

Document Cover Sheet



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Operating Instructions CU240

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Operating Instructions · Edition 10/2007



Control Unit

CU240S
CU240S DP
CU240S DP-F
CU240S PN
CU240S PN-F

Firmware version 3.1

SINAMICS

G120

SIEMENS

SIEMENS

SINAMICS

G120 Control Units CU240S

Operating Instructions

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Valid for

- CU240S, CU240S DP, CU240S DP-F
with FW 3.0
- CU240S PN, CU240S PN-F
with FW 3.1

10/2007

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Safety Guidelines

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

 DANGER
indicates that death or severe personal injury will result if proper precautions are not taken.
 WARNING
indicates that death or severe personal injury may result if proper precautions are not taken.
 CAUTION
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.
CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.
NOTICE
indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Prescribed Usage

Note the following:

 WARNING
This device may only be used for the applications described in the catalog or the technical description and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens. Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.

Trademarks

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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1.2 Description of Document Classes

Description of the documents

The following section describes the available document types for your inverter:

Brochure

The Brochure is advertising literature designed to introduce the product to the marketplace. It contains a basic outline of the product with a brief overview of the technical capabilities of the product.

Catalog

The Catalog presents information that allows the customer to select an appropriate inverter including all available options. It contains detailed technical specifications, ordering and pricing information to allow the customer to order the appropriate items for their application or plant.

Getting Started

The Getting Started presents warnings, dimension drawings and a brief set up information for the customer.

Operating Instructions

The Operating Instructions gives information about the features of the inverter. It gives detailed information about commissioning, control modes, system parameters, troubleshooting, technical specifications and the available options of the product.

Hardware Installation Manual

The Hardware Installation Manual gives information for the Power Modules regarding the features of the product. It gives detailed information on installation, technical specifications, dimension drawings and the available options from the product.

Function Manual

The Function Manual is a list of detailed information about the inverter's functions. It contains descriptions of the internal components, modules and gates as well as examples for usage. Moreover associated parameters and miscellaneous logic operations of the controls are given.

Parameter Manual

The Parameter Manual contains a detailed description of all the parameters that can be modified to adapt the inverter to specific applications. The Parameter Manual also contains a series of function diagrams to diagrammatically portray the nature and interoperability of the system parameters.

Safety notes

Safety Instructions

The following Warnings, Cautions and Notes are provided for your safety and as a means of preventing damage to the product or components in the connected machines. This section lists Warnings, Cautions and Notes, which apply generally when handling the inverter, classified as General, Transport and Storage, Commissioning, Operation, Repair and Dismantling and Disposal.

Specific Warnings, Cautions and Notes that apply to particular activities are listed at the beginning of the relevant sections in this manual and are repeated or supplemented at critical points throughout these sections.

Please read the information carefully, since it is provided for your personal safety and will also help prolong the service life of your inverter and the equipment to which it is connected.

General

WARNING

This equipment contains dangerous voltages and controls potentially dangerous rotating mechanical parts. Non-compliance with the warnings or failure to follow the instructions contained in this manual can result in loss of life, severe personal injury or serious damage to property.

Protection in case of direct contact by means of SELV / PELV is only permissible in areas with equipotential bonding and in dry indoor rooms. If these conditions are not fulfilled, other protective measures against electric shock must be applied e.g. protective insulation.

Only suitably qualified personnel should work on this equipment, and only after becoming familiar with all safety notices, installation, operation and maintenance procedures contained in this manual. The successful and safe operation of this equipment is dependent upon its proper handling, installation, operation and maintenance.

As the earth leakage for this product can be greater than 3.5 mA a.c., a fixed earth connection is required and the minimum size of the protective earth conductor shall comply with the local safety regulations for high leakage current equipment.

If an RCD (also referred to as an ELCB or a RCCB) is fitted, the Power Module will operate without nuisance tripping provided that:

- A type B RCD is used.
- The trip limit of the RCD is 300 mA.
- The neutral of the supply is grounded.
- Only one Power Module is supplied from each RCD.
- The output cables are less than 15 m screened or 30 m unscreened.

The power supply, DC and motor terminals, the brake and thermistor cables can carry dangerous voltages even if the inverter is inoperative. Wait at least five minutes to allow the unit to discharge after switching off the line supply before carrying out any installation work.

It is strictly prohibited for any mains disconnection to be performed on the motor-side of the system; any disconnection of the mains must be performed on the mains-side of the Inverter.

When connecting the line supply to the Inverter, make sure that the terminal case of the motor is closed.

This equipment is capable of providing internal motor overload protection according to UL508C. Refer to P0610 and P0335, i^t is ON by default.

When changing from the ON to OFF-state of an operation if an LED or other similar display is not lit or active; this does not indicate that the unit is switched-off or powered-down.

The inverter must always be grounded.

Isolate the line supply before making or changing connections to the unit.

Ensure that the inverter is configured for the correct supply voltage. The inverter must not be connected to a higher voltage supply.

Static discharges on surfaces or interfaces that are not generally accessible (e.g. terminal or connector pins) can cause malfunctions or defects. Therefore, when working with inverters or inverter components, ESD protective measures should be observed.

Take particular notice of the general and regional installation and safety regulations regarding work on dangerous voltage installations (e.g. EN 50178) as well as the relevant regulations regarding the correct use of tools and personal protective equipment (PPE).



 **CAUTION**

Children and the general public must be prevented from accessing or approaching the equipment!

This equipment may only be used for the purpose specified by the manufacturer. Unauthorized modifications and the use of spare parts and accessories that are not sold or recommended by the manufacturer of the equipment can cause fires, electric shocks and injuries.

NOTICE

Keep this manual within easy reach of the equipment and make it available to all users.

Whenever measuring or testing has to be performed on live equipment, the regulations of Safety Code BGV A2 must be observed, in particular § 8 "Permissible Deviations when Working on Live Parts". Suitable electronic tools should be used.

Before installing and commissioning, please read these safety instructions and warnings carefully and all the warning labels attached to the equipment. Make sure that the warning labels are kept in a legible condition and replace missing or damaged labels.

Transport and storage

 **WARNING**

Correct transport, storage as well as careful operation and maintenance are essential for the proper and safe operation of the equipment.

 **CAUTION**

Protect the equipment against physical shocks and vibration during transport and storage. It is important that the equipment is protected from water (rainfall) and excessive temperatures.

Commissioning

 **WARNING**

Working on the equipment by unqualified personnel or failure to comply with warnings can result in severe personal injury or serious damage to material. Only suitably qualified personnel trained in the setup, installation, commissioning and operation of the product should carry out work on the equipment.

 **CAUTION****Cable connection**

The control cables must be laid separately from the power cables. Carry out the connections as shown in the installation section in this manual, to prevent inductive and capacitive interference from affecting the correct function of the system.

Operation

 WARNING
<p>The SINAMICS G120 inverters operate at high voltages.</p> <p>When operating electrical devices, it is impossible to avoid applying hazardous voltages to certain parts of the equipment.</p> <p>Emergency Stop facilities according to EN 60204, IEC 204 (VDE 0113) must remain operative in all operating modes of the control equipment. Any disengagement of the Emergency Stop facility must not lead to an uncontrolled or an undefined restart of the equipment.</p> <p>Certain parameter settings may cause the SINAMICS G120 inverter to restart automatically after an input power failure, for example, the automatic restart function.</p> <p>Wherever faults occurring in the control equipment can lead to substantial material damage or even grievous bodily injury (that is, potentially dangerous faults), additional external precautions must be taken or facilities provided to ensure or enforce safe operation, even when a fault occurs (e.g. independent limit switches, mechanical interlocks, etc.).</p> <p>Motor parameters must be accurately configured for motor overload protection to operate correctly.</p> <p>This equipment is capable of providing internal motor overload protection according to UL508C.</p> <p>Only Control Units with fail-safe functions can be used as an "Emergency Stop Mechanism" (see EN 60204, section 9.2.5.4).</p>

Repair

 WARNING
<p>Repairs on equipment may only be carried out by Siemens Service, by repair centers authorized by Siemens or by authorized personnel who are thoroughly acquainted with all the warnings and operating procedures contained in this manual.</p> <p>Any defective parts or components must be replaced using parts contained in the relevant spare parts list.</p> <p>Disconnect the power supply before opening the equipment for access.</p>

Dismantling and disposal

CAUTION
<p>The packaging of the inverter is re-usable. Retain the packaging for future use.</p> <p>Easy-to-release screw and snap connectors allow you to break the unit down into its component parts. You can recycle these component parts, dispose of them in accordance with local requirements or return them to the manufacturer.</p>

Description

The SINAMICS G120 range

The SINAMICS G120 inverter has been designed for the accurate and efficient control of the speed and torque for three-phase motors. The SINAMICS G120 system comprises two basic modules, the Control Unit (CU) and the Power Module (PM).

