

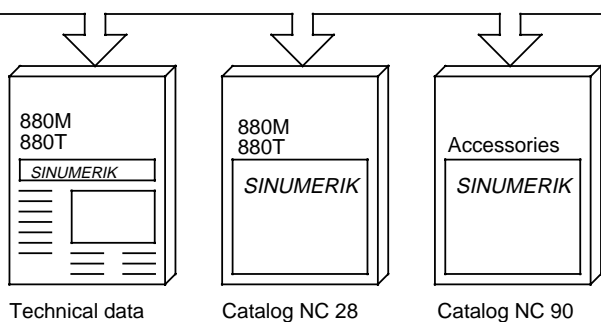
siemens

**SINUMERIK 880 GA2
Software Version 1
Interface Description
Part 2: Connection Conditions**

Planning Guide

01.93 Edition

General Documentation

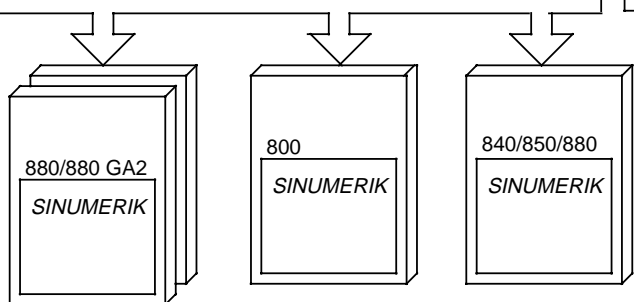


Technical data

Catalog NC 28

Catalog NC 90

User Documentation

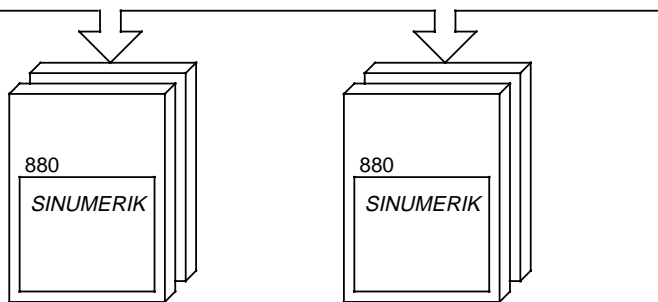


Operator's Guide
Programming Guide

Programming
Guide
Cycles, ASM 4

Measuring Cycles
Version 20

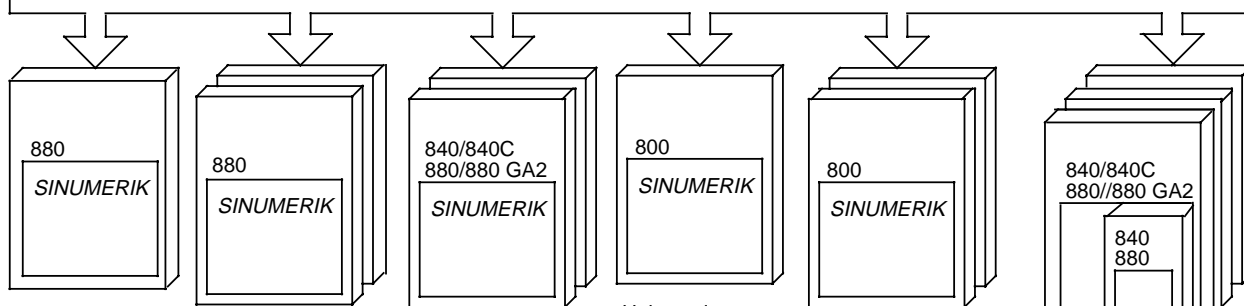
User/Manufacturer/Service Documentation



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

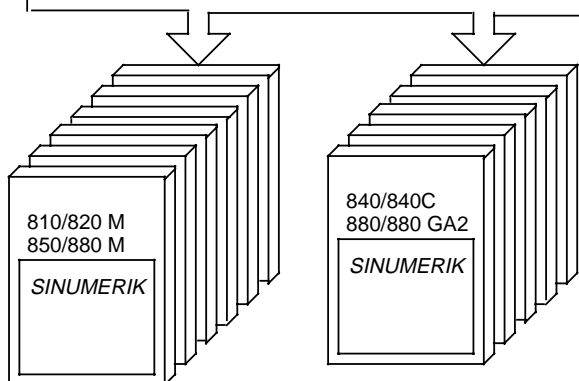
Function block
Packages
Function Macros

Universal
Interface

SINUMERIK
WS 800A
CL800 Cycle
Language

PLC 135 WB
- Quick Reference
- Configuring
- S5-HLL
- PLC S5-155U
Diff. Description

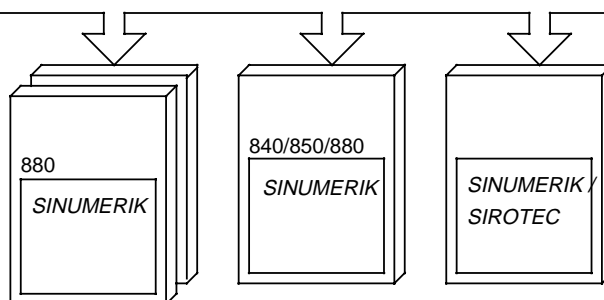
Manufacturer Documentation



Workshop UMS

Computer link

Service Documentation



Installation Guide
- Instructions
- Lists

Measuring Cycles
Version 20

Spare parts list

SINUMERIK 880 GA2 Software Version 1 Interface Description Part 2: Connection Conditions

Planning Guide

Manufacturer Documentation

Valid for:

Control

SINUMERIK 880 GA2

Software Version

1

Edition January 1993

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
01.93	6ZB5 410-0HJ02-0AA0	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.

This publication was produced on the Siemens 5800 Office System.
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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 GA2** 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 135 WB Configuration
- S5-HLL High-Level Language Programming
- Computer Link

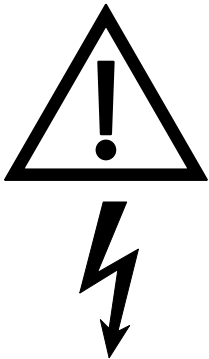
Further SINUMERIK publications apply to all SINUMERIK controls (e.g. Universal Interface, Measuring Cycles, CL 800 Cycle Language).

Consult your local Siemens office for further details.

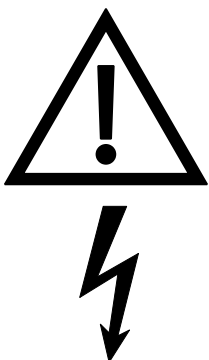
This documentation is intended for manufacturers of machine tools with SINUMERIK 880 GA2. The document describes:

- 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).

Safety guidelines

	WARNING
	<p>When electrical devices are in operation, certain parts of them are inevitably subjected to hazardous voltages.</p> <p>Improper interference with the device/system or failure to observe the warning advice can result in serious physical injury or material damage. Only appropriately trained personnel familiar with the assembly, installation, starting up or operation of the product are permitted to interfere with this device/system.</p>

Qualified personnel


	WARNING
	<p>As far as the safety advice (contained in the documentation or as a sticker on the product) is concerned, "qualified personnel" refers to persons who, for instance:</p> <ul style="list-style-type: none">• have received training or instruction and authorization to energize and deenergize, earth and tag electric circuits and devices according to established safety practices.• have received training or instruction according to established safety practices in the care, use and repair of appropriate safety equipment.• have received training or instruction in working with electrostatically sensitive components or modules.• have been instructed as operators to work with automation technology equipment and are familiar with the contents in the Operator's and/or Programming Guide referring to operation.


When planning, installing, starting up and operating the control, the personnel concerned must be familiar with the documentation relevant to their jobs.


Notes on danger

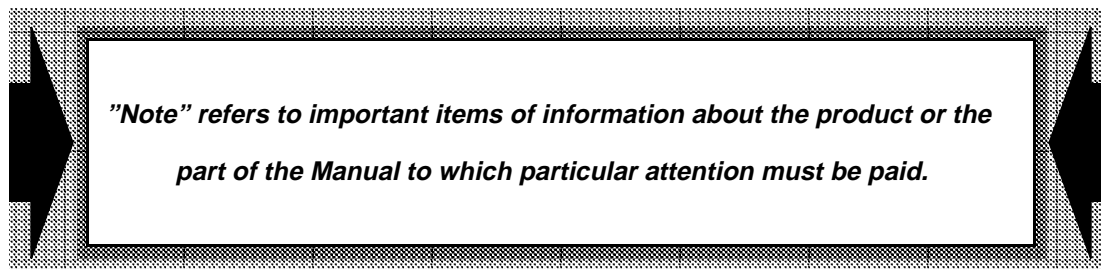
The following notes are provided for your personal safety and to protect the product described here or connected devices and machines against damage.

Safety advice and warnings intended to avert danger to human life and health and to avoid material damage are highlighted in the Manual by the terms defined here. The terms have the following meanings in the context of this Manual and the remarks on the product itself:

	DANGER
	As far as this Manual and the warning advice on the products themselves are concerned, "danger" refers to instances where death, serious physical injury or considerable material damage will result if proper precautions are not taken.

	WARNING
	As far as this Manual and the warning advice on the products themselves are concerned, "warning" refers to instances where death, serious physical injury or considerable material damage can result if proper precautions are not taken.

	CAUTION
	As far as this Manual and the warning advice on the products themselves are concerned, "caution" refers to instances where slight physical injury or material damage can result if proper precautions are not taken.

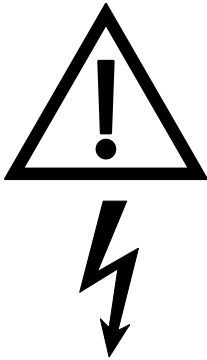


Intended use

- The device/system and system components must be used only for the applications envisaged in the Catalog and Reference Manual and only in conjunction with such non-Siemens devices and components as have been recommended and approved by Siemens.
- The product described in the Manual has been developed, manufactured, tested and documented in compliance with the relevant safety standards. Provided that the handling instructions and safety guidelines described for planning, assembling, proper operation and maintenance are observed, the product will not normally be a source of danger as regards material damage or physical injury.

Active and passive faults in automation equipment

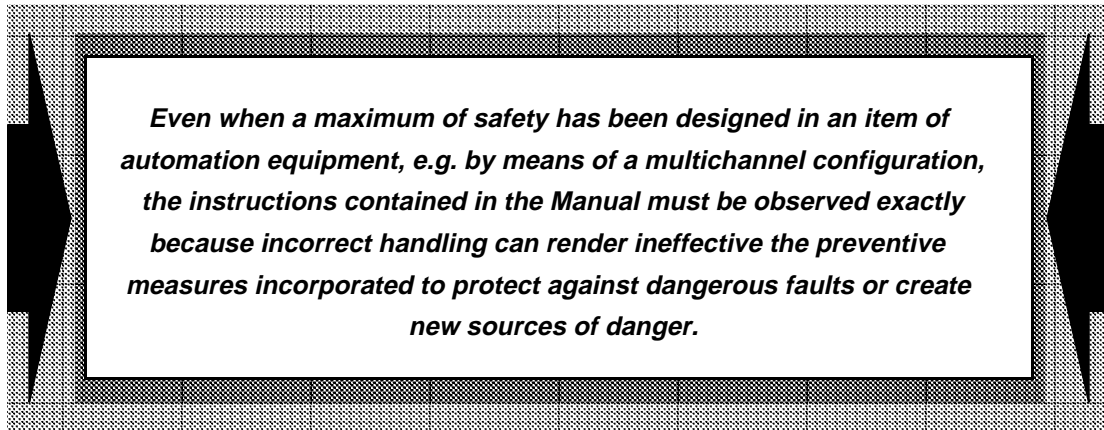
- Depending on the particular task for which the electronic automation equipment is used, both active and passive faults can represent dangerous faults. In the case of a drive control, for example, active faults are generally dangerous because they lead to unauthorized startup of the drive. On the other hand, a passive fault can result in a dangerous operating state not being reported to the operator.
- This differentiation between possible faults and their task-related classification as dangerous and non-dangerous faults is important for all the safety considerations in respect of the product supplied.

	WARNING
	Wherever a fault in the automation equipment can cause serious material damage or even physical injury, in other words wherever dangerous faults can occur, additional external precautions must be taken or devices provided which will ensure or enforce safe operating conditions even in the event of a fault (e.g. by means of independent limit switches, mechanical interlocks etc.).

Notes on product planning

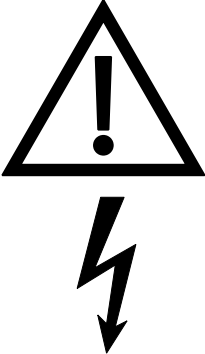
As the product is generally part of larger systems or plants, these notes are intended as a guideline for safe integration of the product in its environment.

Note the following in particular:



Additional notes

If measuring or testing work is required on an active piece of equipment, the stipulations and implementation instructions of the VBG 4.0 accident prevention regulation, in particular § 8 "Permissible departures when working on active parts", must be observed. Suitable electrical tools must be used.

WARNING	
	<ul style="list-style-type: none">• Repairs to equipment supplied by us must be made only by the Siemens customer service or by repair services authorized by Siemens. Use only parts contained in the Spare Parts List when renewing parts or components. Unauthorized opening and improper repairs can lead to fatal or serious physical injury and considerable material damage.• Always pull out the mains connector or open the disconnecting switch before opening the device.• Use only the specified types when renewing fuses.• Do not throw batteries into fires and do not solder on the cell casing because of the risk of explosion (max. temperature 100°C). Do not open and do not recharge lithium batteries or batteries containing mercury. Use only the same types when replacing.• All types of batteries must be disposed of as special waste.• When using monitors: Improper intervention, in particular changes to the high voltage or installation of a different type of picture tube, can lead to intensified X-rays. Equipment modified in this way no longer complies with the approval and must not be used.

System Configuration and Rack Assignments

1

Hardware Description

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Connection Conditions

3

Machine Control Panel

4

Distributed Machine I/Os (DMP)

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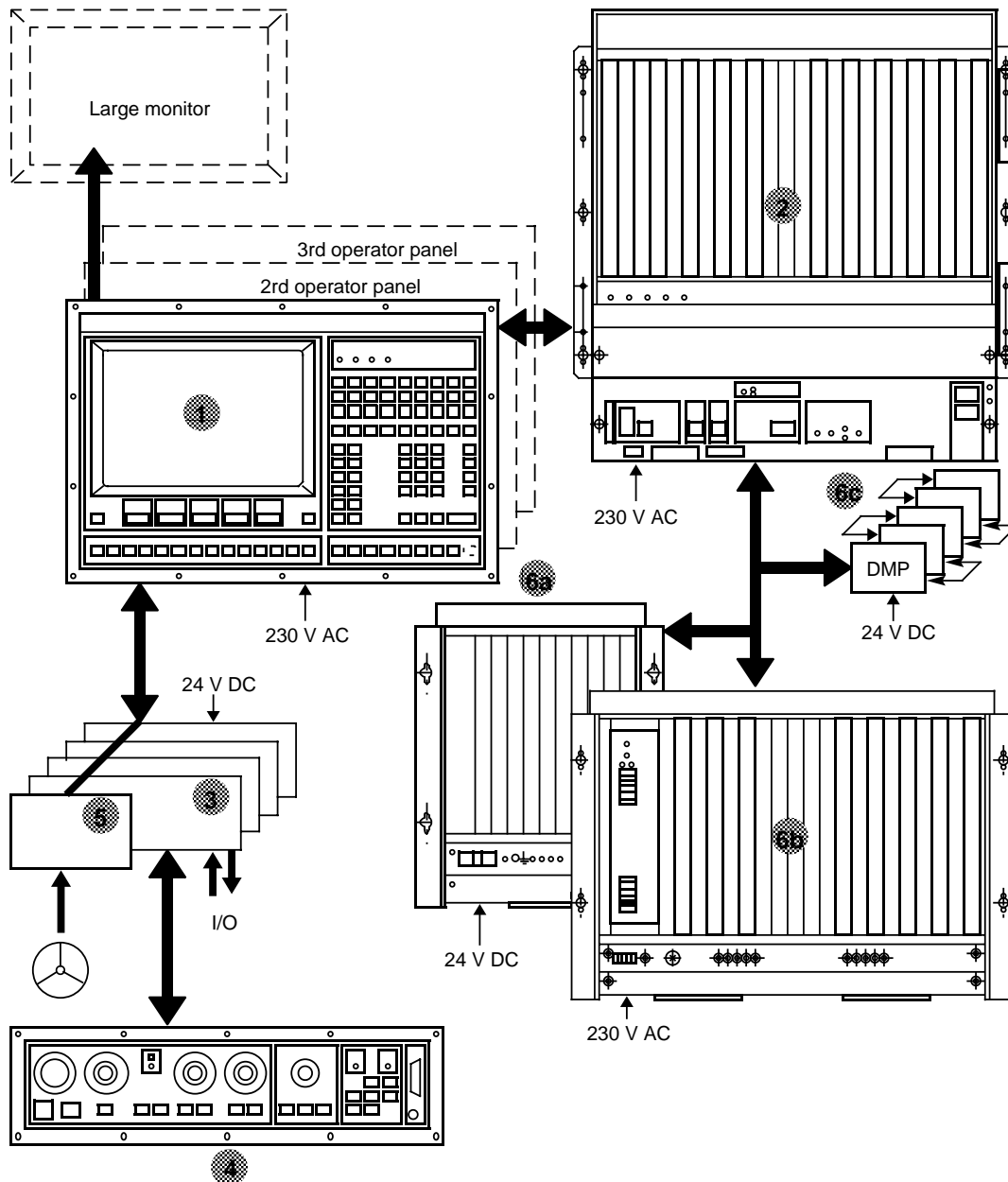
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1 System Configuration and Rack Assignment

1.1 System configuration SINUMERIK 880 GA2



- 1 Operator panel
- 2 Central controller (single-tier and two-tier) with central I/Os
- 3 Operator panel I/Os
- 4 Machine control panel
- 5 Electronic handwheel module
- 6 Distributed I/Os
- 6a Mini EU
- 6b Maxi EU
- 6c Distributed machine I/Os (DMP)

1.2 Rack assignments SINUMERIK 880 GA2, central controller

1.2.1 Rack version 1, Tier B

6FC3 9-5AC

Designation	Module order No.	Order Code	6FC3 9-5AC																							
			COM				NC 1		NC 2		Servo						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	6FX1 121-7BA04		[Diagram showing bus connections across all slots]																							
LOCAL BUS			[Diagram showing local bus connections across all slots]																							
BUS connector	6FX1 126-5BA00		[Diagram showing bus connector connections]																							
Jumper GLOBAL BUS	6FX1 126-5BA00		[Diagram showing jumper connections]																							
MEM/dual-port with clock	SN 502 492		[Diagram showing memory connections]																							
CPU 32-bit (COM)	6FX1 147-4BB00		[Diagram showing CPU connections]																							
INT/MEM submodule with interface	6FX1 147-5BA01		[Diagram showing interface connections]																							
MEM/PAGE	6FX1 126-7BA01		[Diagram showing memory/page connections]																							
SINEC H1 interface	6FX1 123-1BC02	B12	[Diagram showing SINEC H1 connections]																							
MAP 3.0, CP 1476 (Ethernet H1)	6GK1 147-6MA01		[Diagram showing Ethernet connections]																							
Active interface 2 x RS232C (V.24)/TTY	6FX1 131-5BA01	B13	[Diagram showing RS232C connections]																							
Active interface 3 x RS232C (V.24)/TTY	6FX1 137-3BA01	B16	[Diagram showing RS232C connections]																							
CPU 32-bit (NC 1) without 80387	6FX1 147-4BB00		[Diagram showing CPU connections]																							
CPU 32-bit (NC 2) without 80387	6FX1 147-4BB00	D01	[Diagram showing CPU connections]																							
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
CPU/SERVO (power supply 1) without 80387	6FX1 136-3BB01		[Diagram showing power supply connections]																							
CPU/SERVO (power supply 2) without 80387	6FX1 136-3BB01	D15	[Diagram showing power supply connections]																							
CPU/SERVO (power supply 3) without 80387	6FX1 136-3BB01	D16	[Diagram showing power supply connections]																							
Measuring-circuit modules 20 mm	6FX1 121-4BA02 6FX1 145-6BB00	K20 K70	[Diagram showing measuring-circuit connections]																							
Measuring-circuit modules 40 mm	6FX1 121-4B 02 6FX1 145-6BA00	K2 K7	[Diagram showing measuring-circuit connections]																							
MIXED I/O	6FX1 138-4BA01	N52	[Diagram showing mixed I/O connections]																							
PLC 135WB with ACOP 2	6FX1 138-6BL01	D28	[Diagram showing PLC connections]																							
INT/DMP (for EUs, DMP)	6FX1 144-2BA00	N92	[Diagram showing INT/DMP connections]																							
INT/EU 16-bit (for EU 185 U)	6FX1 137-8BB02	N55	[Diagram showing INT/EU connections]																							
SINUMERIK I/O 20 mm	6FX1 1	N7 N79	[Diagram showing SINUMERIK I/O connections]																							
SINUMERIK I/O 40 mm	6FX1 1	N73	[Diagram showing SINUMERIK I/O connections]																							
Front panel 1 1/3 standard slot dimensions	6FC3 985-7AC		[Diagram showing front panel connections]																							



1) Can only be used with 6FX1 131-5BA00 (B13)

1.2.2 Rack version 2, Tier B

6FC3 9-5BC

Designation	Module order No.	Order code	COM				NC 1		NC 2		Servo								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	6FX1 121-7BA04		[Global Bus connections across all slots]																							
LOCAL BUS			[Local Bus connections across all slots]																							
BUS connector	6FX1 126-5BA00		[Bus connector connections]																							
Jumper GLOBAL BUS	SN 502 492		[Jumper connections]																							
MEM/dual-port with clock	6FX1 124-0BA03		[Memory connections]																							
CPU/32-bit (COM)	6FX1 147-4BB00		[CPU connections]																							
INT/MEM submodule with interface	6FX1 147-5BA01		[Interface connections]																							
MEM/PAGE	6FX1 126-7BA01		[Memory connections]																							
INT/SINEC H1 CP 231 A	6FX1 123-1BC02	B12	[SINEC H1 connections]																							
MAP 3.0, CP 1476 (Ethernet H1)	6GK1 147-6MA01		[Ethernet connections]																							
Active interface 2 x RS232C (V.24)/TTY	6FX1 131-5BA01	B13	[RS232C connections]																							
Active interface 3 x RS232C (V.24)/TTY	6FX1 137-3BA01	B16	[RS232C connections]																							
CPU 32 Bit (NC 1) without 80387	6FX1 147-4BB00		[CPU connections]																							
CPU 32 Bit (NC 2) without 80387	6FX1 147-4BB00	D01	[CPU connections]																							
CPU/SERVO (power supply 1) without 80387	6FX1 136-3BB01		[CPU/Servo connections]																							
CPU/SERVO (power supply 2) without 80387	6FX1 136-3BB01	D15	[CPU/Servo connections]																							
CPU/SERVO (power supply 3) without 80387	6FX1 136-3BB01	D16	[CPU/Servo connections]																							
INT/Servo	6FX1 121-4BA02	K20	[Servo connections]																							
INT/HMS	6FX1 145-6BB00	K70	[HMS connections]																							
NT/Servo	6FX1 121-4B 02	K2	[Servo connections]																							
INT/HMS	6FX1 145-6BA00	K7	[HMS connections]																							
MIXED I/O	6FX1 138-4BA01	N52	[Mixed I/O connections]																							
PLC 135WB with ACOP 2	6FX1 138-6BL01	D28	[PLC connections]																							
INT/DMP (for EUs, DMP)	6FX1 144-2BA00	N92	[DMP connections]																							
INT/EU 16-bit (for EU 185 U)	6FX1 137-8BB02	N55	[EU connections]																							
SINUMERIK I/O 20 mm		N7 N79	[SINUMERIK I/O connections]																							
SINUMERIK I/O 40 mm		N73	[SINUMERIK I/O connections]																							
Front panel 1 1/3 standard slot dimension	6FC3 985-7AC		[Front panel connections]																							

Per PLC up to 256 byte inputs and 256 byte outputs can be addressed. (central/distributed)

Possible I/O links: N92 (+N92) or N55 (+N92) only local I/Os possible!

Basic complement of modules
 Option
 Alternative
 Not possible

1.2.3 Rack version 3, Tier B

6FC3 9-5CC

Designation	Module order No	Order code	COM				Servo				PLC								NC							
			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	6FX1 121-7BA04		[Global Bus connections across all slots]																							
LOCAL BUS			[Local Bus connections across all slots]																							
BUS connector	6FX1 126-5BA00		[Bus connector connections]																							
Jumper GLOBAL BUS	SN 502 492		[Jumper connections]																							
MEM/dual-port with clock	6FX1 124-0BA03		[Memory connections]																							
CPU/32-bit (COM)	6FX1 147-4BB00		[CPU connections]																							
INT/MEM submodule with interface	6FX1 147-5BA01		[INT/MEM connections]																							
MEM/PAGE	6FX1 126-7BA01		[MEM/PAGE connections]																							
INT/SINEC H1 CP 231 A	6FX1 123-1BC02	B12	[SINEC H1 connections]																							
MAP 3.0, CP 1476 (Ethernet H1)	6GK1 147-6MA01		[MAP connections]																							
Active interface 2 x RS232C (V.24)/TTY	6FX1 131-5BA01	B13	[Active interface connections]																							
Active interface 3 x RS232C (V.24)/TTY	6FX1 137-3BA01	B16	[Active interface connections]																							
CPU 32-bit (NC 1) without 80387	6FX1 147-4BB00		[CPU connections]																							
			[Empty slots]																							
			[Empty slots]																							
CPU/SERVO (power supply 1) without 80387	6FX1 136-3BB01		[CPU/SERVO connections]																							
			[Empty slots]																							
INT/Servo	6FX1 121-4BA02	K20 K70	[INT/Servo connections]																							
INT/HMS	6FX1 145-6BB00		[INT/HMS connections]																							
NT/Servo	6FX1 121-4B 02	K2 K7	[NT/Servo connections]																							
INT/HMS	6FX1 145-6BA00		[INT/HMS connections]																							
MIXED I/O	6FX1 138-4BA01	N52	[MIXED I/O connections]																							
PLC 135WB with ACOP 2	6FX1 138-6BL01	D28	[PLC connections]																							
			[Empty slots]																							
INT/DMP (for EUs, DMP)	6FX1 144-2BA00	N92	[INT/DMP connections]																							
INT/EU 16-bit (for EU 185 U)	6FX1 137-8BB02	N55	[INT/EU connections]																							
SINUMERIK I/O 20 mm		N7 N79	[SINUMERIK I/O connections]																							
SINUMERIK I/O 40 mm		N73	[SINUMERIK I/O connections]																							
Front panel 1 1/3 standard slot dimensions	6FC3 985-7AC		[Front panel connections]																							

Per PLC up to 256 byte inputs and 256 byte outputs can be addressed. (central/distributed)

Permissible I/O links: N92 (+N92 (+N92)) or N55 (+N92) only local I/Os possible!

Basic complement of modules
 Option
 Alternative
 Not possible

1.2.4 Rack version 5, Tier B

6FC3 9-5EC

Designation	Module order No.	Order code	Rack Slot																							
			COM	PLC 2	PLC 1																					
			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	6FX1 131-8BA02		[Diagram showing bus lines across all slots]																							
LOCAL BUS			[Diagram showing bus lines across all slots]																							
BUS connector	6FX1 126-5BA00		[Diagram showing bus connector connections]																							
Jumper GLOBAL BUS	SN 502 492		[Diagram showing jumper connections]																							
MEM/multi-port with clock	6FX1 136-8BA01		[Diagram showing memory module placement]																							
CPU/32-bit (COM)	6FX1 147-4BB00		[Diagram showing CPU placement]																							
INT/MEM submodule with interface	6FX1 147-5BA01		[Diagram showing interface submodule placement]																							
MEM/PAGE	6FX1 126-7BA01		[Diagram showing memory/page module placement]																							
INT/SINEC H1 CP 231 A	6FX1 123-1BC02	B12	[Diagram showing SINEC module placement]																							
MAP 3.0, CP 1476 (Ethernet H1)	6GK1 147-6MA01		[Diagram showing Ethernet module placement]																							
Active interface 2 x RS232C (V.24)/TTY	6FX1 131-5BA01	B13	[Diagram showing RS232 interface placement]																							
Active interface 3 x RS232C (V.24)/TTY	6FX1 137-3BA01	B16	[Diagram showing RS232 interface placement]																							
<p>Possible I/O links (per PLC): N92 (+N92 (+N92; only PLC 1)) or N55 (+N92)</p>																										
PLC 135 WB with ACOP 2 (PLC 1)	6FX1 138-6BL01	D28	[Diagram showing PLC 1 placement]																							
INT/DMP (for EUs, DMP)	6FX1 144-2BA00	N92	[Diagram showing DMP placement]																							
INT/EU 16-bit (for EU 185 U)	6FX1 137-8BB02	N55	[Diagram showing 16-bit EU placement]																							
SINUMERIK I/O 20 mm		N7 N79	[Diagram showing 20mm I/O placement]																							
SINUMERIK I/O 40 mm		N73	[Diagram showing 40mm I/O placement]																							
PLC 135WB with ACOP 2 (PLC 2)	6FX1 138-6BL01	D29	[Diagram showing PLC 2 placement]																							
Front panel 1 1/3 standard slot dimensions	6FC3 985-7AC		[Diagram showing front panel placement]																							

Basic complement of modules
 Option
 Alternative
 Not possible

Rack version 5, Tier C

Designation	Module order No.	Order code	Servo																							
			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	6FX1 131-1BA02		[Diagram showing bus connections across slots 1-24]																							
LOCAL BUS			[Diagram showing local bus connections across slots 1-24]																							
BUS connector	6FX1 126-5BA00		[Diagram showing bus connector connections]																							
Jumper GLOBAL BUS	SN 502 492		[Diagram showing jumper connections]																							
MEM/multi-port with clock	---		[Diagram showing memory connections]																							
CPU 32-bit (NC 1) without 80387	6FX1 147-4BB00		[Diagram showing CPU connections]																							
CPU 32-bit (NC 2) without 80387	6FX1 147-4BB00	D01	[Diagram showing CPU connections]																							
CPU/SERVO (power supply 1) without 80387	6FX1 136-3BB01		[Diagram showing power supply connections]																							
CPU/SERVO (power supply 2) without 80387	6FX1 136-3BB01	D15	[Diagram showing power supply connections]																							
CPU/SERVO (power supply 3) without 80387	6FX1 136-3BB01	D16	[Diagram showing power supply connections]																							
CPU/SERVO (power supply 4) without 80387	6FX1 136-3BB01	D17	[Diagram showing power supply connections]																							
INT/Servo	6FX1 121-4BA02	K20	[Diagram showing I/O connections]																							
INT/HMS	6FX1 145-6BB00	K70	[Diagram showing I/O connections]																							
INT/Servo	6FX1 121-4B 02	K2	[Diagram showing I/O connections]																							
INT/HMS	6FX1 145-6BA00	K7	[Diagram showing I/O connections]																							
MIXED I/O	6FX1 138-4BA01	N52	[Diagram showing I/O connections]																							
Front panel 1 1/3 standard slot dimensions	6FC3 985-7AC		[Diagram showing front panel connections]																							

 Basic complement of modules
  Option
  Alternative
  Not possible

1.2.5 Rack version 7, Tier B

6FC3 9-5JC

Designation	Module order No.	Order code	COM				NC 1		Servo								PLC 1/2				NC2 PLC1					
			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	6FX1 121-7BA04		[Global Bus connections across all slots]																							
LOCAL BUS			[Local Bus connections across all slots]																							
BUS connector	6FX1 126-5BA00		[Bus connector connections]																							
Jumper GLOBAL BUS	SN 502 492		[Jumper connections]																							
MEM/dual-port with clock	6FX1 124-0BA03		[Memory connections]																							
CPU/32-bit (COM)	6FX1 147-4BB00		[CPU connections]																							
INT/MEM submodule with interface	6FX1 147-5BA01		[INT/MEM submodule connections]																							
MEM/PAGE	6FX1 126-7BA01		[Memory/Page connections]																							
INT/SINEC H1 CP 231 A	6FX1 123-1BC02	B12	[SINEC H1 connections]																							
MAP 3.0, CP 1476 (Ethernet H1)	6GK1 147-6MA01		[Ethernet connections]																							
Active interface 2 x RS232C (V.24)/TTY	6FX1 131-5BA00	B13	[Active interface connections]																							
Active interface 3 x RS232C (V.24)/TTY	6FX1 137-3BA01	B16	[Active interface connections]																							
CPU 32-bit (NC 1) without 80387	6FX1 147-4BB00		[CPU connections]																							
CPU 32-bit (NC 2) without 80387	6FX1 147-4BB00	D01	[CPU connections]																							
CPU/SERVO (power supply 1) without 80387	6FX1 136-3BB01		[CPU/SERVO connections]																							
CPU/SERVO (power supply 2) without 80387	6FX1 136-3BB01	D15	[CPU/SERVO connections]																							
CPU/SERVO (power supply 3) without 80387	6FX1 136-3BB01	D16	[CPU/SERVO connections]																							
INT/Servo	6FX1 121-4BA02	K20	[INT/Servo connections]																							
INT/HMS	6FX1 145-6BB00	K70	[INT/HMS connections]																							
NT/Servo	6FX1 121-4B 02	K2	[NT/Servo connections]																							
INT/HMS	6FX1 145-6BA00	K7	[INT/HMS connections]																							
MIXED I/O	6FX1 138-4BA01	N52	[MIXED I/O connections]																							
PLC 135 WB with ACOP 2	6FX1 138-6BL01	GA/D92	[PLC connections]																							
INT/DMP (for EUs, DMP)	6FX1 144-2BA00	GA/N92	[INT/DMP connections]																							
INT/EU 16-bit (for EU 185 U)	6FX1 137-8BB02	N55	[INT/EU connections]																							
SINUMERIK I/O 20 mm		N7 N79	[SINUMERIK I/O connections]																							
SINUMERIK I/O 40 mm		N73	[SINUMERIK I/O connections]																							
Front panel 1 1/3 standard slot dimensions	6FC3 985-7AC		[Front panel connections]																							

Per PLC up to 256 byte inputs and 256 byte outputs can be addressed. (central/distributed)

Note:
If a 2nd PLC (D29) is connected, the PLC of the basic version is PLC 2 and the 2nd PLC is PLC 1 (from the point of view of the software)!

Link to tier C (cable: 6FC9 344-3UL)

Possible I/O links:
N92 (+N92) or
N55 (+N92; only with right PLC)
only local I/Os possible!



Rack version 7, Tier C

Designation	Module order No.	Order code	Machine I/Os																							
			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	6FX1 134-1BB03																									
SINUMERIK BUS																										
BUS connector	6FX1 126-5BA00																									
Jumper GLOBAL BUS																										

1.3 Rack assignments for expansion units

1.3.1 Rack assignment for maxi EU

6FC3 984-4FJ02

Designation	Module order No.	Order code	Maxi EU machine I/Os																							
			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	6FX1 134-1BA03		[Grid with SIMATIC BUS modules]																							
SINUMERIK BUS			[Grid with SINUMERIK BUS modules]																							
BUS connector	6FX1 126-5BA00		[Grid]																							
Jumper GLOBAL BUS			[Grid]																							
			[Grid]																							
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230 V AC power supply unit	6EW1 861-3AC		[Grid with power supply unit in slot 4]																							
INT/CU-MPC without power supply unit	6FX1 132-1BB01		[Grid with MPC in slot 5]																							
SIMATIC U I/O 20 mm	6ES5 4..	N6	[Grid with SIMATIC U I/O modules]																							
SIMATIC U I/O 40 mm	6ES5 4..	N6	[Grid with SIMATIC U I/O modules]																							
SINUMERIK I/O 20 mm		N7 N79	[Grid with SINUMERIK I/O modules]																							
SINUMERIK I/O 40 mm		N73	[Grid with SINUMERIK I/O modules]																							
Front panel 1 1/3 standard slot dimensions	6FC3 985-7AC		[Grid]																							

Per PLC up to 256 byte inputs **and** 256 byte outputs can be addressed. (central/distributed)

It is not possible to mix SINUMERIK and SIMATIC I/Os.

Basic complement of modules
 Option
 Alternative
 Not possible

1.3.2 Rack assignment for mini EU

6FC3 984-4FG

Designation	Module order No.	Order code	Mini EU machine I/Os												
			1	2	3	4	5	6	7	8	9	10	11	12	
SIMATIC BUS	6FX1 134-8BA00		■	■	■	■	■	■	■	■	■	■	■	■	■
SINUMERIK BUS			■	■	■	■	■	■	■	■	■	■	■	■	■
BUS connector	6FX1 126-5BA00														
Jumper GLOBAL BUS															
INT/CU-MPC with power supply unit	6FX1 132-1BA01		■												
SIMATIC U I/O 20 mm	6ES5 4..	N6		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
SIMATIC U I/O 40 mm	6ES5 4..	N6		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
SINUMERIK I/O 20 mm		N7		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
SINUMERIK I/O 40 mm		N73		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Front panel 1 1/3 standard slot dimensions	6FC3 985-7AC														

Per PLC up to 256 byte inputs and 256 byte outputs can be addressed. (central/distributed)

Caution:
 The Options N74 (INANALOG) N79 (MIXED I/O) cannot be used in the mini EG

It is not possible to mix SINUMERIK and SIMATIC I/Os.

 Basic complement of modules
  Option
  Alternative
  Not possible

1.4 Rack assignment for operator panels

1.4.1 Rack assignment for 1st operator panel











6FC3 986-3AU02

Designation	Module order No.	Order code	Operator panel								
			1	2	3	4	5	6	7	8	9
BUS/OP 220 V	6FX1 131-3BC02		to key-board			←			H H		
230 V AC power supply unit	6EW1 861-3AD		▲								
CPU/COM	6FX1 120-4BD03		▲								
MEM/EPROM-RAM with 32 kB	6FX1 128-1BB00		▲								
INT/KEYBOARD	6FX1 148-7BA01		▲								
INT/OPI	6FX1 138-8BC04		▲								
INTERFACE	6FX1 121-2BA03		▲								
Slot width in mm			60 20 20 20 15 15 20								
Front panel 1/3 standard slot dimens. (5mm)	6FX2 002-6KB00		▲								
Front panel 1 1/3 standard slot dimensions	6FC3 985-7AC		▲								

 Basic complement of modules
  Option
  Alternative
  Not possible

1.4.2 Rack assignment for 2nd/3rd operator panel

6FC3 986-3AJ02

Designation	Module order No.	Order code	Operator panel								
			1	2	3	4	5	6	7	8	9
BUS/OP 220 V	6FX1 131-3BC02		to key-board ←  								
230 V AC filter unit	6EW1 060-0AA										
INT/KEYBOARD	6FX1 148-7BA01										
Slot width in mm			1 2 3 4 5 6 7 8 9 60 20 20 20 15 15 20								
Front panel 1 standard slot dimens. (15 mm)	6FC3 985-7AC02										
Front panel 1 1/3 standard slot dimensions	6FC3 985-7AC										
 Basic complement of modules	 Option	 Alternative	 Not possible								

1.5 Overview of modules

	Module number
COM area	
COM CPU (32-bit CPU)	6FX1 147-4BB00
0.5 MB system EPROM submodule for COM CPU (MEM. DIL 32 bit)	6FX1 124-1CC00
INTERFACE/MEMORY submodule with interfaces and RAM for part programs etc.	6FX1 147-5BA01
MEMORY/PAGE (1 ... 3 memory submodules UMS etc.)	6FX1 126-7BA01
256 kB EPROM submodule	6FX1 128-4BC00
128 kB EPROM submodule	6FX1 128-4BD00
128 kB RAM submodule	6FX1 126-6BA00
256 kB RAM submodule	6FX1 135-3BA00
Memory/dual-port with clock (single-tier)	6FX1 124-0BA03
Memory/dual-port with clock (two-tier)	6FX1 136-8BA01
SINEC H1 CP 231 A	6FX1 123-1BC02
MEMORY EPROM submodul	6FX1 122-6CB00
INT/ACTIVE RS232C (V.24) (CP 315)	6FX1 131-5BA01
MEMORY submodule	6FX1 128-4BA00
INT/ACTIVE 3 x RS232C (V.24)/TTY	6FX1 137-3BA01
NC area	
NC CPU (32-bit CPU)	6FX1 147-4BB00
0.5 MB system EPROM submodule for NC CPU (MEM. DIL 32 bit)	6FX1 124-1CC00
Servo area	
SERVO CPU 386	6FX1 136-3BB01
0.5 MB system EPROM submodule for NC CPU (MEM. DIL 32 bit)	6FX1 124-1CB00
Measuring-circuit module DAC for 3 measuring circuits (20 mm)	6FX1 121-4BA02
Measuring-circuit module DAC for 3 measuring circuits/EXE installed (40 mm)	6FX1 121-4BB02
EXE 5/10-fold	6FX1 151-5BA00
Measuring-circuit module HMS with 3 inputs + 3 slots (40 mm)	6FX1 145-6BA00
Measuring-circuit module HMS with 3 inputs (20 mm)	6FX1 145-6BB00
Measuring setpoint submodule	6FX1 132-5BA02
I/V hybrid for linear scale	6FC3 988-7CN
MIXED I/O	6FX1 138-4BA01

PLC area	Module number
PLC 135 WB CPU (ACOP 2)	6FX1 138-6BL01
EPROM submodule 64 kB	6FX1 130-5BB00
EPROM submodule 256 kB	6FX1 145-8BA00
INT/DMP(for EUs, DMP)	6FX1 144-2BA00
DMP module	6FX1 142-1BA01
DMP module 16 I/16 O	6FX1 142-4BA04
DMP module 32 I	6FX1 142-2BA02
DMP terminating resistor	6FX1 145-2BA00
DMP terminal block, IP 65 version ¹⁾	6FX1 152-7BA01
DMP module, IP 65 version ¹⁾	6FX1 152-8BA01
DMP compact terminal block ¹⁾	6FX1 153-2BA0
DMP compact module 8 O ¹⁾	6FX1 153-0BA0
DMP compact module 16 O ¹⁾	6FX1 153-3BA0
DMP compact module 16 I ¹⁾	6FX1 153-1BA0
INT/EU 16-bit (for EU 185U)	6FX1 137-8BB02
Digital output module, 32 x 0.5 A	6FX1 122-8BC04
Digital output module, 32 x 2 A	6FX1 122-8BD04
Digital input module, 64 I	6FX1 125-7BA01
Analog input module, 8 channels	6FX1 136-1BA01
MIXED I/O	6FX1 138-4BA01
SIMATIC U I/Os (20/40 mm)	6ES5 4 . . .
Operator panel area	
Power supply unit 230 V AC (1st operator panel)	6EW1 861-3AD
Filter unit 230 V AC (2nd/3rd operator panel)	6EW1 060-0AA
Operator panel CPU	6FX1 120-4BD03
MEM/EPROM RAM	6FX1 128-1BB01
EPROM submodule (for operating system or operator panel software)	6FX1 128-4BC00
INT/KEYBOARD	6FX1 148-7BA01
INT/OPI	6FX1 138-8BC04
INTERFACE	6FX1 121-2BA03
I/O submodule	6FX1 124-6AD02
I submodule	6FX1 124-6AC02
INTERFACE/MPG	6FX1 126-5AA01

¹⁾ available soon

	Module number
Maxi EU	
Power supply unit 230 V AC	6EW1 861-3AD
INT/CU MPC without power supply unit	6FX1 132-1BB01
Digital output module, 32 x 0.5 A	6FX1 122-8BC04
Digital output module, 32 x 2 A	6FX1 122-8BD04
Digital input module	6FX1 125-7BA01
Analog input module (8 channels)	6FX1 136-1BA01
MIXED I/O	6FX1 138-4BA01
SIMATIC U I/Os (20/40 mm)	6ES5 4 . . .
 Mini EU	
INT/CU-MPC with power supply unit	6FX1 132-1BA01
Digital output module, 32 x 0.5 A	6FX1 122-8BC04
Digital output module, 32 x 2 A	6FX1 122-8BD04
Digital input module	6FX1 125-7BA01
SIMATIC U I/Os (20/40 mm)	6ES5 4 . . .


2 Hardware Description

2.1 General notes

In the following sections, you will find modules to which you can connect your devices/components.

- **Handling the modules**

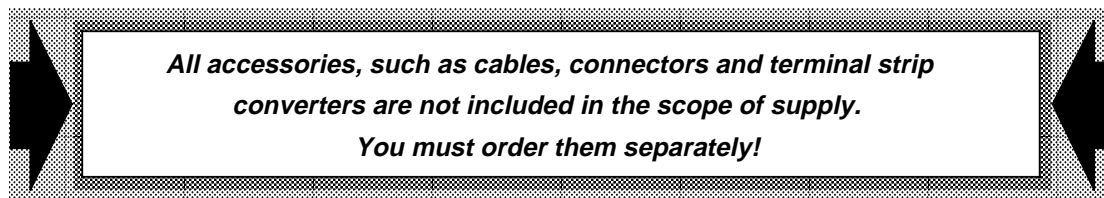
In addition to the EEC protective measures, observe the following precautions:

	CAUTION
	<ul style="list-style-type: none"> • Only ever insert or remove modules when no voltage is applied to them (i.e. the control must be switched off). • Make sure that signal voltages are only ever applied (at interfaces) when the modules are in place. <p>The modules can be destroyed or fail prematurely if you do not observe this!</p>

- **Cables and connectors**

The in the order number of the cables (complete with connectors) indicates where you must insert the cable length. The various cable lengths available are given in Section 8.1 "Tabular overview of cables".

In Section 8.3 "Cable diagrams" you will find the cables and connectors including pin assignments.



- **Jumperings**

Make sure that the jumperings (jumpers, switches, ...) mentioned in the following sections are always open or closed, as specified.

Explanation of symbols:

- Jumper/switch open

- ⌋ Jumper/switch closed or equipped with 0 resistor

• **Adhesive labels**

You might find the following adhesive labels attached to the modules:

- **Type plate** (on bus connectors)
 Colour: white

SIEMENS Made in Germany Fert.-Nr. 222	Product version	A	B	C	D	E	F	G	H
	570 320.9001.	00	01	02	03	04	05	06	07

or

SIEMENS Made in Germany 730 695	Product version	A	B	C	D	E	F	G	H
	570 320.9001.01	J	K	L	M	N	P	Q	R

Example: Module number: 570 320.9001.01 (last cross)
 Product version: E (last cross)
 Production number: 222

} **Always specify these codes with technical enquiries!**

- **Label** (on frontplate, with order no.)
 Colour: brown



or



Always specify this code with technical enquiries!

Type of module; also indicates the software on memory submodules that were fitted and programmed in the factory.

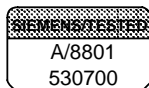
- **Product version label** (on front panel)
 Colour: light beige



- **Test mark**
 Colour: blue or red



or



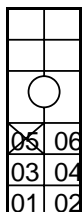
– **Inspection mark**

Colour: white



– **Software version** (on memory submodule front panel)

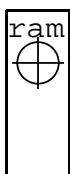
Colour: white



Example: Software version 05

– **RAM label** (on RAM memory submodule front panel)

Colour: white



– **EEC symbol**

Colour: black/yellow




	CAUTION
	<p>The module includes electrostatically endangered components (EEC). Observe the protective measures specified in Section 3.</p>


- **Total current**

The tables headed "Total current" give the current drawn at different voltages for each module (module internal consumption only) (line of table headed: order number 6FX1 1 . . . -).

The table also gives the maximum current which can be drawn at the external interfaces (e.g. for encoder) (line of table headed: connector number X . . .).

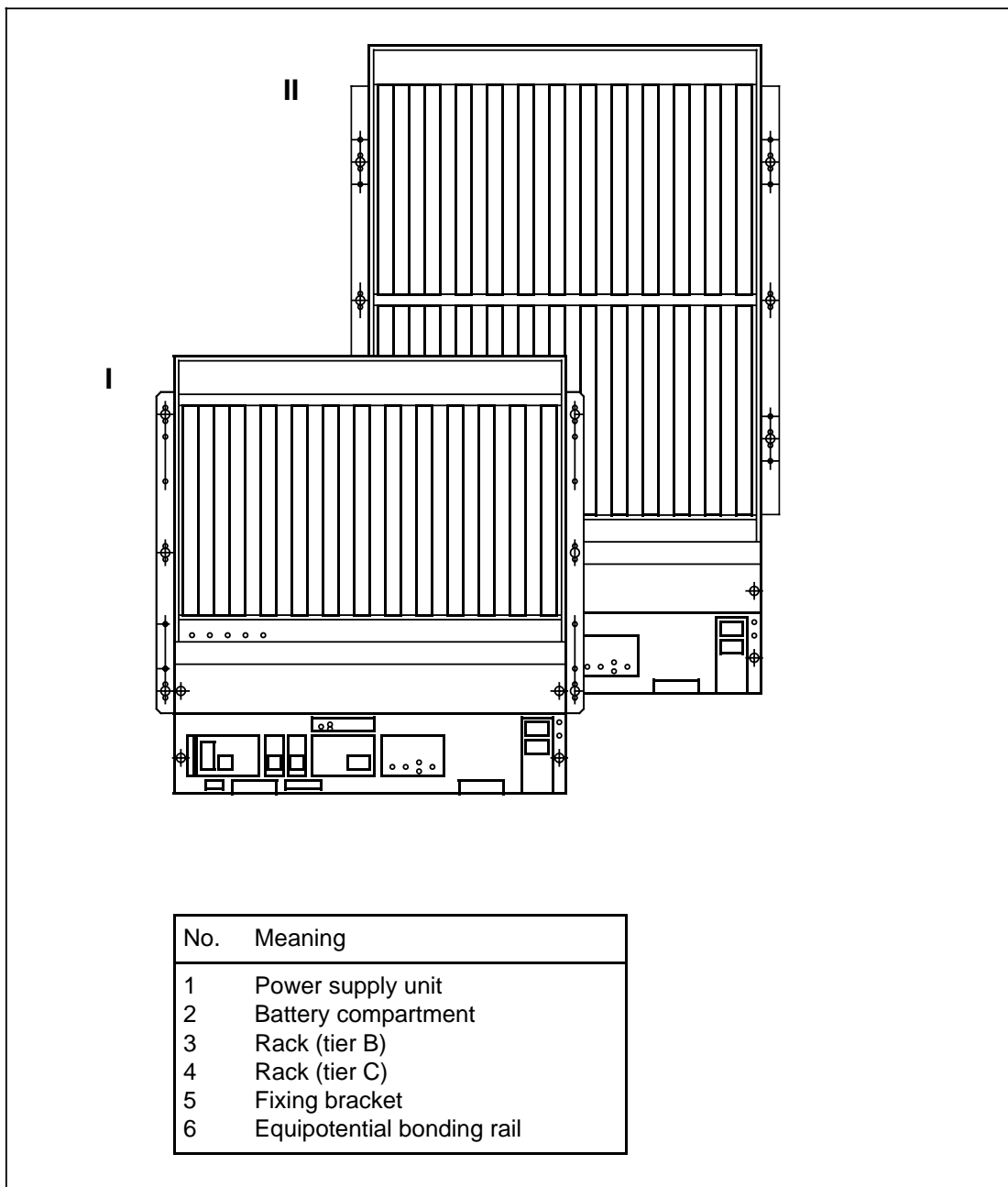
Using the values given in the table for the module current input and the actual current input at the external interfaces, it is possible to determine the actual connected load and power loss of the control.

	CAUTION
	<p>The maximum permissible current withdrawal from external interfaces refers only to the module itself and not to any components connected to it (e.g. power supply unit or external components).</p> <p>The supply voltage outputs at the external interface are not short-circuit-proof and not provided with any fuses.</p>

	WARNING
	<p>The capacitive circuitry of the outputs only compensates for the inductances of the connected cables.</p> <p>If contactors, relays, valves etc. are connected, then additional interference suppression (e.g. RC circuits, free-wheeling diode) must be connected in parallel to these inductive loads (DIN IEC 550 / DIN VDE 0113, Part 200).</p> <p>Non-compliance can result in the destruction of the outputs.</p>

2.2 Central controller

Single-tier rack I: rack versions 1, 2 and 3
Two-tier rack II: rack versions 5 and 7



2.2.1 Slot assignment in the central controller

The SINUMERIK 880 GA2 is supplied in several versions. The exact slot assignments and the modules that you can use with each version are described in Section 1.2.

- **Bus structures of the bus connectors**

The versions differ in size (single-tier or two-tier) and in the bus (local bus).

On today's bus modules the local buses are assembled using bus connectors to match the configuration ordered. You must not move or remove the bus connectors. If you do, you will have changed the characteristics of the control guaranteed in the contract.

The bus connectors are located on the back of the bus module on the first and the last slot of every local bus of a tier. The tiers are connected by a bus connector 6FX1 126-5BA00 (local bus extension).

Note:

You can only see the bus connectors if you remove the backplane cover of the central controller.

- **Jumpers (bus jumpering)**

On the inside of the bus board between the first and the last CPU next to every slot in which there is no module with a plug-in contact on the bus, you will find a jumper. If a jumper is missing before the last CPU, this is not detected by the start-up routine of the COM CPU and proper functioning is no longer possible. The jumpers are inserted in the factory to match the configuration ordered (number of NC CPUs, servo CPUs, PLC CPUs). If you upgrade with a further CPU (i.e. a second NC CPU), remove the jumper next to the new CPU. Otherwise you cannot start up this CPU.

- **The upper tier (link bus):**

- In the first slot (X101), you generally have to jumper the top two pins.
- In the slots without an active module, jumper the pins.
Exception: do not jumper the pins on the right next to the last active module.
- In the slots with active modules, leave the pins open.

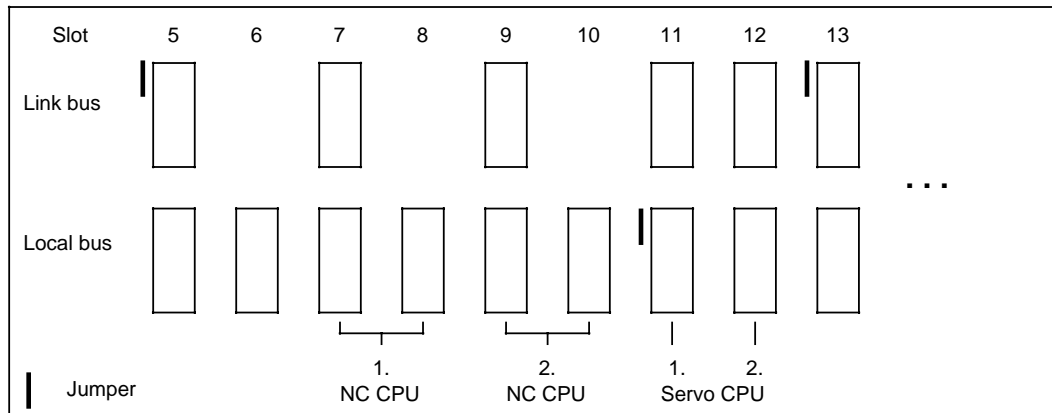
- **The lower tier (local bus):**

- Before the first SERVO CPU, you generally have to jumper the top two pins.

Active modules include:	32-bit CPU	(6FX1 147-4BB00)
	SERVO CPU 386	(6FX1 136-3BB01)
	INT/CU 16-bit	(6FX1 137-7BA02)
	PLC 135WB	(6FX1 138-6BL01)

An example of how to place the jumpers (single-tier, version 1):

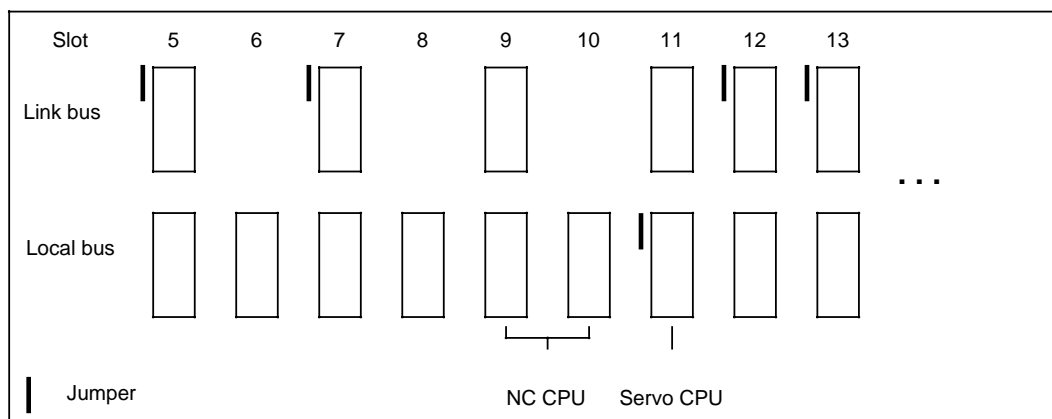
- 2 NC CPUs, 2 servo CPUs:



Note

If no jumper is inserted in slot 13, the PLC in slot 17 will not run (the LED flashes six times). If you upgrade with a third servo CPU, you have to remove the jumper in slot 13.

- 11 NC CPU, 1 servo CPU



Note

If no jumper is inserted in slot 7, none of the CPUs to the right of this slot will run.

Note:

You cannot see the jumpers from the side with the modules.

2.2.2 Power supply unit with/without 5 V_{ext}

6EW 1861 2AE/2BE

There is no jumpering to be done on the power supply unit. See Section 3.2.2.1 for explanations of the module.

2.3 COM area

2.3.1 32-bit CPU

6FX1 147-4BB00

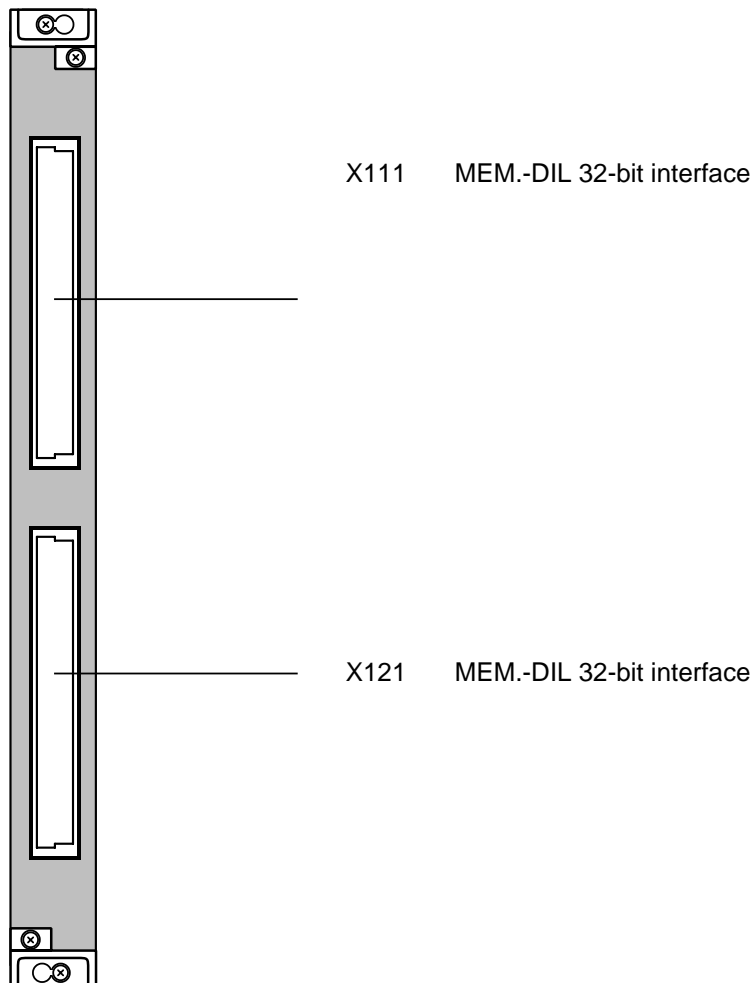
The 32-bit CPU module is used as a COM and NC CPU.

On the front of the module, you will find two 96-pin connectors to which you have to connect the MEM.DIL 32-bit submodule.

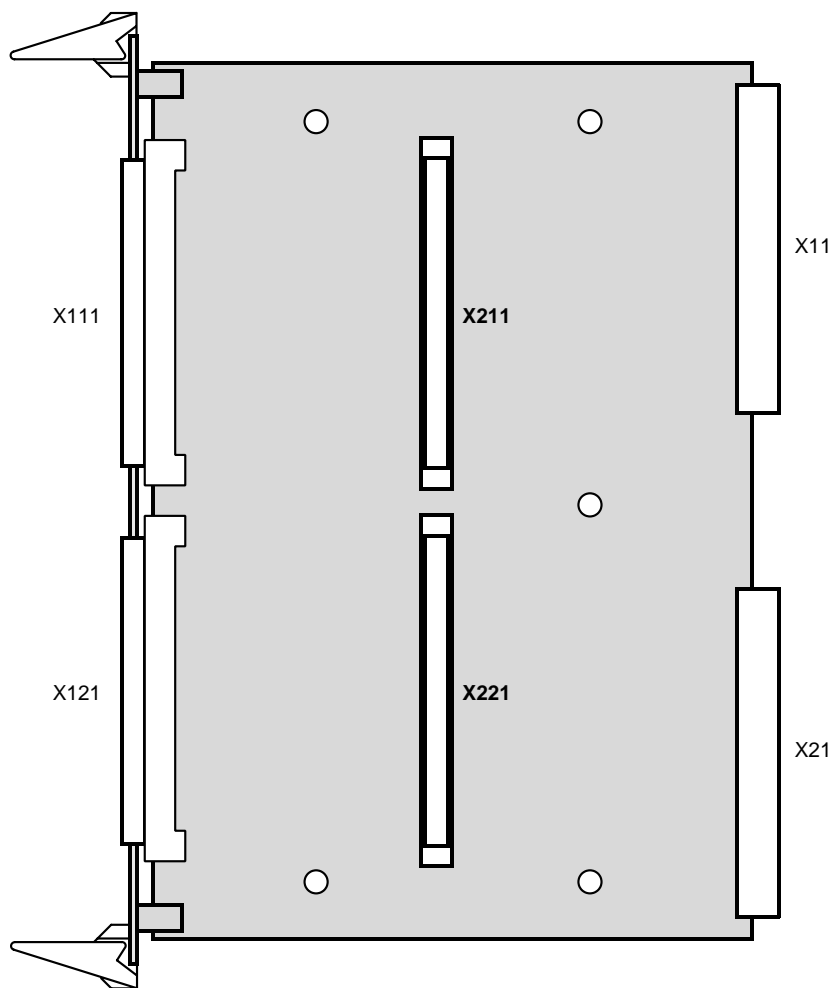
This module comprises:

- Microprocessor 80386 25 MHz
- Coprocessor 80387 (not slotted in)
- 768-Kbyte static RAM (battery-backed)
- Command status register with CPU monitoring
- Interrupt controller
- Timer component

Position of interfaces and operating and display elements



Caution: Back up all data before you remove this module.



X211, X221 Submodule interface (INT/MEM submodule 6FX1 147-5BA01 can be slotted in)

X11, X21 – Bus interface

Total current	+5 V	5 V _{ext}	+15 V	-15 V	+24 V
typical	2.5 A	—	—	—	—
X111/X121	4 A	—	1 A	1 A	—
X111, X121	2 A	—	0.5 A	0.5 A	—
X211/X221	4 A	—	1 A	1 A	—
X211, X221	2 A	—	0.5 A	0.5 A	—

2.3.1.1 MEM. DIL. 32-bit

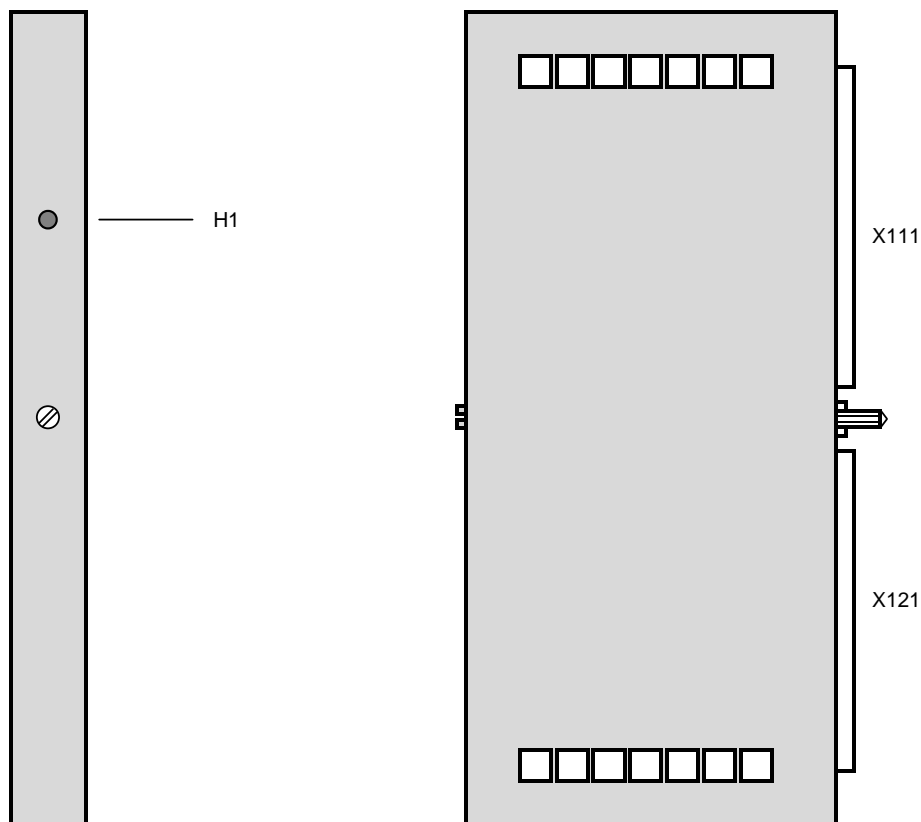
6FX1 124-1CC00

The MEM.DIL. 32-bit is used as a program memory for the 32-bit CPU and has a special format. The submodule is plugged into the front panel of the CPU module and protrudes beyond the rack.

This submodule comprises:

- 4 EPROMs D27C210
- 0.5 Mbyte memory capacity

Position of interfaces and operating and display elements



- H1 – Status LED: red - stop state
- X111 – 32-bit CPU interface
- X121 – 32-bit CPU interface

Total current	+5 V	5 V _{ext}	+15 V	-15 V	+24 V
typical	0.2 A	—	—	—	—

2.3.2 INTERFACE/MEMORY submodule

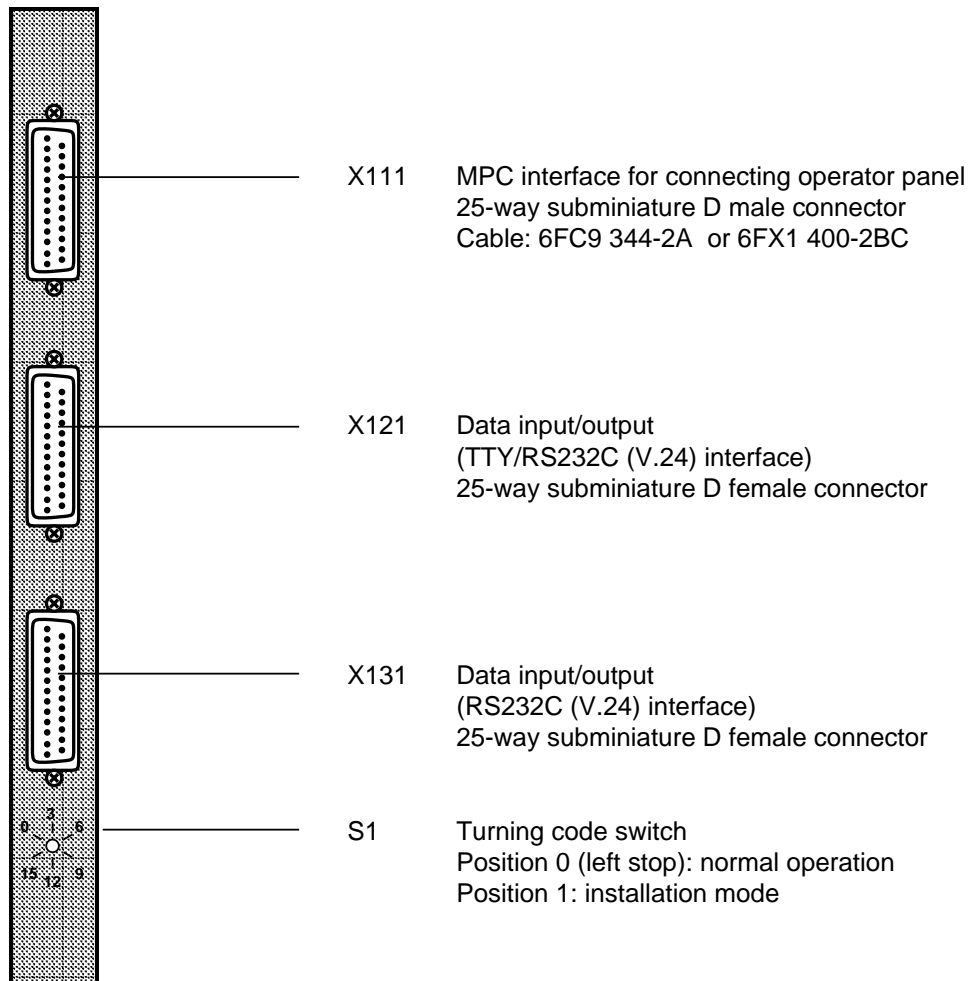
6FX1 147-5BA01

The INTERFACE/MEMORY submodule is used to expand the 32-bit CPU (6FX1 147-5BA01) in the COM area as an interface and memory submodule (if fully fitted).

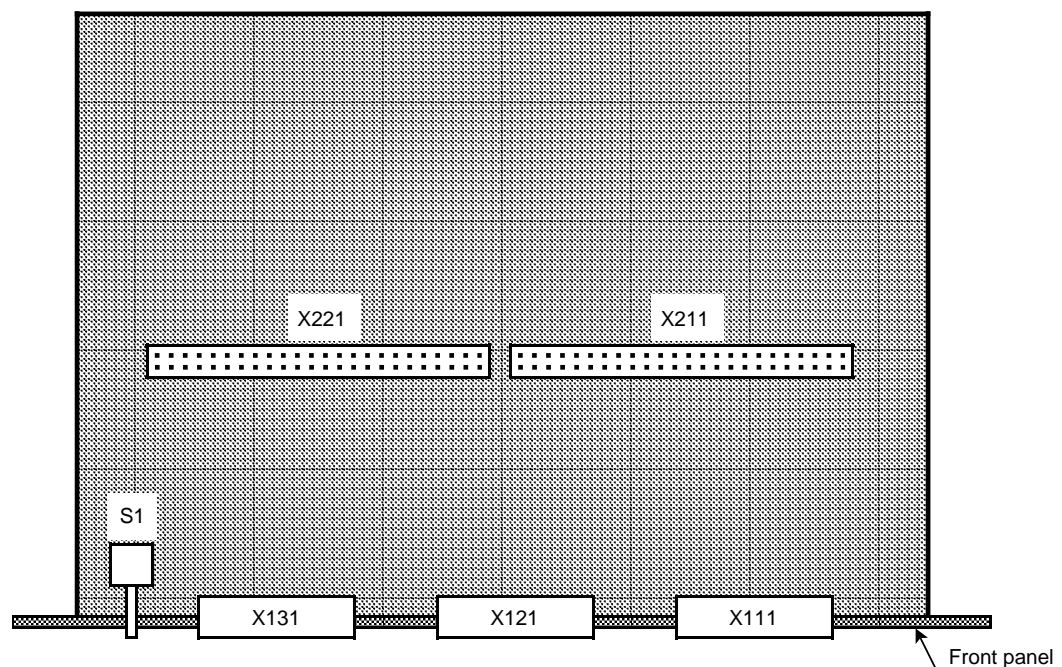
This submodule comprises (if the module is fully fitted):

- Link memory
- MPC
- SCC (serial communications controller Z8530)
- Page register (for memory)
- CSR
- 1 Mbyte of static RAM battery-backed

Position of interfaces and operating and display elements

**Caution:**

Back up all data before you remove this submodule.



X211/X221 – Passive submodule interface (32-bit CPU module 6FX1 147-4BB00 can be plugged in)

Total current	+5 V	5 V _{ext}	+15 V	-15 V	+24 V
typical	1.5 A	—	0.1 A	0.05 A	—
X111 to X131	1 A	—	—	—	—
X111/X131	0.5 A	—	—	—	—

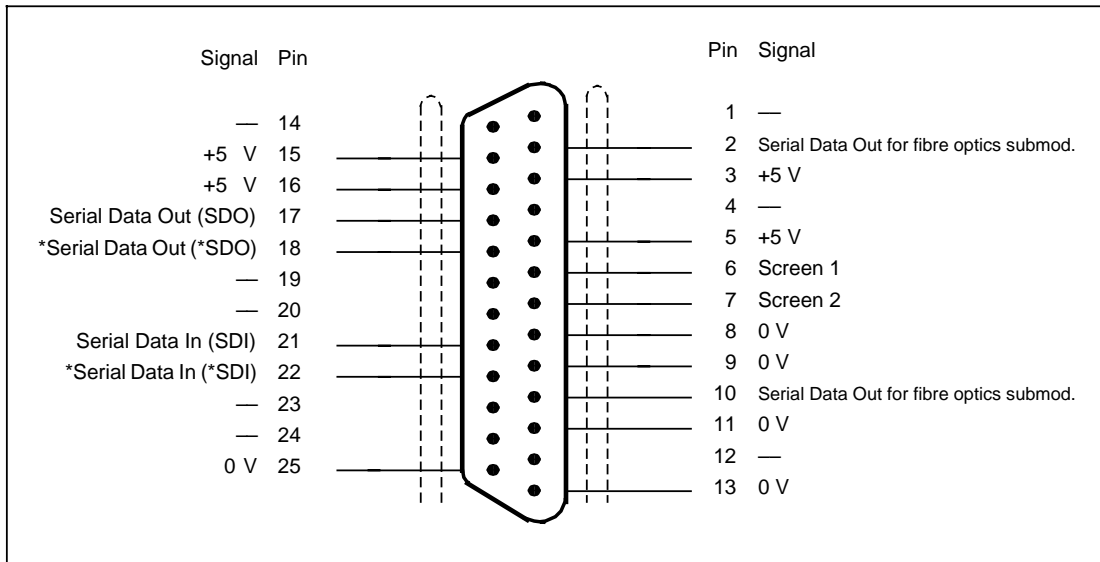
This module is screwed onto the 32-bit CPU module and can only function in conjunction with it.

MPC interface

The MPC interface is used for data transfer between the central controller and the operator panel.

Connector designation: **X111**

Connector type: 25-way subminiature D male connector



The connection can be made in two ways:

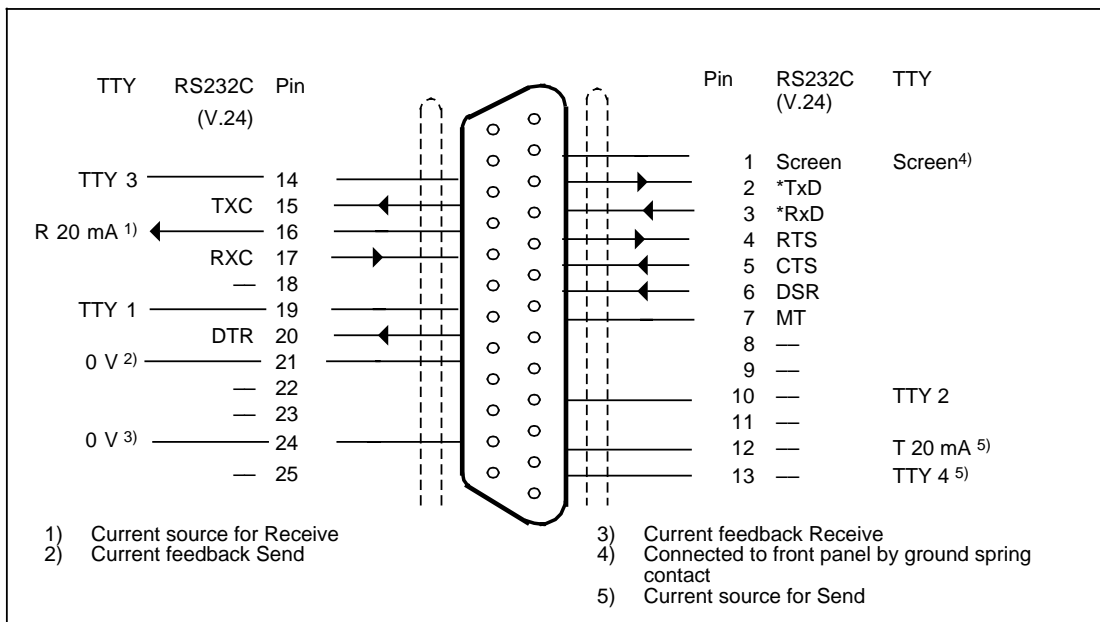
- via copper cable (6FC9 344-2A)
- via fibre optics cable (6FX1 400-2BC)

Serial interface

can be used for: RS232C (V.24)/TTY (20 mA)

Connector designation: **X121**

Connector type: 25-way subminiature D female connector



Characteristic values:

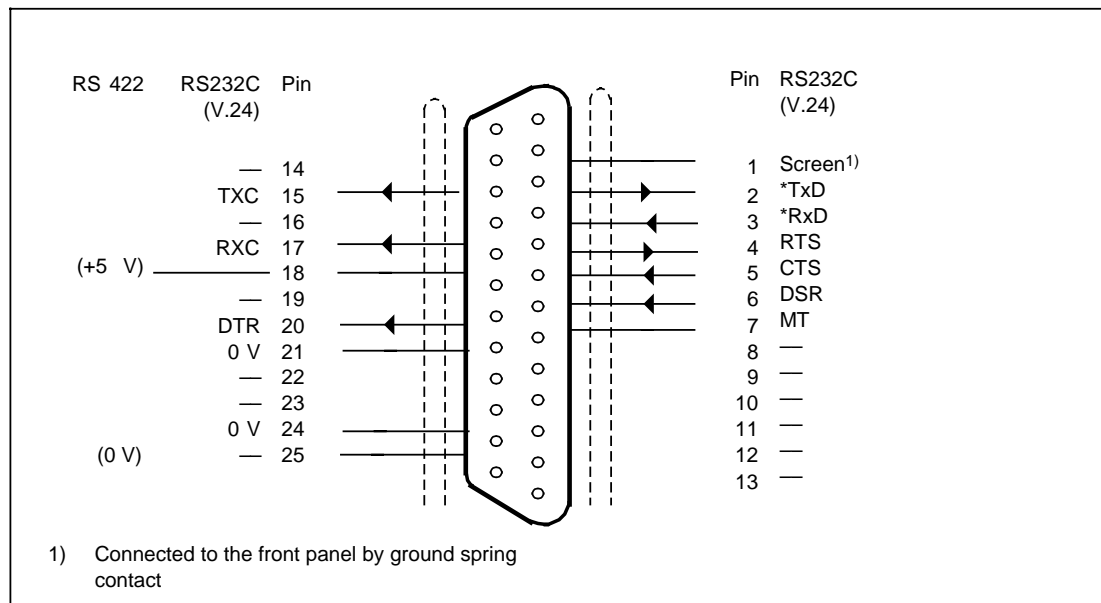
- RS232C (V.24) Level ± 12 V
 Signals *RxD and *TxD are low active
- 20 mA
 Active and passive (is defined in pin assignment);
 only possible in full duplex mode

Serial interface

can be used for: RS232C (V.24)/RS 422 (with RS 422 adapter)

Connector designation: **X131**

Connector type: 25-way subminiature D female connector



Note:

A detailed description of the serial interfaces is contained in the Planning Guide Universal Interface System 800.

2.3.3 MEMORY/PAGE

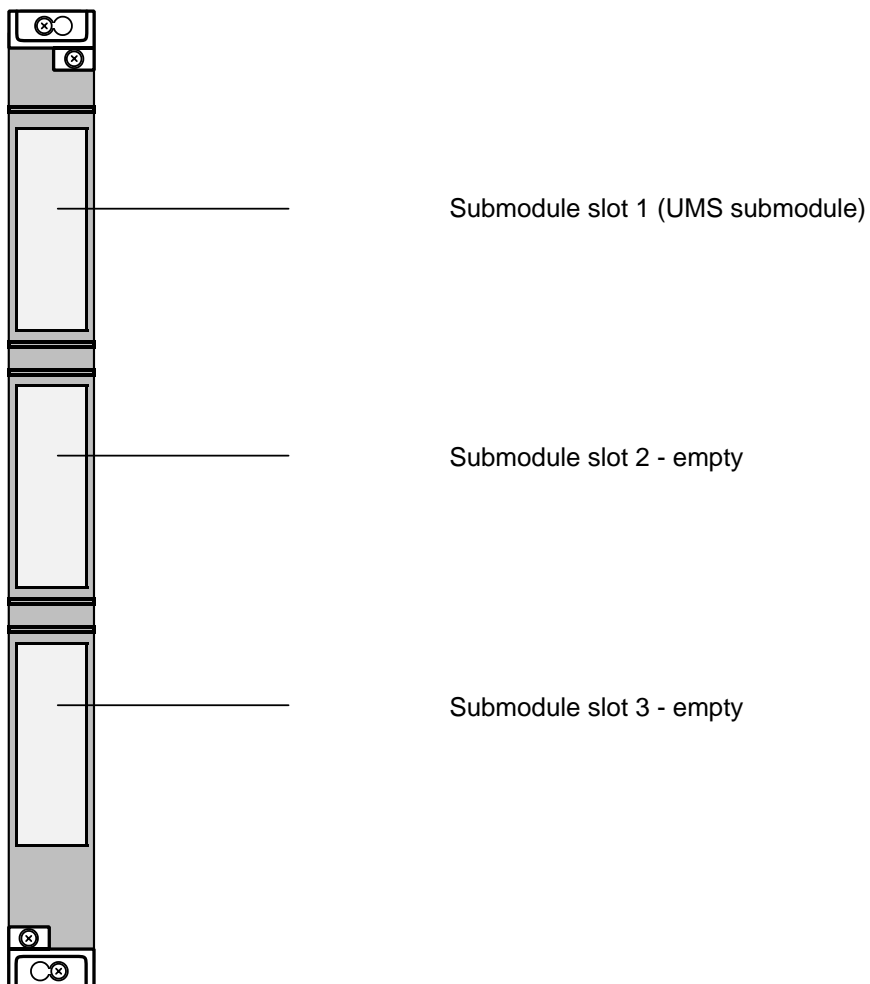
6FX1 126-7BA01

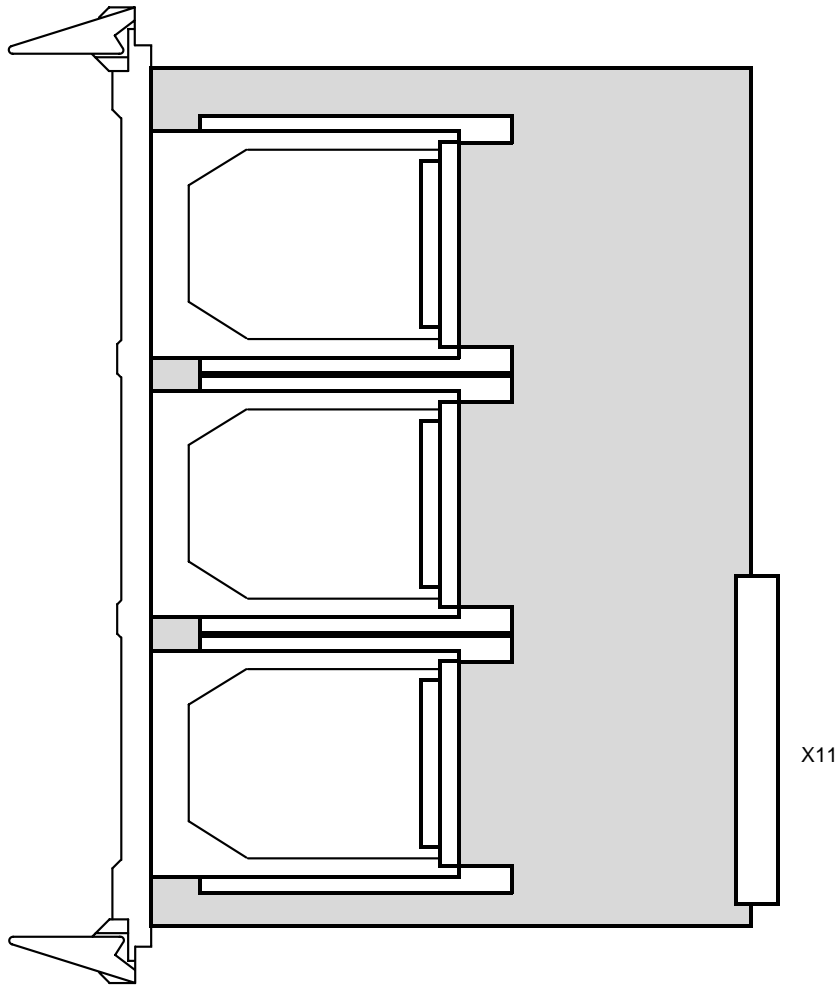
The module is a carrier module for three memory submodules (RAM or EPROM) with a memory capacity of 256 Kbytes each (it can be used as a carrier module for UMS submodules).

This module comprises:

- Automatic detection by the software of the submodules plugged in
- Address routing without software.

Position of interfaces and operating and display elements





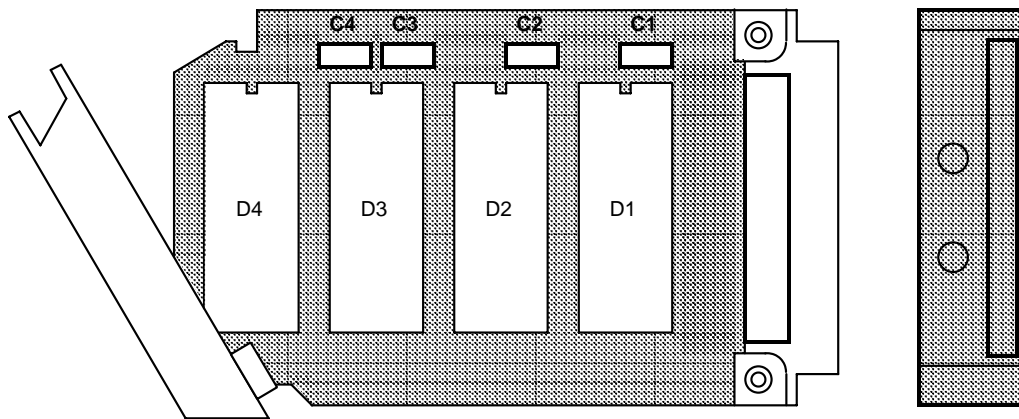
X11 – Bus interface

Total current	+5 V	5 V _{ext}	+15 V	-15 V	+24 V
typical	0.32 A	—	—	—	—

2.3.3.1 128-Kbyte/256-Kbyte EPROM submodule**6FX1 128-4B 00**

This submodule is used to store the system software (for the CP315 or for the operator panel) and as a user memory submodule with two or four EPROMS (type 27C512).

If you only use two EPROMS, slot them into slots D1 and D3.



Total current	+5 V	5 V _{ext}	+15 V	-15 V	+24 V
6FX1 128-4BD00, typical 128 Kbytes (2 EPROMs)	0.04 A	—	—	—	—
6FX1 128-4BC00, typical 256 Kbytes (4 EPROMs)	0.08 A	—	—	—	—

Note:

The standard user memory submodule 6FX1 862-0BX03 has the same dimensions as the 256-Kbyte EPROM submodule 6FX1 128-4BC00.

2.3.3.2 128-Kbyte RAM submodule

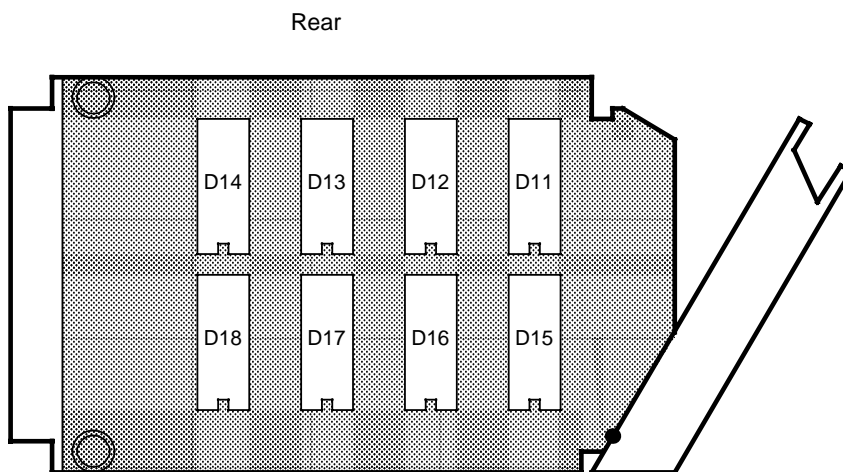
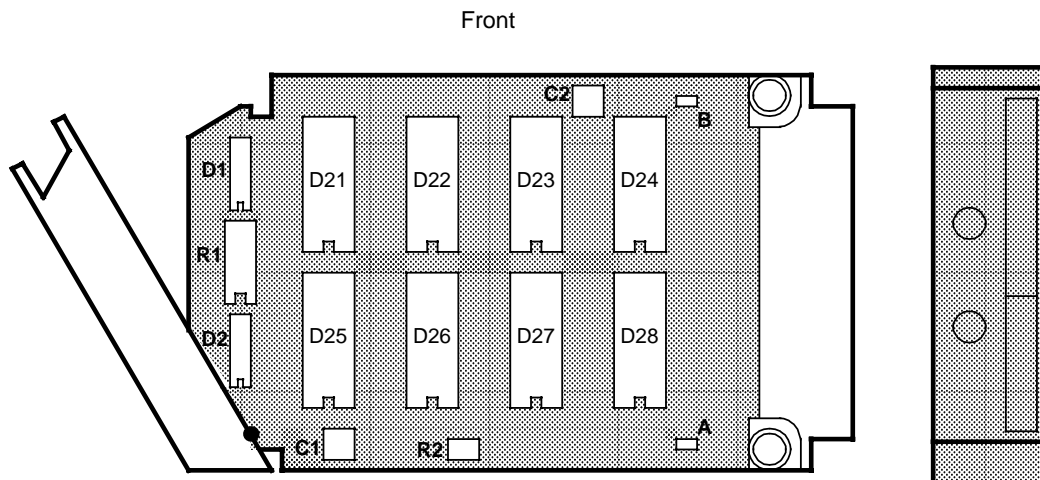
6FX1 126-6BA00

The 128-Kbyte RAM submodule is a memory submodule with 128 Kbytes of CMOS RAM.

If the submodule is removed the data on it is lost.

It is used in the following modules:

- 6FX1 126-7BA01 MEMORY/PAGE (as a UMS, in the upper connector)
- 6FX1 128-1BB01 MEMORY/EPROM-RAM (operator panel area)



Total current	+5 V	5 V _{ext}	+15 V	-15 V	+24 V
typical	0.085 A	—	—	—	—

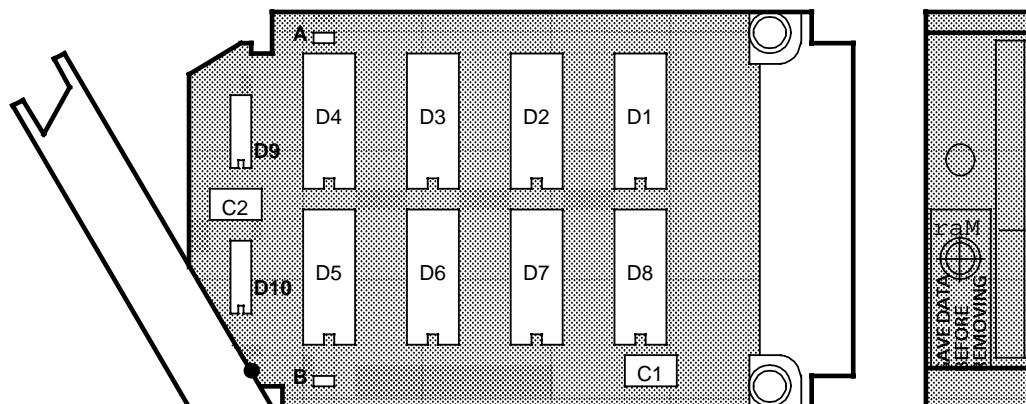
2.3.3.3 256-Kbyte RAM submodule**6FX1 135-3BA00**

The 256-Kbyte RAM submodule is a memory submodule with 256 kbytes of CMOS RAM.

If the submodule is removed the data on it is lost.

It is used in the following modules:

- 6FX1 126-7BA01 MEMORY/PAGE (as a UMS, in the upper connector)
- 6FX1 128-1BB00 MEMORY/EPROM-RAM (operator panel area)



Total current	+5 V	5 V _{ext}	+15 V	-15 V	+24 V
6FX1 135-3BA00 typical	0.07 A	—	—	—	—

2.3.4 MEMORY/DUAL-PORT (single-tier)

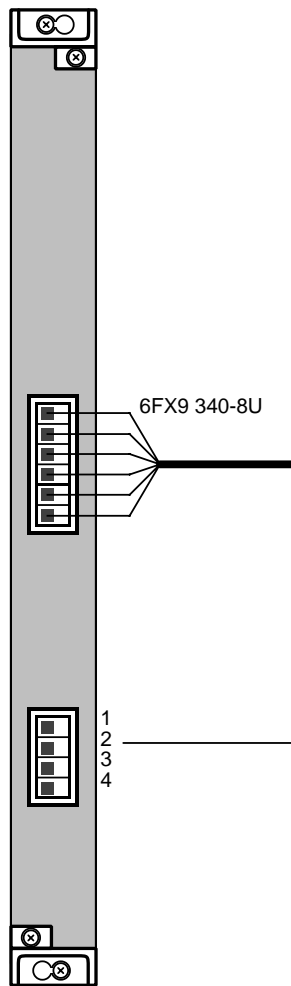
6FX1 124-0BA03

The MEMORY/DUAL-PORT functions as a central link memory, through which the various CPUs exchange data and in which the system-relevant data (e.g. machine data) are stored.

This module comprises:

- 128 Kbyte link RAM (battery-backed)
- Temperature monitoring
- Realtime CMOS clock
- Address routing by software
- Logic for control of bus accesses according to fixed priorities
- System clock pulse generation
- Two measuring pulse inputs ("in-process measurement"), non-floating
- Relay output NC ready (NC ready 2)
- Temperature monitoring: central monitoring of the ambient temperature within the frame of the control for 50 °C in the form of a temperature switch (S4). When the monitoring reponds, F24.2 is set to 0 and NC alarm 2 OVERTEMPERATURE is output. F24.2 is evaluated by the user program which must perform a controlled shut-down of the machine.

Position of interfaces and operating and display elements

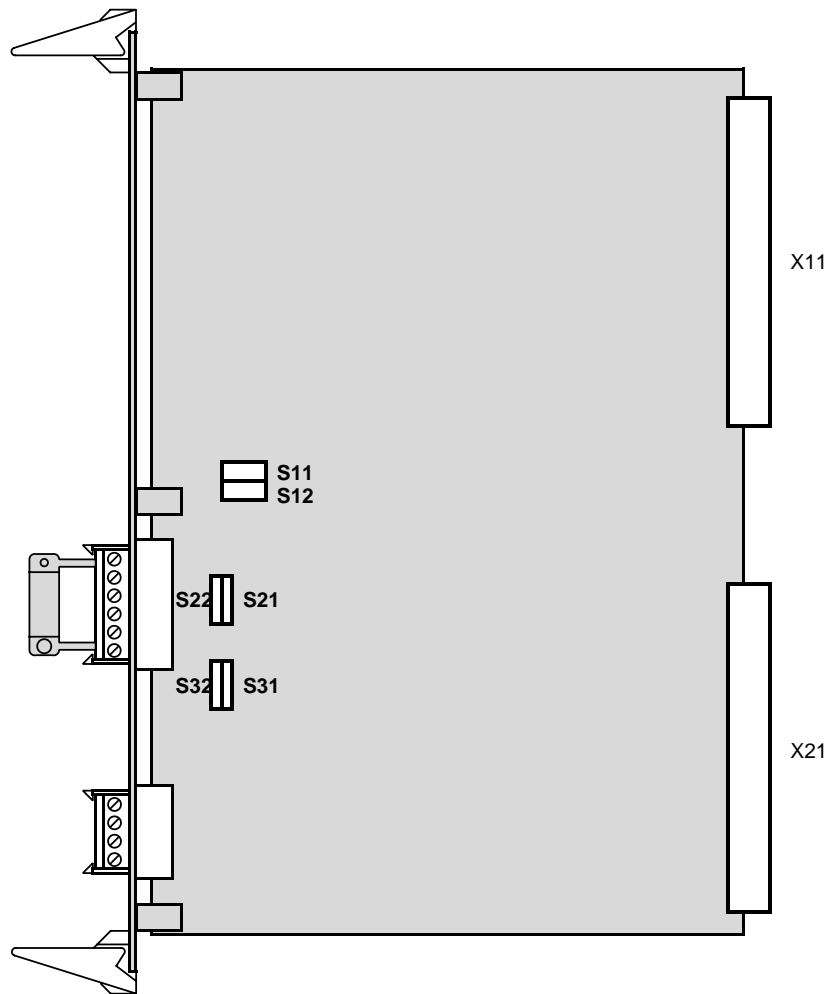


Caution:

Back up all data before you remove this module.

