

Learn-/Training Document

Siemens Automation Cooperates with Education (SCE) | From Version V14 SP1

TIA Portal Module 062-101 Frequency converter G120 on PROFINET with SIMATIC S7-1500

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SINAMICS drive systems

- SINAMICS G120 standard drive for 1-phase 230 VAC network Order no. 6SL3200-3AX00-0UL1
- SINAMICS G120 standard drive for 3-phase 400 VAC network Order no. 6SL3200-3AX00-0UL2

SIMATIC Controllers

- SIMATIC ET 200SP Open Controller CPU 1515SP PC F and HMI RT SW Order no.: 6ES7677-2FA41-4AB1
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- SIMATIC CPU 1516F PN/DP Safety Order no.: 6ES7516-3FN00-4AB2
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Table of contents

1		Obje	ective	6
2		Requ	uirement	6
3		Requ	uired hardware and software	6
4		Theo	ory	8
	4.	1	SINAMICS G120 frequency converter	8
	4.	2	Components for configuring a frequency converter SINAMICS G120	9
		4.2.1	1 Control Units CU250S-2	9
		4.2.2	2 Operator Panels	. 10
		4.2.3	3 Memory cards for Control Unit (optional)	. 10
		4.2.4	4 Brake Relay	. 11
		4.2.5	5 Safe Brake Relay	. 11
		4.2.6	6 PM240-2 Power Modules	. 11
		4.2.7	7 PM250 Power Modules	. 12
		4.2.8	3 Line filter	. 12
		4.2.9	9 Line reactor	. 12
		4.2.1	10 Output reactor	. 13
		4.2.1	11 Sine-wave filter	. 13
		4.2.1	12 Braking resistor	. 13
	4.	3	Safety measures and warnings	.14
		4.3.1	1 General	. 14
		4.3.2	2 Transport and storage	. 15
		4.3.3	3 Commissioning	. 16
		4.3.4	4 During operation	. 16
		4.3.5	5 Repair	. 17
		4.3.6	6 Disassembly and disposal	. 17
	4.	4	Parameter assignment of the SINAMICS G120 frequency converter	.17
		4.4.1	1 Display parameters	. 17
		4.4.2	2 Adjustable parameters	. 18
		4.4.3	B P0010 Drive commissioning parameter filter	. 18
		4.4.4	P0015 Macro drive unit	. 19
		4.4.5	5 Changeability depending on the converter state	. 19
		4.4.6	6 BICO technology	. 20
		4.4.7	7 Control Data Set (CDS) and Drive Data Set (DDS)	. 21
	4.	5	Commissioning of the SINAMICS G120 frequency converter	.22

Learn-/Training Document | TIA Portal Module 062-101, Edition 09/2019 | Digital Industries, FA

	4.5.1	Restoring factory settings through a parameter reset	22
	4.5.2	2 Basic commissioning	23
	4.6	PROFINET interface of the SINAMICS G120, CU250S-2 PN Vector	24
	4.6.1	Telegrams	24
	4.6.2	Assignment of the process data (PZD) for the SINAMICS G120 with Standard Telegram	1 24
	4.6.3	3 Control word 1 (STW1)	25
	4.6.4	Status word 1 (ZSW1)	26
	4.6.5	Main setpoint (HSW/NSOLL_A; 16-bit)	27
	4.6.6	The main actual value (HIW/NIST_A; 16-bit)	27
	4.6.7	Layout of the request telegram in double-word format	
	4.6.8	Layout of the response telegram in double-word format	
	4.7	SINAMICS Startdrive commissioning tool for SINAMICS G120	29
	4.7.1	Resetting frequency converters and setting the IP address	29
5	Tasł	٢	34
6	Plan	ning	34
	6.1	Technology schematic diagram	35
	6.2	Reference table	36
7	Stru	ctured step-by-step instructions	37
	7.1	Retrieving an existing project	37
	7.2	Creating a frequency converter in the TIA Portal	39
	7.3	Assigning parameters of the frequency converter with the commissioning wizard	46
	7.4	Testing and commissioning of frequency converters with control panel	54
	7.5	Creating a program for controlling the frequency converter	58
	7.6	Loading the program in SIMATIC S7 CPU 1516F-3 PN/DP	66
	7.7	Diagnostics of SIMATIC S7 CPU 1516F-3 PN/DP	67
	7.8	Diagnostics with SINAMICS Startdrive for frequency converter G120	68
	7.9	Archiving the project	70
	7.10	Checklist – step-by-step instructions	71
8	Exei	cise	72
	8.1	Task - exercise	72
	8.2	Technology schematic diagram	72
	8.3	Reference table	73
	8.4	Planning	73
	8.5	Checklist – exercise	74
9	Addi	tional information	75