The Control Units are divided into the following:

- Standard CUs (CUs without fail-safe functions)
 - CU240E economic version of the CU240 control units (e.g. less terminals, no encoder interface)
 - CU240S standard version of the CU240 control units
 - CU240S DP like CU240S plus PROFIBUS DP interface (PROFIdrive Profile V4.1)
 - CU240S PN like CU240S plus PROFINET interface (PROFIdrive Profile V4.1)
- CUs with fail-safe functions
 - CU240S DP-F like CU240S DP plus integrated fail-safe functions
 - CU240S PN-F like CU240S PN plus integrated fail-safe functions

The Power Modules are divided as follows:

- PM240 Power Module with dc braking functions, supply voltage 3 AC 400 V
- PM250 Power Module with regenerative mode, supply voltage 3 AC 400 V
- PM260 Power Module with regenerative mode, supply voltage 3 AC 690 V

Control Units and Power Modules are allowed to be combined in any possible configuration. See the respective manual for specific functions and features.

This manual describes functions and features of the control units

- CU240S
- CU240S-DP
- CU240S DP-F
- CU240S PN
- CU240S PN-F

3.1 Accessories for the CU240S

The following options are available for the CU240S control units.

- BOP (Basic Operator Panel)
- PC connection kit
- MMC (Micro Memory Card)
- CU Screen termination kit

A description how to use the individual options or spare parts is part of the option package itself.

Ordering information and a brief functional description is given in the SINAMICS G120 catalog.

3.2 Features and Functions of the CU240S

Common features

- Modular inverter
- Simple to install
- Signal interconnection possible via BICO technology
- Different data sets selectable
- Fast current limiting (FCL) for trip-free operation
- Easy exchange of Power Module or Control Unit
- Rugged EMC design
- Configurable for a wide range of applications
- Status display via LEDs on the Control Unit
- High pulse frequencies for low noise motor operation
- EM brake relay driver

Features in combination with a PM240

- Built-in braking chopper for dynamic braking
- DC-link voltage controller
- Kinetic buffering

Features in combination with a PM250 or a PM260

- Regenerative capability
- Regenerative braking

Commissioning functions

- Quick commissioning
- Motor/control data calculation
- Motor data identification
- Application commissioning
- Series commissioning
- Parameter reset to the factory setting

Operating functions

- Adjustable setpoint channel
- Adjustable ramp-function generator (RFG)
- JOG mode
- Free function blocks (FFB)
- Fast free function blocks (Fast FFB)
- Positioning ramp down
- Automatic restart (WEA)
- Flying restart
- Current limiting
- Slip compensation
- Motor holding brake (MHB)
- Wobble generator

Control functions

- V/f control with different characteristics
- SLVC (Sensorless vector control mode) speed and torque
- VC (Vector control mode with encoder) speed and torque

Protective functions

- Motor protective functions
- Inverter protective functions
- Plant/system protective functions

Fail-Safe Functions (only for CU240S DP-F and CU240S PN-F)

- Safe Torque Off (STO)
- Safe Stop 1 (SS1)
- Safely-Limited Speed (SLS)
- Safe Brake Control (SBC).

The fail-safe functions can be triggered via Digital inputs (FDI0A ... FDI1B) or PROFIsafe.

3.3 Layout and Block diagram

Layout characteristics of the CU240S

The figure below shows the various interfaces of the different types of Control Units.

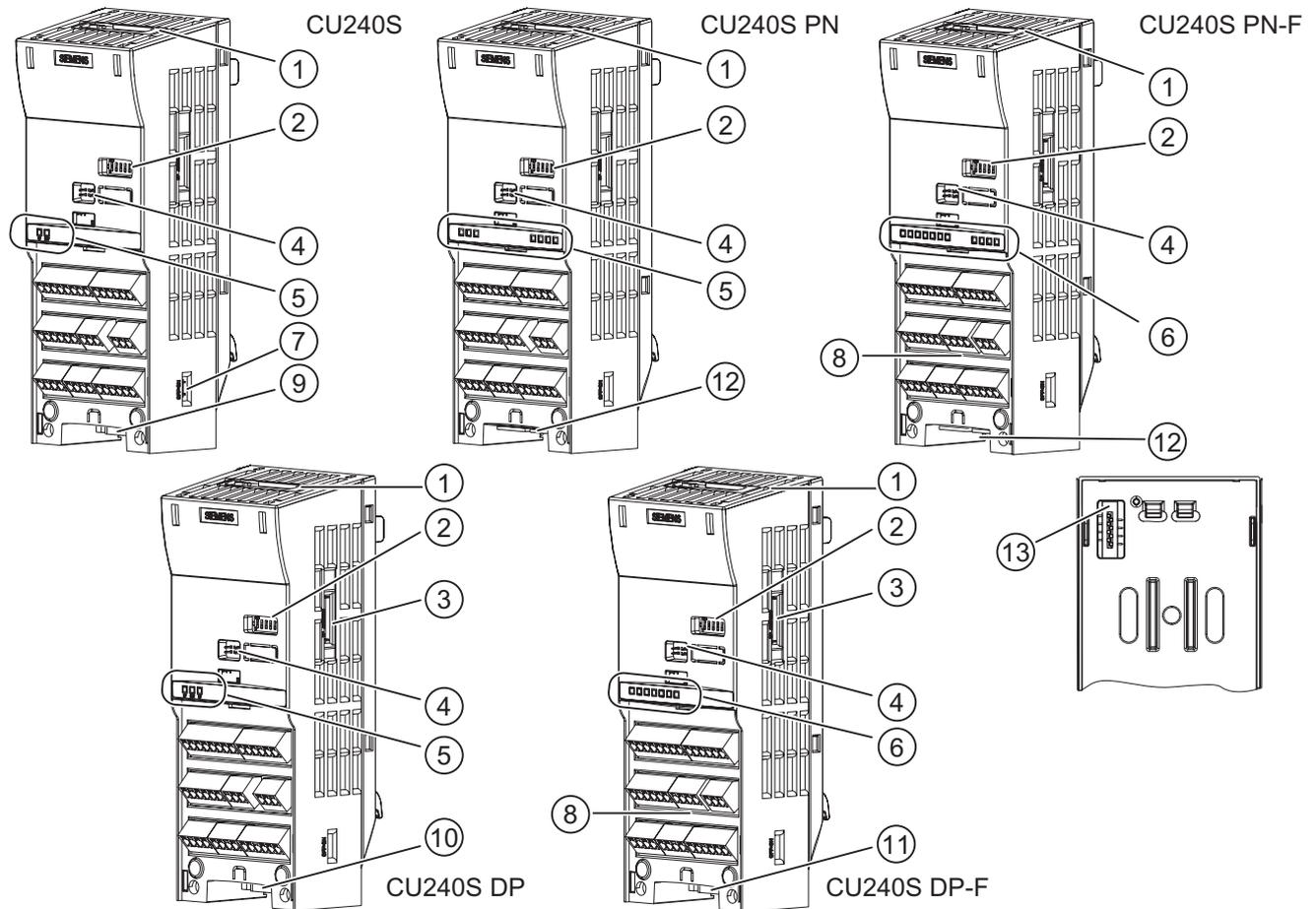


Figure 3-1 Control Units CU240S

- | | |
|---|---|
| ① MMC slot | ⑧ Terminals for fail-safe functions |
| ② General I/O DIP switches | ⑨ RS485 interface via SUB-D connector |
| ③ PROFIBUS DP address DIP switches | ⑩ PROFIBUS DP interface via SUB-D connector |
| ④ Option port | ⑪ PROFIBUS DP (PROFIsafe) interface via SUB-D connector |
| ⑤ Inverter status LED | ⑫ PROFINET interface RJ45 |
| ⑥ Inverter status LEDs and fail-safe LEDs | ⑬ Power Module interface |
| ⑦ Bus terminator switch | |

Installing/Mounting

Installing the Control Unit

The CU controls the functions of the PM. The CU cannot be used without a PM, also the PM cannot be used without a CU.

