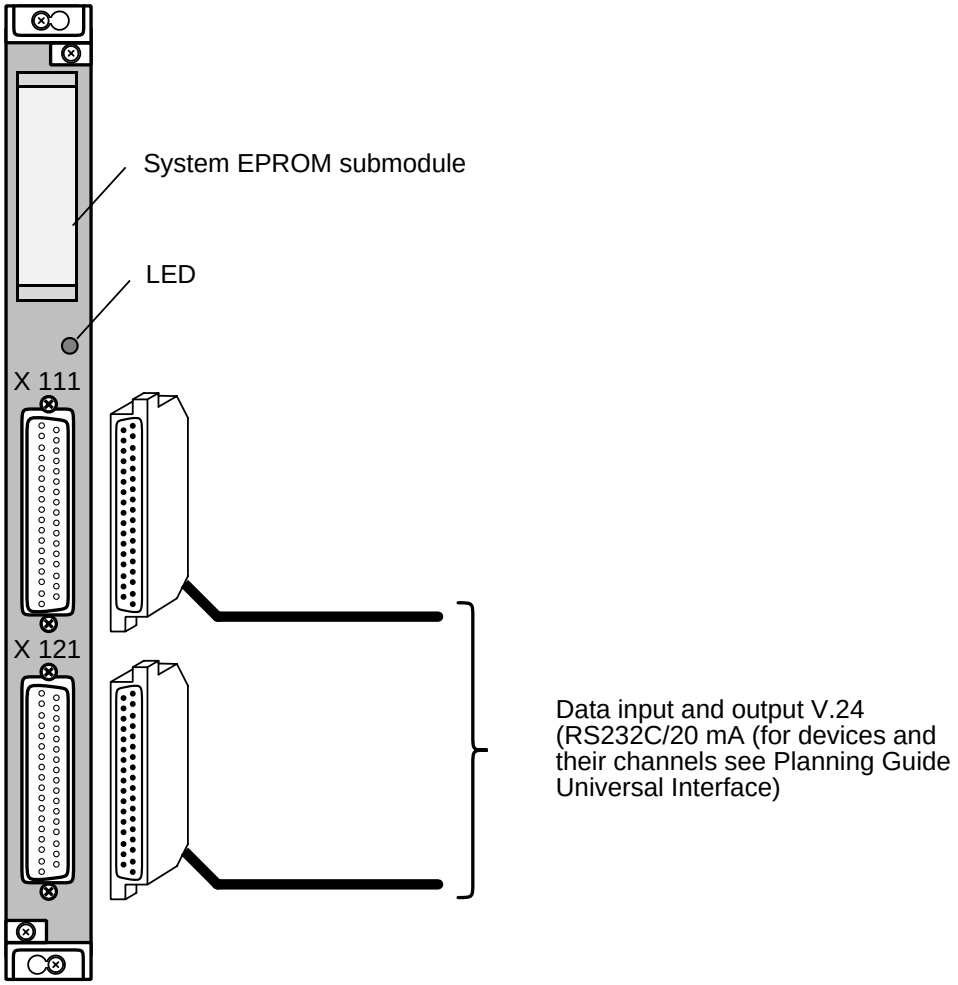
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2.3.2 Communication modules

2.3.2.1 Active serial interface, 2xRS232C/TTY (B13) 6FX1 131-5BA01

The module contains:

Two serial interfaces V.24 (RS232C)/20 mA
One LED (fault display lamp)



For technical data of the interface see Planning Guide Universal Interface.

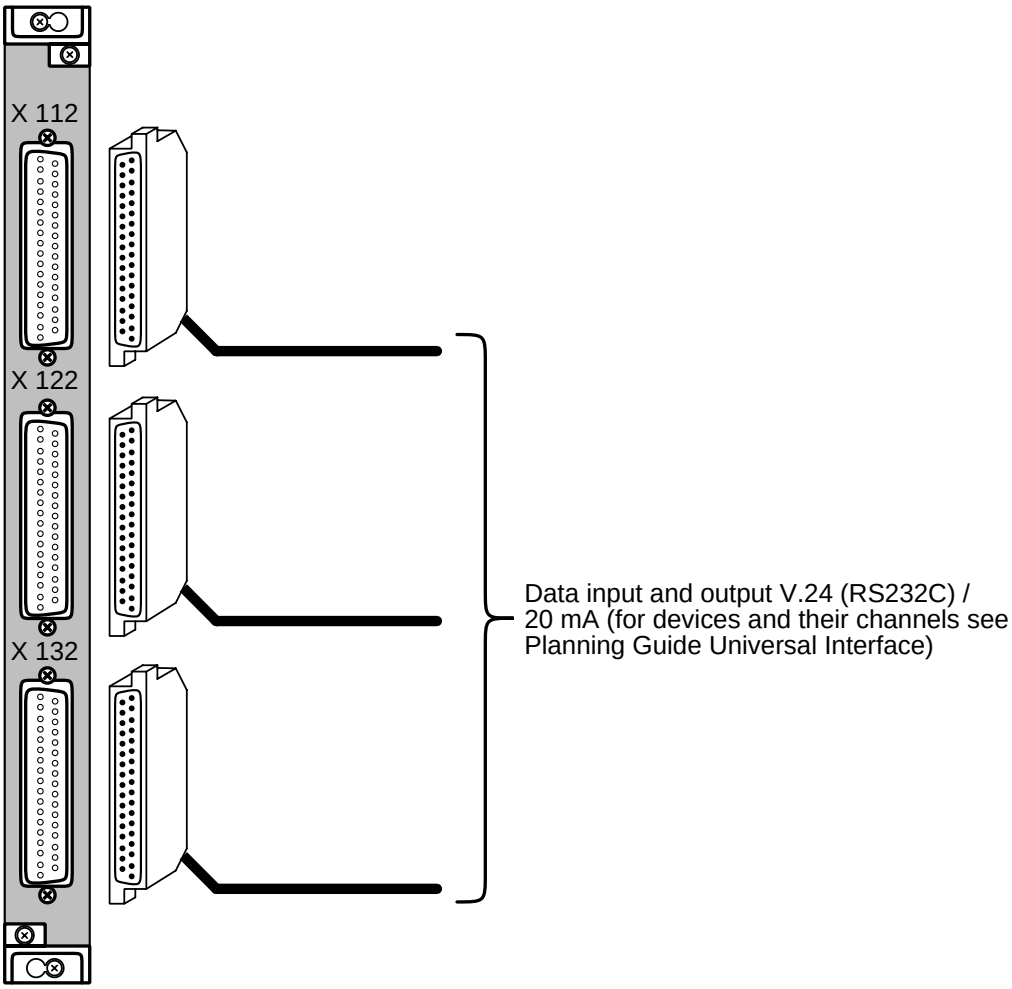
Format	Double-height Eurocard
Module width	20mm
Weight approx.	330g
Degree of protection to DIN 40050	IP00
Relative humidity class to DIN 40040	F
Vibration resistance to SN 29010	Class 12

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2.3.2.2 Active serial interface, 3xRS232C/TTY (B16) 6FX1 137-3BA00

The module contains:

Three serial interfaces V.24 (RS232C) / 20 mA; every interface can be operated as RS 422 if an adapter is used.



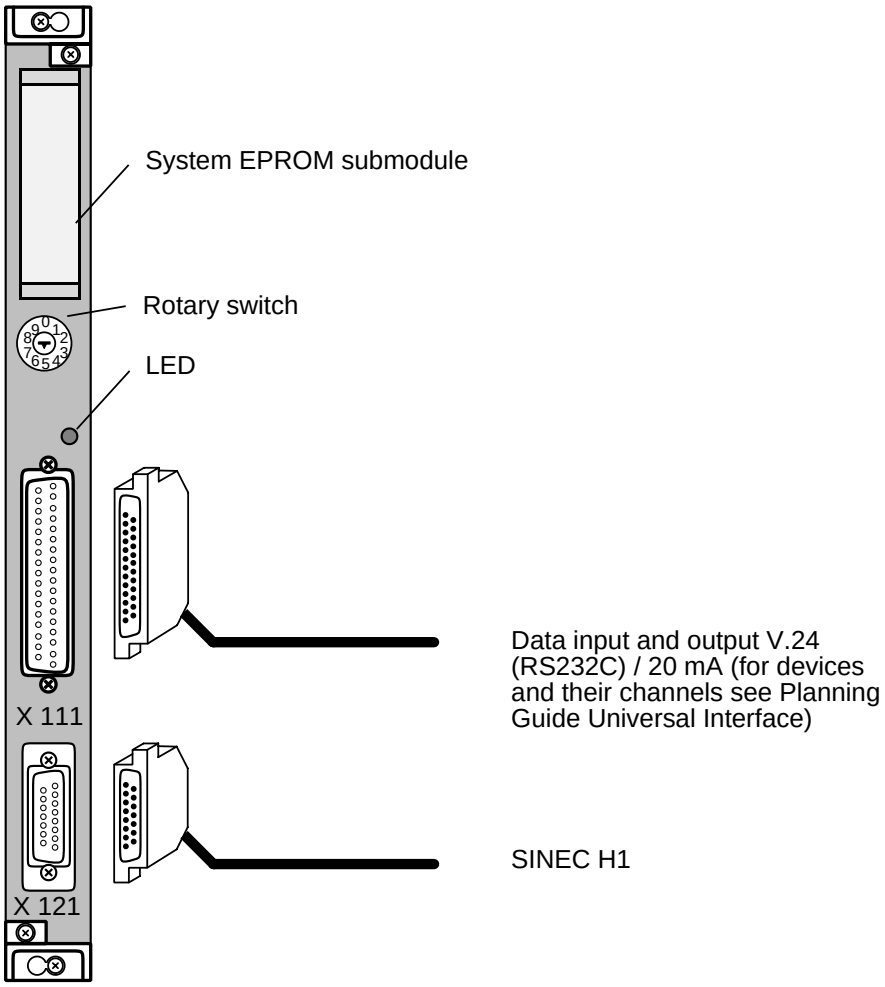
This module is screwed to and can only function with the interface module 6FX1 131-5BA . For technical data of the interface see Planning Guide Universal Interface.

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2.3.2.3 SINEC H1 interface (B12) 6FX1 123-1BA01

The module contains:

One interface to the SINEC H1 bus system
One serial interface V.24 (RS232C) / 20 mA
One rotary switch for selecting individual tests form a hardware test program
One LED (fault display lamp)



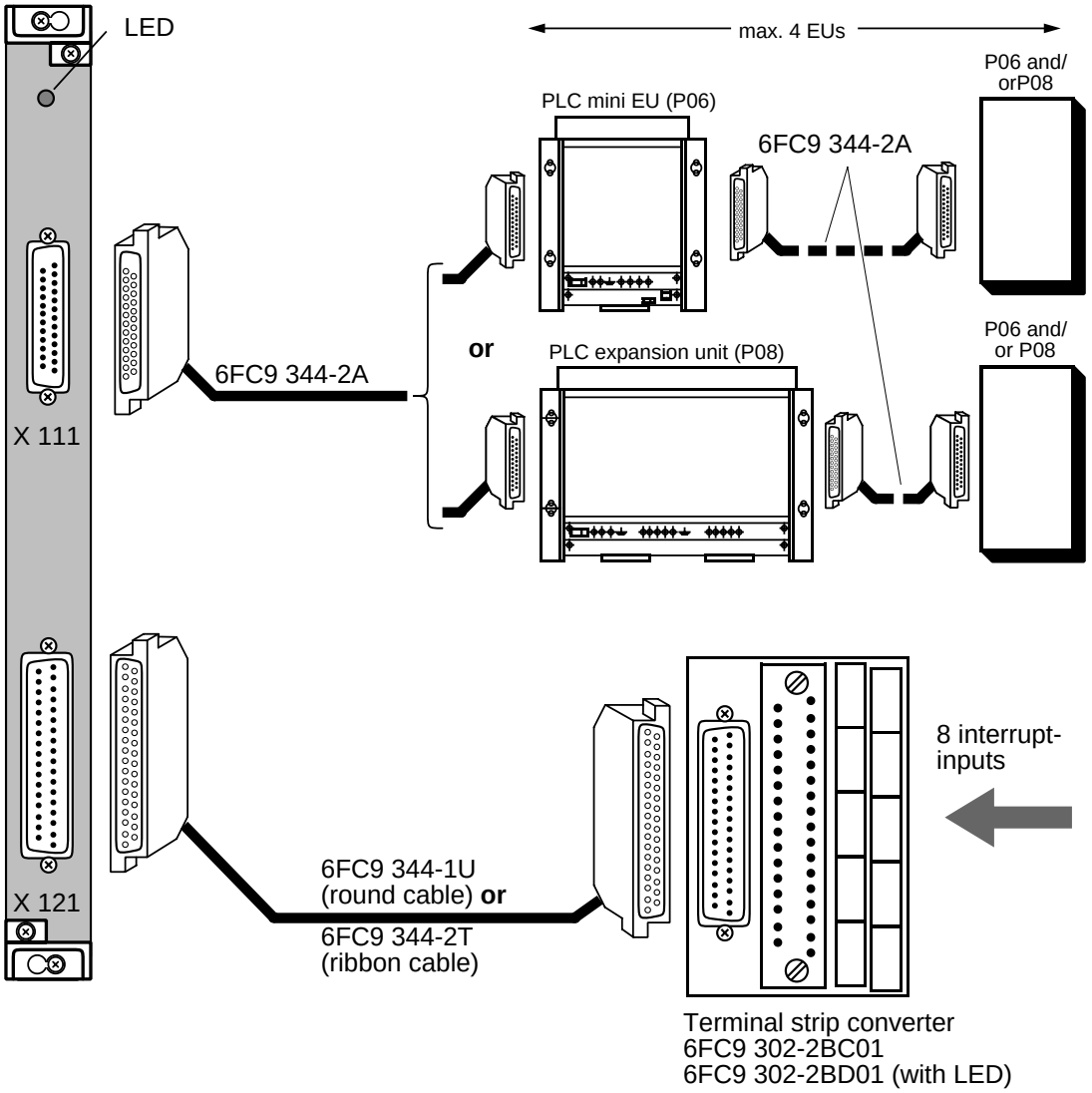
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2.3.3 Expansion units

2.3.3.1 Expansion units (EU) - interface (N95) 6FX1 132-0BA01

The module contains:

One MPC interface for linking expansion units
Eight interrupt inputs, floating
One LED (fault display lamp)



Only input byte 0 is reserved on connector X 121,

i.e. pins 1, 20, 2, 21, 3, 22, 4, 23 and 5.

Note:

If you connect the mini EU to this module, Q 127.7 is reserved by an internal signal.

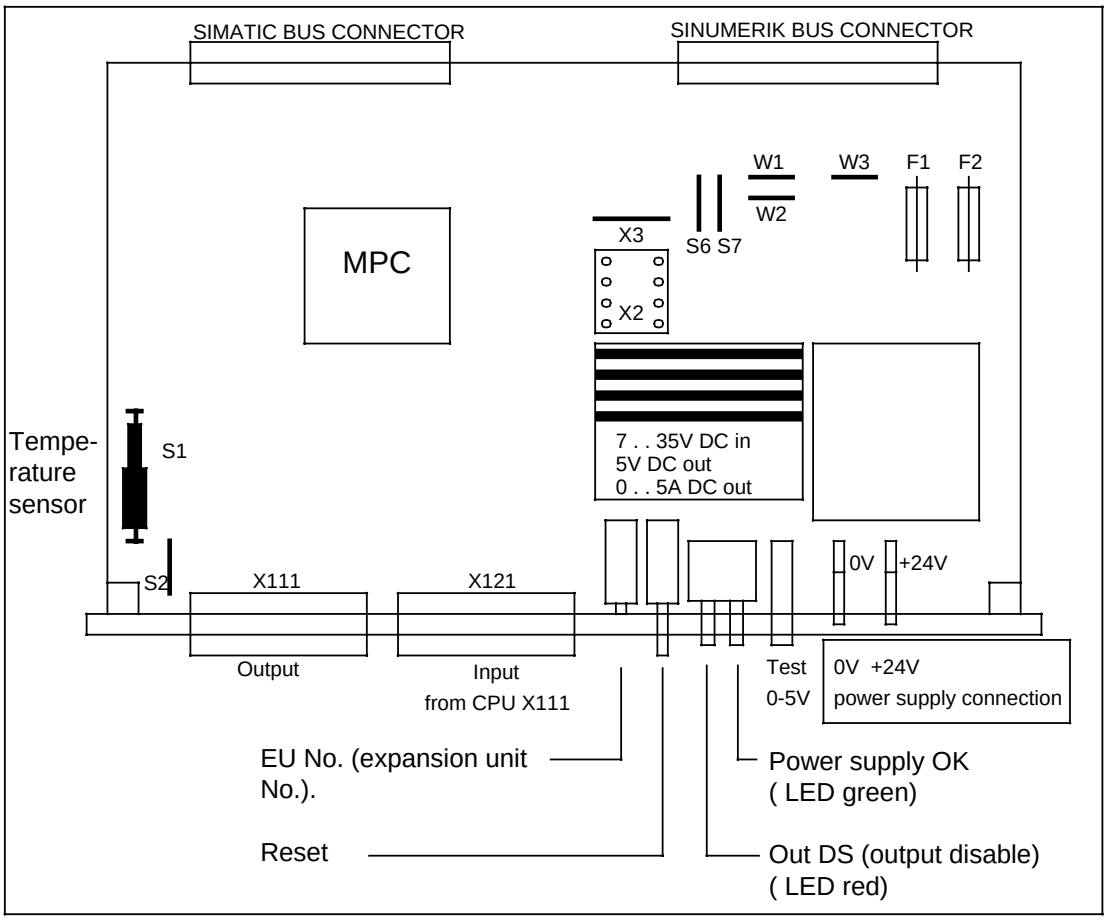
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2.3.3.2 EU interface module CU MPC 6FX1 132-1B

The EU module CU MPC is built in two versions:

6FX1 132-1BA with power supply for mini EU
6FX1 132-1BB without power supply for EU

The EU module CU MPC is plugged into the first slot in the mini EU.

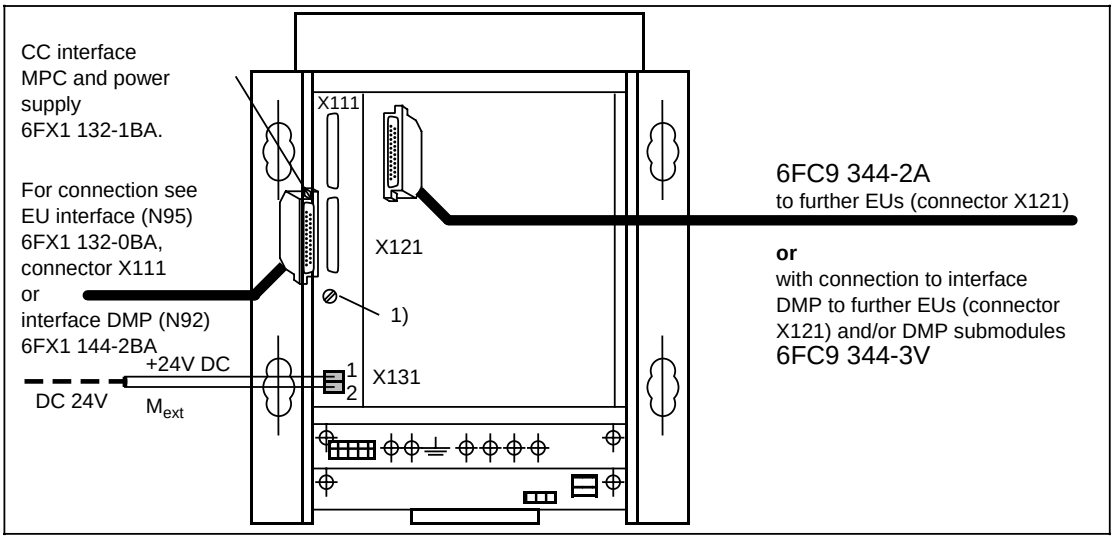


F1	4.0 A	power supply
F2	1.6 A	fan fuse
W1	closed	
W2	internal printed conductor	
W3	internal printed conductor	
X3	closed	
S1	temperature switch	
S2	closed	
S6	closed	
S7	closed	
X2	test field socket	

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2.3.3.3 Mini EU (P06)

The rack assignment of the expansion units is shown in Section 1.3.

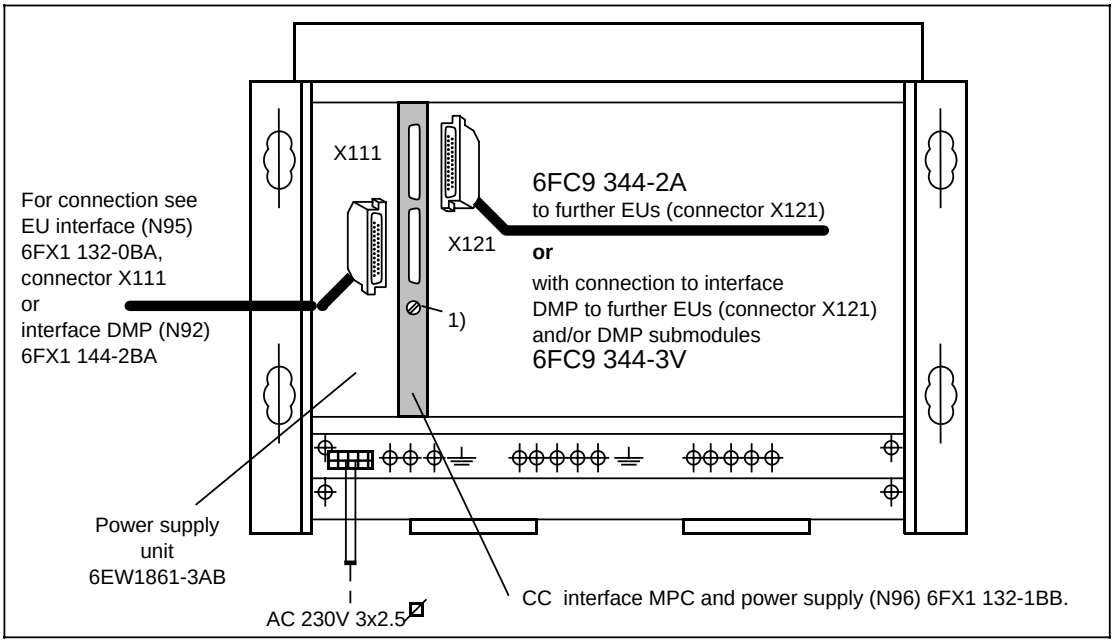


Note:

If you connect the mini EU to the EU interface (N95) 6FX1 132-0BA01, output Q 127.7 is reserved by an internal signal.

2.3.3.4 Expansion unit (P08)

The rack assignment of the expansion units is shown in Section 1.3.



1) The rotary switch is used to set the expansion unit No. (0 to 3).

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2.3.4 Input / output modules

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

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

Overview of the available SINUMERIK I/O modules

Module designation	Order number	Option	Digital inputs	Digital outputs	Output current 1)	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	–	–
6FX1 138-4BA	6FC3 986-4DV	N79	16	16	0.4 A	–	4
6FX1 136-1BA	6FC3 986-4DQ	N74	–	–	–	8	–

1) Output current per output with 50% simultaneity.

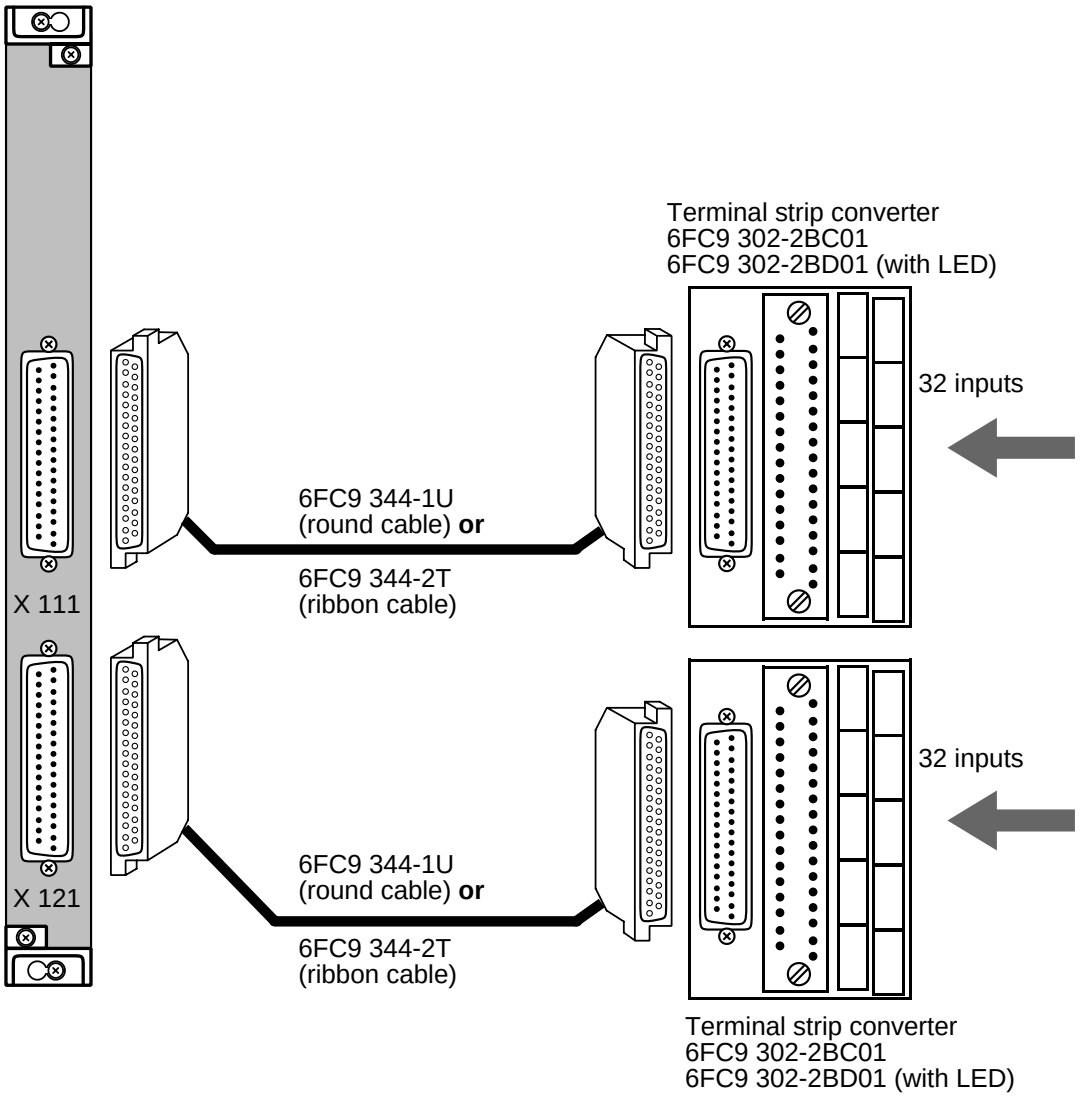
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2.3.4.1 Digital input module (N71) 6FX1 125-7BA00

The module contains:

64 digital inputs, floating, in groups of eight

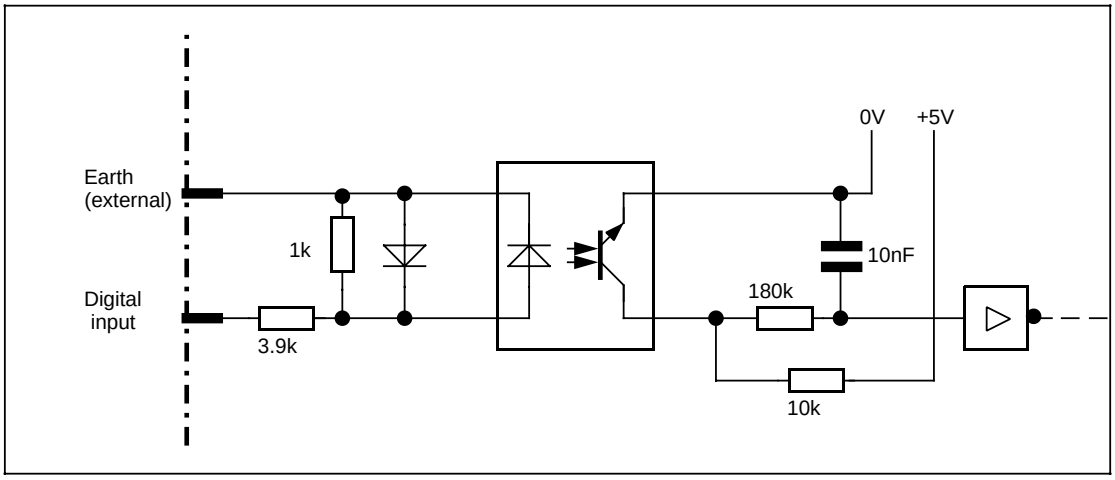
Interference on the mass line (caused by circulating currents) is suppressed by optocouplers. All input signals on the module are also filtered through RC elements. In this way inductive and capacitive interference shorter than two milliseconds is eliminated.



The module reserves eight consecutive input bytes on the PLC interface.

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Digital input circuit



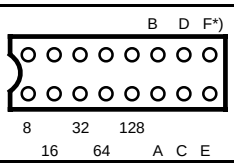
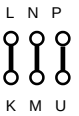
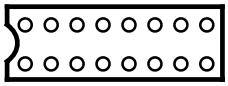
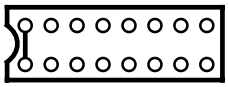
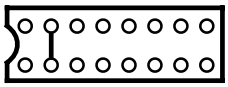
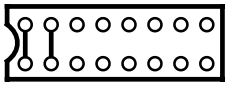
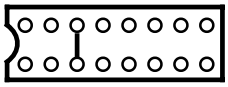
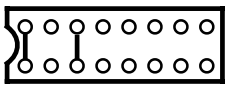
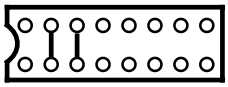
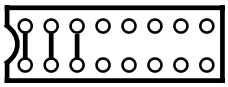
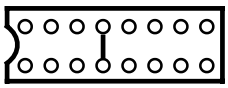
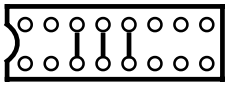
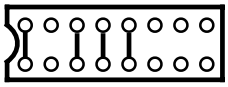
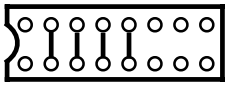
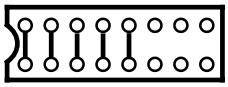
Assignment of the inputs on the PLC interface

Input module 6FX1 125-7BA00								
Byte No.	**Bit No.**							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
IB m	Connector X111 pin No.							
	23	4	22	3	21	2	20	1
IB m +1	Connector X111 pin No.							
	9	27	8	26	7	25	6	24
IB m +2	Connector X111 pin No.							
	32	13	31	12	30	11	29	10
IB m +3	Connector X111 pin No.							
	18	36	17	35	16	34	15	33
IB m +4	Connector X121 pin No.							
	23	4	22	3	21	2	20	1
IB m +5	Connector X121 pin No.							
	9	27	8	26	7	25	6	24
IB m +6	Connector X121 pin No.							
	32	13	31	12	30	11	29	10
IB m +7	Connector X121 pin No.							
	18	36	17	35	16	34	15	33

Set address **m** by jumpering on the module and by PLC MD

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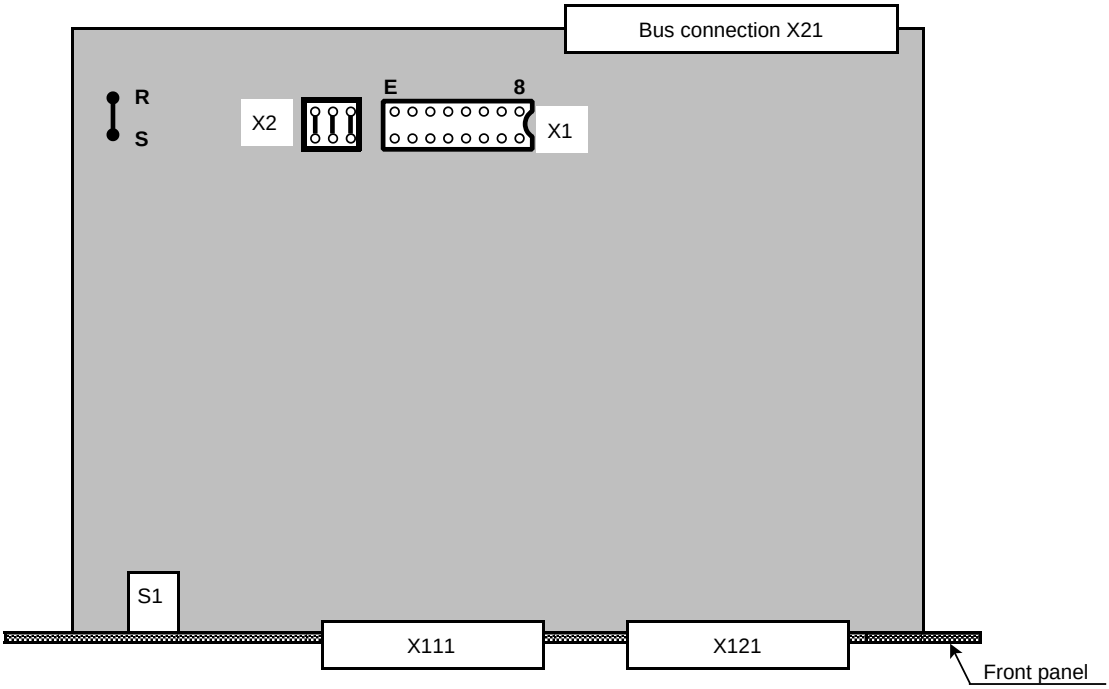
Setting initial address m

Initial address (hex.)	Input byte (dez.)	Socket X1(DIP FIX) 	Socket X2 	Jumpers 
00	0...7			
08	8...15			
10	16...23			
18	24...31			
20	32...39			
28	40...47			
30	48...55			
38	56...63			
40	64...71			
• • •	• • •			
E0	224...231			
E8	232...239			
F0	240...247			
F8	248...255			

On the PLC 135 WB input/output modules can only be addressed from 0 .. 159.

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Location of jumper sockets and jumpers



X1: Initial address setting
X2: All 3 jumpers (U-P, M-N, K-L) are closed as standard

Jumpers R–S: closed as standard

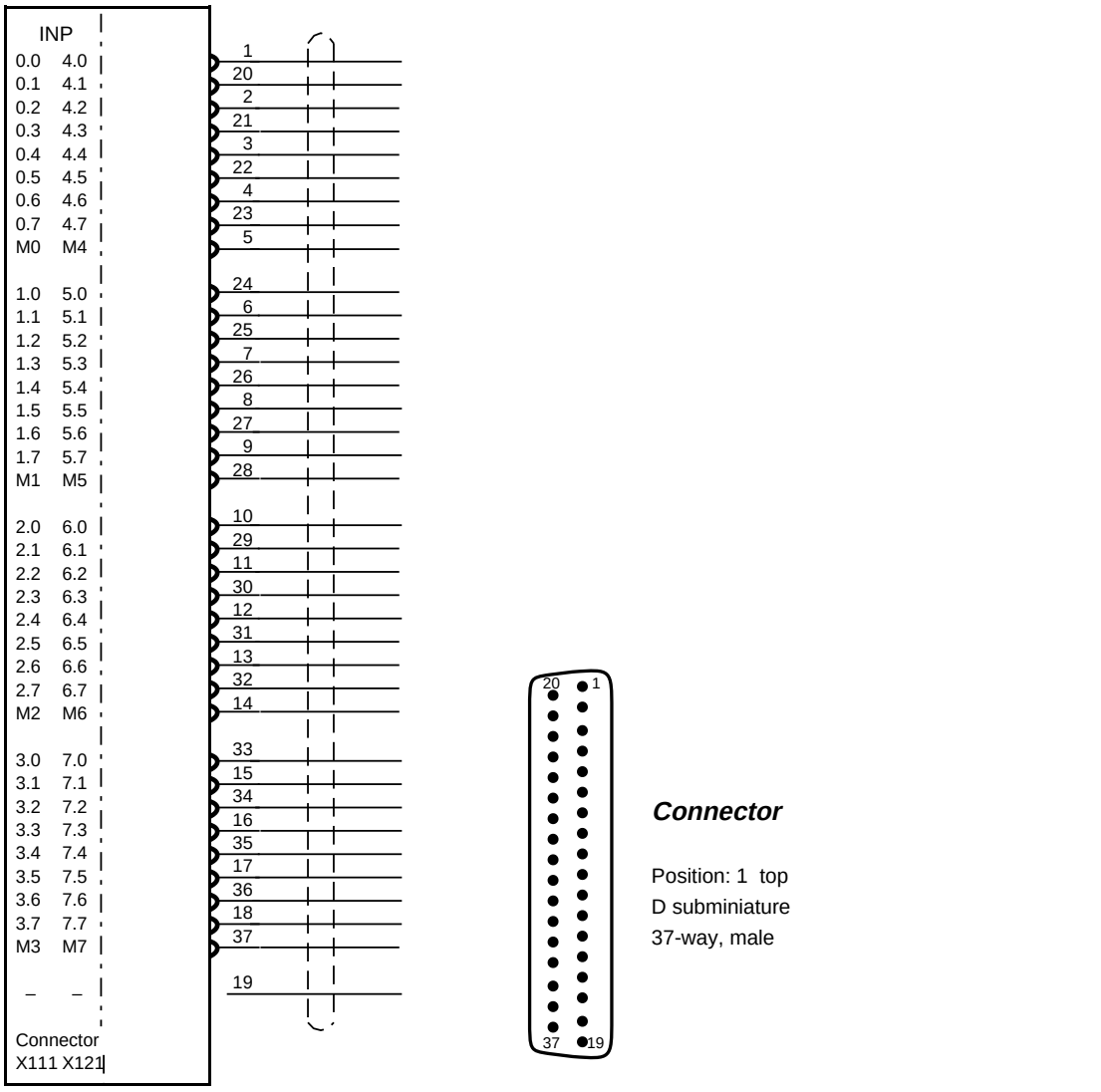
Technical data

No. of inputs Galvanic isolation		64 digital yes
Input voltage (rated)		24V DC
Input voltage	for signal ”0” for signal ”1”	-3V to +5V +14V to +30V
Input current	for signal ”1”	3.6mA to 7.7mA
Delay Delay	for tpLH for tpHL	1.8ms to 2.2ms 1.8ms to 2.2ms
Cable length	max.	50m
Insulation voltage external terminals to housing - to VDE 0160 - tested with		
Current consumption	internal (at 5V) typ. internal (at 24V) typ.	120mA
Format		double-height Eurocard
Module width		20mm
Weight	approx.	350g
Degree of protection to DIN 40050		IP00
Relative humidity to DIN 40040		F

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Connection of inputs

The connection for the 64 inputs is made via two 37-way D subminiature male connectors with 32 inputs each.



Connector

Position: 1 top
D subminiature
37-way, male

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

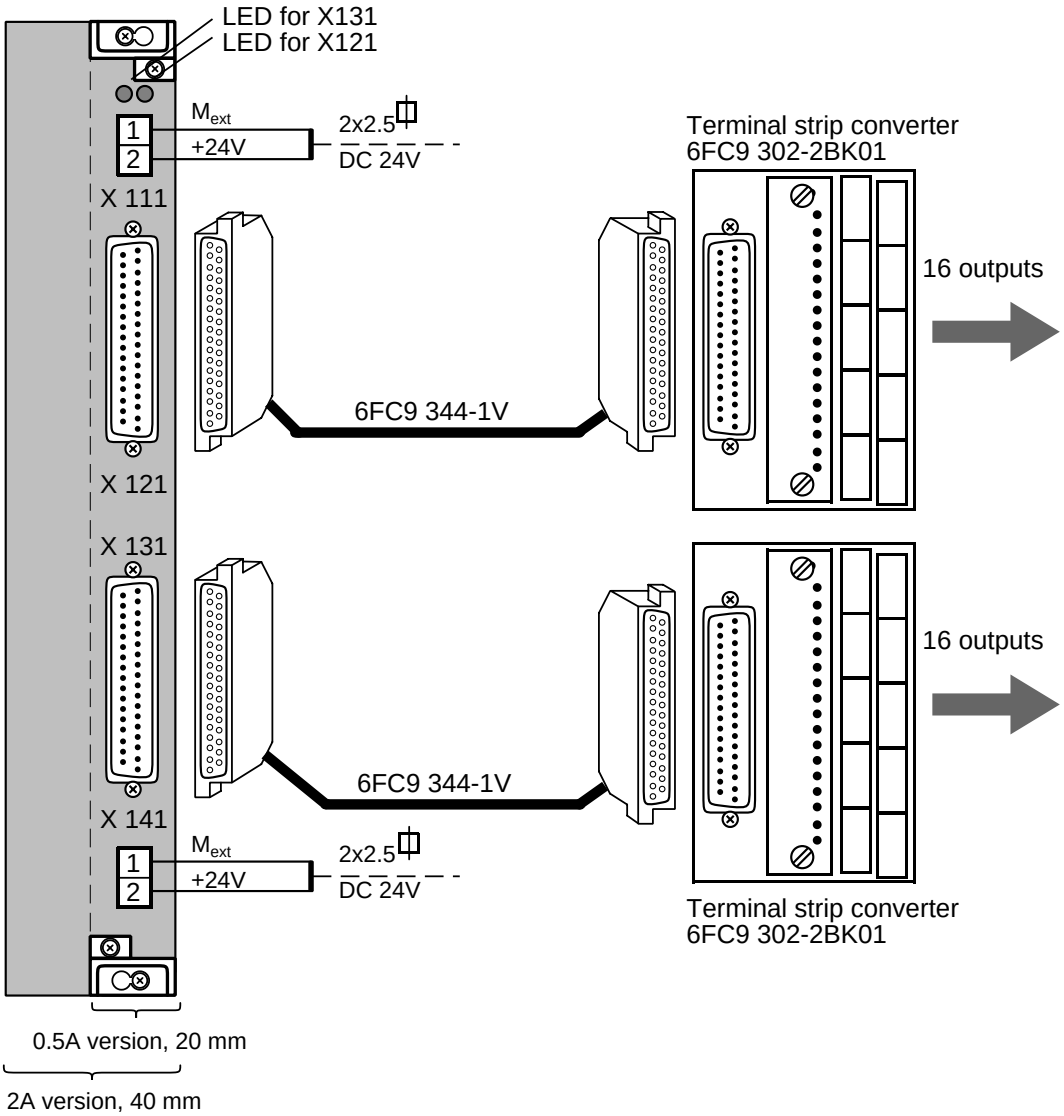
The signals M0 to M7 must be connected.

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2.3.4.2 Digital output module, 0.5 A (N72) 6FX1 122-8BC01
Digital output module, 2 A (N73) 6FX1 122-8BD01

The module contains:

- 32 digital outputs, floating, 24 V/0.5 A or 2A, in groups of 16, short-circuit-proof. The outputs can be switched parallel for increased power.
- 2 terminal blocks for external supply of 24 V DC to the outputs
- 2 red LEDs to display overload and short-circuit (one LED per output block). Each word is monitored.



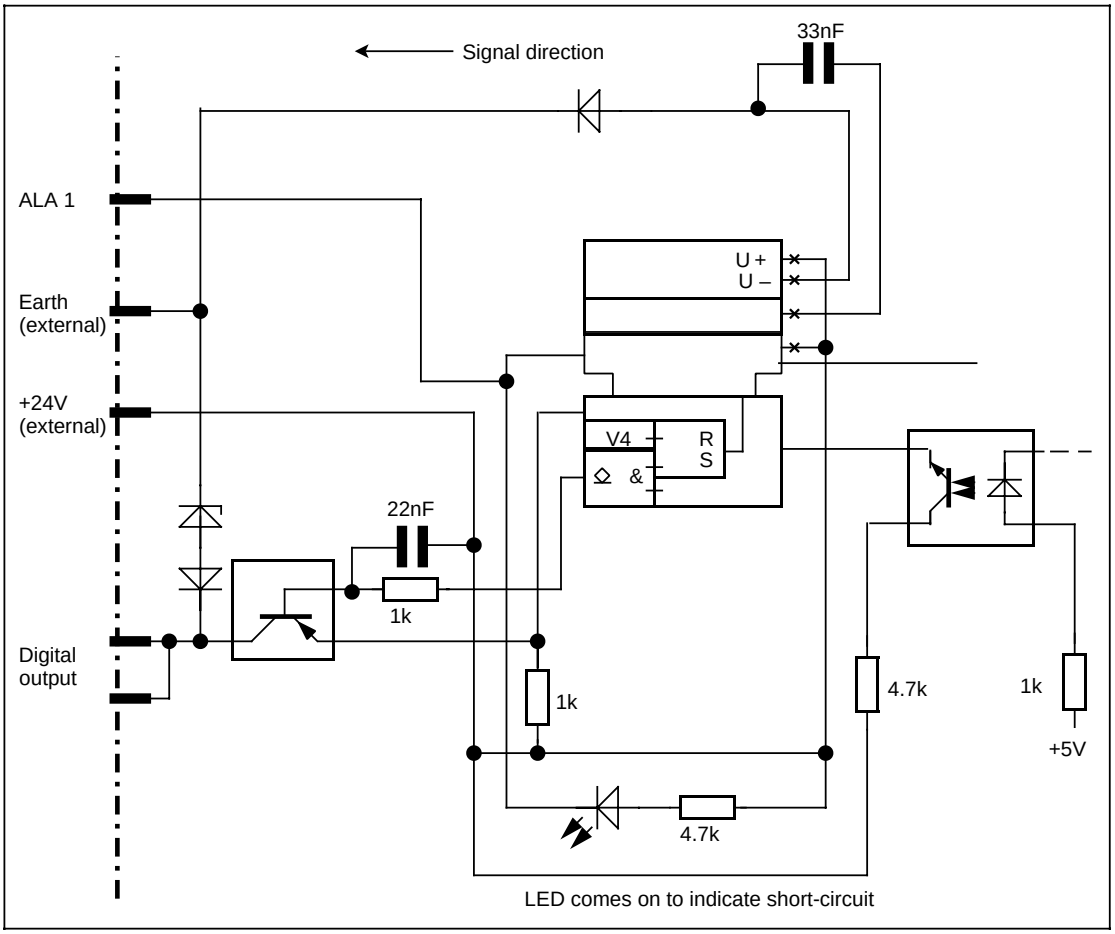
Module versions:

- The 0.5 A version is 20 mm wide. It can be operated with 100% simultaneity factor, if used in a well ventilated plant.
- The 2 A version is 40 mm wide. It can only be operated with 50% simultaneity factor.

The module is assigned four contiguous output bytes on the PLC interface.

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Digital output circuit



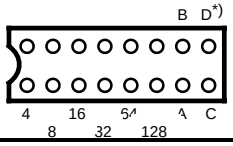
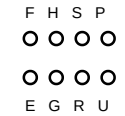
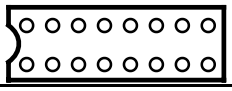
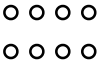
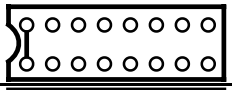
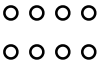
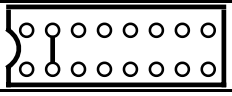
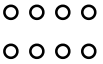
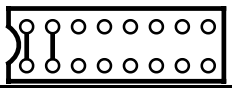
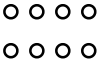
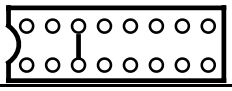
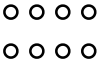
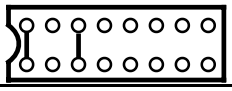
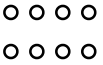
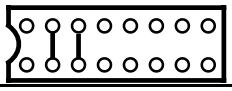
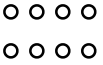
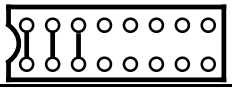
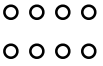
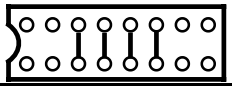
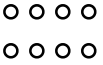
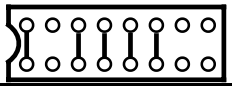
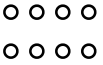
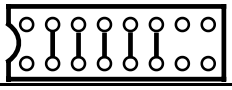
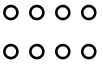
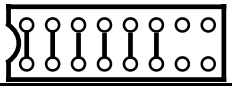
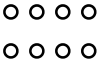
Assignment of the outputs on the PLC interface

Output module 6FX1 122-8B								
Byte No.	**Bit-No.**							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
QB m	Connector X121 pin No.							
	9/27	8/26	7/25	6/24	4/23	3/22	2/21	1/20
QB m +1	Connector X121 pin No.							
	18/36	17/35	16/34	15/33	13/32	12/31	11/30	10/29
QB m +2	Connector X131 pin No.							
	9/27	8/26	7/25	6/24	4/23	3/22	2/21	1/20
QB m +3	Connector X131 pin No.							
	18/36	17/35	16/34	15/33	13/32	12/31	11/30	10/29

Set address **m** by jumpering on the module and by PLC MD.

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Setting initial address m

Initial address (hex.)	Output byte (dec.)	Socket 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		
⋮	⋮		
F0	240...243		
F4	244...247		
F8	248...251		
FC	252...255		

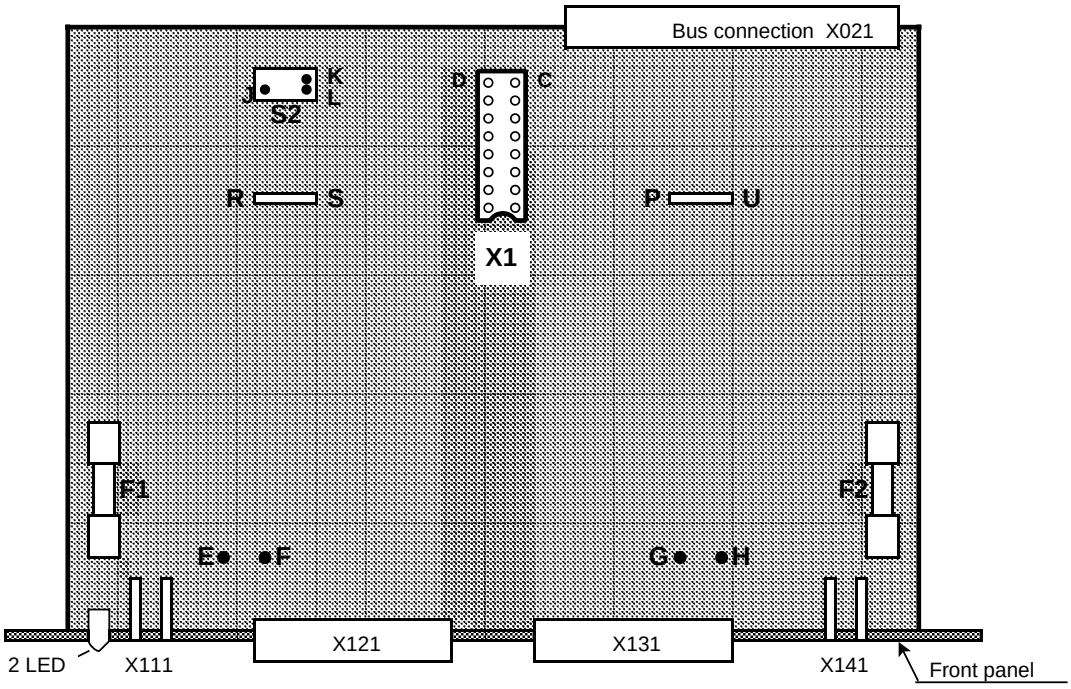
Note:

Jumper C-D must be closed if the module is used on the NC local bus.

On the PLC 135 WB input/output modules can only be addressed from 0 .. 159.

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Position of the jumper socket and jumpers



X1: Initial address setting
Jumpers S2: J-K
E-F, G-H, R-S, U-P: Open

Technical data

	6FX1 122-8BC	6FX1 122-8BD
Number of outputs 32 digital Galvanic isolation	32 digital yes	32 digital yes
Supply voltage V_P - Rated value - Ripple V_{PP} - Permissible range (incl. ripple)	 24V DC 20V to 30V	 24V DC 20V to 30V
Output current at signal "1" (rated)	500mA	2A
Short-circuit protection electronic with optical	electronic with optical display (LED)	electronic with optical display (LED)
Limitation of inductive cut-off voltage a. switching power for lamps		
Switching frequency for - ohmic load - lamps - inductive load (at rated load. At lower load higher values are permitted)	 100Hz 11Hz 2Hz	 100Hz 11Hz 2Hz
Total load at 55°C (Relative to the sum of the rated currents of all outputs)	50%	50%
Signal level of the outputs - for signal ”0” - for signal ”1”	 Output open U_P –1V	 Output open U_P –1V
Cable length max.	50m	50m
:	:	:

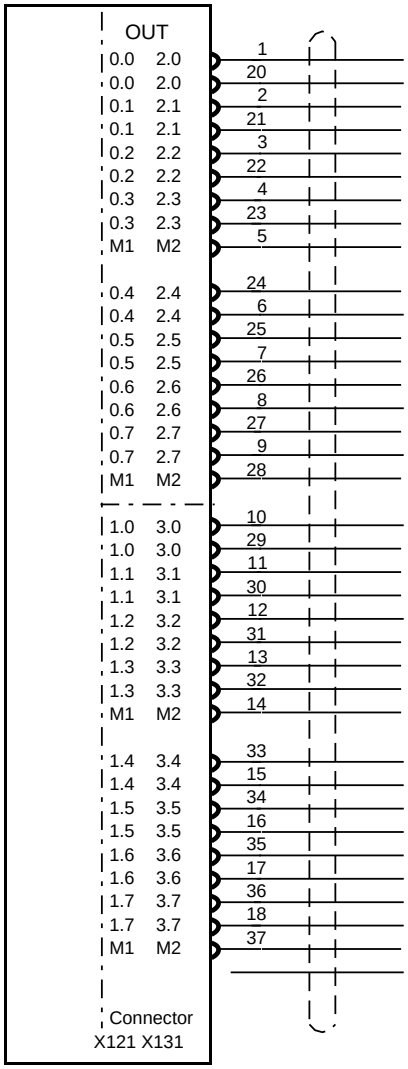
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Technical data (continued)

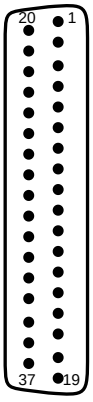
:	:	:
	6FX1 122-8BC	6FX1 122-8BD
Insulation voltage external terminals to housing - to VDE 0160 - tested with		
Current consumption internal (at 5V) typ. internal (at 24V) typ.	320mA 100mA	320mA 100mA
Format	double-height Eurocard	double-height Eurocard
Module width	20mm	40mm
Weight approx.	500g	1210g
Degree of protection to DIN 40050	IP00	IP00
Relative humidity to DIN 40040	F	F

Connection of outputs

The connection for the 32 outputs is made via two 37-way D subminiature male connectors with 16 outputs each.