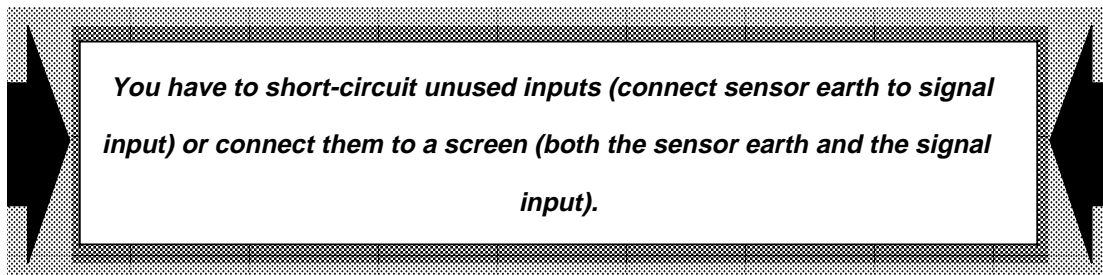
X121 Measuring pulse inputs

X151 NC READY relay output



- S11, S12 – Active signal level of measuring pulse inputs
 S21, S22 – Signal level measuring pulse input sensor 1
 S31, S32 – Signal level measuring pulse input sensor 2
 X11, X21 – Bus interface

Total current	+5 V	5 V _{ext}	+15 V	-15 V	+24 V
typical	1 A	—	—	—	—



Measuring pulse inputs

Connector designation: **X121**
Connector type: Terminal strip

1	0	Screen	
2	0	Measuring pulse	sensor 1
3	0	Earth	sensor 1
4	0	Measuring pulse	sensor 2
5	0	Earth	sensor 2
6	0	Screen	

Technical specifications:

- Jumpering TTL or "open collector"
Voltage "high" 4,2 ... 5.25 V
Voltage "low" -1,5 ... 1.7 V
Current consumption 10 mA
- Jumpering 24 V DC
Voltage "high" 13 ... 30 V
Voltage "low" -3 ... 5 V
Current consumption 10 mA

The delay between the arrival of the edge and to storage of the actual value is up to 10 μ s.
The two measuring pulse inputs are non-floating. The maximum cable length to the sensor is 35 m.

Caution:

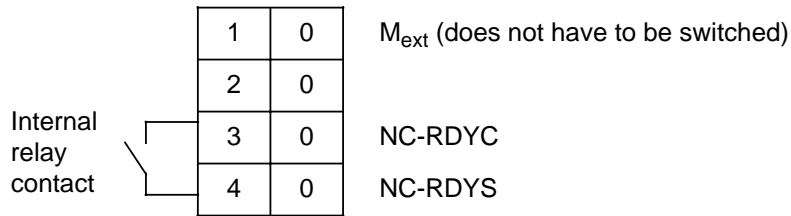
Only **one** of the two measuring pulse inputs can be activated by the NC program with @720.

Case	Active sensor signal		Sensor 1			Sensor 2		
	Edge	Level	S11	S21	S22	S12	S31	S32
Relay contact	normally open	open						
	normally closed	closed						
TTL (open collector)		+5 V						
		0 V						
24 V		+24 V						
		0 V						

Case	Active sensor signal
Relay contact	
TTL (open collector)	
24 V	

NC READY relay output

Connector designation: **X151**
Connector type: Terminal strip



Technical specifications:

Voltage: max. 30 V
Up to current load of the relay contact: 1 A (inductive only 0.5 A)
Up to switching frequency: – 100 Hz (ohmic load)
– 2 Hz (inductive load)
– 11 Hz (lamp load)
Insulation voltage: 0.125 kV

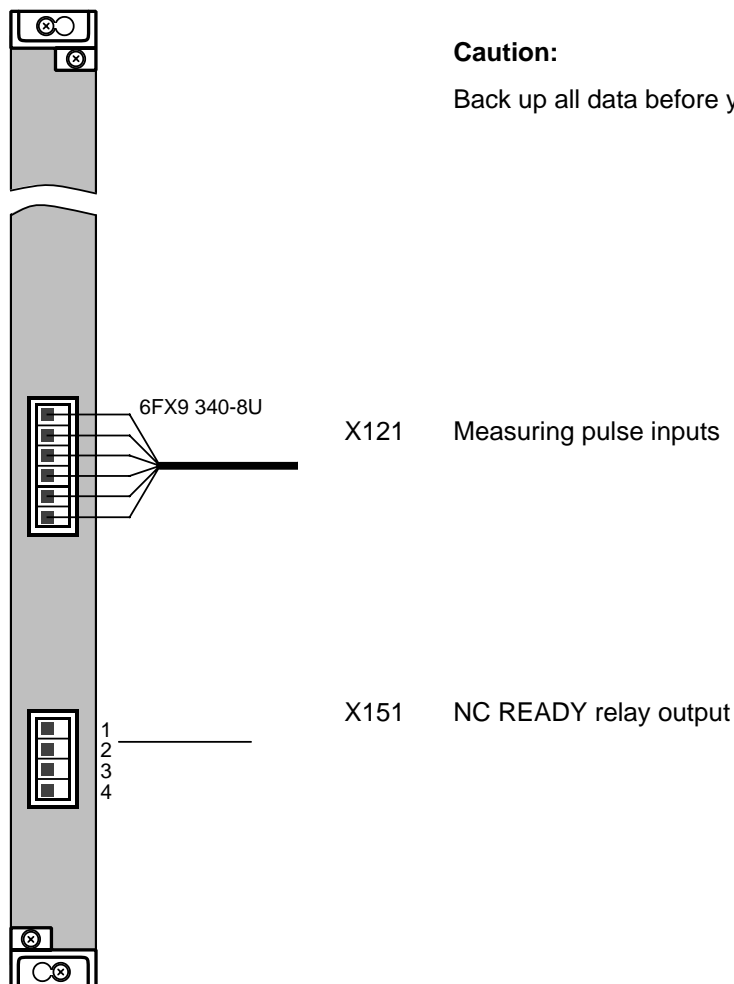
2.3.5 MEMORY/MULTI-PORT (two-tier)

6FX1 136-8BA01

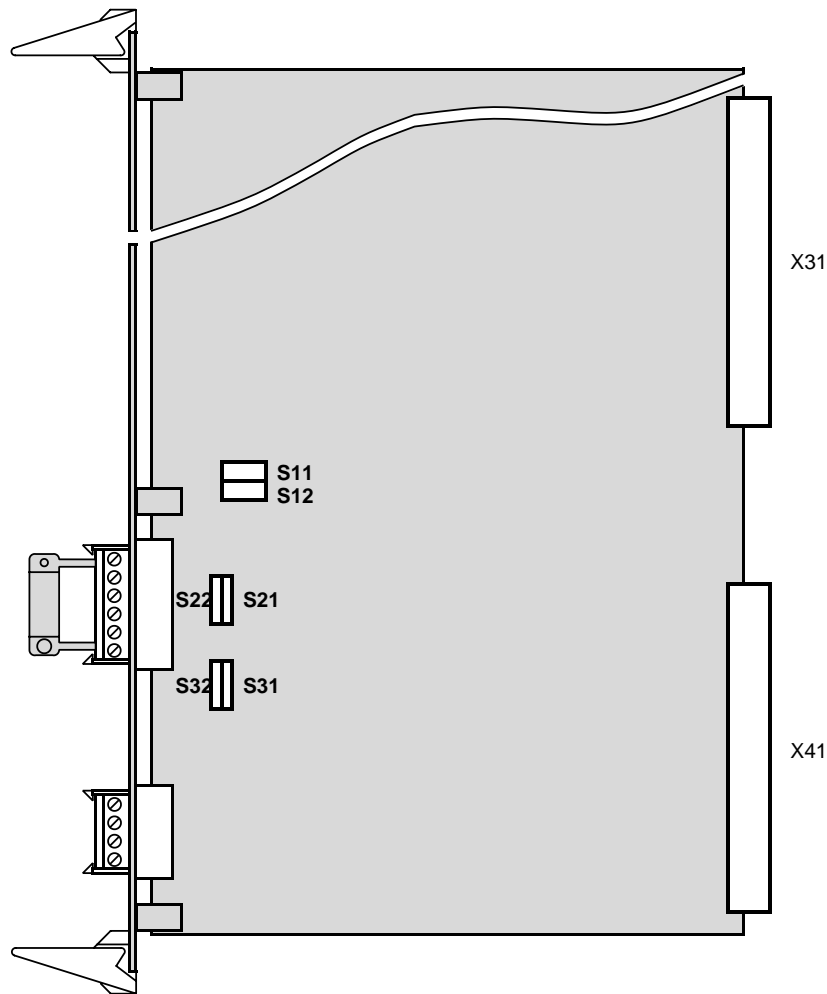
The MEMORY/DUAL-PORT functions as a central link memory, through which the various CPUs exchange data and in which the system-relevant data (e.g. machine data) are stored.

This module comprises:

- 128-Kbyte link RAM (battery-backed)
- Temperature monitoring
- Realtime CMOS clock
- Address routing by software
- Logic for control of bus accesses according to fixed priorities
- System clock pulse generation
- Two measuring pulse inputs ("in-process measurement"), non-floating
- Relay output NC ready (NC ready 2)
- Temperature monitoring: central monitoring of the ambient temperature within the frame of the control for 50°C in the form of a temperature switch (S4). When the monitoring reponds, F24.2 is set to 0 and NC alarm 2 OVERTEMPERATURE is output. F24.2 is evaluated by the user program which must perform a controlled shut-down of the machine.

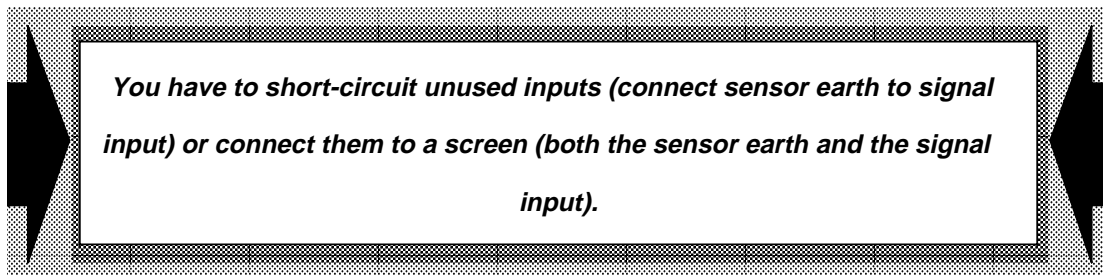
Position of interfaces and operating and display elements

2.3.5 MEMORY/MULTI-PORT (two-tier)



- S11, S12 – Active signal level of measuring pulse inputs
- S21, S22 – Signal level measuring pulse input sensor 1
- S31, S32 – Signal level measuring pulse input sensor 2
- X31, X41 – Bus interface, tier B
- X11, X21 – Bus interface, tier C

Total current	+5 V	5 V _{ext}	+15 V	–15 V	+24 V
typical	1.2 A	—	—	—	—



Measuring pulse inputsConnector designation: **X121**

Connector type: Terminal strip

1	0	Screen	
2	0	Measuring pulse	sensor 1
3	0	Earth	sensor 1
4	0	Measuring pulse	sensor 2
5	0	Earth	sensor 2
6	0	Screen	

Technical specifications:

- Jumpering TTL or "open collector"
 - Voltage "high" 4,2 ... 5.25 V
 - Voltage "low" -1.5 ... 1,7 V
 - Current consumption 10 mA
- Jumpering 24 V DC
 - Voltage "high" 13 ... 30 V
 - Voltage "low" -3 ... 5 V
 - Current consumption 10 mA

The delay between the arrival of the edge to storage of the actual value is up to 10 μ s. The two measuring pulse inputs are non-floating. The maximum cable length to the sensor is 35 m.

Caution:

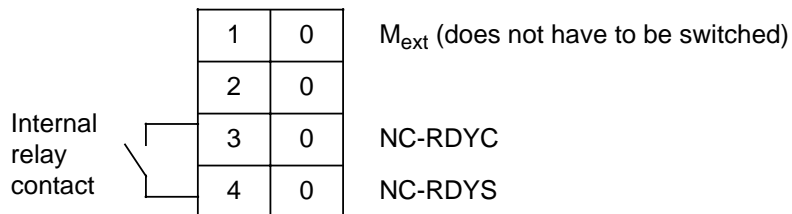
Only **one** of the two measuring pulse inputs can be activated by the NC program with @720.

Case	Active sensor signal		Sensor 1			Sensor 2		
	Edge	Level	S11	S21	S22	S12	S31	S32
Relay contact	normally open	open						
	normally closed	closed						
TTL (open collector)		+5 V						
		0 V						
24 V		+24 V						
		0 V						

Case	Active sensor signal
Relay contact	
TTL (open collector)	
24 V	

NC READY relay outputConnector designation: **X151**

Connector type: Terminal strip

**Technical specifications:**

Voltage:	max. 30 V
Up to current load of the relay contact:	1 A (inductive only 0.5 A)
Up to switching frequency	– 100 Hz (ohmic load) – 2 Hz (inductive load) – 11 Hz (lamp load)
Insulation voltage:	0.125 kV

2.3.6 SINEC H1 module CP 231 A

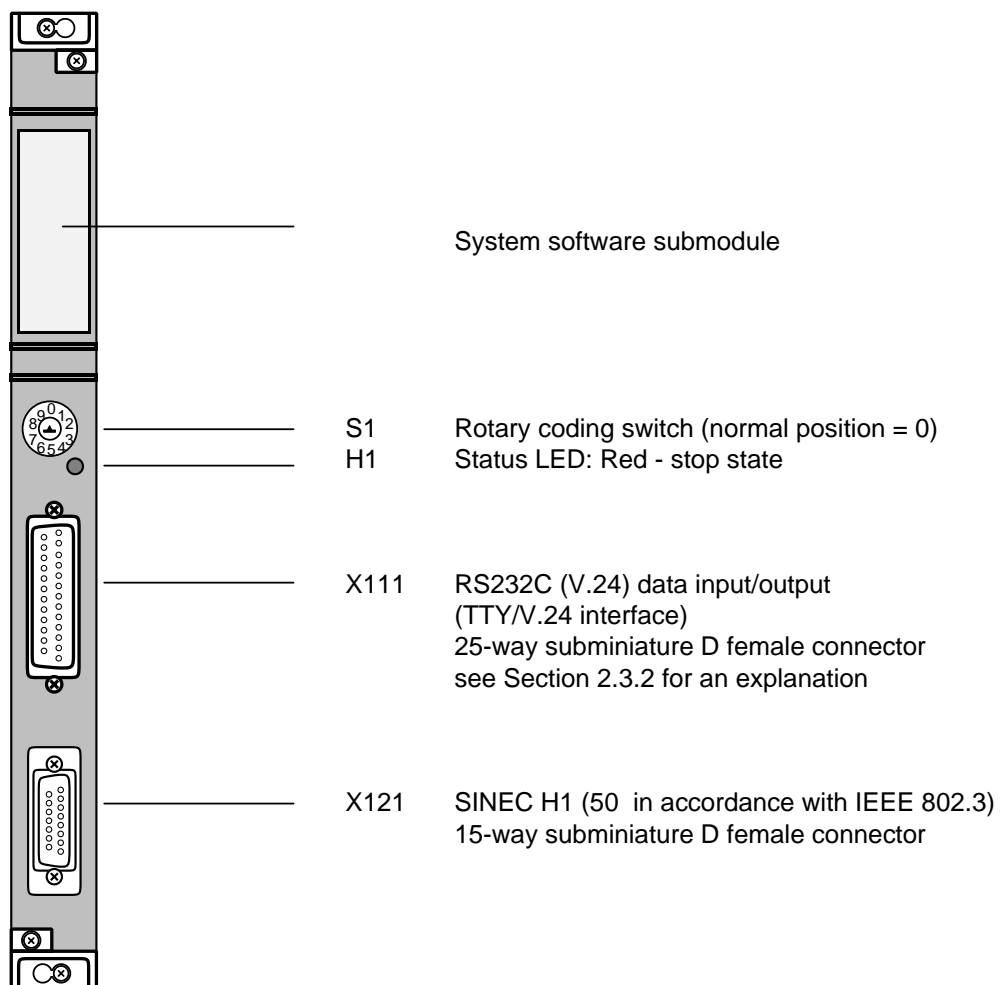
6FX1 123-1BC02

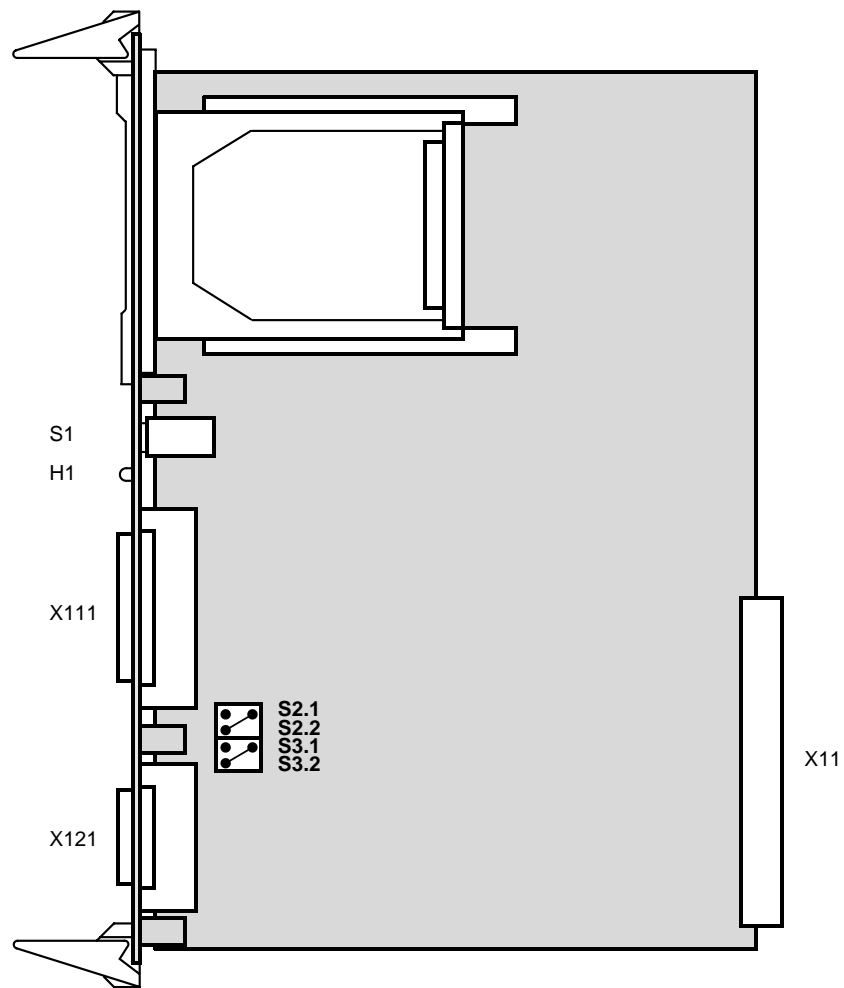
The SINEC H1 module is used for establishing a computer link and links the NC to a local area network via a coaxial cable (50 in accordance with IEEE 802.3). For installation and for testing purposes, the module has a serial RS232C (V.24)/20mA.

This module comprises:

- Plug-in system software submodule
- 1 rotary selector switch for the selection of individual tests from a hardware test program
- 1 LED (error indication)
- 1 serial interface RS232C (V.24) (TTY/V.24)
- 1 interface to the SINEC H1 bus system
- Dual Port memory, 64 Kbytes (battery-backed)
- RAM max. 512 kbyte (dynamic)
- Address routing by software

Position of interfaces and operating and display elements





- S2.1 – open
 S2.2 – closed
 S3.1 – open
 S3.2 – closed
 X11 – Bus interface

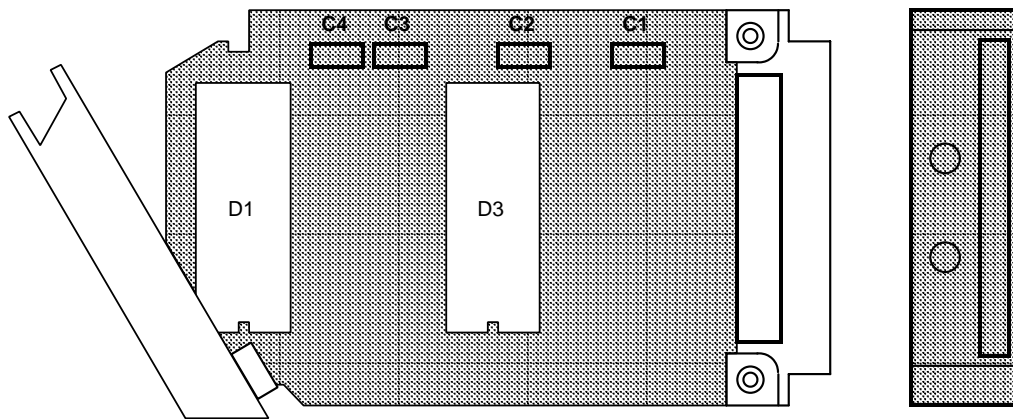
Total current	+5 V	5 V _{ext}	+15 V	-15 V	+24 V
typical	2.1 A	—	0.3 A	0.05 A	—
X111/X121	0.9 A	—	—	—	—

2.3.6.1 MEMORY EPROM submodule

6FX1 122-6CB00

The MEMORY EPROM submodule is a memory submodule with 512 Kbytes capacity.

This submodule is used to store the system software (on the CP 231 A) and has the software order number 6FX1 840-0BX02.



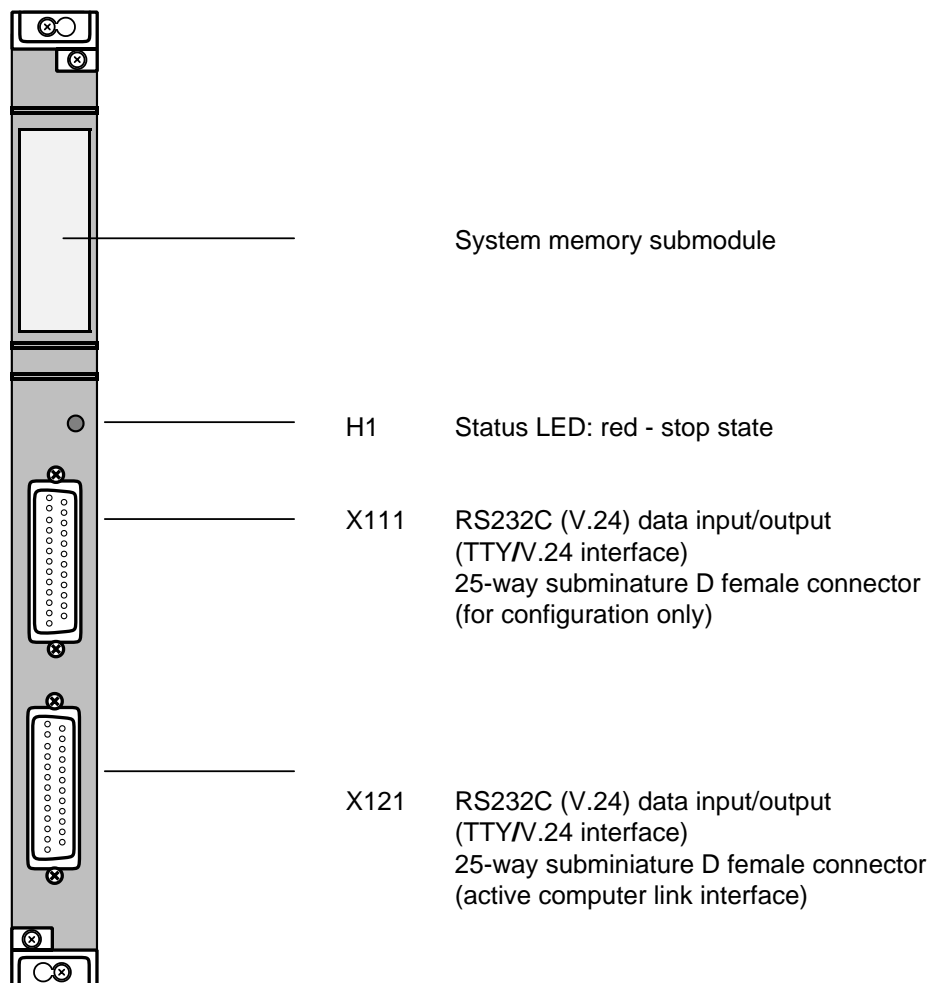
Total current	+5 V	5 V _{ext}	+15 V	-15 V	+24 V
typical	0.04 A	—	—		—

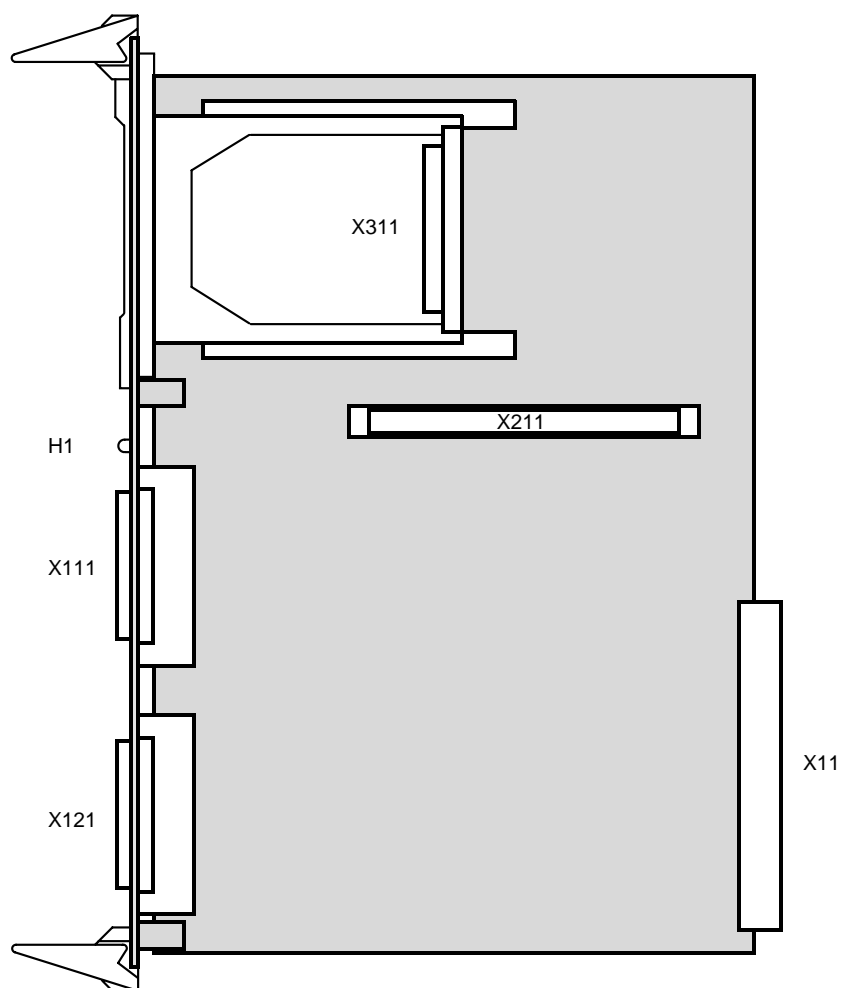
2.3.7 ACTIVE RS232C (V.24) module CP 315**6FX1 131-5BA01**

The ACTIVE RS232C (V.24) module is used for establishing a computer link and controlling the point-to-point link between NC and computers, terminals, printers, etc.

This module comprises:

- Plug-in system software submodule (256-kbyte EPROM submodule)
- 1 LED (error indication)
- 2 serial interfaces RS232C (V.24) RS232C (V.24) (TTY/V.24 interface)
- 64-Kbyte Dual-port RAM (battery-backed)
- 256 Kbytes of RAM
- Address routing by software
- Can be expanded by 3 serial RS232C (V.24)/RS232C (V.24) (TTY/V.24) interfaces by adding the submodule 6FX1 137-3BA01

Position of interfaces and operating and display elements



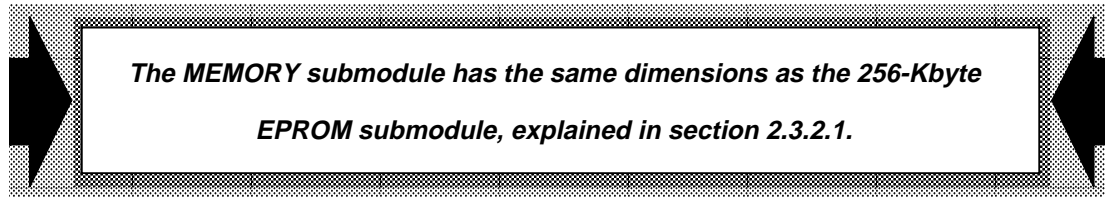
- X211 – Plug-in submodule interface for expansion submodule 6FX1 137-3BA01
- X311 – EPROM submodule interface
- X11 – Bus interface

Total current	+5 V	5 V _{ext}	+15 V	-15 V	+24 V
typical	1.8 A	—	0.08 A	0.02 A	—
X111/X121	1.1 A	—	—	—	—

2.3.7.1 MEMORY submodule

6FX1 128-4BA00

The MEMORY submodule is used in the CP 315 (system program submodule) and has the software order number 6FX1 841-0BX01.



2.3.7.2 ACTIVE 3 x RS232C/TTY submodule

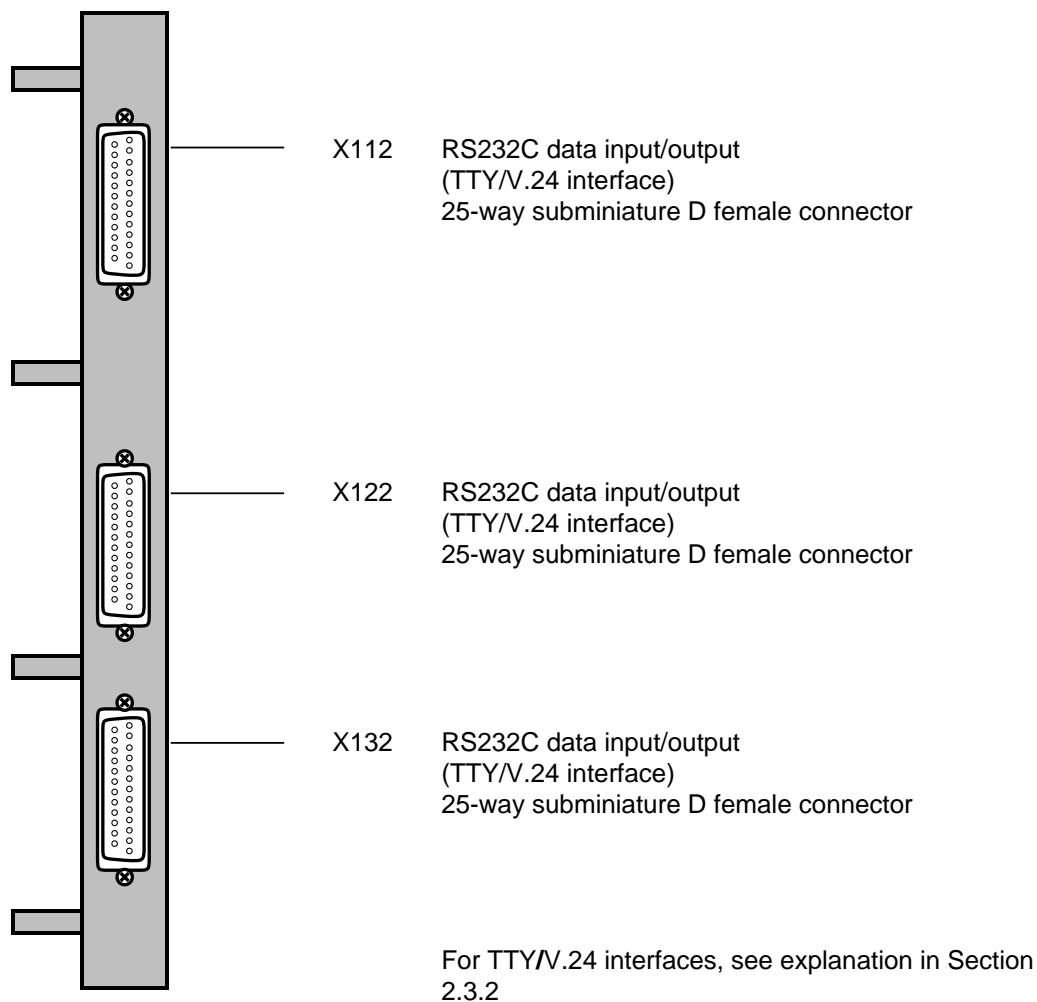
6FX1 137-3BA01

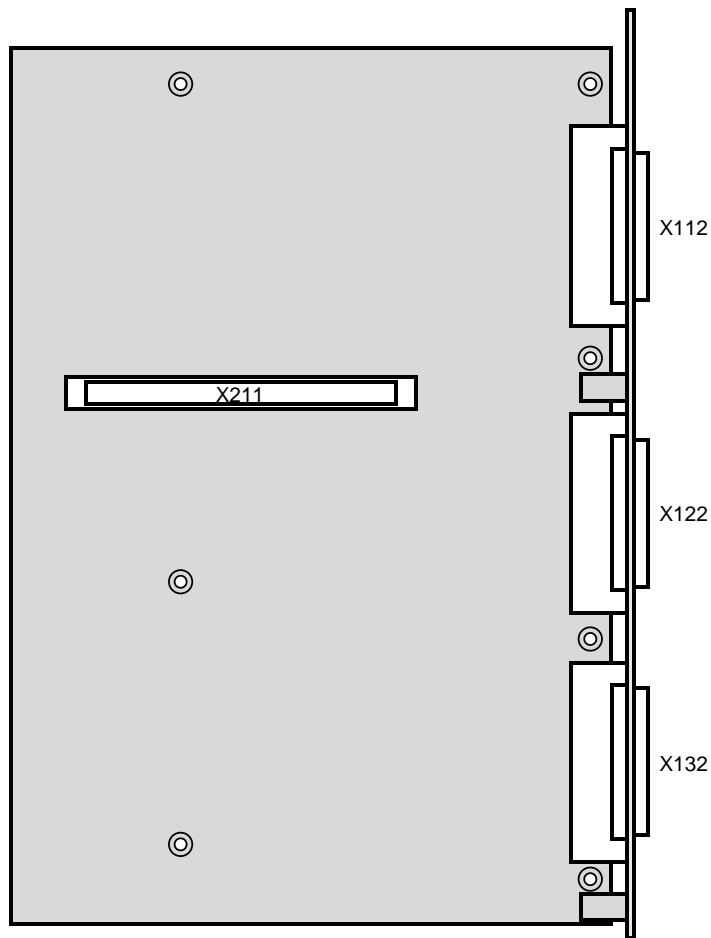
The ACTIVE 3 x RS232C/TTY submodule is used to expand the ACTIVE RS232C module (CP 315). Both control the point-to-point link between the NC and the computers, terminals, printers etc.

This submodule comprises:

- 3 additional serial interfaces RS232C as a TTY/V.24 interface

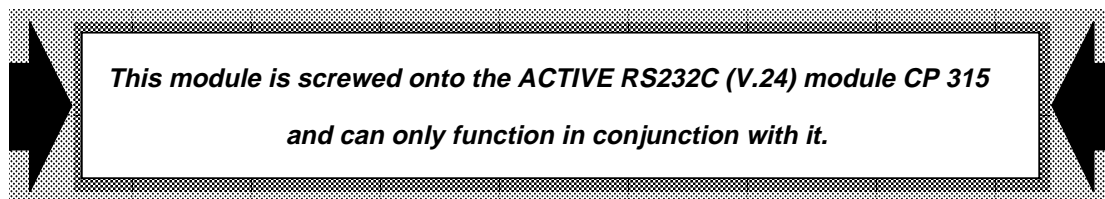
Position of interfaces and operating and display elements





X211 – Submodule interface to ACTIVE RS232C (V.24) module

Total current	+5 V	5 V _{ext}	+15 V	-15 V	+24 V
typical	0.4 A	—	0.122 A	0.041 A	—
X111 to X132	0.5 A	—	—	—	—



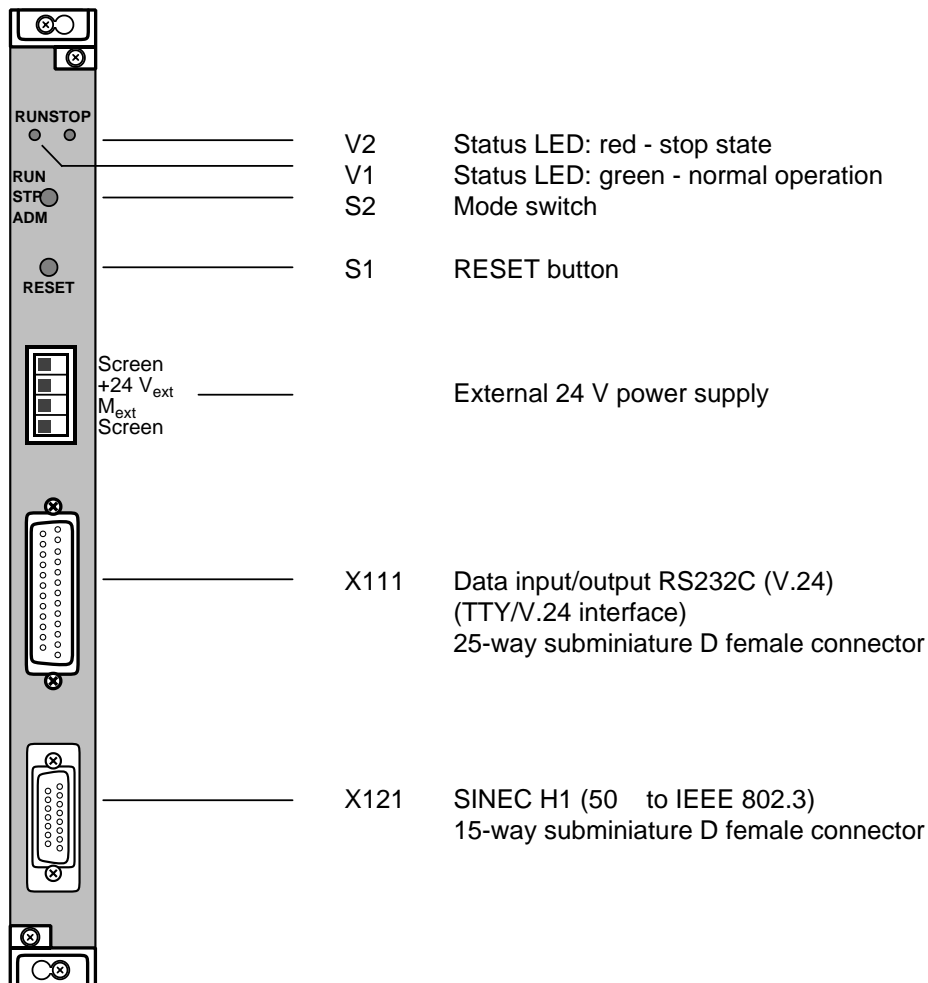
2.3.8 MAP 3.0 module CP 1476 (available soon) 6GK1 147-6MA01

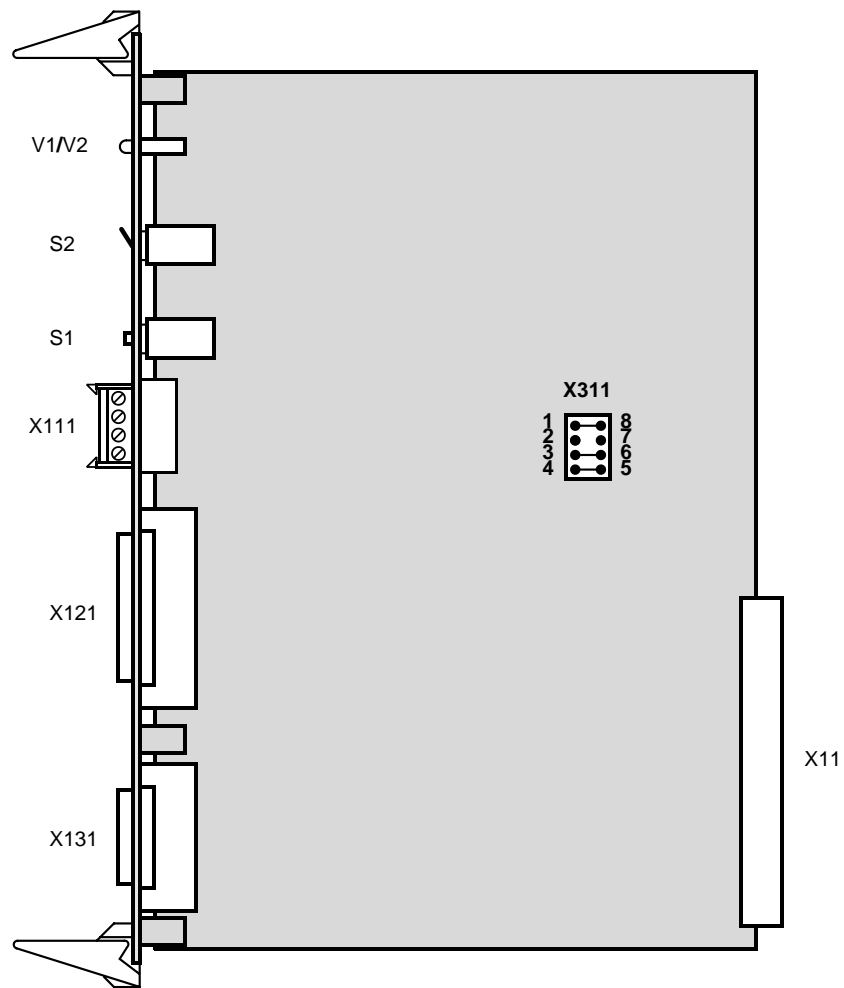
The MAP 3.0 module CP 1476 permits the SINUMERIK control to communicate with other automation systems under the MAP 3.0 international communication standard. The communications interface for the SINEC H1 connection is a 15-way subminiature D female connector.

This module comprises:

- RESET button
- Mode switch
- 2 display LEDs (RUN, STOP)
- 1 serial interface RS232C (V.24)
- 1 interface to the SINEC H1 local area network

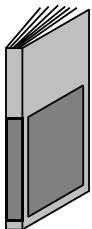
Position of interfaces and operating and display elements



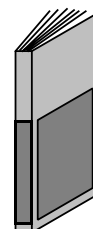


- X311 – Jumpers (set for SINUMERIK)
 1—8, 3—6 and 4—5: closed
 2—7: open
- X11 – Bus interface

Total current	+5 V	5 V _{ext}	+15 V	-15 V	+24 V
typical	3.5 A	—	0.04 A	0.04 A	0.15 A



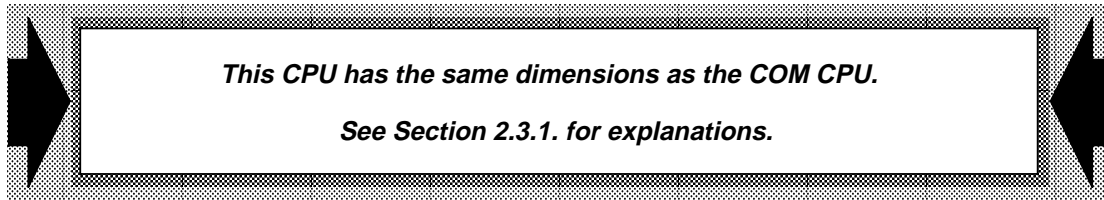
See CP 1476 MAP function manual for further explanations



2.4 NC area

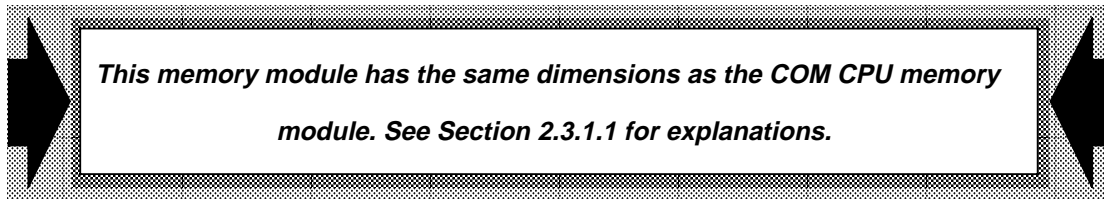
2.4.1 32-bit CPU

6FX1 147-4BB00



2.4.1.1 MEM. DIL. 32 bit

6FX1 124-1CC00



2.5 SERVO area

2.5.1 SERVO CPU 386

6FX1 136-3BB01

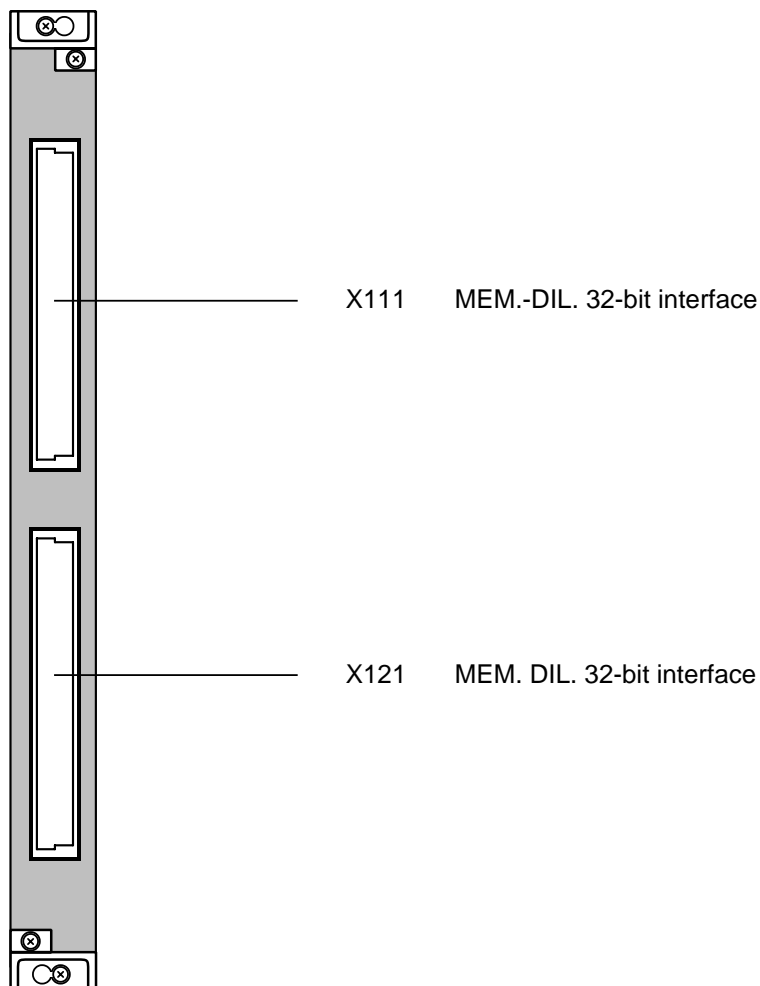
The SERVO CPU 386 module (FX1 136-3BB01 without coprocessor) is a further development of the SERVO CPU 386 module (FX1 136-3BA01) and is fully compatible with it.

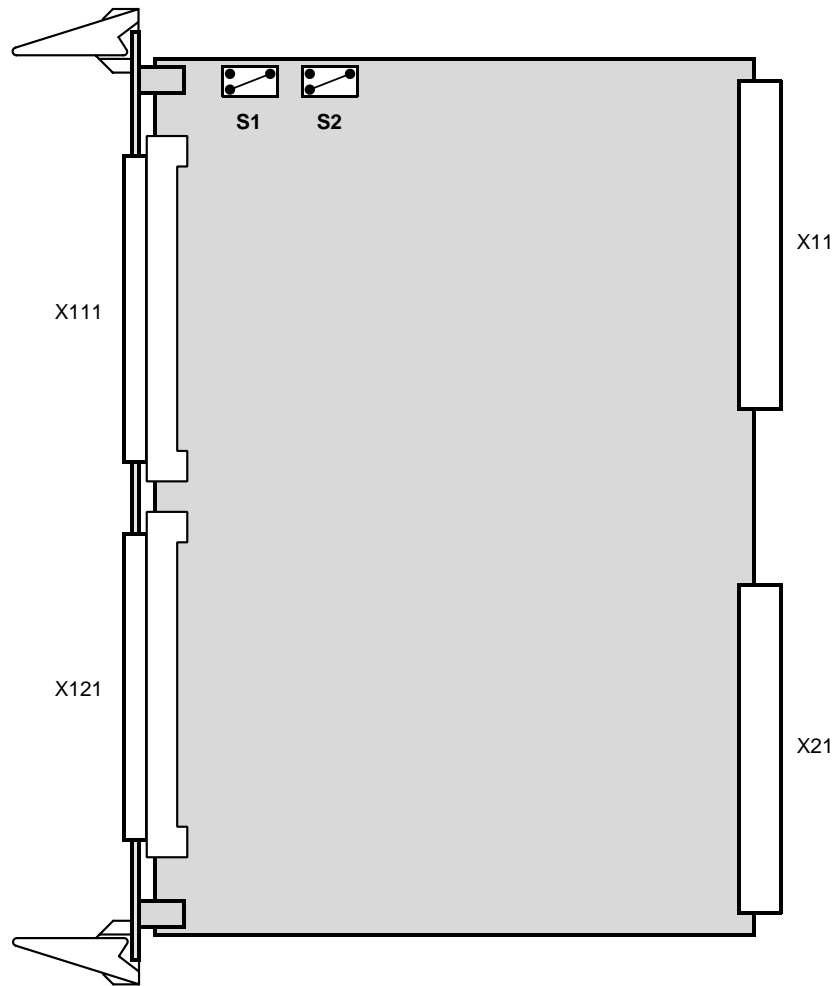
Two 96-way female connectors into which the MEM. DIL. 32-bit module can be plugged are provided on the front panel of the module.

This module comprises:

- CPU 80386/16 MHz
- 128-Kbyte SRAM
- DUAL-PORT RAM submodule, 4 Kbytes

Position of interfaces and operating and display elements





S1, S2 – Switch position 3-2 standard (for SINUMERIK 880 GA2)

X11, X21 – Bus interface

Total current	+5 V	5 V _{ext}	+15 V	-15 V	+24 V
typical	2.4 A	—	—	—	—
X111/X121	0.6 A	—	—	—	—
X111, X121	0.6 A	—	—	—	—

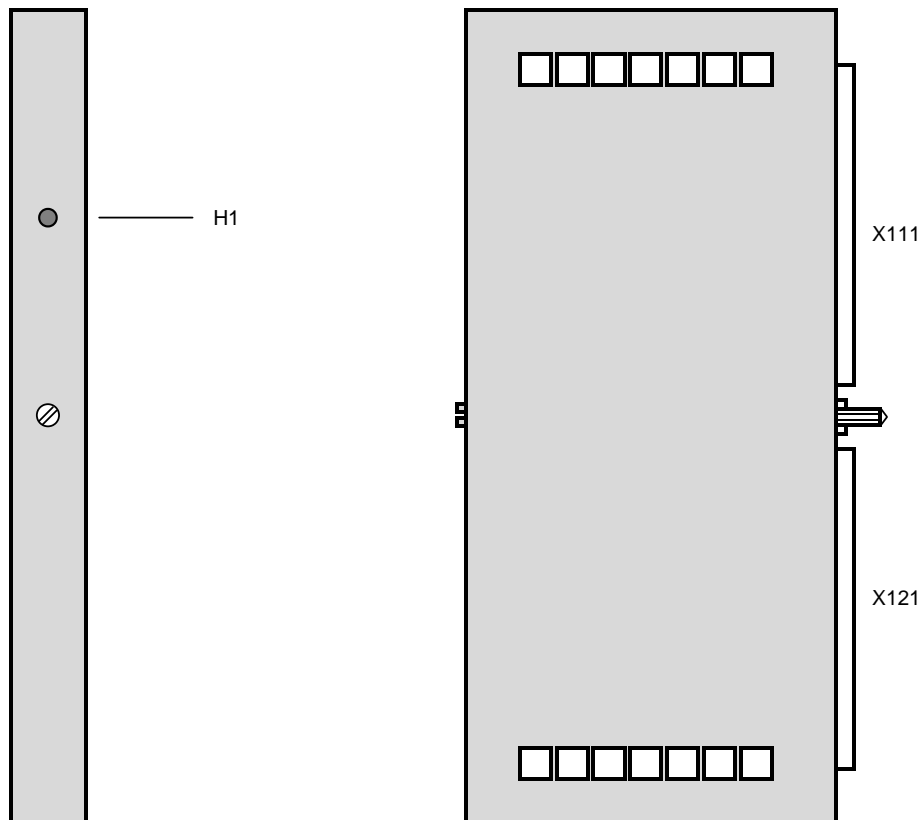
**When re-inserting a CPU, installation and start-up must
 be performed again!**

2.5.1.1 MEM DIL. 32 Bit**6FX1 124-1CB00**

The EPROM submodule is used as program memory for the SERVO CPU 386. It has a special format. The submodule is plugged onto the front panel of the master CPU module and protrudes beyond the rack.

This submodule comprises:

- 4 EPROMs D27C210 (0.5 MByte)
- MAC (Memory Access Controller)

Position of interfaces and operating and display elements

- H1 – Status LED: red - stop state
X111 – SERVO CPU interface
X121 – SERVO CPU interface

Total current	+5 V	5 V _{ext}	+15 V	–15 V	+24 V
typical	0.2 A	—	—	—	—

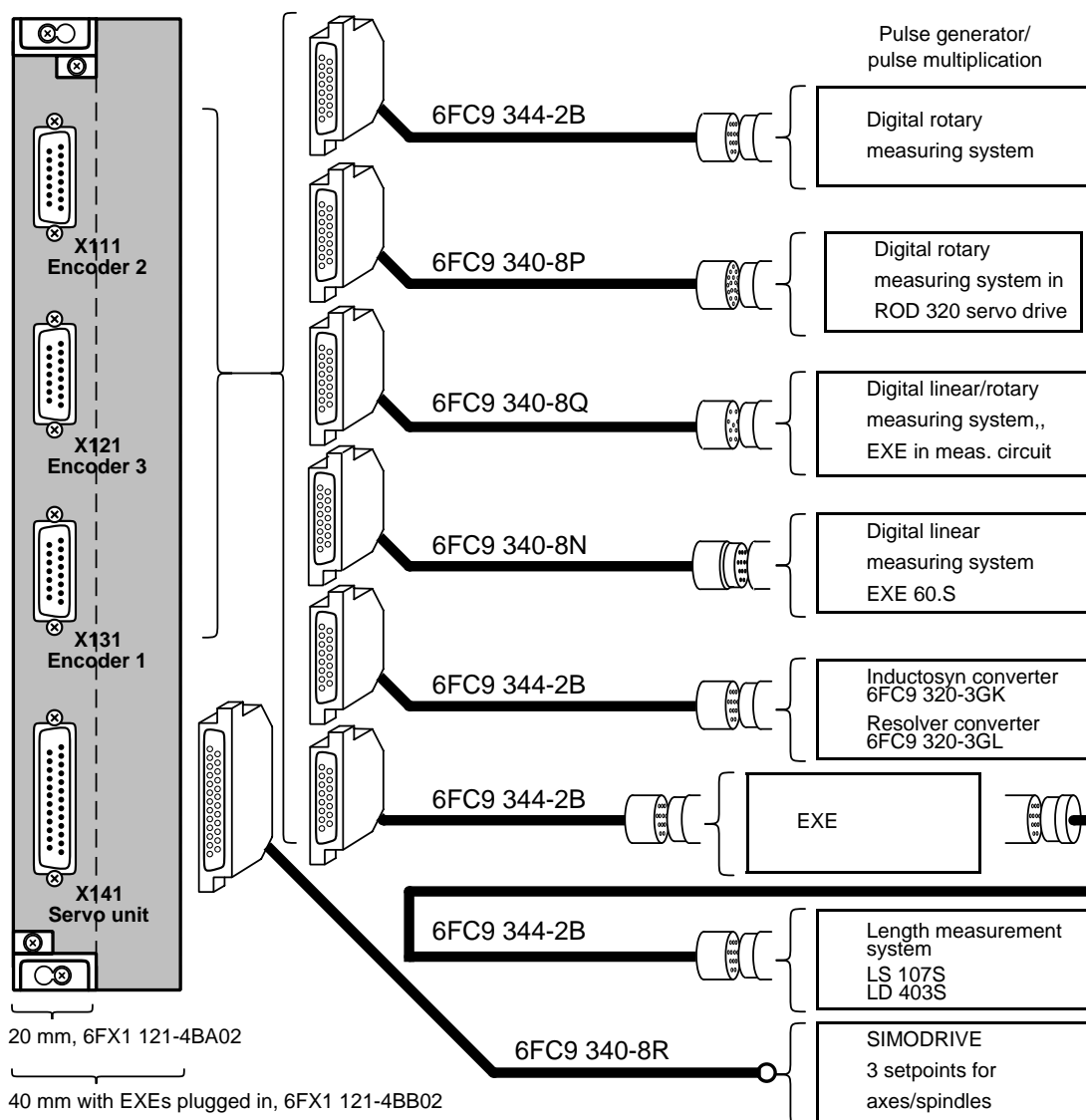
2.5.2 DAC measuring circuit module with/without EXEs 6FX1 121-4B -02

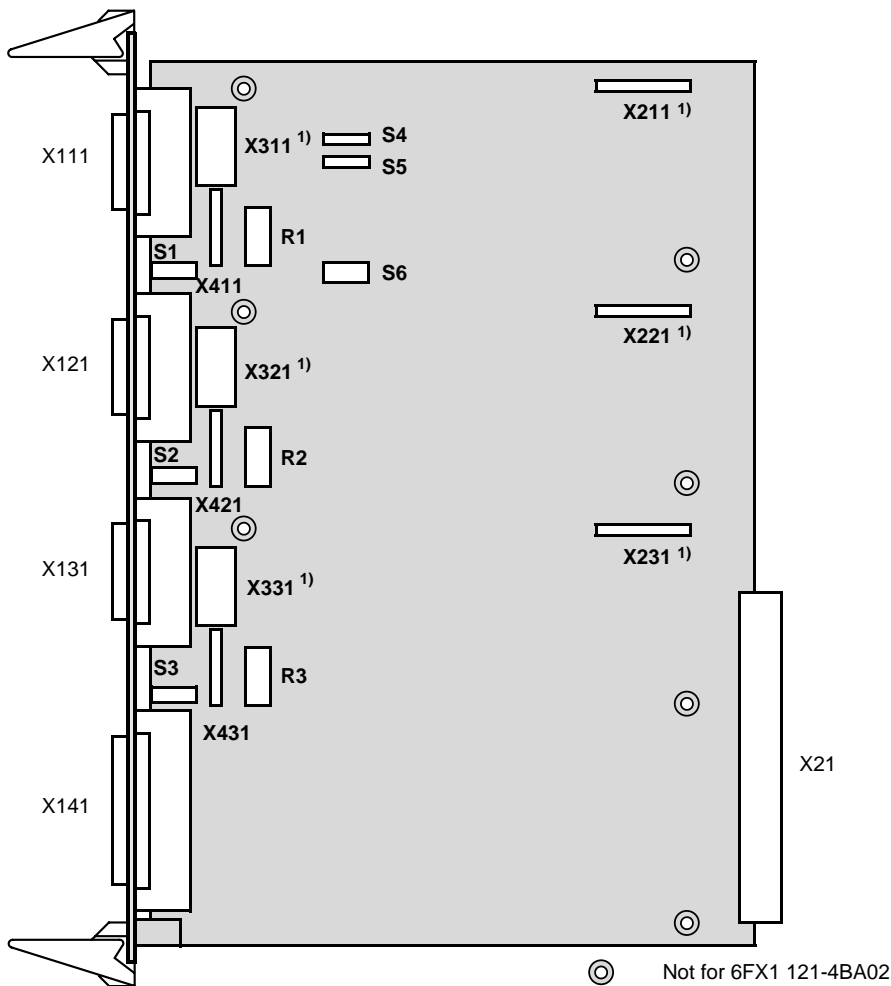
The DAC measuring circuit module with/without EXEs is used for analog setpoint output (setpoint speed) and actual value acquisition (incremental actual position values) for three axes. Sinusoidal signals can also be processed as actual values of linear scales. They are amplified and multiplied by integrated pulse shaper electronics (EXE).

This module comprises:

- 3 measuring circuit/actual value inputs for 3 axes with incremental position encoders
- 1 measuring circuit setpoint output for 3 axes with analog setpoint speeds
- 1 probe input at X111 (6FX1 121-4B 02); not used on SIN 880 GA2
- EXEs 5/10-fold (not 6FX1 121-4BA02)
- Address routing by software
- Wire break monitoring
- Servo enable
- Contamination monitoring

Position of interfaces and operating and display elements





X111	- Actual value axis 2
X121	- Actual value axis 3
X131	- Actual value axis 1
X141	- Setpoint/servo enable axes 1 to 3
X211, X221, X231 ¹⁾	- Output, integrated EXE
X311, X321, X331 ¹⁾	- Customer jumpering Encoder and EXE adjustment, if an integrated EXE is used, the jumper must be removed.
X411, X421, X431 ¹⁾	- Input, integrated EXE
R1, R2, R3	- Customer jumpering Adjustment resistor for encoder power supply $5 V_{ext}$
S1 bis S3	- Customer jumpering; switching the encoder power supply Position 3-1: 5-V encoder power supply Position 3-2: $5-V_{ext}$ encoder power supply
S4 bis S6	- Any position (adaptation to the position pulse encoder; not used with SINUMERIK 880 GA2)
X21	- Bus interface

¹⁾ Not for 6FX1 121-4BB02

Assignment of the switches, resistors and connectors to individual module axis counters

Axis	Switch	Resistor	Connector			
1	S3	R3	X131	X231	X431	X331
2	S1	R2	X111	X211	X411	X311
3	S2	R1	X121	X221	X421	X321

Measuring-circuit module variants with EXE combinations that can be ordered for three axes.

Designation	Order number	Axis		
		1 X 131	2 X 111	3 X 121
Measuring circuit module DAC 20 mm	6FX1121-4BA02			
Measuring circuit module DAC 40 mm	6FX1121-4BB02			
Measuring circuit module DAC 40 mm	6FX1121-4BL02			
Measuring circuit module DAC 40 mm	6FX1121-4BM02			
Measuring circuit module DAC 40 mm	6FX1121-4BN02			

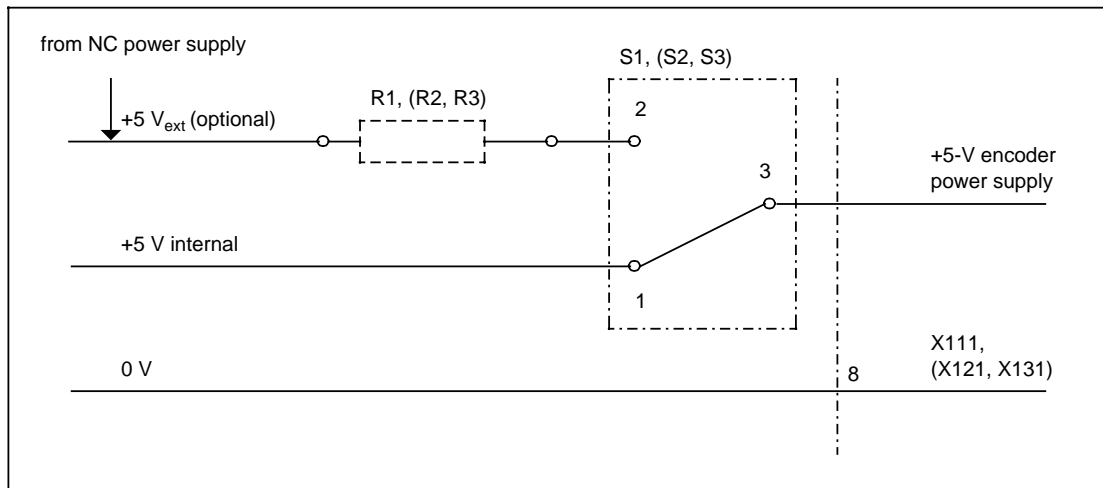


switchable between 5-fold and 10-fold EXE

Total current	+5 V	5 V _{ext}	+15 V	-15 V	+24 V
typical	0.65 A	—	49 mA	48 mA	—
integr. EXE	0.02 A	—	12 mA	1 mA	—
X111 to X131	1.5 A	1.5 A	—	—	—
X111, X121, X131	0.5 A ¹⁾	0.5 A ¹⁾	—	—	—

1) Only draw off current from pin 14! Look out for voltage drop on encoder cable!

Encoder power supply



Actual value input 1, 2, 3

Connector designation: **X111, X121, X131**

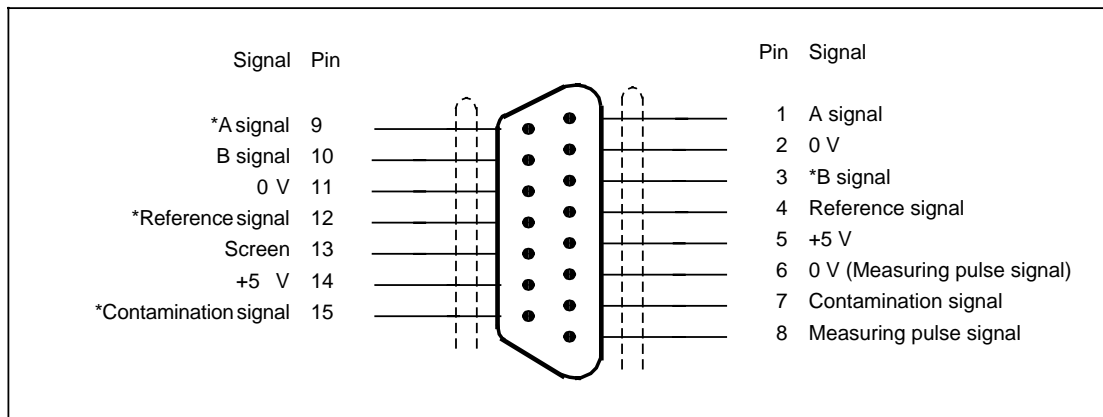
Connector type: subminiature D male connector, 15-way

The actual values are fed in via 15-way connectors of the control

- X131 actual value connector actual value input 1
- X111 actual value connector actual value input 2
- X121 actual value connector actual value input 3

Incremental rotary position encoders (such as ROD 426) for linear axes or incremental linear position encoders with external pulse shaper electronics EXE (such as linear scale LS 703 and LS 603) are connected.

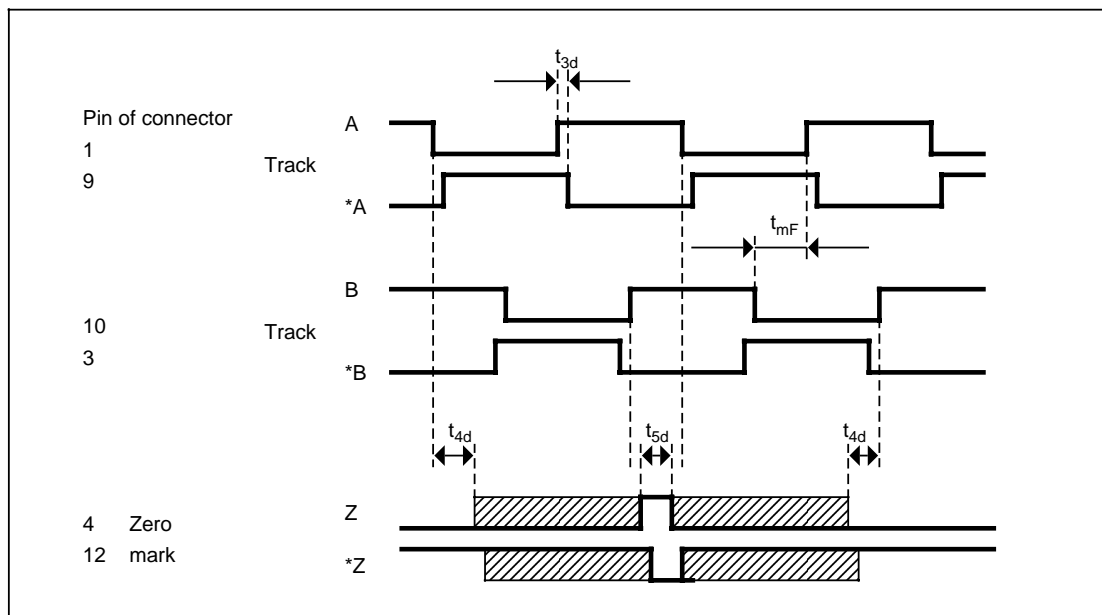
The input signals to the measuring-circuit modules are the same for both encoders.



Note:

- Contamination signal, *contamination signals are only supplied by incremental measuring systems with rectangular output signals.
- The contamination signal (pin 7, pin 15) is supplied by some measuring systems.
- Pins 6, 8 and 13 are assigned to connector X111.

Technical specifications of X111, X121, X131



Technical specifications:

- Encoder supply voltage: 5 V \pm 5 %
- Basic ripple of the power supply: 100 mV_{SS}
- Current per measuring system: 500 mA
- Ohmic input resistance: 110 Ohm
- Differential input voltage: 1 V
- (e.g. between A and *A)
- Differential input voltage max.: 10 V
- Permissible common-mode range: -2 ... +5 V
- Max. input frequency at 90°
 - electrical phase offset: 1 MHz (without EXE)
 - between A and B track pulses: 300 kHz (with EXE)
- Noise immunity (DIN 57847) – interference signal width: 3 kV
- Max. cable length to the encoder with use of SINUMERIK cables: 35 m
- Minimum distance between two consecutive edges t_{mF} : 200 ns
- Max. delay between two consecutive edges of one track t_{3d} : 50 ns
- Condition for zero mark: Z=High, if A and B=High
- Min. length of the zero mark t_{5d} bei A and B=High: 200 ns
- Distance between zero mark and edge of A and B t_{4d} : 50 ns
- Edge gradient (all signals): 1 V/ μ s

Technical data of X111, X121, X131 with intergrated EXEs (6FX1 151-5BA00)

Connector No. Signal type Encoder supply – Short-circuit-proof: no	Sinusoidal current				
	BEZ	MIN	TYP	MAX	EINH.
Encoder supply – Voltage – Ripple – Current per encoder		+4.75	+5.0	+5.25 100 500	V mV _{SS} mA
Input current – Tracks A and B – Reference mark – Direct voltage proportion – Amplitude difference		0.007 0.002		0.016 0.009 6.5 20	mA mA % %
Inputs – Frequency at 90° el A-B – Phase offset A to B – Phase offset ref. mark to A		80 45	90 135	50 100 405	kHz °el °el
Noise immunity (DIN 57847)				3	kV
Cable length to the encoder with use of SINUMERIK cables				20	m

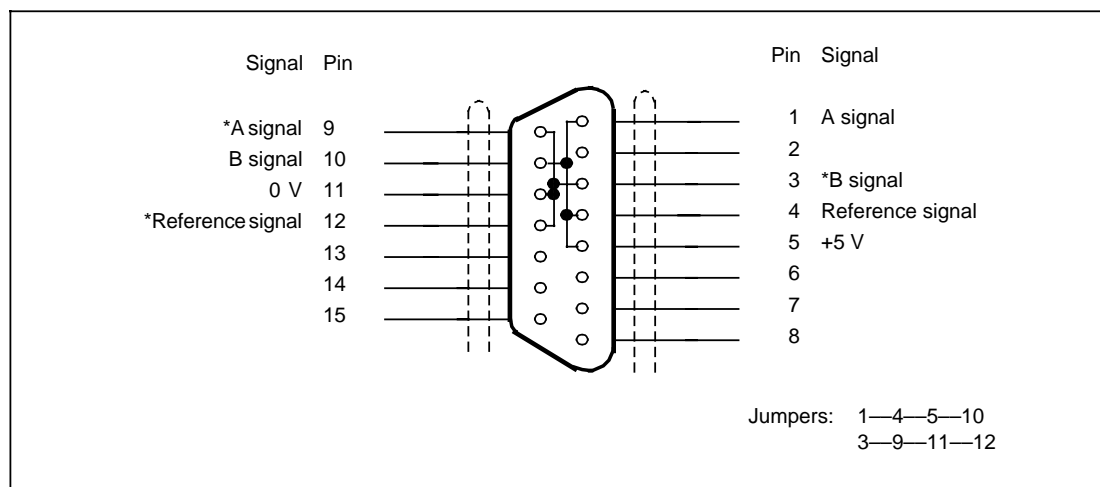
Short-circuit connectors for actual-value input

The short-circuit connector for digital measuring systems of SINUMERIK Systems 3 and 8 **cannot** be used for System 800 because of the different pin assignment.

The connector is used to test the system and the measuring circuits while the measuring systems are not connected or the axis is not installed.

Connector designation: **Short-circuit connector**

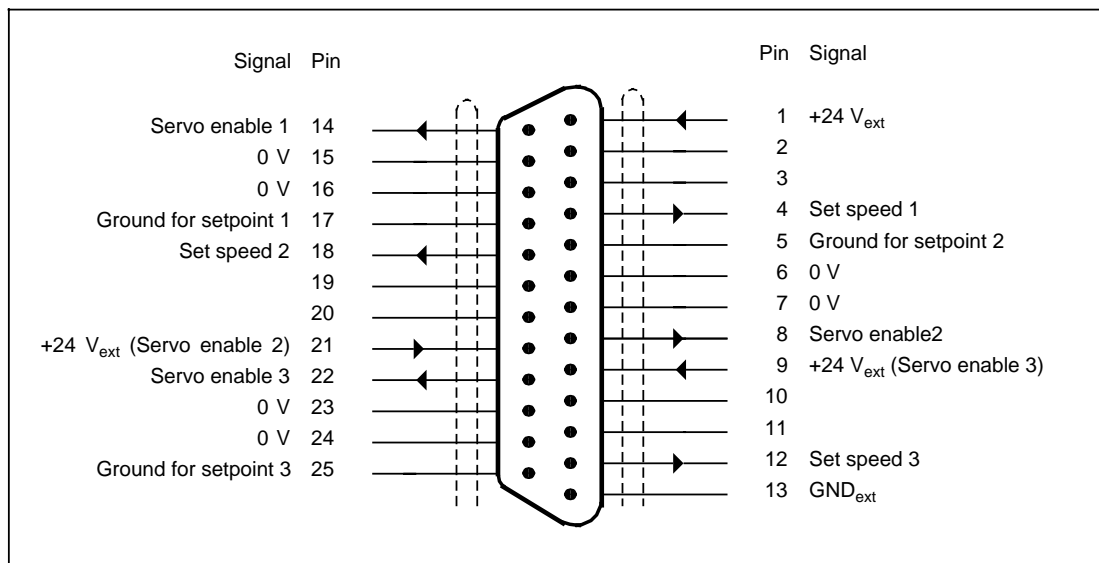
Connector type: Subminiature D female connector, 15-way



Connector assignment X141

The set speeds and the axis-specific servo enables (floating outputs) are output from the control via a 25-way connector.

Connector designation : **X141**
 Connector type: subminiature D male connector, 25-way



Technical specifications:

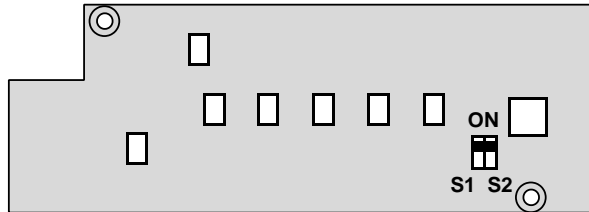
Setpoint:	Max. analog voltage	±10 V
	Max. current	2 mA
Servo enable:	Connection voltage	20 ... 30 V
	Max. current	100 mA (short-circuit-proof)

The signals SERVO ENABLE 1, 2, 3 from the control (in the example: X141 Pin 14) must be used for the proper function on the drive actuator.

2.5.2.1 EXE 5/10-fold

6FX1 151-5BA00

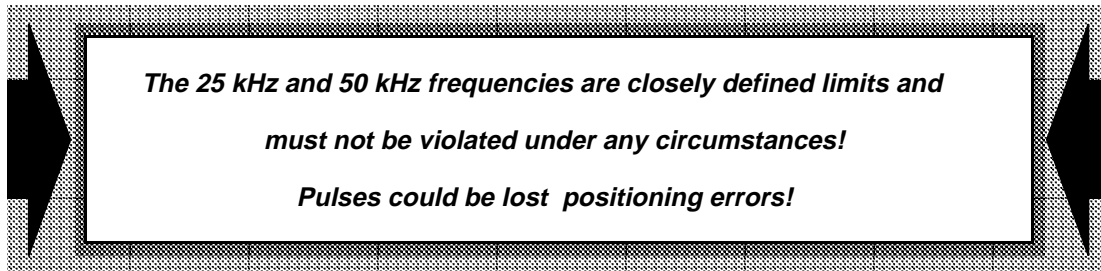
The EXE 5/10 module converts analog input signals into digital output signals with concurrent pulse multiplication (5/10-fold).



- S1 – Input frequency switch
S2 – Subdivision factor

Function selection

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



The EXE is supplied set to 50 kHz/5-fold (S1, S2 ON position).

2.5.3 HMS measuring circuit module

6FX1 145-6B 00

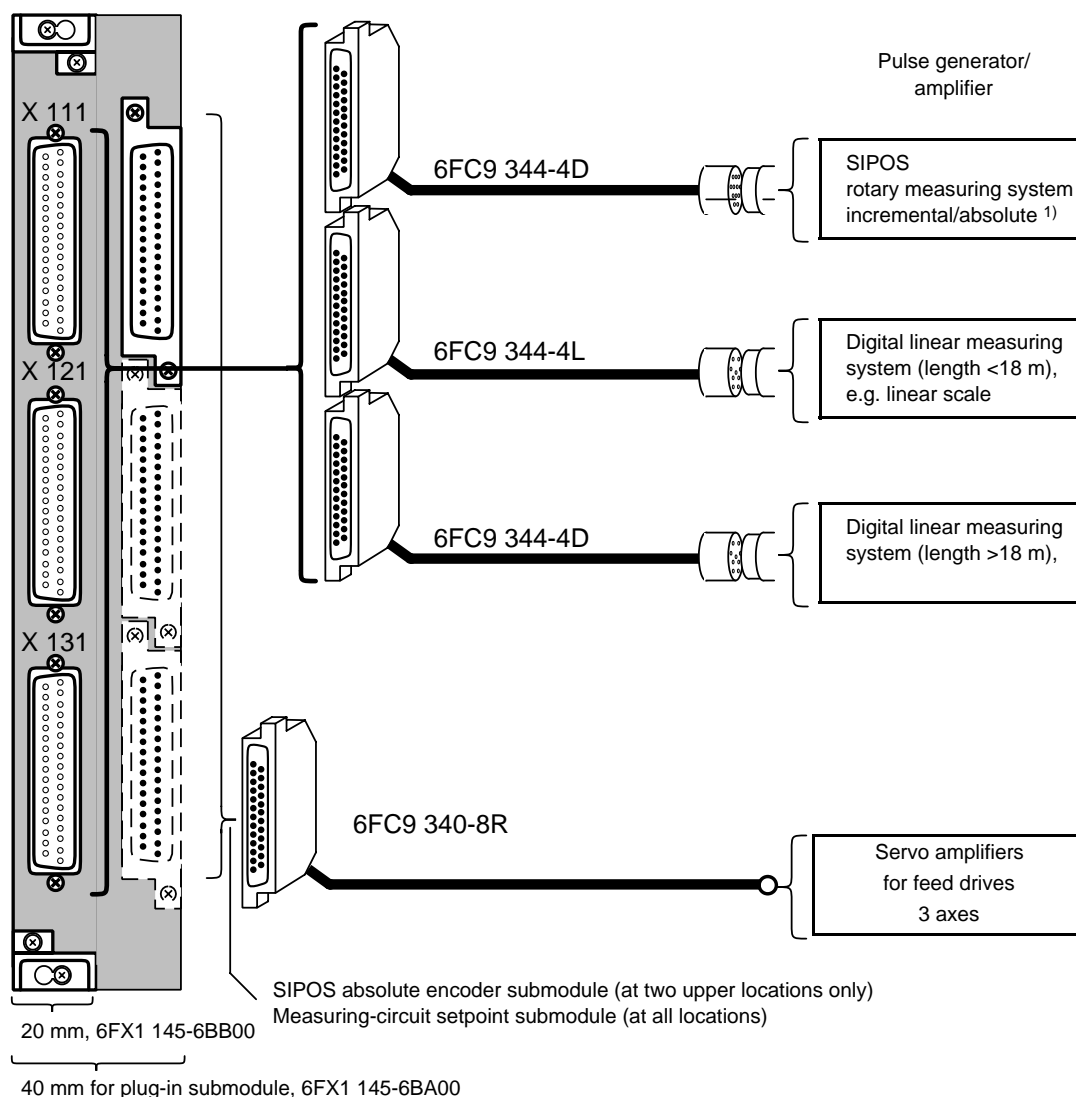
The HMS measuring circuit module is used for high-resolution actual value acquisition on three axes with the aid of incremental unconditioned voltage signal generators or SIPOS absolute encoder submodules. In connection with the measuring-circuit setpoint submodule, the output of analog setpoints is also possible. Setpoints can be output for three axes per submodule.

This module comprises:

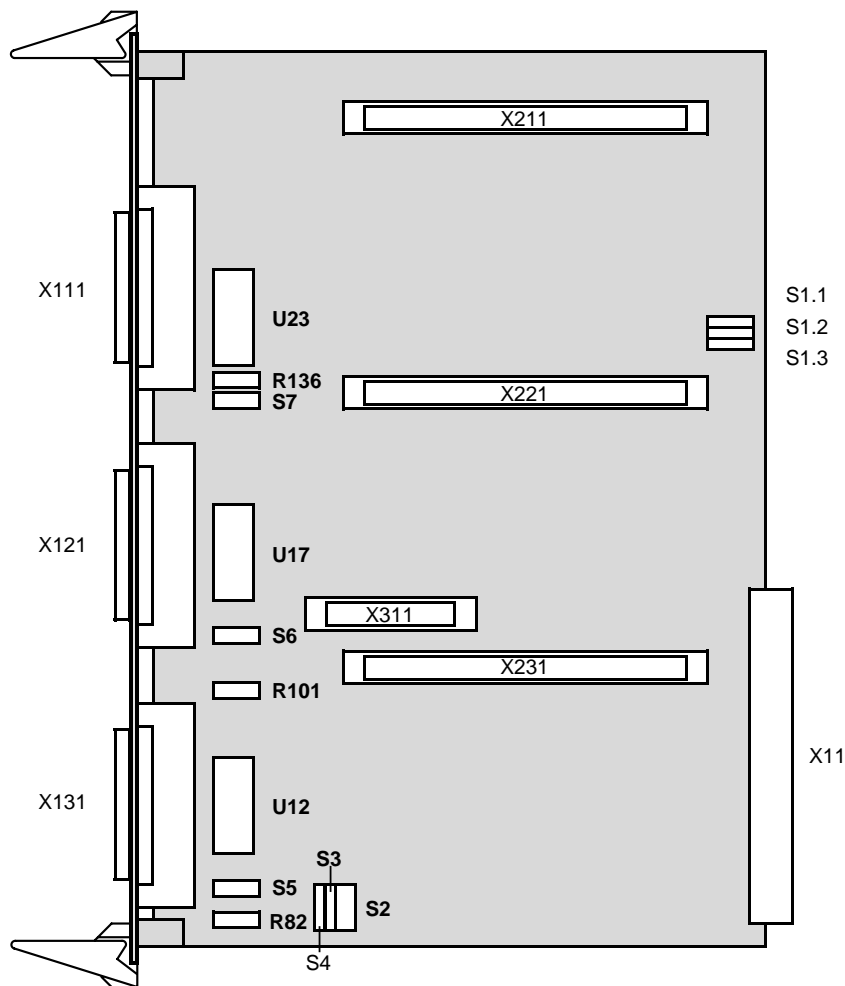
- 3 measuring circuit/actual value inputs for 3 axes with incremental position encoders
- 3 analog measuring-circuit setpoint submodule locations (only 6FX1 145-6BA00)
- Address routing by software
- Wire break monitoring
- Contamination monitoring

The two upper setpoint submodule locations can also be used for the SIPOS absolute encoder submodule. In this case, another measuring-circuit setpoint submodule can be plugged into the lower free location.

Position of interfaces, operating and display elements



1) Only in connection with the absolute encoder submodule

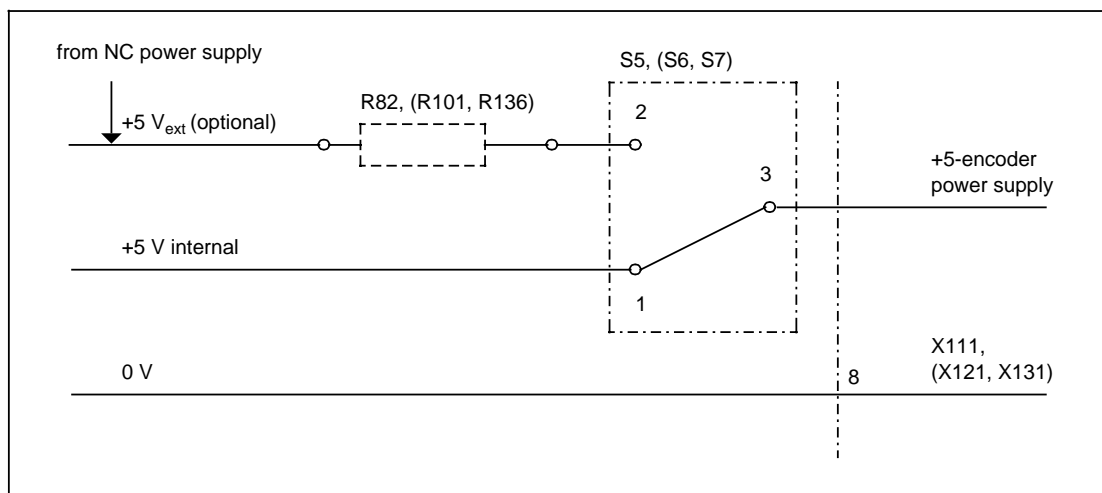


- X111 – Actual value axis 1
- X121 – Actual value axis 2
- X131 – Actual value axis 3
- X211, X221, X231¹⁾ – Submodule interfaces for measuring-circuit setpoint submodule
- X311¹⁾ – Interface to the SIPOS absolute encoder submodule
- S1.1, S1.2, S1.3 – Interrupt jumpering of submodule interfaces,
Switches must be opened
- S2, S3, S4 – Customer jumpering, matching to probe (level, edge),
Any position (is only used for SINUMERIK 880 GA2)
- S5 – Actual value 3, customer jumpering, encoder power supply, switchover
5 V/5 V_{ext}
- R82 – Adjustment resistor for 5 V_{ext}
- S6 – Actual value 2, customer jumpering, encoder power supply,
switchover 5 V/5 V_{ext}
- R101 – Adjustment resistor for 5 V_{ext}
- S7 – Actual value 1, customer jumpering, encoder power supply,
switchover 5 V/5 V_{ext}
- R136 – Adjustment resistor for 5 V_{ext}
- U23, U17, U12 – Jumper for unconditioned voltage signal
– I/V hybrid for unconditioned current signal
- X11 – Bus interface

1) only 6FX1 145-6BA

Total current	+5 V	5 V _{ext}	+15 V	-15 V	+24 V
typical	1.1 A	—	0.12 A	0., A	—
X111 to X131	1.9 A	2 A	1 A	1 A	—
X111 to X131	0.5 A	0.5 A	—	—	—
X211, X221, X231	1.9 A	1 A	0.5 A	0.5 A	—
X331	1.9 A	—	0.5 A	0.5 A	—

Encoder power supply



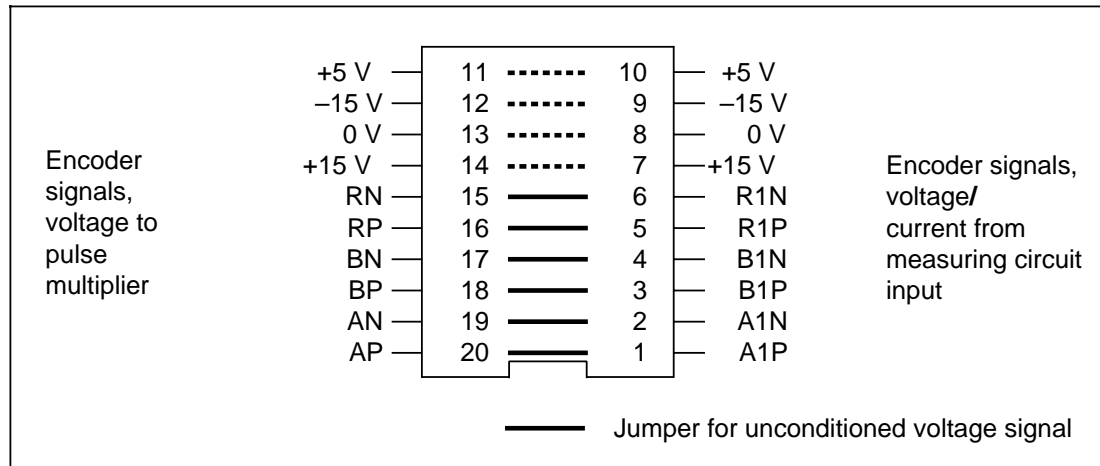
Both measuring-circuit modules have three measuring circuit/actual value inputs for interfacing three axes with incremental position encoders or SIPOS absolute encoder submodules. Three submodule locations for accommodating one analog measuring-circuit setpoint submodule each or one SIPOS absolute encoder submodule plus one measuring-circuit setpoint submodule are additionally provided on the 40 mm wide module. The two modules can be combined in such a way that the double-width HMS measuring-circuit module contains the measuring-circuit setpoint submodules for all six axes/spindles (it is then no longer possible to plug in a SIPOS absolute encoder submodule).

Note:

- The SIPOS absolute encoder submodule can only be plugged into the upper submodule interface of the HMS measuring circuit module.
- Via an I/V hybrid, which can be plugged onto the module or the rotary encoder, it is possible to connect linear scales with unconditioned current signals to the HMS measuring-circuit module. Each of the three measuring system inputs on the HMS measuring-circuit module can be equipped with an I/V hybrid.

Encoder signal jumpering interface for I/V hybrid**6FC3 988-7CN**Connector designations: **U12, U17, U23**

20-pin IC base (DIL 20) for installation of a current/voltage converter hybrid (6FC9 320-4HM12) when encoders with unconditioned current signals (option) are used.

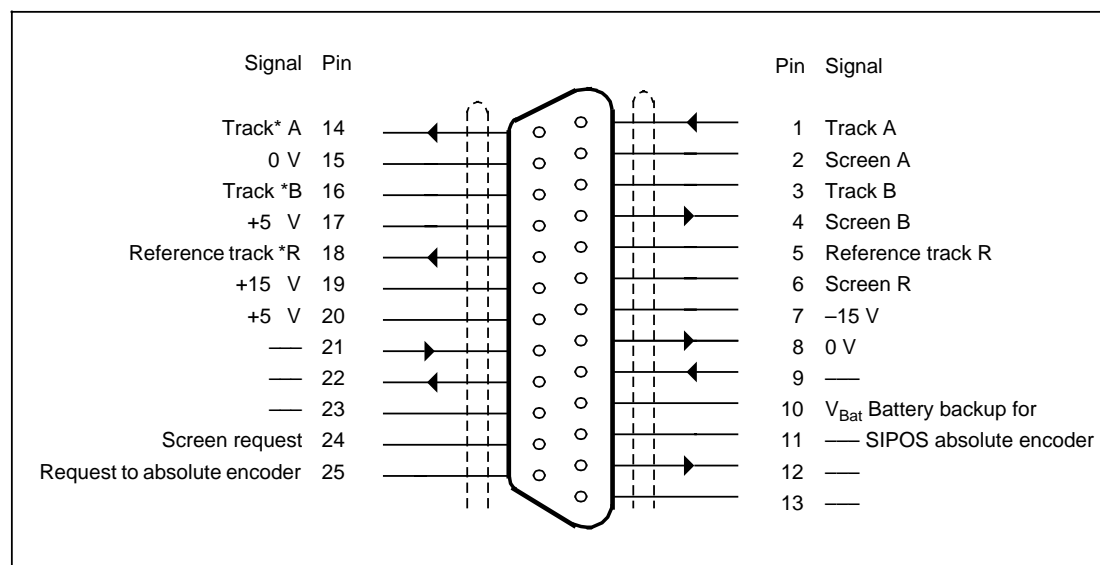


AP ...	Encoder signal	A ...	(Unconditioned voltage or current signal)
AN ...	Encoder signal	*A ...	(Unconditioned voltage or current signal)
BP ...	Encoder signal	B ...	(Unconditioned voltage or current signal)
BN ...	Encoder signal	*B ...	(Unconditioned voltage or current signal)
RP ...	Encoder signal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

When encoders which provide an unconditioned voltage signal (standard) are used, the interfaces are equipped with short-circuit plugs (X12, X17, X23) which join opposing pins (1--20, 2--19, 3--18, ...). The pins of the supply voltages are already joined together on the module).

Connector assignment X111, X121, X131

Connector type: subminiature D female connector, 25-way



The encoder interface can either be used for encoders with voltage signals or with additional current/voltage converter hybrids for encoders with unconditioned current signals. The amplitudes of the sinusoidal signals of tracks A and B are specified as follows.

- Voltage signals (measured between A and *A or B and *B)
 typ. ± 800 mV to a connection resistance of 180 ohms
 min. ± 500 mV
 max. ± 1.0 V
- Current signals (measured in the current loop A, *A or B, *B)
 typ. ± 5.5 μ A to an input resistance < 1 kOhm
 min. ± 3.0 μ A
 max. ± 8.0 μ A

The amplitudes of the zero marks have the following values:

- Voltage signals (measured between R and *R)
 active type $+800$ mV to terminating resistor of 180 ohms
 min. $+200$ mV
 max. $+2.5$ V
 inactive type -800 mV to terminating resistor of 180 ohms
 min. -200 mV
 max. -2.5 V
- Current signals (measured in the current loop R and *R)
 active type $+2$ μ A to terminating resistor < 1 kOhm
 min. $+0.2$ μ A
 max. $+7.7$ μ A
 inactive type -4.0 μ A to terminating resistor < 1 kOhm
 min. -15 μ A
 max. -0.2 μ A

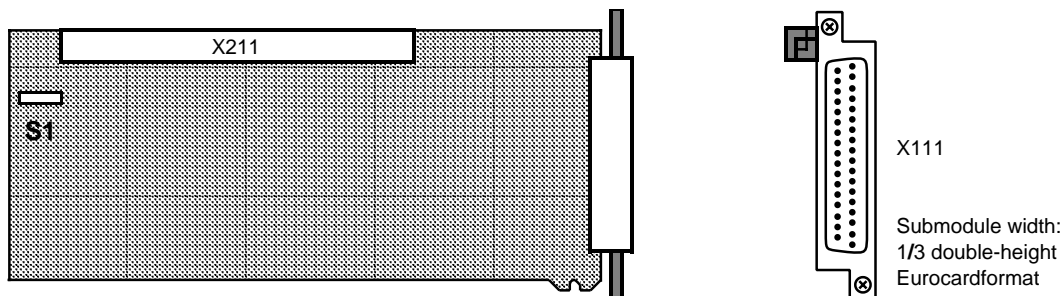
Together with the SIPOS unconditioned signal or absolute encoders, encoder frequencies of up to 500 kHz can be processed.