 **WARNING**

An inverter can be switched on unintentionally if the installation is not performed correctly. The inverter must be started-up by personnel who are qualified and trained in installing systems of this type.

4.1 Fitting the CU to the PM

Fitting the CU to the PM

The Control Unit is snapped onto the Power Module as shown in the figure below. To disconnect the CU push the release button on top of the PM.

The process of fitting the Control Unit to the Power Module is the same technique independent from the type of G120 control unit or G120 power module.

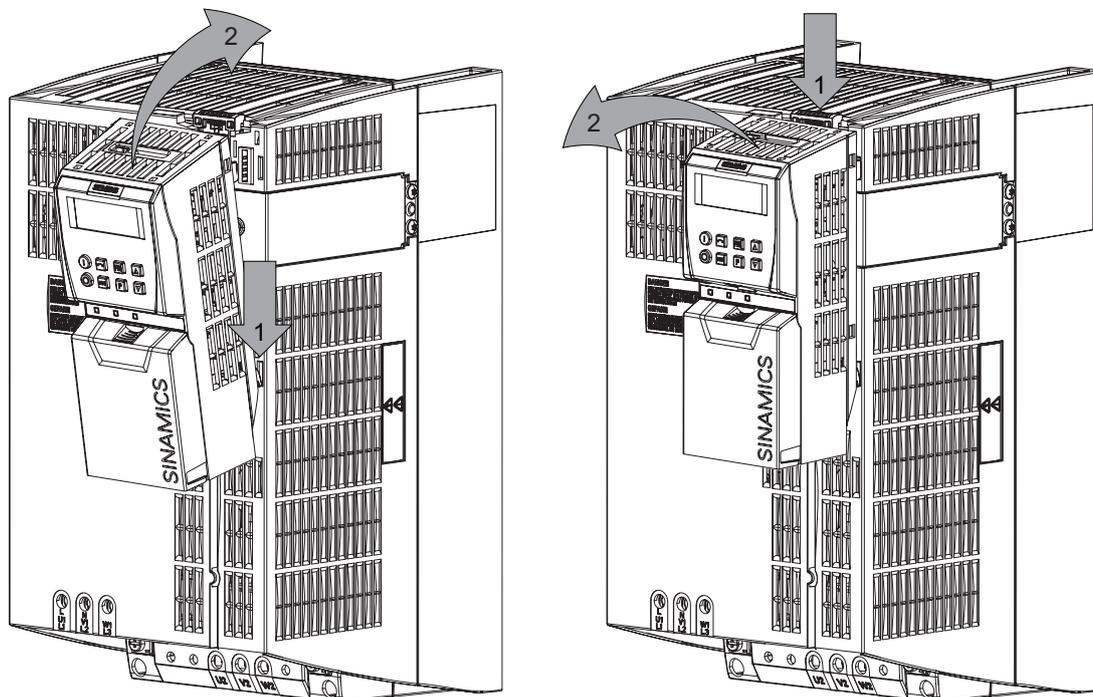


Figure 4-1 Fitting the control unit to the power module

24 V power supply

Normally the CU is supplied with 24 V from Power Module. But it is also possible to use an external DC 24 V supply (20.4 V ... 28.8 V, 0.5 A). It must be connected to the Control Unit terminals 31 (+ 24 V I_n) and 32 (0 V I_n). Some reasons for using an external 24 V power supply are:

- The PROFIBUS DP interface is required to communicate with the Control Unit when the Power Module line power is not present
- Supply for 24 V encoder.

<p>⚠ CAUTION</p> <p>Care must be taken to ensure that the 24 V DC power is connected correctly or damage to the Control Unit may occur.</p> <p>Max. cable length on 24 V DC power supply and I/O cables connected to CU must not exceed 10 m.</p> <p>Use of unshielded cables is possible, however we recommend the use of shielded cables, in order to fulfill the EMC requirements for the CE marking and fail-safe products (CU240S DP-F).</p>
--

Note

If the CU is externally powered with 24 V DC but the power module is disconnected from the mains supply, the faults F0001 ... F0028 are not generated.

4.2 Connecting a CU240S via Terminals

Description

To have access to the control terminals, the terminal cover must be removed, as shown in the figure below. The control terminals have a maximum tightening torque of 0.25 Nm (2.2 lbf.in) and a nominal cable cross section of 1.5 mm².

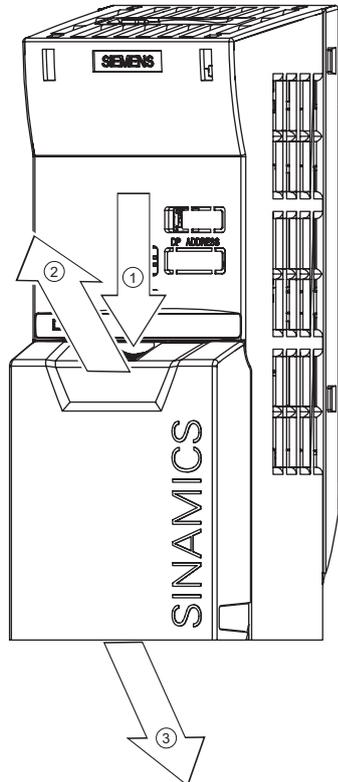


Figure 4-2 Removing the Control Unit terminal cover

The terminals of the CU240 control units are combined to terminal blocks. They can be detached from the control unit, as shown in the figure below. This allows the control units to be swapped out for another of the same type without the need for rewiring.

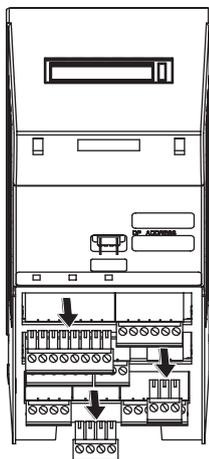


Figure 4-3 Removing the two-part connectors with a CU240S DP as example

After all the wiring of the control unit is completed - ensure that the terminal cover is replaced.

Terminal wiring examples for the Control Unit CU240S

Note

To control the CU240S DP, CU240S DP-F or CU240S PN via terminals is also possible, but in this case the parameter settings for command and setpoint source have to be changed.

In this section examples of controlling a SINAMICS G120 inverter with a CU240S via terminals are shown.

 CAUTION
Use of unscreened cables is possible, however we recommend the use of screened cables in order to fulfill the EMC requirements for the CE marking and fail-safe products (CU240S DP-F).

- Control with the default settings
- Frequency setpoint and an additional setpoint via terminals (AI0 and AI1 used as voltage inputs)
- Frequency setpoint and an additional setpoint via terminals (AI0 and AI1 used as current inputs)

Control with the default settings

When shipped from the factory the G120 inverter (Control Unit and Power Module) must not be operated before the values depending on the specific PM are read into the CU.

This can be done via:

- Downloading a valid parameter set (by MMC, STARTER, or BOP)
- Quick commissioning
- A factory reset

To operate the inverter with the basic settings (e.g. after factory reset, without additional parameterization or DIP switch setting), the following conditions have to be fulfilled:

- The rated current of the inverter is at least as great as the rated current of the motor.
- The power range of the inverter matches the power range of the motor.
- The controlled motor is a 4-pole motor (best Siemens 1LA7).
- The rated motor frequency is 50 Hz, power dimension unit is kW.

Control settings

Digital and analog inputs for commands and setpoints are parameterized for a cabling as shown in the block diagram of the CU240S in the operating instructions. Furthermore the state of the inverter is monitored via digital and analog outputs.

Table 4-5 Permissible cable length for one segment

Baud rate	Max. cable lengths for one segment
9.6 kbaud ... 187.5 kbaud	1000 m (3280 ft)*
500 kbaud	400 m (1312 ft)*
1.5 Mbaud	200 m (656 ft)*
3 Mbaud ... 12 Mbaud	100 m (328 ft)*
* Repeaters can be installed to increase the length of a segment.	

Cable installation rules

During installation the bus cable must not be:

- twisted
- stretched or
- compressed.

Supplementary constraints as regards electromagnetic compatibility must also be observed.

Connectors

To connect the PROFIBUS cable to the PROFIBUS DP interface, a bus connector of one of the types described in the following table is recommended.