Signals M1 and M2 must not be used as they are for testing purposes only.



Connector

LPosition: 1 top
D subminiature
37-way, male

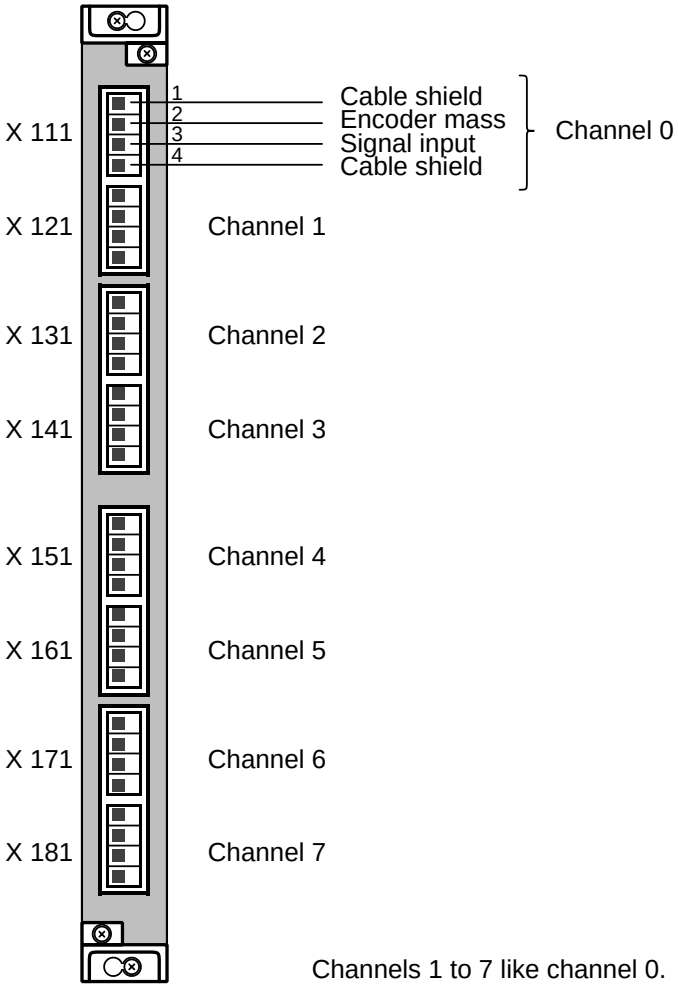
For connection see cable plan 6FC9 344-1V

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2.3.4.3 Analog input module (N74) 6FX1 136-1BA01

The module contains:

Eight analog inputs, non-floating, ± 10 V, with programmable input filters.



The module reserves 16 consecutive input and output bytes on the PLC interface.

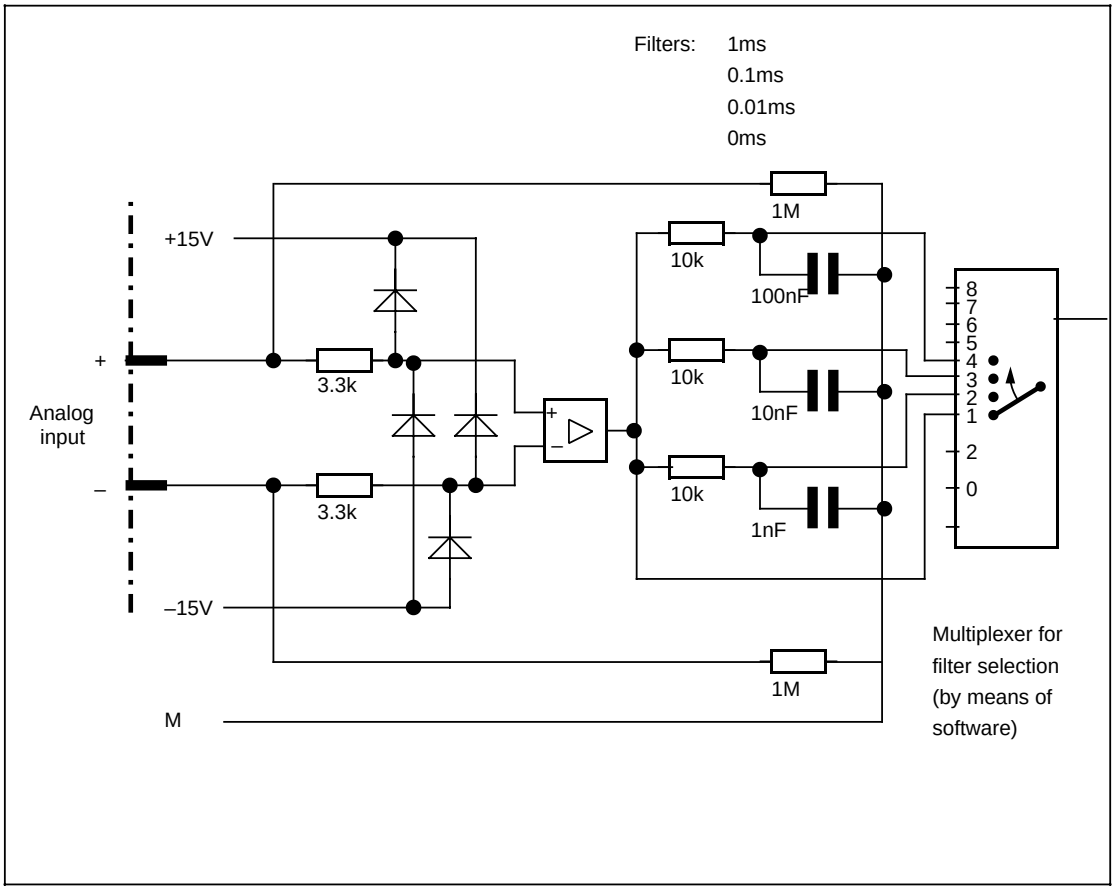
Unused inputs must be short-circuited (connect encoder mass with signal input) or connected to the shield (both encoder mass and signal input).

Note:

This module cannot be used in the mini EU.

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Analog input circuit



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Assignment of inputs on the PLC interface

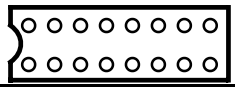
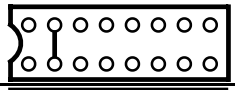
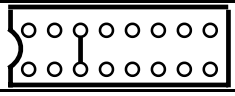
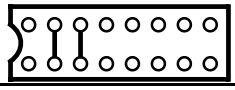
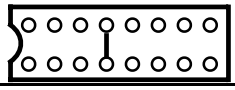
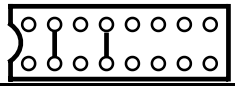
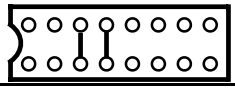
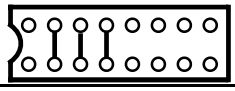
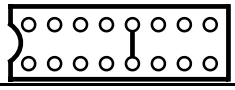
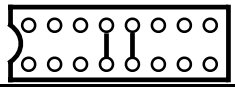
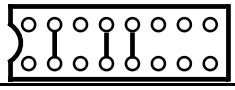
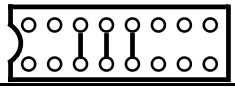
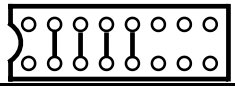
Input word m contains the information of how the digitalized analog value is stored.

Analog input module 6FX1 136-1BA01								
Byte No.	**Bit-No.**							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
IB m	2^{11} Sign	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}
	Connector X111, channel 0 - input 1							
IB m +1	2^{3}	2^{2}	2^{1}	2^{0}	1*)	1*)	1*)	1*)
IB m +2								
	Connector X121, channel 1, input 2							
IB m +3								
IB m +4								
	Connector X131, channel 2, input 3							
IB m +5								
IB m +6								
	Connector X141, channel 3, input 4							
IB m +7								
IB m +8								
	Connector X151, channel 4, input 5							
IB m +9								
IB m +10								
	Connector X161, channel 5, input 6							
IB m +11								
IB m +12								
	Connector X171, channel 6, input 7							
IB m +13								
IB m +14								
	Connector X181, channel 7, input 8							
IB m +15								

On the PLC 135 WB input/output modules can only be addressed from 0 .. 159.

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Setting the initial m

Initial address (hex.)	Input byte (dez.)	Socket S3 (1 ... 8)
0	0...15	
10	16...31	
20	32...47	
30	48...63	
40	64...79	
50	80...95	
60	96...111	
70	112...127	
80	128...143	
• • •	• • •	
C0	192...207	
D0	208...223	
E0	224...239	
F0	240...255	

On the PLC 135 WB input/output modules can only be addressed from 0 .. 159.

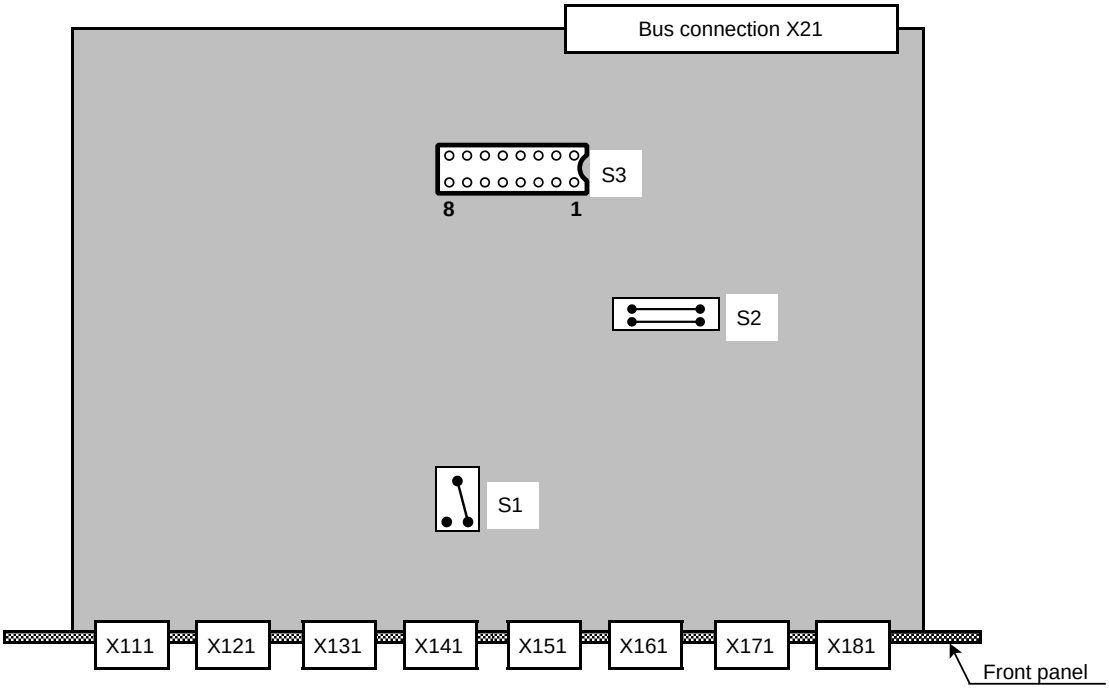
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Digital representation of analog values

The voltage range of the eight analog inputs is ±10 V. With a resolution of 11 bits this results in steps of 4.88 mV. The digital representation of the analog value is in two's complements:

Analog voltage at the input	Bit											
	2^{11}	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
9.99512 V	0	1	1	1	1	1	1	1	1	1	1	1
:							:					
:							:					
4.88 mV	0	0	0	0	0	0	0	0	0	0	0	1
0 V	0	0	0	0	0	0	0	0	0	0	0	0
–4.88 mV	1	1	1	1	1	1	1	1	1	1	1	1
:							:					
:							:					
–10 V	1	0	0	0	0	0	0	0	0	0	0	0

Position of the jumper socket and bridges



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Programmable input filters

The user program can switch on filters in the individual channels which can be used to suppress interference. The filters are selected by describing the output word which corresponds to the addressed input word. No other output word can be addressed on this output word.

Selection of the input filters								
Byte No.	**Bit No.**							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
QB m	Channel 7		Channel 6		Channel 5		Channel4	
	F1	F0	F1	F0	F1	F0	F1	F0
QB m +1	Channel 3		Channel 2		Channel 1		Channel 0	
	F1	F0	F1	F0	F1	F0	F1	F0

The initial address m corresponds to the initial address of the input bytes.

The two bits for filter selection (F0, F1) permit four different input configurations in every channel:

Bit F1 F0	Input configuration
0 0	Direct connection, standard after reset
0 1	Filter T1 = 0.01 ms
1 0	Filter T2 = 0.1 ms
1 1	Filter T3 = 1 ms

Example:

Filter in channel 2: 1 MS, initial address of the module IW 16

LK 0003
T QW16 (in cyclic operation)

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Technical data

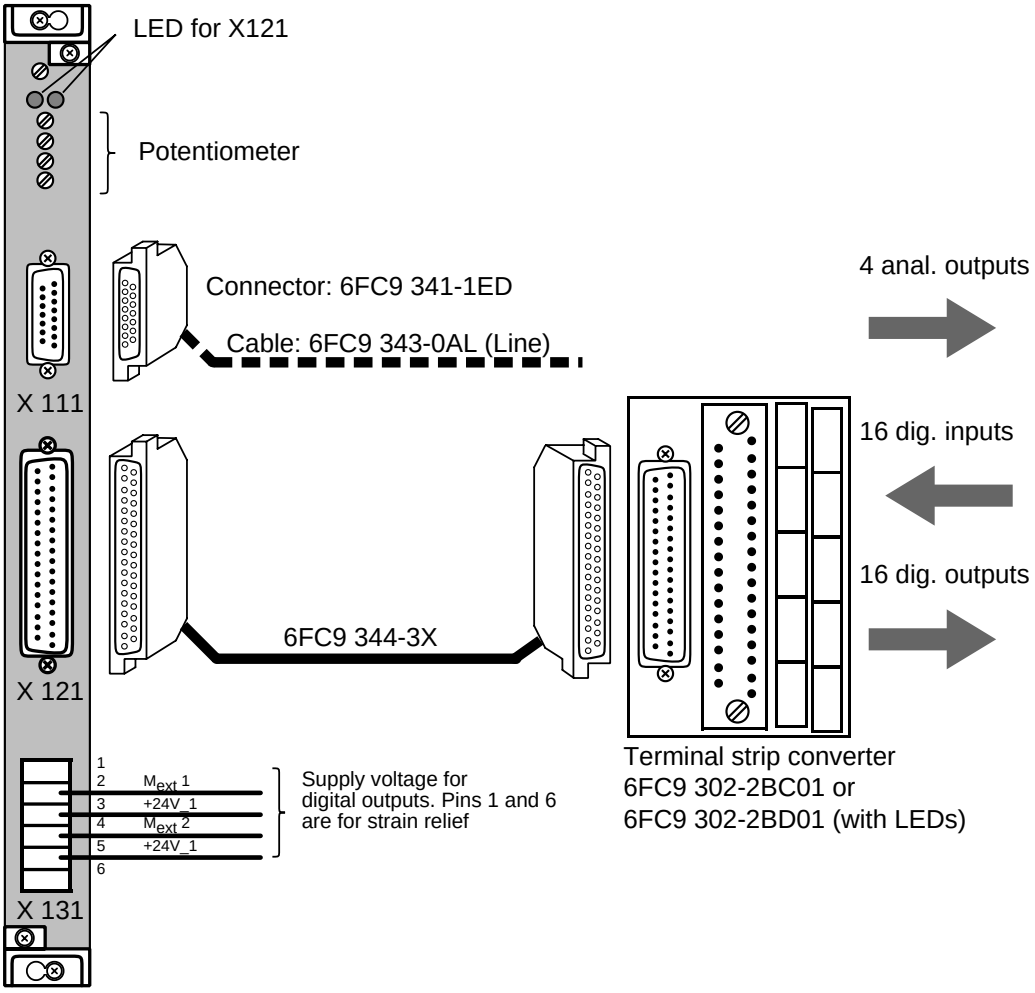
Number of inputs Galvanic isolation	8 voltage inputs, analog no
Input range (rated values)	±10V
Input resistance with in the ranges	
Connection of the encoder	two-wire connection
Digital representation of the input signals	12 bit, two's complement
Measuring principle	successive approximation
Conversion principle	successive approximation
Integration time (settable for optimum interference voltage suppression)	
Coding time max. Individual coding possible	396µs for 8 channels, incl. 1 compensation cycle; no
Cycle time for eight inputs	
Permissible voltage between inputs or between inputs and central earthing point (destruction limit)	DC ±35V
Permissible voltage between reference potential of a non floating encoder and central earthing point	±1V
Error message on - range violation - wire break of encoder line	 no no
Interference voltage suppression for f=n. (50/60Hz ±1%) n=1, 2 . . . - common-mode interference voltage (U_S<1V) min. - normal-mode interference voltage (peak value of the interference < rated value of the range)	 – –
Intrinsic error limits	1 LSB
Operator error limits (0°C to 60°C)	±10V (0°C to 70°C: 7 LSB)
Supply voltage (as for analog outputs)	5V, ±15V
Enabling input (as for analog outputs)	
Cable length max.	
Insulation voltage external terminals to housing - to VDE 0160 - tested with	
Power consumption internal (at 5V) typ. internal (at 24V) typ.	5V: 0.55A ±15V: 0.1A
Format	double-height Eurocard
Module width	20mm
Weight approx.	400g
Degree of protection to DIN 40050	IP0
Relative humidity class to DIN 40040	F

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2.3.4.4 Mixed input/output (N79) 6FX1 138-4BA01

The module contains:

16 digital inputs, floating, in groups of eight
16 digital outputs, floating, 24 V/400 mA, in groups of eight, short-circuit proof
Four analog outputs, non-floating, ± 10 V/3 mA
Two LEDs to display error states of the digital outputs (one LED per output block)
Four potentiometers for offset compensation of the analog outputs
One terminal block for supply of the digital outputs with 24 V DC



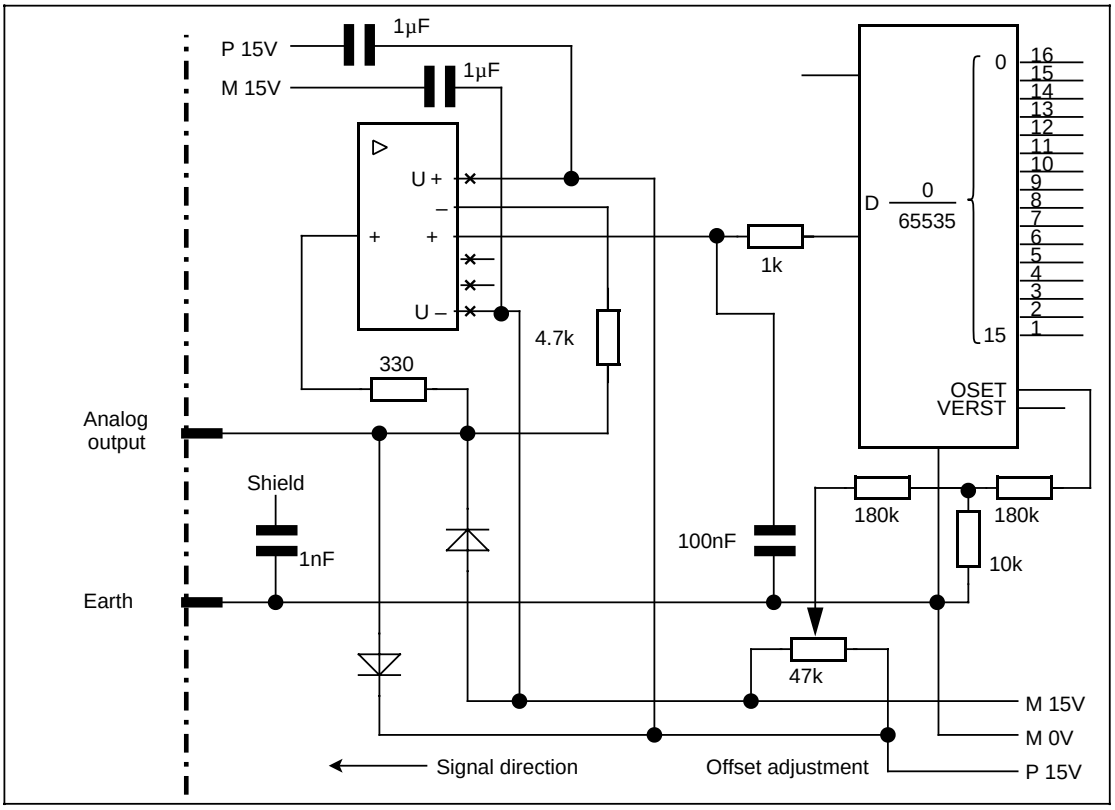
The module reserves on the PLC two input and two output bytes for the digital inputs and outputs and eight output bytes for analog outputs.

Note:

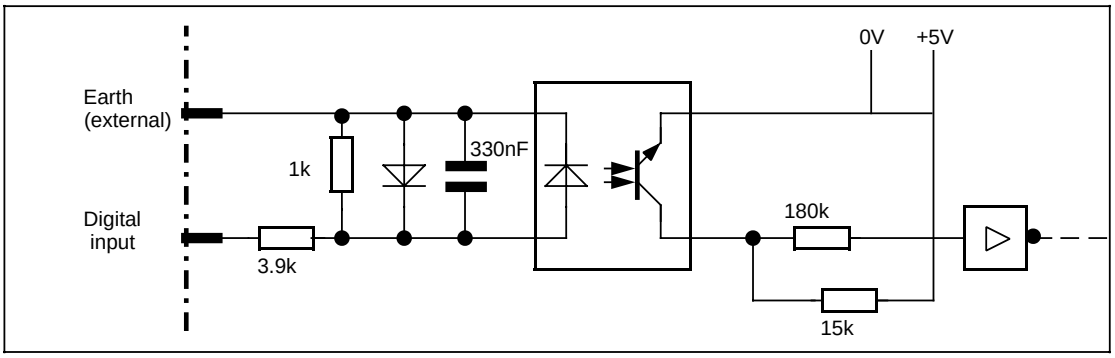
This module cannot be used in the mini EU.

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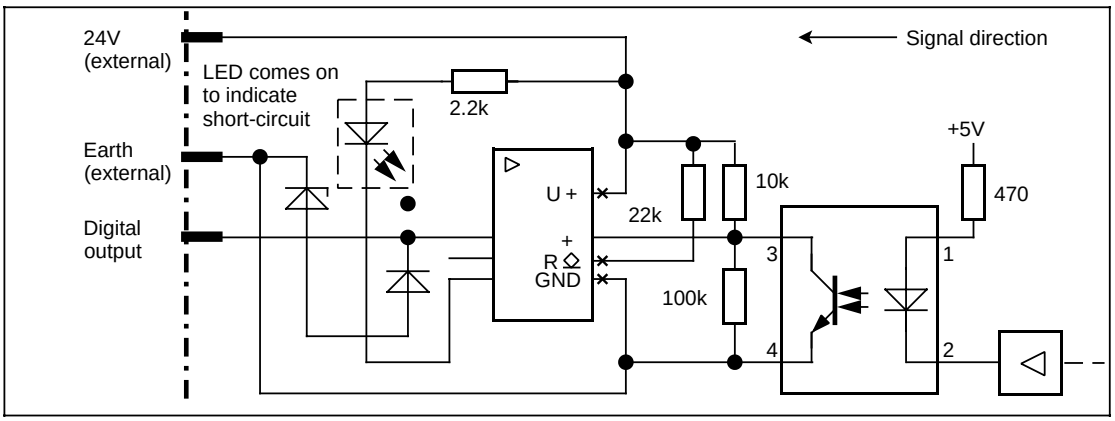
Analog output circuit



Digital input circuit



Digital output circuit



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Assignment of the inputs and outputs on the PLC interface

Digital inputs								
Byte No.	**Bit No.**							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
IB m	Connector X121 pin No.							
	32	13	31	12	30	11	29	10
IB m +1	Connector X121 pin No.							
	18	36	17	35	16	34	15	33

Digital outputs								
Byte No.	**Bit No.**							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
QB m	Connector X121 pin No.							
	23	4	22	3	21	2	20	1
QB m +1	Connector X121 pin No.							
	9	27	8	26	7	25	6	24

Set address **m** by setting jumpers on the module and by setting PLC MD

Note:

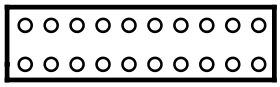
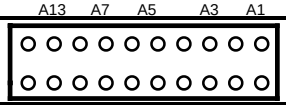
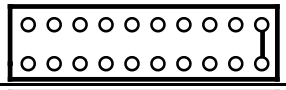
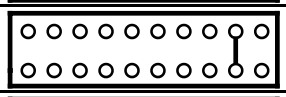
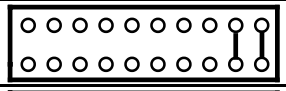
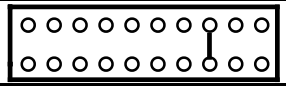
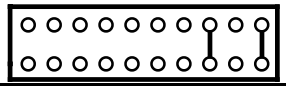
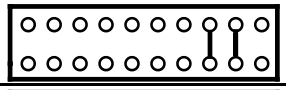
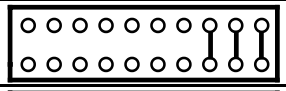
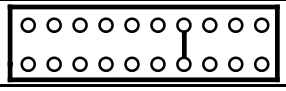
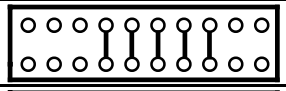
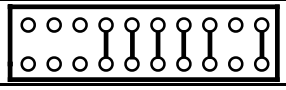
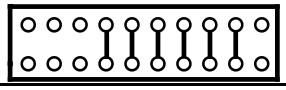
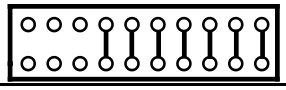
Address **m** must be the same for the input and output range

Analog outputs								
Byte No.	**BitNo.**							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
QB n	Hex code for voltage value output 1							
QB n +1								
QB n +2	Hex code for voltage value output 2							
QB n +3								
QB n +4	Hex code for voltage value output 3							
QB n +5								
QB n +6	Hex code for voltage value output 4							
QB n +7								

Set address **n** by setting jumpers on the module and by setting PLC MD. The address can be set independently of address m of the digital inputs and outputs.

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Setting the initial address m for digital inputs/outputs

Initial address (hex.)	Input byte Output byte (dec.)	DIP FIX right
		 A14 A12 A6 A4 A2 A13 A7 A5 A3 A1
0	0...1	
2	2...3	
4	4...5	
6	6...7	
8	8...9	
A	10...11	
C	12...13	
E	14...15	
10	16...17	
F8	248...249	
FA	250...251	
FC	252...253	
FE	254...255	

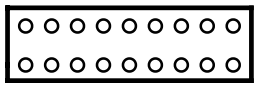
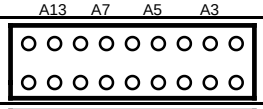
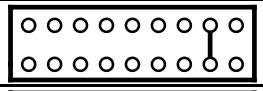
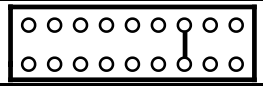
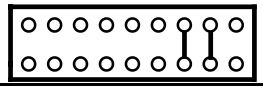
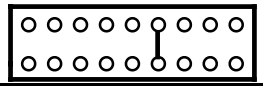
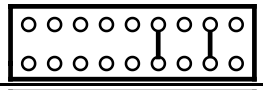
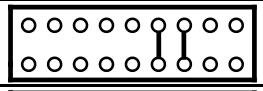
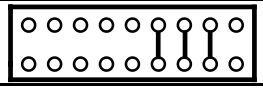
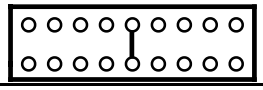
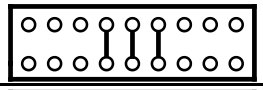
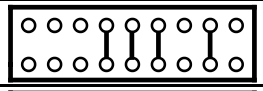
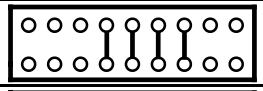
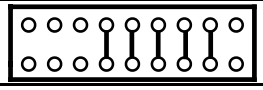
Positional values:
A1 = 2
A2 = 4
A3 = 8
A4 = 16
A5 = 32
A6 = 64
A7 = 128

On the PLC 135 WB input/output modules can only be addressed from 0 ... 159.

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Setting the initial address n for analog ouputs

The address n is set independently of the setting of the digital inputs/outputs. The address area reserved by the analog outputs can no longer be used for inputs.

Initial address (hex.)	Output byte (dez.)	DIP FIX left
		
00	0...7	
08	8...15	
10	16...23	
18	24...31	
20	32...39	
28	40...47	
30	48...55	
38	56...63	
40	64...71	
• • •	• • •	
E0	224...231	
E8	232...239	
F0	240...247	
F8	248...255	

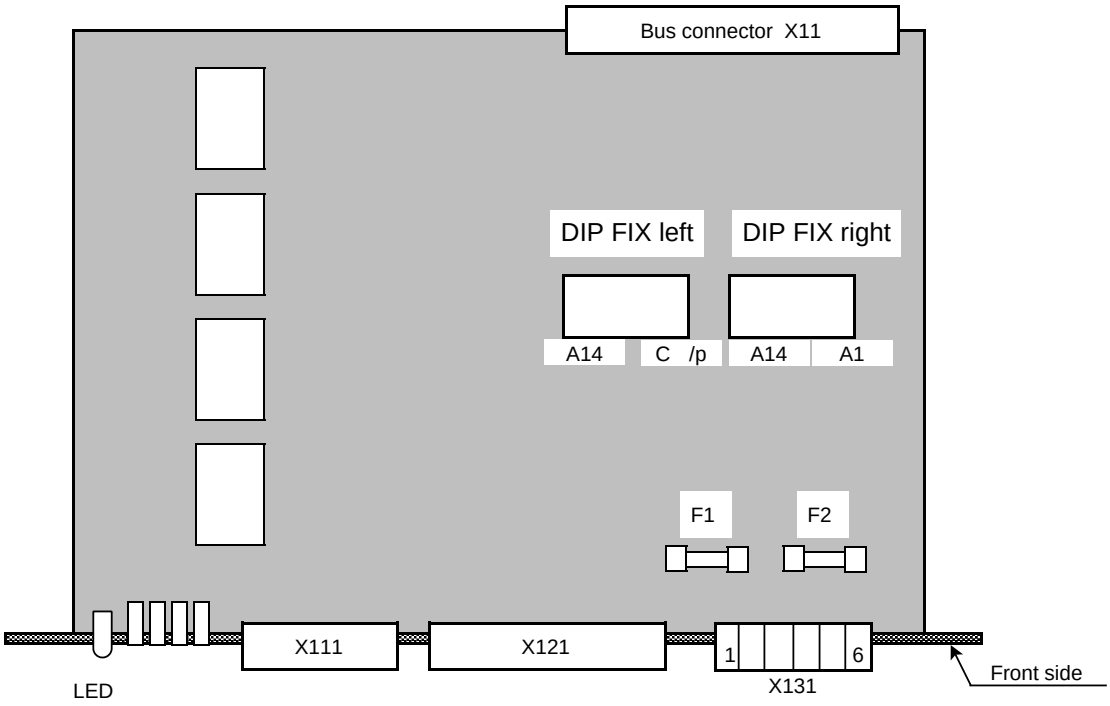
Positional values:
A3 = 8
A4 = 16
A5 = 32
A6 = 64
A7 = 128

If the module is used in the PLC area the jumper C P must be open.

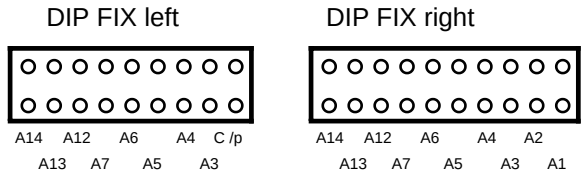
On the PLC 135 WB input/output modules can only be addressed from 0 ... 159.

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Position of the jumper socket and jumpers



F1, F2 . . . Fuses 4 A



Technical data

Number of inputs Galvanic isolation		16 digital yes
Input voltage (rated)		24V DC
Input voltage	for Signal ”0” for Signal ”1”	-3V to +5V +14V to +30V
Input current	at Signal ”1”	
Delay Delay	for tpLH for tpHL	
Cable length	max.	50m
:		:

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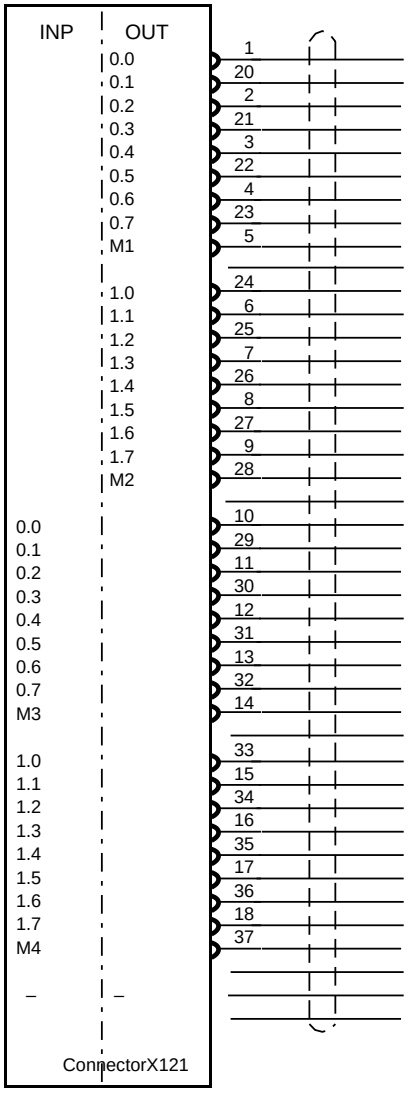
Technical data (continued)

:	:
Number of inputs Galvanic isolation	16 digital ja
Supply voltage U_P - rated value - ripple V_{PP} - permissible range (incl. ripple)	 24V DC 20V to 30V
Output current at signal ”1” (rated)	400mA
Short-circuit protection	electronic with optical display (LED)
Limitation of inductive cut-off voltage a. switching power for lamps	
Switching frequency for - ohmic load - lamps - inductive load (at rated load. At lower load higher values are permitted)	 100Hz 11Hz 2Hz
Total load at 55°C (Relative to the sum of the rated currents of all outputs)	50%
Signal level of the outputs - for signal”0” - for signal”1”	 Output open U_P –1V
Cable length max.	50m
Number of outputs Galvanic isolation	8 voltage outputs, analog no
Output ranges (rated values)	±10V
Load resistance at voltage outputs min.	3.3
Connection type of load	Load against 0V connection
Digital representation of the output signal	13 bits + sign
Permissible overcontrol approx.	
Short-circuit protection	ja
Short-circuit current	
Voltage between reference potential of the load (0V connection and device housing) max.	
Intrinsic error limits	
Operator error limits (0°C to 60°C)	
Cable length (screened) max.	
Insulation voltage external terminals to housing - to VDE 0160 - tested with	
Current consumption internal (at 5V) typ. internal (at 24V) typ.	
Format	double-height Eurocard
Module width	20mm
Weight approx.	
Degree of protection to DIN 40050	IP00
Relative humidity to DIN 40040	F

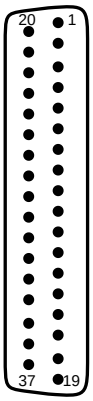
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Connection of digital inputs and outputs

The digital inputs and outputs are connected via a common 37-way D subminiature male connector.



Signals M1 and m2 must not be used.
They are for testing purposes only.



Connector

Position: 1 top
D subminiature
37-way, male

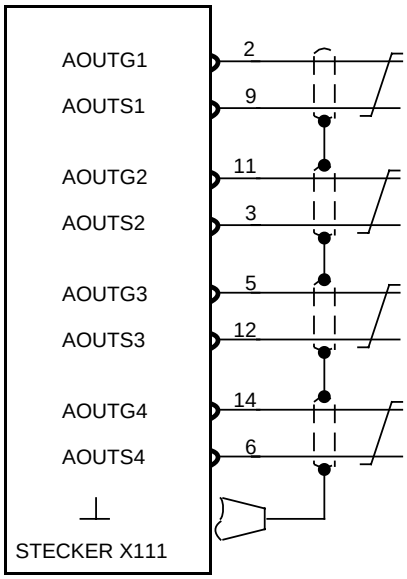
For connection see cable plan 6FC9 344-3X

Signals M3 and M4 must be connected.

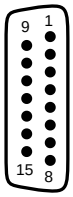
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Connection of the analog outputs

The analog outputs are connected via a 15-way D subminiature male connector.



AOUTGn: **A**nalog **OUT**put **G**round
AOUTSn: **A**nalog **OUT**put **S**ignal
⊥ : Screen
n: Number of the analog output



Connector

Position: 1 top
D subminiature
15-way, male

Recommended cable:
12 x 2 x 0.14
screened in pairs
Order No.: 6FC9 343-0AL (line)

Digital analog output

The voltage range of the four analog outputs is ± 10 V. The voltage is set by entering the appropriate hexadecimal value in the output word.

Hex. value	Voltage of the output
0000 : : 7FFF	0 V : : 10 V
8000 : : FFFF	-10 V : : 0 V

Resolution of the analog output:

$$\frac{10\ V}{32767} = 305.18 \cdot 10^{-6} \quad [\frac{V}{Bit}]$$

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Example

The following voltages are supposed to be output to analog output 1 (module jumpered to 24):

a) 9.5 V

$$\frac{9.5}{305.18 \cdot 10^{-6}} = 31129_{dec} = 7999_{hex}$$

On programming the high and the low byte must be swapped round:

```
L   KH 9979
T   QW24
```

b) – 4.12 V

$$\frac{-4.12}{305.18 \cdot 10^{-6}} = 13500_{dec} = 34BC_{hex}$$

da FFFF = 0 V: $FFFF_{hex} - 34BC_{hex} = CB43$

```
L   KH 43CB
T   QW24
```

c) – 7.125 V

$$\frac{-7.125}{305.18 \cdot 10^{-6}} = 23346_{dec} = 5B32_{hex}$$

$FFFF - 5B32 = A4CD_{hex}$

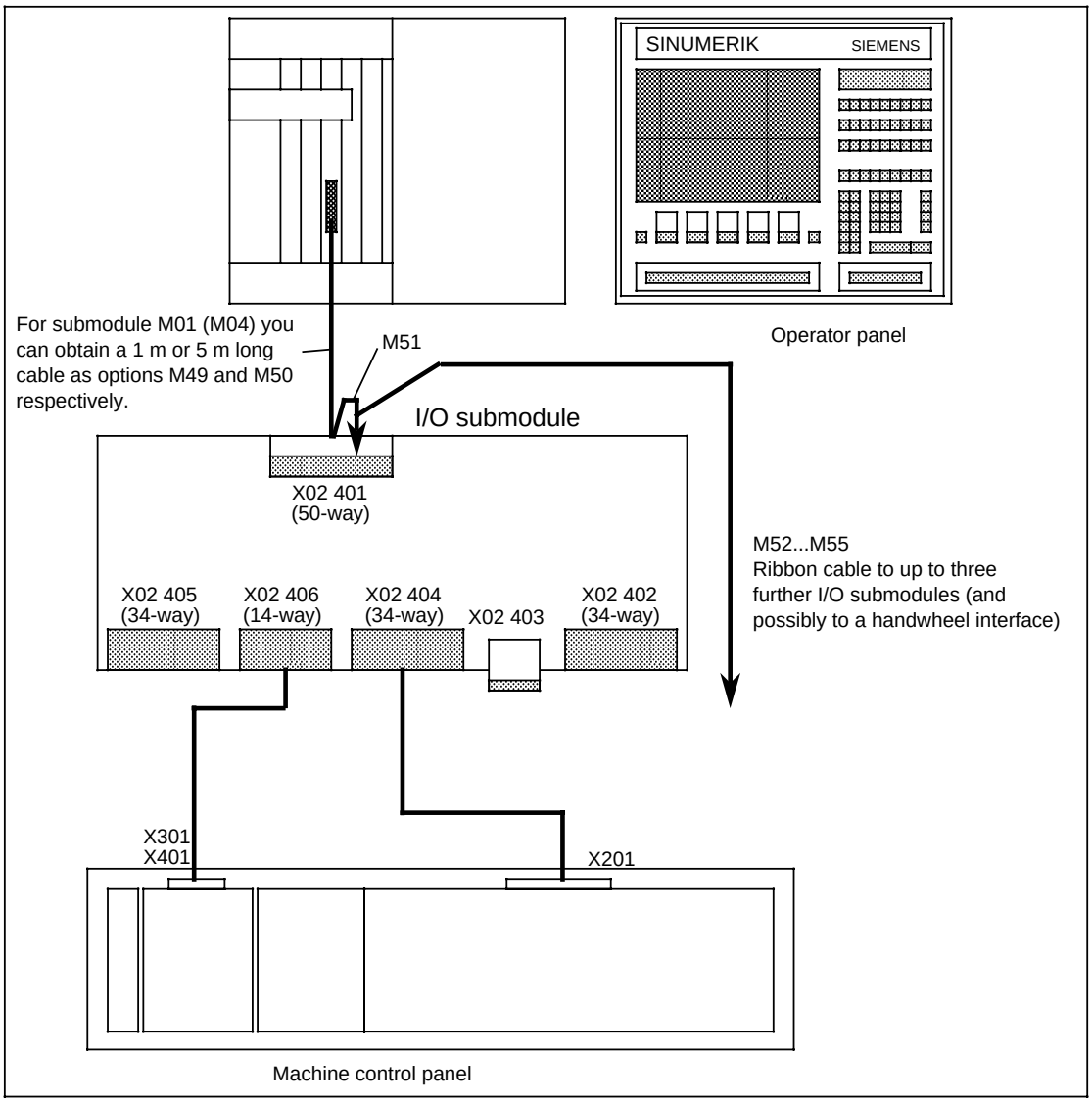
```
L   KH CD A4
T   QW 24
```


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2.3.5 Input submodule, I/O submodule (M01...M04) 6FC3 384-3R

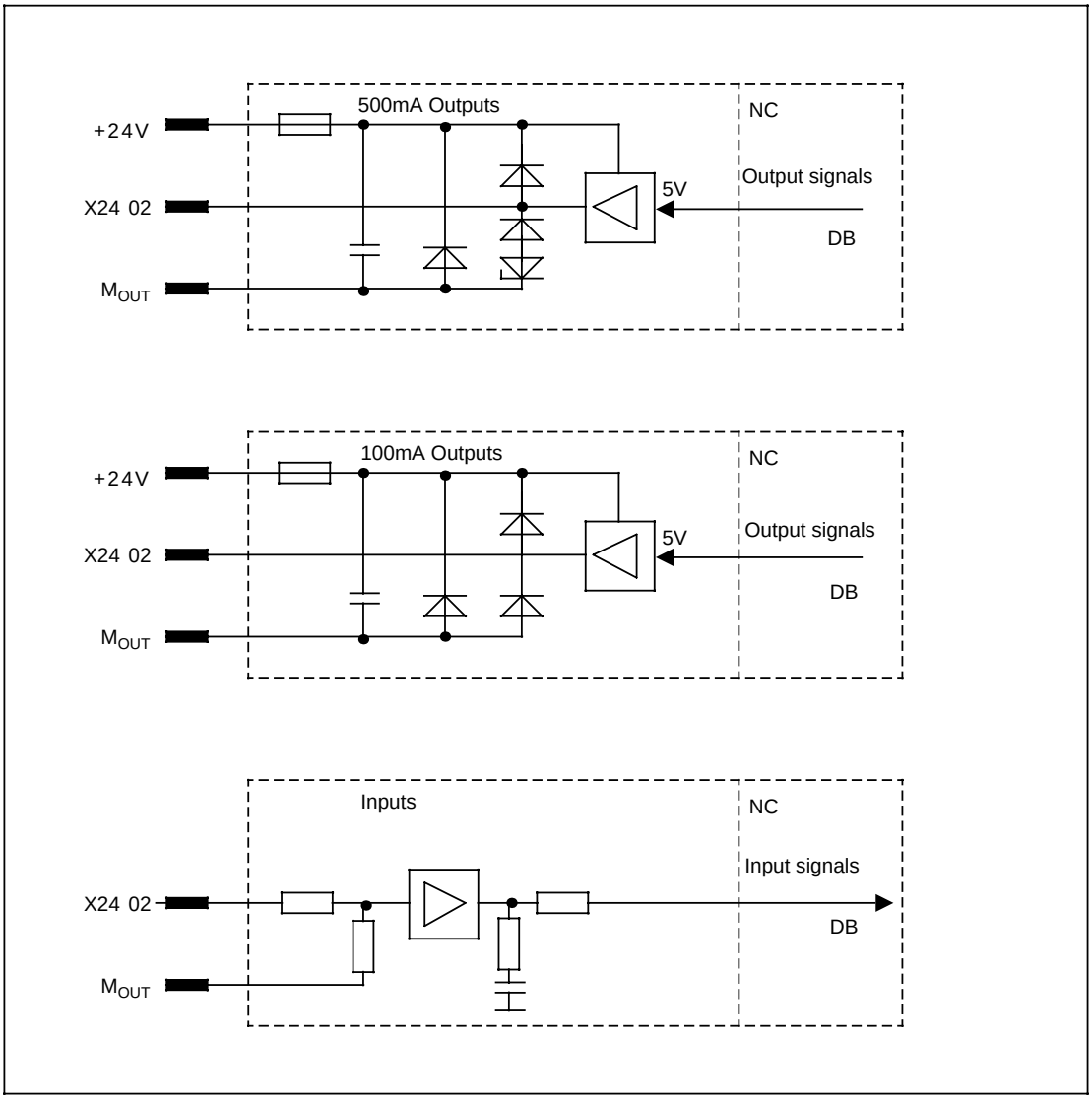
The module contains:

64 inputs 24 V DC, non-floating
24 outputs 24 V DC / 0.5 A (M01 and M02 only)
8 outputs 24 V DC / 0.1 A (M01 and M02 only)
1 mounting plate (M01 and M04 only)
Only one mounting plate is required for all I/O submodules used (up to four).



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Input and output circuits:



M_{out}/24 V are supplied via the terminal block X02 403

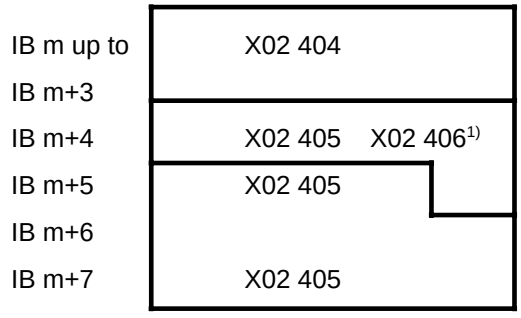
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Assignment of the inputs on the PLC interface

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

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

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



1) The inputs of the connector X02 406 are in parallel to pins No. 3 to 12 of connector X02 405. These inputs must only be switched to one of the connectors X02 405 or X02 406. Signals at connector X02 406 can be read in the corresponding bits for connector X02 405 in the input area.

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Assignment of outputs on the PLC interface

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

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

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

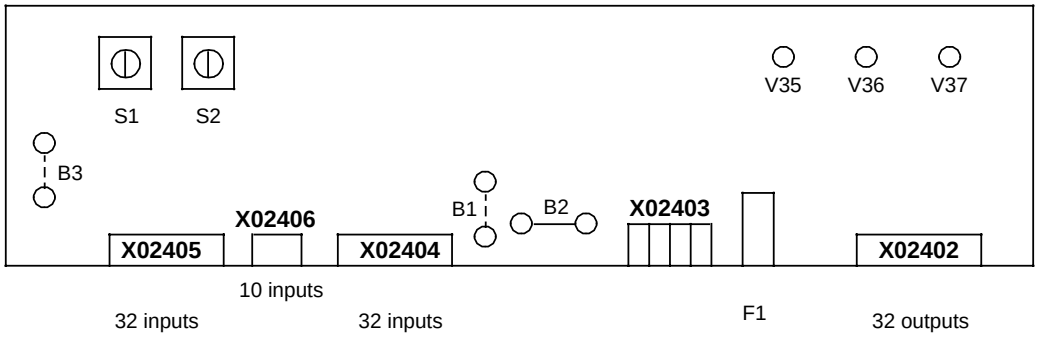
Output load

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

Byte No. QB m+3 — 24V; 0.1A

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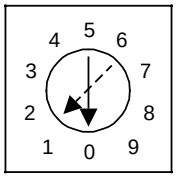
Position of the jumper socket and jumpers



Jumper status:
B1 open
B2 closed
B3 open

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

S1: Addressing of inputs
S2: Addressing of outputs



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Technical data

Inputs (applies to input submodule and I/O submodule):

No. of inputs		64
Galvanic isolation		no
Input voltage (rated)		24 V DC
Input voltage	for 0 signal for 1 signal	–3 V to +5 V or input open +13 V to +30 V
Input current for 1 signal	typ.	6 mA
Delay	for tp LH for tp HL	2.5...4.3 ms 2.5...4.3 ms
Cable length		50 m

Outputs (applies to I/O submodule only):

No. of inputs		32 (8+4)
Galvanic isolation		no
Supply voltage Up Rated Ripple U_{SS} Permissible range (incl. ripple)	 max. 	 24 V DC 3.6 V DC 20 V to 30 V
Output current for 1 signal Rated		 100 mA or 0.5 A
Short-circuit protecton for 100 mA output for 0.5 A output		 without electronic
Limitation of inductive cut-off voltage		–11V
Switching power for lamps for 100 mA output for 0.5 A output	 max. max.	 - - - [3] 14 W
Switching frequency for ohmic load lamps inductive load [1]	 max. max. max.	 500 Hz 500 Hz 10 Hz

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Technical data, ouputs (continued)

Total load at 55 °C [2]		50 %
Signal level of the outputs		
for signal 0	max.	output open
for signal 1		
100 mA output	min.	Up – 1.1 V
0.5 A output	min.	Up – 1.7 V
Cable length max.		50 m
Insulation voltage external terminals to housing		
to VDE 0160		
tested with		– – – – – –
Current consumption		
internal (at 5 V)		0.1 A
internal (at 24 V)		0.05 A
Dimensions		391 x 127 x 15 mm
Weight		
with installation panel (m01,M04)		approx. 1.3 kp
without installation panel (m02,M03)		approx. 1.0 kp

[1] At rated load; Higher values are permissible with a smaller load.

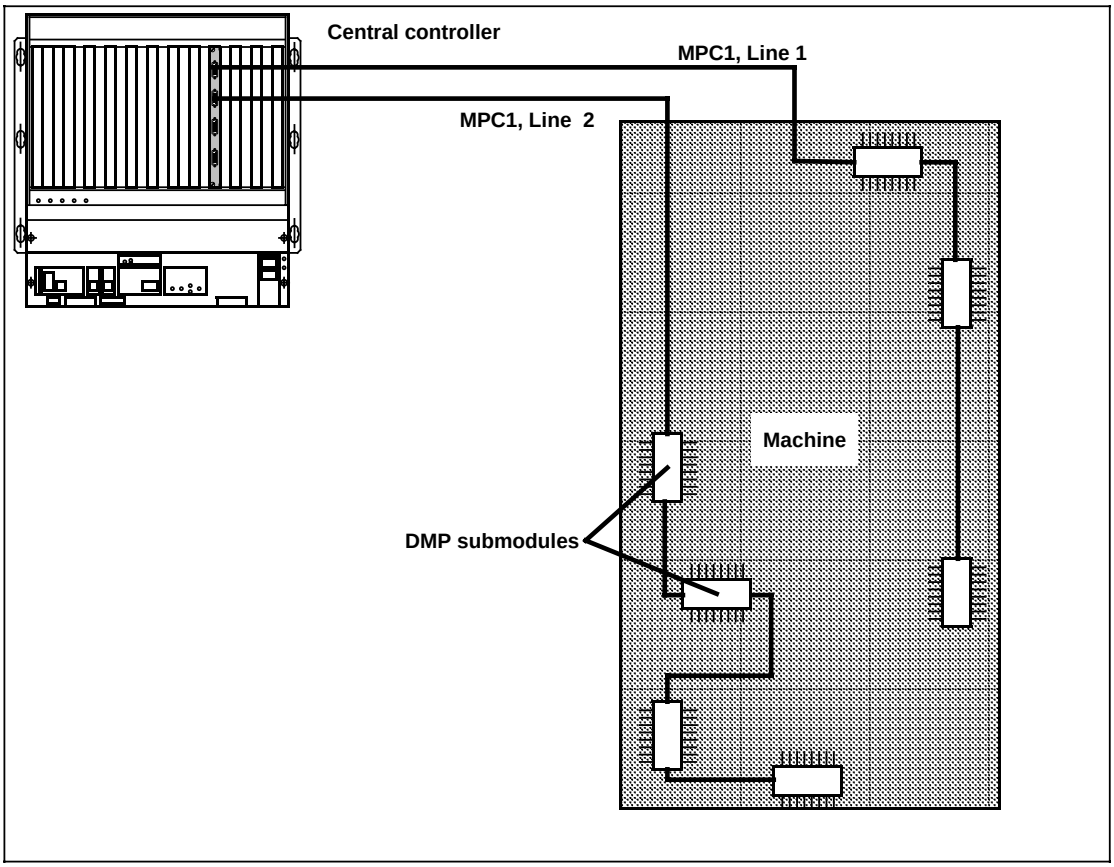
[2] Relative to the sum of the rated currents of all outputs.