2.5.3.1 Measuring-circuit setpoint submodule

6FX1 132-5BA00

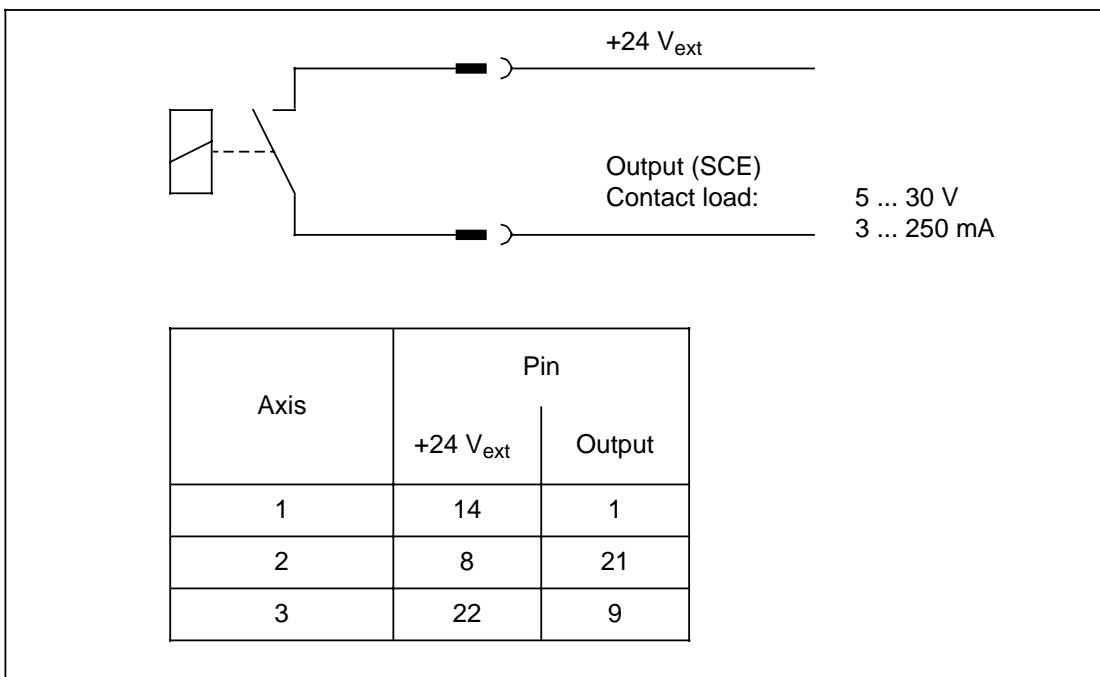
The measuring-circuit setpoint submodule (servo command submodule) is used for the output of setpoints for up to three axes/spindles and is plugged into the interface on the HMS measuring circuit module (double-width with submodule interface) especially provided for this purpose. The interface is on the front panel and is compatible with the setpoint interface of the measuring-circuit module DAC (see Section 2.5.2). You can connect a maximum of three submodules to this measuring-circuit module HMS. The measuring-circuit setpoint module additionally enables the following functions in the measuring-circuit module HMS:

- 3 analog setpoint outputs (one output per axis)
- 3 servo enables (one enable per axis)



- X111 – Setpoint/servo enable for 3 axes
- X211 – Submodule interface
- S1 – Submodule ready (closed)

Output for the servo enable



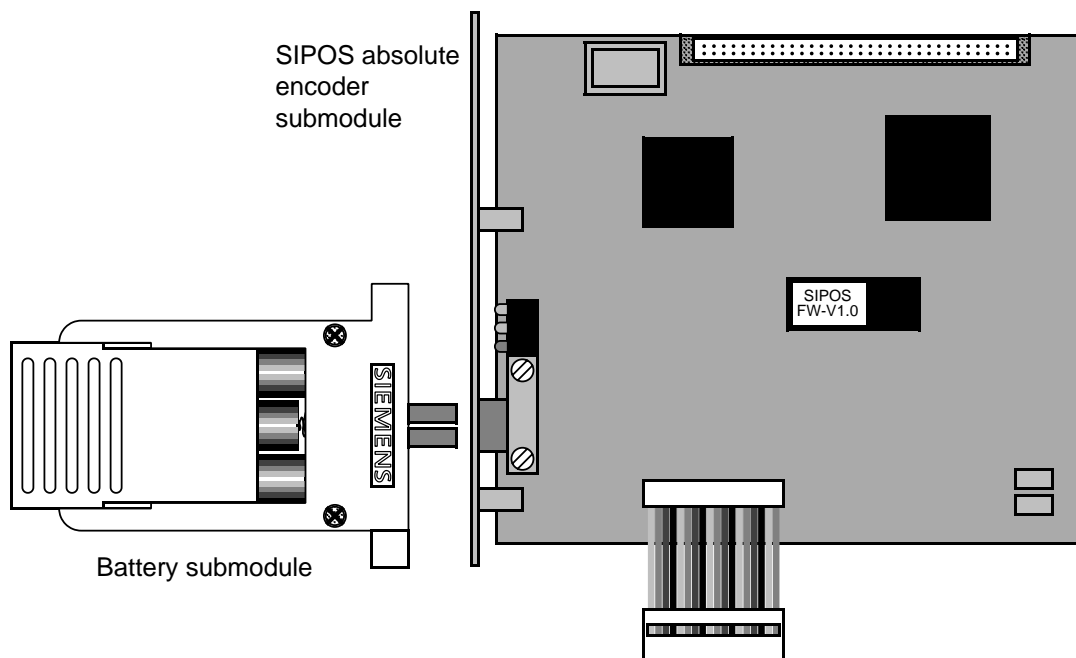
Total current	+5 V	5 V _{ext}	+15 V	-15 V	+24 V
typical	0.10 A	0.05 A	0.05 A	—	—

2.5.3.2 SIPOS absolute encoder submodule

G33961-A3729-L1

You can insert a SIPOS absolute encoder submodule into the upper submodule interface (X211) of the double-width HMS measuring circuit module. In this way, evaluation of SIPOS absolute encoders is possible for all three inputs in connection with SIPOS absolute encoder submodules. You can insert a measuring-circuit setpoint submodule into the remaining slot.

You must insert a battery submodule into the SIPOS absolute encoder submodule for saving the absolute values in case of a power failure.



***The HMS measuring circuit module and
the ANALOG measuring circuit module can be used together.***

Restriction:

If you insert a SIPOS absolute encoder submodule into the HMS measuring circuit module, you can only connect one measuring-circuit setpoint submodule to this module.

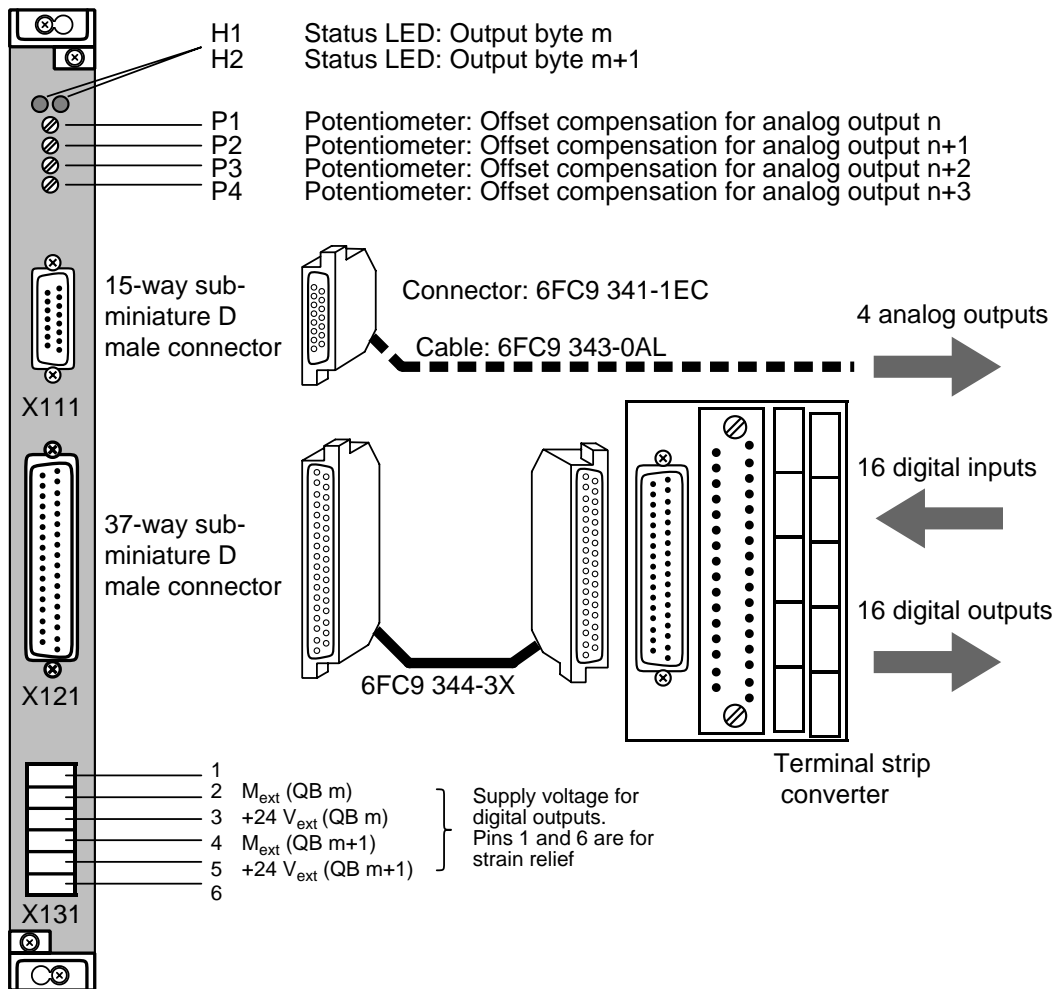
2.5.4 MIXED I/O module

6FX1 138-4BA01

This module comprises:

- 4 analog outputs, non-floating, ± 10 V/3 mA, current-limited, resolution 16 bits with sign
- 16 digital inputs, floating, groups of eight
- 16 digital outputs, floating, 24 V/400 mA, groups of eight, current-limited
- 4 potentiometers for analog output offset compensation
- 2 LEDs for indicating digital output faults (one LED per output block)
- 1 terminal block for 24 V DC power supply of digital outputs
- Address routing via comparator or software

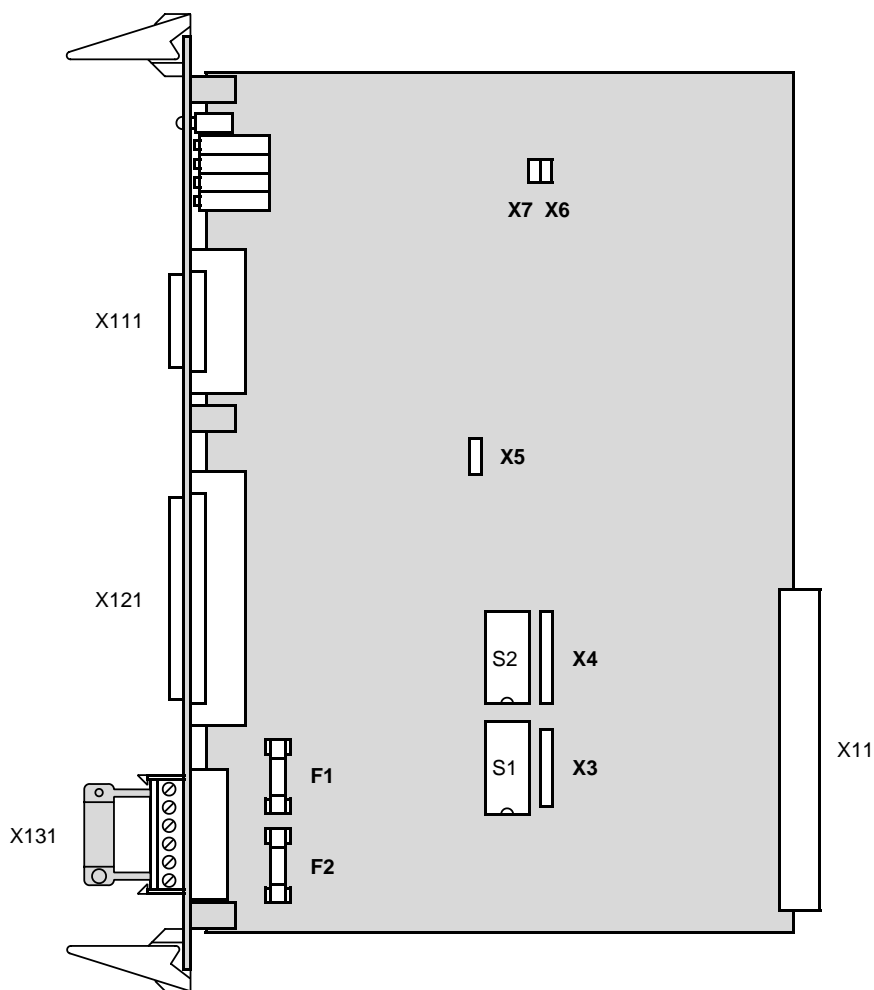
Position of interfaces and operating and display elements



Two input and two output bytes for digital inputs and outputs and eight output bytes for analog outputs are assigned to this module on the PLC interface.

Note:

- This module cannot be used in the mini EU.
- It is absolutely necessary to connect external grounds.



- X3, X4, X5 – For test purposes only
- X6, X7 – For test purposes only
- S1 – Customer jumpering, address decoding for digital inputs/outputs
- S2 – Customer jumpering, address decoding for analog outputs
- F1, F2 – Fuse 250 V/IF 4 A
- X11 – Bus interface

Total current	+5 V	5 V _{ext}	+15 V	-15 V	+24 V
typical	0.52 A	—	0.07 A	0.08 A	3.3 A

- Input voltage – logic "1": 13,5 V ... 33 V
 – logic "0": -3 V ... 5 V
- Input current – 6 mA ±10 % at 24 V

Setting the initial address m for digital inputs/outputs

Initial address (hex.)	Input byte Output byte (dec.)	S1
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	

Setting the initial address n for analog outputs

Initial address (hex.)	Output byte (dec.)	S2
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	

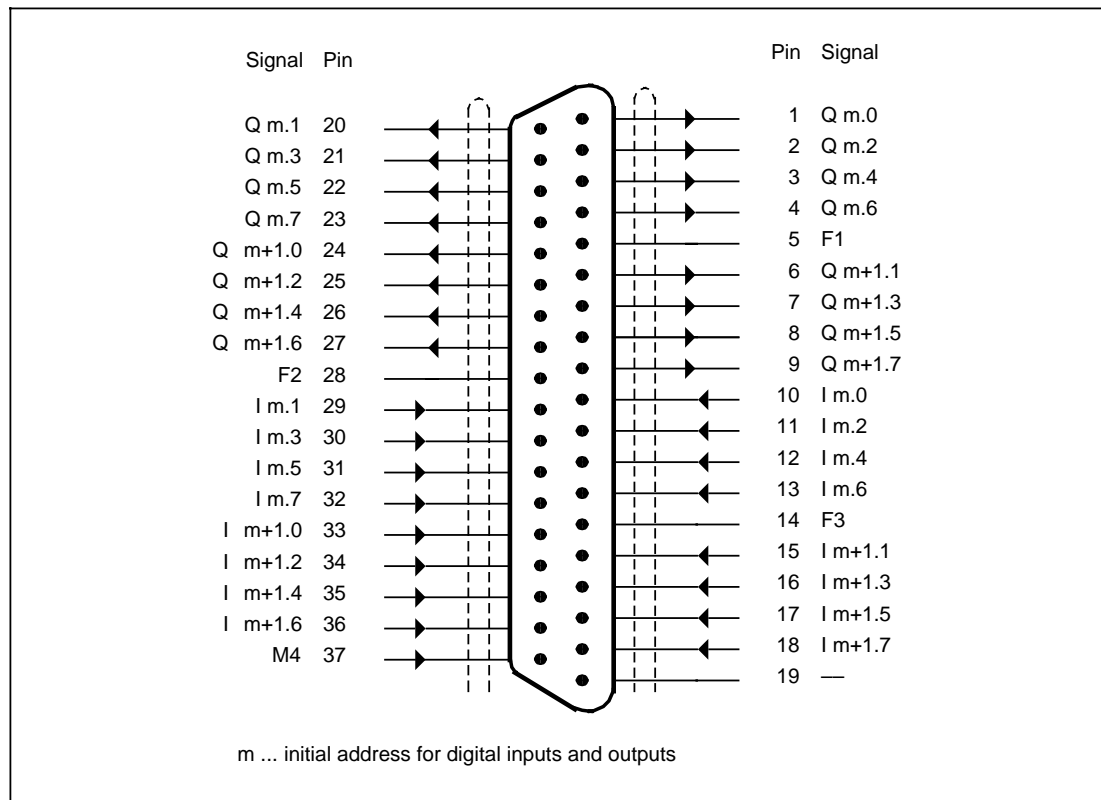
When using this module in the PLC, the C /P jumper must be open.

Connection of digital inputs and outputs

The 16 digital inputs and the digital outputs are connected to the X121 connector.

Connector designation: **X121**

Connector type: subminiature D male connector, 37-way



The M1 and M2 signals must not be used, they are only used for test purposes. The signals M3 and M4 must be connected.

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

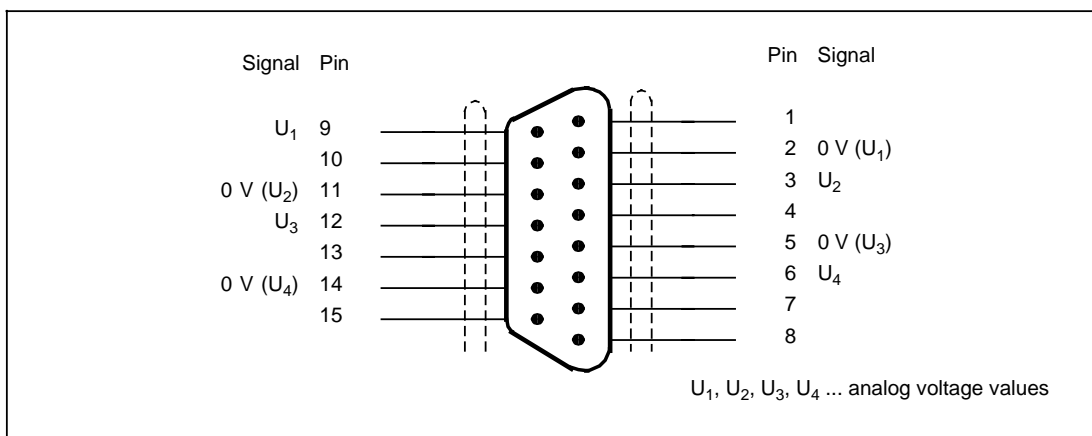
Digital outputs										
Byte No.	Bit No.									
	7	6	5	4	3	2	1	0		
QB m	23	4	22	Connector X121 pin No.		3	21	2	20	1
QB m+1	9	27	8	Connector X121 pin No.		26	7	25	6	24

The address m is set by routing on the module and is the same for the input and output areas.

Connection of analog outputs

Connector designation: **X111**

Connector type: subminiature D male connector, 15-way



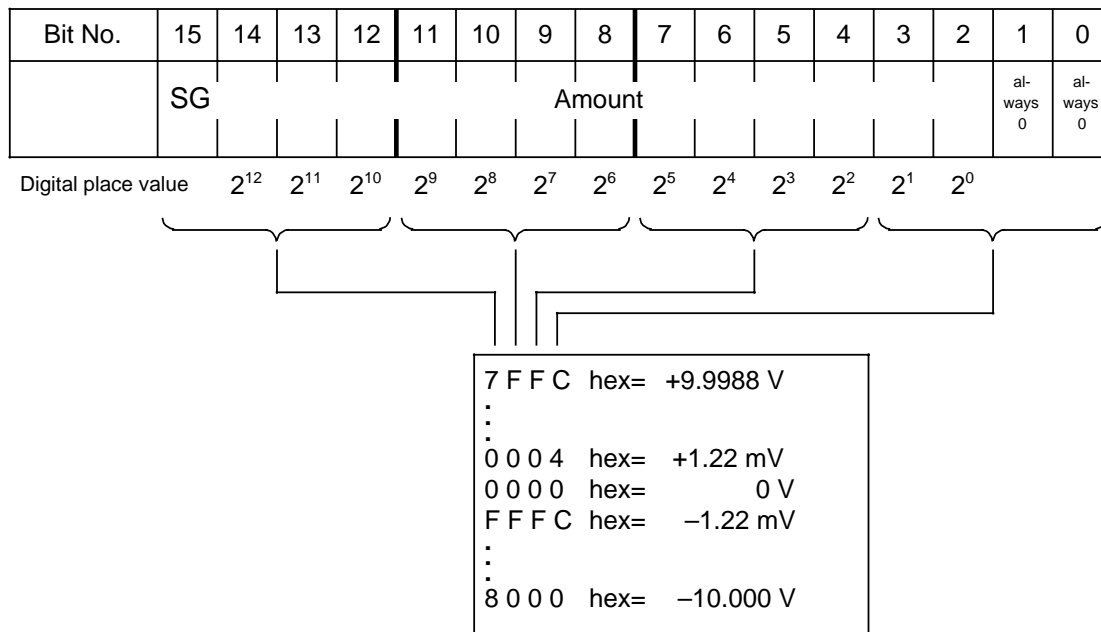
Actuating analog outputs

To output voltage values, the output word corresponding to the analog output must be written (hexadecimal number).

The address n is set by jumpering on the module.

QW n	hexadecimal number for analog output 1
QW n+1	hexadecimal number for analog output 2
QW n+2	hexadecimal number for analog output 3
QW n+3	hexadecimal number for analog output 4

A word is structured as follows:



Note:

- The amount (decimal number) = |U analog (V)| : 10 V x 8192
- Negative values are represented as two's complement.
- When the hexadecimal number is output to the output word, the high and the low byte are swapped round.

Examples:

The following voltages must be output to analog output 1, if the address n is set to 16:

Example 1: 9.5 V		PLC program
Amount (decimal number):	7782	.
Amount (binary number):	0111 1001 1001 10	L KH 9879
Word (binary number):	0111 1001 1001 1000	T QW 16
Word (hex number):	7998	.
 Example 2: -4.12 V		 PLC program
Amount (decimal number):	3375	.
Amount (binary number):	0011 0100 1011 11	L KH 44CB
Two's complement:	1100 1011 0100 01	T QW 16
Word (binary number):	1100 1011 0100 0100	.
Word (hex number):	CB44	.

Technical data

Number of inputs Electrical isolation	16 digital yes
Input voltage (nominal value)	24 V DC
Input voltage for signal "0" for signal "1"	-3 V to +5 V +13.5 V to +33 V
Input current with signal "1"	
Delay time for tpLH Delay time for tpHL	
Cable length max.	50m
Number of outputs Electrical isolation	16 digital yes
Supply voltage U_P - Nominal value - Ripple U_{PP} - Permissible range (including ripple)	24 V DC 20 V to 30 V
Output current with signal "1" (nominal value)	400 mA
Short-circuit protection	Electronic with LED indication
Limitation of inductive cutout voltage to the switching capacity for lamps	
Switching frequency with - ohmic load - lamps - inductive load (at nominal load. At lower loads, higher values are permissible.)	100 Hz 11 Hz 2 Hz
Overall loading capacity at 55°C (referred to the sum of nominal currents of all outputs)	50%
Signal level output - for signal "0" - for signal "1"	Output open $U_P - 1V$
Cable length max.	50m
Number of outputs Electrical isolation	4 voltage outputs, analog no
Output ranges (nominal values)	$\pm 10 V$
Load impedance with voltage outputs min.	3.3
Load connection type	Load against 0 V connection
Digital representation of output signal	13 bits +sign
Permissible overload capability approx.	
Short-circuit protection	yes
Short-circuit current	
Voltage between load reference potential (0V connection) and device housing max.	
Basic error limits	
Operational error limits (0°C to 60°C)	
Cable length (shielded) max.	
Insulation voltage external connections against housing - to VDE 0160 - tested with	
Current input internal (at 5V) internal (at 24V) typ. typ.	
Format	Double-height Eurocard
Module width	20 mm
Weight approx.	
Degree of protection to DIN 40050	IP00
Humidity class to DIN 40040	F

2.6 PLC area

2.6.1 PLC 135 WB CPU

6FX1 138-6BL01

The PLC 135 WB CPU module (**P**rogrammable **L**ogic **C**ontrol) is a PLC CPU with a frequency of 16 MHz. The user data memory and the user program memory are integrated into the module.

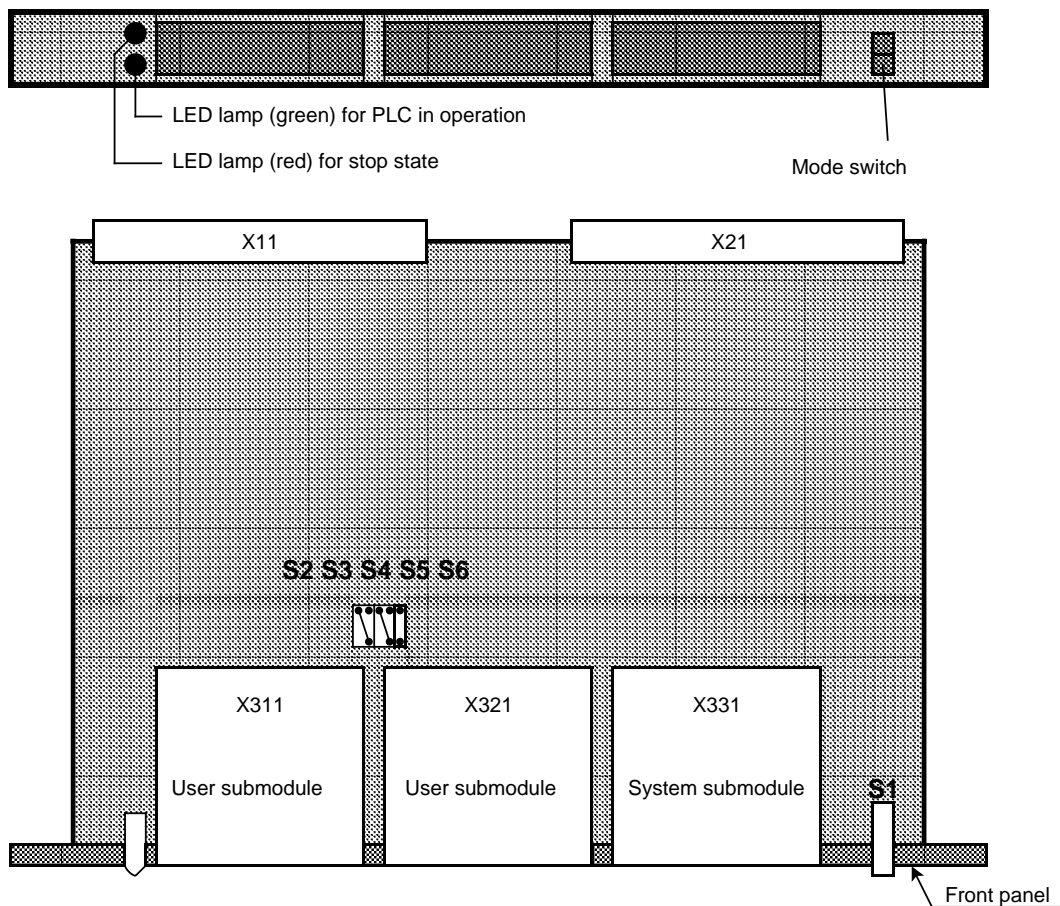
You can slot user program submodules into slots X311 or X321. Slot X331 is permanently occupied by the system memory submodule 6FX1 145-8BA00

The gate array ACOP 2 is used to support STEP 5 program execution. The gate array PSU contains monitoring and control logic.

This module comprises:

- WOP 80C186
- Gate arrays ACOP, PSU
- 128-Kbyte user program expandable to 256 Kbytes (**option** - selectable in machine data)
- 256-Kbyte system program

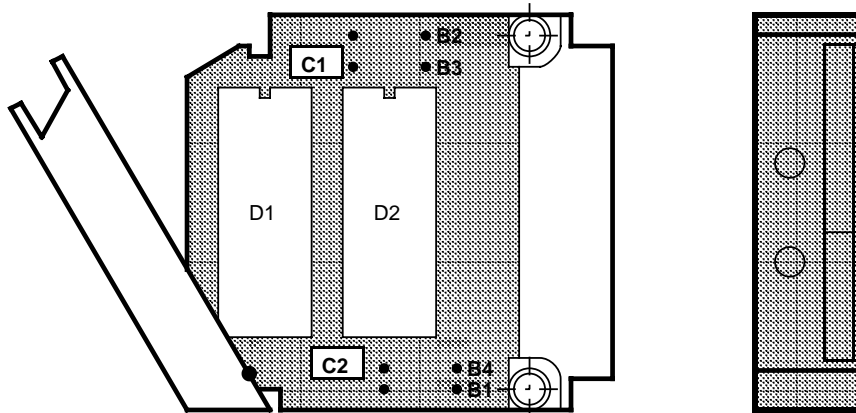
Position of interfaces, jumper bases and jumpers



2.6.1.1 64 KB EPROM submodule

6FX1 130-5BB00

The MEM submodule is a memory submodule for two EPROMs 27256 (6FX1 130-5BB). The EPROM submodule can be used as a user program submodule. Up to two submodules can be plugged in (in X311 and X321).



Jumper \ Memory	B1	B2	B3	B4 ¹⁾
2x 27256 (64 Kbytes)	x	x		

x = jumper closed

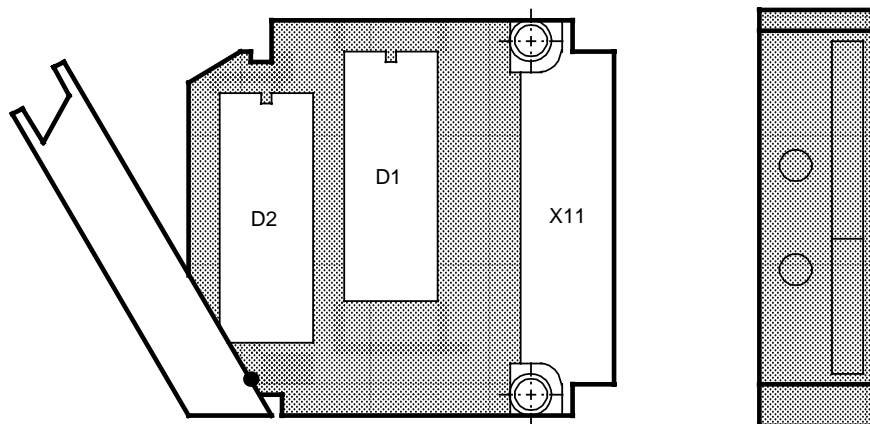
Total current	+5 V	+5 Vext	+15 V	- 15 V	+24 V
6FX1 130-5B ..	0.1 A	—	—	—	—

1) Closed for S5 programming with the PG 675.

2.6.1.2 256 Kbytes EPROM submodule**6FX1 145-8BA00**

The 256-Kbyte EPROM submodule (2 EPROM 27C100) is a memory submodule with short dimensions and contains a 256 Kbyte memory. The 256 KB EPROM submodule can be used as the system program submodule for the PLC 135 WB and has the order number 6FX1 890-0BX73-1B (incl. software).

The 256 Kbyte EPROM submodule can also be programmed using a programmer (PG). In this way, it can be used as a user program submodule.



Total current	+5 V	+5 V EX	+15 V	- 15 V	+24 V
6FX1145-8BA . .	0.05 A	—	—	—	—

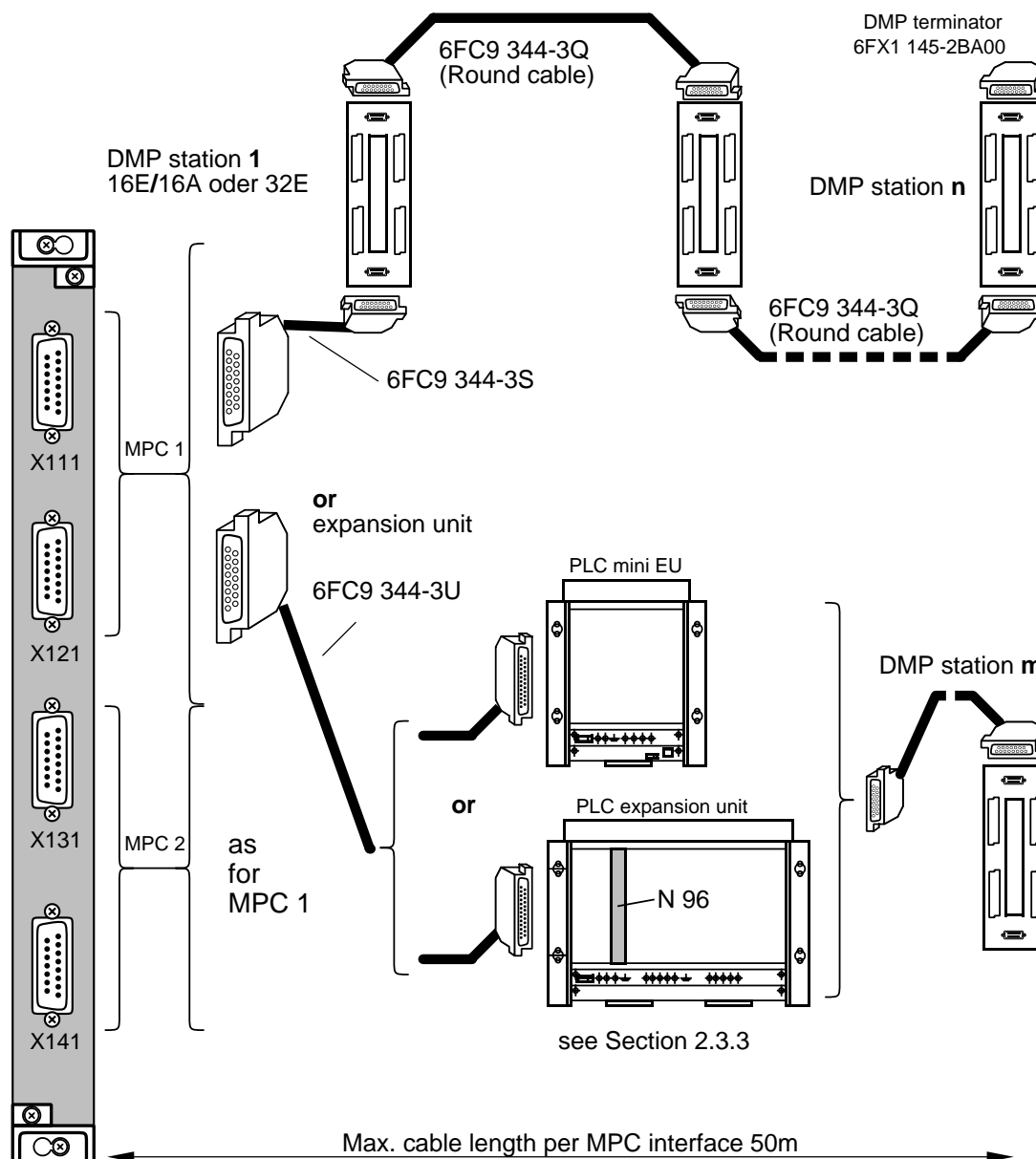
2.6.2 INTERFACE DMP

6FX1 144-2BA00

This module is used for interfacing distributed machine peripherals to the PLC. For this purpose, two independent MPC interfaces with two RS-485 interfaces each are provided.

This module comprises:

- Addressing by software
- Dual-port RAM 4 Kbytes
- 80186 processor
- Working memory 32 Kbytesx16
- EPROM firmware (6FX1 848-2BX85-4B) 32 Kbytesx16
- Two MPC (Multi-Port Controllers)



Note:

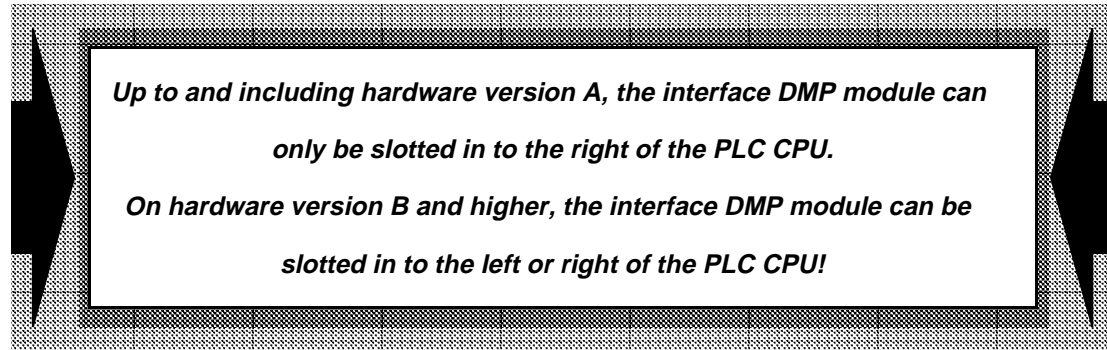
You can connect several DMP stations to each MPC interface. These can include up to three expansion units.

You can connect one interrupt-capable DMP submodule to each DMP. If an interrupt-capable DMP is connected, you can connect a EU to this line.

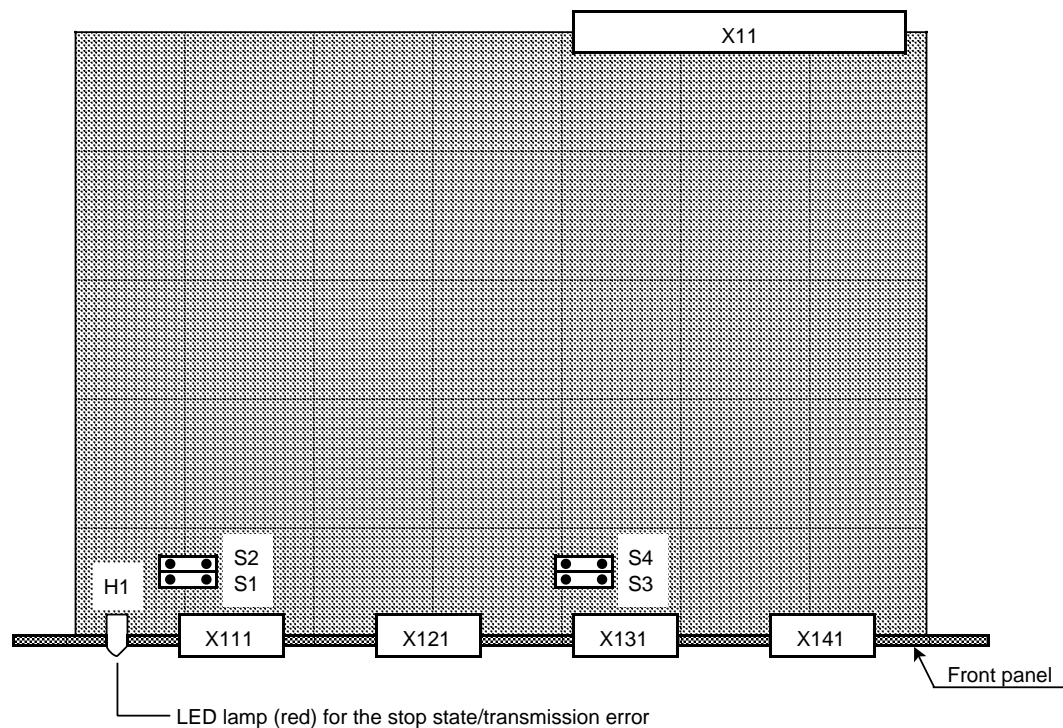
Mixed operation of interface DMP and INT.EU/16bit is possible.

You must connect a DMP terminator to the last free connector of the end of every DMP line!

Before you can use the interface DMP, you must slot the appropriate firmware into the EPROM slots D47 and D56 (EPROM 27C256).



Position of interfaces, jumper bases and jumpers



- X11 – Bus interface
- X111/X121 – MPC interface 1 (RS 485); 15-way subminiature D male connector
- X131/X141 – MPC interface 2 (RS 485); 15-way subminiature D male connector

- S1, S2, S3, S4 – Jumping the terminating resistors, see next page for setting.
 (switch)

Total current	+5 V	+5 V _{ext}	+15 V	- 15 V	+24 V
6FX1 144-2BA . .	1.18 A	—	—	—	—
X111 to X141	1.8 A	—	—	—	—
X111, X121, X131, X141	0.5 A	—	—	—	—

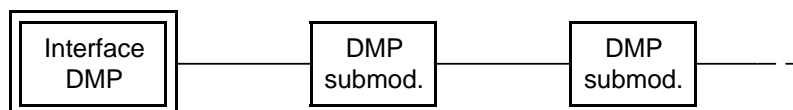
Jumpering the terminating resistors for the MPC interfaces

By closing jumpers S1/S2 and S3/S4, you connect the terminating resistors for the MPC interfaces (serial RS 485 bus).

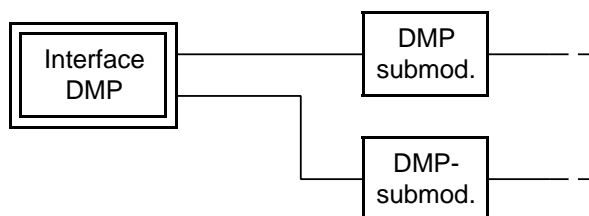
Only close the jumpers in pairs and as shown in the following table.

Bus connection	Jumper	Application
X111 or X121 (one connector assigned)	S1/S2 closed	A
X111 and X121 (two connectors assigned)	S1/S2 open	B
X131 or X141 (one connector assigned)	S3/S4 closed	A
X131 and X141 (two connectors assigned)	S3/S4 open	B

Application A



Application B



2.6.3 INT. EU 16 Bit

6FX1 137-8BB02

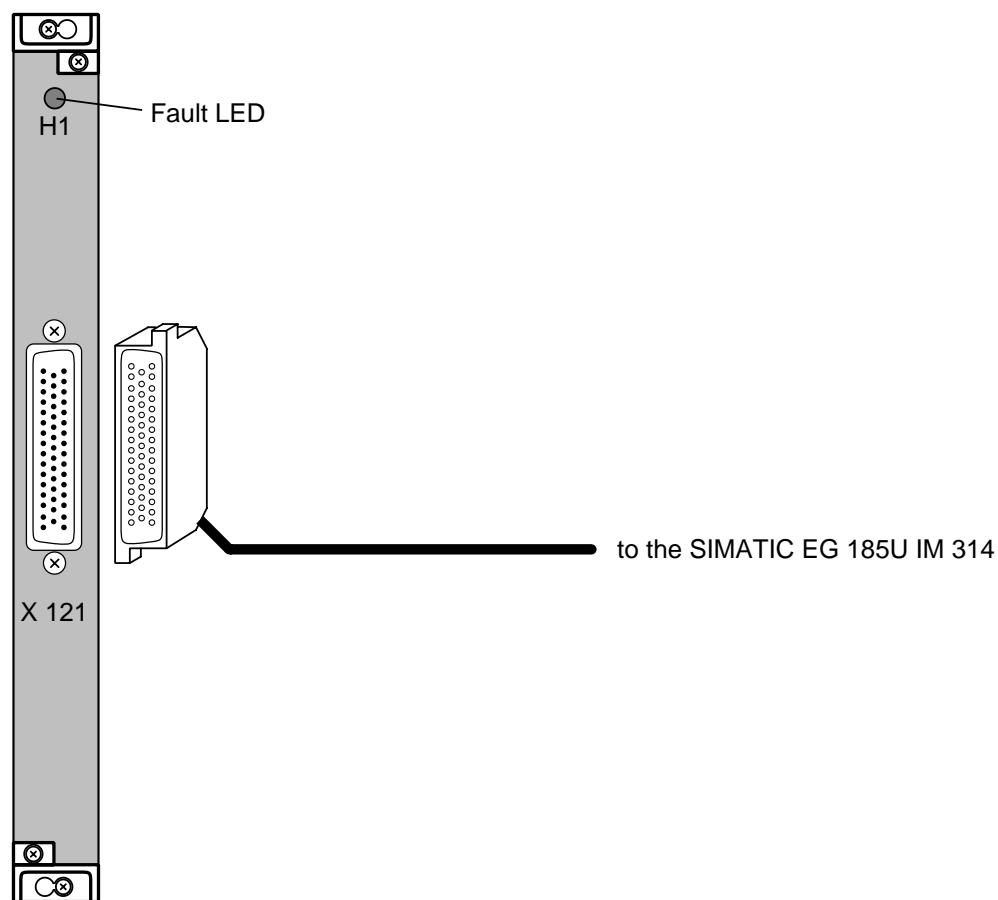
The INT. EU 16 Bit interface (**Interface Extension Unit 16 Bit**) is used to connect the EU 185U expansion unit and the PLC 135 WB.

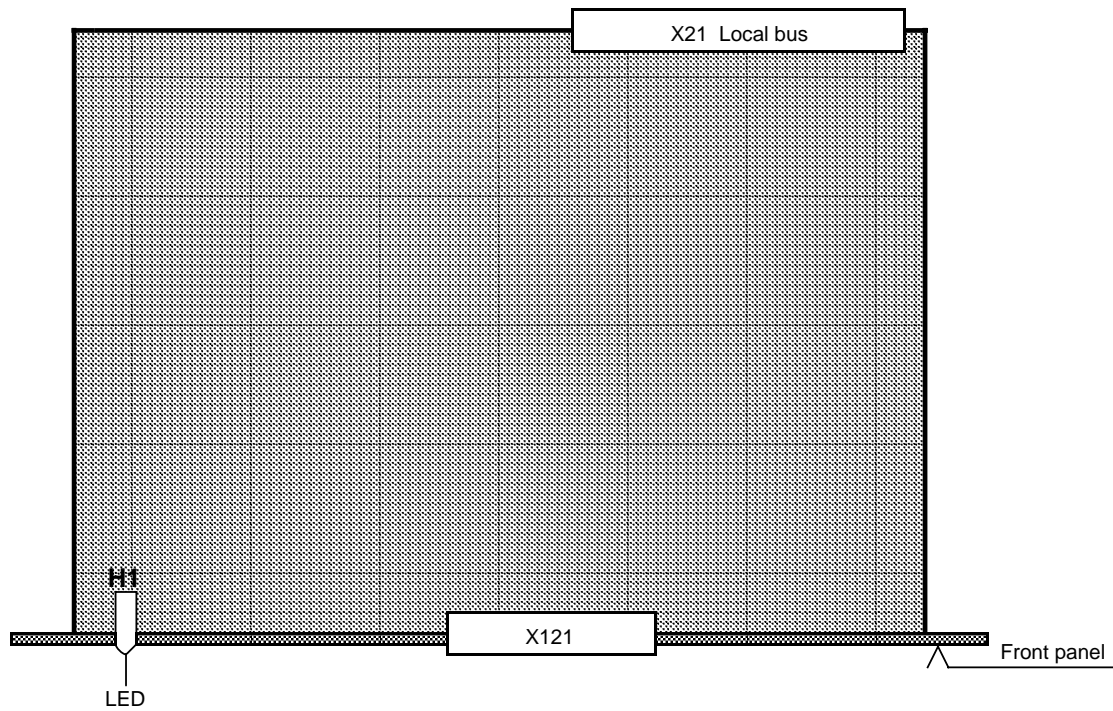
The interface is compatible with the SIMATIC interface module IM 304 to IM 314 (**Interface Module**). The IM 314 is used in the SIMATIC EU.

Functional blocks:

- Programmable address decoding (PAD)
- Monitoring of the external unit by current loop
- Access assignment of link and local bus via bus arbiter
- Command and status register for monitoring jumper setting and monitoring
- Address switchover to link to a SIMATIC control (for front interface)
- LED lamp to indicate failure of the external unit

Total current	+5 V	+5 V _{ext}	+15 V	- 15 V	+24 V
6FX1137-8BB02	1.3 A	—	—	—	—
X121	1 A	—	—	—	—





- X21: – Passive local bus interface to the NC or the PLC (X21)
- X121: – Active interface to the external unit (X121)
 – Parallel interface (16 bit address/data multiplexed)
 – Differential driver and receiver to RS 422
 – 50-way subminiature D, male connector
- H1: – Fault LED

There are no jumper settings to be made on this module.

2.6.4 SINUMERIK input/output modules

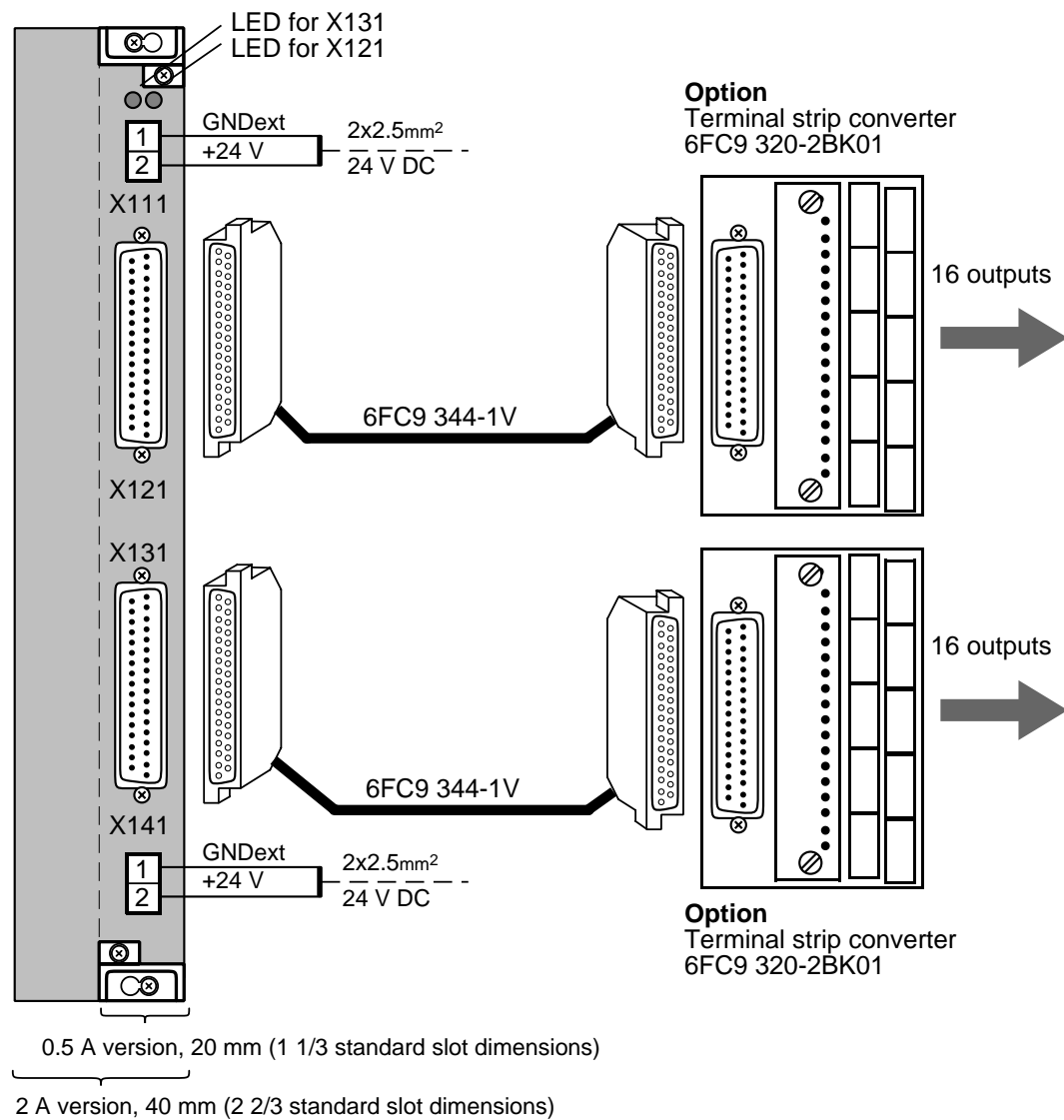
2.6.4.1 Digital output module, 0.5 A Digital output module, 2 A

6FX1 122-8BC04
 6FX1 122-8BD04

The module is a digital output module for 32 outputs with 24 V level.

This module comprises:

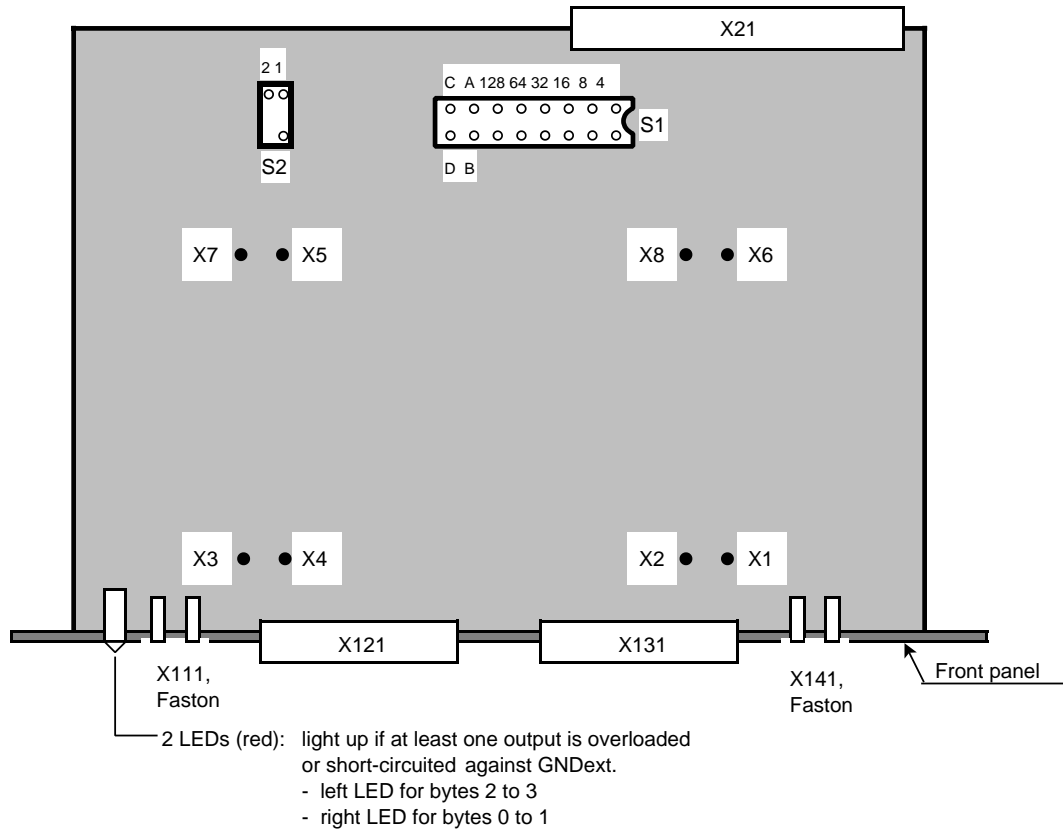
- 32 digital outputs, floating, 24 V/0.5 A or 2A, one power supply per word, short-circuit-proof. The outputs can be switched parallel for increased power. In this case the user program must set the outputs simultaneously.
- 2 terminal blocks for external supply of 24 V DC to the outputs
- 2 red LEDs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



Versions:

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

Position of interfaces, jumpers bases and jumpers



Total current	+5 V	+5 V _{ext}	+15 V	- 15 V	+24 V
6FX1 122-8B ..	0.24 A	—	—	—	0.1 A

- X21 – Bus interface
- X111 – 24 V supply for X121
- X121 – 16 outputs (bytes 0 and 1)
- X131 – 16 outputs (bytes 2 and 3)
- X141 – 24 V supply for X131

Switch S1: Setting of the initial address (see table on next page)

Jumper	Central controller	Mini EU
C - D	closed	open

- Jumpers:
- X1 - X2 open
 - X3 - X4 open
 - X5 - X7 open
 - X6 - X8 open

Switch S2:

Jumper	Central controller	Mini EU
	1	2

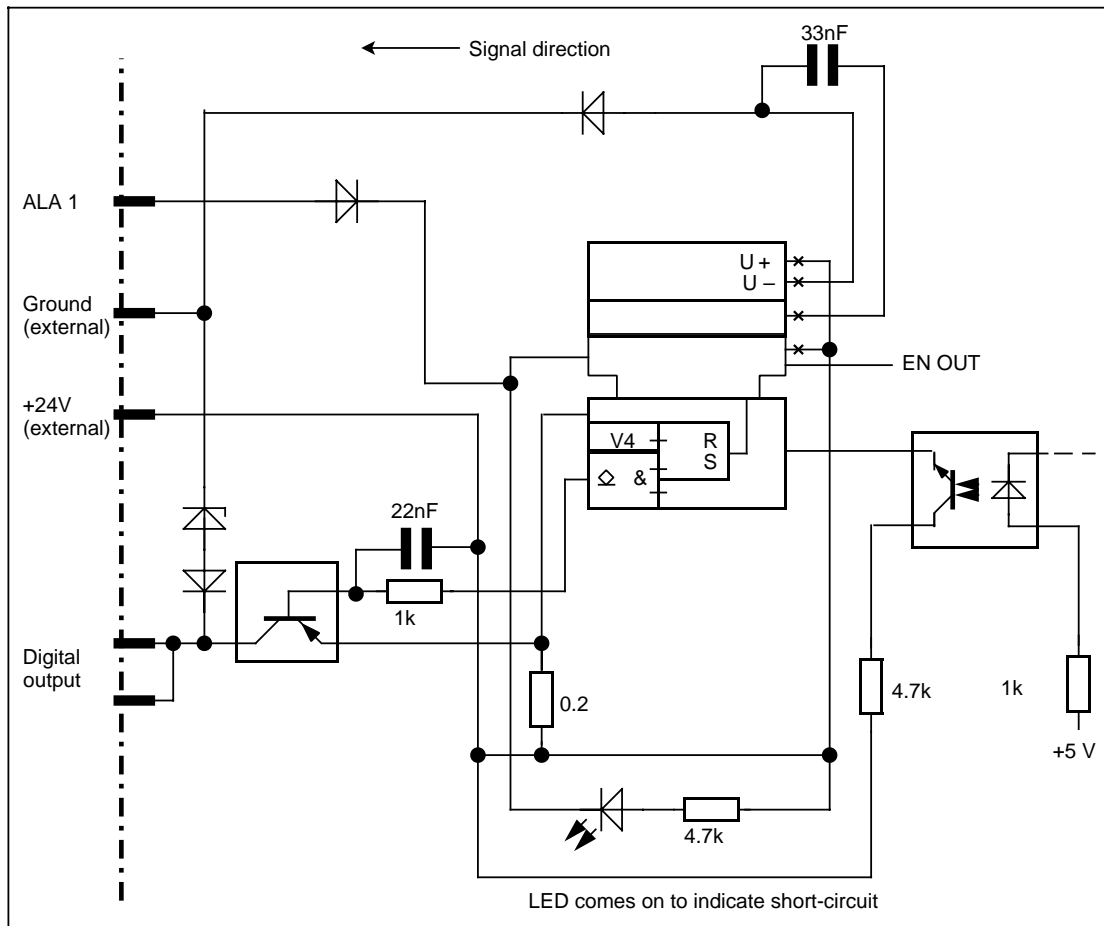
Setting initial address m

Initial address (hex.)	Output byte (dec.)	Base X1(DIP FIX)
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.

Digital output circuit



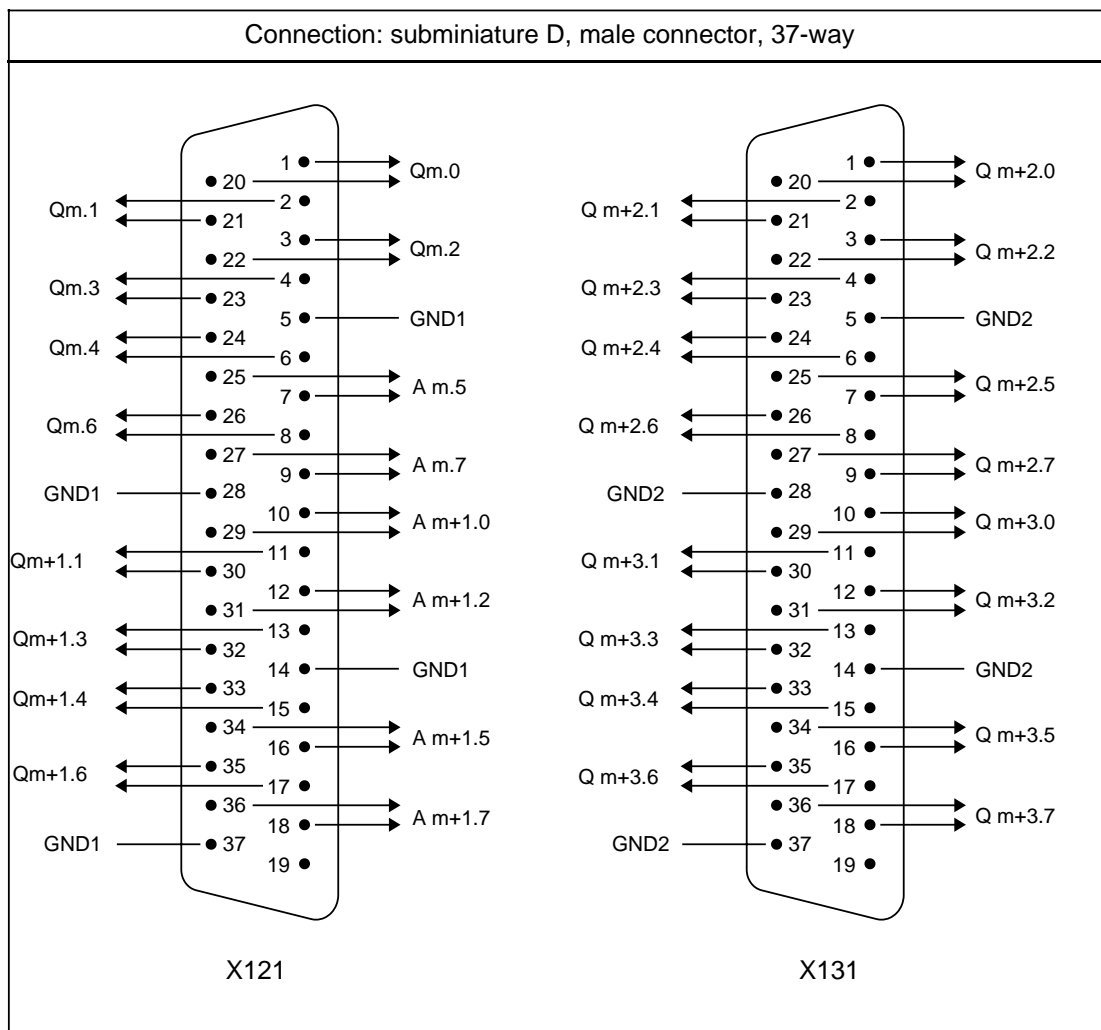
Assignment of the outputs on the PLC interface

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

Connection of the outputs

The 32 outputs are connected to connectors X121 and X131 (16 outputs to each).



**Do not use GND1, GND2 or any of the undesigned pins.
 They are only for testing purposes.**

Technical data

	6FX1 122-8BC	6FX1 122-8BD
Number of outputs	32 digital	32 digital
Galvanic isolation	yes	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)	500 mA	2 A
Short-circuit protection	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)	100 Hz 11 Hz 2 Hz	100 Hz 11 Hz 2 Hz
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.	50 m	50 m
Insulation voltage external terminals to housing - to VDE 0160 - tested with		
Current consumption internal (at 5V) internal (at 24V)	typ. typ. 240 mA 100 mA	240 mA 100 mA
Format	double-height Eurocard	double-height Eurocard
Module width	20 mm	40 mm
Weight approx.	500 g	1210 g
Degree of protection to DIN 40050	IP00	IP00
Relative humidity to DIN 40040	F	F

2.6.4.2 Digital input module

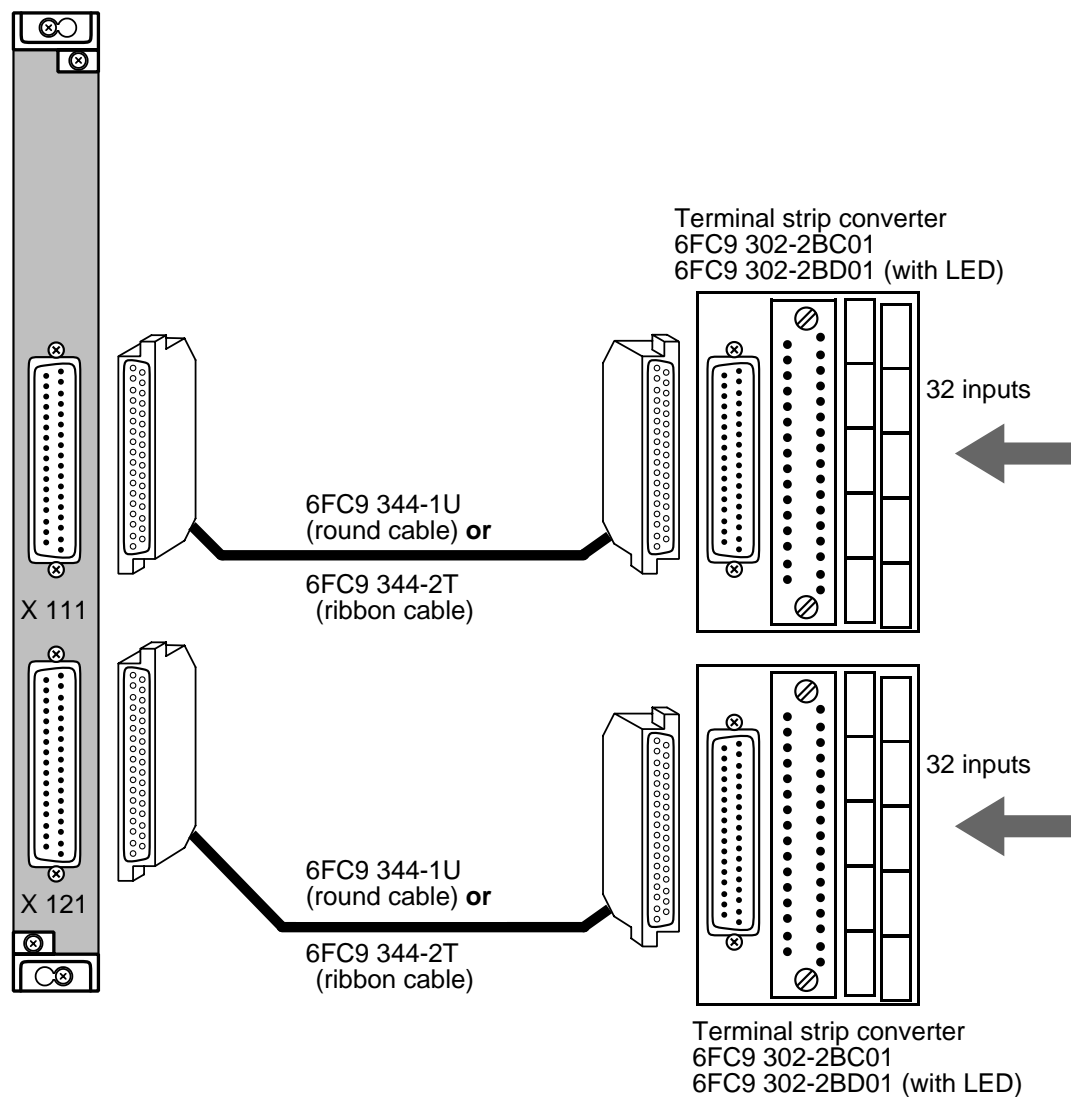
6FX1 125-7BA01

The module is a digital input module for 64 inputs with 24 V level.

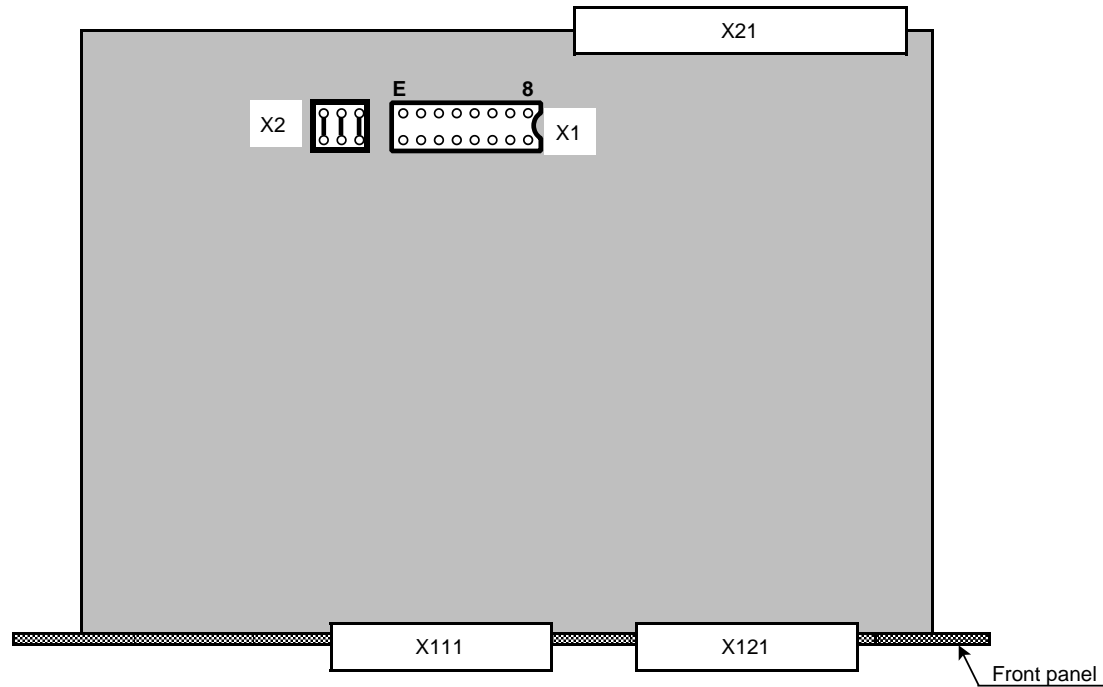
This module comprises:

- 64 inputs in 8 groups (floating)
- 64 input filters to suppress interference 2 ms
- Separate reference ground for each input byte

All 64 inputs are galvanically isolated from the logic part of the module 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.

Position of jumper bases and jumpers

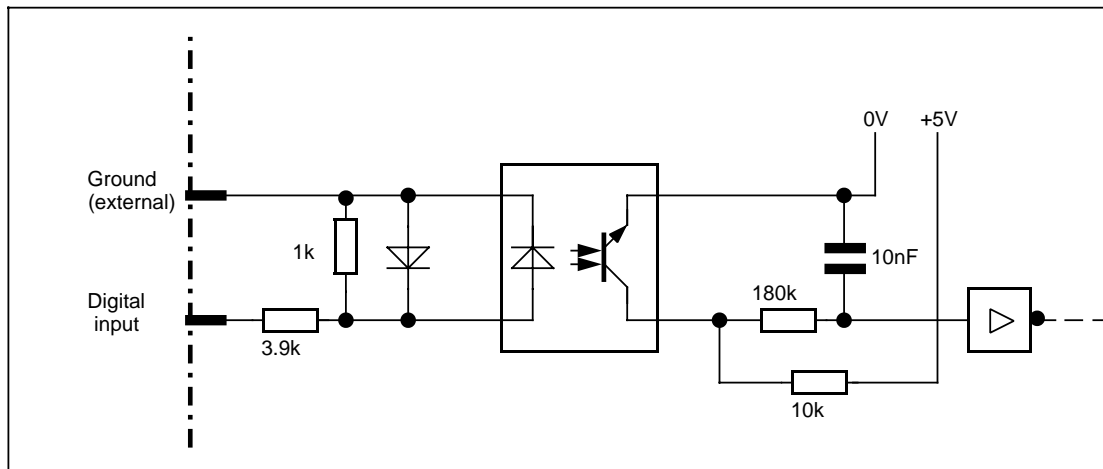
Total current	+5 V	+5 V _{ext}	+15 V	- 15 V	+24 V
6FX1 15-7BA . .	0.14 A	—	—	—	—

- X21 – Bus interface
 X111 – 32 inputs (bytes 0 and 3); 37-way subminiature D male connector
 X121 – 32 inputs (bytes 4 and 7); 37-way subminiature D male connector
- X1 – Setting the initial address
 X2 – All three jumpers are closed as a standard setting

Setting initial address m

Initial address (hex.)	Input byte (dec.)	Base X1(DIP FIX)	Base X2
		 B D F*) 8 32 128 16 64 A C E	 L N P K M U
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		

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.

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	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) internal (at 24V)	typ. 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	

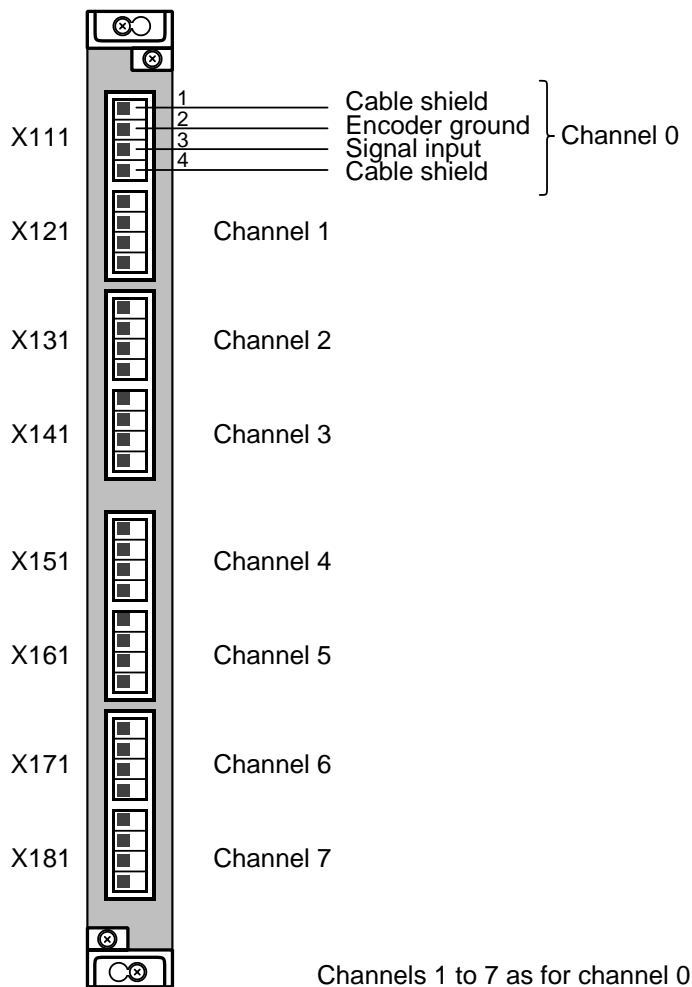
2.6.4.3 Analog input module

6FX1 136-1BA01

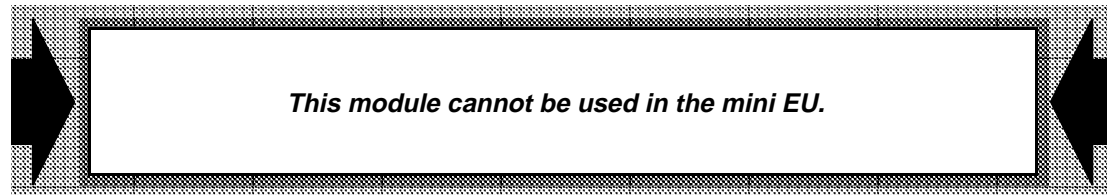
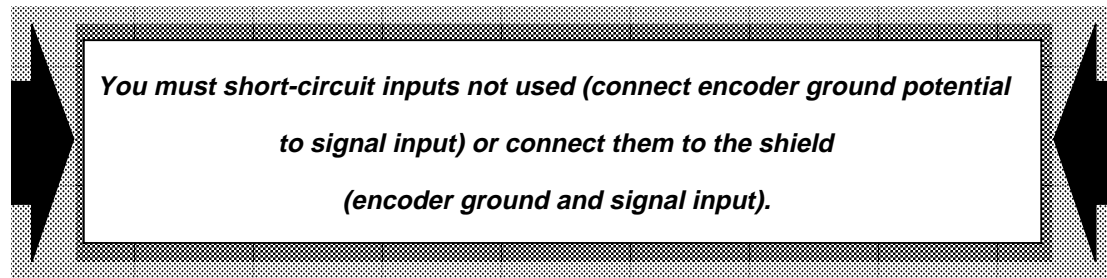
The module is used for the acquisition of analog measured values.

This module comprises:

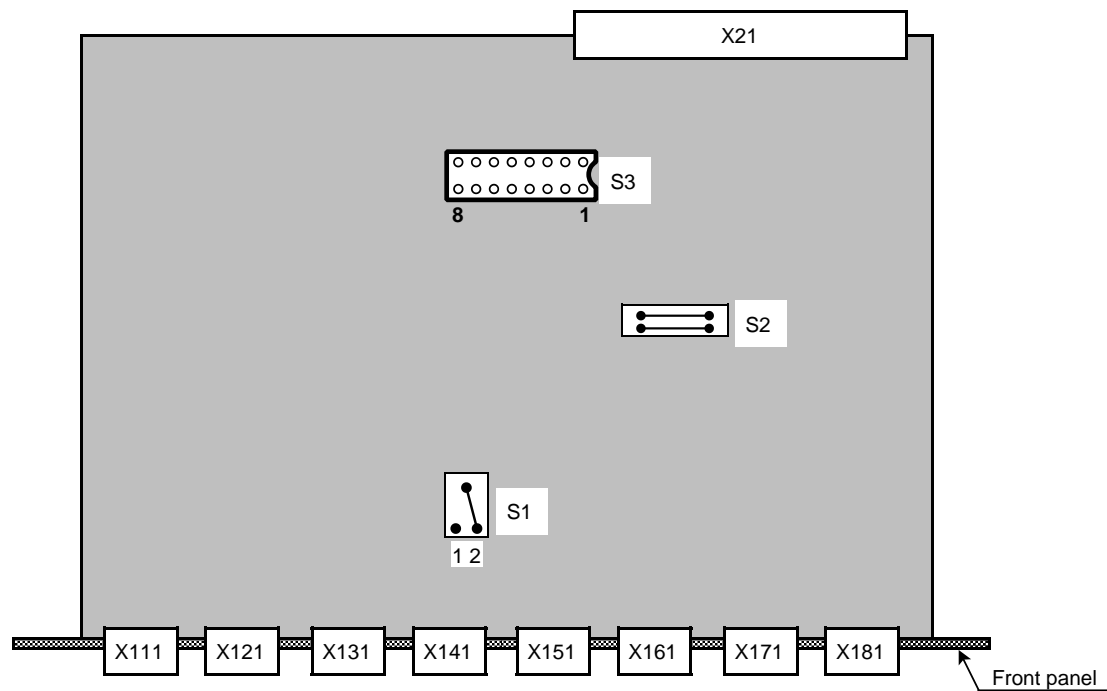
- 8 analog inputs, non-floating, with programmable input filters (voltage range -10 V to +10 V, smallest resolution: 4.88 mV)
- Overvoltage protection ± 35 V
- RC low-pass filters which can be connected by software (three different time constants: 0.01 ms; 0.1 ms; 1 ms)
- Hardware-controlled offset compensation
- Addressing optionally by software (PAD) or address comparator



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



Position of jumper bases and jumpers



Total current	+5 V	+5 V _{ext}	+15 V	- 15 V	+24 V
6FX1 136-1BA . .	0.55 A	—	0.09 A	0.1 A	—

- X21 – Bus interface
- X111 to X181 – 8 analog inputs ± 10 V; 4-way terminal block

- S1 (switch) – Permanently set by the manufacturer (do not alter)
- S2 (switch) – Permanently set by the manufacturer to match hardware version (do not alter)
- S3 (switch) – Customer jumpering

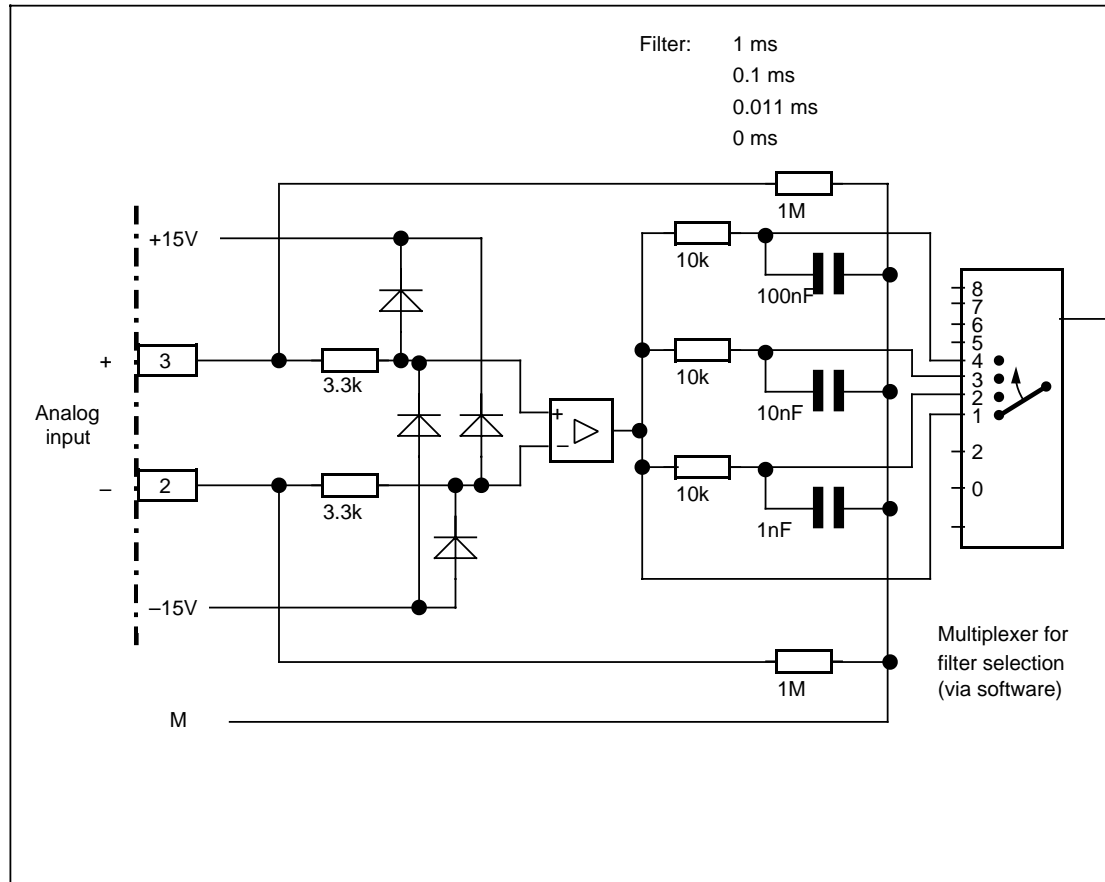
Setting the starting address m with S3:

Initial address (hex.)	Input byte (dec.)	Dip-Fix S3
00	0 - 15	
10	16 - 31	
20	32 - 47	
30	48 - 63	
40	64 - 79	
58	80 - 95	
⋮	⋮	
E0	224 - 239	
F0	240 - 255	

Note:

Jumpers 1, 6, 7 and 8 must be open.

Analog input IC



Assignment of inputs on the PLC interface

Input word *m* contains the information 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 <i>m</i>	2 ¹¹ Sign	2 ¹⁰	2 ⁹	2 ⁸	2 ⁷	2 ⁶	2 ⁵	2 ⁴
IB <i>m</i> +1	Connector X111, channel 0 - input 1							
	2 ³	2 ²	2 ¹	2 ⁰	1 ¹⁾	1 ¹⁾	1 ¹⁾	1 ¹⁾
IB <i>m</i> +2	Connector X121, channel 1 - input 2							
IB <i>m</i> +3								
IB <i>m</i> +4	Connector X131, channel 2 - input 3							
IB <i>m</i> +5								
IB <i>m</i> +6	Connector X141, channel 3 - input 4							
IB <i>m</i> +7								
IB <i>m</i> +8	Connector X151, channel 4 - input 5							
IB <i>m</i> +9								
IB <i>m</i> +10	Connector X161, channel 5 - input 6							
IB <i>m</i> +11								
IB <i>m</i> +12	Connector X171, channel 6 - input 7							
IB <i>m</i> +13								
IB <i>m</i> +14	Connector X181, channel 7 - input 8							
IB <i>m</i> +15								

Set address *m* with jumpers on the module and in PLC MD.

¹⁾ These bits are permanently set to a 1 signal. Mask them if necessary.

Digital representation of analog values

The voltage range of the eight analog inputs is $\pm 10\text{V}$. With a resolution of 11 bits, increments of 4.88 mV each are attained. The analog values are digitized in two's complement.

Analog voltage at input	Bit											
	211	210	29	28	27	26	25	24	23	22	21	20
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

Programmable input filters

Filters for interference suppression can be cut in by the user program in the individual analog channels. The filters are selected by describing the output word corresponding to the addressed input word. No other output module must be addressed on this output word.

Byte No.	Bit No.							
	7	6	5	4	3	2	1	0
QB m	Channel 7 F1 F0		Channel 6 F1 F0		Channel 5 F1 F0		Channel 4 F1 F0	
QB m +1	Channel 3 F1 F0		Channel 2 F1 F0		Channel 1 F1 F0		Channel 0 F1 F0	
⋮	Reserved by the system. Do not use.							
QB m +15	Reserved by the system. Do not use.							

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 each channel:

Bit		Input configuration
F1	F0	
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

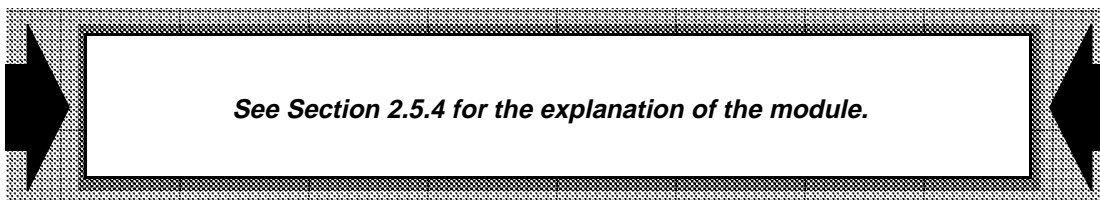
Example:

Filter channel 2: 1ms, initial address of IW 16 module
 LK 0003
 T QW16 (cyclic operation)

Technical data

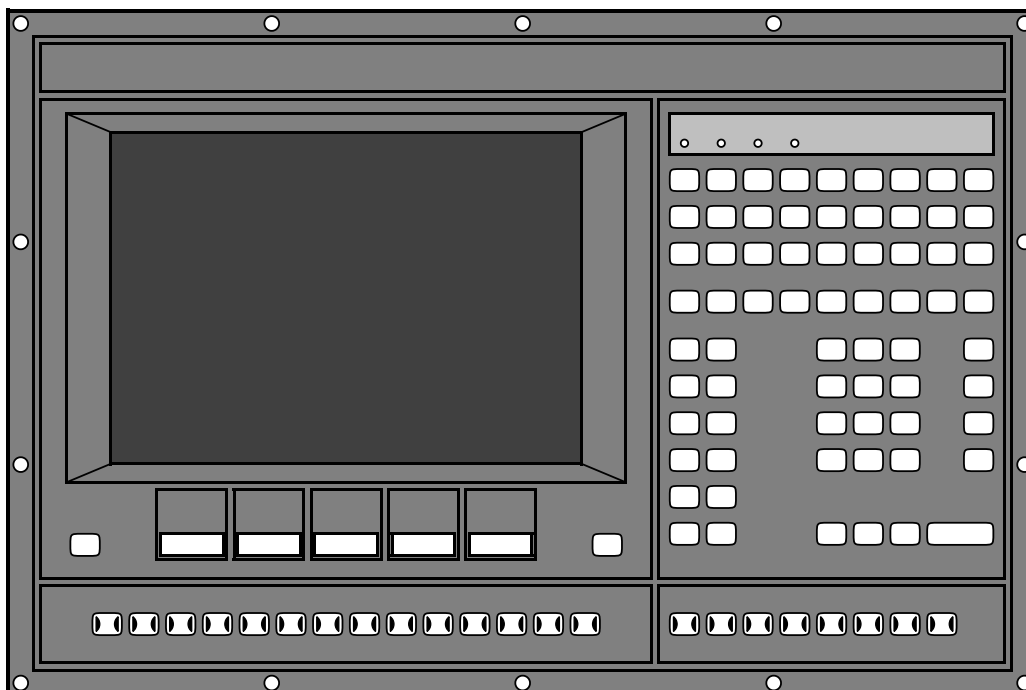
Number of inputs	8 voltage inputs, analog	
Isolation	No	
Input range (rated values)	±10 V	
Input resistance in the individual ranges		
Connection of the sensors	Two-wire connection	
Digital representation of the input signal	12 bits, two's complement	
Measuring principle	Successive approximation	
Conversion principle	Successive approximation	
Integration time (adjustable for optimal interference voltage suppression)		
Coding time	max.	396 µs for 8 channels, including 1 adjustment cycle;
Single coding possible		No
Scan time for 8 inputs		
Permissible voltage between inputs or between inputs and central earthing point (destructive limit)	±35 V DC	
Permissible voltage between reference potential of a non-floating encoder and central earthing point	±1 V	
Fault report in case of		
- Limit violation	No	
- Wire break of the sensor line	No	
Interference voltage suppression for $f = n$ (50/60 Hz ±1 %) $n=1, 2 \dots$		
- Common-mode interference ($U_S < 1V$) min.	-	
- Normal-mode interference (peak value of interference voltage < rated value of the range)	-	
Basic error limits	1 LSB	
Operating error limits (0 °C to 60 °C)	±10 V (0 °C to 70 °C: 7 LSB)	
Power supply (as for analog outputs)	5 V, ±15 V	
Enable input (as for analog outputs)		
Wire length for cable	max.	
Insulation voltage of external connections against casing		
- to VDE 0160		
- checked with		
Current consumption internal (for 5 V)	typ.	5 V: 0.55 A
internal (for 24 V)	typ.	±15 V: 0.1 A
Format	Double-height Eurocard	
Module width	20 mm	
Weight	approx.	400 g
Degree of protection to DIN 40050	IP0	
Humidity class to DIN 40040	F	

2.6.4.4 Mixed I/O, 16 I/O (digital) and 4 O (analog)



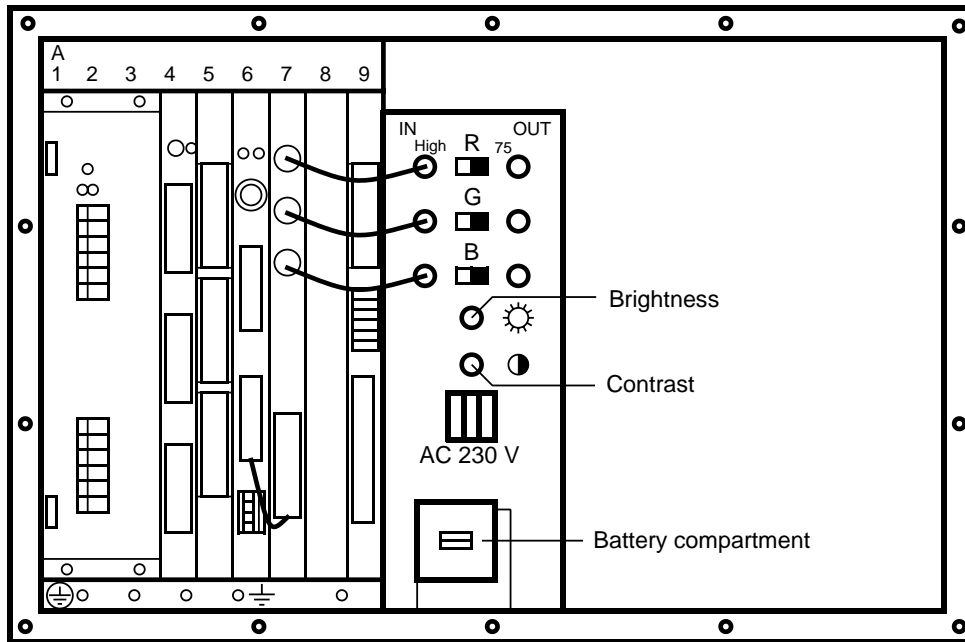
2.7 Operator panel area

The operator panel contains the integrated keyboard, the integrated RGB monitor and the rack for the operator panel modules.



2.7.1 Monitor

On the SINUMERIK 880 GA2, an RGB monitor (12") with 640 x 480 pixels is used. The monitor is supplied with voltage internally (wired in the factory). The monitor is controlled via three coax cables (order number: 6FC9340-8WZ03) from the operator panel interface (slot 7). The terminating switches of the RGB inputs must be in position "75".



Operator panel rear view

2.7.2 Operator panel power supply unit

6EW 1861-3A0

There are no jumpers to be set on the operator panel power supply unit. See Section 3.2.2.2 for explanations of the module.

2.7.3 Filter unit

6EW 1060-0AA

The filter unit is required for the power supply to the monitor on the 2nd and the 3rd operator and there are no jumpers to be set on it. See Section 3.2.2.2 for explanations of the module.

2.7.4 Operator panel CPU

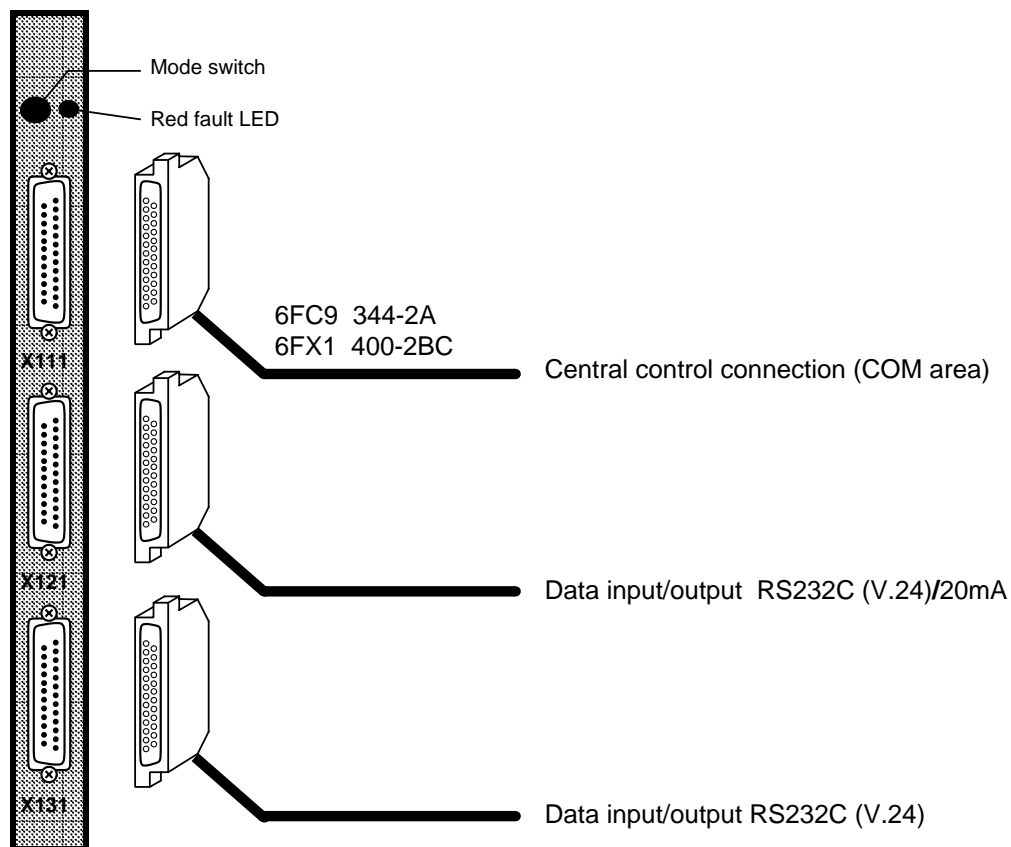
6FX1 120-4BD03

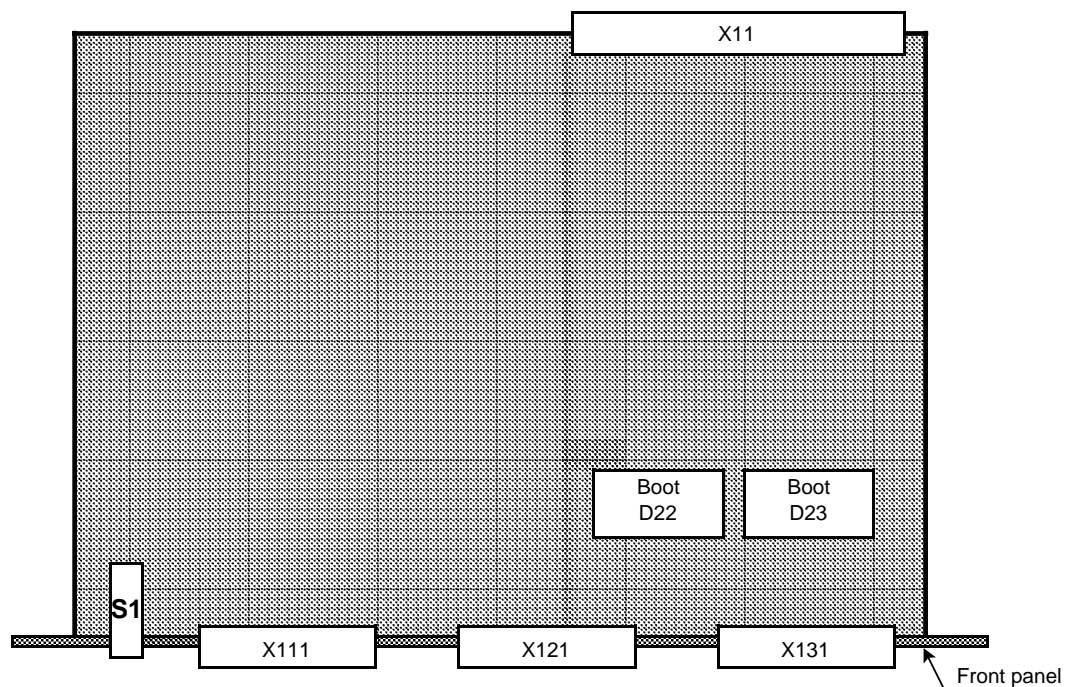
The module for the operator panel CPU is used to link the central controller via an MPC interface. There are also two serial interfaces to link I/O modules.

This module comprises:

- EPROM (boot EPROM, 6FX1 890-0BX84-)
- 128-Kbytes of RAM (battery-backed)
- Multi-port controller (MPC)

Position of interfaces, jumper bases and jumpers





- X11 – Bus interface
- X111 – MPC interface for connecting the cables to the central controller operator panel, 25-way subminiature D male connector, for pin assignment, see Section 2.3.2
- X121 – RS232C (V.24)/20 mA, 25-way subminiature D male connector, for pin assignment, see Section 2.3.2
- X131 – RS232C (V.24) or RS 422 (with adapter 6FX1 137-2BA . .), 25-way subminiature D male connector, for pin assignment, see 2.3.2
- S1 – Mode switch
 - position 0: normal operation
 - position 8: initialization of the operator panel, operator panel must start up in this position even without a central controller.