Table 4-6 Recommended PROFIBUS connectors

Order Number	6GK1 500-0FC00	6GK1 500-0EA02
		
PG socket	No	No
Max. baud rate	12 Mbaud	12 Mbaud
Terminating resistor	On/Off switch	On/Off switch
Outgoing cable unit	180°	180°
Interfaces		
PROFIBUS nodes	9-pin sub D socket	9-pin sub D socket
PROFIBUS bus cable	4 modular terminals for wires up to 1.5 mm ²	4 modular terminals for wires up to 1.5 mm ²
Connectable PROFIBUS cable diameter	8 ± 0.5 mm	8 ± 0.5 mm

Note

We recommend only these two connectors since they can be used without difficulty for all SINAMICS G120 models and are completely compatible in terms of outgoing cable unit angle.

PROFIBUS terminator

Each bus segment must have a resistor network at both ends as shown in the figure below.

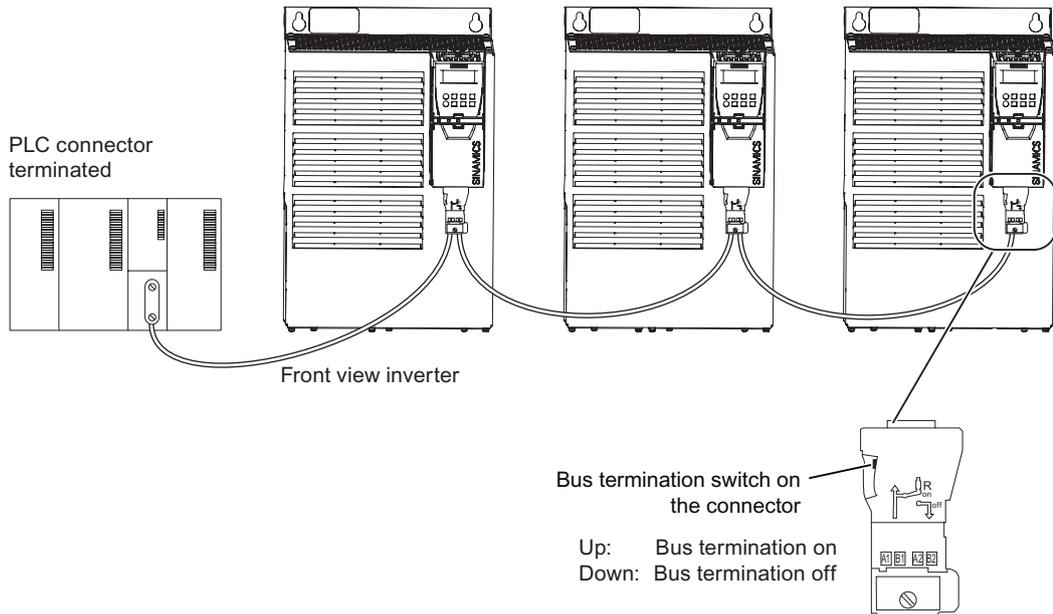


Figure 4-4 PROFIBUS network with bus termination

The bus termination resistor has to be activated via the terminator switch on the recommended PROFIBUS connector

The switches of the bus terminator provides both the 220 Ω termination and the 390 Ω biasing. The 390 Ω biasing maintains the potential difference between the signals in the PROFIBUS network cables.

 WARNING
It must be ensured that any node, where the biasing components of the bus are connected, is powered at all times in which the bus is in operation.

Removing a bus connector

You can remove the bus connector with looped-through bus cable from the PROFIBUS DP interface at any time without interrupting the data exchange on the bus. Only the final node must be terminated.

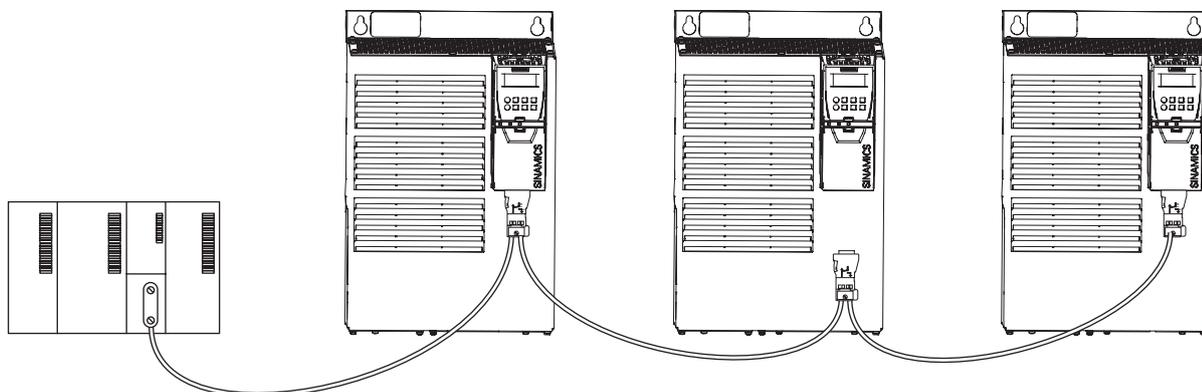


Figure 4-5 Removing a bus connector

4.4.2 Screening the bus cable and EMC precautions

Description

The following EMC-related precautions must be taken to ensure interference-free PROFIBUS DP operation.

Screening

The screen of the PROFIBUS DP cable must be connected in the bus connector. Additional screening is provided using a screen clamp on the bus cable screen which must make 360° contact with the protective earth. The solid copper core must not be scored when the insulation is removed from the core ends. You must also ensure that the screen of each bus cable is connected to protective earth at both the cabinet entry point and in the inverter housing.

Note

The bus cables must be internally twisted and screened, and installed separately from power cables with a minimum distance 20 cm (7.8 inches). The braided screen and underlying laminated foil screen (if applicable) must be connected in a 360°, positive connection at both ends, that is, the screen on the bus cable between two inverters must be connected to the inverter housing at both ends. The same applies to the screen of the bus cable between the PROFIBUS DP master and inverter.

Crossovers between bus and power cables must be laid at an angle of 90°.

Equipotential bonding

Differences in potential (for example, due to different mains supplies) between the inverters and the PROFIBUS DP master must be avoided.

- Recommended equipotential bonding cables:
 - 16 mm² Cu for equipotential bonding cables up to 200 m long
 - 25 mm² Cu for equipotential bonding cables of over 200 m long.
- Equipotential bonding cables must be routed as close as possible to signal leads; this means that the area between the bonding conductor and signal lead is as small as possible.
- Equipotential bonding cables must be contacted in a 360° connection with the earth electrode/PE conductor.

4.5 Connecting a CU240S PN via PROFINET

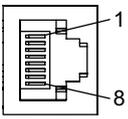
Socket

The Control Units CU240S PN and CU240S PN-F are equipped with a two port ethernet switch, carried out as RJ45 female sockets. Connection to optical nets is achieved by using switches with both electrical and optical ports, the drive is then connected to an electrical port. Therefore, no power supply for an external electrical/optical inverter is provided.

The assembly of the SIMATIC NET Industrial Ethernet FastConnect RF45 Plug 180 is described in the product information "Assembly Instructions for SIMATIC NET Industrial Ethernet FastConnect RJ45 Plug". For downloading this document, refer to:

<http://support.automation.siemens.com/WW/view/en/23175326/130000>

Table 4-7 PIN assignment of the RJ45 female socket

	Pin	Designation	Meaning	Core color
	1	TX+	Transmission data +	Yellow
	2	TX	Transmission data -	Orange
	3	RX+	Receiver data +	White
	4	-		
	5	-		
	6	RX-	Receiver data -	blue

Connector

Table 4-8 Recommended PROFINET connectors

Order Number	6GK1901-1BB10-2Ax0
	
Label	Industrial Ethernet FC RJ45 Plug 180
Max. baud rate	100 Mbit/s; Cat5e
Outgoing cable unit	180°
Degree of protection	IP20
Operating temperature	-20 °C ... +70 °C

Commissioning

Overview

A G120 inverter is composed of the Power Module and the Control Unit. After snapping the Control Unit on to the Power Module for the first time, the devices must identify each other.

To indicate, that the Power Module and the Control Unit are not yet identified, F0395 is displayed. For further information to the message F0395, refer to section "Message F00395".