[3] Maximum power-on current 350 mA
With display lamp control:
12 V lamps with series resistor or
24 V lamps with preheating

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2.3.6 Distributed machine I/Os (DMP)

With the DMP submodules, inputs/outputs from/to the machine can be implemented with only one cable per line to the central controller.



The DMP comprises a carrier module (M30), which accommodates the terminals, and the DMP submodules

DMP submodule with 16 inputs/16 outputs	6FX 1142-4BA03
DMP submodule with 32 inputs	6FX 1142-2BA02

which are plugged in on the carrier module.

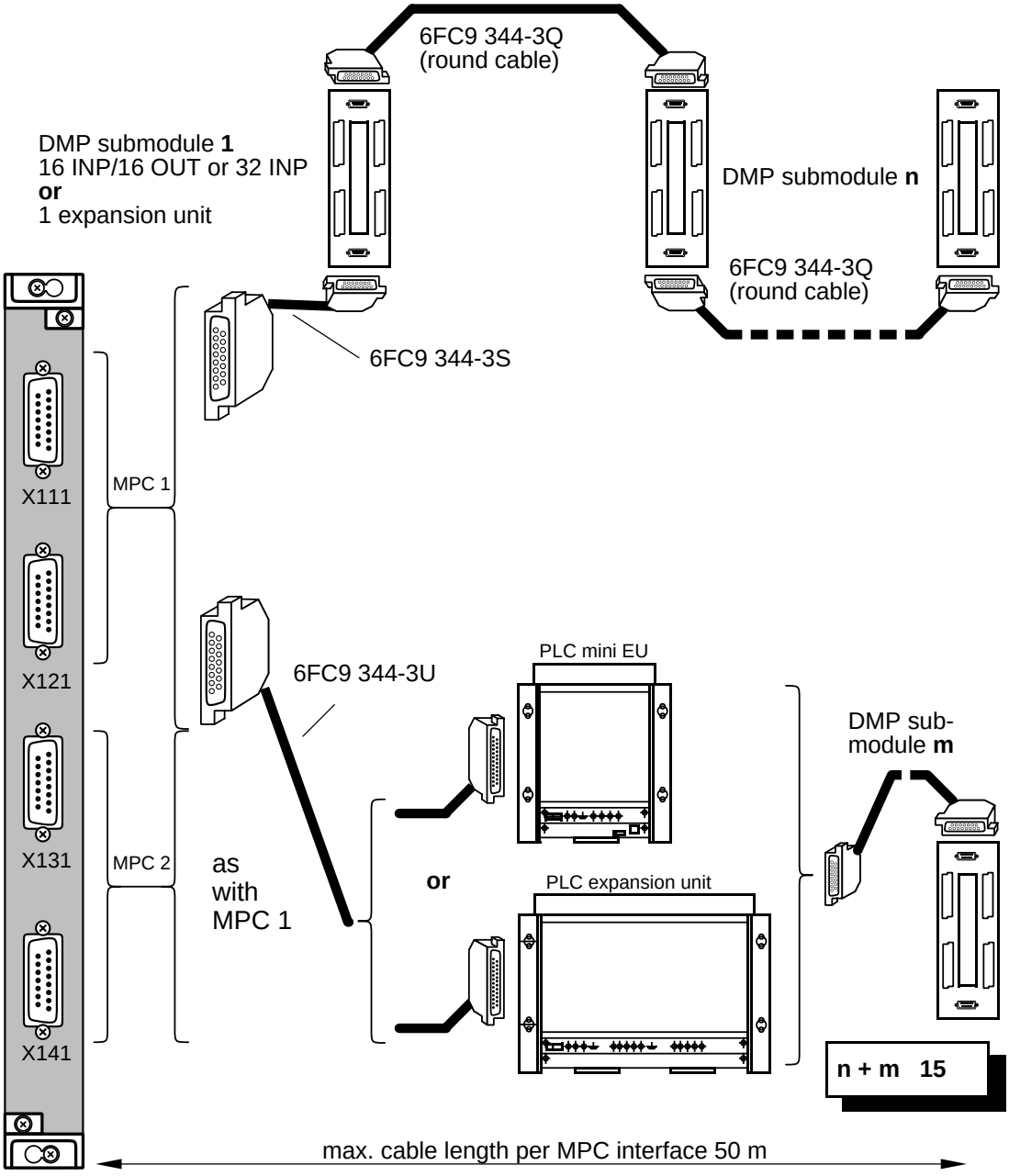
The individual DMP submodules must each be assigned a submodule No..
These addresses are set with the DIL rotary switch at the top left of the DMP carrier module. PLC MD 34 to 123, in which the DMP submodules are assigned their specific 1st input and 1st output bytes, refer to these addresses.

DMP submodules are connected to one another and to the central controller via a serial bus (MPC link).

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2.3.6.1 Interface DMP 6FX1 144-2BA00

This module has the function of linking distributed peripherals to the PLC. Two independently operating MPC interfaces each with two RS 485 interfaces are provided for this purpose.

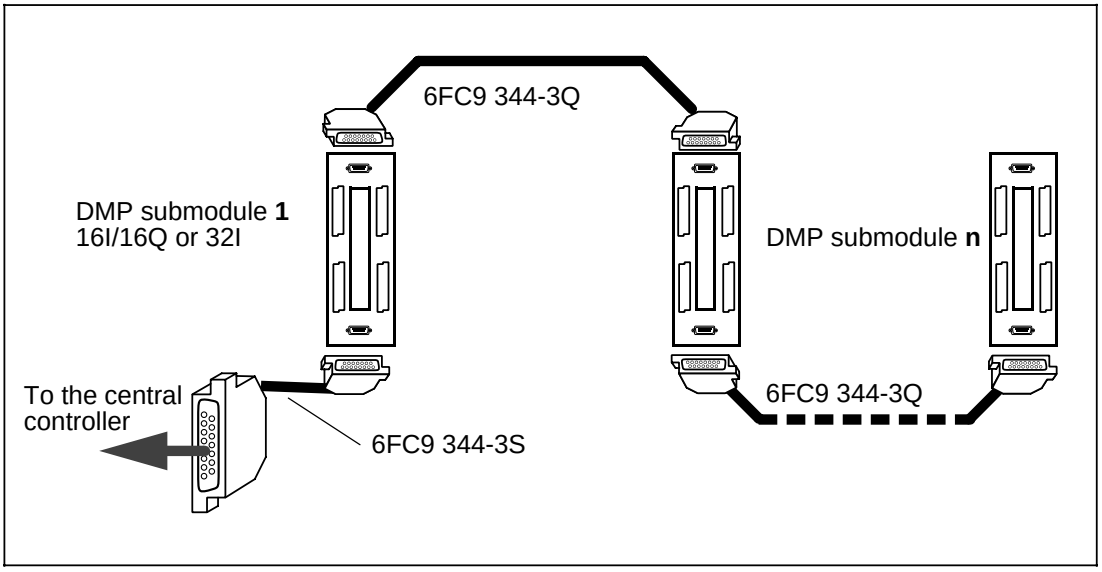


A total of 15 submodules can be connected per MPC interface, including a maximum of three expansion units. The three expansion units must be connected directly to the interface DMP; i.e. no DMP submodules can be connected in front of the expansion units.

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2.3.6.2 DMP submodules, M30 + M33 or M34

DMP submodules permit the connection of inputs from and outputs to the machine with only one cable per line to the central controller.

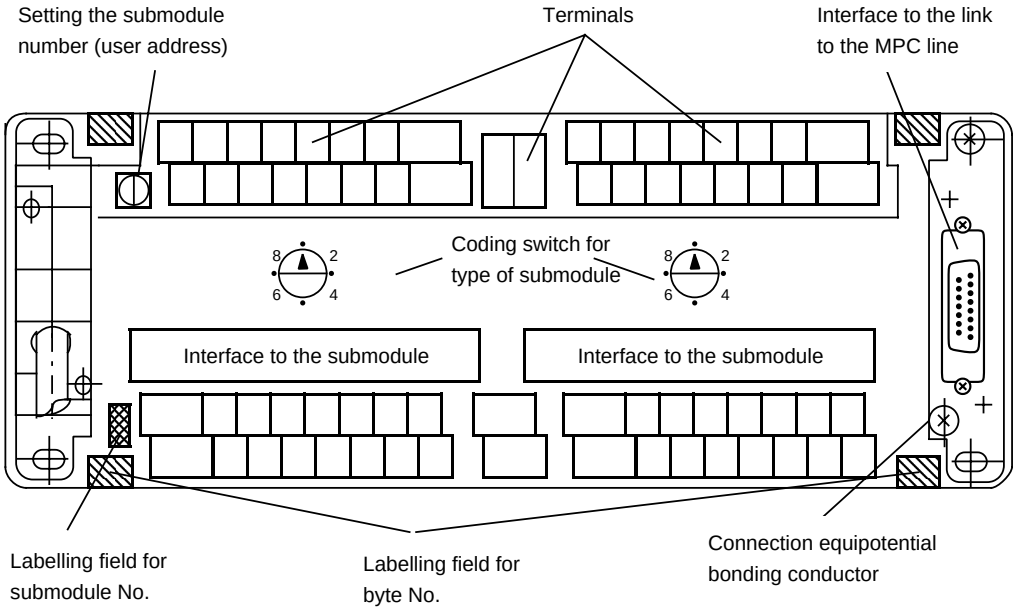


There are two types of DMP submodule:

- DMP submodule with 16 inputs and 16 outputs, M33
- DMP submodule with 32 inputs, M34

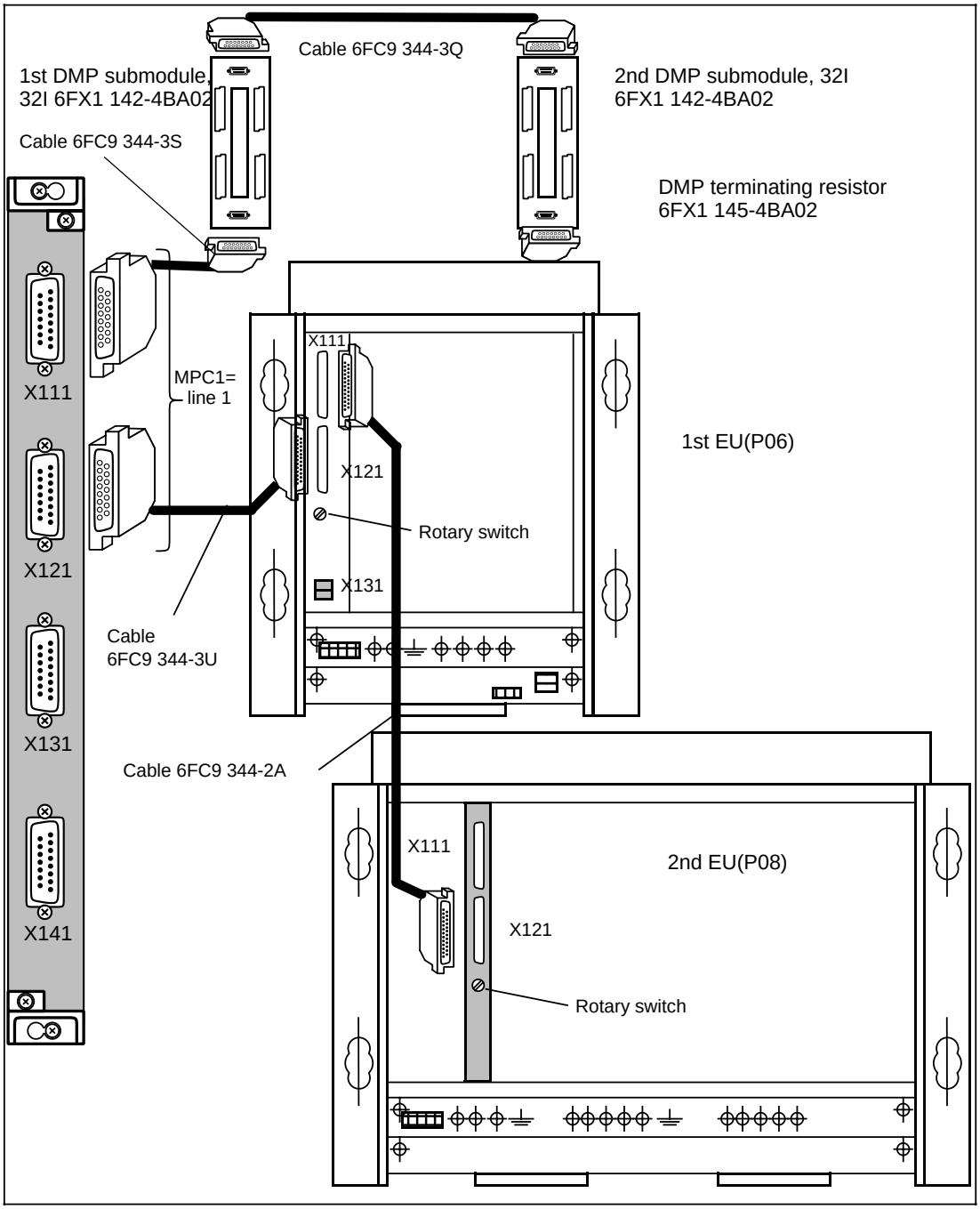
The DMP submodule must be plugged into DMP carrier module, which contains the terminals. The meaning and the jumpering of the terminals varies when different submodules are inserted.

DMP carrier module, M30 (6FX1 142-1BA01)



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Example of connecting I/O devices to the DMP interface



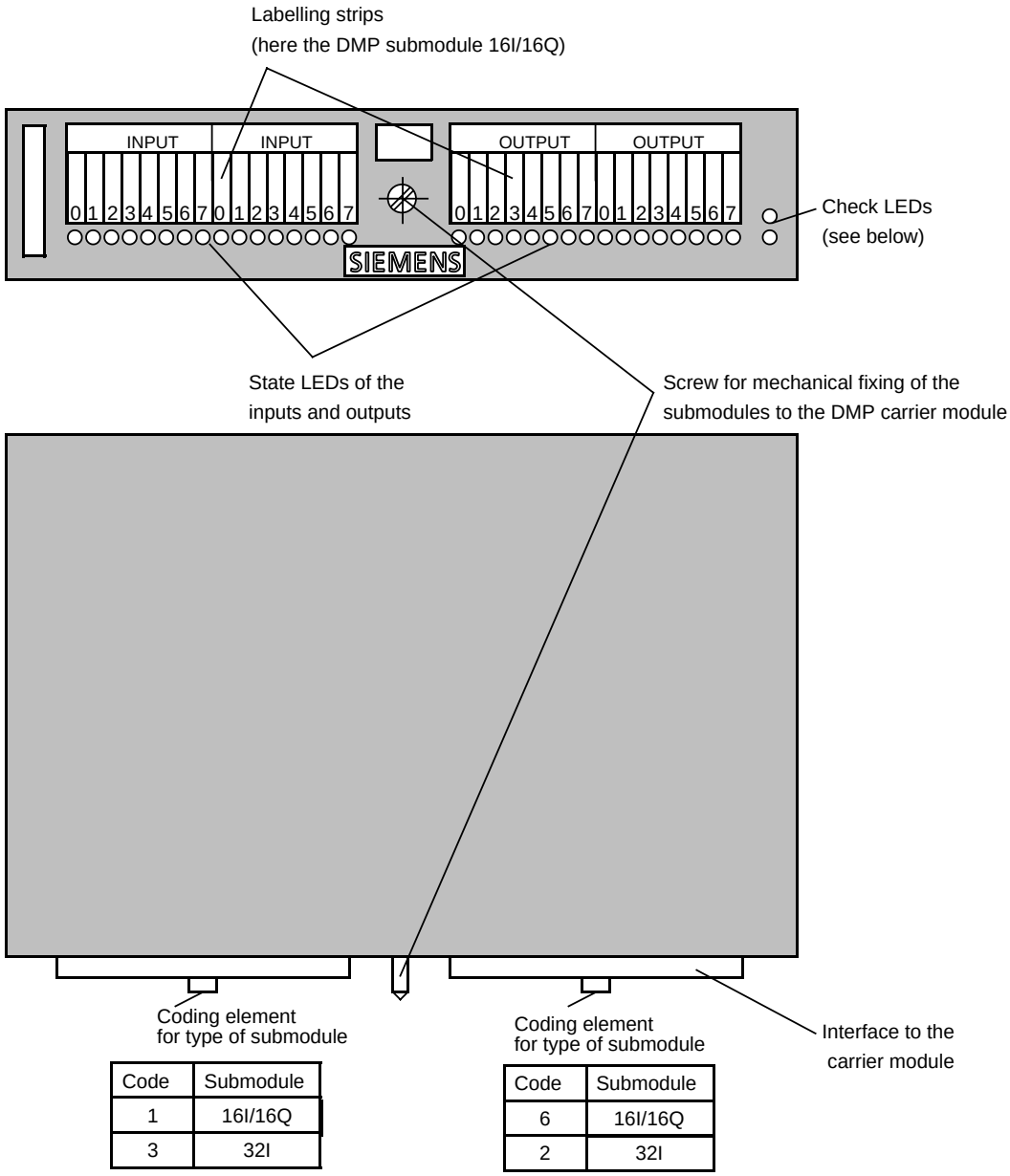
In this example the inputs of the DMP submodules are switched to input bytes 40 and 42. The inputs/outputs of the I/O submodules plugged into the EUs are set by jumpering on the modules.
The PLC machine data to be entered are shown in the table on the next page.

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PLC MD	DMP interface	Line	DMP sub-module	EU	MD standard value	DMP/EU rotary switch position	Entry for example	Comment
13							0	Only valid for EU interface N95
34	1	1	1		–1	E	E	
35	1	1	2		–1	D	D	
36	1	1	3		–1	C		
37	1	1	4		–1	B		
38	1	1	5		–1	A		
39	1	1	6		–1	9		
40	1	1	7		–1	8		
41	1	1	8		–1	7		
42	1	1	9		–1	6		
43	1	1	10		–1	5		
44	1	1	11		–1	4		
45	1	1	12		–1	3		
46	1	1	13	3	–1	2		Values for EUs must only be not equal to –1
47	1	1	14	2	–1	1	0	
48	1	1	15	1	–1	0	0	

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DMP submodule 16I/16Q (6FX1 142-4BA03)
DMP submodule 32I (6FX1 142-2BA02)



Code	Submodule
1	16I/16Q
3	32I

Code	Submodule
6	16I/16Q
2	32I

The coding switches on the carrier module must be turned to match the coding elements on the submodule, which indicate the type of submodule. The coding elements on the submodule are **fixed**.

Meaning of the check LEDs:

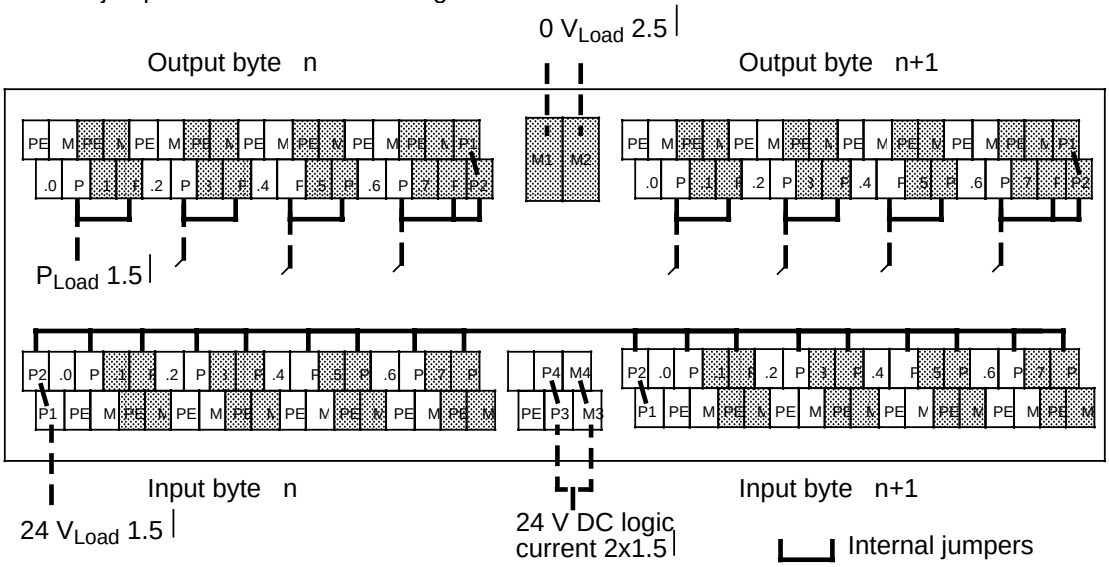
Red LED is lit:
- The 24 V electronic supply voltage has sunk below the value of 15 V
- Transmission error

Yellow LED is lit:
- The 5 V logic supply voltage generated from the 24 V electronic supply voltage is within the tolerance range of 4.75 V to 5 V.

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DMP-Modul 16I/16Q, M33 (6FX1 142-4BA03)

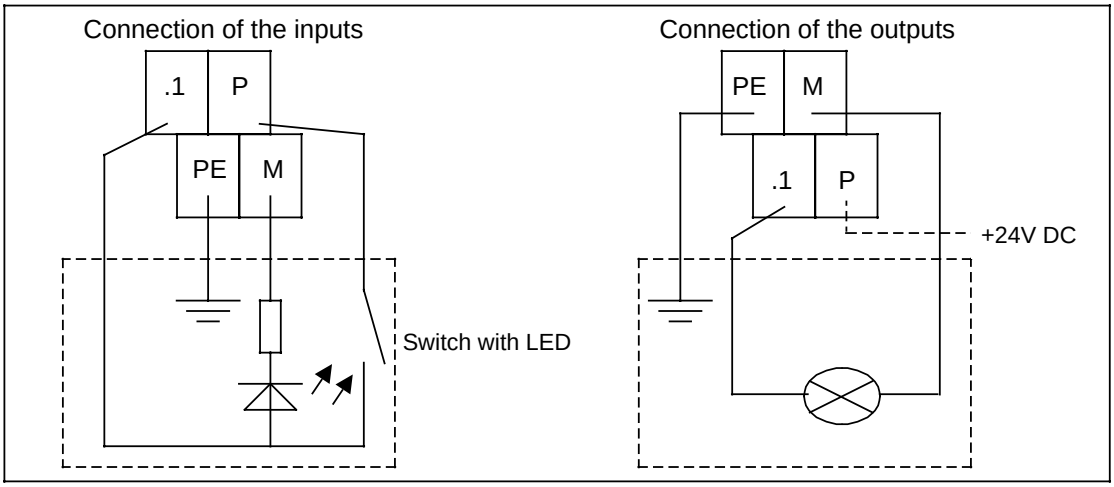
The following terminals are internally connected by jumpers:
all PE terminals,
all M1, M2, M terminals,
all other jumpers are shown in the diagram



This DMP submodule requires two current supplies:
A 24 V DC logic supply and a 24 V DC load supply.

The 24 V/0 V logic current supply is connected to P3 (P4) and M3 (M4).

The 0 V potential for the load current supply of the inputs and outputs must be connected to M1 (M2) and is thus applied to all M terminals via the internal jumpers of the DMP carrier module. Likewise, the +24 V load current supply for the input bytes only needs to be connected to P1 (P2) and is thus supplied to all P terminals of the input bytes via internal jumpers on the DMP submodule. The P terminals of the output bytes are arranged in pairs by means of jumpers in the DMP submodule. The +24 V load current supply must thus be connected only to every second terminal.



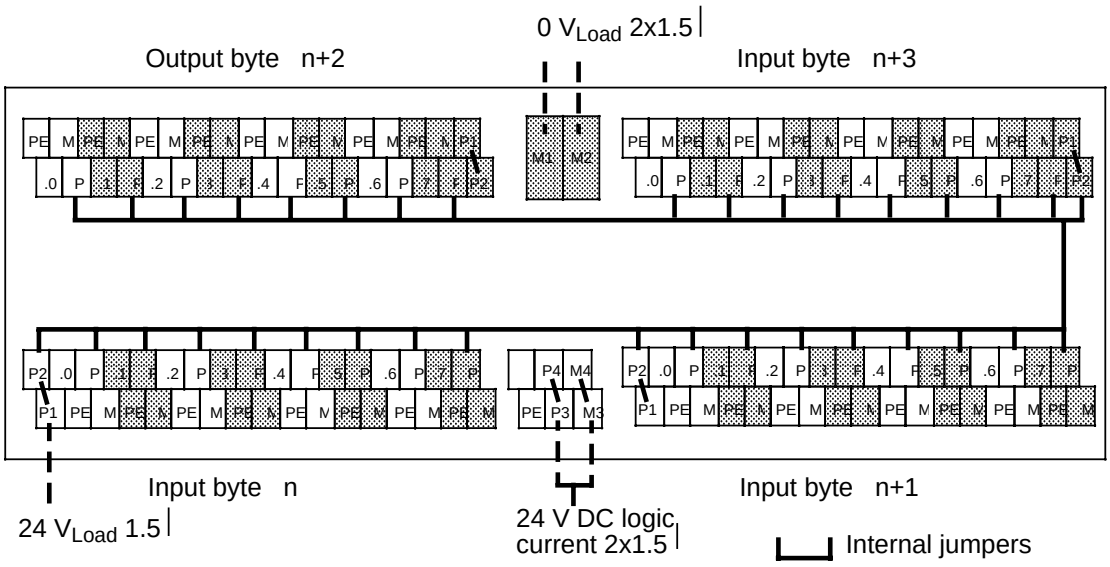
Connection of the inputs and outputs

Technical data:
Inputs: +24 V, 10 mA
Outputs: +24 V, 2 A short-circuit proof, non-floating, simultaneity factor per byte 0.5 V

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DMP-Modul 32I, M34 (6FX1 142-2BA02)

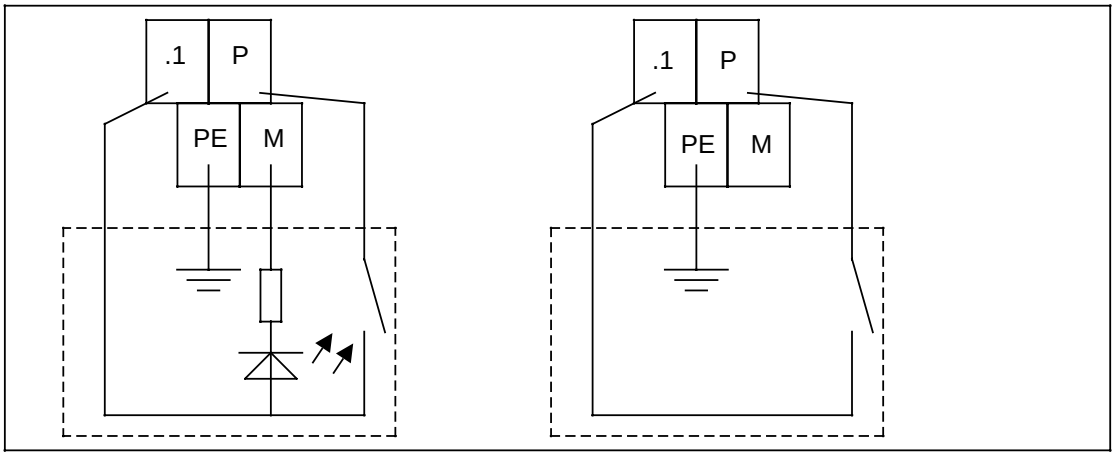
The following terminals are internally connected by jumpers:
all PE terminals,
all M1, M2, M terminals,
all other jumpers are shown in the diagram



This DMP submodule requires two current supplies:
A 24 V DC logic supply and a 24 V DC load supply.

The 24 V/0 V logic current supply is connected to P3 (P4) and M3 (M4).

The 0 V potential for the load current supply of the inputs and outputs must be connected to M1 (M2) and is thus applied to all M terminals via the internal jumpers of the DMP carrier module. Likewise, the +24 V load current supply for the input bytes only needs to be connected to P1 (P2) and is thus supplied to all P terminals of the input bytes via internal jumpers on the DMP submodule.



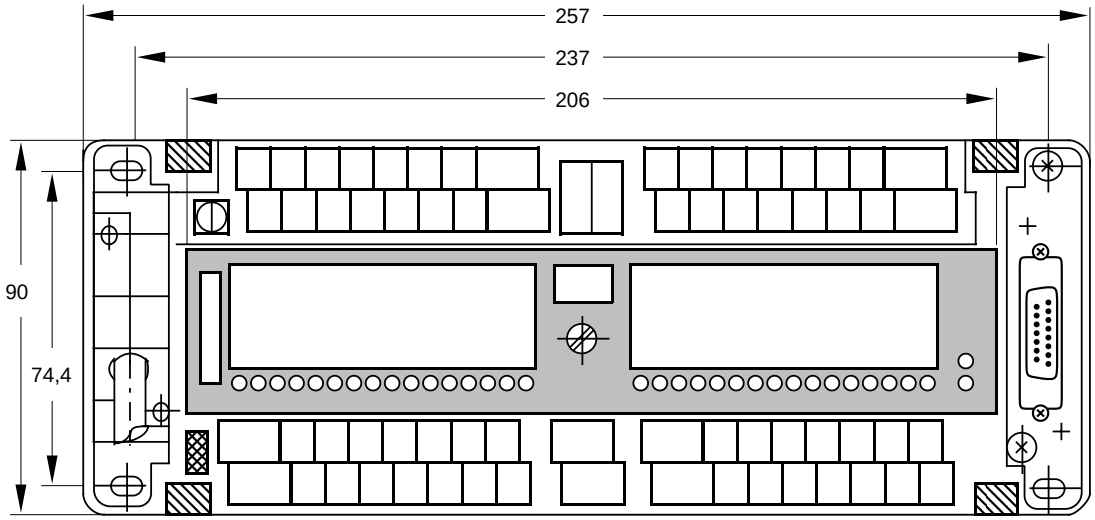
Connection of the inputs

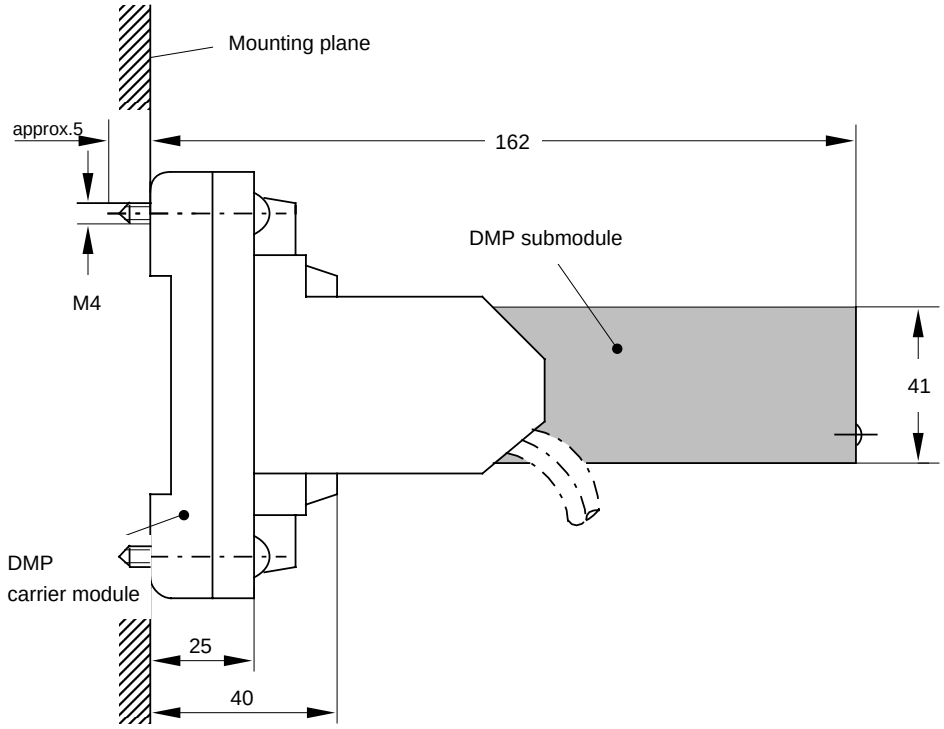
Technical data:
Inputs: +24 V, 10 mA

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Dimensions and mounting dimensions of the complete DMP submodule

(carrier module with submodule plugged in)
The dimensions shown apply to both DMP submodules.





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Technical Data (for submodules complete with carrier module)

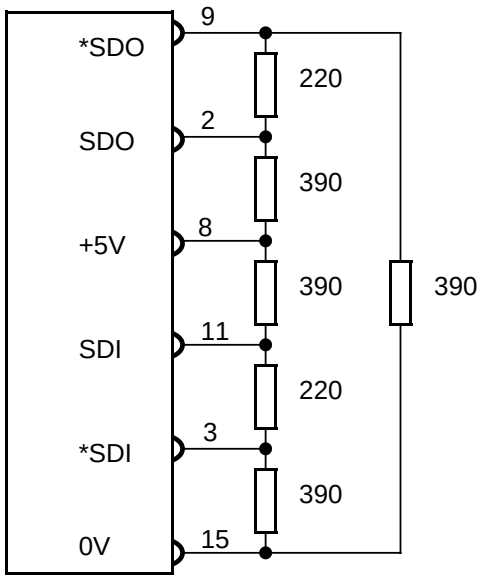
	16I/16Q	32I
Rated voltage - logic current supply - load current supply	 24 V DC 24 V DC	 24 V DC 24 V DC
Max. connection power at rated voltage	387.6 VA	10.8 VA
Typical power dissipation at rated voltage	25 VA	7 VA
Maximum power-on current	500 mA	500 mA
Weight	1310 g	1050 g
Degree of protection to DIN 40050	IP 20	IP 20
Shock protection class to DIN VDE 0160	1	1

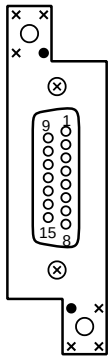
DMP terminating resistor, (6FX1 145-2BA00)

Order No.: 6FC3 988-3SV28
Order code: M39 (for SINUMERIK 840/880 only)

This DMP terminating resistor must be plugged into the second (free) MPC interface connector of the last DMP submodule or MPC node to prevent interference.

DMP submodule X21/X24 or distributor box X21/24





Connector
Position: 1 top
D subminiature
15-way, female
Connection side
SINUMERIK housing
6FC9 341-1EC

Designation: DMP

Connector code

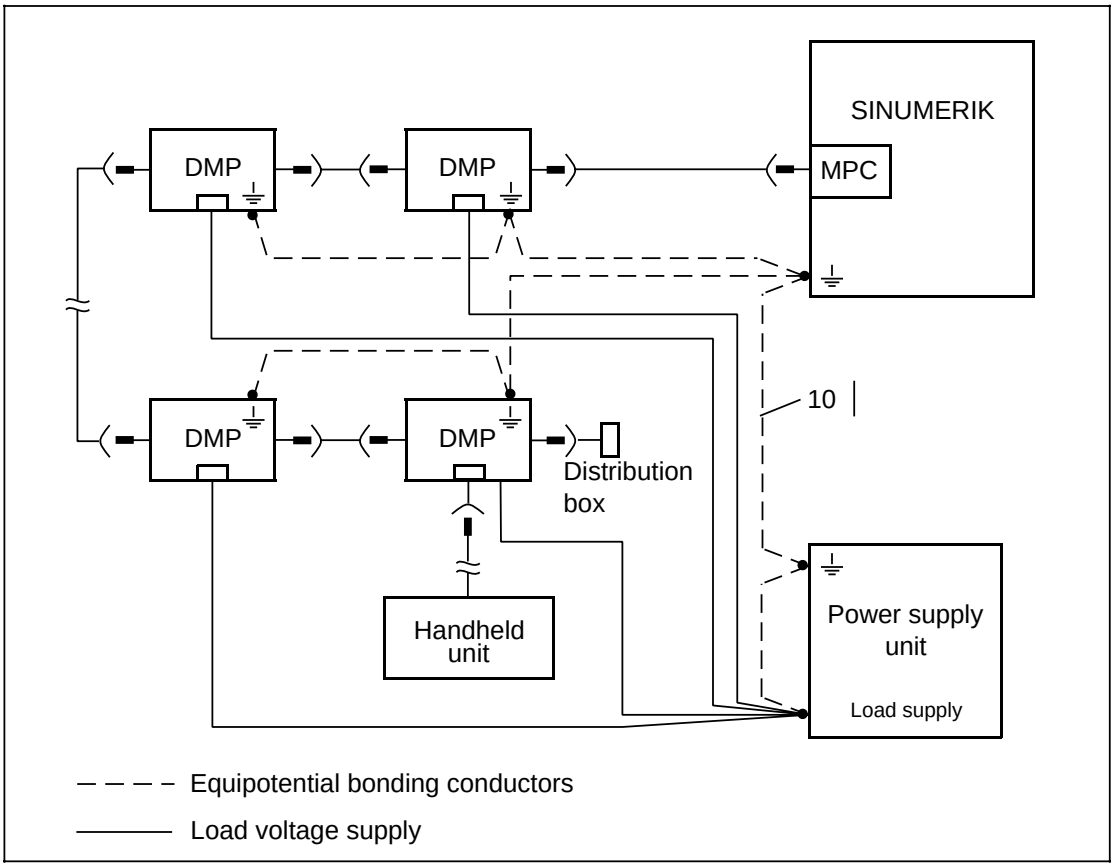
● coding pin
× no coding pin

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Earthing concept for distributed I/O devices

When setting up an MPC line which links the DMP submodules, the distribution box/hand-held unit, the following rules regarding the equipotential bonding conductors and the 0V cables must be observed:

- A cable with a cross-section of at least 2.5 mm^2, or better 4 mm^2, should be used for the load supply 0V cable. The load supply cables should be laid in a star shape from the power supply unit. Jumpers between the submodules should be avoided.
- The equipotential bonding conductors should also be laid in a star shape from the central earthing point of the control. The equipotential bonding conductor can be laid parallel to the signal line (DMP cable) if the submodules are situated close to each other (less than 2 m apart).
  Both of the equipotential bonding conductors (cable from one submodule, cable to the next submodule) must be connected on one side of the equipotential bonding conductors at one of the two earthing plates. The equipotential bonding conductor must have a minimum cross-section of 6 mm^2.
- The power supply units used for the load supply must also be provided with an equipotential bonding conductor which must be connected to the power supply unit 0V output.



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2.4 Current total and total power loss

2.4.1 Current total for central controller

Since the individual versions of the SINUMERIK 880 (3 different single-tier and 4 different two-tier systems) are equipped to match specific machine tools, it is essential to compile a current total at the planning stage. Each version has the same power supply, so that the maximum current in the current total must not exceed the permissible value of the 6EW1 861-2AC power supply **in any range** (+ 5 V, + 15 V, - 15 V, Vcc).

The following table lists all the modules, with typical current consumptions, that can be connected to the central controller.

Modules in central controller	6FX1 ..-.	+ 5V [A]			+ 15V [mA]			- 15V [mA]			V_{cc} [µA]		
		+ 5V [A]	No. of mod-ules	Total [A]	+ 15V [mA]	No. of mod-ules	Total [mA]	- 15V [mA]	No. of mod-ules	Total [mA]	Vcc [µA]	No. of mod-ules	Total [µA]
Multiport (or Dualport)	368		1	1.2								1	115
Dualport (or Multiport)	240		1	0.8								1	115
COM-CPU	204		1	2.3		1	70		1	70		1	20
Memory module	281		1	0.5								1	10
Part program memory module	267	0.5											
128 Kbyte RAM submod.	266	0.08									32		
256 Kbyte RAM submod.	353	0.2									24		
Interface module SINEC H1	231	2.1			23			/			35		
Active serial interface	315	0.02			50			50			8		
Active serial interface	373				145			35					
NC-CPU	205	1.6									16		
Memory module	281	0.5									10		
16 bit servo CPU	213	1.9									6		
ACC module	420	0.65			50			50					
32 bit servo CPU	363	2.4			/			/			/		
Measuring circuit module	214	0.65			50			50					
Integral EXE 5x	354	0.02			12								
Integral EXE 10x	355	0.035			17								
HMS measuring circuit module	364 (456)	1.2			150			100			/		
Setpoint speed submodule for HMS	325	0.1			50			50			/		
Absolute encoder submodule		0.35			25			25					
SIPOS encoder		0.1			60			60					
SIPOS absolute encoder	355	0.035			17								
Digital encoder		< 0.3											

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Current total for central controller

Modules in central controller	6FX11..-.	+ 5V [A]			+ 15V [mA]			- 15V [mA]			V_{cc} [µA]		
		+ 5V [A]	No. of mod-ules	Total [A]	+ 15V [mA]	No. of mod-ules	Total [mA]	- 15V [mA]	No. of mod-ules	Total [mA]	Vcc [µA]	No. of mod-ules	Total [µA]
PLC-CPU 135W 2)	206	1.4			/			/			20		
Memory module 2)	281	0.5			/			/			10		
PLC 135 WB 3)	386	1.6			/			/			32		
Interface 155U		1.6											
Input module	257	0.2											
Output module	228	0.3											
Mixed I/O module	384	0.5			70			80			/		
Analog input module	361	0.6			100			100			/		
EU interface module CU-MPC	321	0.6			/			/			/		
EU interface module EU-MPC	320	0.5			/			/			/		
EU interface module CU 16 bit	377	1.6			/			/			/		
EU interface module EU 16 bit	378	1.3			/			/			/		
Interface DMP	442	1.3			/			/			/		
Net current of central controller		/	/		/	/		/	/		/	/	
Power supply 6EW1861-2AC		/	/	40	/	/	2500	/	/	2000	/	/	600

2) Up to and including software version 3

3) From software version 4 onwards

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2.4.2 Current total for operator panel

No current total is required for the operator panel.

2.4.3 Total power loss

Calculation of total power loss to determine required heat dissipation:

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

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

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

P_S = Device connected load

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

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

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3 Machine Control Panel

3.1 General

The machine control panel is interfaced to the operator panel through an I/O submodule. Apart from the machine control panel signals, other input/output signals can be transferred to the PLC via the I/O submodule. A maximum of 4 I/O submodules can be attached. The pin assignments are given in Section 2.3.5.

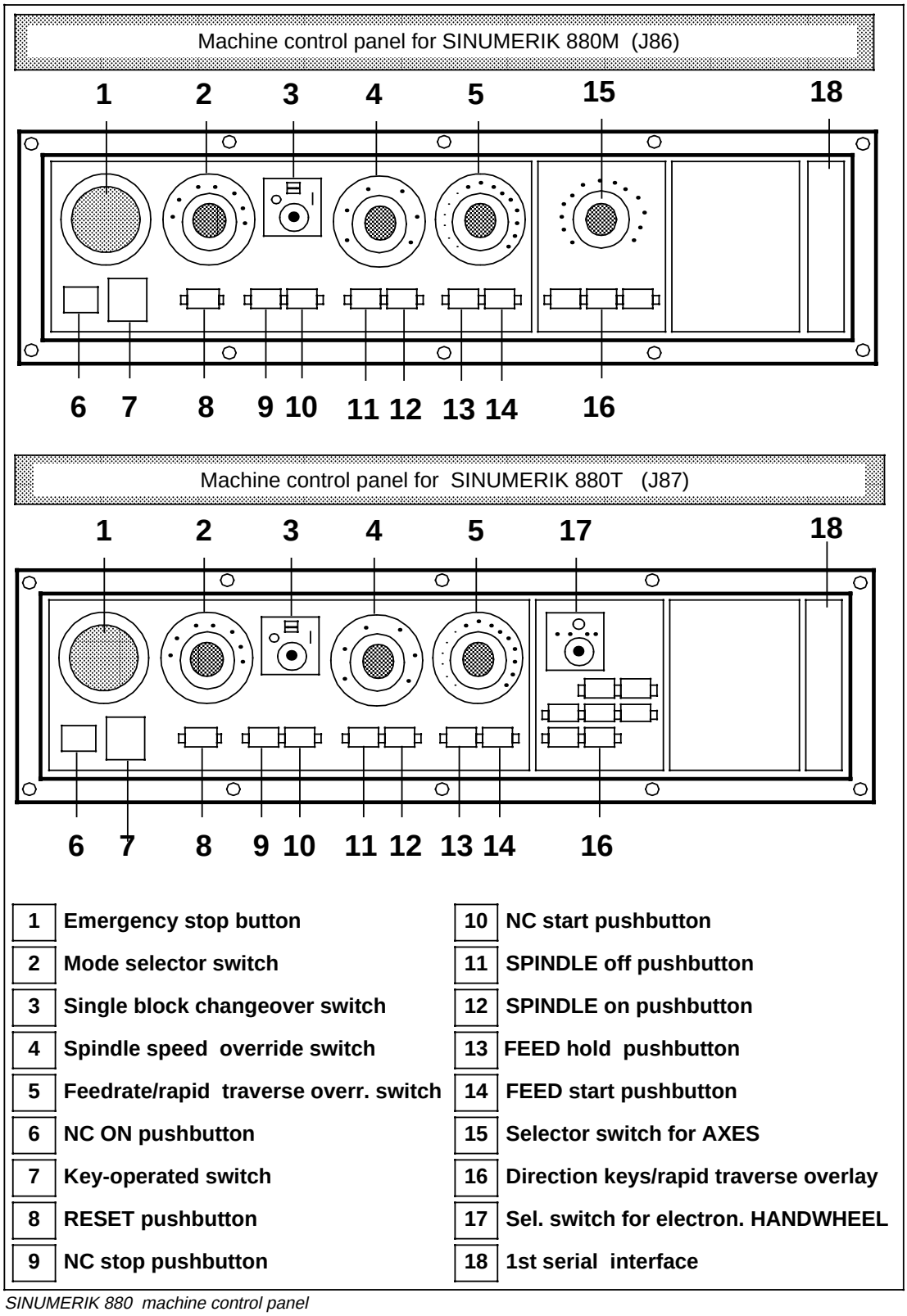
There are two possibilities for transferring the machine control panel signals to the NC link RAM FB 78 can be used for transferring the machine control panel signals to the NC/PLC interface.

3.2 Arrangement of the machine control panel

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

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The machine control panel can also be made up and wired from single elements. The coded selector switches can be used as single elements. These coded selector switches are described in Section 4.



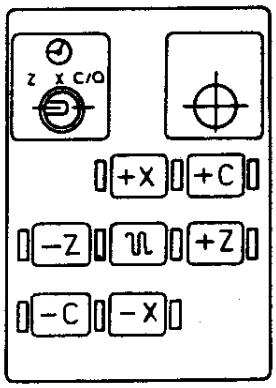
1	Emergency stop button	10	NC start pushbutton
2	Mode selector switch	11	SPINDLE off pushbutton
3	Single block changeover switch	12	SPINDLE on pushbutton
4	Spindle speed override switch	13	FEED hold pushbutton
5	Feedrate/rapid traverse overr. switch	14	FEED start pushbutton
6	NC ON pushbutton	15	Selector switch for AXES
7	Key-operated switch	16	Direction keys/rapid traverse overlay
8	RESET pushbutton	17	Sel. switch for electron. HANDWHEEL
9	NC stop pushbutton	18	1st serial interface

SINUMERIK 880 machine control panel

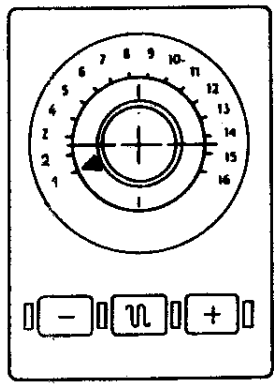
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Expansion submodules

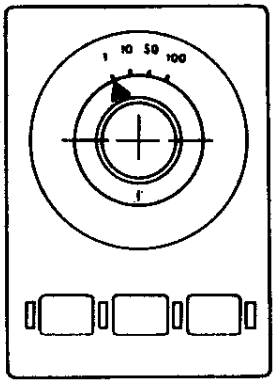
J80
Double slide submodule



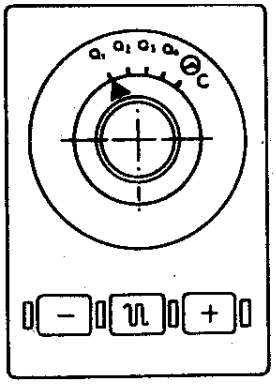
J81
2nd axis submodule



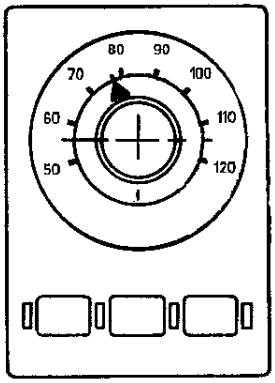
J82
Rapid traverse override switch submodule



J83
Auxiliary axis submodule



J90
2nd spindle speed override submodule



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Assignment of inputs by machine control panel

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

All pins, connector X02 404

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

All pins, connector X02 404

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Assignment of inputs by machine control panel
Expansion assemblies of the machine control panel

Double slide submodule
(Connector X 02 406 I/O submodule)

ByteNo.	Bit: 7	6	5	4	3	2	1	0
IB 68	Handwheel	Direction keys		Direction keys		Rapid traverse	Direction keys	
	Bit 1	X+	X-	Z+	Z-		C+	C-
	10	9	8	7	6	5	4	3
IB 69	Free for user via connector X 02 405						reserved	Handwheel Bit 2
	18	17	16	15	14	13	12	11

Auxiliary axes submodule
(Connector X 02 406 I/O submodule)

ByteNo.	Bit: 7	6	5	4	3	2	1	0
IB 68	Direction keys		Rapid traverse	Axis selector switch				
	+	-		E	D	C	B	A
	10	9	8	7	6	5	4	3
IB 69	Free for user via connector X 02 405						reserved	
	18	17	16	15	14	13	12	11

Rapid traverse override submodule
(Connector X 02 406 I/O submodule)

ByteNo.	Bit: 7	6	5	4	3	2	1	0
IB 68	Free for user via connector X 02 405						Rapid traverse override	
						C	B A	A
	10	9	8	7	6	5	4 0	3
IB 69	Free for user via connector X 02 405						reserved	
	18	17	16	15	14	13	12	11

2nd axis submodule
(Connector X 02 406 I/O submodule)

ByteNo	Bit: 7	6	5	4	3	2	1	0
IB 68	Direction keys		Rapid traverse	Axis selector switch				
	+	-		E	D	C	B	A
	10	9	8	7	6	5	4	3
IB 69	Free for user via connector X 02 405						reserved	
	18	17	16	15	14	13	12	11

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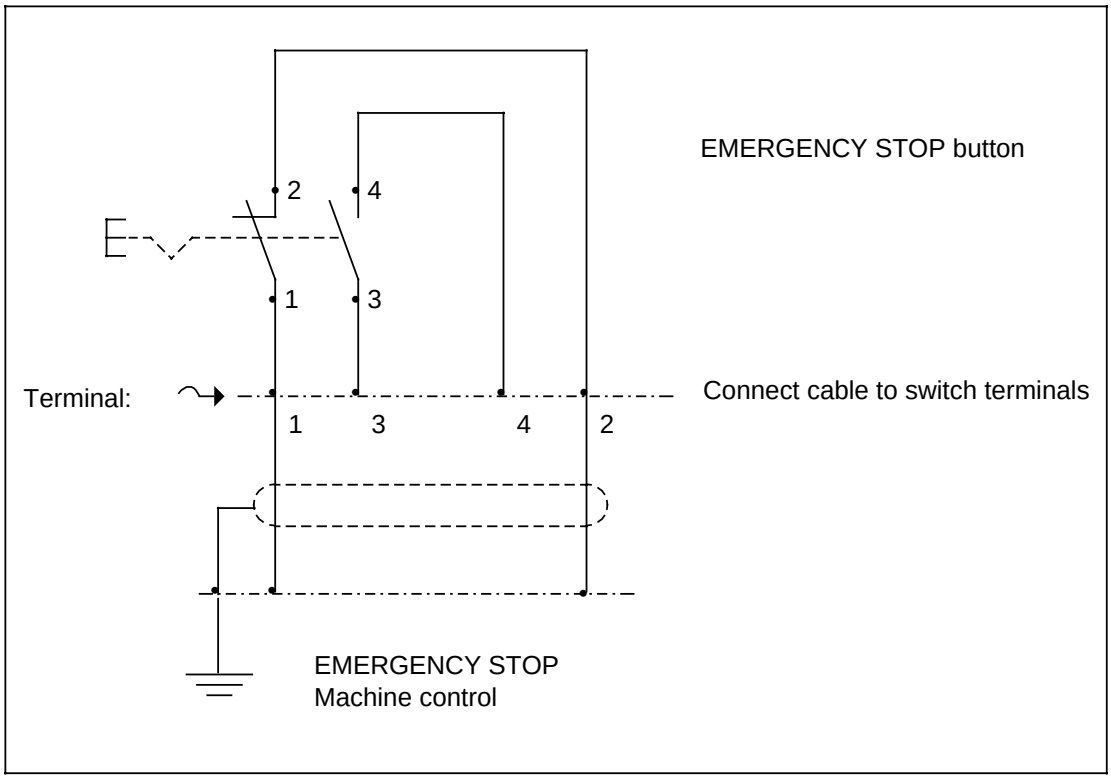
3.3 Description of machine control panel signals

3.3.1 EMERGENCY STOP

EMERGENCY STOP button (with turn-to-reset feature) switching voltage 230V max.

