

Training Document
for
Comprehensive Automation Solutions
Totally Integrated Automation (T I A)

MODULE H01

Frequency Converter SINAMICS G120

on the

PROFIBUS DP and PROFINET

This document has been written by Siemens AG for training purposes for the project entitled "Siemens Automation Cooperates with Education (SCE)".
Siemens AG accepts no responsibility for the correctness of the contents.

Transmission, use or reproduction of this document is only permitted within public training and educational facilities. Exceptions require the prior written approval by Siemens AG (Michael Knust michael.knust@siemens.com).

Offenders will be liable for damages. All rights, including the right to translate the document, are reserved, particularly if a patent is granted or utility model is registered.

We would like to thank the following: Michael Dziallas Engineering, the teachers at vocational schools, and all others who helped to prepare this document.

	PAGE
1. preface.....	6
2. notes on using the CPU 315F-2 PN/DP	9
3. notes on using the frequency converter SINAMICS G120.....	10
3.1 Description of the Frequency Converter SINAMICS G120	10
3.2 Configuring the Drive with the Software SIZER	16
3.3 Safety Precautions and Warnings	28
3.4 Connecting the Frequency Converter SINAMICS G120.....	32
3.4.1 Connecting the Power Module	32
3.4.2 Block Diagrams for the Control Units CU240S DP and CU240S PN	33
3.4.3 Setting the Frequency Setpoints with DIP Switches	36
3.4.4 Settings for the Encoder with DIP Switches.....	36
3.4.5 Setting the PROFIBUS Address with DIP Switches	36
3.4.6 PROFIBUS Interface	37
3.4.7 PROFINET Interface	37
3.5 Starting Up the Frequency Converter SINAMICS G120	38
3.5.1 Startup Using the Basic Operator Panel (BOP)	40
3.5.1.1 Function Keys of the Basic Operator Panel (BOP)	41
3.5.1.2 Parameters that are visible/Parameters that can be changed	42
3.5.1.3 BICO Technology	44
3.5.1.4 Changing Parameters with the Basic Operator Panel (BOP)	46
3.5.1.5 Starting Performance of the SINAMICS G120	48
3.5.1.6 Reset to Factory Setting	49
3.5.1.7 Quick Commissioning for V/f Control, for example	50
3.5.2 Startup with the Software STARTER using the Connection Kit.....	52
3.5.3 Startup with the Micro Memory Card (MMC).....	72
3.5.3.1 Manual Parameter Upload from the Converter to the MMC	72
3.5.3.2 Manual Parameter Download from a MMC to the Converter.....	73
3.6 Exercises	74
4. Starting Up the frequency converter SINAMICS G120 on the PROFIBUS	75
5. starting up the frequency converter SINAMICS G120 on the PROFINET.....	105
6. CONTROL PROGRAM 'BUCKET ELEVATOR' ON THE PROFIBUS DP/PROFINET	134
6.1 Assigning the Process Data for the SINAMICS G120	134
6.1.1 The Control Word (STW).....	134
6.1.2 The Status Word (ZSW).....	136
6.1.3 The Main Setpoint (HSW)	137
6.1.5 Arrangement of the Request Message in Double Word Format.....	138
6.1.6 Arrangement of the Response Message in Doubleword Format.....	138
6.2 Assignment List and Symbol Table.....	139

6.3	Generating the Data Block for the Request Message.....	141
6.4	Generating the Data Block for the Response Message.....	143
6.5	Generating Function FC10 to Control the Bucket Elevator.....	144
6.6	Generate Organization Block OB1 for Controlling the Bucket Elevator.....	146
6.7	Load the blocks for controlling the bucket elevator to the CPU 315-2DP.....	147

The following symbols are provided as a guide through Module H01:



Information



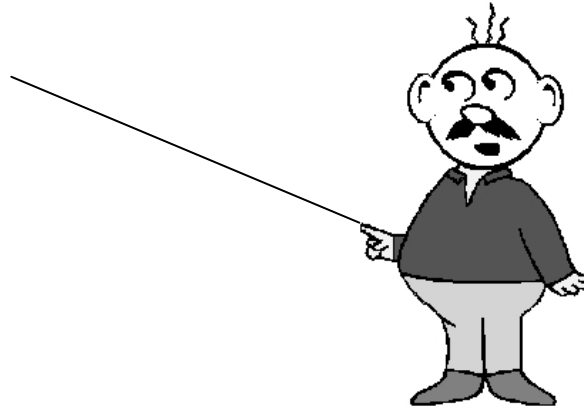
Programming



Sample Exercise

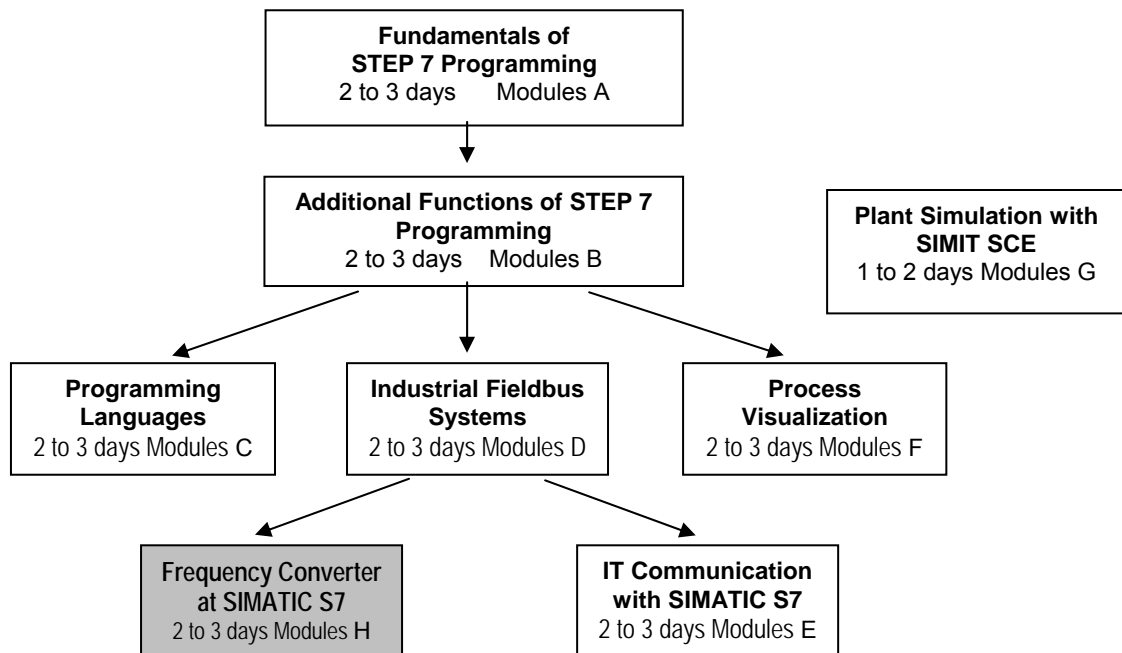


Notes



1. PREFACE

In terms of its contents, Module H01 is part of the teaching unit entitled 'Frequency Converter at SIMATIC S7'.



Learning Objective:

In Module H01, the reader learns how the frequency converter SINAMICS G120 is started up together with the CPU 315F-2 PN/DP on PROFIBUS DP as well on PROFINET. Module H01 shows the method in principle, using a brief example for each the PROFIBUS and the PROFINET.

Prerequisites:

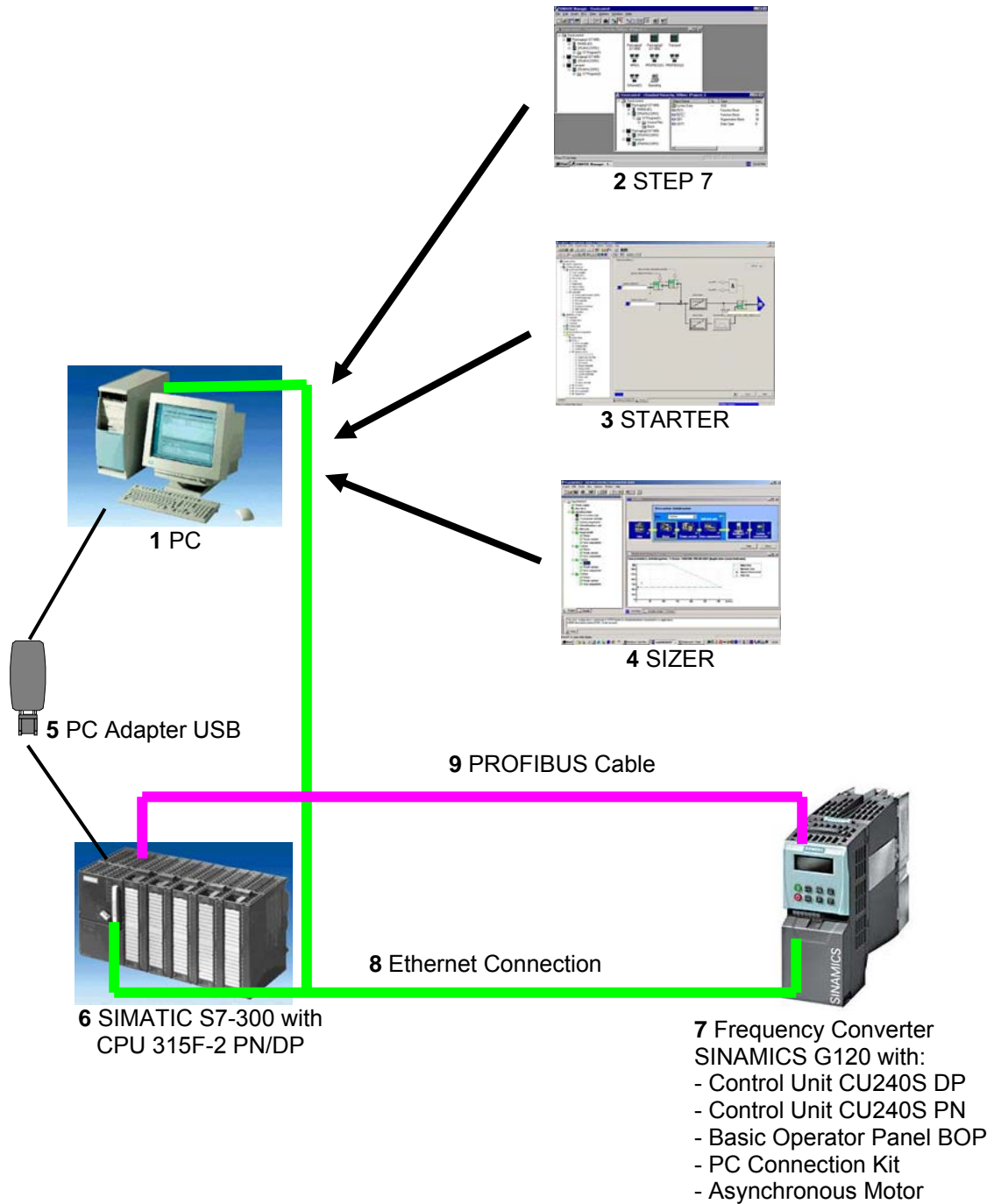
To successfully work through Module H01, the following knowledge is assumed:

- Knowledge in handling Windows
- Fundamentals of PLC programming with STEP 7 (for example, Module A3 - 'Startup' PLC Programming with STEP 7)
- Fundamentals of PROFIBUS DP (for example, Appendix IV – Fundamentals of Fieldbus Systems with SIMATIC S7-300)
- Fundamentals of network engineering (for example, Appendix V - Basics of Network Engineering)

Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
----------------	-------	-----------------------	-----------------------	-----------------

Hardware and Software Required

1. PC, operating system Windows 2000 Professional starting with SP4/XP Professional starting with SP1/Server 2003 with 600MHz and 512RAM, free hard disk storage approx 650 to 900 MB, MS Internet Explorer 6.0, and network card
2. Software STEP 7 V 5.4
3. Startup Software STARTER V4.1
4. Configuring Software SIZER V2.8
5. MPI for the PC (such as PC Adapter USB)
6. PLC SIMATIC S7-300 with CPU 315F-2 PN/DP and at least one digital input and output module
Sample configuration:
 - Power unit: PS 307 2A
 - CPU: CPU 315F-2 PN/DP
 - Digital inputs: DI 16x DC 24V
 - Digital Outputs: DO 16x DC 24V / 0.5 A
7. Frequency Converter SINAMICS G120 with:
 - Control Unit CU240S DP
 - Control Unit CU240S PN
 - Basic Operator Panel BOP
 - PC Connection Kit
 - Asynchronous Motor
8. Ethernet connection between PC, CPU 315F-2 PN/DP and SINAMICS G120 with CU240S PN
9. PROFIBUS cable with 2 PROFIBUS connectors for connecting the CPU 315F-2 PN/DP and the SINAMICS G120 with CU240S DP



Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
----------------	-------	-----------------------	-----------------------	-----------------

2. NOTES ON USING THE CPU 315F-2 PN/DP



The CPU 315F-2 PN/DP is a CPU that is shipped with two integrated interfaces.

- The first interface is a combined MPI/PROFIBUS-DP interface that can be used on the PROFIBUS DP as Master or as Slave to connect distributed peripherals/fieldbus devices with very fast response timing.
Moreover, the CPU can be programmed here by means of the MPI or also PROFIBUS DP
- The second interface is an integrated PROFINET interface.
It allows for using the CPU as a PROFINET IO controller to operate distributed peripherals on the PROFINET. The CPU can be programmed by means of this interface also!
- At both interfaces, frequency converters and also fault-tolerant IO devices can be used.

Notes:

- In Module H01, the CPU 315F-2 PN/DP is used as IO controller on the PROFINET and as master on the PROFIBUS DP.
- To operate this CPU, a micro memory card is required!
- The addresses of the input and output modules can be parameterized in the case of this CPU.

3. NOTES ON USING THE FREQUENCY CONVERTER SINAMICS G120



Below, important information is provided about starting up and operating the SINAMICS G120. However, we do not claim that this information is comprehensive, and refer to the following technical documentation:

- Getting Started
- Operating Instructions
- Installation Manual
- Function Manual
- List Manual
- Product Information

These documents are available on the Service and Support Internet page:

- <http://support.automation.siemens.com>

There, you can download the current version of these documents, free of charge.

3.1 Description of the Frequency Converter SINAMICS G120

The converter SINAMICS G120 is used for more accurate and efficient closed loop speed control of three phase motors.

The SINAMICS G120 is available in different device versions ((size FSA to FSF) in the performance range of 0.37 KW to 90 KW. It is suitable for a large number of drive solutions

- As a universal drive in industry and trade
- In different branches such as automotive, textile, printing, and chemical
- For general applications, such as conveyor systems



Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	--------------	-----------------------	-----------------------	-----------------



General Features of the SINAMICS G120

Flexibility through modularity for a future proof drive concept:

- Tailored to the customer, selectable and scalable
- Modules can be exchanged live (hot swap)
- Insertable terminals
- Easily exchanged; very maintenance-friendly
- Because of the safety functionalities, less effort when integrating drives into safety oriented machines are plants
- Capable of communicating with PROFIBUS and PROFINET with PROFIdrive Profile 4.0
- Reduction of interfaces
- Plant-wide engineering
- Simple handling
- Increased robustness and longer life because of an innovative cooling concept and painted electronic modules
- Simple device exchange and time-saving copying of parameters by means of the Basic Operator Panel (BOP) or the optional memory card MMC
- Non-volatile storage of the parameter settings –either in the EEPROM of the CU or on an MMC
- Low noise motor operation because of high pulse frequency
- Compact design that saves space
- Software parameters for simple adaptation to 50Hz or 60Hz motors (IEC or NEMA motors)
- 2/3 wire control (static/pulsed signals) for universal control by means of the digital inputs
- Signal wiring by means of binector/connector (BICO) technology possible
- Different data sets can be selected
- Robust, non-sensitive EMC configuration
- LED status display at the control unit
- Built-in brake chopper for dynamic braking
- Fast Current Limitation (FCL), to prevent undesired disconnections during operation
- Engineering and startup with standard engineering tools such as SIZER and STARTER ensure fast configuring and simple startups
- Globally certified according to CE, UL, cUL, c-tick, and Safety Integrated according to IEC 61508 SIL 2
- With PM250 or PM260 capability of energy regeneration and regenerative breaking

Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	--------------	-----------------------	-----------------------	-----------------



- **Special Functions for Startup**
- Resetting of the parameters to the plant setting
- Quick commissioning
- Calculation of motor/control data
- Motor data identification

Restart Functions

- Setpoint channel can be set
- Ramp generator can be set
- Inching mode
- Free function blocks (FFB)
- Fast free function blocks (fast FFBs)
- Positioning deceleration ramp
- Automatic restart (WEA)
- Flying restart allows for starting the converter while the motor is rotating
- Current limiting
- Slip compensation so the speed of a drive does not change depending on the load
- Motor holding brake (MHB)

Control Functions

- V/f control with different curves
- Vector control without encoder (SLVC) for speed and torque
- Vector control with encoder (VC) for speed and torque

Protection Functions

- Motor protection functions
- Converter protection functions
- Plant/system protection functions

Failsafe Functions (only for CU240S DP-F)

- Safely switched off moment of force (STO)
- Safe stop 1 (SS1)
- Safely limited speed (SLS)
- Safe break control (SBC)
- The failsafe functions can be triggered by means of digital outputs (FDI0A ... FDI1B) or PROFIsafe.



Modularity

SINAMICS G120 is a modular converter system that consists of different functional units. The two basic building blocks are the **Control Unit (CU)** and the **Power Module (PM)**.

The **Control Unit** controls and monitors the power module and the connected motor in several control modes that can be selected. It supports communication with a local or central controller as well as with monitoring devices. In addition to controlling, other functions are available that can be adapted to the respective application through corresponding parameter assignment.

The control units are available in the following types:

- Standard CUs (CUs without safety oriented functions)
 - CU240S
 - CU240S DP like the CU240S but with PROFIBUS DP interface (PROFIdrive Profile 4.0)
 - CU240S PN like the CU240S but with PROFINET interface (PROFIdrive Profile 4.0)
- CUs with safety oriented functions
 - CU240S DP-F like the CU240S DP but with integrated safety oriented functions

The **Power Module** provides the motor with a performance range of 0.37 KW to 90 KW. The control unit controls the power module by means of a micro processor. For highly reliable and flexible motoring, the most modern IGBT technology with pulse width modulation is used. Comprehensive protection functions provide a high measure of protection for the power module and the motor.

The power modules are available in the following types:

- Power Module PM240 with DC braking functions, supply voltage 3 AC 400V
The PM240 has an integrated brake chopper, and is designed for drives without power recovery for the network. Possible regenerative energy is converted into heat by means of brake resistors that are connected externally.
 - Power Module PM250 with energy regeneration capability, supply voltage 3 AC 400V
 - Power Module PM260 with energy regeneration capability, supply voltage 3 AC 690V
- Power modules PM250 and PM260 have an innovative circuit concept which makes line commutated power recovery possible. This innovation allows for returning regenerative energy to the network, and thus saves energy.

Control units and power modules can be combined into any configuration. In this training document, the control units CU240S DP and CU240S PN are described, together with the Power Module PM240.

Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	--------------	-----------------------	-----------------------	-----------------



Optional Additional Components

Numerous supplementary components are available for the SINAMICS G120, such as:

- **Basic Operator Panel (BOP)**

With the Basic Operator Panel BOP -that can be inserted in the control unit- drives can be started up, current operations can be monitored, and individual parameters can be set. In addition, the BOP provides a function for copying parameters in a time-saving way.

- **PC Converter – Connecting Set (PC Connection Kit)**

This kit is used for controlling and starting up a converter directly from the PC, provided the corresponding software (STARTER) is installed. The startup tool STARTER on CD ROM is included in the PC Converter Connection Set.

- **Brake Relay**

With the brake relay, you can set up a connection between the power module and an electro-mechanical motor brake. Thus, the motor brake can be controlled directly with the control unit.

- **Safe Brake Relay**

With the safe brake relay, you can establish a connection between the power module and an electrical-mechanical motor brake. Thus, safe brake controls can be implemented directly with the control unit according to EN 954-1 Safety Category 3 and IEC 61508 SIL 2.

- **MicroMemoryCard (MMC)**

On the MMC, you can store the parameter assignment of the converter. If servicing is required, the plant is immediately ready after the converter is replaced and the data is copied back from the memory card. The associated slot is located on top of the control unit.

- **Line-Side Power Components**

- **Network Filters Class A and B**

With an additional network filter, the Power Module PM240 attains a higher radio interference class.

- **Line Reactors**

A line reactor is needed if the system fault level is high, for two reasons: on the one hand, to protect the converter itself from harmonic currents and overloads, on the other hand to limit system perturbation to the permissible values.



- **Intermediate Circuit Components**

- **Brake Resistors**

By means of the braking resistors, excess energy of the intermediate circuit is reduced. The braking resistors are intended for use with the PM240. It has an integrated brake chopper (electronic switch).

- **Power Components on the Output Side**

They allow for longer, shielded motor cable lengths for operation with output reactors or LC filters and sinusoidal filters; in addition, the life of the motor is extended.

- **Output Reactors**

Output reactors reduce the voltage load on the motor winding. At the same time, the capacitive charge reversal currents are reduced which additionally strain the power unit when longer motor cables are used.

- **LC Filters and Sinusoidal Filters**

LC filters and sinusoidal filters limit the voltage rise rate and the capacitive charge reversal currents that usually occur at converter operation. Output reactors are then no longer needed.

Safety Integrated

The converter built-in units SINAMICS G120 offer variants of safety oriented applications. All power modules are already fail-safe units. If a power module is combined with a corresponding failsafe control unit, this drive becomes a Safety Integrated Drive.

The failsafe frequency converter SINAMICS G120 offers four safety functions, certified according to EN 954-1, Kat.3 and IEC 61508 SIL 2:

- Safe Stop 1 (SS1)
- Safely Limited Speed (SLS)
- Safe Brake Control (SBC)
- Safely switched-off torque (STO)

Innovative Cooling Concept and Painted Electronic Modules

The innovative cooling concept of the electronic module and painting the module extend its life or use considerably, and results in the following:

- Dissipation of power loss exclusively by means of the external heat sink
- Electronic modules not in the air duct
- Consistent convection cooling of the control unit
- The air flow of the fan blows exclusively through the heat sink

PROFIdrive Profile 4.0

The user data structure of the cyclical/acyclical communication channel is specified for PROFIBUS and PROFINET in the PROFIdrive Profile, Version 4.0.

The PROFIdrive Profile specifies for the converters how a master/controller can access the converters (slaves/devices) by means of cyclical or acyclical data transmission.

Note:

PROFIdrive for drive technology is standardized and described in the following document: Literature: [P5] PROFIdrive Profile Drive Technology

Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	--------------	-----------------------	-----------------------	-----------------

3.2 Configuring the Drive with the Software SIZER



The drive family SINAMICS and MICROMASTER 4 are conveniently configured with the PC tool SIZER. It provides support when configuring the hardware and firmware components needed for a drive task. SIZER includes the configuration of the entire drive system so that you can handle basic single drives as well as complex multi-axis applications.

SIZER supports all configuring steps in a guided work sequence:

- Selection of system supply
- Motor design as the result of load configuring
- Calculation of the work components
- Assembling the required accessories
- Selection of line-side and motor-side power options

The drive configuration is stored in a project. In the project, the components and functions used are represented in a tree structure, according to their assignment. The project view allows for configuring the drive systems as well as for copying, inserting, modifying drives that are already configured.

The results of a configuration are:

- List of components required
- Technical data
- Characteristic curves
- Information regarding system perturbations
- Location diagram and dimensioned diagrams

These results are displayed in a result tree, and can be used also for documentation purposes. To support the user, technological Online Help is available, providing the following:

- Detailed technical data
- Information about the drive systems and their components
- Decision criteria for selecting components

Minimum Hardware and Software Requirements are:

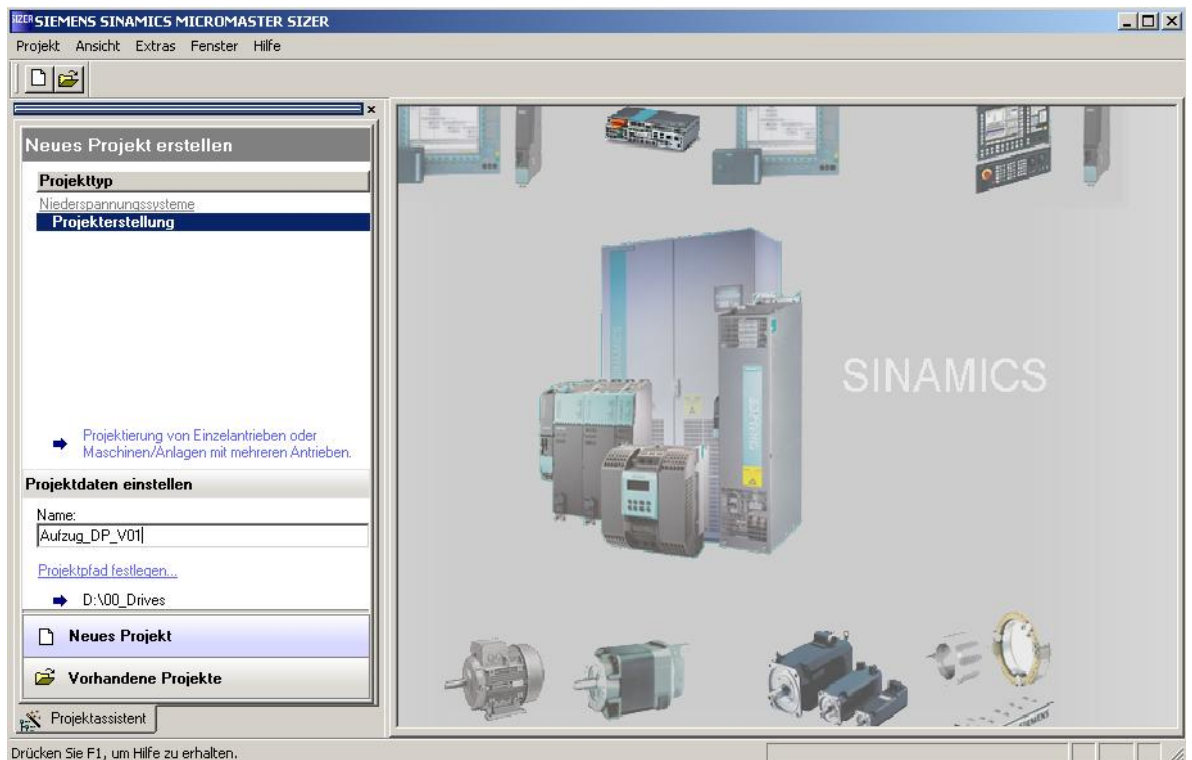
- PG or PC with Pentium™ II 400 MHz (Windows™ 2000)
- Pentium™ III 500 MHz (Windows™ XP)
- 256 Mbyte RAM (recommended 512 Mbyte RAM)
- At least 990 Mbyte free hard disk memory
- In addition, 100 Mbyte free hard disk memory on the Windows system drive
- Monitor resolution 1024×768 pixels
- Windows™ 2000 SP2, XP Professional SP1, XP Home Edition SP1
- Microsoft Internet Explorer 5.5 SP2

The description below explains how a drive is configured by using Sizer. First, we generate a project and select the desired components as follows:

1. From the desktop, call the '**SIZER**' with a double click. (→ Sizer)

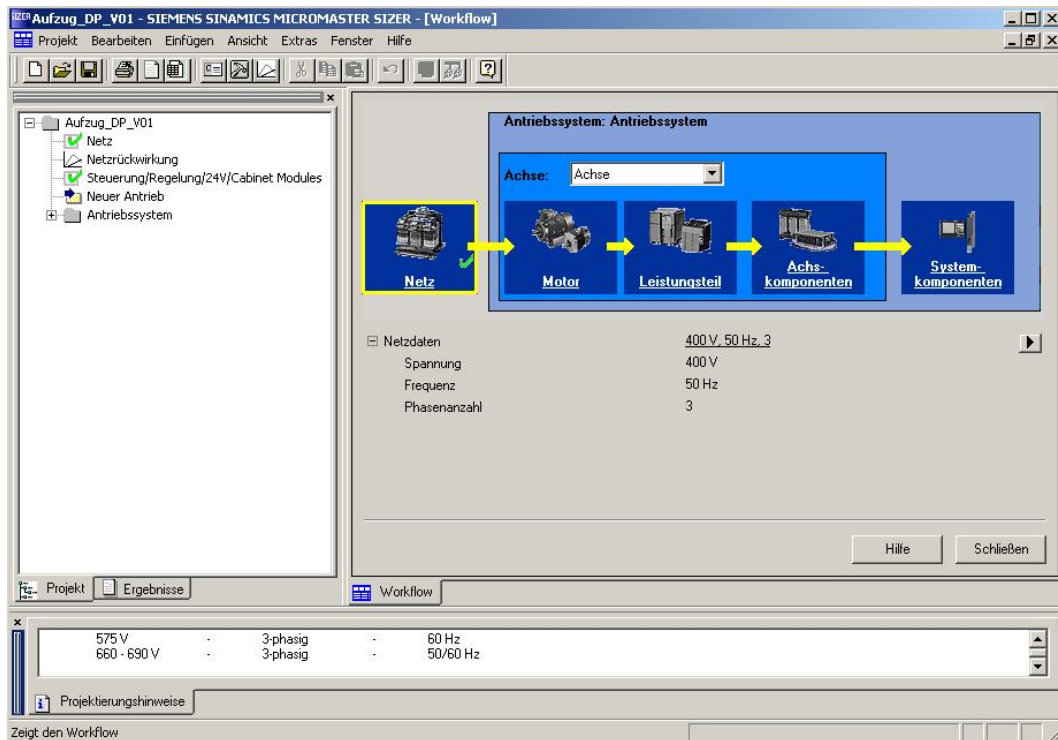




2. By double-clicking on '**Project Generation**', a new project is set up with the name '**Elevator_DP_V01**' in the project path (→ Aufzug_DP_V01 → Project generation)

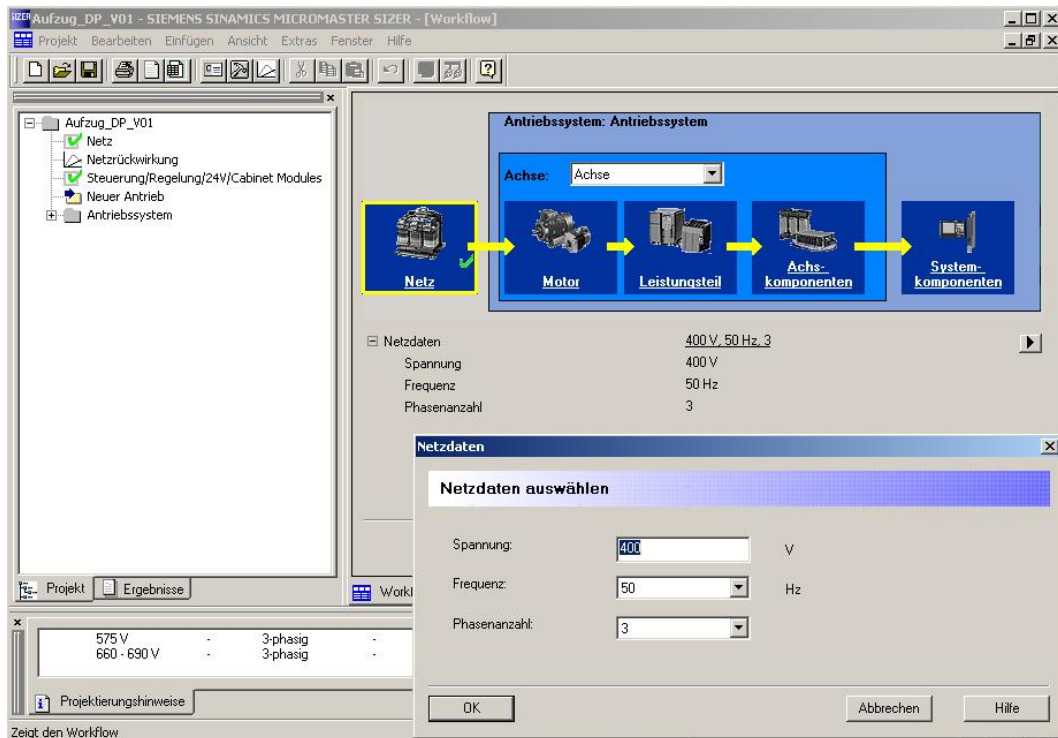




3. In the Sizer on the left, the project tree is located with the structure of the drive project; on the right, 'Workflow' shows you the steps required to set up the drive system.

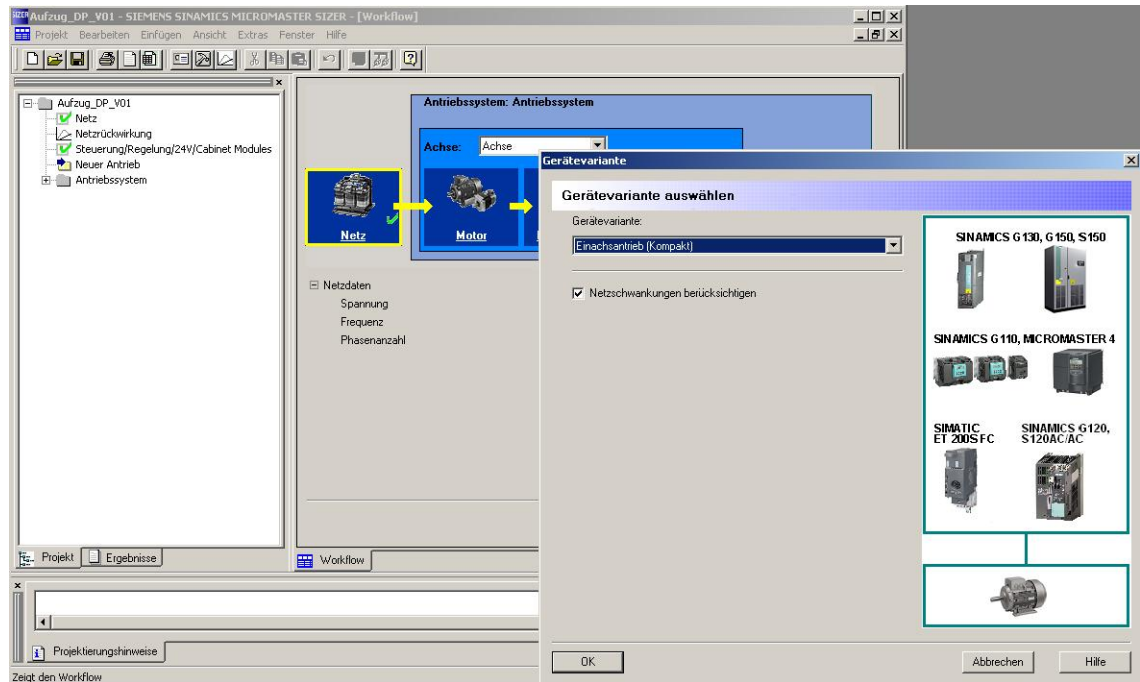


4. Now, first click on 'Network' to view the network data. By clicking on the button , you get to the dialog for setting the voltage, the frequency, and the number of phases. (→ Network →  → Voltage 400V → Frequency 50Hz → Number of phases 3 → OK)

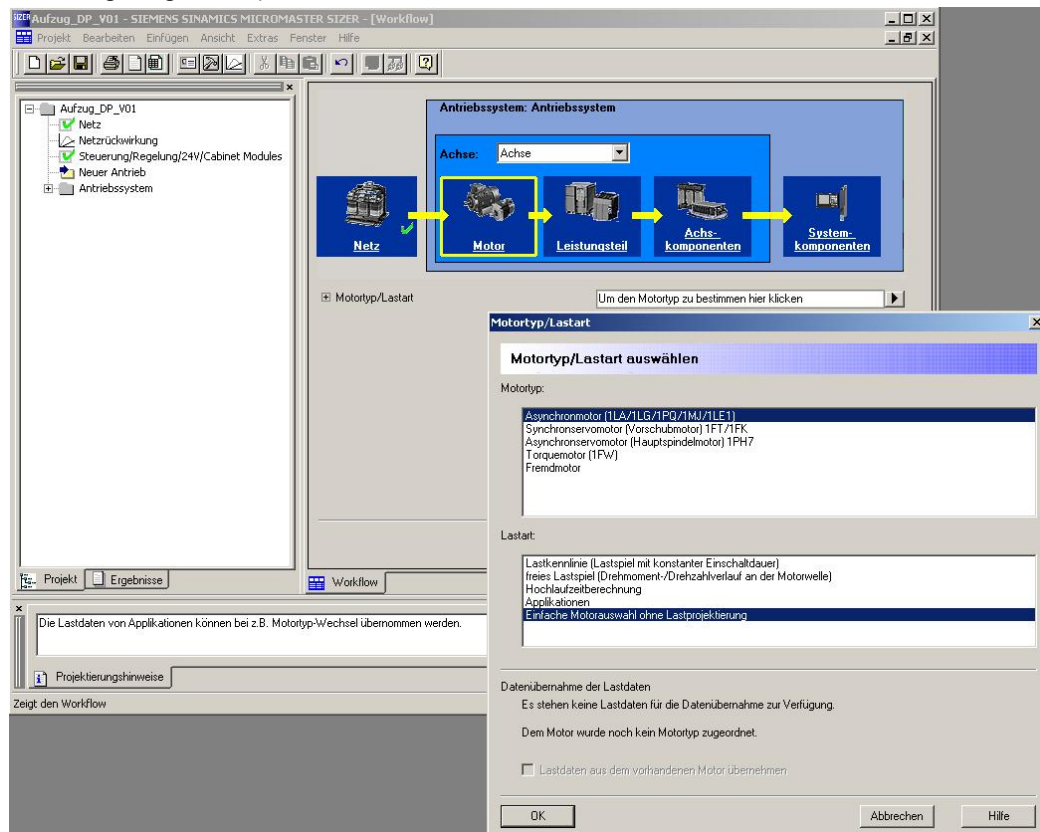




5. When selecting the **'Motor'** -the next step in 'Workflow'-, first a selection of the device variant appears. We are selecting **'Single Axis Drive (Compact)'**. (→ Motor → Single Axis Drive (Compact) →OK)

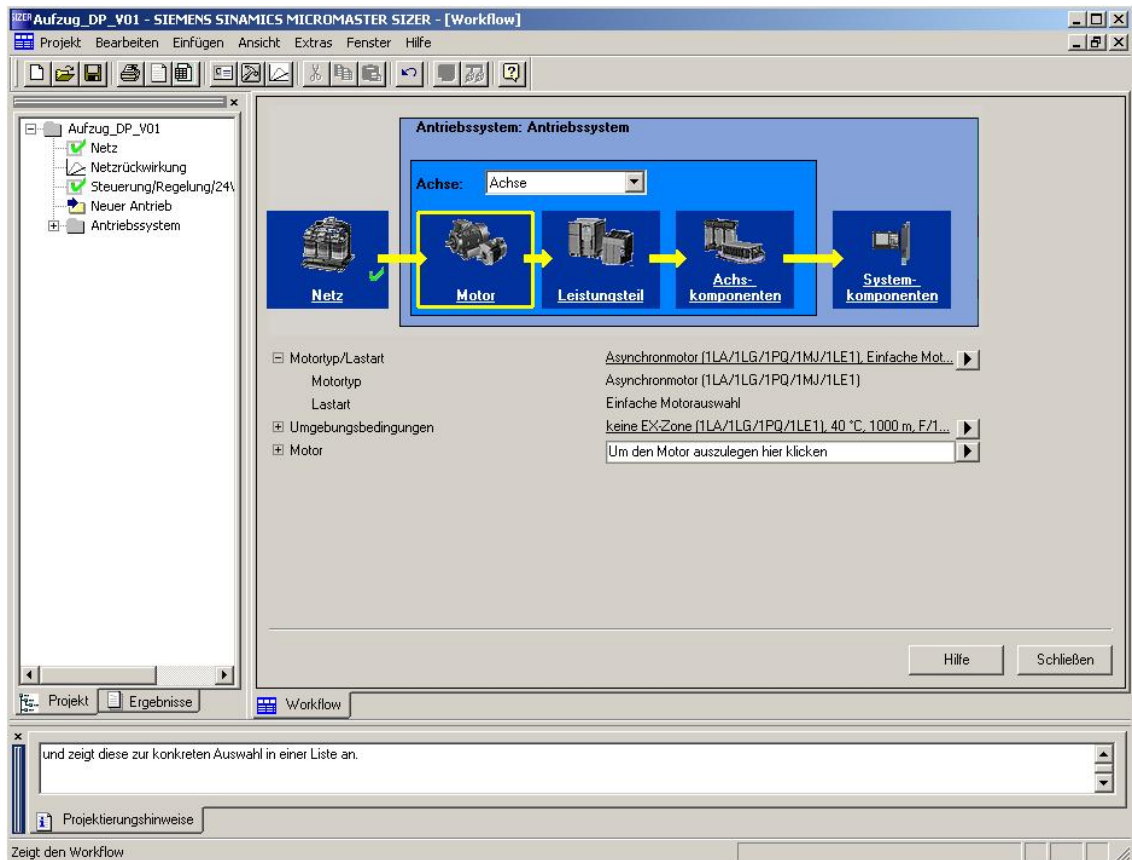


6. As the motor type, we select **'Asynchronous Motor'**, and for load type **'Basic motor selection without load configuring'**. (→ Asynchronous motor → Basic motor selection without load configuring → OK)

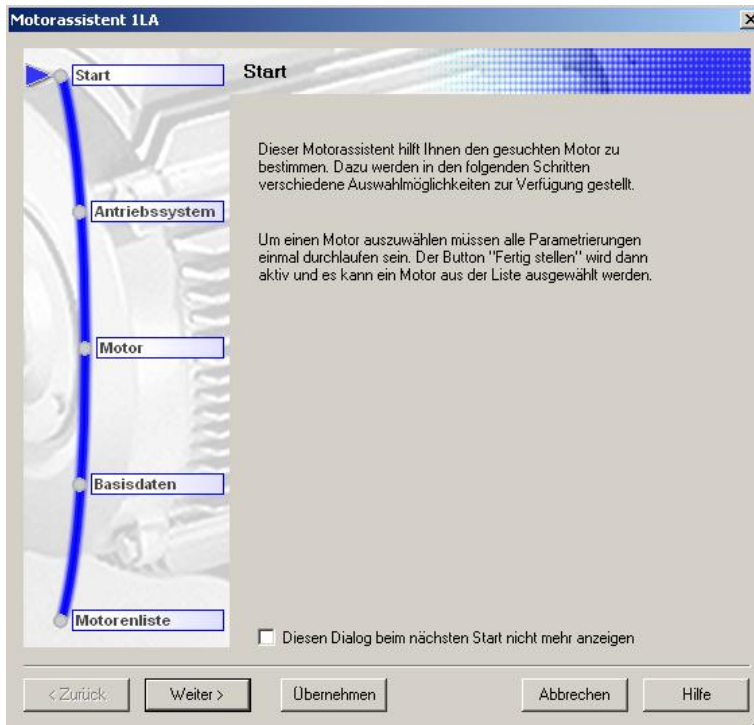




7. After selecting 'Environmental conditions', we now click on '▶' to select the motor. (→ Umgebungsbedingungen → Motor ▶)

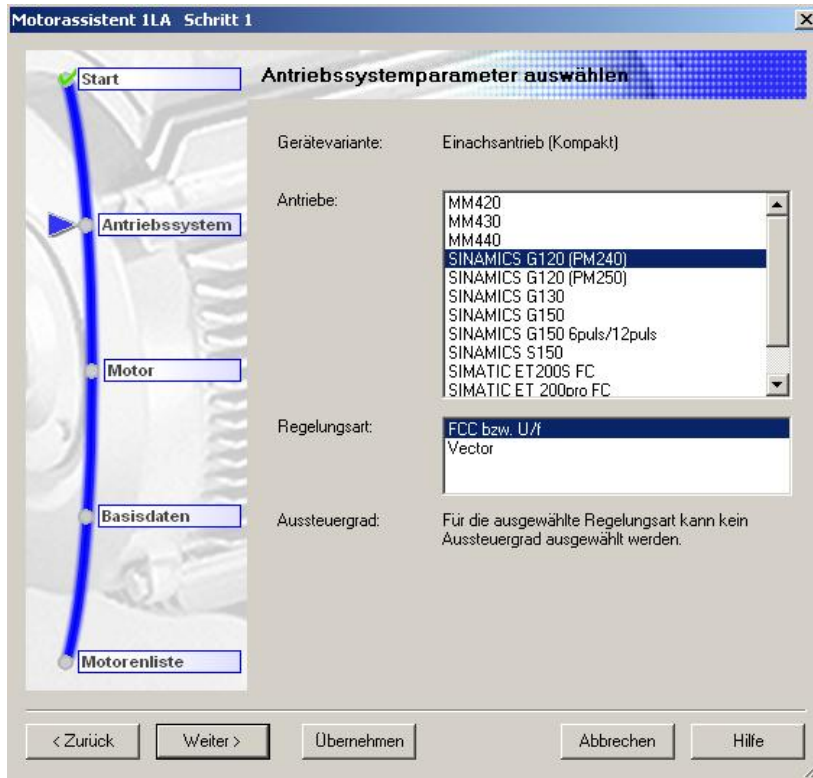


8. Then, we are starting the motor wizard 1LS by clicking on the button 'Continue'. (→ Weiter >)

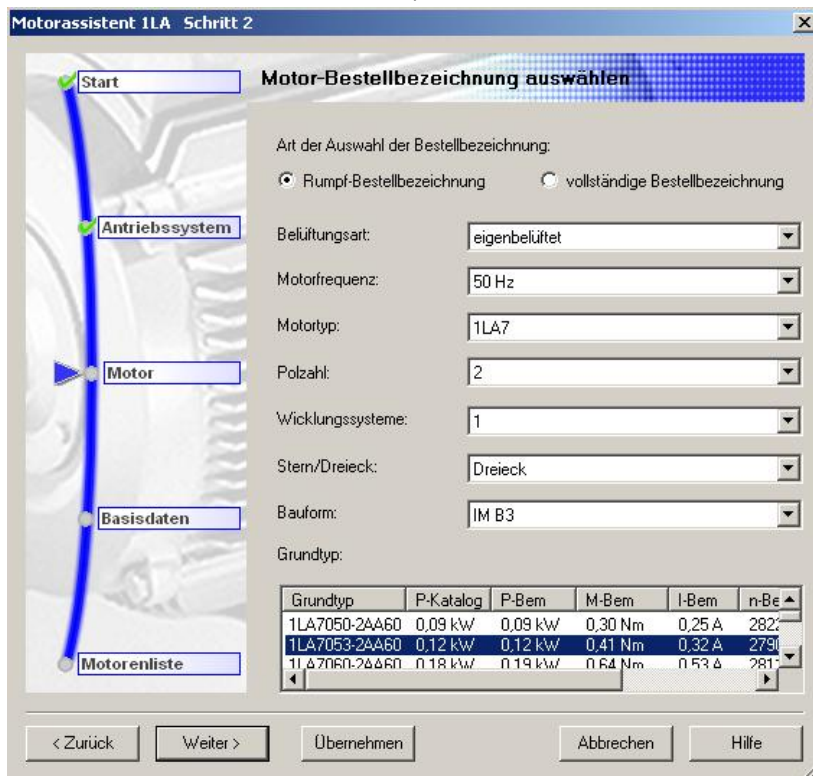




9. First, we select the converter type '**SINAMICS G120 (PM240)**', and as control type FluxCurrentControl '**FCC with V/f**' curve (→ SINAMICS G120 (PM240) → FCC with V/f → Continue >)

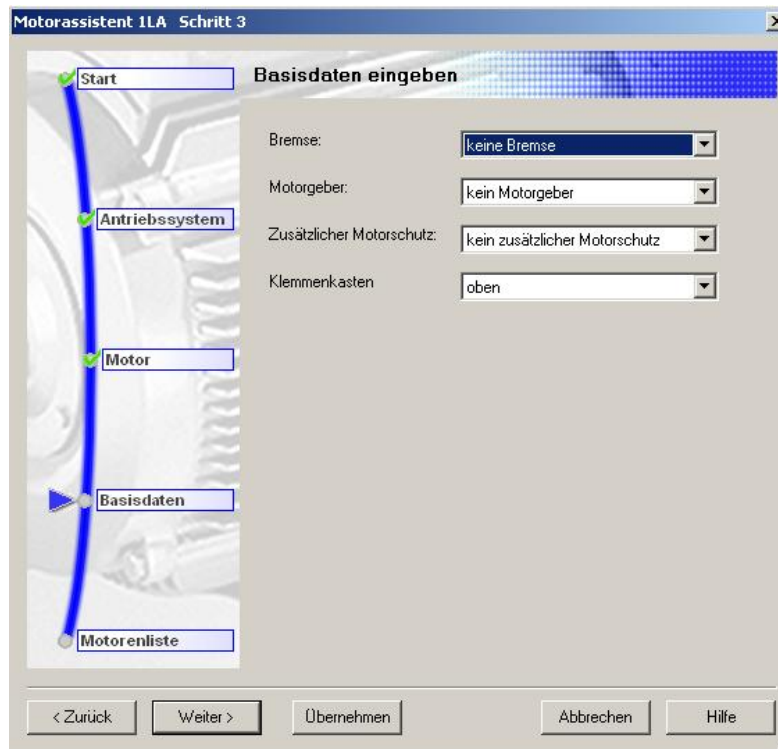


10. Next, selecting additional options takes us to the order number of the power supply. (→ 1LA7053-2AA60 → Continue >)

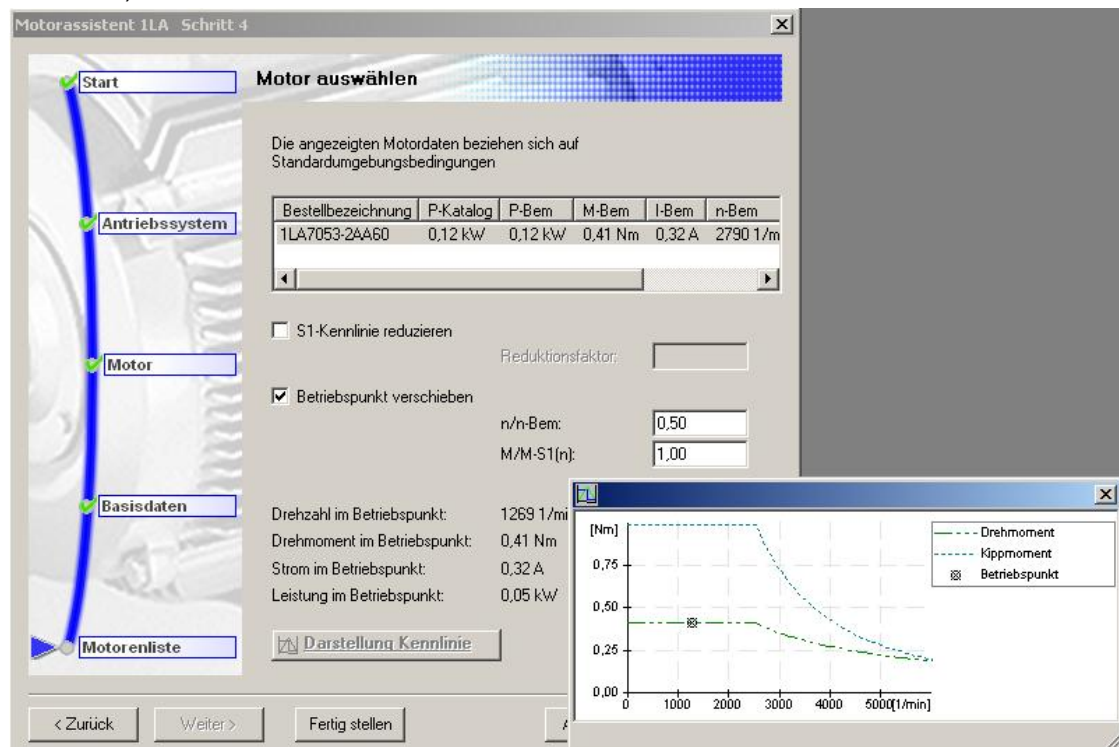




11. Now we specify whether a **'Brake'**, a **'Motor encoder'** or **'additional motor protection'** is desired. Here, the position of the **'Terminal box'** is selected also. (→ Continue >)



12. After we have determined the order name in this way, we can set the operating point (using the characteristic curve) before we **'Complete'** the motor. (→ Betriebspunkt verschieben → Fertig stellen)





13. All data pertaining to the motor is now represented in Workflow.

Projekt Bearbeiten Einfügen Ansicht Extras Fenster Hilfe

Aufzug_DP_V01 - SIEMENS SINAMICS MICROMASTER SIZER - [Workflow]

Projekt Ergebnisse Workflow

Antriebssystem: Antriebssystem

Achse: Achse

Netz → Motor → Leistungsteil → Achs-komponenten → System-komponenten

Lastart: Einfache Motorauswahl
 keine EX-Zone (1LA/1LG/1PQ/1LE1), 40 °C, 1000 m, F/1...
 ATEX-Zone: keine EX-Zone (1LA/1LG/1PQ/1LE1)
 Umgebungstemperatur: 40 °C
 Aufstellhöhe: 1000 m
 Wärmeklasse: F/105K
 Motor: 1LA7053-2AA60
 Motor Daten:
 P-Katalog: 0,12 kW
 P-Bem: 0,12 kW
 M-Bem: 0,41 Nm

Hilfe Schließen

Berechnung berücksichtigt eine eventuelle Ausnutzung nach Wärmeklasse B.
 Achtung: Einsatz von isolierten Lagern für 1LA6; 1LG4,6; 1LA8 und 1PQ8 für Baugröße >= 280 erforderlich -> siehe Hilfe "Allgemein - Motor 1LA".