The G120 inverter provides two options for commissioning:

- **Single commissioning**

One inverter is parameterized for commissioning with an individual parameter set. Usually, you use the STARTER or BOP for single commissioning.

- **Series commissioning**

Several inverters are parameterized for commissioning via download of a complete parameter set. Usually, you use the MMC for series commissioning.

Note

We recommend commissioning via STARTER. The commissioning process using STARTER is driven by dialog boxes and will not be interpreted in this manual. This manual describes the parameter related commissioning via BOP.

Interfaces

The G120 inverter provides different communication interfaces. The following figure provides you an overview:

4.6 Installation Check List

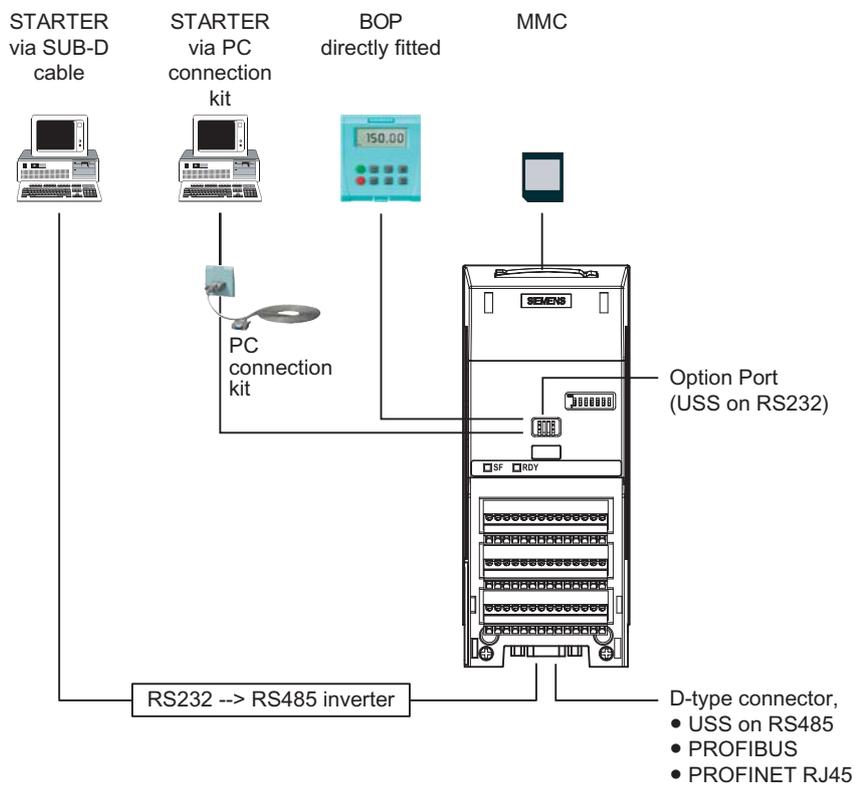


Figure 5-1 Communications interfaces

5.1 Single Commissioning

Overview

For single commissioning, you set the parameter of the inverter manually. You use BOP (Basic Operator Panel) or STARTER (Commissioning software via PC) for commissioning.

Note

We recommend commissioning via STARTER. The commissioning process using STARTER is driven by dialog boxes and will not be interpreted in this manual. This manual describes the parameter related commissioning via BOP.

Settings of commissioning

Commissioning the G120 inverter comprises different settings and kinds of single commissioning. The following list provides you an overview:

- Basic commissioning
 - Quick commissioning
 - Motor data identification
 - Speed control optimization
- Further settings for commissioning
 - Calculating the motor/control data
 - Commissioning the application
 - Reset parameters to factory settings
 - Commissioning the fail-safe functions (only in fail-safe applications)

For detailed information to the settings of single commissioning, refer to the section "Commissioning with BOP".

Factory settings

The inverter is delivered with identical factory settings for all CU240S Control Units; except the following settings:

- Command source
- Setpoint source
- Values depending on the Power Module

The factory settings of the Power Modules are specific for the type of PM.

For details to the factory settings, refer to the Parameter Manual.

Note

After the first power on, the fault F0395 will appear. This means, no commission is until now implemented. After confirming the message, you can proceed commissioning.

5.2 Series Commissioning

5.2.1 Common Information to Series commissioning

Description

Series commissioning means transferring the parameter set from one inverter into a number of other inverters. This provides fast commissioning for identical applications, e. g. series machines or group inverters.

Components for series commissioning

Commissioning the G120 inverter can be done in different ways. The following list provides you an overview:

- Series commissioning with MMC
- Series commissioning with BOP
- Series commissioning with STARTER

For detailed information to series commissioning, refer to the chapters "Commissioning with BOP", "Commissioning with MMC", and "Commissioning with STARTER".

Order of series commissioning

The series commissioning is divided into the following steps:

- Creating a valid parameter set
- Uploading this parameter set
- Downloading of the uploaded parameter set into the next inverter

An appropriate parameter set can be created by parameterizing an inverter via BOP or STARTER.

 CAUTION
Parameter download between different types of Control Units and of different firmware versions is not recommended.
It is possible to download parameter sets from different Control Unit types, however, as the parameter sets might differ, the user is fully responsible for the consistency of the downloaded parameter set.
Therefore, the customer has to confirm his responsibility in case of an automatic download by acknowledging F0395.
During download of a parameter set from an MMC to the EEPROM of the Control Unit CU240S (e.g. during serial commissioning) you have to note that the LEDs are flashing correctly. If the Control Unit CU240S is in a fault state, the LEDs indicate this fault state with higher priority than the download. It is not sure that the parameter set is downloaded correctly.

 **WARNING**

For series commissioning, all of the communication interfaces as well as also the digital and analog interfaces are re-initialized. This results in a brief communications failure or causes the digital outputs to switch.

Potentially hazardous loads must be carefully secured before starting a series commissioning.

Potentially hazardous loads can be secured as follows before starting series commissioning:

- Lower the load to the floor, or
- Clamp the load using the motor holding brake.

Note

Upload

Before the upload starts, the parameters will be copied from RAM to EEPROM

Manual and automatic download

With a manual download all necessary parameters excluding the fail-safe parameters (only with CUs with fail-safe functions) are downloaded into the inverter. How to perform a manual download is described in the following section.

With an automatic download even the fail-safe parameters are downloaded into the inverter.

An automatic download can only be performed with an MMC.

An automatic download can be performed at Start-up or by swapping an inverter component (CU or PM), details are described in the following sections and in the chapter "Operation" of this manual.

Note

Restrictions to be considered when performing upload and download:

- Only the parameter set stored in the EEPROM of the inverter is uploaded.
- Fail-safe parameters cannot be uploaded via BOP or STARTER.
- Once the upload or download procedure has started, it should not be interrupted.
- Parameter download from a standard CUs to a CUs with fail-safe functions and vice versa is not possible.
- During the up or download all LEDs are flashing (the "BF" LED is not relevant). After finishing that process successfully the "RDY" LED is on.
- During the upload process any data already held by the BOP is overwritten.
- If the download fails, the inverter will not function correctly and the "SF" LED (red) is on.
 - Possible fault messages in case of download failure with BOP
F0051, F0055, F0056, F0057 or F0058
 - Possible fault messages in case of download failure with MMC
F0051, F0061, F0062 or F0063

NOTICE

After upload and download of parameters between differing Control Units, the parameter settings must be checked.

Parameter download from a different CU might fail with F0063 if parameters cannot be downloaded (Check P949 for the (first) parameter number which cannot be downloaded).

If F0061 or F0063 occurs during startup it cannot be cleared except via a power cycle.

5.2.2 Upload and Download of Parameter Sets

Upload of parameter sets

With an upload, a parameter set can be saved in one of the following devices:

- PC (via STARTER)
- MMC
- BOP

Note

The file format for the MMC is FAT. Any other format, such as FAT32 or NTFS are not compatible with uploading and downloading parameter sets from the inverter.

Formatting can be accomplished using the DOS command line as follows:

C:\>format volume /FS:FAT - where volume has to be replaced by the name of the MMC drive, for example A.

Please keep in mind that formatting will delete all the contents of the MMC.

An upload can be triggered via

- Communication interface
- BOP
- STARTER

A detailed description is given in "Series Commissioning" in the commissioning section.

Download of parameter sets

In the case of a parameter download it is important to distinguish between the following possibilities:

- Manual download
- Automatic download.