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

Suggested wiring for EMERGENCY STOP system:



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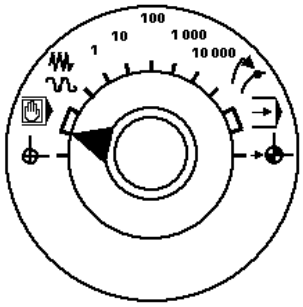
3.3.2 Mode switch

Order No.: 6FC9 301 - 0AE

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

The operating modes are selected with the mode switch.

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



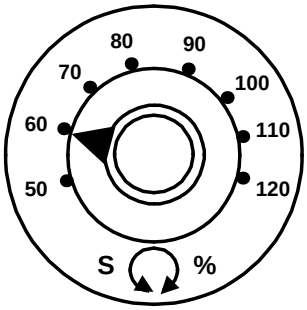
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3.3.3 Spindle speed override switch

Order No.: 6FC9 301 - 0EC

Selector switch, 16 positions, Gray-coded, overlapping contact arrangement. The switch allows the spindle speed to be changed in steps between 50 % and 120 %. Each switch position is assigned a fixed override value via machine data.
In the case of rotary feed and constant cutting speed, spindle speed override causes the feed drives to adapt automatically. In thread cutting, the switch is inactive.

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



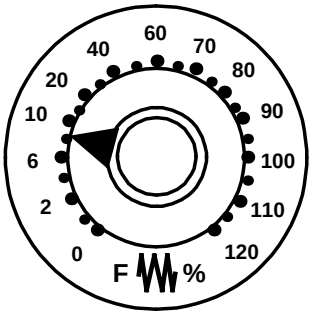
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3.3.4 Feedrate override switch

Order No.: 6FC9 301 - 0BC

Selector switch, 23 positions, Gray-coded, overlapping contact arrangement.
The switch allows the feedrate to be modified in steps between 0 % and 120 %. Each switch position is assigned a fixed override value via machine data.
The position 0 % of the feedrate override switch is always active, even for rapid traverse. In thread cutting, the switch is inactive.

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



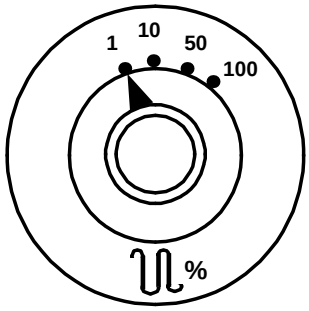
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3.3.5 Rapid traverse override switch

Order No.: 6FC9 301- 0CD

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

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

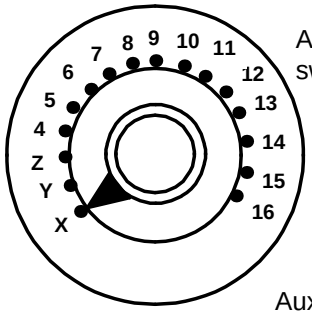


3.3.6 Axis selector switch

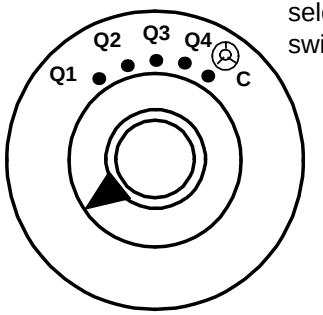
Order No.: 6FC9 301- 0DE (auxiliary axis selector)
6FC9 301- 0DD (axis selector)±

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

Position	Axes 880 M	880 T
1	X	Q1
2	Y	Q2
3	Z	Q3
4	4	Q4
5	5	C
6	6	
7	7	
8	8	
9	9	
10	10	
11	11	
12	12	
13	13	
14	14	
15	15	
16	15	



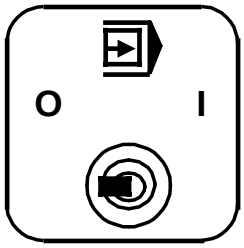
Axis selector switch



Auxiliary axis selector switch

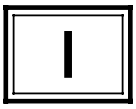
3.3.7 Single block

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



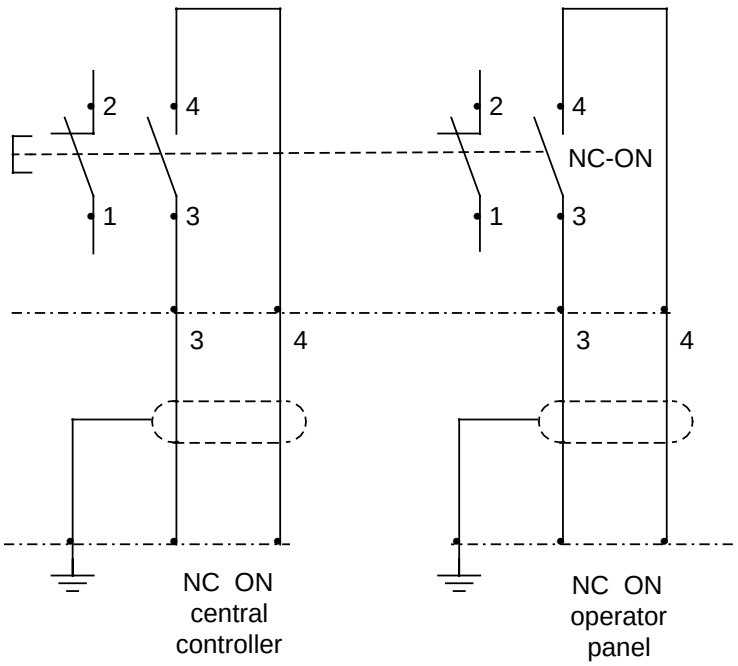
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3.3.8 NC - ON

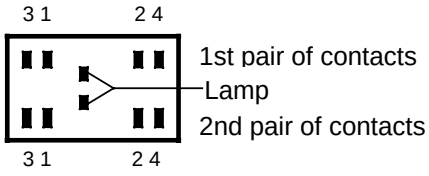


Connection via screened cable direct on pushbutton. The screen is placed on one side on the power supply of the central controller and of the operator panel.

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



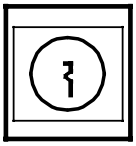
Pushbutton connection diagram:



The NC - ON from the operator panel and central controller must not be connected to the same pushbutton (NO contact). Two separate NO contacts are always required.

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3.3.9 Key-operated switch



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

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

3.3.10 RESET



Pushbutton, 1 normally closed contact
1 signal: RESET button pressed

3.3.11 NC - Stop



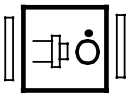
Pushbutton, 1 normally open contact
0 signal: NC STOP button pressed

3.3.12 NC - Start



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

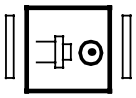
3.3.13 SPINDLE OFF



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

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3.3.14 SPINDLE ON



Pushbutton, 1 normally closed contact
1 - Signal: SPINDLE ON button pressed

3.3.15 FEED HOLD



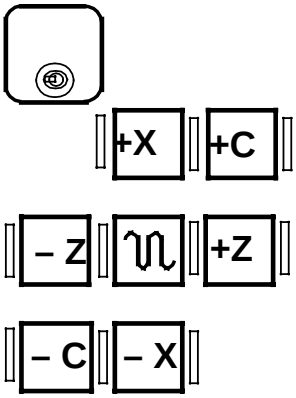
Pushbutton, 1 normally open contact
0 - Signal: FEED HOLD button pressed

3.3.16 FEED START



Pushbutton, 1 normally closed contact
1 - Signal: FEED START button pressed

3.3.17 Direction keys



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

3.3.18 PLUS / MINUS direction keys



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

3.3.19 Rapid traverse overlay

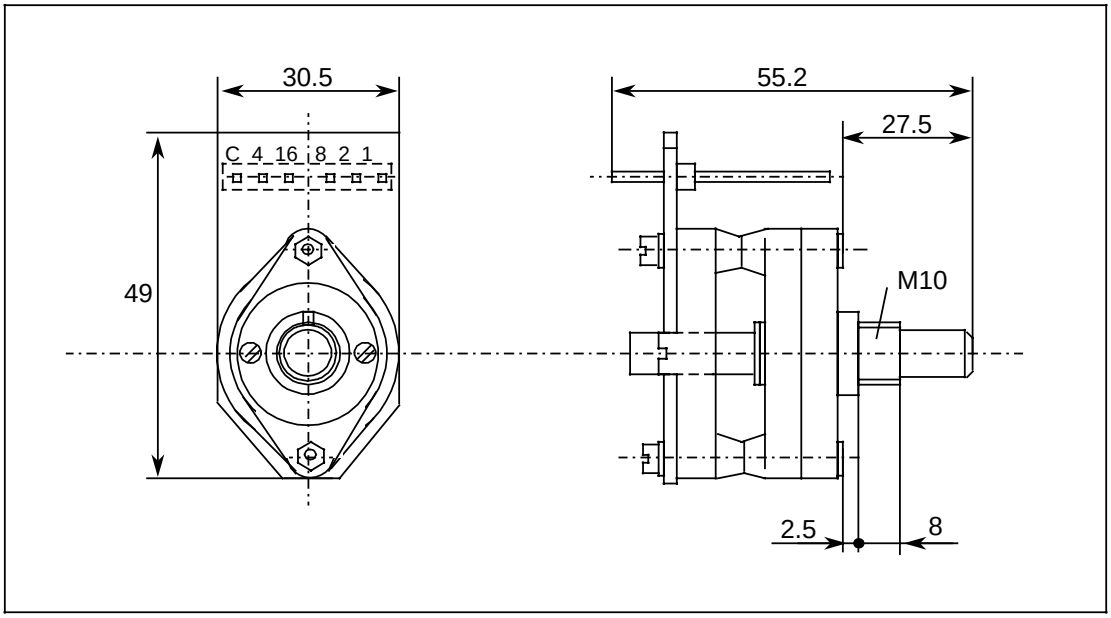


1 normally closed contact per pushbutton
1 signal: RAPID TRAVERSE OVERLAY button pressed

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4 Coded Selector Switches / Codings

4.1 Coded selector switch



Used in the machine control panel as ...	Possible switch positions available	in use	Switching angle	Order No.
Mode switch	16	13	15°	6FC9 301 - 0AE
Spindle speed override switch	16	15	15°	6FC9 301 - 0EC
Feedrate override switch	23	23	11.25°	6FC9 301 - 0BC
Rapid traverse override switch	16	4	15°	6FC9 301 - 0CD
Rapid traverse override switch	8	4	30°	6FC9 301 - 0CC
Axis selector switch 880M	16	16	15°	6FC9 301 - 0DD
Auxiliary axis selector switch 880T	16	5	15°	6FC9 301 - 0DE

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4.2 Mode switch coding

Order No.: 6FC9 301-0AE

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

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

4.3 Spindle override switch coding

Order No.: 6FC9 301-0EC

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

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

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4.4 Feedrate override switch coding

Order No.: 6FC9 301-0BC

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

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

4.5 Rapid traverse override switch coding

Order No.: 6FC9 301-0CD

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

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

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4.6 Rapid traverse override switch coding

Order No.: 6FC9 301-0CC

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

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

When using this switch, a code conversion to the NC/PLC user interface is required in the PLC user program.

4.7 Axis and auxiliary axis selector switch coding

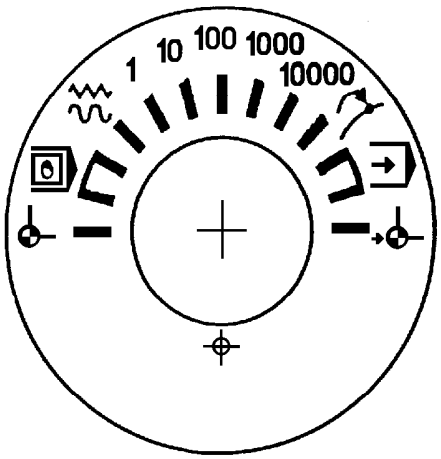
Order Nos.: 6FC9 301-0DD and 6FC9 301-0DE

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

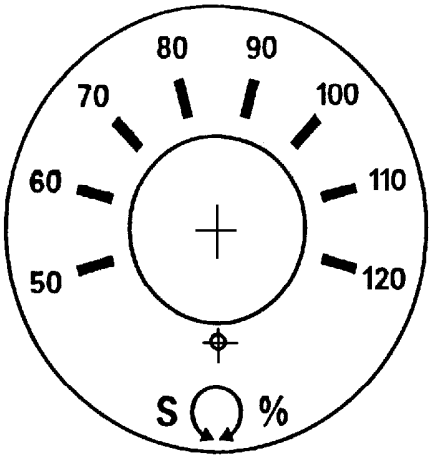
Position	Code 8	4	2	1
1	0	0	0	1
2	0	0	1	1
3	0	0	1	0
4	0	1	1	0
5	0	1	1	1
6	0	1	0	1
7	0	1	0	0
8	1	1	0	0
9	1	1	0	1
10	1	1	1	1
11	1	1	1	0
12	1	0	1	0
13	1	0	1	1
14	1	0	0	1
15	1	0	0	0
16	1	0	0	0

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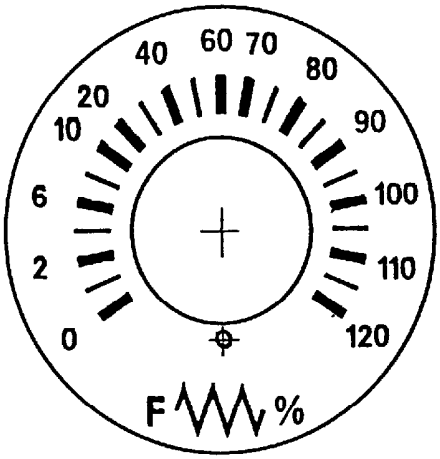
4.8 Engravings



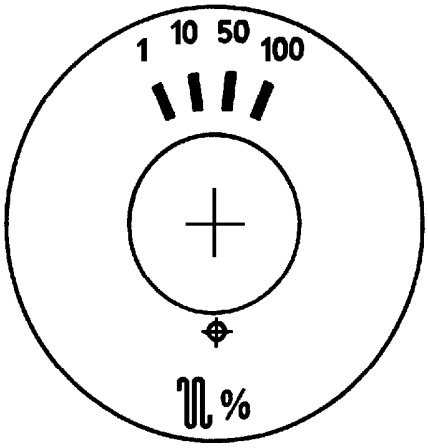
Mode switch



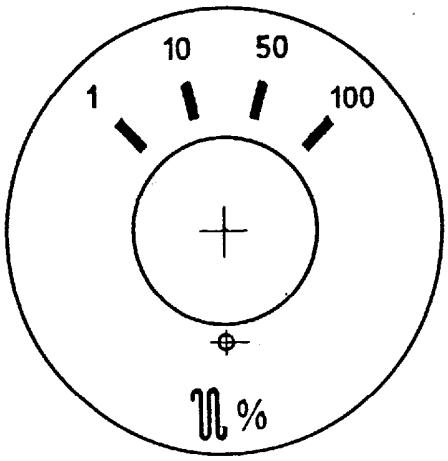
Spindle speed override switch



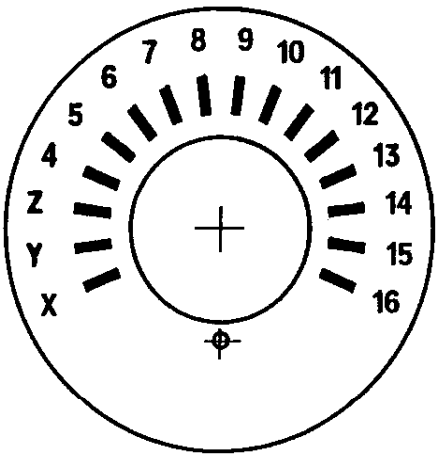
Feedrate override switch



Rapid traverse override switch

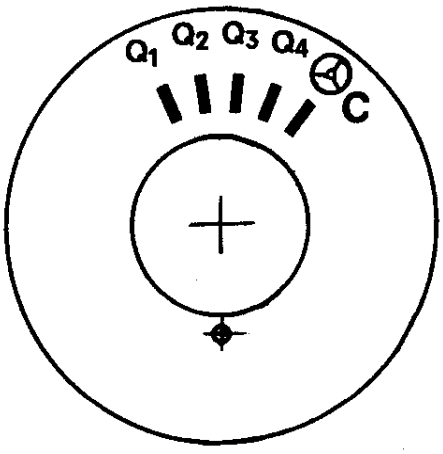


Rapid traverse override switch



Axis selector switch (880M)

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Auxiliary axis selector switch (880T)

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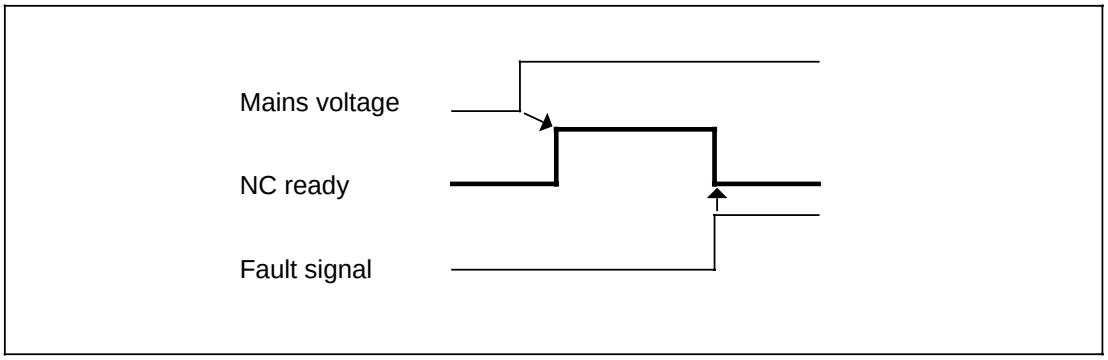
5 NC - Machine Signals

5.1 NC ready

The NC ready signal is supplied as a floating relay on multiport 6FX1 121-8BC or 6FX1 136-0BA, or dualport 6FX1 124-0BA at connector X151 pins 3 and 4.

1 signal: The relay contact is closed after switching on when all voltages have built up and the complete control is in the cyclic mode.

0 signal: The relay contact is open when
a) undervoltage monitoring responds
b) overvoltage monitoring responds
c) computer monitoring responds
d) control configuration (NC MD) has been input incorrectly
e) PLC or other CPU goes to STOP
f) operator panel fails



Application note:

The NC ready signal is one of the safety signals on the control. It indicates that a fault of such seriousness affecting several modes has occurred on the control that all axes and spindles have to be shut down. The control is no longer in a ready state and cannot perform any monitoring functions. If the NC Ready signal becomes 0 (relay drops out), all speed controller enable signals on the measuring circuit modules are forcibly disabled. The control is not ready to operate again until after POWER ON (mains off/on).

Caution:

The NC- Ready signal must be used for stopping all motions on the machine. The relay output can be loaded with:

20 to 30 V DC
1 A ohmic load
0.5 A inductive load
2 Hz switching frequency

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5.2 Feed drives

5.2.1 Set speed (axes)

Analog set speed ±10 V/2 mA for the feed motor. The maximum voltage can also be limited via software (via NC-MD). The set speed value is a pure DC voltage. The maximum voltage cannot exceed ±14 V.

Comment:

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

5.2.2 Speed controller enable (axes)

The speed controller enable signal is supplied as a non-floating switching transistor at the measuring circuit (setpoint connector, 25-way). The relay output can be loaded with 20 ... 30 V DC/100 mA.

1 signal: The switching transistor is closed when all the axes and spindles defined in the relevant operating mode group are operating faultlessly and the axis-specific interface signals "follow-up operation", "parking axis" and "controller enable" are present, permitting position control to commence.

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

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

The braking path and following error are recorded within the control in such a way that the actual value memory contains the machine position following the braking operation. It is not necessary to resynchronize the axes (approach the reference points).

The speed control enable signal can be used to disable the speed controller but also to disable the pulses for the thyristors.

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5.3 Spindle drives

5.3.1 Set speed (spindles)

Analog set speed ±10 V/2 mA for the spindle motor. The spindle is controlled by the NC via the M functions M3 (clockwise), M4 (counterclockwise) and M5 (spindle stop).
The following polarity allocation of setpoint voltage is recommended:

PLUS voltage:	Clockwise M03
MINUS voltage:	Counterclockwise M04

The set speed is a pure DC voltage. The maximum voltage cannot exceed ±14 V.

Comment:

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

5.3.2 Speed controller enable (spindles)

The speed controller enable signal is supplied at the measuring circuit (setpoint connector, 25-way) as a non-floating switching transistor. The relay output can be loaded with 20 ... 30 V DC/100 mA.

1 signal: The switching transistor is closed when all the axes and spindles defined in the relevant operating mode group are operating faultlessly and the spindle-specific interface signal "controller enable" has been set to "1".

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

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

The speed control enable signal can be used to disable the speed controller but also to disable the pulses for the thyristors.

Synchronization of the spindles is not lost when the speed controller enable is removed.

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5.4 EMERGENCY STOP

An EMERGENCY STOP panic button is mounted on the machine control panel (also see Section 3.3.1). The EMERGENCY STOP button is **not** directly connected to the NC but has to be signalled to the NC by way of the PLC (digital input module). For this purpose any "EMERGENCY STOP to NC" interface bit is set in DW1 to DW7 of DB 58 (also see Interface Description Part 1).

The "EMERGENCY STOP to NC" interface signal immediately resets all axis and spindle setpoint speeds to 0 Volt, whereby the drive can be decelerated with maximum current. After a delay determined by NC machine data, the axis position control is ceased, the NC switches to follow-up operation and removes the speed controller enable for axes and spindles. Alarm 2000 is issued.

Since the EMERGENCY STOP signal is fundamental to safety it is essential that the valid safety regulations for properly shutting down the machine are observed **outside** the machine as well.

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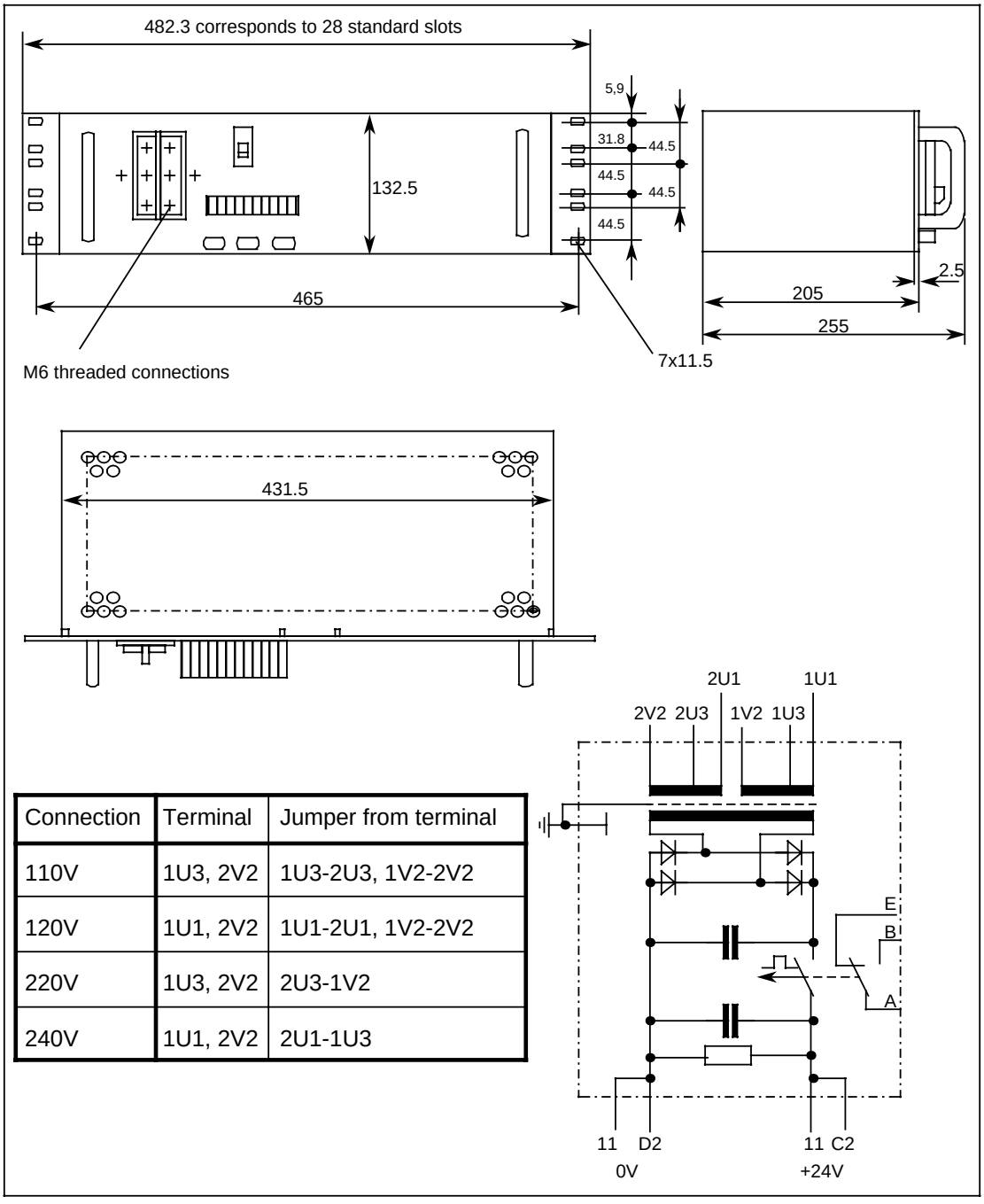
6 External Devices

6.1 Power supplies

6.1.1 Power supply unit (110V/230V)

Type: 6EV1 334 - 4AK00

For 230V AC and 110V AC mains connection



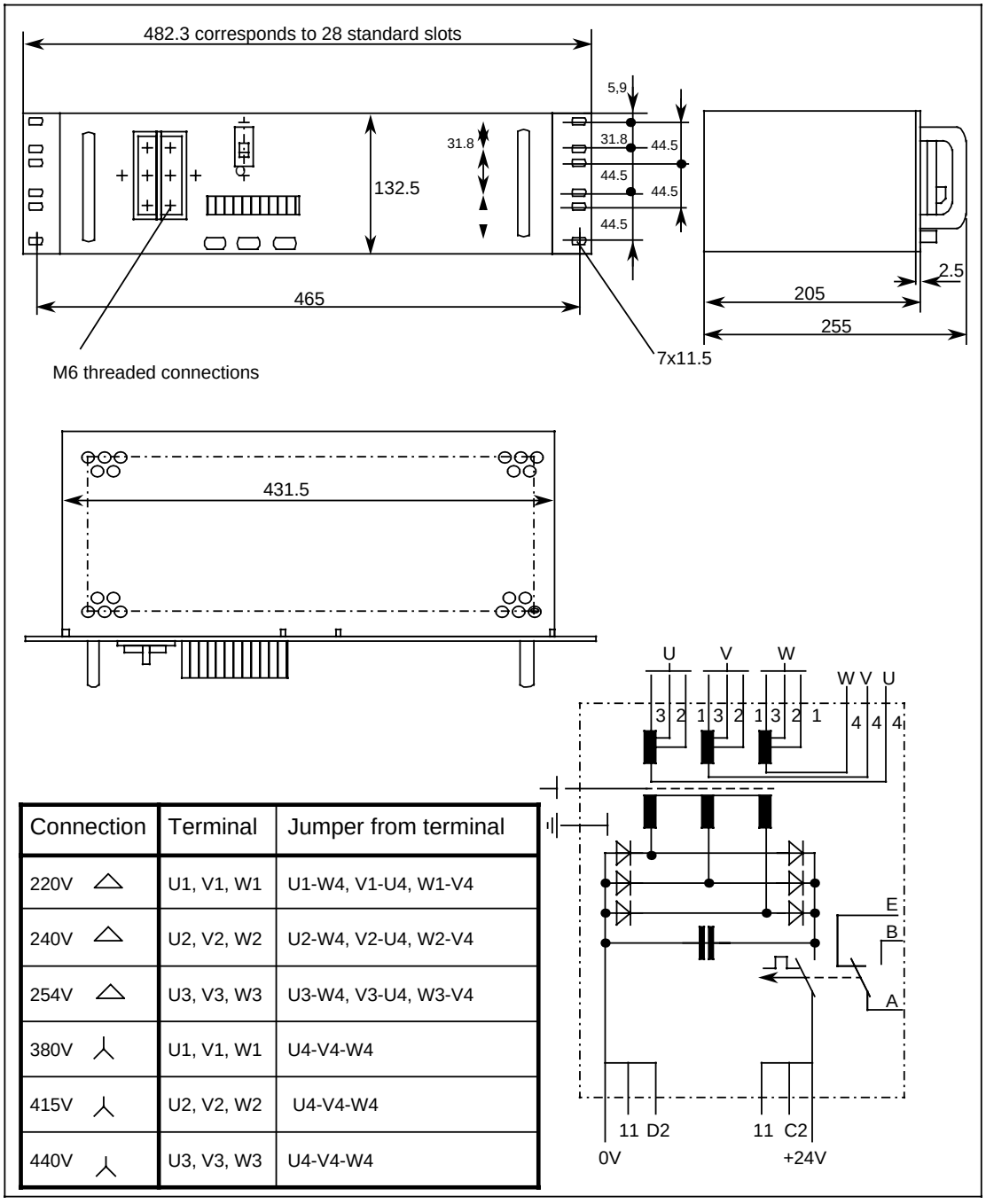
Connection	Terminal	Jumper from terminal
110V	1U3, 2V2	1U3-2U3, 1V2-2V2
120V	1U1, 2V2	1U1-2U1, 1V2-2V2
220V	1U3, 2V2	2U3-1V2
240V	1U1, 2V2	2U1-1U3

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6.1.2 Power supply unit (230V/400V)

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

For 400V AC mains connection



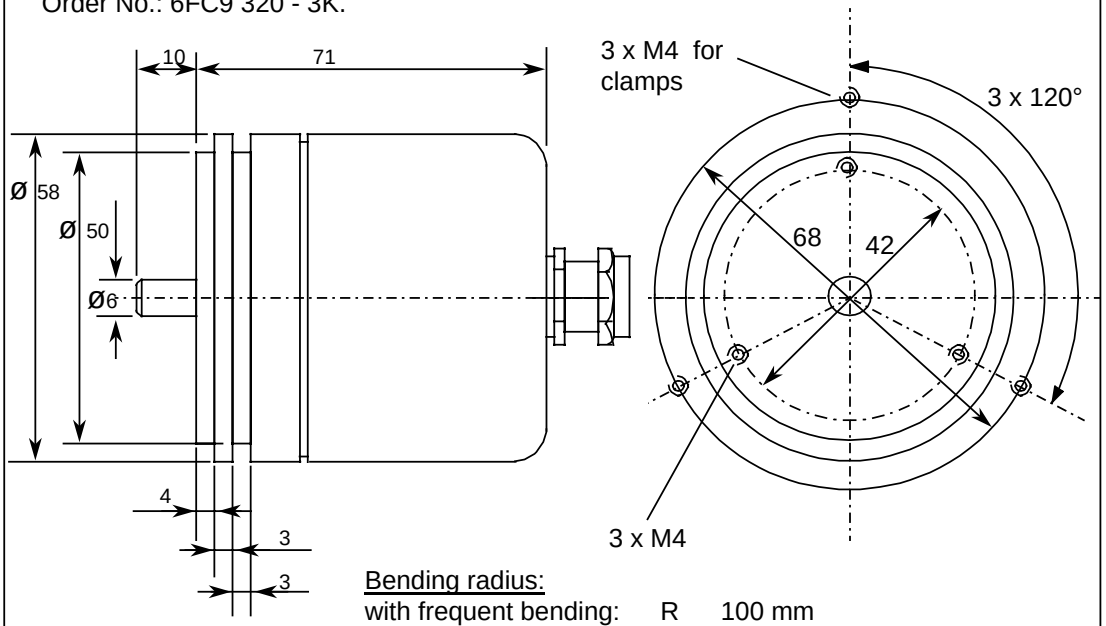
Connection	Terminal	Jumper from terminal
220V △	U1, V1, W1	U1-W4, V1-U4, W1-V4
240V △	U2, V2, W2	U2-W4, V2-U4, W2-V4
254V △	U3, V3, W3	U3-W4, V3-U4, W3-V4
380V Y	U1, V1, W1	U4-V4-W4
415V Y	U2, V2, W2	U4-V4-W4
440V Y	U3, V3, W3	U4-V4-W4

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6.2 Incremental encoders

6.2.1 Rotary encoder and main spindle encoder

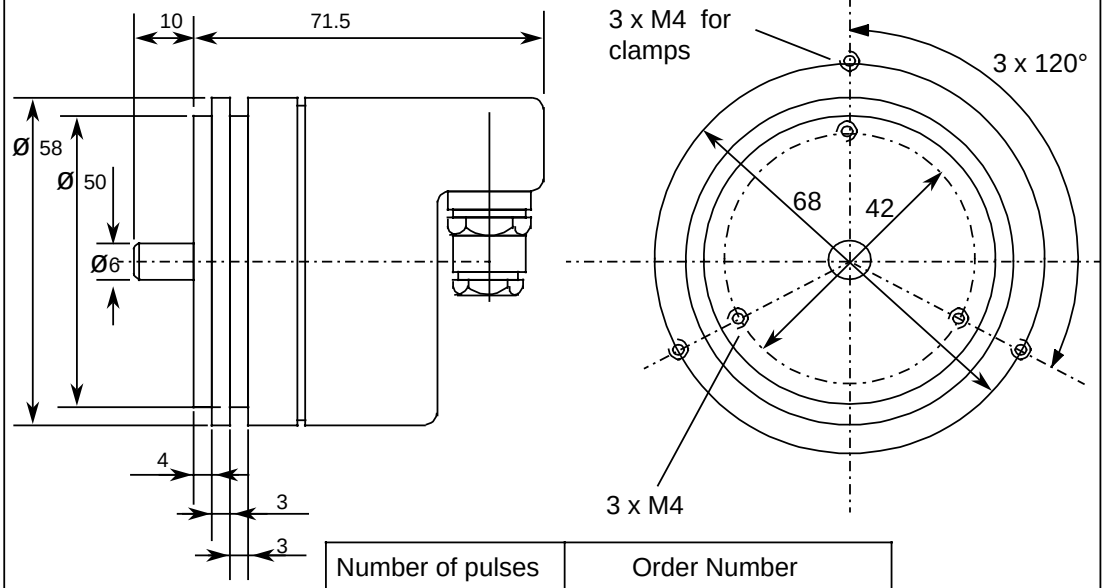
- cable output axial:
  Order No.: 6FC9 320 - 3K.



Bending radius:
with frequent bending: R 100 mm
with once-only bending: R 40 mm

- cable output radial:
  Order No.: 6FC9 320 - 3M.

Bending radius:
with frequent bending: R 100 mm
with once-only bending: R 40 mm



Number of pulses	Order Number
1024 Pulse / U	6FC9 320 - 3KB / -3MB
2000 Pulse / U	6FC9 320 - 3KB / -3MK
2500 Pulse / U	6FC9 230 - 3KB / -3MN
5000 Pulse / U	6FC9 320 - 3KB / -3MS

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Incremental rotary and main spindle encoders

Order data

Radial cable output with connector 6FC9 341-1FQ

Order No.	Pulses/rev.	Remarks
6FC9 320-3LS00	500	Supplied without coupling and clamps
6FC9 320-3MA00	1000	”
6FC9 320-3MB00	1024	”
6FC9 320-3MK00	2000	”
6FC9 320-3MN00	2500	”
6FC9 320-3MS00	5000	”

Order data

Axial cable output with connector 6FC9 341-1FQ

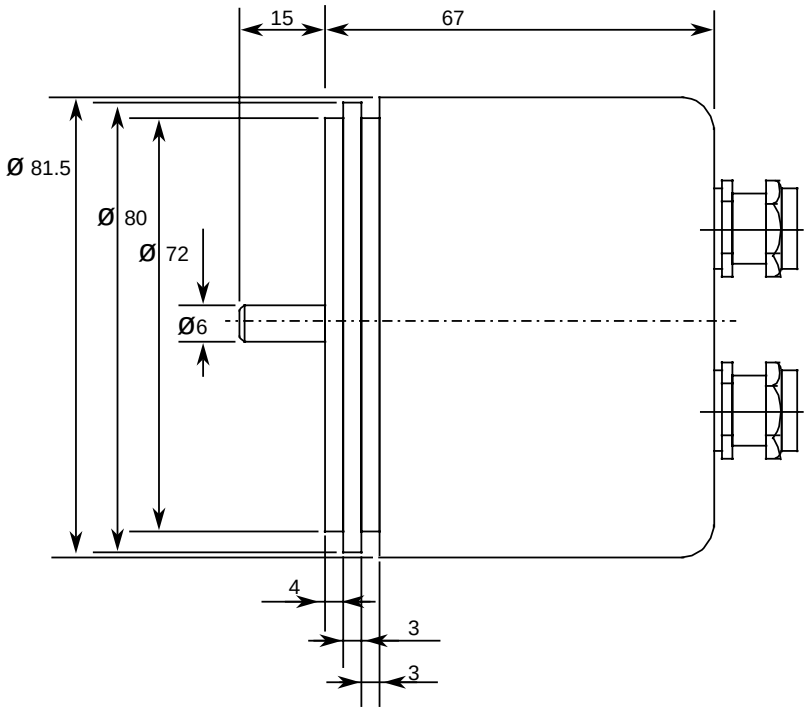
Order No.	Pulses/rev.	Remarks
6FC9 320-3HS00	500	Supplied without coupling and clamps
6FC9 320-3KA00	1000	”
6FC9 320-3KB00	1024	”
6FC9 320-3KK00	2000	”
6FC9 320-3KN00	2500	”
6FC9 320-3KS00	5000	”
6FC9 320-3KT00	9000/1024	”

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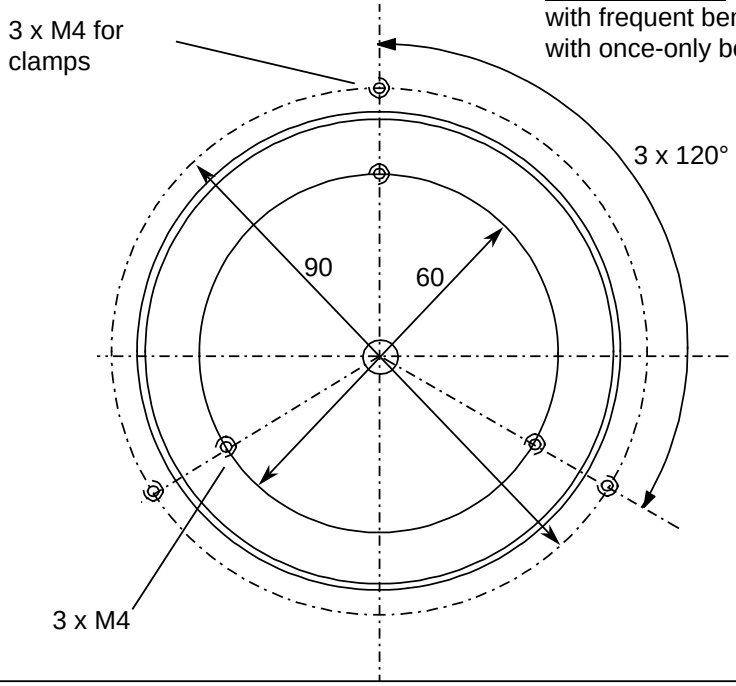
6.2.2 Combined rotary encoder for spindle and C axis

Order No.: 6FC9 320 - 3KT00

Pulse rate - spindle: 1024 pulses / rev
Pulse rate - C axis : 9000 pulses / rev



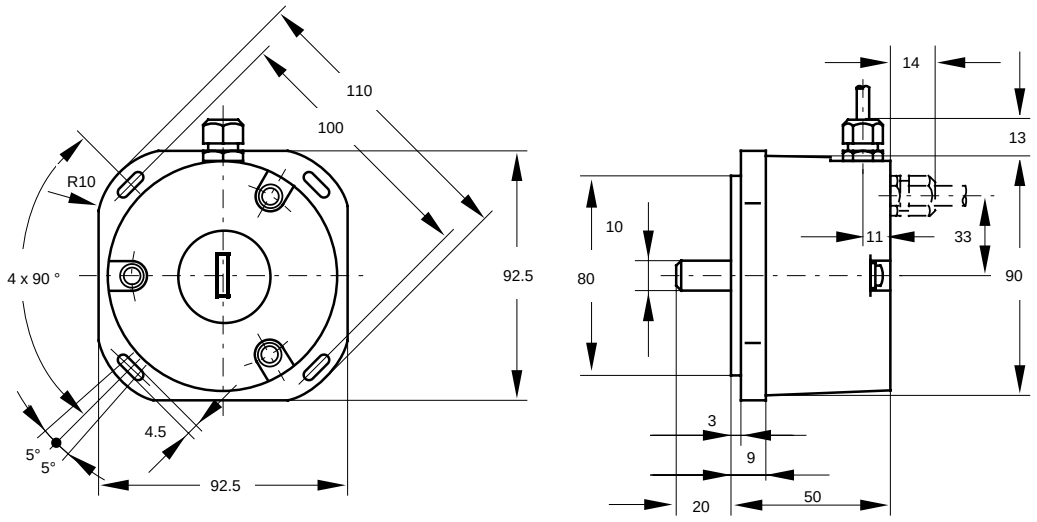
Bending radius:
with frequent bending: R 100 mm
with once-only bending: R 40 mm



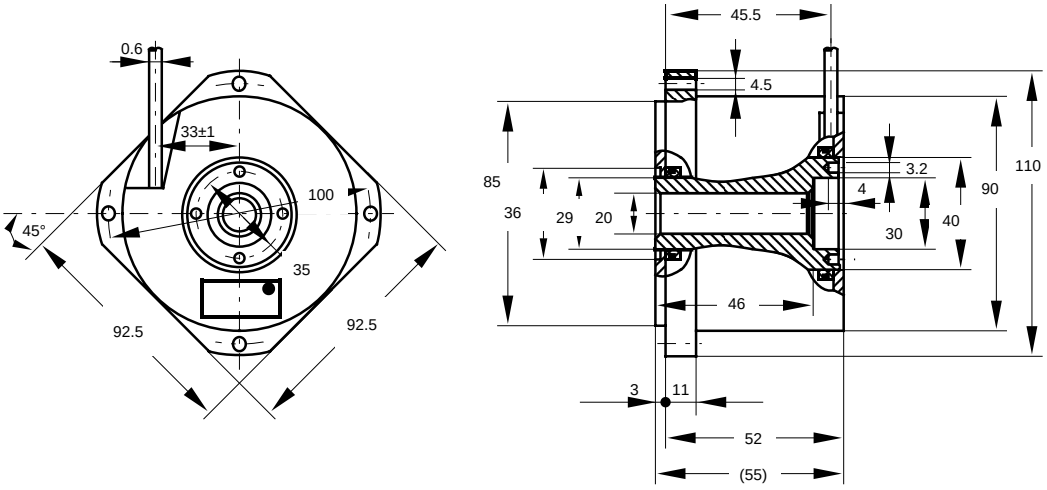
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6.2.3 High-resolution rotary encoders for rotary axes

ROD 250
Order No.: 6FC9 320-3CM00



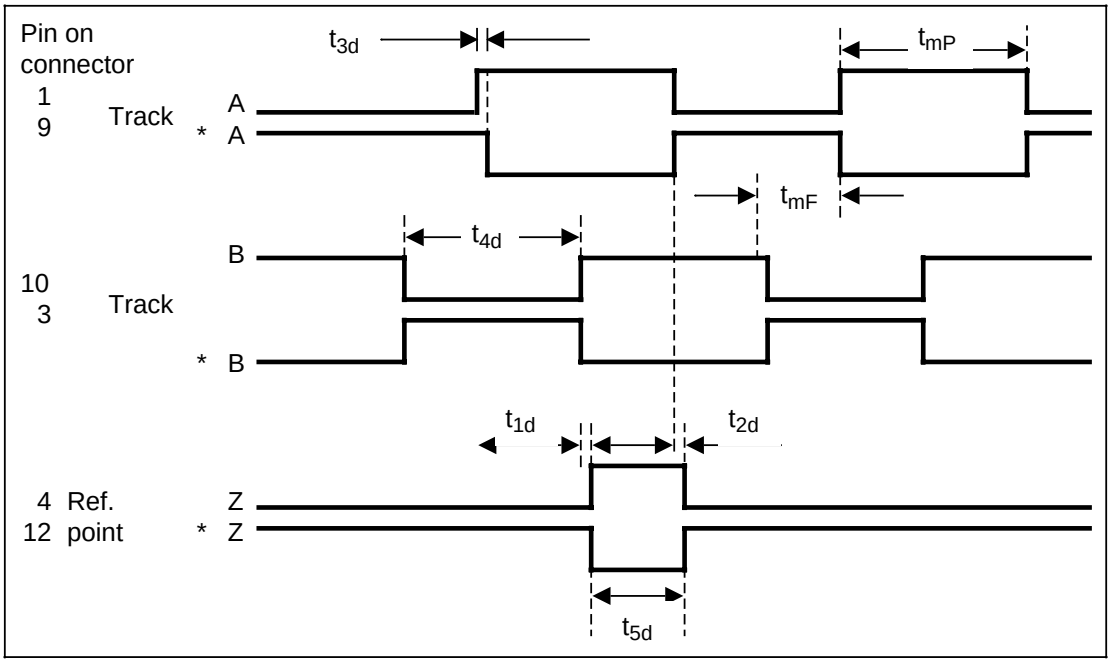
RON 255
Order No.: 6FC9 320-3CN00



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6.2.4 Key data for measuring system input

Data sheet for measuring circuit interface.
Actual value digital (measuring circuit module 6FX1 121-4B.)



Input signals for digital measuring systems with differential output

Some principal data:

- Encoder supply voltage . . . . . 5 V± 5%
- Ripple of supply voltage . . . . . 100 mV_{pp}
- Current per encoder system . . . . . 300 mA
- Ohmic input resistance . . . . . 470 Ohm
- Dynamic input resistance . . . . . 110 Ohm
- Differential input voltage
  e.g. between A and *A . . . . . 1 V
- Maximum differential input voltage . . . . . 10 V
- Maximum input frequency with 90°
  electrical phase displacement 1 MHz (without EXE)
  between A and B track pulses . . . . . 300 kHz (with EXE)
- Minimum pulse width t_{mP} . . . . . 400 ns
- Minimum edge spacing (signal change) . . . . . 350 ns
- Noise immunity (DIN 57847) - noise signal width . . . . . 3 kV
- Maximum cable length to encoder
  when using SINUMERIK cables . . . . . 35 m
- Minimum interval between consecutive edges t_{mF} . . . . . 200 ns
- t_{1d} and t_{2d} . . . . . 60 ns
- Maximum time delay between
  consecutive edges of a track t_{3d} . . . . . 6 ns
- Condition for reference track (zero mark) . . . . . Z = high
  when A and B=high
- Edge steepness (all signals) . . . . . 1 V / µs
- Minimum length of zero mark t_{5d} . . . . . 200 ns

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Data sheet for measuring circuit interface
Actual value with integrated EXE

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

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

The 6FX1 121-4B. module can also be delivered with integrated EXE. In this case, the signals from the measuring head are taken direct to measuring circuit modules and converted on the module into the A, B and reference signals.

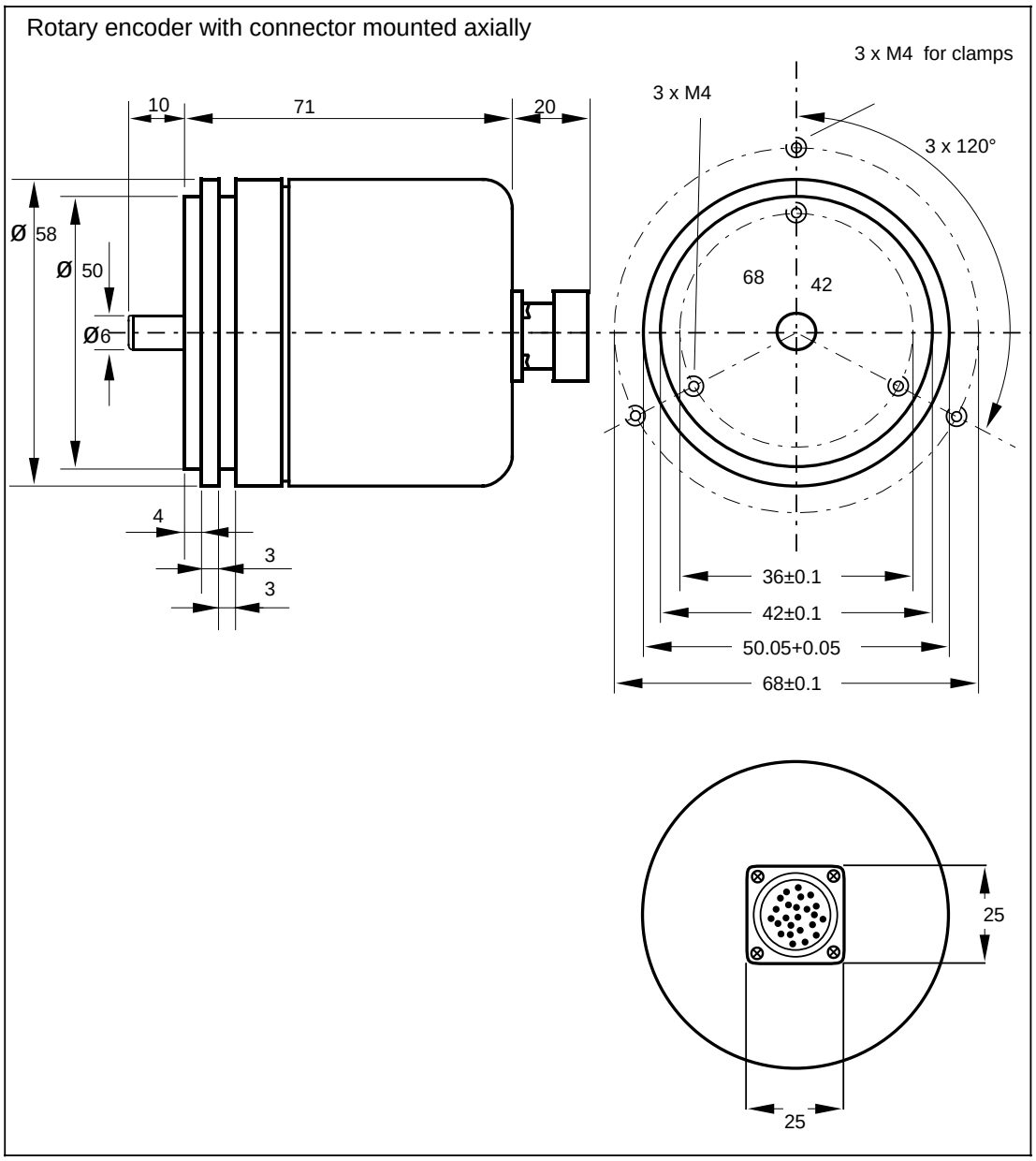
6.2.5 SIPOS encoders

	Order number:
SIPOS incremental encoder (connector mounted axially)	6FC9 320-3CS
SIPOS incremental encoder (connector mounted radially)	6FC9 320-3CW
SIPOS absolute encoder (connector mounted axially)	6FC9 320-3CT
SIPOS absolute encoder (connector mounted radially)	6FC9 320-3CV

SIPOS encoders are unconditioned signal angular encoders. The SIPOS encoder is obtainable as a purely incremental encoder or as a multiturn absolute encoder. The absolute encoder supplies an absolute value to the NC and then functions incrementally. The dimensions and cable are identical for the SIPOS incremental encoder and the SIPOS absolute encoder. The SIPOS encoders can only be connected to HMS measuring-circuit modules. For the absolute encoder an absolute encoder submodule is also required.

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Rotary encoder with connector mounted axially



Coupling to drive spindle/leadscrew with set of fixing parts 6FC9 382-1CA. For pure position measurement (the SIPOS encoder is **not** used for measurement of speed of rotation) the spring disk coupling 6FC9 320-4GB.

