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- Drives
- Encoders and Resolvers
- Power Supplies

20 Years Automation Experience

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SIEMENS

SINAMICS

SINAMICS S120

AC Drive

Manual

Edition 04/2014

Answers for industry.

Fundamental safety instructions 1

1.1 General safety instructions

DANGER

Danger to life due to live parts and other energy sources

Death or serious injury can result when live parts are touched.

- Only work on electrical devices when you are qualified for this job.
- Always observe the country-specific safety rules.

Generally, six steps apply when establishing safety:

1. Prepare for shutdown and notify all those who will be affected by the procedure.
2. Disconnect the machine from the supply.
   - Switch off the machine.
   - Wait until the discharge time specified on the warning labels has elapsed.
   - Check that it really is in a no-voltage condition, from phase conductor to phase conductor and phase conductor to protective conductor.
   - Check whether the existing auxiliary supply circuits are de-energized.
   - Ensure that the motors cannot move.
3. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems, or water.
4. Isolate or neutralize all hazardous energy sources by closing switches, grounding or short-circuiting or closing valves, for example.
5. Secure the energy sources against switching on again.
6. Ensure that the correct machine is completely interlocked.

After you have completed the work, restore the operational readiness in the inverse sequence.

WARNING

Danger to life through a hazardous voltage when connecting an unsuitable power supply

Touching live components can result in death or severe injury.

- Only use power supplies that provide SELV (Safety Extra Low Voltage) or PELV-(Protective Extra Low Voltage) output voltages for all connections and terminals of the electronics modules.

1.3 Handling electrostatic sensitive devices (ESD)

Electrostatic sensitive devices (ESD) are individual components, integrated circuits, modules or devices that may be damaged by either electric fields or electrostatic discharge.

NOTICE

Damage through electric fields or electrostatic discharge

Electric fields or electrostatic discharge can cause malfunctions through damaged individual components, integrated circuits, modules or devices.

- Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g conductive foam rubber of aluminum foil.
- Only touch components, modules and devices when you are grounded by one of the following methods:
  - Wearing an ESD wrist strap
  - Wearing ESD shoes or ESD grounding straps in ESD areas with conductive flooring
- Only place electronic components, modules or devices on conductive surfaces (table with ESD surface, conductive ESD foam, ESD packaging, ESD transport container).

1.4 Industrial security

Note

Industrial security

Siemens provides automation and drive products with industrial security functions that support the secure operation of plants or machines. They are an important component in a holistic industrial security concept. With this in mind, our products undergo continuous development. We therefore recommend that you keep yourself informed with the latest information and updates of our product.

Information and newsletters can be found at:

http://support.automation.siemens.com

To ensure the secure operation of a plant or machine, it is also necessary to take suitable preventive action (e.g. cell protection concept) and to integrate the automation and drive components into a state-of-the-art holistic industrial security concept for the entire plant or machine. Any third-party products used must also be taken into account.

For more detailed information, go to:

http://www.siemens.com/industrialsecurity

WARNING

Danger as a result of unsafe operating states resulting from software manipulation

Software manipulation (e.g. by viruses, Trojan horses, malware, worms) can cause unsafe operating states to develop in your installation which can lead to death, severe injuries and/or material damage.

- Keep the software up to date.
  Information and newsletters can be found at:
  http://support.automation.siemens.com
- Incorporate the automation and drive components into a state-of-the-art, integrated industrial security concept for the installation or machine.
  For more detailed information, go to:
  http://www.siemens.com/industrialsecurity
- Make sure that you include all installed products into the integrated industrial security concept.

1.5 Residual risks of power drive systems

The control and drive components of a drive system are approved for industrial and commercial use in industrial line supplies. Their use in public line supplies requires a different configuration and/or additional measures.

These components may only be operated in closed housings or in higher-level control cabinets with protective covers that are closed, and when all of the protective devices are used.

These components may only be handled by qualified and trained technical personnel who are knowledgeable and observe all of the safety instructions on the components and in the associated technical user documentation.

When assessing the machine's risk in accordance with the respective local regulations (e.g., EC Machinery Directive), the machine manufacturer must take into account the following residual risks emanating from the control and drive components of a drive system:

1. Unintentional movements of driven machine components during commissioning, operation, maintenance, and repairs caused by, for example:
   - Hardware defects and/or software errors in the sensors, controllers, actuators, and connection technology
   - Response times of the controller and drive
   - Operating and/or ambient conditions outside of the specification
   - Condensation / conductive contamination
   - Parameterization, programming, cabling, and installation errors
   - Use of radio devices / cellular phones in the immediate vicinity of the controller
   - External influences / damage