Projektierungshinweise

Zeigt den Workflow

14. Next, we specify the 'Power unit'. (→ Leistungsteil → )

Projekt Bearbeiten Einfügen Ansicht Extras Fenster Hilfe

Aufzug_DP_V01 - SIEMENS SINAMICS MICROMASTER SIZER - [Workflow]

Projekt Ergebnisse Workflow

Antriebssystem: Antriebssystem

Achse: Achse

Netz → Motor → Leistungsteil → Achs-komponenten → System-komponenten

Antriebssystem: SINAMICS G120 (PM240) - FCC bzw. U/i
 Umgebungsbedingungen: 40 °C, 1000 m
 Umgebungstemperatur: 40 °C
 Aufstellhöhe: 1000 m
 Leistungsteil: Keine Details vorhanden
 Um das Leistungsteil auszulegen hier klicken

Hilfe Schließen

Die Anzeige des nächst kleineren Umrichters dient der Übersicht vorhandener Leistungsabstände.

Projektierungshinweise

Zeigt den Workflow



15. Based on the current setpoints and the selection/deselection for 'failsafe variant', the power unit can now be specified (→ 6SL3224-0BE13-7UA0 → OK)

Leistungsteil

Leistungsteil auswählen

Korrigierter Motorstrom im Betriebspunkt: 0,32 A ✓

Fehlersichere Ausführung

Bestellbezeichnung	Bemessungsstrom	Verfügbare Strom bei Grundlast	Interner Filter	Framesize	Bremsmodul
6SL3224-0BE13-7UA0	1,30 A	1,30 A	-	A	integriert
6SL3224-0BE15-5UA0	1,70 A	1,70 A	-	A	integriert
6SL3224-0BE17-5UA0	2,20 A	2,20 A	-	A	integriert

Nächstkleineres Leistungsteil:

Bestellbezeichnung	Bemessungsstrom	Verfügbare Strom bei Grundlast	Interner Filter	Framesize	Bremsmodul
Es ist kein kleinerer Umrichter dieser Produktgruppe verfügbar.					

OK Abbrechen Hilfe

16. Details about the power unit are now shown in the Workflow.

Aufzug_DP_V01 - SIEMENS SINAMICS MICROMASTER SIZER - [Workflow]

Projekt Bearbeiten Einfügen Ansicht Extras Fenster Hilfe

Projekt Ergebnisse Workflow

Antriebssystem: Antriebssystem

Achse: Achse

Netz → Motor → **Leistungsteil** → Achskomponenten → Systemkomponenten

Antriebssystem: SINAMICS G120 (PM240) - FCC bzw. U/i

Umgebungsbedingungen: 40 °C, 1000 m

Umgebungstemperatur: 40 °C

Aufstellhöhe: 1000 m

Leistungsteil: 6SL3224-0BE13-7UA0

Bemessungsstrom: 1,30 A

Framesize: A

Pulsfrequenz/Weikeinstellung: 4000 Hz

Interner Filter: Nein

Verfügbare Strom bei Grundlast: 1,30 A

Motorstrom im Betriebspunkt: 0,32 A

Hilfe Schließen

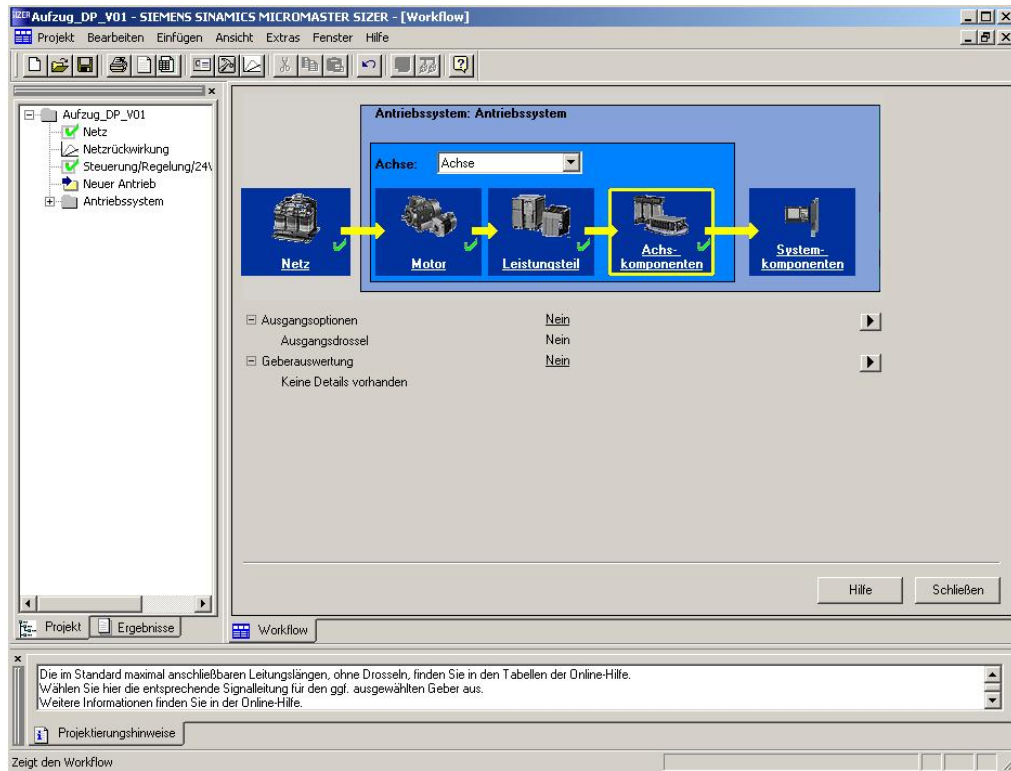
Weitere Informationen erhalten Sie in der Hilfe.


Projektierungshinweise

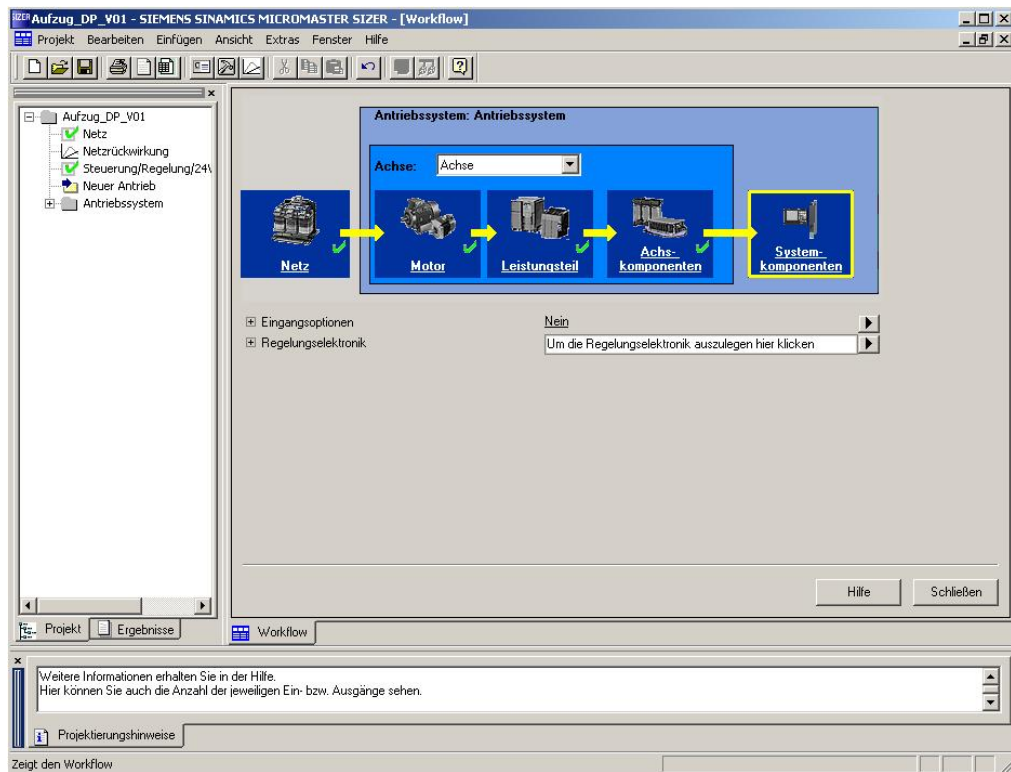
Zeigt den Workflow



17. The 'Axis components' such as 'Output reactor' and 'Encoder evaluation' are deselected here. (→ Axis components → Output options → No → Encoder evaluation → No)

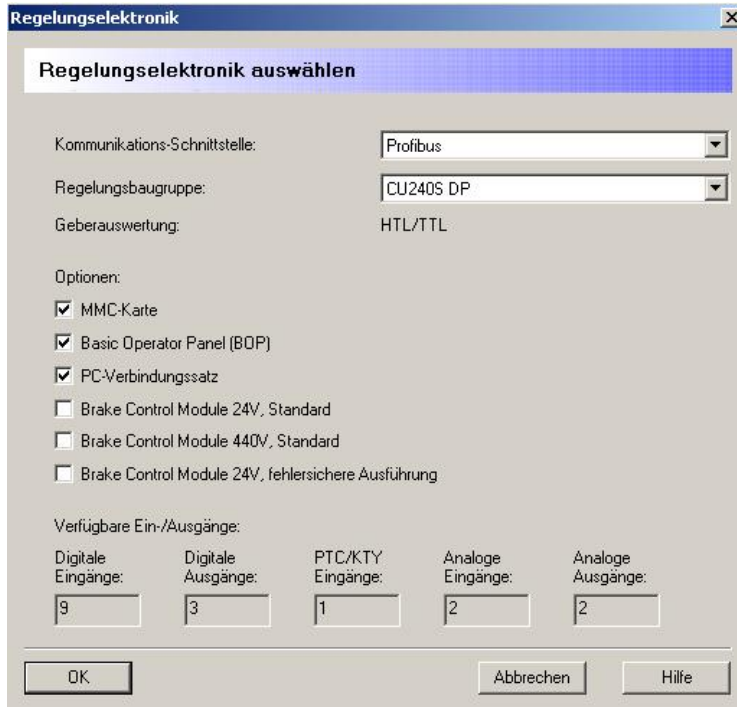


18. At 'System components', the 'Input options' are deselected and the 'Control electronics' are specified (→ System components → Input options → No → Control electronics → )

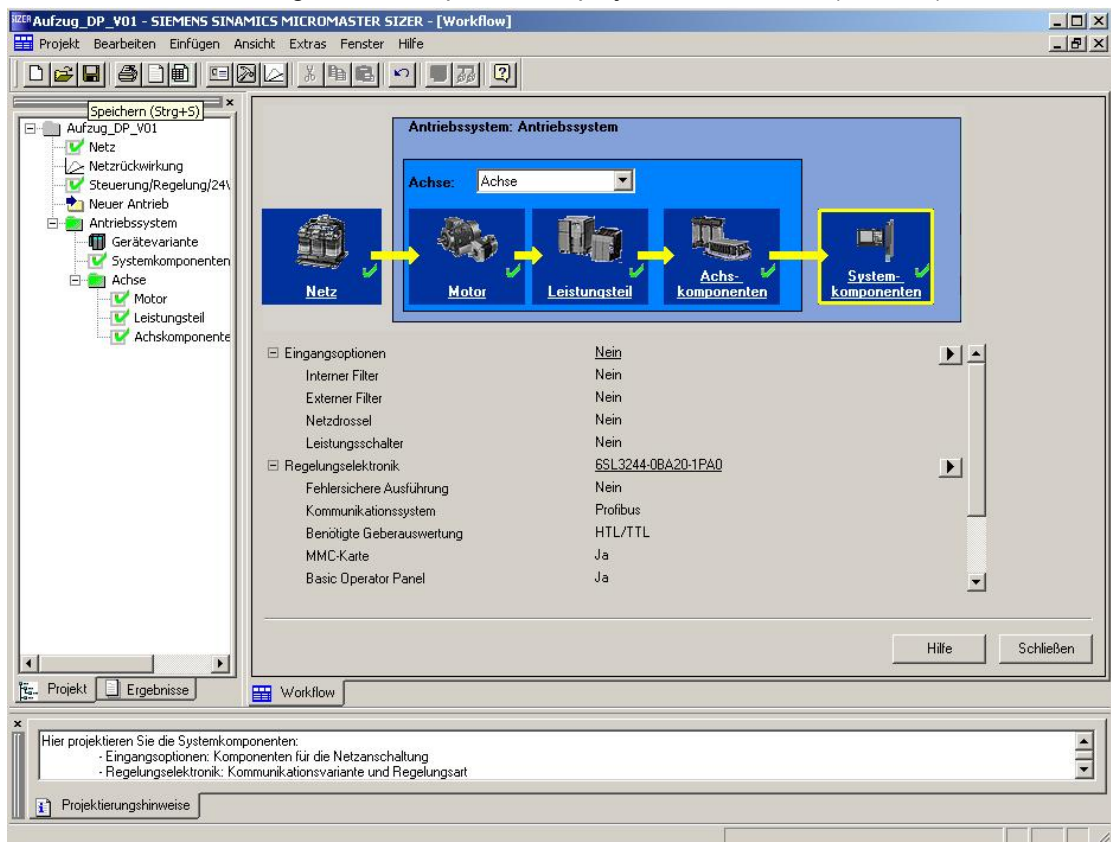




19. Regarding the control electronics, we have to select the Control Unit (CU) and its options such as 'MMC', 'Basic Operator Panel (BOP)' and 'PC connection set'. (→ Profibus → CU240S DP → MMC card → Basic Operator Panel (BOP)→ PC connection set → OK)



20. With the drive configuration completed, the project can be saved (→ Save)





21. In the results, you will see the 'Component list', 'Technical data', 'Characteristics' and 'Dimensional diagrams' for the drive project. (→ Stückliste → Technical data → Characteristics → Dimensional diagrams)

Aufzug_DP_V01 - SIEMENS SINAMICS MICROMASTER SIZER - [Stückliste]

Projekt Bearbeiten Einfügen Ansicht Extras Fenster Hilfe

Stückliste

Pos.	Anzahl	Bestellbezeichnung	Produkt
Antriebssystem			
10	1	6SL3244-0BA20-1PA0	CU; CU240S DP
20	1	6SL3254-0AA00-0AA0	MMC-Karte
30	1	6SL3255-0AA00-4BA1	Basic Operator Panel
40	1	6SL3255-0AA00-2AA1	PC-Verbindungssatz
Antriebssystem / Achse			
50	1	6SL3224-0BE13-7VA0	Leistungsteil; PM240; 1,30 A
60	1	1LA7052-2AA60-2 M33	Asynchronmotor (1LA/1LG/1PQ/1MJ/1LE1); 0,12 kW; 400 V; Dreieck; 056 M; IM B3

Legende

Bitte beachten Sie:

- Der Motorbemessungsstrom darf bei voller Regelungsgüte nicht kleiner sein als:
 - 1/12 * Umrichterbemessungsstrom - U/f bzw. FCC
 - 1/4 * Umrichterbemessungsstrom - Vector
 - 1/4 * Umrichterbemessungsstrom - Servo
- Der Motorbemessungsstrom darf beim SINAMICS S120 bei zyklischem Betrieb mit Einschränkungen bzgl. Drehmomentgenauigkeit und Rundlaufverhältnissen nicht kleiner sein als:
 - 1/8 * Umrichterbemessungsstrom - Vector
 - 1/8 * Umrichterbemessungsstrom - Servo

Die Überlastfähigkeit bei der Auslegung nach Lastkennlinie (z.B. Lastspiel mit konstanter Einschaltdauer) bezieht sich auf eine kurzzeitig erforderliche Überlast am Motor. Bei längeren oder zyklischen Überlasten ist eine Projektierung über das freie Lastspiel/Applikation notwendig.

Bei "einfacher Motorwahl ohne Lastkennlinie" werden abhängig vom gewählten Antrieb und Einschränkung

Hier legen Sie die Einstelldaten für die Netzrückwirkungsrechnung fest.

Projektionshinweise

Drücken Sie F1, um Hilfe zu erhalten.

DXFAnzeiger - [1LA70532AA60-2 M33]

Datei Bearbeiten Ansicht Hilfe

Vorderansicht | Seitenansicht rechts | Wellenende WE | VD - SL - E1 | Maßbild / dimension drawing

Dist: xxxxxxxxxx xxxxxxxxxx Pos: 353.97 836.74

Drücken Sie F1, um Hilfe zu erhalten.

3.3 Safety Precautions and Warnings



Prior to installing and starting up the SINAMICS G120, the following safety related guidelines and warnings have to be noted.

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.

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.

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 Warehousing



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.

During Operation

 **Warning**

The SINAMICS G120 inverters operate at high voltages.

When operating electrical devices, it is impossible to avoid applying hazardous voltages to certain parts of the equipment.

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.

Certain parameter settings may cause the SINAMICS G120 inverter to restart automatically after an input power failure, for example, the automatic restart function.

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.).

Motor parameters must be accurately configured for motor overload protection to operate correctly.

This equipment is capable of providing internal motor overload protection according to UL508C.

Only Control Units with fail-safe functions can be used as an "Emergency Stop Mechanism" (see EN 60204, section 9.2.5.4).



Repairs



Warning

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.

Any defective parts or components must be replaced using parts contained in the relevant spare parts list.

Disconnect the power supply before opening the equipment for access.

Dismantling and Disposal

Caution

The packaging of the inverter is re-usable. Retain the packaging for future use.

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.



Note

For the following operational steps and task definitions, it is assumed that a preassembled converter unit with asynchronous motor is used.

For electrical installation, please note the safety regulations and warnings provided by the manufacturers.

Notes and guidelines regarding the assembly and the electrical installation are provided in the manuals of the SINAMICS G120.

3.4 Connecting the Frequency Converter SINAMICS G120

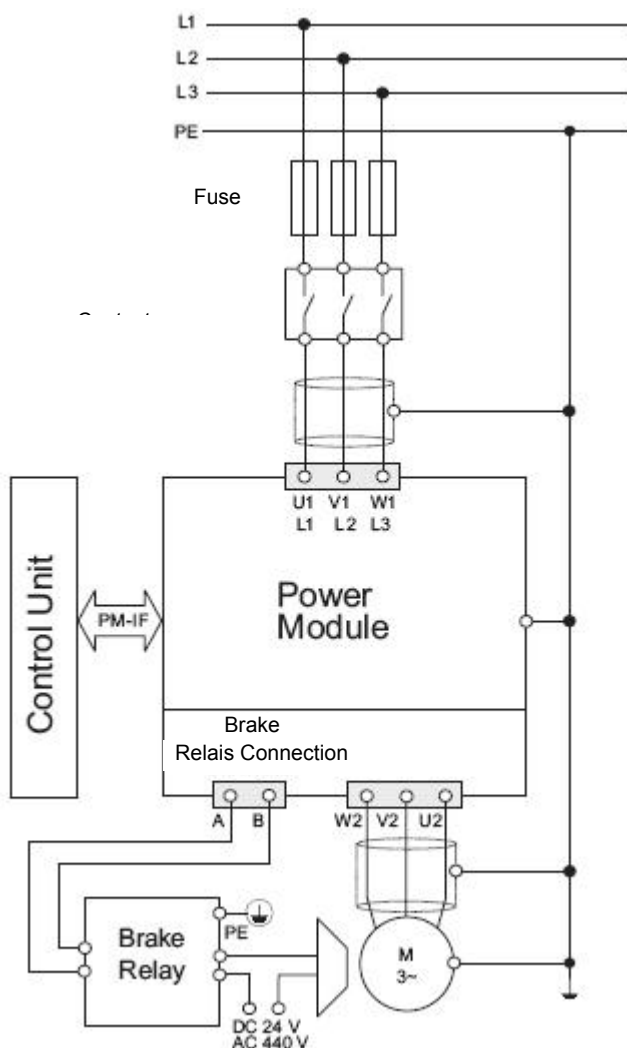
3.4.1 Connecting the Power Module



The power modules are available in the following variants:

- Power Module PM240 with DC braking functions, supply voltage 3 AC 400V
 - Power Module PM250 with inverter operation, supply voltage 3 AC 400V
 - Power Module PM260 with inverter operation, supply voltage 3 AC 690V
- Control units and power modules can be combined in any configuration.

Configuration and connection of the different variants corresponds to the block diagram below.



Note:

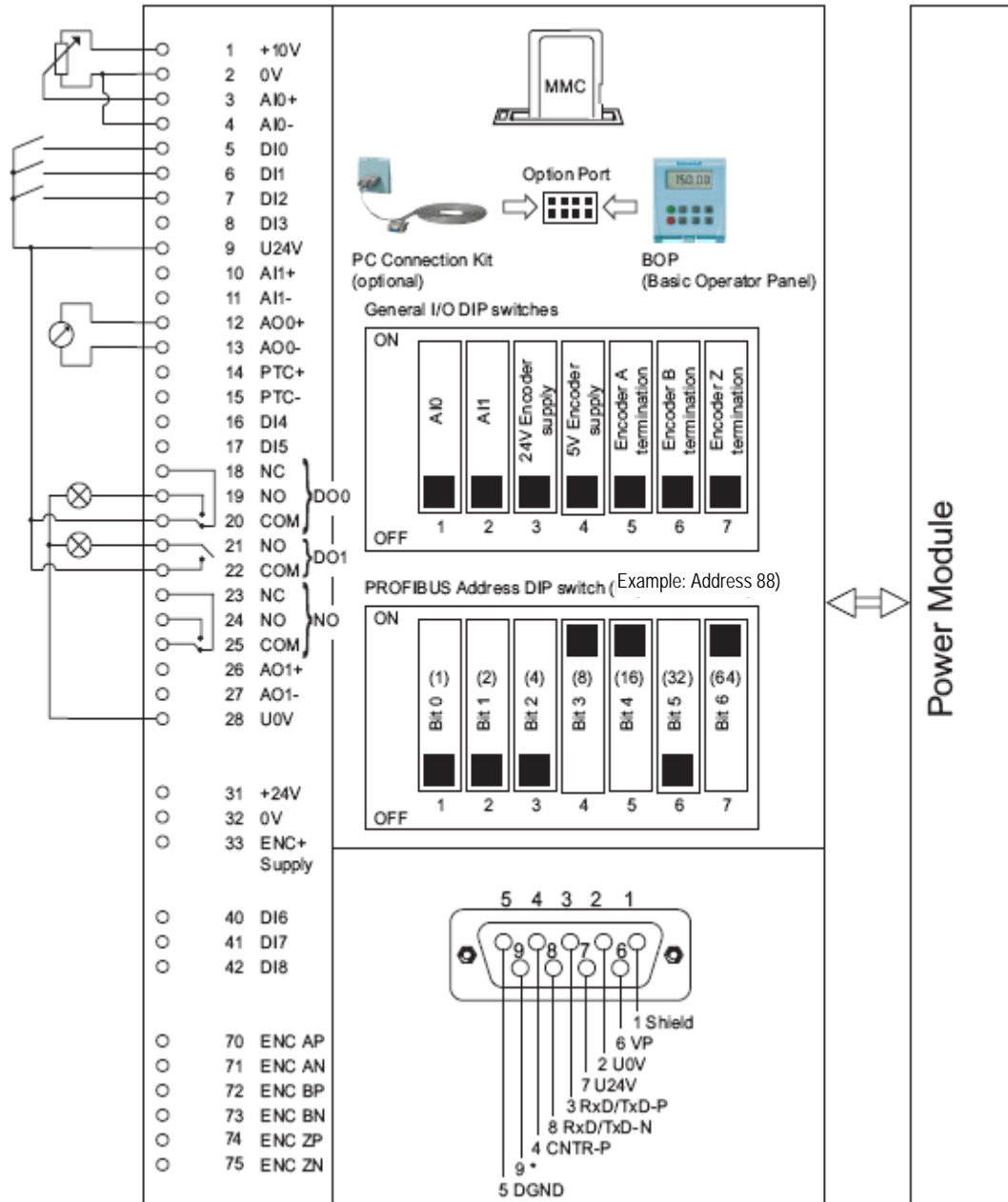
Details for connecting the power module are provided in the installation manual for the power modules.

Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	--------------	-----------------------	-----------------------	-----------------

3.4.2 Block Diagrams for the Control Units CU240S DP and CU240S PN



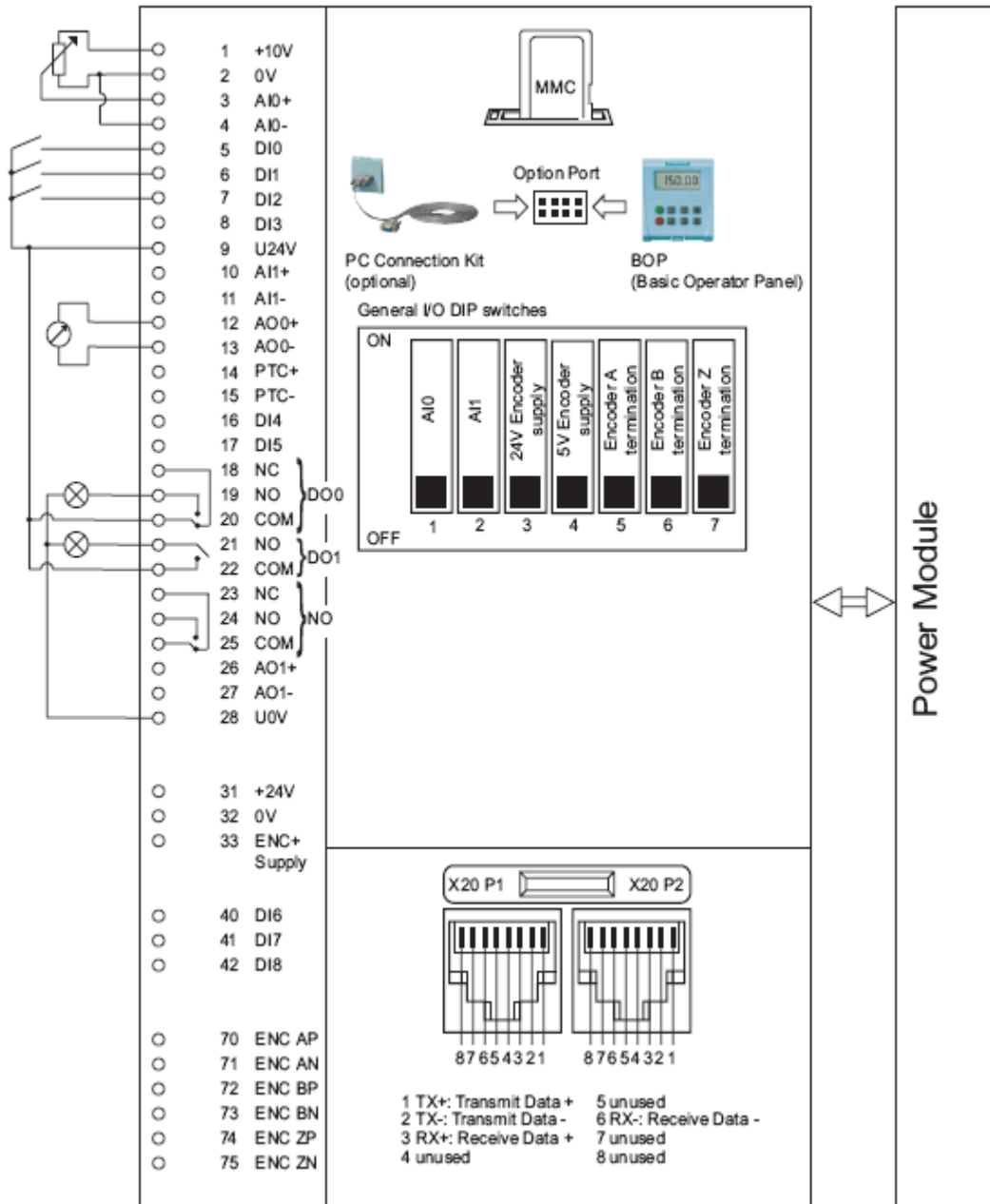
The figure below shows the block diagram for the CU240S DP.



Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	--------------	-----------------------	-----------------------	-----------------



Below, the block diagram for the CU240S PN is shown.





Terminal Number with Name and Function:

- 1 +10V OUT Output without isolation, +10V, max. 10mA
- 2 0V OUT Reference potential of supply voltage (Terminal 1)
- 3 AI0+ Analog input 0, positive
- 4 AI0- Analog input 0, negative
- 5 DI0 Digital input 0, isolated
- 6 DI1 Digital input 1, isolated
- 7 DI2 Digital input 2, isolated
- 8 DI3 Digital input 3, isolated
- 9 U24V OUT Isolated output +24 V – max. 100mA
- 10 AI1+ Analog input 1, positive
- 11 AI1- Analog input 1, negative
- 12 AO0+ Analog output 0, positive (0/4 ... 20mA, 0/2 ... 10 V with 500 Ω load)
- 13 AO0- Analog output 0 negative
- 14 PTC+ Motor thermometer (PTC or KTY84-130)
- 15 PTC- Motor thermometer (PTC or KTY84-130)
- 16 DI4 Digital input 4, isolated
- 17 DI5 Digital input 5, isolated
- 18 DO0, NC Digital output relay 0, break contact, 0.5 A, 30 V DC
- 19 DO0, NO Digital output relay 0, make contact, 0.5 A, 30 V DC
- 20 DO0, COM Digital output relay 0, mid-position contact, 0.5 A, 30 V DC
- 21 DO1, NO Digital output relay 1, a-contact, 0.5 A, 30 V DC
- 22 DO1, COM Digital output relay 1, mid-position contact, 0.5 A, 30 V DC
- 23 DO2, NC Digital output relay 2, break contact, 0.5 A, 30 V DC
- 24 DO2, NO Digital output relay 2, a-contact, 0.5 A, 30 V DC
- 25 DO2, COM Digital output relay 2, mid-position contact, 0.5 A, 30 V DC
- 26 AO1+ Analog output 1, positive (0/4 ... 20 mA, 0/2 ... 10 V with 500 Ω load)
- 27 AO1- Analog output 1 negative
- 28 U0V OUT Reference potential of supply voltage (Terminal 9)
- 31 +24V IN External supply input 24 V
- 32 0V IN Reference potential of supply voltage (Terminal 31)
- 33 ENC+ SUPPLY Supply voltage for the encoder (5 V or 24 V configured by means of DIP switch, max. 300mA)
- 40 DI6 Digital input 7, isolated
- 41 DI7 Digital input 8, isolated
- 42 DI8 Digital input 9, isolated
- 70 ENC AP Encoder channel A, non-inverting input
- 71 ENC AN Encoder channel A, inverting input
- 72 ENC BP Encoder channel B, non-inverting input
- 73 ENC BN Encoder channel B, inverting input
- 74 ENC ZP Encoder channel 0 (zero), non-inverting input
- 75 ENC ZN Encoder channel 0 (zero), inverting input

Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	-------	-----------------------	-----------------------	-----------------

3.4.3 Setting the Frequency Setpoints with DIP Switches



The analog inputs (AI) are configured with the usual IO DIP switches. To use AI0 and AI1 as voltage input, DIP switches 1 and 2 have to be switched off.

Setting the AI DIP Switches

DIP switch	1	2	1	2
ON				
OFF				
AI0 and AI1 as voltage input	-10 V ... + 10 V	-10 V ... + 10 V		
AI0 and AI1 as current input			0 mA ... 20 mA	0 mA ... 20 mA

3.4.4 Settings for the Encoder with DIP Switches

DIP switches 3 to 7 are used for setting the encoder channels A, B and Z



Note:

Details for connecting the encoder are provided in the operating instructions for the Control Unit.

3.4.5 Setting the PROFIBUS Address with DIP Switches

Before using the PROFIBUS DP interface, the address of the converter has to be set.

The PROFIBUS DP address can be set as follows:

- Using the 7 DIP switches at the Control Unit
- Using the parameter "P0918"

The PROFIBUS DP address can be set between 1 and 125 as shown in the table below:

DIP switch	1	2	3	4	5	6	7
Add to address	1	2	4	8	16	32	64
Example 1: Address = 3 = 1 + 2							
Example 2: Address = 88 = 8 + 16 + 64							

The valid address area is shown in the table below:

DIP switch settings	Meaning
0	PROFIBUS DP address is determined by P0918
1 ... 125	Valid PROFIBUS DP address
126, 127	Invalid PROFIBUS DP address



Note:

Details for connecting the PROFIBUS are provided in the operating instructions for the Control Unit.

3.4.6 PROFIBUS Interface



The Control Unit CU240S DP is equipped with a 9-pole Sub-D socket connector for connecting the converter to a PROFIBUS DP network. The socket contact is short circuit proof and insulated.

Contact assignment of the 9-pol Sub D-socket connector

	Pin	Designation	Description	Range
	1	Shield	Ground connection	
	2	U0V	Isolated and user supply reference	
	3	RxD/TxD-P	Receive/send data P (B/B')	RS485
	4	CNTR-P	Control Signal	TTL
	5	DGND	PROFIBUS data reference potential (C/C')	
	6	VP	Supply voltage positive	5 V ± 10 %
	7	U24V	Isolated user supply +24 V @ 100 mA	
	8	RxD/TxD-N	Receive/send data N (A/A')	RS485
	9	-	Not assigned	
Case	Cable shield	Cable shield		



Note:

Details for connecting to PROFIBUS are provided in Appendix IV of the training document, or the operating instructions for the CU240S DP.

3.4.7 PROFINET Interface



The CU240S PN is equipped with two Ethernet connections. This Ethernet switch for two connections is designed in the form of RJ45 plugs.

Contact assignment of the RJ45 plugs

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



Note:

Details for connecting to PROFINET are provided in Appendix IV of the training document, or in the product information "Installation Instructions SIMATIC NET Industrial Ethernet FastConnect RJ45 Plug".

Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	--------------	-----------------------	-----------------------	-----------------

3.5 Starting Up the Frequency Converter SINAMICS G120



Converters of the type G120 consist of the power module and the control unit. After the initial latching of the control unit onto the power module, the devices have to recognize each other. A note that the power module and the control unit are not yet identified is indicated with F0395. After confirming the message, you can begin with the startup.

Usually, the converter G120 is started up doing the following:

- Reset to factory settings
- Basic startup
 - Quick startup
 - Motor data identification
 - Optimizing the speed control
- Additional settings for startup
 - Calculation of the motor/control data
 - Starting up the application
 - Starting up the failsafe functions (only for failsafe applications)

Except for the following settings, the converter is shipped with identical factory settings for all CU240S control units:

- Command source
- Setpoint source
- Values depending on the power module

The converter G120 provides two options for startup:

Individual Startup

For individual startups, the parameters for the converter are set manually. It is started up using the BOP (Basic Operator Panel) or STARTER (startup software via PC).

Standard Startup

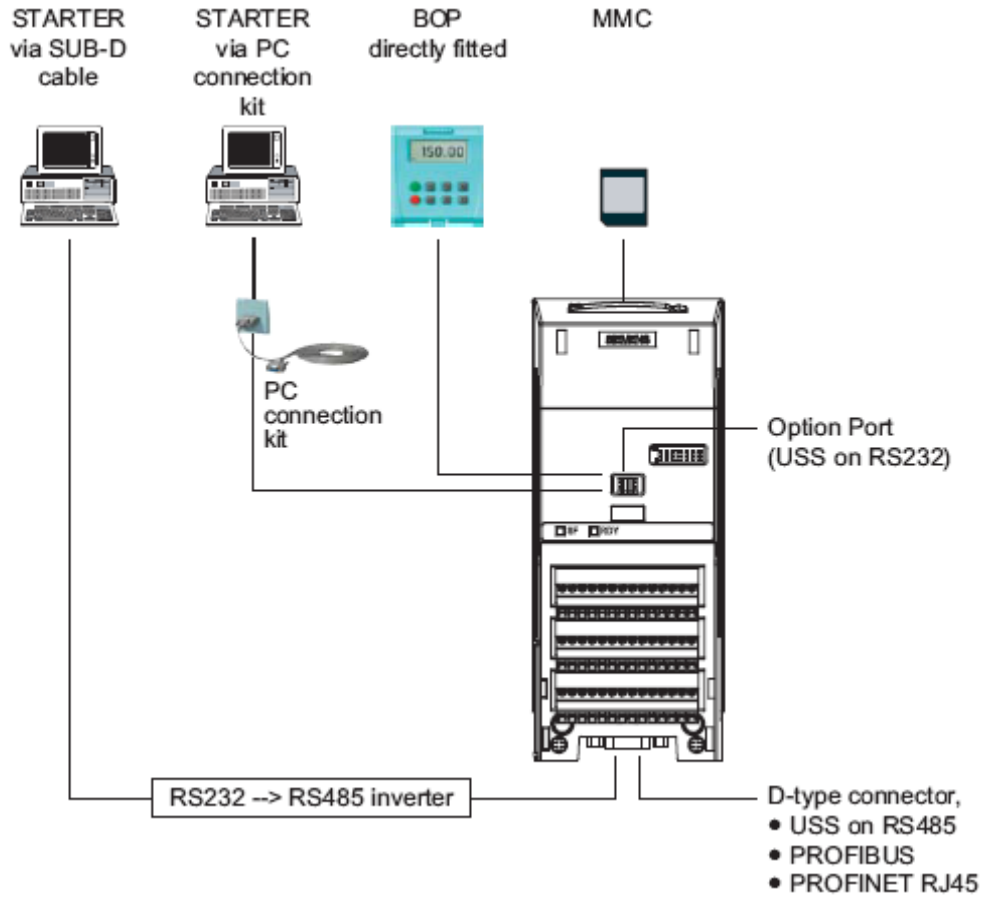
Standard system startup means that the parameter set is transferred from one to several converters. This allows for fast startups for identical applications, such as series machines or group converters. The standard startup of the converter G120 can be performed as follows:

- Standard startup with the BOP
- Standard startup with STARTER
- Standard startup with the MMC

It is recommended to use STARTER. The startup with STARTER is controlled by dialog boxes that contain detailed information about the parameters.



To connect the converter G120 to Starter, the BOP or the MMC, it is equipped with the following communication interfaces:



Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	--------------	-----------------------	-----------------------	-----------------

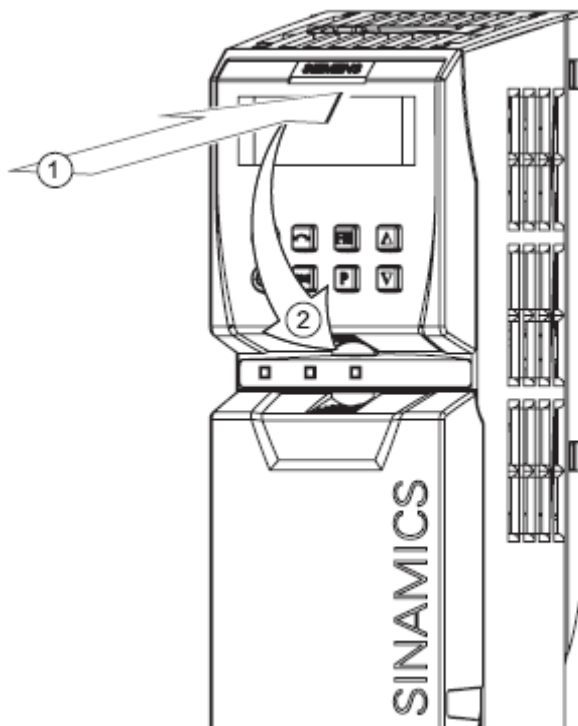
3.5.1 Startup Using the Basic Operator Panel (BOP)



The Basic Operator Panel (BOP) is available as an option and is used as a display and parameter assignment device. Parameters are set by pressing the keys. The BOP includes a 5 digit seven segment display on which parameter numbers and parameter values, alarm indications and fault messages as well as setpoint and actual values are shown. The BOP is able to store parameters, and thus allows for copying parameter sets from one converter to another.



The BOP is attached to the control unit according to the figure below, regardless of the type of control unit.



Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	--------------	-----------------------	-----------------------	-----------------

3.5.1.1 Function Keys of the Basic Operator Panel (BOP)



The following keys are available on the BOP.

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.

Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	-------	-----------------------	-----------------------	-----------------

3.5.1.2 Parameters that are visible/Parameters that can be changed



There are two main types of parameters:

- Parameters that can be changed are marked **P**....
- Parameter, that can only be read are marked **r**....

Not every parameter can always be viewed/modified. This can be influenced with the following parameters:

P0004 Parameter Filter

Filters parameters according to functionality, to specify settings during startup.

The following filter settings can be made:

- 0: All parameters
- 2: Converter
- 3: Motor
- 4: Speed sensor
- 5: Technological application/units
- 7: Commands, Digital I/O
- 8: AI and AO
- 10: Setpoint channel/RFG
- 12: Drive characteristics
- 13: Motor control
- 19: Motor identification
- 20: Communication
- 21: Messages/warnings/monitoring
- 22: Technology controller

P0003 User Access Level

Specifies the level for parameter access. For most simple applications, the factory setting (standard) is sufficient.

The following access levels are implemented in the converters:

- 0: User defined parameter list; for details, refer to P0013
- 1: Standard: permits access to the parameters needed most often
- 2: Expanded: permits expanded access to converter functions/IO functions, for example
- 3: Expert: only for experts
- 4: Service: only for use by authorized Service; password protected

Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	--------------	-----------------------	-----------------------	-----------------



P0010 Startup Parameter Filter

Filters parameters, so that only parameters are selected that are assigned to a certain function group. For example, the parameters needed for quick startups are displayed according to their sequence.

The following settings are available

- 0: Ready
- 1: Quick startup
- 2: Converter
- 29: Download
- 30: Factory setting

- P0010 = 0

To start the converter, P0010 has to be reset to 0.

- P0010 = 1

The converter can be started up very quickly with the setting P0010 = 1. After that, only the most important parameters are visible (for example, P0304, P0305, etc.). The individual parameter values have to be entered successively.

The startup is completed and internal calculation is started by setting P3900 = 1 to 3. Then, the parameters P0010 and P3900 are automatically set to zero.

- P0010 = 2

Only for service purposes

- P0010 = 29

To transfer a parameter file by means of a PC tool (such as STARTER), the PC tool sets the parameter P0010 to 29. As soon as the data is downloaded, the PC tool resets the parameter P0010 to zero.

- P0010 = 30

If the parameters of the converter are reset, P0010 has to be set to 30.

The reset is started by setting P0970 = 1. The converter automatically resets all parameters to their factory setting. This can be of advantage if problems arise while parameters are configured, and the parameters have to be reconfigured. The reset to the factory settings takes approx. 60s.

Modifiable depending on the converter state

In addition, "P"-parameters can be modified only depending on the state of the converter.

For example, the parameter for quick startups P0010 (with the attribute "CT" in the parameter list) can be modified only in the quick startup "C" or in the ready mode "T"; not, however, in the "U" mode.

State	Description
C	Quick startup
U	Operation (drive is running)
T	Drive ready

Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	--------------	-----------------------	-----------------------	-----------------

3.5.1.3 BICO Technology



A state of the art converter has to be able to connect internal and external signals (setpoints or actual values, control as well as status signals).

This wiring has to offer a high degree of flexibility in order to adapt the converter easily to new applications.

These requirements are met with BICO technology and fast parameterization by means of the parameters P0700/P1000 (refer to Quick Startup).

Through BICO technology, the process data is freely configurable by using the converter's "Standard" parameter assignment.

All values that can be configured freely are defined as "connectors"; such as frequency setpoint, frequency actual value, current actual value, etc.

All digital signals that can be configured freely are defined as "Binectors"; for example, the status of a digital input; ON/OFF; indication function if limits are overrange/underrange etc.

A converter includes many input and output variables as well as variables within the control that can be configured.

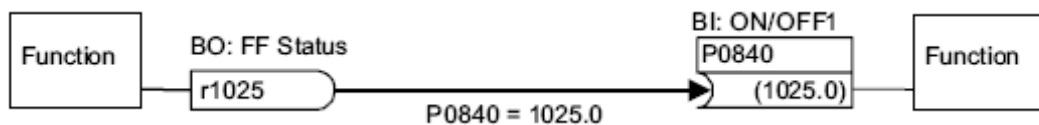
Using BICO technology makes it possible to adapt the converter to different applications.

Binectors

A binector is a digital (binary) signal without any units, it can take the value 0 or 1. Binectors always refer to functions and are sub-divided into binector inputs and binector outputs. The binector input is always designated using a "P" parameter (e.g. P0840 BI: ON/OFF1), while the binector output is always represented using an "r" parameter (e.g. r1025 BO: FF status).

Example

Combine the ON/OFF1 command with selecting a fixed frequency.



When selecting a fixed frequency, the fixed frequency status bit (r1025) is internally set from 0 to 1.

The source for the ON/OFF1 command is parameter P0840 (default DI0). If the fixed frequency status bit is connected as source for P0840 (P0840 = 1025), the inverter starts with activating a fixed frequency and stops with OFF1 with deactivating.

Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	--------------	-----------------------	-----------------------	-----------------



Binector Symbols

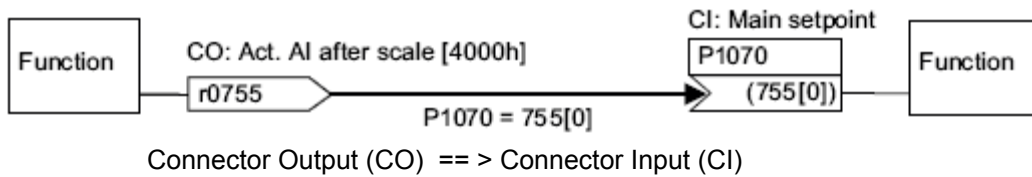
Abbreviation and symbol	Name	Function
BI	Binector input (signal sink)	
BO	Binector output (signal source)	

Connectors

A connector has a value (16 or 32 bit) that can include a normalized quantity (without dimension) as well as a quantity with associated units. Connectors always refer to functions and are sub-divided into connector inputs and connector outputs. Essentially it is the same as for the binectors; the connector inputs are characterized by a "P" parameter (e.g. P0771 CI: AO (analog output)) while the connector outputs are always represented using an "r" parameter (e.g. r0021 CO: Act. frequency).

Example

Associate parameter r0755 (Displays analog input) with an internal value (main frequency setpoint). Thus interconnect the CO Parameter r0755 (scaled analog input) with CI parameter P1070 (main setpoint).



