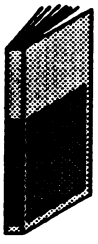
3 Connection Conditions

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

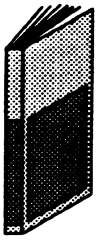
Please also refer to the descriptions given

in the publications listed below:



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

Conditions / Unit	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.*

Conditions / Unit	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)

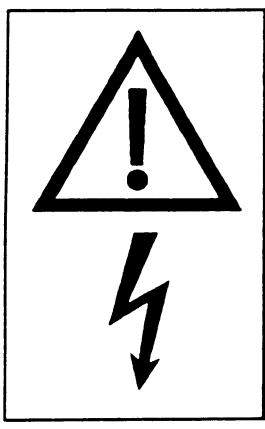
3.1.1.2 Requirements for AC supply

- **Nominal voltage** — 1 AC 230 V
  - Tolerance — − 20 %, + 10 % (184 V to 253 V)
  - Frequency — 47 ... 63 Hz
  - 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 %
- **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-conformace 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
≤ 20 %	0.50
20 % to 30 %	0.58
30 % to 40 %	0.62
40 % to 50 %	0.66
50 % to 60 %	0.68
≥ 60 %	0.69

Efficiency

- Power loss P_v
  When calculating power loss P_v, note that:
  - the power loss of the external components P_{vext} is not included in the power loss of the compact control or central controller:
  - the switching power losses of the output modules $P_{vI/O}$ 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	U_{A1} = +5 V			U_{A2} = +15 V			U_{A3} = – 15 V			Notes
	A	No. of mod.	Σ A	A	No. of mod	Σ A	A	No. of mod.	Σ A	
		1								

Power supply unit capacity utilization $A_n = I_{An} / I_{Amn} \times 100\ \%$										
Modules (mod.) Order number	U_{A1} = +5 V			U_{A2} = +15 V			U_{A3} = – 15 V			Notes
	A	No. of mod.	Σ A	A	No. of mod.	Σ A	A	Zahl der Bgr.	Σ A	
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 A			I_{Am2} = 2,5 A			I_{Am3} = 2 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	$P_{An} = I_{An} \times \lvert U_{An} \rvert$
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.)				$P_{Vextn} = \lvert U_{An} \rvert \times I_{extn}$
Power loss P_{Vext} (ext. Komp.)				$P_{Vext} = \Sigma P_{Vextn}$
Switching power loss P_{Vout} (output)				P_{Vout} = No. of outputs x switching current x voltage drop on the switch
Power loss P_V				

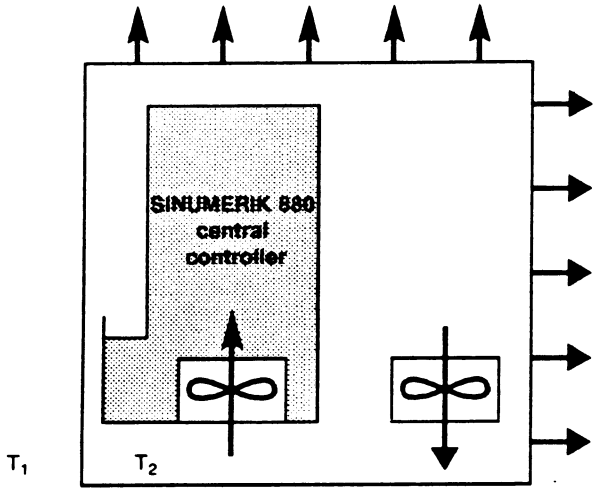
Calculation table for power loss

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.