2. In the event of a fault, exceptionally high temperatures, including an open fire, as well as emissions of light, noise, particles, gases, etc. can occur inside and outside the inverter, e.g.:
   - Component malfunctions
   - Software errors
   - Operating and/or ambient conditions outside of the specification
   - External influences / damage

   Inverters of the Open Type / IP20 degree of protection must be installed in a metal control cabinet (or protected by another equivalent measure) such that the contact with fire inside and outside the inverter is not possible.
3. Hazardous shock voltages caused by, for example:
   - Component malfunctions
   - Influence of electrostatic charging
   - Induction of voltages in moving motors
   - Operating and/or ambient conditions outside of the specification
   - Condensation / conductive contamination
   - External influences / damage
4. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc. if they are too close.
5. Release of environmental pollutants or emissions as a result of improper operation of the system and/or failure to dispose of components safely and correctly.

Note

The components must be protected against conductive contamination (e.g. by installing them in a control cabinet with degree of protection IP54 according to IEC 60529 or NEMA 12).

Assuming that conductive contamination at the installation site can definitely be excluded, a lower degree of cabinet protection may be permitted.

For more information about residual risks of the components in a drive system, see the relevant sections in the technical user documentation.

System overview

2

2.1 Field of application

SINAMICS is the family of drives from Siemens designed for machine and plant engineering applications. SINAMICS offers solutions for all drive tasks:

- Simple pump and fan applications in the process industry.
- Complex single drives in centrifuges, presses, extruders, elevators, as well as conveyor and transport systems
- Drive line-ups in textile, plastic film, and paper machines as well as in rolling mill plants.
- High precision servo drives in the manufacture of wind turbines
- Highly dynamic servo drives for machine tools, as well as packaging and printing machines

Figure 2-1 SINAMICS applications

2.3 Overview, SINAMICS S120 AC Drive

SINAMICS S120 AC Drive is a modular drive system for individual axes and addresses sophisticated drive tasks for an extremely wide range of industrial applications.

Applications include:

- Machine concepts with a central drive (e.g. presses, printing, packaging)
- Modular machine concepts where the machine modules were broken down into single axes
- Single-motor drives that when compared to standard drives have a high accuracy, stability and smooth running requirements in machinery and industrial plant construction
- Single-motor drives for transport applications (conveying, raising, lowering)
- Drives without regenerative feedback into the line supply (wire-drawing, extruding)
- Drive groups with high requirements placed on the availability (when the infeed fails, this may not cause all of the axes to fail)

The combination of a power unit (Power Module) and a Control Unit (CU) or a Control Unit Adapter form a single-motor drive in a compact design for machinery and plant construction.

SIZER, a high-performance engineering tool, makes it easier to choose and determine the optimum drive configuration. The drive can be simply commissioned a user-friendly fashion using the STARTER commissioning tool.

SINAMICS S120 AC Drive is supplemented by a wide range of motors. Whether synchronous or induction, whether rotary or linear motors, all motor types are supported by SINAMICS S120 AC Drive.