Total current	+5 V	+5 V _{ext}	+15 V	- 15 V	+24 V
6FX1 120-4BB/-4BD	1.7 A	—	70 mA	30 mA	—
X111 to X131	0.7 A	—	—	—	—
X111, X121, X131	0.25 A	—	—	—	—

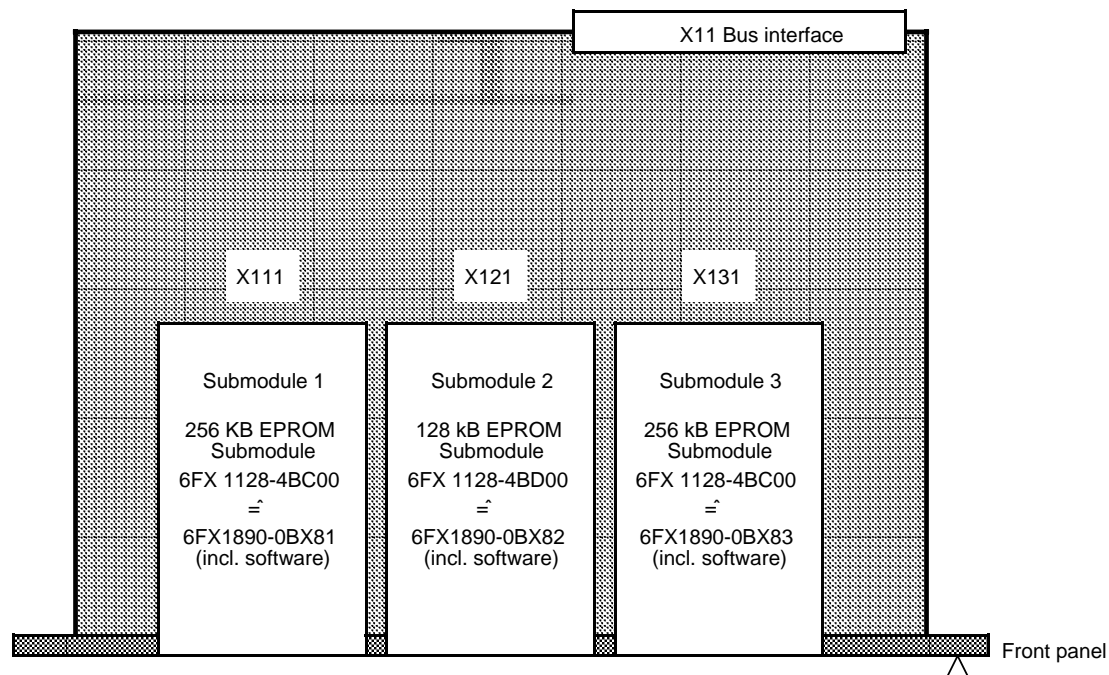
2.7.5 MEMORY/EPROM RAM**6FX1 128-1BB00**

The MEMORY/EPROM RAM module takes three memory submodules (RAM or EPROM) with a memory capacity of 64/128 Kbytes or 128/256 Kbytes each.

This module comprises:

- 32-Kbyte RAM on the module (battery-backed)
- Automatic detection of submodules by the software
- Address routing by software

Total current	+5 V	+5 V _{ext}	+15 V	- 15 V	+24 V
6FX1128-1BB00	0,22 A	—	—	—	—

**Note:**

The EPROM submodules are described in Section 2.3.3.1.

2.7.6 INTERFACE KEYBOARD

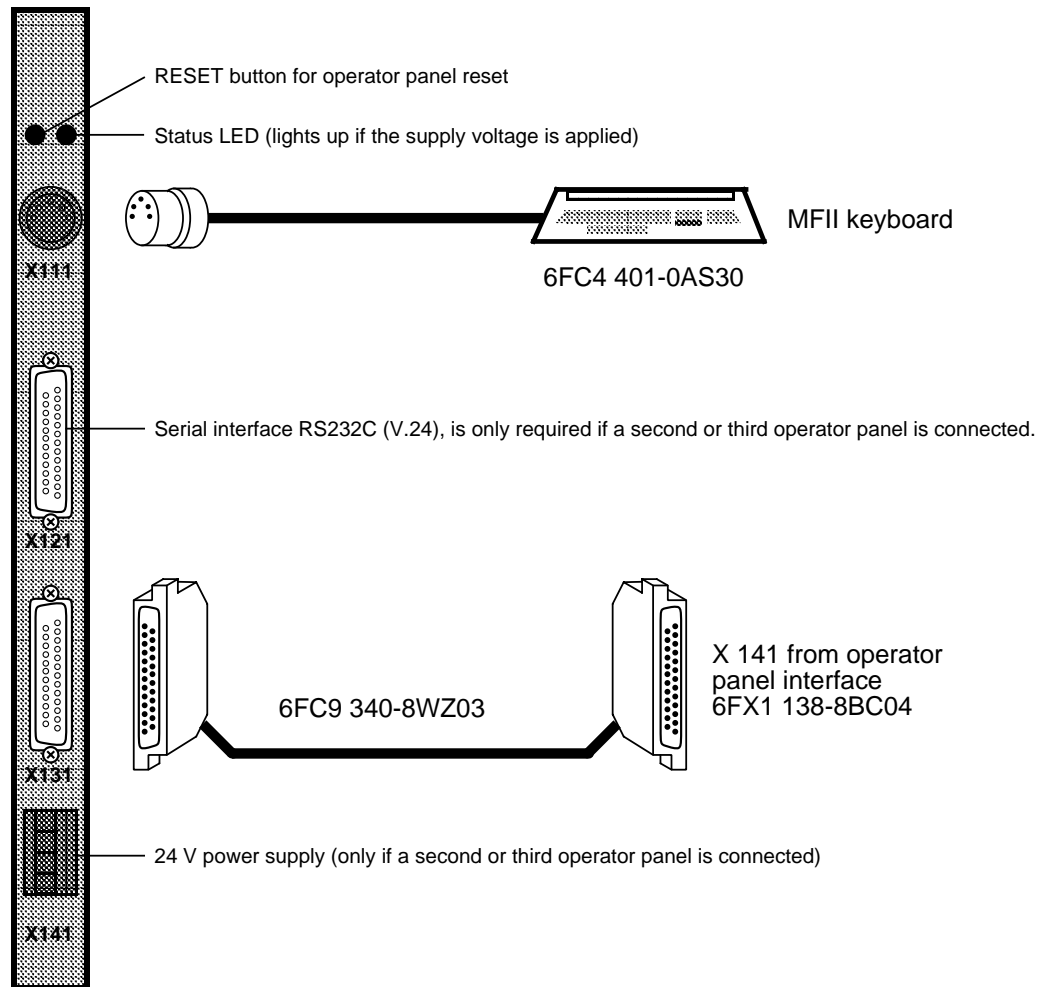
6FX1 148-7BA01

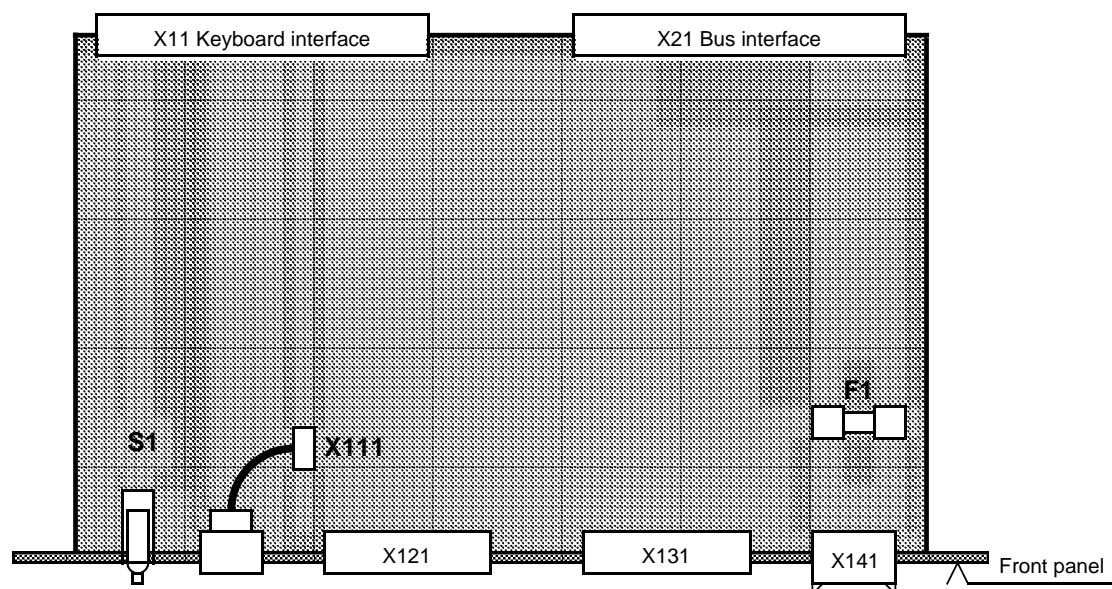
The INTERFACE KEYBOARD module is used to interface the operator panel to the SINUMERIK 880 GA2. Data is exchanged between the module and the control via a serial interface. Using a second serial interface, you can connect a second or third operator panel.

Function blocks:

- 80C31 microcomputer
- External EPROM 32 Kbytes x8 (firmware 570 874.9382.)
- External RAM 32 Kbytes x8
- DC/DC converter 24 V/5 V (1 A)

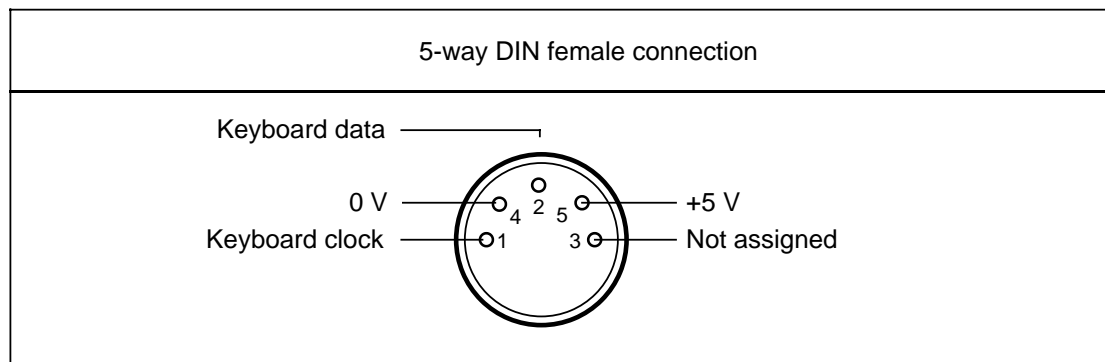
Total current	+5 V	+5 V _{ext}	+15 V	- 15 V	+24 V
6FX1148-7BA . .	0.3 A	—	—	—	—



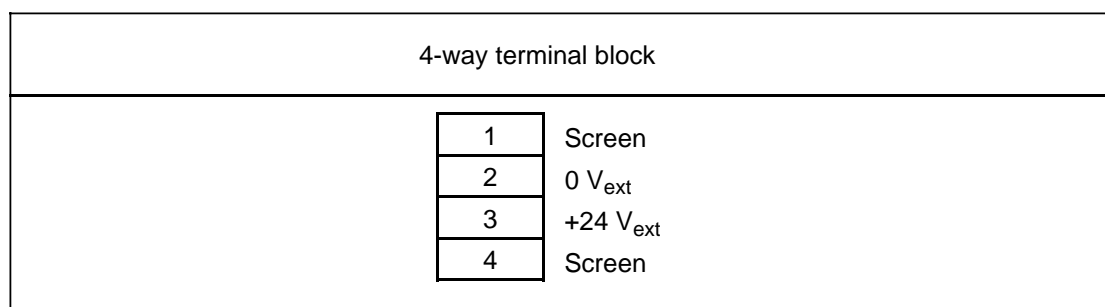


- | | |
|-------------|--|
| LED | – Supply voltage switched on |
| S1 (button) | – Reset |
| F1 (fuse) | – F 0.63 A, 250 V |
| X111 | – Keyboard interface, connection option of MFII keyboard (PC industry standard), can be plugged in and removed during operation; 5-way DIN round connector |
| X121, X131 | – Serial interfaces (RS232C (V.24)), 25-way subminiature D female connector, for pin assignment, see Section 2.3.2 |
| X141 | – 24 V current supply connection, is only required for a second or third operator panel. |

MFII keyboard interface (X111)



Voltage supply (X141)



If the INTERFACE KEYBOARD is used for the 1st operator panel the voltage is supplied internally via the bus interface (X21). No external supply is required.

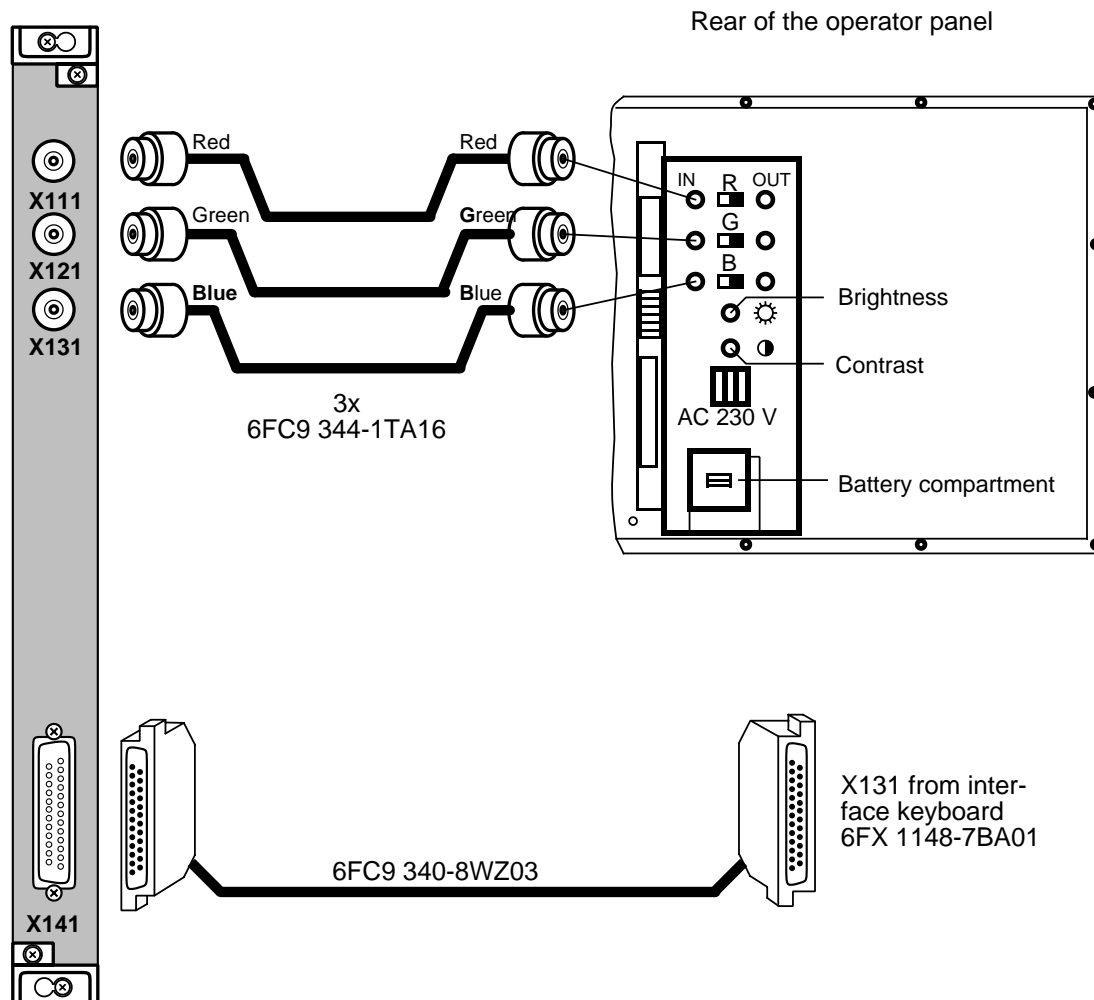
If the INTERFACE KEYBOARD is used for a 2nd or 3rd operator panel, the +24 V voltage is supplied externally via X141. There are no jumpers to set.

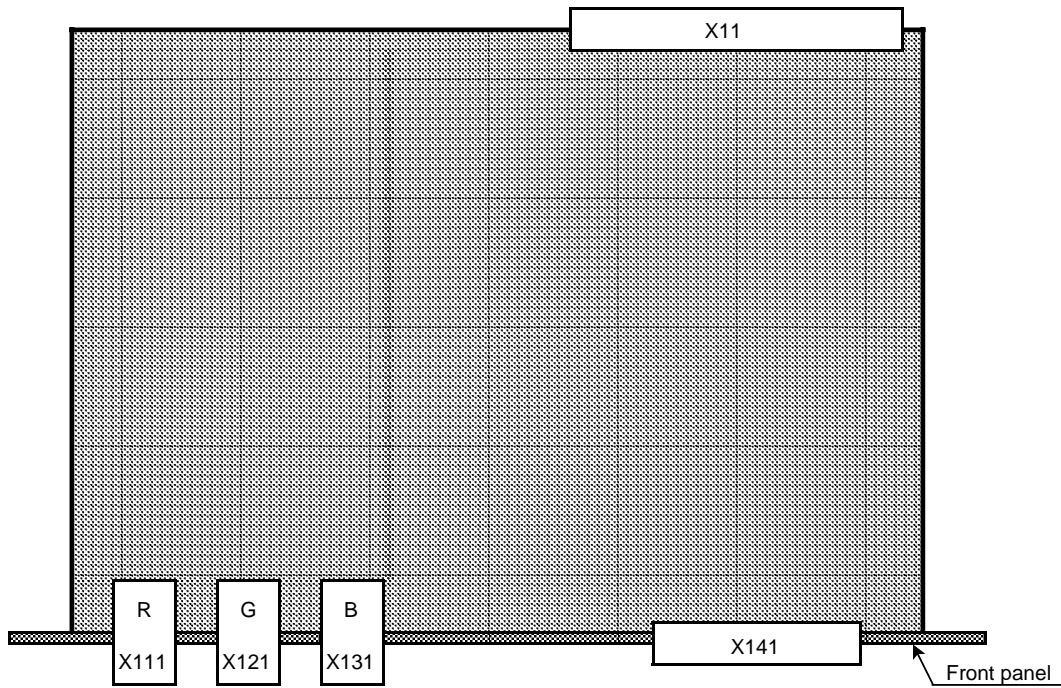
2.7.7 OPERATOR PANEL INTERFACE**6FX1 138-8BC04**

The module is the interface between the NC control and the operator panel.

This module comprises:

- Three BNC female connectors for monitor interface, RGB analog to RS 343
- Graphics processor, 16 colours
- One serial keyboard interface, RS232C (V.24)
- Eight-bit microcontroller
- EPROM 32 Kbyte (firmware 570 856.9584.)





- X11 – Passive parallel local bus interface to the NC
- X111/X121/X131 – Monitor interface (RGB), signal level to RS 343
- X141 – Serial keyboard interface (RS232C (V.24))

Total current	+5 V	+5 V _{ext}	+15 V	- 15 V	+24 V
6FX1 138-8BC . .	1.5 A	—	0.01 A	0.01 A	—

2.7.8 INTERFACE

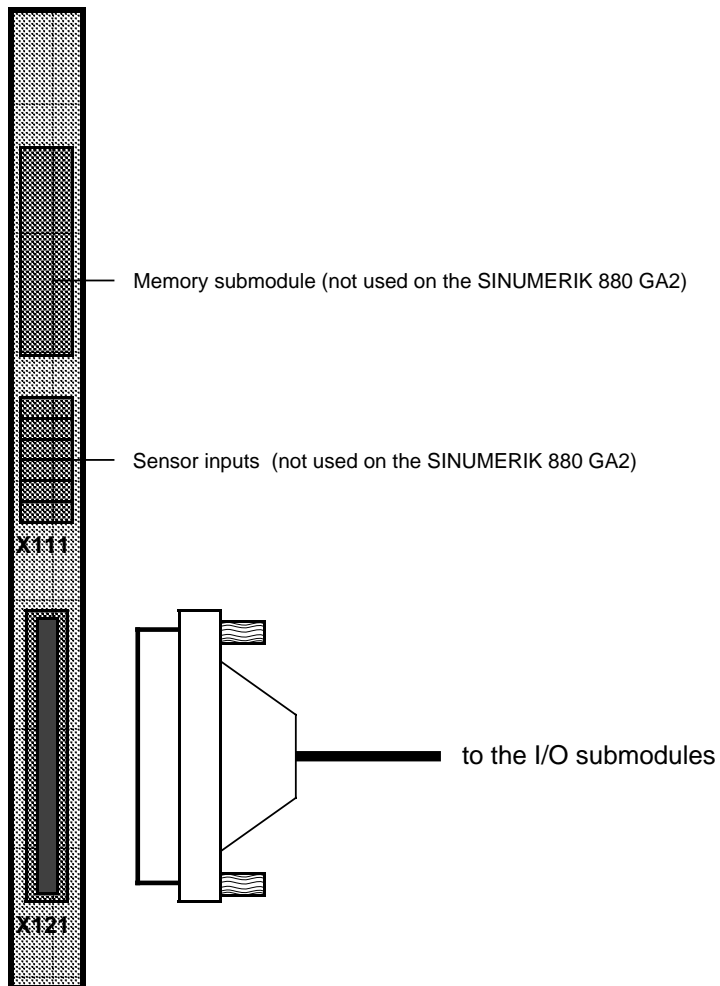
6FX1 121-2BA03

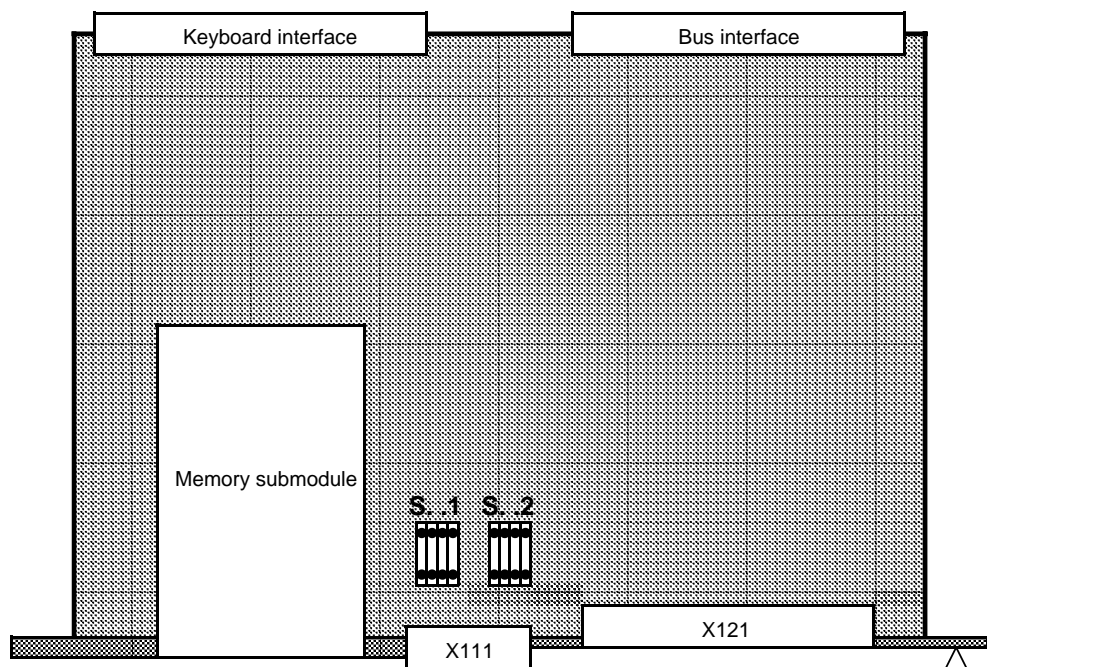
The INTERFACE module is used to connect the machine control panel, I/O modules, handwheels and sensors.

This module comprises:

- Memory submodule slot for 16/32 Kbyte or 64/128 Kbyte submodule
- Address routing by software

Position of interfaces, jumper bases and jumpers





- X111 – Two sensor inputs (not used on the SINUMERIK 880 GA2)
- X121 – I/O bus for I/O and electronic handwheel

- S . . 1, S . . 2 – Customer jumpering
 (switch) Adaptation to sensors (levels, edges)
 Any position because SINUMERIK 880 GA2 is not used

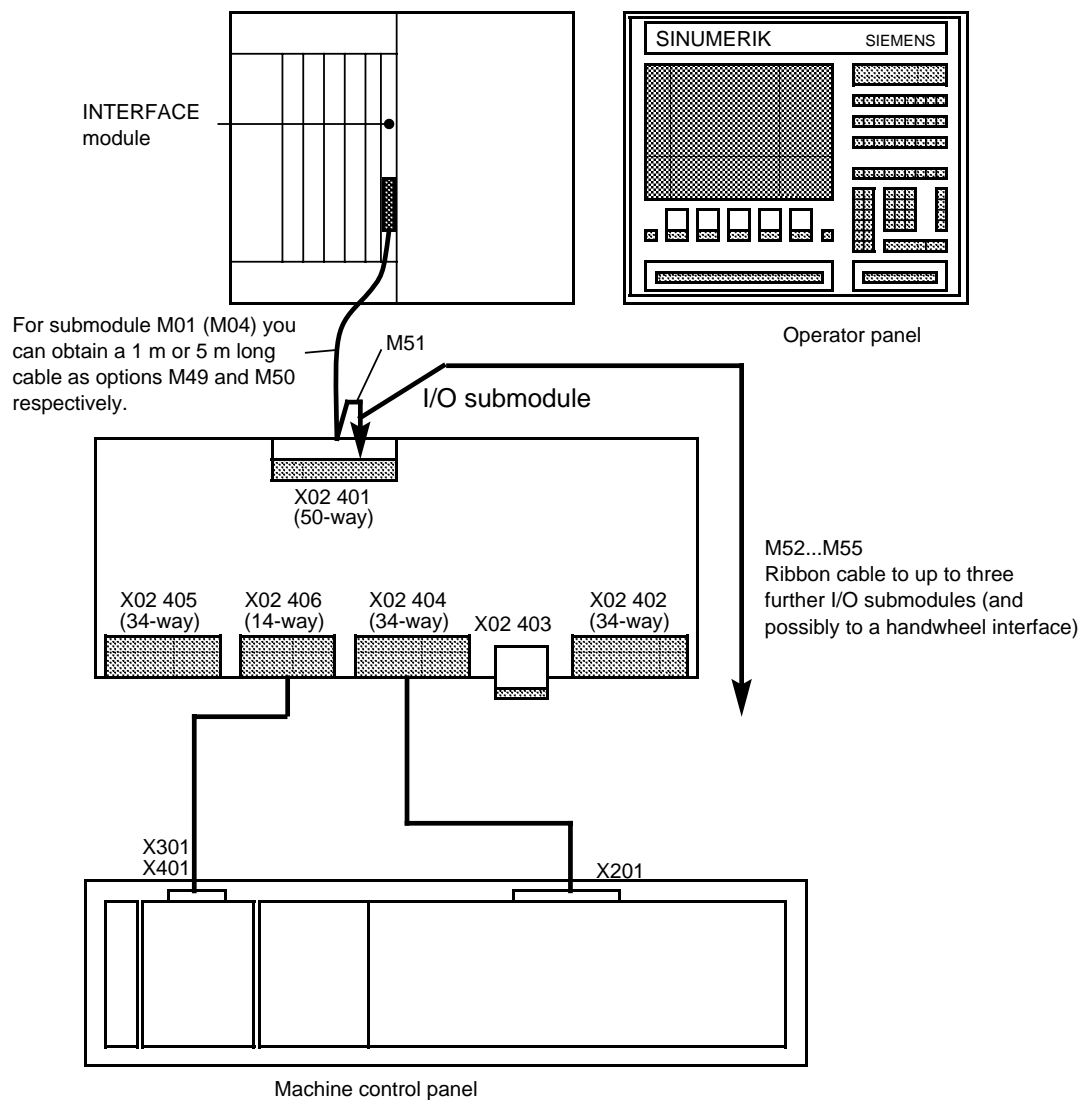
Total current	+5 V	+5 V _{ext}	+15 V	- 15 V	+24 V
6FX1 121-2BB . .	0.47 A	—	—	—	—
X121	2.4 A *)	—	—	—	—

*) Voltage drop on I/O bus! (cable resistance $R_L = 0,025 \Omega/m$)

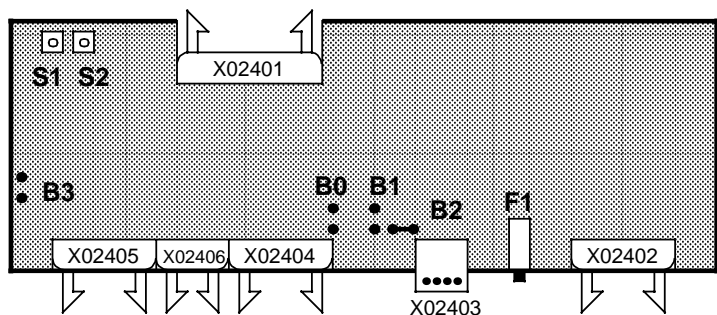
2.7.8.1 I submodule, I/O submodule

6FX1 124-6AD02

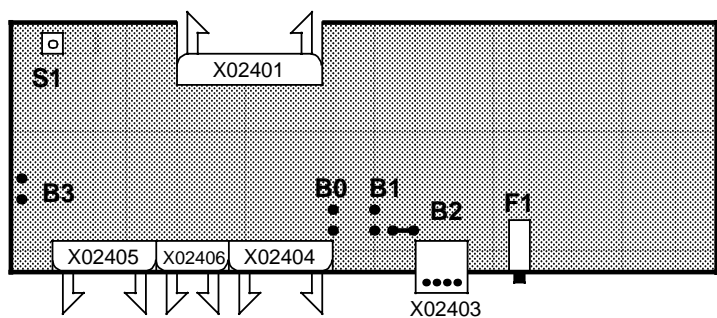
The module is a digital I/O module for 64 inputs and 32 outputs with 24 V voltage level (non-floating). It is mounted on a mounting plate. This mounting plate is required once for all the I/O submodules (max. four).



Position of interfaces, jumper bases and jumpers



6FX1 124-6AD02

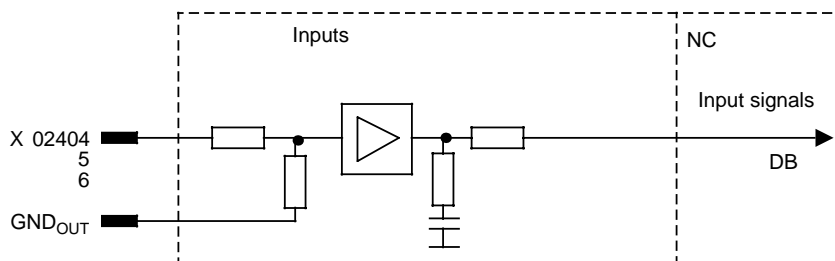
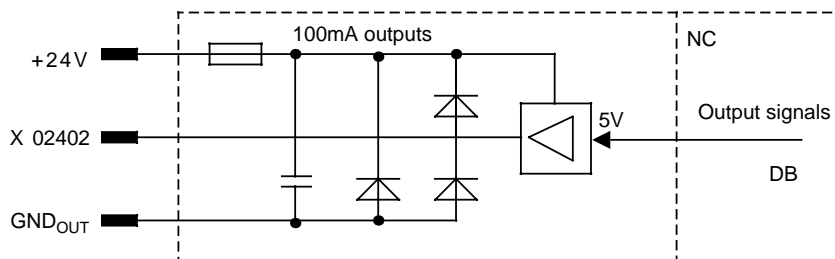
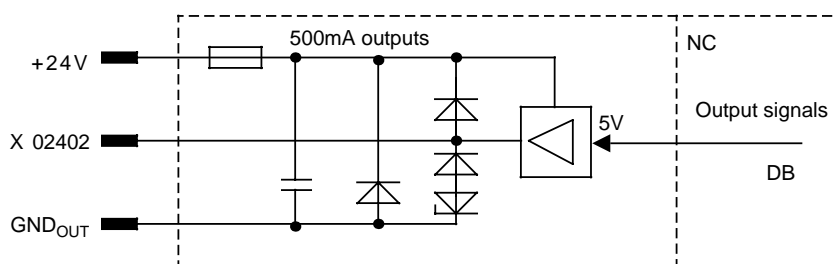


6FX1 124-6AC02
6FX1 124-6AC03

- | | |
|--------------------|--|
| Jumpering | closed: B2
open: B0, B1, B3 |
| S1, S2
(switch) | – Customer jumpering
– Address coding S1: inputs
S2: outputs |
| F1 | – Fuse for the outputs and the external machine control panel
F 6.3 A / 250 V, 20 mm×5 mm
(6FX1 124-6AD02)
F 0.5 A / 250 V, 20 mm×5 mm
(6FX1 124-6AC02/-6AC03) |
| X02 401 | – Interface to the interface module |
| X02 402 | – 32 outputs 24 V/0.5 A, short-circuit-proof (only 6FX1 124-6AA03)
– 24 outputs 24 V/0.5 A, short-circuit-proof
(only 6FX1 124-6AA02;-6AD02)
8 outputs (last output byte) 24 V/0.1 A, not short-circuit-proof
(only 6FX1 124-6AA02;-6AD02) |
| X02 403 | – 24 V current supply connection |
| X02 404 | – 32 inputs 24 V, non-floating |
| X02 405 | – 32 inputs 24 V, non-floating |
| X02 406 | – 10 inputs 24 V, non-floating, parallel to pins 3 to 12 of X 02405 |

Total current	+5 V	+5 V _{ext}	+15 V	- 15 V	+24 V
6FX1 124-6AA02/6AA03	0.1 A	—	—	—	50 mA
X02405	—	—	—	—	320 mA ¹⁾
X02402 each 0.1 A output	—	—	—	—	0.1 A
X02402 0.1 A output	—	—	—	—	0.4 A
X02402 each 0.5 A output	—	—	—	—	0.5 A
X02402 0.5 A output	—	—	—	—	8.0 A

Input and output circuits:



GND_{OUT}/24 V are supplied via the terminal block X02 403.

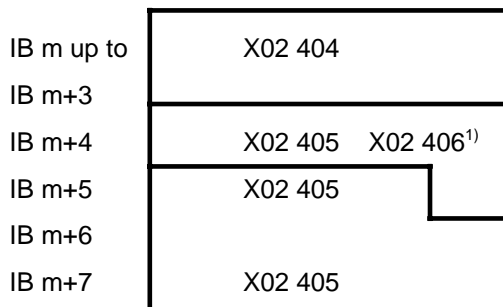
1) Required for the Siemens machine control panel!

Assignment of the inputs on the PLC interface to interfaces X02 404 and X02 405/X02 406 ¹⁾

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



Note:

Only change the position of the selector switch when the control is switched off!

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.

Assignment of outputs on the PLC interface to interface X02 402

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	Adress m
0	64
1	68
2	72
3	76

Note:

Only change the position of the selector switch when the control is switched off!

Output load:

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

Byte No.	QB m+3	24 V/0.1 A
----------	--------	------------

Technical data

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

No. of inputs		64
Galvanic isolation		no
Input voltage (rated)		24 V–
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 outputs		32 (8+4)
Galvanic isolation		no
Supply voltage U_p Rated Ripple U_{SS} Permissible range (incl. ripple)	max.	24 V– 3.6 V– 20 V to 30 V
Output current for 1 signal Rated		100 mA or 0,5 A
Short-circuit protection 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
Total load at 55 °C ²⁾		50 %
Signal level of the outputs for signal 0 for signal 1 100 mA output 0.5 A output	max. min. min.	output open $U_p - 1.1$ V supply voltage $U_p - 1.7$ V supply voltage
Cable length max.		50 m
Insulation voltage external terminals to housing to VDE 0160 tested with		– – –
Current consumption internal (at 5 V) internal (at 24 V)		0.1 A 0.05 A
Dimensions		391 x 127 x 15 mm
Weight with installation panel (M01,M04) without installation panel (M02,M03)		approx. 1.3 kp 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

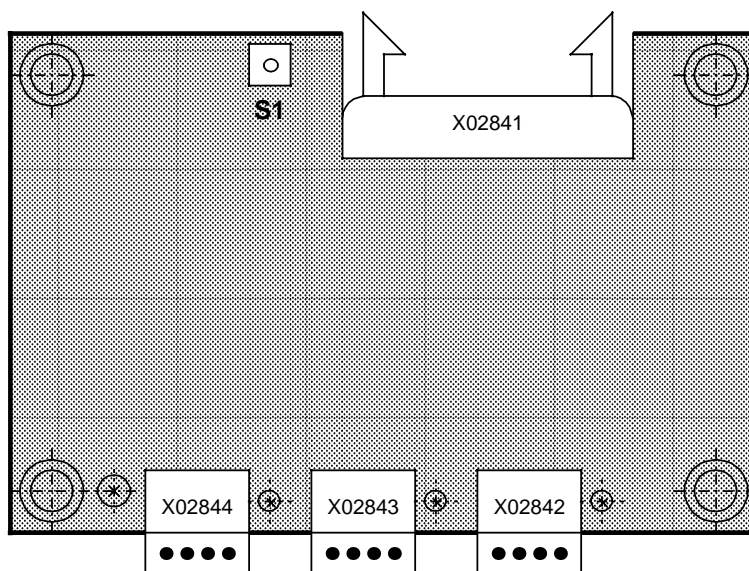
3) Maximum power-on current 350 mA With display lamp control:
12 V lamps with series resistor or
24 V lamps with preheating

2.7.8.2 INTERFACE/MPG**6FX1 126-5AA01**

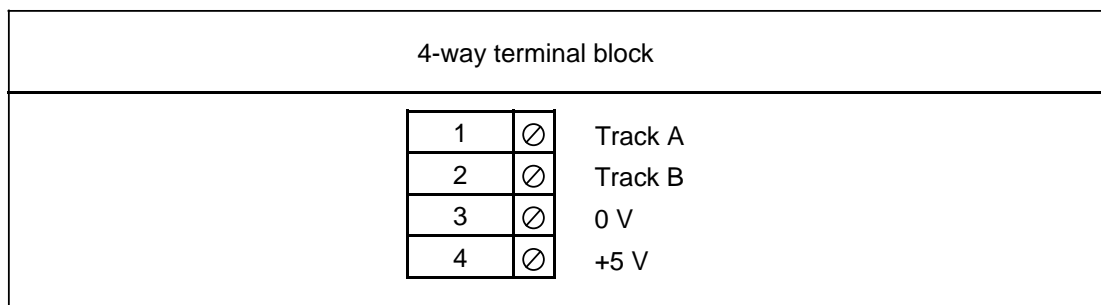
The INTERFACE/MPG module is an interface module for three handwheels (MPG = **M**anual **P**ulse **G**enerator) for the incremental input of traverse paths (incremental position setpoints).

This module comprises:

- Input signal filtering
- Detection of direction of rotation



- X02841 – Bus interface
X02842 – Handwheel connection 1
X02843 – Handwheel connection 2
X02844 – Handwheel connection 3



- S1 (switch): – always in position 0
 – address coding

1) See note and calculation method

Total current	+5 V	+5 V _{ext}	+15 V	- 15 V	+24 V
6FX1 126-5AA01	0.1 A	—	—	—	—
X02842 to X02844	1.5 A ¹⁾	—	—	—	—
X02842 to X02844	1.0 A ¹⁾	—	—	—	—

Note:

The common power supply (I_V) of the INTERFACE/MPG, of the I/O SUBMODULES and the handwheels passes through a 5 m long ribbon cable from the INTERFACE. You have to limit the cable length to match the supply current required I_V or take the voltage drop into account.

Ribbon cable length	Max. permissible supply current I_{max}	Guaranteed voltage to the handwheel interfaces X0284 .
1 m	2.4 A	4.9 V ¹⁾
5 m	1.1 A	4.85 V ¹⁾

Calculation method:

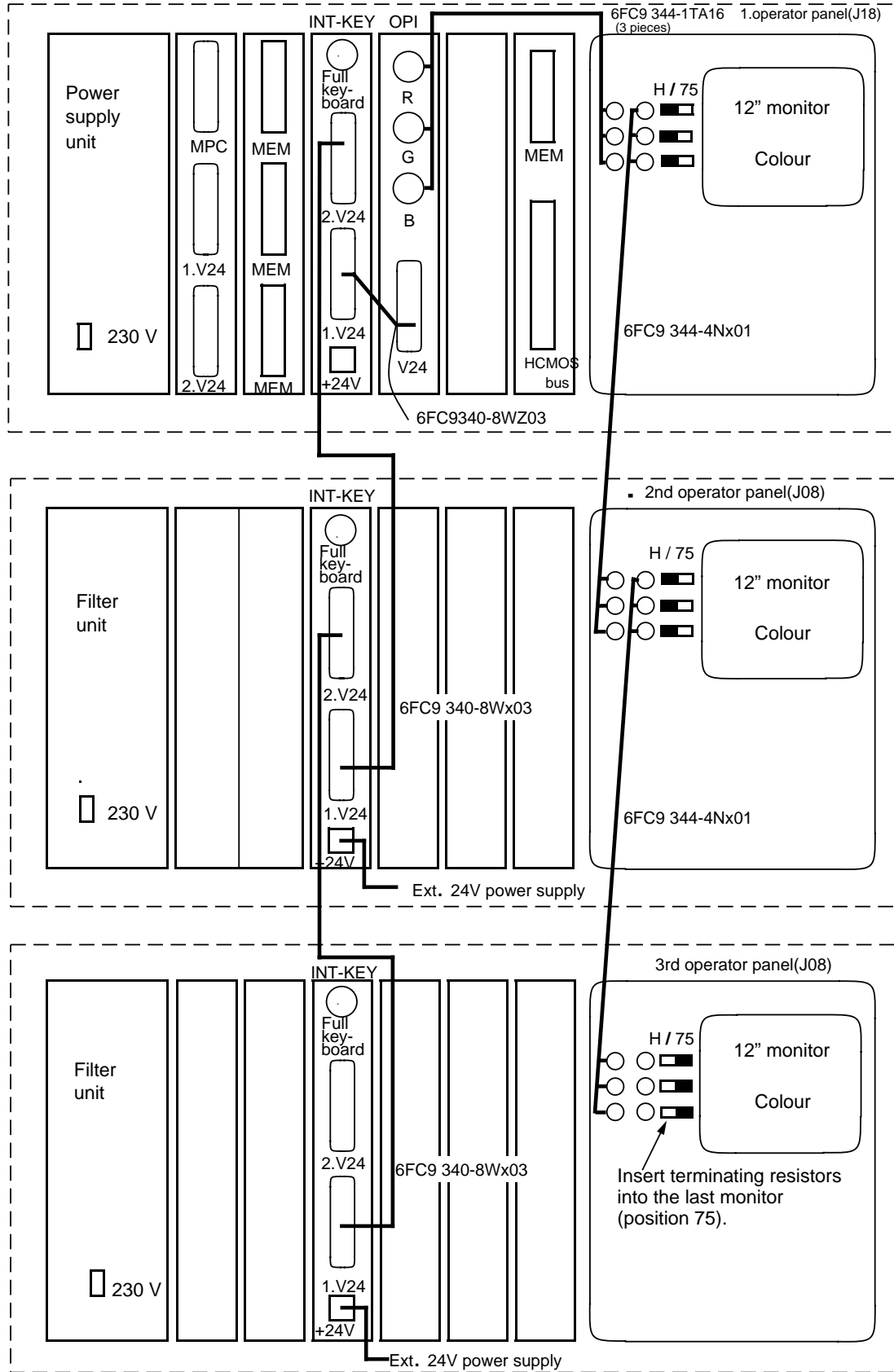
I_{max} minus the current for the I/O SUBMODULES and INTERFACE/MPG, but not exceeding the value given in the total current table, is the current available to all the handwheels.

2.7.9 Second or third operator panel

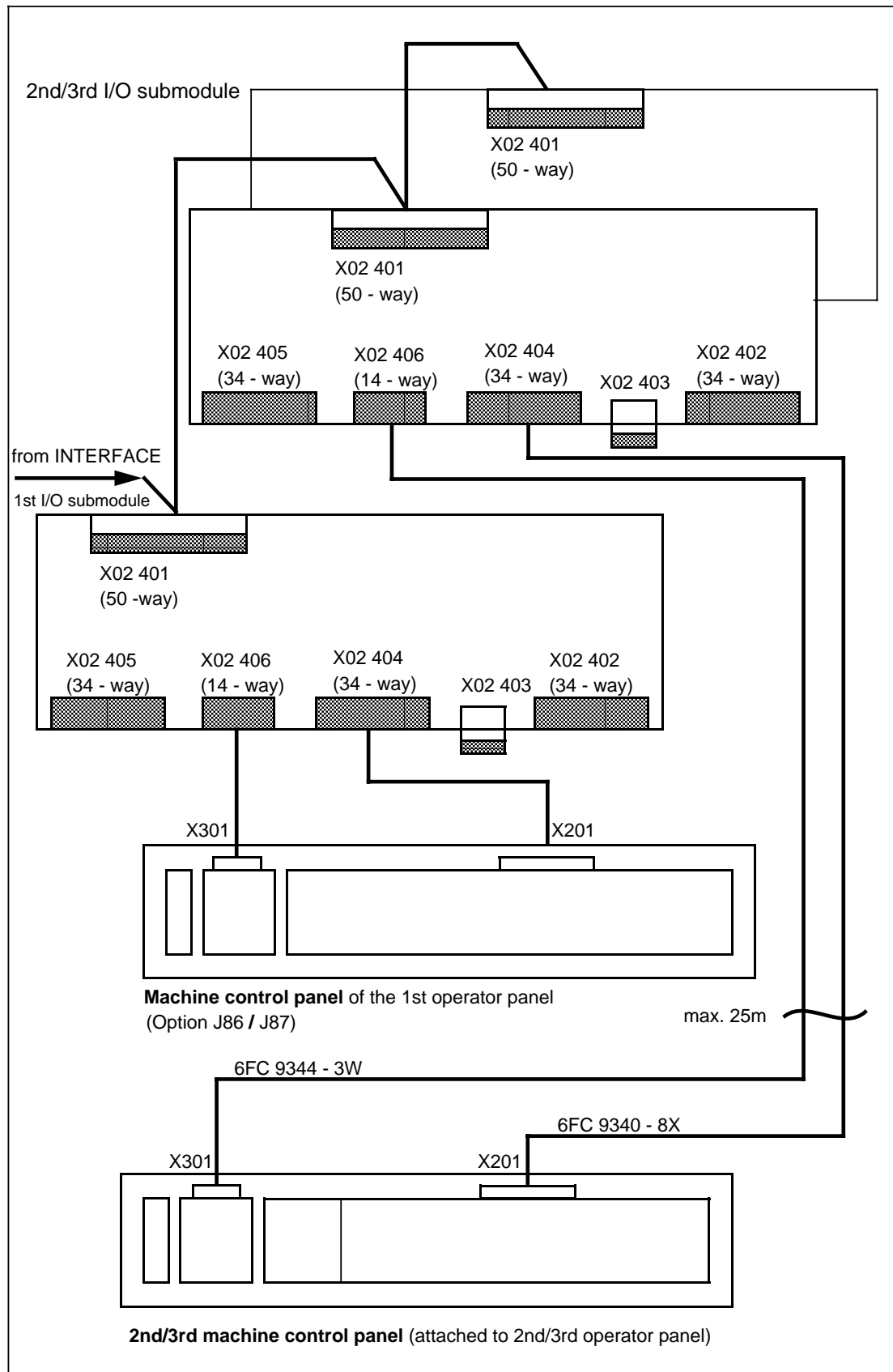
On the SINUMERIK 880 GA2, you can connect a second or third operator panel with the same functionality as the first operator panel. For the rack assignment of these additional operator panels, see Section 1.4.

1) *Note voltage drop to the handwheel!*

Connecting a second and third operator panel

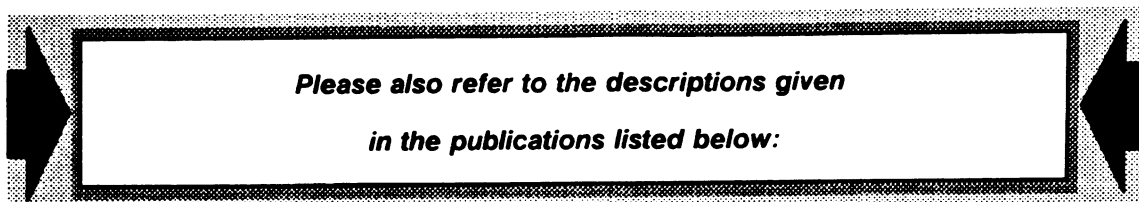


Connecting a second and third machine control panel



3 Connection Conditions

To ensure that the control functions without interference in the vicinity of the machine tool, the following connection conditions must be complied with.



EMC Guidelines for SINUMERIK AND SIROTEC Controls

Order from: Gerätewerk Erlangen
Order number: see SINUMERIK documentation list



Installation

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. four I/O submodules (operator panel extension)
- 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 stations for PLC I/O devices

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

3.1 Technical data

SINUMERIK 880 controls are manufactured in accordance with the requirements for equipment specified in DIN VDE 0160.

3.1.1 Electrical data

3.1.1.1 Overview

Unit \ Conditions	Nominal voltage and tolerance	Nominal frequency	Max. connected load at nom. voltage	Max. power loss at nominal voltage	Max. inrush current
Operator panel	see table 2.13				
Central controller single-tier or two-tier	230 V AC + 10 % - 20 %	50/60 Hz ± 5 Hz	990 VA	495 W	$20 \times I_N$ for 10 ms
Central I/Os single-tier	24 V DC (20 ... 30 V incl. ripple)	—	3850 VA	180 W	$20 \times I_N$ for 10 ms
Central I/Os two-tier		—	9600 VA	450 W	
Input/output submodule 6FX1 124-6AA ... (1 pc.) (operator panel I/O)	24 V DC (20 ... 30 V incl. ripple)	—	130 VA	16 W ^{*)}	$20 \times I_N$ for 10 ms
Input submodule (1 piece) 6FX1 124-6AB ... /-6AC (operator panel I/O)		—	5 VA	6 W	
Siemens machine control panel	Power supply via I/O submodule	—	Power supply via I/O submodule	0 W	—
Customer machine control panel	Power supply from customer machine control panels via I/O submodules is not permissible				
Electronic handwheel	Power supply via operator panel	—	Power supply via operator panel	1 W	—

Electrical data, overview

*) The power data contain not only the module's own consumption but also the switching losses of the outputs at 50% load.

Unit	Conditions	Nominal voltage and tolerance	Nominal frequency	Max. connected load at nominal voltage	Max. power loss at nominal voltage	Max. inrush current
Distributed machine I/Os						
DMP terminal block		24 V DC (20 ... 30 V incl. ripple)	—	—	5.3 W	—
DMP submodule 16 I/16 O		—	—	387.6 W	25 W	500 mA
DMP submodule 32 I		—	—	10.8 W	7 W	900 mA
DMP compact terminal block		—	—	—	—	—
DMP compact submodule 8O		24 V DC (20 ... 30 V incl. ripple)	—	—	2.5 W	—
DMP compact submodule 16 I			—	—	165 mW per input 2.5 W per module	—
DMP submodule IP 65 version with terminal block			—	—	—	—
Mini expansion unit		24 V DC (20 ... 30 V incl. ripple)	—	48 VA	—	$20 \times I_N$ for 10 ms
Maxi expansion unit		230 V AC + 10 % - 20 %	50/60 Hz ± 5 Hz	200 VA	—	$20 \times I_N$ for 10 ms
1st operator panel						
RGB monitor		230 V AC + 10 % - 20 %	50/60 Hz ± 5 Hz	typ. 70 VA	100 W	$20 \times I_N$ for 10 ms
Power supply unit and modules		230 V AC + 10 % - 20 %	50/60 Hz ± 5 Hz	typ. 100 VA	100 W	$20 \times I_N$ for 10 ms
2nd/3rd operator panel						
RGB monitor		230 V AC + 10 % - 20 %	50/60 Hz ± 5 Hz	typ. 70 VA	100 W	$20 \times I_N$ for 10 ms
Interface keyboard		24 V DC (20 ... 30 V incl. ripple)	—	—	—	$20 \times I_N$ for 10 ms

Electrical data of the operator panels (without operator panel I/Os) overview (continued)

3.1.1.2 Requirements for AC supply

- **Nominal voltage**
 - Tolerance
 - Frequency
 - Ramp-up time at power up
- 1 AC 230 V
- 20 %, + 10 % (184 V to 253 V)
47 ... 63 Hz
 ≤ 100 ms

3.1.1 Electrical data

- **Harmonic content**

In accordance with IEC 550, Section 6.5 and
DIN VDE 0160, Section 5.3.1.2 10 %

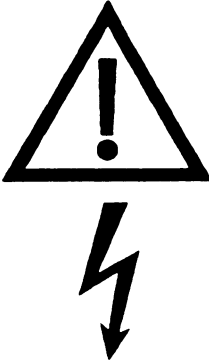
- **Short voltage dips**

In accordance with IEC 550, Section 6.5 and
DIN VDE 0160, Section 5.3.1.1

- Voltage interrupts at nominal voltage and current ≤ 10 ms
- Restoration time ≥ 10 s
- Events per hour ≤ 10

Non-conformance to IEC 550, Section 6.5: 50% voltage drops for a whole mains power cycle not possible (= 20 ms to 50 Hz)

3.1.1.3 Requirements for DC supply

	WARNING
	The DC supply is always referred to earth and must not be generated by an autotransformer.

- **Nominal voltage** DC 24 V
 - Voltage range including ripple DC 20 V to DC 30 V
 - Voltage ripple at nominal voltage and current peak to peak 3.6 V
 - Ramp-up time at power up ≤ 100 ms
- **Harmonic content**

In accordance with IEC 550, Section 6.5 and
DIN VDE 0160, Section 5.3.1.2 10 %
- **Non-periodic overvoltages** ≤ 35 V
 - Duration of overvoltage ≤ 500 ms
 - Restoration time ≥ 50 s
 - Events per hour ≤ 10
- **Short voltage dips**

Referred to 24 V DC nominal voltage ≥ 14.25 V

 - Duration of voltage dips ≤ 5 ms
 - Restoration time ≥ 10 s
 - Events per hour ≤ 10

3.1.1.4 Connected load and power loss calculation.

The maximum values for the connected load (central controller, machine control panel) specified in Table "Electrical data of the individual components" in Fig. 3.1 are based on a power supply unit capacity utilization of $A = 100\%$.

The values stated for maximum power loss (central controller, machine control panel) are based on the following conditions:

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

The following tables can be used to determine the actual connected load and power loss. This is primarily necessary when the maximum power loss according to Fig. 3.1 demands an unrealistic convection surface area for heat removal (see Section 3.1.1.5).

If the electrical connection and heat removal are designed for the maximum values given in Fig. 3.1, you do not have to calculate the connected load and power loss.

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

Notes on calculation table:

- Power supply unit capacity utilization A_n
Enter all required modules, additional and external components along with the required currents. Check power supply unit capacity utilizations A_n for individual power supply output voltages.
- Power supply unit capacity utilization P_S
For the calculation of the connected load, the efficiency η , which depends on the power supply unit capacity utilization A , is taken from the following table:

A	η
$\leq 20\%$	0.50
20 % to 30 %	0.58
30 % to 40 %	0.62
40 % to 50 %	0.66
50 % to 60 %	0.68
$\geq 60\%$	0.69

Efficiency

- Power loss P_v
When calculating power loss P_v , note that:
 - the power loss of the external components $P_{v\text{ext}}$ is not included in the power loss of the compact control or central controller;
 - the switching power losses of the output modules $P_{v\text{I/O}}$ in the compact control or central controller increase the power loss in the latter.

Power supply unit capacity utilization $A_n = I_{An} / I_{Amn} \times 100 \%$										
Modules (mod.) Order number	$U_{A1} = +5 \text{ V}$			$U_{A2} = +15 \text{ V}$			$U_{A3} = -15 \text{ V}$			Notes
	A	No. of mod.	ΣA	A	No. of mod.	ΣA	A	Zahl der Bgr.	ΣA	
Σ mod. currents (central controller)	—	—		—	—		—	—		①
Encoder										
external EXEs										
Σ currents (ext. components)										② I_{extn}
Σ currents ① to ②										③ I_{An}
Max. PS unit output currents	$I_{Am1} = 40 \text{ A}$			$I_{Am2} = 2,5 \text{ A}$			$I_{Am3} = 2 \text{ A}$			I_{Amn}
Power supply unit capacity util. A_n										max. zul.: 100 %

Calculation table for power supply unit capacity utilization

Power supply unit connected load $P_S = 1 / \lambda \times 1 / \eta \times P_A + P_L + P_M$				
Voltages U_{An}	+5 V	+15 V	-15 V	
Currents I_{An}				transf. from ③
Power supply unit outputs P_{An}	VA	VA	VA	$P_{An} = I_{An} \times U_{An} $
Actual power supply unit output P_A				$P_A = \Sigma P_{An}$
Max power supply unit outputs P_{Am} with 6EW1861-2AE	268 VA			
Power supply unit capacity util. A				$A = P_A / P_{Am}$
Power factor λ	0.55			
Efficiency η				see Table 2.14
Fan connection power P_L	15 VA			
Monitor connection power P_M	70 VA			
Power supply unit conn. load P_S				

Calculation table for power supply unit connected load

Power loss $P_v = 1 / \eta \times P_A + 0,9 \times P_L + 0,5 \times P_M - P_{vext} + P_{vout}$				
Current I_{extn} (ext. components)				transf. from ②
Power loss P_{vextn} (ext. comp.)				$P_{vextn} = U_{An} \times I_{extn}$
Power loss P_{vext} (ext. Komp.)				$P_{vext} = \Sigma P_{vextn}$
Switching power loss P_{vout} (output)				$P_{vout} = \text{No. of outputs} \times \text{switching current} \times \text{voltage drop on the switch}$
Power loss P_v				

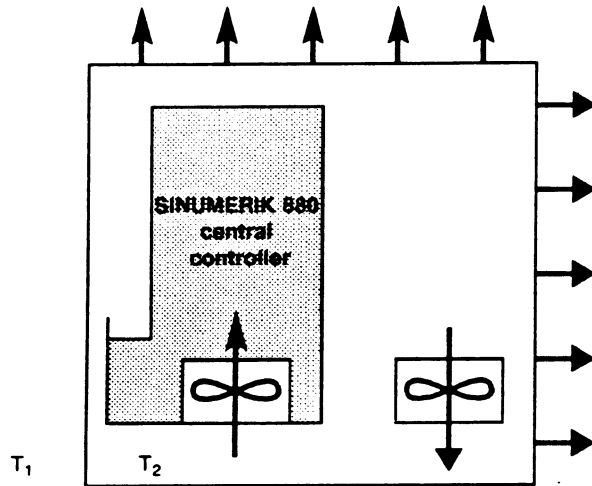
Calculation table for power loss

3.1.1.5 Heat removal

The climatic data, degree of protection and power loss for the SINUMERIK 880 control are given in the technical data (Section 3.1).

The surfaces of the front and underside have not been included in the calculation of the convection surface.

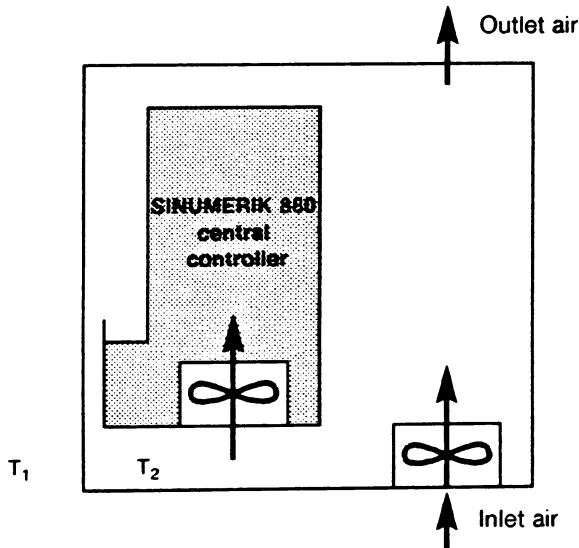
- Heat removal by natural convection



The necessary free convection surface of the surrounding space (steel or aluminium sheet 1.5 mm thick) is determined, referred to a temperature difference $T_2 - T_1 \geq 10$ K, approximately from:

$$A \text{ [m}^2\text{]} = \frac{P_v \text{ [W]}}{10 \Delta T \text{ [K]}}$$

- Heat removal by open-circuit ventilation



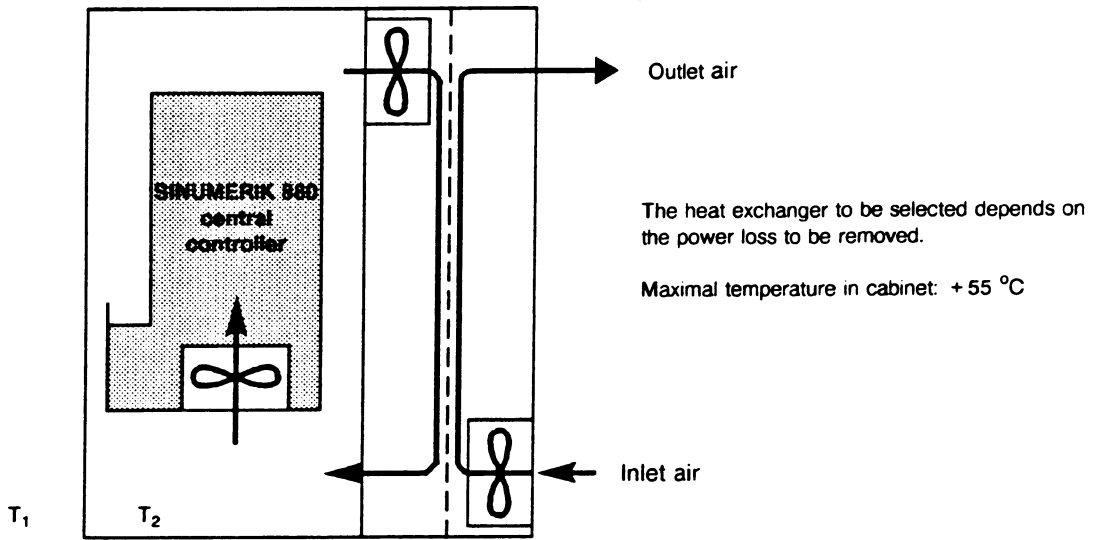
The air flow for removing lost heat is calculated from:

$$V \text{ [m}^3\text{/h]} = \frac{3.5 P_v \text{ [W]}}{\Delta T \text{ [K]}}$$

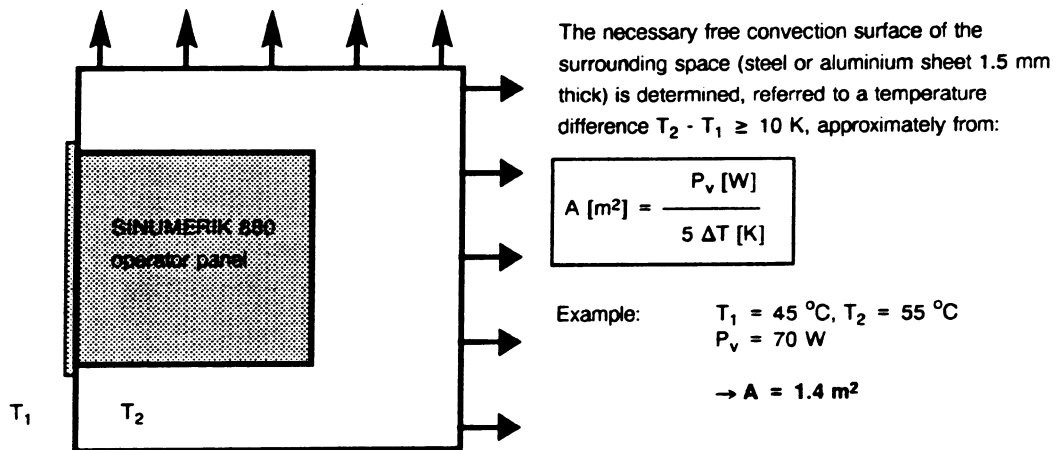
Note:

Air filters must be provided to maintain the permissible environmental conditions given in Section 3.1.4 "Exposure to contaminants"

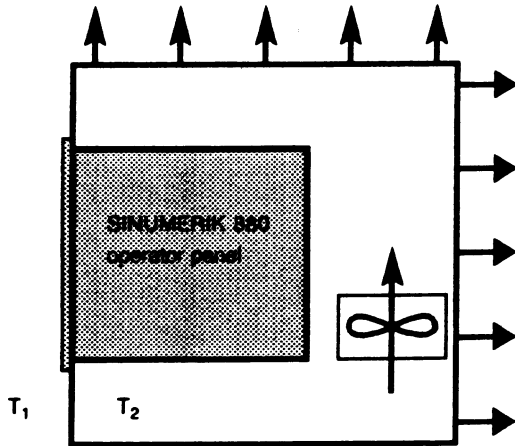
• Heat removal by means of heat exchanger



• Heat removal by natural convection



● Heat removal by natural convection and internal air turbulence



The necessary free convection surface of the surrounding space (steel or aluminium sheet 1.5 mm thick) is determined, referred to a temperature difference $T_2 - T_1 \geq 10$ K, approximately from:

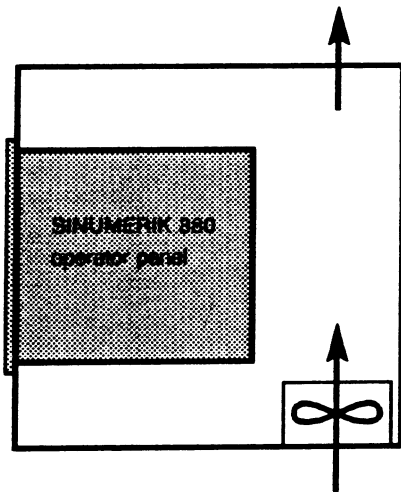
$$A \text{ [m}^2\text{]} = \frac{P_v \text{ [W]}}{10 \Delta T \text{ [K]}}$$

Air flow through fan: 100 to 165 m³/h

Example: $T_1 = 45$ °C, $T_2 = 55$ °C
 $P_v = 70$ W

→ $A = 0.7$ m²

● Heat removal by open-circuit ventilation



The air flow for removing lost heat is calculated from:

$$V \text{ [m}^3\text{/h]} = \frac{3.5 P_v \text{ [W]}}{\Delta T \text{ [K]}}$$

Example: Intake air temp. ≤ 45 °C, $\Delta T = 10$ K,
 $P_v = 70$ W

→ $A = 24.5$ m³/h

Note: Air filters must be provided to maintain the permissible environmental conditions given in Section 3.1.4 "Exposure to contaminants"

3.1.2 Mechanical data

3.1.2.1 Overview

Unit	Conditions	Dimensions	Weight	Degree of protection	Protection against contact, class to DIN VDE 0160
		Width Height Depth		to DIN 40050	
Operator panel (with modules)	see Table 2.19				
Central controller, single-tier, version 1,2,3 (without modules with power supply unit)		550 mm 544 mm 321 mm	27 kg	IP 20	I
Central controller, two-tier, version 5, 7 (without modules with power supply unit)		816 mm 544 mm 321 mm	32 kg	IP 20	I
I/O and I submodule 6FX1124-6AA/AB/AC... with mounting plate (option M01 and M04)		414 mm 150 mm 33 mm	1,5 kg	IP 00	I
I/O and I submodule 6FX1124-6AA/AB/AC... without mounting plate (option M02 and M03)		414 mm 150 mm 22 mm	1 kg	IP 00	I
Siemens machine control panel		530 mm 144 mm 100 mm	1.2 kg	Front panel IP 54 Rear panel IP 00	I
Customer machine control panel					
Cabinet version (empty cabinet with heat exchanger)		720 mm 1802 mm 852 mm	160 kg	over the whole surface IP 54	I

Mechanical data, overview

Unit	Conditions	Dimensions		Weight	Degree of protection to DIN 40050	Protection, against contact class to DIN VDE 0160
		Width	Height Depth			
DMP terminal block		257 mm	90 mm 40 mm		IP 00	I
DMP submodule 16 I/16 O		206 mm	41 mm 137 mm		IP 00	I
DMP submodule 32 I		206 mm	41 mm 137 mm		IP 00	I
DMP compact terminal block		257 mm	100 mm 40 mm		IP 00	I
DMP compact submodule 8 O		100 mm	90 mm 24.5 mm		IP 00	I
DMP compact submodule 16 I		100 mm	90 mm 24.5 mm		IP 00	I
DMP submodule in IP 65 version with terminal block		172 mm	230 mm 70 mm	1.8 kg	IP 65	I
Mini expansion unit		300 mm	370 mm 255 mm		IP 00	I
Maxi expansion unit		544 mm	370 mm 255 mm		IP 00	I

Mechanical data, overview (continued)

Unit	Conditions	Dimensions		Weight	Degree of protection to DIN 40050	Protection against contact to DIN VDE 0160
		Width	Height Depth			
1./2./3. Operator panel						
12" RGB monitor		530 mm	350 mm 370 mm	20 kg	front panel IP 54 rear panel IP 00	I

Mechanical data of the operator panels, overview

3.1.2.2 Resistance to vibration

- **Vibratory load**
 - During operation Severity 12 to SN 29010, Part 1 ¹⁾ for all components
 - During transport in original packaging Severity 22 to SN 29010, Part 2 ¹⁾ for all components
Siemens standard, see Section 3.1.1.5
- **Shock load**
 - Test group E, test Ea to DIN 40046, part 7
 - Acceleration 15 g (1 g=9.81 m/s²)
 - Duration of nominal shock 11 ms

3.1.3 Climatic environmental conditions

General requirements

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

3.1.3.1 Installation and operation

- **Temperature range** (see Section 3.1.1.5)
 - Lower limit temperature 0 °C
 - Upper limit temperature +45 °C (Handheld unit, operating surface)
+55 °C (Rack, modules)
- **Dew point temperature t_d and relative air humidity U**
 - Annual average U = 75 %
 t_d = 17 °C
 - On 30 days (24 hours) per year U = 95 %
 t_d = 24 °C
These days should be distributed naturally over the year.
 - On the remaining days (< 24 hours) observing the annual average U = 85 %
 t_d = 20 °C
- **Condensation** Not permissible
- **Temperature variation**
 - Within 1 hour 10 K
 - Within 3 minutes 1 K
- **Atmospheric pressure** 860 mbar to 1080 mbar
(86 kPa to 108 kPa)

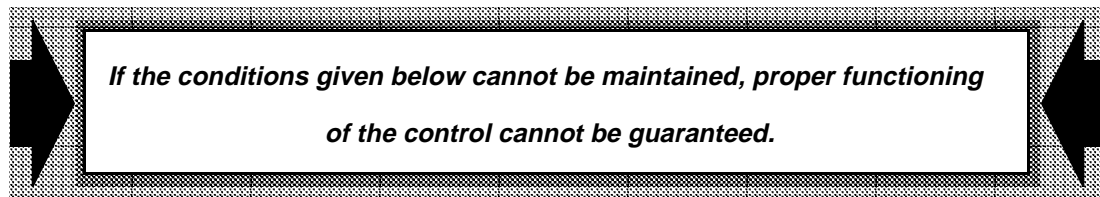
The values specified apply to a transportation altitude of up to 1500 m above mean sea level. For greater altitudes, the upper limit must be reduced by 3.5°C per 500 m.

3.1.3.2 Transportation and storage

- **Temperature range**
 - Lower limit temperature – 40 °C
 - Upper limit temperature +70 °C
- **Dew point temperature t_d and relative air humidity U**
 - Annual average U=75 %
 $t_d=17$ °C
 - n 30 days (24 hours) per year U=95 %
 $t_d=24$ °C
These days should be distributed naturally over the year.
 - On the remaining days (< 24 hours) U=85 %
observing the annual average $t_d=20$ °C
- **Condensation** Rare, briefly, light
Rare, brief and light condensation covers situations where the following conditions also apply:
 - Max. duration of a single condensation event 3 hours
 - Frequency of occurrence: Annual average 3
Maximal 10
 - Shortest sequence of condensation cycles 1 day
- **Temperature variation**
 - Within 1 hour 20 K
- **Atmospheric pressure** 660 mbar to 1080 mbar
(66 kPa to 108 kPa)

The values specified apply to a transportation altitude of up to 3265 m above mean sea level.

3.1.4 Exposure to contaminants



Standards complied with: DIN 40046, Parts 36 and 37
DIN 40050

3.1.4.1 Hazardous gases

- **Sulphur dioxide (SO₂)**
Test conditions:
 - Severity 10 cm³/m³ ± 0.3 cm³/m³
 - Temperature 25 °C ± 2 °C
 - Relative air humidity 75 % ± 5 %

- **Hydrogen sulphide (H₂S)**

Test conditions:

- Severity 1 cm³/m³ ± 0.3 cm³/m³
- Temperature 25 °C ± 2 °C
- Relative air humidity 75 % ± 5 %

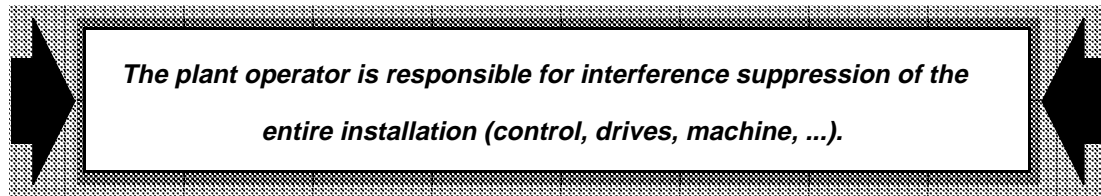
3.1.4.2 Hazardous dust

When working in areas where there is an unacceptably high dust burden, the control must be operated in a cabinet with heat exchanger or in a cabinet with suitable air intake.

In addition, an air filter must be used when performing service work with the cabinet door open.

3.1.5 Electromagnetic compatibility (EMC)

3.1.5.1 Interference suppression



3.1.5.2 Immunity to noise

Relevant standards IEC 801-2, 3 and 4

- **Immunity to noise carried in cables**

Test in accordance with IEC 801-4, 65

- Power supply cables:
 - Test voltage 2 kV
 - Test duration 1 min
- Signal cables:
 - Test voltage 2 kV
 - Test duration 1 min

- **Immunity to static discharging**

Test in accordance with IEC 801-2	Air gap	Contact
Test voltage (operating surface)	15 kV	8 kV
Test voltage (device surface)	8 kV	6 kV
Test duration	10 discharges at 1 discharge/s	

- **Immunity to high frequency irradiation**

Test in accordance with IEC 801-3

Test field strength	10 V/m
Sweep velocity	11.5 · 10 ³ decades
Frequency	26 MHz ... 1000 MHz

3.1.6.3 Standards

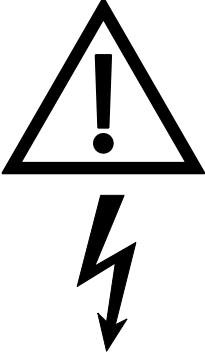
In addition to the relevant international and national standards, the Siemens standards (SNI) listed in the table below have been observed in the design of the SINUMERIK control. You can obtain these Siemens standards from your local Siemens office.

	Text	Part																				
SN 26555	<p>Electrical interfaces</p> <p>The definitions contained in this standard for DC voltage and current signal interfaces should be used with preference for applications of energy, process and drive technology as well as research and development in local information processing, measurement and control technology. The purpose of these interfaces is to unify function units, and to improve the combinability and interaction of the function units.</p>	1, 2, 3																				
SN 26556	<p>Application classes for constructional units in electrical engineering</p> <p>Air temperature, humidity, pressure</p> <p>This standard contains application classes for constructional units in electrical engineering, e.g. in measurement and control technology. Considering the conditions to be expected in operation, during transportation and storage, constructional units can therefore be selected in accordance with uniform considerations. An application class within the framework of this standard is formed by the values of the upper and lower limit temperature of the medium directly surrounding the constructional unit and the humidity and air pressure which is created in this area.</p>																					
SN 29010	<p>Mechanical testing loads for electrical engineering</p> <p>This standard covers severities of test loading for installations, equipment and constructional units in electrical engineering. With these severities, the resistance of the installations, equipment and constructional units against mechanical vibration can be determined.</p> <table border="1" data-bbox="402 1213 1258 1486"> <thead> <tr> <th rowspan="2">Severity</th> <th rowspan="2">Frequency range (Hz)</th> <th colspan="2">Constant amplitude of</th> </tr> <tr> <th>Deflection (mm)</th> <th>Acceleration (m/s²)</th> </tr> </thead> <tbody> <tr> <td rowspan="2">12</td> <td>10 to 58</td> <td>0.075</td> <td>—</td> </tr> <tr> <td>58 to 500</td> <td>—</td> <td>9.8</td> </tr> <tr> <td rowspan="2">22</td> <td>5 to 8</td> <td>3.5</td> <td>—</td> </tr> <tr> <td>8 to 500</td> <td>—</td> <td>9.8</td> </tr> </tbody> </table>	Severity	Frequency range (Hz)	Constant amplitude of		Deflection (mm)	Acceleration (m/s ²)	12	10 to 58	0.075	—	58 to 500	—	9.8	22	5 to 8	3.5	—	8 to 500	—	9.8	1, 2
Severity	Frequency range (Hz)			Constant amplitude of																		
		Deflection (mm)	Acceleration (m/s ²)																			
12	10 to 58	0.075	—																			
	58 to 500	—	9.8																			
22	5 to 8	3.5	—																			
	8 to 500	—	9.8																			
SN 29080	<p>Climatic resistance of electrical equipment</p> <p>This standard includes a climatic overview map with sea routes.</p>																					
SN 29081	<p>Packaging recommendations for electrical equipment</p> <p>Permissible climatic exposure before start-up</p> <p>In this standard, the limits of climatic exposure are given that are permissible for electrical equipment during transportation and storage before start-up.</p>																					


Siemens standard	Text	Part
SN 29500	<p>Failure rates of construction elements</p> <p>Part1: General The most frequently used quantity required for reliability calculations of modules and units is the failure rate. This standard contains explanations and should be used in conjunction with one of the following parts:</p> <p>Part 2: Empirical values for integrated circuits (IS). Part 3: Empirical values for discrete semiconductors (DH). Part 4: Empirical values of passive components (PB). Part 5: Empirical values for electrical connection points. Part 6: Empirical values for printed circuit connectors. Part 7: Empirical values for relays. Part 8: Empirical values for integrated circuit holders. Part 9: Empirical values for switches. Part 10: Empirical values for pilot and signal lamps. Part 11: Empirical values for contactors.</p>	1 to 11
SN 30901	<p>Choice of colours for products</p> <p>Siemens colors and surfaces This standard is intended to ensure the uniform coloring of Siemens AG products and applies to surfaces that affect the external appearance. It is valid for plastics, paint finishes and similar coatings.</p>	
SN 30920	<p>Surface treatment</p> <p>Paint finishes and similar coatings This standard governs the uniform designation of paint finishes and similar coatings within Siemens AG, without defining specific production processes. By applying this standard, it is possible to process surface designations on computers as Siemens item numbers.</p>	
SN 47030	<p>Moulded materials, thermoplastic moulding compounds</p> <p>Date in documents, choice of materials This standard contains information on entering materials and the properties of moulded parts in manufacturing documents as well as notes on selecting materials.</p>	1
SN 47030	<p>Moulded materials, thermoplastic moulding compounds</p> <p>Colors This standard contains colour data for the moulding compounds specified in SN 47030 Part 1.</p>	2
SN 69154	<p>Packaging recommendations for electrical equipment</p> <p>Register of destinations This standard provides information relating to transportation to the listed destinations and the local conditions. This is a help for anyone involved with packaging to select the right packaging for the particular conditions.</p>	

3.2 Electrical installation

3.2.1 Installation codes of practice

	WARNING
	<ul style="list-style-type: none"> • If the enclosure or touch guard is removed or if the system cabinet is opened, access is provided to certain, possibly live and dangerous, parts of these devices/systems. • Only qualified personnel are allowed to manipulate this device/system. • This personnel must be thoroughly familiar with all sources of danger and maintenance measures according to the information in the documentation. • Proper transportation, storage, installation and assembly of the product, as well as careful operation and maintenance, are prerequisites of trouble free and reliable working. • The safety and accident prevention regulations applicable to each specific case must be observed. • Panel-mounted devices for enclosures or cabinets must be operated only when mounted. Table top devices and portables must be operated only with their housings closed. • Where permanently connected equipment is not provided with all-pole mains disconnecting switches and/or fuses, the building installation must include a mains disconnecting switch or fuses; the equipment must be connected to a protective earth conductor. • Where equipment has a permanently connected cable at the equipment end and a plug at the other end and all pole mains disconnecting switches, the earthed socket outlet for the device must be located in its vicinity and be easily accessible. • In the case of equipment operated from the mains supply, it is important to check that the set nominal voltage range corresponds to the local mains voltage before starting up. • With 24 V power supplies, safe electrical separation of the extra-low voltage must be ensured. Use only power supply units manufactured to IEC 364-4-41 or HD 384.04.41 (VDE 0100 Part 410). • Emergency stop devices to EN 60204/IEC 204 (VDE 0113) must remain effective in all operating modes of the automation equipment. Resetting of the emergency stop devices must not cause any uncontrolled or undefined movements.

In the operational state, protection against direct contact is provided, making the device suitable for installation in closed electrical operating areas (DIN VDE 0160, Sections 5.5 and 6.5).

	CAUTION
	The modules contain electrostatically sensitive components. You must discharge your body before touching any electronic modules. The simplest way to do so is to touch a conductive earthed object (e.g. bright metal part of a switch cabinet, water pipe) immediately before touching the module

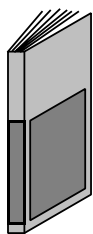
3.2.1.1 Installation of equipotential bonding conductors

Basic principles:

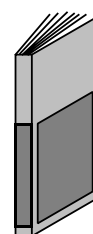
If the control is to be operated without interference, all its components that are connected to signal lines must also be connected to equipotential bonding conductors.

Exception:

Components that are connected using fibre optics cables do not require equipotential bonding conductors.



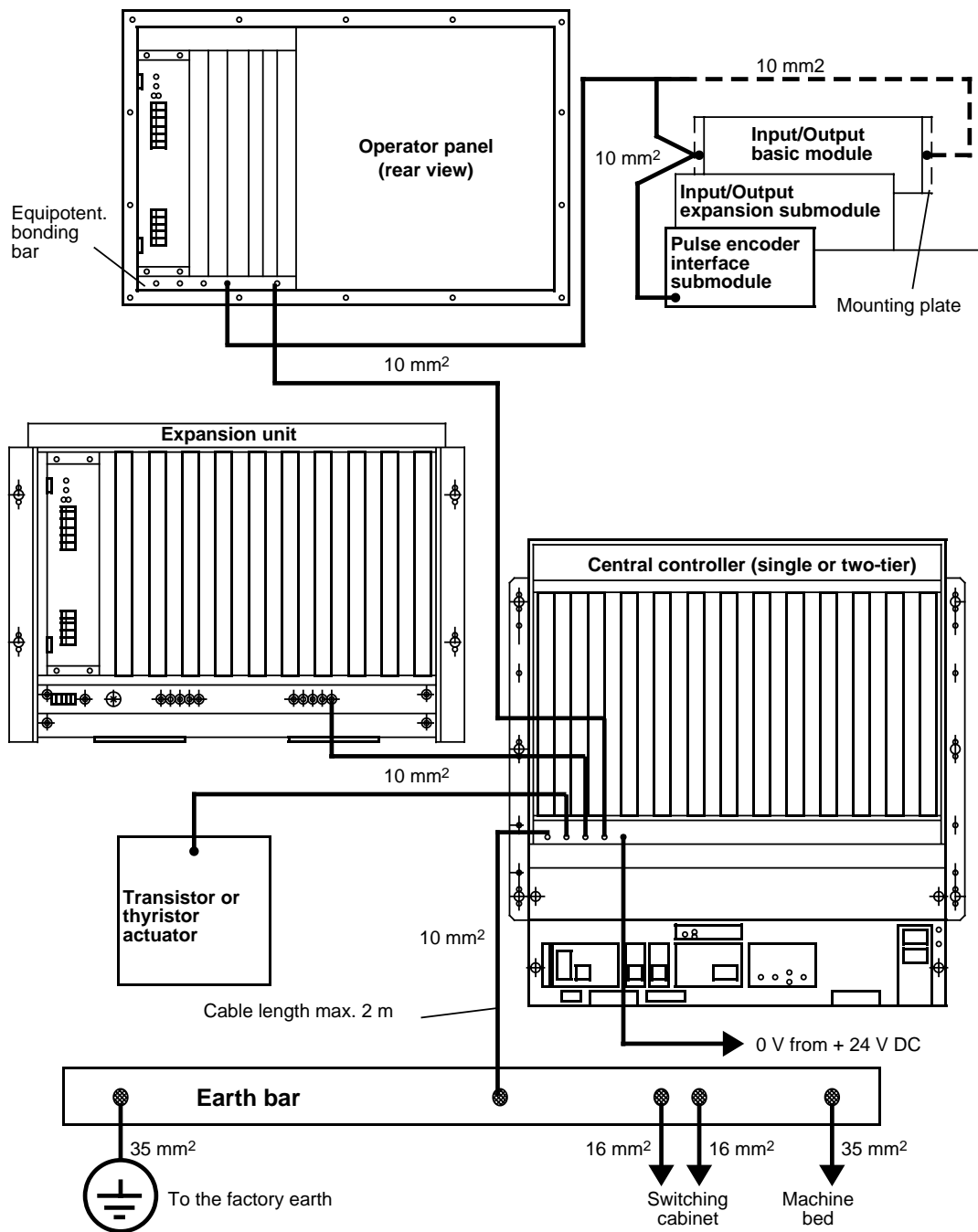
In any plant configuration, the "EMC Guidelines for SINUMERIK and SIROTEC Controls" must be observed when installing equipotential bonding conductors.



Order from: Gerätewerk Erlangen
Order number: see SINUMERIK documentation list

Minimum cross section of the equipotential bonding conductors: 10 mm².
The whole installation is earthed through the earth bar.

Example of the arrangement of the equipotential bonding conductors



CAUTION, for safety reasons you must connect all protective conductors.

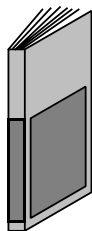
3.2.1.2 Laying signal and power lines

Definition:

- **Signal lines** (e.g.)
 - Setpoint and actual value cables
 - Data lines (RS232C (V.24), RS 422, links, . . .)
 - All NC power supply signalling and control lines
 - Binary inputs and outputs
 - EMERGENCY STOP lines
- **Power lines** (e.g.)
 - Low voltage power supply lines (+24 V DC,...)
 - Power supply lines (100 V AC, 230 V AC,...) from NC, PLC expansion units, drives, ...
 - Lines from contactors (primary circuit and secondary circuit)

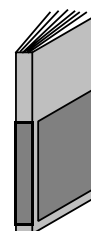
To achieve the greatest possible noise immunity for the the whole system (control and machine), you must observe the following EMC guidelines:

- The signal lines must be as far as possible away from the load lines.
- Signal and load lines can cross if necessary, but never run parallel and close to each other.
- Use only the cables supplied by the NC or PLC manufacturer for the signal lines to and from the NC or PLC.
- Signal lines must not run close to strong magnetic fields (e.g. motors and transformers).
- Pulse-loaded high-current or high-voltage lines must always be laid separate from all other cables.
- If sufficient spacing cannot be achieved, lay signal lines in shielded (metal) cable ducts.
- The distance (noise radiation surface) of the following cables must be kept as small as possible:
 - signal lines and signal lines
 - signal lines and their equipotential bonding conductors
 - equipotential bonding conductors and their protective conductors.



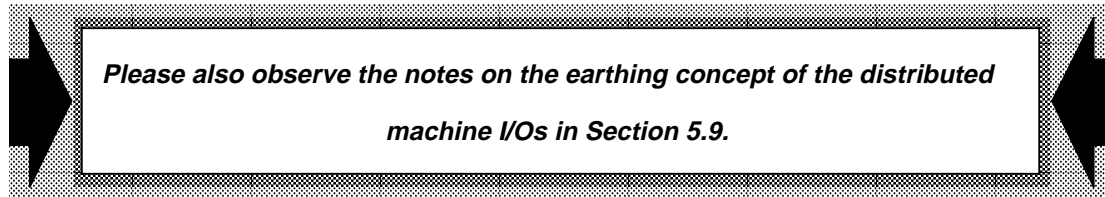
**For further notes on noise immunity measures and
connecting *shielded cables* see
"EMC Guidelines for SINUMERIK and SIROTEC controls".**

Order from: Gerätewerk Erlangen
Order number: see SINUMERIK documentation list



3.2.1.3 Potential connection with external 24 V power supply

When an external 24 V power supply is used (e.g. for I/O modules), the mass (0 V) of the 24 V power supply must be connected to the equipotential bonding bar of the central or the compact controller.



3.2.2 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).

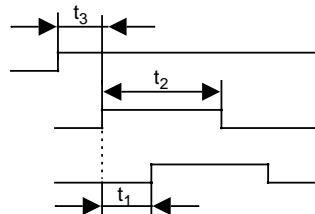
With the power supplies central controller (6EW1 861-2AC (40 A) and operator panel 6EW1 861-3AB the NC ON can also be a **switch** or jumper.

- Switch on sequence

Voltage on

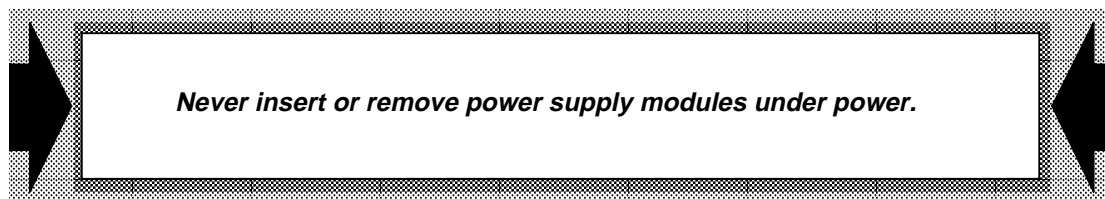
NC ON operator panel

NC ON central controller

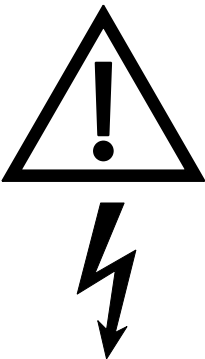


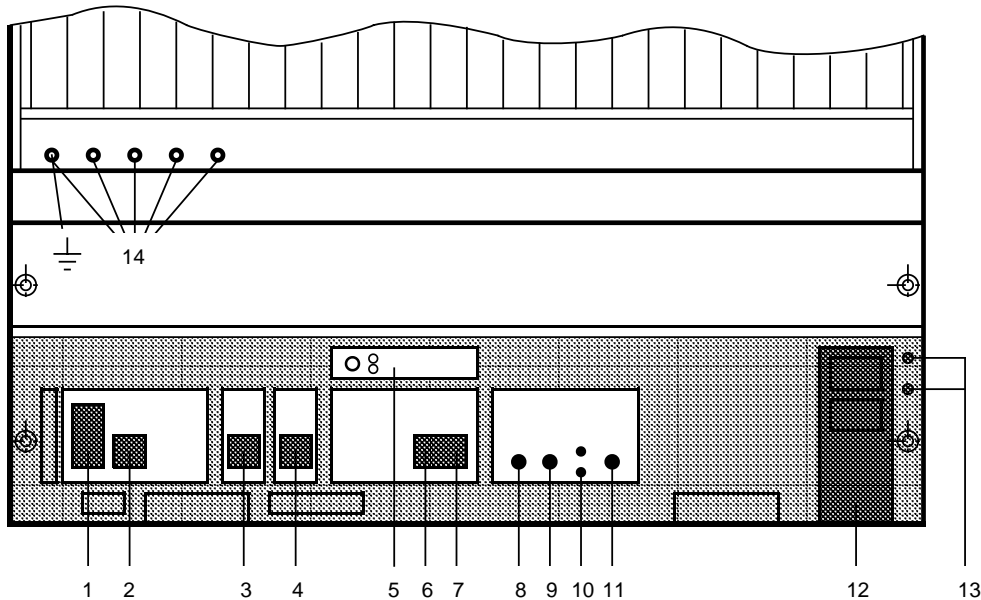
The time t_3 500 ms must have elapsed before NC ON is operated (except with power supplies stated above). The time t_1 must be 0 seconds, i.e. the NC ON of the operator panel must be pressed before (or at the same time as) the NC ON of the central controller. The pushbutton must be operated at least for a time of $t_2 = 500$ ms ($t_2 =$ if a switch is used as NC ON on the relevant power supplies).

- The 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 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.



3.2.2.1 Central controller (with power supply unit 1861-2AE)

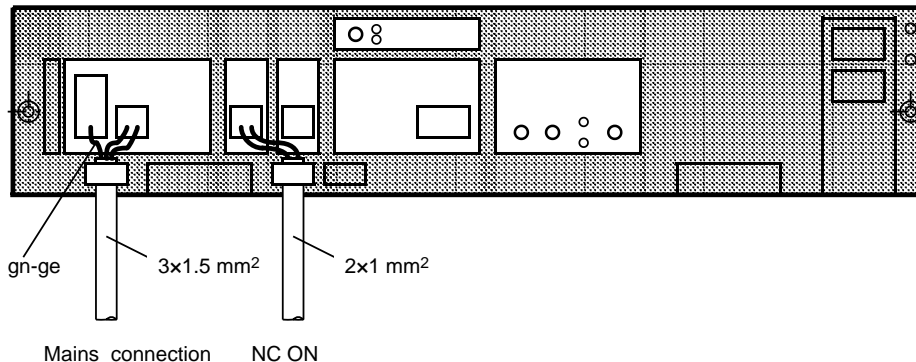
	WARNING
	When the mains power is on, 230 V AC are applied to the terminals.
	Never touch the NC ON terminals or their clamps while the device is in use or while the mains power connector U-V/N is plugged in. Non-observance of this warning can cause death or serious injury.



- 1 Protective earth connection
- 2 Mains power connection
- 3 Power supply unit ON (only pushbutton allowed)
- 4 24 V load voltage monitoring (from power supply unit)
- 5 5 ... 6.5 V_{ext} adjustments with measuring sockets (option, required with encoder distances of > 35 m)
- 6 Ready message for 24 V load voltage monitoring
- 7 Fan failure message
- 8 LED lamp: power supply unit ready message
- 9 5 V setting
- 10 Measuring socket for 5 V
- 11 RESET button
- 12 Cover for back-up battery (observe section on replacing the battery)
- 13 For the external supply of battery voltage 3.4 V while replacing the battery
- 14 Equipotential bonding conductors

Mains connection

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



Power supply unit (6EW1 861-2AE) max. power supply unit output currents


Total current	+5 V	5 V _{ext}	+15 V	-15 V	+24 V
typical	40 A	—	2.5 A	2 A	—

Technical data

Input voltage	230 V $-20\%/+10\%$ Single phase/neutral with loadable neutral Two-phase Phase/phase without loadable neutral Other voltages to be matched by means of autotransformer
Frequency	48 to 63 Hz
Power consumption for operator panel	700 VA + fan
Permissible voltage interrupt with: nominal voltage V_N $V_N - 15\%$	max. 10 ms ($V_N=230\text{ V}$) max. 3 ms
Operating temperature	0 to 55° C
Storage and transportation temperature	-40 bis +70° C
Humidity rating (DIN 40040)	F
Degree of protection	IP 00 IP 20 (when mounted)
Vibration and impact load (DIN 20010)	stationary 12 transportation 22

Signal outputs

- Fan control
Floating relay output (100 V/250 mA/20 VA; insulation voltage against housing 100 V).
Fan control signals that one or both fans are working correctly (but not the power supply).


	CAUTION
	Make sure that no more than three minutes after the fan control has signalled a fault, the power supply module is switched off, otherwise overheating can result (material damage).

Additional monitoring

- External voltage monitoring 24 V DC input
External 24 V DC output
Monitoring of the load voltage 24 V DC
Floating relay output (100 V/250 mA/20 VA; insulation voltage against housing 100 V).
OK signal at voltages 20 V DC
Fault signal at voltages 15 V DC

Control inputs

- NC ON
The power supply unit is switched on via NC ON (jumper, switch or push-button).
It is not possible to switch on via NC ON.