Connector Symbols

Abbreviation and symbol	Name	Function
CI	Connector input (signal sink)	
CO	Connector output (signal source)	



Note:

For additional details, please refer to the function manual.

Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	--------------	-----------------------	-----------------------	-----------------

3.5.1.4 Changing Parameters with the Basic Operator Panel (BOP)



The description below is an example of changing any parameter using the BOP.

The SINAMICS G120 has parameters with and without index.

By using the index, a parameter (for example, P0013[20]) with several follower parameters is defined (in our case, 20). Each individual index is defined by means of a numerical value.

How to change the values of parameter P0003 (parameter access level).

Step		Result on display
1	Press P to access parameters	r0000
2	Press ▲ until P0003 is displayed	P0003
3	Press P to display the parameter value	1
4	Press ▲ or ▼ to set the required value (set to 3)	3
5	Press P to confirm and store the value	P0003
6	All level 1 to level 3 parameters are now visible to the user.	

How to change the value of an index parameter; for example: P0700[1] (setting the BOP control).

Step		Result on display
1	Press P to access parameters	r0000
2	Press ▲ until P0719 is displayed	P0700
3	Press to access the parameter value	0
4	Press ▲ or ▼ to select index 1	r0001
5	Press P to display actual set value	0
6	Press ▲ or ▼ to the required value	1
7	Press P to confirm and store the value	P0700
8	Press ▼ until r0000 is displayed	r0000
9	Press P to return the display to the standard drive display (as defined by the customer)	

Do exactly the same for the other parameters that you want to set using the BOP.



Note:

Sometimes, the BOP displays "bUSY" when parameter values are changed. This means the converter is processing a higher priority task.

Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	--------------	-----------------------	-----------------------	-----------------



Note:

A complete parameter list with a detailed description of all parameters, as well as overview diagrams of the internal program structure (function charts) are provided in the List Manual.



The parameter description looks like this in the List Manual (principle):

Read Mode Parameters

	BICO (if exist) ↓		
r0063	CO: Frequency actual value/Frequency actual val.		
CU240S	Access level: 3		Data Type: Floating Point
CU240S DP	Unit: [Hz]	P-Group: Control	Data Set: -
↑			
CU/PM Variants			

Write Mode Parameters

Index ↓	BICO (if exist) ↓		
p0700[0...2]	Selection of command source/Sel.Comm.Source		
	Access level: 1	P-Group:	Data Type: Unsigned 16
CU240E	Quick startup: YES	Commands	Data Set: CDS
CU240S	Can be changed: C, T	Active: NO	
↑			
CU/PM Variants	Min	Max	Factory setting
	0	6	2

Here, the following is described:

- Parameter number (possibly with index)
- Parameter text
- Access level (depends on P0003)
- Parameter(P) group (depends on P0004)
- Data type (Unsigned8, Unsigned16, Unsigned32, Integer 16, or floating point)
- Quick commissioning Yes/No
- Active Yes (modifying the parameter values is immediately effective after input), or No (the button "P" on the Operator Panel (OP) has to be pressed for the changes to become effective)
- Data set: parameters that are associated with data sets are here assigned correspondingly with CDS (command data set) or DDS (drive data set).
- Can be changed in the converter mode Startup C, Mode U, or Ready T
- Unit if there is a physical measuring unit for this parameter
- Min indicates the lowest value to which the parameter can be set
- Max indicates the highest value to which a parameter can be set
- Factory setting indicates the default value for the factory setting



Note:

Further details are provided in the List Manual.

Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	--------------	-----------------------	-----------------------	-----------------

3.5.1.5 Starting Performance of the SINAMICS G120



After the initial latching of the control unit onto the power module, the devices recognize each other. As an indication that the power module and the control unit were initially not identified, the message F0395 is displayed.

After confirming the message, you can begin with the startup.

For control units (CUs) without a failsafe function, F00395 is confirmed in one of the following ways:

- By a reset to the factory setting
- Using the function key FN on the BOP
- Digital input or PLC signal "Acknowledge" (depends on the setting of P0700)
- Setting P7844 = 0

A standard power-up is a start after switching the unit on/off, or if power fails. It can be performed with or without the MMC.

Standard start without MMC

After a load cycle or a power failure, the converter copies the parameters from the EEPROM to the RAM.

Standard start with MMC

The CPU automatically recognizes the MMC.

The power-up is controlled via P8458 as follows:

P8458 = 0: No automatic download of the parameters by the MMC.

P8458 = 1: One-time automatic download of parameters from the MMC (at the next power-up of the CPU (factory setting)). After the download, P8458 is set to 0 to prevent additional automatic parameter downloads.

P8458 = 2: Parameters are loaded automatically from the MMC (if present) after each power-up of the control unit.

The MMC can be removed after the download is completed. If no MMC is inserted, the converter powers up -without alarm indication or error message- with the parameters stored in the EEPROM, even if P8458 is set to 1 or 2.

3.5.1.6 Reset to Factory Setting



The original values of all converter parameters can be restored with a reset to the factory setting by means of P0970.

These values are indicated in the List Manual with "Factory Setting".



Note

When resetting the parameters to the factory setting, the data transmission memory is reinitialized. That means that data transmission is interrupted while the reset takes place.



Parameter or action	Description
P0003 = 1	User access level* 1: Standard: Allows access into most frequently used parameters.
P0004 = 0	Parameter filter 0: All parameters
P0010 = 30	Commissioning parameter* 30: Factory setting, parameter transfer
P0970 = 1	Factory reset* 1: Parameter reset to the default values
BUSY (on BOP) Progress bar (STARTER)	When the factory reset has been finished, P0970 and P0010 are set to 0 and the BOP changes back to the standard display.



Note

The following parameters remain unchanged when a reset to factory values is performed:

- P0014 memory mode
- P0100 Europe/North America
- P0201 Power stack code number
- Communication parameters (USS and PROFIBUS and PROFINET settings)
- Data depending on the power module

Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	--------------	-----------------------	-----------------------	-----------------

3.5.1.7 Quick Commissioning for V/f Control, for example



For applications that are processing with V/f control (P1300 = 0 [standard assignment]) or flow current control (FCC) (P1300 = 1 or 6), quick commissioning can be performed by setting the following parameters:



Parameter	Description
P0003 = 3	User access level* 1: Standard: Allows access into most frequently used parameters (default) 2: Extended: Allows extended access e.g. to inverter I/O functions 3: Expert: For expert use only
P0004 = 0	Parameter filter* 0: All parameters (default) 2: Inverter 3: Motor 4: Speed sensor
P0010 = 1	Commissioning parameter filter* 0: Ready (default) 1: Quick commissioning 30: Factory setting Note: P0010 should be set to 1 in order to parameterize the data of the motor rating plate.
P0100 = 0	Europe/North America (enter the motor frequency) 0: Europe [kW], frequency default, 50 Hz (default) 1: North America [hp], frequency default, 60 Hz 2: North America [kW], frequency default, 60 Hz
P0304 = ...	Rated motor voltage (enter value from the motor rating plate in volts) The input of rating plate data must correspond with the wiring of the motor (star/delta). This means, if delta wiring is used for the motor, delta rating plate data has to be entered.
P0305 = ...	Rated motor current enter value from the motor rating plate in ampere
P0307 = ...	Rated motor power enter value from the motor rating plate in kW or hp Note: if P0100 = 0 or 2, data is in kW and if P0100 = 1, data is in hp.
P0310 = ...	Rated motor frequency enter value from the motor rating plate in Hz Pole pair number recalculated automatically if parameter is changed.
P0311 = ...	Rated motor speed enter value from the motor rating plate in RPM) Setting P0311 = 0 causes internal calculation of value. Note: Required for vector control and V/f control with speed controller. Slip compensation in V/f control requires rated motor speed for correct operation.

Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	--------------	-----------------------	-----------------------	-----------------



Parameter	Description
P0700 = 2	Selection of command source* 0: Factory default setting 1: BOP (keypad) 2: Terminal (Default for CU240S) 4: USS on RS232 5: USS on RS485 6: Fieldbus (Default for CU240S DP and CU240S DP-F)
P1000 = 2	Selection of frequency setpoint* 0: No main setpoint 1: MOP setpoint 2: Analog setpoint (Default for CU240S) 3: Fixed frequency 4: USS on RS232 5: USS on RS485 6: Fieldbus (Default for CU240S DP and CU240S DP-F) 7: Analog setpoint 2
P1080 = ...	Minimum frequency Enter the lowest motor frequency (in Hz) to which the motor operates independently of the frequency setpoint. The value set here is valid for both clockwise and anticlockwise rotation.
P1082 = ...	Maximum frequency Enter the maximum frequency (in Hz) to which the motor is limited independently of the frequency setpoint. The value set here is valid for both clockwise and anticlockwise rotation.
P1120 = ...	Ramp-up time Enter the time (in seconds) in which the motor should accelerate from standstill up to maximum motor frequency P1082. If the ramp-up time is set too short, this can cause alarm A0501 (current limit value) or tripping the inverter with fault F0001 (overcurrent).
P1121 = ...	Ramp-down time Enter the time (in seconds) in which the motor should decelerate (using braking) from the maximum frequency P1082 down to standstill. If the ramp-down time is set too short, this can cause alarm A0501 (current limit value) or A0502 (overvoltage limit value) or tripping the inverter with fault F0001 (overcurrent) or F0002 (overvoltage).
P1300 = 0	Control mode* 0: V/f with linear characteristic (default) 1: V/f with FCC 2: V/f with parabolic characteristic 3: V/f with programmable characteristic 20: Sensorless vector control 21: Vector control with sensor 22: Sensorless vector torque-control

P3900 = ...	End quick commissioning (QC)* 0: No quick commissioning (no motor calculations, default) 1: Motor calculation and reset of all parameters that haven't been changed while QC process to factory setting. 2: Motor calculation and reset of all I/O settings to factory settings. 3: Only motor calculation - other parameters are not reset. Note: If P3900 = 1, 2, or 3 P0340 is set to 1 and the value from P1082 is written into P2000. The appropriate motor data will be calculated. While end of quick commissioning is performed "bUSY" will be displayed on the BOP. This means that the control data are being calculated and the respective parameter values are stored in the EEPROM. After quick commissioning has been completed, P3900 and P0010 will be set to 0. The actual frequency is displayed.
-------------	--

Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	--------------	-----------------------	-----------------------	-----------------

3.5.2 Startup with the Software STARTER using the Connection Kit



Below, the startup of the frequency converter SINAMICS G120 with the software STARTER is described. The PC on which the software STARTER is running has to be connected to the SINAMICS G120 by means of the Connection Kit and a serial interface.

After the parameter assignment was successful, the converter can be controlled with the Basic Operator Panel (BOP).



The buttons are assigned as follows:



Start motor



Stop motor



Reversal



Take motor to the inching mode



Increase speed

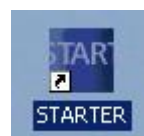


Decrease speed

To assign the parameters for the SINAMICS G120, perform the following steps:

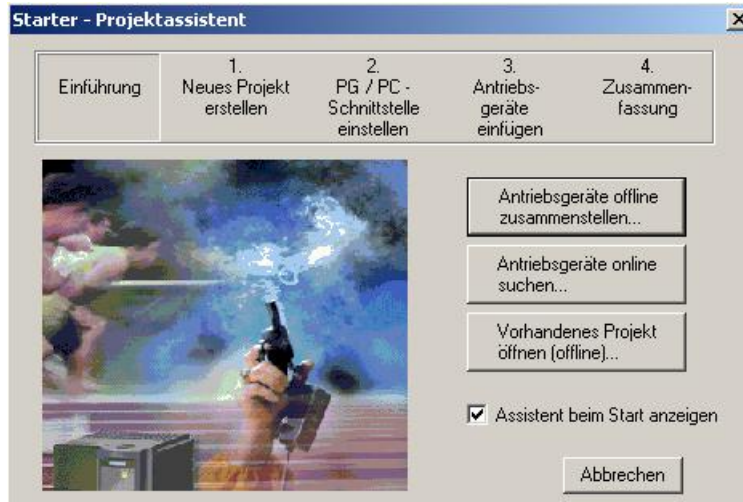


1. The parameter assignment tool for the SINAMICS G120 is the '**STARTER**' that is called here with a double click. (→ STARTER)





2. Along with the STARTER, the project wizard is started. We are going to use the wizard to set up a project, set up the connection between the PC and the converter, and to insert a drive unit. In the first selection, we click on '**Search for drive unit online...**' (→ Antriebsgerät online suchen...)

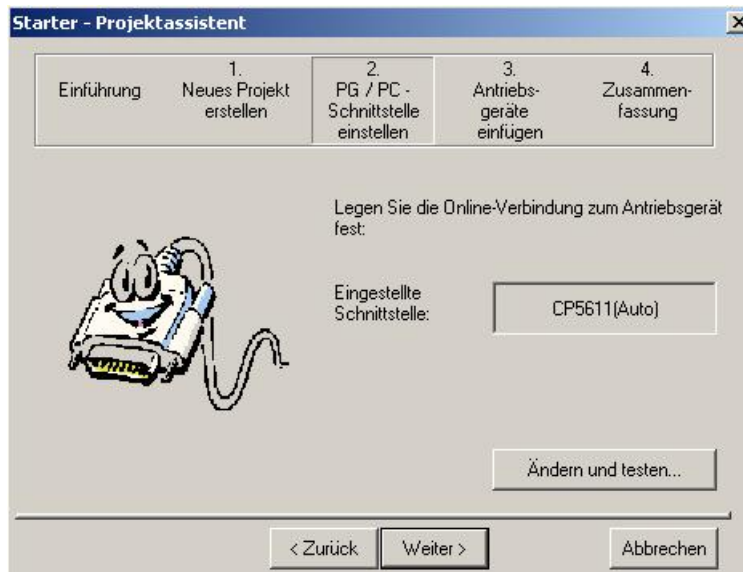


3. Next, the project name is assigned and the memory location is specified. (→ Projektname → Speicherort → Continue >)

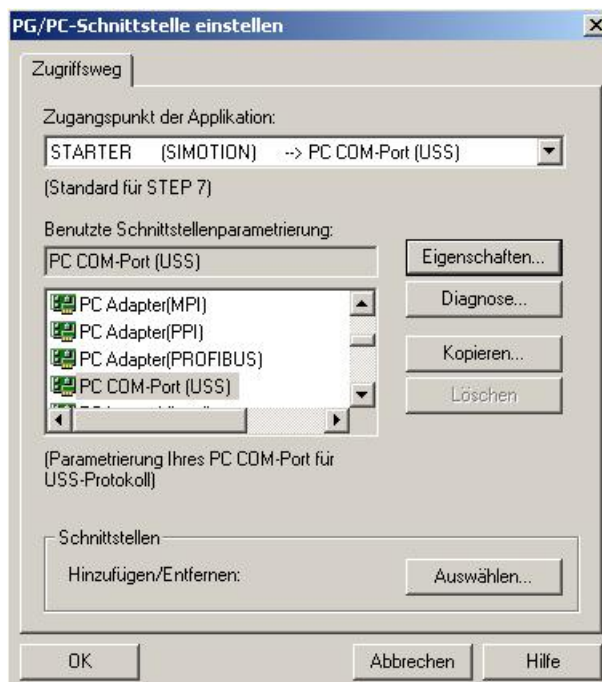




4. Now, we are changing and testing the PG/PC interface. (→ Ändern and testen...)

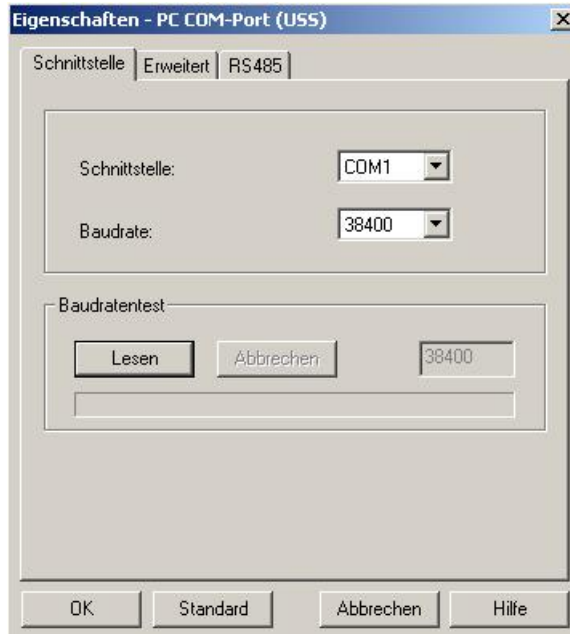


5. Select the interface 'PC COM Port (USS)' and its 'Properties'. (→ PC COM Port (USS) → Eigenschaften)

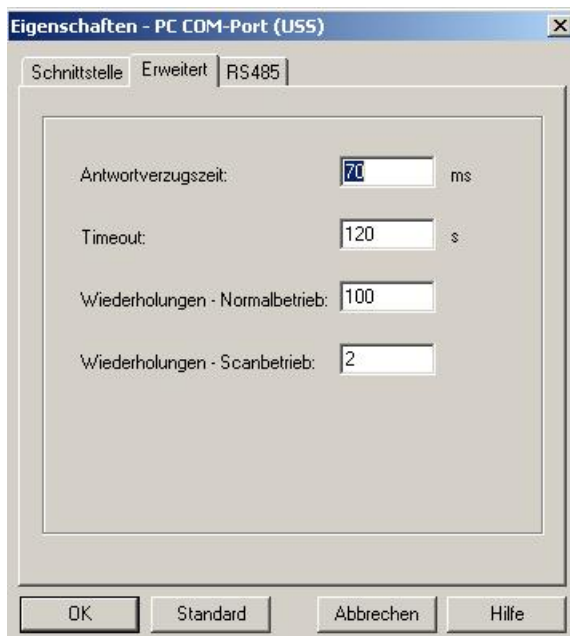




- Under the tab **'Interface'**, select the **'Interface'**; for example, **'COM1'** and the **'Baudrate'**, for example **'38400'**. (→ Schnittstelle → Schnittstelle COM1 →Baudrate 38400)



- Under the tab **'Expanded'**, we use the standard setting regarding the performance of the interface. (→ Erweitert)

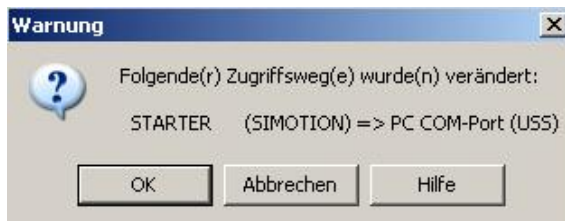




8. Under the tab 'RS 485', select the 'Automatic Mode'. Then we accept all settings with 'OK'. (→ RS 485 → Automatik-Betrieb → OK → OK)



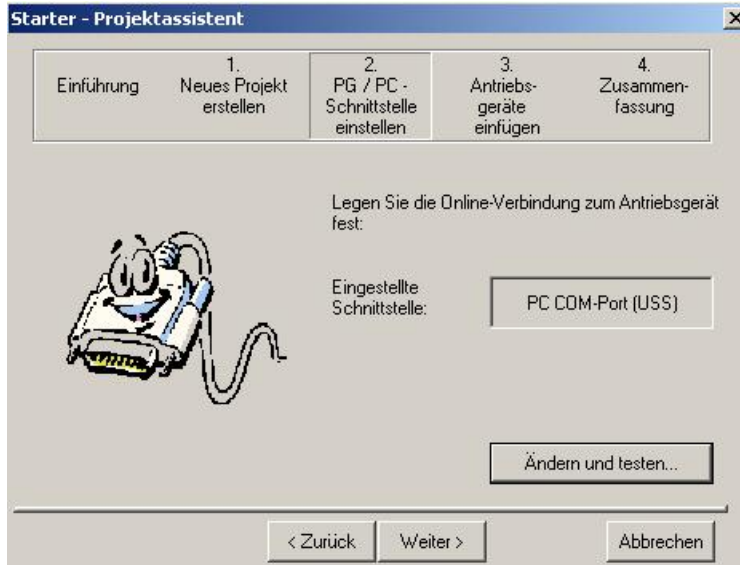
9. Accept the reference to the modified access path with 'OK'. (→ OK)



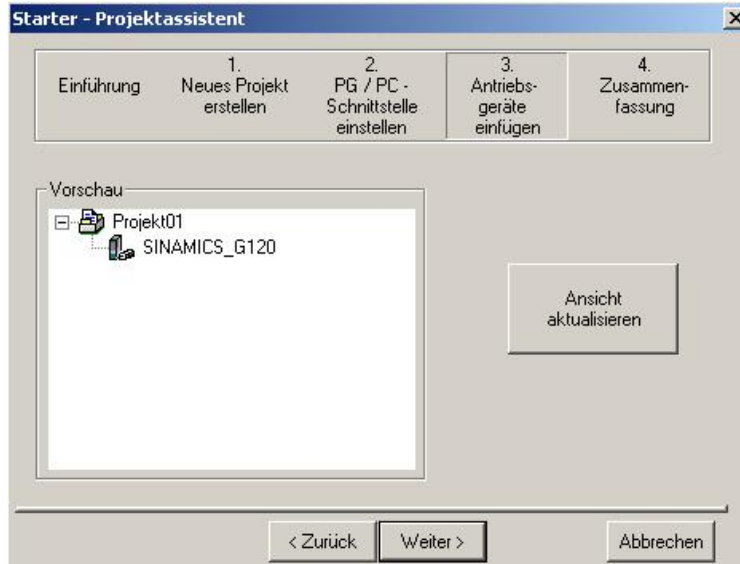
The following access path(s) were changed:



10. We are accepting the interface '**PC COM-Port (USS)**' that is now set with '**Continue**'. (→ Weiter >)



11. In Item 3 (Insert drive units), a SINAMICS_G120 has already been inserted in our project. (→ Weiter >)

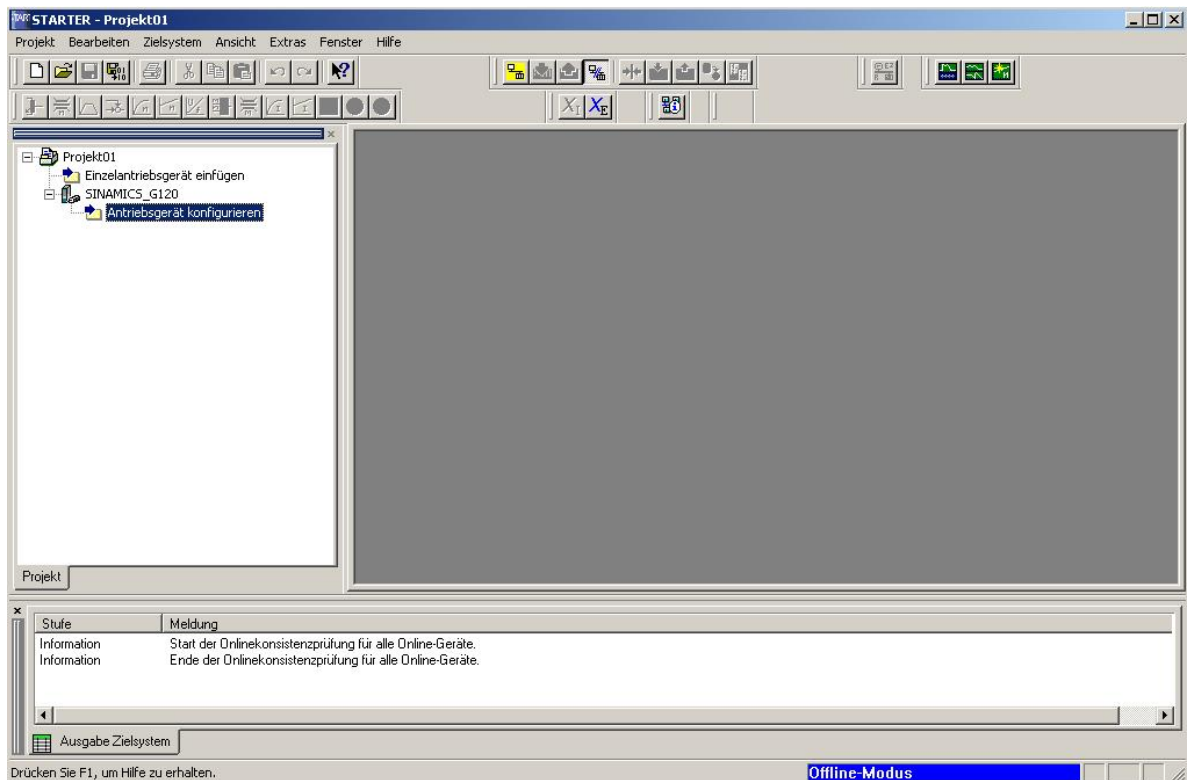




12. Under '**Summary**' (Item 4), we once more see all project settings. By clicking on '**Complete**' this project is set up in the STARTER. (→ Fertigstellen)

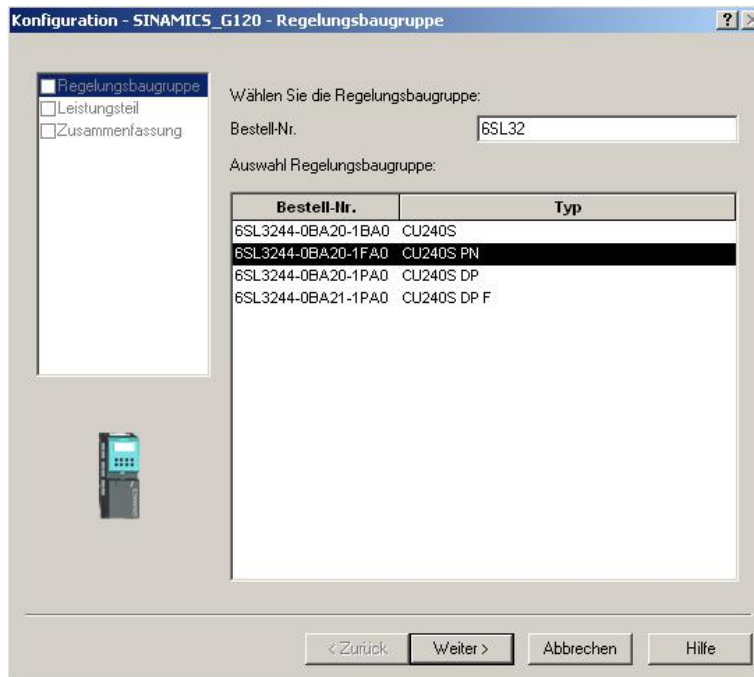


13. The software '**STARTER**' provides for a guided configuration. Start it by double clicking on '**Configure drive unit**'. (→ Antriebsgerät konfigurieren)



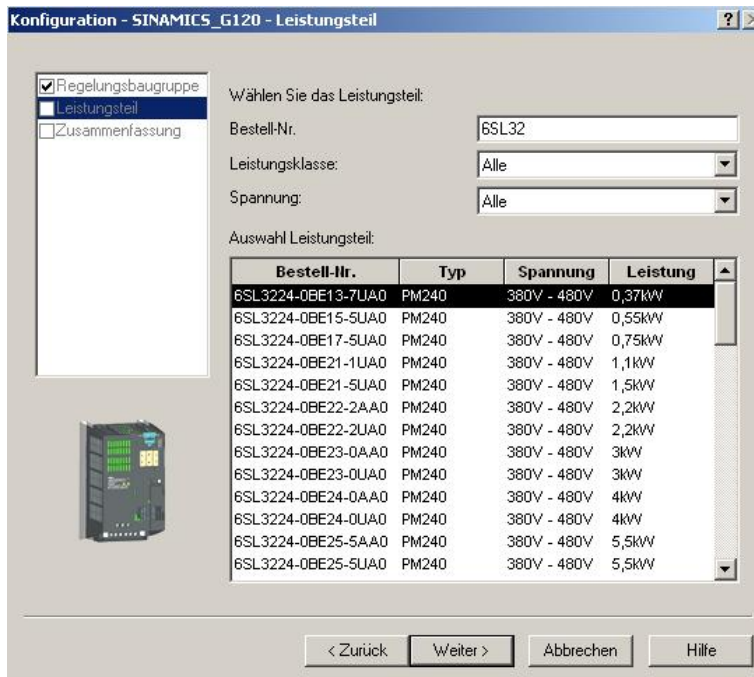


14. Now, first select your control unit (CU240S PN) on the basis of the order number. (→ CU240S PN → Weiter >)



Note: The button 'Help' takes you to the Online Help of the STARTER if you need additional information about the individual items of the guided configuration.

15. In the dialog box below, select the power module based on the order number. (→ Continue >)

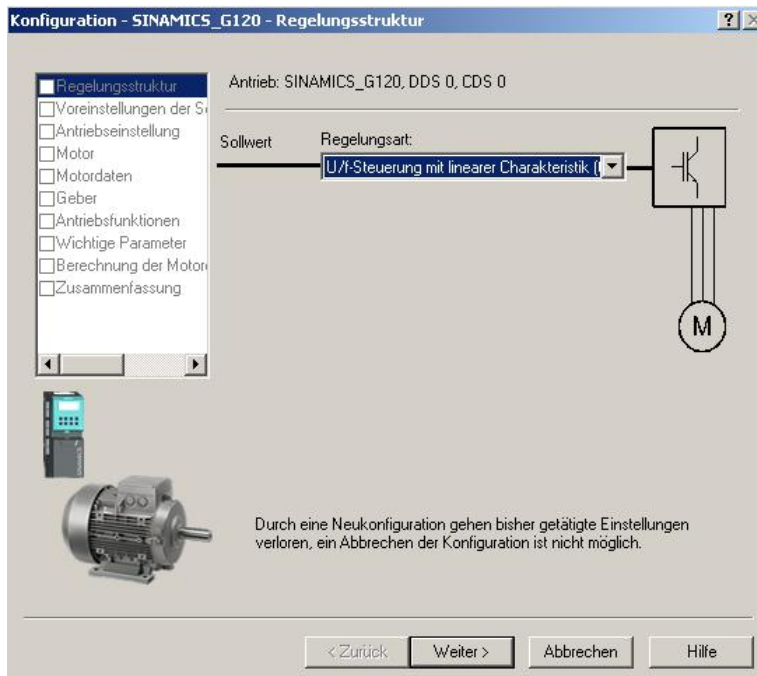




16. After you have checked your selection, choose the option: **'Start the Startup wizard'**. (→ Anschließend IBN- Assistenten starten → Fertigstellen)



17. The startup wizard first offers the selection of the control mode; here, we are selecting **'V/f control with linear characteristic'**. (→ U/f-Steuerung mit linearer Charakteristik → Weiter >)

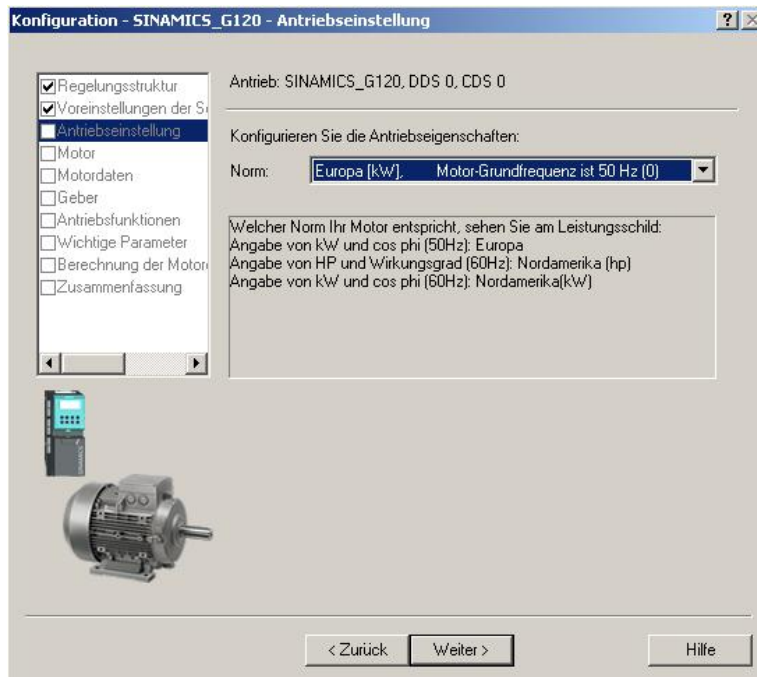




18. We then select as 'Command source' the 'BOP(Key pad)(1)' and as setpoint source for 'Speed setpoint' the motor potentiometer 'MOP setpoint(1)'. (→ BOP(Tastefeld)(1) → MOP Sollwert(1) → Weiter >)

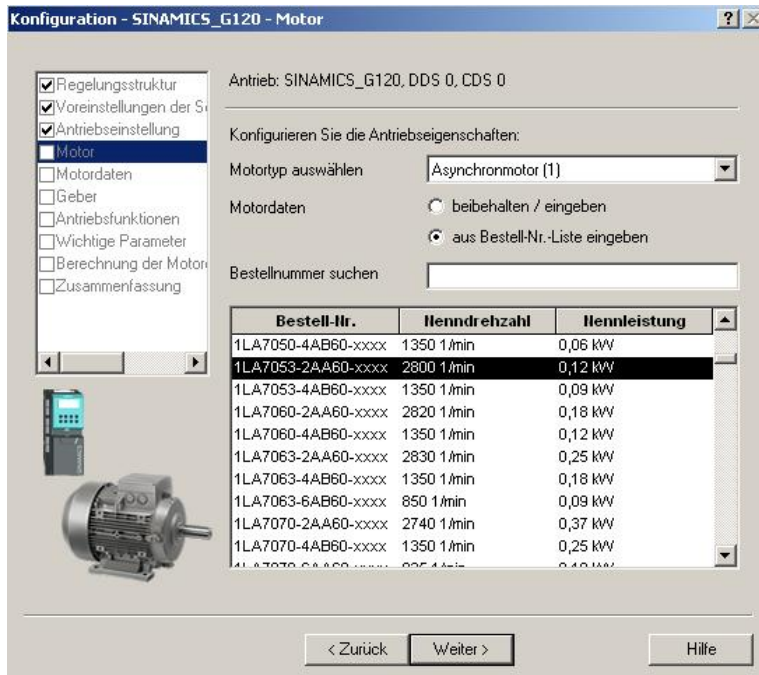


19. In the next dialog box, we select as standard for the 'Drive properties' 'EUROPA[kW] with a basic motor frequency of 50Hz'. (→ EUROPA[kW], Motor-Grundfrequenz ist 50Hz(0) → Weiter >)

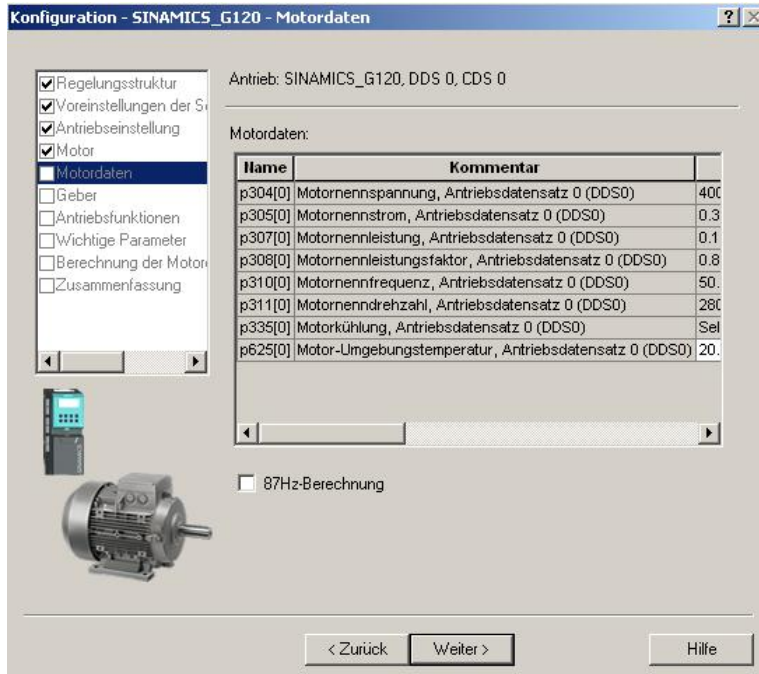




20. Now, the 'Motor type' is selected. If you have a SIEMENS motor, you can enter it from 'Enter order number list'. (→ aus Bestell- Nr.-Liste eingeben → Weiter >)

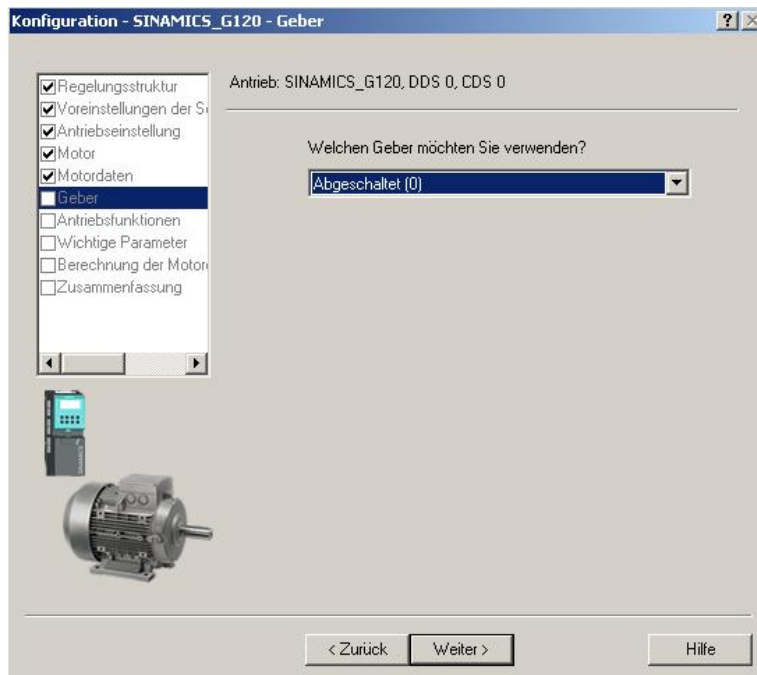


21. The motor data is displayed in the next dialog box. (→ Weiter >)

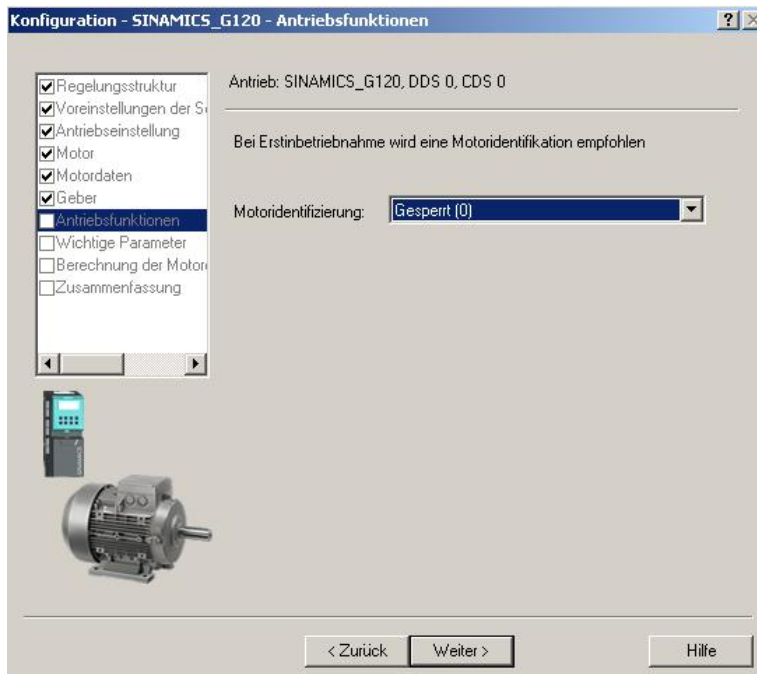




22. If you connected an encoder, select it now, or select '**Switched off (0)**'. (→ Abgeschaltet(0) → Weiter >)

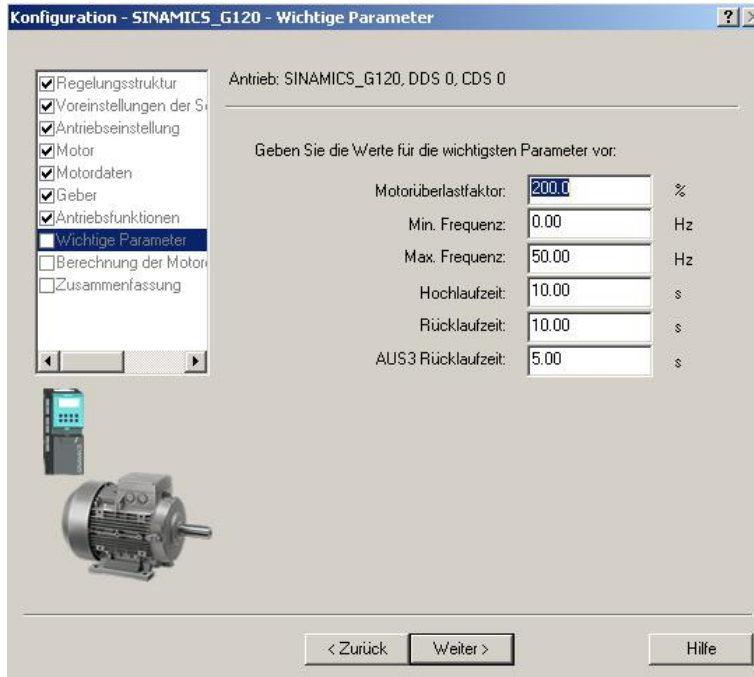


23. For an optimized control, you can execute a '**Motor identification**'. If it is '**disabled**', you can process with approximated data by using the data on the motor type label, or by entering the order number of a SIEMENS converter. (→ Gesperrt(0) → Weiter >)

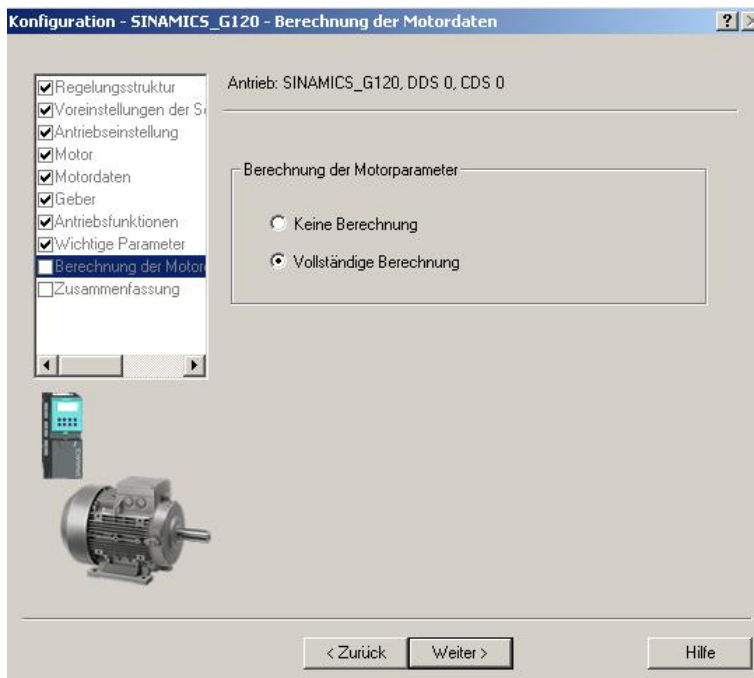




24. Now, important parameters can be set such as **'Motor overload factor'**, **'Min. and Max. Frequency'**, **'Power-up and deceleration time'** as well as **'OFF3 deceleration time'** for fast stops. (→ Weiter >)

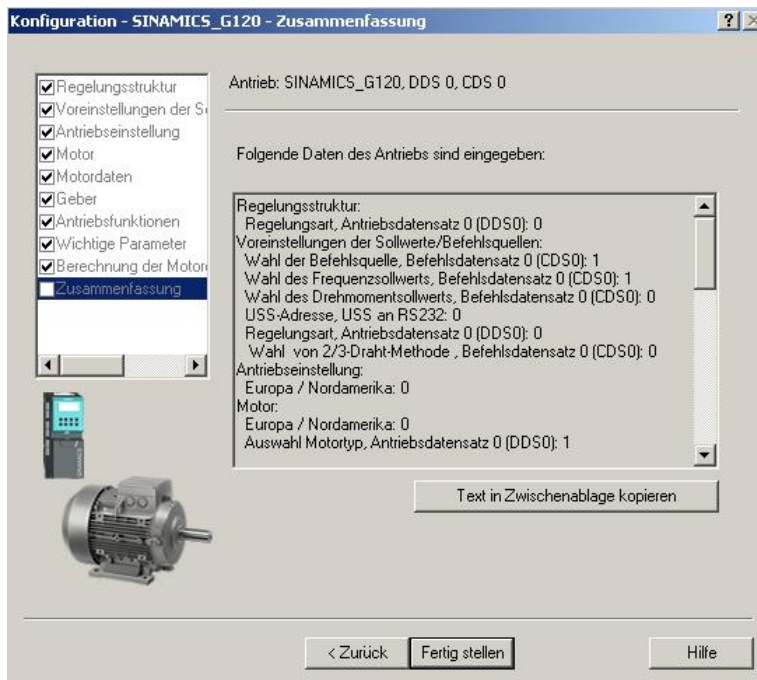


25. In the following dialog box, it is recommended to select the **'Complete calculation'** of the motor parameters. (→ Vollständige Berechnung → Weiter >)

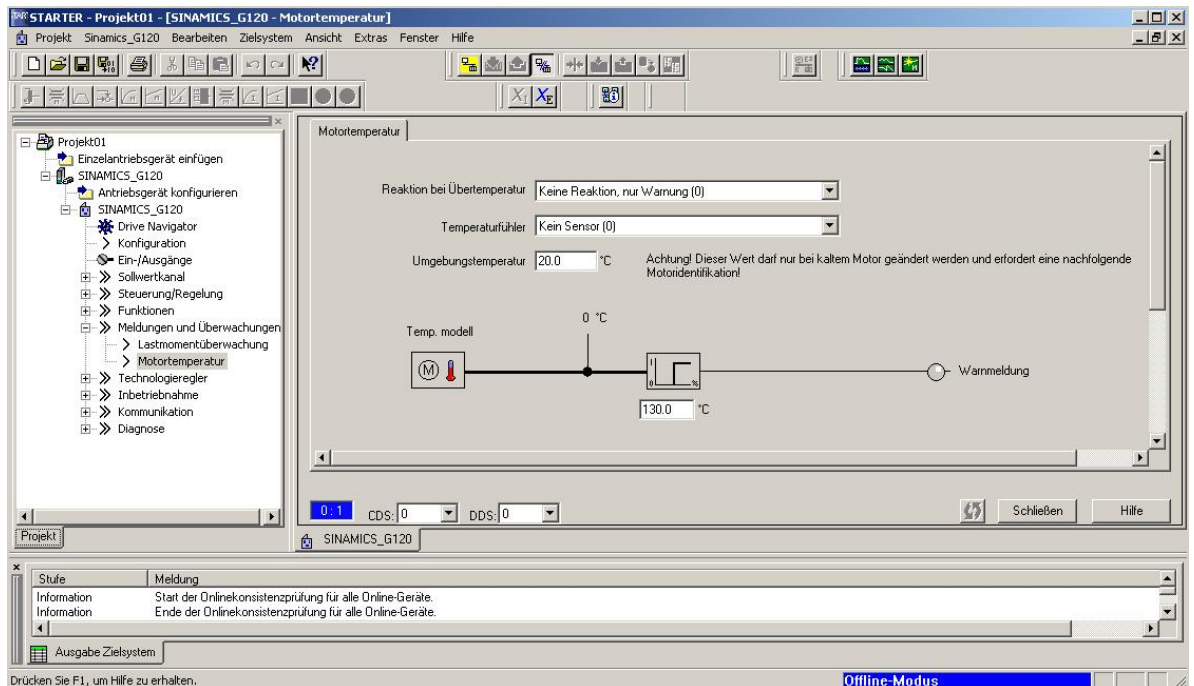




26. Finally, the data entered for the drive is displayed, and the configuration can be accepted with 'Complete'. (→ Fertig stellen)





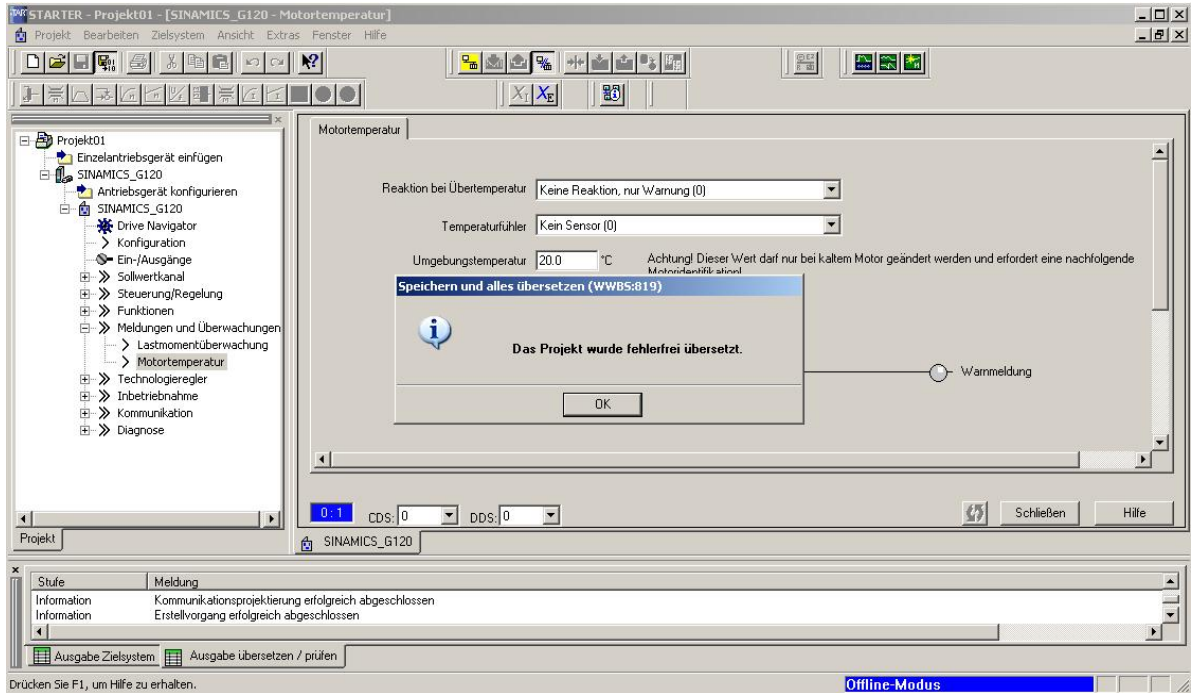
27. Dialog boxes for setting additional parameters can be selected to the left of the project tree with a double click (→ for example, Motor temperature)





Note: If you place the mouse pointer over the parameter fields, you get in the "Tooltip" the respective parameter number with the most important information.