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Technical data

Electrical values:

Increments of the disk	pulses/rev	2500
Max. sampling frequency	kHz	500
Max. output frequency	kHz	500
Output signals track A, B		Sinusoidal, el. phase diff. 90°,differential, amplified photoelement signals of the incremental track
Ouput signal zero pulse		Signal peak of reference mark
Output voltage track A, B	volts	+0.8V/– 0.8V + 0.5 dB – 2 dB (at 100 Hz. terminating res.: 180)
Output voltage zero pulse	volts	+0.8V/– 0,8V + 3 dB – 2 dB (at 100 Hz. terminating res.: 180)
Amplitude error track A to track B	%	5 < 25 kHz 10 25 to 500 kHz
Temperature coefficient of output amplitude of track A, B and N	%K	0.2
Frequency response track A, B and N	dB	–3 (from 0 to 500 kHz, without cable) –6 (from 0 to 500 kHz, with cable 100m)
Phase angle error (without cable)	Degrees	1.5 < 25 kHz 3.0 < 25 to 500 kHz
Offset error track A and B	%	2 < 25 kHz 5 < 25 bis 500 kHz
Voltage supply		5 volts, ± 10%, approx. 100 mA ± 15 volts, ± 10%, approx. 60 mA
System accuracy	Output signals A and B suitable for multiplication up to factor 128 for position control and factor 512 for speed control	
Light source	Infrared LED controlled	
Sampling	Photoelectrically with light	
Light receiver	Photodiodes	
Max. cable length	meter	100 (SINUMERIK cable)

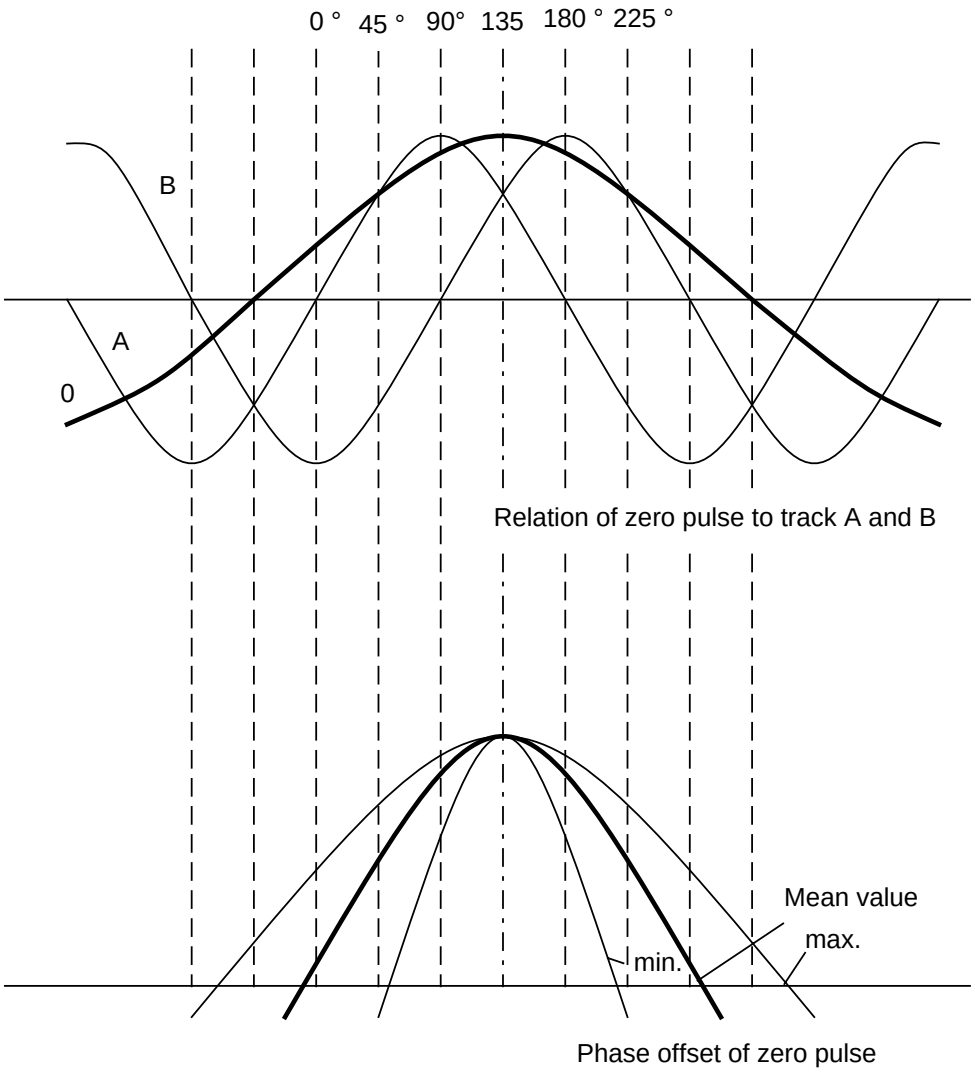
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Technical data, continued

Increments of the disk	pulses/rev	2500
Max. speed	rev/min	12000
Ball bearing life	h	10^4 at 8000 rev/min and 50 °
Fiction moment	Ncm	1
Max. shaft load axial radial	 N N	 15 25
Max. permissible angular acceleration	rad/s^2	10^5
Vibration resistance to DIN 40046 Part 7 3 Hz to 60 Hz: 60 Hz to 600 Hz: 500 Hz to 2 kHz:		 ± 3 mm 15 g 12 g } ÷ 120 ms $^{-2}$
to DIN 40046 test Fc	m/s^2	300 (30g)
Degree of protection to DIN 40050		IP 65 (except shaft input) IP 54 (shaft input)
Operating temperature range	°C	0 to + 70
Storage temperature range	°C	–25 to + 80
Rel. air humidity during operation	%	75
Rel. air humidity during transport and storage	%	65
Rel. air pressure during operation	HPa	>700
Rel. air pressure during transport and storage	HPa	>700
Weight (incl. 1m cable and connector)	g	approx. 440

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Phase position of the unconditioned signals:

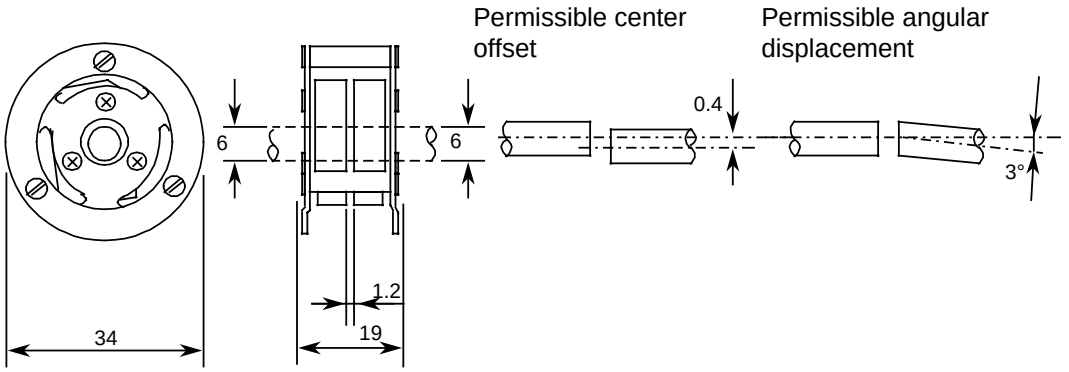


Maximum phase offset from zero crossover of track A: ± 67.5°
Frequency: 0 - 500 kHz

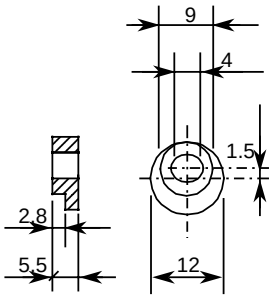
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6.2.6 Spring disk coupling/clamp

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



- Clamp
  Order No.: 6FC9 320 - 4GA

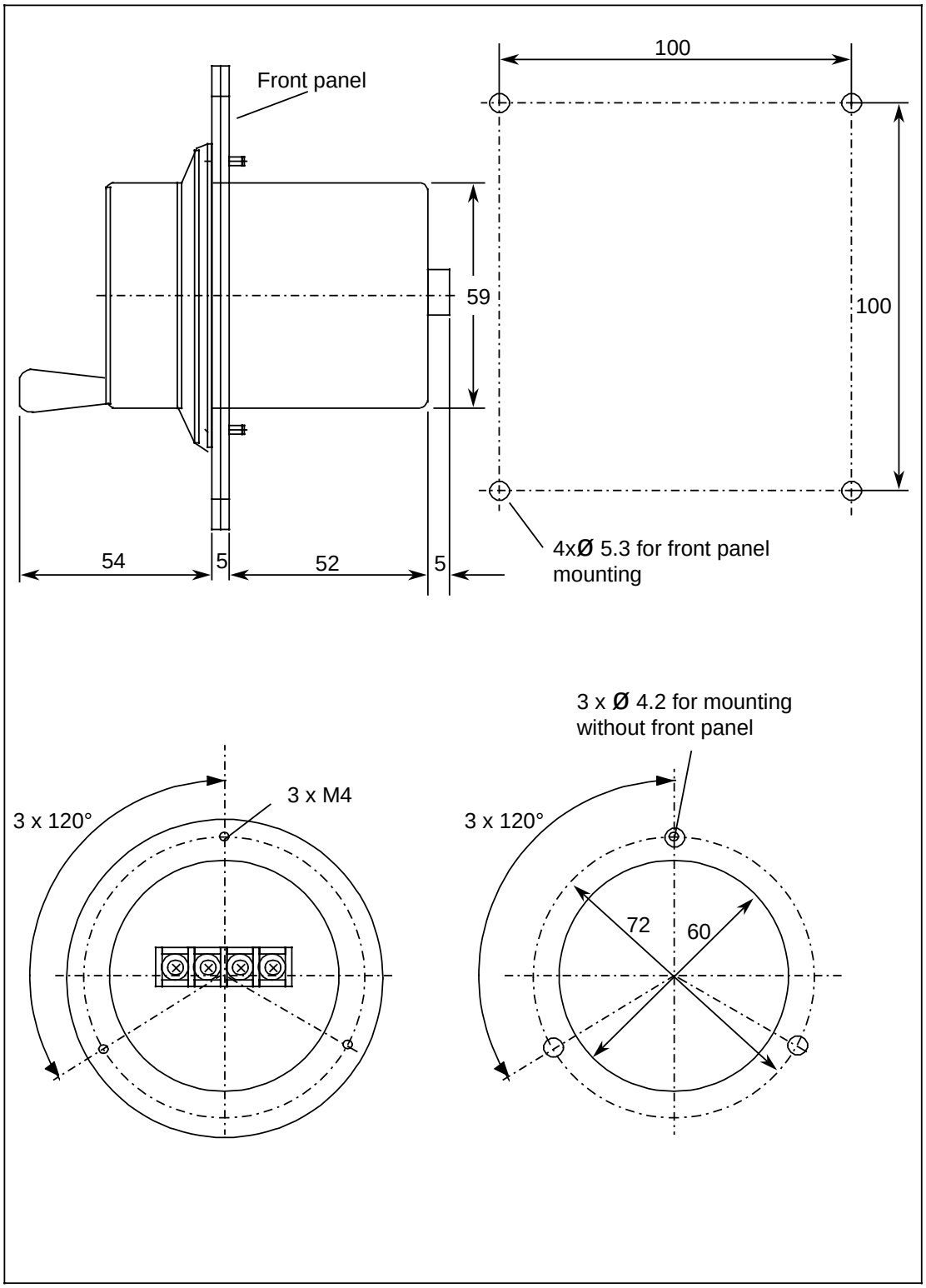


Spring disk coupling and clamp

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6.3 Electronic encoder (handwheel)

Order No. : 6FC9 320-5DA

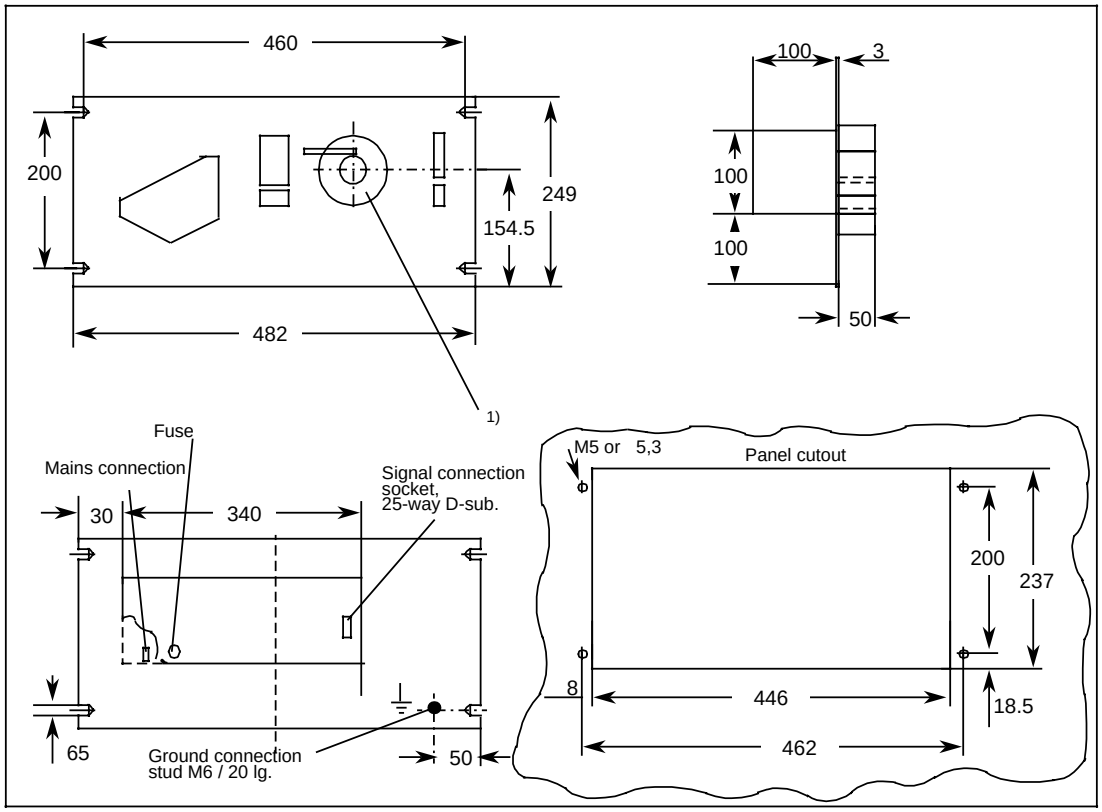


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6.4 Tape readers

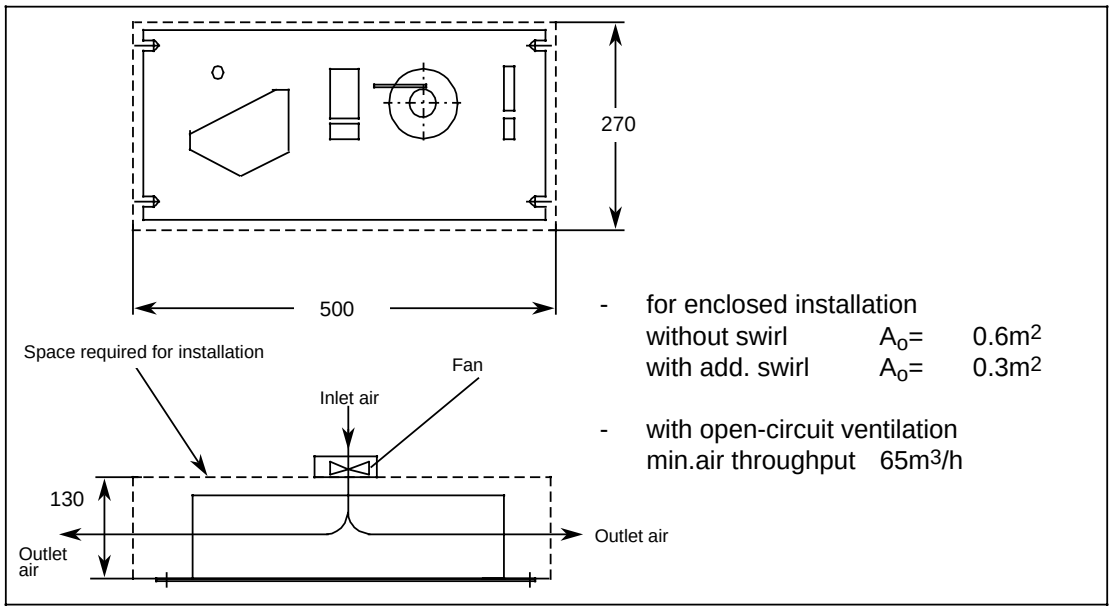
6.4.1 Reader T40, with take-up reel

Order No.: 6FC3 984 - 1FC



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

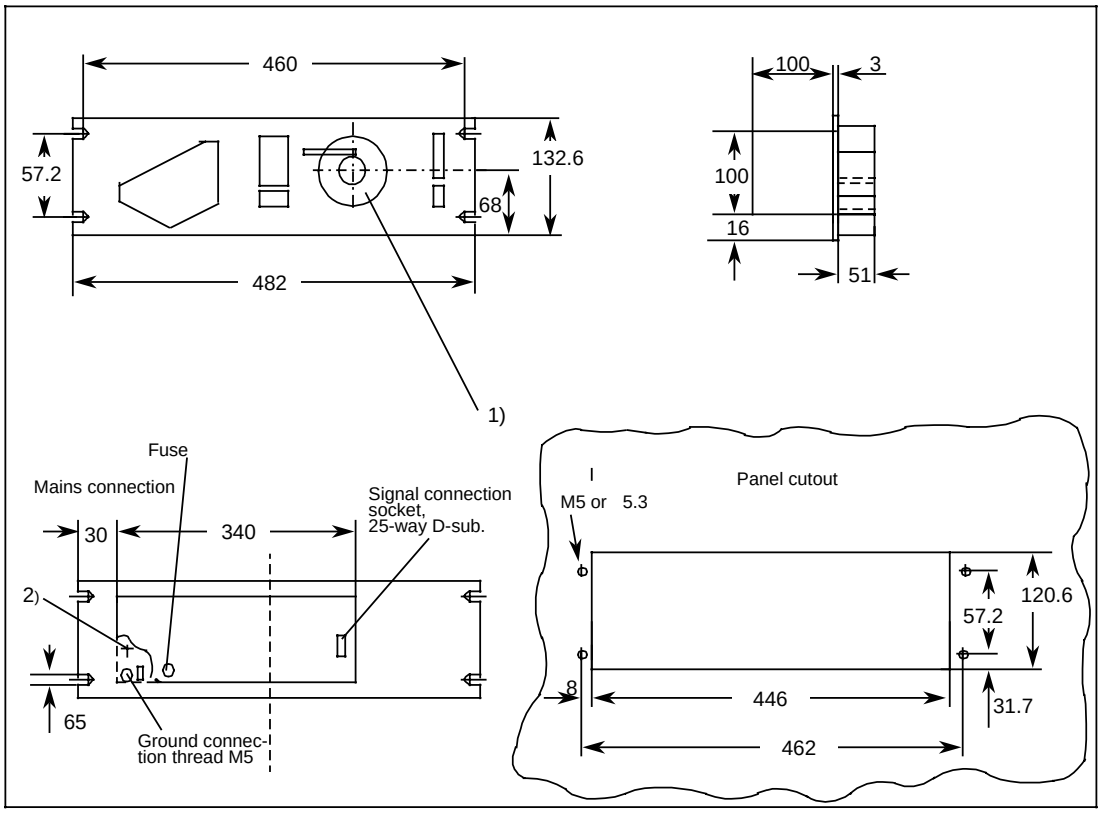
Suggested installation:



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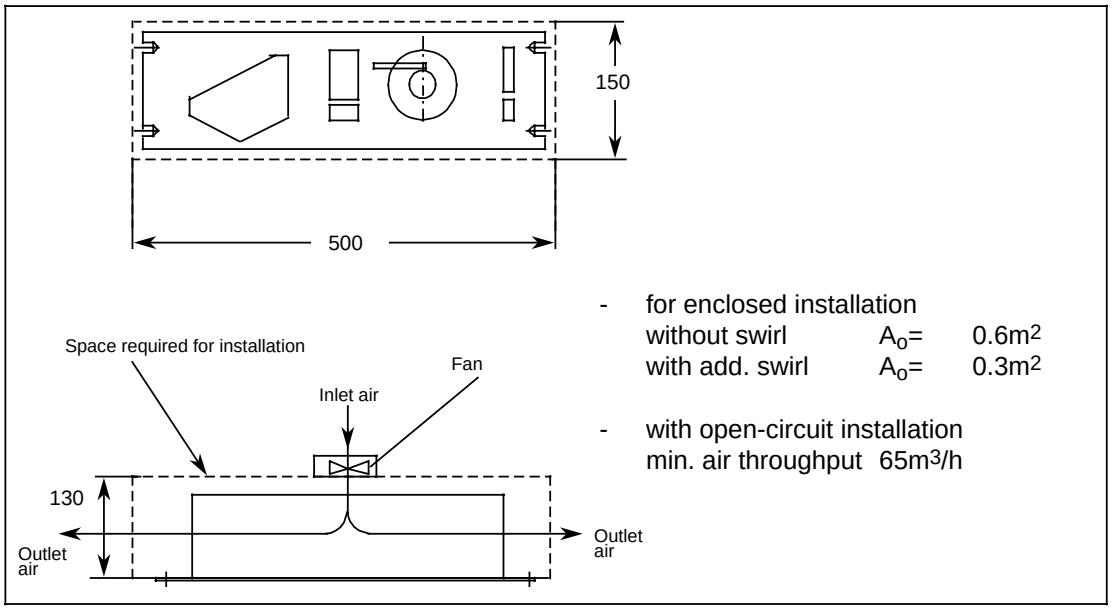
6.4.2 Reader T41, with take-up reel and smaller front panel

Order No.: 6FC3 984 - 1GB



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

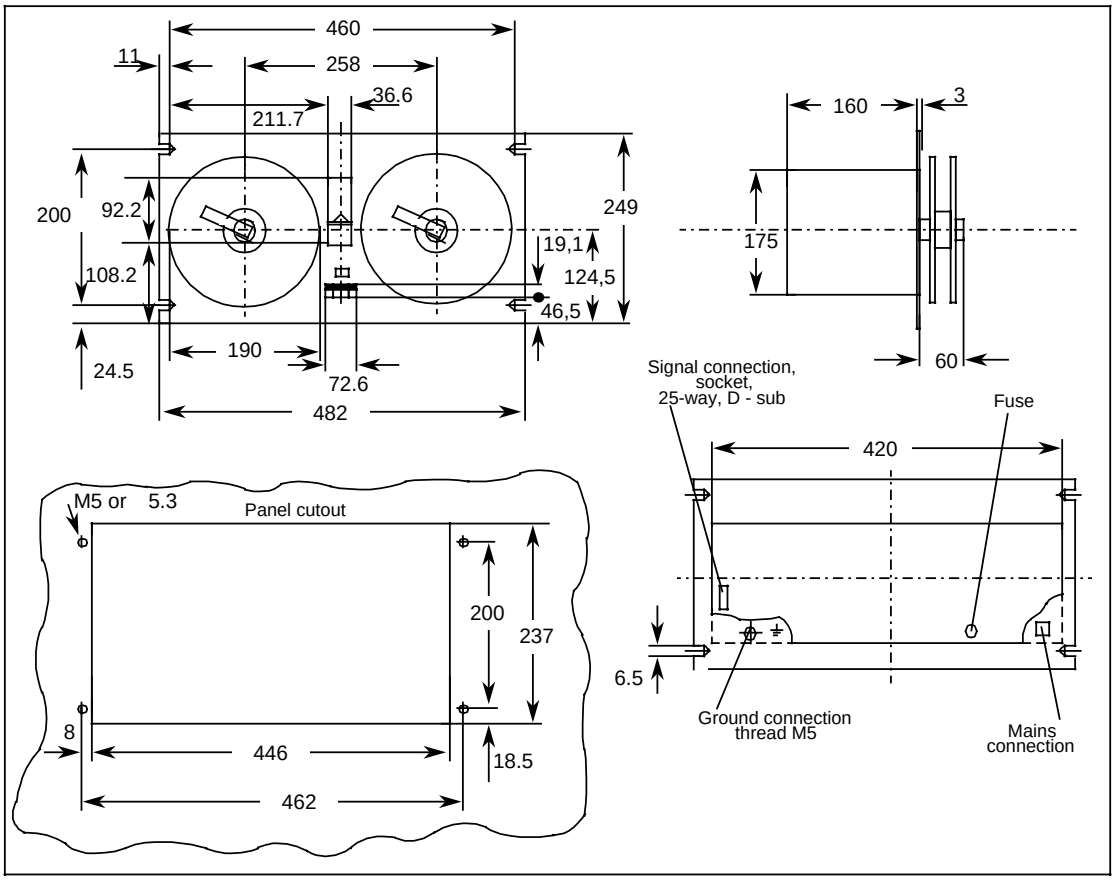
Suggested installation:



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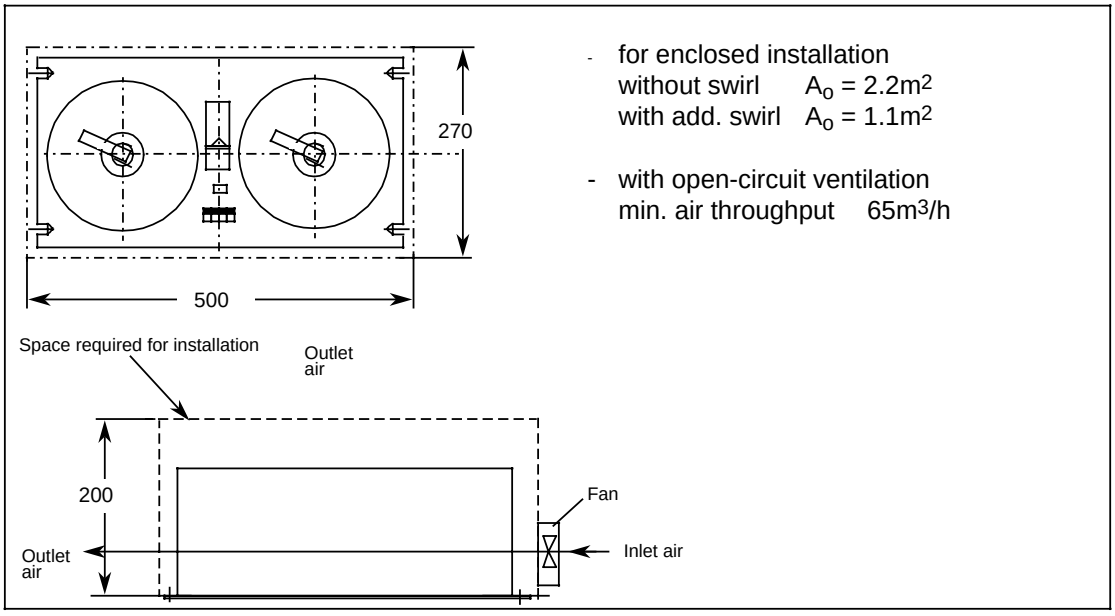
6.4.3 Reader T50, with winder

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:

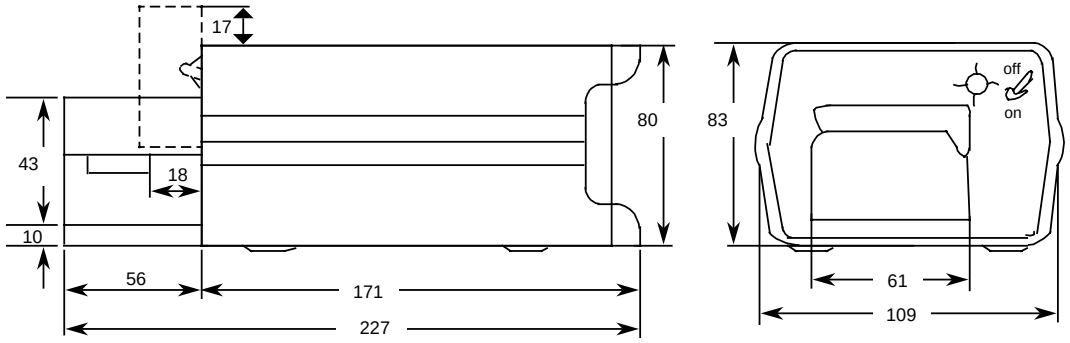


- for enclosed installation
  without swirl $A_o = 2.2m^2$
  with add. swirl $A_o = 1.1m^2$
- with open-circuit ventilation
  min. air throughput $65m^3/h$

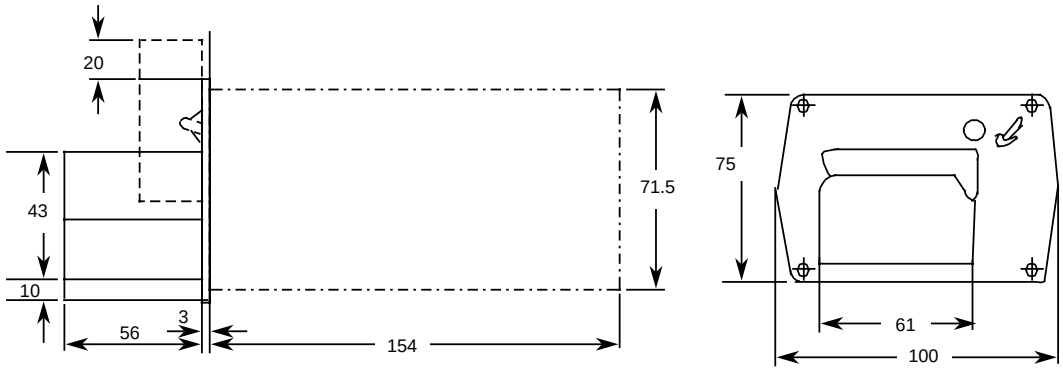
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6.4.4 Reader T60, portable

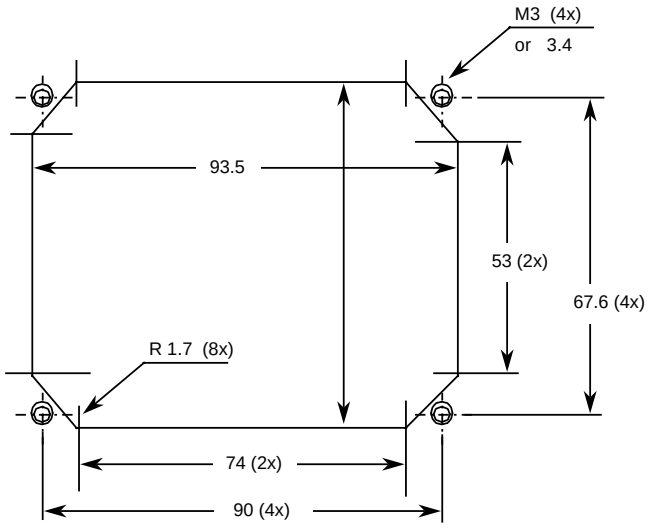
Order No. : 6FC3 984 - 1FB



Tape reader T60
portable version



Tape reader T60
Panel-mounting version, casing removed



Panel cutout T60

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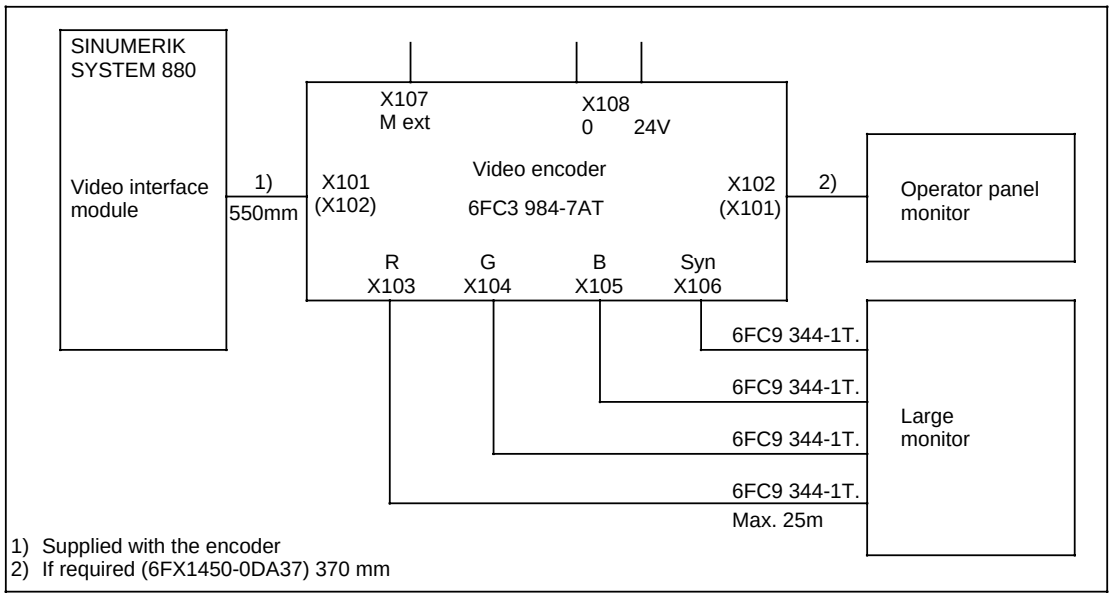
6.5 Video encoder

Order No. : 6FC3 984-7AT

By means of the video encoder, a large monitor can be connected to the System 880. The encoder is connected to the video interface by means of the cable supplied, and the NC display is connected to the encoder with the standard NC cable. If the cable length between NC display and encoder is not sufficient, a ribbon cable can be obtained as an alternative and installed in place of the cable supplied.

The maximum cable length between NC display and video interface must not be greater than 1 m because unscreened ribbon cables are used.
Power is supplied to the encoder through the ribbon cable, a separate source is not necessary. The 6SD3 401-8BH special monitor should be used because the standard type of RGB monitor does not produce satisfactory displays.

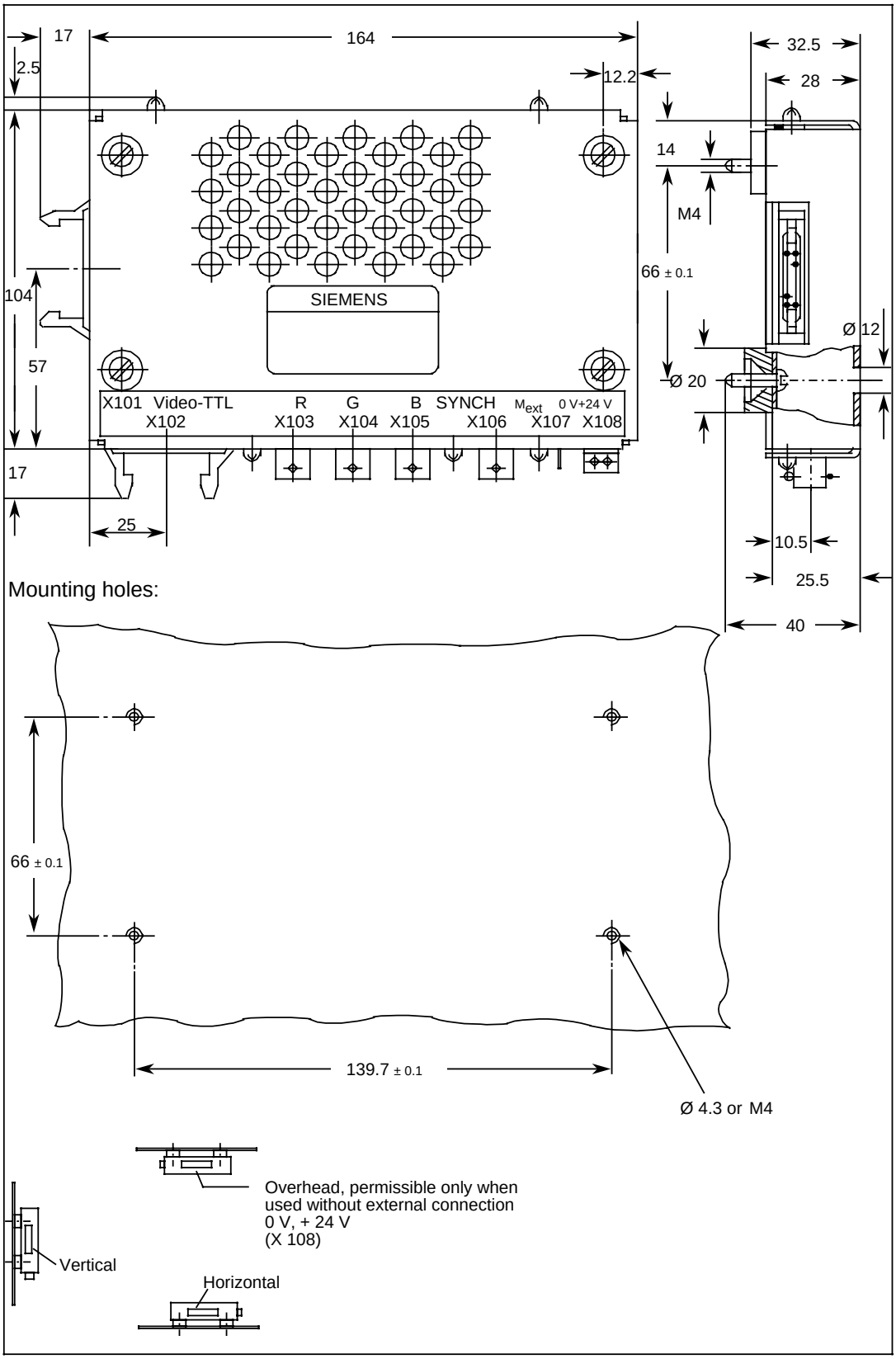
Video encoder connection



1) Supplied with the encoder
2) If required (6FX1450-0DA37) 370 mm

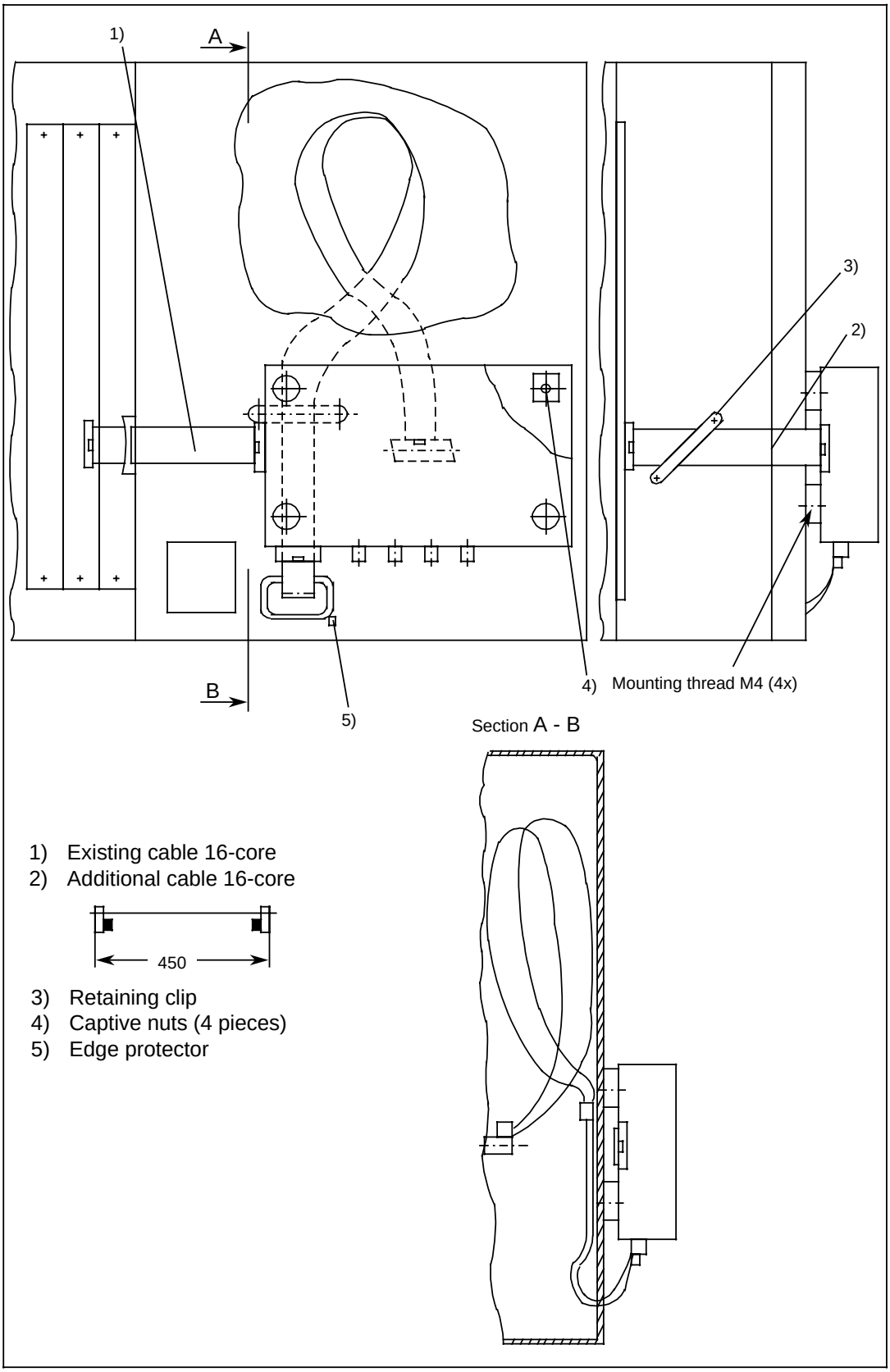
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Dimension drawings:



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Suggested installation ”monochrome”

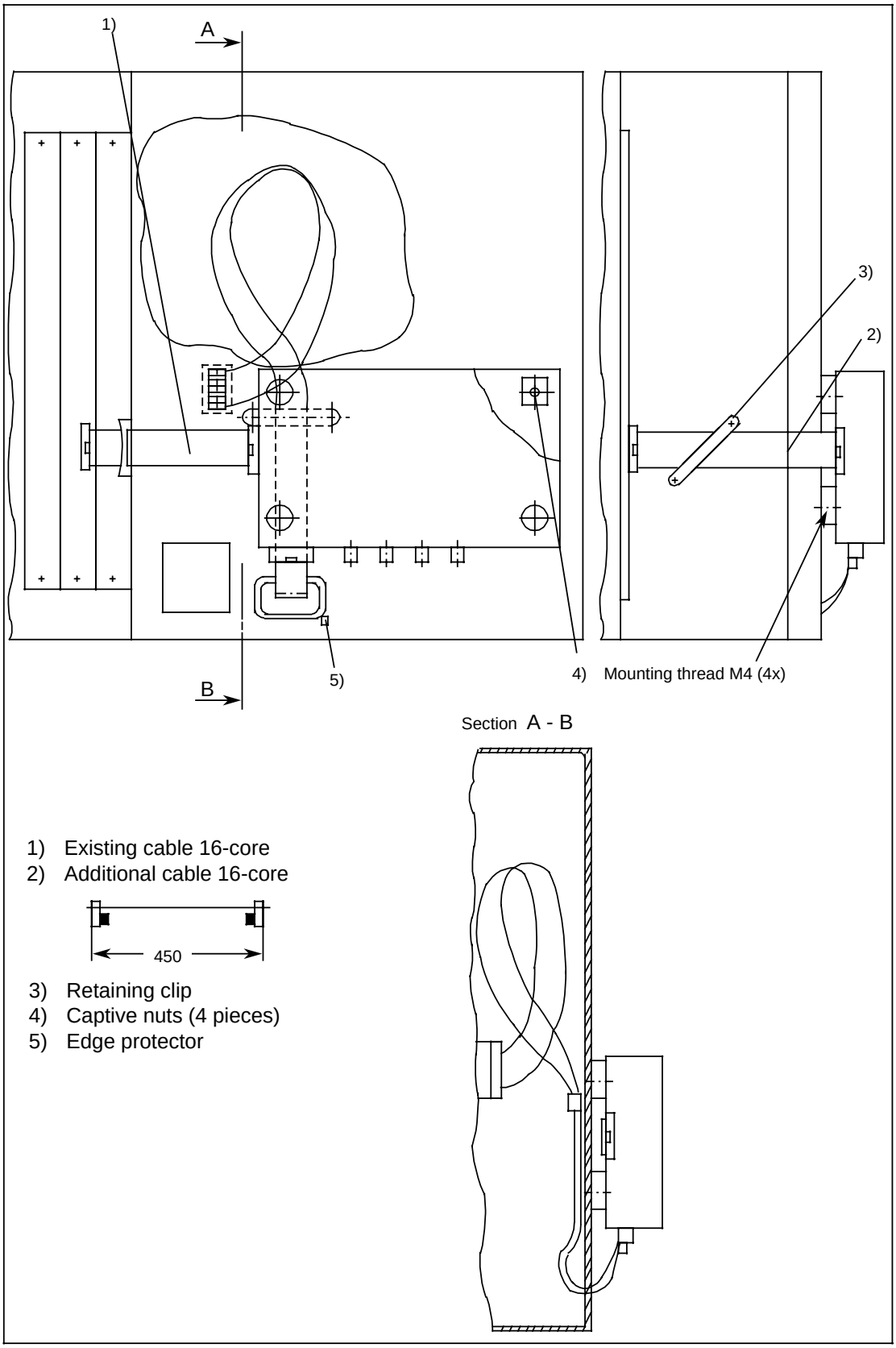


1) Existing cable 16-core
2) Additional cable 16-core

3) Retaining clip
4) Captive nuts (4 pieces)
5) Edge protector

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Suggested installation ”colour”



1) Existing cable 16-core
2) Additional cable 16-core

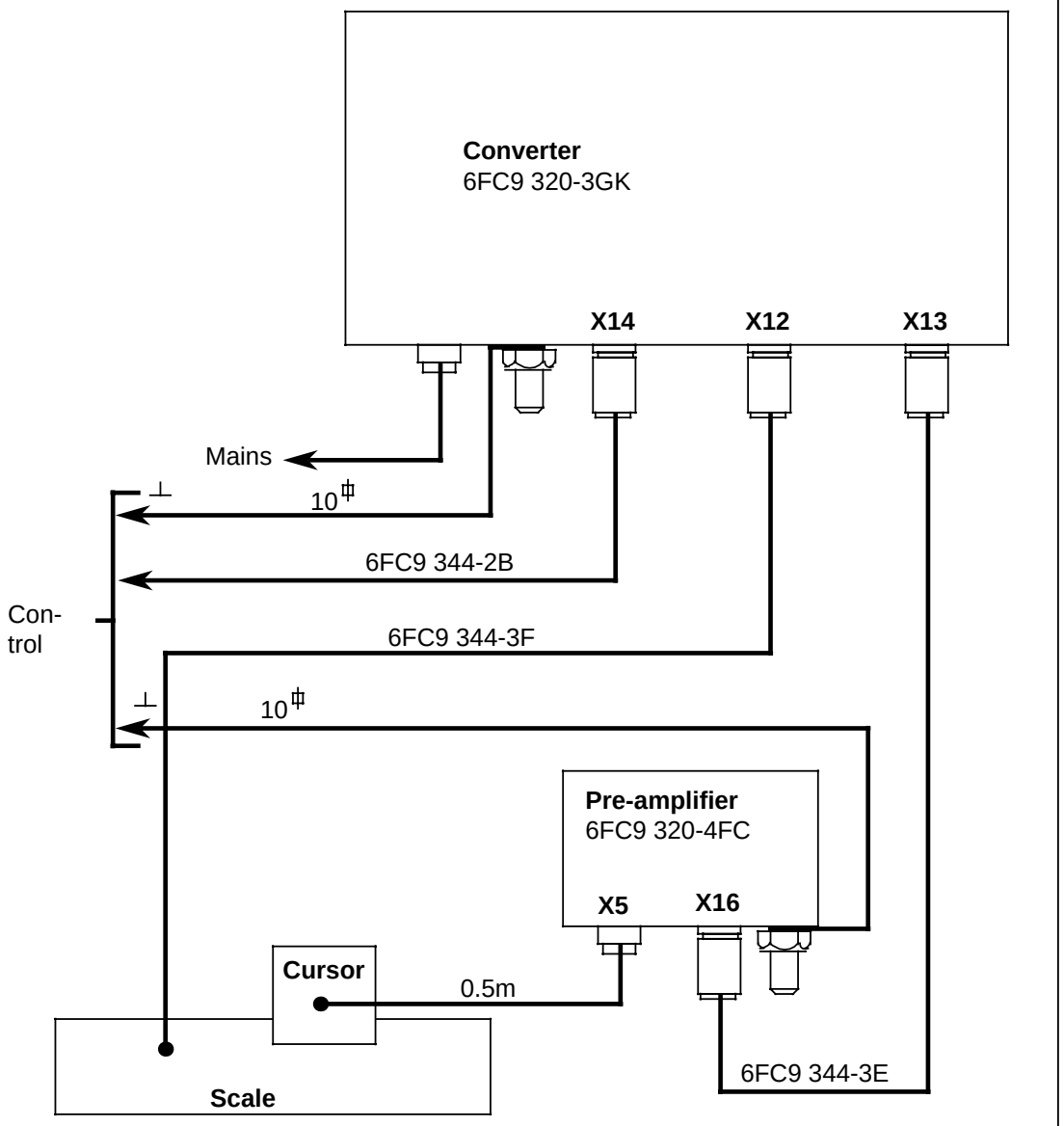
3) Retaining clip
4) Captive nuts (4 pieces)
5) Edge protector

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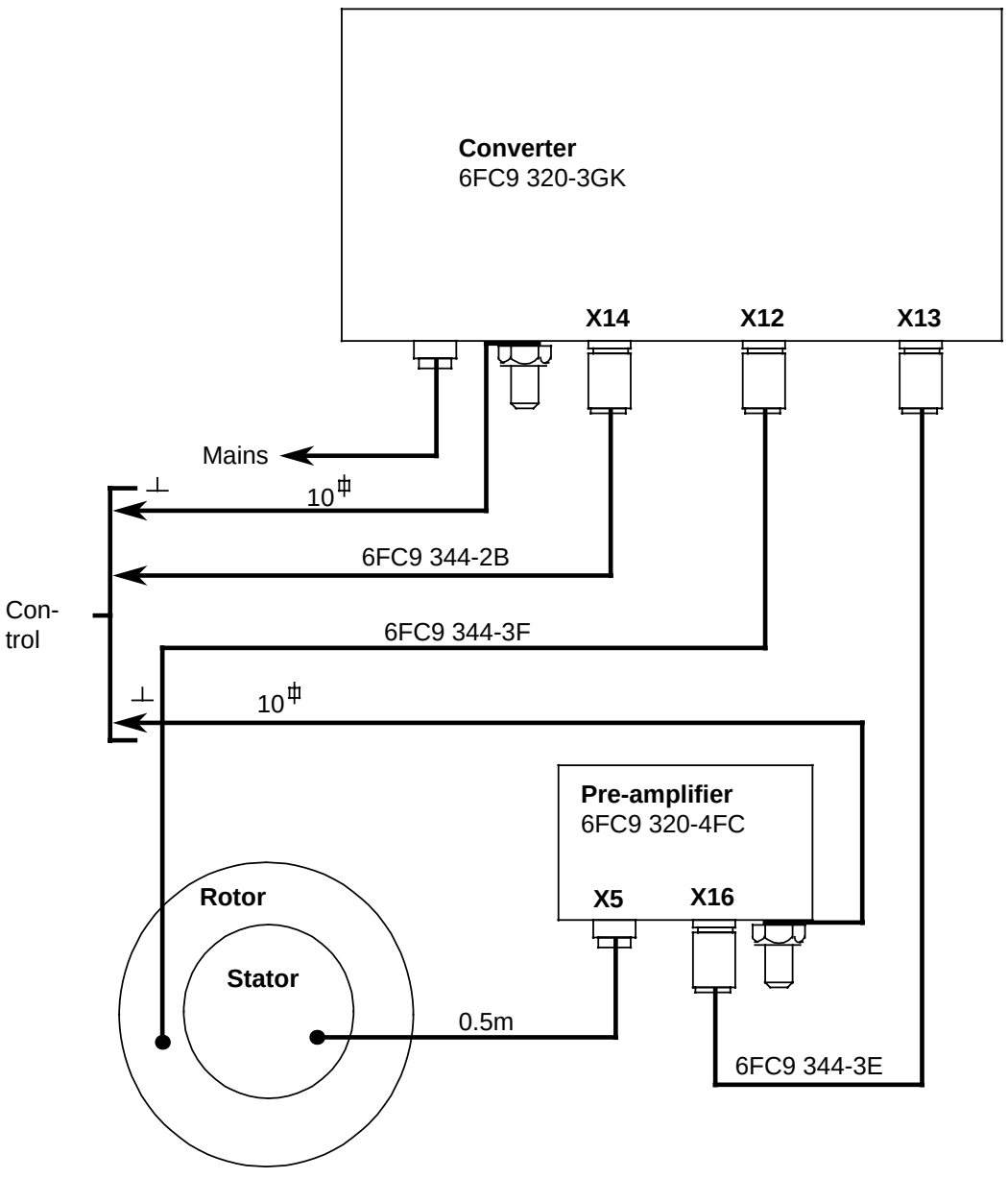
6.6 Inductosyn converter

6.6.1 Wiring

- **Linear inductosyn wiring**



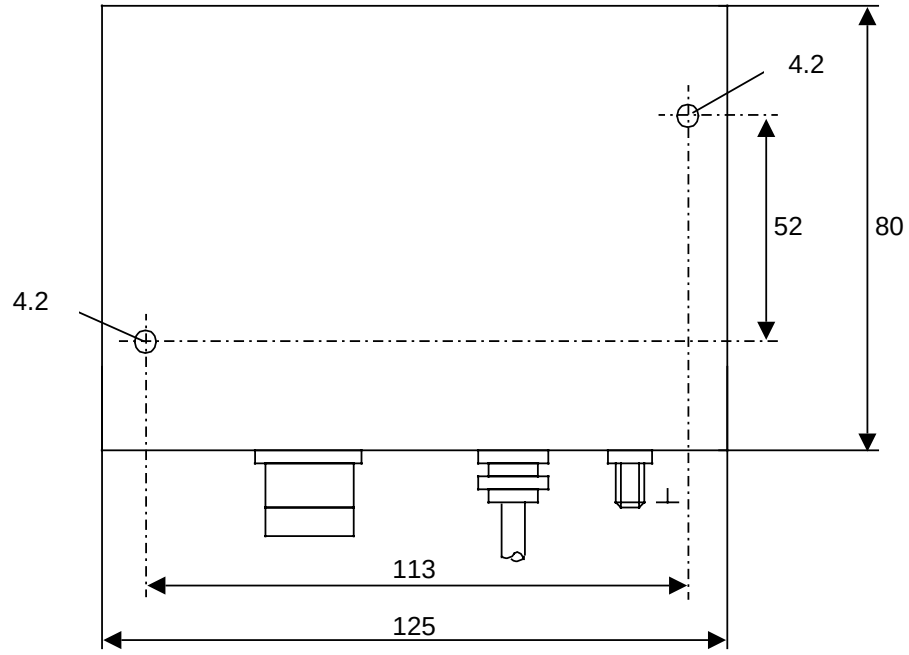
- **Rotary inductosyn wiring**



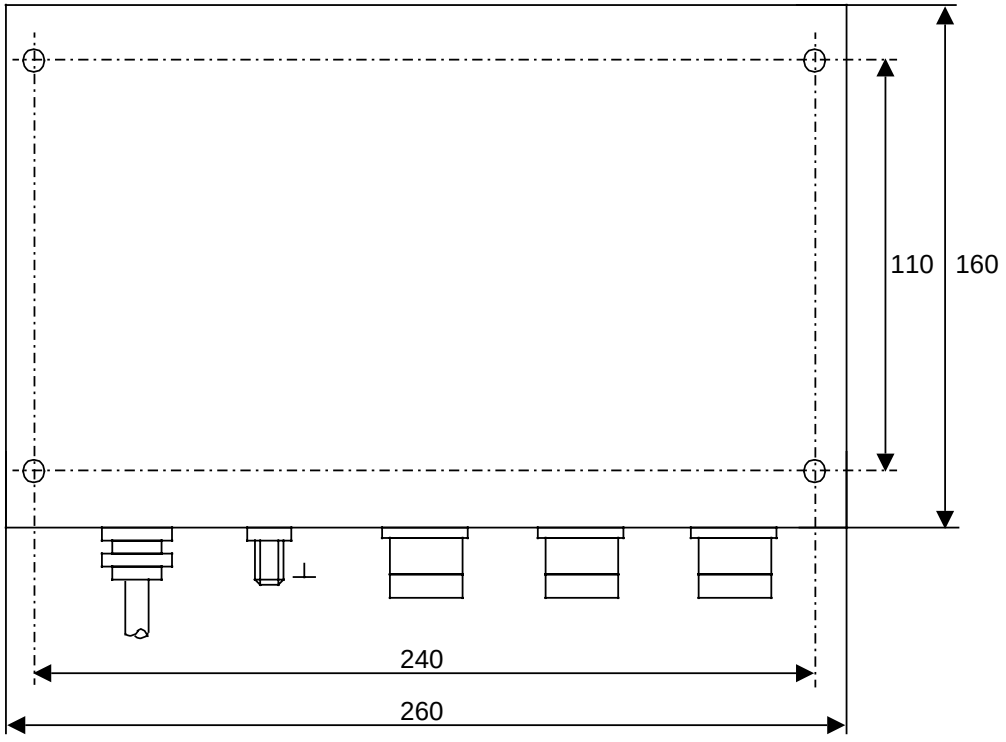
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6.6.2 Dimension drawings

- **Pre-amplifier**
  6FC9 320-4FC



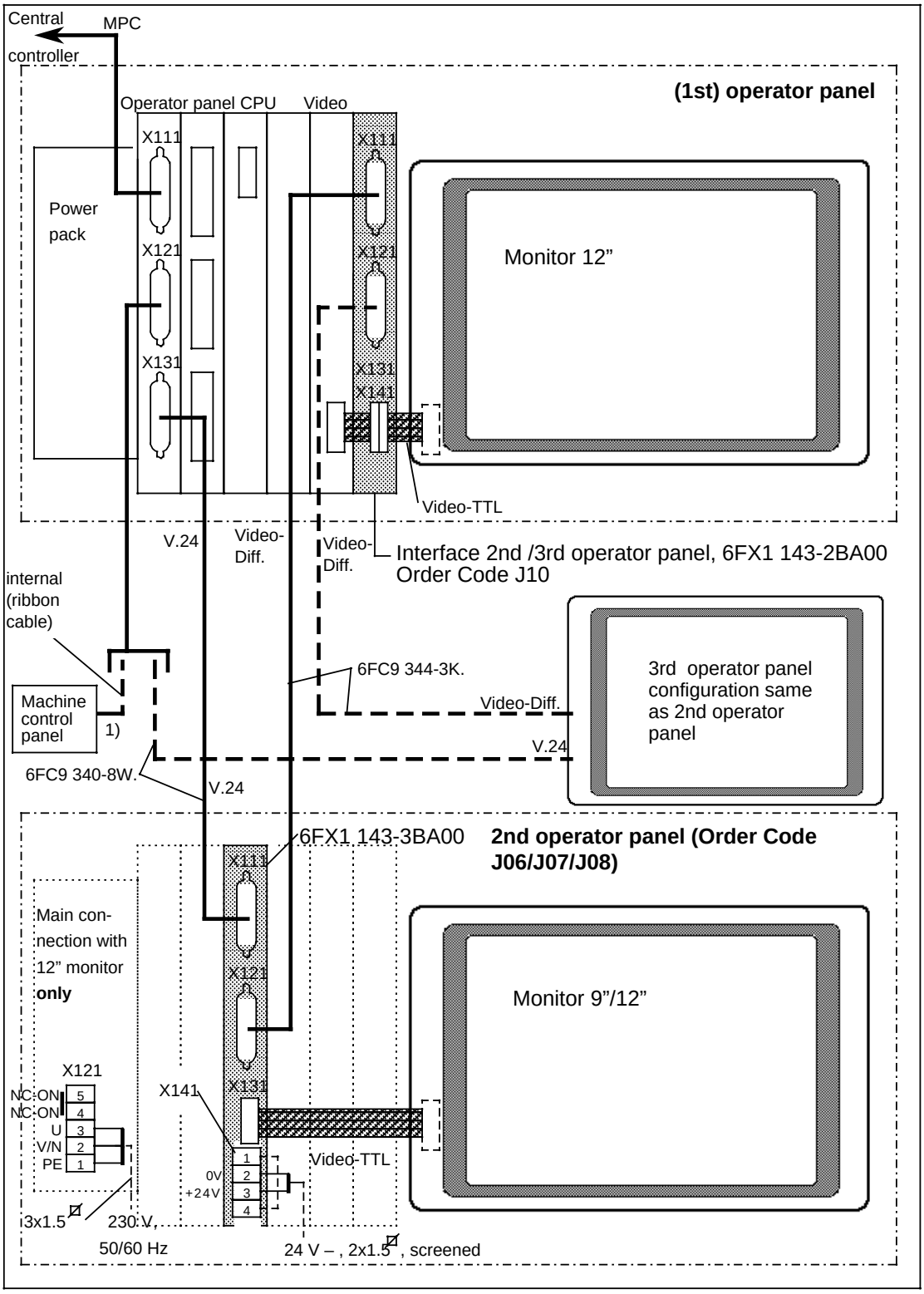
- **Converter**
  6FC9 320-3GK



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6.7 Connecting a 2nd/3rd operator panel

On the SINUMERIK 880TE / TEC / ME / MEC the second operator panel is connected to the 1st serial interface: a 3rd operator panel is **not** possible.