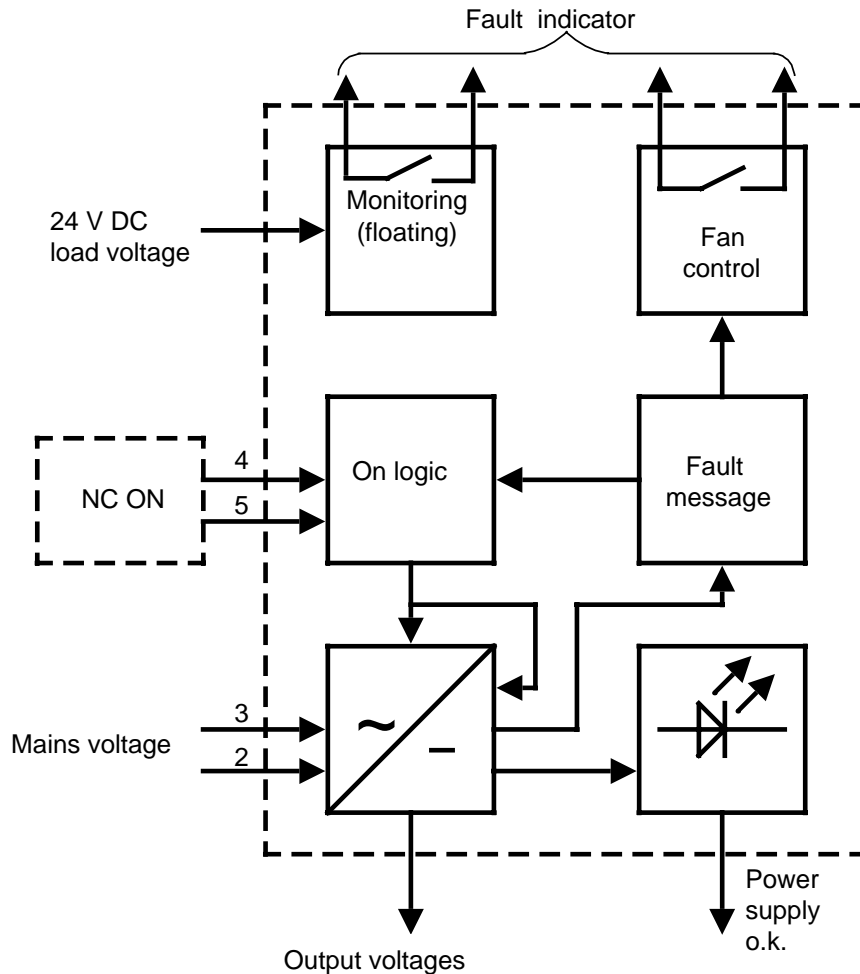
	CAUTION
	Never connect the NC ON input to NC ON inputs of other power supply units (destruction of the power supply unit)

Response to power on/off

- **RESET**
Push-button for initializing the power on and off routine without switching off the power supply unit.
- **Power on**
The power supply unit can be switched on via
 - NC ON (switch or push-button)
 - Mains power ON (NC ON switch or jumper)

- Power off**
 The power supply unit can only be switched off via mains power OFF. It is not possible to switch off via NC ON.
- Power off because of fault**
 The input/output voltage monitoring can switch the power supply unit off. The fan control can also switch the power off if connected externally.
- Switching on the power supply unit again**
 The power supply unit can be switched on again
 - with power OFF/ON (and NC ON push-button or switch) after power-off due to fault
 - automatically (if NC ON is jumpered) after power-off and power-on.
- Backup voltage VCC**
 The backup battery is positioned in such a way that the power supply unit can be replaced while the battery continues to back up.

Outline diagram for ON/OFF logic

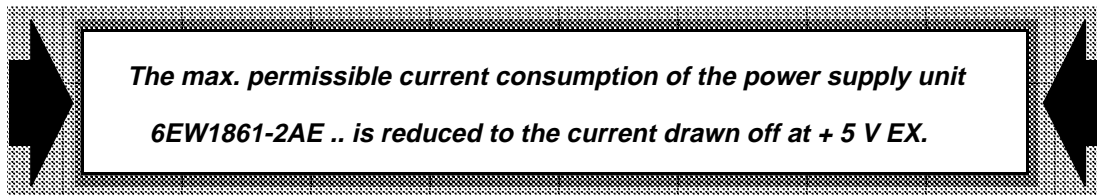


+ 5 V EX submodule

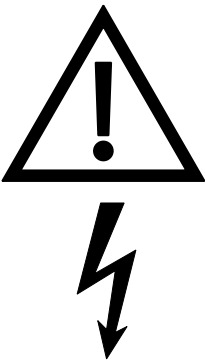
6EW1190-0AB ..

The + 5 V EX submodule is an expansion option for the power supply unit 6EW1 861-2A .. . The power supply unit then has the number 6EW1 861-2B .

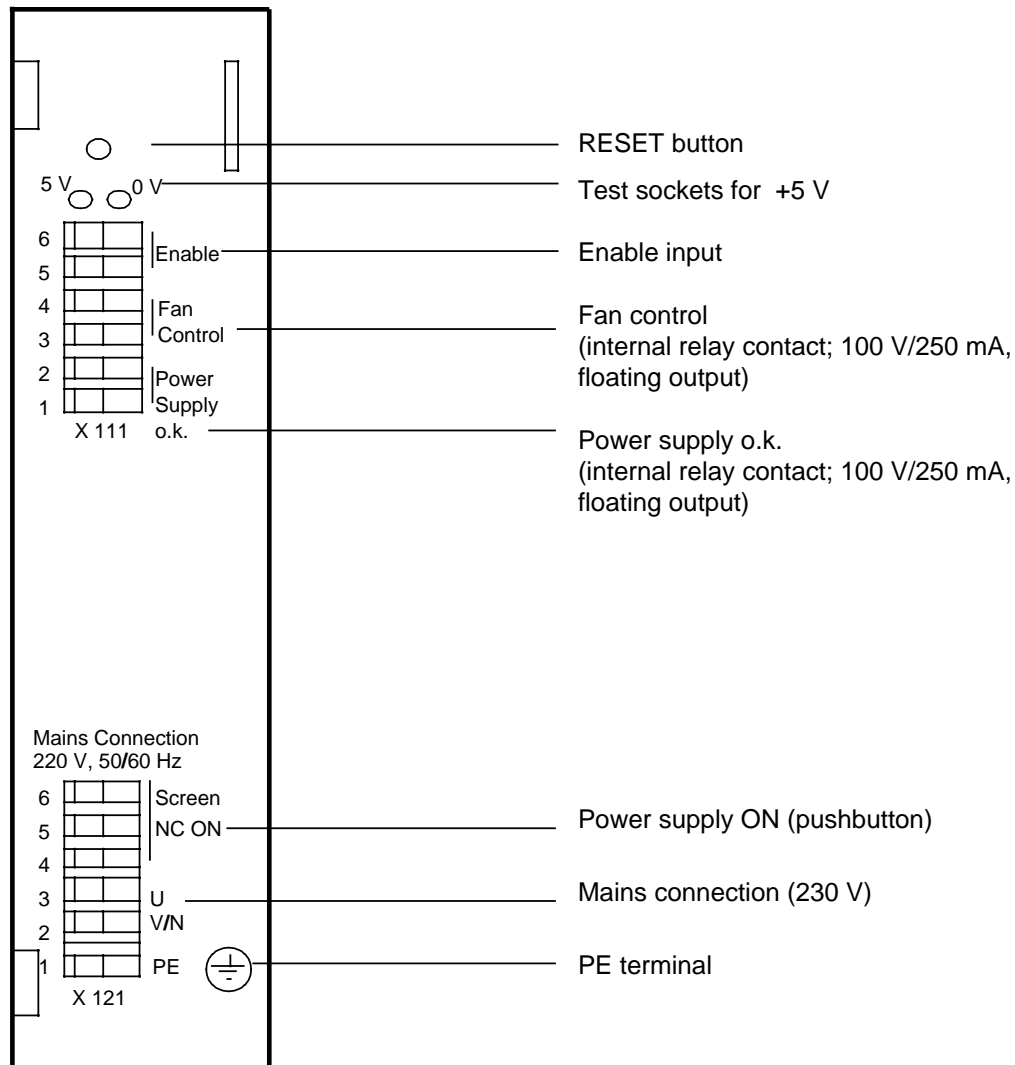
It supplies a settable voltage (+ 5 V EX) in the range + 5 V to + 6.5 V/7.5 A DC, that can be used as a power supply for the encoder. The jumpering + 5 V or + 5 V EX is performed on the measuring circuit modules. The voltage is set on the + 5 V EX submodule.



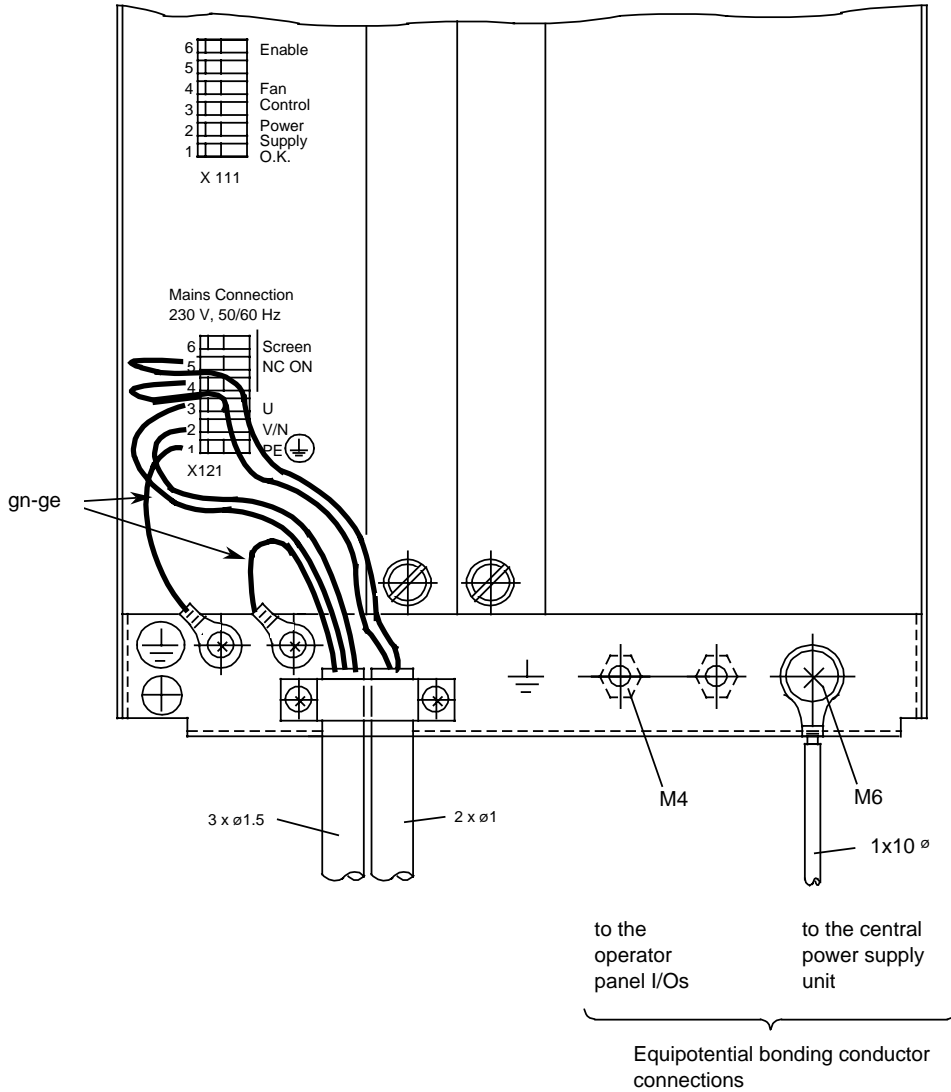
3.2.2.2 Operator panel (with power supply 6EW1 861-3AD..)

	WARNING
	<p>When the mains power is on, 230 V AC are applied to the terminals.</p> <p>Never touch the NC ON terminals or their clamps while the device is in use or while the mains power connector U-V/N is plugged in.</p> <p>Non-observance of this warning can cause death or serious injury</p>

Power supply operator panel 6EW1 861-3AD..

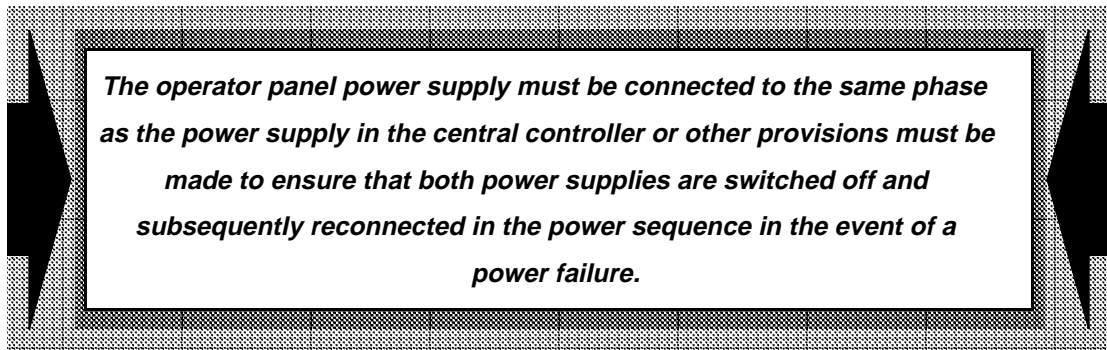


Mains connection



Power supply unit (6EW1 861-3AD.) max. power supply unit output currents

Total current	+5 V	5 V _{ext}	+15 V	-15 V	+24 V
typical	15 A	—	0.5 A	0.5 A	—



Technical data:

Input voltage	230 V $-20\%/+10\%$ single phase/neutral with loadable neutral two-phase phase/phase without loadable neutral other voltages to be matched by means of autotransformer
Frequency	48 to 63 Hz
Power consumption for operator panel	215 VA+ fan+ display
Permissible voltage interrupt with: nominal voltage U_N $U_N - 20\%$	max. 10 ms ($U_N=230$ V) max. 3 ms
Operating temperature	0 to 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 during transport 22

Signal outputs

- Power supply O.K. (PSO)
Floating relay output (100 V/250 mA/20 VA; insulation voltage against housing 100 V).
PSO signals correct functioning of the power supply (but not the fan).
PSO can be used
 - as an enable for further power supply units (chaining of power supply units; implementation of power on sequences).
 - to implement a power supply unit monitoring loop.

3.2.2 Power supply connection and switch-on conditions

- Fan Control (FC)

Floating relay output(100 V/250 mA/0 VA; insulation voltage against housing 100 V)

FC signals correct functioning of the fan (but not the power supply).


FC can be used

- as a power supply enable

Note:

In this case, the power supply unit switches off the power supply unit as soon as the fan control responds.

- to trigger an external switch-off logic that switches off the power supply unit after a delay.


	CAUTION
	<p>Make sure that no more than three minutes after the fan control has signalled a fault, the power supply module is switched off, otherwise overheating can result (material damage).</p>

Control inputs

- NC ON


NC ON the power supply unit is switched on via NC ON (jumper, switch or push-button).

It is not possible to switch off via NC ON.

	CAUTION
	<p>Never connect the NC ON input to NC ON inputs of other power supply units (destruction of the power supply unit)</p>

- Enable (EN)

Via the EN input, you can enable or disable the power supply unit. It is not possible to switch on via EN.

	CAUTION
	<p>Never connect the EN input to EN inputs of other power supply units (destruction of the power supply unit)</p>

Behaviour on power on and power off

- **RESET**

Push-button for initializing the power on/off routine without the power supply unit.

- **Power on**

The power supply unit can be switched on using

- NC ON (switch or key)
- Power ON (NC ON switch or jumper)

Note:

The EN input must be jumpered from the moment of NC ON or power ON.

- **Power off**

The power supply unit can be switched off using

- Power OFF
- Open EN jumper/switch

It is not possible to switch off via NC ON.

- **Power off because of a fault**

The input/output voltage monitoring can switch off the power supply unit. The fan control can also switch off the power supply unit.

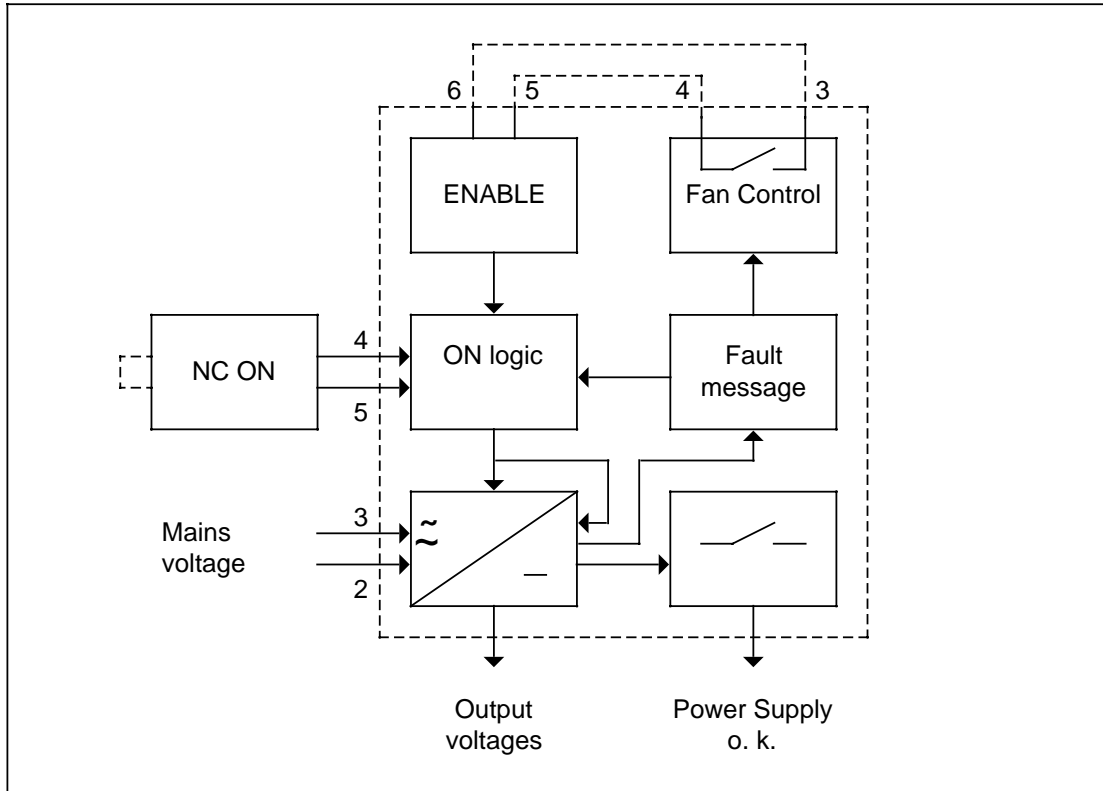
- **Switching on the power supply unit**

The power supply unit can be switched on

- with power OFF/ON (and NC ON pushbutton or switch) after power off due to fault.
- automatically (with NC ON jumpered) after a power off and power on.

Outline diagram for ON/OFF logic

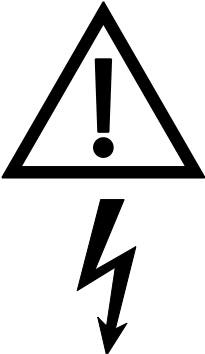
- Only ENABLE jumpered (jumper 5-6):
Fan failure is signalled to FAN CONTROL (connection 4-3) and can be evaluated by the customer.
- FAN CONTROL jumpered with ENABLE (jumpers 5-4; 6-3):
The power supply switches off in the event of fan failure.

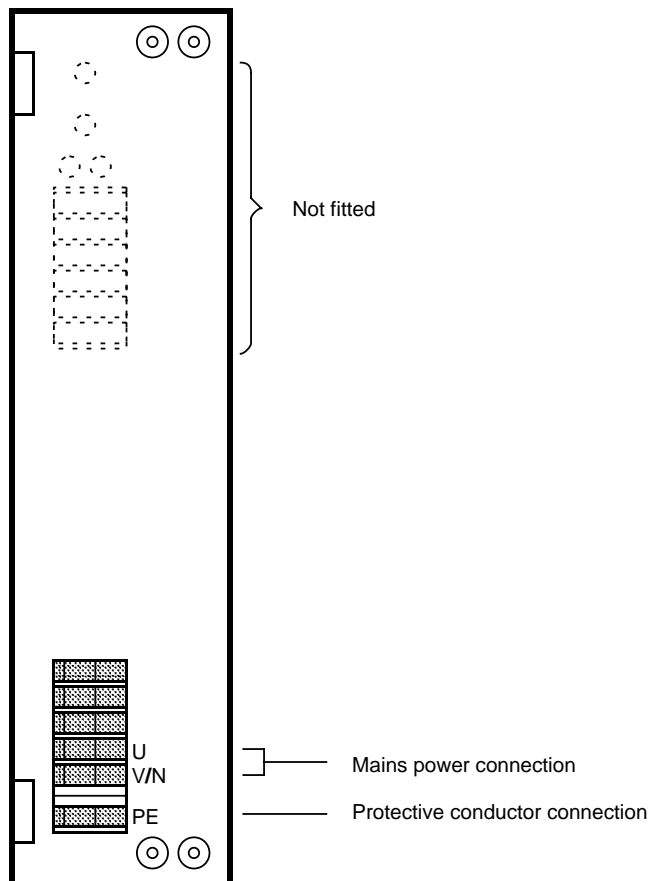


3.2.2.3 Filter unit

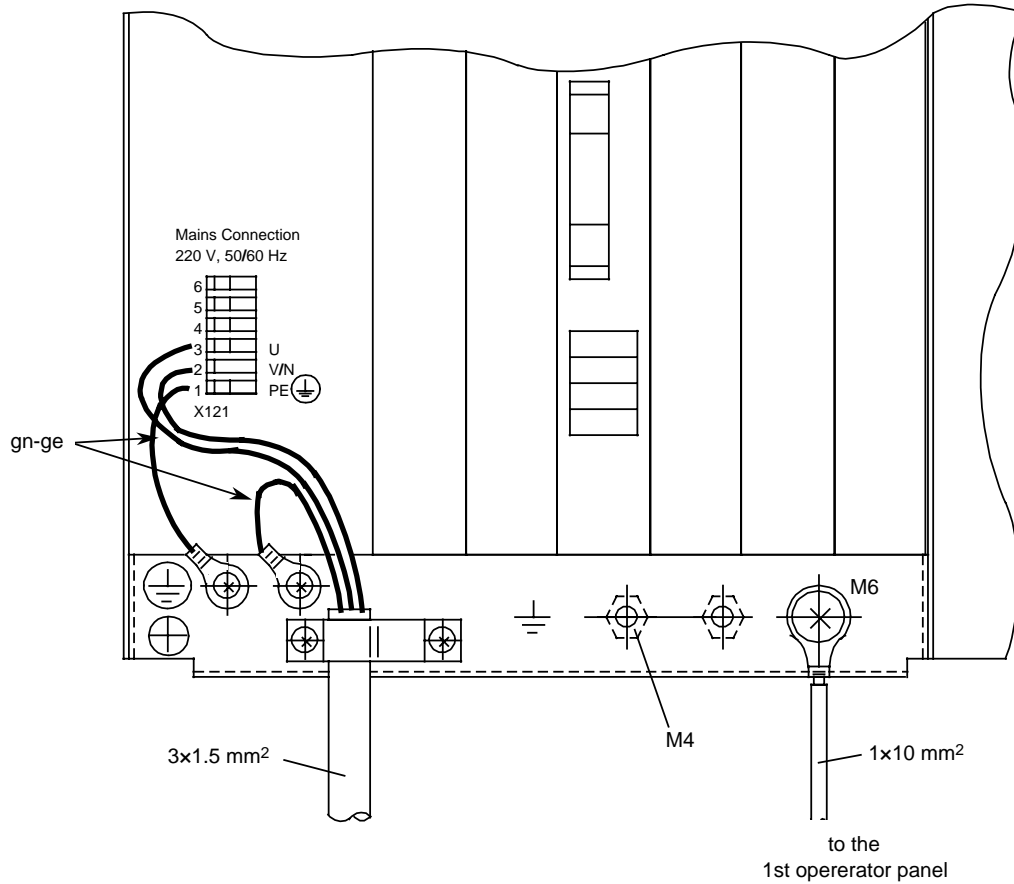
6EW1 060-0AA

The filter unit 6EW1 060-0AA is used for the power supply to the 12" monitor and the fan (2nd and 3rd operator panel).

	WARNING
	<p>When the mains power is on, 230 V AC are applied to the terminals. Non-observance of this warning can cause death or serious injury.</p>



Mains connection



3.2.2.4 Central I/Os

The I/O modules require a power supply of +24 V DC.

Module	Inputs	Outputs	+24 V DC	Max. power consumption (per module)
6FX1122-8BC01/-8BC04	—	32, digital	x	8.4 A
6FX1122-8BD01/-8BD04	—	32, digital	x	32.5 A
6FX1125-7BA ..	64, digital	—	x	300 mA
6FX1136-1BA01	8, analog	—	—	—
6FX1138-4BA ..	16, digital	16, digital 4, analog	x	3.3 A

3.2.2.5 Operator panel I/Os

Power supply + 5 V DC

The I/O submodules are connected to the operator panel via a 50-way connection cable. The I/O submodules are automatically supplied with + 5 V DC.

Power supply + 24 V DC

A Siemens machine control panel requires a supply voltage of + 24 V DC. The output drivers of the I/O submodules also have to be supplied with + 24 V DC.

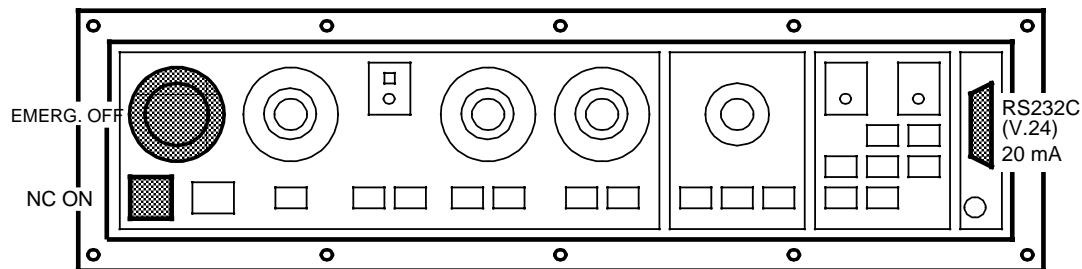
This is done via the X 02 403 connector.

Submodule type	Inputs	Outputs	+24 V DC	Max. power consumption (per module)
6FX1 124-6AD	64	32	x	8 A
6FX1 124-6AC	64	—	x	320 mA

3.2.2.6 Machine control panel

The machine control panel is connected via an I/O submodule. Siemens machine control panels are automatically via a 34-way connecting cable supplied with + 24 V DC.

Customer machine control panels must have a separate + 24 V DC power supply.




EMERGENCY OFF

Slam button with turn-to-reset feature and positive opening operation.

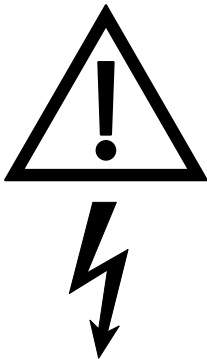
Contact load 230 V/6 A AC

Insulation rated voltage 660 V AC

	WARNING
	The EMERGENCY OFF pushbutton is not wired up in the factory but has to be connected to terminals 1 and 2 (normally closed contacts). If the EMERGENCY OFF pushbutton is not connected and an emergency occurs, the consequence can be death, serious injury or extensive material damage. (Pressing the EMERGENCY OFF pushbutton would have no effect.)

NC ON

The NC ON pushbutton can be connected with the NC ON terminals of the power supply unit (soldering lugs 3 and 4).

	WARNING
	When the mains power is on, 230 V AC are applied to the terminals. Never touch the NC ON terminals or their clamps while the device is in use or while the mains power connector U-V/N is plugged in. Non-observance of this warning can cause death or serious injury.


3.2.2.7 Electronic handwheel module

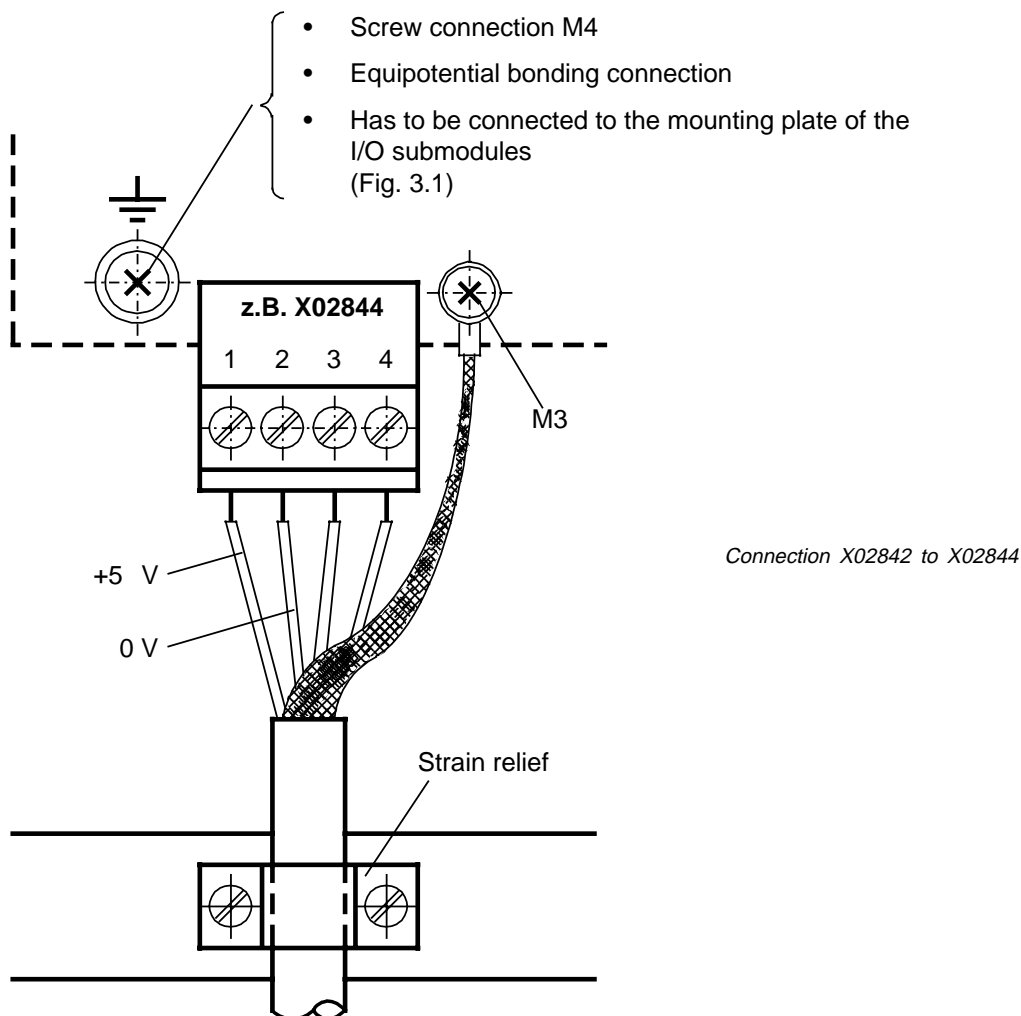
Power supply + 5 V DC (logic)

The electronic handwheel module is connected to the operator panel via a 50-way connecting cable. Through this cable the electronic handwheel module is automatically supplied with + 5 V DC.

Power supply + 5 V DC (encoder)

The electronic handwheels are supplied via the appropriate 4x terminal block X02842 to X02844 with + 5 V DC.

	CAUTION
	<p>The maximum permissible power consumption at the external interfaces always refers to the module itself and not to any components that may be connected before or after the module (e.g. a power supply unit or external components).</p> <p>The power supply outputs at the external interfaces are not short-circuit-proof and there is no fuse between them and the power supply unit.</p>



The maximum cable length between the pulse encoder and the control 50 m.

3.2.2.8 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 ground connections.

3.2.2.9 Screened signal cables

To ensure that the installation operates safely and without interference, use screened cables as shown in 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 have their internal reference potential connected 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, you cannot connect the screen on both sides, you require four equipotential bonding conductors. Connect these on both sides to the respective housings.

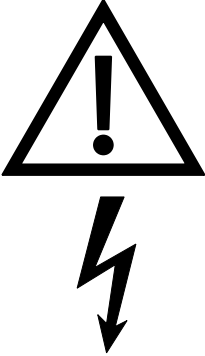
In the case of units that do not have their own power supply but use the 5 V power supply from the associated component unit of the control (e.g. incremental encoder), leave the screen on the device itself unconnected because these devices cannot be insulated. Do not use equipotential bonding conductors. Do not connect the reference potential GND of these devices to the housing. It is connected to the reference potential of the associated components units of the control only via the signal cables.

Lay cables for transmitting low frequency signals (e.g. relay interface) 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), lay unscreened single wires. Place these signal lines in their own ducts, separate from power cables.

3.3 Installation

3.3.1 Installation codes of practice

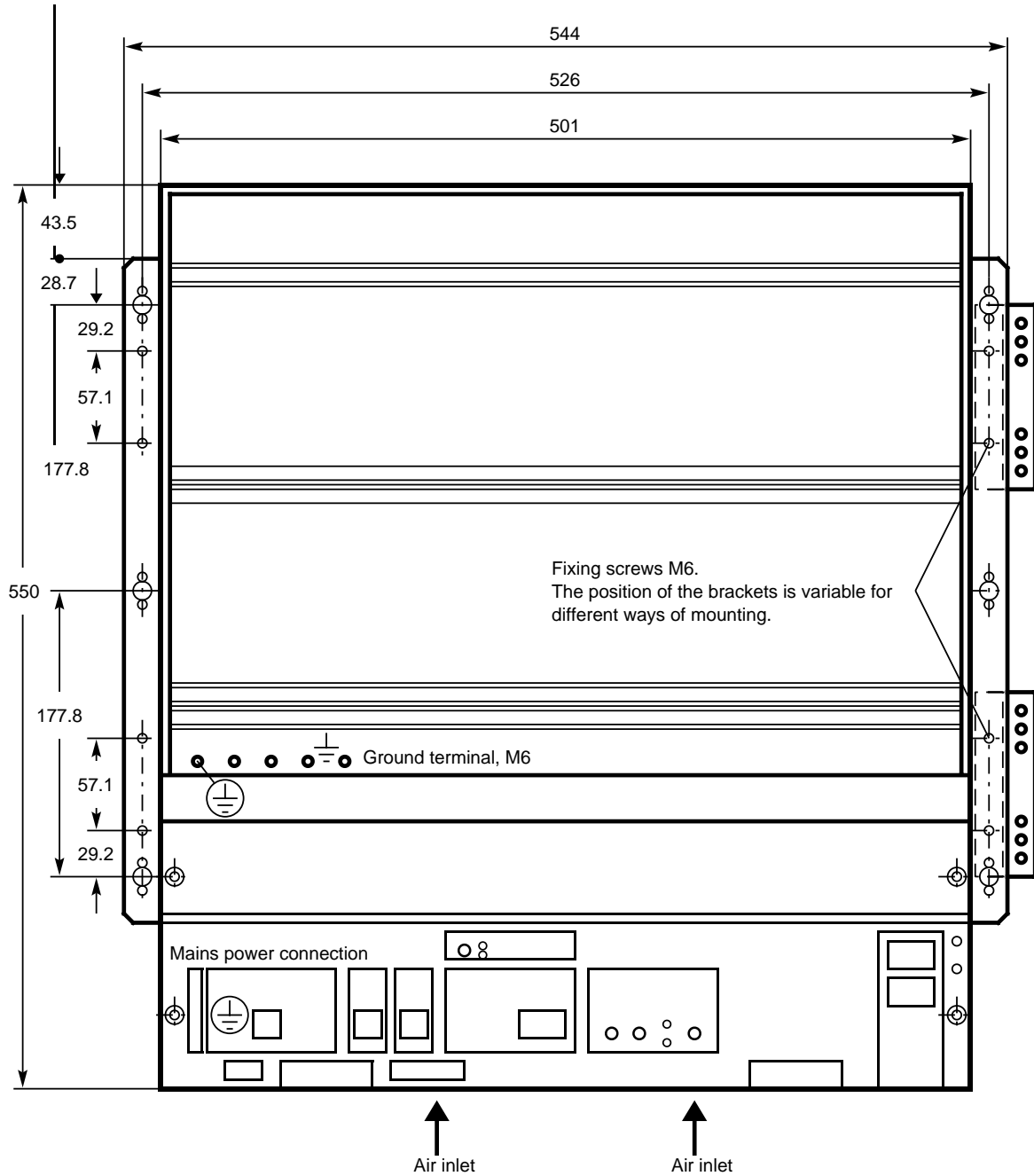
	WARNING
	<ul style="list-style-type: none"> • If the enclosure or touch guard is removed or if the system cabinet is opened, access is provided to certain, possibly live and dangerous, parts of these devices/systems. • Only qualified personnel are allowed to manipulate this device/system. • This personnel must be thoroughly familiar with all sources of danger and maintenance measures according to the information in the documentation. • Proper transportation, storage, installation and assembly of the product, as well as careful operation and maintenance, are prerequisites of trouble free and reliable working. • The safety and accident prevention regulations applicable to each specific case must be observed. • Panel-mounted devices for enclosures or cabinets must be operated only when mounted. Table top devices and portables must be operated only with their housings closed. • Where permanently connected equipment is not provided with all-pole mains disconnecting switches and/or fuses, the building installation must include a mains disconnecting switch or fuses; the equipment must be connected to a protective earth conductor. • Where equipment has a permanently connected cable at the equipment end and a plug at the other end and all pole mains disconnecting switches, the earthed socket outlet for the device must be located in its vicinity and be easily accessible. • In the case of equipment operated from the mains supply, it is important to check that the set nominal voltage range corresponds to the local mains voltage before starting up. • Emergency stop devices to EN 60204/IEC 204 (VDE 0113) must remain effective in all operating modes of the automation equipment. Resetting of the emergency stop devices must not cause any uncontrolled or undefined movements.

In the operational state, protection against direct contact is provided making the device suitable for installation in closed electrical operating areas (DIN VDE 0160, Sections 5.5 and 6.5).

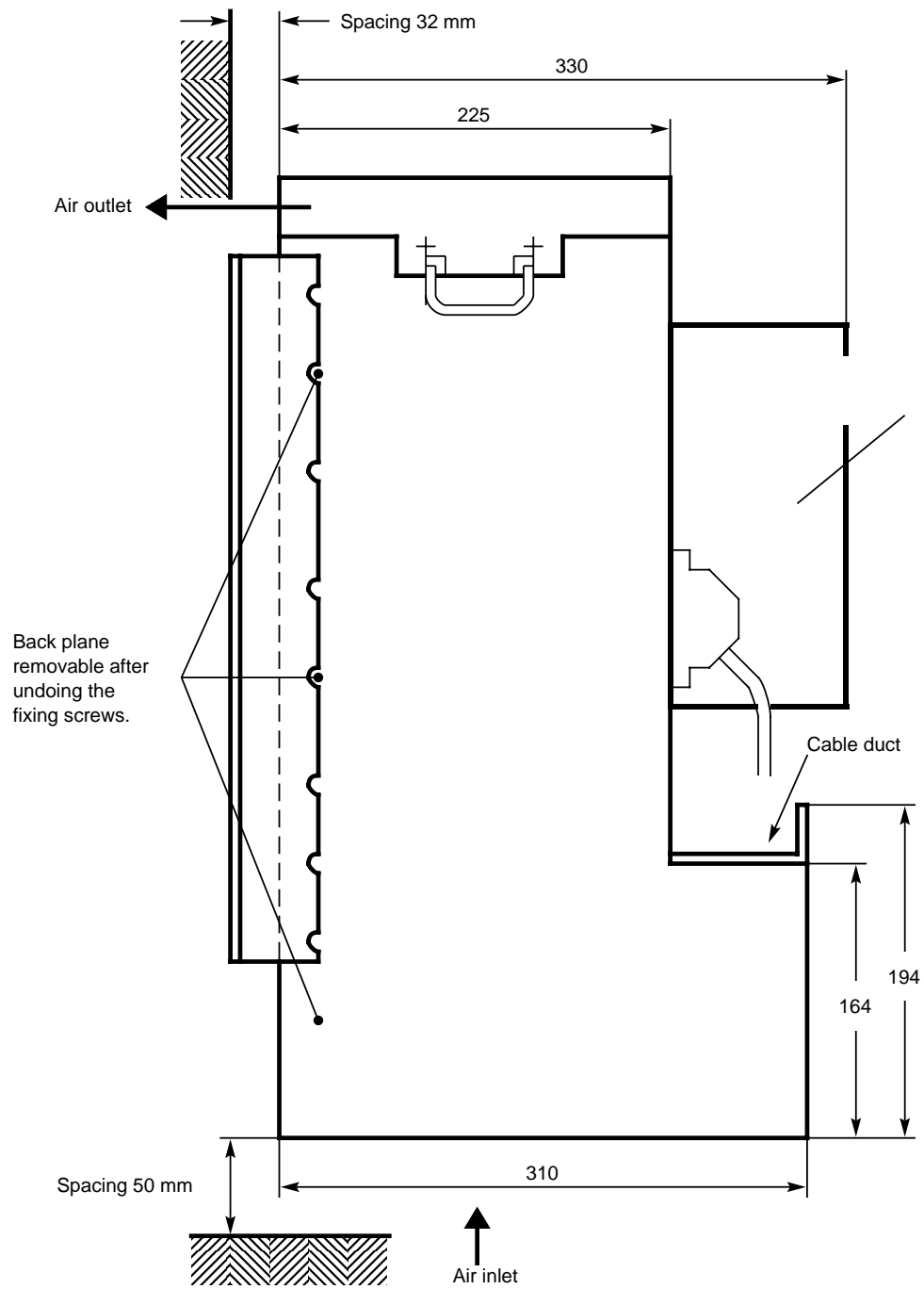
	CAUTION
	<p>The modules contain electrostatically endangered components. You must discharge your body before touching any electronic modules. The simplest way to do so is to touch a conductive earthed object (e.g. bare metal part of a switching cabinet, water pipe) immediately before touching the module.</p> <p>Never remove modules while the control is under power.</p>

3.3.2 Central controller

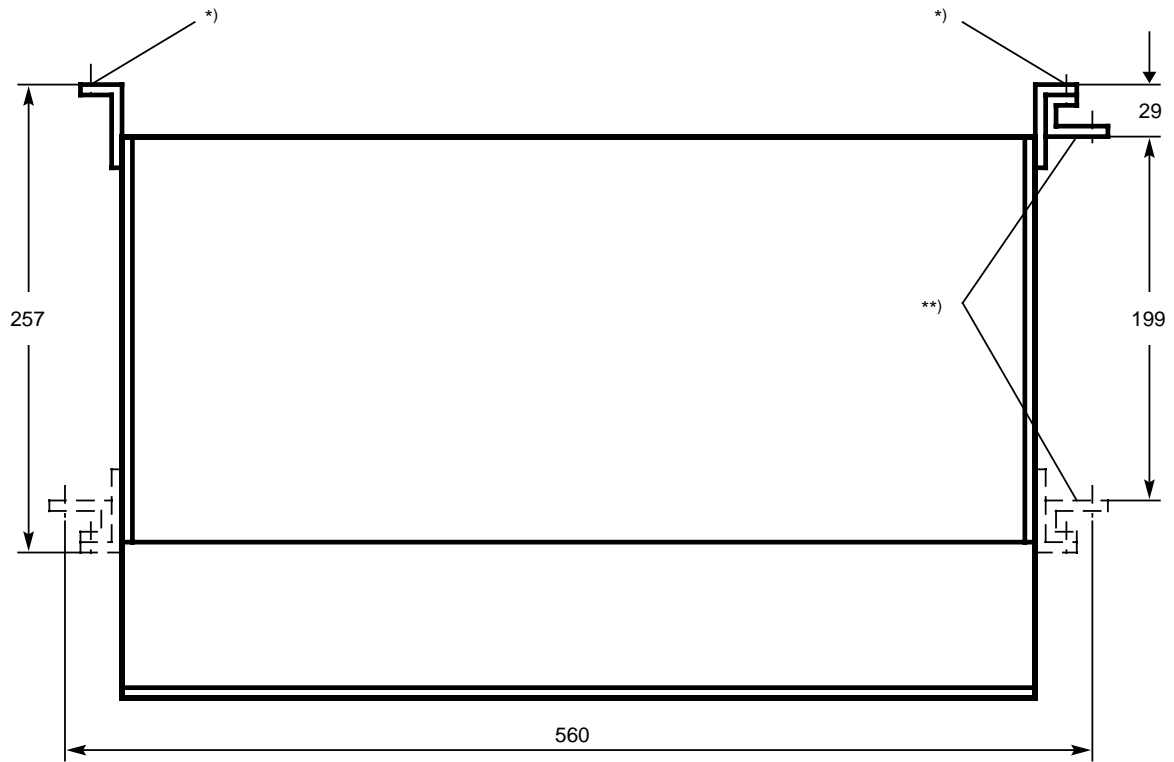
- Single-tier, versions 1, 2, 3



Dimension drawing of the central controller, single-tier (front view)



Dimension drawing of the central controller, single-tier (side view)



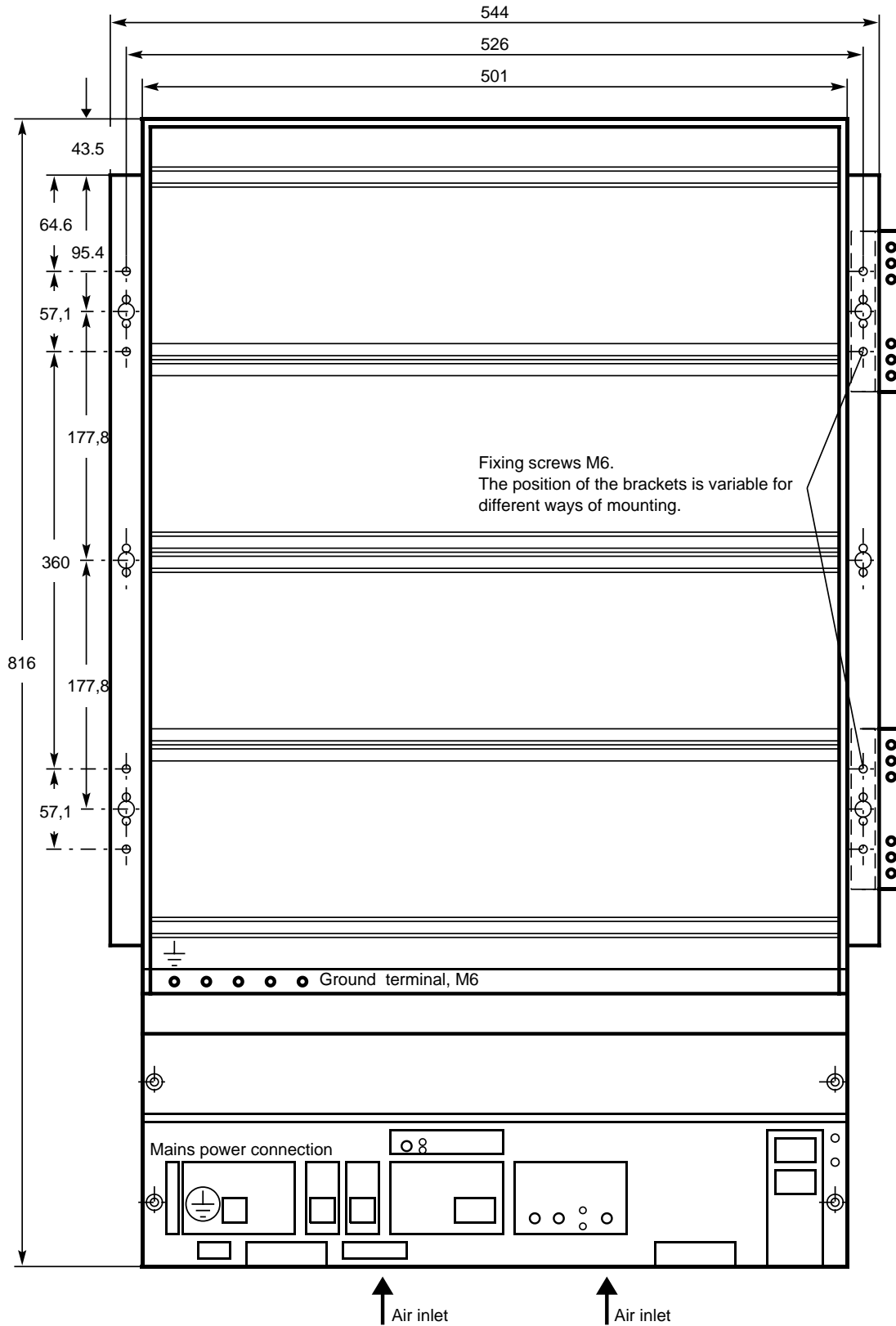
Dimension drawing of the central controller (top view)

*) Fixing screw M6.

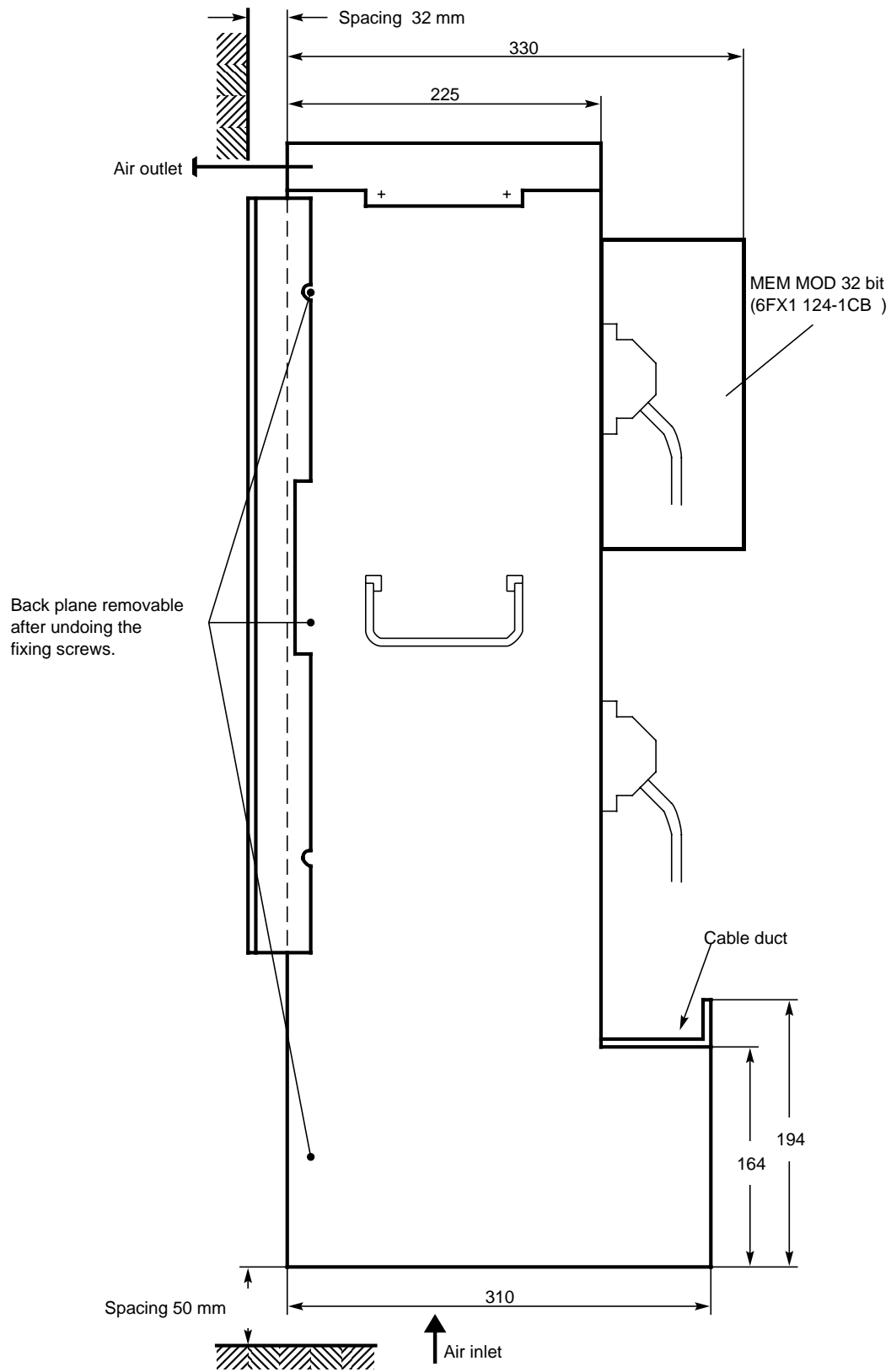
The bracket position is variable for different ways of mounting.

***) Set of parts (order no. 6XB9807) for mounting in an 8MF cabinet, width 600 mm (contains: 2 brackets).

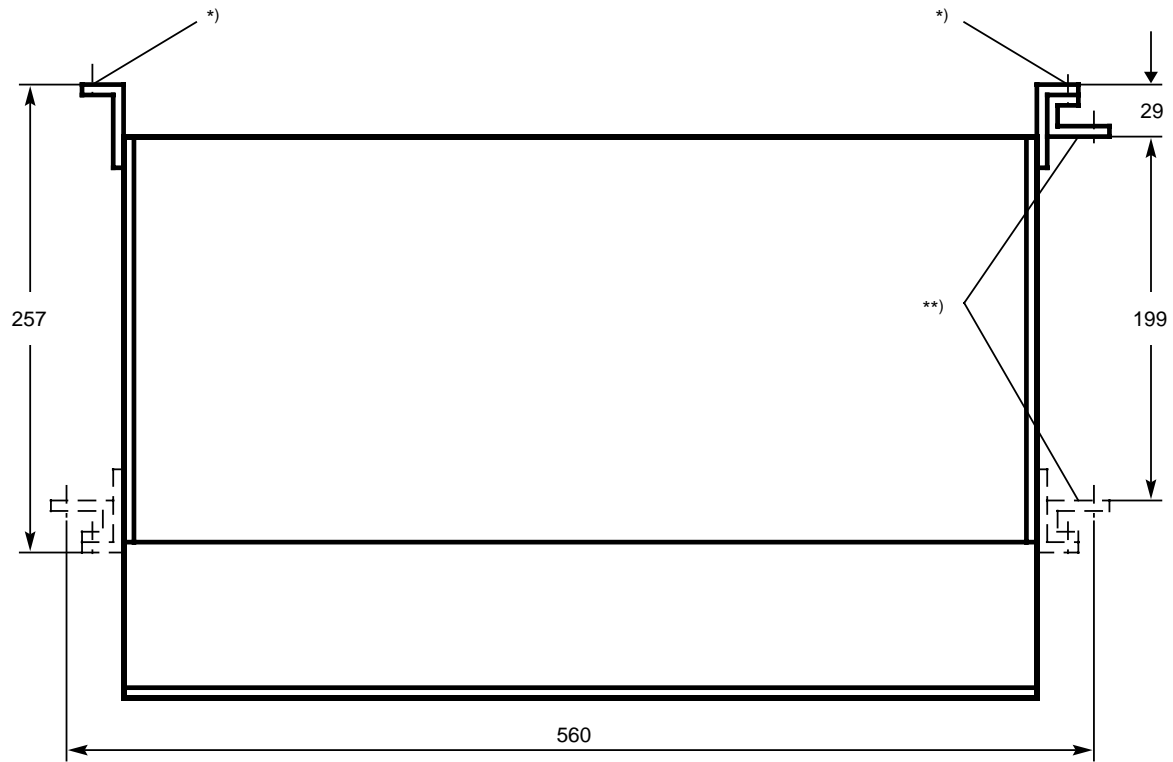
• **Two-tier, versions 4 and 7**



Dimension drawing of the central controller, two-tier, (front view)



Dimension drawing of the central controller, two-tier (side view)



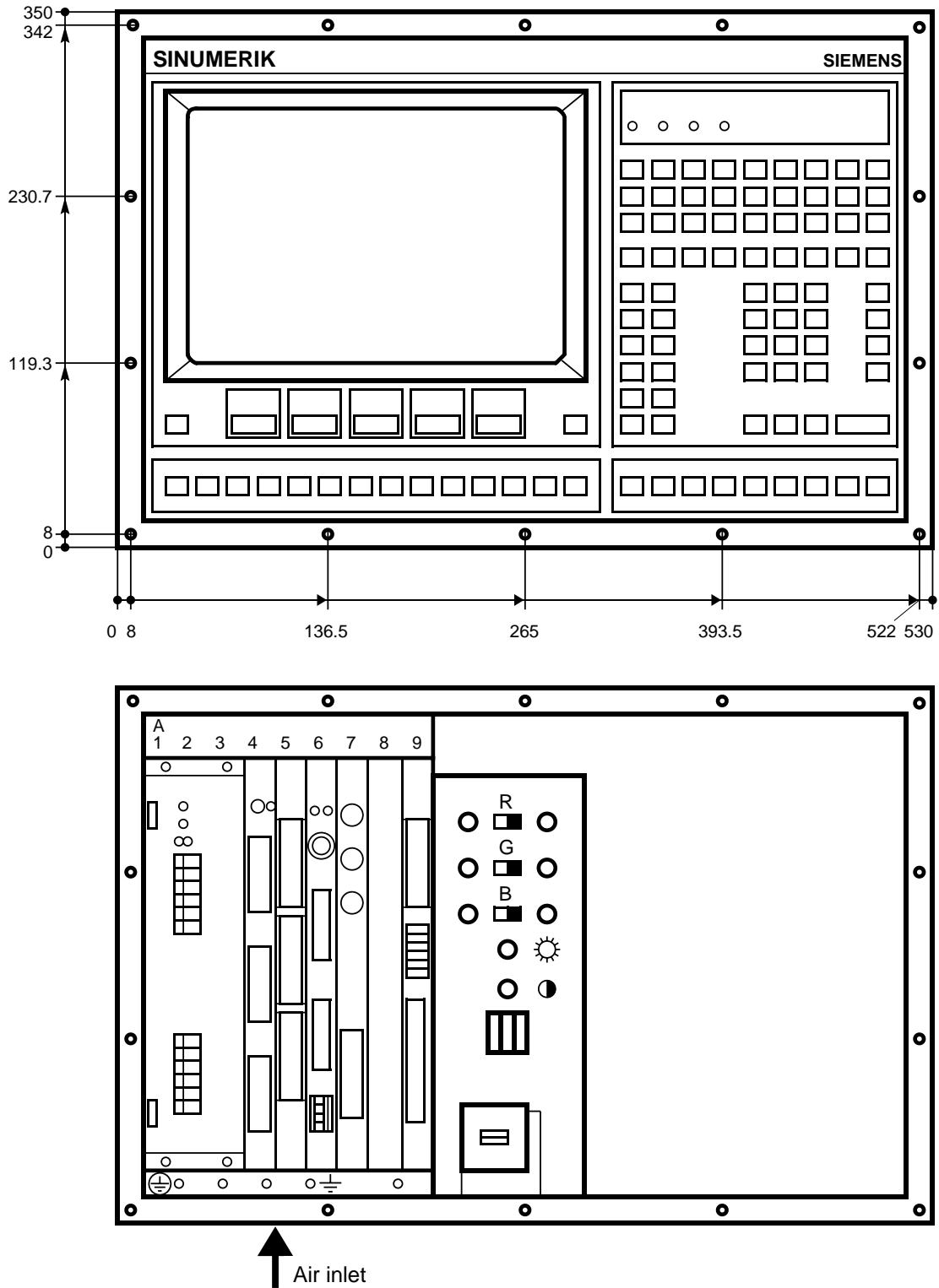
Dimension drawing of the central controller (top view)

*) Fixing screw M6.
The bracket position is variable for different ways of mounting.

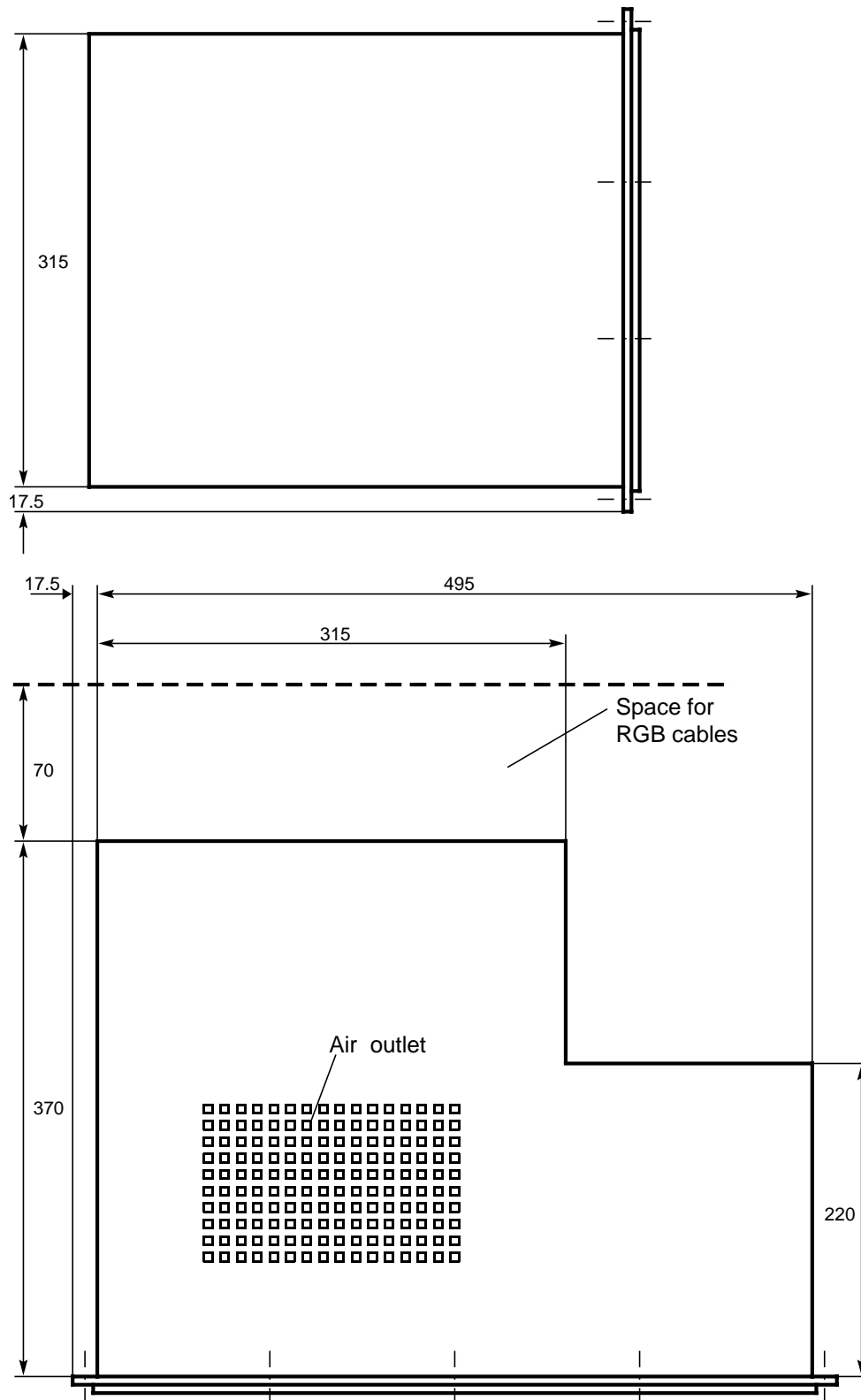
***) Set of parts (order no. 6XB9807) for mounting in an 8MF cabinet, width 600 mm (contains: 2 brackets).

3.3.3 12" operator panel, colour

- Dimension drawings

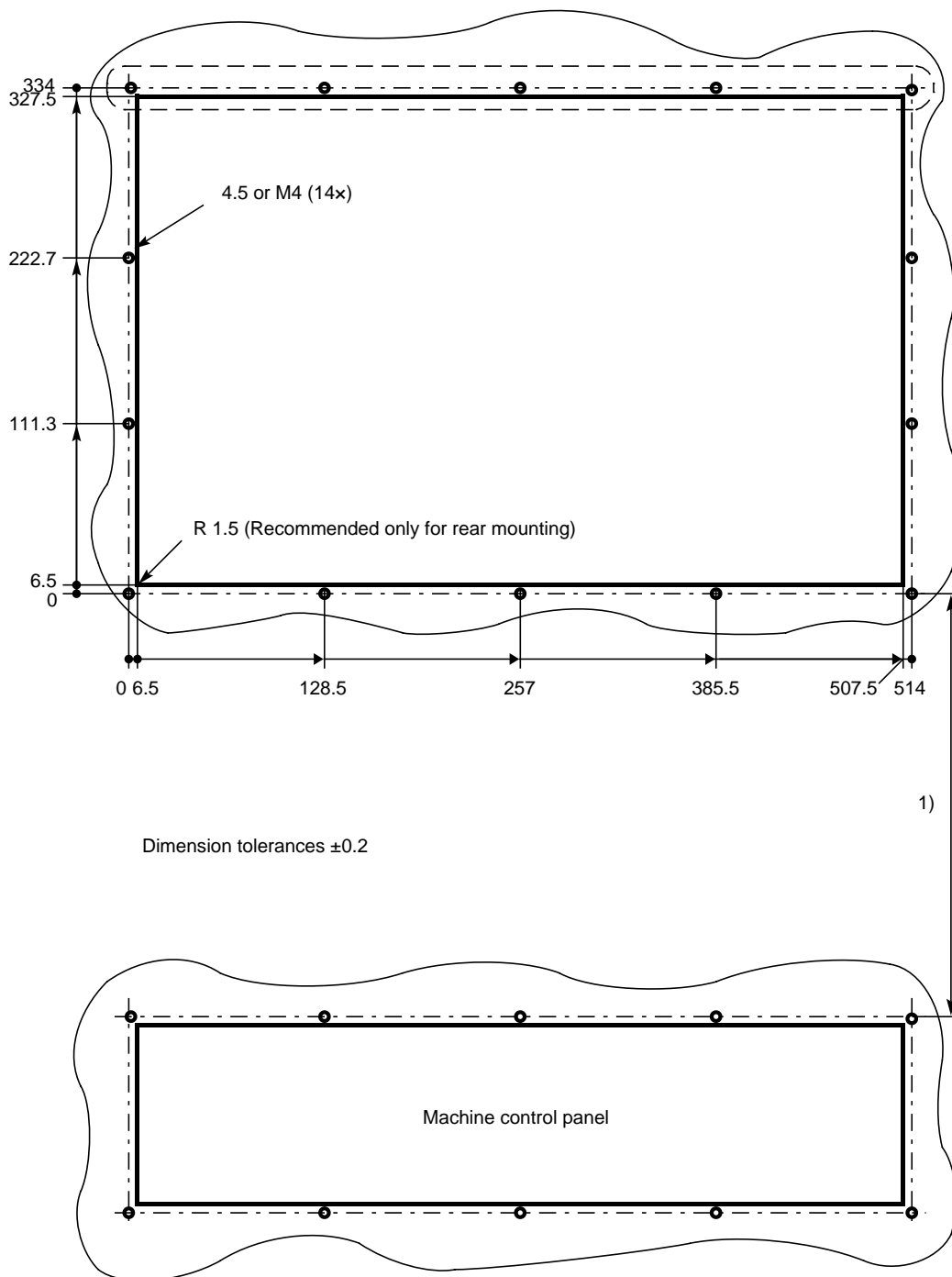


Dimension drawing of the 12" operator panel, (front and rear views)



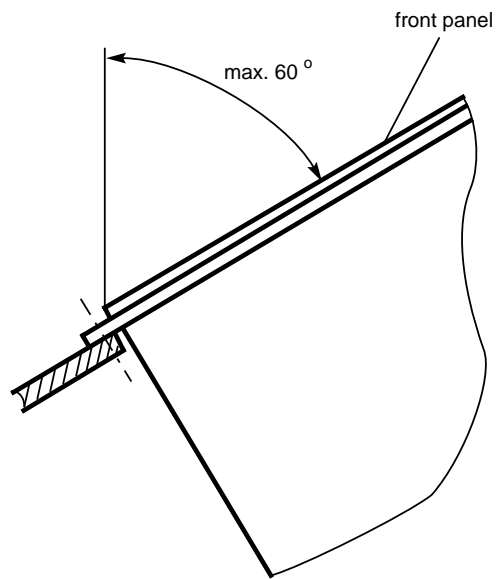
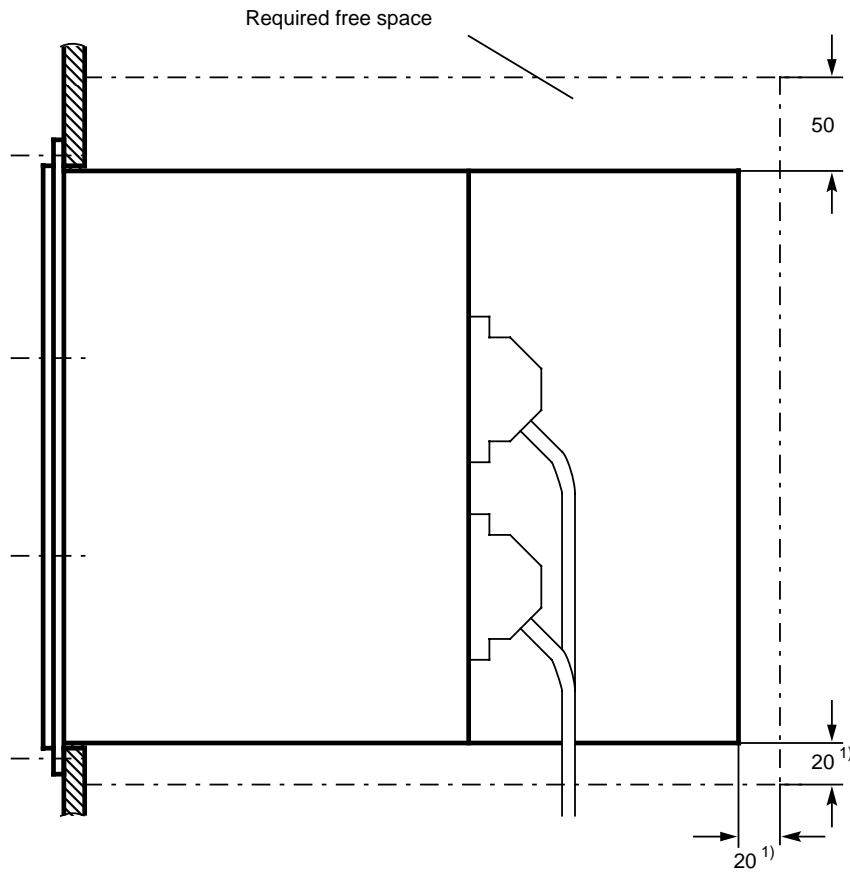
Dimension drawing of the 12" operator panel, (side view and top view)

- **Panel cutout**



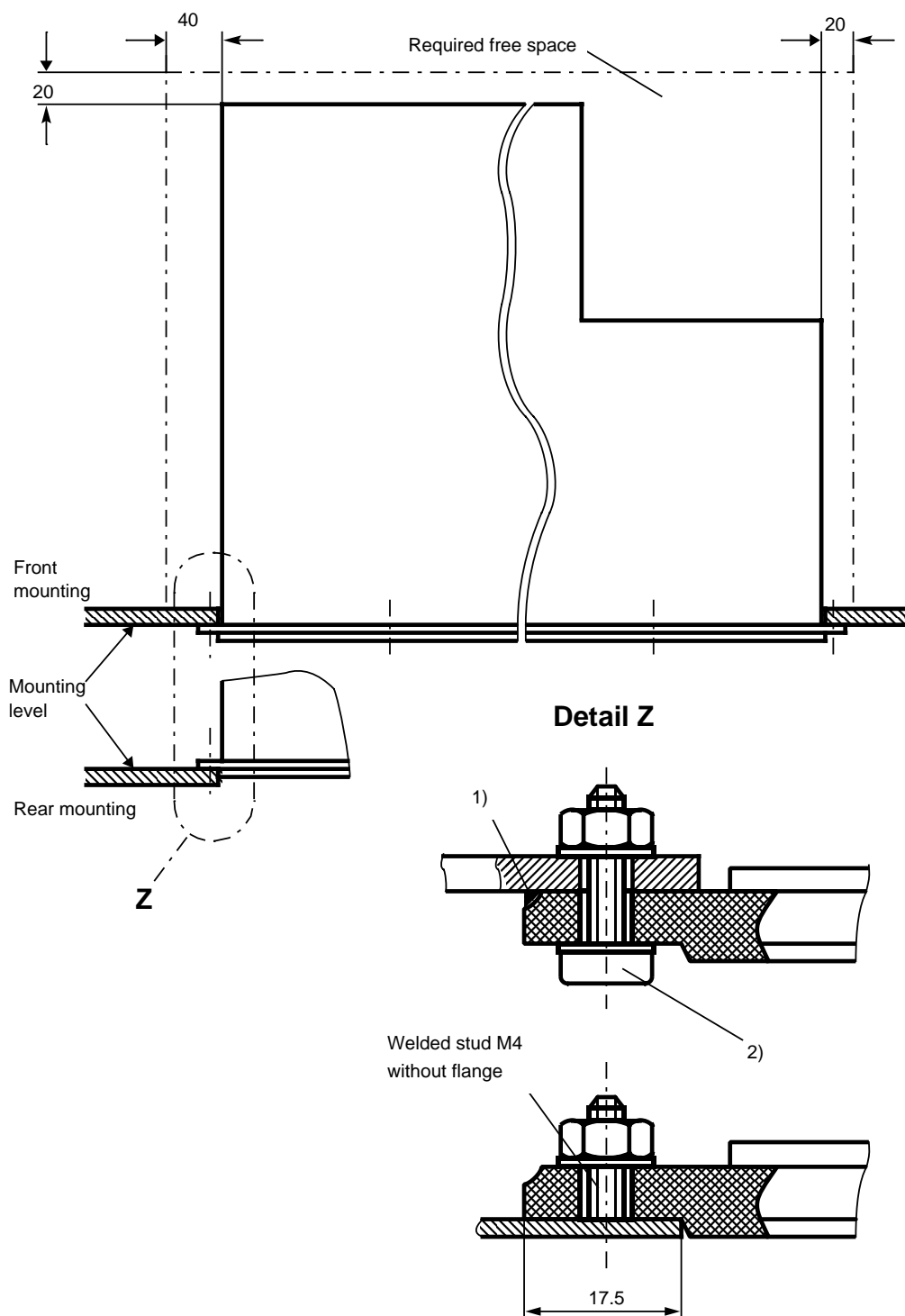
Panel cutout of the 12" operator panel

1) Spacing when mounting the operator panel and the machine control panel one above the other 16.5 mm.



Mounting the operator panel (side view)

1) At least 100 mm, if you want to be able to replace the fans of the mounted operator panel.

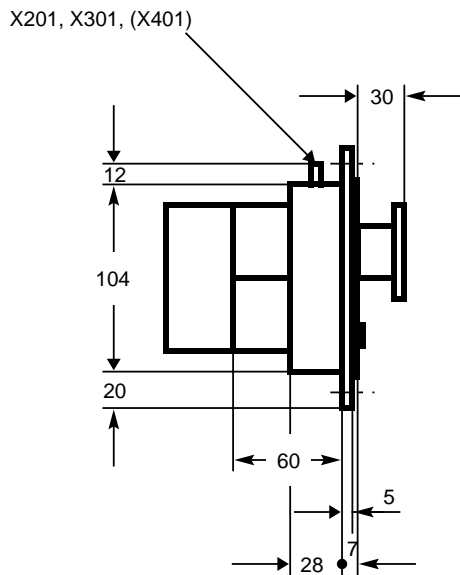
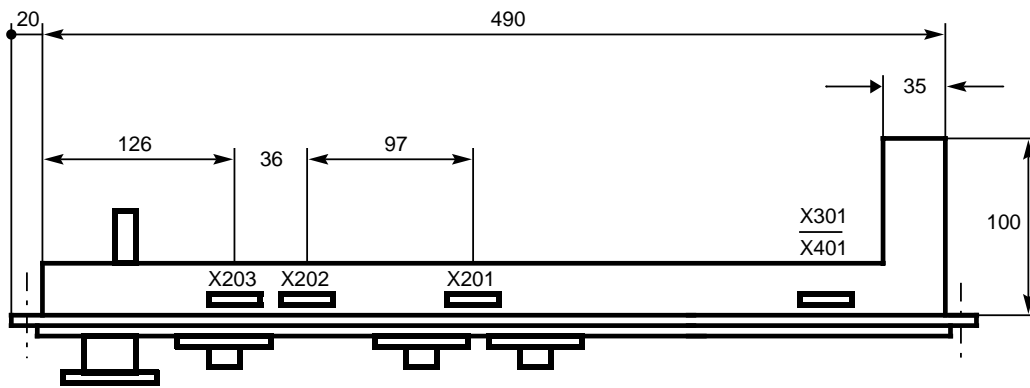
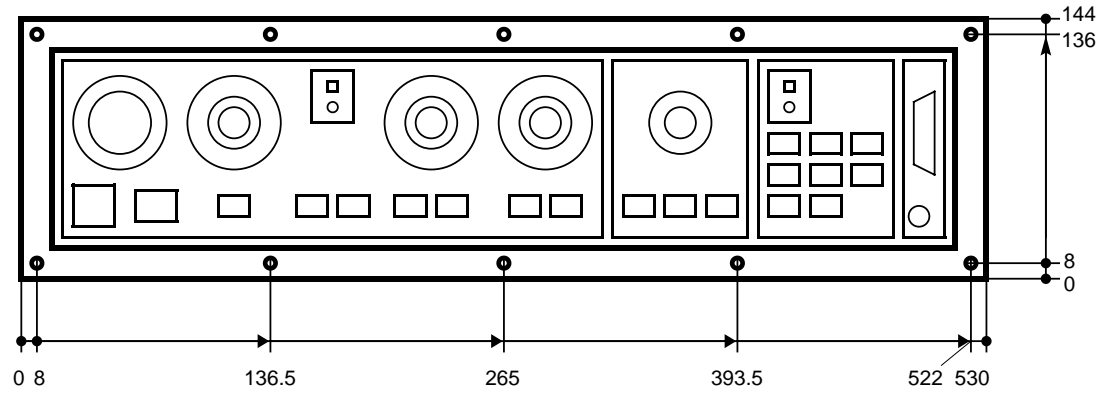


Mounting the operator panel (top view)

- 1) For use under harsh environmental conditions, e.g. oil vapour, use of a sealing cord with a dia. of 2 mm
- 2) Screw for front mounting, max. tightening torque $1.0 + 0.5 \text{ Nm}$;

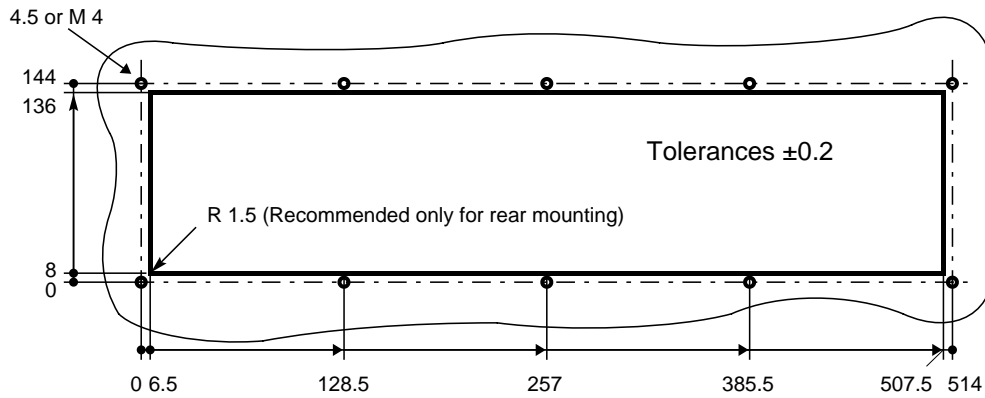
3.3.4 Machine control panel (MSTT)

- Dimension drawings



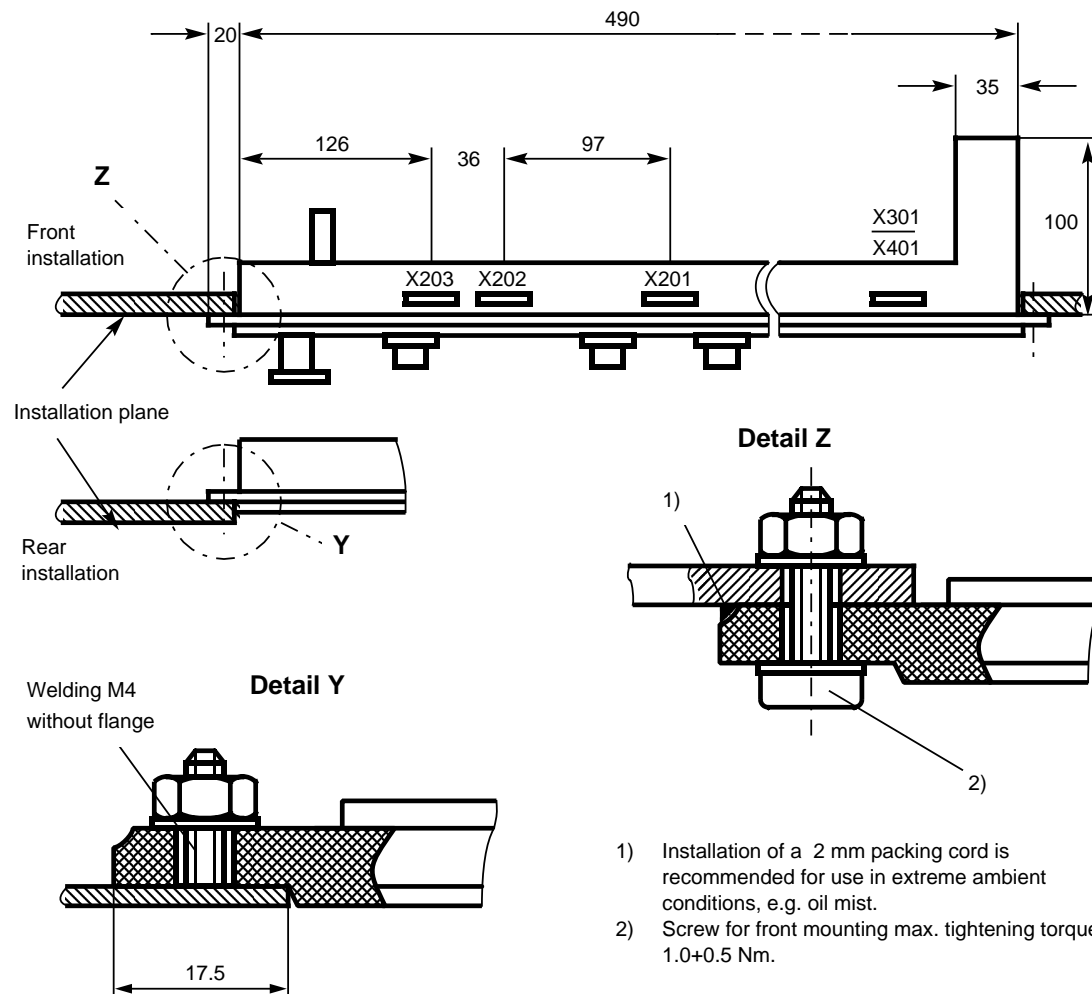
Dimension drawing of the machine control panel (front, top and side views)

- Panel cutout



Cutout for the machine control panel

- Installation instructions



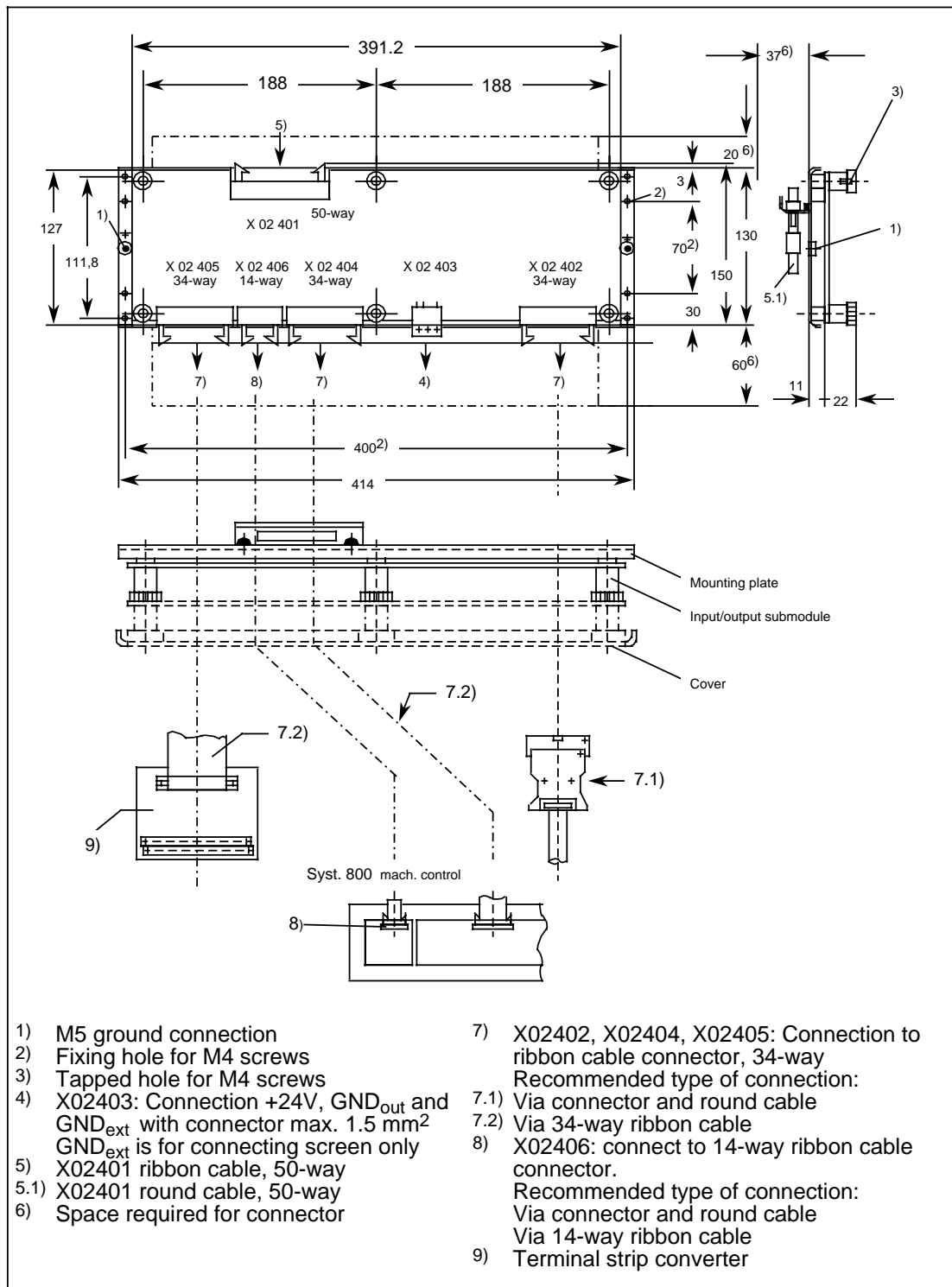
Installation of the machine control panel (front view)

3.3.5 I/O modules

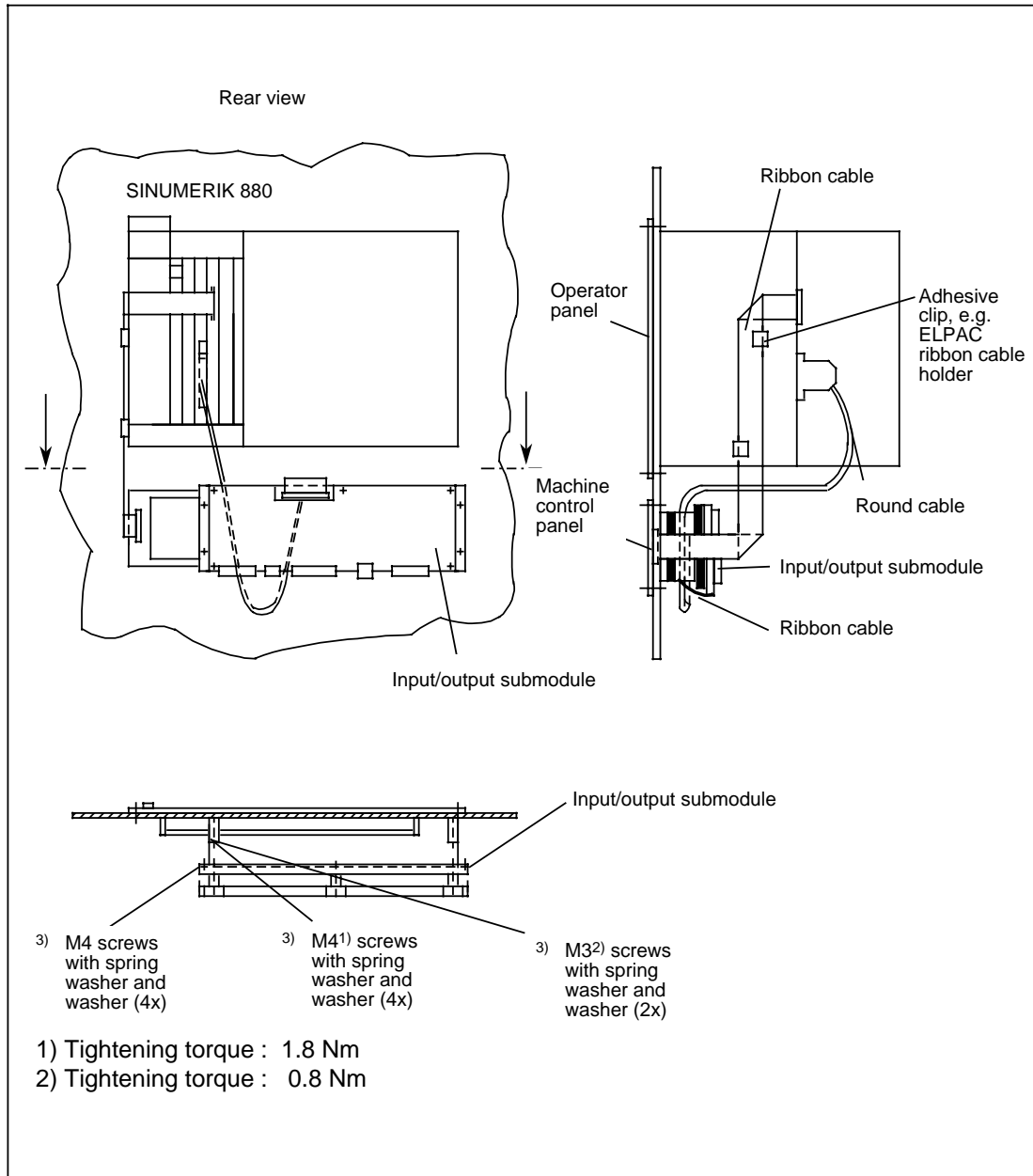
6FC3 984-3R (M01, M02, M03, M04)

Type: 6FX1 124-6A

Dimension drawings



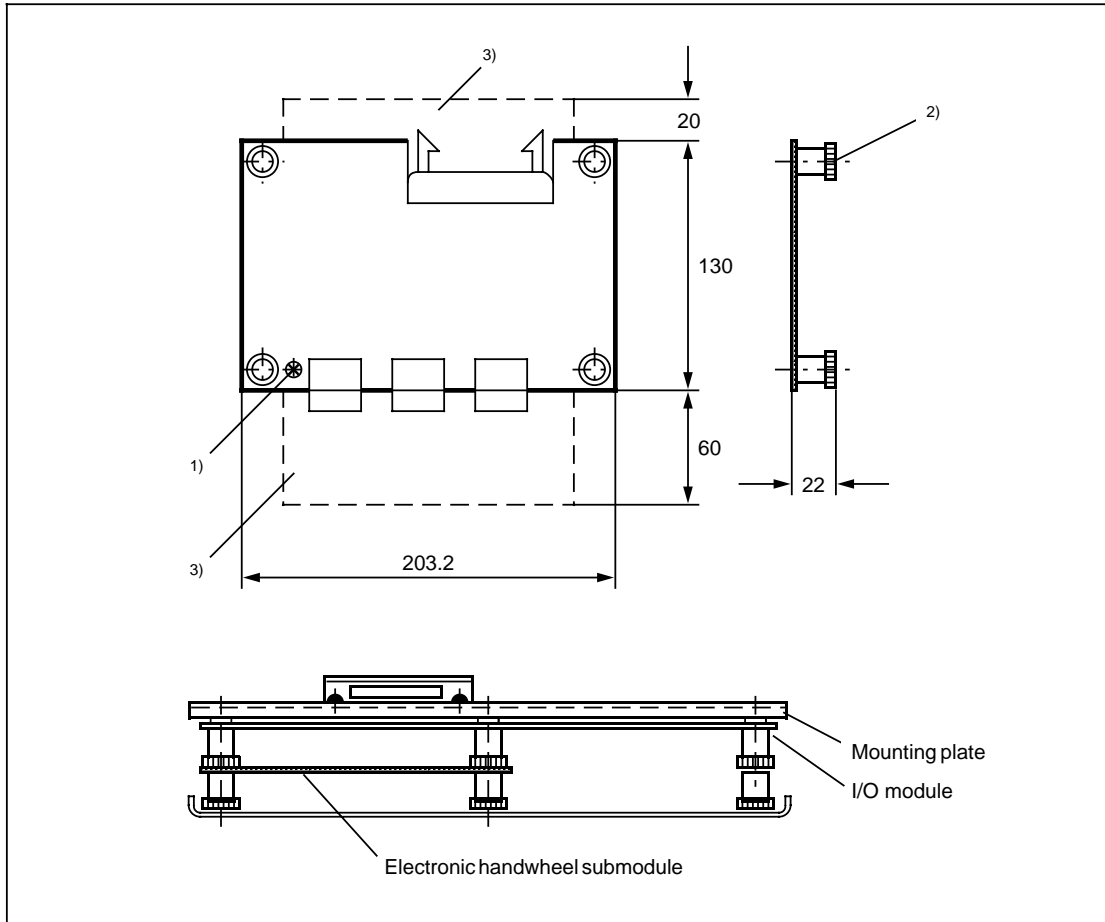
Installation instructions



3.3.6 Interface submodule for electronic handwheels 6FC3 984-3RJ (M10)

Type: 6FX1 126-5AA

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



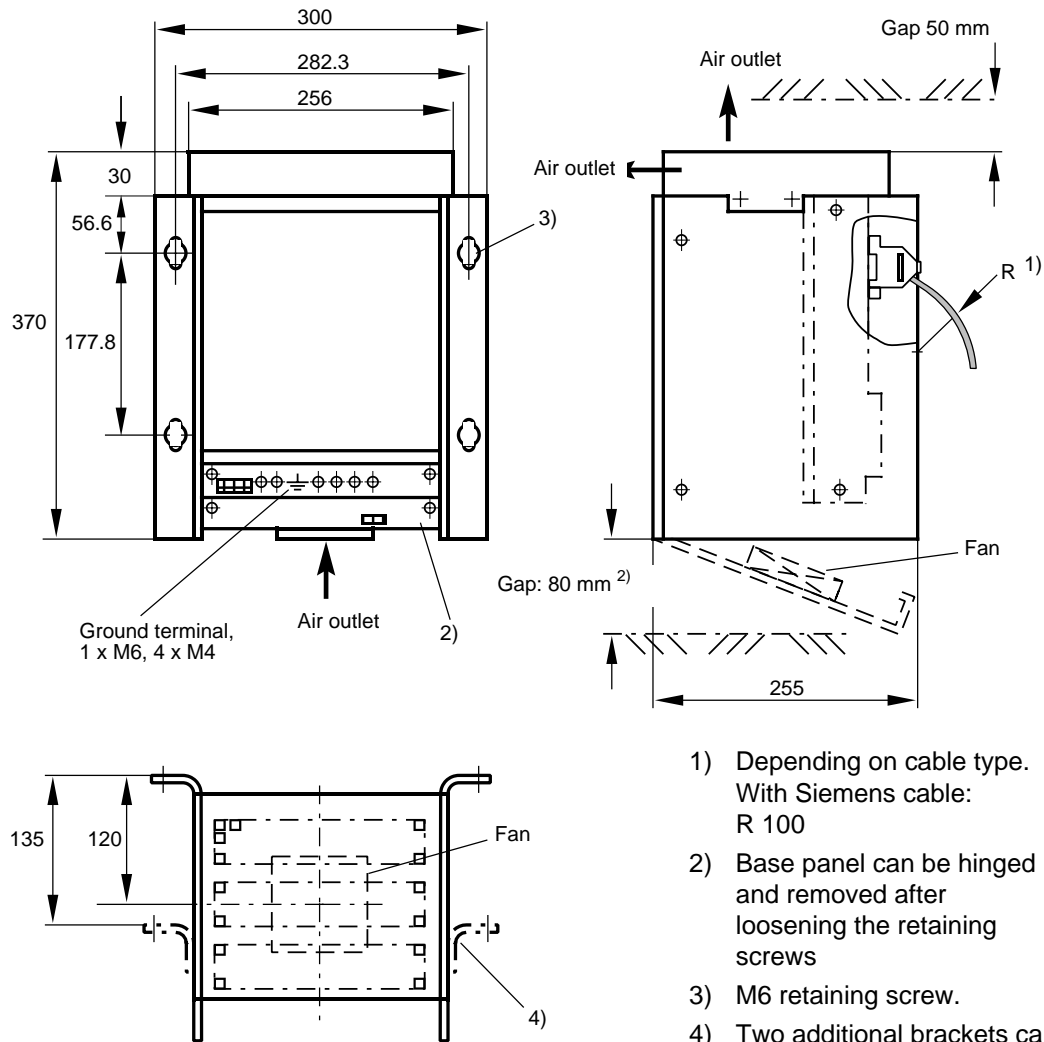
Note:

The interface submodule for electronic handwheels (max. 1 submodule possible) is screwed on top of the I/O submodules.

3.3.7 Expansion units

3.3.7.1 Mini expansion unit

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 ($\pm 15V$) is available, analog modules (N74, N79) cannot be operated.