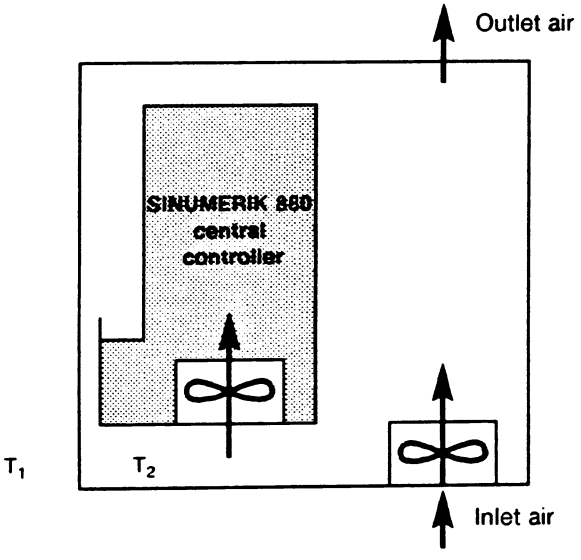
- **Heat removal by natural convection**



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:

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

- **Heat removal by open-circuit ventilation**

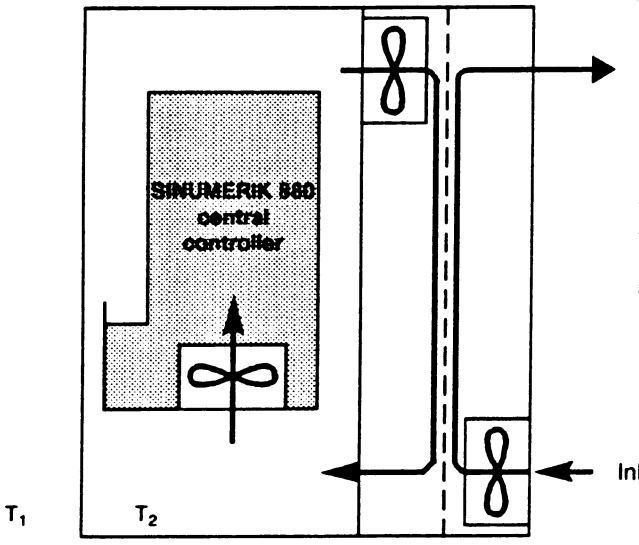


The air flow for removing lost heat is calculated from:

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

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

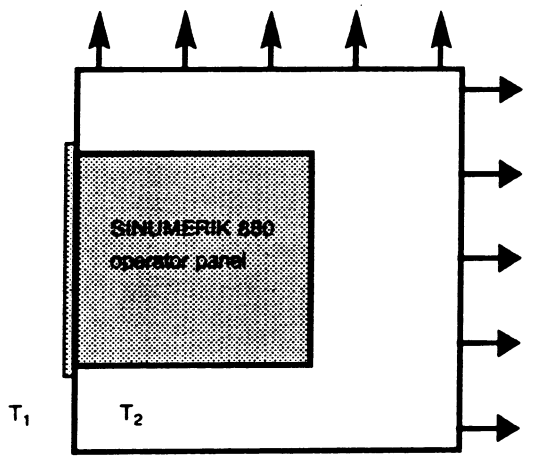
- **Heat removal by means of heat exchanger**



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

Maximal temperature in cabinet: +55 °C

- **Heat removal by natural convection**



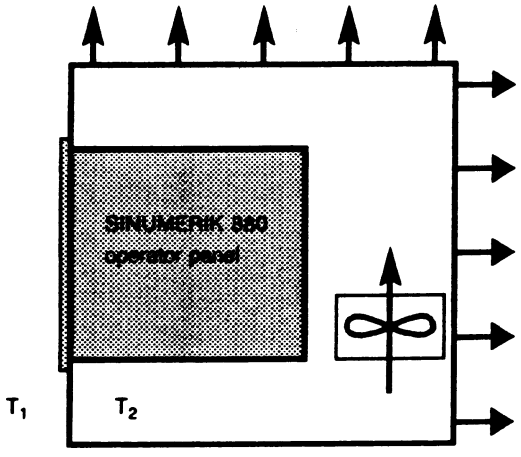
The necessary free convection surface of the surrounding space (steel or aluminium sheet 1.5 mm thick) is determined, referred to a temperature difference $T_2 - T_1 \geq 10$ K, approximately from:

$$A\ [m^2] = \frac{P_v\ [W]}{5\ \Delta T\ [K]}$$

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

→ **A = 1.4 m²**

• Heat removal by natural convection and internal air turbulance



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:

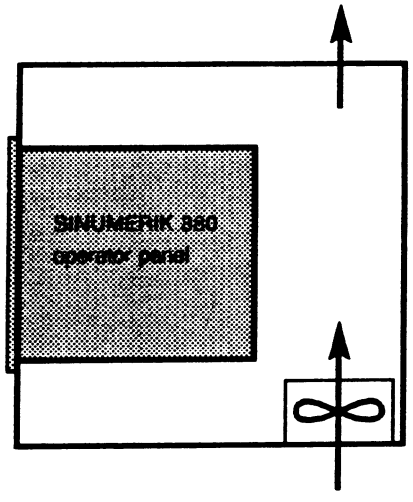
$$A\ [m^2] = \frac{Pv\ [W]}{10\ \Delta T\ [K]}$$

Air flow through fan: 100 to 165 m^3/h

Example: $T_1 = 45\ ^\circ C$, $T_2 = 55\ ^\circ C$
$P_v = 70$ W

→ **A = 0.7 m^2**

• Heat removal by open-circuit ventilation



The air flow for removing lost heat is calculated from:

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

Example: Intake air temp. ≤ 45 °C, ΔT = 10 K, P_v = 70 W

→ **A = 24.5 m^3/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

Conditions / Unit	Dimensions Width Height Depth	Weight	Degree of protection to DIN 40050	Protection against contact, class to DIN VDE 0160
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

Conditions / Unit	Dimensions Width Height Depth	Weight	Degree of protection to DIN 40050	Protection, against contact class to DIN VDE 0160
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)

Conditions / Unit	Dimensions Width Height Depth	Weight	Degree of protection to DIN 40050	Protection against contact to DIN VDE 0160
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/s^2)
  - 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) observing the annual average U=85 %
    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

If the conditions given below cannot be maintained, proper functioning of the control cannot be guaranteed.

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

3.1.4.1 Hazardous gases

- **Sulphur dioxide** (SO_2)
  Test conditions:
  - Severity 10 cm^3/m^3 ± 0.3 cm^3/m^3
  - Temperature 25 °C ± 2 °C
  - Relative air humidity 75 % ± 5 %

- **Hydrogen sulphide** (H_2S)
  Test conditions:

– Severity	1 cm^3/m^3 ± 0.3 cm^3/m^3
– 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

The plant operator is responsible for interference suppression of the entire installation (control, drives, machine, ...).

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	$11.5 \cdot 10^3$ decades
Frequency	26 MHz ... 1000 MHz

3.1.5.3 Protection from X-radiation

- Extract from the German regulation RÖV §5:
  Authorization is required to operate a source of X-radiation.
- Routine tests ensure that the SINUMERIK 880 complies with the above regulation. The X-rays originating in the SINUMERIK 880 are sufficiently shielded.

Acceleration voltage (typ.)	22.8 kV
Authorization number to RÖV	By 367**/**86**/**Rö

If you use a video encoder with an RGB monitor connected, RÖV §5 is also relevant.

3.1.6 Miscellaneous

3.1.6.1 Colors

Application	Basic color anthracite	
	Color	Color No. *)
Housing, front panels for operator panels	Anthracite	-614
Background color of keys	Ergo grey	-611
Key contrast color **/** key groups	Mid-grey	6115
STOP function keys	Red	RAL 3018
START functions keys	Green	-506
Symbols, lettering, outlines	Black	RAL 9005
Surface beneath EMERGENCY STOP button	Yellow	RAL 1021
EMERGENCY STOP button	Red	RAL 3000
Siemens logo and strip labels	Petrol	-615

3.1.6.2 Data protection, stored energy times

For storage media requiring a backup power supply (volatile semiconductor memories), a stored energy time of $\underline{\geq}$ 1 year is guaranteed.
The above time commences on the day of delivery from the factory (date on factory delivery note). Battery replacement is described in Section 3.4.4.