1) If a third operator panel is used, the serial interface of the machine control panel must be connected to interface four of the central controller (via cable 6FC9 344-1F).

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2nd/3rd operator panel

12" version

Colour 6FC3988-3AJ J08
Monochrome 6FC3988-3AH J07

Designation	Order No.	Order code	Subrack slots 1	2	3	4	5	6	7	8	9	Firmware
BUS/OP 230V	6FX1131-3BA01							■	■	■		
			■			■	■	■	■	■	■	
Filter unit 230V	6EW1060-0AA		■	■	■							
KYRU 24V external	6FX1143-3BA00							■				6FX1853-2BX20-1B
Front panel 1 1/3 SPS	6FC3985-7AC					■	■		■	■	■	

■ Basic version ■ Option

9" version

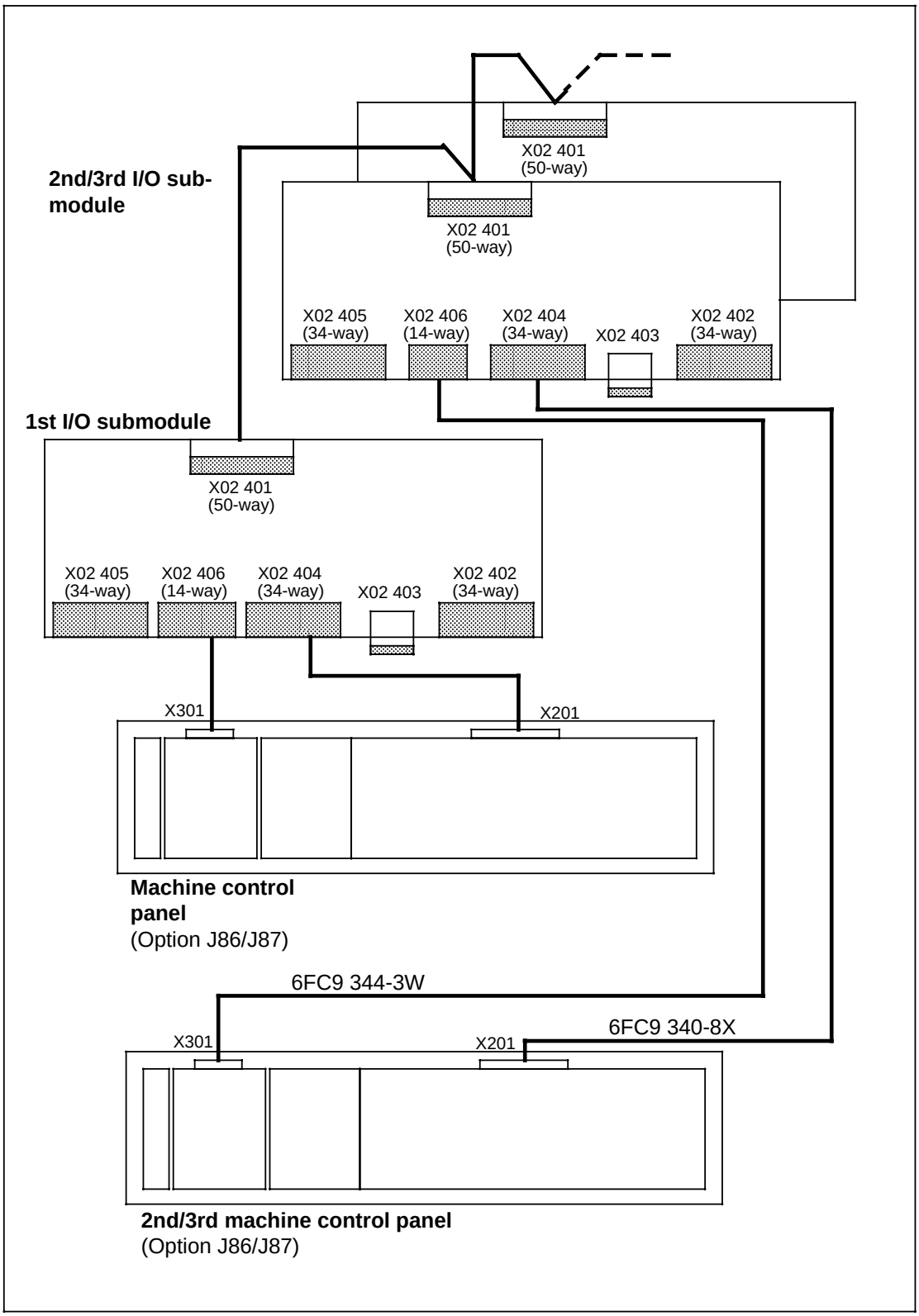
Monochrome 6FC3988-3AG J06

Designation	Order No.	Order code	Subrack slots 1	2	3	4	5	6	7	Firmware
BUS 810 24V	6FX1131-3BA01						■			
			■	■	■	■	■	■	■	
KYRU 24V external	6FX1143-3BA00						■			6FX1853-2BX10-1B
Front panel 1 1/3 SPS	6FC3985-7AC		■	■	■	■		■	■	

■ Basic version ■ Option

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6.8 Connecting a 2nd/3rd machine control panel



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6.9 Connecting the machine control panel when no operator panel is used

If no operator panel is used the machine control panel can no longer be connected to the I/O submodules of the operator panel.
The machine control panel is connected to PLC I/O modules. A cable is provided to do this 6FC9 344-4Q .

Notes:

- The operator panel must have its own ON/OFF switch.
- If the option bit "control without operator panel" is set, the PLC user program must scan the switch setting both during startup (OB 20) and in cyclic operation (OB 1) and then enter it in DB 48, D 0.10.
- It is only possible to switch the control on and off if the control was installed with an operator panel.
- Disconnecting the operator panel while the NC is running:
  This is only possible if the NC/PLC was already installed with the operator panel and the PLC function CONTROL WITHOUT OPERATOR PANEL (NC/PLC interface signal) was selected before switching off.

  The operator panel is switched off and the MPC connector on the operator panel removed.
- Connecting the control panel while the NC is running:
  The preconditions for this are the same as for ”disconnecting” except that the operator panel is connected to the MPC line while it is switched off. After that the operator panel is switched on and the PLC interface signal CONTROL WITHOUT OPERATOR PANEL is cleared by the PLC.

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6.10 Installation conditions

6.10.1 Electrical and mechanical installation conditions

Conditions / Device	Nominal voltage U_N	Max. power loss P_V	Degree of protection (to DIN 40050)	Dimensions w h d	Weight
Power supply unit 6FC9 304 - 0AC 6FC9 304 - 0AD 6FC9 304 - 0A	3x400 V AC 415 V AC 440 V AC 24V / 20A 24V / 40 A 1x230 V AC 24V / 10A		IP00	431.5mm 132mm 255mm	
Incremental encoder 6FC9 320 - 3..	Internal voltage 5V D.C.		IP54	58mm 83mm	
Comb. rotary encoder 6FC9 320 - 1EA	Internal voltage 5V D.C.		IP54		
High-resolution rotary encoder for rotary axes	5V				
Electronic encoder (handwheel) 6FC9 320 - 5DA	Internal voltage 5V D.C.	0.5W	Front IP63 Rear IP00	100mm 100mm 106mm	0.7kg
Tape reader T40, with take-up reel B02 6FC9 984 - 1FC	230 V AC +10% / - 15%	30W	IP00	482mm 249mm 100mm	3.1kg
Tape reader T41, with take-up reel and smaller front panel B21 6FC3 984 - 1GB	230 V AC +10% / - 15%	30W	IP00	482mm 133mm 100mm	3.1kg
Tape reader T50, with winder B03 6FC9 984 - 1FD	230 V AC +10% / - 15%	110W	IP00	482mm 249mm 160mm	8.3kg
Tape reader T60, portable B01 6FC3 984 - 1FB	230 V AC +10% / - 15%	23W	IP00	108mm 85mm 230mm	1.4kg
Video encoder 6FC3 984 - 7AT	5V		IP00	170mm 72(92)mm	

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6.10.2 Climatic conditions for installation

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

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7 Overview of Cables and Devices

7.1 Accessories, cables

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

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Cable, complete	Max. possible length	Order No.
To probe	35 m	
Length **5 m**		**6FC9 340-8UB**
Length **10 m**		**6FC9 340-8UC**
Length **18 m**		**6FC9 340-8UE**
Length **25 m**		**6FC9 340-8UF**
Between inductosyn converter and inductosyn scale	50 m	
Length **5 m**		**6FC9 344-3FB**
Length **10 m**		**6FC9 344-3FC**
Length **18 m**		**6FC9 344-3FE**
Length **25 m**		**6FC9 344-3FF**
Length **50 m**		**6FC9 344-3FG**
Between inductosyn converter and inductosyn pre-amplifier	50 m	
Length **5 m**		**6FC9 344-3EB**
Length **10 m**		**6FC9 344-3EC**
Length **18 m**		**6FC9 344-3EE**
Length **25 m**		**6FC9 344-3EF**
Length **50 m**		**6FC9 344-3EG**
Between inductosyn scales	–	
Length **0.335 m**		**6FC9 198-4AL**
Between I/O submodule and terminal strip converter, ribbon cable, 34-core	2.5 m	
Length **0.5 m**		**6FC9 340-8LA**
Length **1 m**		**6FC9 340-8LL**
Length **2 m**		**6FC9 340-8LM**
Between I/O submodule and terminal strip converter and between I/O submodule and 2nd/3rd machine control panel, round cable, 34-core	25 m	
Length **5 m**		**6FC9 340-8XB**
Length **10 m**		**6FC9 340-8XC**
Length **18 m**		**6FC9 340-8XE**
Length **25 m**		**6FC9 340-8XF**
Between I/O submodule and 2nd/3rd machine control panel	25 m	
Length **5 m**		**6FC9 344-3WB**
Length **10 m**		**6FC9 344-3WC**
Length **18 m**		**6FC9 344-3WE**
Length **25 m**		**6FC9 344-3WF**
Machine control panle to PLC I/O module (no precutting and terminating)		**6FC9 334-4Q**
Between PLC input modules and machine control	50 m	
Length **5 m**		**6FC9 344-1UB**
Length **10 m**		**6FC9 344-1UC**
Length **18 m**		**6FC9 344-1UE**
Length **25 m**		**6FC9 344-1UF**
Between PLC input modules and machine control, ribbon cable	5 m	
Length **2 m**		**6FC9 344-2TM**

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Cable, complete	Max. possible length	Order No.
Between PLC mixed I/O modules and machine control	50 m	
Length **5 m**		**6FC9 344-3XB**
Length **10 m**		**6FC9 344-3XC**
Length **18 m**		**6FC9 344-3XE**
Length **25 m**		**6FC9 344-3XF**
Between PLC output modules and machine control	50 m	
Length **5 m**		**6FC9 344-1VB**
Length **10 m**		**6FC9 344-1VC**
Length **18 m**		**6FC9 344-1VE**
Length **25 m**		**6FC9 344-1VF**
Between operator panel and central controller (MPC interface), copper cable	50 m	
Length **2 m**		**6FC9 344-2AM**
Length **5 m**		**6FC9 344-2AB**
Length **10 m**		**6FC9 344-2AC**
Length **18 m**		**6FC9 344-2AE**
Length **25 m**		**6FC9 344-2AF**
Length **50 m**		**6FC9 344-2AG**
Between operator panel and central controller (MPC interface), optical-fibre cable	300 m	
Length **5 m** (plastic)		**6FX1 400-2BC05**
Length **10 m** (plastic)		**6FX1 400-2BC10**
Length **18 m** (glass)		**6FX1 400-1BC18**
Length **25 m** (glass)		**6FX1 400-1BC25**
Length **50 m** (glass)		**6FX1 400-1BC50**
Length **75 m** (glass)		**6FX1 400-1BC75**
Length **100 m** (glass)		**6FX1 401-1BC00**
Between operator panel and central controller (MPC interface) divisible max. 3 times (up to 4 part lengths) Part lengths to order Left part cabl . . . m Middle 1st part cable . . . m Middle 2nd part cable . . . m Right part cable . . . m	50 m	**6FC9 344-2RZ**
To 2nd/3rd operator panel, monitor encoder	30 m	
Length **10 m**		**6FC9 344-3KC**
Length **18 m**		**6FC9 344-3KE**
Length **25 m**		**6FC9 344-3KF**
To 2nd/3rd operator panel, keyboard interface RS232C	30 m	
Length **10 m**		**6FC9 340-8WC**
Length **18 m**		**6FC9 340-8WE**
Length **25 m**		**6FC9 340-8WF**

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Cable, complete	Max. possible length	Order No.
To digital linear measuring system Length **5 m** Length **10 m** Length **18 m** Length **25 m**	50 m	 **6FC9 344-4LB** **6FC9 344-4LC** **6FC9 344-4LE** **6FC9 344-4LF**
To DMP terminal blocks Round cable Length **0.5 m** Length **5 m** Length **10 m** Length **18 m** Length **25 m**	50 m	 **6FC9 344-3QZ** **6FC9 344-3QB** **6FC9 344-3QC** **6FC9 344-3QE** **6FC9 344-3QF**
Between interface DMP and DMP terminal block Length **5 m** Length **10 m** Length **18 m** Length **25 m**	50 m	 **6FC9 344-3SB** **6FC9 344-3SC** **6FC9 344-3SE** **6FC9 344-3SF**
Between interface DMP and expansion unit Length **2 m** Length **5 m** Length **10 m** Length **18 m** Length **25 m**	50 m	 **6FC9 344-3UM** **6FC9 344-3UB** **6FC9 344-3UC** **6FC9 344-3UE** **6FC9 344-3UF**
Between servo drive and ACC **Length on request**		**6FC9 344-4Cx**
Encoder cable 1 FT5 motor to the ACC module (no precutting and terminating)		**6FC9 348-5Q**
To rotary measuring system SIPOS Length **5 m** Length **10 m** Length **18 m** Length **25 m**	50 m	 **6FC9 344-4DB** **6FC9 344-4DC** **6FC9 344-4DE** **6FC9 344-4DF**
Between machine control panel and input module if no operator panel is used. Length **5 m** Length **10 m** Length **18 m** Length **25 m**	50 m	 **6FC9 344-4QB** **6FC9 344-4QC** **6FC9 344-4QE** **6FC9 344-4QF**

Note:
The connecting cables for the peripheral devices are described in the Configuring Instructions - Universal Interface - for the SINUMERIK 800 System.

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7.2 Accessories, connectors

Connector, complete	Order No.	Diagram ref. No.
12-way round female connector (Siemens) 10 mm cable 8 mm cable 6 mm cable	 **6FC9 341-1FD** **6FC9 341-1FR** **6FC9 341-1FT**	37
12-way round male connector coupling (Siemens) 10 mm cable 8 mm cable 6 mm cable	 **6FC9 341-1FC** **6FC9 341-1FQ** **6FC9 341-1FS**	38
9-way round male connector (Siemens) 8 mm cable	 **6FC9 341-1AT**	40
9-way round female connector (Siemens) 8 mm cable	 **6FC9 341-1AU**	43
9-way round female connector coupling (Siemens) 8 mm cable	 **6FC9 341-1EW**	25
12-way round male connector (Souriau)	**6FC9 341-1AB**	2
17-way round female connector (Tuchel)	**6FC9 341-1AC**	11
15-way female D-Sub connector (Siemens) with SINUMERIK casing	**6FC9 341-1EC**	5
15-way male D-Sub connector (Siemens) with SINUMERIK casing	**6FC9 341-1EU**	18
25-way female D-Sub connector (Siemens) with SINUMERIK casing	**6FC9 341-1ED**	6
37-way female D-Sub connector (Siemens) with SINUMERIK casing	**6FC9 341-1FH**	32
37-way, female D-Sub connector (Siemens) with SINUMERIK ribbon cable casing	**6FC9 341-1FX**	42
34-way, female ribbon cable connector (Siemens) for ribbon cable	**6FC9 341-1FE**	30
34-way female connector (Honda) for round cable with ribbon cable connector insert	**6FC9 341-2AD**	34
14-way female connector (Honda) for round cable with ribbon cable connector insert (special version)	**6FC9 341-2HF**	44
25-way male D-Sub connector (Siemens) with SINUMERIK casing	**6FC9 341-2AB**	22
25-way male D-Sub connector (Siemens) Casing with push latch	**6FC9 341-2AA**	21
25-way male D-Sub cable connector (Siemens) Post-office casing	**6FC9 341-1ES**	20
25-way female D-Sub connector insert with 2 push latching buttons, solder connection	**6FC9 341-1EB**	41

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7.3 Accessories, devices

Device	Order Code	Order No.
Electronic handwheel		**6FC9 320-5DA**
Incremental rotary encoder[1] and main spindle encoder with axial cable output 1024 pulses/rev 2000 pulses/rev 2500 pulses/rev 5000 pulses/rev		 **6FC9 320-3KB00** **6FC9 320-3KK00** **6FC9 320-3KN00** **6FC9 320-3KS00**
Incremental rotary encoder[1] and main spindle encoder with radial cable output 1024 pulses/rev 2000 pulses/rev 2500 pulses/rev 5000 pulses/rev		 **6FC9 320-3MB00** **6FC9 320-3MK00** **6FC9 320-3MN00** **6FC9 320-3MS00**
Combined rotary encoder for spindles and C axis 1024/9000 pulses/rev		 **6FC9 320-1KT00**
Incremental rotary encoder for rotary axes ROD 250 RON 255		 **6FC9 320-3CM00** **6FC9 320-3CN00**
SIPOS encoder **SIPOS incremental encoder** [1] **SIPOS absolute encoder** [1]		 **6FC9 320-3CS** **6FC9 320-3CT**
Clamp[2] **Spring disk coupling**		**6FC9 320-4GA** **6FC9 320-4GB**
Current/voltage converter hybrid		**6FC3 988-7CN**
Amplifier for current unconditioned signal		**6FC9 320-4HM12**
DMP terminator		**6FC1 145-2AA00**
Set of fixing parts for SIPOS encoder [3]		**6FC9 328-1CA**
Inductosyn converter (1 axis)		**6FC9 320-3GK**
Inductosyn pre-amplifier		**6FC9 320-4FC**
Tape reader T40	**B02**	**6FC9 320-1FC**
Tape reader T41	**B21**	**6FC9 320-1GB**
Tape reader T50	**B03**	**6FC3 984-1FD**
Tape reader T60	**B01**	**6FC3 984-1FB**

1) Without spring disk coupling and clamps
2) 3 clamps are required for each encoder
3) Without clamp

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Device	Order Code	Order No.
I/O submodule (basic submodule), 64 INP, 32 OUT	**M01**	**6FC3 984-3RA**
I/O submodule (expansion 1), 64 INP, 32 OUT	**M02**	**6FC3 984-3RB**
I submodule (basic submodule), 64 INP	**M04**	**6FC3 984-3RD**
I submodule (expansion 2), 64 INP	**M03**	**6FC3 984-3RC**
Interface submodule for electronic handwheel	**M10**	**6FC3 984-3RJ**
Power supply unit, Input 380V 3-phase AC / Output 24V DC 20A Input 380V 3-phase AC / Output 24V DC 40A Input 230V AC / Output 24V DC 10A	 - - -	 **6EV1 353-5AK** **6EV1 363-5AK** **6EV1 334-4AK00**
Terminal strip converter, 34-way, ribbon cable for I/O submodules M01 to M04 without LEDs with LEDs	 - -	 **6FC9 302-2AA** **6FC9 302-2AB**
Terminal strip converter, 37-way, for input module N71 without LEDs with LEDs	 - -	 **6FC9 302-2AC** **6FC9 302-2AD**
Terminal strip converter, 37-way, for output modules N72 and N73 with LEDs	 -	 **6FC9 302-2AK**
Installation components for external machine control panel	-	**6FC3 981-7AC**
Air filters for central controller, pack of 10	-	**6ES5 981-0EA11**
Filter holder	-	**6ES5 981-0FA11**

See also Catalog

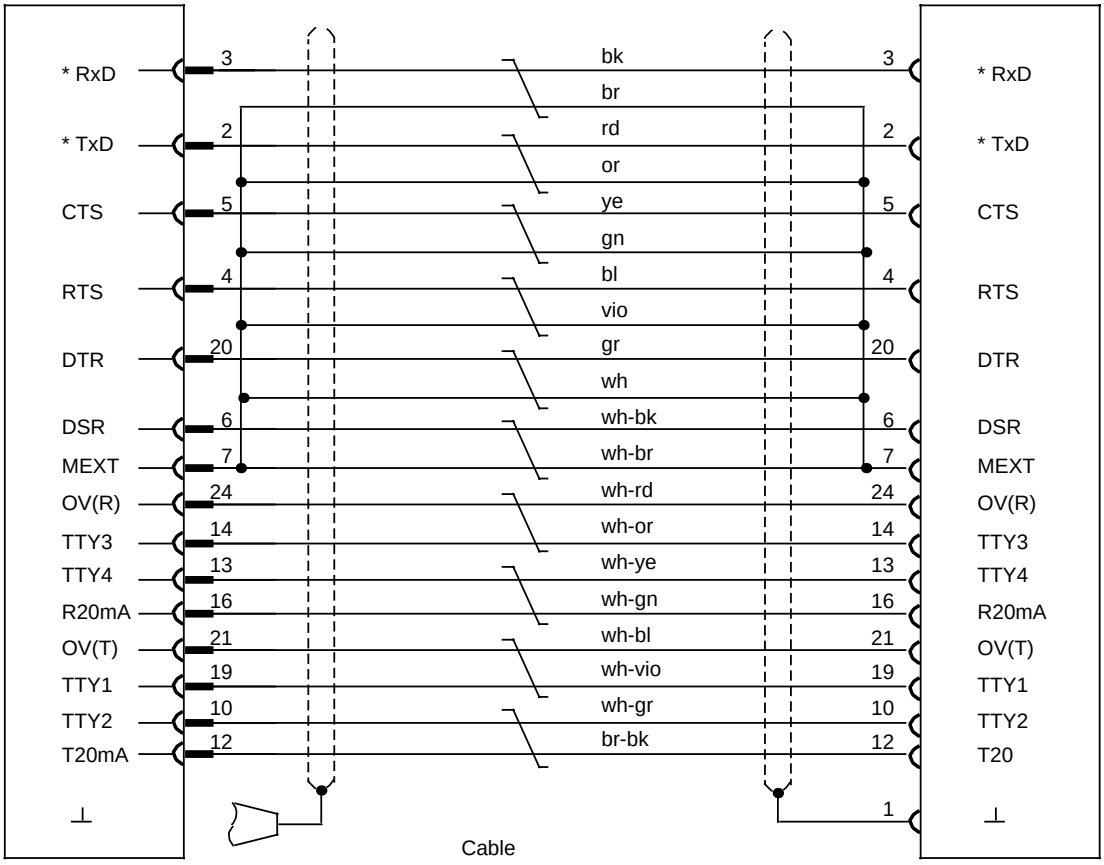
SINUMERIK 880

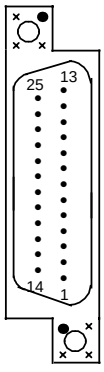
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7.4 Cable diagrams

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

SINUMERIK		**Operating area**
PCB slot	**: B 3**	**Connector**
PCB connector	**: X 121**	**V.24/TTY**





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

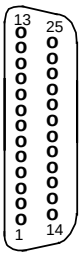
6FC9 341-2AB

Connector code

● coding pin

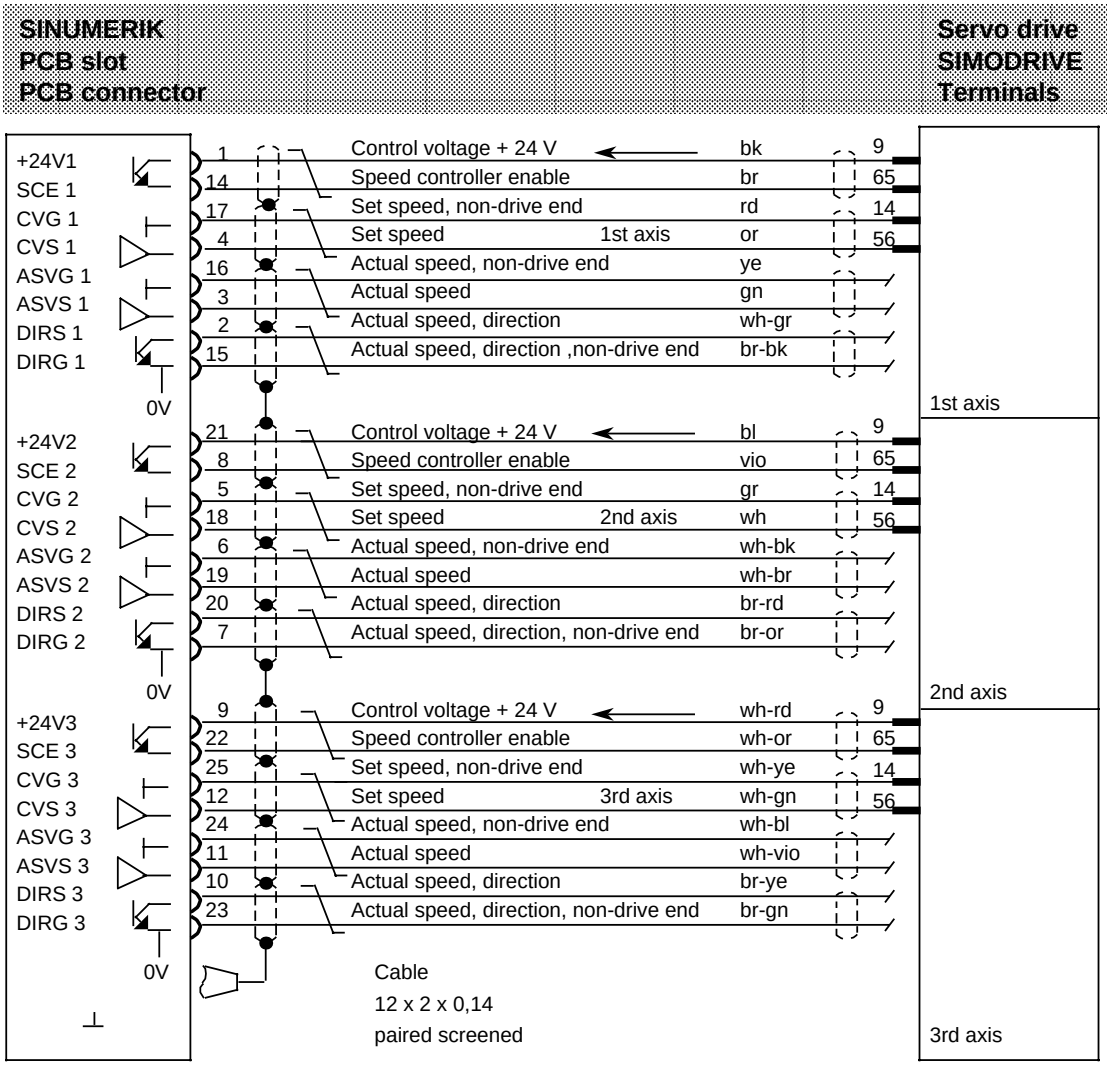
× no coding pin

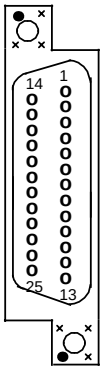
Connector
Position 1 bottom
D - Sub
25-way socket
Connection side
Connector insert and
2 push latching buttons
with nuts
6FC9 341-1EB



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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

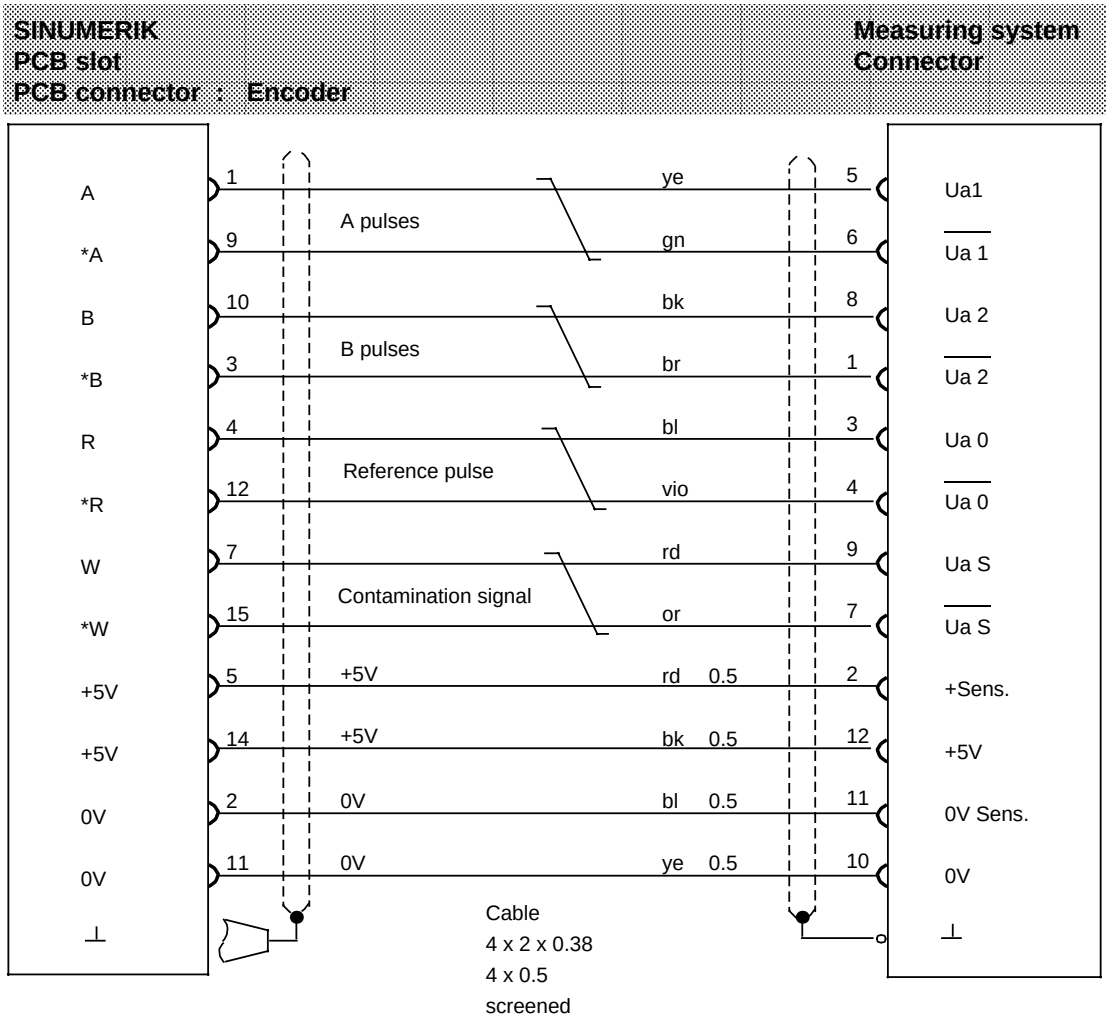
Outer shield
400 mm
unshielded

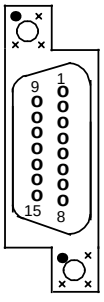
Bare wire ends
30 mm

Pin terminal
+ terminal marking
on designated wires

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





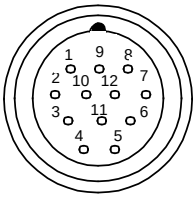
Connector
Position: 1 top
D-Sub
15-way, socket
Connection side
SINUMERIK housing
6FC9 341-1EC

Connector code

● coding pin
× no coding pin

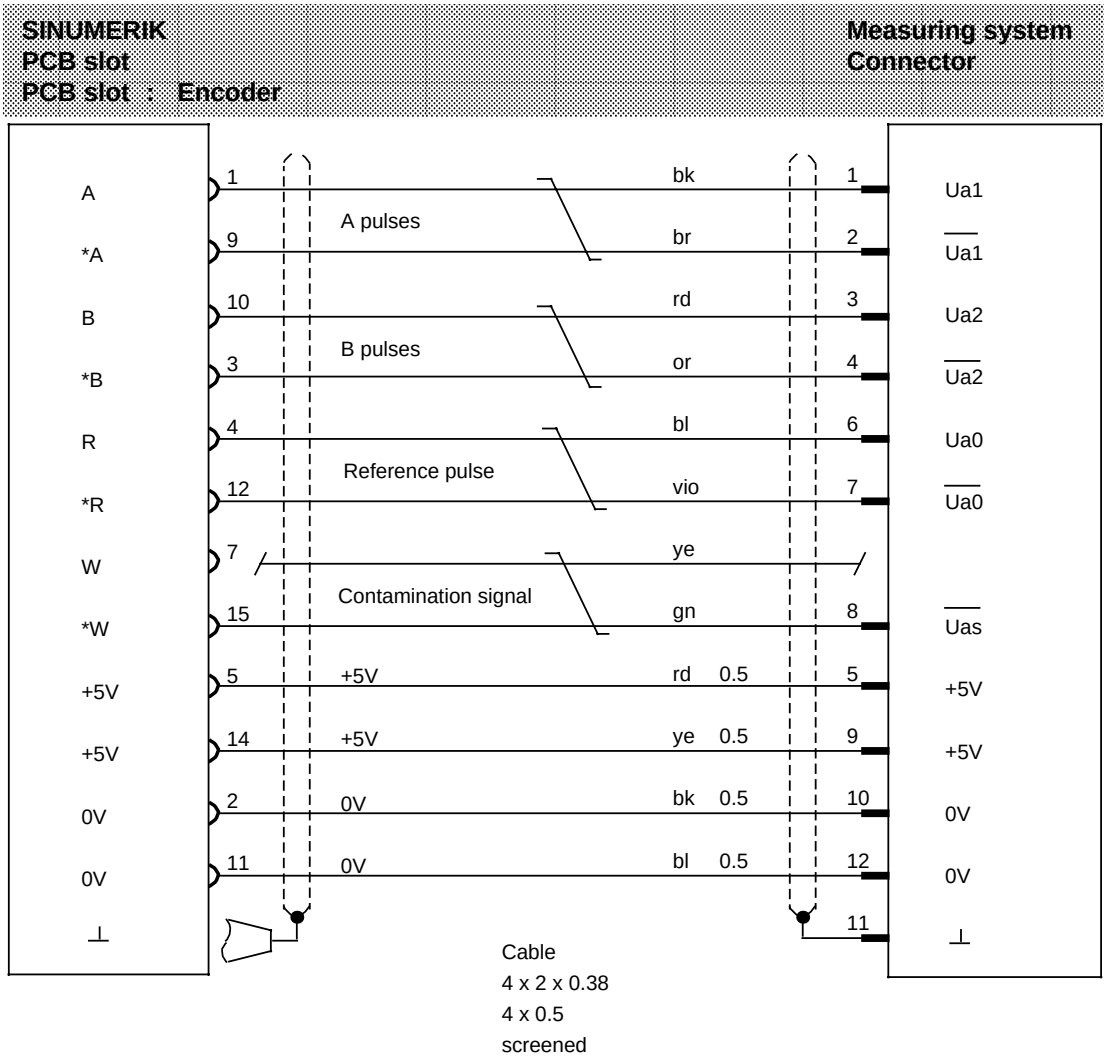
Connector
12-way, socket
SIEMENS
10 mm cable
Connection side

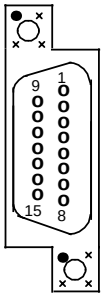
6 FC9 341 - 1FD



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





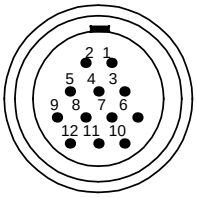
Connector
Position: 1 top
D-Sub
15-way, socket
Connection side
SINUMERIK housing
6FC9 341-1EC

Connector code

- ● coding pin
- × no coding pin

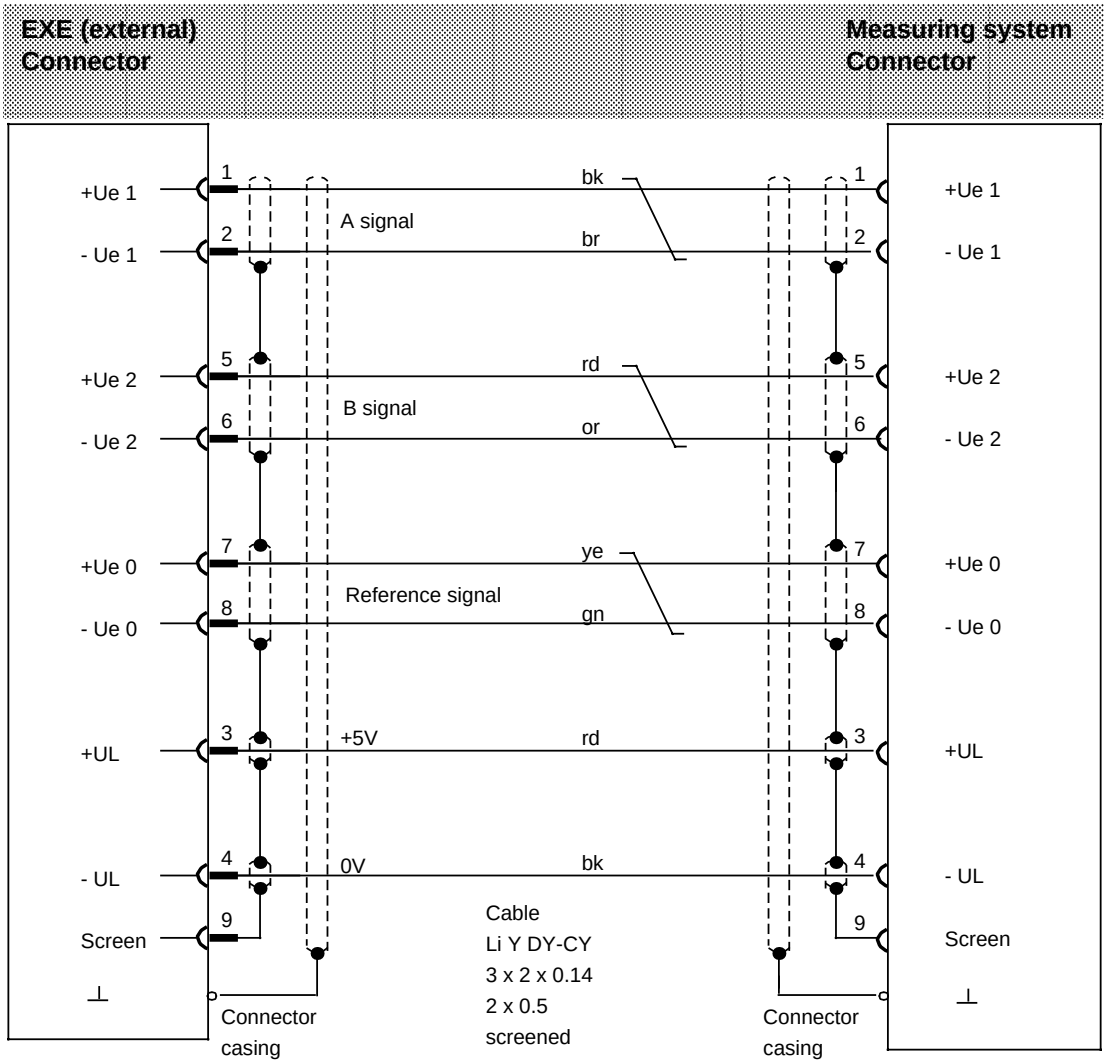
Connector
12-way, pin
Souriau
8.40-31-830
Connection side

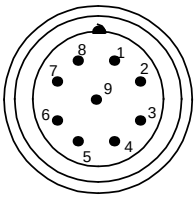
6 FC9 341 - 1AB



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



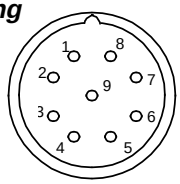


Connector
9-way, pin
SIEMENS
8 mm cable
Connection side

6 FC9 341 - 1AT

Designation: EXE

Connector coupling
9-way, socket
SIEMENS
8 mm cable
Connection side

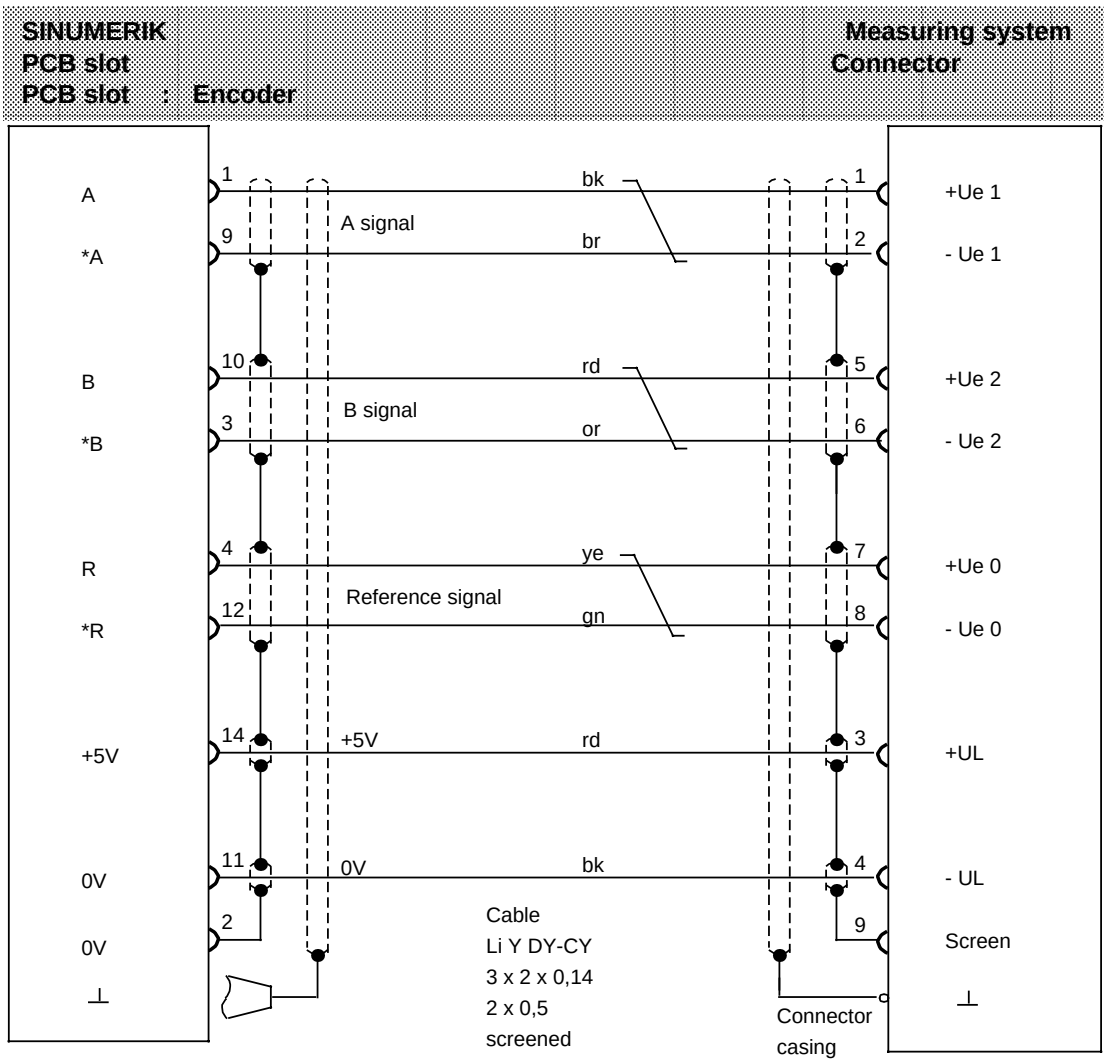


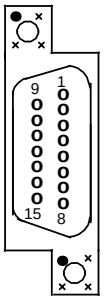
6 FC9 341 - 1EW

Designation: LINEAL

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





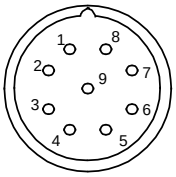
Connector

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

Connector code

● coding pin
× no coding pin

Connector coupling

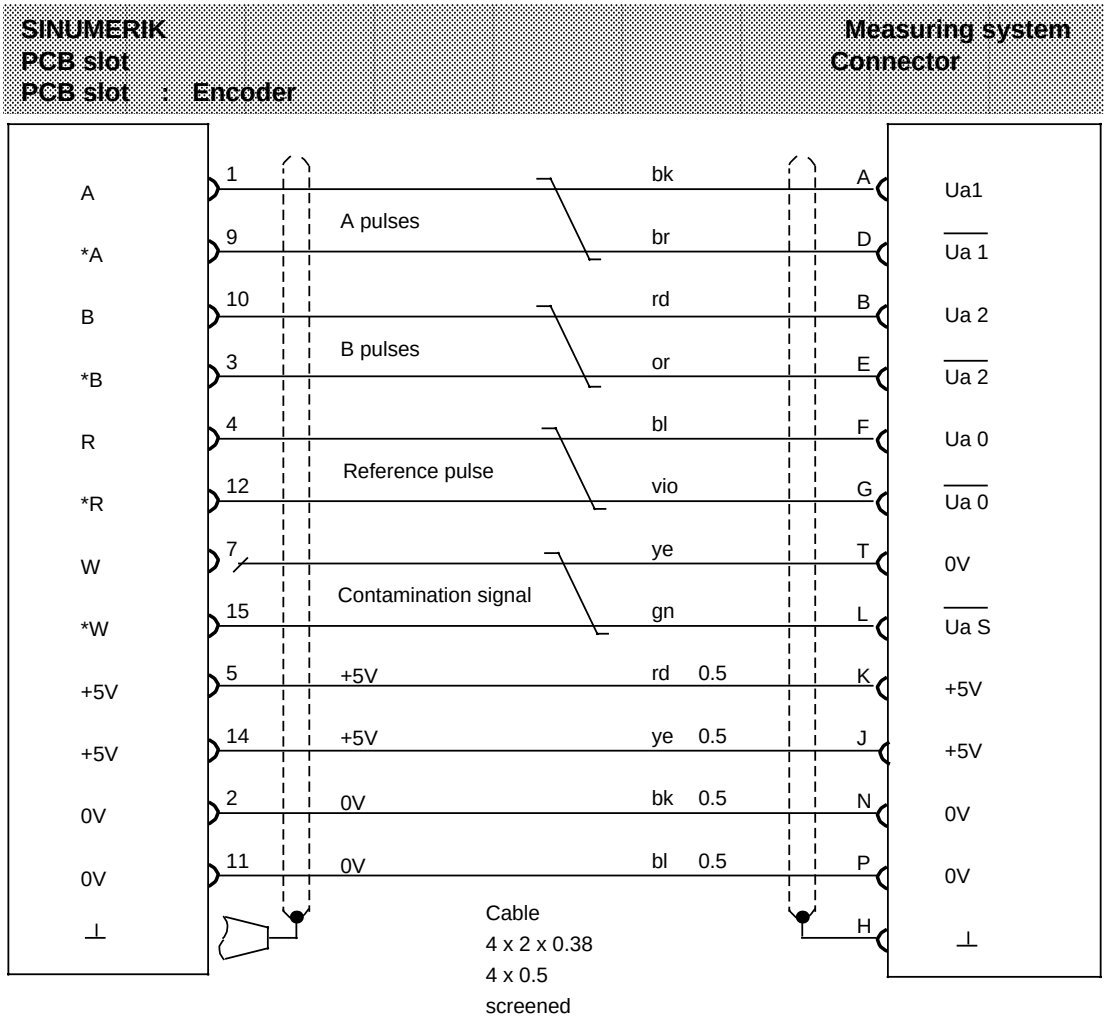


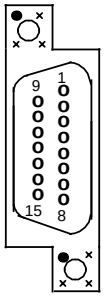
9-way, socket
SIEMENS
8 mm cable
Connection side