5.3 Common Commissioning Information

Prerequisites

Before commissioning is started, the following data must be available:

- Line supply frequency
- Motor rating plate data
- Command/setpoint sources
- Min./max. frequency or ramp-up/ramp-down time
- Control mode

An example for a rating plate is shown in the figure below. The precise definition and explanation of this data is defined in DIN EN 60034-1.

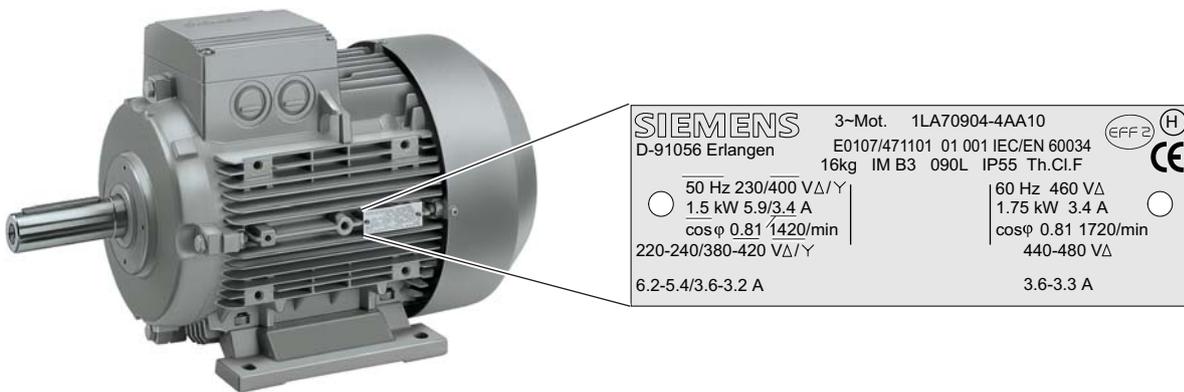


Figure 5-2 Example of a typical motor rating plate

Note

If the inverter is to be commissioned from a defined state, it can be reset to its default settings by performing a factory reset (see section "Reset Parameters to Factory Settings")

NOTICE

Parameters can be changed independent whether an MMC is plugged in or not. Depending on the settings in P8458 after power cycle the parameters from EEPROM or MMC are used for start up. The customer has to take care that the parameter set used for start-up is valid (see also "Start-Up Behavior").

⚠ WARNING

In case of automatic parameter download from the MMC at start up, F0395 will be generated. Clearing F00395 is described in the section "Message F00395" of this manual.

5.4 Message F00395

Description

The message F00395 is displayed to prompt you to check the parameter set. In case of standard CUs you accept the responsibility for a parameter set by confirming F00395. In case of fail-safe CUs you have to carry out an acceptance test.

F00395 does not indicate an inverter fault.

Confirming F00395 on standard CUs

For CUs without fail-safe function, you confirm F00395 in one of the following ways:

- Via a factory reset
- Via the function key FN on the BOP
- Digital input or PLC signal (depends on the settings of P0700)
- Setting P7844 = 0

Confirming F00395 on fail-safe CUs

For CUs with fail-safe functions, it is necessary to do an acceptance test to confirm F00395. For details to the acceptance test (refer to the "Commissioning the Fail-Safe functions" section in this manual).

You confirm F00395 on fail-safe CUs in the following way:

- P0010 = 30
- P9761 = safety password
- P7844 = 0
- Carry out acceptance test

Procedures which require a release of a parameter set via F00395

A Control Unit indicates F00395 in the following states:

- After the first power ON
- After an automatic download
- After a swap of the Control Unit

5.5 Commissioning using the BOP

5.5.1 The Basic Operator Panel (BOP)

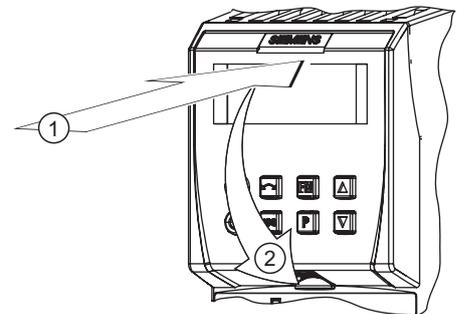
The Basic Operator Panel (BOP) is used for effective parameterizing and control of the inverter. The control signals and speed reference can easily be set by pressing the appropriate buttons. The BOP has the ability to upload and download parameter sets from an inverter to another inverter.



Basic Operator Panel (BOP),
6SL3255-0AA00-4BA1

Fitting the BOP to the Control Unit

The BOP is fitted to the Control Unit as shown in the figure below. No matter which type of Control Unit is being used, the process is the same.



Fitting the BOP to the CU

5.5.1.1 Function Keys of the BOP

Basic Operator Panel - function keys

Table 5-3 BOP keys and their functions

Basic Operator Panel Key	Function	Effects
	Status display	The LCD indicates the settings which the drive inverter is presently using. The display reports faults and alarms.
	Start motor	The inverter is started by pressing the key. This key is deactivated in the default setting. Parameter P0700 should be changed as follows to activate the key: BOP: P0700 = 1
	Stop motor	OFF1 When this key is pressed, the motor comes to a standstill within the selected ramp-down time. It is deactivated in the default setting; to activate → refer to the "Start motor" key.
		OFF2 The motor coasts down to a standstill by pressing the key twice (or pressing once for a longer period of time). This function is always activated.
	Direction reversal	To reverse the direction of rotation of the motor, press this key. The opposing direction is displayed using the minus character (-) or by the flashing decimal point. In the default setting this function is deactivated. To activate it → refer to the "Start motor" key.
	Jog motor	In the "Ready to run" state, when this key is pressed, the motor starts and rotates with the pre-set jog frequency. The motor stops when the key is released. When the motor is rotating, this key has no effect.
	Function key	This key can be used to display additional information. If you press the key during operation, independent of the particular parameter, for two seconds, the following data will be displayed: 1. Voltage of the DC current link (designated by d – units V). 2. Output current (A) 3. Output frequency (Hz) 4. Output voltage (designated by o – units V). 5. The value, selected in P0005 (if P0005 is configured so that one of the above pieces of data is displayed (1 to 4), then the associated value is not re-displayed). The displays mentioned above are run-through one after the other by pressing again. Step function Pressing the FN button briefly makes the display to jump from any parameter (rXXXX or PXXXX) to r0000 and vice versa. After quitting an alarm, r0000 will be displayed and the "jumped from parameter" is forgotten. Acknowledgement If alarm and fault messages are present, then these can be acknowledged by pressing key FN .
	Parameter access	Parameters can be accessed by pressing this key.
	Increase value	When this key is pressed, the displayed value is increased.
	Reduce value	When this key is pressed, the displayed value is decreased.

5.7.2 Series commissioning with MMC

Inserting and removing the MMC

Before upload or download can be performed an MMC has to be fitted. How to fit and remove the MMC see the following figure:

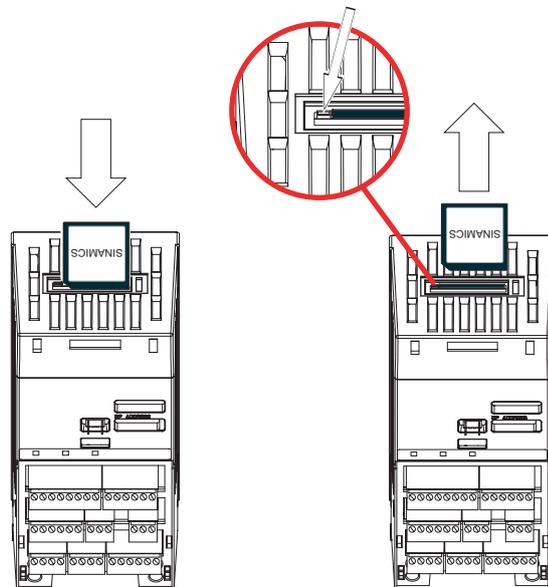


Figure 5-3 Fitting and Removing the MMC

WARNING

When inserting an MMC during operation Alarm A0564 appears if P8458 is set to 0. This is a hint that with P8458 = 0 no Automatic Download will be performed at startup.

If the MMC is inserted to perform an upload this alarm can be quitted without any further action.

If the MMC is inserted to perform an Automatic Download P8458 must be set accordingly.