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*) *Full color designation:*
or plastics *SN 30901 - SN 47030 Part 2 - xxx*
for coatings *SN 30901 - SN 30920 - xxx* *(Siemens standard, see Section 3.1.6.3)*
Color number

3.1.6.3 Standards

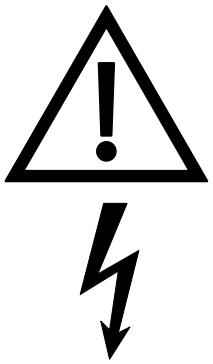
In addition to the relevant international and national standards, the Siemens standards (SNI) listed in the table below have been observed in the design of the SINUMERIK control. You can obtain these Siemens standards from your local Siemens office.

<table>
<tr><th></th><th>Text</th><th>Part</th></tr>
<tr><td>SN 26555</td><td>Electrical interfaces
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.</td><td>1, 2, 3</td></tr>
<tr><td>SN 26556</td><td>Application classes for constructional units in electrical engineering
Air temperature, humidity, pressure
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.</td><td></td></tr>
<tr><td>SN 29010</td><td>Mechanical testing loads for electrical engineering
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.
<table><tr><th rowspan="2">Severity</th><th rowspan="2">Frequeny range
(Hz)</th><th colspan="2">Constant amplitude of</th></tr><tr><th>Deflection
(mm)</th><th>Acceleration
(m/s²)</th></tr><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></table></td><td>1, 2</td></tr>
<tr><td>SN 29080</td><td>Climatic resistance of electrical equipment
This standard includes a climatic overview map with sea routes.</td><td></td></tr>
<tr><td>SN 29081</td><td>Packaging recommendations for electrical equipment
Permissible climatic exposure before start-up
In this standard, the limits of climatic exposure are given that are permissible for electrical equipment during transportation and storage before start-up.</td><td></td></tr>
</table>

Siemens standard	Text	Part
SN 29500	**Failure rates of construction elements** 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: 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.	1 to 11
SN 30901	**Choice of colours for products** 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.	
SN 30920	**Surface treatment** 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.	
SN 47030	**Moulded materials, thermoplastic moulding compounds** 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.	1
SN 47030	**Moulded materials, thermoplastic moulding compounds** Colors This standard contains colour data for the moulding compounds specified in SN 47030 Part 1.	2
SN 69154	**Packaging recommendations for electrical equipment** 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.	

3.2 Electrical installation

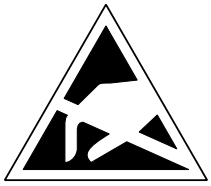
3.2.1 Installation codes of practice



WARNING

- 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).



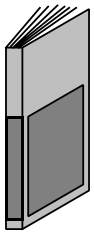
CAUTION

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

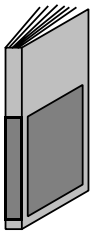
Basic principles:
If the control is to be operated without interference, all its components that are connected to signal lines must also be connected to equipotential bonding conductors.