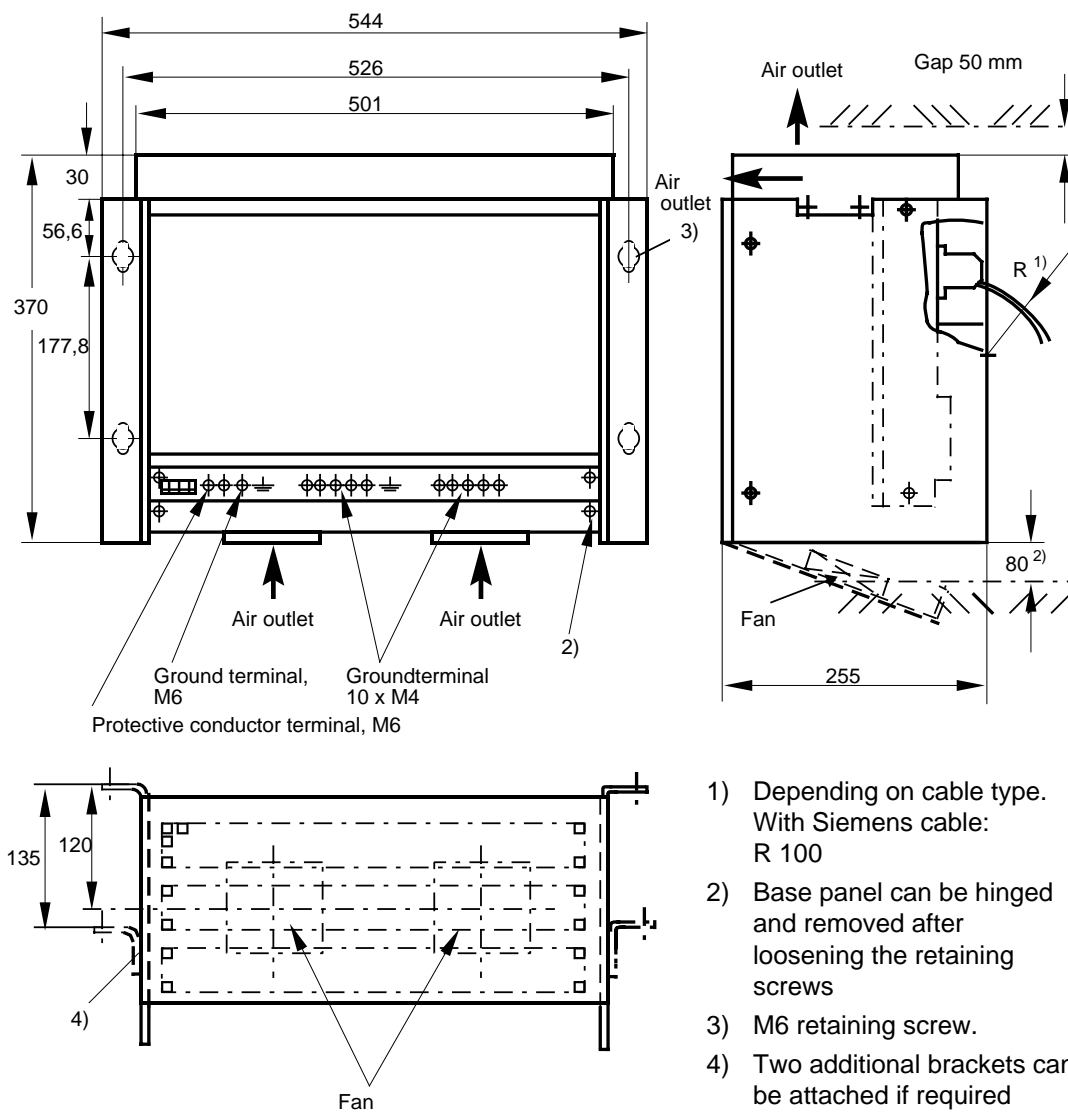
- 1) Depending on cable type.
With Siemens cable:
R 100
- 2) Base panel can be hinged and removed after loosening the retaining screws
- 3) M6 retaining screw.
- 4) Two additional brackets can be attached if required (Order No. 226 104.0362.01)

Mounting conditions

Rated voltage	DC 24 V
Degree of protection to DIN 40050	IP00
Relative humidity class to DIN 40040	F
Temperature of intake air and ambient temperature during operation	0 to 55 °C

3.3.7.2 Expansion unit

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.

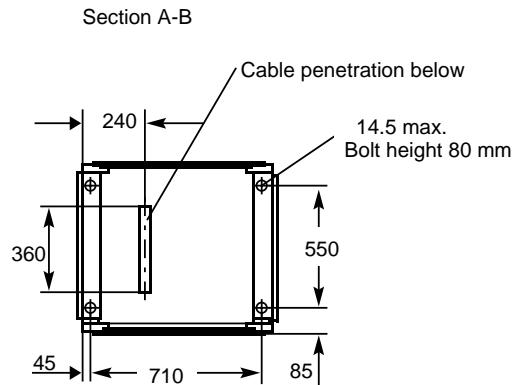
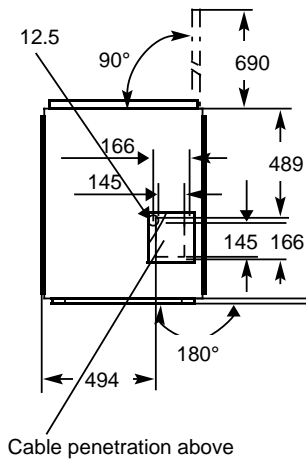
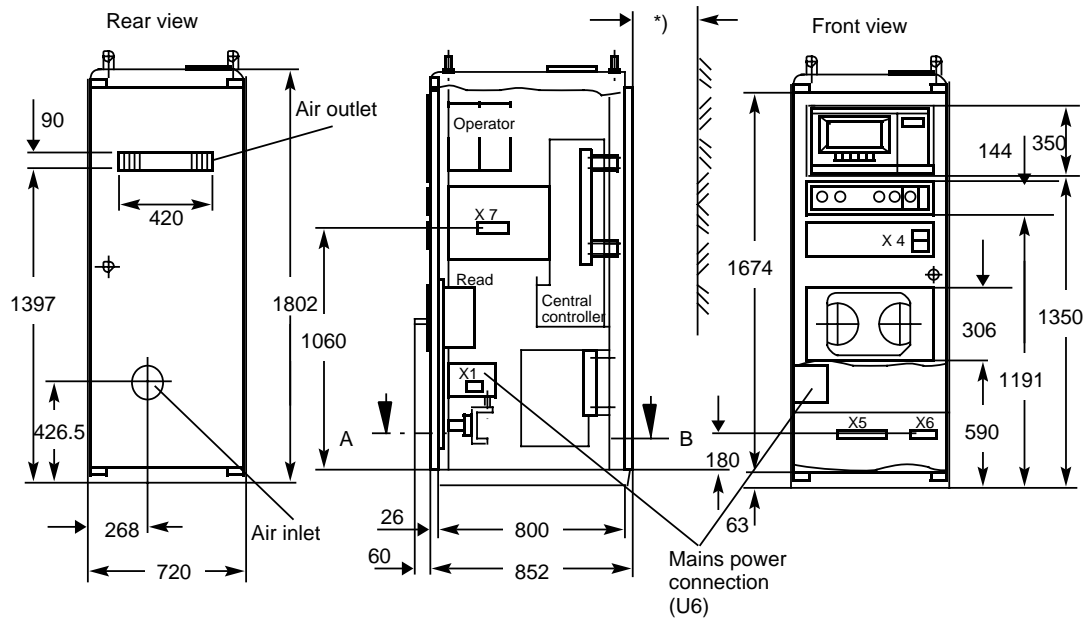


- 1) Depending on cable type.
With Siemens cable:
R 100
- 2) Base panel can be hinged and removed after loosening the retaining screws
- 3) M6 retaining screw.
- 4) Two additional brackets can be attached if required (Order No. 226 104.0362.01)

Mounting conditions

Degree of protection to DIN 40050	IP00
Relative humidity class to DIN 40040	F
Temperature of intake air and ambient temperature during operation	0 to 55 °C

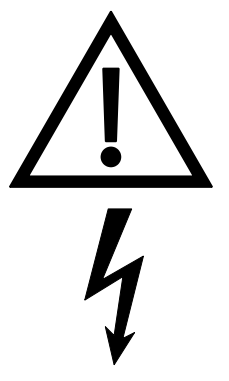
3.3.8 Cabinet-mounted version with heat exchanger



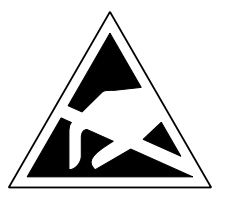
Air flow rate per fan:	440 m ³ /h
Temperature of intake air and ambient temperature T_u	+45 °C
Temperature change	max. 1.1 K / min
Perm. rel. humidity, humidity class F to DIN 40040	F
Intake air	no aggressive gases
Degree of protection DIN 40050	IP 54
max. power loss at $T = 10$ K	725 W equivalent to T_u 45°C
$T = 20$ K	1450 W equivalent to T_u 35°C
Servicing the heat exchanger 8ME78	see Catalog NV21
	Jan. 1984 Supplement
	(order number: E86010-K1921-A111-A1)
	order from: Siemens ZN / LG)

*) Space behind the cabinet
 – for air outlet 150 mm
 – to be able to open the door 750 mm

3.4 Maintenance and servicing

	WARNING
	<p>Hazardous voltages are present in this electrical equipment during operation.</p> <p>Failure to maintain the equipment properly can result in death, serious bodily injury or substantial material damage.</p> <p>The instructions contained in this Section and on product labels have to be followed when carrying out maintenance work.</p> <ul style="list-style-type: none">• Maintenance must be performed by qualified personnel only.• Always de-energize and ground the equipment before carrying out any work (exception: when changing batteries).• Use only authorized spare parts.• The inspection intervals as well as the instructions for repair and replacement must be adhered to.

3.4.1 Electrostatically endangered components (EEC)

	CAUTION
	<p>All modules contain electrostatically endangered components (EEC). Damage can occur if the following precautions are not taken.</p>

Never touch electronic modules unless you are going to carry out work on them.

Before touching an electronic module, you must discharge your body. The simplest way of doing this is to touch a conductive earthed object (e. g. a bare metal part on a switching cabinet, water pipe) immediately before touching the module.

Do not allow modules to come in contact with highly insulating materials such as plastic film, insulating table tops or clothing made of synthetic fibres.

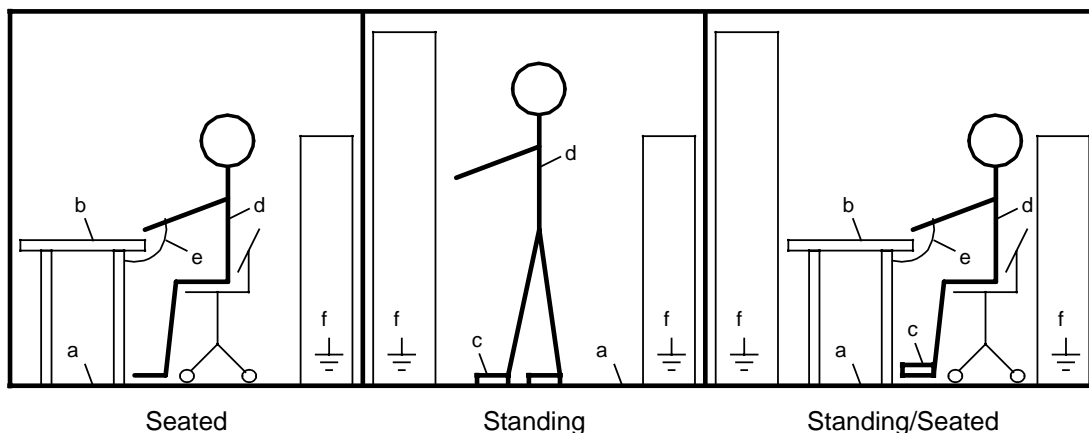
Only ever put modules down only on electrically conducting surfaces.

When carrying out soldering work on modules, make sure that the soldering tip is earthed.

Always pack modules and electronic components in conductive containers (such as metallized plastic boxes or metal cans) before they are stored or shipped.

If the packaging is not conductive, wrap modules in a conductive material first. Conductive foam rubber or household aluminium foil are suitable materials for this.


The necessary protective measures when dealing with sensitive electronic components are illustrated in the Fig. below.



- | | |
|-------------------------|---------------------------------|
| a = Conductive flooring | d = Antistatic overall |
| b = Antistatic table | e = Antistatic chain |
| c = Antistatic footwear | f = Ground terminal on cabinets |

3.4.2 Handling the modules

In addition to the EEC protective measures, please also observe the following:

	CAUTION
	<ul style="list-style-type: none"> • Only ever insert or remove modules when no voltage is applied to them (i. e. the control must be switched off). • Only ever allow signal voltages (at interfaces) to be applied when modules are inserted. <p>The modules can be destroyed or fail prematurely if this is not observed.</p>

3.4.3 Cleaning


The front of the monitor and the surfaces of the control can be cleaned. Remove light dirt with household washing-up liquid or with an industrial cleanser such as "Special Swipe". These cleansers also remove dirt containing graphite.

Other cleansers containing one or several of the following components may also be used for a short time:

- diluted mineral acids
- bases
- alcohol
- organic hydrocarbons
- dissolved detergents
- greases and oils

3.4.4 Replacing batteries

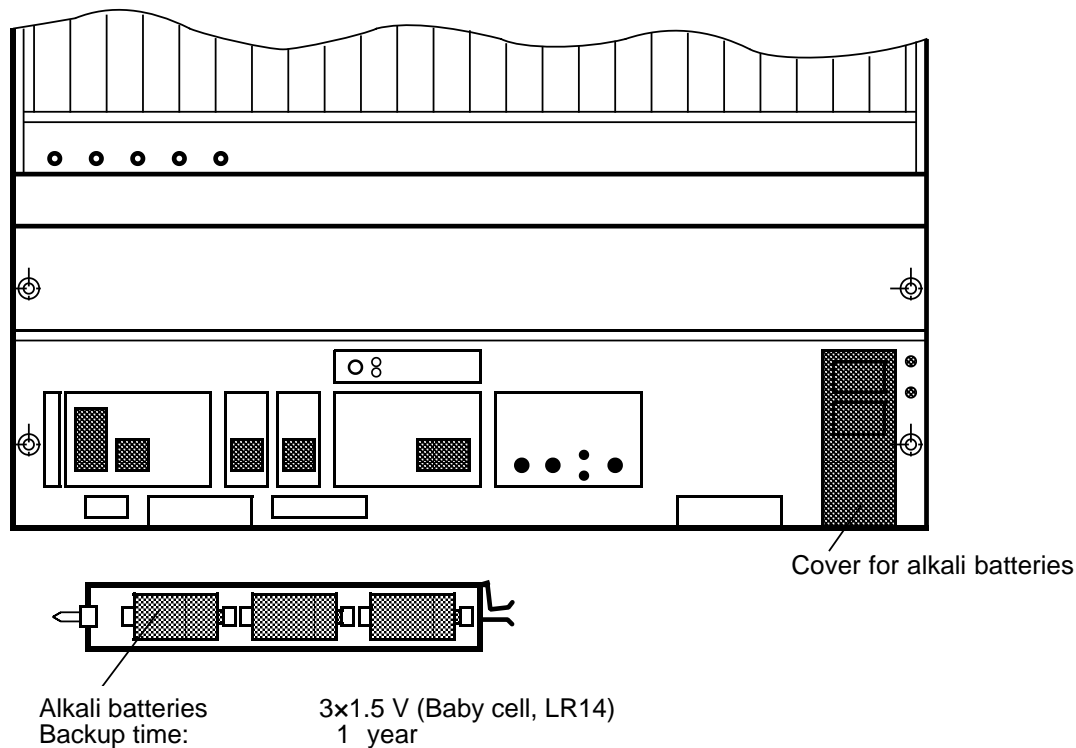
The backup-battery voltage is monitored and an alarm is output if it falls too low. When the monitoring has responded, you must replace the batteries within a week.

	CAUTION
	<p>Do not attempt to reactivate discharged batteries by heating or other methods. Batteries must not be recharged, as this can lead to leakage and/or explosion.</p> <p>Failure to comply with these regulations can lead to injury or material damage.</p>

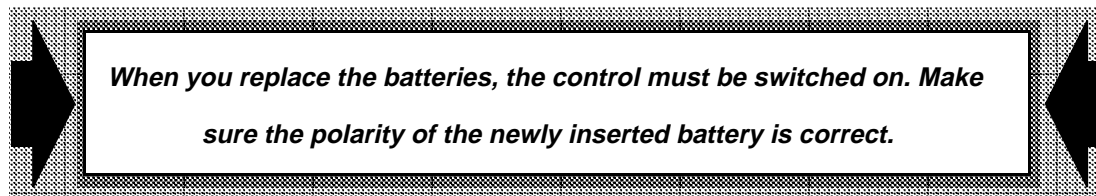
When you replace the batteries, the control must be switched on, otherwise data will be lost. Make sure the polarity of the newly inserted battery is correct.

3.4.4.1 Replacing the batteries in the central controller

Before you can replace the batteries you must pull the cover downwards.

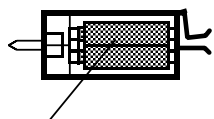
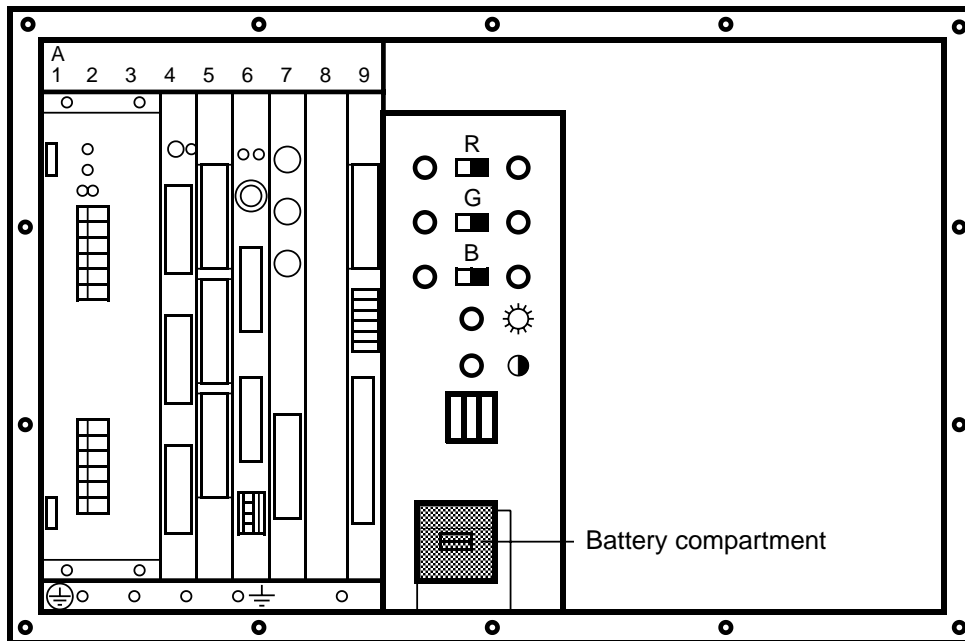


Lower quality batteries (R14) can also be used for a short time. However, this reduces the backup time and increases the risk of leaks.



CAUTION	
	Never throw batteries into fires.
	Never dismantle batteries.
	Dispose of used batteries separately from other waste (special waste disposal). The national regulations valid in the country of installation must be observed.

3.4.4.2 Replacing the batteries in the operator panel



Alkali batteries: 3x1.5 V (Mignon cell, LR6)
 Backup time: 1 year

Lower quality batteries (R6) can also be used for a short time. However, this reduces the backup time and increases the risk of leaks.

When you replace the batteries, the control must be switched on. Make sure the polarity of the newly inserted battery is correct.

	CAUTION
	<p>Never throw batteries into fires.</p> <p>Never dismantle batteries.</p> <p>Dispose of used batteries separately from other waste (special waste disposal). The national regulations valid in the country of installation must be observed.</p>

4 Machine Control Panel

4.1 General

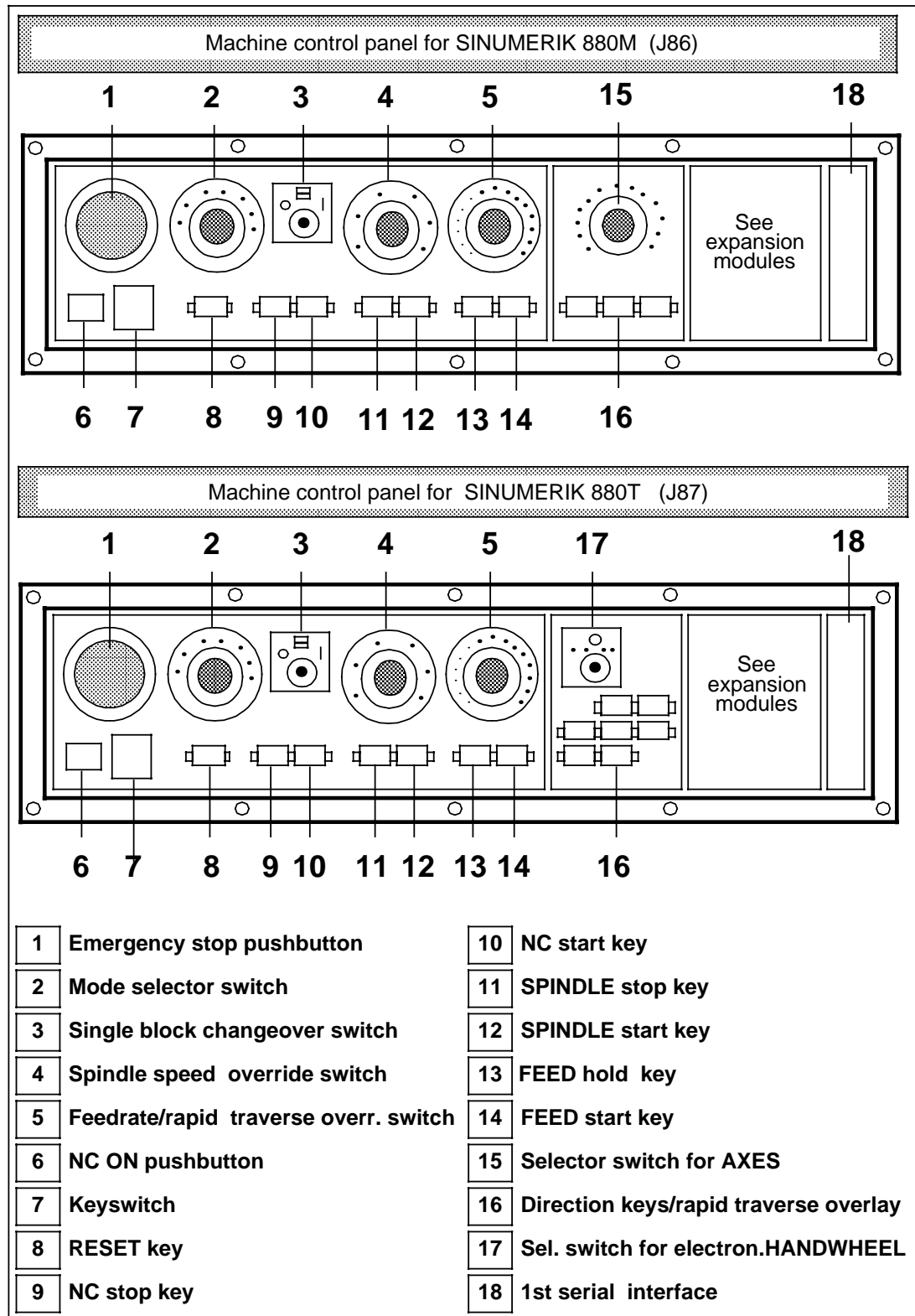
The machine control panel is interfaced to the operator panel through an I/O submodule. Apart from the machine control panel signals, other input/output signals can be transferred to the PLC via the I/O submodule. You can connect a maximum of four I/O submodules.

You can use FB 78 for transferring the machine control panel signals to the NC/PLC interface.

4.2 Arrangement of the machine control panel

The machine control panel operates at a level of 24 V DC. 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.

The machine control panel can also be made up and wired from single elements. The coded selector switches are such single elements. These coded selector switches are described in Section 4.4.

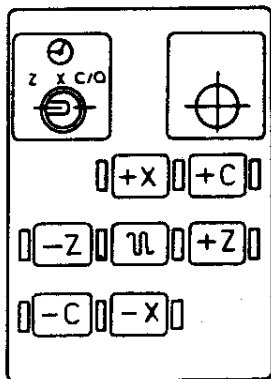


SINUMERIK 880 machine control panel

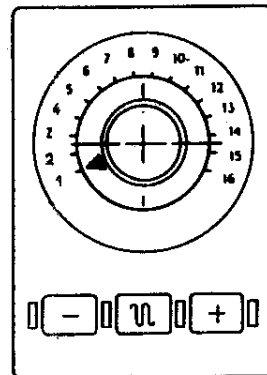
Expansion module:

The short order code (J) designates the machine control panel with the expansion module fitted, the long order number (6FC3 ...) designates the expansion module alone.

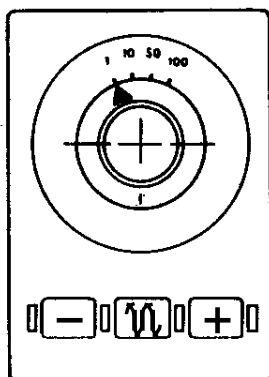
6FC3 986-3DR20 (J75)
Double-slide module



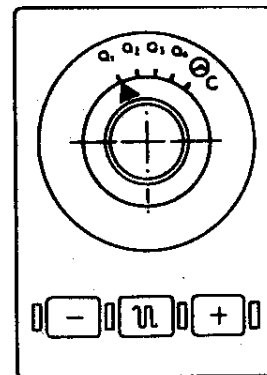
6FC3 986-3DB20 (J61) M version
6FC3 986-3DC20 (J62) T version
2nd axis module (16 positions)



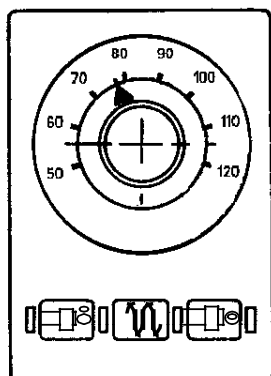
6FC3 986-3DD20 (J63) M version
6FC3 986-3DE20 (J64) T version
Rapid traverse override switch module



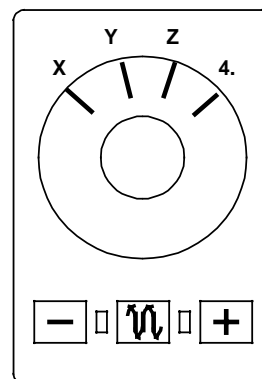
6FC3 986-3DJ20 (J68) M version
6FC3 986-3DK20 (J69) T version
Auxiliary axis module



6FC3 986-3DM20 (J71) M version
6FC3 986-3DN20 (J72) T version
2nd spindle speed override module



6FC3 986-3DP20 (J73) M version
6FC3 986-3DQ20 (J74) T version
2nd axis module (4 positions)



Assignment of inputs by machine control panel

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

All pins, connector X02 404

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

Double-slide submodule (Connector X 02 406 I/O submodule)										
ByteNo.	Bit: 7	6	5	4	3	2	1	0		
IB 68	Handwheel Bit 1 10	Direction keys X+ 9	Direction keys X- 8	Direction keys Z+ 7	Direction keys Z- 6	Rapid traverse 5	Direction keys C+ 4	Direction keys C- 3		
IB 69	18	17	16	15	14	13	spare 12	Handwheel Bit 2 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 + 10	Direction keys - 9	Rapid traverse 8	E 7	D 6	Axis selector switch C 5			B 4	A 3
IB 69	18	17	16	15	14	13	spare 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					C 5	Rapid traverse override B 4			A 3
IB 69	18	17	16	15	14	13	spare 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 + 10	Direction keys - 9	Rapid traverse 8	E 7	D 6	Axis selector switch C 5			B 4	A 3
IB 69	Free for user via connector X 02 405					spare 13		12		11

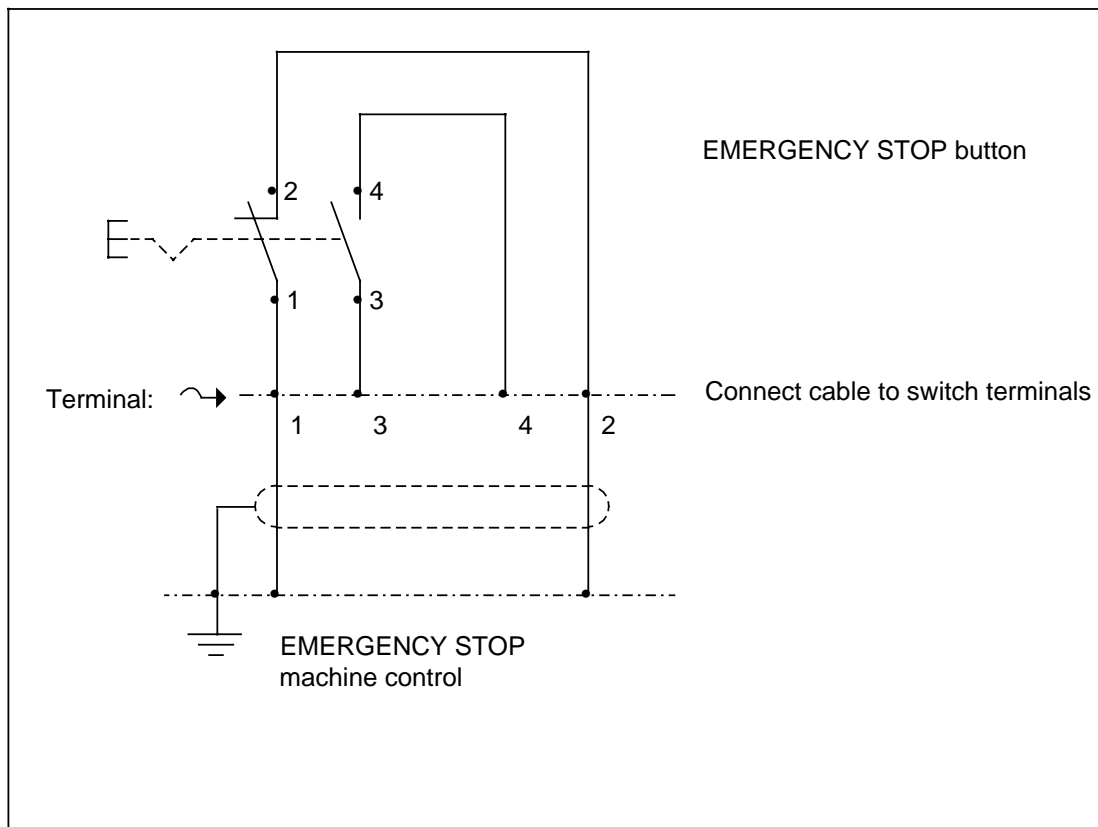
4.3 Description of machine control panel signals

4.3.1 EMERGENCY STOP

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

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

Suggested wiring for EMERGENCY STOP system:









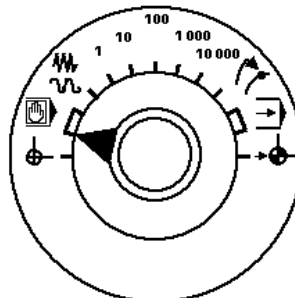
4.3.2 Mode switch

Order No.: 6FC9 301-0AE

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

The operating modes are selected with the mode switch.

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

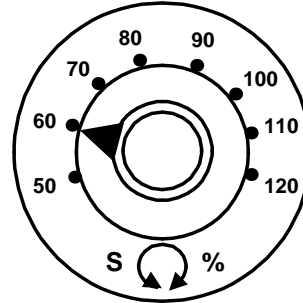


4.3.3 Spindle speed override switch

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 in machine data.
 In the case of rotary feed or constant cutting speed, spindle speed override causes the feed drives to adapt their speed 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



4.3.4 Feedrate override switch

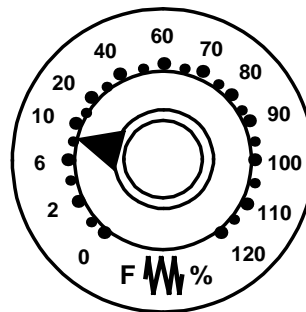
Order No.: 6FC9 301-0BC

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 in machine data.

The 0% position 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

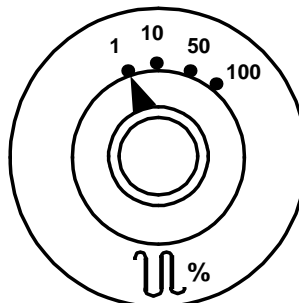


4.3.5 Rapid traverse override switch

Order No.: 6FC9 301- 0CD

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

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



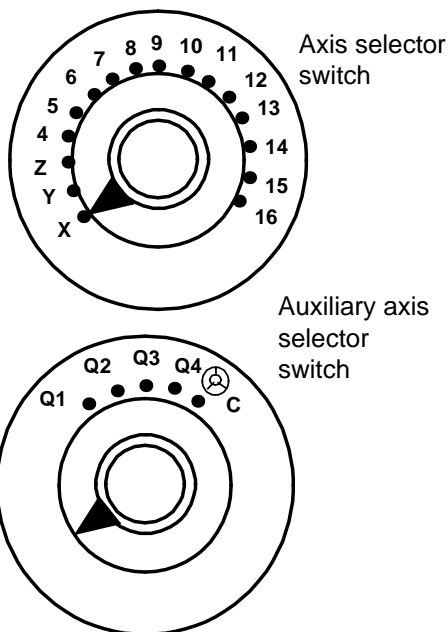
4.3.6 Axis selector switch

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

6FC9 301- 0DD (axis selector)

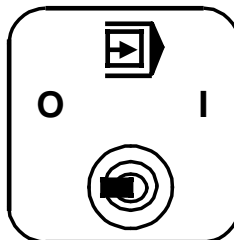
Selector switch, 16 positions, Gray-coded, overlapping contact arrangement.
 In the JOG, INC, REF and REPOS setup modes, the axis to be traversed is preselected using the axis selector switch. The selected axis then moves when you press the +or the - direction key.

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	



4.3.7 Single block

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

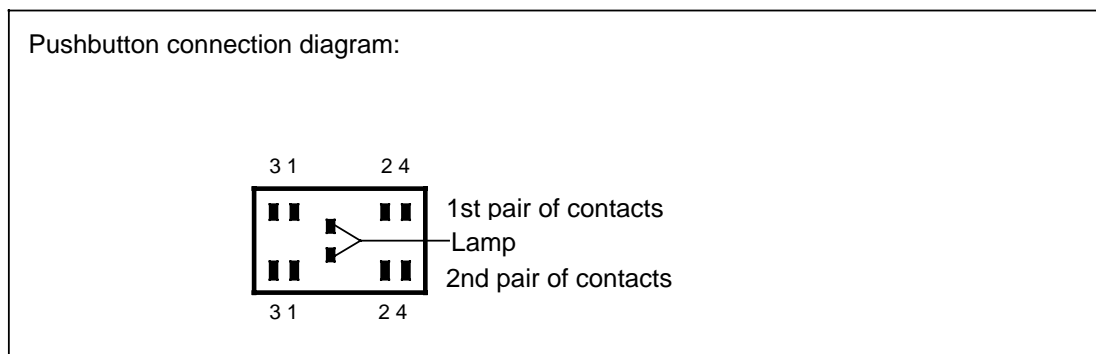
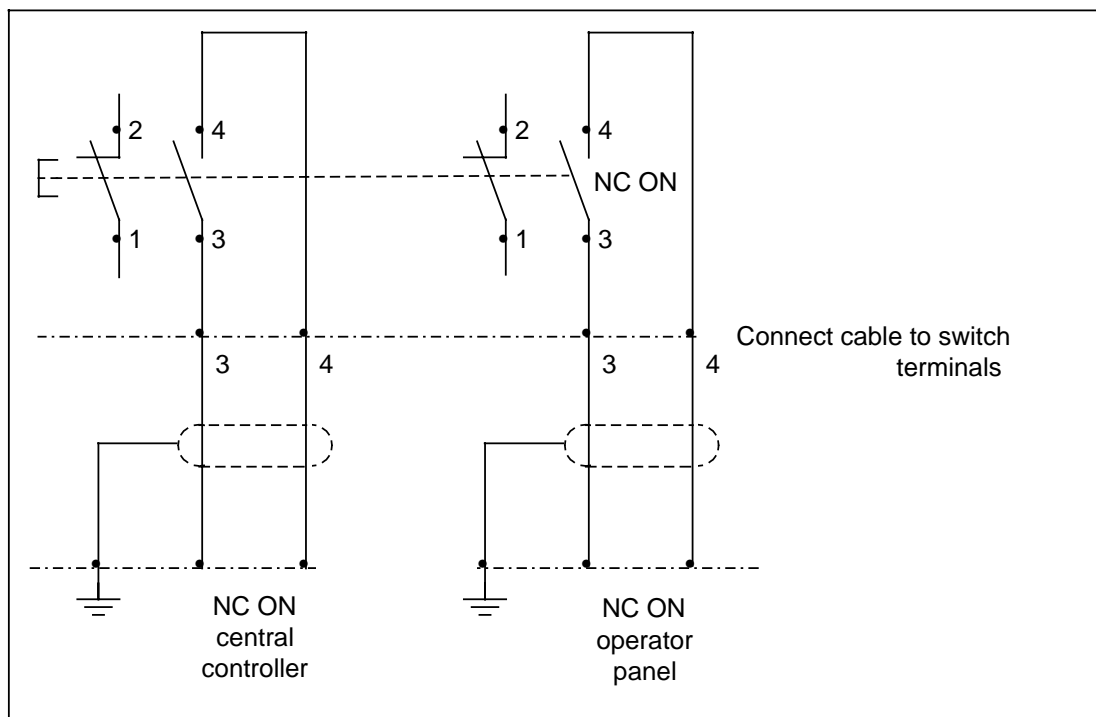


4.3.8 NC ON



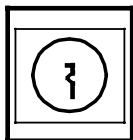
Connected via screened cable directly on pushbutton. The screen is connected to the power supply of the central controller and of the operator panel on one side.

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



Do not connect the NC ON from the operator panel and central controller to the same pushbutton (NO contact). Two separate NO contacts are always required.

4.3.9 Keypad



Keypad, 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.

4.3.10 RESET



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

4.3.11 NC stop



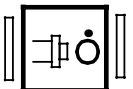
Pushbutton, 1 normally open contact
0 signal: NC STOP button pressed

4.3.12 NC start

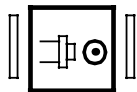


Pushbutton, 1 normally closed contact
1 signal: NC START button pressed

4.3.13 SPINDLE STOP



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

4.3.14 SPINDLE START

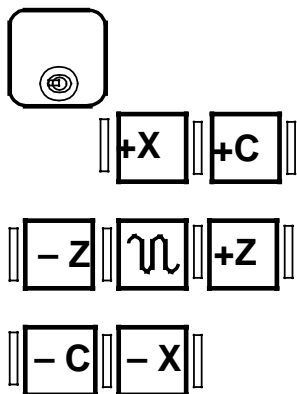
Pushbutton, 1 normally closed contact
1 signal: SPINDLE START button pressed

4.3.15 FEED HOLD

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

4.3.16 FEED START

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

4.3.17 Direction keys

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

4.3.18 PLUS/MINUS direction keys

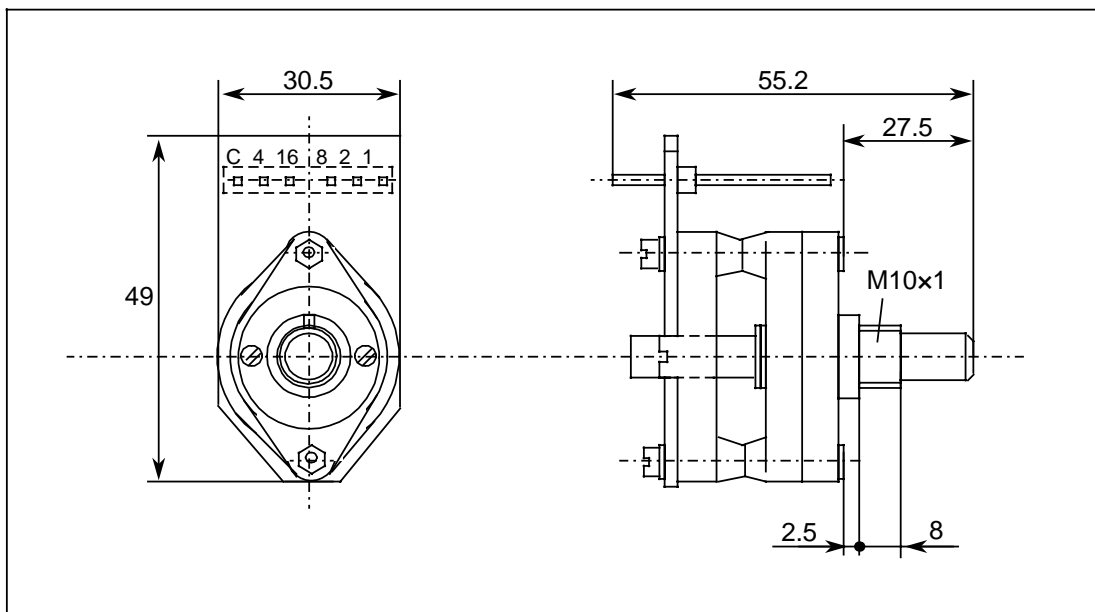
1 normally closed contact per key
1 signal: + or - direction key pressed

4.3.19 Rapid traverse overlay

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

4.4 Coded selector switches / codings

4.4.1 Coded selector switch



Used in the machine control panel as ...	Possible switch positions		Switching angle	Order No.
	available	in use		
Mode switch	16	13	15°	6FC9 301 - 0AE
Spindle speed override switch	16	15	15°	6FC9 301 - 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

4.4.2 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

4.4.3 Spindle override switch coding

Order No.: 6FC9 301-0EC

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

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

4.4.4 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

4.4.5 Rapid traverse override switch coding

Order No.: 6FC9 301-0CD

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

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

4.4.6 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.

4.4.7 Axis and auxiliary axis selector switch coding

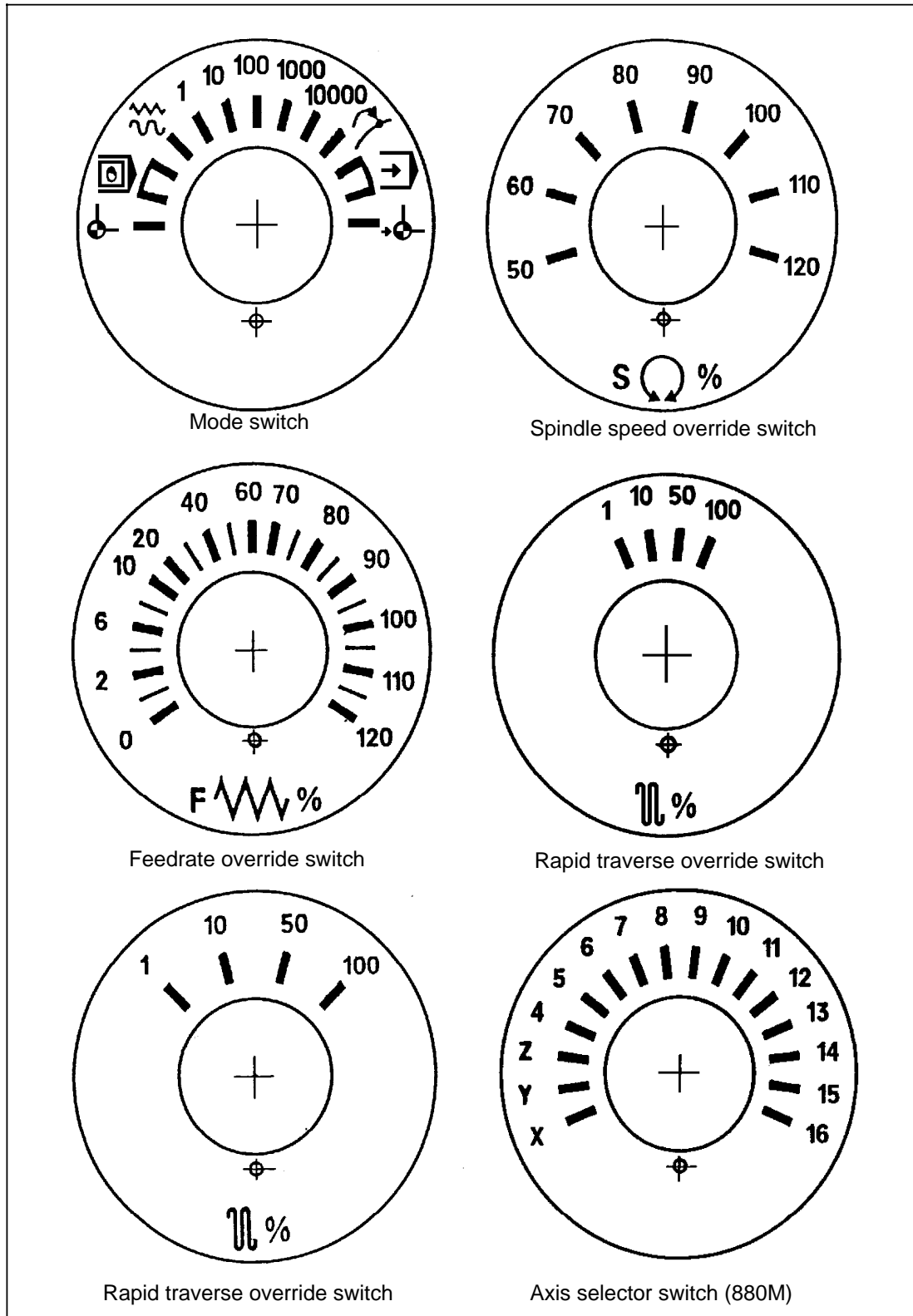
Order No.: 6FC9 301-0DD

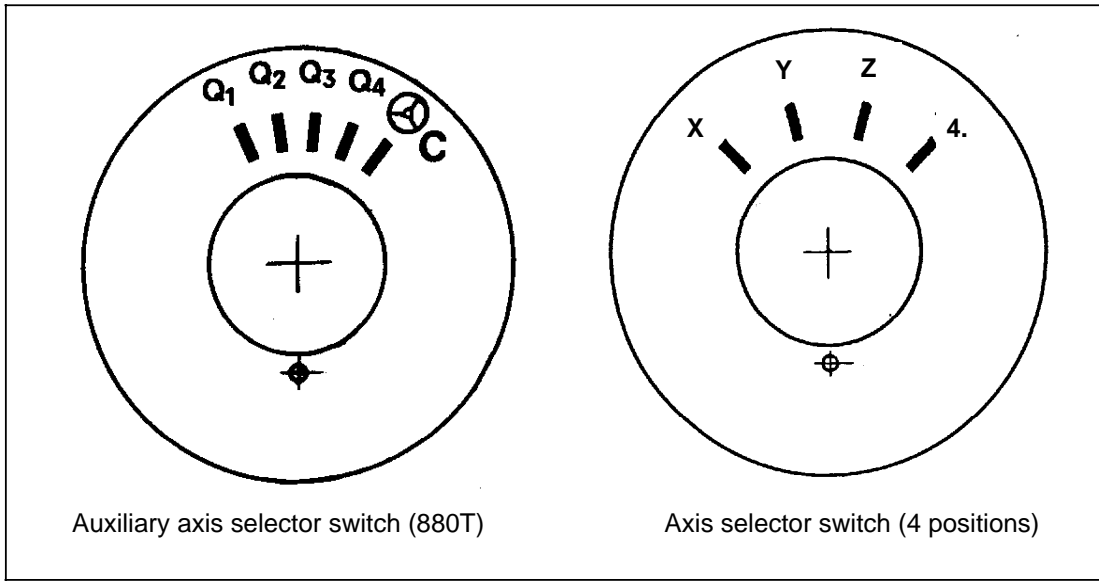
6FC9 301-0DE

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

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

4.4.8 Labelling





5 Distributed Machine I/Os (DMP)

DMP is a range of devices enabling I/O devices (e.g. digital input and output modules) to be used in different places on the machine. Distributed configuration means that the SINUMERIK control and the input/output points at the process level may be far apart. Those distances can be covered by a serial bus (four-wire cable).

Distributed machine I/Os can be connected both optionally or additionally to the inputs/outputs in the central controller (central I/O devices). Like central I/O devices, inputs/outputs of the DMP can be accessed via the PLC program.

5.1 General

DMP operates on the MASTER-SLAVE principle with the distributed I/O modules constituting the slaves.

In the central controller the interface DMP fulfills the function of an MPC interface module. Several DMP stations can be linked into each MPC line, which you can split into two "MPC sub-lines" to facilitate cabling. You must assign a DMP station number to every DMP station. The DMP station numbers can be assigned in any order.

Addressing (setting the DMP station numbers):

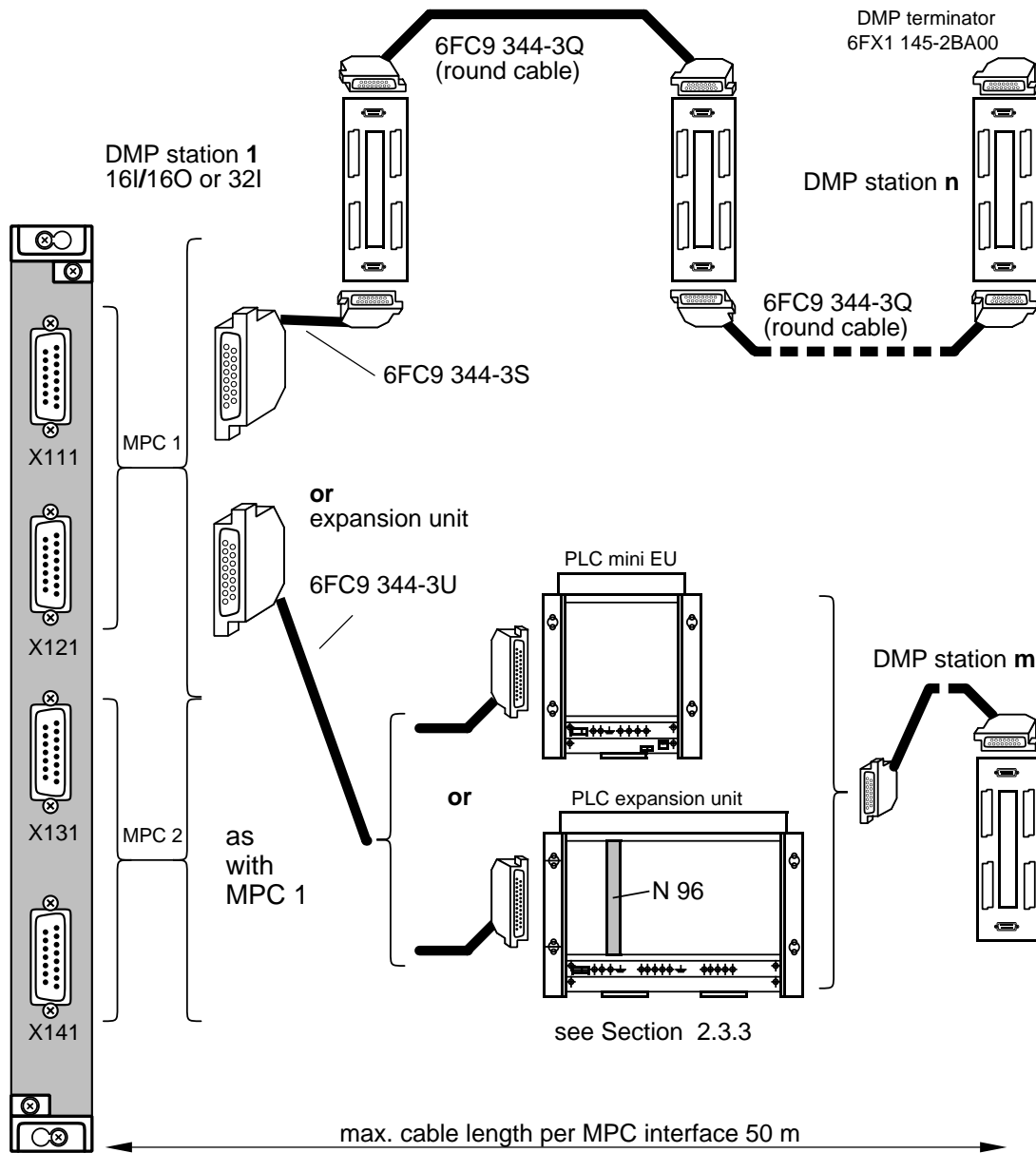
Rotary switch position	DMP station number
F	Not permissible
E	1
D	2
C	3
⋮	⋮
0	15

You can set the DMP station numbers to the DMP stations using the rotary switch.

Note:

Configuring is possible either via machine data or data blocks (see Installation Guide, Instructions). Mixed configuring is not possible. In contrast to the machine data configuring method, configuring via data blocks is less restrictive and does not require any particular order (see Installation Guide, Instructions) of slot and address assignments.

5.2 Typical applications

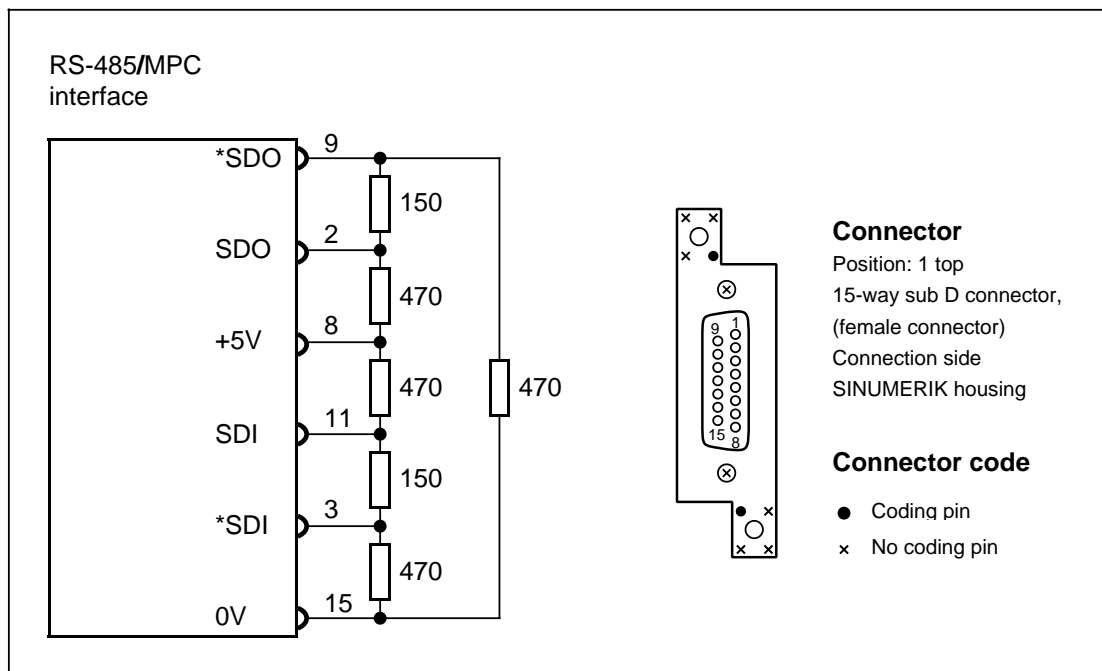


Various DMP stations are available:

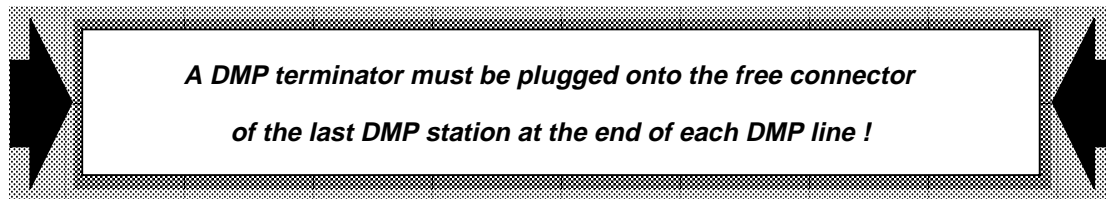
- DMP terminal block, can be fitted with
 - DMP module with 16 inputs and outputs
 - DMP module with 32 inputs
- DMP compact terminal block (available soon), can be fitted with
 - DMP compact module with 8 outputs
 - DMP compact module with 16 outputs
 - DMP compact module with 16 inputs
- DMP terminal block with DMP submodule in IP 65 version (available soon)
- SINUMERIK mini/maxi expansion unit

5.3 DMP terminator**6FX1 145-2BA0**

To terminate the bus, the DMP terminator must be plugged into the second (free) RS-485/MPC interface connector of the last DMP station.

**Note:**

In the case of the DMP terminal block with the DMP submodule version with degree of protection IP 65, the termination is achieved by closing the DIP-FIX switches in the lower part of the housing. The termination must be carried out on the master side!

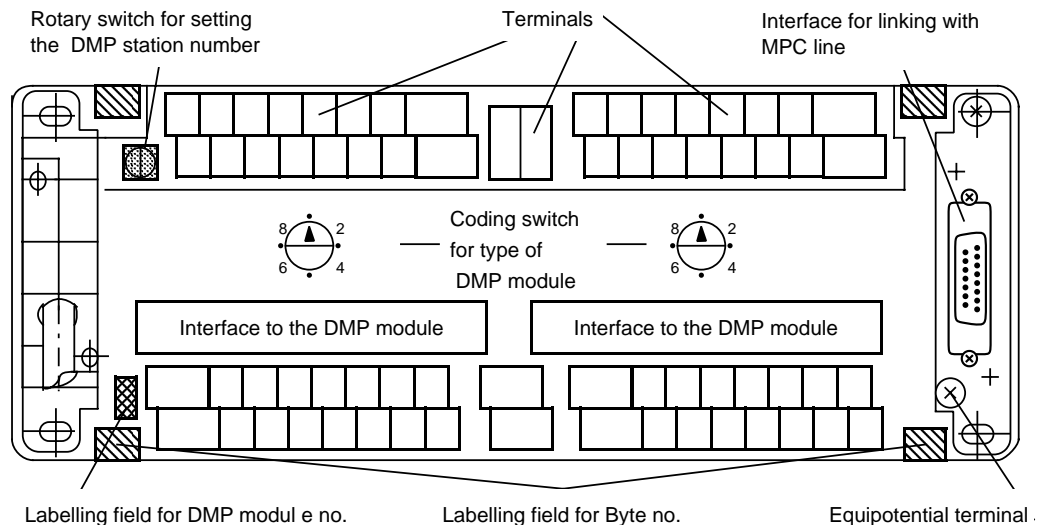


5.4 DMP modules

5.4.1 DMP terminal block

6FX1 142-1BA01

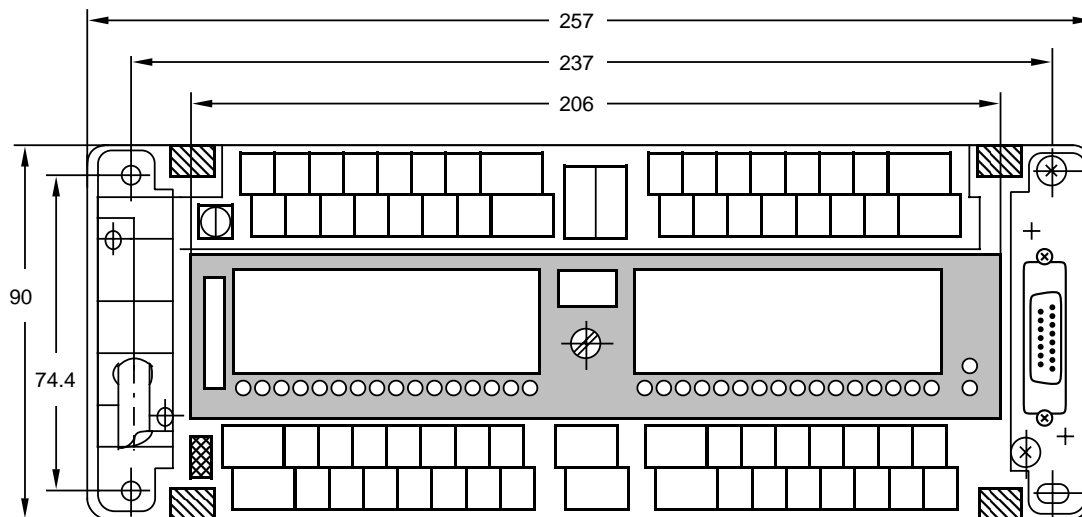
The DMP terminal block is a carrier module for the DMP modules. It is fitted with two RS-485/MPC interfaces.

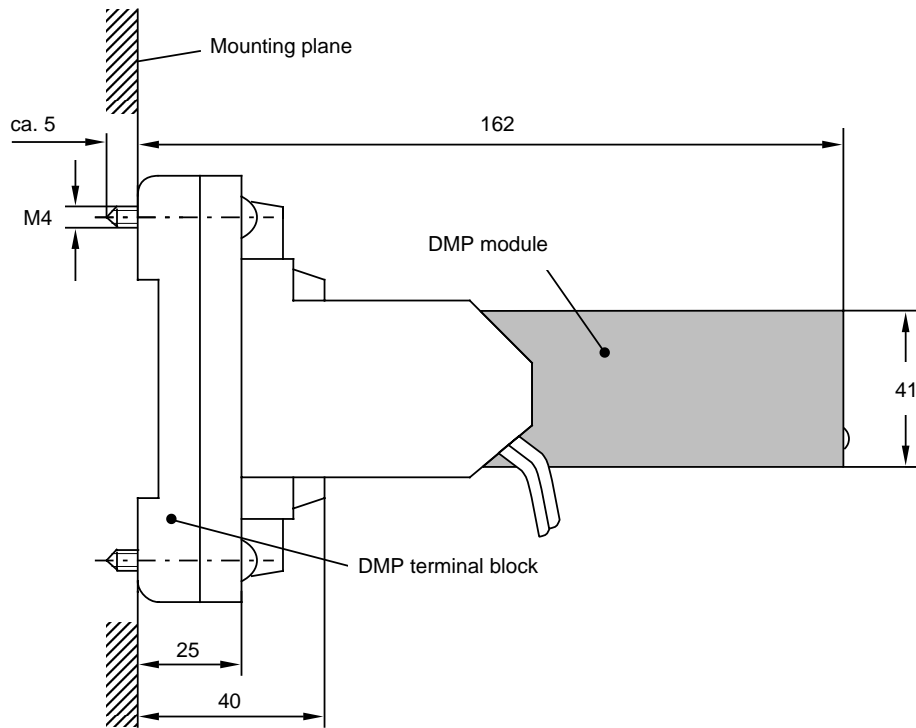


You must set the rotary switches for the type of DMP module on the DMP terminal block to agree with the DMP module used. The position of the rotary switch on the DMP submodules **must** correspond to the position in the following table.

CODE I	CODE II	DMP modul
1	7	only DMP module 16 I/16 O
1	8	only DMP module 32 I

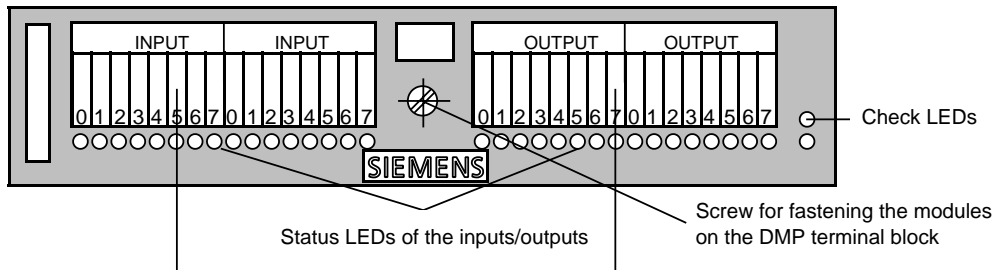
Dimensions and mounting dimensions of the DMP terminal block with DMP modules



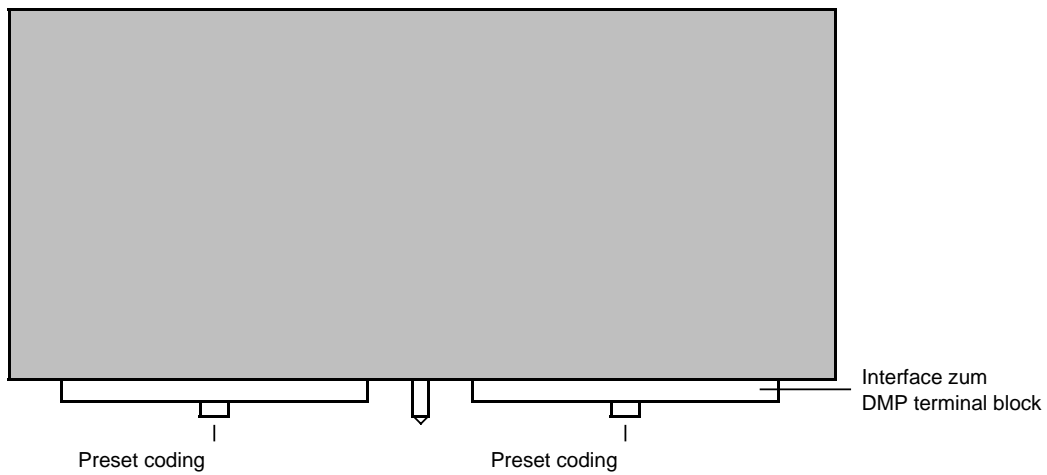


5.4.2 DMP module 16 I/16 O

6FX1 142-4BA04



Labelling strips (shown here for DMP module 16 I/16 O)



Meaning of the check LEDs:

Red LED is lit:

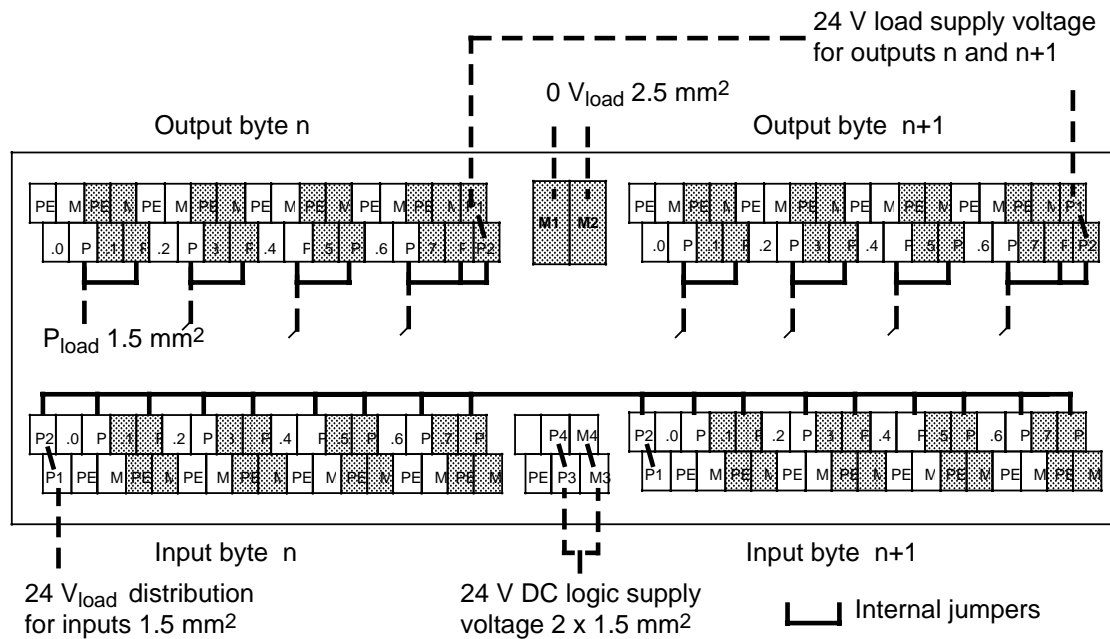
- The 24 V logic supply voltage has dropped below the value of 15 V.
- Transmission error

Yellow LED is lit:

- The 5 V supply voltage generated from the 24 V logic supply voltage is within the tolerance range of 4.75 V to 5.25 V.

The following terminals are internally connected by jumpers:

- all PE terminals,
- all M1, M2, M terminals,
- all other jumpers are shown in the diagram

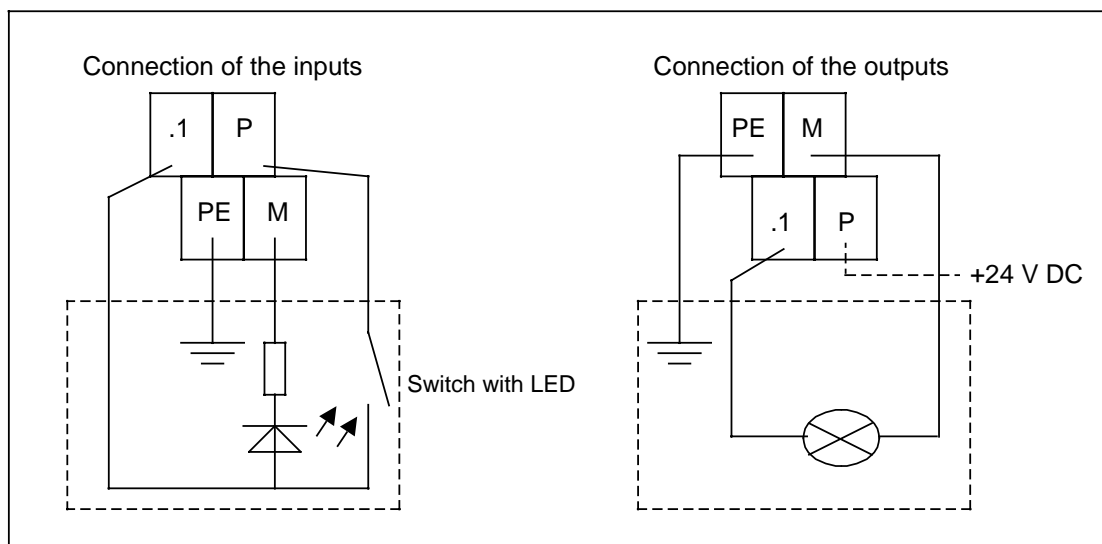


Connection of supply voltages:

- Logic supply voltage, 24 V DC
 The 24 V/0 V logic supply voltage is connected to P3 (P4) and M3 (M4).

- Load supply voltage, 24 V DC
 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 terminal block. The +24 V load current supply for the two 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 module.

The P terminals of the output bytes are arranged in pairs by means of jumpers in the DMP module. The +24 V voltage (load current supply) must therefore be connected only to every second terminal.



Connection of the inputs and outputs

Technical data:

Inputs:	+24 V, 3 ... 10 mA
Operating point:	H level >13 V
	L level <5 V
Operating time:	<1 ms
Outputs:	+24 V, 2 A short-circuit proof, non-floating, simultaneity factor per byte: 0.5

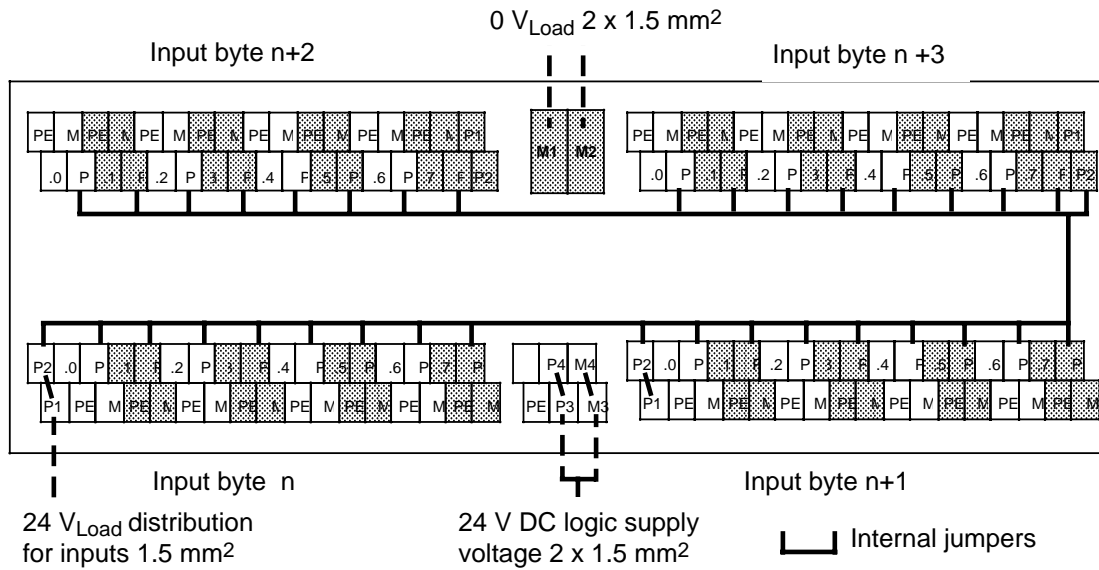
5.4.3 DMP module 32 I

6FX1 142-2BA02

See Section 5.4.2 for a diagram of a DMP module.

The following terminals are internally connected by jumpers:

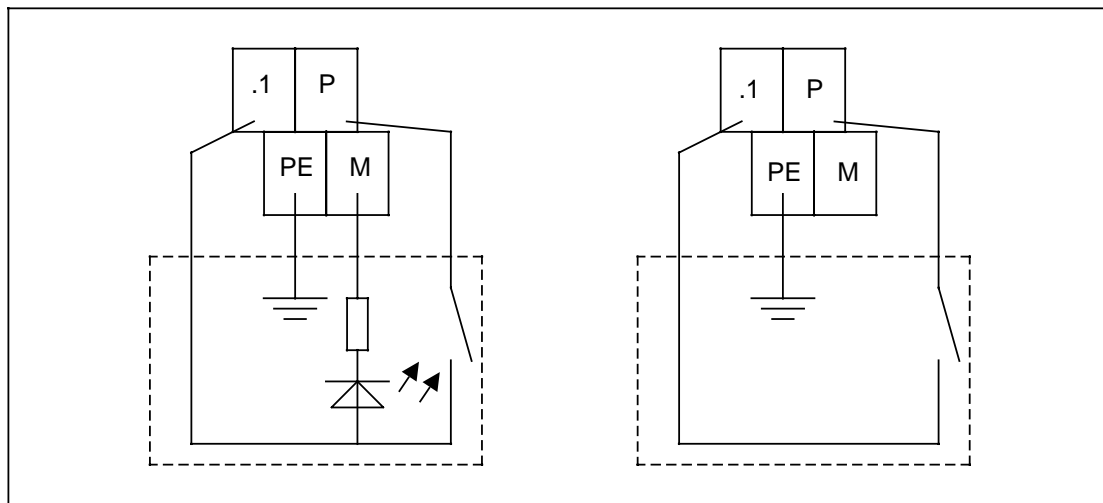
- all PE terminals
- all M1, M2, M terminals
- all other jumpers are shown in the diagram



Connection to power supply:

- Logic supply voltage, 24 V DC
 The 24 V I/O V logic supply voltage is connected to P3 (P4) and M3 (M4).
- Load supply voltage, 24 V DC

The 0 V potential for the load supply voltage 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 terminal block. The +24 V load current supply for all 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 module.



Connection of inputs

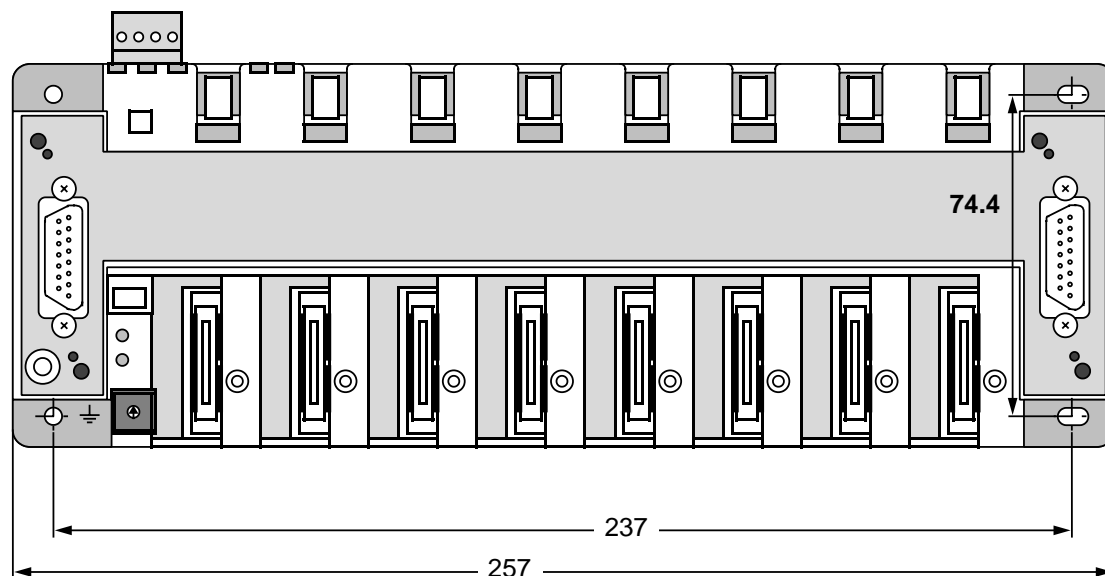
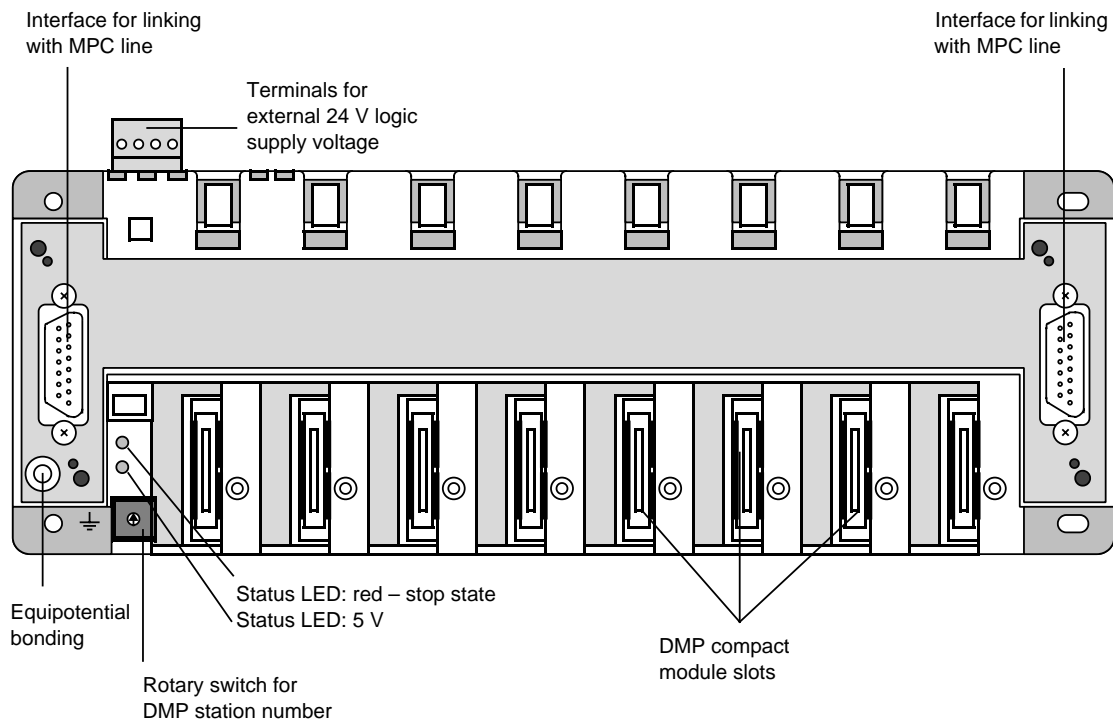
Technical data:
 Inputs: +24 V, 3 ... 10 mA
 Operating point: H level >13 V; L level <5 V
 Operating time: <1 ms

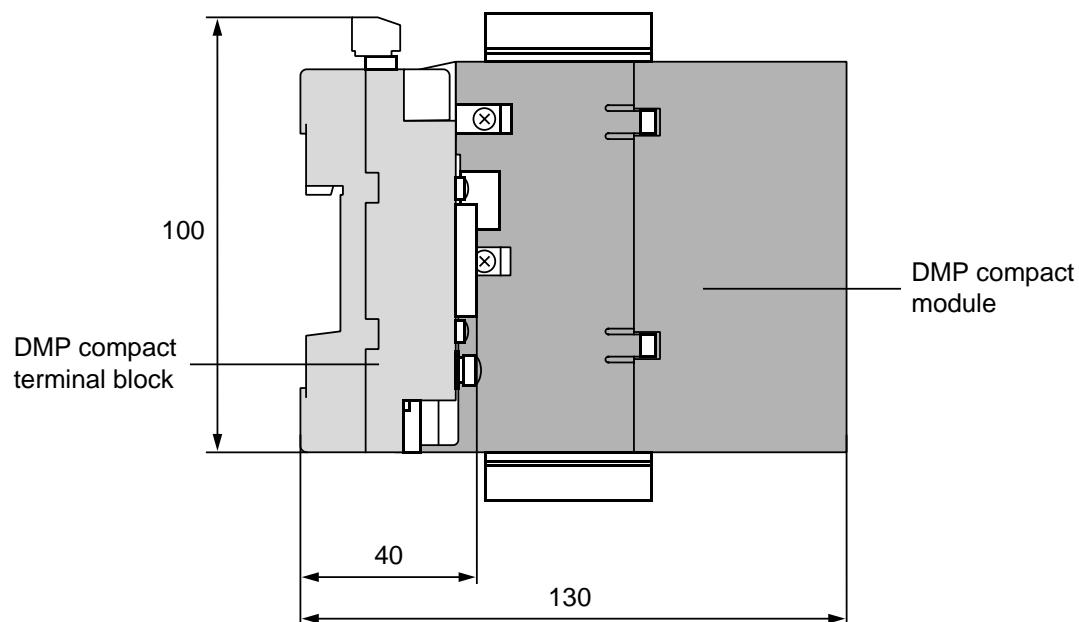
5.5 DMP compact


5.5.1 DMP compact terminal block (available soon)

6FC5 111-0CA73-0AA1

The DMP compact terminal block is a carrier module for the DMP compact modules. It is fitted with two RS-485/MPC interfaces. Up to eight DMP compact modules can be connected to the DMP compact terminal block. Not all slots need be used.





	DANGER
	Never remove or insert the DMP compact modules during operation. Make sure that the DMP compact modules are properly secured.

Interfaces:

- Two 15-way sub D male connectors for connection to MPC line
- Voltage supply via 24 V DC terminal block
P1—P2 jumpered
M1—M2 jumpered to "loop through" the current supply
- Eight 30-way connectors for connecting the DMP compact modules. (The modules are supplied and addressed via these female connectors.)

Meaning of the check LEDs:

Red LED is lit:

- General fault

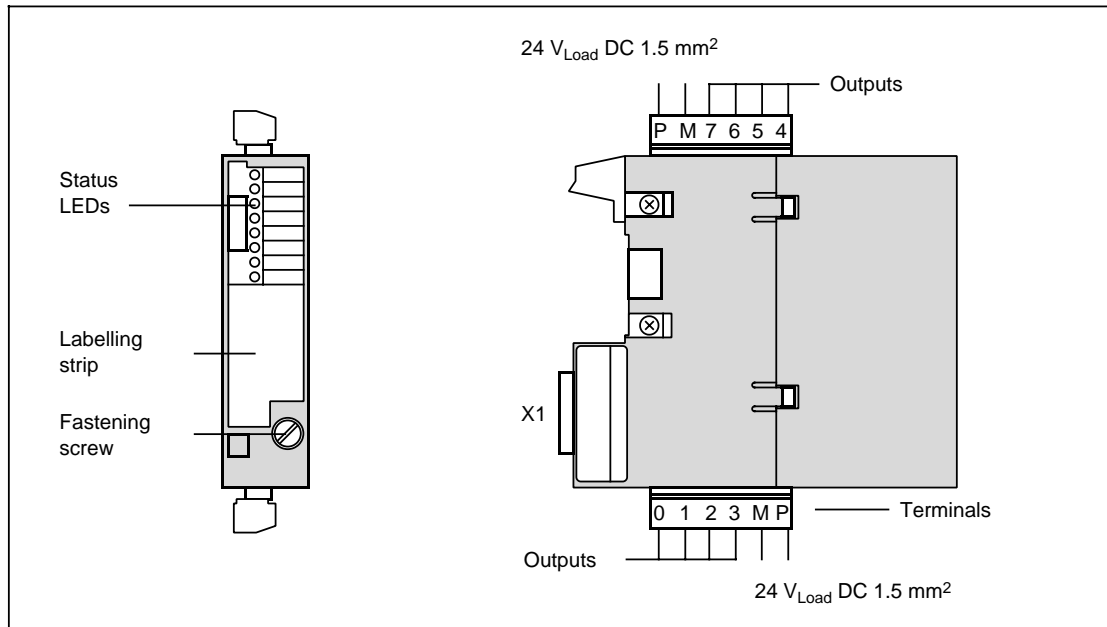
Yellow LED is lit:

- The 5 V supply voltage generated from the 24 V logic supply voltage is within the tolerance range of 4.75 V to 5.25 V.

5.5.2 DMP compact module 8 O (available soon)

6FC5 111-0CA03-0AA1

The DMP compact module 8 O is an encapsulated module. It can be inserted into a slot on the DMP compact terminal block.



Interfaces:

- A 30-way connector X1 for connection to the DMP compact terminal block.
- Two 6-terminal blocks for connection of the 8 outputs and the load power supply (24 V).
- The terminals can be plugged in and coded.

Display elements:

Eight LEDs as status display for the logic states of the outputs.

Technical data:

Outputs: +24 V, short-circuit proof, electrically isolated

The module has 8 outputs. These outputs are designed for load voltages of 24 V (max. 30 V) and a current load of max. 2 A (= 48 VA typ. per output). Either ohmic, inductive or lamp loads can be operated.

Four outputs are supplied by one power supply each. For each group of four outputs (outputs 0 to 3 and 4 to 7), the sum of output currents must not exceed 4 A (this corresponds to a simultaneity factor of 50 % if all outputs are fully loaded). For example, all eight outputs can be loaded with 1 A.

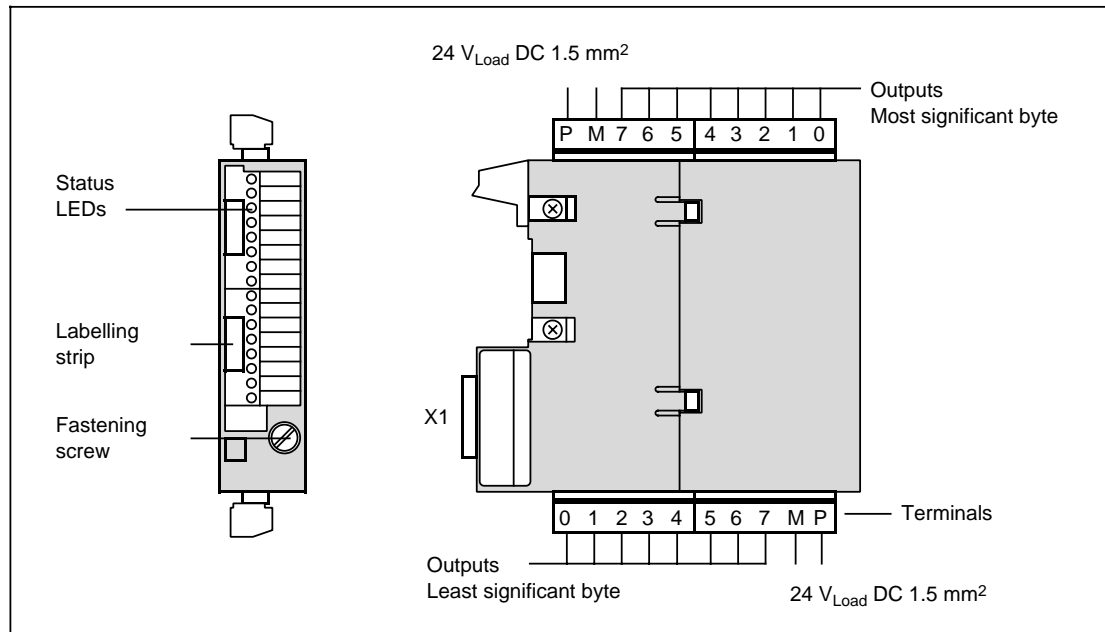
Note:

When inductive loads are used, switching voltage peaks have to be suppressed by external free-wheeling diodes!

5.5.3 DMP compact module 16 O (available soon)

6FC5 111-0CA02-0AA0

The DMP compact 16 O is an encapsulated module. It can be inserted into a slot on the DMP compact terminal block.



Interfaces:

- A 30-way connector X1 for connection to the DMP compact terminal block.
- Two 10-terminal blocks for connection of the 16 outputs and the load power supply (24 V).
- The terminals can be plugged in and coded.

Display elements:

16 LEDs as status display for the logic states of the outputs.

Technical data:

Outputs: +24 V, short-circuit proof, electrically isolated

The module has 16 outputs. These outputs are designed for load voltages of 24 V (max. 30 V) and a current load of max. 0.5 A (= 12 VA typ. per output). Either ohmic, inductive or lamp loads can be operated.

Eight outputs are supplied by one power supply each. For each group of 8 outputs (2 x outputs 0 ... 7), the sum of output currents must not exceed 2 A (this corresponds to a simultaneity factor of 50 % if all outputs are fully loaded). For example, all 16 outputs may be loaded with 0.25 A.

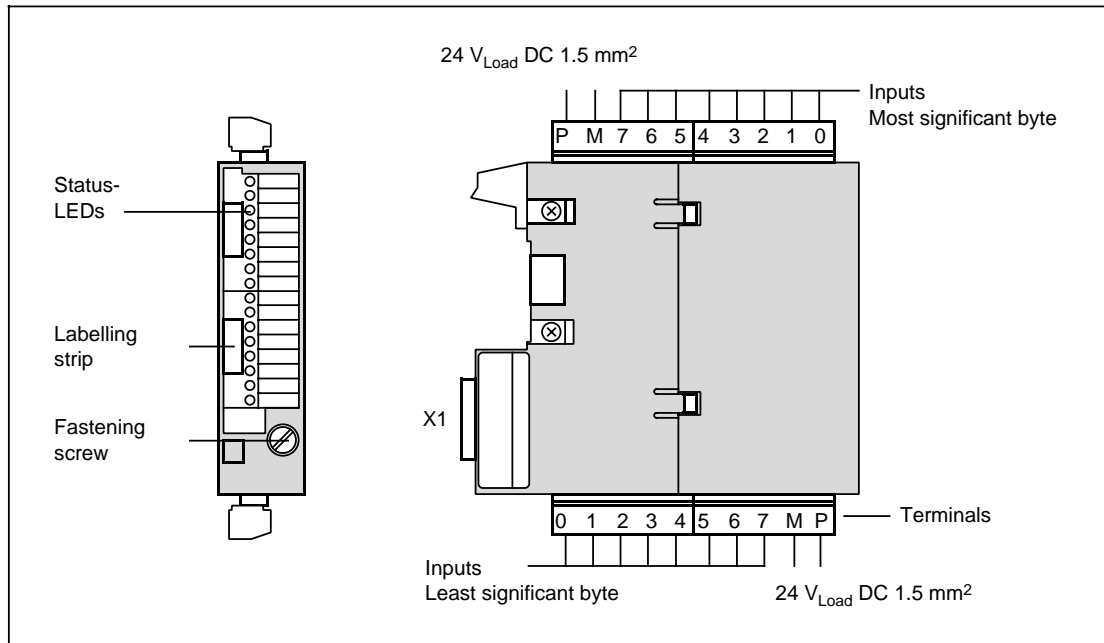
Note:

When inductive loads are used, switching voltage peaks have to be suppressed by external free-wheeling diodes!

5.5.4 DMP compact module 16 I (available soon)

6FC5 111-0CA01-0AA0

The DMP compact module 16 I is an encapsulated module. It can be plugged into a slot on the DMP compact terminal block.



Interfaces:

- A 30-way connector X1 for connection to the DMP compact terminal block.
- Two 10-terminal blocks for connection of the 16 inputs and the load power supply
- The terminals can be plugged in and coded.

Display elements:

16 LEDs as status display for the logic states of the inputs.

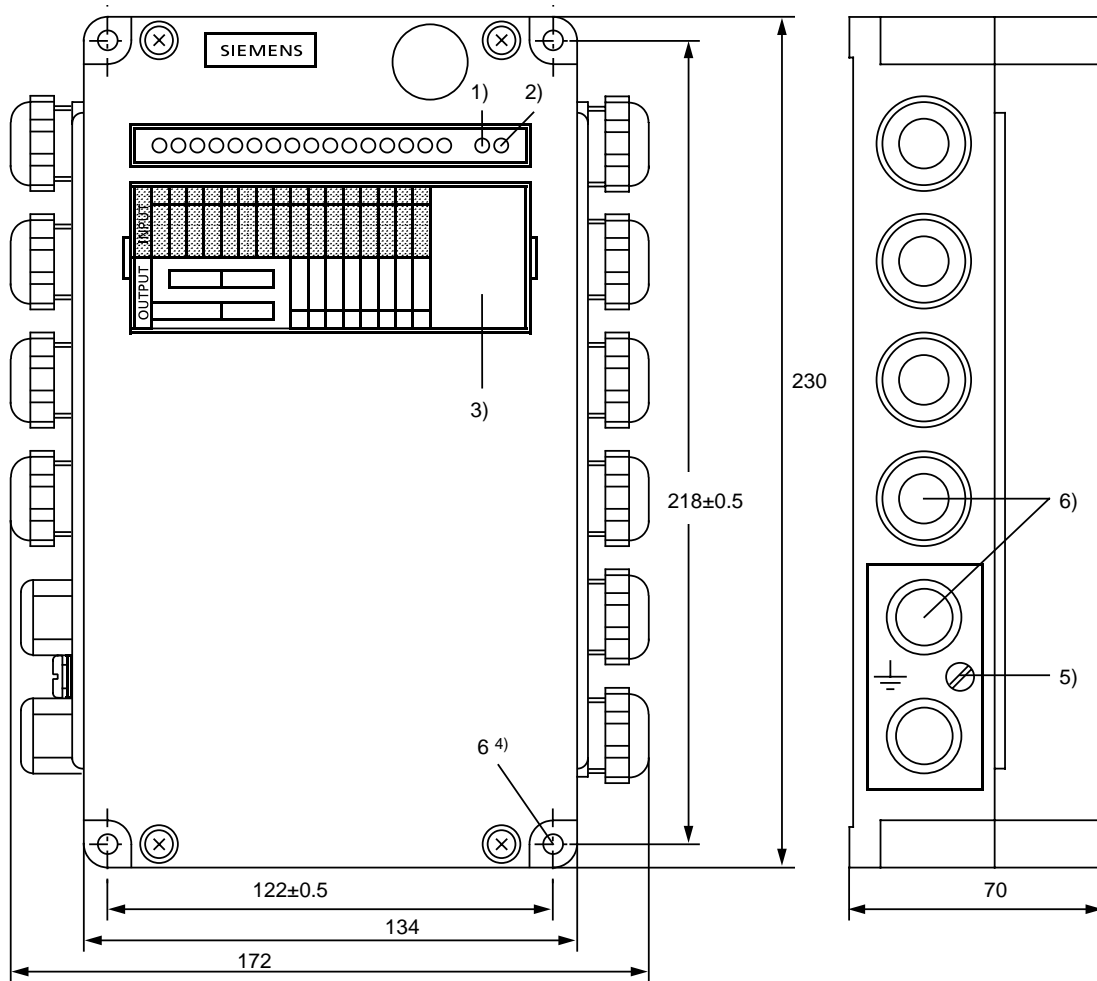
Technical data:

Inputs: +24 V, 3 ...6 mA
 Operating points: H level >13 V
 L level <5 V
 Operating times: <1 ms

The module can process sixteen 24 V inputs. The input data (0 V/24 V) present is electrically isolated and passed on to the DMP compact terminal block.