Note

PROFINET communication

If you use the MMC for commissioning a SINAMICS G120 inverter with CU240S PN, keep in mind, that the device name of the inverter must be set manual either using the Primary Setup Tool (PST) or using HW Config from STEP 7.

6.4.2 Communication Settings PROFBUS DP

Setting the PROFIBUS DP address

Prior to using the PROFIBUS DP interface, the address of the node (inverter) must be set.

There are two methods for setting the PROFIBUS DP address:

- Using the seven DIP-switches on the Control Unit
- Using parameter "P0918"

CAUTION

If changing the PROFIBUS DP address, a power cycle is necessary for the Control Unit CU240S to make the new PROFIBUS DP address setting effective. The restart must be initiated by switching the power off and then on again, irrespective of whether the interface is supplied from the inverter mains supply or its own, separate 24 V power supply connection.

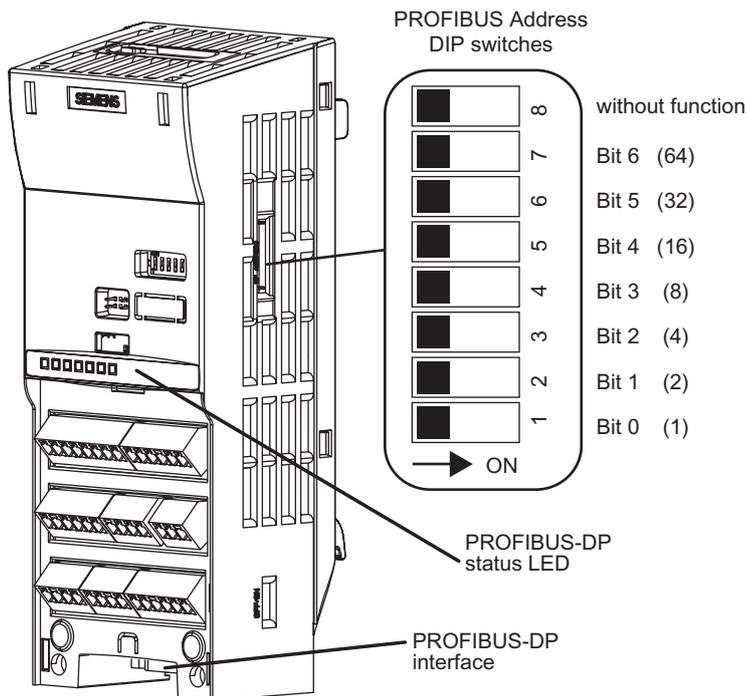


Figure 6-7 PROFIBUS DP address DIP-switches

6.4.3 PROFIBUS Configuration Example with SIMATIC S7

Installing a G120 GSD file

The inverter can be integrated into a higher level control device, e.g. SIMATIC S7 via the GSD file. It can be downloaded from the internet via:
<http://support.automation.siemens.com/WW/view/de/23450835>

The GSD file must be installed in HW Config of SIMATIC S7 as shown in the example below.

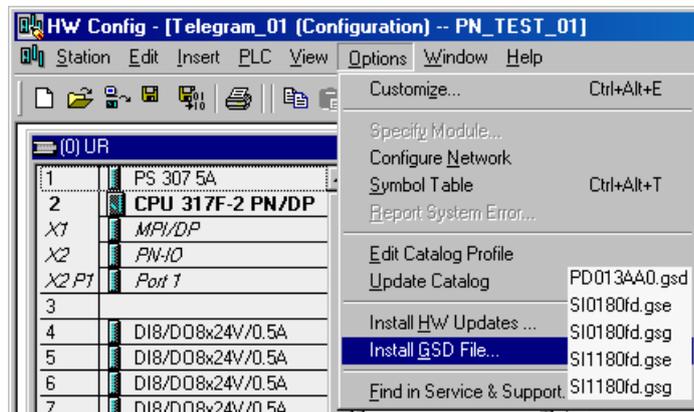


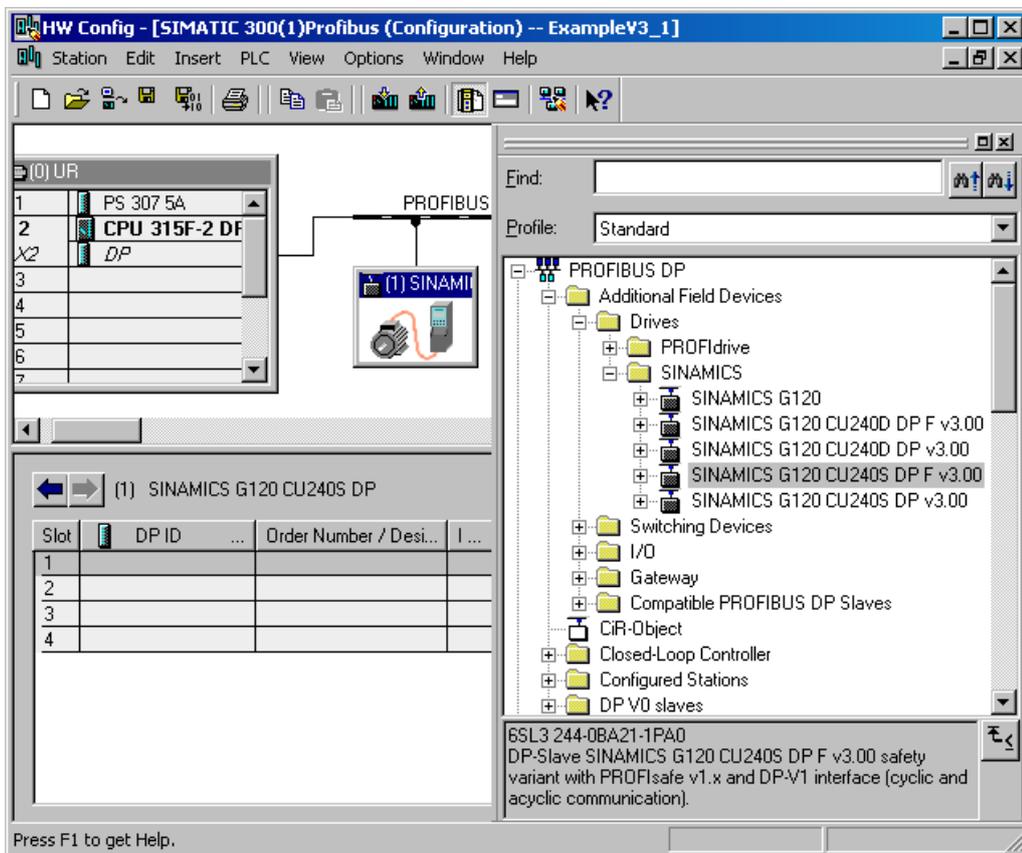
Figure 6-8 Installing the G120 GSD in HW config SIMATIC S7

Install the *.GS* file in the desired language (english, french, german, italian or spanish) from the folder where you have stored the data.

Adding a SINAMICS G120 inverter to HW Config

To add the SINAMICS G120 inverter as a PROFIBUS slave, perform the following steps:

1. Select the PROFIBUS in HW config.
2. Open " PROFIBUS DP > Additional Field Devices > Drives > SINAMICS" in the hardware catalog.
3. Double click onto e.g. "SINAMICS G120 CU240S DP F v3.00". This inserts a fail-safe G120 inverter as PROFIBUS slave and opens the properties dialog. Assign a PROFIBUS address and a unique device name or accept the ones, the system offers. Confirm your settings with OK.



Setting the telegram addresses

Note

The inverters are able to operate with different telegram types. The telegram, selected in the inverter via P0922, must be identical to the type selected in HW Config.

The addresses can be changed by opening the properties dialog via double click. Set the addresses to the appropriated values or accept the ones, the system offers and confirm your settings with OK. The addresses set here must be used in the S7- program for the cyclic data transfer.

Failsafe inverters

Note

In case of installing a fail-safe inverter, ensure that the PROFIsafe Module is installed in slot 1 (as shown in the figure below). In the following slot a SIEMENS telegram or a standard telegram can be installed.

6.6 Communication via USS

6.6.1 Universal serial interface (USS)

Data

Parameter range:	P2010 ... r2037
Warnings:	–
Faults:	F0071, F0072
Function chart number:	FP2500, FP2510, FP2600, FP2610

Description

Using the Universal Serial Interface (USS) protocol, a user can establish a serial point-to-point data link (RS232 interface) and a serial bus data link between a higher-level master system and several slave systems (RS485 interface). Master systems can be e.g. PLCs (e.g. SIMATIC S7-200) or PCs. The inverters are always the slaves on the bus system.