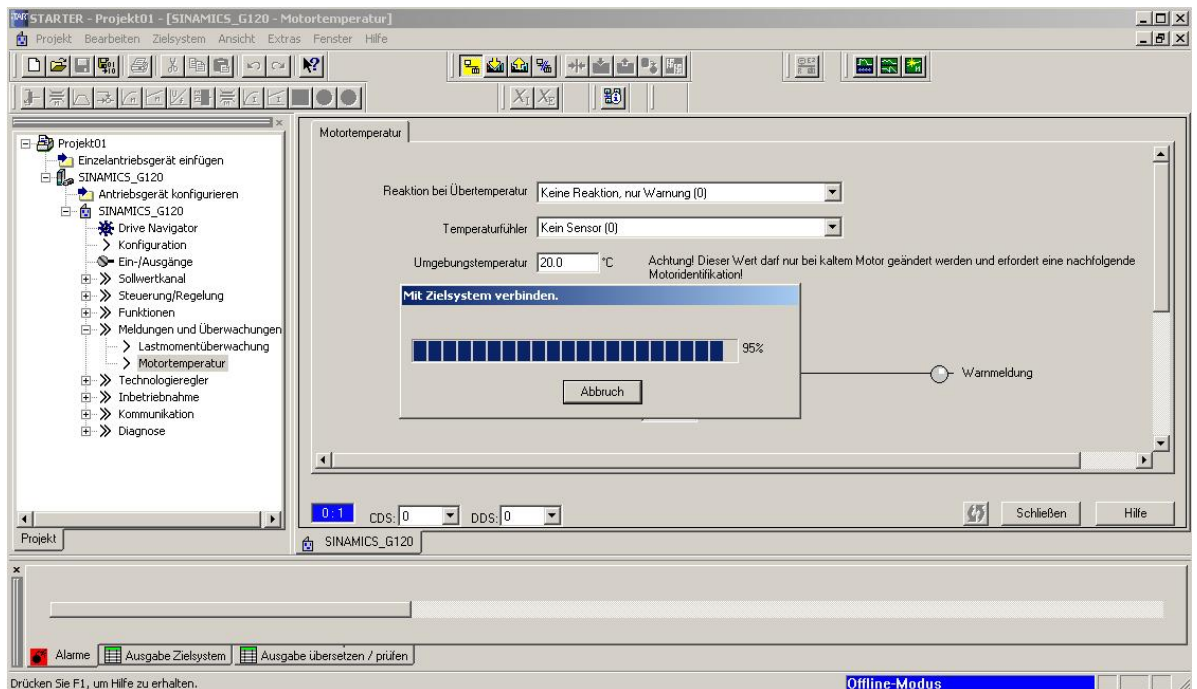


28. By clicking on '  ', the configuration is saved and compiled (→  → OK)





The project was compiled without error

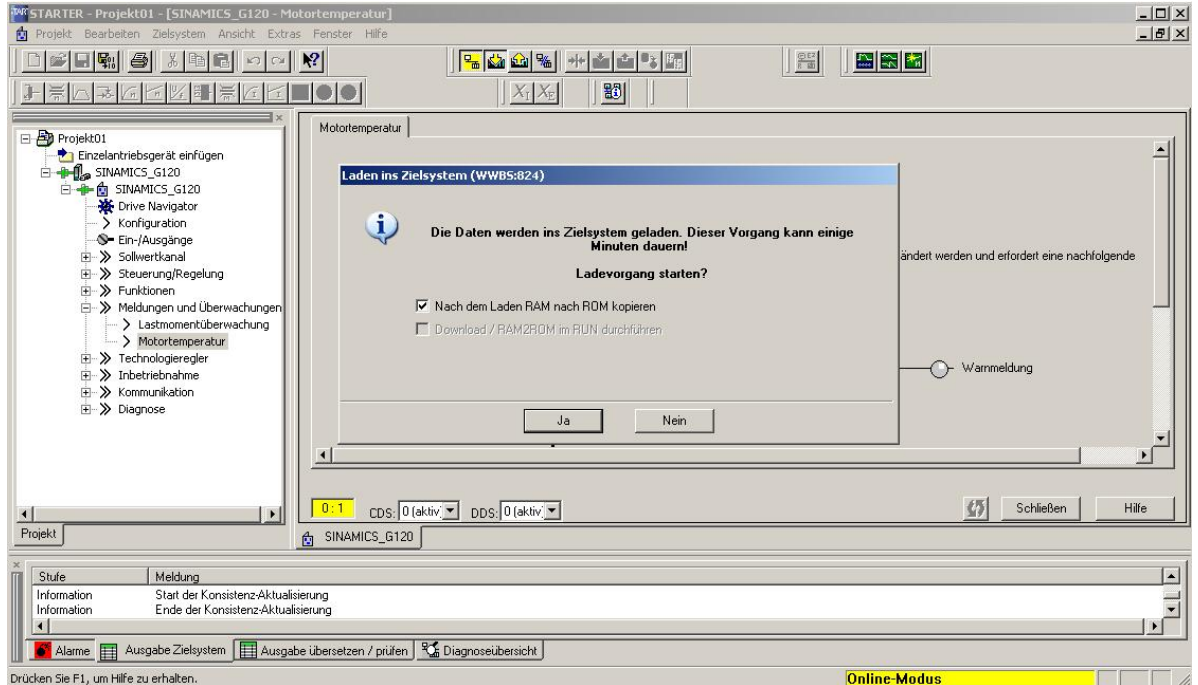
29. By clicking on the button '  ', we are connected to the target system, the SINAMICS G120. (→ )



Note: Make sure that your programmer is connected to the converter via the Connection Kit!

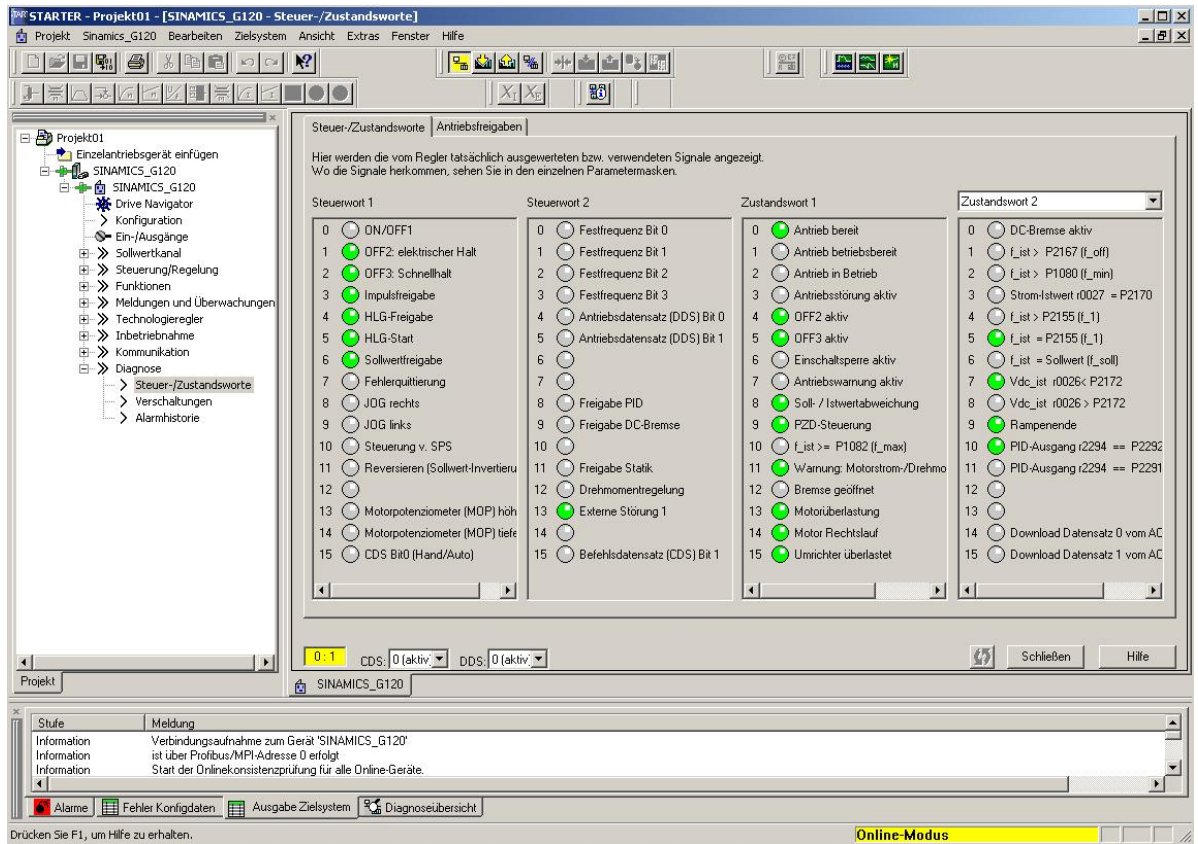


30. Now, click on , and the configuration is loaded to the SINAMICS G120. **'After loading, copy the RAM to the ROM'** should be selected in that case. (→  → 'Nach dem Laden RAM nach ROM kopieren' → Ja)





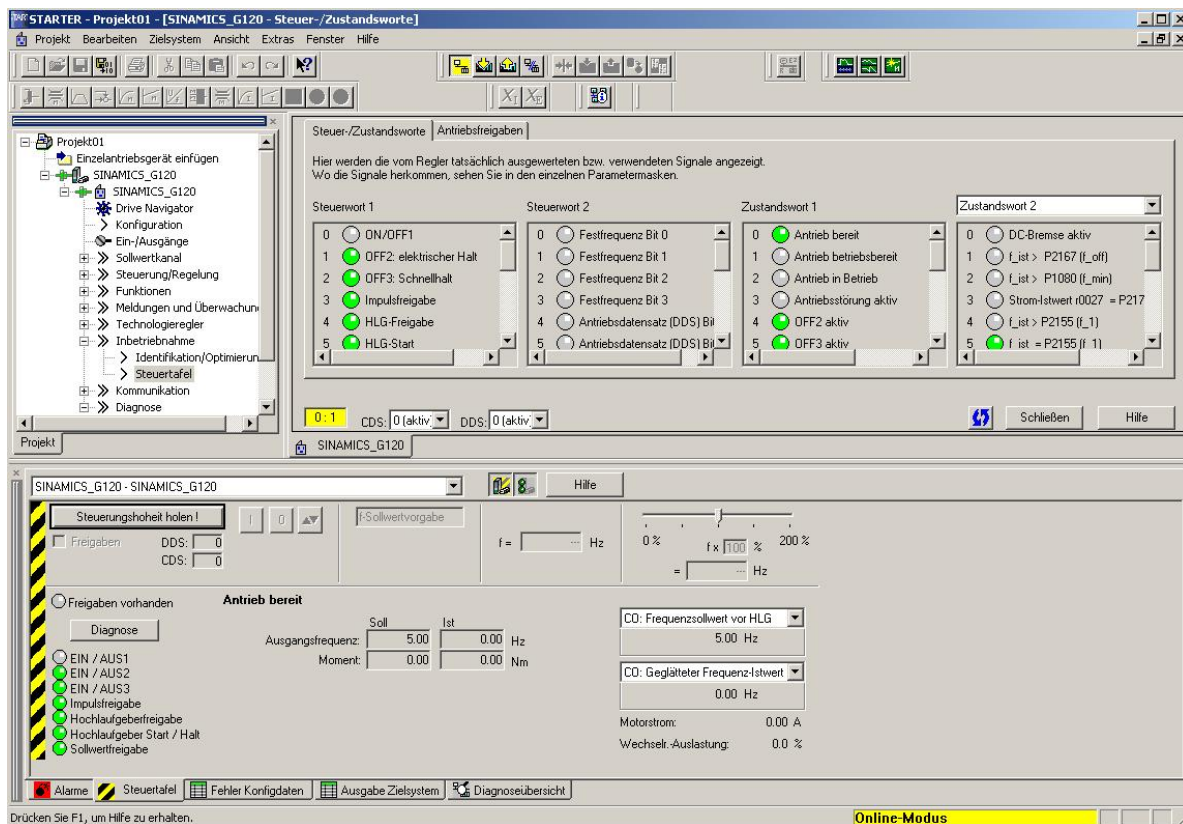
31. For error searches and further commissioning, we can -as long as we are connected to the target system- select the view 'Control/Status words' for example, in the project tree under 'Diagnosis'. (→ Diagnose → Steuer-/Zustandsworte)



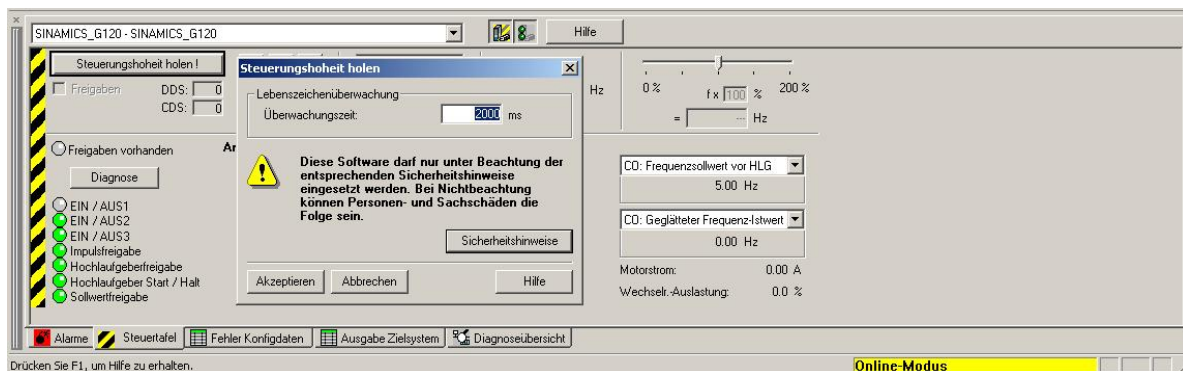
Note: Alarms are indicated in the footer of the STARTER. Here, the necessary acknowledgement can be made after an error.



32. With the 'Control board', the SINAMICS G120 can be controlled directly from the STARTER for test purposes. (→ Inbetriebnahme → Steuertafel)

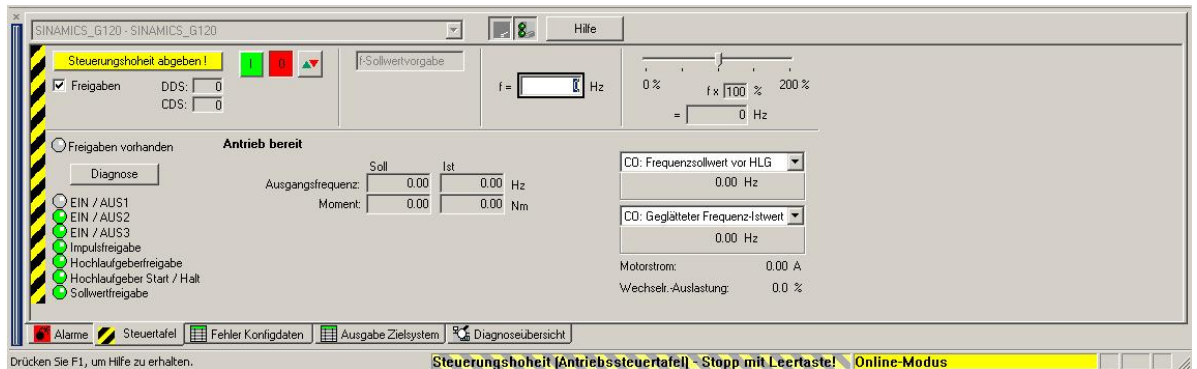






33. In order to start the converter from the STARTER, we first have to 'Fetch master control' and set the monitoring time for the connection STARTER <-> SINAMICS G120. (→ Steuerhoheit holen → Überwachungszeit 2000ms → Akzeptieren)

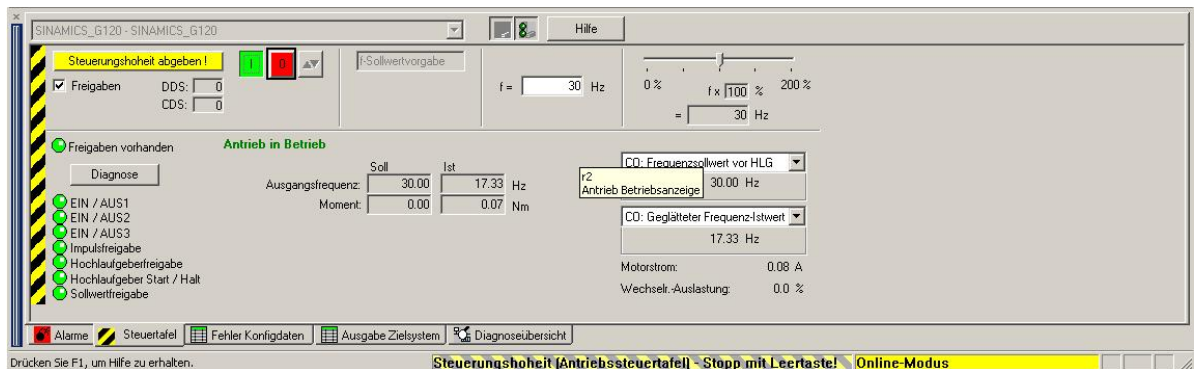




34. With a checkmark, the 'Enables' required for operation can be set without further ado. (→ Freigaben → Steuer-/Zustandsworte)



35. Now, the frequency can be specified, and the converter can be started with the  button. The  button stops the converter. (→ 30Hz →  → )





36. Ultimately, the 'master control' has to be 'returned'. It should be ensured that no other ON command is pending. (→ Steuerhoheit abgegeben → Ja)









Setpoint and commands from set sources. Please make sure that no ON command from the CPU (automation) is pending. Although the PC removes all enables before returning the master control, the setpoints and commands subsequently come again from the parameterized sources. If a setpoint is pending there, the drive responds immediately! This can be dangerous. Do you want to continue? Yes No

37. Now you can control the SINAMICS G120 as desired with the Basic Operator Panel (BOP).



The buttons are assigned as follows:

-  Start motor
-  Stop motor
-  Reversal
-  Take motor to the inching mode
-  Increase speed
-  Decrease speed

3.5.3 Startup with the Micro Memory Card (MMC)

3.5.3.1 Manual Parameter Upload from the Converter to the MMC



Preconditions

To upload a parameter set, the following conditions have to be met:

- A converter with a suitable parameter set is available
- A MMC of the type 6SL3254-0AM00-0AA0 is available
- The supply voltage is applied to the upload converter
- The upload converter is in the "Operational" mode
- The parameters were copied from the RAM to the EEPROM

How it is done:

Parameter	Description (Parameter name and factory setting (if not variable) in bold)
	Insert the MMC to the inverter - for the parameter set to be uploaded, perform the following steps:
P0010 = 30	Commissioning parameter* 0: Ready 1: Quick commissioning 2: Inverter 30: Factory setting, parameter transfer 95: Safety commissioning (for CUs with fail-safe functions only)
P0804 = ...	Select Clone file 0: clone00.bin ... 99: clone99.bin Note: Via P0804 the name of the clone file can be selected. Theoretically up to 100 (0 ... 99) parameter sets can be stored on an MMC.
	Note: Before uploading, the parameters will be copied from RAM to EEPROM.
P0802 = 2	Transfer data from EEPROM 0: Disabled 1: Start BOP Transfer 2: Start MMC Transfer
	If the upload has been completed successfully, P0010 and P0802 will be set to 0 and the "RDY" LED is on. If the upload has failed, F0061 (MMC-PS not fitted) or F0051 (failure while accessing EEPROM) will be displayed, LED "SF" (red) is on. In this case insert an MMC and attempt another upload.

3.5.3.2 Manual Parameter Download from a MMC to the Converter



Preconditions

- The supply voltage has to be applied at the download converter
- The download converter is in the "Ready Mode"
- The directory structure /USER/SINAMICS/DATA/clonexx.bin has to be on the MMC



Notes on the Download

When performing the download, the following important conditions have to be met:

- During the download, the converter does not respond to any commands.
- Once the download is started, it can not be interrupted.
- After uploading and downloading parameters between the different control units, the parameter settings have to be checked.
- Downloading parameters from another CPU could possibly fail with F0063 if there are parameters that can not be loaded.
- If the download fails, the previous EEPROM parameters are restored again on the converter.



How it is done

Parameter	Description (Parameter name and factory setting (if not variable) in bold)
	Insert the MMC to the download inverter and perform the Manual Download according the flow chart.
P0010 = 30	Commissioning parameter* 0: Ready 1: Quick commissioning 2: Inverter 30: Factory setting, parameter transfer 95: Safety commissioning (for CUs with fail-safe functions only)
P0804 = ...	Select Clone file (for download) 0: clone00.bin ... 99: clone99.bin
P0803 = 2	Transfer data to EEPROM 0: Disabled 1: Start BOP Transfer 2: Start MMC Transfer
	If the download has been completed successfully, P0010 and P0803 will be set to 0 and the "RDY" LED is on. If the upload has failed, F0061 (MMC-PS not fitted), F0062 (MMC-PS contents invalid) resp. F0063 (MMC-PS contents incompatible) or F0051 (failure while accessing EEPROM) will be displayed, LED "SF" (red) is on. In this case insert a proper MMC and attempt another download or perform a factory reset.
	After a successful Manual Download the MMC can be removed from the inverter and inserted into the next download inverter. Then perform the download steps again until the series commissioning has been completed for all inverters.

3.6 Exercises



1. Changing the start and the braking behavior of the motor

Change the parameters of the SINAMICS G120 in a way that the effective acceleration time to a maximum of 50Hz amounts to 18 seconds. The effective deceleration time of 50Hz to 0Hz is to amount to 12 seconds. When accelerating and decelerating the motor, acceleration and deceleration is to take place with a rounding time of 3 seconds each.

You can read the actual frequency off the converter's display and in this way recognize the motor's approach behavior and braking behavior. Check the correctness of your parameter inputs with a stop watch.

The motor potentiometer setpoint is to be accelerated to 25Hz with the BOP. If you then stop the motor with the BOP, you can observe the deceleration ramp, and stop it.



2. Controlling the converter by means of the digital inputs DIN1 to DIN3

Change the parameters of the SINAMICS G120 in a way that the motor can be started by means of the digital inputs DIN1 to DIN3. The fixed frequency 1 is set to 25Hz. By means of the digital inputs DIN2 and DIN3, the respective fixed frequencies 2 and 3 can be connected. DIN2 = 15Hz, DIN3 = 10Hz. If several inputs are enabled, the frequency value is totaled. The acceleration time to 50Hz maximum is to amount to 9.7s, the deceleration time 7.8s. This includes a rounding time of 3.6s. Check the correctness of your parameter inputs at the indication on the converter's display, and by using a stop watch.



3. Speed Control via Analog Value

Change the parameters of the SINAMICS G120 in a way that the speed of the motor can be specified by means of a voltage of from 0V to 10V at the converter's analog input. Starting and stopping the motor as well as reversal and the jog function are to be performed with the operator panel. The acceleration time to a maximum of 50Hz is to amount to 11.3s. The deceleration time amounts to 6.5s. The motor is to be accelerated and slowed down without rounding time. Check the correctness of your parameter inputs at the indication on the converter's display, and by using a stop watch.



Note:

As you do the exercises, use the software STARTER: For each exercise, set up a project, test and save it by using the commissioning wizard.

If you need additional information about the individual parameters, refer to Online Help, or the function charts and the parameter descriptions in the List Manual.

4. STARTING UP THE FREQUENCY CONVERTER SINAMICS G120 ON THE PROFIBUS



Below, the startup of the PROFIBUS DP network with the CPU 315F-2 PN/DP as master and the frequency converter SINAMICS G120 as slave is described.

We are generating the hardware configuration for the SIMATIC S7 and we are assigning parameters to the SINAMICS G120 as follows:

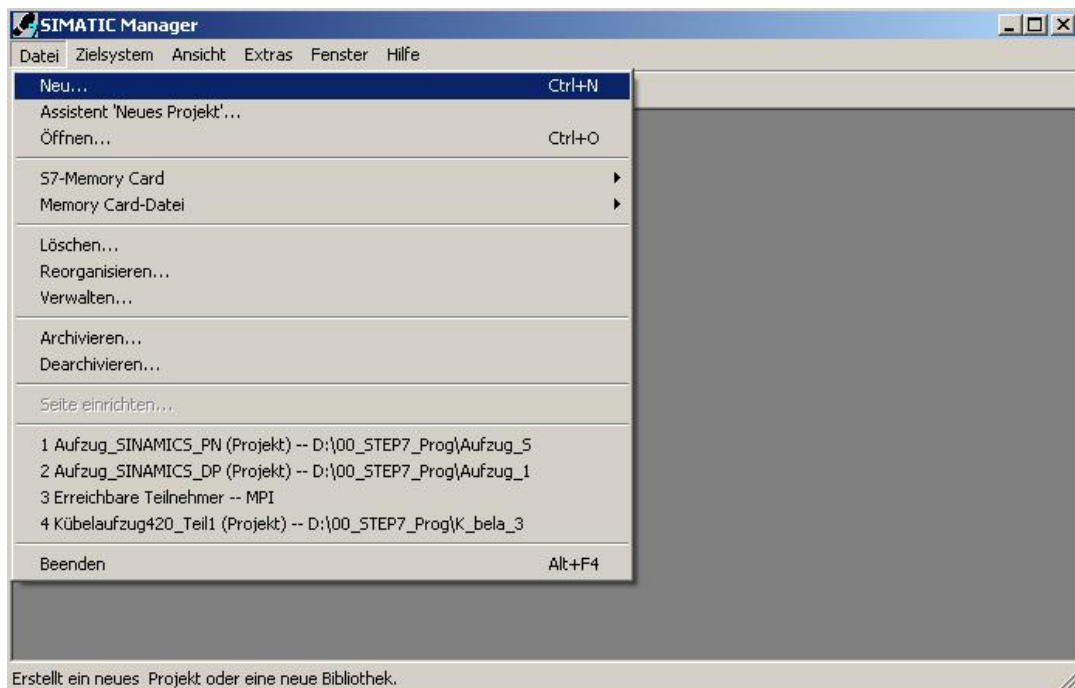


1. The central tool for SIMATIC is the '**SIMATIC Manager**'. It is called here with a double click. (→ SIMATIC Manager)



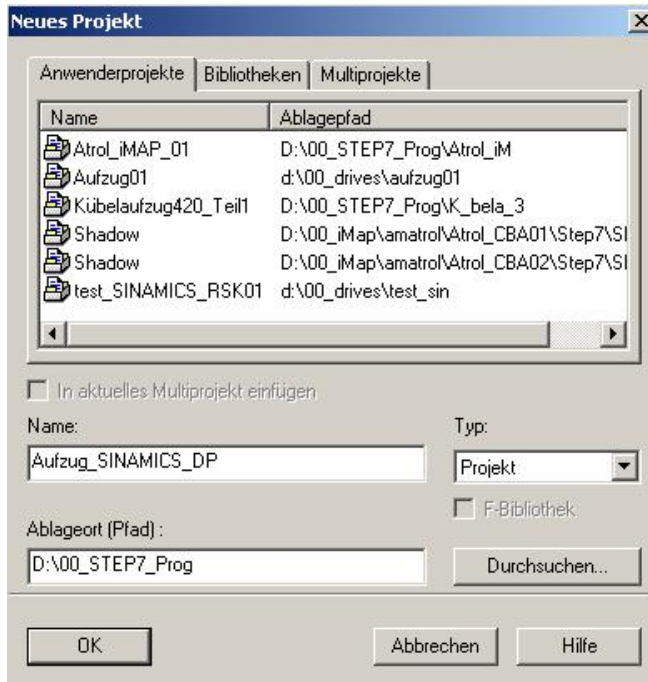
SIMATIC Manager

2. STEP 7 programs are managed in projects. We are now setting up such a project. (→ File → New)

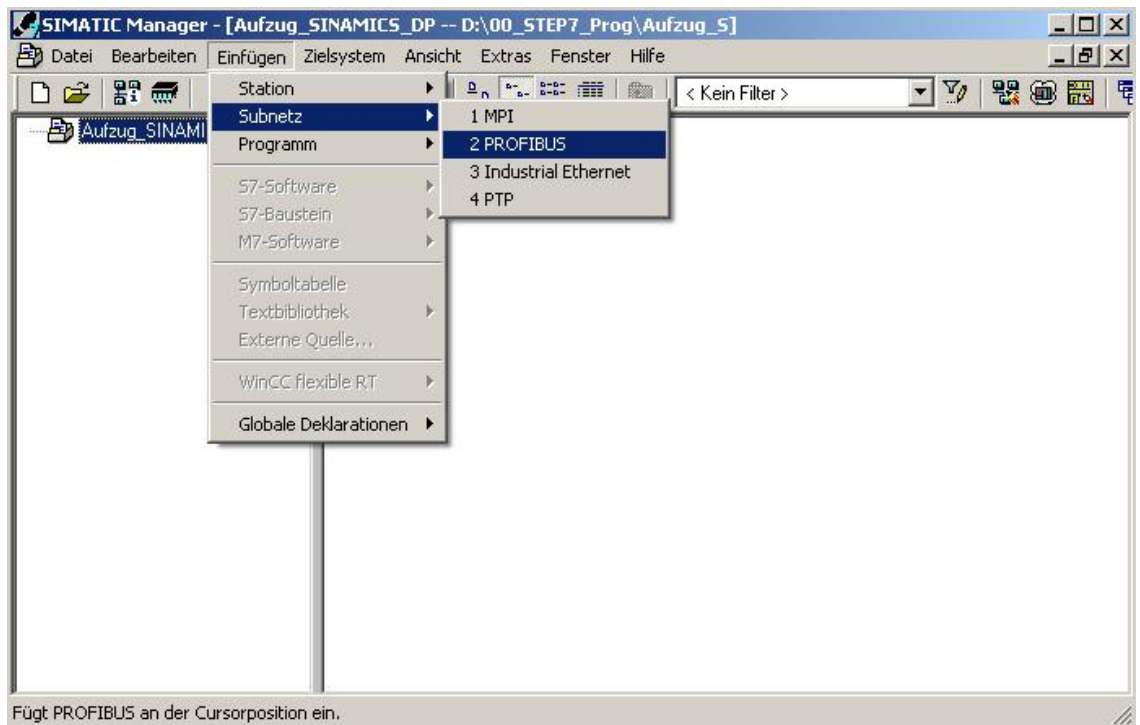




- The project is now assigned the 'Name' 'Elevator_SINAMICS_DP' (→ Aufzug_SINAMICS_DP → OK)

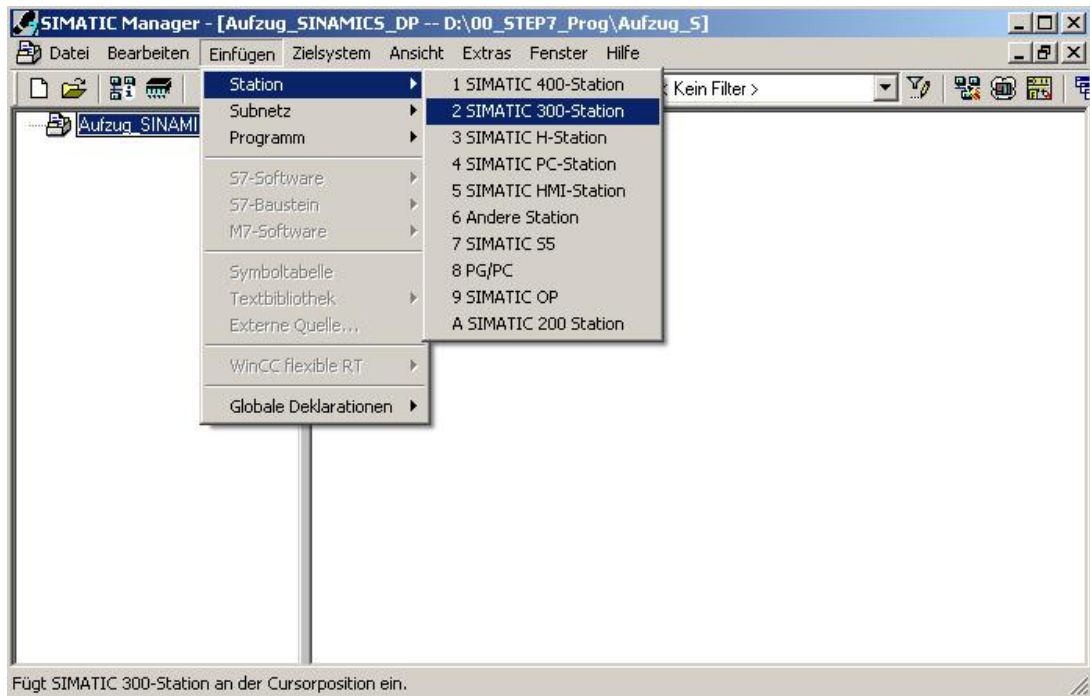


- Highlight your project and insert a '**PROFIBUS Subnet**'. (→ Aufzug_SINAMICS_DP → Einfügen → Subnetz → PROFIBUS)

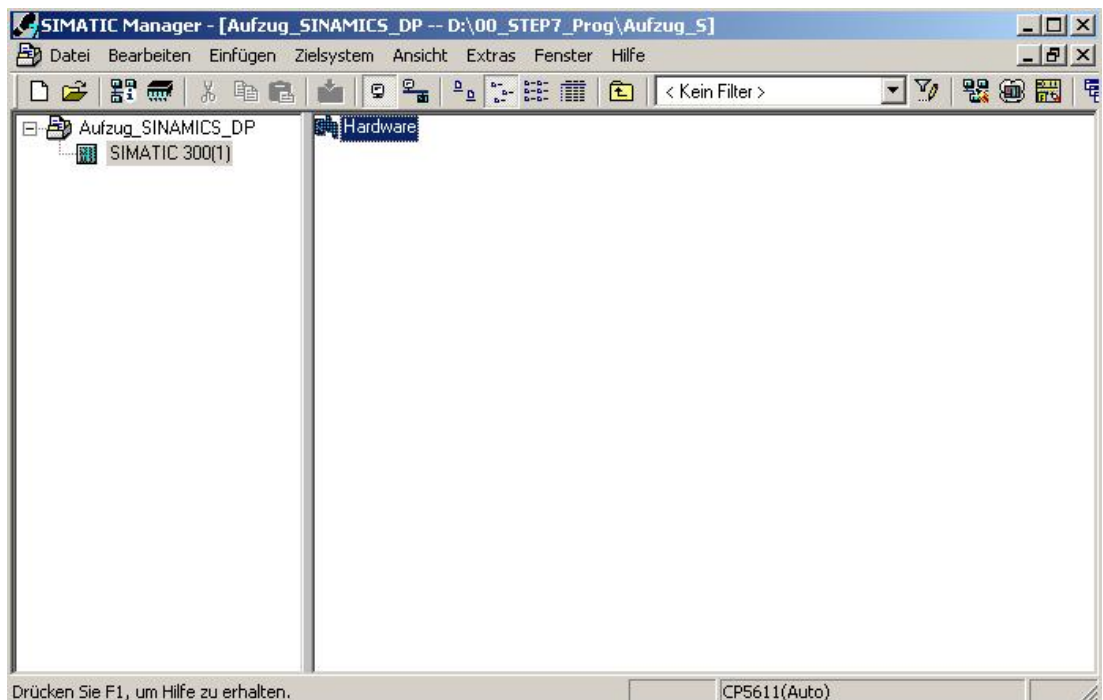




5. Then, a '**SIMATIC 300-Station**' is inserted. (→ Einfügen → Station → SIMATIC 300-Station)



6. With a double click, open the configuration tool for '**Hardware**'. (→ Hardware)





7. Open the hardware catalog by clicking on . (→)

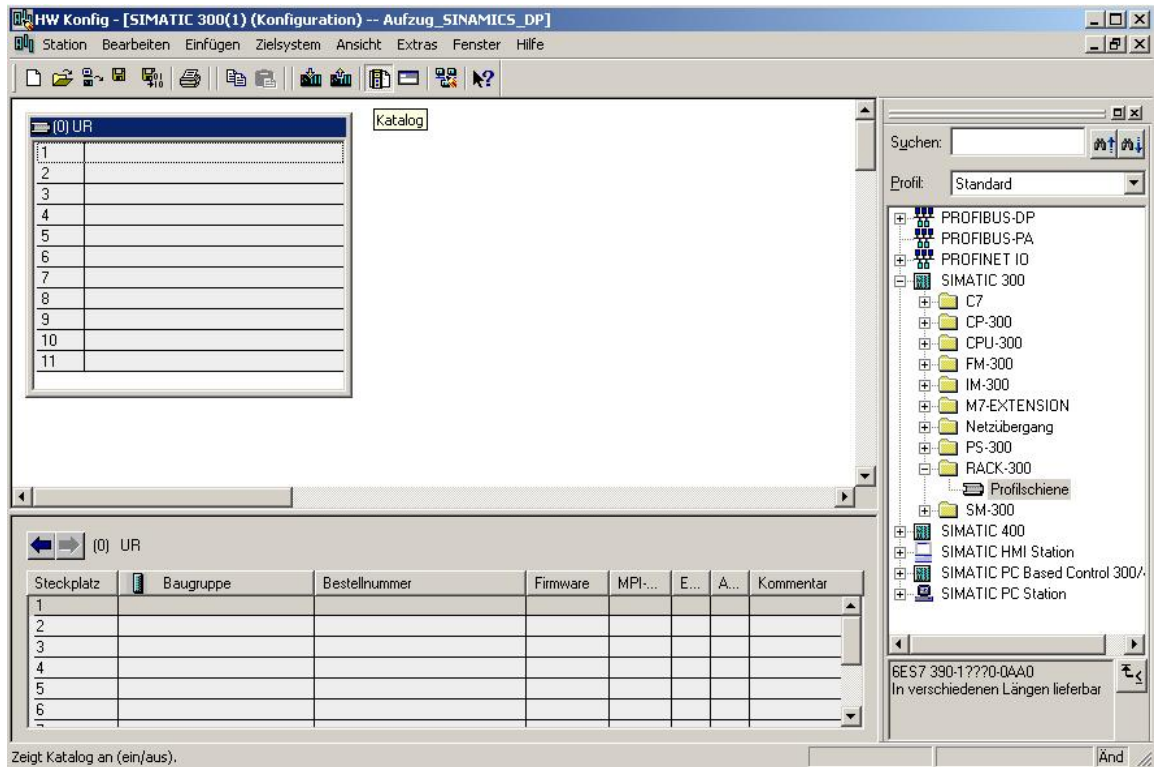
There, arranged in the following directories:

PROFIBUS DP, PROFIBUS PA, PROFINET IO, SIMATIC 300, SIMATIC 400,
SIMATIC PC Based Control, and SIMATIC PC Station,

all racks, modules and interface modules are provided for configuring your hardware.

Insert 'Rail' with a double click. (→ SIMATIC 300 → RACK 300

→ Rail).



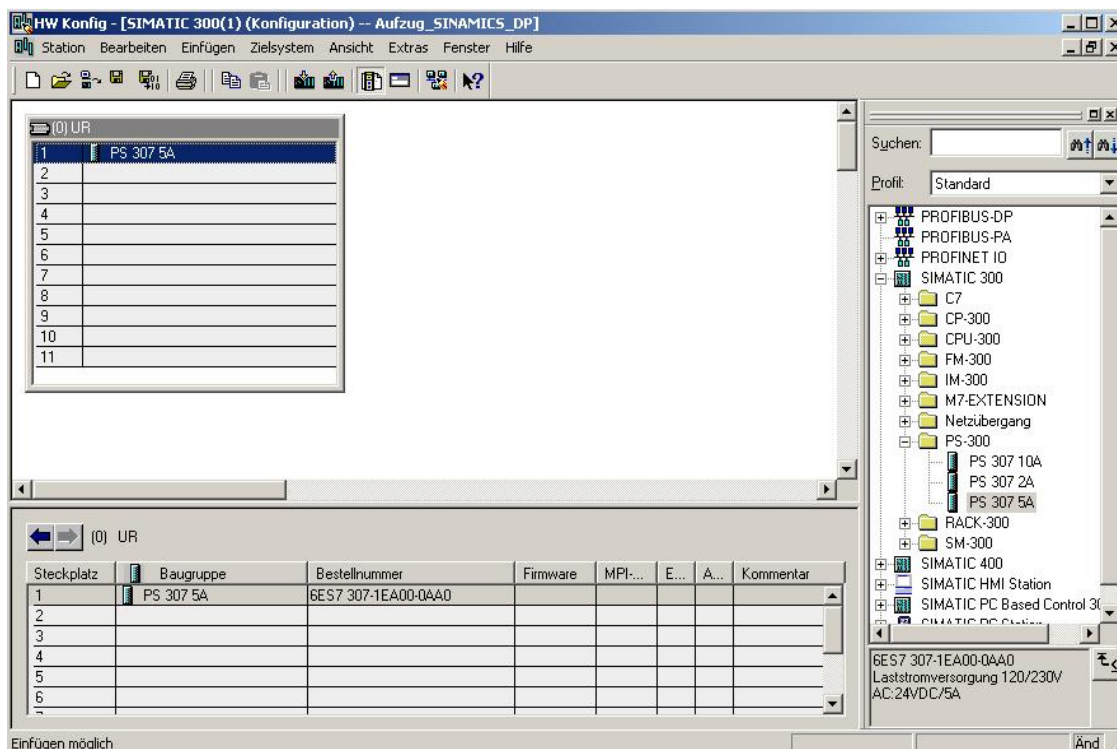
After that, a configuration table is displayed automatically for configuring Rack 0.



- From the hardware catalog, you can now select all modules that are also in your real rack, and insert them in the configuration table.

To this end, click on the name of the respective module, hold the mouse key and drag the module to a line in the configuration table.

We are starting with the power unit 'PS 307 2A'. (→ SIMATIC 300 → PS-300 → PS 307 5A)



Note: If your hardware differs from the one displayed here, simply select the corresponding modules from the catalog and insert them in your rack.

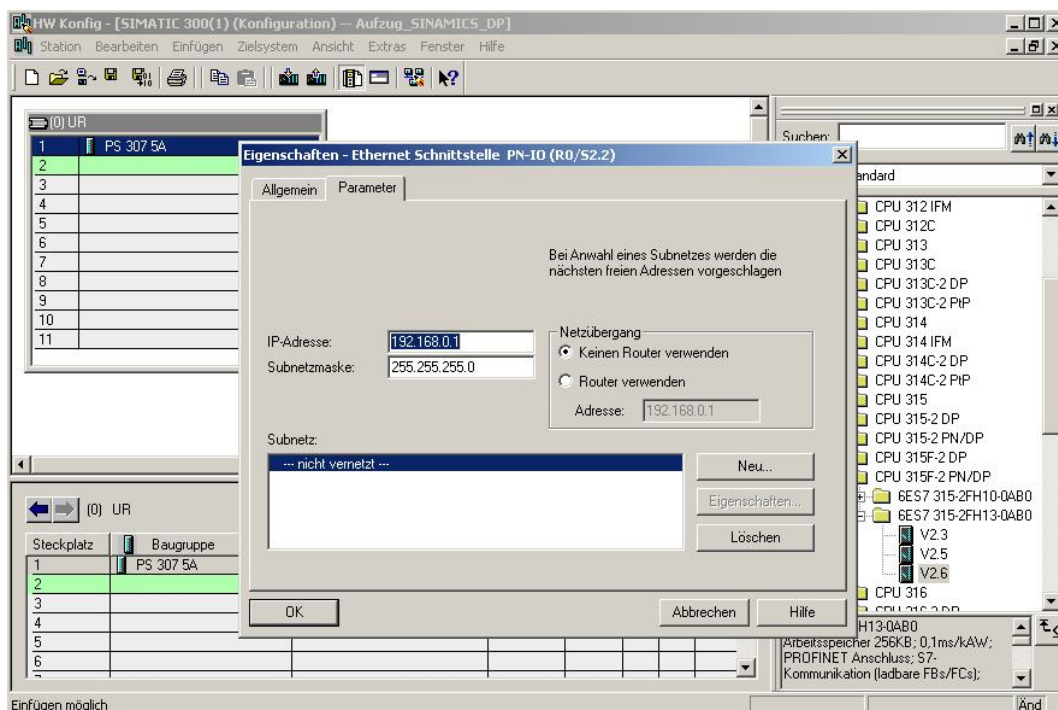
The order numbers of the individual modules -that are also indicated on the components- are displayed in the footer of the catalog.



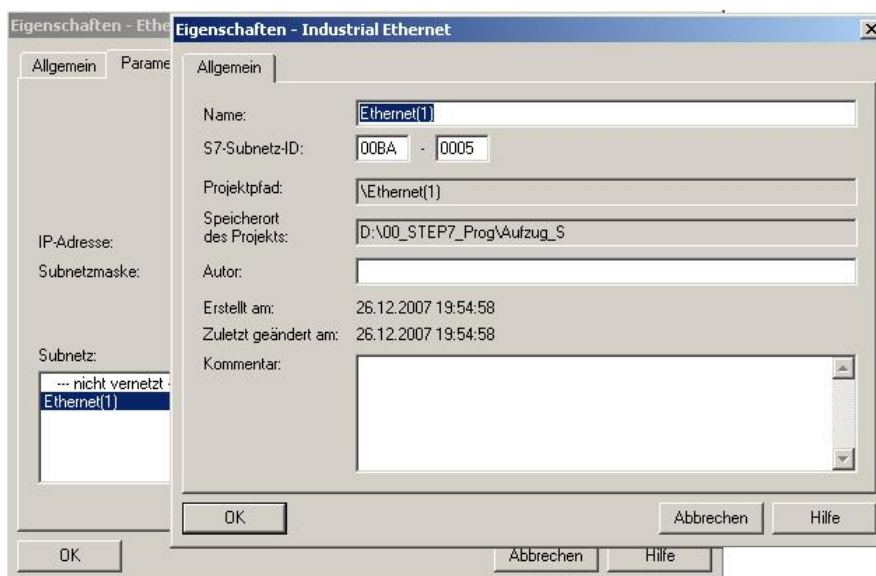
9. Next, we drag the '**CPU 315F-2 PN/DP**' to the second slot. The order number and the version of the CPU can be read off the front of the CPU.

(→ SIMATIC 300 → CPU-300 → CPU 315F-2 PN/DP → 6ES7 315-2FH13-0AB0 → V2.6)

When entering the CPU, a window appears where you can assign an '**IP address**' to the CPU315F-2 PN/DP and specify the '**Subnet screen form**'. Option: for general network communication, a '**Router address**' can be selected. And by clicking on '**New**', we are setting up an '**Ethernet**'. (→ IP address: 192.168.0.1 → Subnet screen form: 255.255.255.0 → Don't use a router → New)



10. Accept the newly generated Ethernet and your settings with '**OK**'. (→ OK → OK)





Notes on Networking on the Ethernet (additional information is provided in Appendix V of the training document):

MAC Address:

The MAC address consists of a permanent and a variable part. The permanent part ("Basis MAC Address") identifies the manufacturer (Siemens, 3COM, ...). The variable part of the MAC address differentiates the different Ethernet stations, and should be assigned uniquely world-wide. On each module, a MAC address specified by the factory is imprinted.

Value range for the IP address:

The IP address consists of 4 decimal numbers from the value range 0 to 255 which are separated by a period; for example 141.80.0.16

Value range for the subnet screen form:

This screen form is used in order to recognize whether a station or its IP address is part of the local subnet, or can be accessed only by means of a router.

The subnet screen form consists of 4 decimal numbers from the value range 0 to 255 that are separated by a period; for example, 255.255.0.0

In their binary representation, the 4 decimal numbers of the subnet screen form have to contain from the left a series of gapless values "1" and from the right a series of gapless values "0".

The values "1" determine the area of the IP address for the network number. The values "0" determine the area of the IP address for the station address.

Example:

Correct values: 255.255.0.0 decimal = 1111 1111.1111 1111.0000 0000.0000 0000 binary
 255.255.128.0 decimal = 1111 1111.1111 1111.1000 0000.0000 0000 binary
 255.254.0.0 decimal = 1111 1111.1111 1110.0000 0000.0000.0000 binary
 Incorrect value: 255.255.1.0 decimal = 1111 1111.1111 1111.0000 0001.0000 0000 binary

Value range for the address of the network transition (Router):

The address consists of 4 decimal numbers from the value range 0 to 255 which are separated by a period; for example, 141.80.0.1.

Relationship of IP addresses, router address, and subnet screen form:

The IP address and the address of the network transition may differ only in positions that have a "0" in the subnet screen form.

Example:

You entered: for the subnet screen form 255.255.255.0; for the IP address 141.30.0.5, and for the router address 141.30.128.1.

The IP address and the address for the network transition are to have a different value only in the 4th decimal number. In the example, however, the 3rd position already differs.