6 FC9 341 - 1EW

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





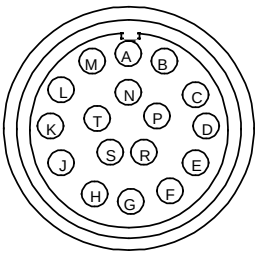
Connector
Position: 1 top
D-Sub
15-way, socket
Connection side
SINUMERIK housing
6FC9 341-1EC

Connector code

- ● coding pin
- × no coding pin

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

6 FC9 341 - 1AC

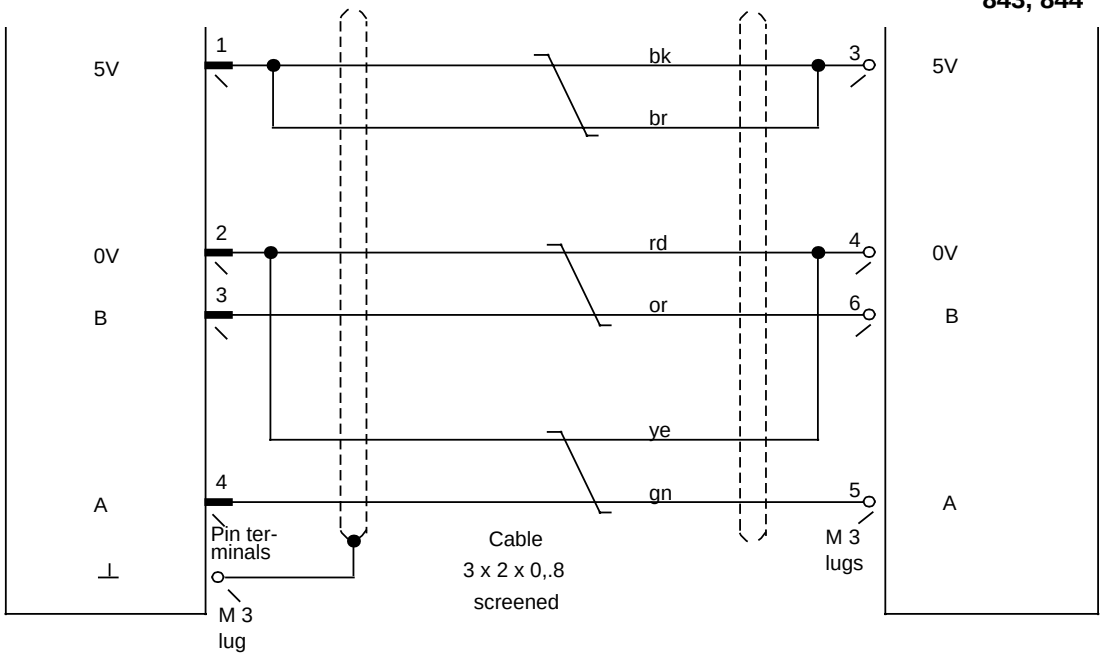


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Cable name: Electronic encoder (handwheel)
Order No.: **6FC9 340-8M**

SINUMERIK
Handwheel submodule:6 FX 1126 - 5AA
Terminal block

Handwheel
Terminals
: X02 842, 843, 844



Cable end prepared for connection

Bare wire ends 50 mm

Pin terminal +
terminal marking
on designated wires

Screen end with M3 lug

Designation: NC

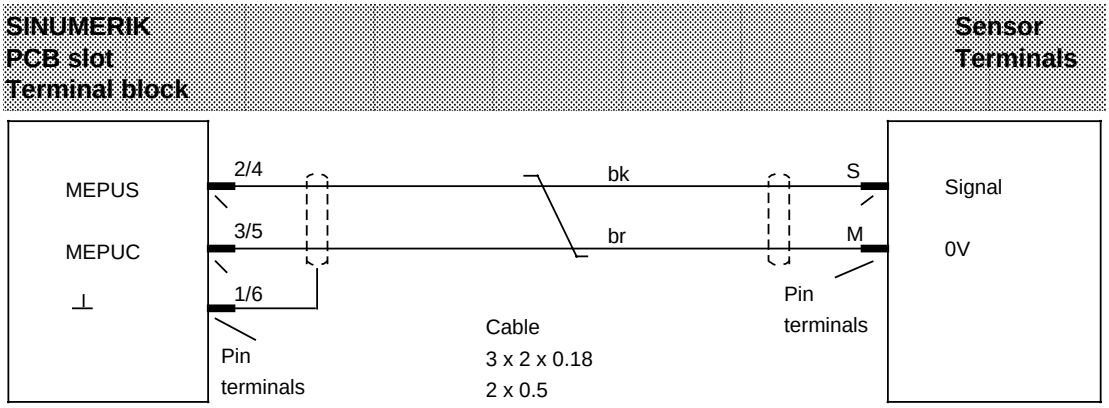
Cable end prepared for connection

Bare wire ends 50 mm

M3 lugs +
terminal marking
on designated wires

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



Cable end prepared for connection

Bare wire ends 30 mm

Pin terminal+
terminal marking
on designated wires

Designation: NC

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

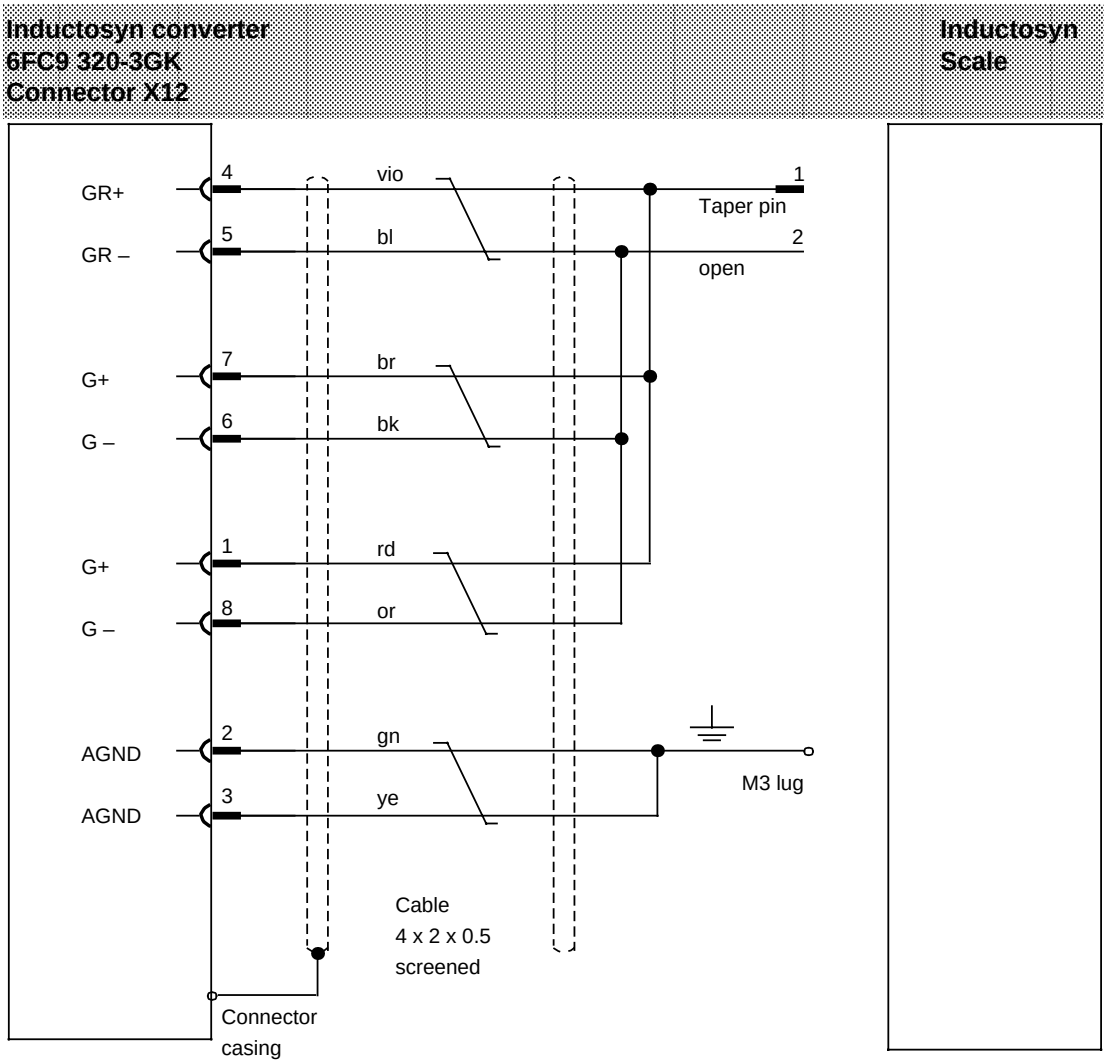
Wiring of the measurement inputs

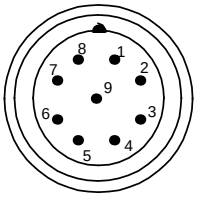
			Sensor 1				Sensor 2			
SINUMERIK 850 / 880			S1.1	S1.2	S2.1	S2.2	S1.3	S1.4	S3.1	S3.2
SINUMERIK 810 / 820			S3.1		S1.1	S2.1	S3.2		S1.2	S2.2
Situation	Edge	Level	N	P			N	P		
Open collector Relay contact	⌐	open (+5V)	*		*	*	*		*	*
	⌐	closed (0V)		*	*	*		*	*	*
TTL (5V)	⌐	+5V	*		*	*	*		*	*
	⌐	0V		*	*	*	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

* Dip-Fix closed

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





Connector
9-way, pin
SIEMENS
8 mm cable
Connection side

6 FC9 341 - 1AT

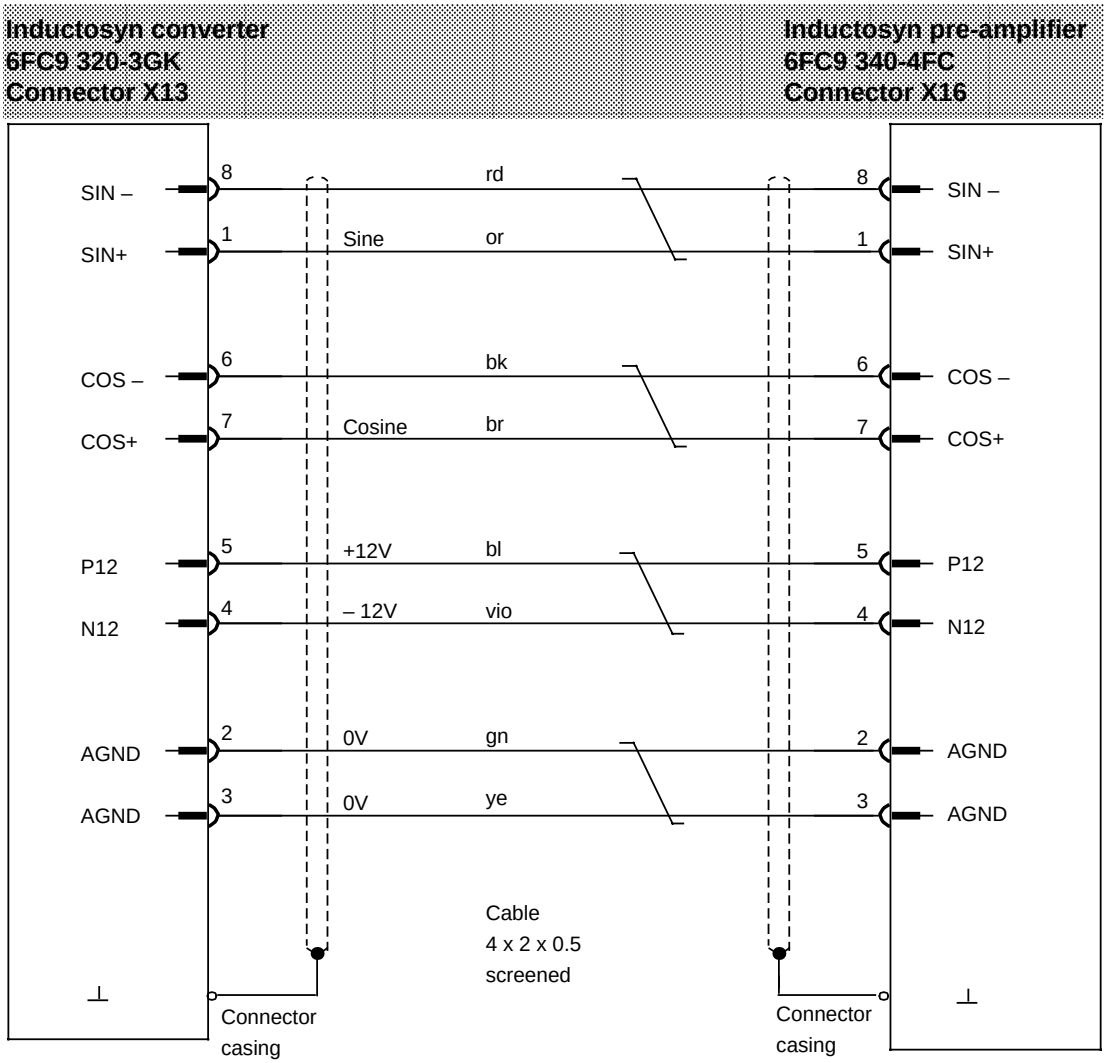
Cable end prepared for connection

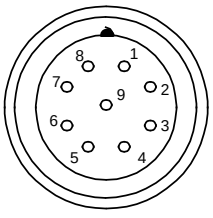
Bare wire ends
1,2 40 mm
⏚ 60 mm
Terminal marking on designated wires

Designation: SCALA

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



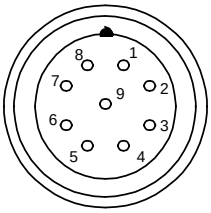


Connector
9-way, socket
SIEMENS
8 mm cable
Connection side

6 FC9 341 - 1AU

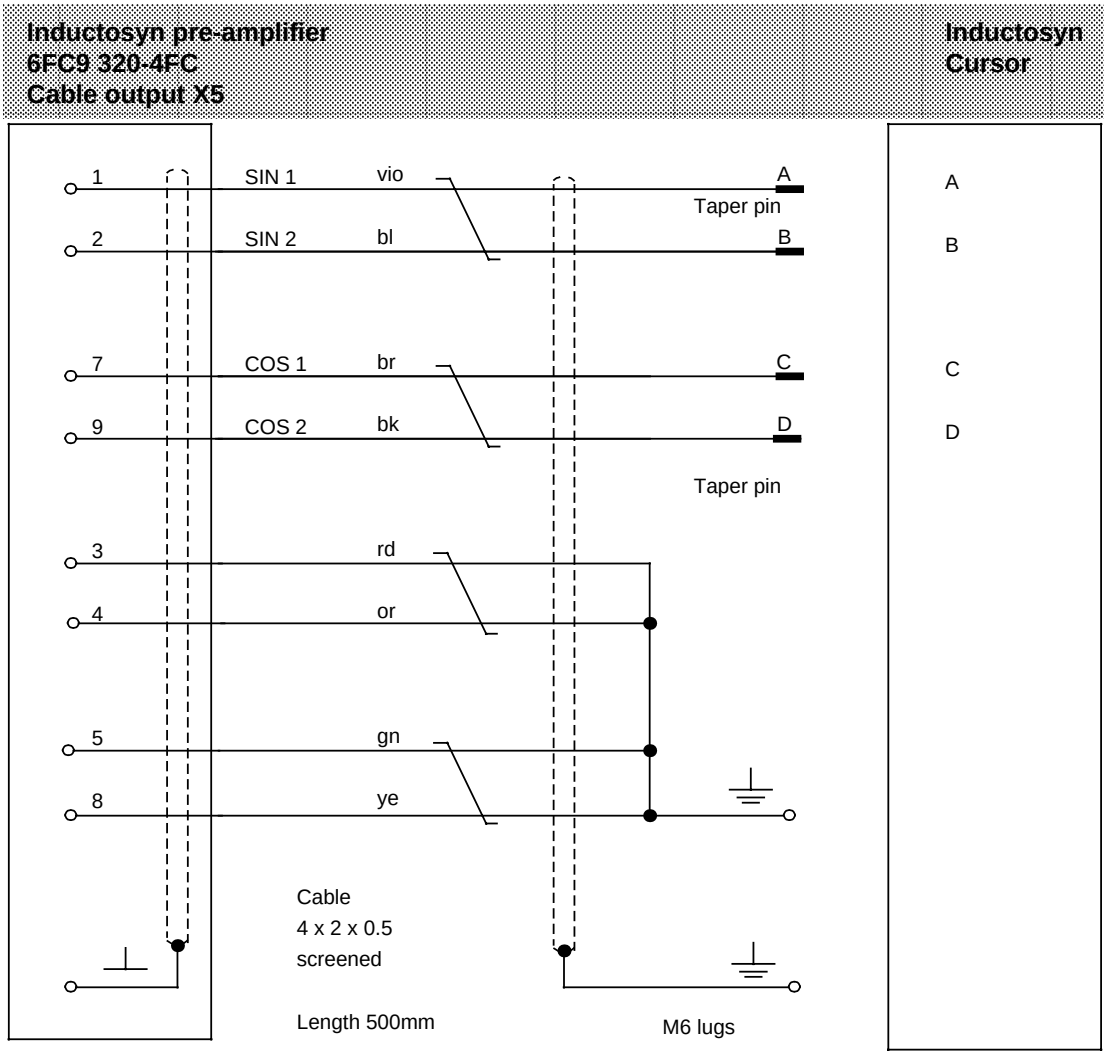
Connector
9-way, socket
SIEMENS
8 mm cable
Connection side

6 FC9 341 - 1AU



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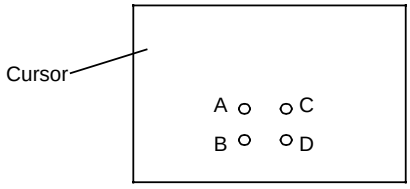
Cable name: Inductosyn cursor
Order No.: – – – – – (permanently installed on inductosyn pre-amplifier)



Cable connection fixed via gland

Cable end prepared for connection

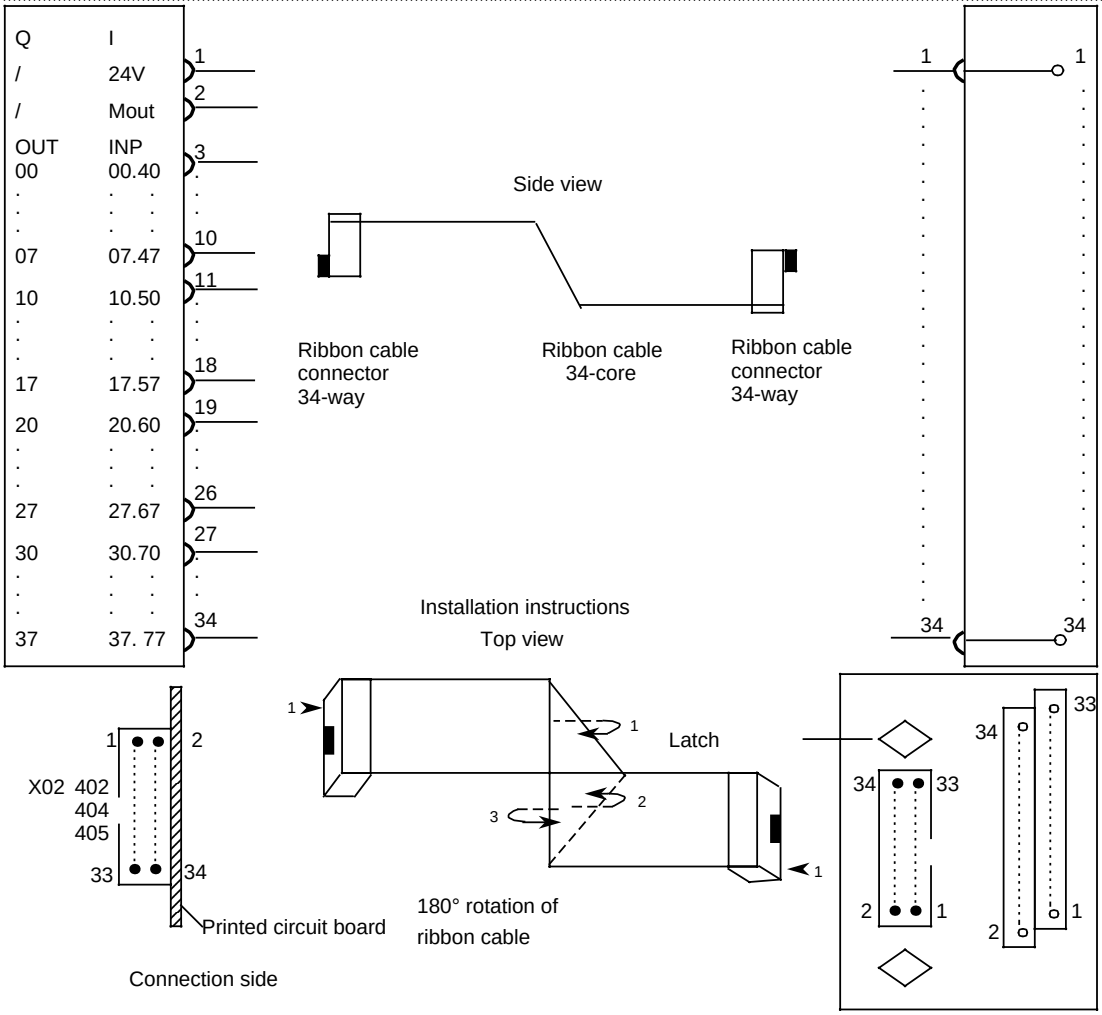
Bare wire ends
A . . . D 40 mm
⏚ 60 mm
Terminal marking on designated wires
Designation: SLIDER



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

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



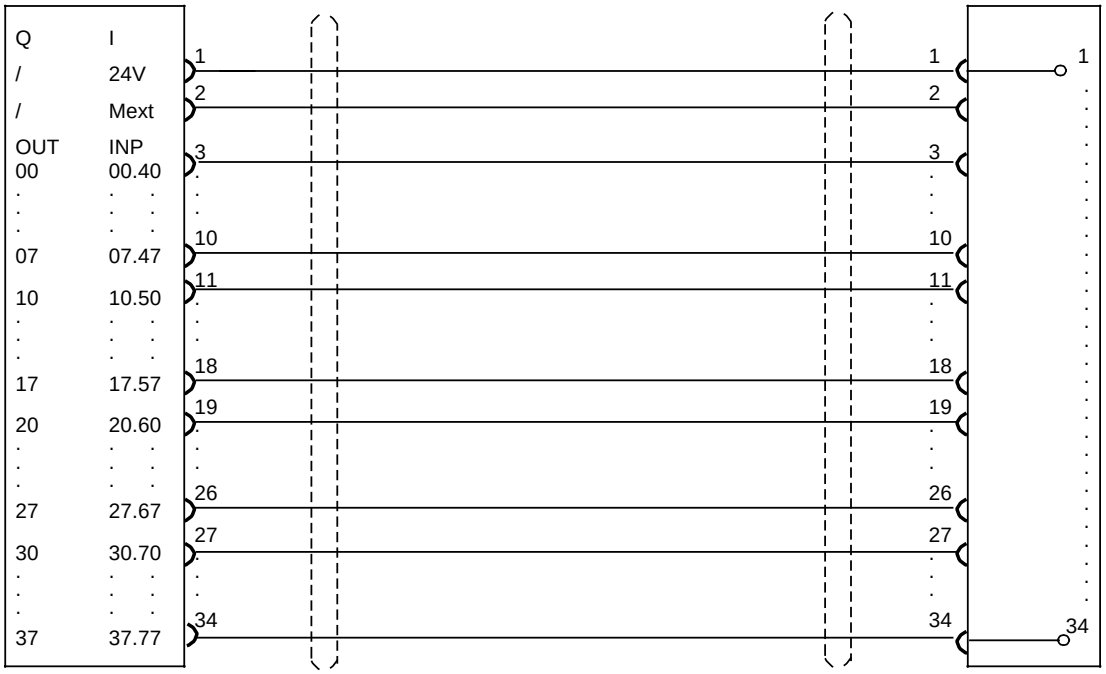
Terminal strip converter
34-core ribbon cable
Connection side
6FC9 302-2AA (without LED)
6FC9 302-2AB (with LED)

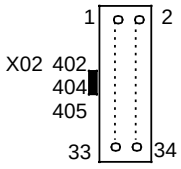
I/O sub-module No.	Rot. switch position		PLC outputs connector X02 402 OUT 00 . . . 37	PLC inputs connector X02 404 INP 00 . . . 37	PLC inputs connector X02 405 INP 40 . . . 77	PLC inputs connector X02 406 INP 40 . . . 51
	S1	S2				
1	0	0	Q64.0 . . . 67.7	I64.0 . . . 67.7	I68.0 . . . 71.7	I68.0 . . . 69.1
2	1	1	Q68.0 . . . 71.7	I72.0 . . . 75.7	I76.0 . . . 79.7	I76.0 . . . 77.1
3	2	2	Q72.0 . . . 75.7	I 80.0 . . . 83.7	I84.0 . . . 87.7	I84.0 . . . 85.1
4	3	3	Q76.0 . . . 79.7	I88.0 . . . 91.7	I92.0 . . . 95.7	I92.0 . . . 93.1

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

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

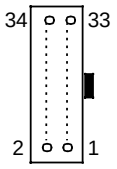




Connector
Honda
MFC 34 LH/HF
34-way socket
Crimp contacts
Connection side
6FC9 341-2AD

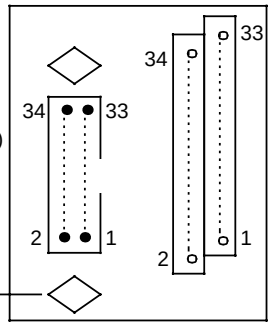
Cable
21 x 2 x 0.18
(screened)
4 pairs unassigned

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-dt	23	br-ye	33	gn-bl
4	or	14	wh-or	24	br-gn	34	gn-vio
5	ye	15	ws-ye	25	br-bl		
6	gn	16	wh-gn	26	br-vio		
7	bl	17	wh-bl	27	br-gr		
8	vio	18	wh-vio	28	br-wh		
9	gr	19	wh-gr	29	gn-bk		
10	wh	20	br-bk	30	gn-br		

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



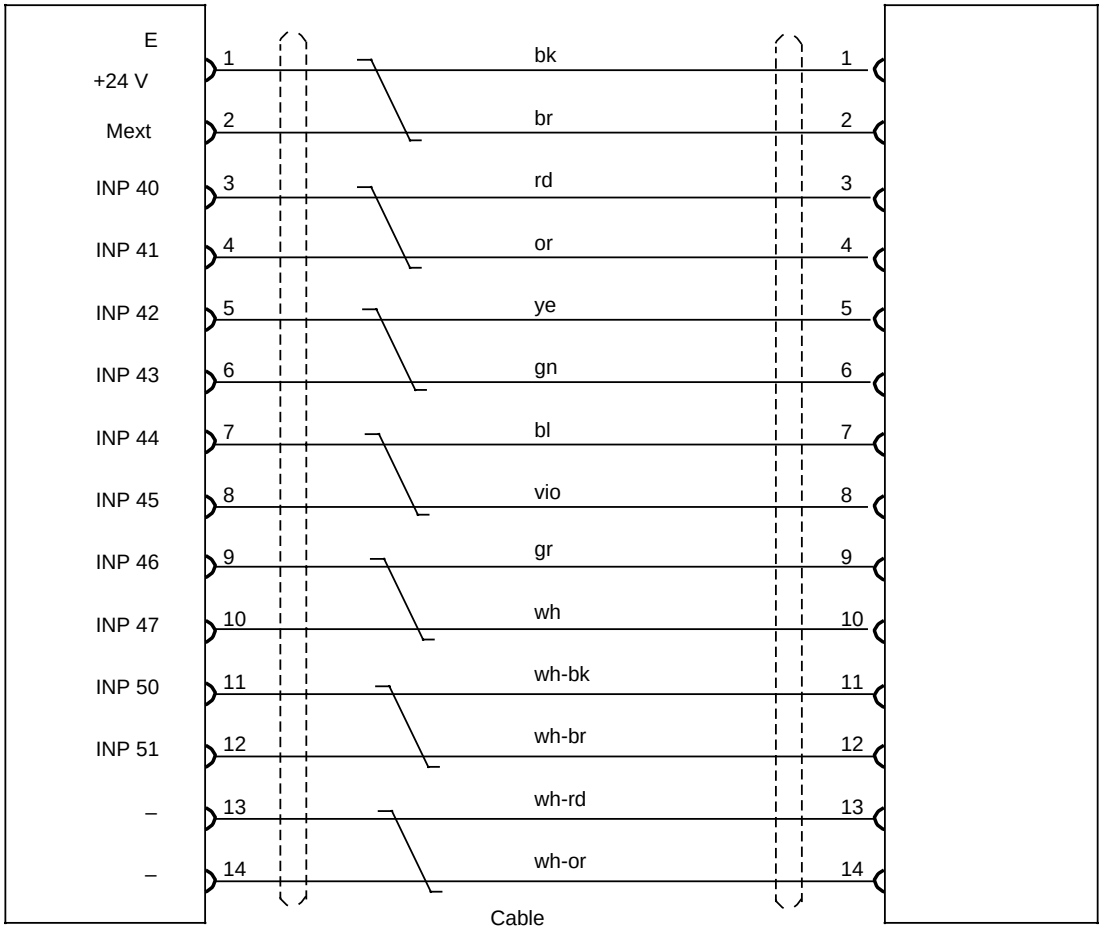
I/O sub-module No.	Rot. switch position		PLC outputs connector X02 402	PLC inputs connector X02 404	PLC inputs connector X02 405	PLC inputs connector X02 406
	S1	S2	OUT 00 . . . 37	INP 00 . . . 37	INP 40 . . . 77	INP 40 . . . 51
1	0	0	Q64.0 . . . 67.7	I64.0 . . . 67.7	I68.0 . . . 71.7	I68.0 . . . 69.1
2	1	1	Q68.0 . . . 71.7	I72.0 . . . 75.7	I76.0 . . . 79.7	I76.0 . . . 77.1
3	2	2	Q72.0 . . . 75.7	I 80.0 . . . 83.7	I84.0 . . . 87.7	I84.0 . . . 85.1
4	3	3	Q76.0 . . . 79.7	I88.0 . . . 91.7	I92.0 . . . 95.7	I92.0 . . . 93.1

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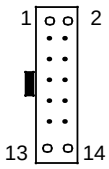
Cable name: Machine control panel I/O submodule, round cable

Order No.: **6FC9 344-3W**

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

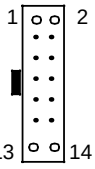


Cable
8 x 2 x 0.18
screened
1 pair unassiged



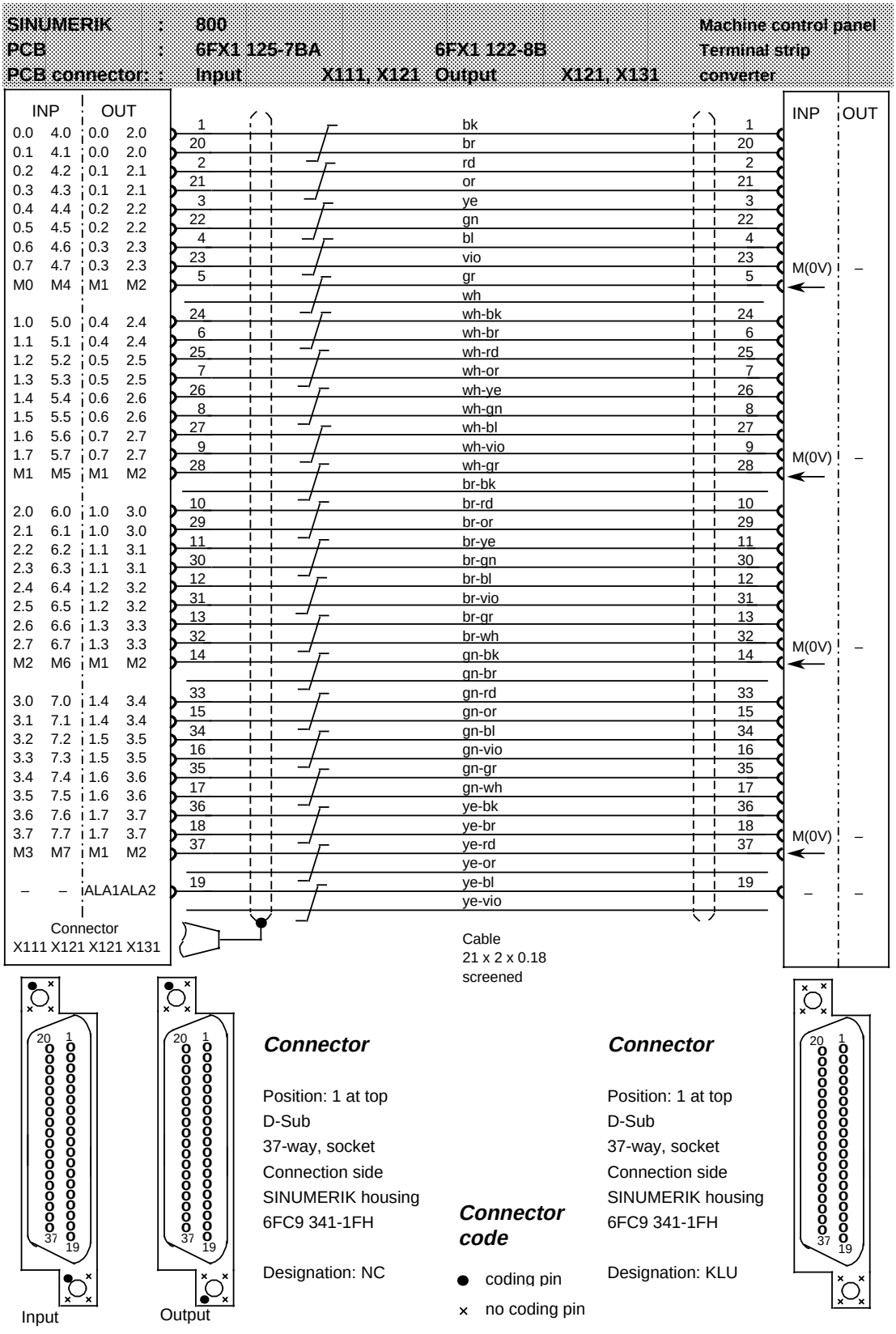
Connector
Honda
MFC 16 LH/HF mod.
14-way, socket
Crimp contacts
Connection side
6FC9 341-1HF

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



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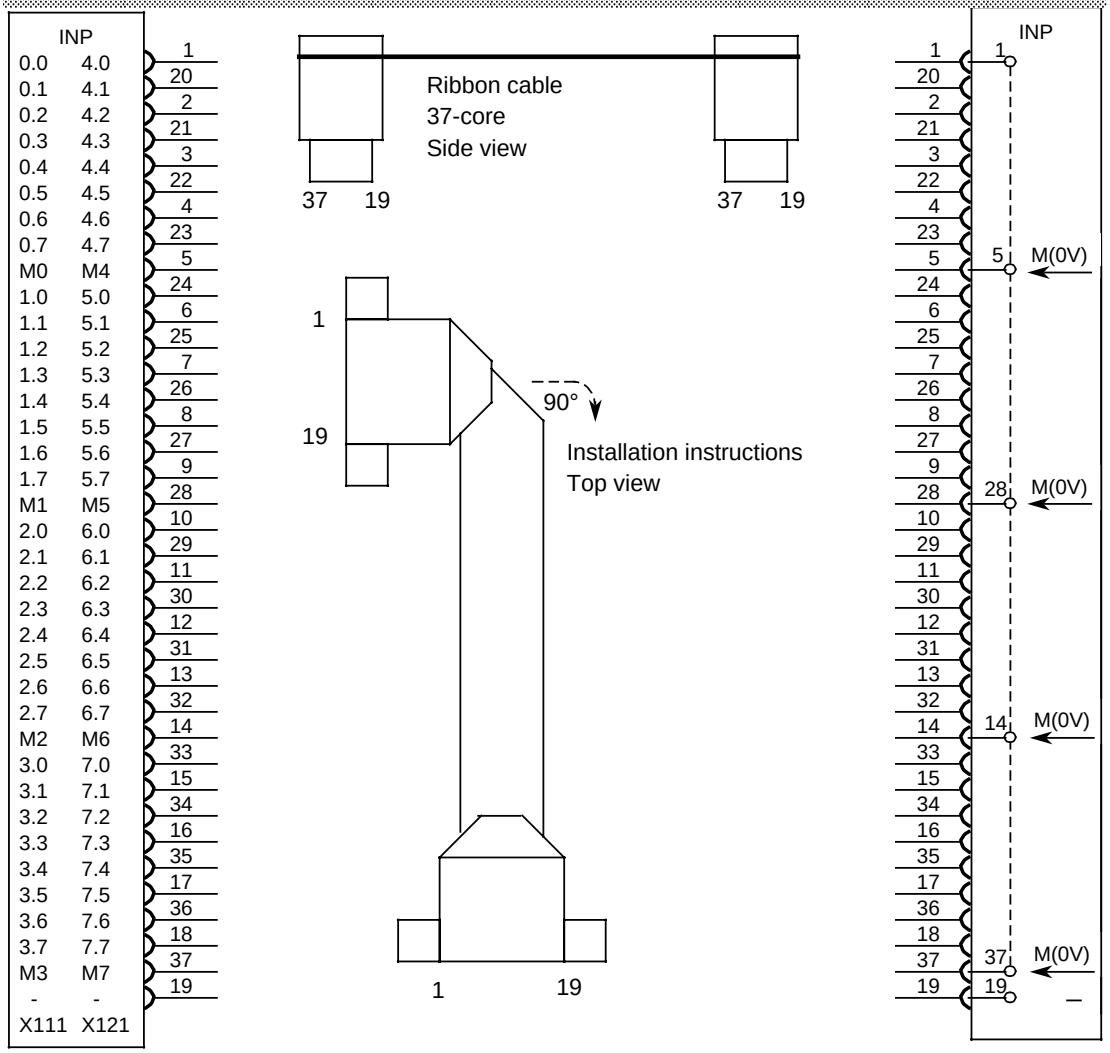
Cable name: Machine control Input/output
Order No.: **6FC9 344-1U** **Input**
6FC9 344-1V **Output**

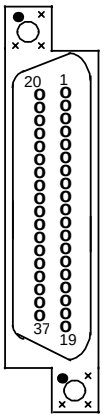


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Cable name: Machine control input (ribbon cable)
Order No.: **6FC9 344-2T**

SINUMERIK : 880 **Machine control panel**
PCB : 6FX1 125-7BA **Terminal strip converter**
PCB connector : Input X111, X121





Ribbon cable connector
Position: 1 at top
D-Sub
37-way, socket
Connection side
SINUMERIK housing
6FC9 341-1FX

Designation: NC

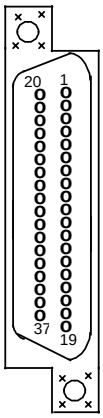
Connector code

● coding pin

× no coding pin

Ribbon cable connector
Position: 1 at top
D-Sub
37-way, socket
Connection side
SINUMERIK housing
6FC9 341-1FX

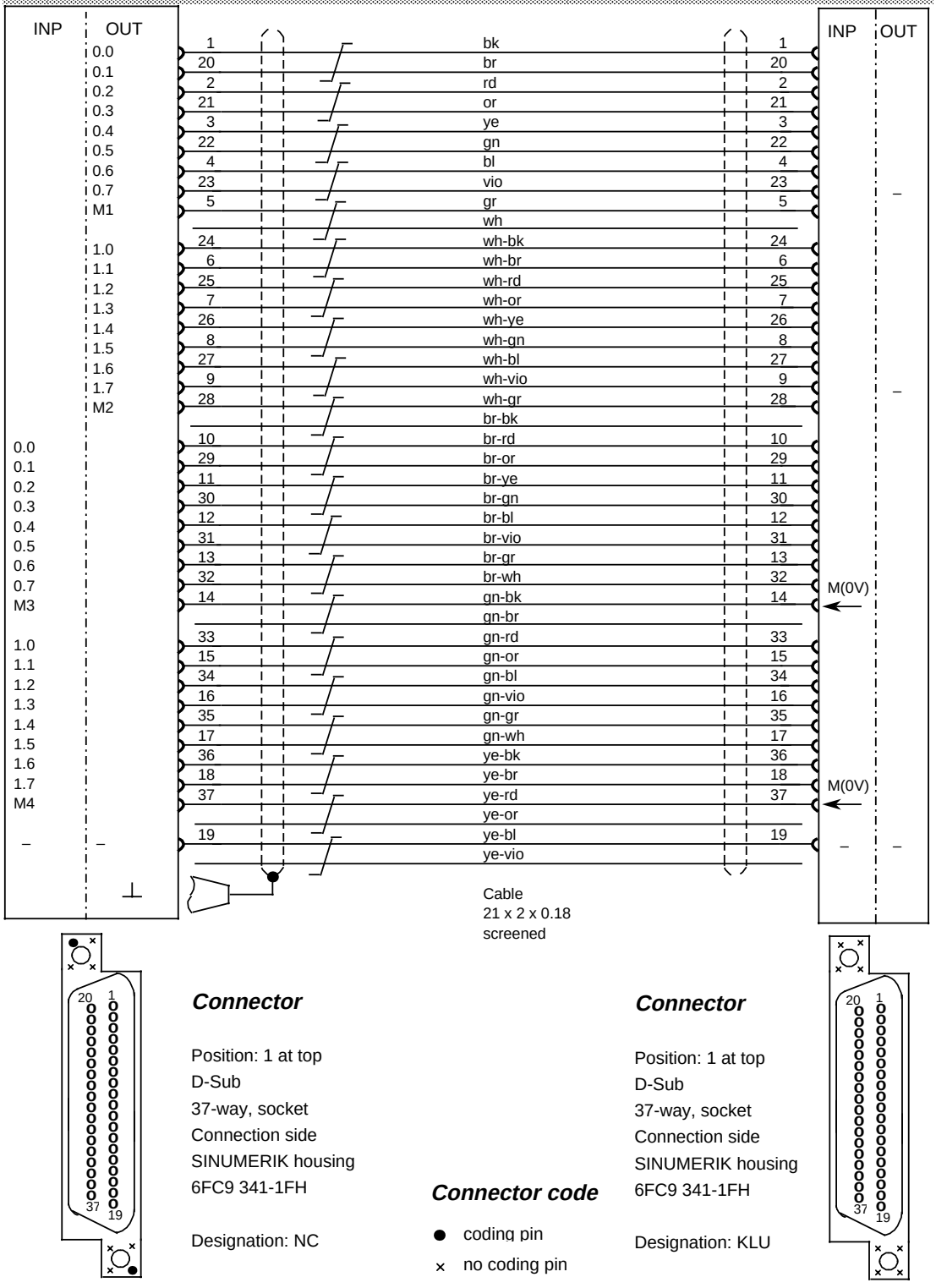
Designation: KLU



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Cable name: Machine control, mixed input/output
Order No.: **6FC9 344-3X**

SINUMERIK : 800 — **Machine control panel**
PCB : 6FX1 138-4BA — **Terminal strip converter**
PCB connector : X121



Connector

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

Designation: NC

Connector code

● coding pin
× no coding pin

Connector

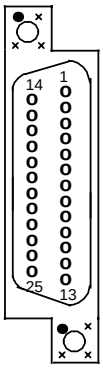
Position: 1 at top
D-Sub
37-way, socket
Connection side
SINUMERIK housing
6FC9 341-1FH

Designation: KLU

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Cable name: MPC interface (plastic optical fibre conductor)
Order No.: **6FX 1400 -**

SINUMERIK	**: 880**			**880**	**:**
PCB slot	**: B3**			**A 4**	**: PCB slot**
PCB connector	**: X111**			**X111**	**: PCB connector**
SDO1	17	LWL	21		SDI1
* SDO1	18		22		* SDI1
SDI1	21	LWL	17		SDO1
* SDI1	22		18		* SDO1
SDI2	23		23		SDI2
* SDI2	24		24		* SDI2
SDI2-FOL	12		12		SDI2-FOL
SDO2-FOL	4		4		SDO2-FOL
* SDO2	20		20		* SDO2
SDO2	19		19		SDO2

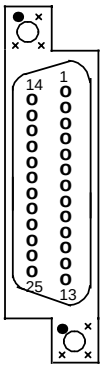


Connector

Position: 1 at top
D-sub
25-way socket
Connection side
SINUMERIK housing

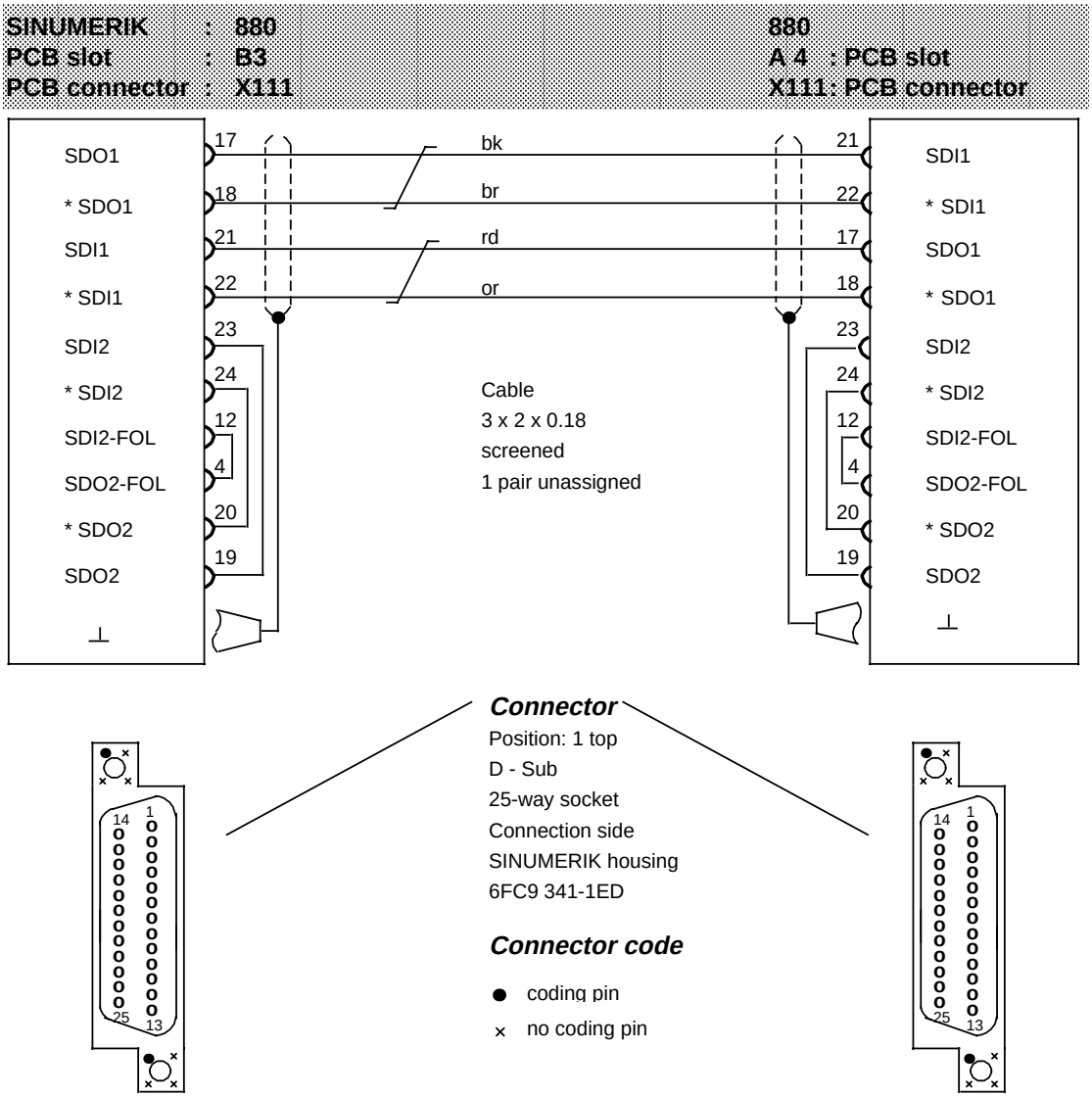
Connector code

● coding pin
× no coding pin



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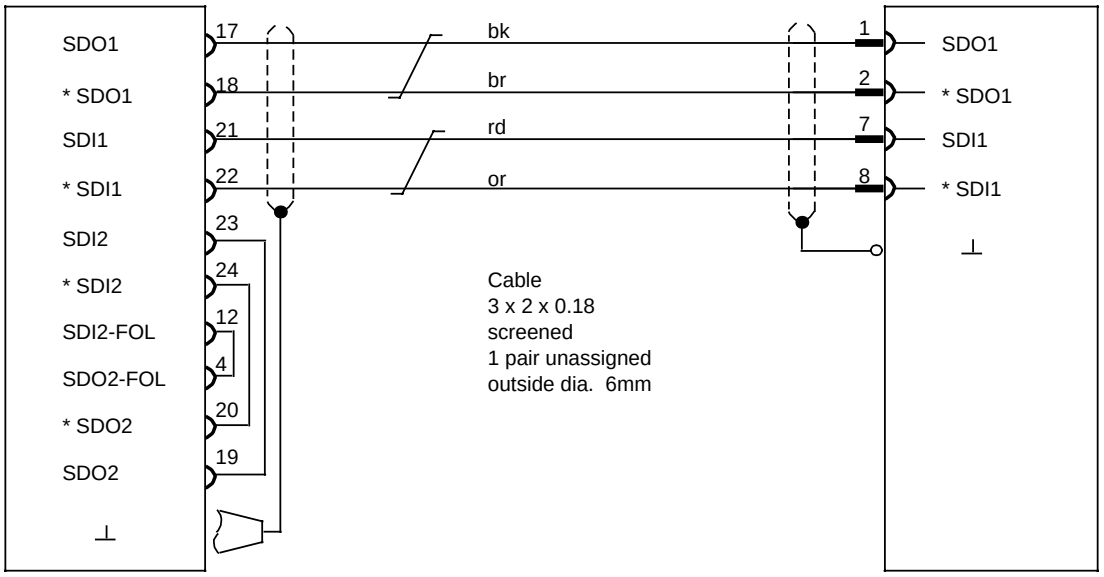
Cable name: MPC interface(Cu-L)
Order No.: **6FC9 344-2A**

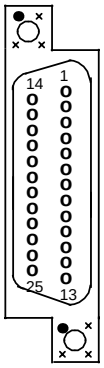


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Cable name: MPC interface (Cu-L) with disconnection points, left part cable
Order No.: **6FC9 344-2RZ**

SINUMERIK	**:**	**850**	**880 A1, 2, 3**	**880 A4, 5**	**Disconnection point 1**
PCB slot	**:**	**B3**	**B2**	**B3**	
PCB connector	**:**	**X111**	**X111**	**X111**	

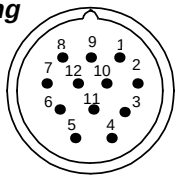




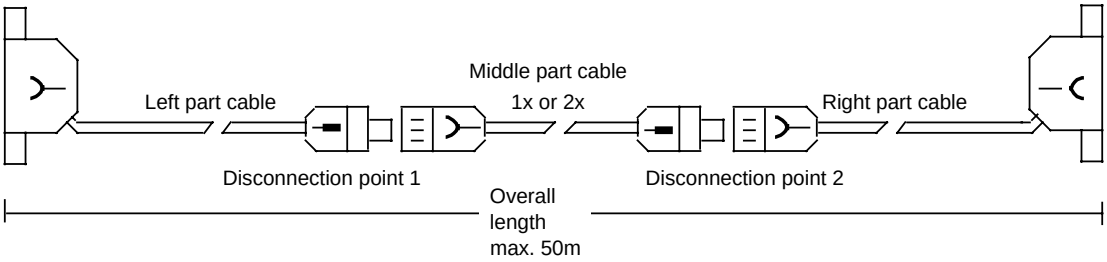
Connector
Position: 1 top
D - Sub
25-way socket
Connection side
SINUMERIK housing
6FC9 341-1ED

Connector code
● coding pin
× no coding pin

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



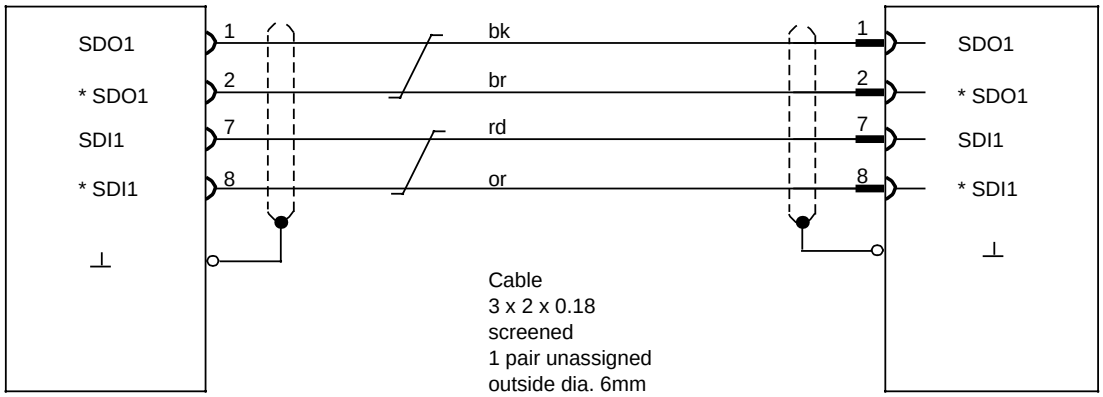
Complete cable configuration

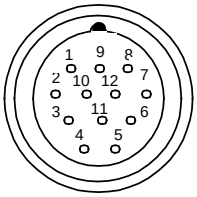


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Cable name: MPC interface (Cu-L) with disconnection points, middle part cable
Order No.: **6FC9 344-2RZ**