2.4 SINAMICS S120 components

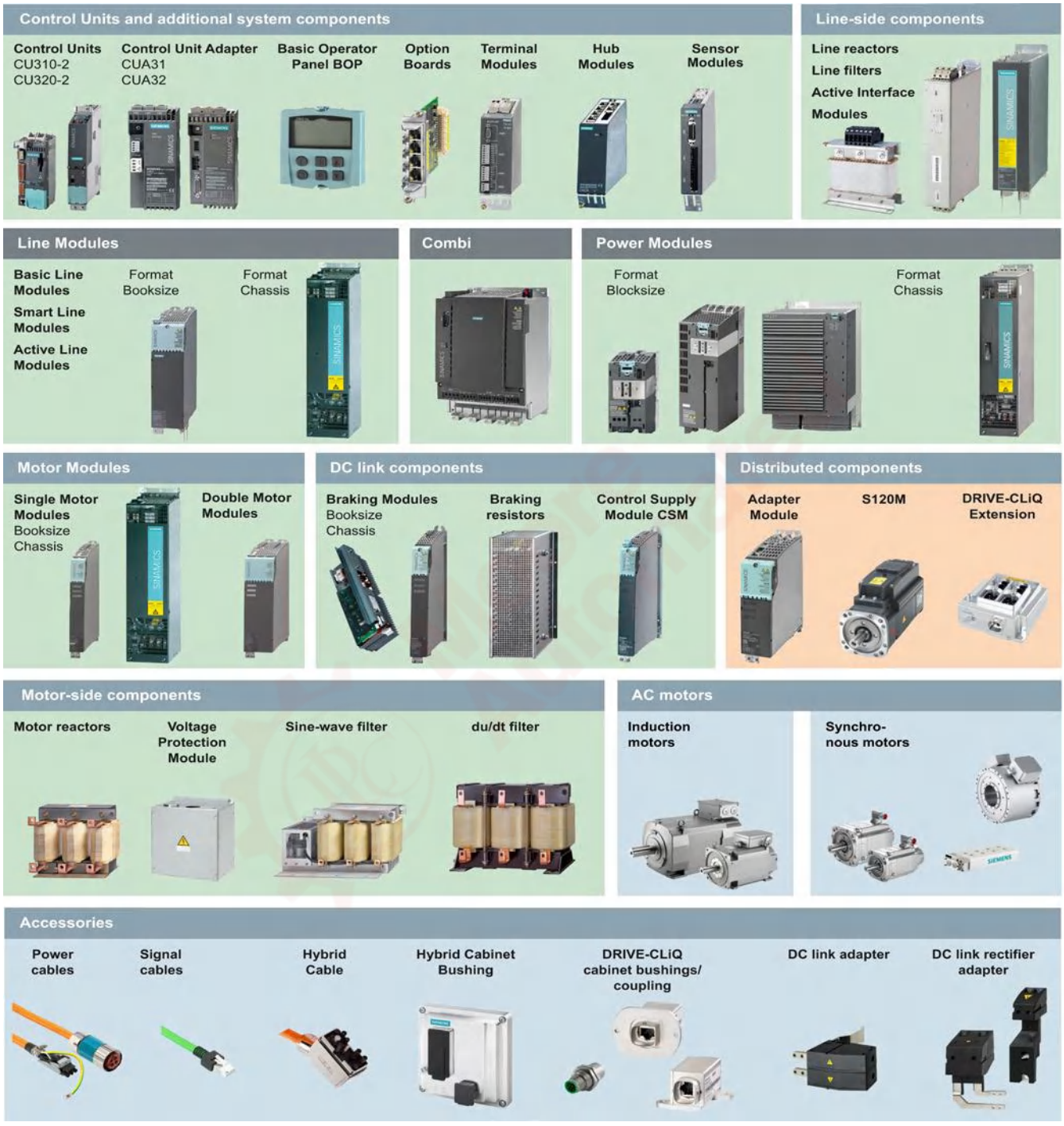

Figure 2-3 SINAMICS S120 component overview

2.5 System data

Table 2- 1 Electrical data

Line connection voltage	
Blocksize format units	1-phase 200 … 240 VAC ±10% 3-phase 200 … 240 VAC ±10% 3-phase 380 … 480 VAC ±10%
Chassis format units	3-phase 380 … 480 VAC ±10%
Rated pulse frequency	
Blocksize format units	4 kHz At higher pulse frequencies, the corresponding characteristic for current derating must be taken into consideration.
Chassis format units	2 kHz At higher pulse frequencies, the corresponding characteristic for current derating must be taken into consideration.
Line frequency	47 … 63 Hz
Output voltage	
Blocksize format units	0 V to 0.74 line supply voltage for devices with 1-phase 200 … 240 VAC 0 V to 0.95 line supply voltage for devices with 3-phase 200 … 240 VAC 0 V to 0.95 line supply voltage for devices with 3-phase 380 … 480 VAC
Chassis format units	0 V to line supply voltage for 3-phase 380 VAC to 480 VAC units
Electronics power supply	24 VDC -15/+20% [1], Safety extra-low voltage PELV or SELV (see Chapter 24 V DC Supply Voltage (Page 422))
Short-circuit current rating SCCR according to UL508C (up to 600 V)	• 1.1 … 447 kW: 65 kA • 448 … 671 kW: 84 kA • 672 … 1193 kW: 170 kA • ≥ 1194 kW: 200 kA For Blocksize and Chassis components, UL certification applies only in conjunction with the fuses prescribed by Siemens and not with other types or just with circuit-breakers.
Electromagnetic compatibility according to EN 61800-3	Category C3 (option) Category C2 (option) Category C1 (option) for systems implemented in conformance with the documentation
Overvoltage category	III
Degree of pollution	2

[1] If a motor holding brake is used, restricted voltage tolerances (24 V ±10%) may have to be taken into account.

2.6 Derating as a function of the ambient temperature, pulse frequency, and installation altitude

Preliminary remark

The air pressure and therefore the air density drop at altitudes above sea level. At these altitudes, the same quantity of air does not have the same cooling effect and the air gap between two electrical conductors can only insulate a lower voltage. Typical values for air pressure are summarized in the table below:

Table 2- 4 Air pressure for various installation altitudes

Installation altitude above sea level in [m]	0	1000	2000	3000	4000
Air pressure in mbar [kPa]	100	90	80	70	62

Derating

The Power Modules are designed for operation under the following conditions:

- Ambient temperature 0° C up to 40° C
- The pulse frequency specified for each Power Module
- Installation altitude of up to 1000 m above MSL for Blocksize Power Modules.
- Up to 2000 m above MSL for Chassis Power Modules.