5.6 DMP terminal block with DMP module in IP 65 design (available soon)

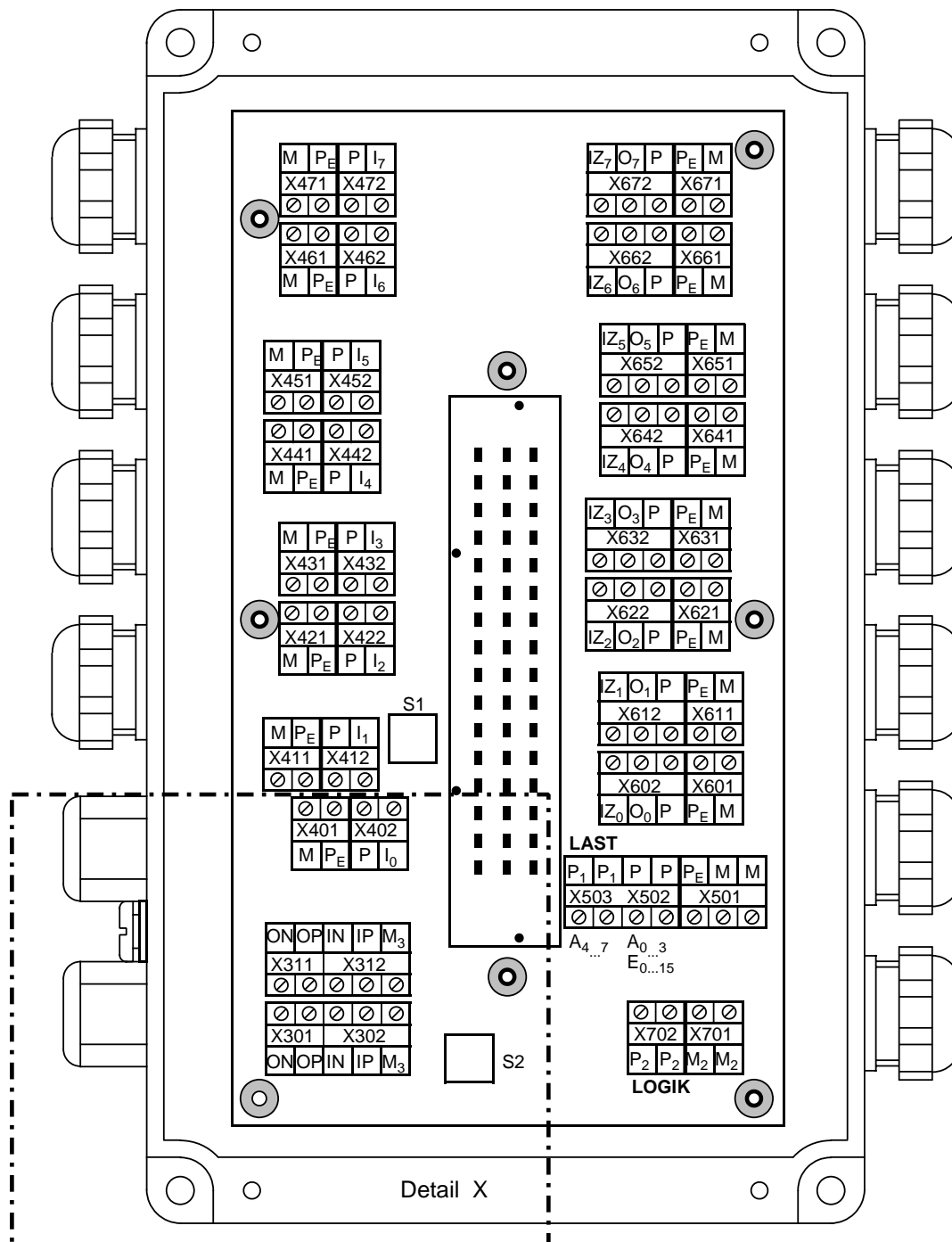
**6FC5 111-0CA72-0AA0
6FC5 111-0CA22-0AA0**



- | | | |
|--|------------------------------------|-------------------------|
| 1) Alarm/fault (check LED) | Temperature in enclosed space: | 55 °C |
| 2) Operation indicator (check LED) | Temperature change to SN 26556: | 10 K/h; max. 1 K/3 min. |
| 3) Replaceable labelling strip | Degree of protection to DIN 40050: | IP 65 |
| 4) Fastening screws for M5 screws | Maximum power loss: | 3 W |
| 5) M5 ground terminal | Total weight: | 1.8 kg |
| 6) Use enclosed sealing material if no cable connected;
if necessary, remove inner cone before connecting metal cable entry gland
(push out of gland from the inside). | | |

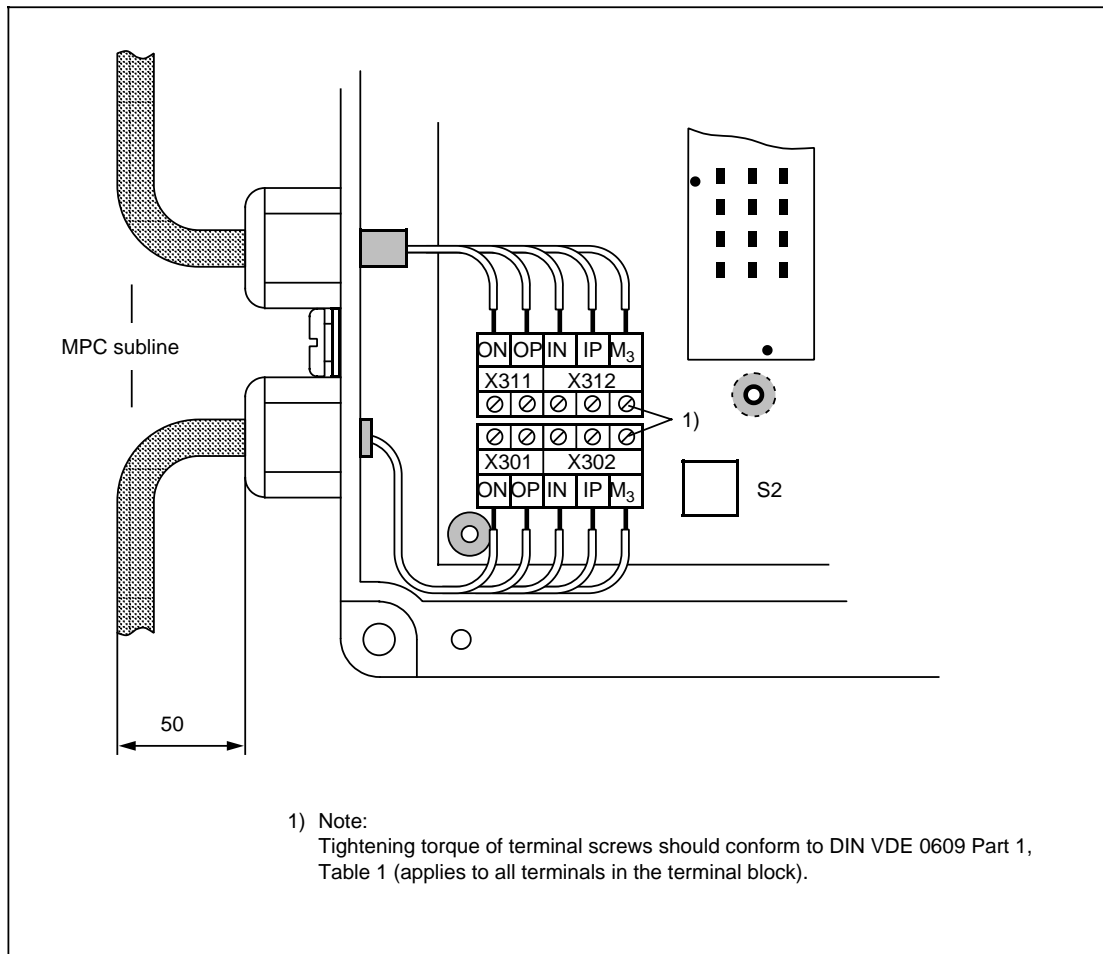
The DMP terminal block and DMP module in IP 65 version comprises two integrated parts, the DMP terminal block and the DMP module. The DMP terminal block is the lower part of the whole assembly with terminals (s. diagram on next page). Here, the user switching elements and sensors are directly connected according to the permanent wiring principle. The DMP module is in the upper part. By putting on the upper part you close contacts of the connector electrically and the DMP station mechanically.

The DMP station number is set using a hexadecimally coded rotary switch (see Section 4.1). A four-jumper DIP-FIX switch is located on the DMP terminal block to connect the termination circuit (all jumpers must be closed on the DMP station that is the last in the MPC line).



- $I_{Z_0} \dots I_{Z_7}$ IN, additional $I_{N_0} \dots I_{N_7}$ (additional input 0 ... 7)
 $I_0 \dots I_7$ $I_{N_0} \dots I_{N_7}$ (Inputs 0 ... 7)
 $O_0 \dots O_7$ $O_{U_0} \dots O_{U_7}$ (Outputs 0 ... 7)
 ON/IN OUT/INPUT negated – for RS-485/MPC interface
 OP/IP OUT/INPUT normal – for RS-485/MPC interface
 S1 Setting of DMP station number
 S2 Acts in place of termination connector
 – open: If DMP line continued
 – closed: If DMP line **not** continued (last module)

5.6 DMP terminal block with DMP module in IP 65 design



Detail X

Interface assignment:

Connector No.	Designation/signal type	Signal name
X301	ON/Output negated OP/Output normal	SDOX SDO
X302	IN/Input negated IP/Input normal M ₃ /Ground for RS 485 (must not be connected)	SDIX SDI 2M
X311	ON/Output negated OP/Output normal	SDOX SDO
X312	IN/input negated IP/input normal M ₃ /Ground for RS 485 (need not be connected)	SDIX SDI 2M

Interface assignment (continued):

Connector	Designation/signal type	Signal name
X401	M/Common ground of 24 V supply P _E /Protective earth	MEXT PE
X402	P/Distribution of +24 V supply voltage I ₀ /Input 0	1P24 EXT IN
X411	M/Common ground of 24 V supply P _E /Protective earth	MEXT PE
X412	P/Distribution of +24 V supply voltage I ₁ /Input 1	1P24 EXT IN
X421	M/Common ground of 24 V supply P _E /Protective earth	MEXT PE
X422	P/Distribution of +24 V supply voltage I ₂ /Input 2	1P24 EXT IN
⋮	⋮	⋮
X472	P/Distribution of +24 V supply voltage I ₇ /input 7	1P24 EXT IN
X501	M/Common ground of 1st and 2nd load supply P _E /Protective earth	1 MEXT PE
X502	P/+24 V of 1st load supply for outputs O ₀ ... O ₃ and inputs	1P24 EXT
X503	P ₁ /+24 V of 2nd load supply for outputs O ₄ ... O ₇	2P24 EXT
X601	P _E /Protective earth M/Common ground of 24 V supply	PE MEXT
X602	I _{Z0} /Additional input 0 O ₀ /Output 0 P/+24 V of 1st load supply	IN OUT 1P24 EXT
X611	P _E /Protective earth M/Common ground of 24 V supply	PE MEXT
X612	I _{Z1} /Additional input 1 O ₁ /Output 1 P/+24 V of 1 load supply	IN OUT 1P24 EXT
⋮	⋮	⋮
X672	I _{Z7} /Additional input 7 O ₇ /Output 7 P/+24 V of 1 load supply	IN OUT 1P24EXT
X701	M ₂ /Ground of logic supply of DMP module	3MEXT
X702	P ₂ /+24 V of logic supply of DMP module	3P24 EXT

This DMP station requires two different supply voltages:

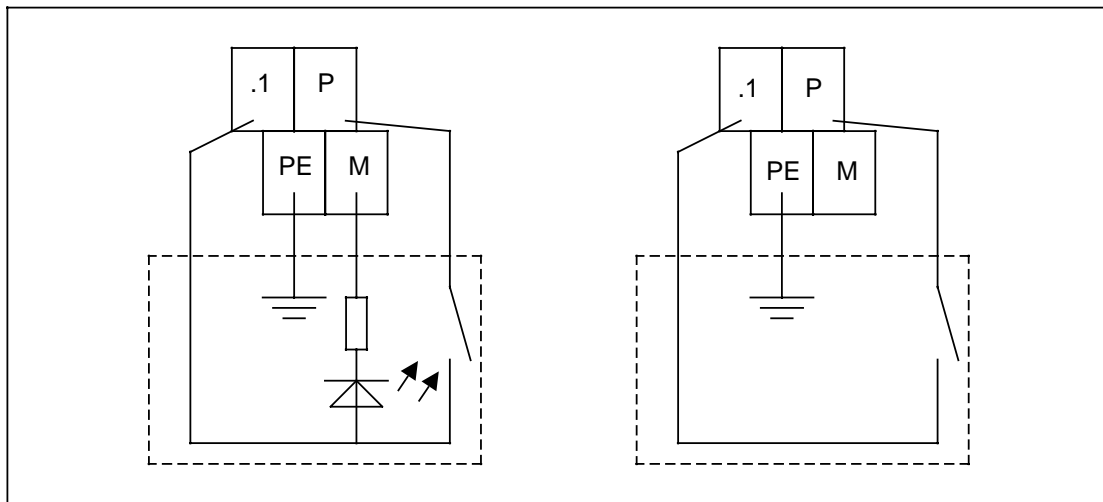
- Logic supply voltage, 24 V DC

The 24 V/0 V logic supply voltage is connected to X701 and X702.

- Load supply voltage, 24 V DC

The 0 V potential must be connected to X501 and is thus supplied to all M (ground) terminals via internal jumpers on the DMP terminal block.

Two 24 V load supply voltages are available at P₁ (outputs 0 to 3) and P₂ (outputs 4 to 7) (X502 and X503).



Connection of inputs

Technical data:

Inputs:	+24 V, 3 ... 10 mA
Operating point:	H level >13 V L level <5 V
Operating time:	<1 ms
Inputs/outputs:	+24 V, 2 A short-circuit proof, floating, simultaneity factor per byte: 50 %

Note:

Eight of the 16 I/O channels are permanently assigned as inputs; another eight channels can either be inputs or outputs.

When using terminals IZx: Channel x is an input

When using terminals Ox: Channel x is an output

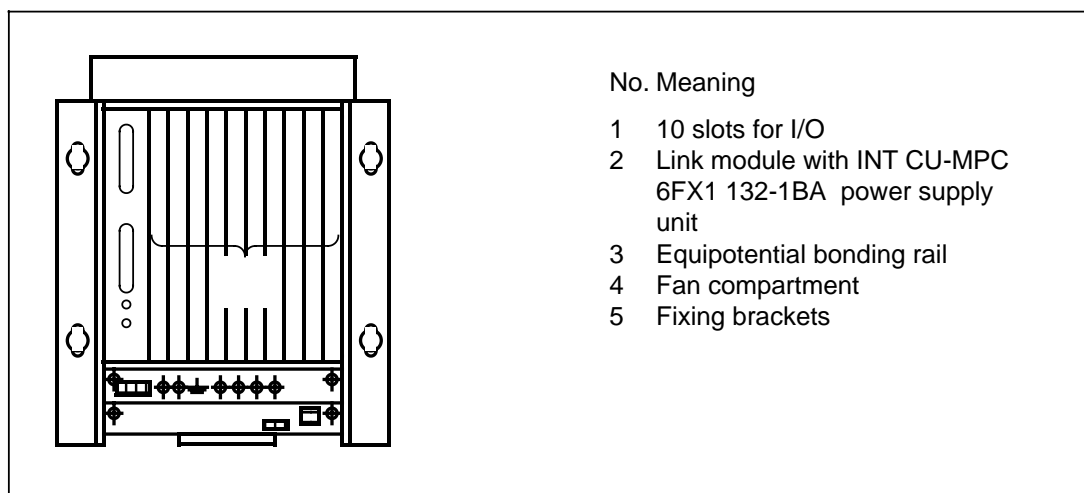
The unassigned terminals can be used, for example, for jumpers within the DMP terminal block.

5.7 Mini EU

The mini expansion unit consists of a 9 1/2" (= 16 standard slot dimensions). You can slot in up to ten input/output modules of 20 mm mounting width (=1 1/3 standard slot dimensions) each. You can slot in SINUMERIK 800 input/output modules and selected SIMATIC input/output modules of the U and K series. For rack assignment, see Section 1.4.

Exception: You cannot slot in I/O modules that require ± 15 V, e.g. the MIXED I/O and IN ANALOG.

The INT CU/MPC (6FX1 132-1BA) link module is used in the mini EU both as a power supply unit and as a link module to the NC and to further EUs or DMP stations.



Mini expansion unit

Technical data:

Rated voltage and frequency: 24 V DC; 20 ... 30 V
 Max. connected load at U_N : 48 VA
 Max. making current: 20 x I_N for 10 ms

Power on/off behaviour:

- **RESET**
Key for initiating the power off/on routine without switching off the power supply.
- **Power on**
The power supply unit switches itself on when the input voltages X131 are applied.
- **Power off**
You can switch off the power supply unit, by switching off the input voltage.
- **Power off because of an error**
The input/output voltage monitoring can be switched off
- **Switch on again**
The power supply unit is switched on again automatically after the input voltage was switched off and on again.
- The mini EU has to be supplied with voltage before or simultaneously with the central controller.

5.7.1 Link module INT CU/MPC

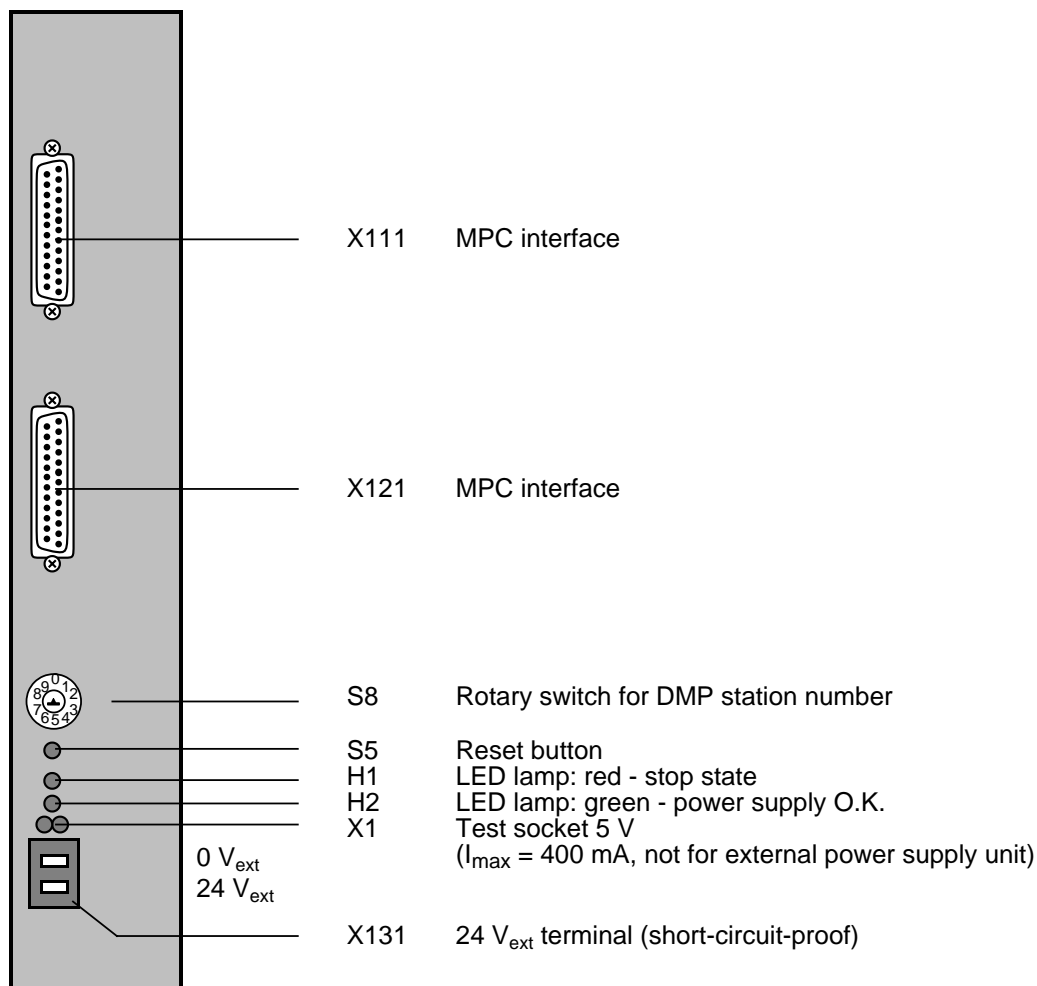
6FX1 132-1BA

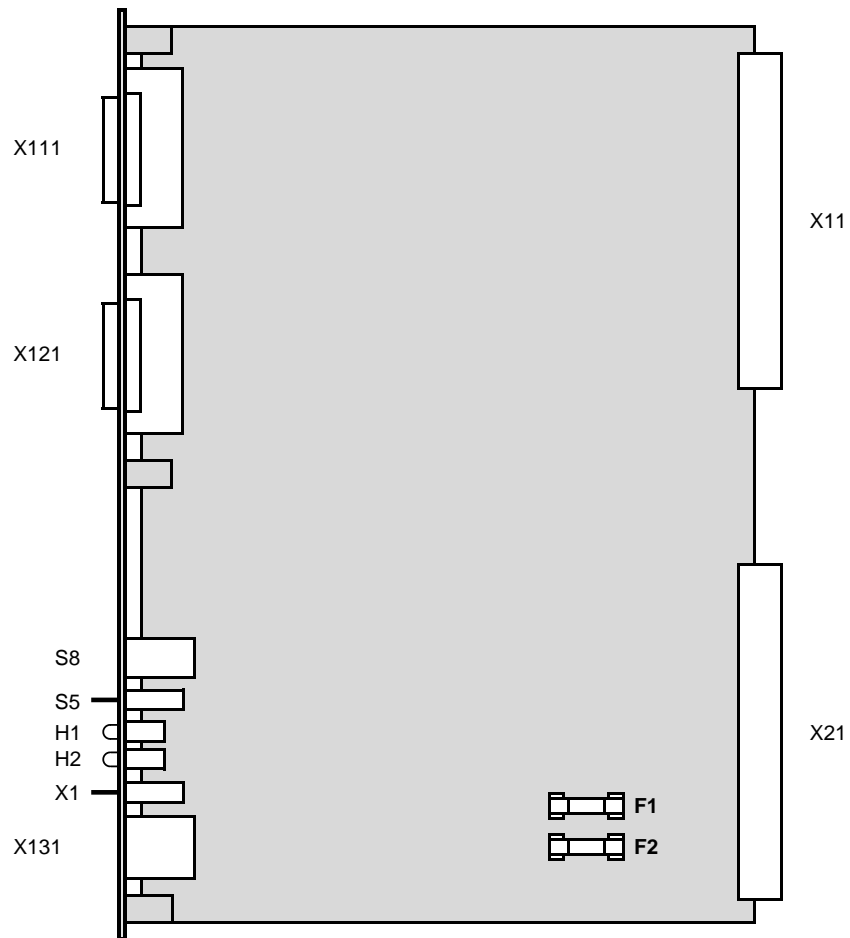
The link module INT CU/MPC is used as a central device interface module when you connect distributed standard I/Os via an MPC interface. The module also contains the power supply (DC/DC converter, 24 V/5 V, max. 5 A) for the mini EU.

This module comprises:

- MPC interface
 fibre optics cable RS 485; 1.3 Mbaud, full duplex
- Power supply unit DC/DC 24 V/5 V; 5 A

Position of interfaces, operating and display elements



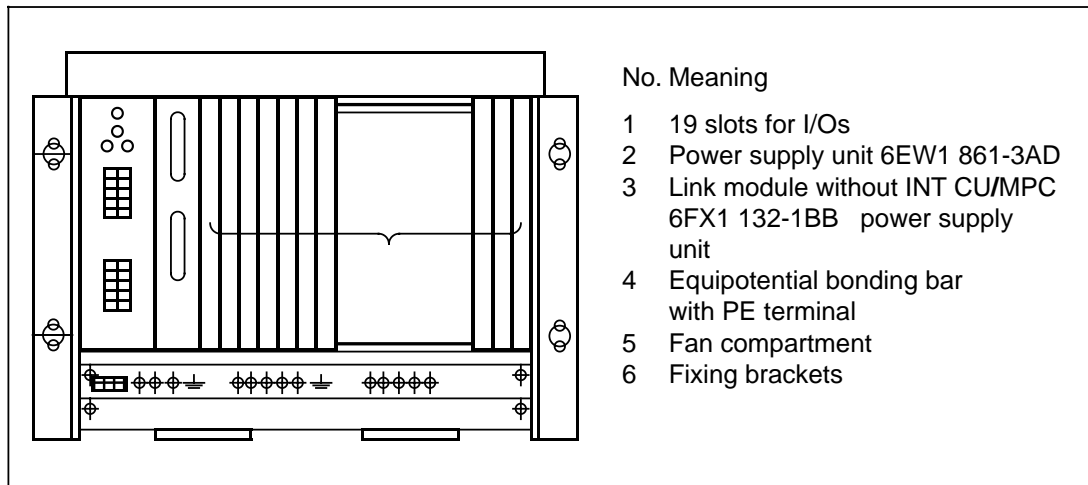


- F1 - 4 A FF
- F2 - 1.6 A M
- X11 - S5 bus
- X21 - SINUMERIK bus

Total current	+5 V	5 V _{ext}	+15 V	-15 V	+24 V
typical	—	—	—	—	1 A

5.8 Maxi EU

The maxi expansion unit consists of a 19" (= 32 standard slot dimensions) rack. You can slot in up to ten input/output modules of 20 mm mounting width (=1 1/3 standard slot dimensions) each. You can slot in SINUMERIK 800 input/output modules and selected SIMATIC input/output modules of the U and K series. The link module used is the INT CU/MPC. For the rack assignment, see Section 1.4. You can use the power supply unit 6EW1 861-3AD for the power supply.



Maxi expansion unit

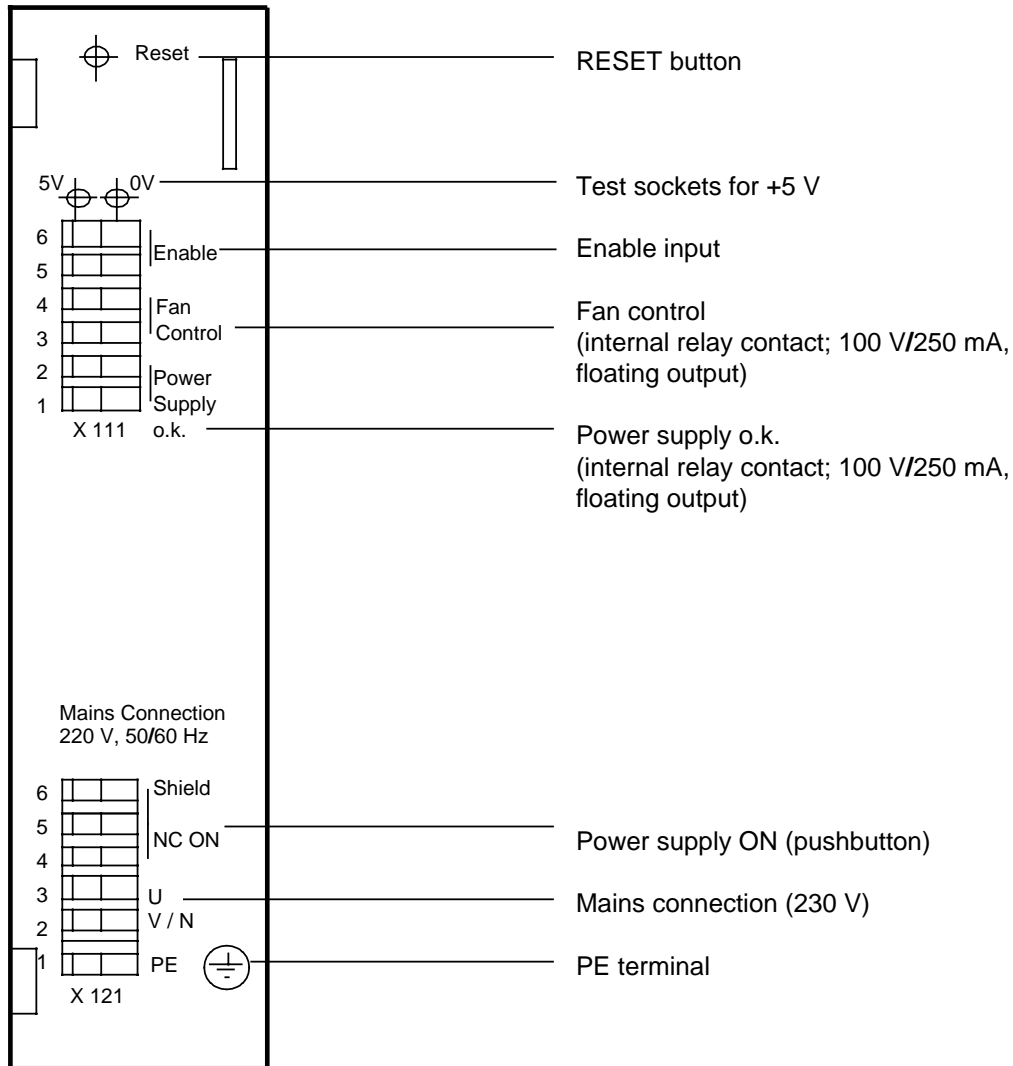
Technical data: see Section 5.8.1

Behaviour on power on/off:

- The maxi EU can be switched on before, with or after the central controller.
- Observe all relevant standards and regulations (VDE 0160, EC 550) when connecting the input voltage to the power supply unit.

5.8.1 Power supply unit for the maxi EU

6EW1 861-3AD

**Note:**

The ENABLE input has to be jumpered otherwise the mini EU cannot function. You can do this by jumpering with the fan control relay contact (standard) or by direct jumpering across terminals 5-6.

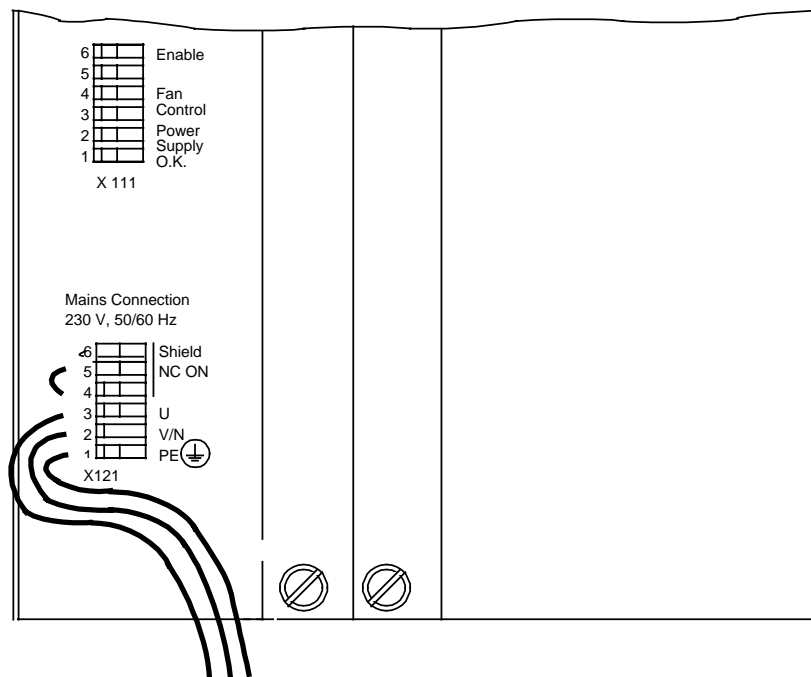
The NC ON is used to switch on the maxi EU. You can connect a pushbutton to the NC ON terminals with which the maxi EU can be switched on once it is supplied with a voltage.

If you want the maxi EU to start up as soon as you apply a supply voltage, jumper the NC ON directly (on version 3 AC and higher).

Technical data (Power supply unit for the maxi EU)

Input voltage:	230 V+10 %/-20 % -Single phase/neutral with loadable neutral -Two-phase phase/phase without loadable neutral -adapt other voltages using autotransformer
Frequency:	48 to 63 Hz
Power consumption:	max. 200 VA
Permissible voltage interrupt with:	nominal voltage V_N max. 10 ms ($V_N \dots 230$ V) $V_N - 20\%$ max. 3 ms
Operating temperature:	0 ... +55 °C
Storage and trans-temperature:	-40 ... +70 °C
Humidity rating: (DIN 40040)	F
Degree of protection:	IP 00 IP 20 (built-in)
Vibration and impact load : (DIN 20010)	stationary 12 during transport 22

Mains connection



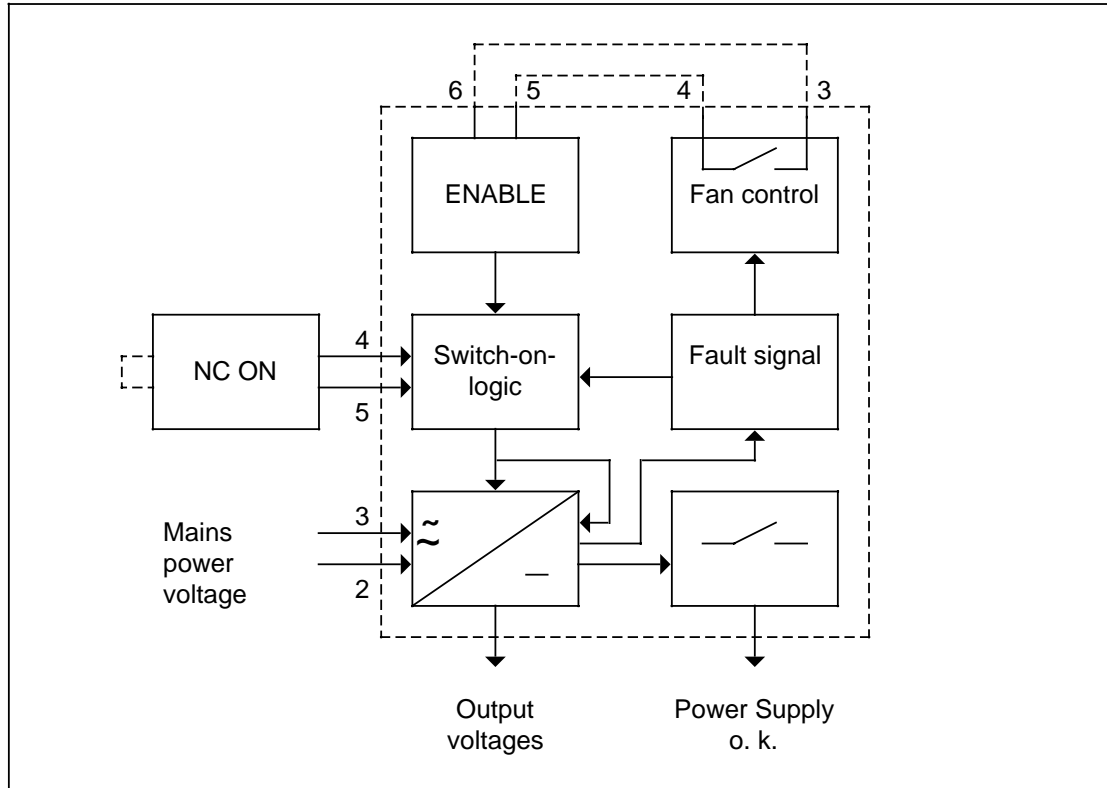
Monitoring the maxi EU

Fan failure is signalled to the FAN CONTROL (terminal 4-3) and can be evaluated.

Application:

FAN CONTROL jumpered with ENABLE (jumpers 5-4, 6-3):

If the fan fails, the power supply unit is switched off (standard).



5.8.2 Link module INT CU/MPC

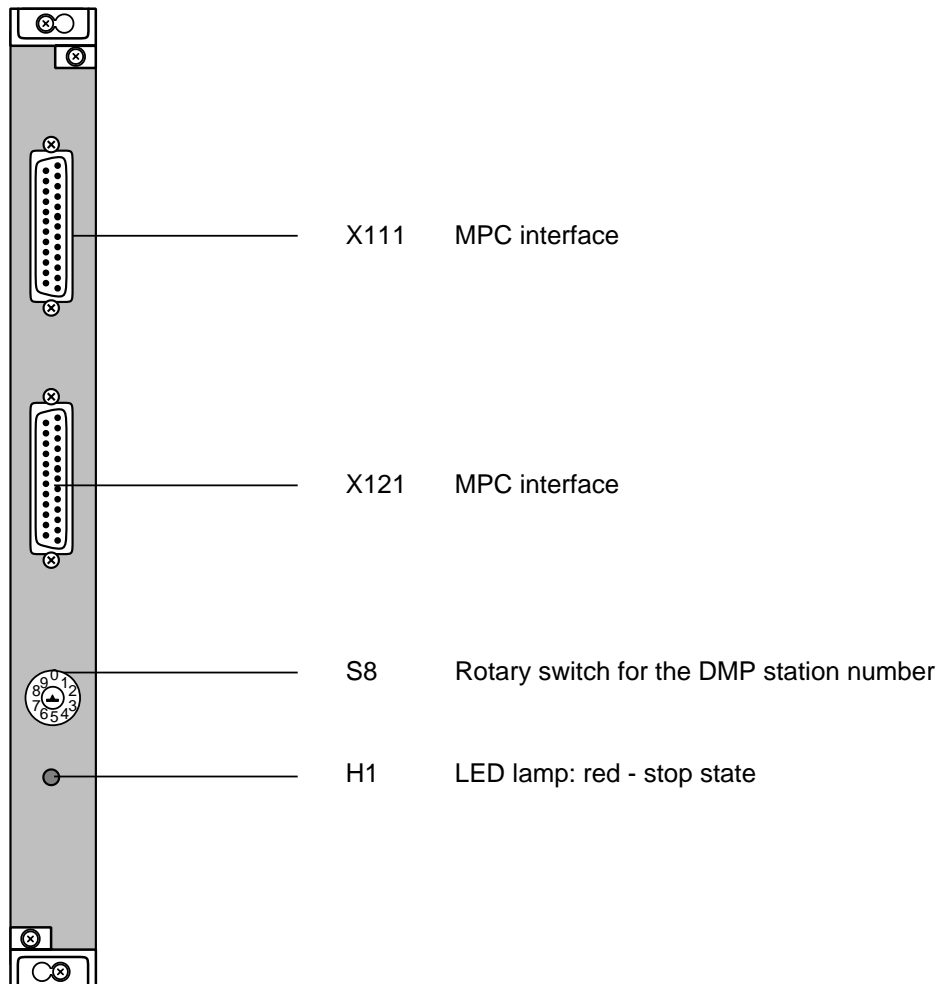
6FX1 132-1BB

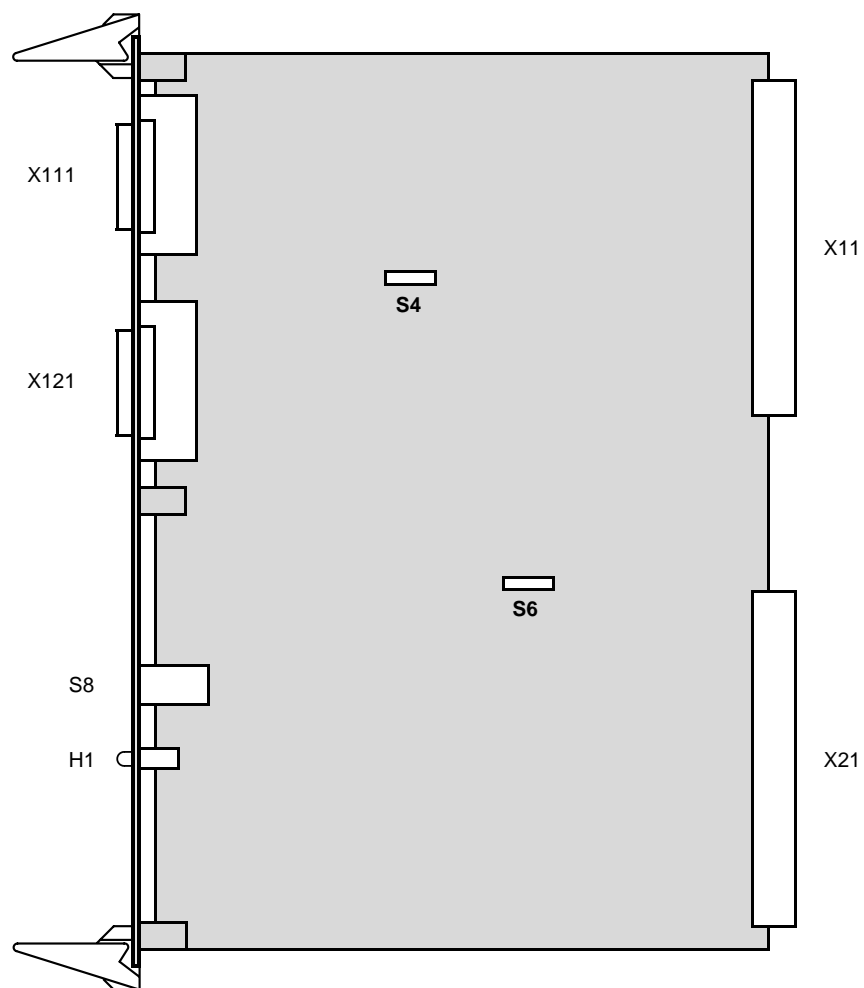
The link module INT CU/MPC is used as a central device interface module in the expansion unit if distributed standard I/Os are connected via an MPC interface.

This module comprises:

- MPC interface
Fibre optics cable or RS 485; 1.3 Mbaud, full duplex

Position of interfaces, operating and display elements





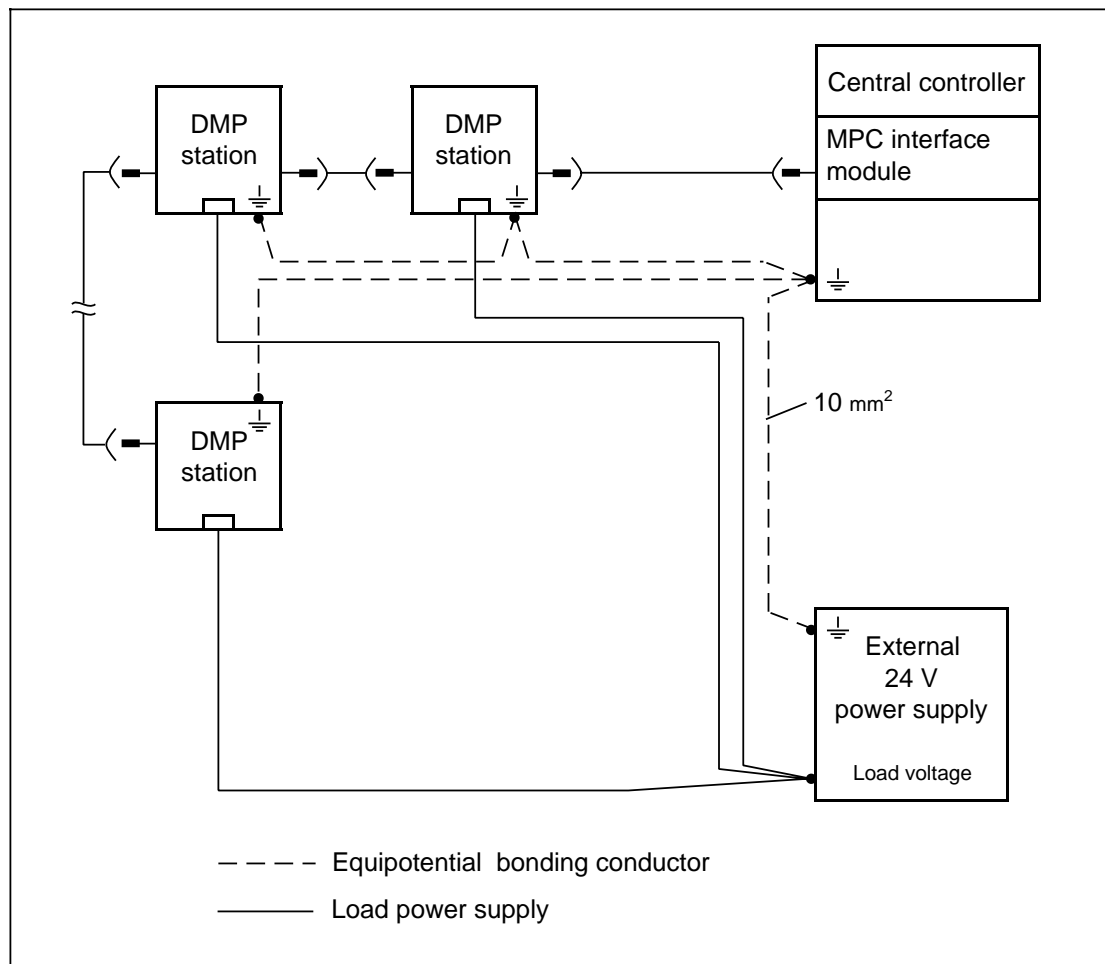
- S4 – For test purposes only, position: closed
 S6 – For test purposes only, position: open
 X11 – S5 bus
 X21 – SINUMERIK bus

Total current	+5 V	5 V _{ext}	+15 V	-15 V	+24 V
typical	0.5 A	—	—	—	—

5.9 Earthing concept for distributed machine I/Os

When setting up an MPC line, the following rules regarding the equipotential bonding conductors and the 0 V cables must be observed :

- A cable with a cross-section of at least 2.5 mm², or preferably 4 mm² (only applies to DMP terminal blocks) should be used for the 0 V load supply 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 SINUMERIK control. The equipotential bonding conductor can be laid parallel to the signal line (MPC line) if the DMP stations are situated close to each other (less than 2 m apart). Both equipotential bonding conductors (supply conductor and outgoing cable to the next DMP station) must be connected at one side of the DMP terminal block (see Section 5.4.1) to one of the two earthing plates. A cross-section of at least 10 mm² is required for the equipotential bonding conductors.
- The power supply units used for the load supply must also be provided with an equipotential bonding conductor which must be connected to the 0V output of the power supply unit.



6 NC - Machine Signals

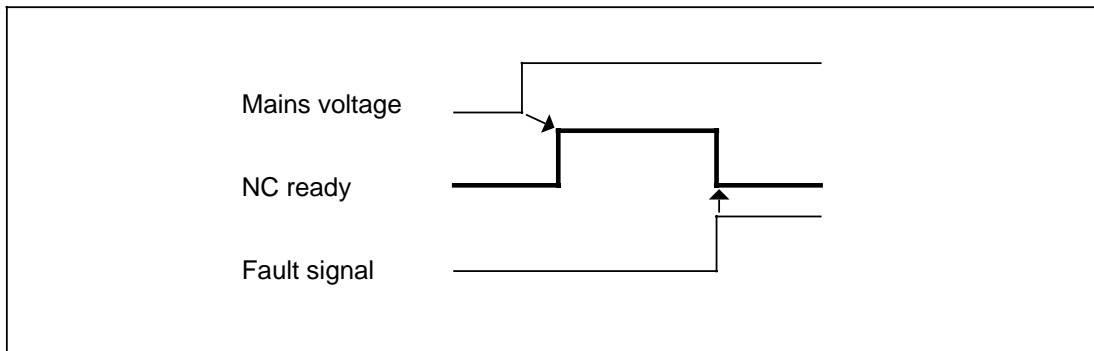
6.1 NC ready

The NC ready signal is supplied as a floating relay on multiport 6FX1 136-8BA, 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 to stop all motions on the machine.

6.2 Feed drives

6.2.1 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.

6.2.2 Speed controller enable (axes)

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

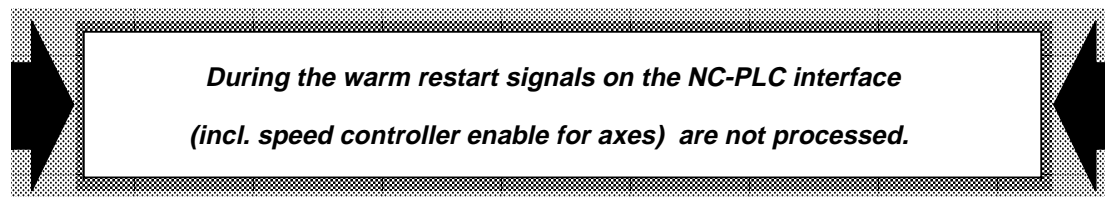
1 signal: The floating relay contact is closed when all the axes and spindles defined in the relevant operating mode group are operating faultlessly and the axis-specific interface signals "follow-up operation", "parking axis" and "controller enable" are present, permitting position control to commence.

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 relay contact of the speed controller enable always opens 5 to 1000 ms (NC-MD 156) after the fault has been detected. 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.



6.3 Spindle drives

6.3.1 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 too high) 0 V is output instantaneously as setpoint value. The spindle motor is braked with maximum current.

6.3.2 Speed controller enable (spindles)

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

1 signal: The relay contact 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".

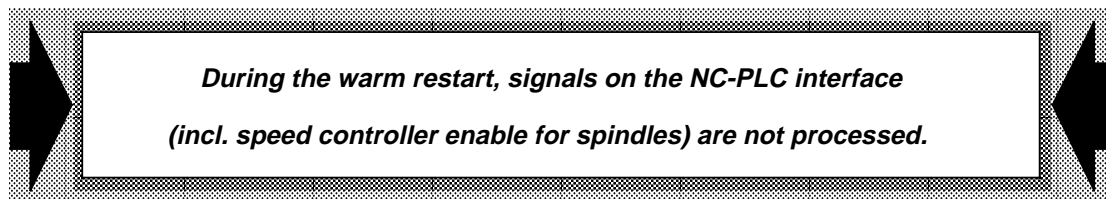
0 signal: The relay contact is open when

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

The relay contact of the speed controller enable always opens 5 to 10000 ms (NC MD 447*) after the fault has been detected. 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.

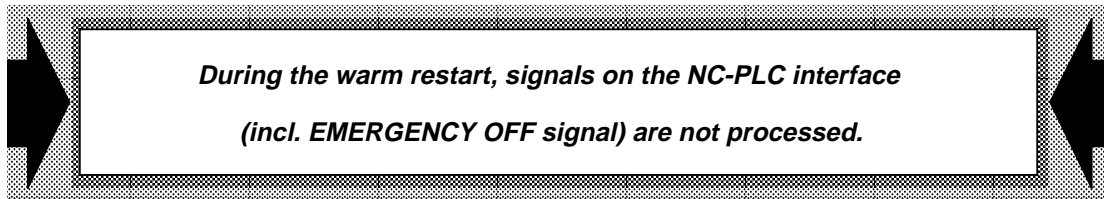


6.4 EMERGENCY STOP

An EMERGENCY STOP slambutton 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 output.

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



7 External Devices and Accessories

7.1 Devices and accessories

The following table gives you a complete overview of the external devices and accessories that you can order. The devices and accessories are ordered according to order numbers.

Consult Catalog NC 28 for external views and technical data. If you require further information, look in the relevant part of this Section starting from 7.2.

If you require a spare part, you will find the information in the spare part catalog.

Devices and accessories	Order number
Air filter for the central controller, content of a pack 10 pieces	6ES5 981-0EA11
Filter holder	6ES5 981-0FA11
Power supply unit – Input 230 V AC/output 24 V DC, 10 A – Input 3 x 380 V AC/output 24 V DC, 20 A – Input 3 x 380 V AC/output 24 V DC, 40 A Cover for power supply units, to achieve degree of protection IP 20	6EV1 337-5AK 6EV1 354-5AK 6EV1 364-5AK 6XB9 798-0SV00
Set of mounting parts for external machine control panel	6FC3 981-7AC
Air filter for operator panel (only to be used for installation)	6FC3 988-7AV
I/V hybrid (Option for HMS measuring-circuit module)	6FC3 988-7CN
Terminal strip converter with LEDs for output module N73	6FC9 302-2AK01
Terminal strip converter without LEDs	6FC9 302-2BA01
Terminal strip converter with LEDs, for I/O module	6FC9 302-2BB01
Terminal strip converter for input PCB N71	6FC9 302-2BC01
Terminal strip converter with LEDs for input PCB N71	6FC9 302-2BD01
Terminal strip converter with LEDs for output PCB N72	6FC9 302-2BK01
Incremental rotary position encoder ¹⁾ and main spindle encoder 1024/9000 pulses/rev	6FC9 320-3KT00

Devices and accessories, continued

Devices and accessories	Order number	
Incremental rotary encoders for rotary axes 18000 pulses/rev – Rotary encoder with shaft ¹⁾ – Rotary encoder with hollow shaft and integrated coupling	6FC9 320-3CM00 6FC9 320-3CN00	
SIPOS incremental encoder ¹⁾ – Axial connector – Radial connector SIPOS absolute encoder ¹⁾ – Axial connector – Radial connector	6FC9 320-3CS 6FC9 320-3CW 6FC9 320-3CT 6FC9 320-3CV	
INDUCTOSYN converter (1 axis)	6FC9 320-3GK	
Resolver converter (1 axis)	6FC9 320-3GL	
Rotary encoder, incremental¹⁾ for feed axes and spindles	cable connected axially radially	
– 60 pulses/rev	6FC9 320-3HB01	6FC9 320-3LB01
– 100 pulses/rev	6FC9 320-3HC01	6FC9 320-3LC01
– 200 pulses/rev	6FC9 320-3HK01	6FC9 320-3LK01
– 250 pulses/rev	6FC9 320-3HL01	6FC9 320-3LL01
– 400 pulses/rev	6FC9 320-3HQ01	6FC9 320-3LQ01
– 500 pulses/rev	6FC9 320-3HS01	6FC9 320-3LS01
– 720 pulses/rev	6FC9 320-3HX01	6FC9 320-3LX01
– 1000 pulses/rev	6FC9 320-3KA01	6FC9 320-3MA01
– 1024 pulses/rev	6FC9 320-3KB01	6FC9 320-3MB01
– 1250 pulses/rev	6FC9 320-3KE01	6FC9 320-3ME01
– 1500 pulses/rev	6FC9 320-3KG01	6FC9 320-3MG01
– 1800 pulses/rev	6FC9 320-3KH01	6FC9 320-3MH01
– 2000 pulses/rev	6FC9 320-3KK01	6FC9 320-3MK01
– 2500 pulses/rev	6FC9 320-3KN01	6FC9 320-3MN01
– 3600 pulses/rev	6FC9 320-3KQ01	6FC9 320-3MQ01
– 5000 pulses/rev	6FC9 320-3KS01	6FC9 320-3MS01

¹⁾ Supplied without coupling and without clamp

Devices and accessories, continued

Devices and accessories	Order number
Rotary encoder, incremental ¹⁾ for feed axes and spindles cable connected axially – 60 pulses/rev 6FC9 320-3HB21 – 100 pulses/rev 6FC9 320-3HC21 – 200 pulses/rev 6FC9 320-3HK21 – 250 pulses/rev 6FC9 320-3HL21 – 400 pulses/rev 6FC9 320-3HQ21 – 500 pulses/rev 6FC9 320-3HS21 – 720 pulses/rev 6FC9 320-3HX21 – 1000 pulses/rev 6FC9 320-3KA21 – 1024 pulses/rev 6FC9 320-3KB21 – 1250 pulses/rev 6FC9 320-3KE21 – 1500 pulses/rev 6FC9 320-3KG21 – 1800 pulses/rev 6FC9 320-3KH21 – 2000 pulses/rev 6FC9 320-3KK21 – 2500 pulses/rev 6FC9 320-3KN21 – 3600 pulses/rev 6FC9 320-3KQ21 – 5000 pulses/rev 6FC9 320-3KS21	cable connected radially 6FC9 320-3LB21 6FC9 320-3LC21 6FC9 320-3LK21 6FC9 320-3LL21 6FC9 320-3LQ21 6FC9 320-3LS21 6FC9 320-3LX21 6FC9 320-3MA21 6FC9 320-3MB21 6FC9 320-3ME21 6FC9 320-3MG21 6FC9 320-3MH21 6FC9 320-3MK21 6FC9 320-3MN21 6FC9 320-3MQ21 6FC9 320-3MS21
INDUCTOSYN pre-amplifier	6FC9 320-4FC
Clamp²⁾ Spring disk coupling	6FC9 320-4GA 6FC9 320-4GB
Resolver converter	6FC9 320-4FC
Amplifier for current unconditional signals	6FC9 320-4HM12
Electronic handwheel – with front panel 120 x 120 mm – with front panel 76 x 76 mm	6FC9 320-5DB 6FC9 320-5DC
Set of fixing parts for SIPOS encoder ³⁾	6FC9 328-1CA

1) Supplied without coupling and without clamp

2) Three clamps per encoder required

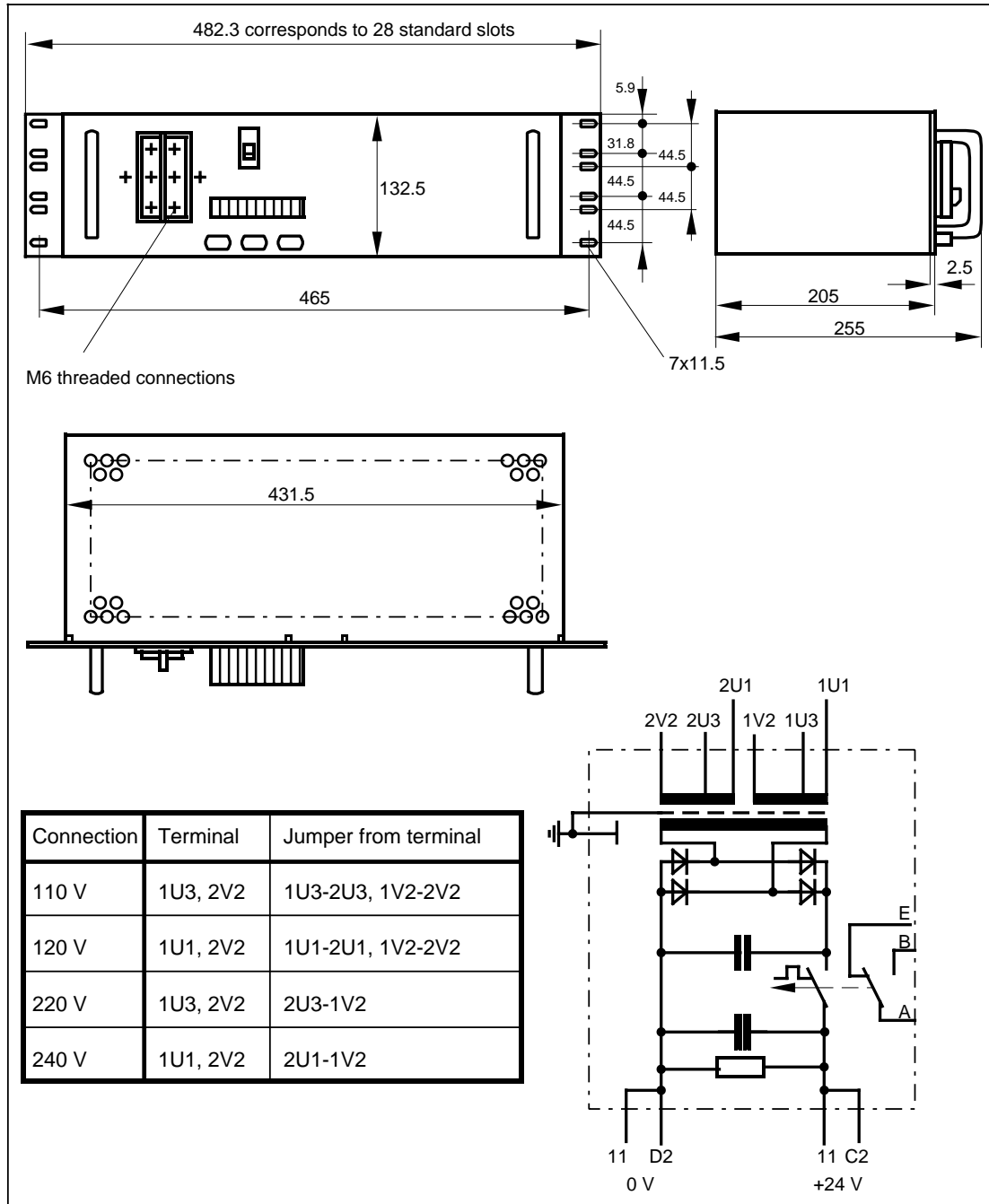
3) Without clamps

7.2 Power supplies

7.2.1 Power supply unit (110 V/230 V)

6EV1 337-5AK

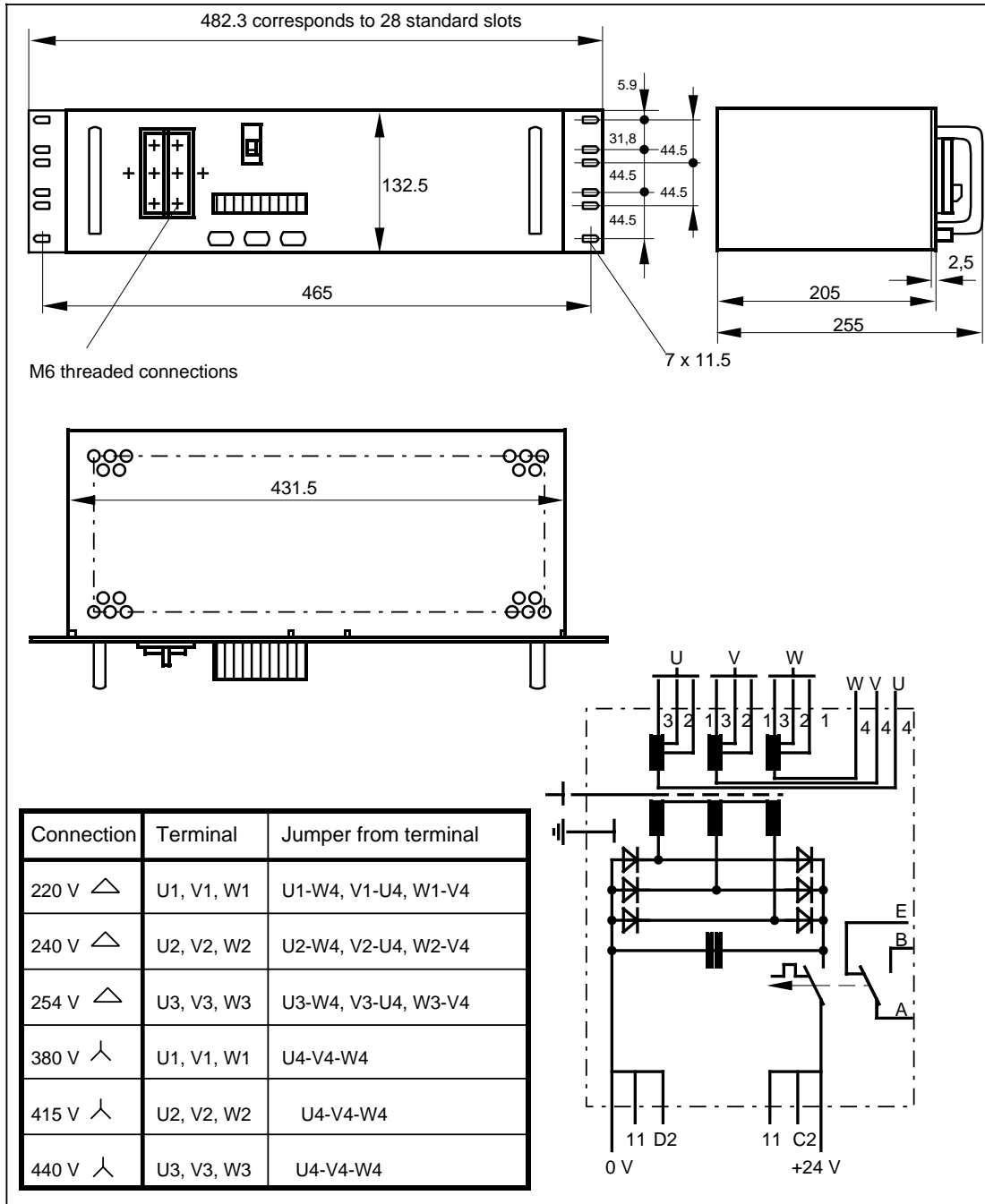
For 230V AC and 110V AC mains connection.



7.2.2 Power supply unit (230 V/400 V)

6EV1 3 4-5AK

For 400 V AC mains connection

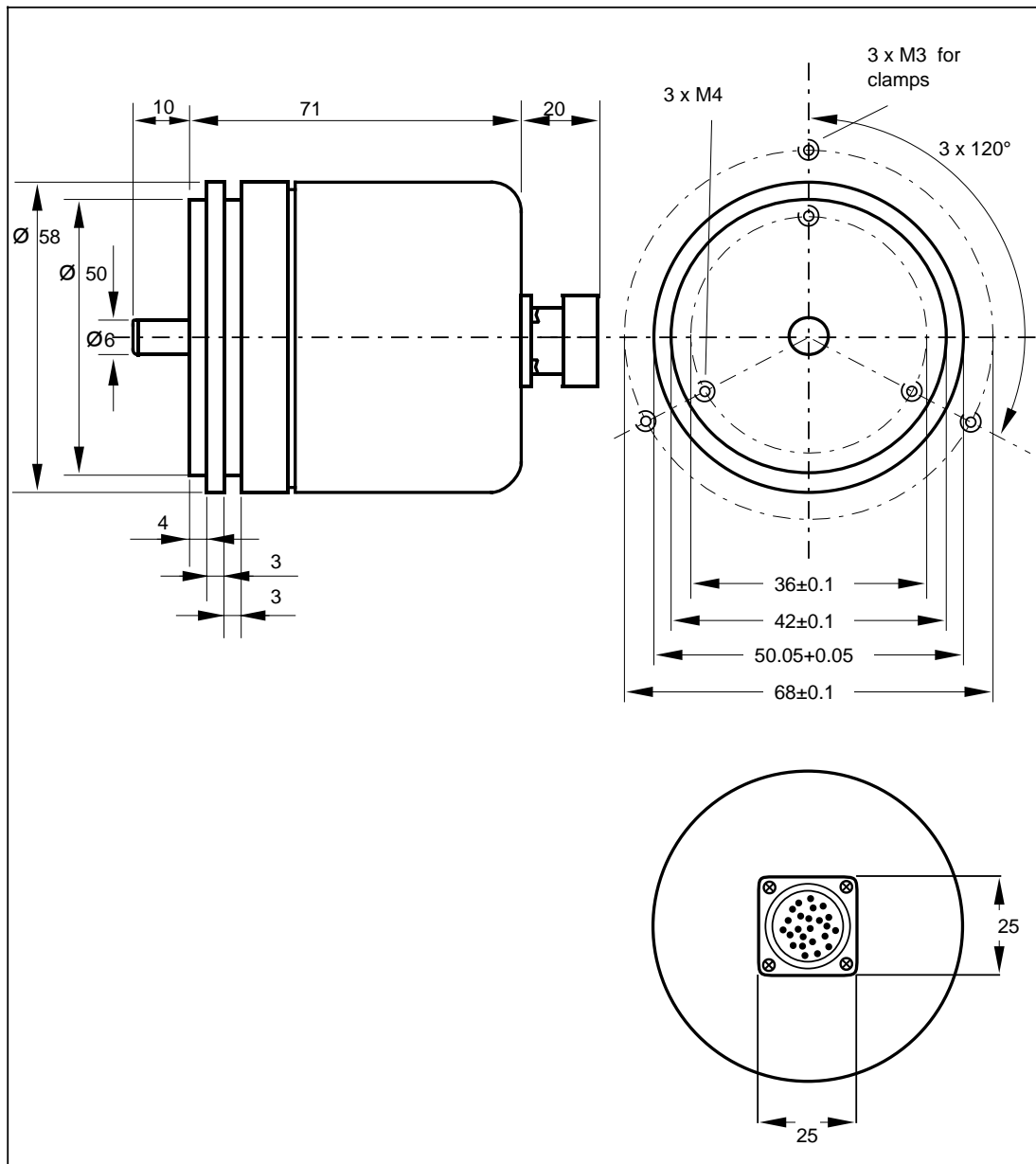


7.3 SIPOS encoders

6FC9 320-3C

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.

Rotary encoder with cable 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.

Technical data, mechanical values

Increments of the disk	pulses/rev	2500
Max. speed	rev/min	12000
Ball bearing life	h	10 ⁴ bei 8000 U/min und 50 °C
Fiction moment	Ncm	1
Moment of inertia	kgm ²	1.45 · 10 ⁻⁶
Max. shaft load		
– axial	N	15
– radial	N	25
Max. permissible angular acceleration	rad/s ²	10 ⁵
Vibration resistance to DIN 40046, Part 8 (FC test)		
– 3 Hz to 60 Hz:		±3 mm ÷ 120 ms ⁻²
– 60 Hz to 2 kHz:		12 g ÷ 120 ms ⁻²
Vibration resistance to DIN 40046, Part 7	m/s ²	300 (30 g)
Degree of protection to DIN 40050		IP 65 (except shaft input) IP 54 (shaft input)
Operating temperature range	°C	0 to +60
Storage temperature range	°C	-25 to +70
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. 1 m cable and connector)	g	approx. 440

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
Output signal zero pulse		Signal peak of reference mark
Output voltage track A, B	V	± 0.8 V, 0,5 dB/-2 dB (at 1000 Hz: terminating res. 180)
Output voltage zero pulse	V	$U_{ss\ N-N}$ 200 mV (useful signal) (terminating res.: 180)
Temperature coefficient of output amplitude of track A, B and N	%/K	0.2
Frequency response track A, B and N	dB	-4 (from 0 to 500 kHz, without cable) -7 (from 0 to 500 kHz, with cable 100 m)
Phase angle error (without cable)	Grad	1.5 < 25 kHz 3.0 25 to 500 kHz
Voltage supply	V	5 V ± 10 %, approx. 100 mA ± 15 V +3 %, -10 % approx. 60 mA
Achievable resolution		Output signals A and B can be resolved up to a factor of 512 in 2" increments using the HMS measuring system.
System fault at 20 °C/1 ... 2 kHz		$\pm 1/64$ division periods ± 10 angle seconds
Light source		Infrared LED controlled
Sampling		Photoelectrically with light
Light receiver		Photodiodes
Max. cable length	m	100 (SINUMERIK cable)

7.4 Installation conditions

7.4.1 Electrical and mechanical installation conditions

Device	Conditions	Nominal voltage V_N	Max. power loss P_V	Degree of protection (to DIN 40050)	Dimensions w h d	Weight
Power supply unit 6EV1 337-5AK		1 x 230 V AC 24 V DC/10 A		IP 00	431.5 mm 132 mm 255 mm	
Power supply unit 6EV1 354-5AK 6EV1 364-5AK		3 x 400 V AC 415 V AC 440 V AC 24 V DC/20 A 24 V DC/40 A		IP 00	431.5 mm 132 mm 255 mm	

8 Cables

8.1 Tabular overview of cables

Cable , complete	Max.poss. length	Order No.
Between inductosyn scales Length 0.335 m	–	6FC9 198-4AL
Between I/O submodule and terminal strip converter and between I/O submodule and 2nd/3rd machine control panel, round cable, 34-core Length 0.5 m Length 1 m Length 2 m Length 3 m	2.5 m	6FC9 340-8LA 6FC9 340-8LL 6FC9 340-8LM 6FC9 340-8LN
To electronic handwheel Length 1 m Length 5 m Length 10 m Length 18 m Length 25 m	25 m	6FC9 340-8MA 6FC9 340-8MB 6FC9 340-8MC 6FC9 340-8ME 6FC9 340-8MF
To digital rotary encoders and main spindle encoder (old version) Length 10 m Length 18 m Length 25 m	35 m	6FC9 340-8NC 6FC9 340-8NE 6FC9 340-8NF
To digital rotary encoder in servo drive (ROD 320) Length 5 m Length 10 m Length 18 m Length 25 m Length 5 m (can be trailed) Length 10 m (can be trailed) Length 18 m (can be trailed) Length 25 m (can be trailed) Length 30 m (can be trailed)	35 m	6FC9 340-8PB 6FC9 340-8PC 6FC9 340-8PE 6FC9 340-8PF 6FC9 340-8PB01 6FC9 340-8PC01 6FC9 340-8PE01 6FC9 340-8PF01 6FC9 340-8PJ01
To digital linear measuring system (integrated EXE) Length 5 m Length 10 m Length 17 m Length 25 m	17 m	6FC9 340-8QB 6FC9 340-8QC 6FC9 340-8QE 6FC9 340-8QF
To servo drives and main spindle drive Length 5 m Length 10 m Length 18 m Length 25 m	50 m	6FC9 340-8RB 6FC9 340-8RC 6FC9 340-8RE 6FC9 340-8RF
To probe Length 5 m Length 10 m Length 18 m Length 25 m	35 m	6FC9 340-8UB 6FC9 340-8UC 6FC9 340-8UE 6FC9 340-8UF

8.1 Tabular overview of cables

Cable, complete	Max. possible length	Order No.
To 2nd/3rd operator panel, keyboard interface RS232C (V.24) Length 2 m Length 5 m Length 10 m Length 18 m Length 25 m	30 m	6FC9 340-8WM 6FC9 340-8WB 6FC9 340-8WC 6FC9 340-8WE 6FC9 340-8WF
Between I/O submodule and terminal strip converter and between I/O submodule and 2nd/3rd machine control panel, round cable, 34-core Length 5 m Length 10 m Length 18 m Length 25 m	25 m	6FC9 340-8XB 6FC9 340-8XC 6FC9 340-8XE 6FC9 340-8XF
To universal interface operating area Length 2 m Length 5 m Length 10 m Length 18 m Length 25 m	30 m	6FC9 344-1FM 6FC9 344-1FB 6FC9 344-1FC 6FC9 344-1FE 6FC9 344-1FF
Between PLC input modules and machine control Length 1 m Length 2 m Length 3 m Length 5 m Length 10 m Length 18 m Length 25 m	50 m	6FC9 344-1UL 6FC9 344-1UM 6FC9 344-1UN 6FC9 344-1UB 6FC9 344-1UC 6FC9 344-1UE 6FC9 344-1UF
Between PLC input modules and machine control Length 1 m Length 2 m Length 3 m Length 5 m Length 10 m Length 18 m Length 25 m	50 m	6FC9 344-1VL 6FC9 344-1VM 6FC9 344-1VN 6FC9 344-1VB 6FC9 344-1VC 6FC9 344-1VE 6FC9 344-1VF
Between operator panel and central controller (MPC interface), copper cable Length 2 m Length 5 m Length 10 m Length 15 m Length 18 m Length 25 m Length 50 m	50 m	6FC9 344-2AM 6FC9 344-2AB 6FC9 344-2AC 6FC9 344-2AD 6FC9 344-2AE 6FC9 344-2AF 6FC9 344-2AG

Cable, complete	Max. possible length	Order No.
To digital rotary encoders and main spindle encoder (new version) and to inductosyn converter Length 1 m Length 2 m Length 3 m Length 5 m Length 10 m Length 15 m Length 18 m Length 25 m Length 30 m Length 50 m Length 5 m (can be trailed) Length 10 m (can be trailed) Length 15 m (can be trailed) Length 18 m (can be trailed) Length 25 m (can be trailed) Length 30 m (can be trailed) Length 50 m (can be trailed)	35 m	6FC9 344-2BL 6FC9 344-2BM 6FC9 344-2BN 6FC9 344-2BB 6FC9 344-2BC 6FC9 344-2BD 6FC9 344-2BE 6FC9 344-2BF 6FC9 344-2BJ 6FC9 344-2BG 6FC9 344-2BB01 6FC9 344-2BC01 6FC9 344-2BD01 6FC9 344-2BE01 6FC9 344-2BF01 6FC9 344-2BJ01 6FC9 344-2BG01
Between operator panel and central controller (MPC interface) divisible max. 3 times (up to 4 part lengths) Part lengths to order Left part cable 15 m Middle 1st part cable 15 m Middle 2nd part cable . . . m Right part cable 15 m	50 m	6FC9 344-2RD10 6FC9 344-2RD20 6FC9 344-2RD20 6FC9 344-2RD30
Between PLC input modules and machine control, ribbon cable Length 1 m Length 2 m Length 3 m Length 5 m	5 m	6FC9 344-2TL 6FC9 344-2TM 6FC9 344-2TN 6FC9 344-2TB
Between inductosyn converter and inductosyn pre- amplifier Length 5 m Length 10 m	50 m	6FC9 344-3EB 6FC9 344-3EC
Between inductosyn converter and inductosyn scale Length 5 m Length 10 m Length 18 m Length 25 m Length 50 m	50 m	6FC9 344-3FB 6FC9 344-3FC 6FC9 344-3FE 6FC9 344-3FF 6FC9 344-3FG
To 2nd/3rd operator panel, monitor encoder Length 18 m Length 25 m Length 30 m	30 m	6FC9 344-3KE 6FC9 344-3KF 6FC9 344-3KJ

8.1 Tabular overview of cables

Cable, complete	Max. possible length	Order No.
Between digital linear measuring system and EXE (extension) Length 17 m	17 m	6FC9 344-3LD
To DMP terminal blocks Round cable Length 0.25 m Length 1 m Length 2 m Length 5 m Length 10 m Length 18 m Length 25 m	50 m	6FC9 344-3QA 6FC9 344-3QL 6FC9 344-3QM 6FC9 344-3QB 6FC9 344-3QC 6FC9 344-3QE 6FC9 344-3QF
Between interface DMP and DMP terminal block Length 1 m Length 2 m Length 3 m Length 5 m Length 10 m Length 18 m Length 25 m	50 m	6FC9 344-3SL 6FC9 344-3SM 6FC9 344-3SN 6FC9 344-3SB 6FC9 344-3SC 6FC9 344-3SE 6FC9 344-3SF
Between interface DMP and expansion unit Length 5 m	50 m	6FC9 344-3UB
Between I/O submodule and 2nd/3rd machine control panel Length 5 m Length 10 m Length 25 m	25 m	6FC9 344-3WB 6FC9 344-3WC 6FC9 344-3WF
Between PLC mixed I/O modules and machine control Length 5 m Length 10 m	50 m	6FC9 344-3XB 6FC9 344-3XC
To rotary measuring system SIPOS Length 5 m (can be trailed) Length 10 m (can be trailed) Length 18 m (can be trailed) Length 25 m (can be trailed)	100 m	6FC9 344-4DB01 6FC9 344-4DC01 6FC9 344-4DE01 6FC9 344-4DF01
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
Between machine control panel and input module if no operator panel is used. Length 25 m	50 m	6FC9 344-4QF

Cable , complete	Max. possible length	Order No.
Between operator panel and central controller (MPC interface), optical-fibre cable Length 10 m (plastic) Length 30 m (glass) Length 50 m (glass) Length 75 m (glass)	50 m	6FX1 400-2BC10 6FX1 400-1BC30 6FX1 400-1BC50 6FX1 400-1BC75

Note:

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

8.2 Tabular overview of connectors

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

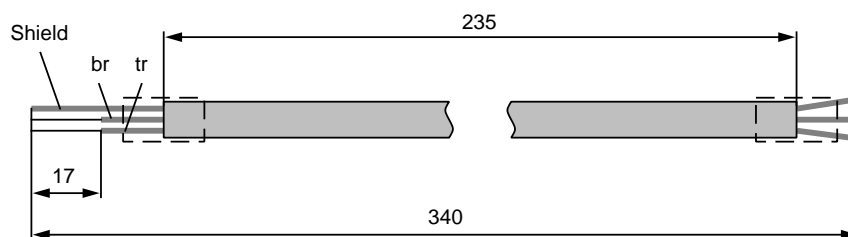
8.3 Cable diagrams

The order numbers of the cable diagrams are listed in ascending order.

Cables connecting INDUCTOSYN scales

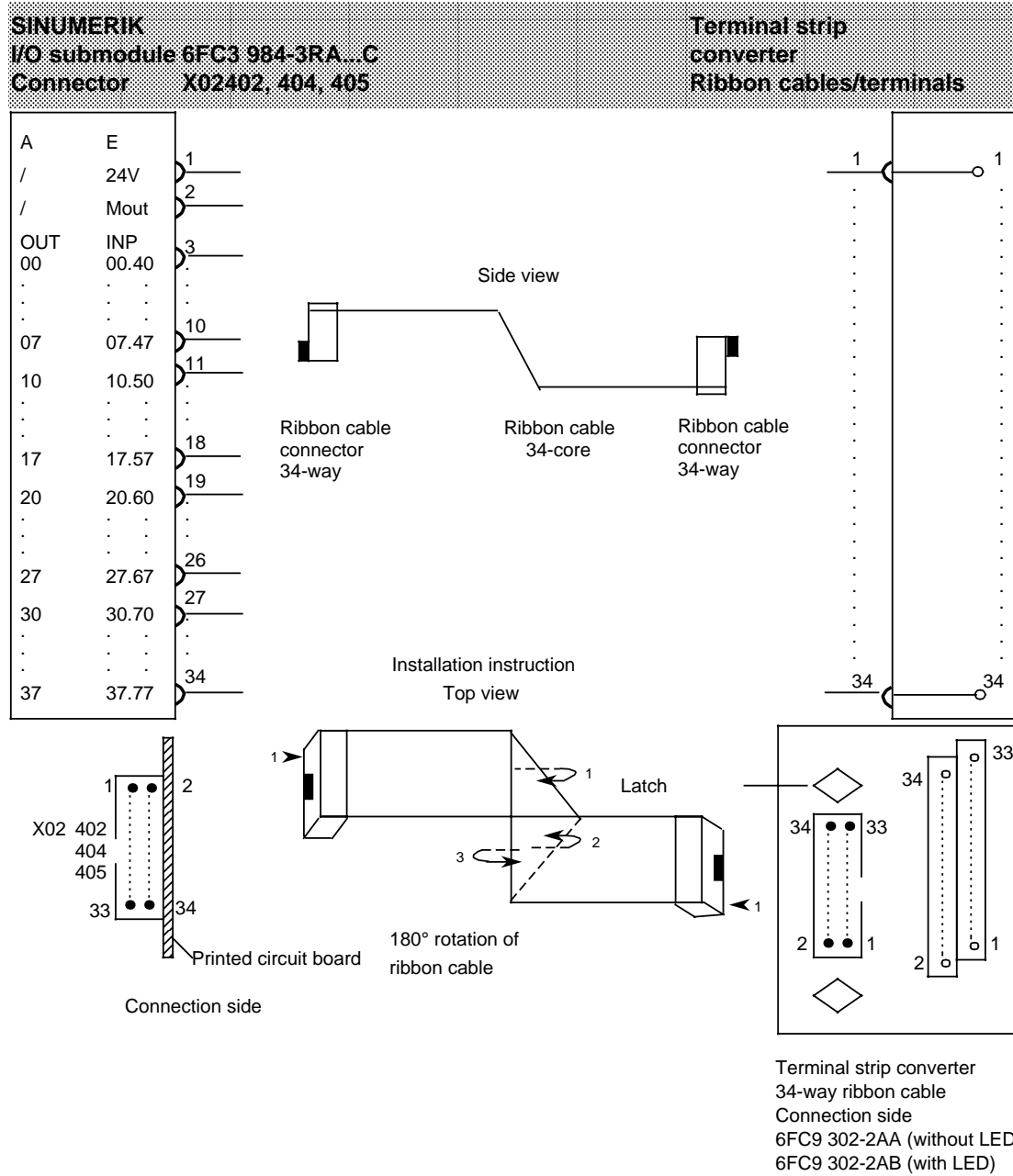
Order No.: **6FC9 198-4AL**

SINUMERIK System 800
Module slot:
Module connector:



Cable:
2YD(ms)Y 2 x 0.5/1.5

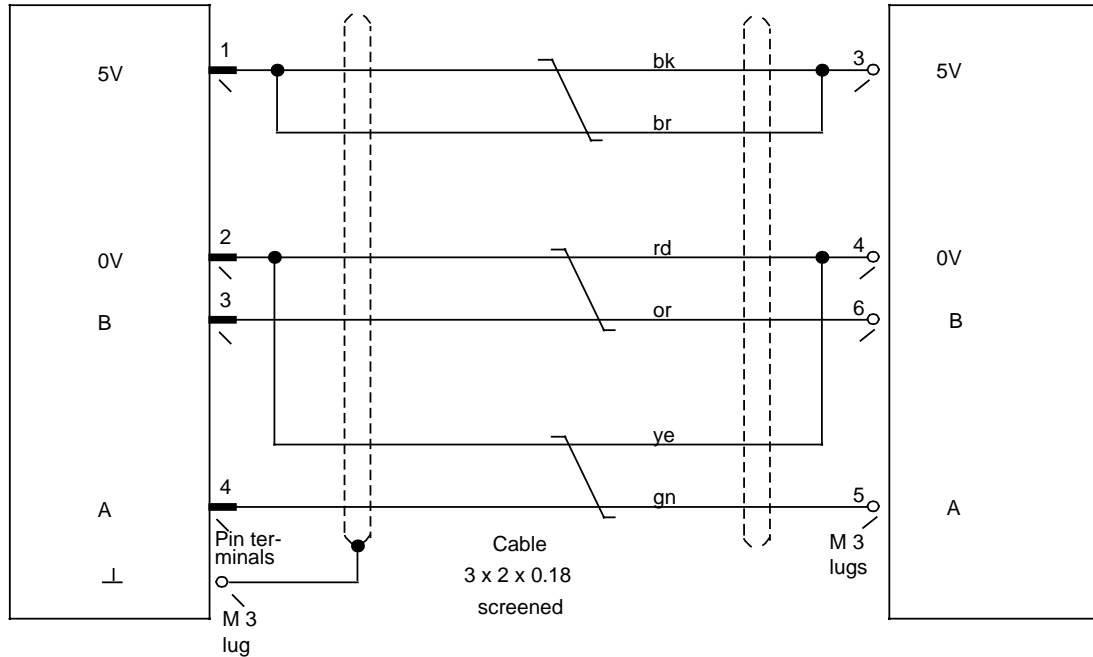
Cable name: Terminal strip converter for I/O submodule, ribbon cable
Order No.: **6FC9 340-8L**



I/O sub-module No.	Rot. switch position		PLC outputs connector X402 OUT 00 ... 37	PLC inputs connector X02404 INP 00 ... 37	PLC inputs connector X02405 INP 40 ... 77	PLC inputs connector X02406 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	I80.0 ... 83.7	I84.0 ... 87.7	I84.0 ... 85.1
4	3	3	Q76.0 ... 79.7	I88.0 ... 91.7	I92.0 ... 95.7	I92.0 ... 93.1

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

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



Cable end prepared for connection

Cable end prepared for connection

Bare wire ends 50 mm

Bare wire ends 50 mm

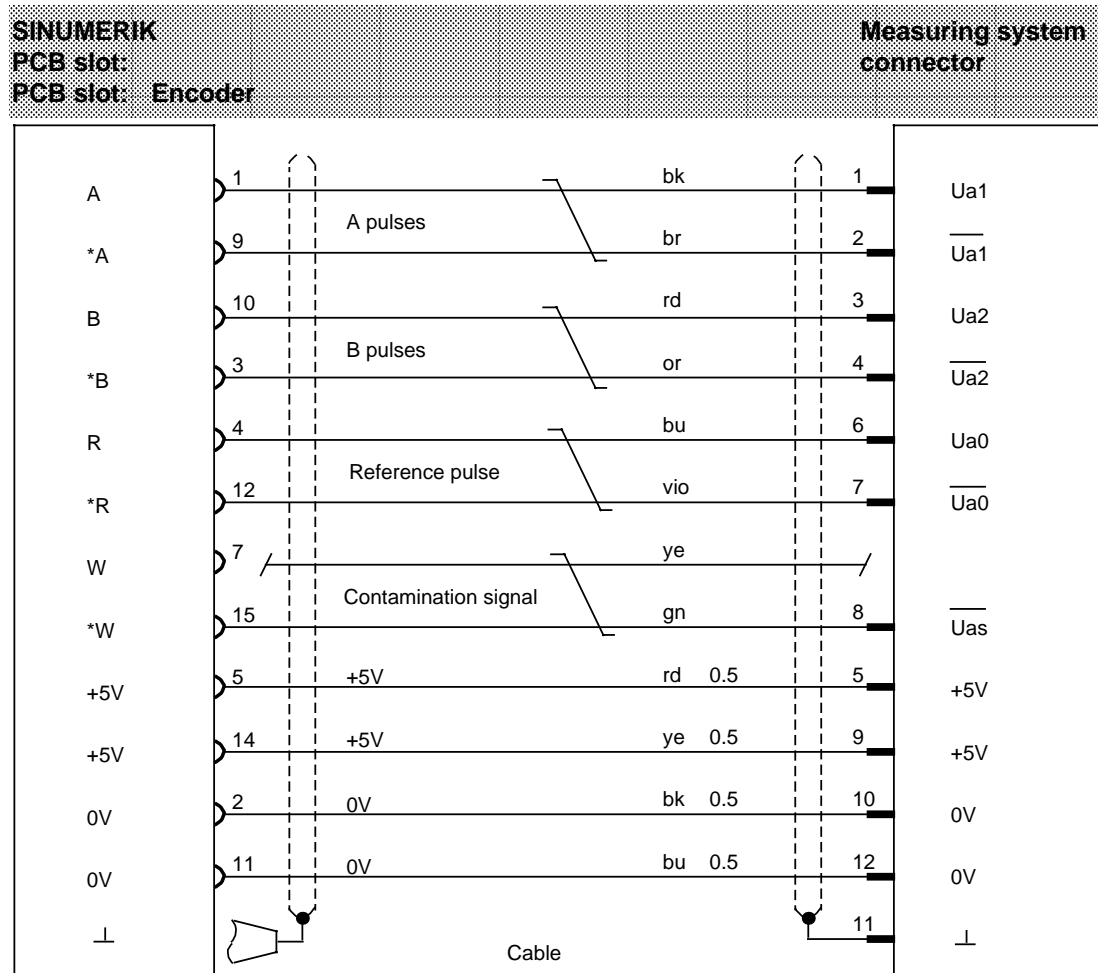
Pin terminal + terminal marking on designated wires

M3 lugs + terminal marking on designated wires

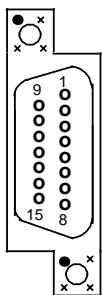
Screen end with M3 lug

Designation: NC

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



Cable
4 x 2 x 0.38
4 x 0.5
screened



Connector

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

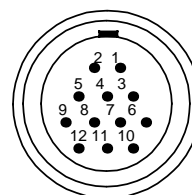
Connector code

- coding pin
- x no coding pin

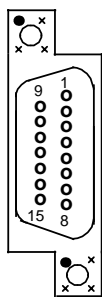
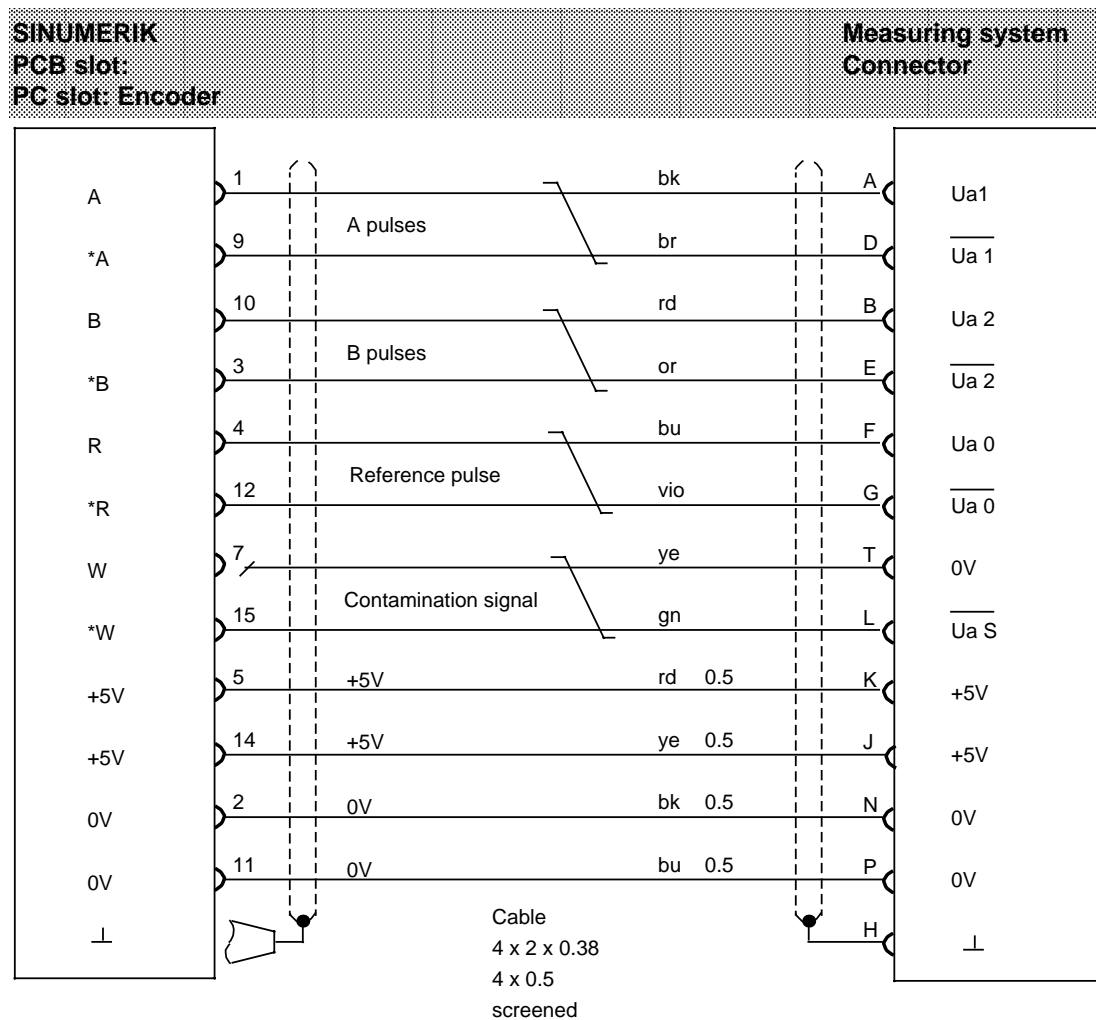
Connector

12-way, male
Souriau
8.40-31-830
Connection side

6 FC9 341 - 1AB



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



Connector

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

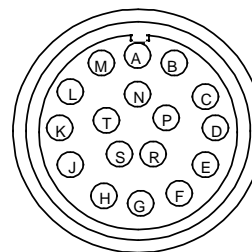
Connector code

- coding pin
- x no coding pin

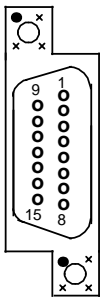
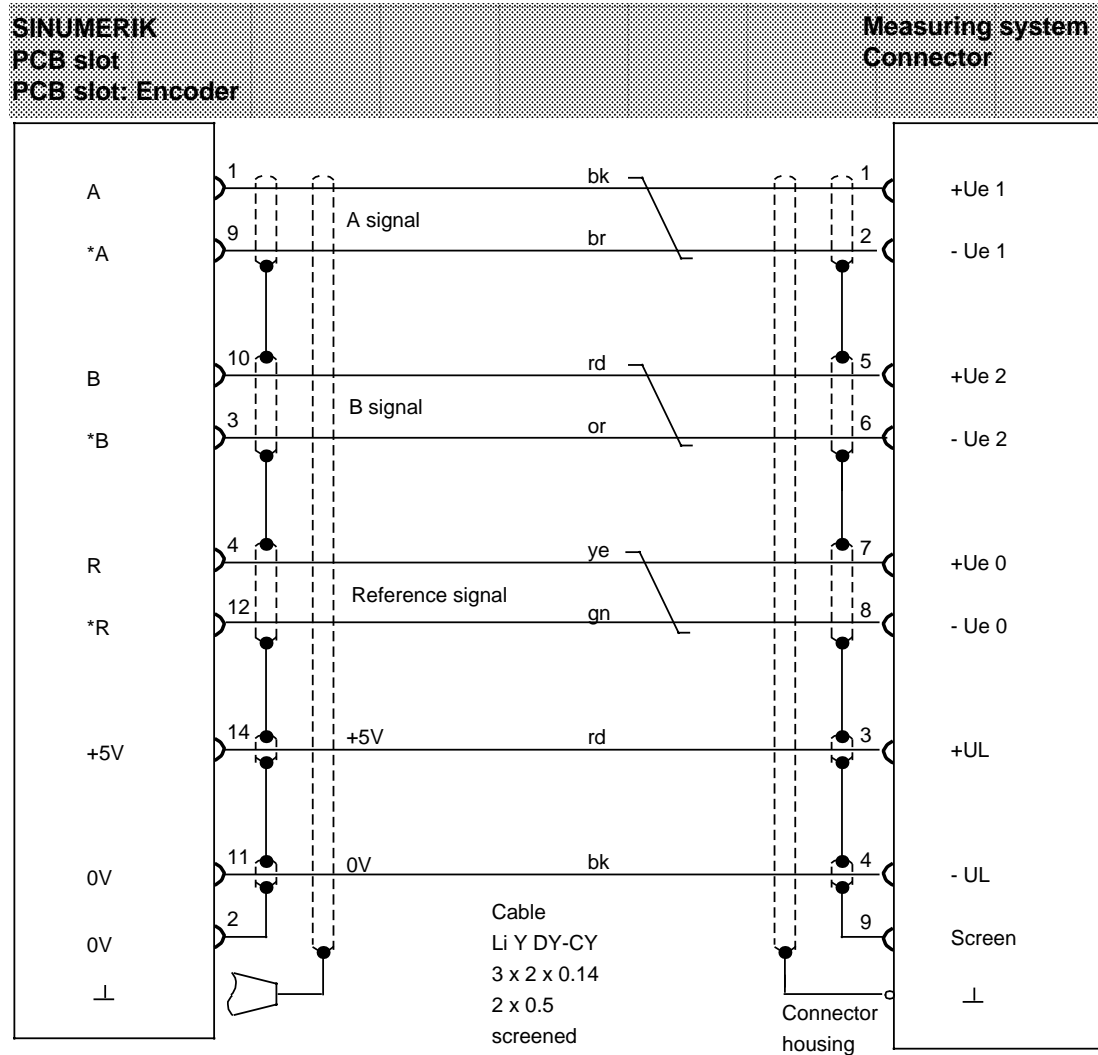
Connector

17-way, female
Tuchel
CA 08-20-295
Connection side

6 FC9 341 - 1AC



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



Connector

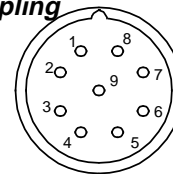
Position: 1 top
D sub
15-way, female
Connection side
SINUMERIK housing
6FC9 341-1EC

Connector code

- coding pin
- x no coding pin

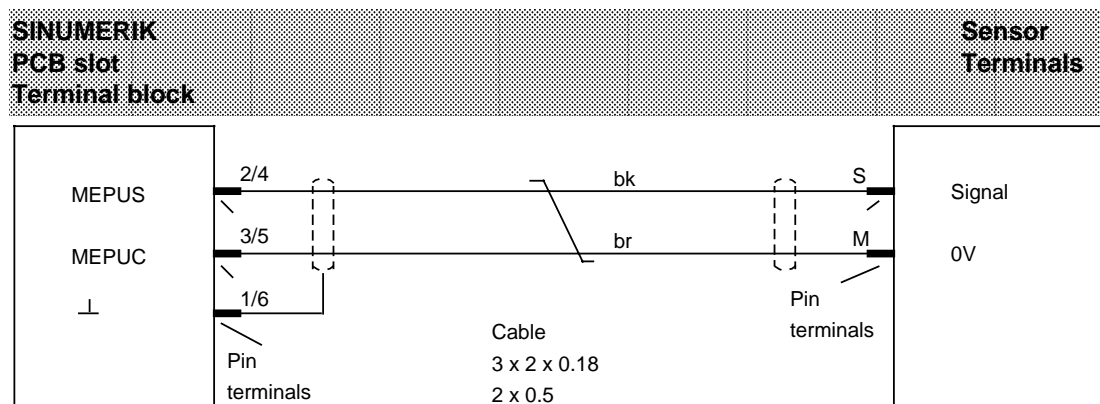
Connector coupling

9-way, female
SIEMENS
8 mm cable
Connection side



6 FC9 341 - 1EW

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

Terminal marking on the NC:

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

Measuring with 2 sensors requires two cables

Cable end prepared for connection

Bare wire ends 30 mm

Pin terminal+
terminal marking
on designated wires

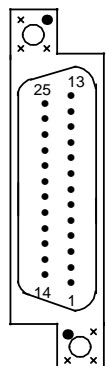
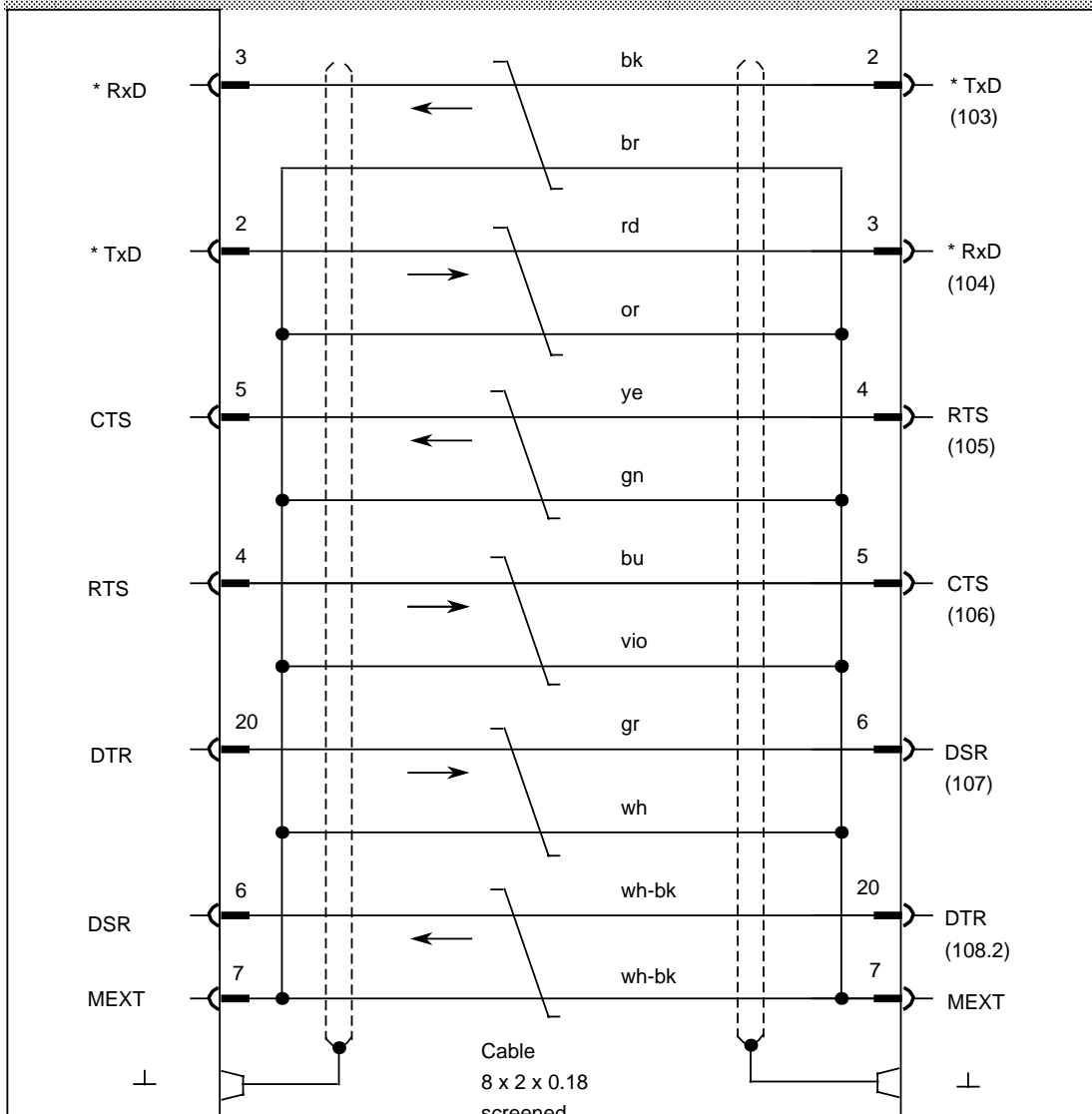
Wiring of the measurement inputs

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

* Dip-Fix closed

Cable name: 2nd/3rd operator panel, keyboard interface RS232C (V.24)
Order No.: **6FC9 340-8W**

SINUMERIK
PCB: **6FX 1120-4BB** PCB connector: **X 131**
PCB: **6FX 1143-3BA:** PCB connector: **X 111:**

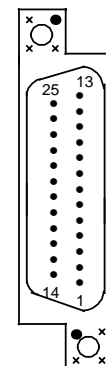


Connector
Position: 1 at bottom
D - Sub
25-way, male
Connection side
SINUMERIK housing
6FC9 341-2AB
Designation: NC 1

Connector code

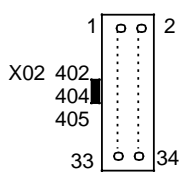
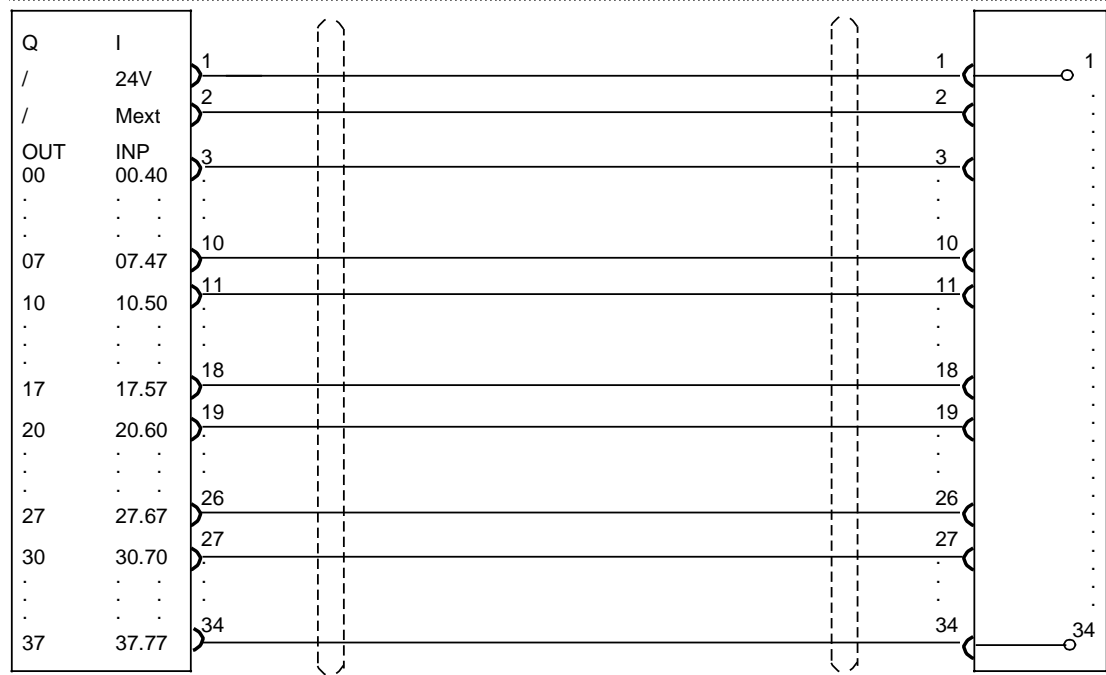
- coding pin
- x no coding pin

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



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

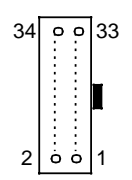
SINUMERIK I/O submodule: 6FC3 984-3RA...C Connector: X02402, 404, 405	Terminal strip converter Ribbon cable/terminals
--	--



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

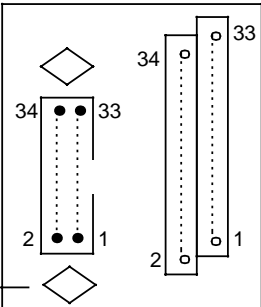
Cable
21 x 2 x 0.18
(screened)
4 pairs unassigned

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



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

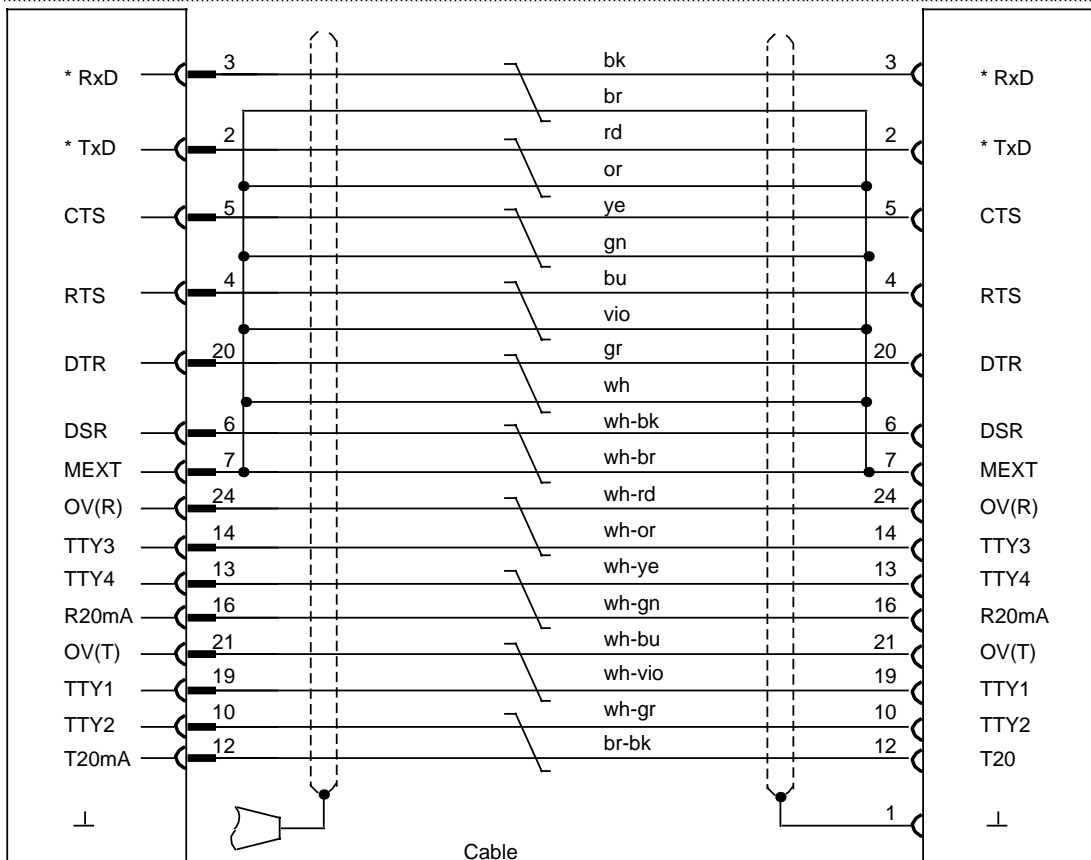
Terminal strip converter
34-core ribbon cable
Connection side
6FC9 302-2AA (without LED)
6FC9 302-2AB (with LED)



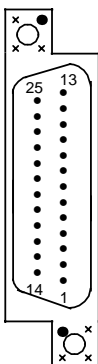
I/O sub-module No.	Rot. switch position		PLC outputs connector X02 402	PLC inputs connector X02 404	PLC inputs connector X02 405	PLC inputs connector X02 406
	S1	S2	OUT 00 ... 37	INP 00 ... 37	INP 40 ... 77	INP 40 ... 51
1	0	0	Q64.0 ... 67.7	I64.0 ... 67.7	I68.0 ... 71.7	I68.0 ... 69.1
2	1	1	Q68.0 ...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

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

SINUMERIK	Operating area
PCB slot : B 3	Connector
PCB connector : X 121	RS232C V.24/TTY



Cable
10 x 2 x 0.18
screened



Connector

Position 1 bottom
D sub
25-way male
Connection side
SINUMERIK housing

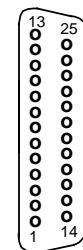
6FC9 341-2AB

Connector code

- coding pin
- x no coding pin

Connector

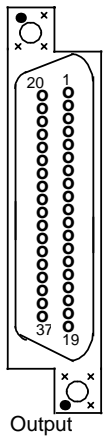
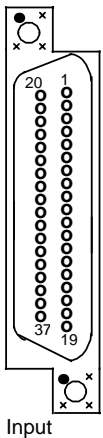
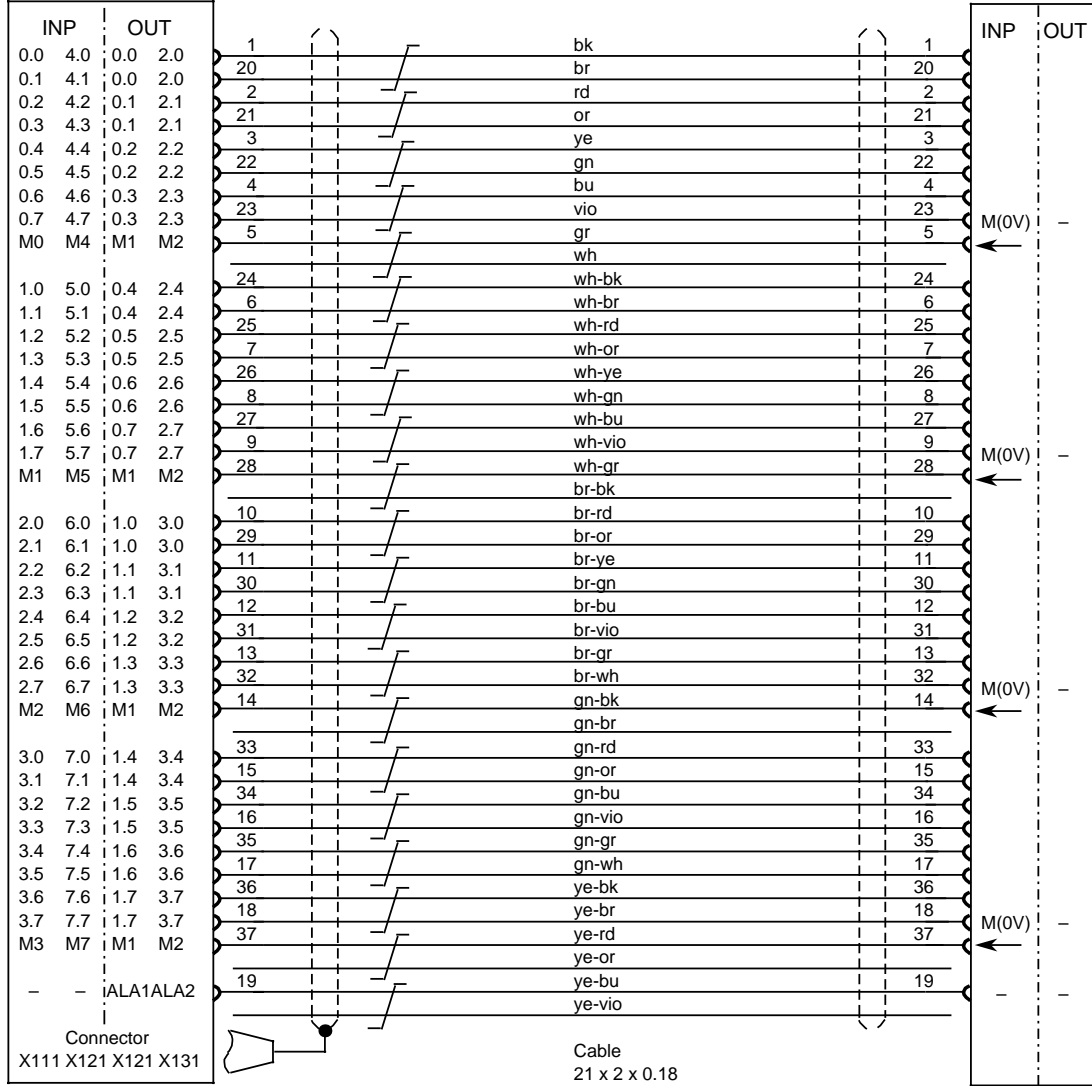
Position 1 bottom
D sub
25-way female
Connection side
Connector insert and
2 push latching buttons
with nuts
6FC9 341-1EB



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

Input/output
Input
Output

SINUMERIK	800			Machine control panel
PCB	6FX1 125-7BA	6FX1 122-8B	Terminal strip	
PCB connector	Input	X111, X121	Output	X121, X131
				converter



Connector

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

Designation: NC

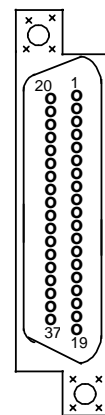
Connector code

- coding pin
- x no coding pin

Connector

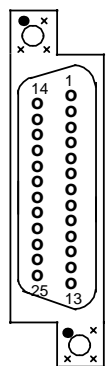
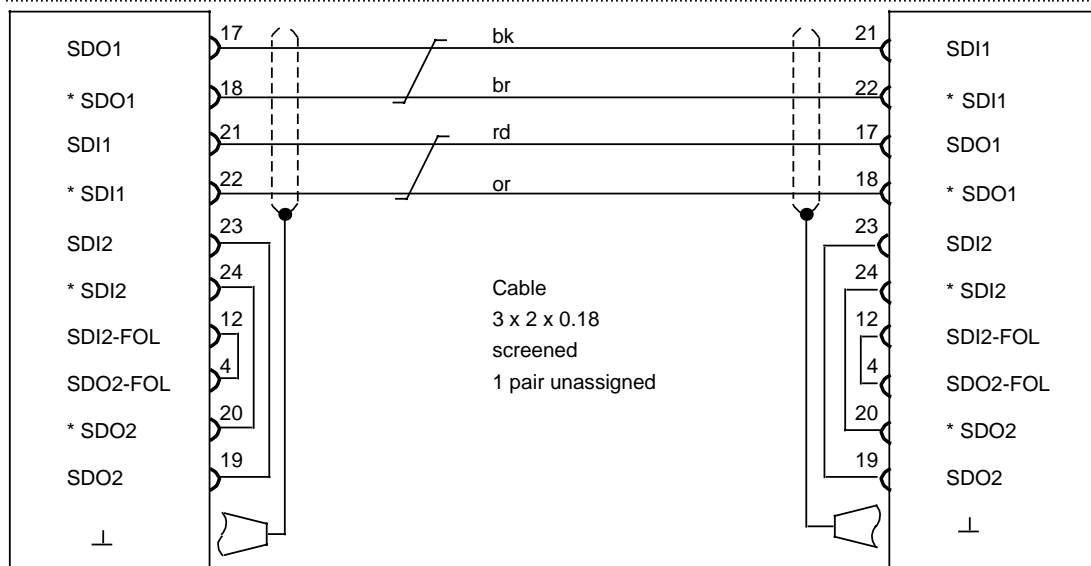
Position: 1 at top
D sub
37-way, female
Connection side
SINUMERIK housing
6FC9 341-1FH

Designation: KLU



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

SINUMERIK : 880	880
PCB slot : B3	A 4 : PCB slot
PCB connector : X111	X111: PCB connector

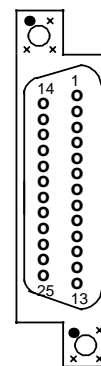


Connector

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

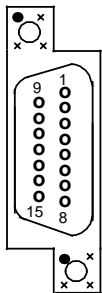
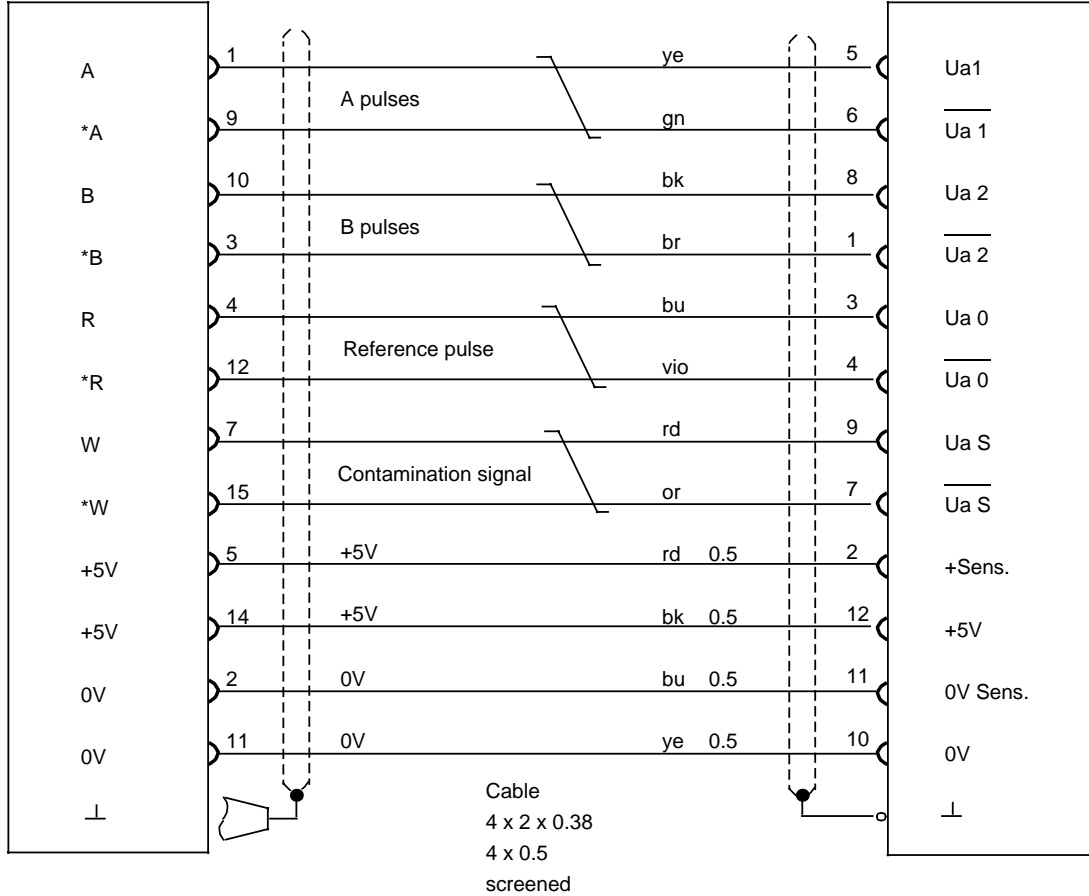
Connector code

- coding pin
- x no coding pin



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

SINUMERIK **Measuring system**
PCB slot **Connector**
PCB connector : Encoder

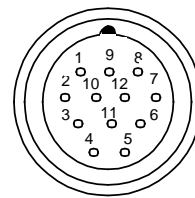


Connector
Position: 1 top
D sub
15-way, female
Connection side
SINUMERIK housing
6FC9 341-1EC

Connector code

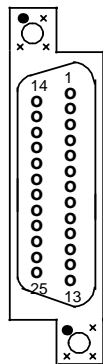
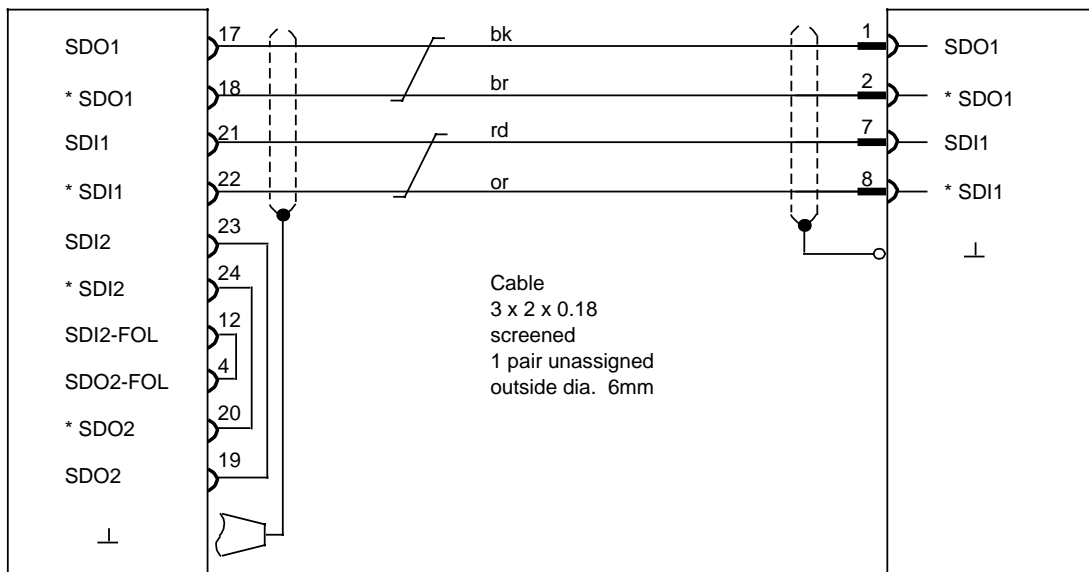
- coding pin
- x no coding pin

Connector
12-way, female
SIEMENS
10 mm cable
Connection side
6 FC9 341 - 1FD



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

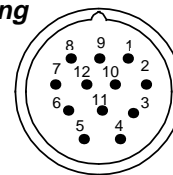
Position: 1 top
D sub
25-way female
Connection side
SINUMERIK housing
6FC9 341-1ED

Connector code

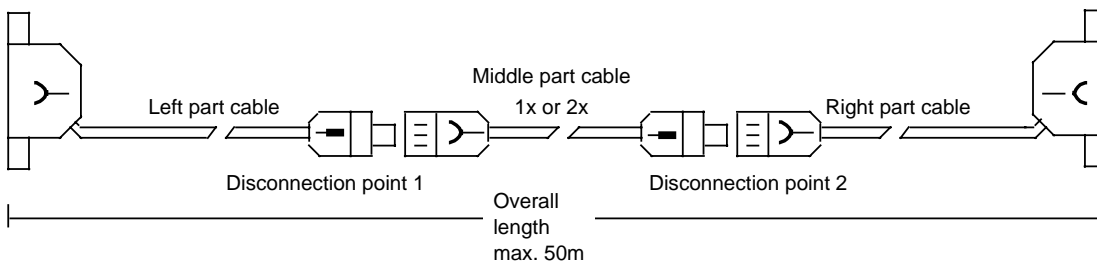
- coding pin
- × no coding pin

Connector coupling

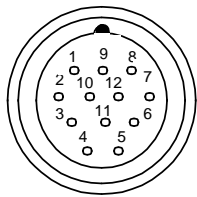
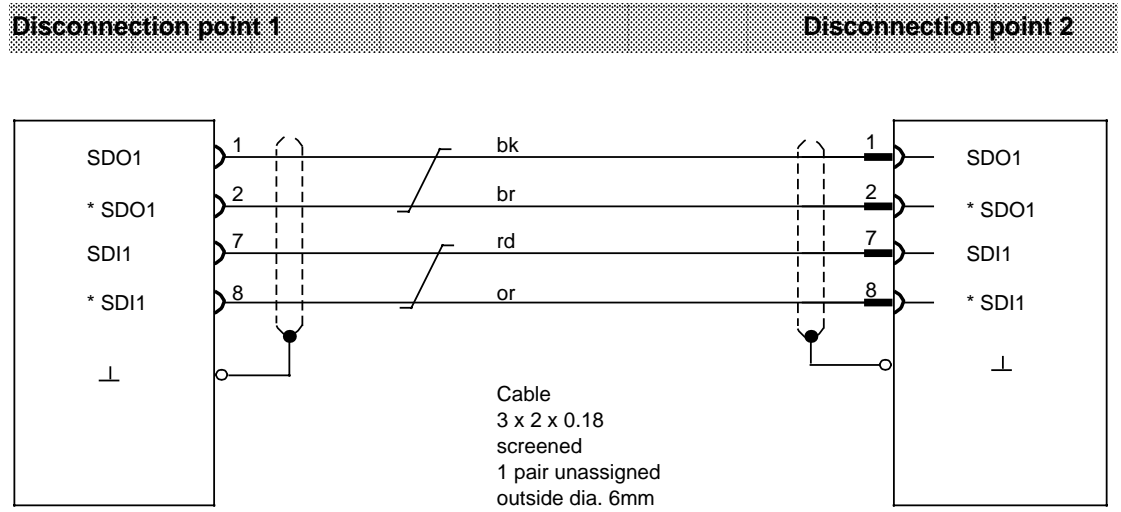
12-way, pin
SIEMENS
6 mm cable
Connection side
6 FC9 341 - 1FS



Complete cable configuration



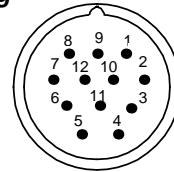
Cable name: MPC interface (Cu-L) with disconnection points, middle part cable
 Order No.: **6FC9 344-2RZ**



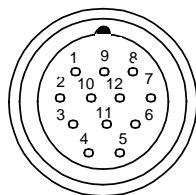
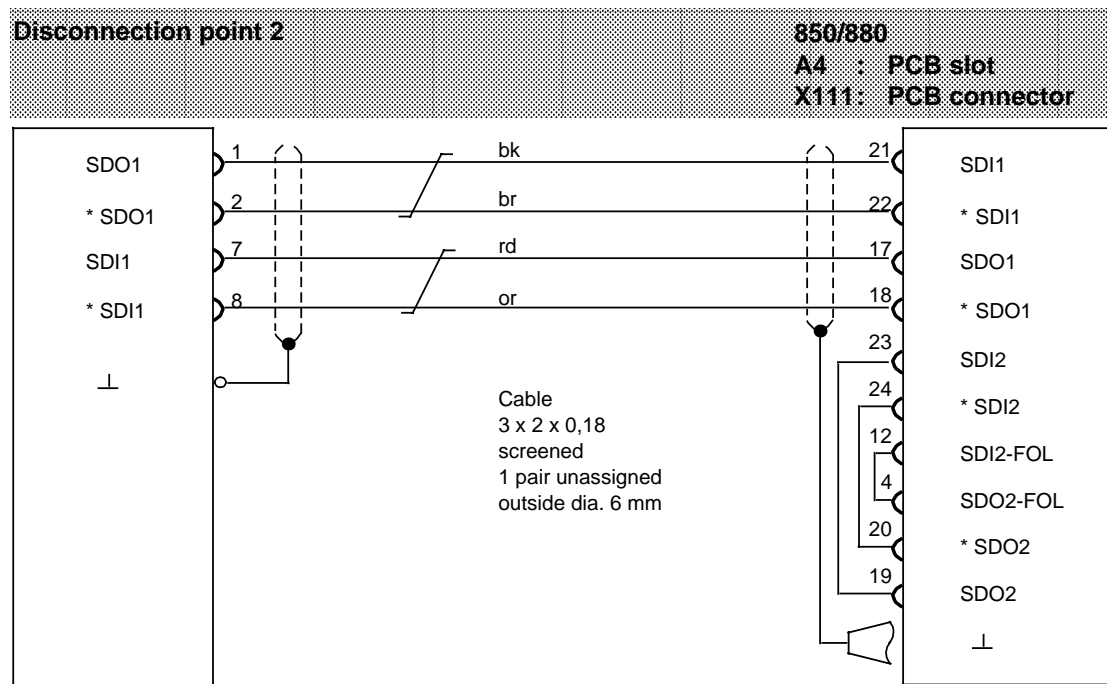
Connector
 12-way, female
 SIEMENS
 6 mm cable
 Connection side
 6 FC9 341 - 1FT

Connector coupling

12-way, male
 SIEMENS
 6 mm cable
 Connection side
 6 FC9 341 - 1FS



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

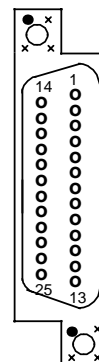


Round connector

12-way female
SIEMENS
6 mm cable
Connection side
6 FC9 341 - 1FT

Connector

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

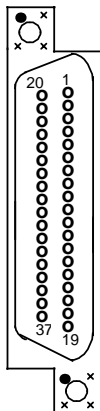
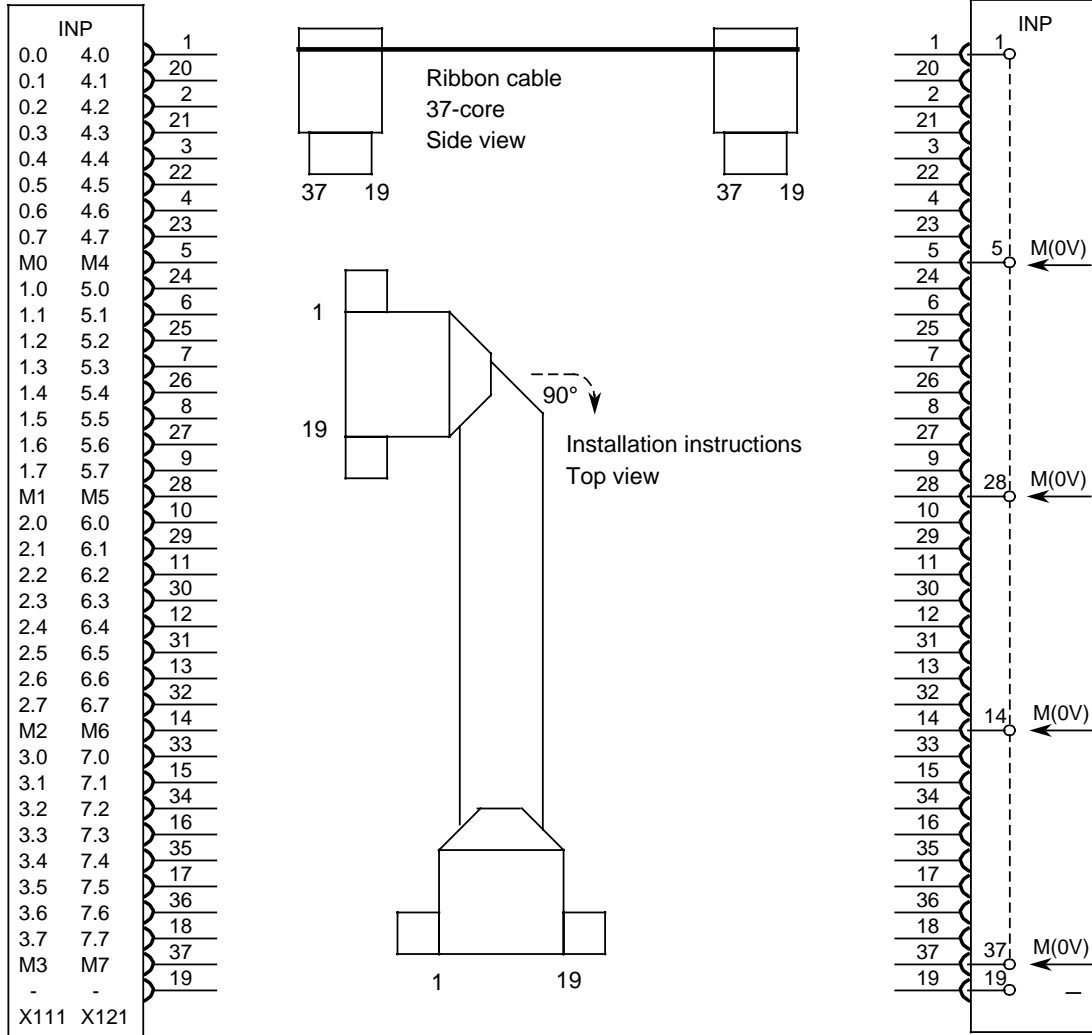


Connector code

- coding pin
- x no coding pin

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

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



Ribbon cable connector

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

Designation: NC

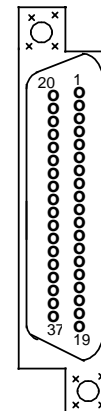
Connector code

- coding pin
- x no coding pin

Ribbon cable connector

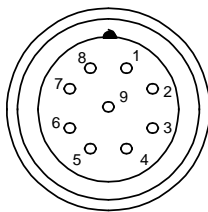
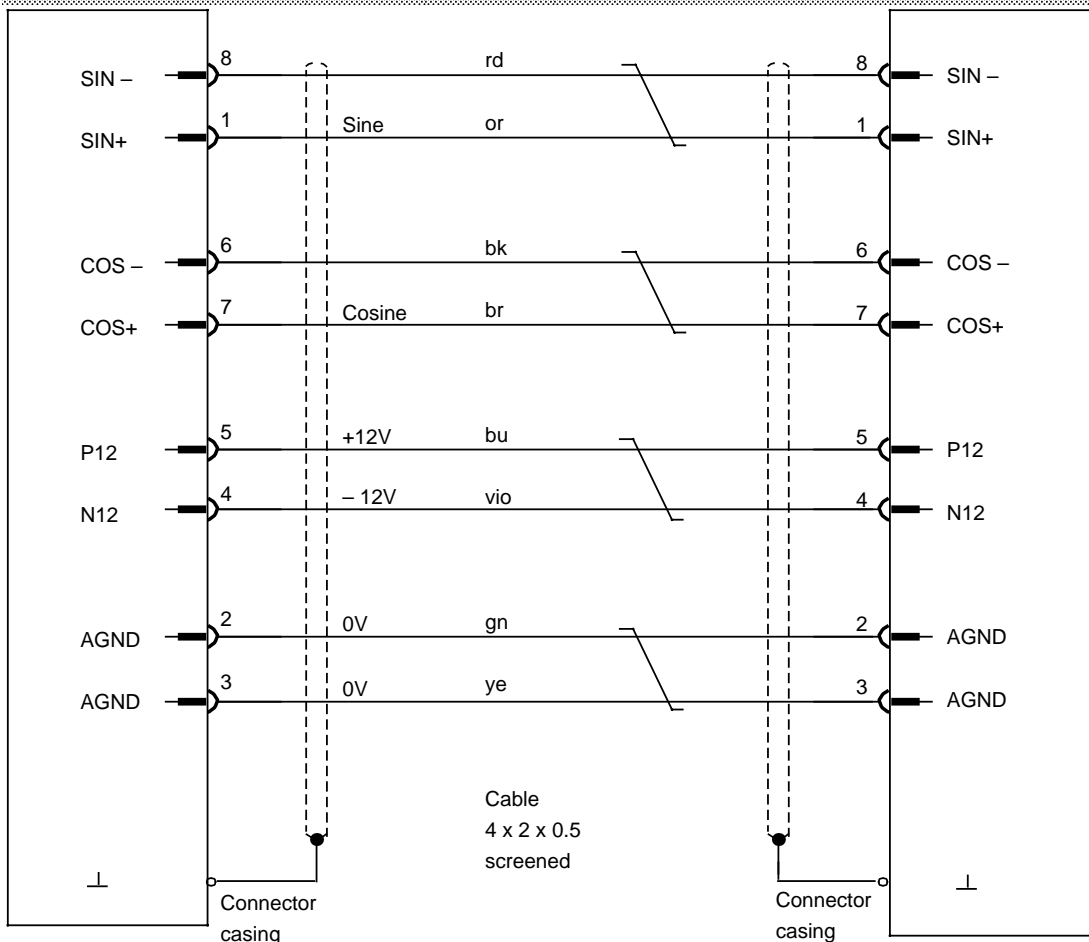
Position: 1 at top
D sub
37-way, female
Connection side
SINUMERIK housing
6FC9 341-1FX

Designation: KLU



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

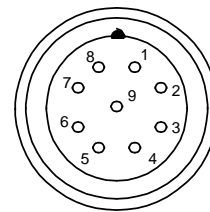
Inductosyn converter 6FC9 320-3GK Connector X13	Inductosyn pre-amplifier 6FC9 340-4FC Connector X16
--	--



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

6 FC9 341 - 1AU

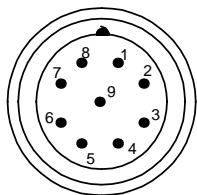
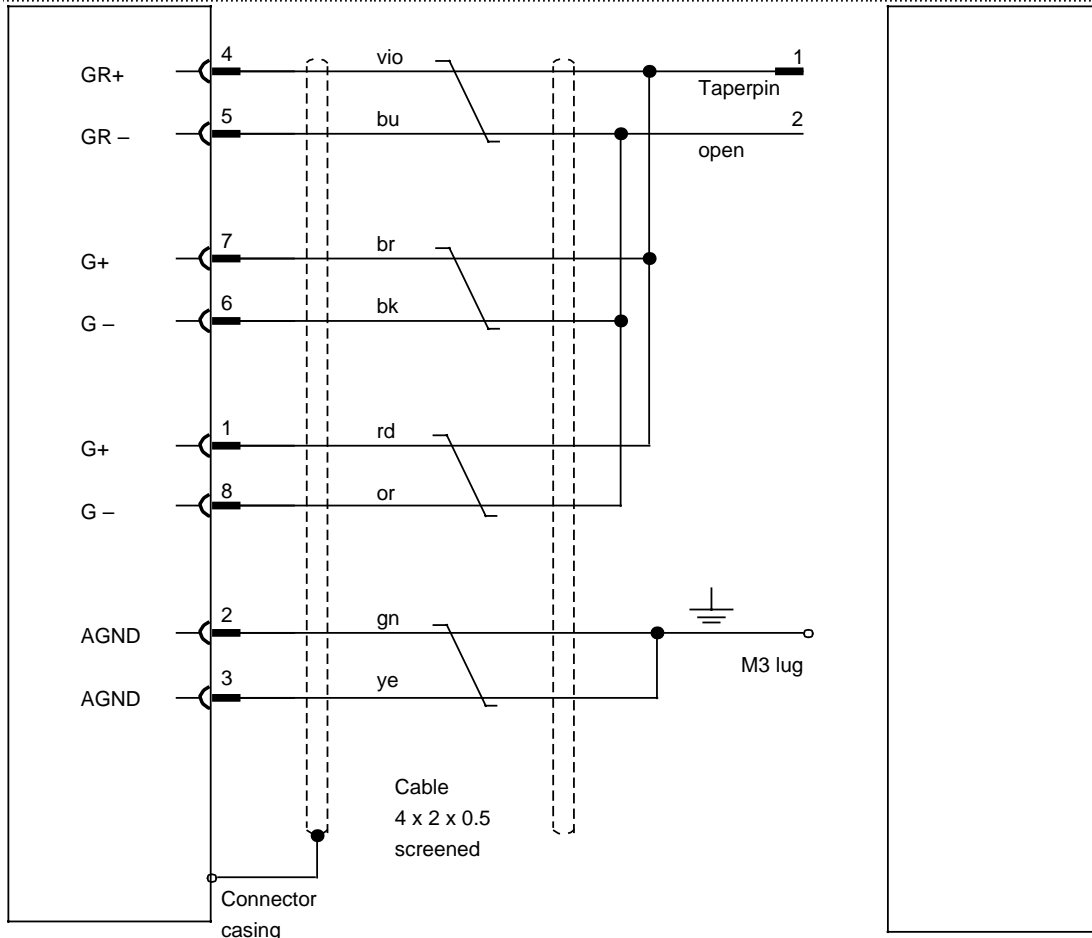
Connector
9-way, female
SIEMENS
8 mm cable
Connection side



6 FC9 341 - 1AU

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

Inductosyn converter
6FC9 320-3GK
Connector X12 **Inductosyn Scale**



Connector
9-way, male
SIEMENS
8 mm cable
Connection side
6 FC9 341 - 1AT

Cable end prepared for connection

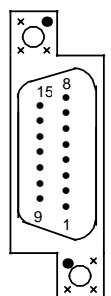
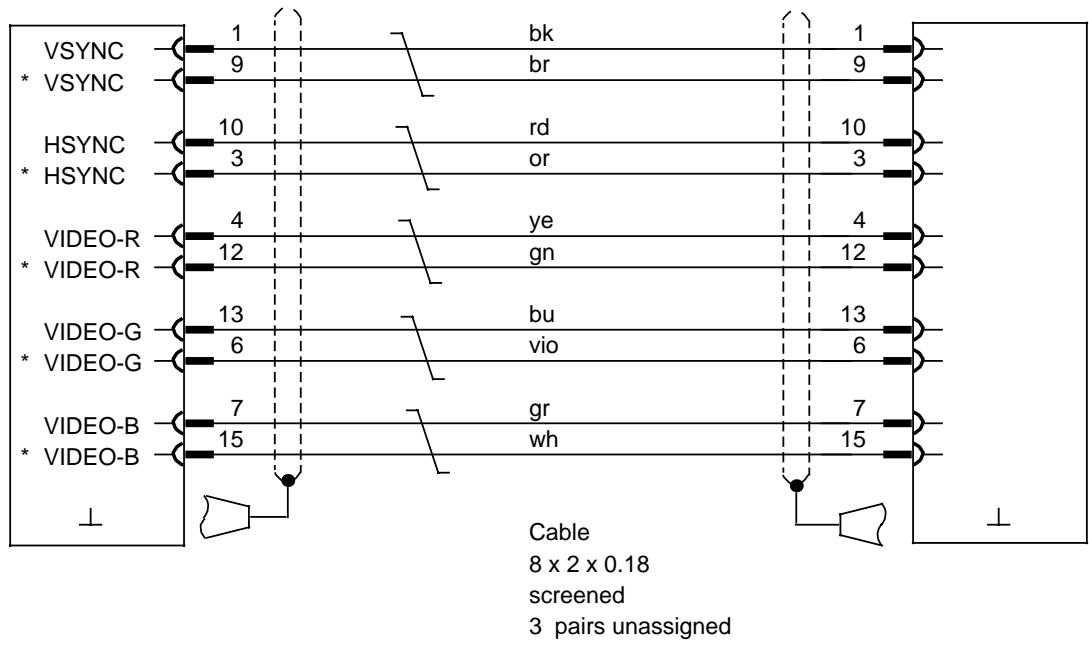
Bare wire ends
1.2 40 mm
 60 mm

Terminal marking on designated wires

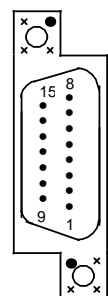
Designation: SCALA

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

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



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

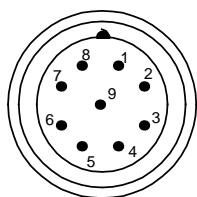
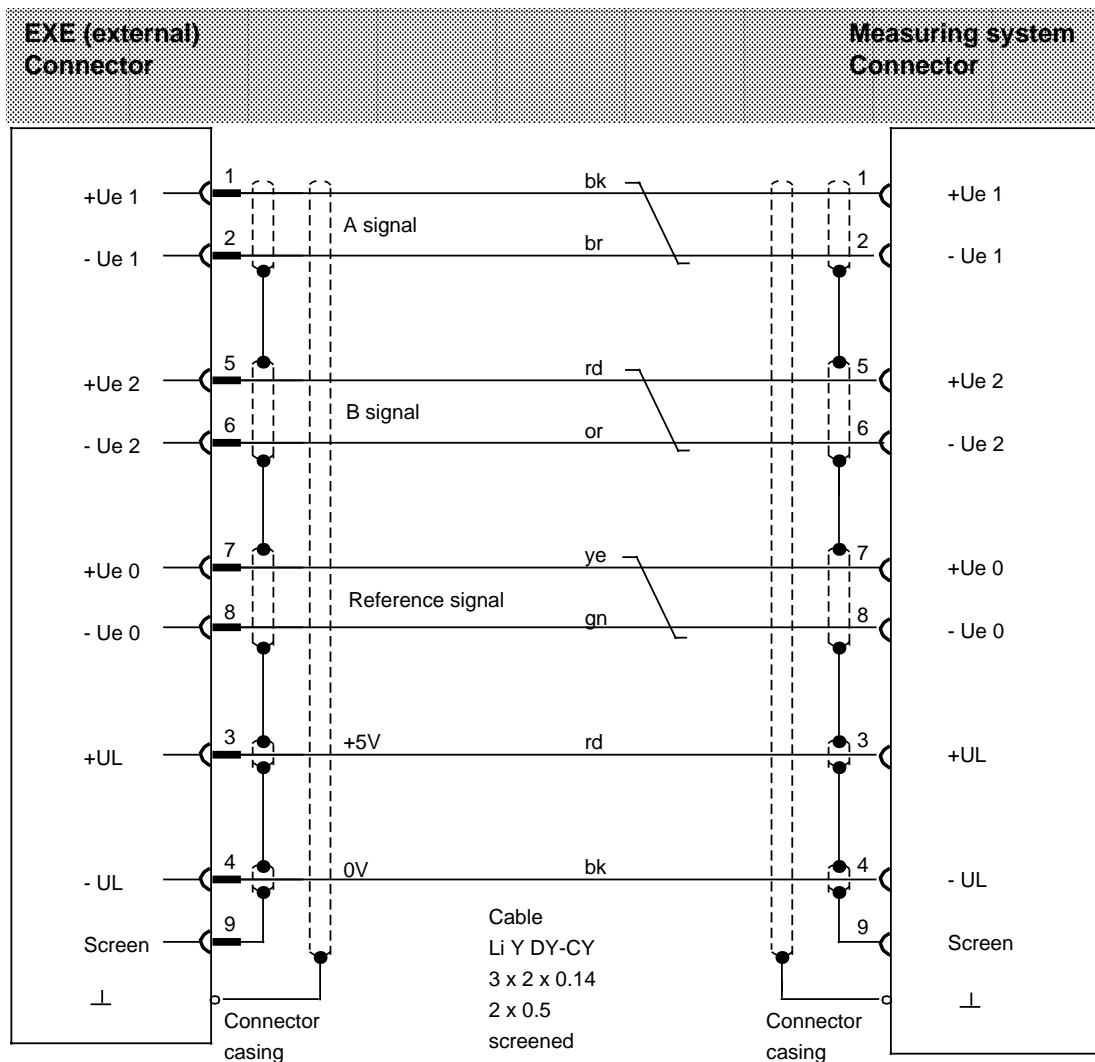


Connector
Position: 1 at top bottom
D sub
15-way, male
Connection side
SINUMERIK housing
6FC9 341-1EU

Connector code

- coding pin
- x no coding pin

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



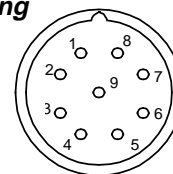
Connector
9-way, male
SIEMENS
8 mm cable
Connection side

6 FC9 341 - 1AT

Designation: EXE

Connector coupling

9-way, female
SIEMENS
8 mm cable
Connection side

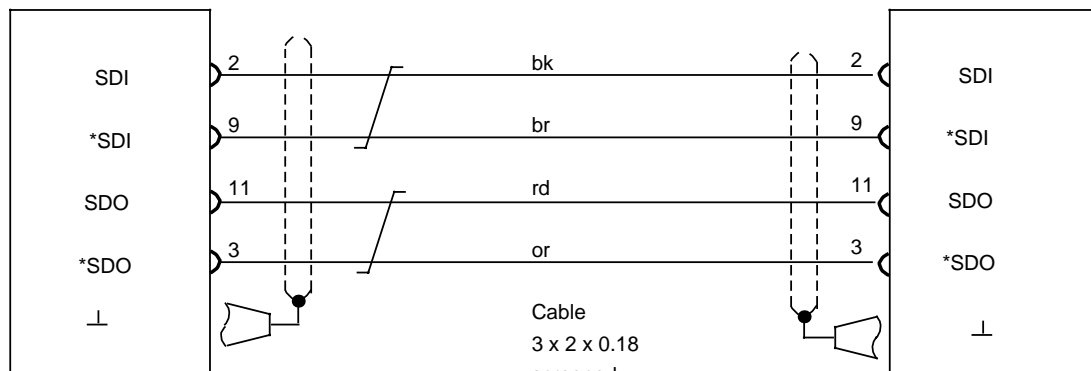


6 FC9 341 - 1EW

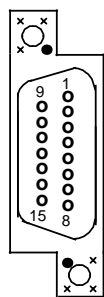
Designation: LINEAL

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

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



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



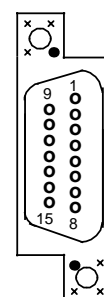
Connector

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

Designation: DMP

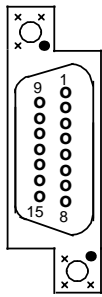
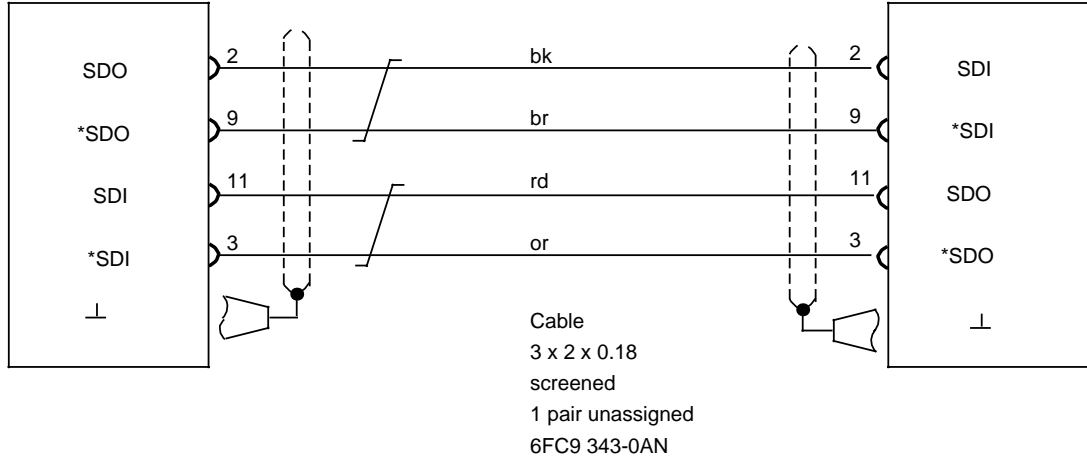
Connector code

- coding pin
- × no coding pin



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



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

Connector code

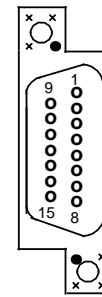
- coding pin
- x no coding pin

Connector

Position: 1 at top
 D sub
 15-way female
 Connection side
 SINUMERIK housing
 6FC9 341-1EC
 Designation: NC

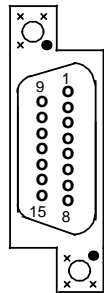
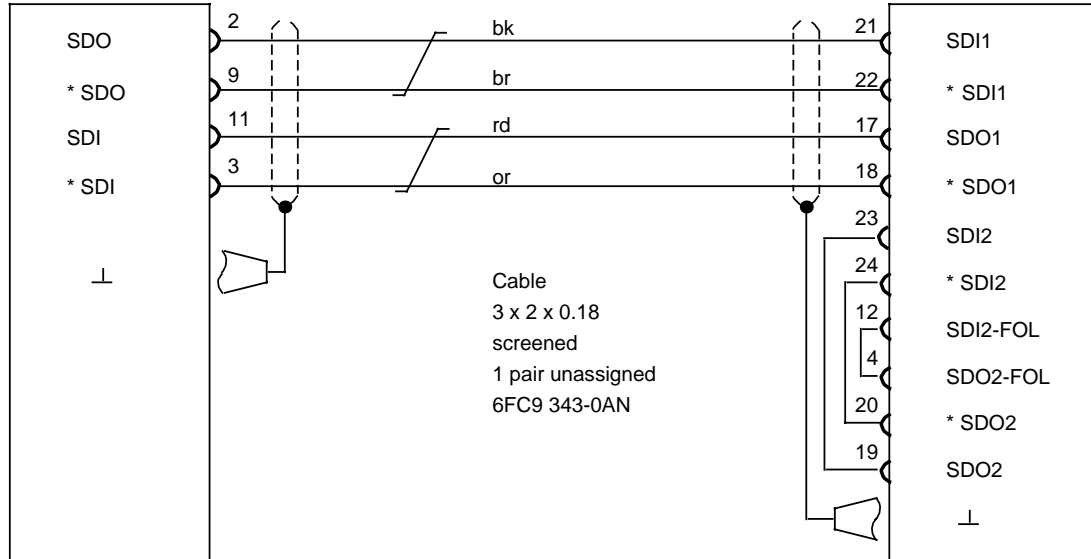
Connector code

- coding pin
- x no coding pin



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 female
Connection side
SINUMERIK housing
6FC9 341-1EC
Designation: NC

Connector code

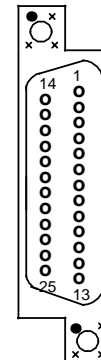
- coding pin
- x no coding pin

Connector

Position: 1 at top
D sub
25-way female
Connection side
SINUMERIK housing
6FC9 341-1ED
Designation: EU

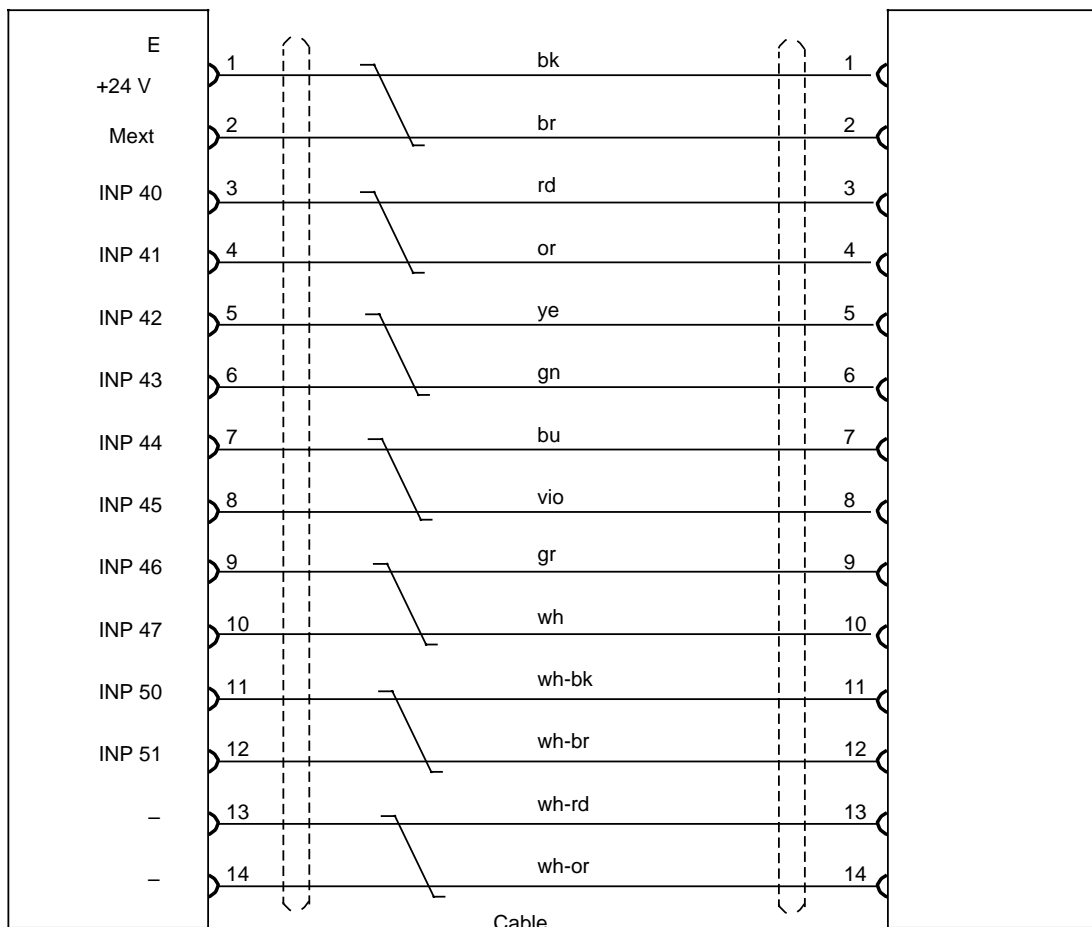
Connector code

- coding pin
- x no coding pin

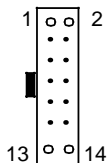


Cable name: Machine control panel I/O submodule, round cable
Order No.: **6FC9 344-3W**

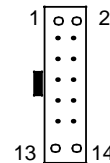
SINUMERIK		Machine control panel
I/O submodule : 6FC3 984-3RA C		X301
Connector : X02 406		



Cable
8 x 2 x 0.18
screened
1 pair unassigned



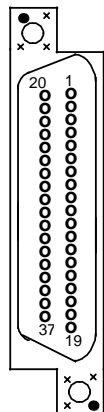
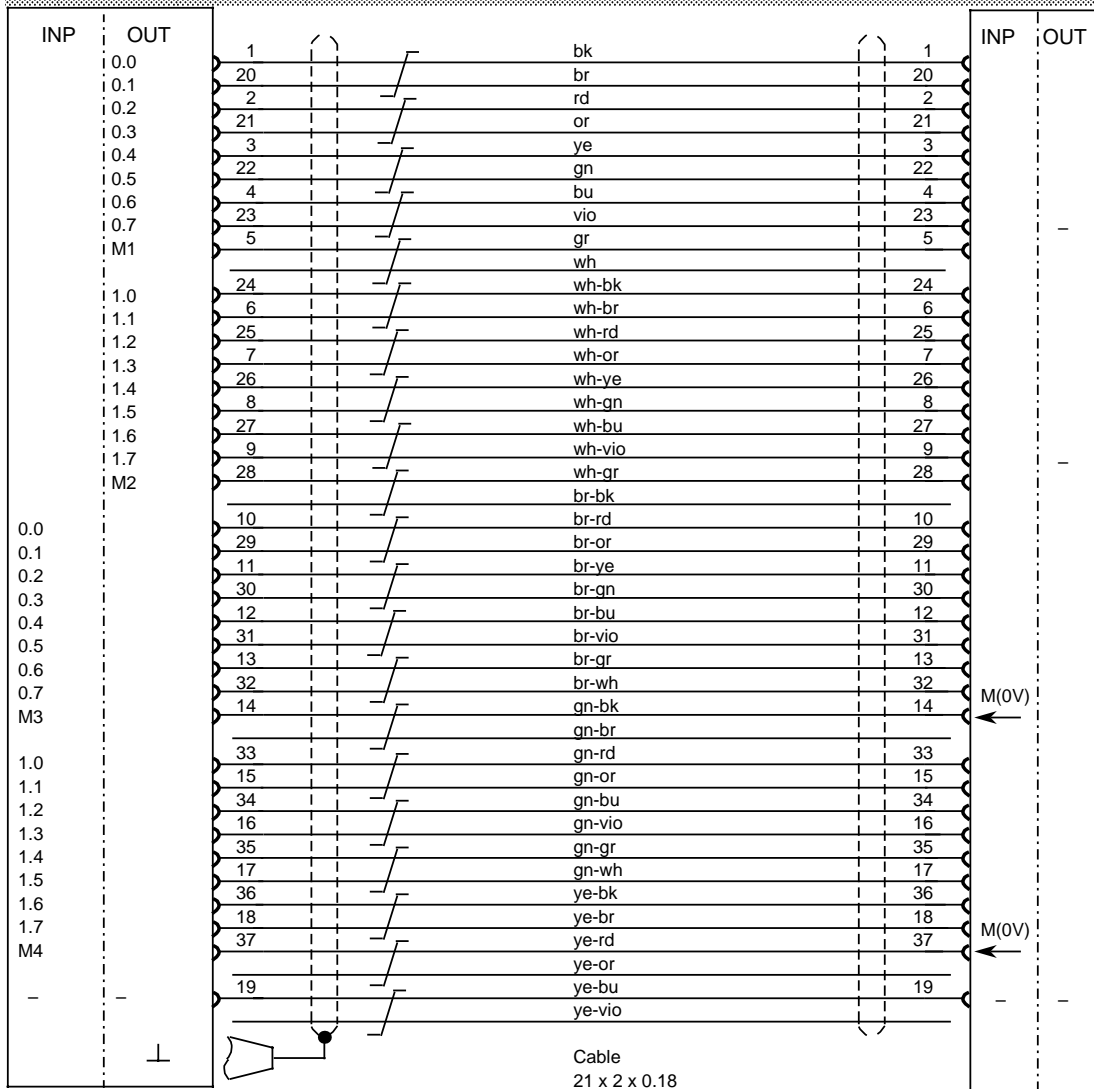
Connector
Honda
MFC 16 LH/HF mod.
14-way, female
Crimp contacts
Connection side
6FC9 341-1HF



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

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

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



Connector

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

Designation: NC

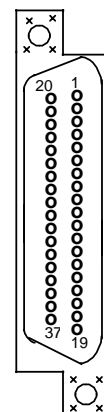
Connector code

- coding pin
- x no coding pin

Connector

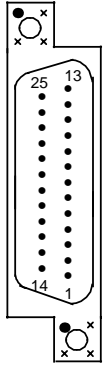
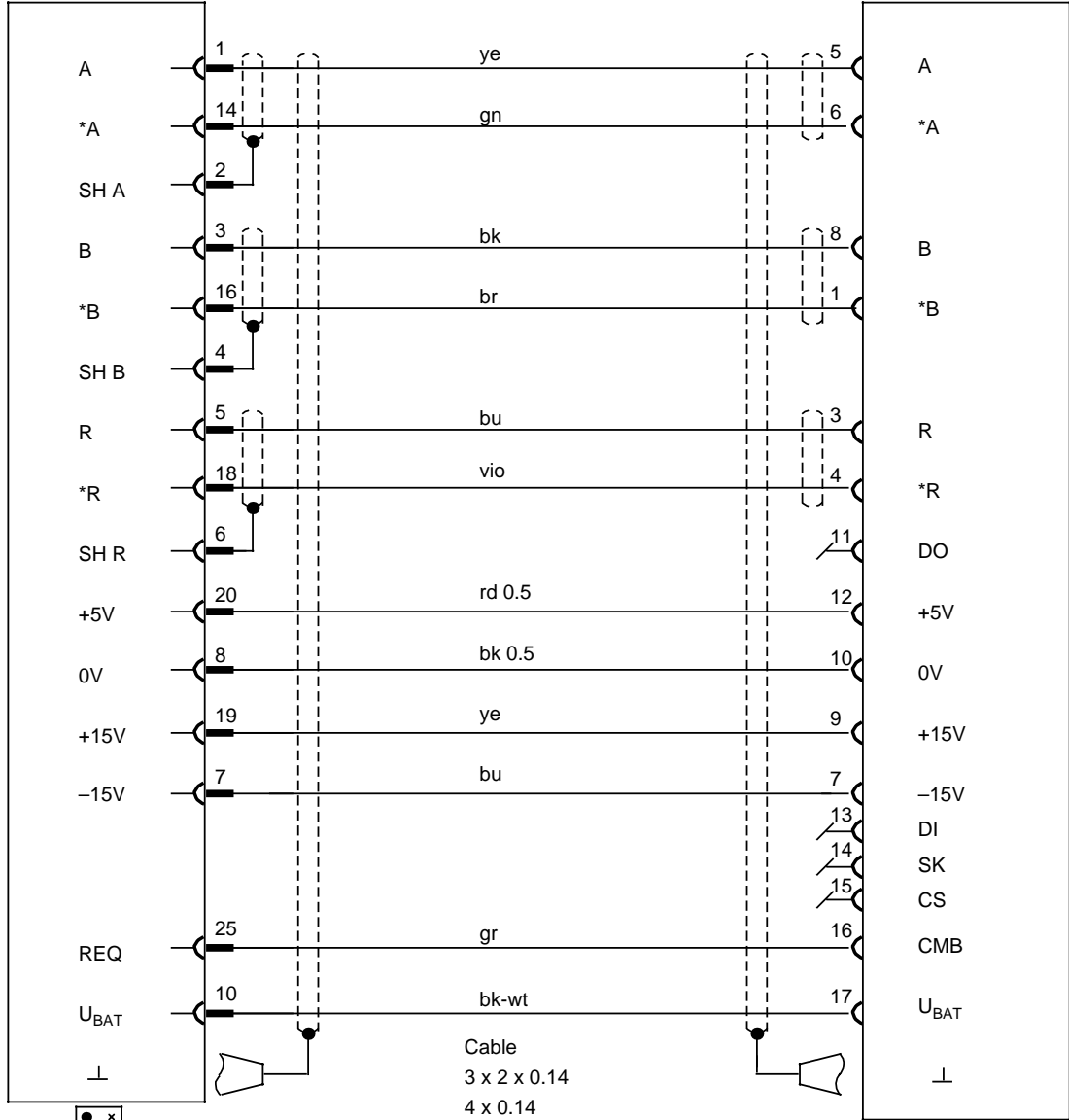
Position: 1 at top
D sub
37-way, female
Connection side
SINUMERIK housing
6FC9 341-1FH

Designation: KLU



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



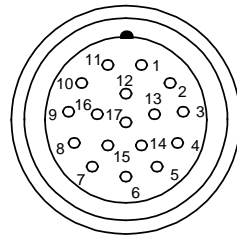
Connector
Position: 1 at bottom
D sub
25-way male
Connection side
SINUMERIK housing
6FC9 341-2AB
Designation: NC

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

Connector code

- coding pin
- x no coding pin

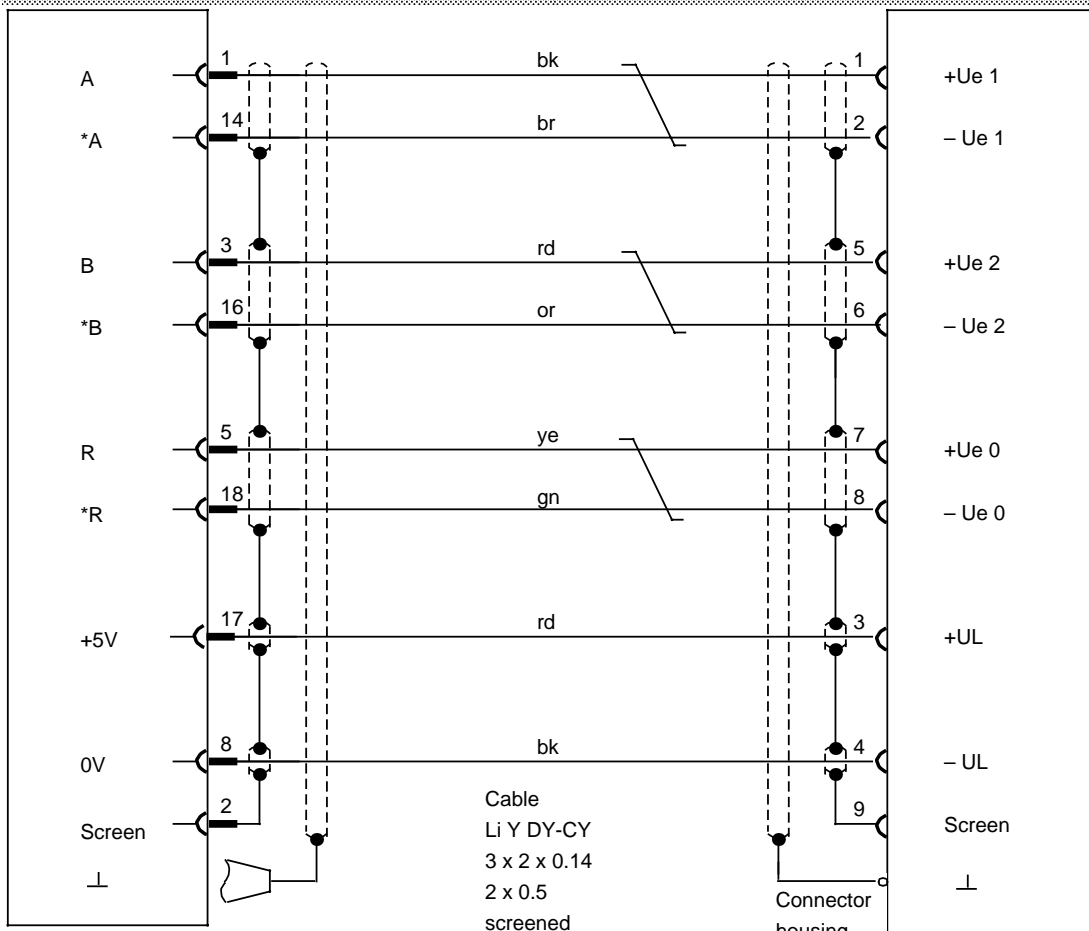
Connector
17-way female
SIEMENS
8 mm cable
Connection side



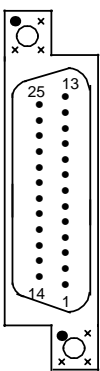
6FC9 341-1HA
Designation: SIPOS

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		

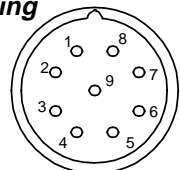


Cable
Li Y DY-CY
3 x 2 x 0.14
2 x 0.5
screened
6FC9 343-0AM



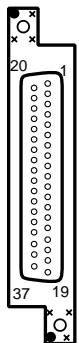
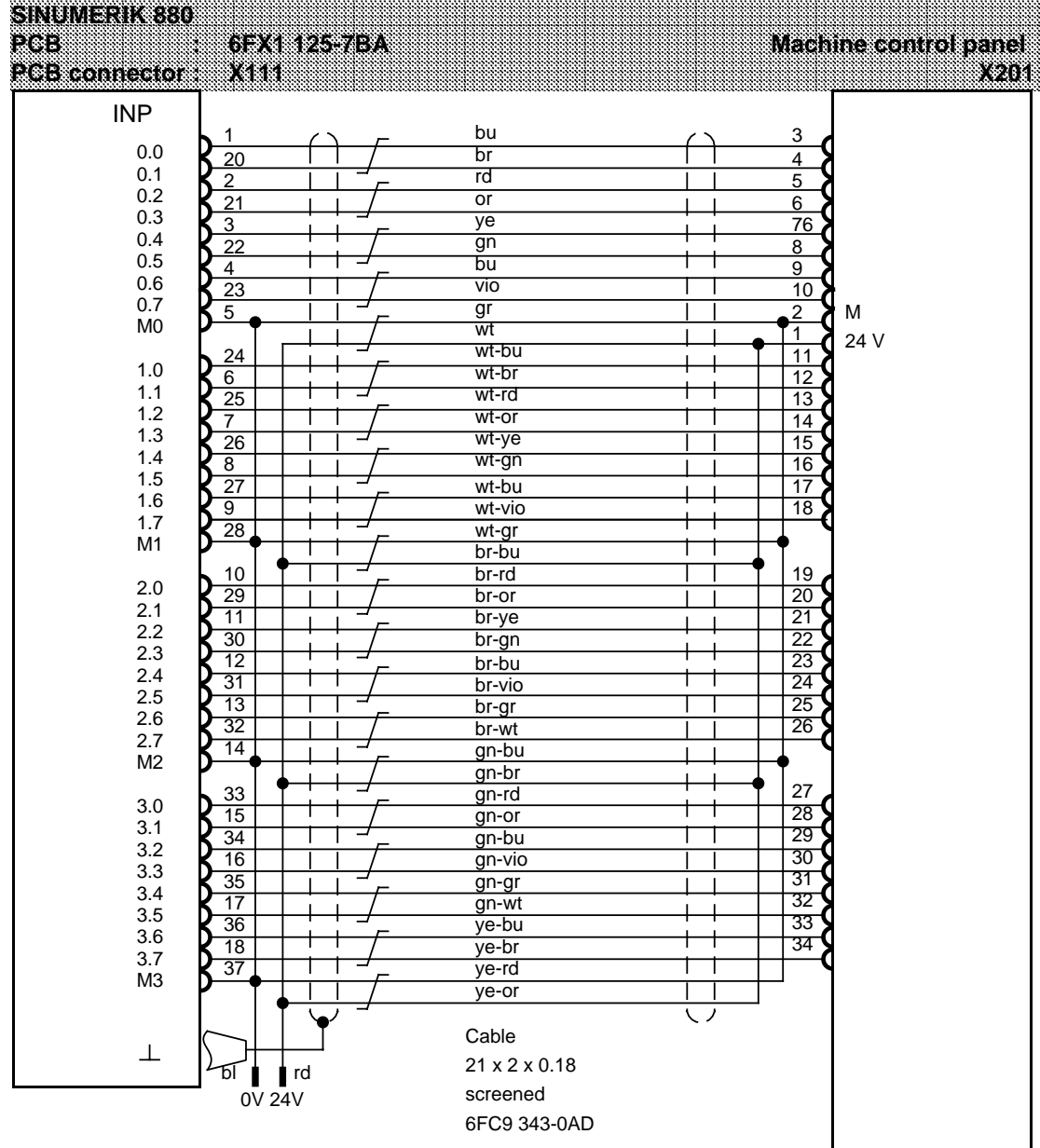
Connector
Position: 1 at bottom
D sub
25-way male
Connection side
SINUMERIK housing
6FC9 341-2AB
Designation: NC

Connector coupling
9-way female
SIEMENS
8 mm cable
Connection side
6FC9 341-1EW
Designation: LINEAL



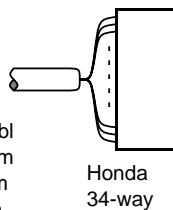
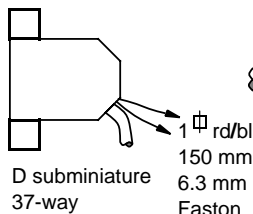
Connector code
● coding pin
× no coding pin

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



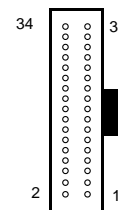
Connector

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



Connector

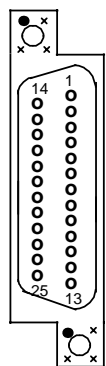
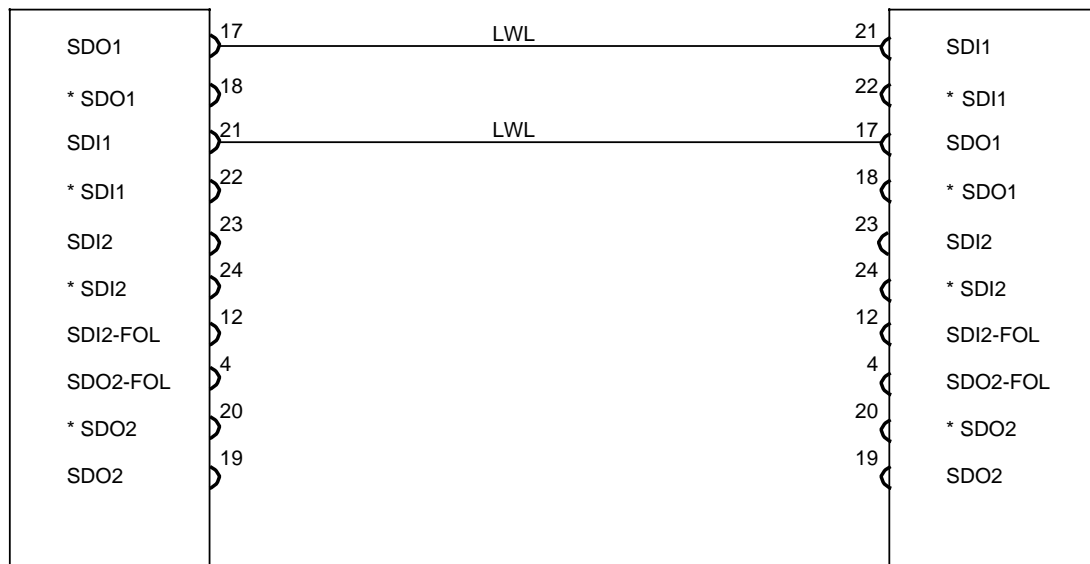
Honda
MFC 34 LH/HF
34-way female
Crimp contacts
Connection side
6FC9 341-2AD
Designation: machine control panel



GA27.70

Cable name: MPC interface (plastic optical fibre conductor)
Order No.: **6FX1 400- BC**

SINUMERIK	: 880	880	
PCB slot	: B3	A 4	: PCB slot
PCB connector	: X111	X111	: PCB connector

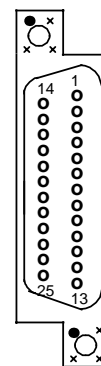


Connector

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

Connector code

- coding pin
- x no coding pin

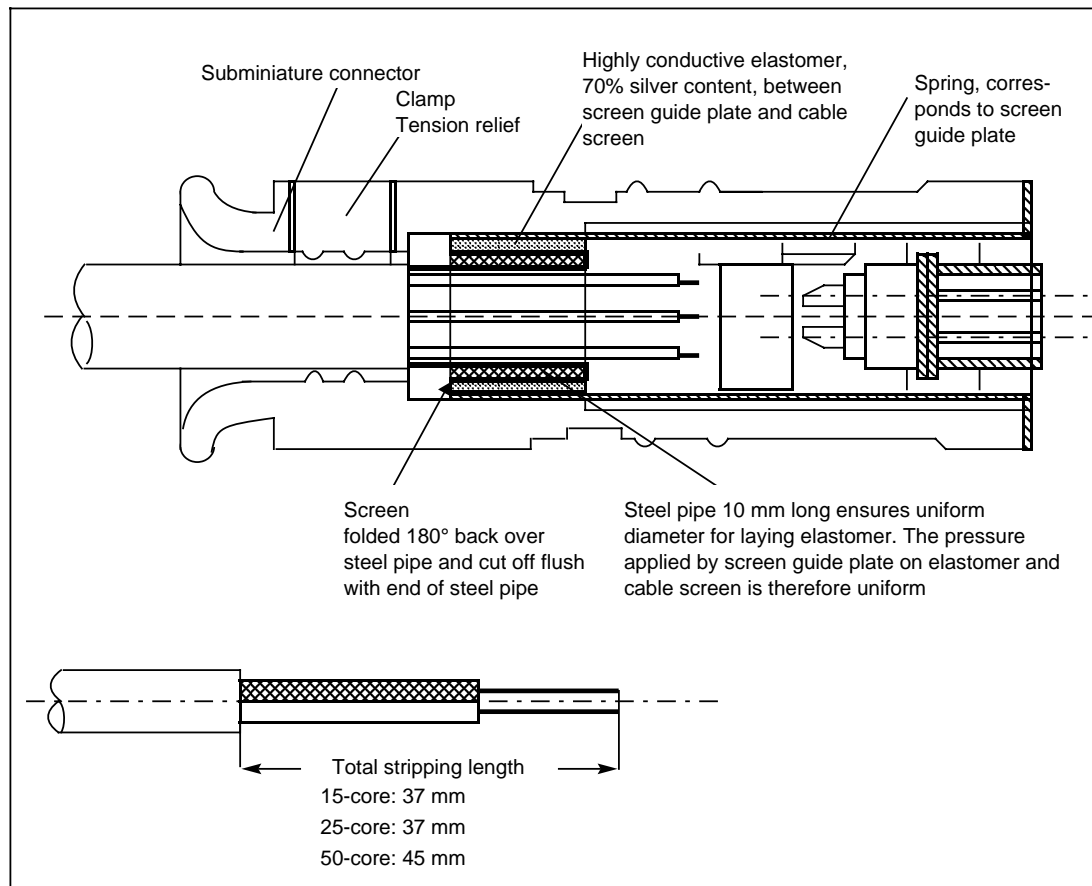


8.4 Cables and connectors

Only connect the units with the prescribed types of cable in accordance with Section 2, Hardware Description.

You must protect the cables against mechanical damage, for example by means of cable channels or sheet metal covers. Avoid penetration of oil, coolant or chips. Make sure that communications cables do not run in parallel to power cables and that cables not belonging to the control are not taken through the central controller.

Screw the connectors securely onto the front panels of the modules.



Subminiature connector

Connector features:

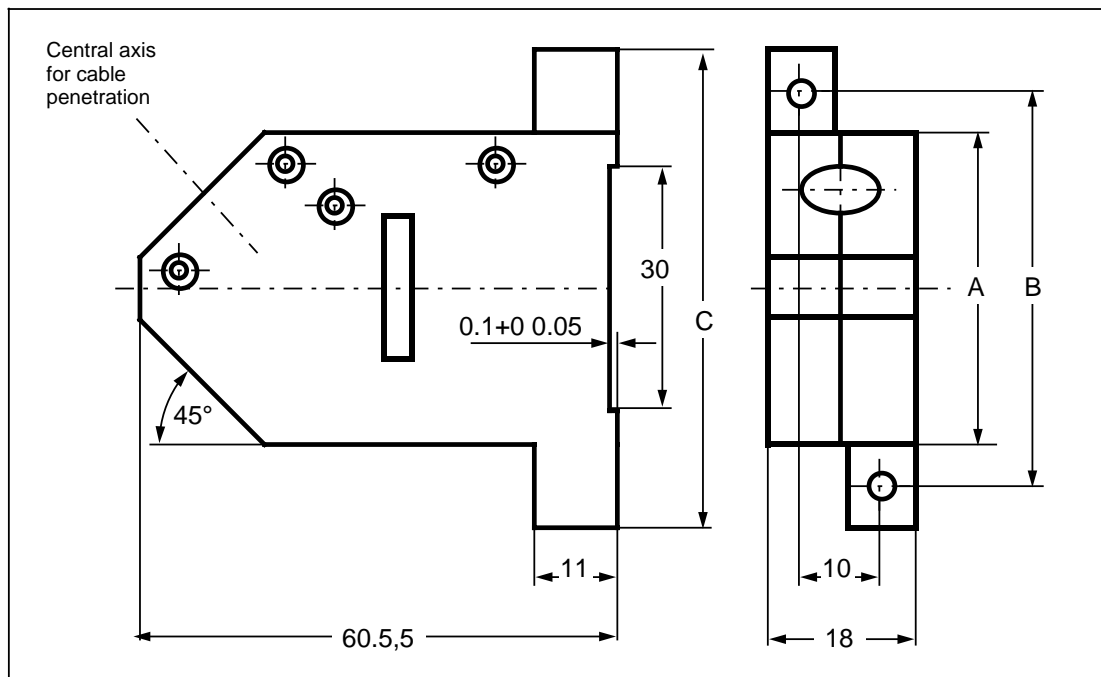
- Uniform international standard connector as 15, 25, 37 and 50-way version with special SINUMERIK housing.
- Securing of the connector by means of captive screws on the front panels of the printed circuit boards.
- Cable strain relief in the connector.
- Plug-in coding for unmistakable connection of the cable connector.
- Perfect connection to frame between cable outside screen and electronics of the SINUMERIK by means of springs fitted in the connector.

Installation rules

On the NC side, this SIEMENS subminiature connector must be used because no commercial-ly available connector housing has these features.

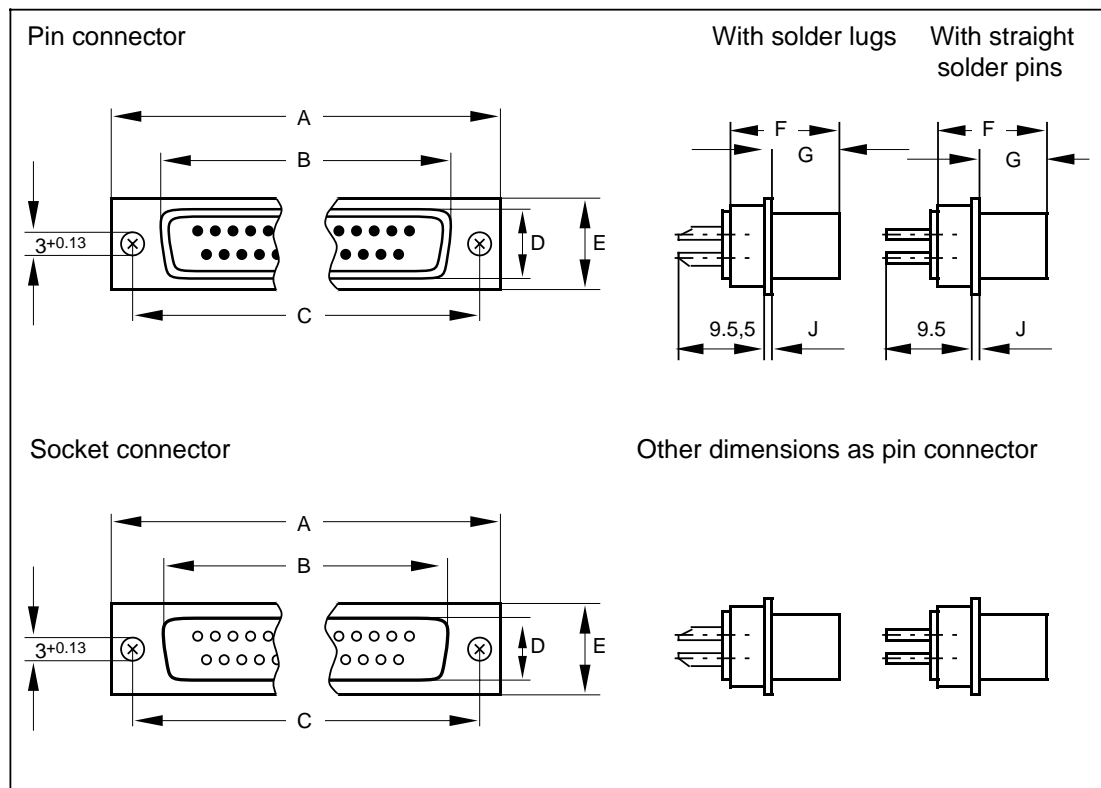
If the customer makes his own cable, he must follow the installation rules, otherwise proper functioning cannot be guaranteed.

Subminiature connector with SINUMERIK housing



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

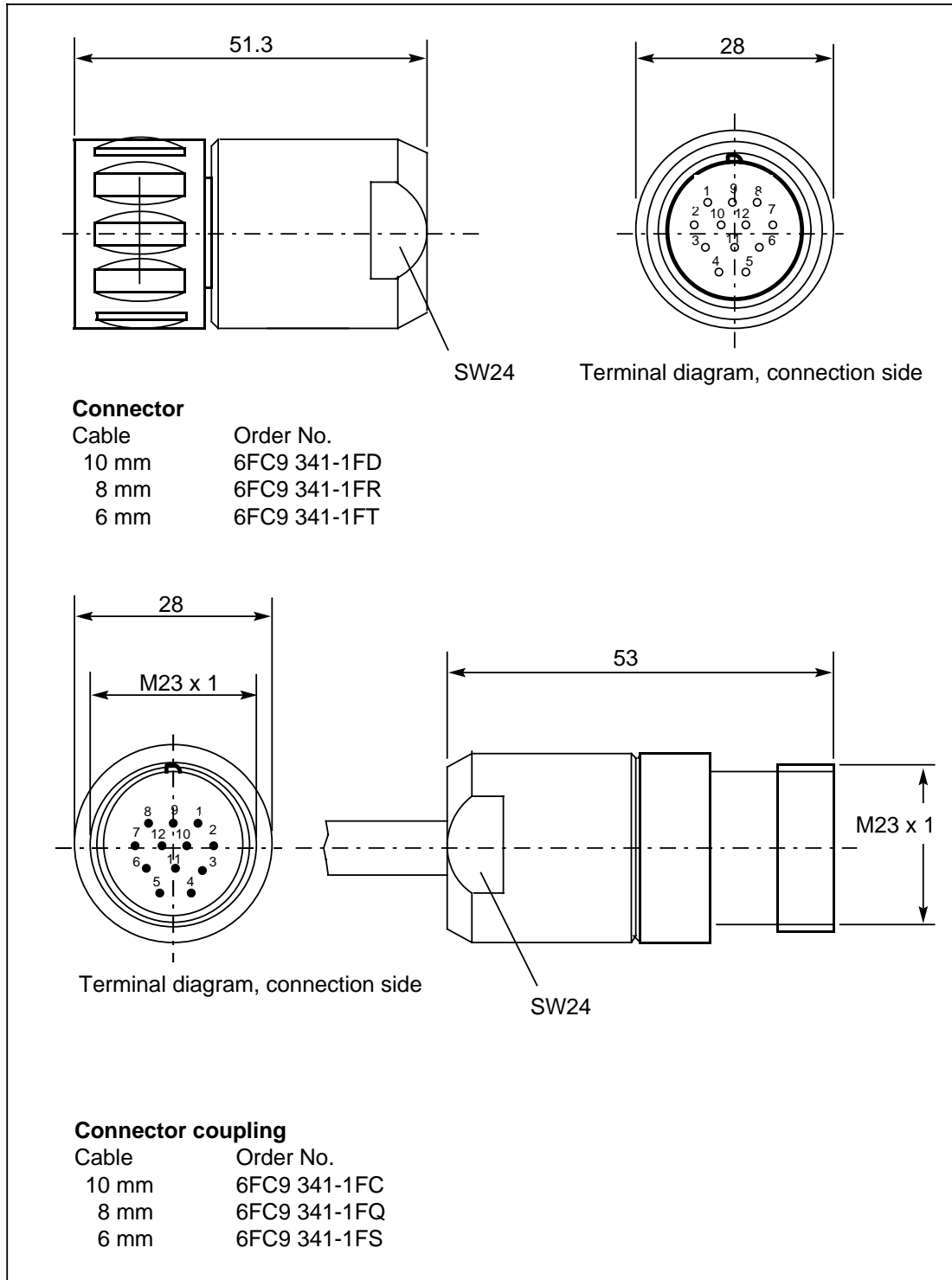
Installation data



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

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

2) Three rows of pins/sockets

Siemens connector for rotary encoder

9 Terms and Abbreviations

Die folgenden Abkürzungen und Begriffe sind für die Steuerungen der SINUMERIK-800-Familie allgemeingültig.

AC	A lternating C urrent
ACC	A nalog C urrent C ontrol (of the feed and main spindle drive actuators)
ACOP	A dvanced C OProcessor
ASCII	A merican S tandard C ode for I nformation I nterchange;
Baud	Unit of transmission speed: 1 baud = 1 bit/sec
Bit	B inary digit; binary unit of information; yes/no signal; binary place; dimensional unit for information quantity; unit for memory capacity
Bus	Link for transmitting signals, feed voltages, ground potential
Byte	Storage unit generally with 8 bits, can accommodate two decimal digits or one alphanumeric character; smallest addressable unit
CAD	C omputer A ided D esign;
CL	C omputer L ink
CMOS	C omplementary M etal O xide S emiconductor
CNC	C omputerized n umerical c ontrol; numerical control with one or more integrated microcomputers and suitable operating software to implement several or all NC functions; since all controls are equipped with microprocessors these days, CNC has become a synonym for NC.
COP	C OProcessor
CSB	C entral S ervice B oard
CPU	C entral P rocessing U nit;
DB	D ata B lock
DC	D irect C urrent
DL	D ata byte L eft
DMP	D istributed M achine P eripherals (I/Os)
DNC	D irect N umerical C ontrol; several NC controls linked to a host computer

DR	Data byte R ight
DRF	Differential R esolver F unction (handwheel mode)
DW	Data W ord
EIA	Electronic Industries A ssociation
ELG	E lectronic G earbox
EM	Error M essage
ENABLE	Enable signal or input
EU	Expansion U nit
EXE	E Xternal Pulse-Shaper E lectronics
FB	Function B lock in the PLC
FD	Floppy disk (D rive)
FMS	F lexible M anufacturing S ystem; group of machines linked by an automatic material handling system; manufacturing and handling are controlled by computer
FY	Flag b Y te
HD	Hard D isk
HMS	H igh-resolution M easuring S ystem; is used for the actual-value preparation of current or voltage signals from position encoders.
IB	Input B yte
IM	Interface M odule
Increment	a) Smallest unit of digital representation b) Increment in traversing a specified path
Incremental dimension	A dimension measured from the preceding point in a series of points
Incremental system	A control system in which each coordinate or positional dimension is taken from the last position rather than from a common zero point as in an absolute system
ISO	International O rganization for S tandardization
Jog	Manual mode with feed and rapid traverse as long as a direction key is pressed
LCD	Liquid C rystal D isplay
LED	Light E mitting D iode

MAC	Memory Access Controller
MD	Machine Data
MPC	Multi-Port Control
NC	Numerical Control
NCK	Numerical Control Kernel
NCRDY	NC READY
OB	Organization Block in the PLC
OM	Operational Message
HD	Hard Disk
HMS	High Resolution Measuring System for the actual-value preparation of unconditional current and voltage signals from position encoders.
IM	Interface Module
ISO	International Organization for Standardization
Jog	"Jogging" mode with feed or rapid traverse rate while a direction key is pressed.
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MAC	Memory Access Controller
MD	Maschine Data
MMC	Man Machine Communication
MPC	Multi Port Control
NC	Numerical Control
OPI	Operator Panel Interface
OS	Operating System
Override	Correction of programmed values by manually operated step switch (e.g. feedrate override, rapid traverse override)
PB	Program Block in the PLC
PCB	Printed Circuit Board
PLC	Programmable Logic Controller
PP	Part Program
PRESET	Setting of values before operation

PS	P ower S upply
PSU	P LC S upport U nit
Pulse encoder	The analog quantity "path" is represented digitally by a pulse encoder in conjunction with counters.
QB	O utput B yte
RAM	R andom A ccess M emory
Resolver	Electromagnetic position encoder for indirect analog position measurement
RGB	R ed G reen B lue
ROM	R ead- O nly M emory
SBC	S ingle B oard C omputer
SE	S ETting data
SN	Siemens standard
SPS	S tandard P lug-in S tation = standard slot dimension in a subrack (1 SPS = 15.24 mm)
SPC	S tored P rogram C ontrol
TB	T erminal B lock
TO	T ool O ffset
UI	U ser I nterface
UMS	U ser M emory S ubmodule

Siemens AG

AUT V250
Postfach 48 48
D-8500 Nürnberg 1
Federal Republic of Germany

Suggestions

Corrections

For Publication/Manual:
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Software Version 1
Interface Description
Part 2: Connection Conditions
Planning Guide

Manufacturer Documentation

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Siemens AG
Automation Group
Automation Systems
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P.O. Box 3180, W-8520 Erlangen
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