In the example, you have to change alternatively:

- the subnet screen form to: 255.255.0.0 or
- the IP address to: 141.30.128.5 or
- the address of the network transition to: 141.30.0.1

Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	-------	------------------------------	-----------------------	-----------------



11. Drag the digital input module with 16 inputs to Slot 4. (→ SM 321 DI 16xDC 24V)

The screenshot shows the HW Config interface for a SIMATIC 300 system. The rack configuration is as follows:

Steckplatz	Baugruppe	Bestellnummer	Firmw...	MPI...	E-Adresse	A-Adresse	K...
1	PS 307 5A	6ES7 307-1EA00-0AA0					
2	CPU 315F-2 PN/DP	6ES7 315-2FH13-0AB0	V2.6	2			
X1	MPI/DP			2	2047*		
X2	PN-IO				2046*		
X2 P1	Port 1				2045*		
3							
4	DI16xDC24V	6ES7 321-1BH01-0AA0			0...1		
5							
6							

The right-hand pane shows the component selection tree, with 'SM 321 DI16xDC24V' selected under the 'SM-300' folder.

12. Drag the digital output module with 16 outputs to Slot 5. (→ SM 322 DO16xDC 24V/0.5A)

The screenshot shows the HW Config interface after adding a digital output module. The rack configuration is updated as follows:

Steckplatz	Baugruppe	Bestellnummer	Firmw...	MPI...	E-Adresse	A-Adresse	K...
1	PS 307 5A	6ES7 307-1EA00-0AA0					
2	CPU 315F-2 PN/DP	6ES7 315-2FH13-0AB0	V2.6	2			
X1	MPI/DP			2	2047*		
X2	PN-IO				2046*		
X2 P1	Port 1				2045*		
3							
4	DI16xDC24V	6ES7 321-1BH01-0AA0			0...1		
5	DO16xDC24V/0.5A	6ES7 322-1BH01-0AA0				4...5	
6							

The right-hand pane shows the component selection tree, with 'SM 322 DO16xDC24V/0.5A' selected under the 'DO-300' folder.



13. By default, the RS485 interface of the CPU is set to the MPI. Double click on it to make the change to PROFIBUS. (→ MPI/DP)

The screenshot shows the 'HW Konfig' window for a SIMATIC 300(1) system. The hardware rack is configured as follows:

Steckplatz	Baugruppe	Bestellnummer	Firmw...	MPI...	E-Adresse	A-Adresse	K...
1	PS 307 5A	6ES7 307-1EA00-0AA0					
2	CPU 315F-2 PN/DP	6ES7 315-2FH13-0AB0	V2.6	2	2047*		
X1	MPI/DP				2046*		
X2	PN-IO				2045*		
X2 P1	Port 1				2045*		
3							
4	DI16xDC24V	6ES7 321-1BH01-0AA0			0...1		
5	DO16xDC24V/0.5A	6ES7 322-1BH01-0AA0				4...5	
6							
7							
8							
9							

14. Change the interface type to 'PROFIBUS' and select the 'Properties' of the interface. (→ PROFIBUS → Eigenschaften)

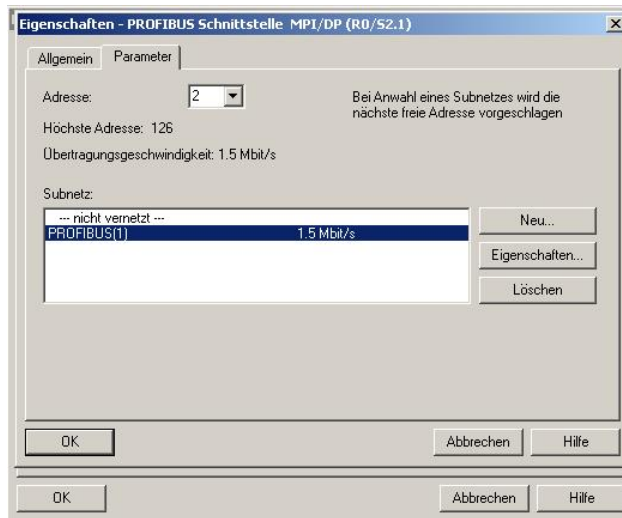
The screenshot shows the 'Eigenschaften - MPI/DP - (R0/S2.1)' dialog box. The 'Schnittstelle' section is expanded, showing the following settings:

- Typ: PROFIBUS
- Adresse: MPI
- Vernetzt: Nein

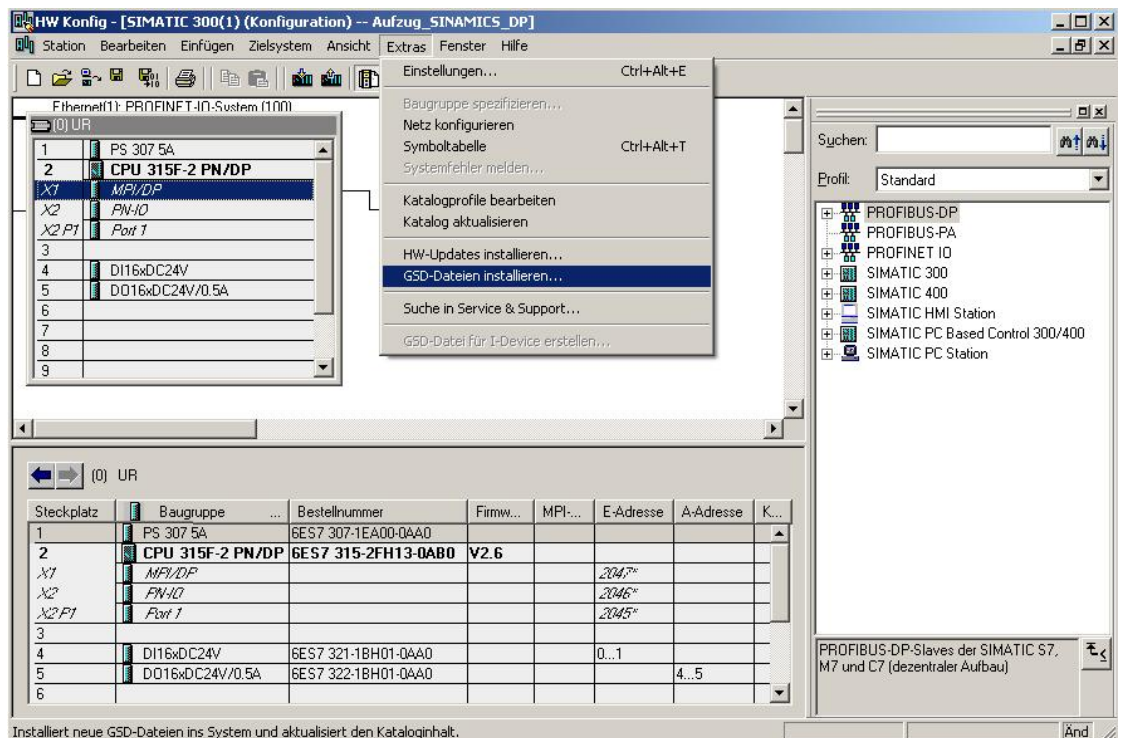
The 'Eigenschaften...' button is visible next to the 'Vernetzt' field.



15. Now, select an 'Address' and click on the 'PROFIBUS(1)' network. (→ 2 → PROFIBUS(1) → OK → OK)



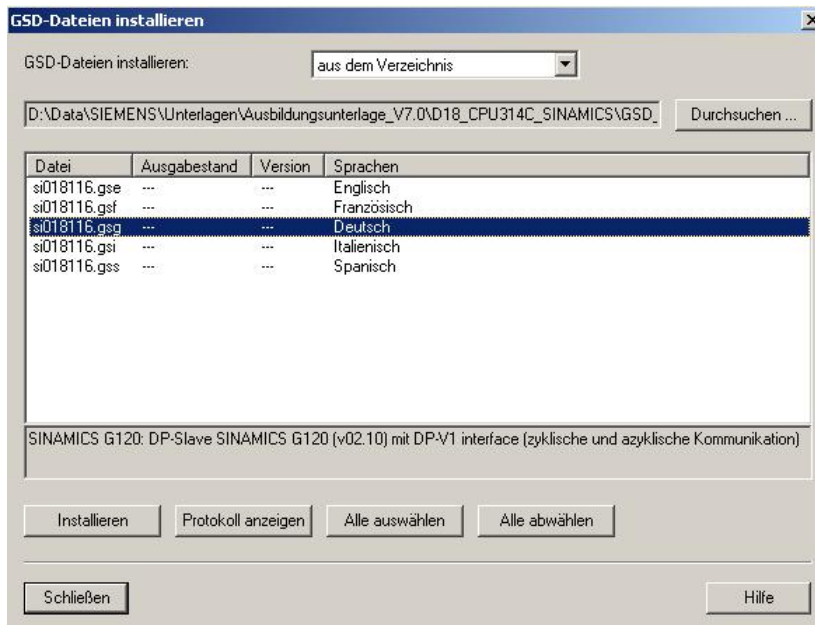
16. If you can't locate the SINAMICS G120 in the hardware catalog under the item PROFIBUS-DP, its device description data (GSD) has to be installed. To this end, select the menu 'Options' in the tool 'HWConfig', and then 'Install GSD files'. (→ Extras → GSD Dateien installieren)



Note: You can download GSD files free of charge from the Internet under <http://support.automation.siemens.com>.



17. With **'Browse'**, select the path on your PC where you stored the GSD files. Then select the English version and start **'Install'**. (→ Durchsuchen → si018116.gse → Installieren)



18. Confirm the message below with **'OK'**. (→ OK)



IMPORTANT: The installation of GSD files cannot be undone. Do you want to carry out this action anyway?

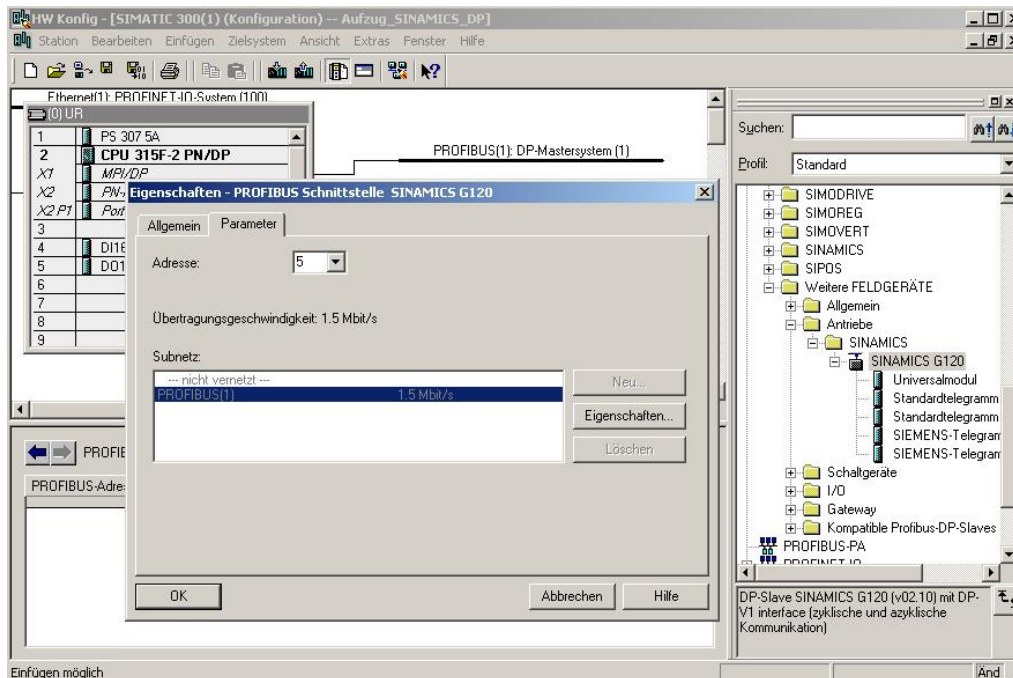
19. Confirm the next message also with **'OK'**. (→ OK)



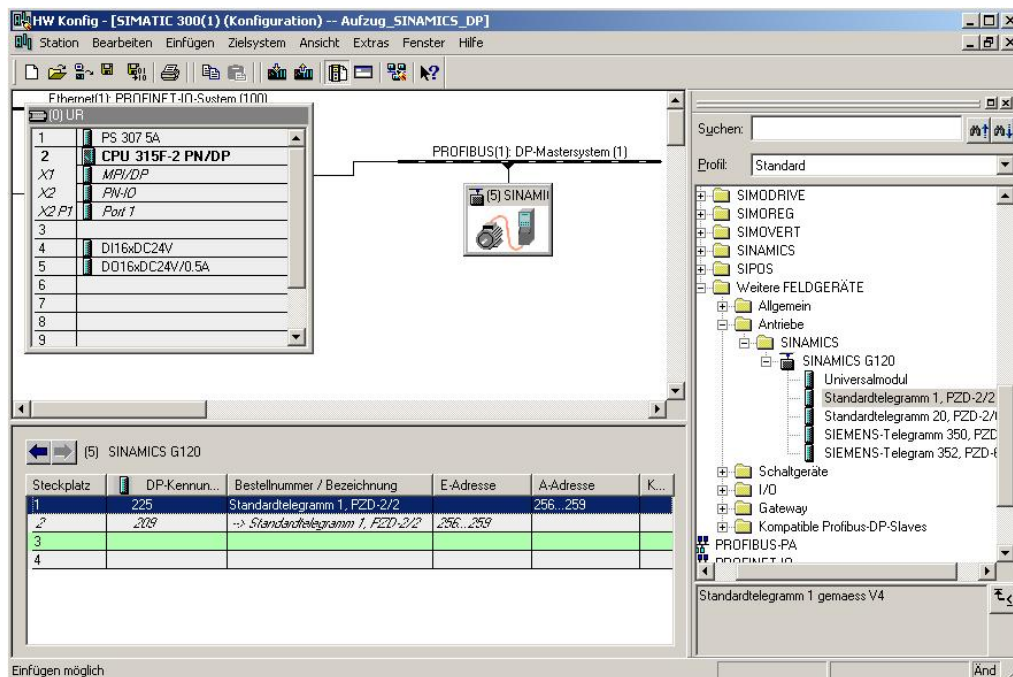
Installation was completed successfully




20. From the 'PROFIBUS DP' folder, under 'Additional field devices/Drives/SINAMICS', you can now select the 'SINAMICS G120' and drag it to the PROFIBUS network. Enter PROFIBUS Address 5 and confirm with OK. (→ Weitere Feldgeräte → Antriebe → SINAMICS → SINAMICS G120 → 5 → OK)



21. Select 'Standard Telegramm 1, PZD 2/2' and drag it to Slot 1 of the SINAMICS G120 (→ Standardtelegramm 1, PZD 2/2)





22. By clicking on , the configuration table is saved and compiled. (→ )

The screenshot shows the HW Config interface for a SIMATIC 300 system. The main window displays a rack configuration for 'F1hemel(1): PROFIBUS DP-Mastersystem (100)'. The rack contains the following modules:

Slot	Module
1	PS 307 5A
2	CPU 315F-2 PN/DP
X1	MP/DP
X2	PN-IO
X2 P1	Port 1
3	
4	DI16xDC24V
5	DO16xDC24V/0.5A
6	
7	
8	
9	

The PROFIBUS DP-Mastersystem (1) is connected to a SINAMICS G120 drive. The drive configuration table is shown below:

Steckplatz	DP-Kennun...	Bestellnummer / Bezeichnung	E-Adresse	A-Adresse	K...
1	225	Standardtelegramm 1, PZD-2/2		256...259	
2	208	→ Standardtelegramm 1, PZD-2/2	256...259		
3					
4					

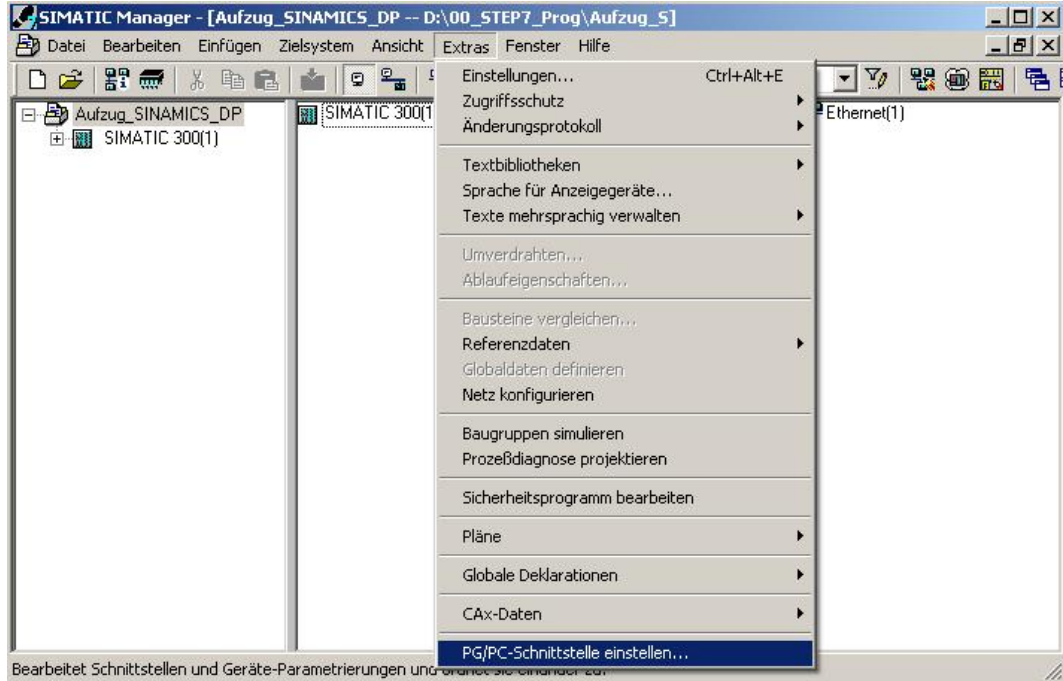
The right-hand pane shows the project tree with the following structure:

- Suchen: []
- Profil: Standard
- SIMODRIVE
- SIMOREG
- SIMOVERT
- SINAMICS
- SIPOS
- Weitere FELDERGÄTE
 - Allgemein
 - Antriebe
 - SINAMICS
 - SINAMICS G120
 - Universalmodul
 - Standardtelegramm 1, PZD-2/2
 - Standardtelegramm 20, PZD-2/1
 - SIEMENS-Telegramm 350, PZD-
 - SIEMENS-Telegramm 352, PZD-
- Schaltgeräte
- I/O
- Gateway
- Kompatible Profibus-DP-Slaves

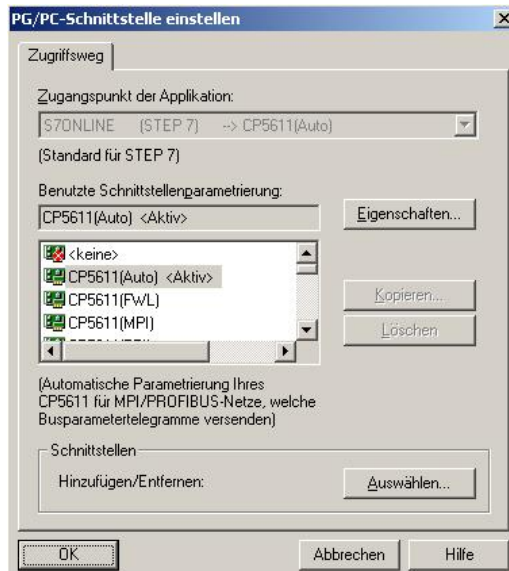
- PROFIBUS-PA
- PROFINET IO
- Standardtelegramm 1 gemäss V4



23. In order to access the CPU315F 2PN/DP and later the frequency converter SINAMICS G120 by means of PROFIBUS and also the MPI, the PG/PC interface has to be set to [Auto]. This is done in the '**SIMATIC Manager**' in the menu '**Options**', '**Set PG/PC interface**'. (→ SIMATIC Manager → Extras → PG/PC Schnittstelle einstellen)

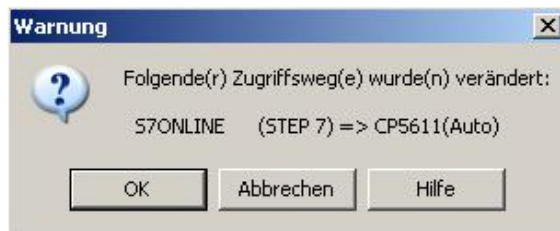


24. With your MPI card/adaptor, select [Auto] as interface. For example, '**CP5611[Auto]**', and accept with '**OK**'. (→ CP5611[Auto] →OK)





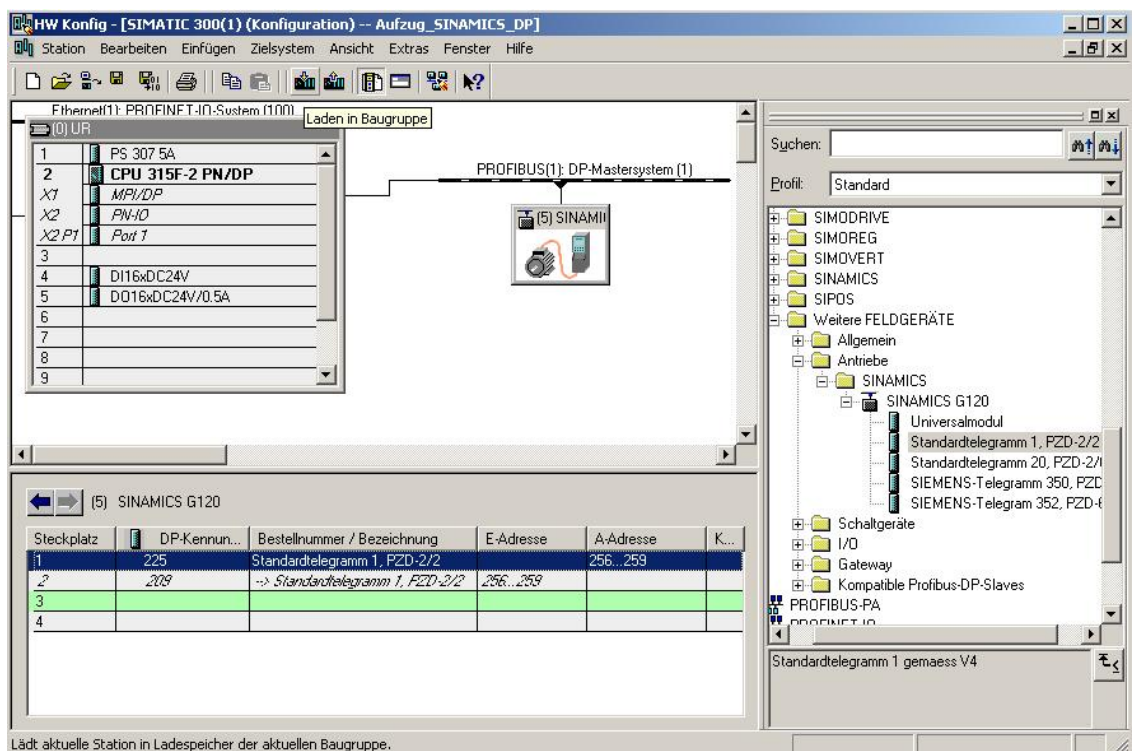


25. Confirm the change of the access path to CP5611[Auto] with 'OK'. (→ OK)



The following access path(s) was/were changed

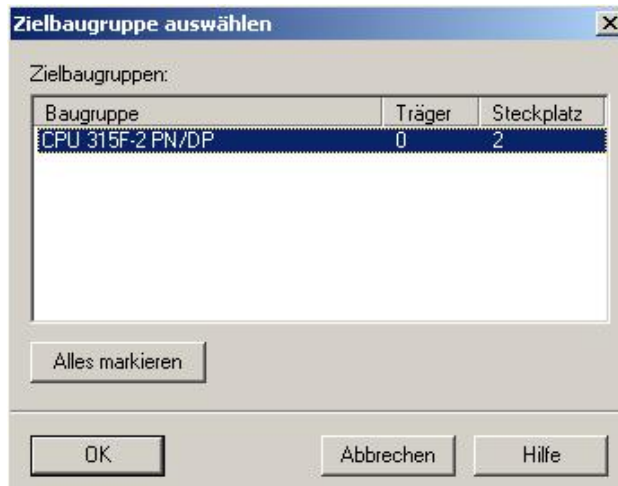
26. By clicking on , load the configuration table to the PLC. The CPU's operating mode switch should be on Run! (→ )



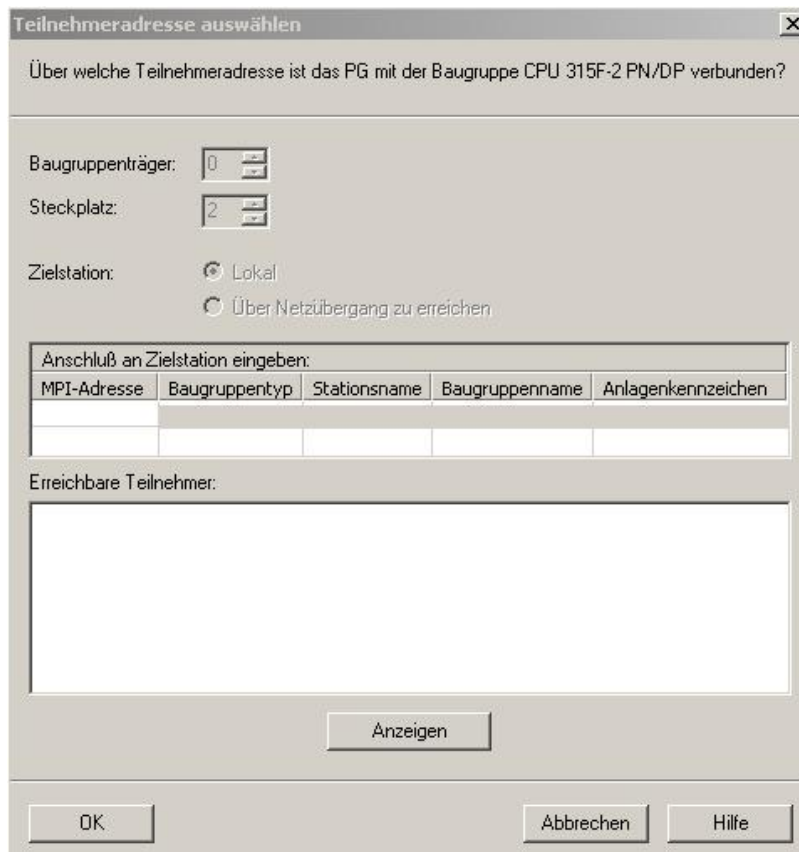
Note: Make sure your programmer is connected to the CPU via the MPI/PROFIBUS!



27. Confirm the CPU 315F-2 PN/DP as destination module for loading the configuration table. (→ OK)

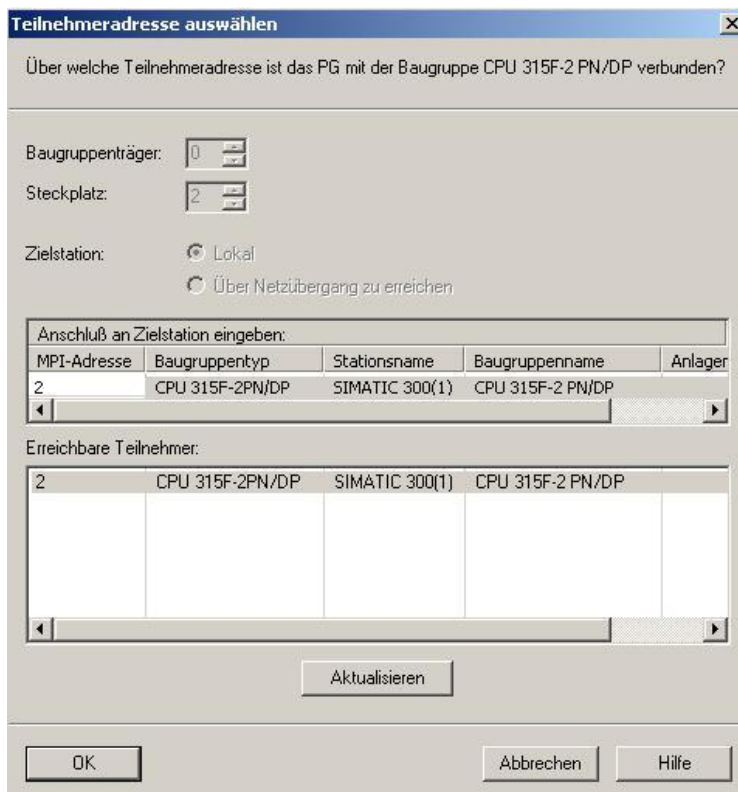


28. In the dialog box below, you can have the devices connected to the network 'display(ed)'. (→ Anzeigen)





29. Then, the MPI address of the CPU in the network is selected. If you are connected to only one CPU, just accept with 'OK'. (→ OK)



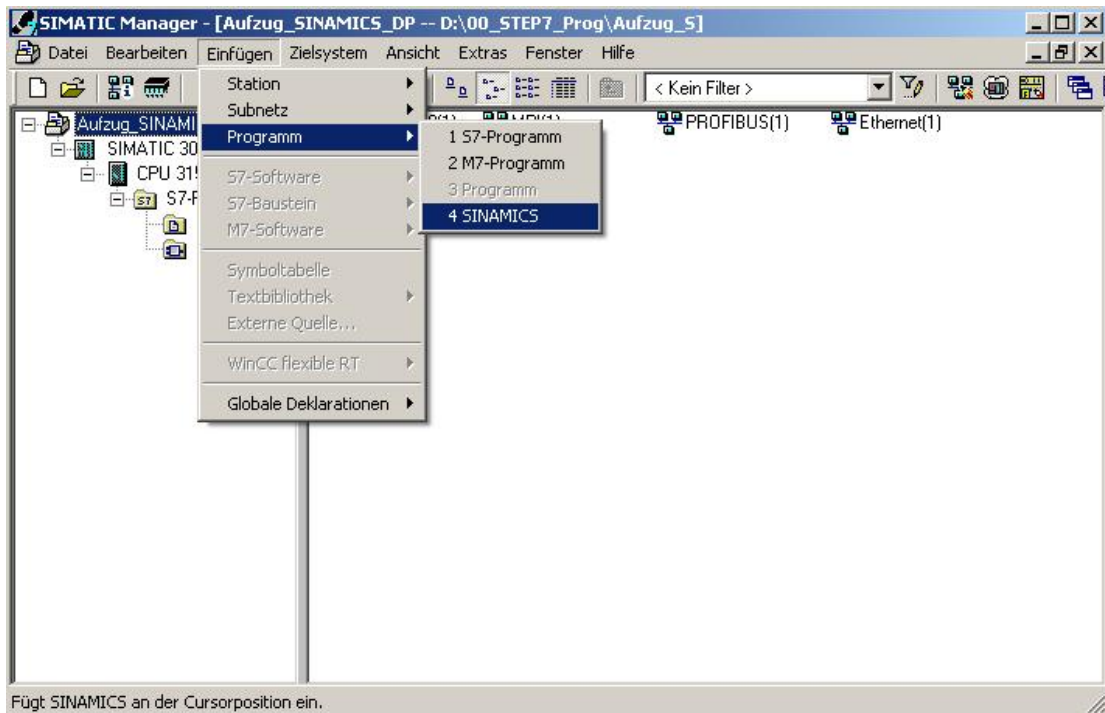
30. Confirming the dialog box below with 'Yes' starts the CPU. (→ Ja)



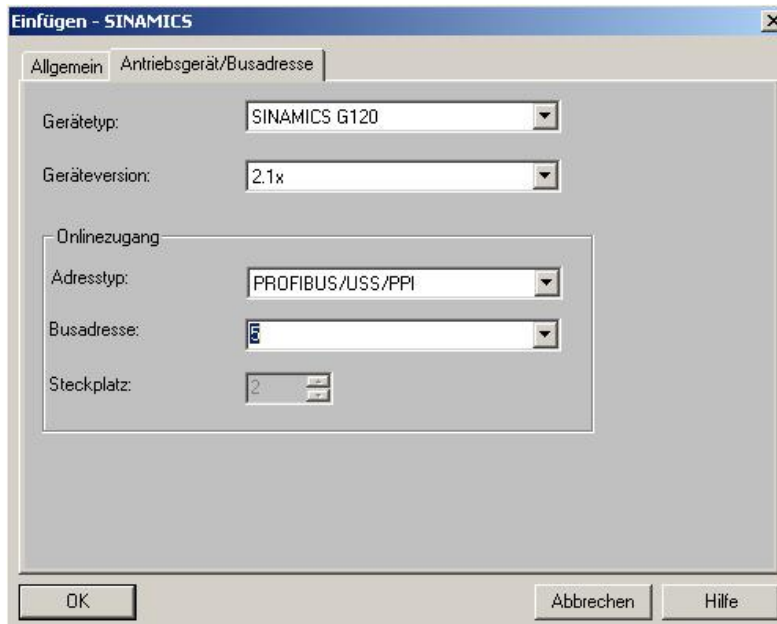
The module CPU 315F-2 PN/DP [R0/S 2] is in the STOP mode. Do you want to start the module now (restart)?



31. After the hardware configuration is created, the '**SIMATIC 300 Station**' is located in the SIMATIC Manager. The '**SINAMICS G120**' still has to be set up. (→ SIMATIC Manager → Einfügen → Programm → SINAMICS)

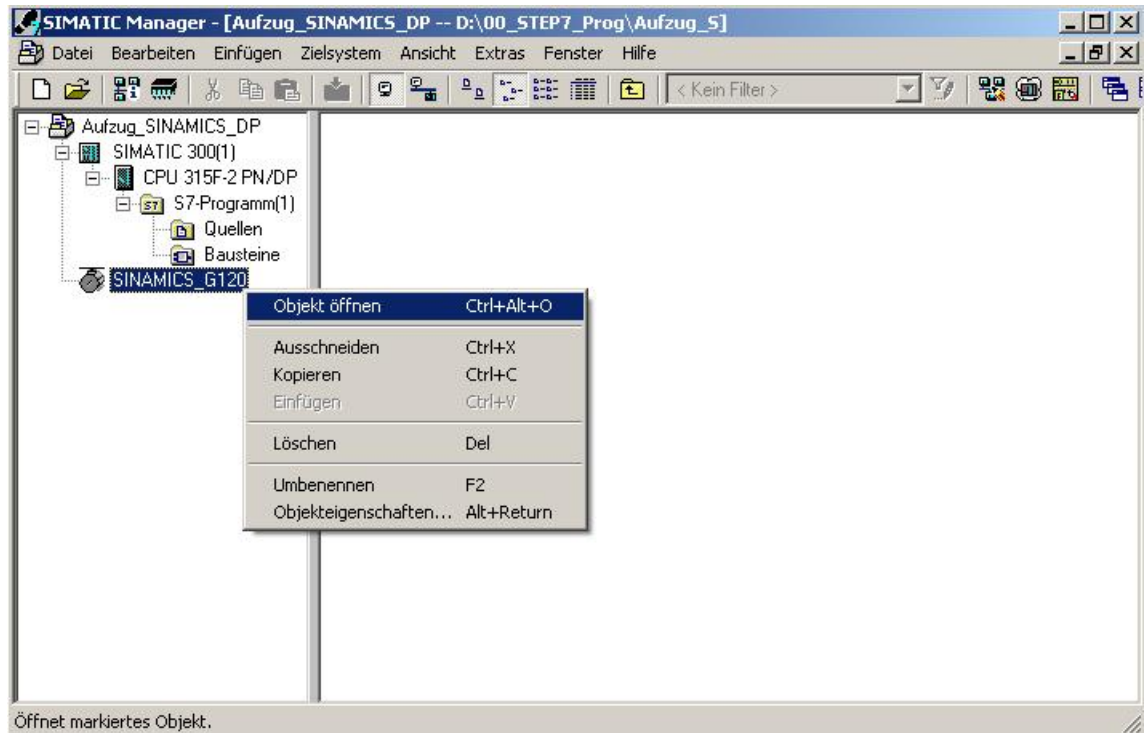


32. Now select the following: '**Device type**', '**Device version**', '**Address type**' and '**Bus address**' and accept with '**OK**'. (→ SINAMICS G120 → 2.1x → PROFIBUS/USS/PPI → 5 → OK)

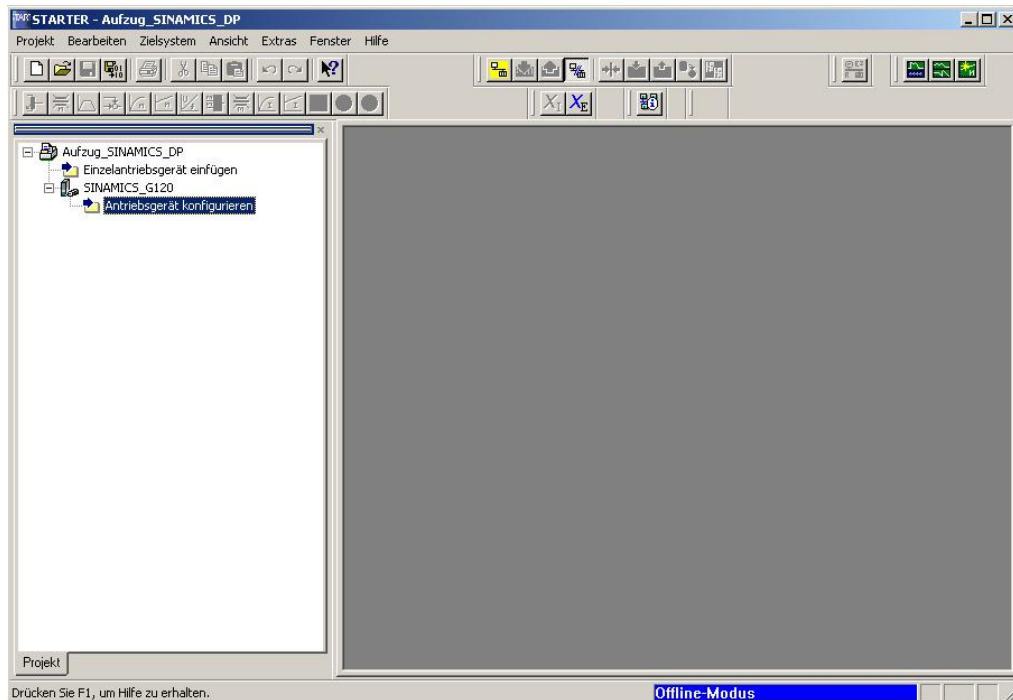




33. To configure the SINAMICS G120, the parameter assignment tool '**STARTER**' is opened with '**Open object**'. (→ SIMATIC Manager → SINAMICS_G120 → Objekt öffnen)

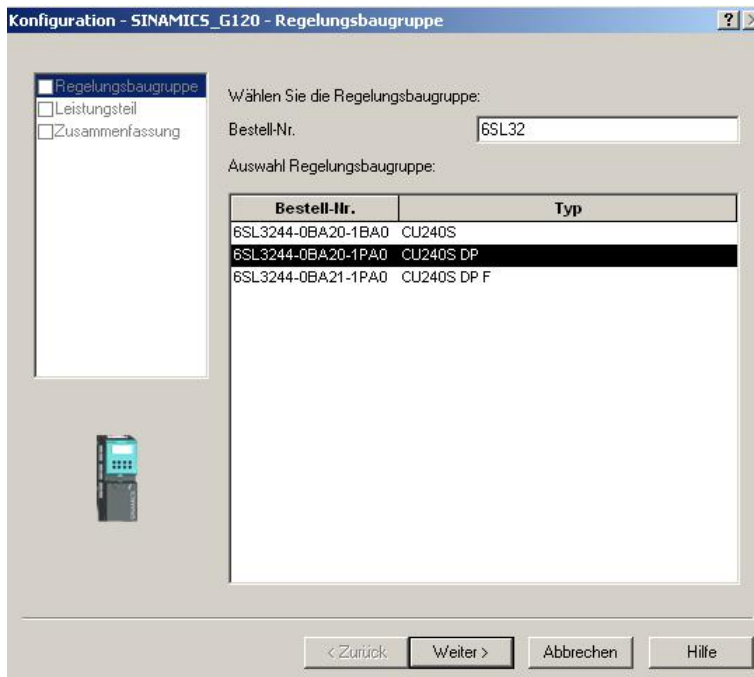


34. The software '**STARTER**' provides for a guided configuration. Start the configuration by double clicking on '**Configure drive unit**'. (→ Antriebsgerät konfigurieren)



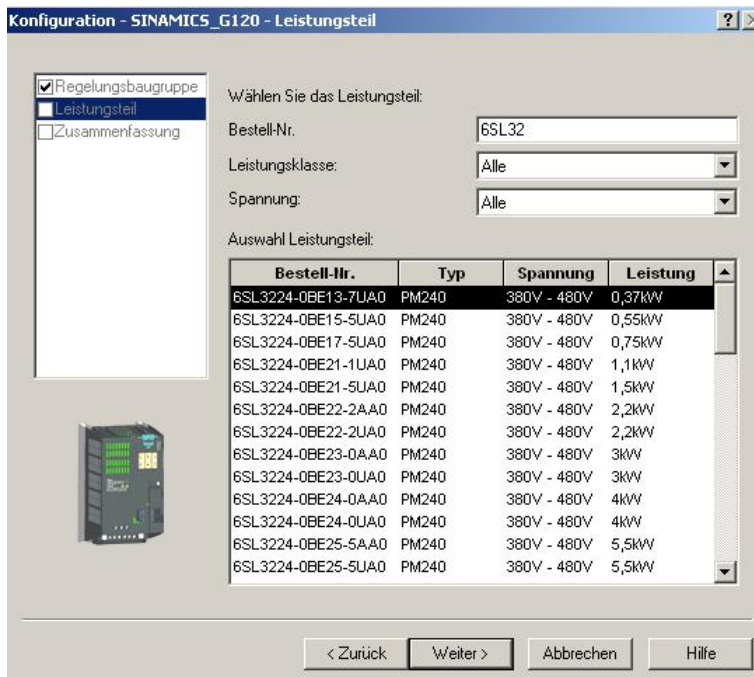


35. Now, first select your control unit based on the order number (Control Unit CU240S DP). (→ CU240S DP → Weiter >)



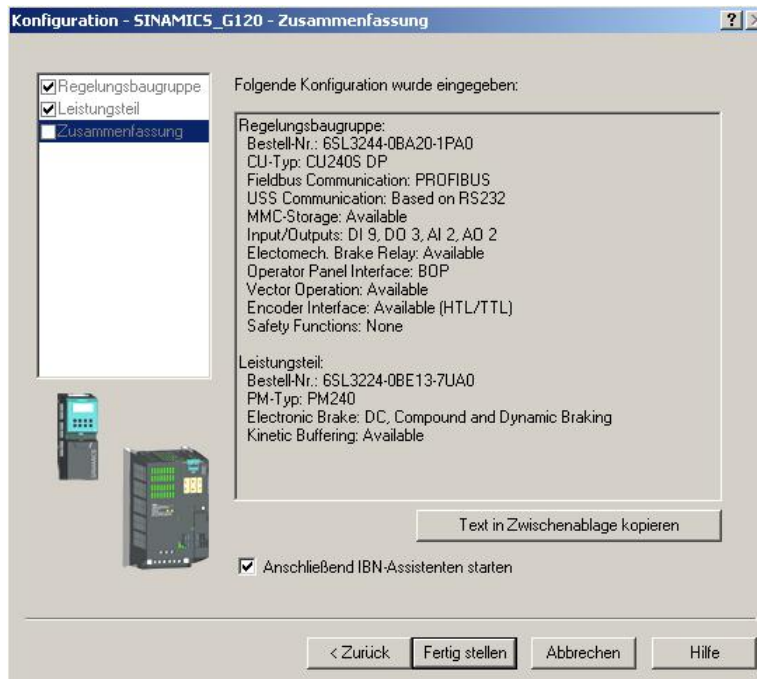
Note: For additional information about the individual items of the guided configuration, press the button 'Help' to get to Online Help for the STARTER.