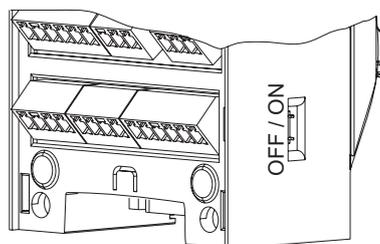
The USS protocol allows the user to implement both automation tasks with cyclical telegram traffic (a fixed telegram length is necessary) as well as visualization tasks. In this case, the protocol with variable telegram length is advantageous, as texts and parameter descriptions can be transferred in one telegram without chopping up the information.

USS via RS232

With the RS232 interface only direct connections (point-to-point) are possible with cable lengths of 2 m ... 5 m typically. This is typically used to commission a drive where the commissioning software (e.g. STARTER) runs on a PC. For this configuration the optional PC Connection Kit is available.

USS via RS485

With the RS485 interface communication networks can be constructed. The topology must be that of a line with the first and last devices of the line terminated with termination resistors. The figure shows the termination DIP switch on the CU240S. Default position is OFF (no termination resistor).



Short branches are possible to connect the devices. Up to 31 inverters can be integrated as slaves into a network with a PLC as master.

7.2 Operation States Displayed via LED

7.2.1 LED Display

Status display

The SINAMICS G120 provides LEDs to show the operating states for standard or fail-safe inverters.

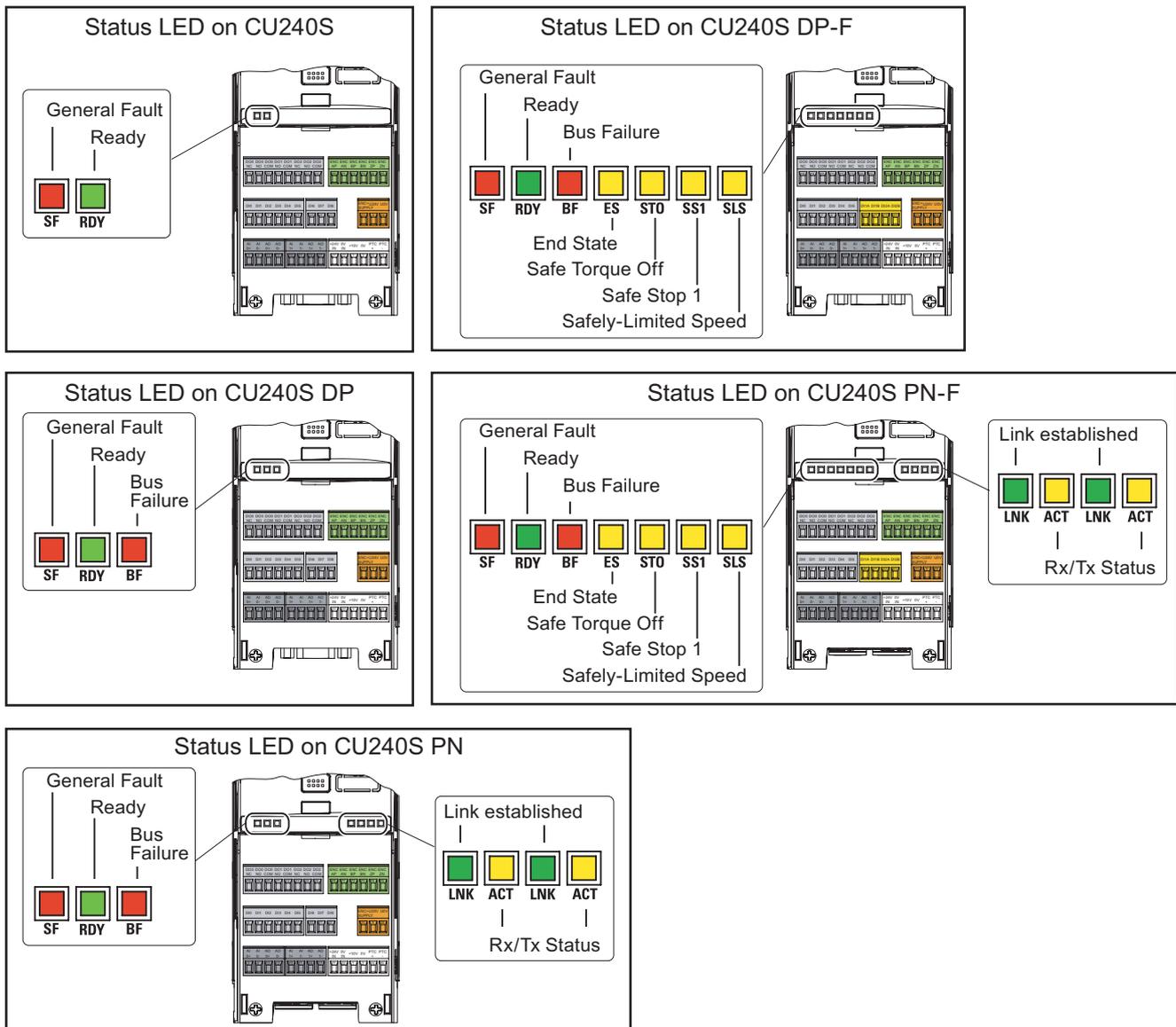


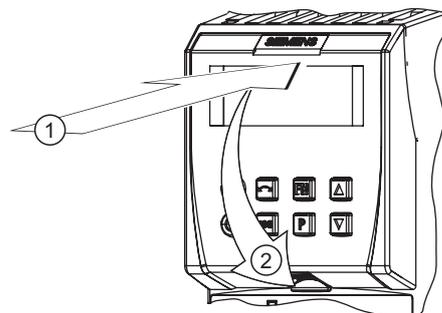
Figure 7-1 State LED on the CU240S, CU240S DP, CU240S DP-F, CU240S PN

Spare parts/Accessories

11.1 Basic Operation Panel

Basic Operator Panel (BOP)

The BOP is a parameterization tool that is fitted directly to the SINAMICS G120 inverter via the option port. It can also be used for up and download of parameter sets. For a detailed description refer to chapter "Commissioning using the BOP".



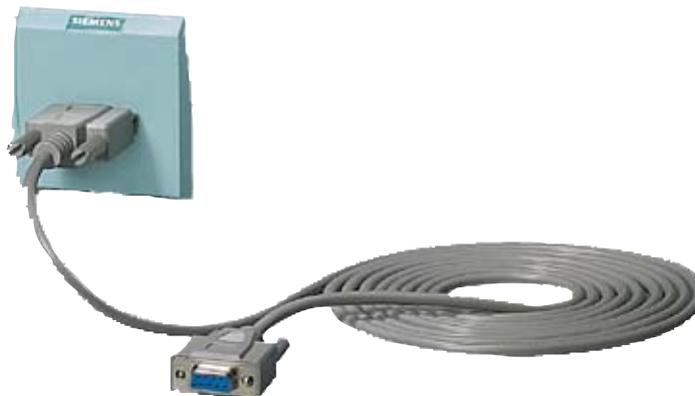
11.2 PC Connection Kit

PC Connection Kit

The PC connection kit consists of a PC inverter connector module with a 9-pin sub-D socket and a null modem cable allowing connection to a PC running STARTER software.

Using this equipment it is possible to provide the following operations:

- To parameterize the inverter (Commissioning, optimizing)
- To monitor the inverter (Diagnosis)
- To control the inverter (For the purpose of testing, STARTER has the priority to control)



11.3 Micro Memory Card (MMC)

Micro Memory Card (MMC)

The MMC is used to save parameters from a Control Unit.

Thus saved parameter set can be transferred to another Control Unit. In the case of service, the drive system is immediately ready for use, e. g. after swapping an inverter.

The MMC stores up to 100 parameter sets and supports series commissioning without using additional commissioning tools as BOP or STARTER.

The commissioning of MMC depends on user settings (Parameter p8458)



Note

The inverter can be operated with or without MMC plugged in.

Siemens AG

Automation and Drives
Standard Drives
Postfach 32 69
91050 Erlangen
Deutschland

www.siemens.de/sinamics-g120