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



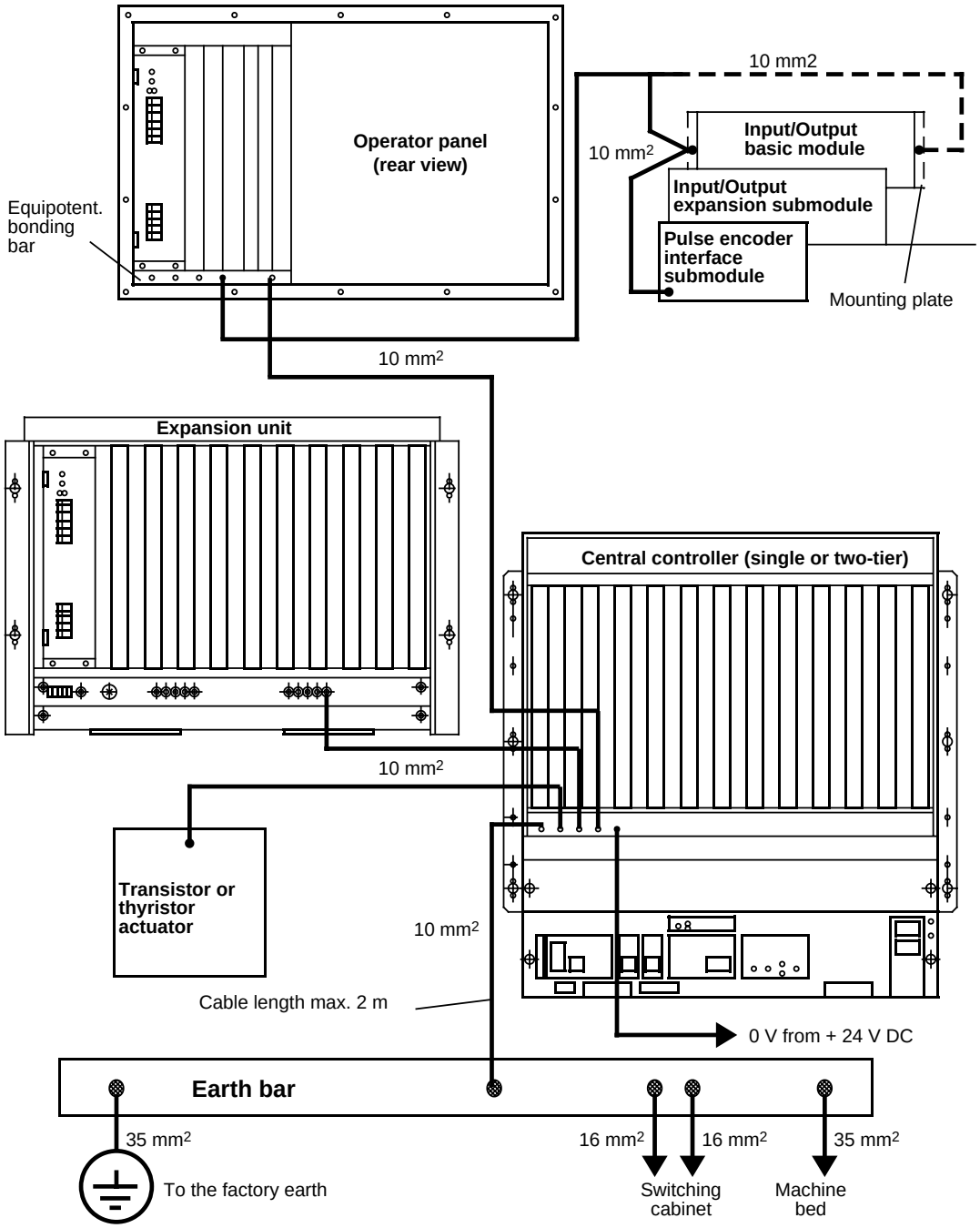
In any plant configuration, the ”EMC Guidelines for SINUMERIK and SIROTEC Controls” must be observed when installing equipotential bonding conductors.

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



Minimum cross section of the equipotential bonding conductors: 10 mm^2.
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 <u>all</u> protective conductors.

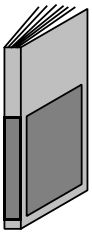
3.2.1.2 Laying signal and power lines

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.