36. In the dialog box below, select the power module by using the order number. (→ Weiter >)

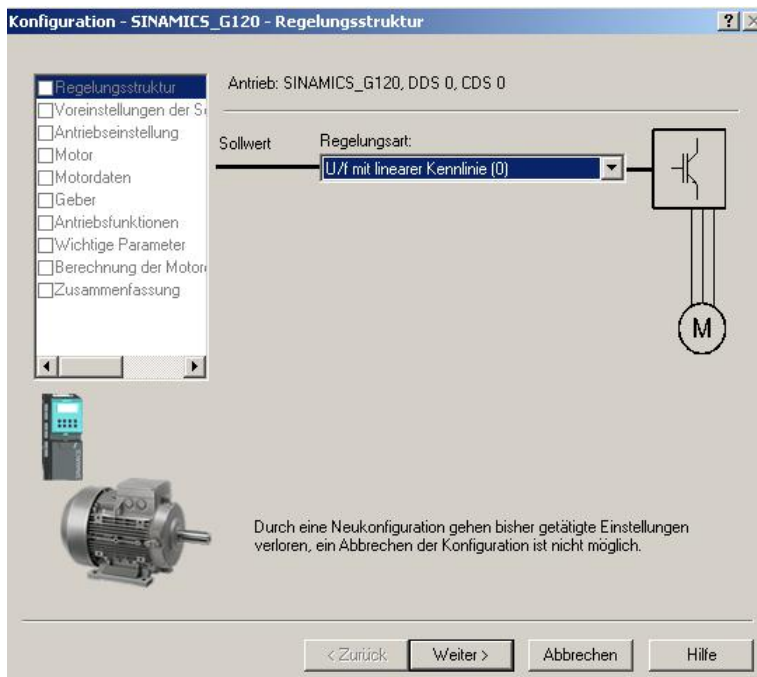




37. After you have checked your selection, select the option: **'Now start the startup wizard'**. (→ Anschließend IBN- Assistenten starten → Fertigstellen (Complete))



38. The startup wizard first offers the selection of the control mode. We are selecting here, for example, **'V/f control with linear characteristic'**. (→ U/f-Steuerung mit linearer Charakteristik → Weiter >)

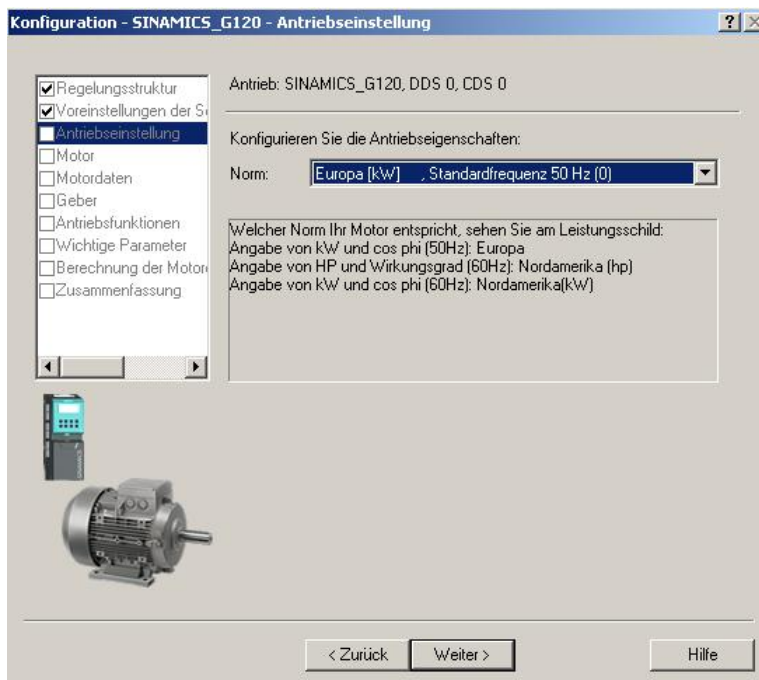




39. Then, we select as 'Command source' the 'Fieldbus(6)' and as setpoint source for the 'Speed setpoints' also 'Fieldbus(6)'. (→ Feldbus(6) → Feldbus(6) → Weiter >)

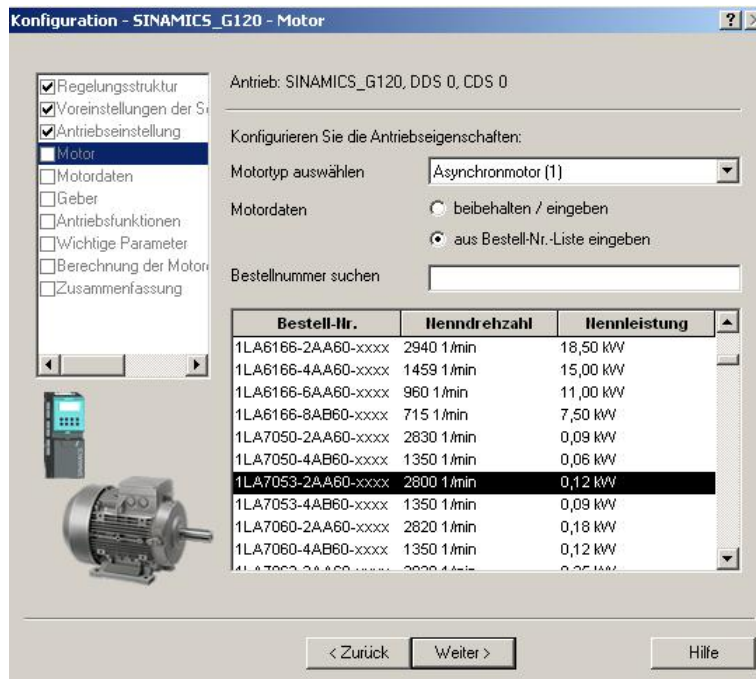


40. In the next dialog box, we select as standard 'EUROPA[kW] with the basic motor frequency of 50Hz' for the 'Drive properties'. (→ EUROPA[kW], Motor-Grundfrequenz ist 50Hz(0) → Weiter >)

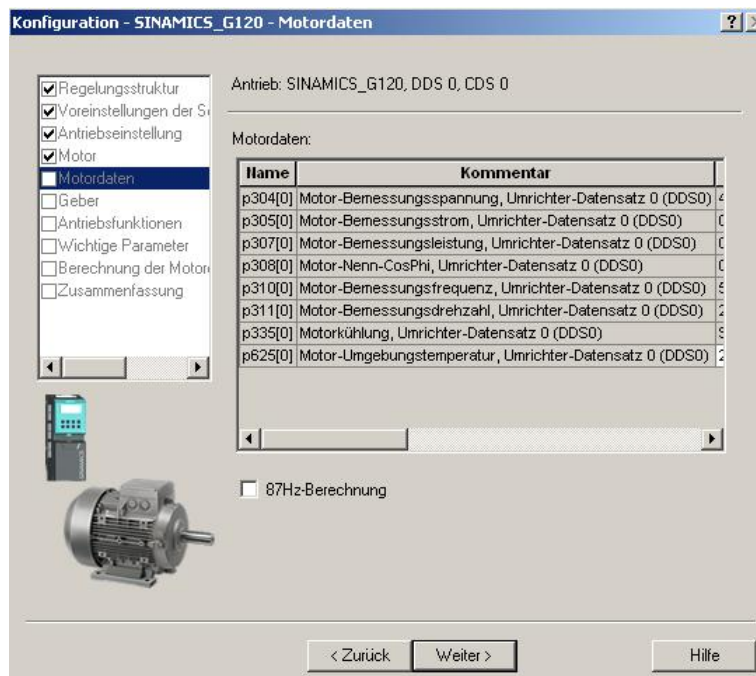




41. Now, select the 'Motor type'. If you have a SIEMENS motor, you can enter it from 'Enter Order Number List'. (→ aus Bestell- Nr.-Liste eingeben → Weiter >)

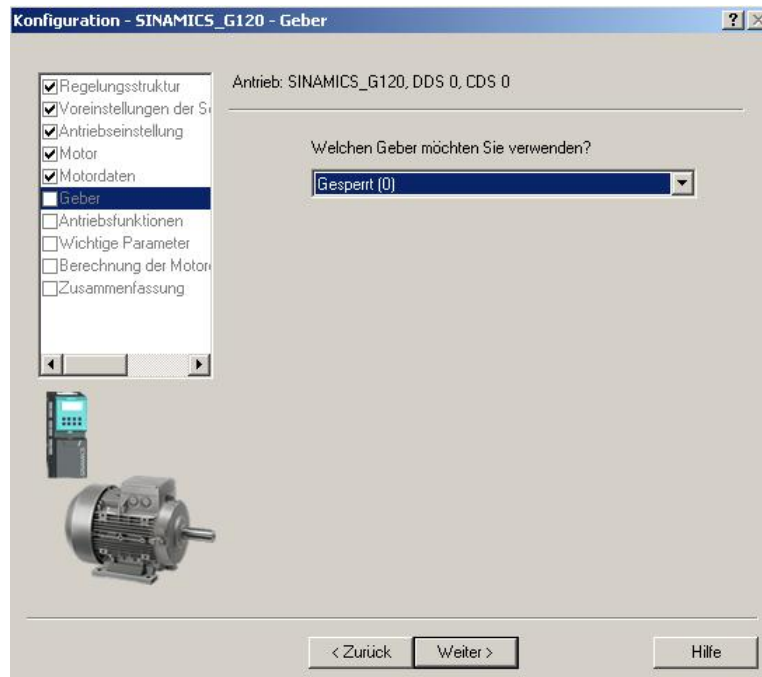


42. The motor data is displayed in the following dialog box. (→ Weiter >)

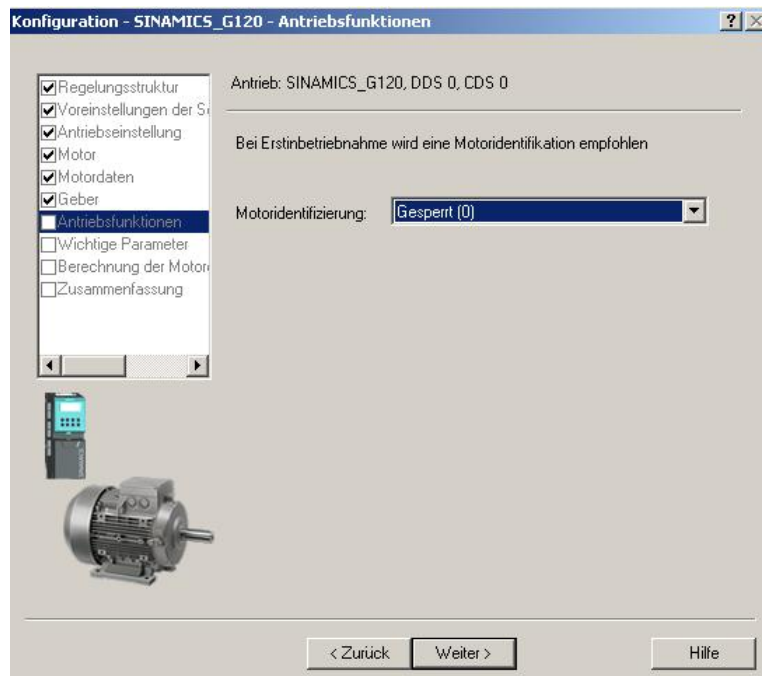




43. If you connected an encoder, you have to select it now, or select '**Disabled(0)**'. (→ Gesperrt(0) → Weiter >)

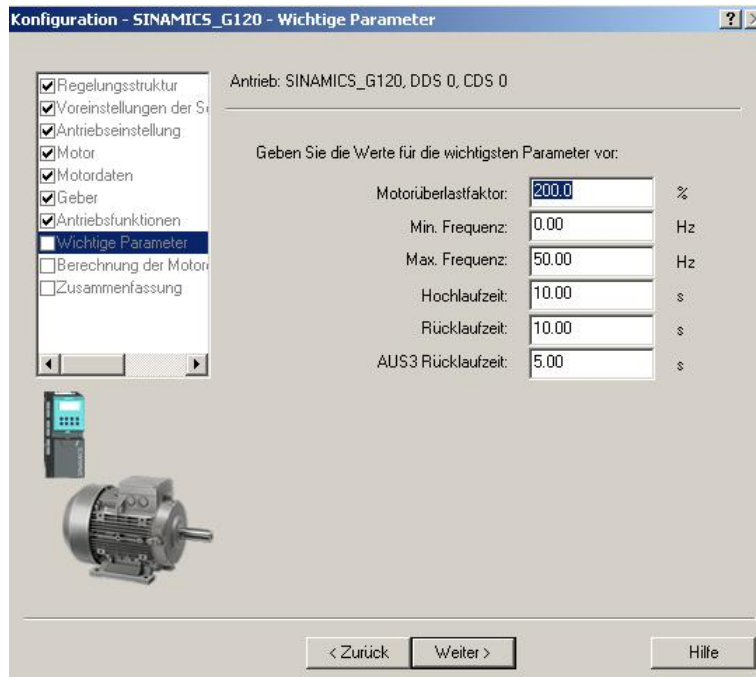


44. For optimized control, a '**Motor identification**' can be executed. If it is '**disabled**', processing is possible with approximated data by using the data of the motor type label.(→ Gesperrt(0) → Weiter >)

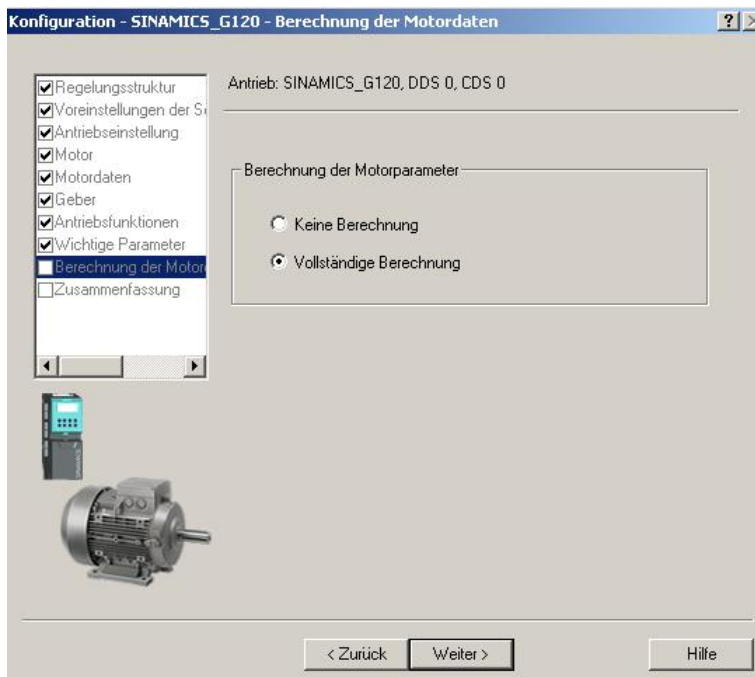




45. Now, important parameters can be set such as '**Motor overload factor**', '**Min. and Max. Frequency**', '**Acceleration and deceleration time**' as well as the '**OFF3 ramp down time**' for quick stops. (→ Weiter >)

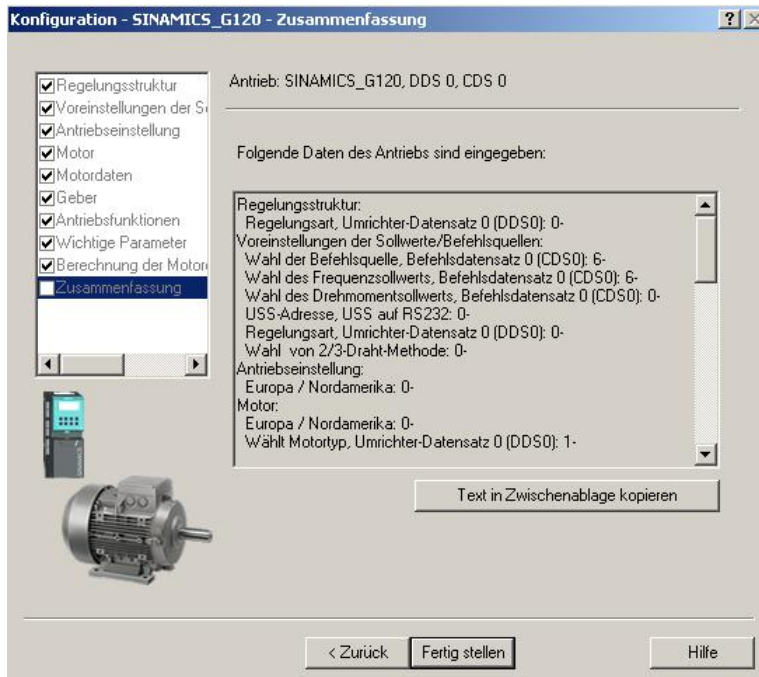


46. In the dialog box below, it is recommended to select the '**Complete calculation**' of the motor parameters (→ Vollständige Berechnung → Weiter >)

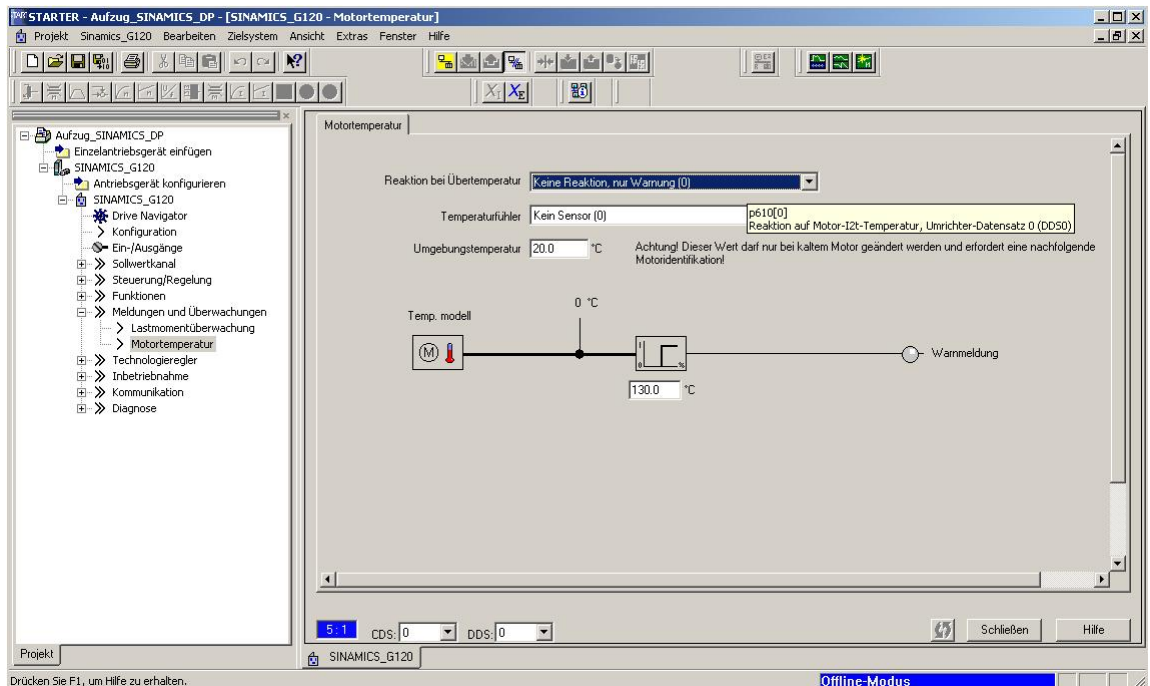




47. Finally, the entered data for the drive is displayed and the configuration can be accepted with 'Complete'. (→ Fertig stellen)





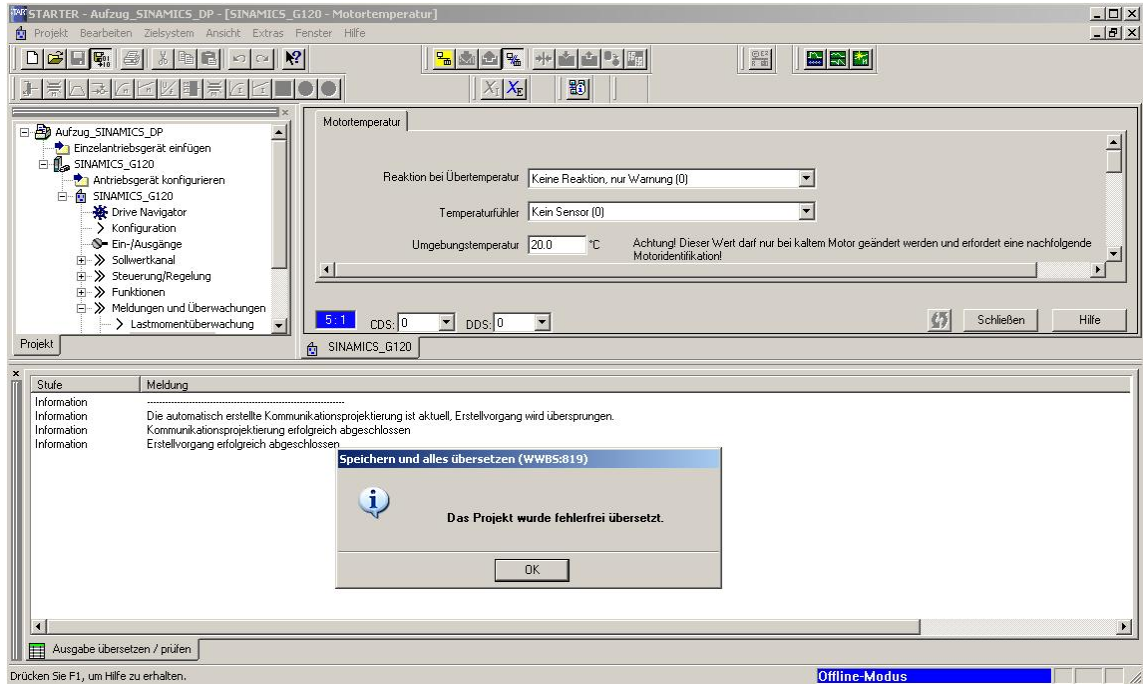
48. Dialog boxes for setting additional parameters can be selected to the left in the project tree with a double click. (→ for example, Motortemperatur)



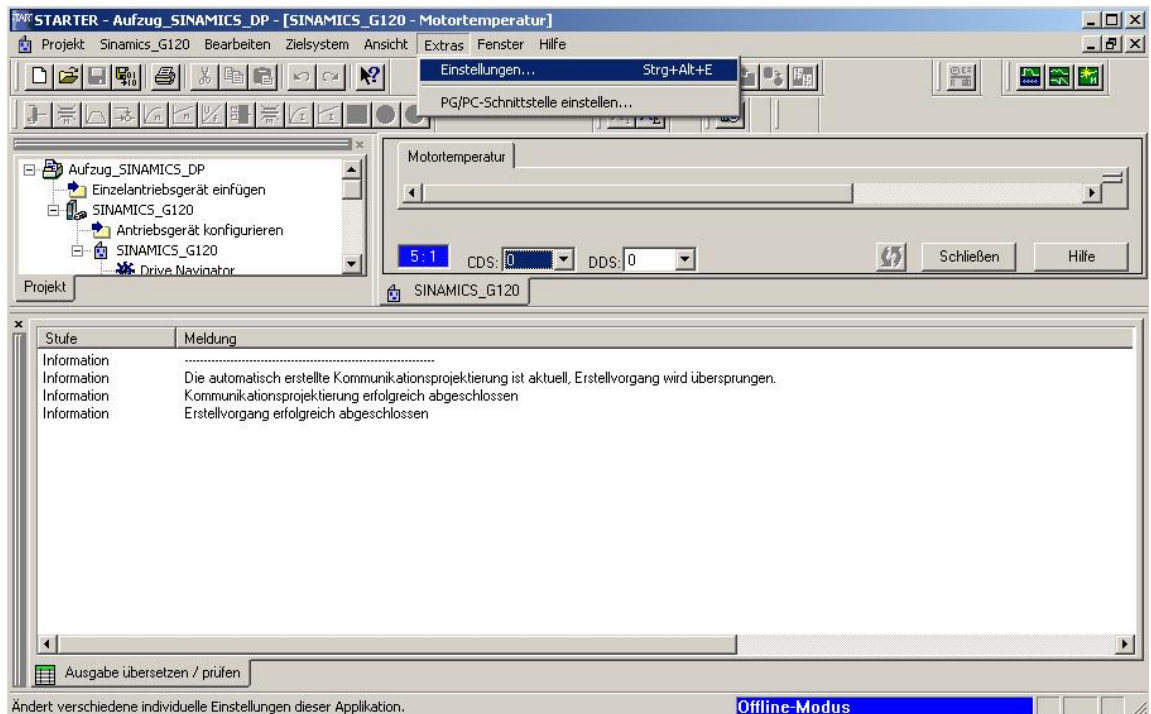
Note: If you place the mouse pointer over the parameter fields, you will get in the "Tool tip" the respective parameter number with the most important information.



49. By clicking on , the configuration is saved and compiled (→  → OK)



50. Before we can load the data to the frequency converter SINAMICS G120, we have to set the interface. (→ Extras → Einstellungen)

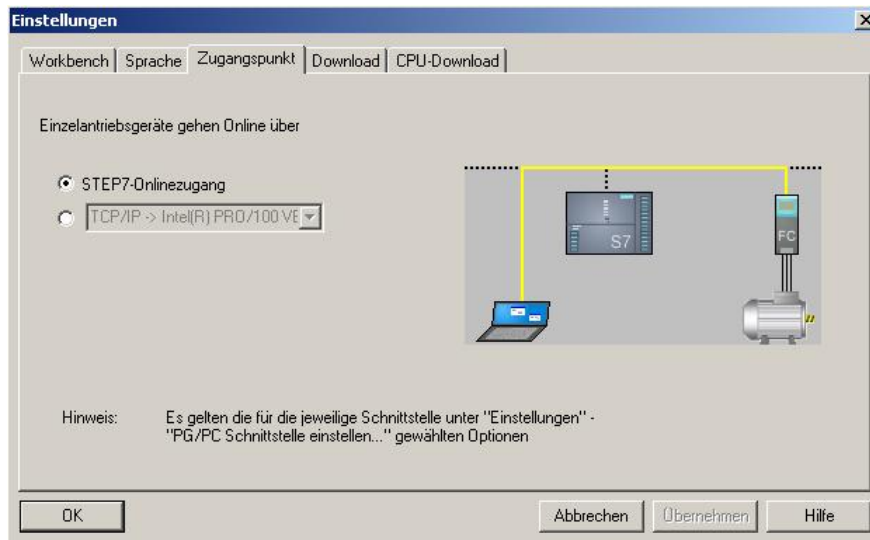




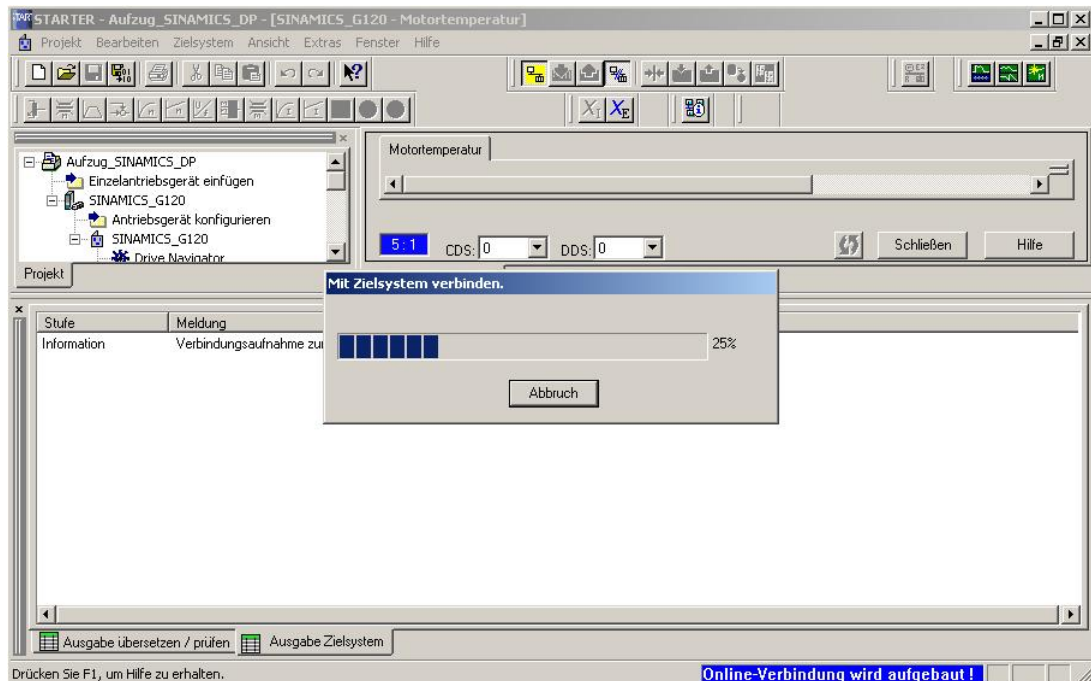
51. If we select here as 'Access point' the 'STEP7 Online access', we can use the settings in STEP7 and don't have to make any other changes.
 (→ Access point → STEP7 Onlinezugang → OK)



Note: A precondition here is that in the SINAMICS G120, the PROFIBUS address is preset to 5 with parameter 918.





52. By clicking on the 'Mit Zielsystem verbinden' (Connect to Target System) button, we are establishing a connection to the target system, the SINAMICS G120. (→)



Note: Make sure that your programmer is connected to the CPU via PROFIBUS!



53. By clicking on , the configuration can now be loaded to the SINAMICS G120. **'After loading, copy the RAM to the ROM'** should be selected. (→  → 'Nach dem Laden RAM nach ROM kopieren' → Ja)

Projekt

Stufe | Zeit | Quelle | Meldung

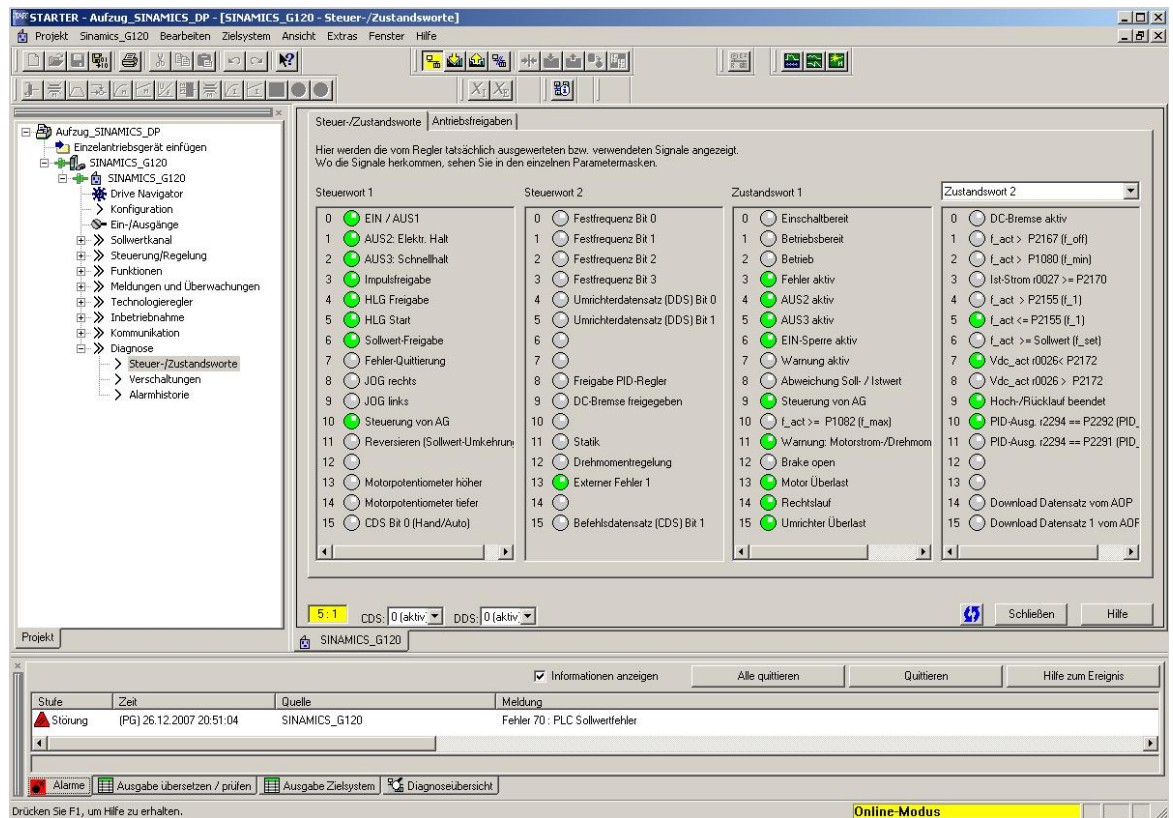
Störung	(PG) 26.12.2007 20:48:40	SINAMICS_G120	Fehler 70 : PLC Sollwertfehler
---------	--------------------------	---------------	--------------------------------

Alarmer | Ausgabe übersetzen / prüfen | Ausgabe Zielsystem | Diagnoseübersicht

Drücken Sie F1, um Hilfe zu erhalten. **Online-Modus**



54. For error search and further startup -as long as we are connected to the target system- we can select in the project tree under '**Diagnosis**' the view of the '**Control/status words**' for example. (→ Diagnose → Steuer-/Zustandsworte)



Note: Alarms are displayed in the footer of the STARTER. Here, after an error, the required acknowledgement can be made also.

5. STARTING UP THE FREQUENCY CONVERTER SINAMICS G120 ON THE PROFINET



Below, the startup of a PROFINET network with the CPU 315F-2 PN/DP as IO controller and the frequency converter SINAMICS G120 as IO device is described. We are creating the hardware configuration for the SIMATIC S7 and assigning parameters to the SINAMICS G120 as follows:

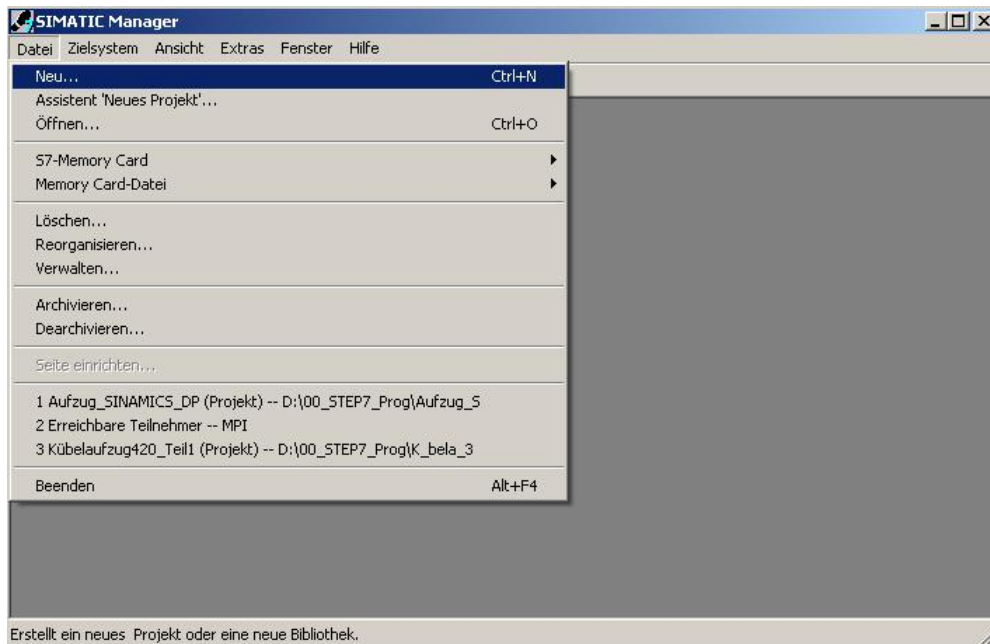


1. The central tool in STEP 7 is the '**SIMATIC Manager**'. It is called here with a double click. (→ SIMATIC Manager)



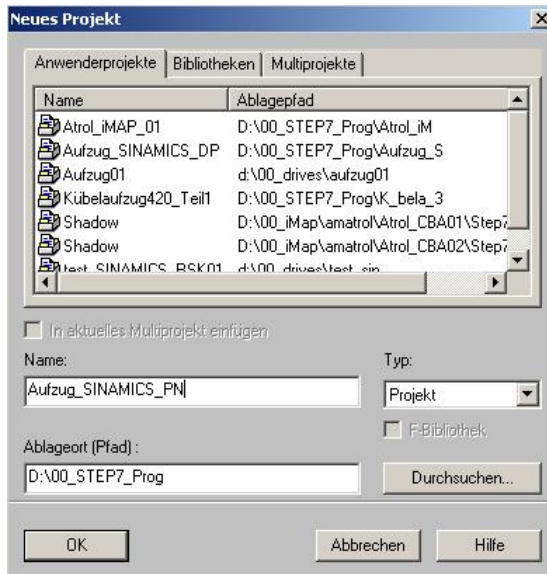
SIMATIC Manager

2. STEP7 programs are managed in projects. We are now setting up such a project. (→ File → New)

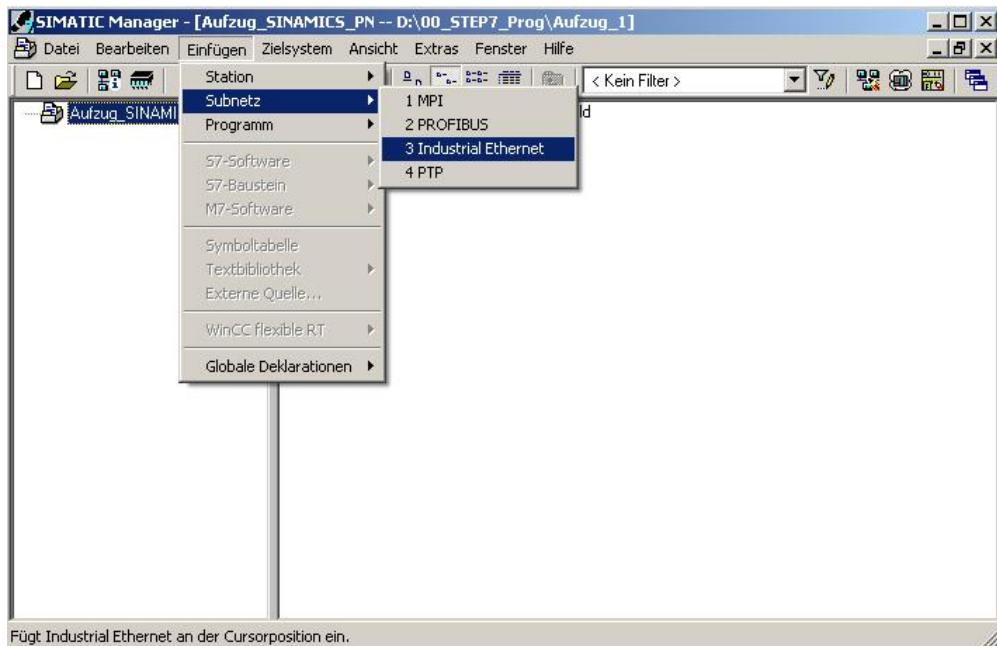




- The project is now assigned the 'Name' 'Elevator_SINAMICS_PN' (→ Aufzug_SINAMICS_PN → OK)

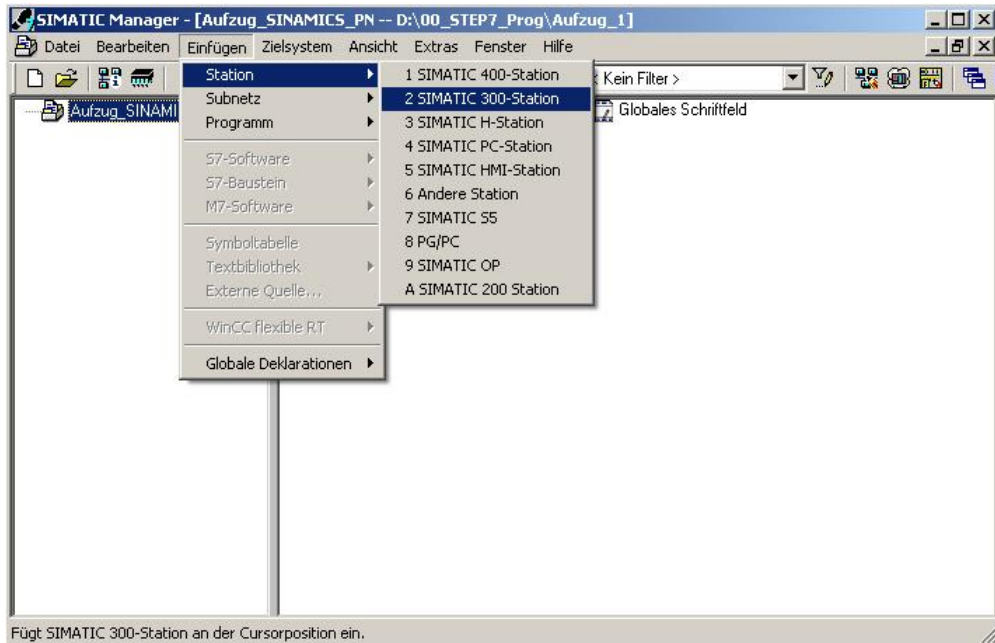


- Highlight your project and insert an 'Industrial Ethernet Subnet' (→ Aufzug_SINAMICS_PN → Einfügen → Subnetz → Industrial Ethernet).

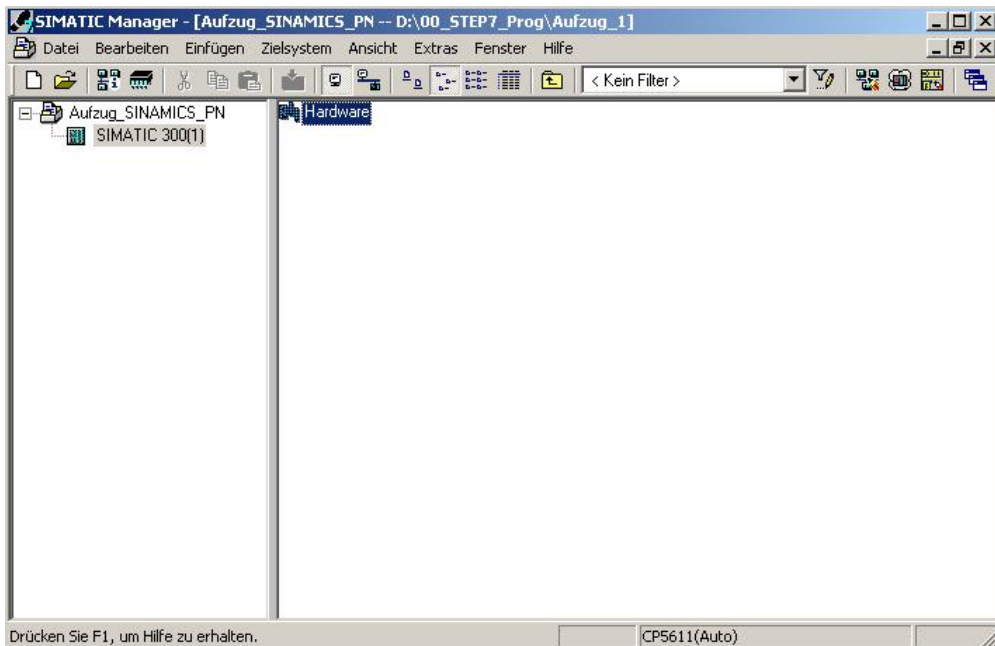




5. Then, a '**SIMATIC 300 Station**' is inserted. (→ Einfügen → Station → SIMATIC 300-Station)



6. With a double click, open the configuration tool for the '**Hardware**'. (→ Hardware)





7. Open the hardware catalog by clicking on . (→)

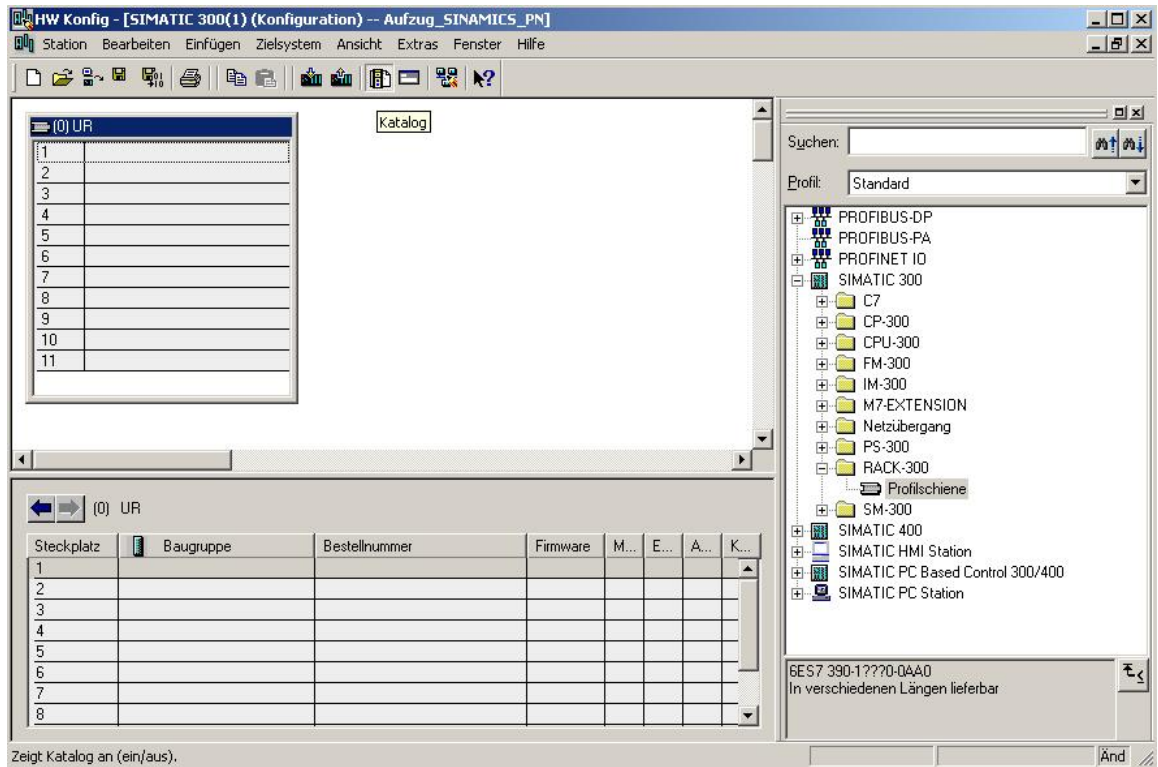
There, arranged in the following directories:

PROFIBUS DP, PROFIBUS PA, PROFINET IO, SIMATIC 300, SIMATIC 400,
SIMATIC PC Based Control, and SIMATIC PC Station,

all racks, modules and interface modules are provided for configuring your hardware.

Insert 'Rail' with a double click. (→ SIMATIC 300 → RACK 300

→ Rail).



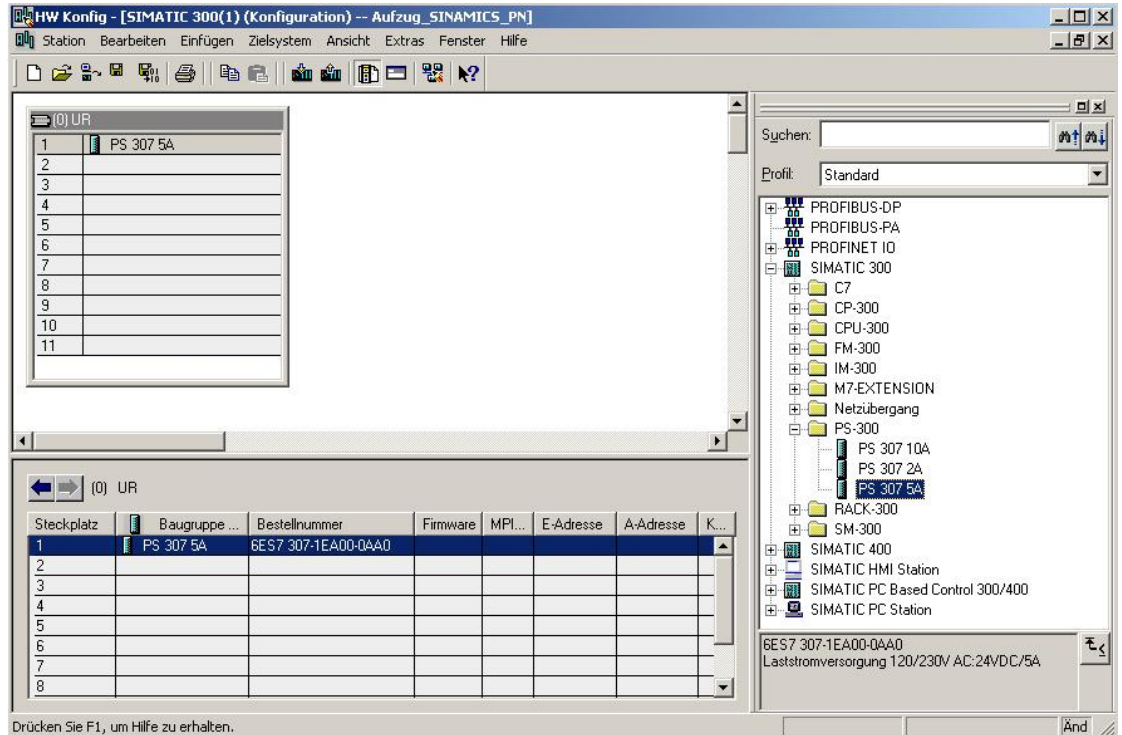
After that, a configuration table is displayed automatically for configuring Rack 0.



8. From the hardware catalog, you can now select all modules that are also in your real rack, and insert them in the configuration table.

To this end, click on the name of the respective module, hold the mouse key and drag the module to a line in the configuration table.

We are starting with the power unit 'PS 307 2A'. (→ SIMATIC 300 → PS-300 → PS 307 5A)

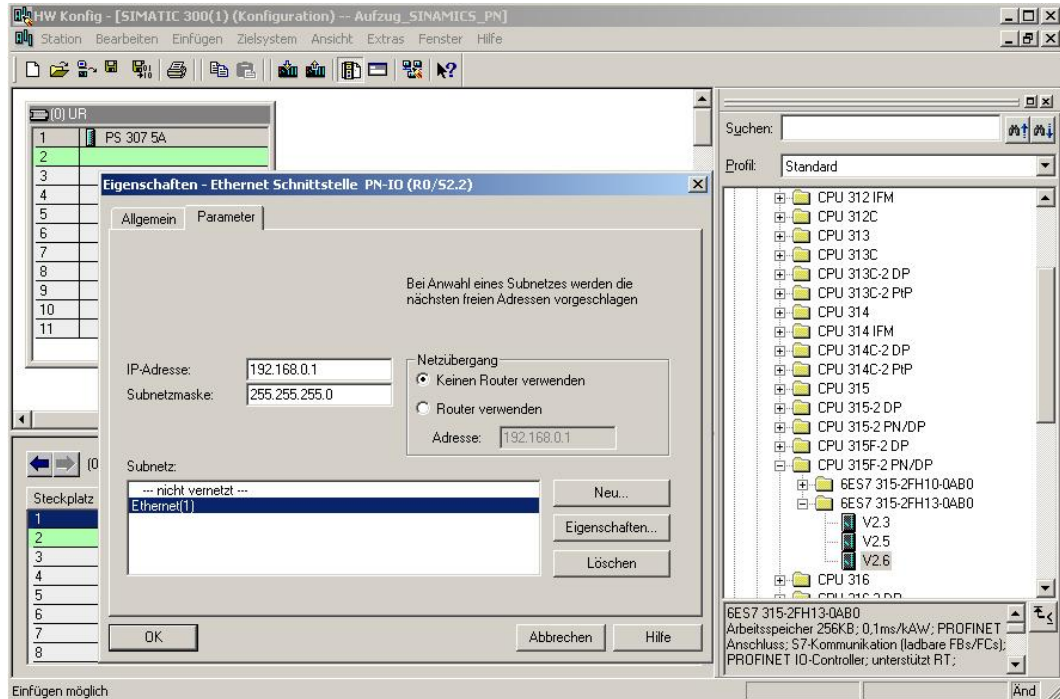


Note: If your hardware differs from the one displayed here, simply select the corresponding modules from the catalog and insert them in your rack. The order numbers of the individual modules -that are also indicated on the components- are displayed in the footer of the catalog



9. Next, we are dragging the '**CPU 315F-2 PN/DP**' to the second slot . The order number and the version of the CPU can be read off the front of the CPU. (→ SIMATIC 300 → CPU-300 → CPU 315F-2 PN/DP → 6ES7 315-2FH13-0AB0 → V2.6).

When entering the CPU, a window appears in which you assign an '**IP address**' to the CPU315F-2 PN/DP, specify the '**Subnet screen form**' and select the '**Ethernet**' that has already been generated. Optional: for general communication, a '**Router address**' can be selected also. Confirm your inputs with '**OK**' (→ IP Adresse: 192.168.0.1 → Subnetzmaske: 255.255.255.0 → Ethernet(1) → Keinen Router verwenden (don't use a router) → OK)





Notes on Networking on the Ethernet (additional information is provided in Appendix V of the training document):

MAC Address:

The MAC address consists of a permanent and a variable part. The permanent part ("Basis MAC Address") identifies the manufacturer (Siemens, 3COM, ...). The variable part of the MAC address differentiates the different Ethernet stations, and should be assigned uniquely world-wide. On each module, a MAC address specified by the factory is imprinted.

Value range for the IP address:

The IP address consists of 4 decimal numbers from the value range 0 to 255 which are separated by a period; for example 141.80.0.16

Value range for the subnet screen form:

This screen form is used in order to recognize whether a station or its IP address is part of the local subnet, or can be accessed only by means of a router.

The subnet screen form consists of 4 decimal numbers from the value range 0 to 255 which are separated by a period; for example, 255.255.0.0

In their binary representation, the 4 decimal numbers of the subnet screen form have to contain from the left a series of gapless values "1" and from the right a series of gapless values "0".

The values "1" determine the area of the IP address for the network number. The values "0" determine the area of the IP address for the station address.

Example:

Correct values: 255.255.0.0 decimal = 1111 1111.1111 1111.0000 0000.0000 0000 binary
 255.255.128.0 decimal = 1111 1111.1111 1111.1000 0000.0000 0000 binary
 255.254.0.0 decimal = 1111 1111.1111 1110.0000 0000.0000.0000 binary
 Incorrect value: 255.255.1.0 decimal = 1111 1111.1111 1111.0000 0001.0000 0000 binary

Value range for the address of the network transition (Router):

The address consists of 4 decimal numbers from the value range 0 to 255 which are separated by a period; for example, 141.80.0.1.

Relationship of IP addresses, router address, and subnet screen form:

The IP address and the address of the network transition may differ only in positions that have a "0" in the subnet screen form.

Example:

You entered: for the subnet screen form 255.255.255.0; for the IP address 141.30.0.5, and for the router address 141.30.128.1.

The IP address and the address for the network transition are to have a different value only in the 4th decimal number. In the example, however, the 3rd position already differs.

In the example, you have to change alternatively:

- the subnet screen form to: 255.255.0.0 or
- the IP address to: 141.30.128.5 or
- the address of the network transition to: 141.30.0.1



10. Drag the digital input module with 16 inputs to Slot 4. (→ SM 321 DI 16xDC2 4V)

The screenshot shows the HW Config interface for a SIMATIC 300 rack. The rack configuration is as follows:

Steckplatz	Baugruppe ...	Bestellnummer	Firmware	MPI...	E-Adresse	A-Adresse	K...
1	PS 307 5A	6ES7 307-1EA00-0AA0					
2	CPU 315F-2 PN	6ES7 315-2FH13-0AB0	V2.6	2	2047*		
X1	MPI/DP				2046*		
X2	PN-IO				2045*		
X2 P1	Port 1						
3							
4	DI16xDC24V	6ES7 321-1BH01-0AA0			0...1		
5							

The right-hand pane shows the component selection tree with 'SM 321 DI16xDC24V' selected. The status bar at the bottom indicates 'Drücken Sie F1, um Hilfe zu erhalten.'