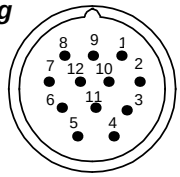
Disconnection point 1	**Disconnection point 2**





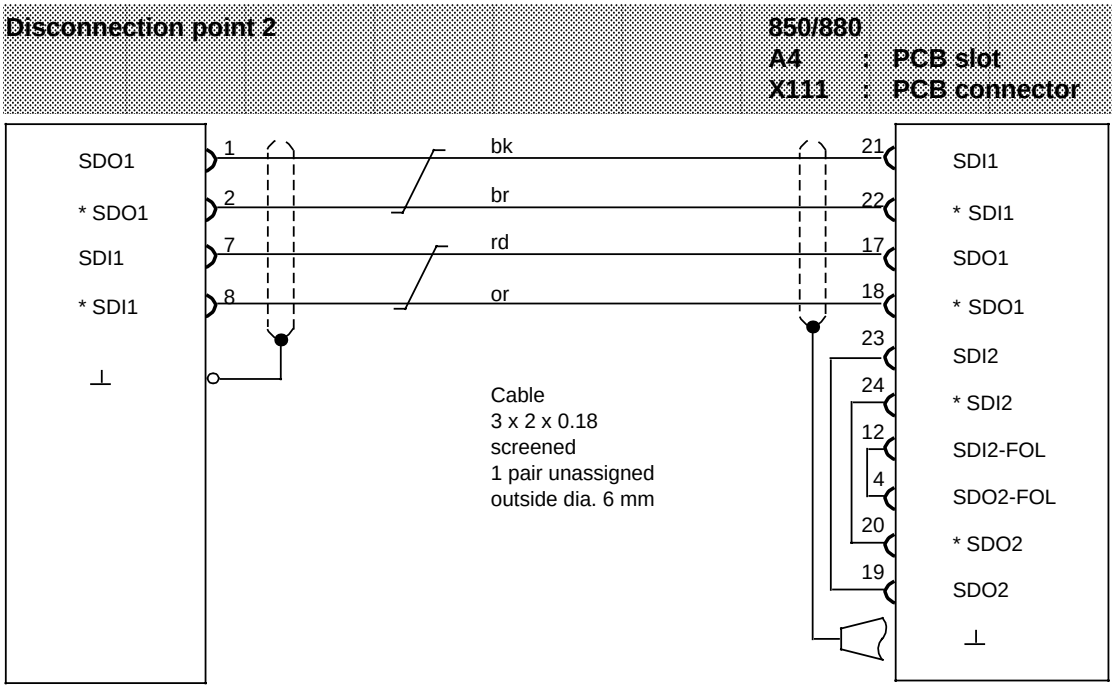
Connector
12-way, socket
SIEMENS
6 mm cable dia.
Connection side
6 FC9 341 - 1FT

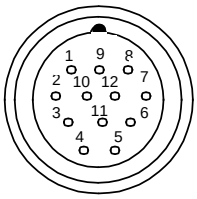
Connector coupling
12-way, pin
SIEMENS
6 mm cable dia.
Connection side
6 FC9 341 - 1FS



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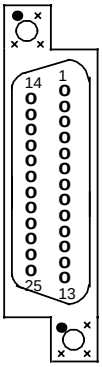
Cable name: MPC interface (Cu-L) with disconnection points, right part cable
Order No.: **6FC9 344-2RZ**





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

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



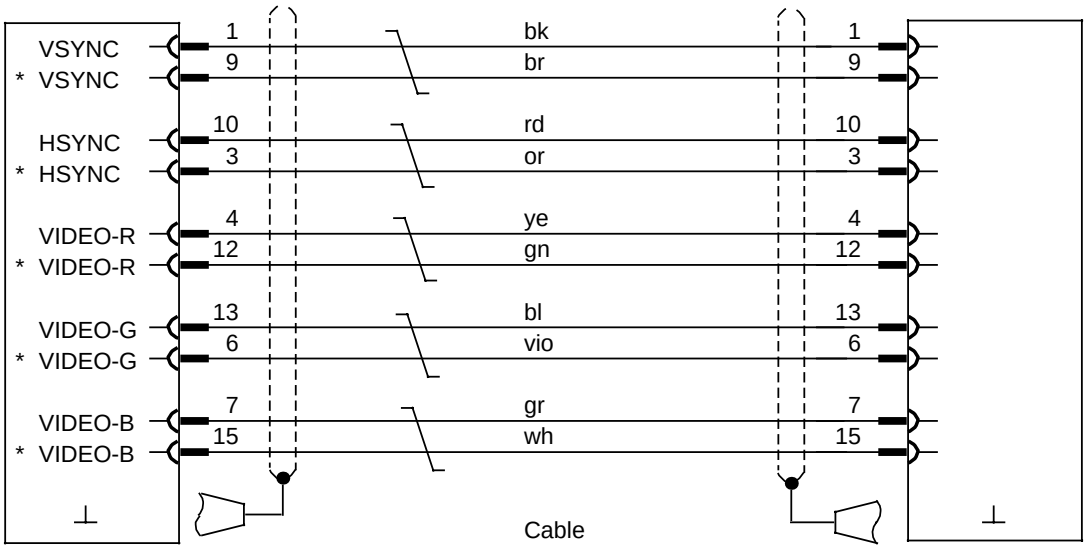
Connector code

● coding pin
× no coding pin

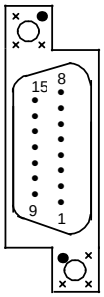
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Cable Name: 2nd/3rd operator panel, monitor encoder
Order No.: **6FC9 344-3K**

SINUMERIK	**: 850/880**				
PCB	**: 6FX1 143-2BA**		**6FX1 143-3BA**	**:**	**PCB**
PCB connector	**: X111, X121**		**X121**	**:**	**PCB connector**

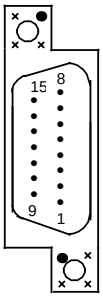


Cable
8 x 2 x 0.18
screened
3 pairs unassigned



Connector
Position: 1 at top bottom
D-Sub
15-way, pin
Connection side
SINUMERIK housing
6FC9 341-1EU

Connector
Position: 1 at top bottom
D-Sub
15-way, pin
Connection side
SINUMERIK housing
6FC9 341-1EU



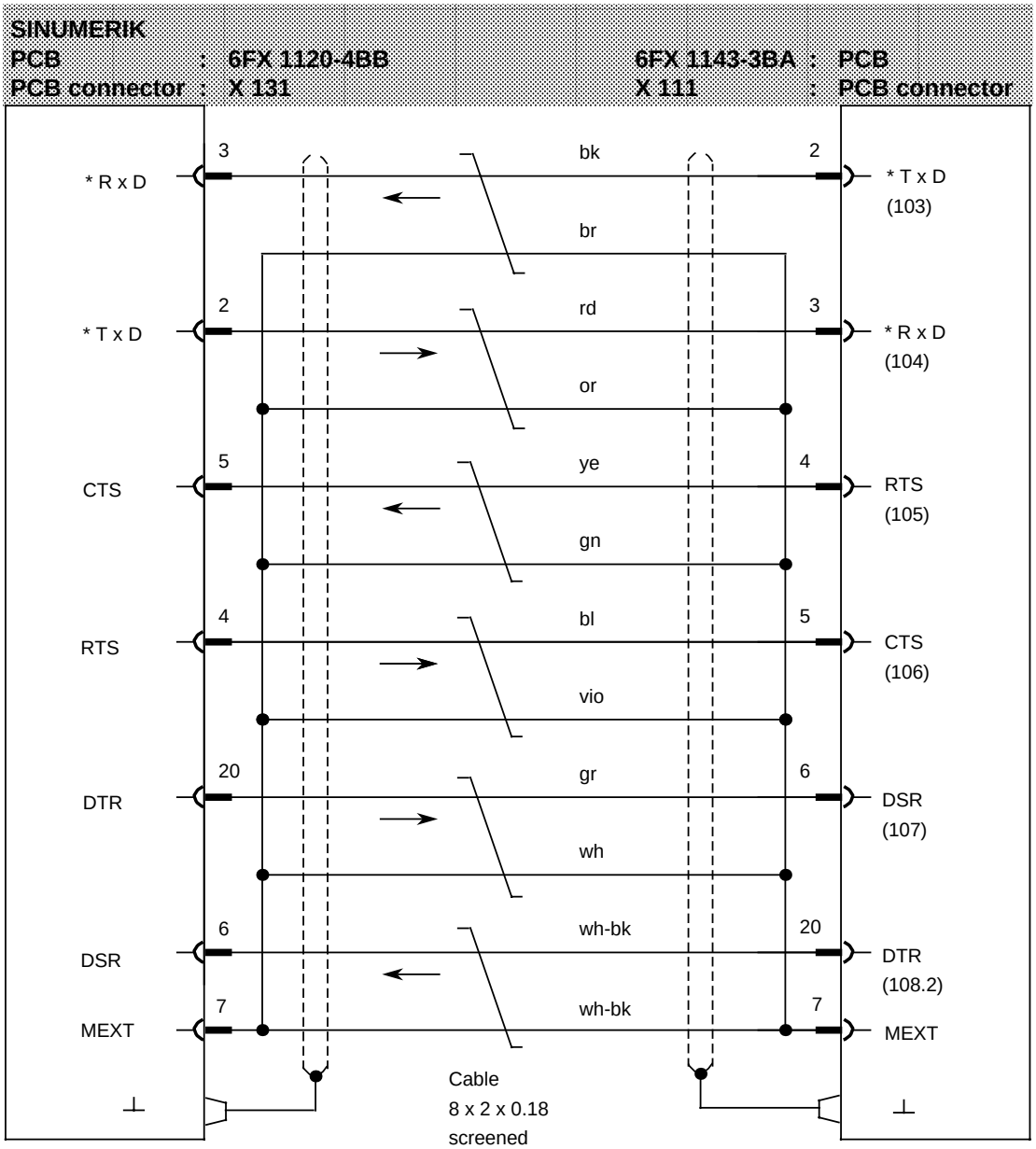
Connector code

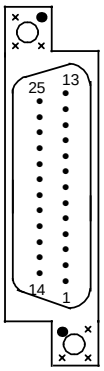
● coding pin

× no coding pin

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Cable name: 2nd/3rd operator panel, keyboard interface RS232C
Order No.: **6FC9 340-8W**

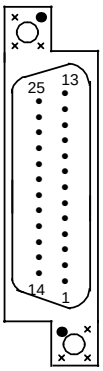




Connector
Position: 1 at bottom
D - Sub
25-way, pin
Connection side
SINUMERIK housing
6FC9 341-2AB
Designation: NC 1

Connector code
● Coding pin
× No coding pin

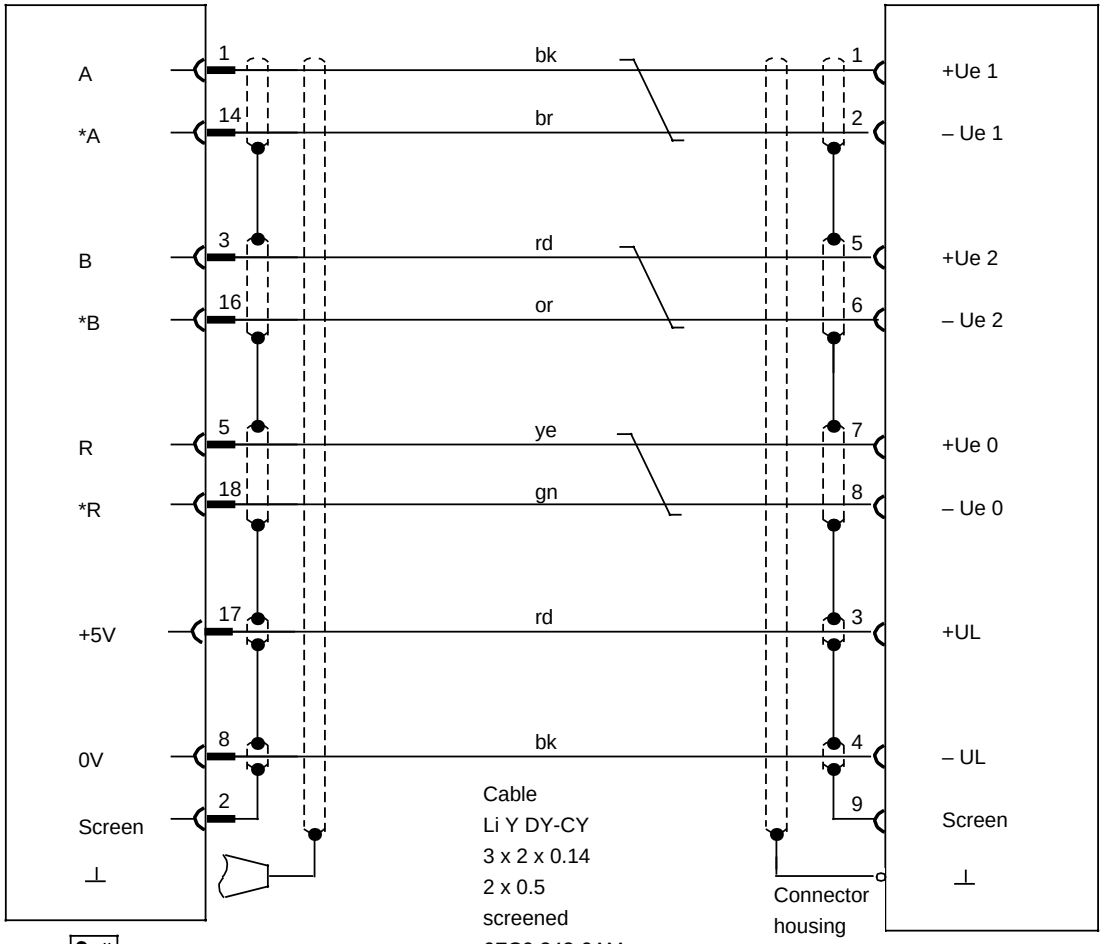
Connector
Position: 1 at bottom
D - Sub
25-way, pin
Connection side
SINUMERIK housing
6FC9 341-2AB
Designation: NC 2

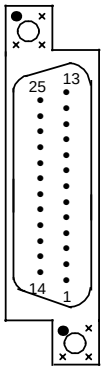


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Cable name: Digital linear measuring system (HMS)
Order No.: **6FC9 344-4L**

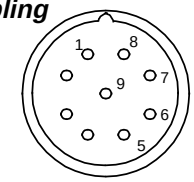
SINUMERIK **Measuring system**
PCB slot : 6FX1 145-6BA **Connector**
PCB connector : X111, X121, X131





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

Connector coupling
9-way socket
SIEMENS
8 mm cable dia.
Connection side



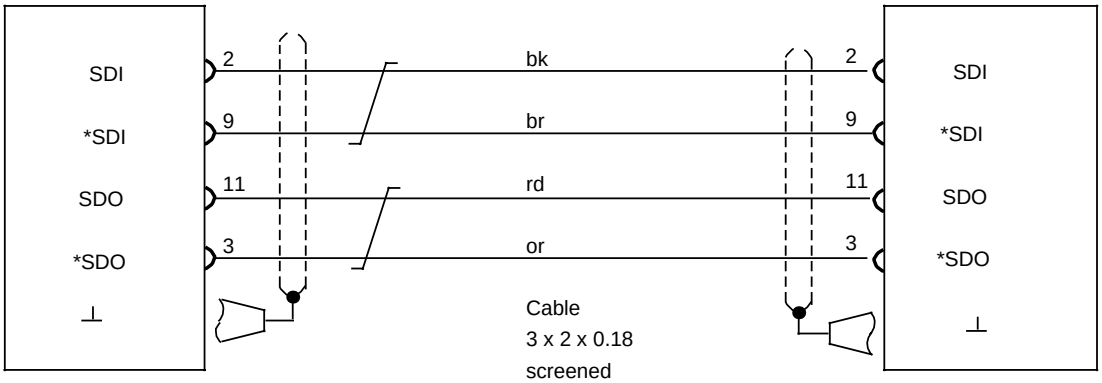
6FC9 341-1EW
Designation: LINEAL

Connector code
● coding pin
× no coding pin

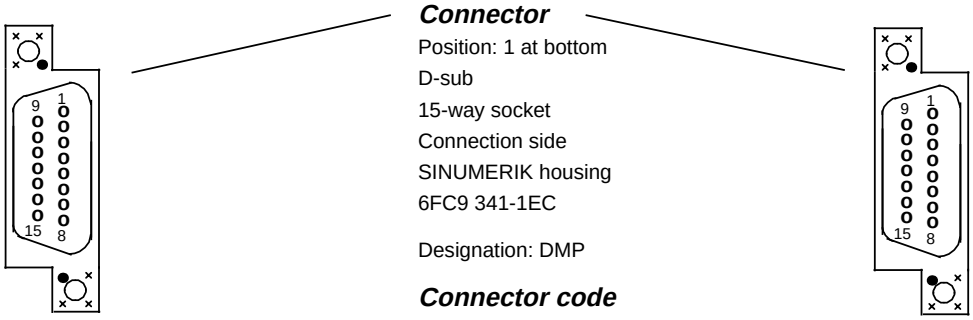
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Cable name: DMP terminal block (round cable)
Order No.: **6FC9 344-3Q**

SINUMERIK	**:**	**System 800**		**SINUMERIK**
PCB slot	**:**	**DMP-TB**		**DMP-TB : PCB slot**
PCB connector	**:**	**X21/X24**		**X21/X24 : PCB connector**



Cable
3 x 2 x 0.18
screened
1 pair unassigned
6FC9 343-0AN



Connector

Position: 1 at bottom
D-sub
15-way socket
Connection side
SINUMERIK housing
6FC9 341-1EC

Designation: DMP

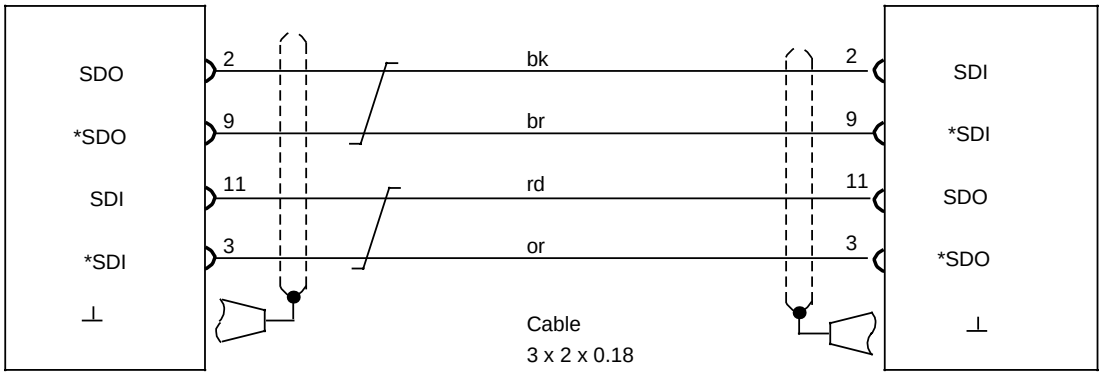
Connector code

● coding pin
× no coding pin

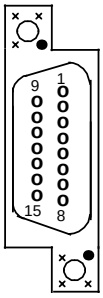
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Cable name: DMP link
Order No.: **6FC9 344-3S**

SINUMERIK	**:**	**System 800**			**SINUMERIK**
PCB slot	**:**	**Interface DMP, DMP-CPU**	**DMP-TB**	**:**	**PCB slot**
PCB connector			**X21/X24**	**:**	**PCB connector**



Cable
3 x 2 x 0.18
screened
1 pair unassigned
6FC9 343-0AN



Connector
Position: 1 at top
D-sub
15-way socket
Connection side
SINUMERIK housing
6FC9 341-1EC

Designation: NC

Connector code

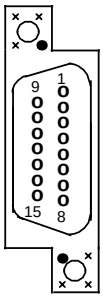
● coding pin
× no coding pin

Connector
Position: 1 at top
D-sub
15-way socket
Connection side
SINUMERIK housing
6FC9 341-1EC

Designation: NC

Connector code

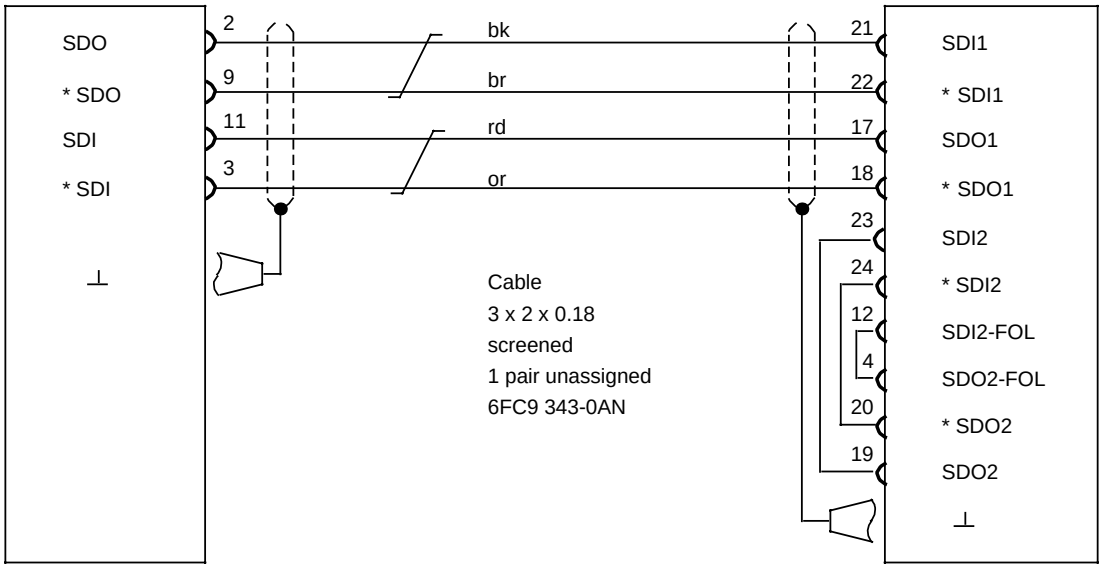
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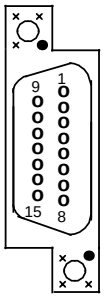


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Cable name: DMP-EU link
Order No.: **6FC9 344-3U**

SINUMERIK	**: 805**	**840**	**EU**	**:**	**SINUMERIK**
PCB slot	**: 6FX1 144-4BA**	**6FX1 144-2BA**	**6FX1 132-1BA**	**:**	**PCB slot**
PCB connector	**: X141**	**X111 . . . X141**	**X121**	**:**	**PCB connector**





Connector
Position: 1 at top
D-sub
15-way socket
Connection side
SINUMERIK housing
6FC9 341-1EC

Designation: NC

Connector code

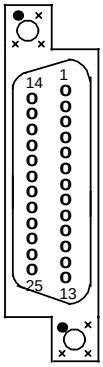
- ● coding pin
- × no coding pin

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

Designation: EU

Connector code

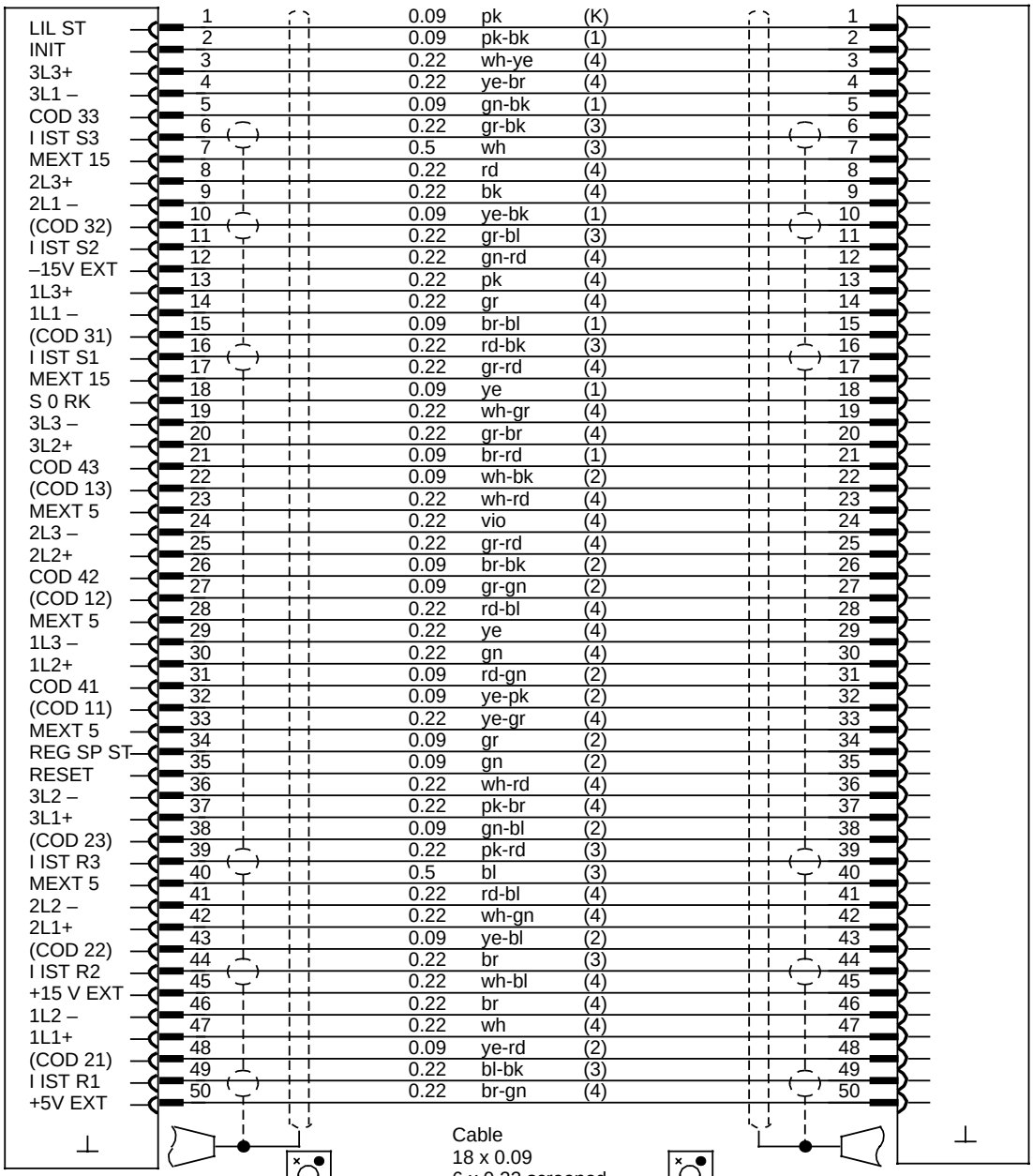
- ● coding pin
- × no coding pin



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Cable name: Servo drive ACC
Order No.: **6FC9 344-4C**

SINUMERIK	**: 880**	**SIMODRIVE**
PCB slot.	**: 6FX1 142-0BA**	**6SC 61**
PCB connector	**: X141**	**IAR**



Cable
18 x 0.09
6 x 0.22 screened
2 x 0.5
25 x 0.22 screened
1 wire unassigned
0.09 or (2)
6FC9 343-0AW

Connector
Position: 1 at bottom
D-sub
50-way pin
Connection side
SINUMERIK housing
6FC9 341-1EH

Designation: NC

Connector code
● coding pin
× no coding pin

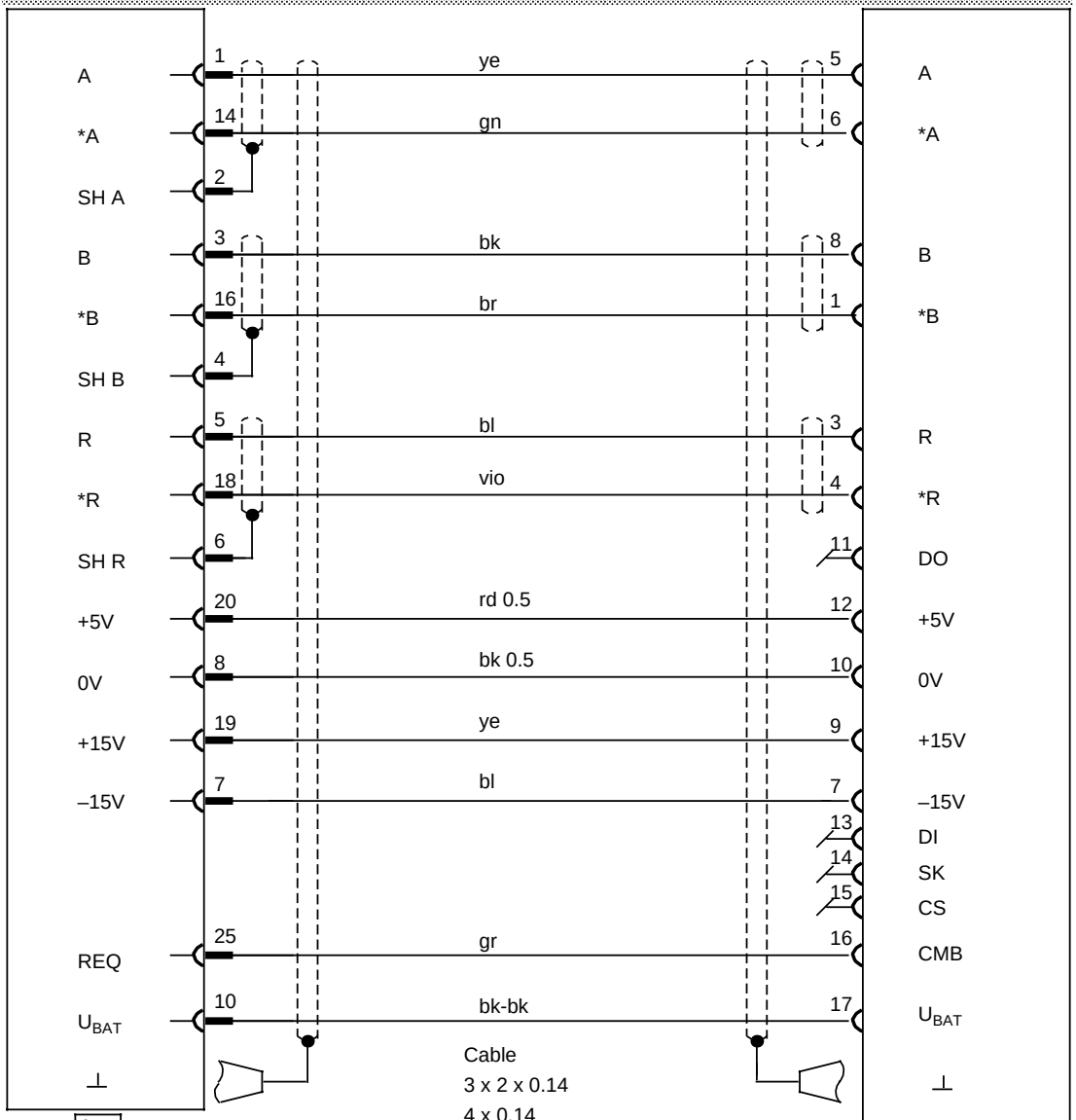
Connector
Position: 1 at bottom
D-sub
50-way pin
Connection side
SINUMERIK housing
6FC9 341-1EH

Designation: SERVO

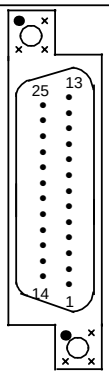
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Cable name: Rotary measuring system SIPOS
Order No.: **6FC9 344-4D**

SINUMERIK	**: 840/880**	**SIPOS**
PCB slot	**: 6FX1 145-6BA**	**Measuring system**
PCB connector	**: X111 / X121**	**Connector**



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

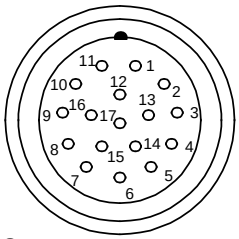


Connector
Position: 1 at bottom
D-sub
25-way pin
Connection side
SINUMERIK housing
6FC9 341-2AB
Designation: NC

Connector code
● coding pin
× no coding pin

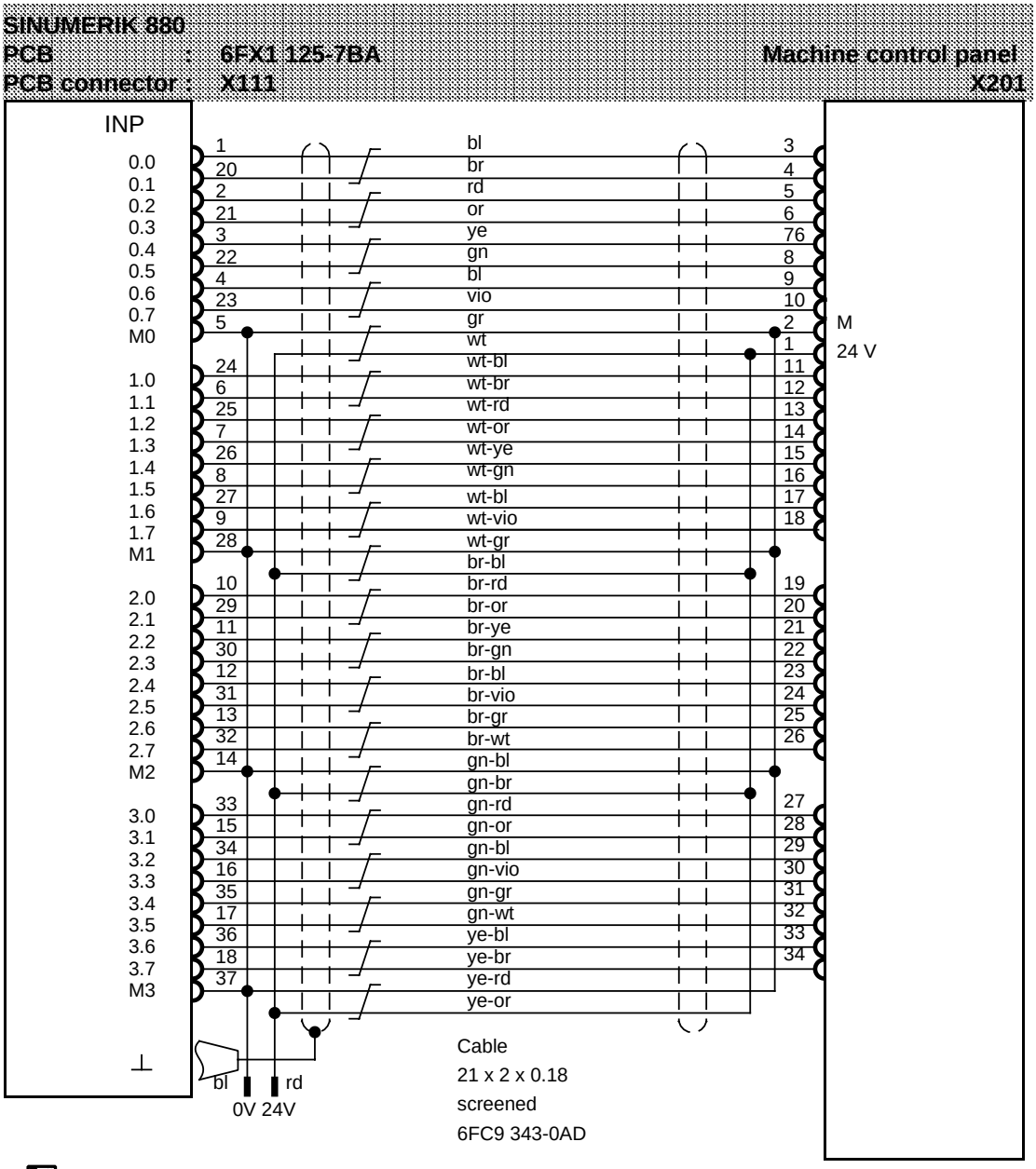
Connector
17-way socket
SIEMENS
8 mm cable dia.
Connection side

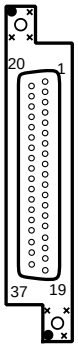
6FC9 341-1HA
Designation: SIPOS



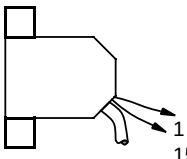
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Cable name: Machine control panel PLC, round cable
Order No.: **6FC9 344-4Q**

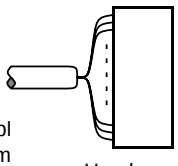




Connector
Position 1 top
D subminiature
37-way female
Connection side
SINUMERIK housing
6FC9 341-1FH
Designation: NC

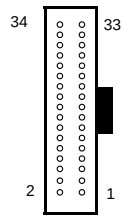


D subminiature
37-way



Honda
34-way

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



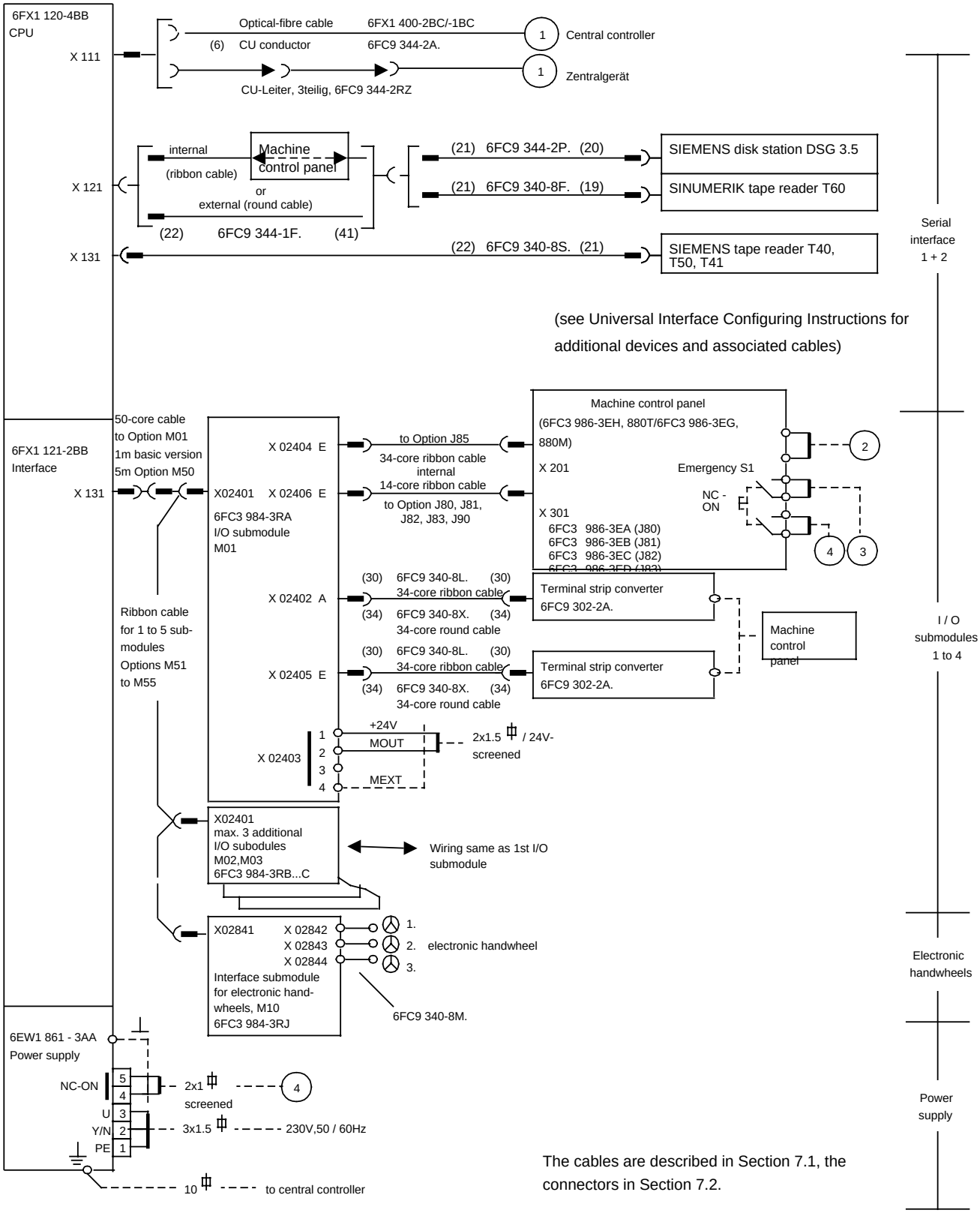
Designation: machine control panel

GA27.70

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7.5 Cable and hardware wiring diagrams

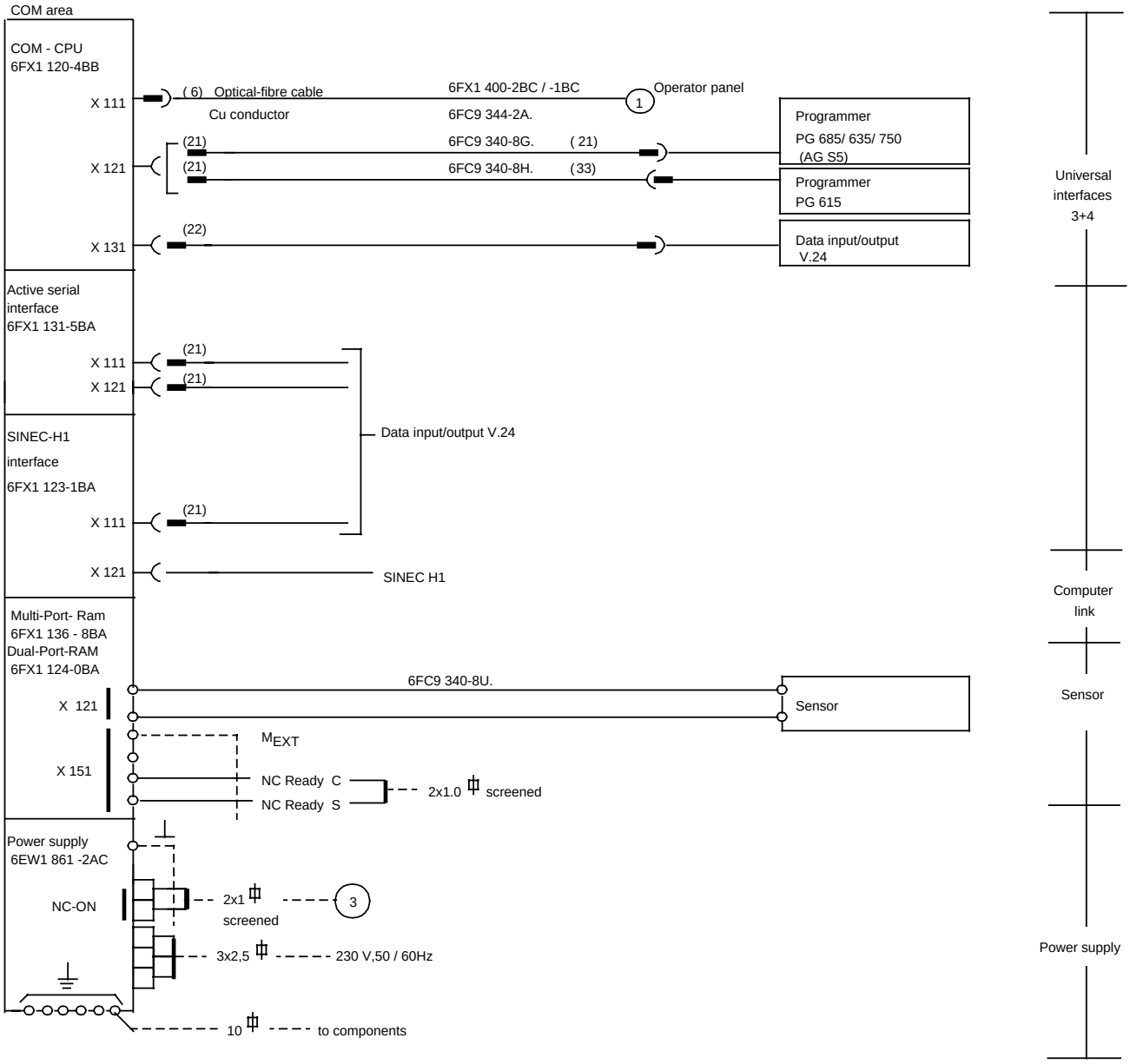
Operator panel SINUMERIK 880



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

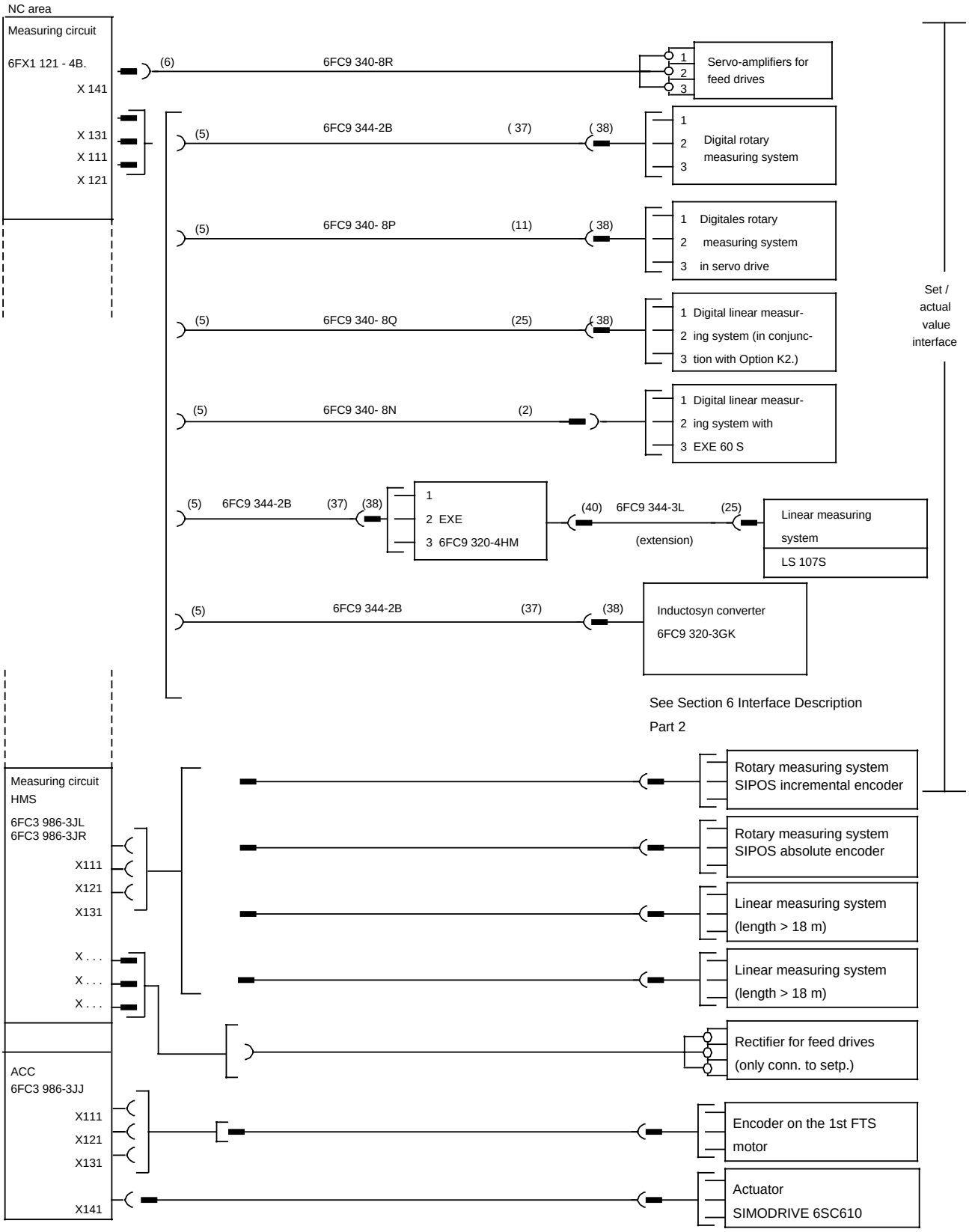
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Central controller



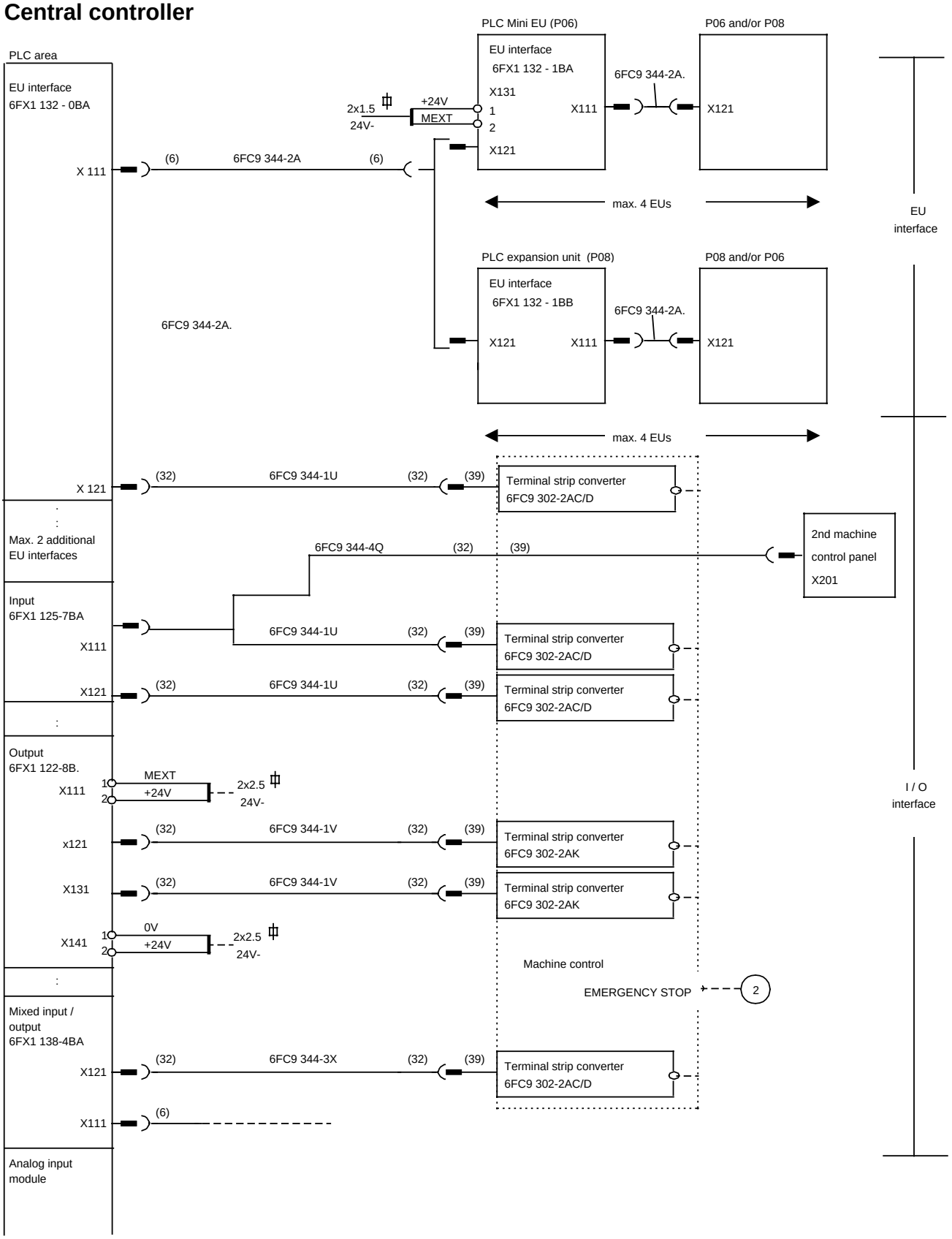
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Central controller



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Central controller



8 Terms and Abbreviations

AC
Alternating Current

ACC
Analog Current Control of the feed and leadscrew drive actuators

ASCII
American Standard Code for Information Interchange

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

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

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

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

CC
Central Controller

CNC
Computerized Numerical Control; controls with microprocessors; all controls are equipped with microprocessors these days, so CNC is synonymous with NC.

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

DC
Direct Current

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

EEC
Electrostatically endangered components

EIA
Electronic Industries Association

ENABLE
Enable signal or enable input

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

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EU
Expansion Unit

EXE
External pulse shaper electronics

FB
Function Block in the PLC

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

HMS
High-resolution Measuring System, used for actual value preparation of current or voltage unconditioned signals from position encoders.

IB
Input Byte

IM
Interface Module

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

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

ISO
International Organization for Standardization

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

LCD
Liquid Crystal Display

LED
Light Emitting Diode

MD
Machine Data

NC
Numerical Control

Override
Correction or modification of programmed values by manually operated step switch

PCB
Printed Circuit Board

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PLC
Programmable Logic Control

PRESET
Setting of actual value

PS
Power Supply

QB
Output Byte

RAM
Random Access Memory; read-write memory

RESET
Reset, delete

Resolver
Electromagnetic position transducer for indirect analog position measurement

ROM
Read Only Memory

SPC
Stored Program Control

SPS
Standard Plug-in Station; 1 SPS unit = 15.24 mm

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

UMS
User memory submodule

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Suggestions

Corrections

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Software Version 4
Part 2: Connection Conditions

Planning Guide

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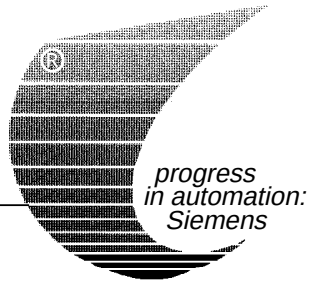
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Suggestions and/or corrections

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