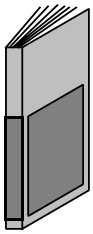


For further notes on noise immunity measures and

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.

Please also observe the notes on the earthing concept of the distributed machine I/Os in Section 5.9.

3.2.2 Power supply connection and switch-on conditions

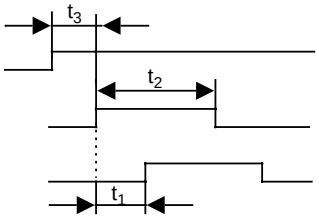
General

- 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.

Never insert or remove power supply modules under power.

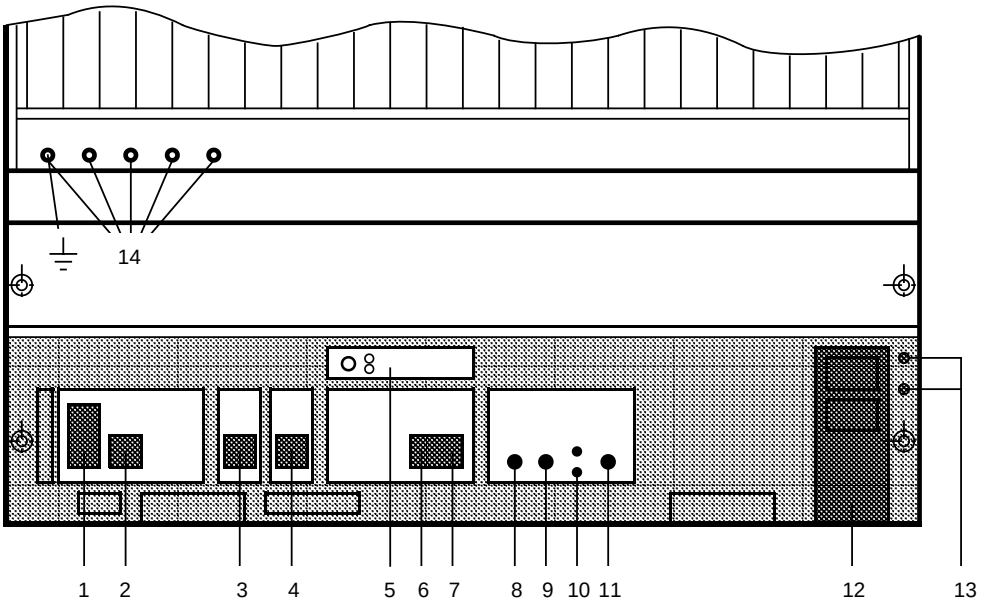
3.2.2.1 Central controller (with power supply unit 1861-2AE)

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.

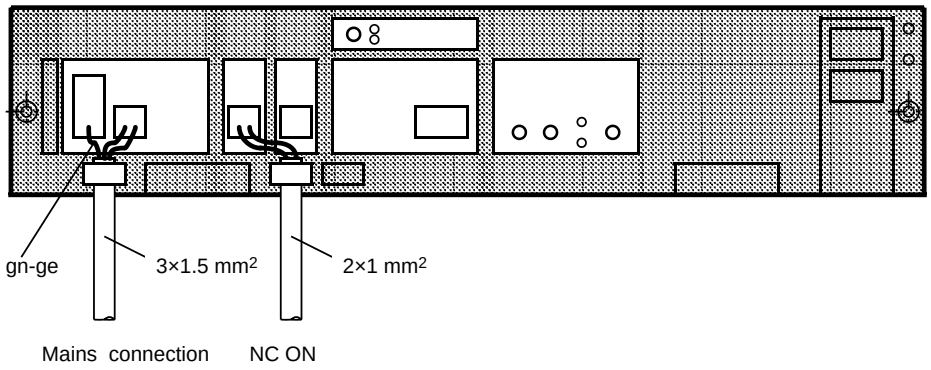
Non-observance of this warning can cause death or serious injury.



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 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)