11. Drag the digital output module with 16 outputs to Slot 5. (→ SM 322 DO16xDC 24V/0.5A)

The screenshot shows the HW Config interface after adding a digital output module to Slot 5. The rack configuration is updated as follows:

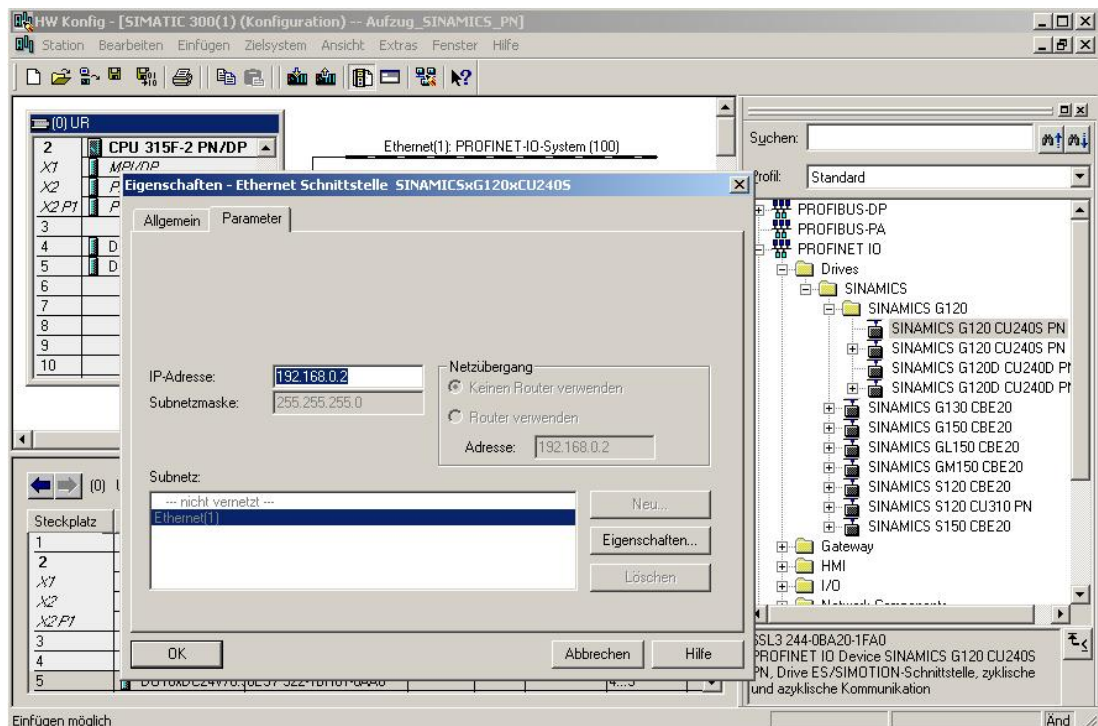
Steckplatz	Baugruppe ...	Bestellnummer	Firmware	MPI...	E-Adresse	A-Adresse	K...
1	PS 307 5A	6ES7 307-1EA00-0AA0					
2	CPU 315F-2 PN	6ES7 315-2FH13-0AB0	V2.6	2	2047*		
X1	MPI/DP				2046*		
X2	PN-IO				2045*		
X2 P1	Port 1						
3							
4	DI16xDC24V	6ES7 321-1BH01-0AA0			0...1		
5	DO16xDC24V/0.5A	6ES7 322-1BH01-0AA0				4...5	

The right-hand pane shows the component selection tree with 'SM 322 DO16xDC24V/0.5A' selected. The status bar at the bottom indicates 'Einfügen möglich'.



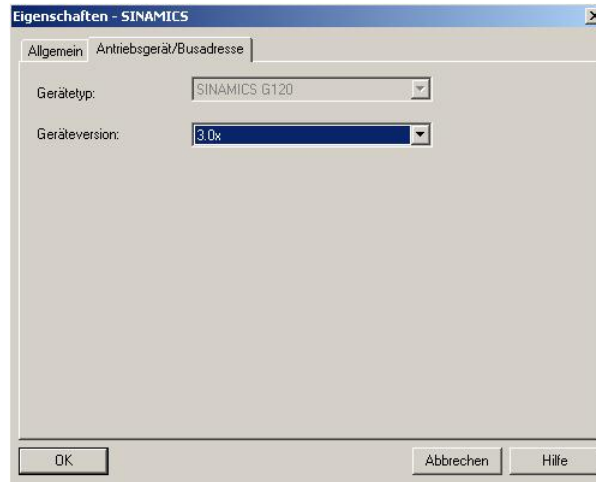
12. After you have accepted the network settings, a bar appears to the right of the CPU315F-2 PN/DP, the '**PROFINET IO System**', where you can arrange PROFINET IO devices. This is done by clicking on the desired module (here, the '**SINAMICS G120**' with '**SINAMICS G120 CU240S PN**') and dragging it from the hardware catalog in the path '**PROFINET IO**' to the '**PROFINET IO System**'. (→ PROFINET IO → Drives → SINAMICS → SINAMICS G120 → SINAMICS G120 CU240S PN).

When entering the SINAMICS G120 CU240S PN, a window appears where you assign an '**IP Address**' to the SINAMICS G120, specify the '**Subnet screen form**' and select the '**Ethernet**' that is already generated. Optional: for general communication, a '**Router Address**' can be selected. Confirm your inputs with '**OK**' (→ IP Adresse: 192.168.0.2 → Subnetzmaske: 255.255.255.0 → Ethernet(1) → Keinen Router verwenden (don't use a router) → OK)

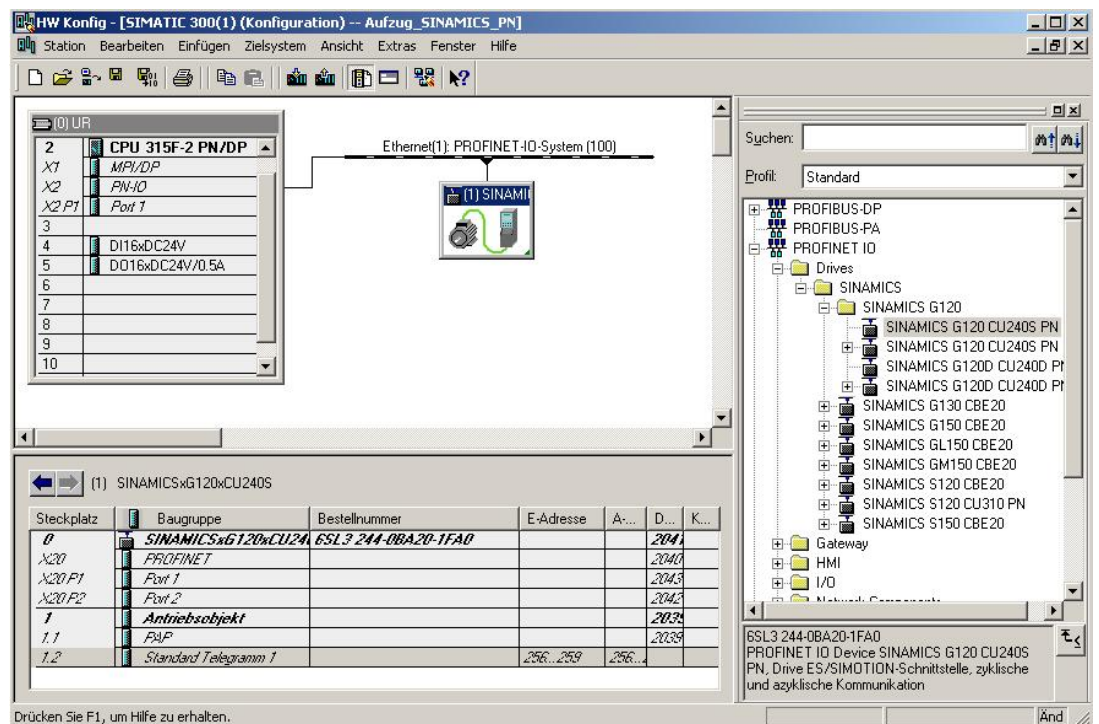




13. Now, select the 'Device version' and confirm with 'OK'. (→ V3.0x → OK)

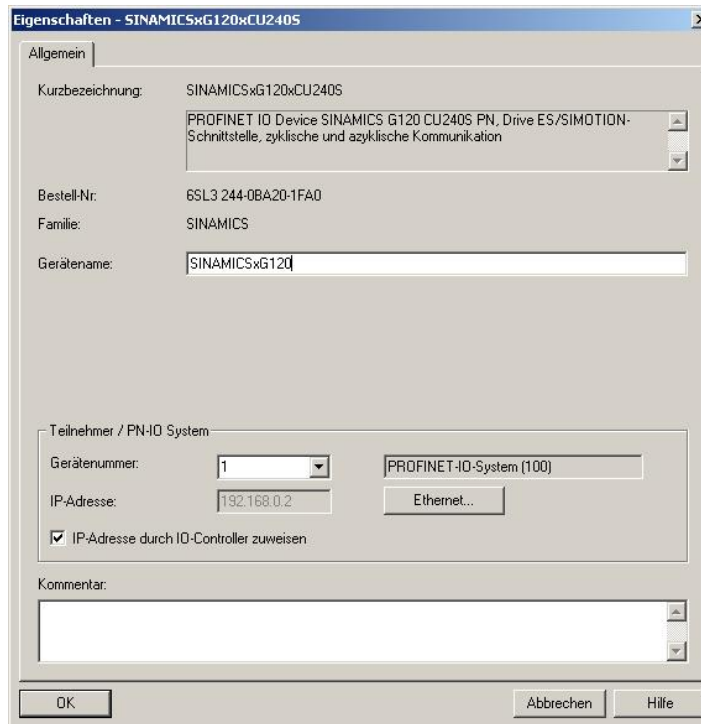




14. By double clicking on 'SINAMICSxG120xCU240S', its properties are opened. (→ SINAMICSxG120xCU240S)

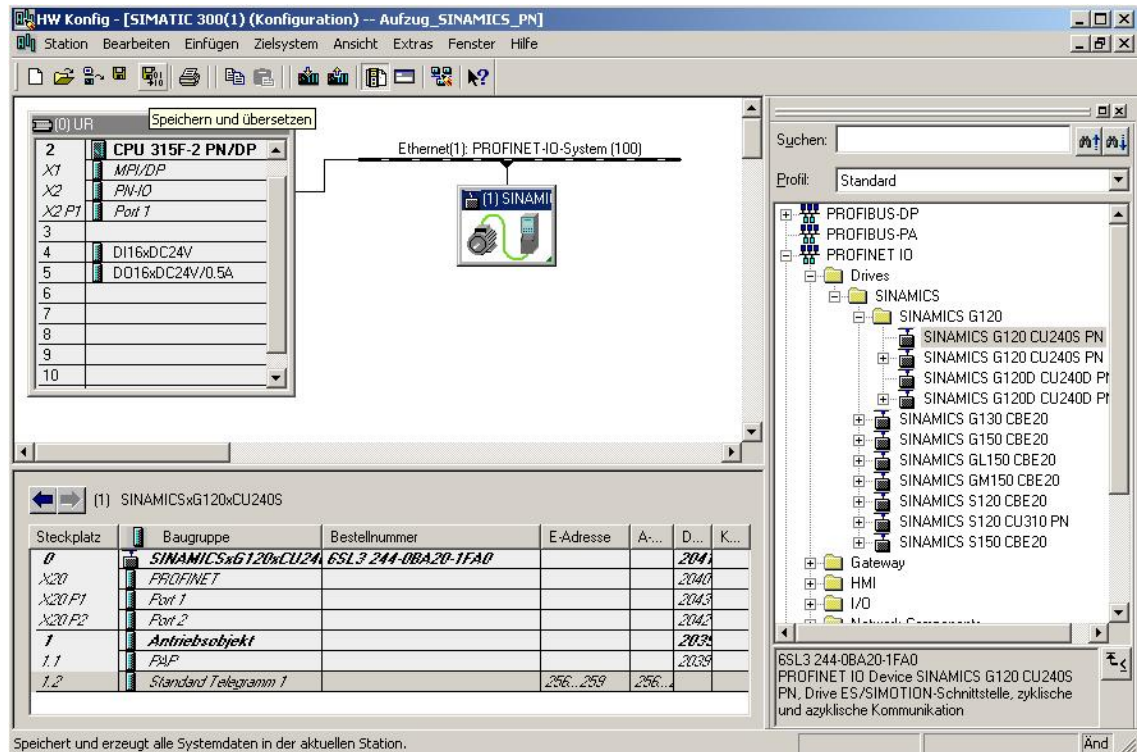




15. To each IO device, a 'Device name' has to be assigned that is unique within the PROFINET IO system. (→ Geräteame: SINAMICSxG120 → OK)

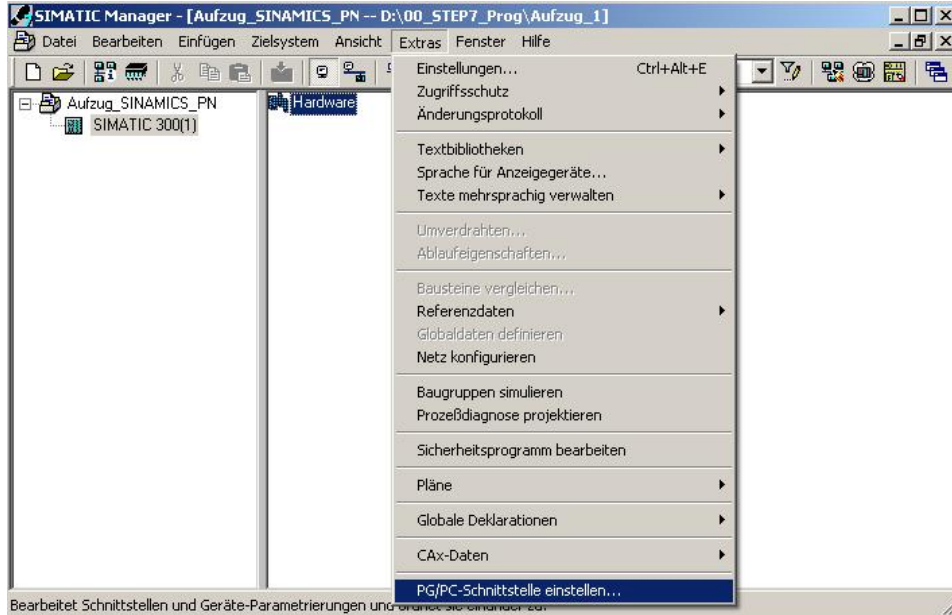


16. By clicking on , the configuration table is saved and compiled. (→ )

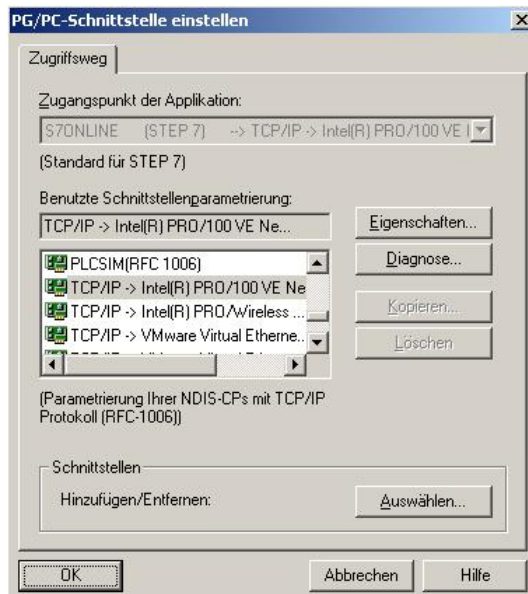




17. To access the CPU315F 2PN/DP and later the frequency converter SINAMICS G120 by means of Ethernet Online, the PG/PC interface has to be set to TCP/IP. This is done in the '**SIMATIC Manager**' in the menu '**Options**', '**Set PG/PC interface**'. (→ SIMATIC Manager → Extras → PG/PC Schnittstelle einstellen)



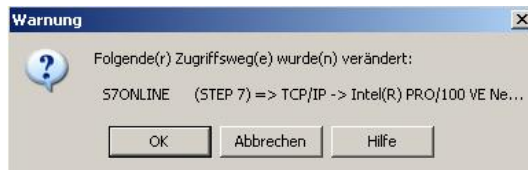
18. As interface, select TCP/IP with your network card. For example, '**TCP/IP -> Intel(R) PRO/100 VE Network Connection**' and accept with '**OK**'. (→ TCP/IP -> Intel(R) PRO/100 VE Network Connection →OK)



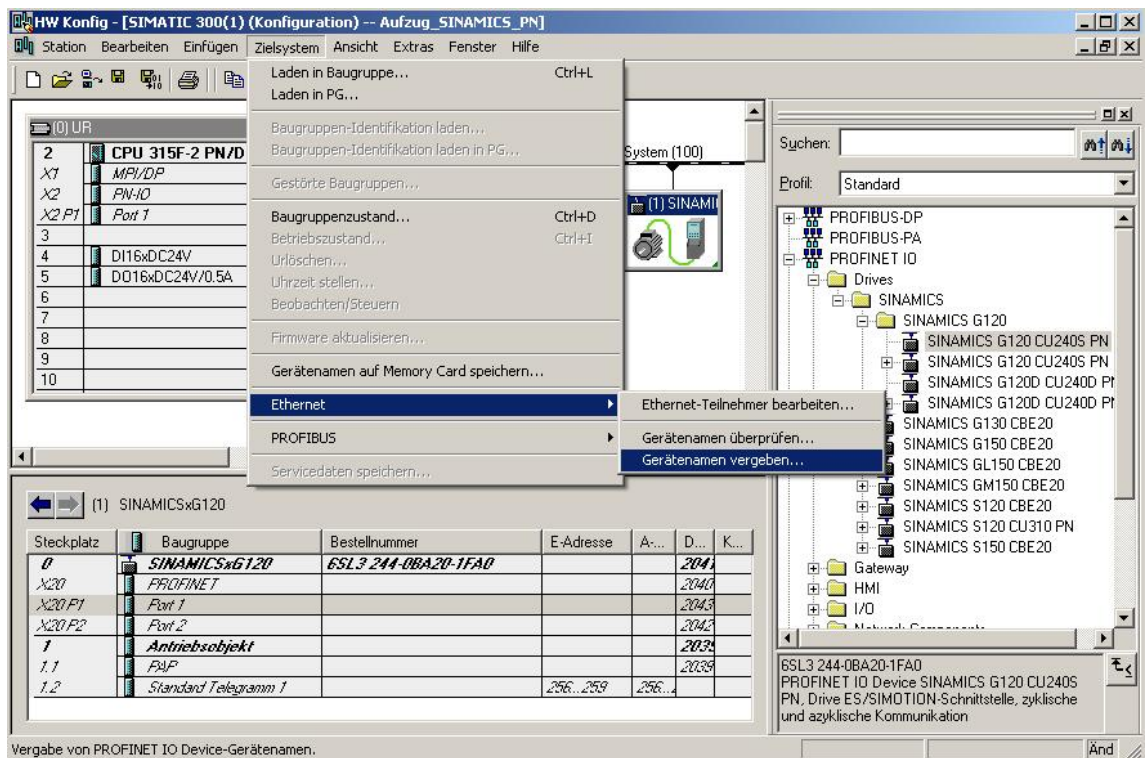
Note: A precondition for this is that the network card of the PC is configured correctly; for example, IP address 192.168.0.99, Subnet 255.255.255.0 (refer to Module E02).



19. Confirm changing the access path to TCP/IP with 'OK' (→ OK)



20. After the frequency converter is highlighted, a 'Device name' has to be assigned to it. (→ SINAMICSxG120 → Zielsystem → Ethernet → Gerätenamen vergeben)



Note: Make sure that your programmer is connected to the frequency converter via the Ethernet!



21. Now, the frequency converter has to be selected in order to '**Assign name**'. (→ sinamicsxg120 → Name zuweisen)

The new device name is displayed in the area '**Existing devices**'. Then, '**Close**' the dialog. (→ Schließen)

Gerätenamen vergeben

Gerätename: Gerätetyp:

Vorhandene Geräte:

IP-Adresse	MAC-Adresse	Gerätetyp	Gerätename
192.168.0.2	08-00-06-9...	PNIO D...	sinamicsxg120



Teilnehmer-Blinktest
Dauer (Sekunden):

nur Geräte gleichen Typs anzeigen nur Geräte ohne Namen anzeigen



Note: If several IO devices are on the network, the device can be identified by means of the imprinted MAC address.



22. By clicking on , the configuration table can now be loaded to the PLC. The CPU's operating mode switch should be on Run! (→ )

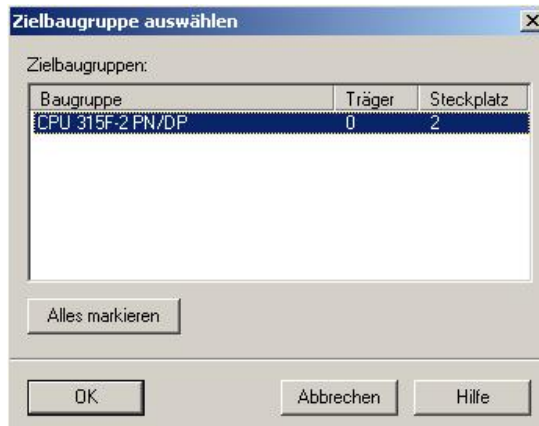
Steckplatz	Baugruppe	Bestellnummer	E-Adresse	A...	D...	K...
0	SINAMICSxG120	6SL3 244-0BA20-1FA0			204	
X20	PROFINET				2040	
X20.F1	Port 1				2043	
X20.F2	Port 2				2042	
1	Antriebsobjekt				2032	
1.1	PAF				2039	
1.2	Standard Telegramm 1		256...259	256...		



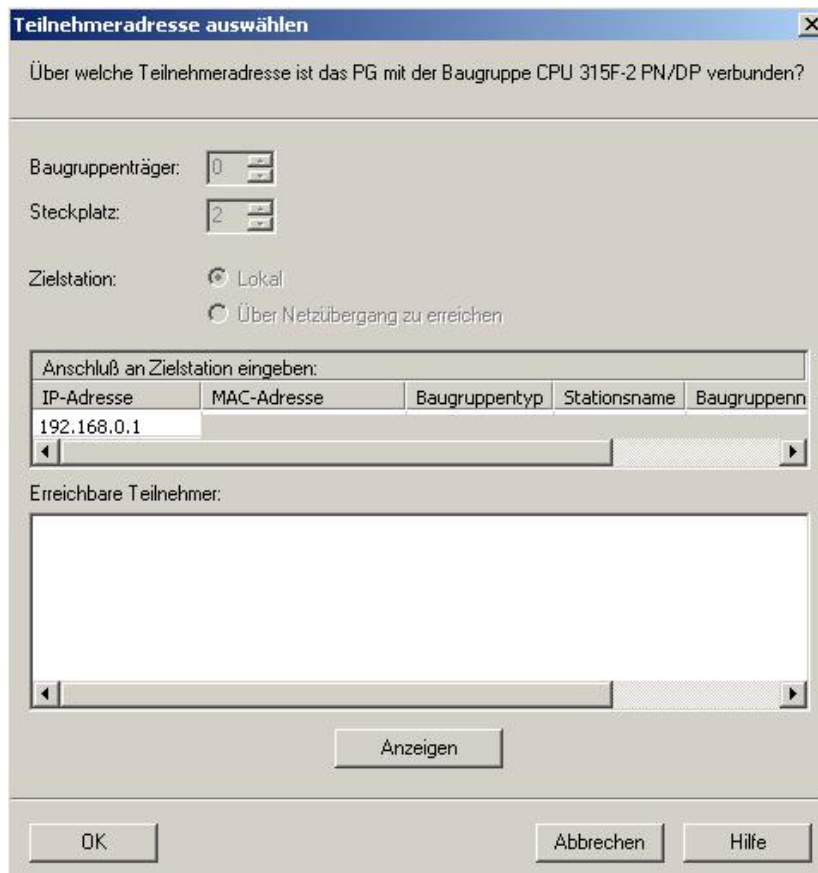
Note: Make sure your programmer is connected to the CPU via the Ethernet!



23. The CPU 315F-2 PN/DP is confirmed as the destination module for loading the configuration table. (→ OK)



24. In the dialog box that follows, the devices connected to the network can be 'Display(ed)'. (→ Anzeigen)





25. Then, the MAC address of the CPU on the Ethernet is selected. If you are connected to only one CPU, just accept with 'OK'. (→ OK)



Note: If several IO controllers are on the network, the device can be identified by means of the imprinted MAC address.



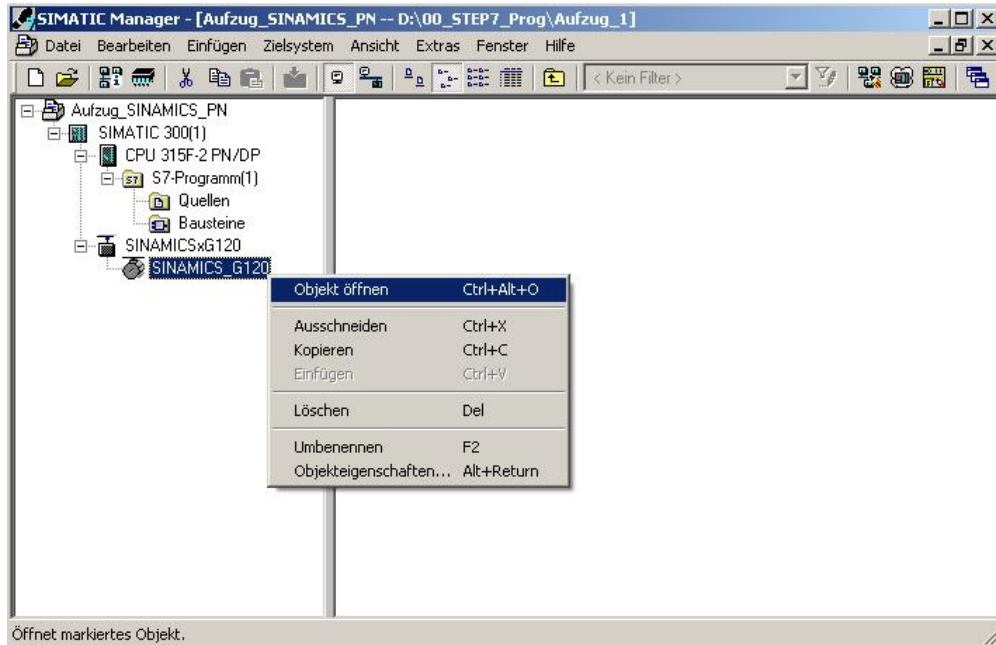
26. Now, assign the correct IP address to the IO controller if it has not been set correctly yet. In the dialog box that follows, confirm this with 'Yes' and then start the CPU. (→ Ja → Ja)

The selected station does not have an IP address. Do you want to assign the address 192.168.0.1 now?

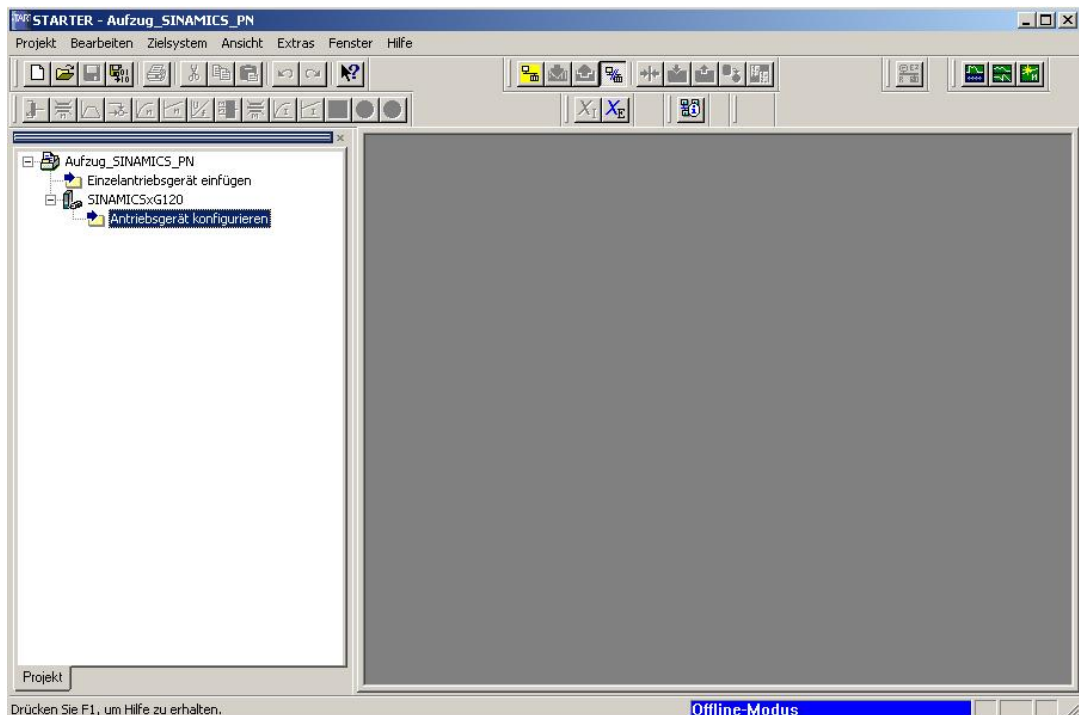
The module CPU 315F-2 PN/DP [R 0/S 2] is in the STOP mode. Do you want to start the module now (restart)?



27. After the hardware is configured, the '**SINAMICS G120**' is located in the SIMATIC Manager in the '**SIMATIC 300 Station**'. To configure it, the parameter assignment tool '**STARTER**' is opened with '**Open object**'. (→ SIMATIC Manager → SINAMICSxG120 → SINAMICS_G120 → Objekt öffnen)

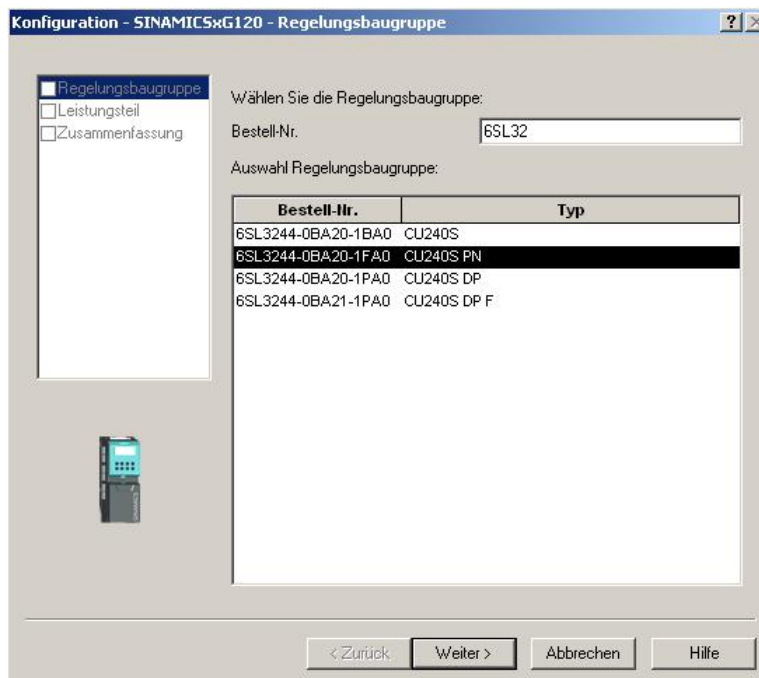


28. The software '**STARTER**' provides for guided configuration. Start it by double clicking on '**Configure drive unit**'. (→ Antriebsgerät konfigurieren)



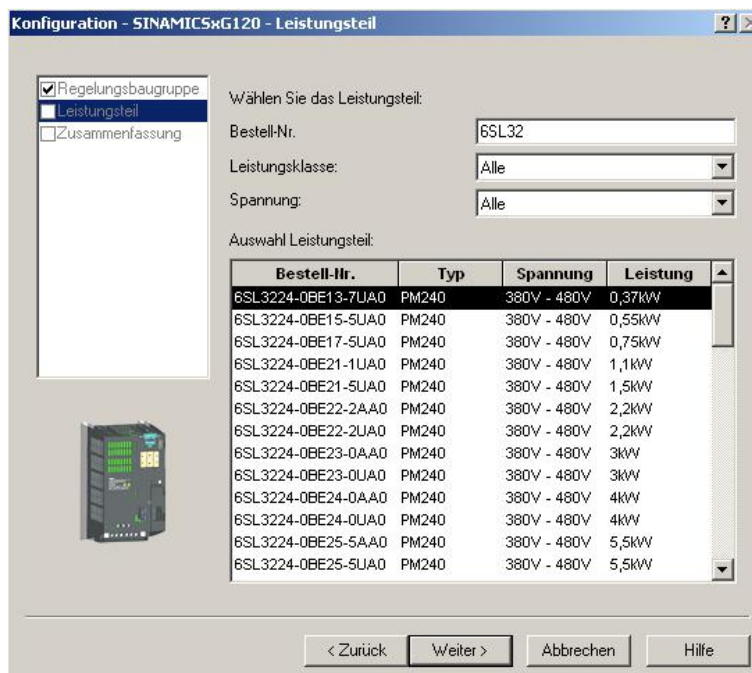


29. Now, first select your control unit by using the order number (CU240S PN). (→ CU240S PN → Weiter >)



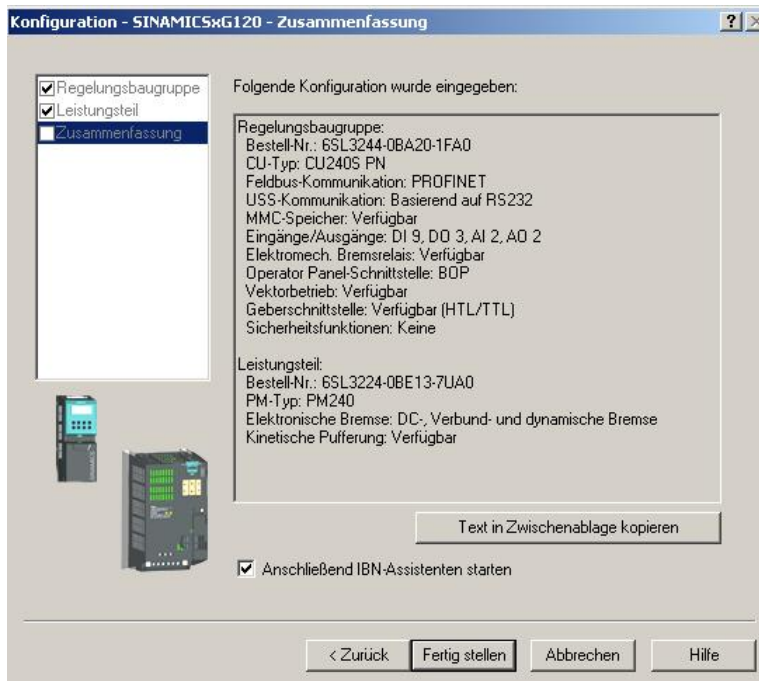
Note: The button 'Help' takes you to the Online Help of the STARTER for additional information about the individual items of the guided configuration,

30. In the following dialog, select the power module by using the order number. (→ Weiter >)

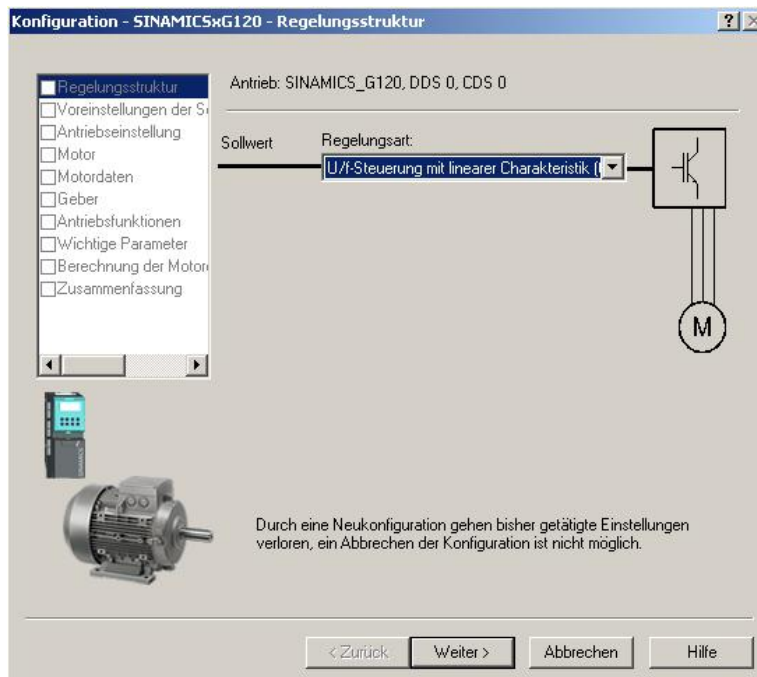




31. After you have checked your selection, select the option: **'Now start the commissioning wizard'**. (→ Anschließend IBN-Assistenten starten → Fertigstellen (Complete))



32. The commissioning wizard first offers the selection of the control mode; here, we are selecting **'V/f control with linear characteristic'** for example. (→ U/f-Steuerung mit linearer Charakteristik → Weiter >)

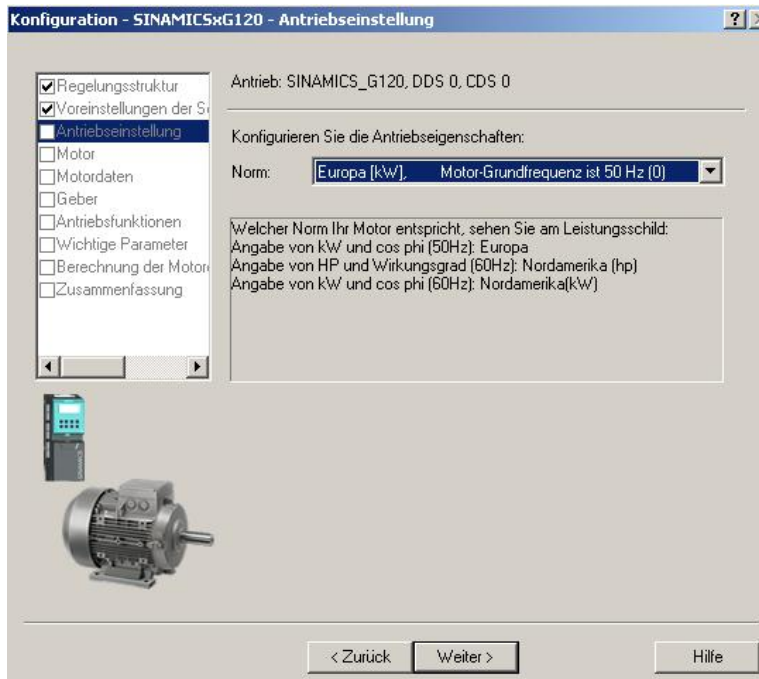




33. Then, we select '**Fieldbus(6)**' as '**Command source**', and '**Fieldbus(6)**' also as setpoint source for the '**Speed setpoints**'. (→ Feldbus(6) → Feldbus(6) → Weiter >)

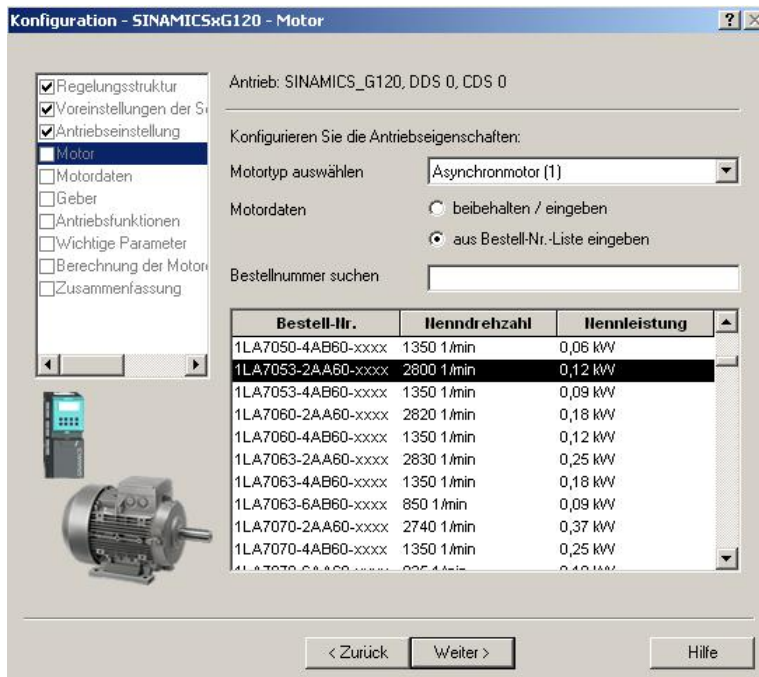


34. In the following dialog box, we select '**EUROPA[kW]** with the basic motor frequency of **50Hz**' as standard for the '**Drive properties**'. (→ EUROPA[kW], Motor-Grundfrequenz ist 50Hz(0) → Weiter >)

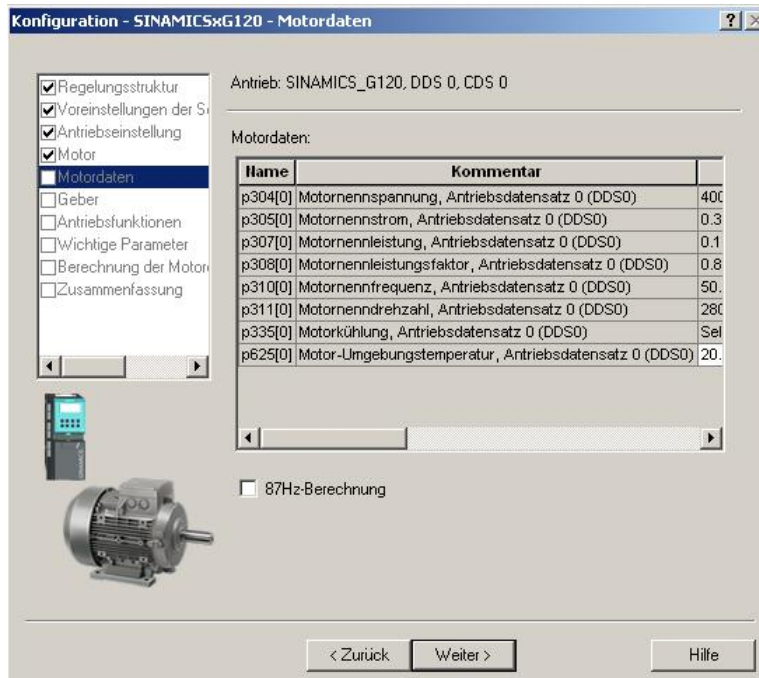




35. Now, the 'Motor type' is selected. If you have a SIEMENS motor, you can enter it with 'Enter order number list'. (→ aus Bestell- Nr.-Liste eingeben → Weiter >)



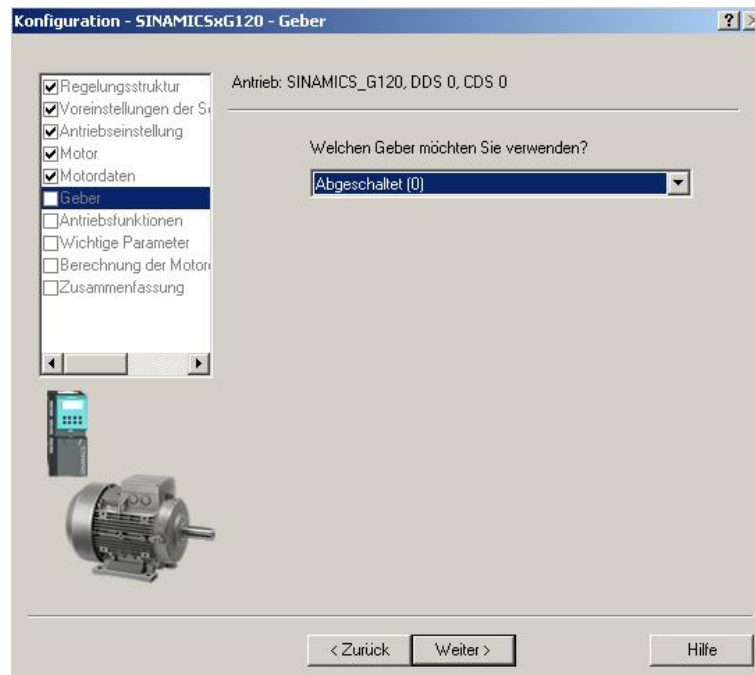
36. The motor data is displayed in the following dialog box. (→ Weiter >)



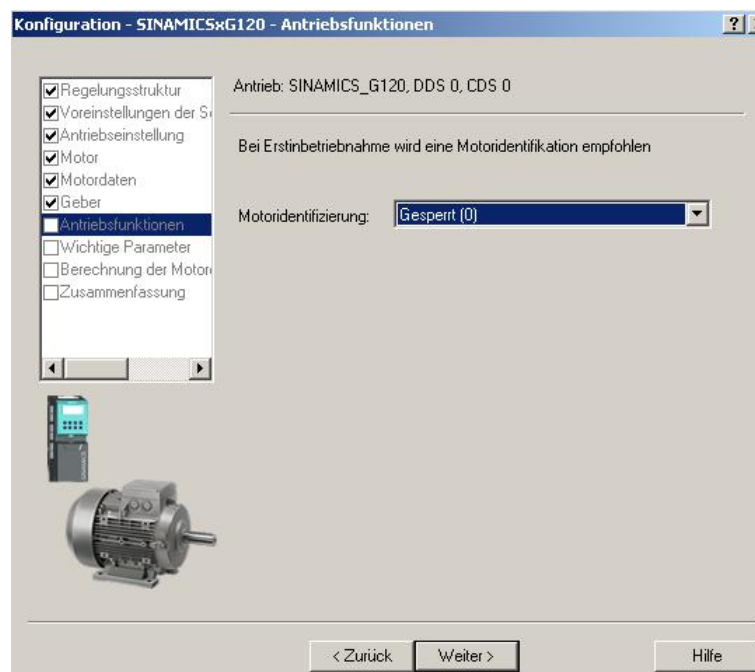
Rated motor voltage, Drive data set; Rated motor current; rated motor output; rated motor cosΦ; rated motor frequency; rated motor speed; motor cooling; ambient motor temperature



37. If an encoder is connected, you either have to select it, or select '**SwitchedOff(0)**'. (→ Abgeschaltet(0) → Weiter >)



38. For optimized control systems, you can perform a '**Motor identification**'. If it is '**disabled**', you can process with approximated data by using the data of the motor type label.(→ Gesperrt(0) → Weiter >)

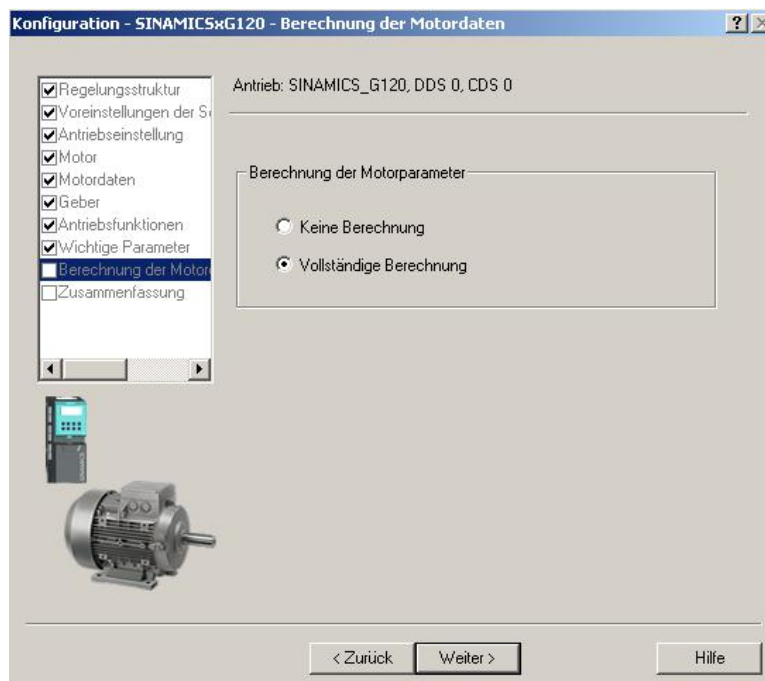




39. Now, important parameters can be set such as '**Motor overload factor**', '**Min. and Max. Frequency**', '**Acceleration and deceleration time**' as well as the '**OFF3 deceleration time**' for quick stops. (→ Weiter >)

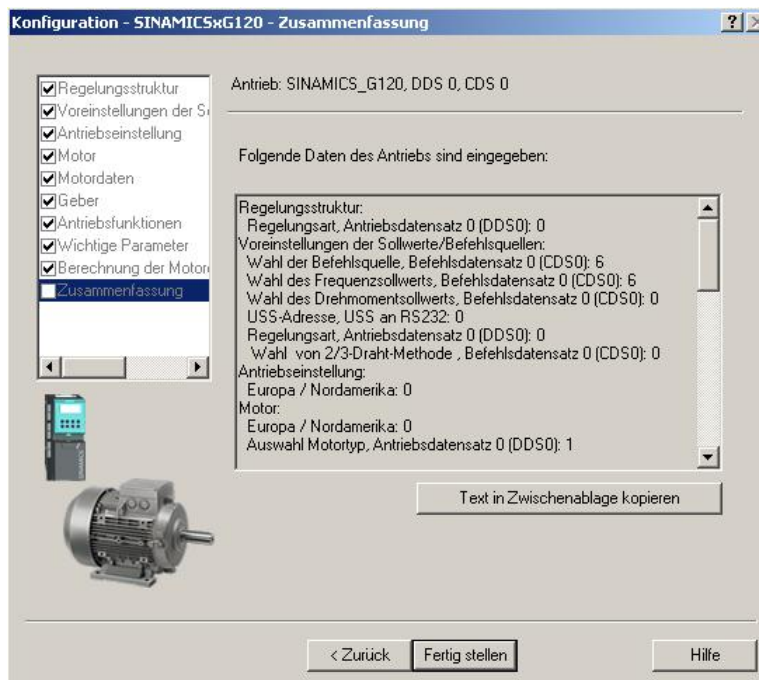


40. It is recommended to select '**Complete calculation**' of the motor parameters in the following dialog box. (→ Vollständige Berechnung → Weiter >)