If you operate the Power Modules at higher ambient temperatures, pulse frequencies, or installation altitudes, you must reduce the output current.

You will find the reduction factors for the individual units in the technical data of the relevant Power Modules.

The maximum permissible ambient temperature for all Power Modules is 55° C.

A TN or TT system with grounded neutral point is required (no grounded phase conductor) for installation altitudes above 2000 m. If the neutral point is not grounded, an isolating transformer must be connected upstream for which the secondary windings are grounded at the neutral point.

A reduction of the line supply voltage phase-phase is not necessary.

Mains connection and line-side power components 3

3.1 Introduction

The following line-side components should be used to connect a SINAMICS drive line-up to the supply network:

- Line disconnector
- Overcurrent protection device (line fuses or circuit-breaker)
- Line contactor (this is required for electrical isolation)
- Line filter (optional)
- Line reactor (optional)

The possible supply voltages for the drive line-up are:

- 1-phase 200 VAC to 240 VAC ± 10%
- 3-phase 200 VAC to 240 VAC ± 10%
- 3-phase 380 VAC to 480 VAC ± 10%

The following line reactor variants are available:

- 4 versions for PM240-2 Blocksize format Power Modules, frame sizes FSA to FSC (stand-alone)
- 3 versions for PM340 Blocksize format Power Modules, frame sizes FSA to FSC (base)
- 5 versions for PM340 Blocksize format Power Modules, frame sizes FSD to FSF (3 base and 2 standalone)
- 4 versions for chassis format

The following line filter variants are available:

- Integrated
- External
  - Base
  - Stand-alone

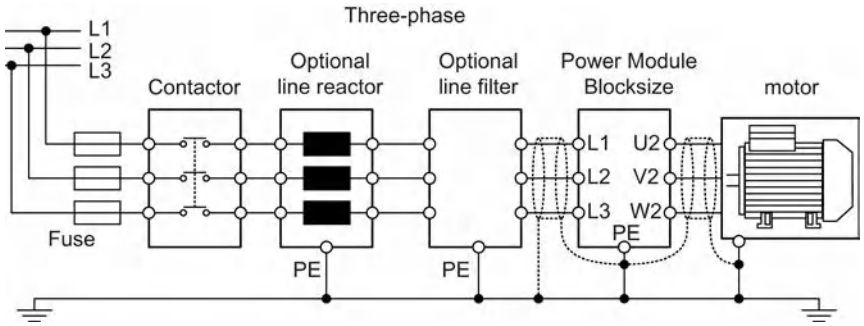

Figure 3-1 Example of a Blocksize line connection

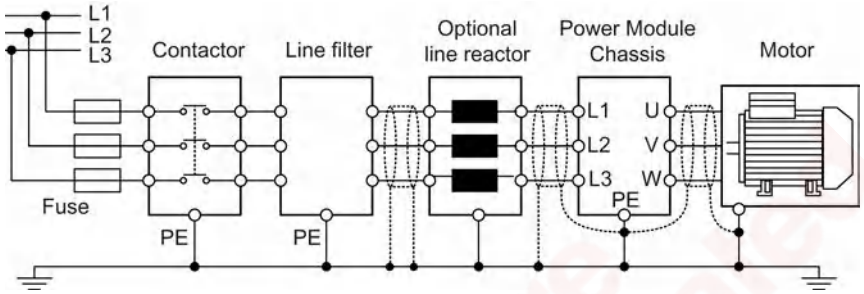

Figure 3-2 Example of a chassis line connection

3.2 Information on the disconnector unit

A disconnector unit is required for disconnecting the drive line-up from the supply system correctly. The disconnector unit of the machine's electrical equipment can be used for this purpose. The disconnector unit must be selected in compliance with the requirements of the internationally binding standard relating to the electrical equipment of machines IEC 60204-1, Section 5.3. The relevant technical data and any other loads connected to the electrical equipment must be taken into account when making your selection.

The accessories required for the line disconnector must be selected from the manufacturer catalogs. Refer also to catalogs PM21 and NC61.

NOTICE
Damage to the drive electronics when switching the line disconnection equipment under load When switching the line disconnection equipment (type according to the recommended selection) under load, then the contacts will be subject to premature wear. This can cause the line disconnection equipment to malfunction, with subsequent damage to the drive electronics. • Use a leading auxiliary break contactor and/or use a Voltage Sensing Module (VSM10). • If this is not possible, then avoid switching the line disconnection equipment under load.

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