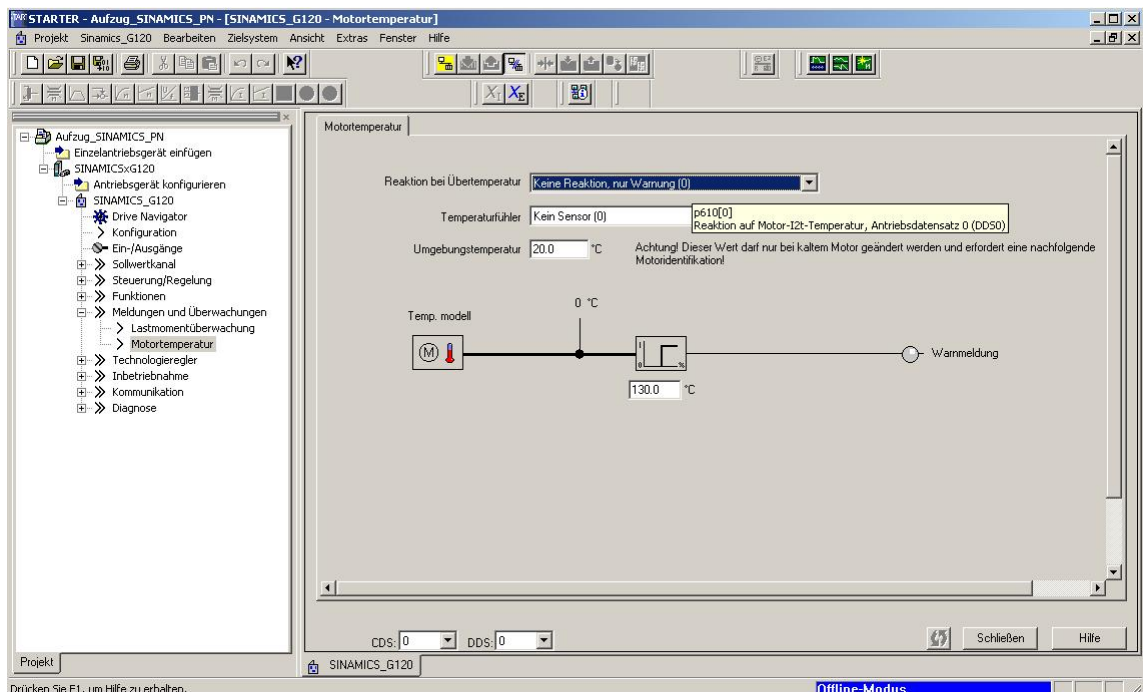




41. Finally, the data entered for the drive is displayed, and the configuration can be accepted with 'Complete'. (→ Fertig stellen)





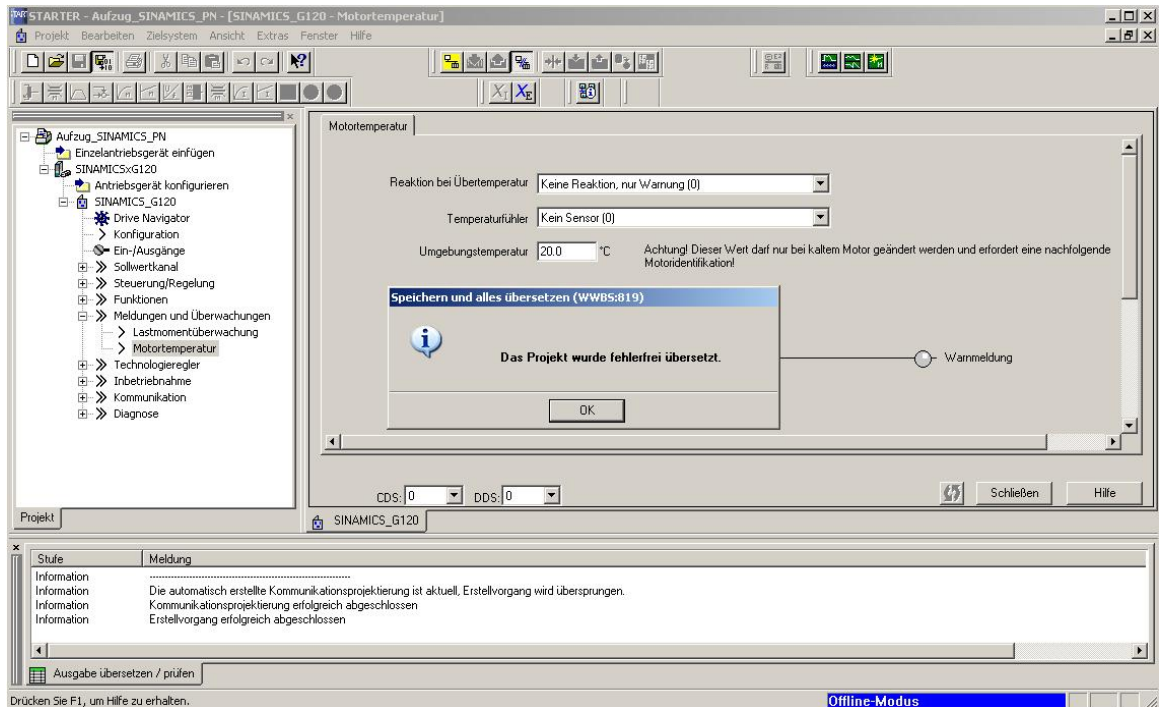
42. With a double click, dialog boxes for setting additional parameters can be selected on the left in the project tree (→ for example, Motortemperatur)



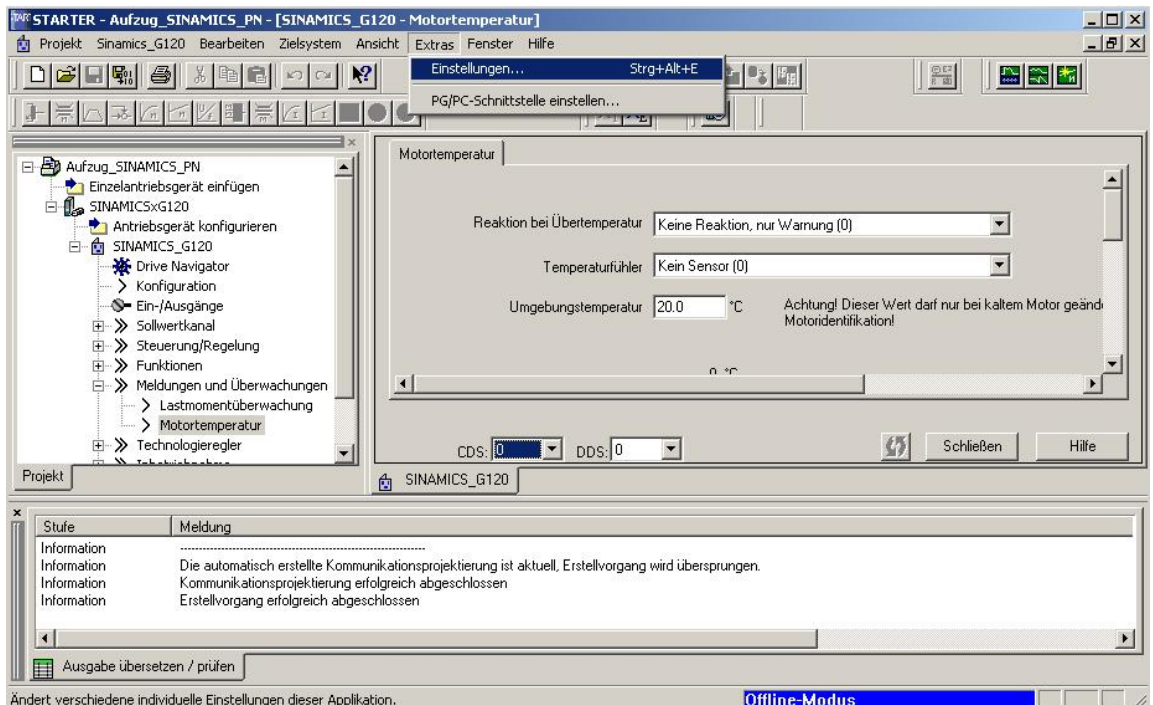
Note: If you place the mouse pointer over the parameter fields, the "Tooltip" displays the respective parameter number with the most important information



43. By clicking on , the configuration is saved and compiled (→  → OK)

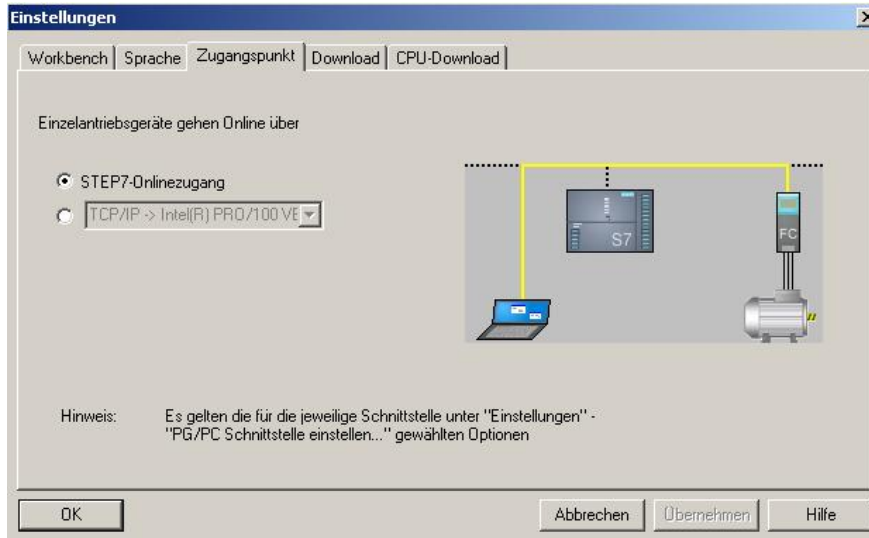




44. Before we can load the data to the frequency converter SINAMICS G120, we have to set the interface. (→ Extras → Einstellungen)

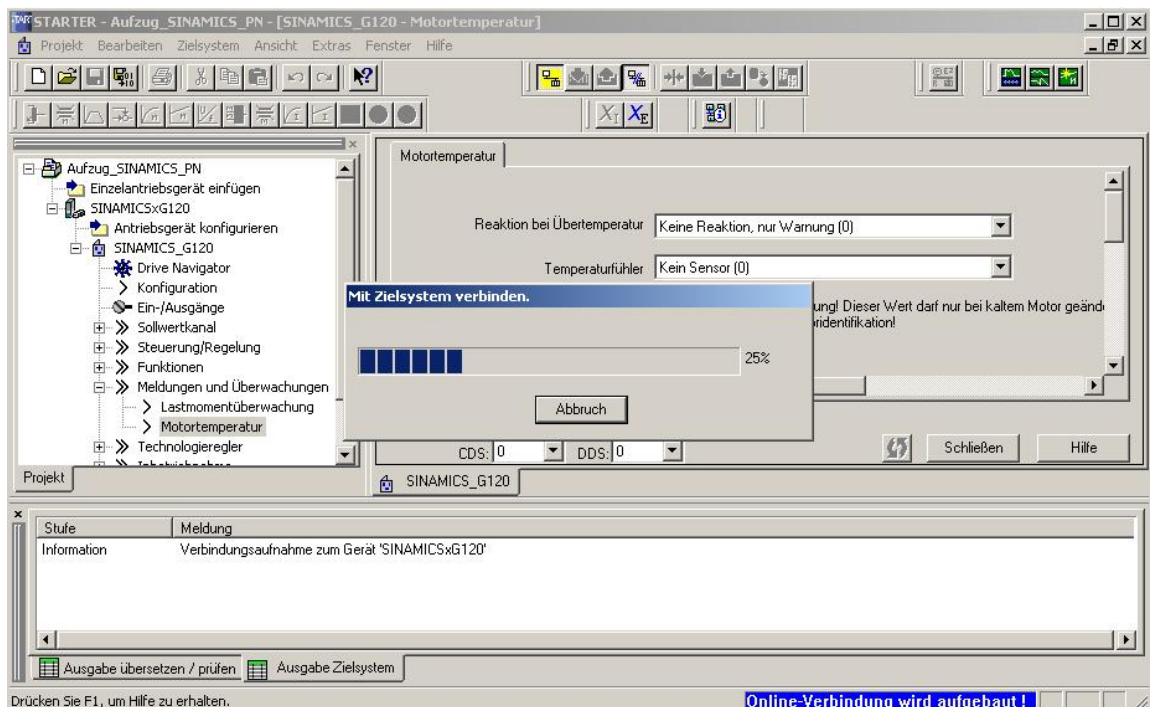




45. If we select the 'STEP7 Online Access' as 'Access point', we can use the settings in STEP7 and no additional changes are necessary.
 (→ Zugangspunkt' → STEP7 Onlinezugang → OK)





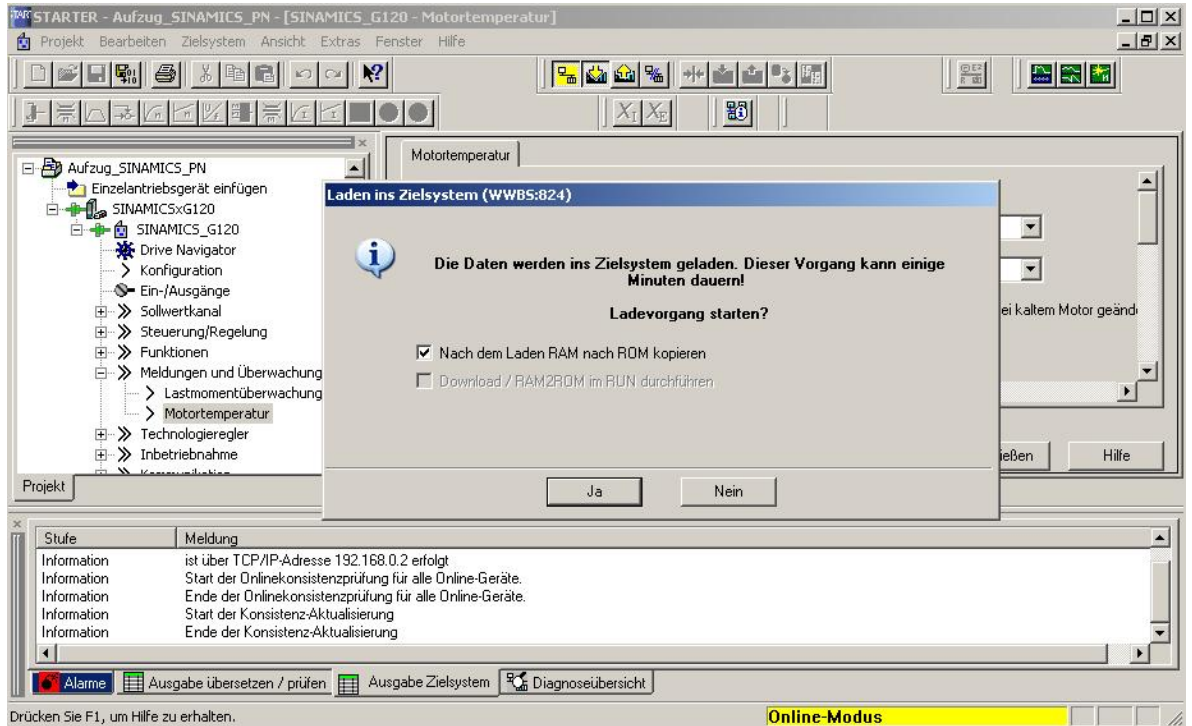
46. By clicking on the button '  ', we are connected to the target system, the SINAMICS G120. (→ )



Note: Make sure that your programmer is connected to the CPU via the Ethernet!

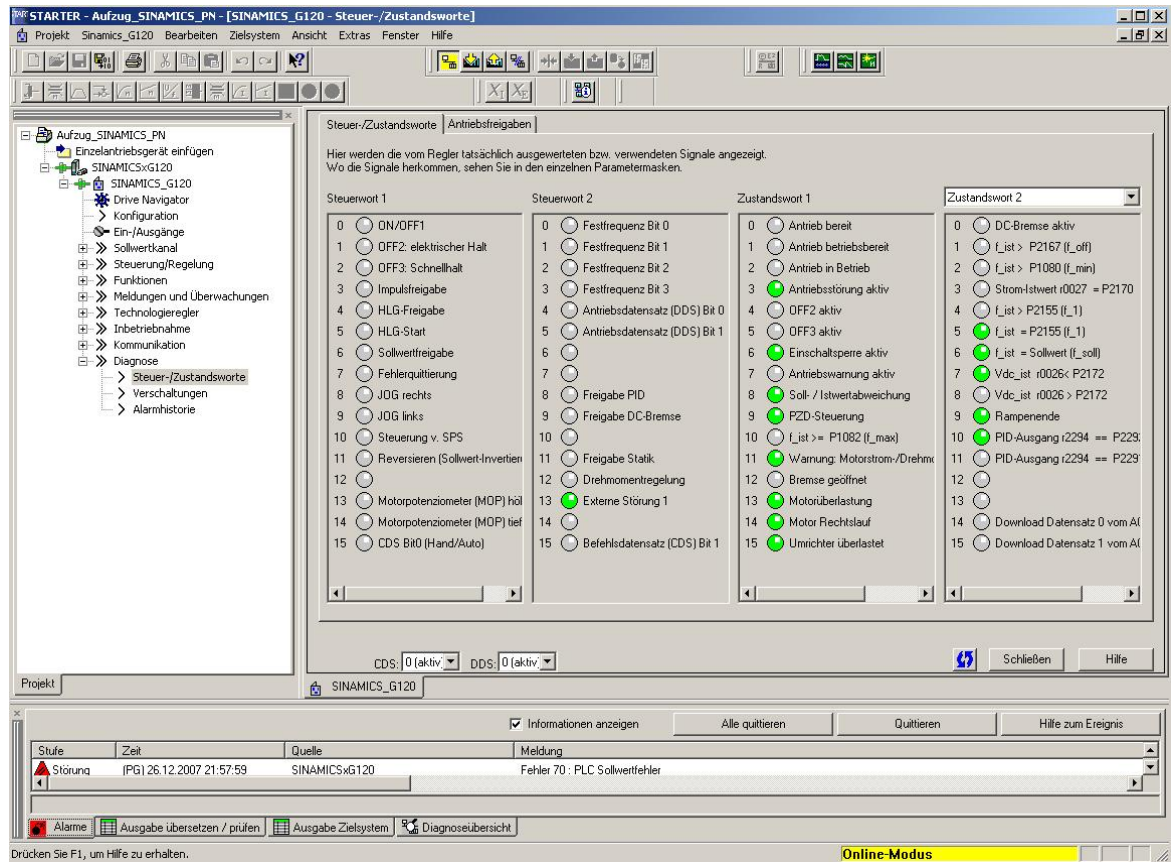


47. By clicking on , you can now load the configuration to the SINAMICS G120. **'After loading, copy the RAM to the ROM'** should be selected. (→  → Nach dem Laden RAM nach ROM kopieren → Ja)





48. For error search and further startup, you can -as long as you are connected to the PLC- select in the project tree under '**Diagnosis**' the view of the '**Control and status words**' for example (→ Diagnose → Steuer-/Zustandsworte)



Note: Alarms are displayed in the STARTER's footer. Here, the necessary acknowledgement can be made after an error also.

6. CONTROL PROGRAM 'BUCKET ELEVATOR' ON THE PROFIBUS DP/PROFINET

6.1 Assigning the Process Data for the SINAMICS G120

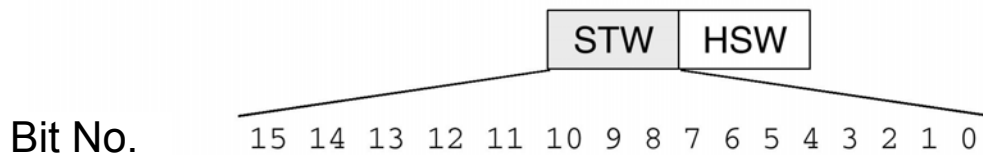


With the process data, the control words and the setpoints (PLC -> SINAMICS) or the status words and the actual values (SINAMICS – PLC) can be transferred.

The structure of the process data (PZD) area is the same in the sequence of its elements (words) for the two indicated interfaces by means of PROFIBUS DP and PROFINET.

	Process Data 1	Process Data 2
Request message (SPS -> SINAMICS)	Control word (STW)	Main setpoint (HSW)
Response message (SINAMICS -> SPS)	Status word (ZSW)	Main actual value (HIW)

6.1.1 The Control Word (STW)

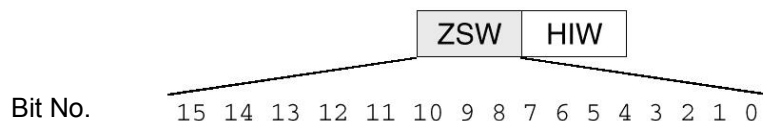




Bit	Val.	Meaning comment
0	0	OFF1 Shutdown, deceleration along RFG ramp, pulse disable when $f < f_{min}$.
	1	ON Sets the inverter to the "Ready to run" state, direction of rotation must be defined via bit 11.
1	0	Coast Stop (OFF2) Instantaneous pulse disable, drive coasts to a standstill
	1	No Coast Stop All Coast Stop (OFF2) commands are withdrawn.
2	0	Quick Stop (OFF3) Rapid stop: Shutdown at fastest possible acceleration rate.
	1	No Quick Stop All Quick Stop (OFF3) commands are withdrawn.
3	0	Disable Operation Closed-loop control and inverter pulses are disabled
	1	Enable Operation Closed-loop control and inverter pulses are enabled
4	0	Reset Ramp Generator Output of RFG is set to 0 (fastest possible braking operation), inverter remains in the ON state.
	1	Enable Ramp Generator
5	0	Freeze Ramp Generator Setpoint currently supplied by the RFG is "frozen".
	1	Unfreeze Ramp Generator
6	0	Disable Setpoint Value selected at the RFG input is set to 0.
	1	Enable Setpoint Value selected at the RFG input is activated.
7	1	Fault Acknowledge Fault is acknowledged with a positive edge, inverter then switches to "starting lockout" state.
8	0	JOG 1 OFF Drive brakes as quickly as possible.
	1	JOG 1 ON The drive runs up as quickly as possible to jogging setpoint (direction of rotation: CW).
9	0	JOG 2 OFF Drive brakes as quickly as possible.
	1	JOG 2 ON The drive runs up as quickly as possible to jogging setpoint (direction of rotation: CCW).
10	0	No PLCControl Process data not valid, expect Sign-Of-Life.
	1	PLC Control Control via interface, process data valid.
11	0	No Setpoint Inversion Motor rotates CW in response to positive setpoint.
	1	Setpoint Inversion Motor rotates CCW in response to positive setpoint.
12		Not used
13	1	Motor potentiometer UP
14	1	Motor potentiometer DOWN
15	1	Depends on the protocol On the SINAMICS G120 it is possible, using the function local/remote control, to change between the command data set (CDS) 0 and 1 of the control word 1 bit 15. This results in a switching of the command data sets. The command data set 0 is active in local operation and the command data set 1 for remote operation. Now in both command data sets the application-specific parameters for the command and target value sources can be set. *Note: In PROFIdrive Profile P0810 = 2090:15 must be set manually.

Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	-------	-----------------------	-----------------------	------------------------

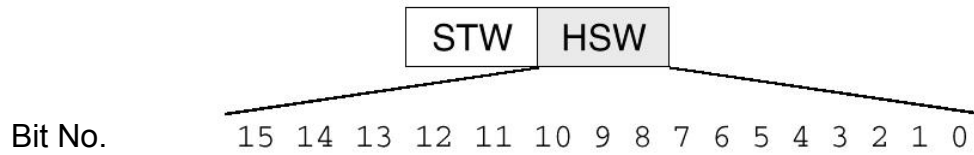
6.1.2 The Status Word (ZSW)



Bit	Value	Meaning	Remarks
0	1	Ready to switch on	Power supply is switched on, electronics initialized, pulses disabled.
	0	Not ready to switch on	--
1	1	Ready to operate	Inverter is switched on (ON command is applied), no fault is active, inverter can start when "Enable operation" command is issued. See control word 1, bit 0.
	0	Not ready to operate	--
2	1	Operation enabled	Drive follows setpoint. See control word 1, bit 3.
	0	Operation disabled	--
3	1	Fault present	Drive has faulted. Drive is faulty and thus inoperative, switches to starting lockout state after successful correction and acknowledgement of fault.
	0	No fault	--
4	1	Coast Stop not activated	--
	0	Coast Stop activated	Coast Stop (OFF 2) command is present.
5	1	Quick Stop not activated	--
	0	Quick Stop activated	Quick Stop (OFF 3) command is present.
6	1	Switching on inhibited	The drive goes only again in the "Switched On" condition with "No Coast Stop AND No Quick Stop" followed by "ON".
	0	Switching on not inhibit	--
7	1	Warning present	Drive still works; warning in the service/maintenance parameter; no acknowledgement, see alarm parameter r2110.
	0	No warning	There is no warning or the warning has disappeared again.
8	1	Speed error within tolerance range	Setpoint/actual value deviation within tolerance range.
	0	Speed error out of tolerance range	--
9	1	Master control requested	The automation system is requested to assume control.
	0	No control requested	The master is not currently the master control.
10	1	Maximum frequency reached or exceeded	Inverter output frequency is higher or equal to the maximum frequency.
	0	Maximum frequency not reached	--
11	1	--	--
	0	Warning: Motor at current/torque limit	--
12	1	Motor holding brake active	Signal can be used to control a holding brake.
	0	--	--
13	1	--	Motor data indicate overload condition.
	0	Motor overload	--
14	1	CW rotation	--
	0	CCW rotation	--
15	1	--	--
	0	Inverter overload	e.g. current or temperature.

Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	-------	-----------------------	-----------------------	------------------------

6.1.3 The Main Setpoint (HSW)



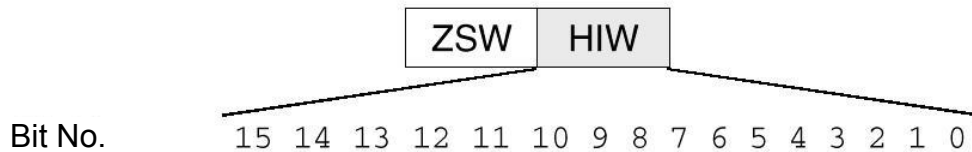
The main setpoint is a 16 bit word that transmits the required frequency setpoint to the converter. The setpoint is transmitted as a signed integer (-32768 to 32767). The value 16384 (4000 hex) corresponds to +100%.

By means of the parameter P1082, the value 100% is normalized to a plant frequency. In this parameter, the frequency value is entered to which a setpoint of 100% is to correspond over the serial interface.

The output frequency is calculated as follows:

$$f = (\text{HSW} \times \text{P1082}) / 16384$$

6.1.4 The Main Actual Value (HIW)



The main actual value is a 16 bit word that transmits the converter's actual frequency output. The normalization of this value corresponds to that of the setpoint.

6.1.5 Arrangement of the Request Message in Double Word Format



The request message is sent to the SINAMICS G120 in the double word format. The table below shows the arrangement of the bits.

Control Word														Main Setpoint																	
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
PAB 256							PAB 257							PAB 258							PAB 259										
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

6.1.6 Arrangement of the Response Message in Double Word Format

The SINAMICS G120 returns the response message in the double word format. The table below shows the arrangement of the bits.

Status Word														Main Actual Value																	
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
PEB 256							PEB 257							PEB 258							PEB 259										
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0



Note

In the control program of the bucket elevator, a data block each is used for the request message and the response message.

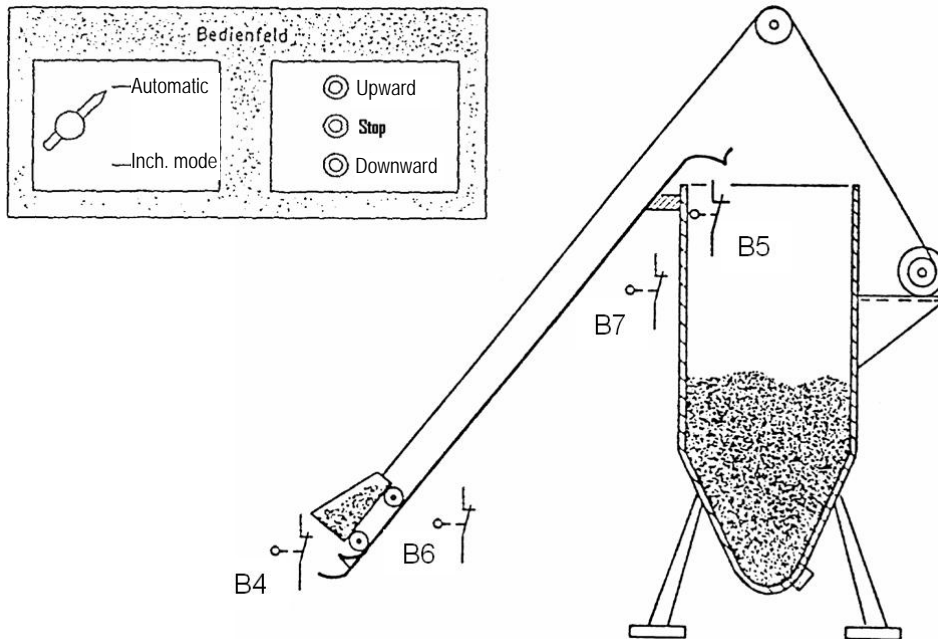
Preface	Notes	Startup with PROFIBUS	Startup with PROFINET	Program Example
---------	-------	-----------------------	-----------------------	------------------------

6.2 Assignment List and Symbol Table

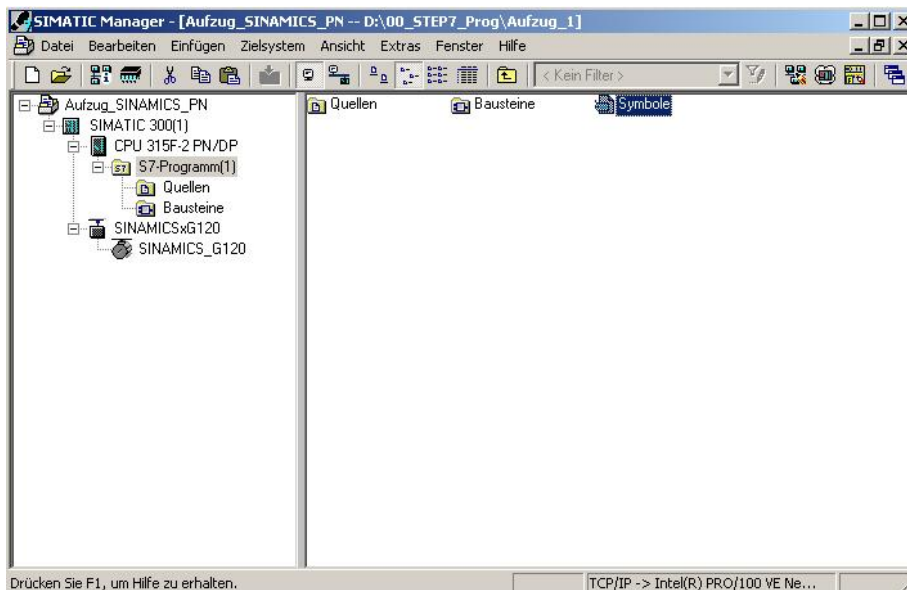


The following assignments are made to the operator panel and the position switches:

- I0.0 Switch Automatic/inching mode
- I0.1 Button upward (make contact)
- I0.2 Button downward (make contact)
- I0.3 Button Stop (break contact)
- I0.4 Position switch B4 for elevator at bottom (break contact)
- I0.5 Position switch B5 for elevator at top (break contact)
- I0.6 Position switch B6 for braking phase down (break contact)
- I0.7 Position switch B7 for braking phase up (break contact)



1. Open the symbol table by double clicking on '**Symbols**'. (→ SIMATIC Manager → Symbole)





2. Enter the following symbol table in your project.


Symbol Editor - [57-Programm(1) (Symbole) -- Aufzug_SINAMICS_PN\SIMATIC 300(1)\CPU 315F-2 PN/DP]

Tabelle Bearbeiten Einfügen Ansicht Extras Fenster Hilfe

Alle Symbole

	Status	Symbol	Adresse	Datentyp	Kommentar
1		Abwärts	E 0.2	BOOL	Abwärts-Taste (Schließer)
2		Aufwärts	E 0.1	BOOL	Aufwärts-Taste (Schließer)
3		Auto/Tippt	E 0.0	BOOL	Wahlschalter für Automatik/Tipptbetrieb (Auto=1)
4		B4_unten	E 0.4	BOOL	Endschalter Aufzug unten (Öffner)
5		B5_oben	E 0.5	BOOL	Endschalter Aufzug oben (Öffner)
6		B6_BremsUnten	E 0.6	BOOL	Geber Bremsenphase an der unteren Endlage (Öffner)
7		B7_BremsOben	E 0.7	BOOL	Geber Bremsenphase an der oberen Endlage (Öffner)
8		Halt	E 0.3	BOOL	Halt-Taste (Öffner)
9		M_Abwärts	M 70.1	BOOL	Merker für Aufzug nach unten
10		M_Aufwärts	M 70.0	BOOL	Merker für Aufzug nach oben
11		Sp-Ab	M 71.1	BOOL	Speicher für nach unten fahren
12		Sp-Auf	M 71.2	BOOL	Speicher für nach oben fahren
13		Sp_SlowAb	M 0.1	BOOL	Speicher Slow abwärts
14		Sp_SlowAuf	M 0.0	BOOL	Speicher Slow aufwärts
15		Steuern_Umrichter	DB 20	DB 20	Datenbaustein um Daten zum Umrichter zu senden
16		Zustand_Umrichter	DB 21	DB 21	Datenbaustein um Daten vom Umrichter zu lesen
17					

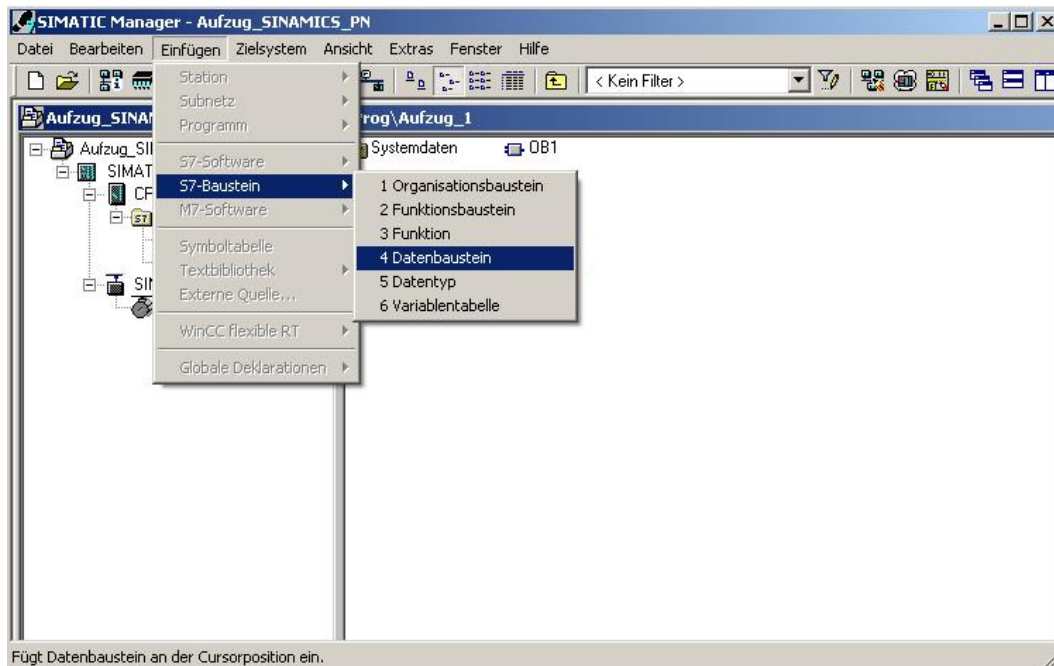
Drücken Sie F1, um Hilfe zu erhalten.

3. Save the symbol table and close the Symbol Editor. (→  → X)

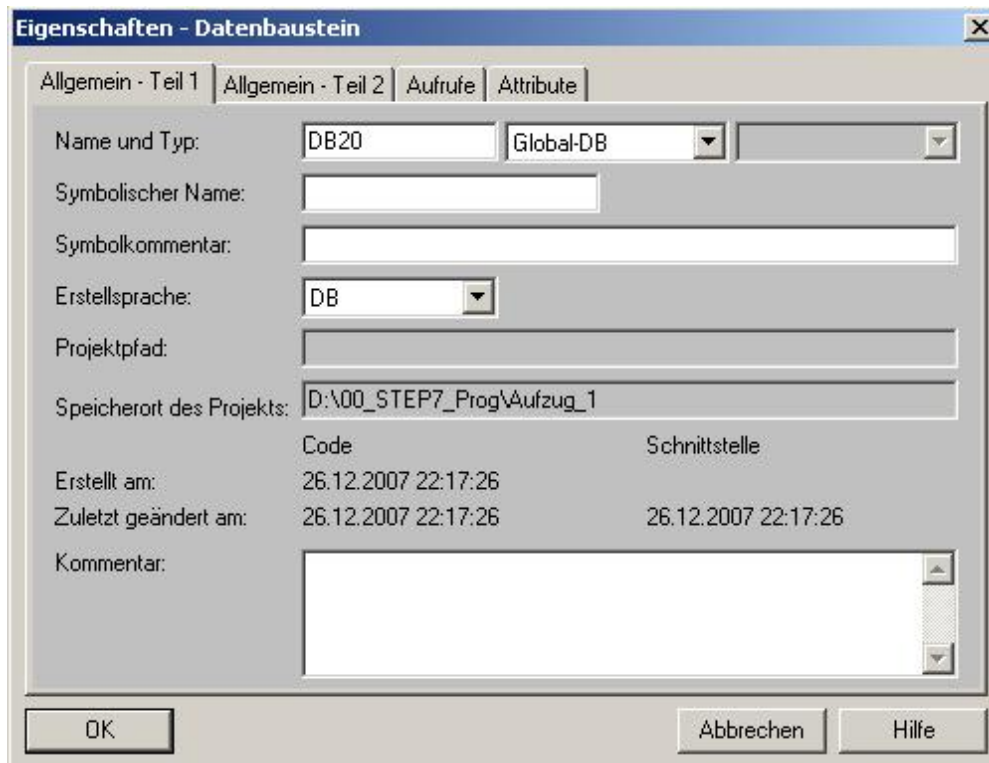
6.3 Generating the Data Block for the Request Message



4. Highlight the folder **'Blocks'** and insert a **'Data Block'**. (→ Bausteine→ Einfügen → S7-Baustein → Datenbaustein)




5. As name, enter **'DB20'** and accept with **'OK'**. (→ DB20 → OK)



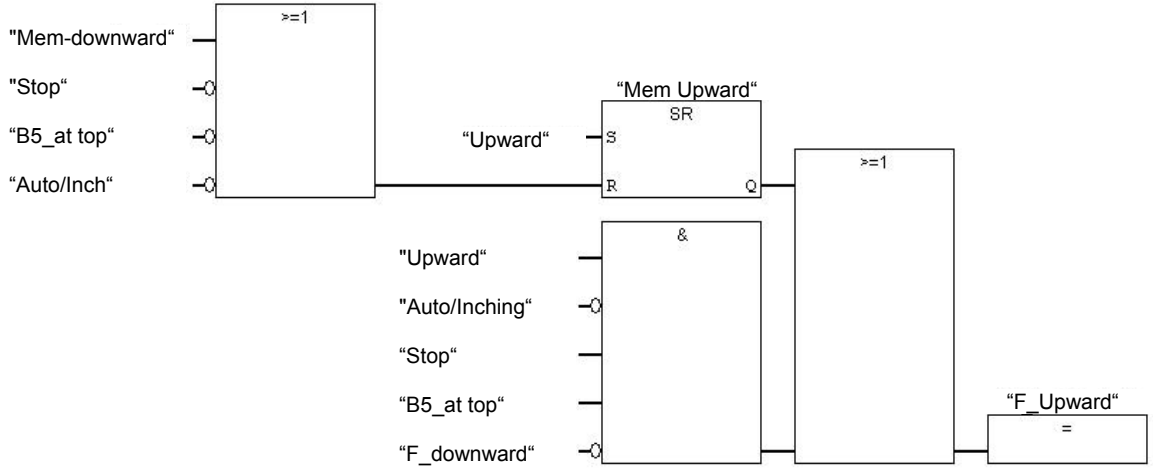
6.5 Generating Function FC10 to Control the Bucket Elevator



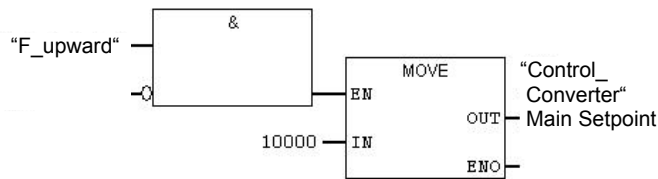
8. Generate an FC10, enter the following networks and save the FC10. (→ )

FC10 : Bucket Elevator

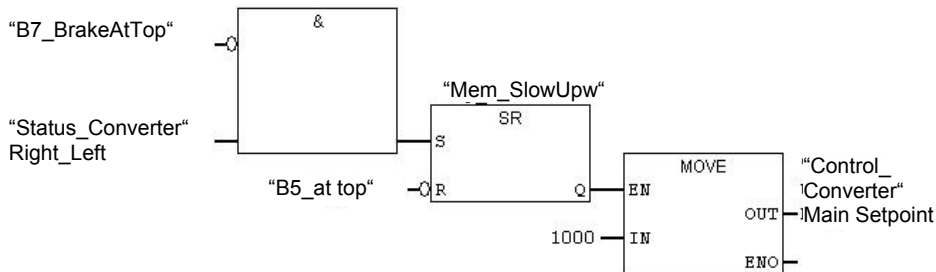
Netzwerk 1: Move bucket elevator upward



Network 2: Conveying Speed

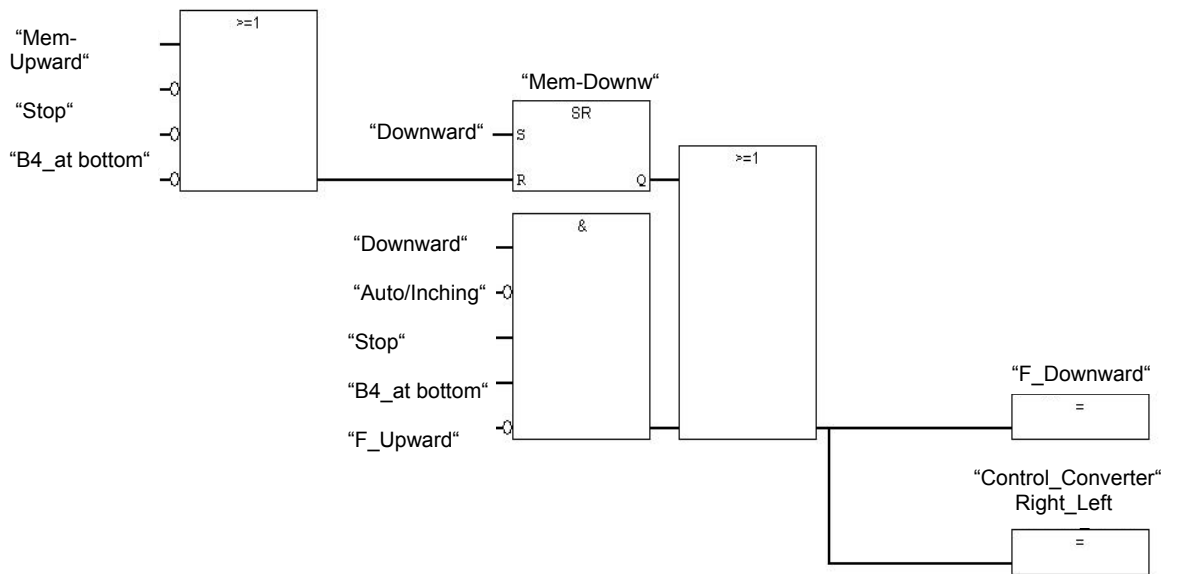


Network 3: Braking phase at top

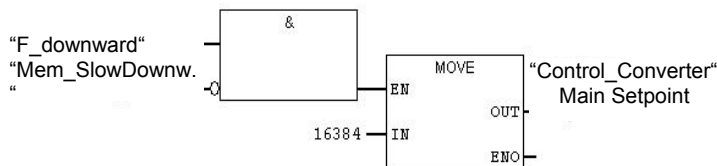




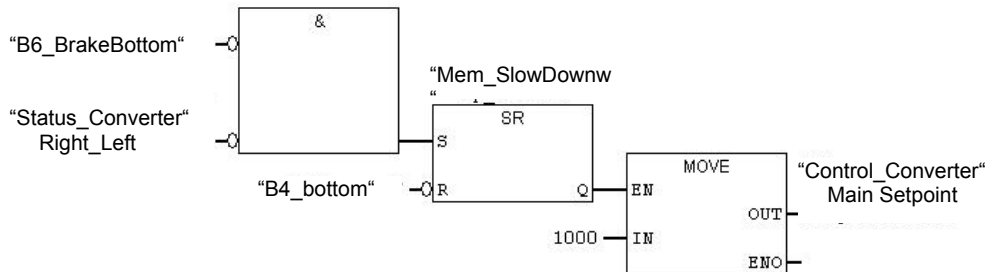
Network 4 : Move elevator downward



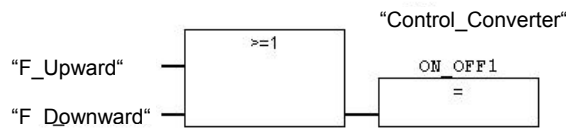
Network 5 : Maximum Speed



Network 6 : Braking Phase at Bottom




Network 7 : Bucket Elevator Start/Stop



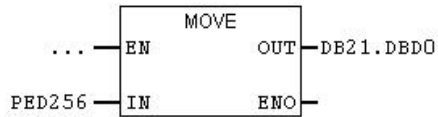
6.6 Generate Organization Block OB1 for Controlling the Bucket Elevator



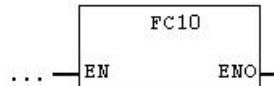
9. Enter the following networks in OB1, and store it also. (→ )

OB1 : "Main Program Sweep (Cycle)"

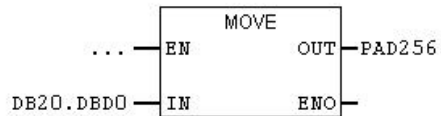
Netzwerk 1 : Enter the status data of the converter, and save to DB21



Network 2 : Call the control program



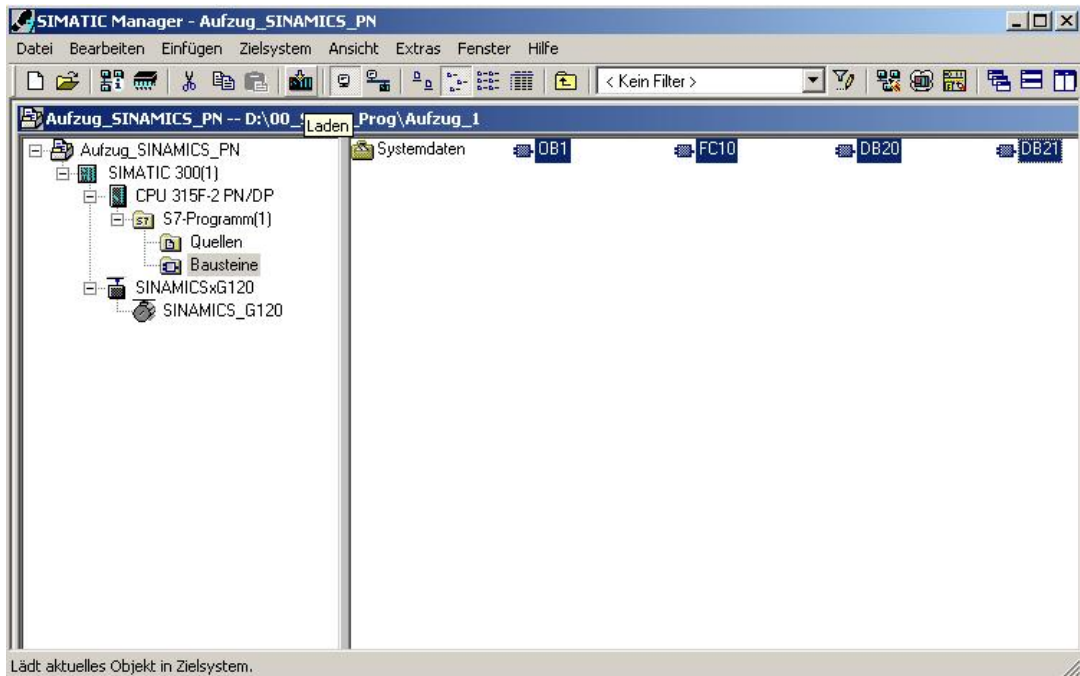
Network 3 : Send control data from DB20 to the converter



6.7 Load the blocks for controlling the bucket elevator to the CPU 315-2DP



10. In the folder 'Blocks', highlight 'OB1', 'FC10', 'DB20' and 'DB21'. Load them to the CPU315F-2PN/DP. (→ OB1 → FC10 → DB20 → DB21 → )



After the blocks have been transferred, the program can be started.