Frequency Converter G120 with Control Unit CU250S-2 PN Vector on PROFINET with SIMATIC S7-1500

1 Objective

In this chapter you learn how a frequency converter SINAMICS G120 with the Control Unit CU250S-2 PN Vector and together with a CPU1516F-3 PN/DP on PROFINET is put into operation.

The module explains the basic commissioning of the frequency converter SINAMICS G120 with the SINAMICS Startdrive software in the TIA Portal.

Subsequently we show step-by-step how the frequency converter SINAMICS G120 can be controlled and monitored from the program of the CPU1516F-3 PN/DP.

The SIMATIC S7 controllers listed in Chapter 3 can be used.

2 Requirement

This chapter is based on chapter "Global data blocks for SIMATIC S7 CPU1516F-3 PN/DP". In order to carry out this chapter you can for example, use the following project: "SCE_EN_032-600_Globale_Datenbausteine _R1508.zap13".

3 Required hardware and software

- **1** Engineering station: requirements include hardware and operating system (for additional information, see Readme on the TIA Portal Installation DVDs)
- 2 SIMATIC STEP 7 Professional software in TIA Portal as of V13
- **3** SINAMICS Startdrive software in TIA Portal as of V13
- 4 SIMATIC S7-1500/S7-1200/S7-300 controller, CPU 1516F-3 PN/DP e.g. Firmware of V1.6 with and 16DI/16DO as memory card Note: The digital inputs should be fed out to a control panel.
- 5 SINAMICS G120 frequency converter with:
 - Control Unit CU250S-2 PN as of Firmware 4.6
 - Power Module PM240-2
 - IOP Intelligent Operator Panel
 - Induction motor
- **6** Ethernet connection between engineering station and controller and between controller and frequency converter



4 Theory

4.1 SINAMICS G120 frequency converter

Each SINAMICS G120 converter consists of a Control Unit (CU) and a Power Module (PM).

- The Control Unit controls and monitors the Power Module and the connected motor.
- The Power Modules contain rectifiers and converters for motors in a power range of 0.37 kW to 250 kW.



Note:

 More detailed information about the frequency converter G120 with Control Unit CU250S-2 PN Vector is available in the manuals. In this module the frequency converter SINAMICS G120 is used as a PROFINET IO device.

4.2 Components for configuring a frequency converter SINAMICS G120

4.2.1 Control Units CU250S-2



The Control Units CU250S-2 differ with regard to their type of fieldbus connections. There are Control Units CU250S-2 with:

- RS485 interface for USS, Modbus RTU
- PROFIBUS interface
- RS485 interface for PROFINET, Ethernet/IP
- CANopen interface

All the Control Units have an **EEPROM** in order for power-failure-proof storage of the configuration data.

The used Control Unit CU250S-2 Vector has a **PROFINET interface** with two ports that supports the **PROFIdrive**, **PROFIsafe** and **PROFIenergy** profiles.

In addition, for example, **HTL or TTL encoders and temperature sensors** can be connected directly to a 15-pin encoder interface and **DRIVE-CLiQ-compatible encoders** as well as sensor modules to a DRIVE-CLiQ interface of the Control Unit.

The Control Unit supports the following functions of Safety Integrated (SIL 3, PL e, Cat. 3):

- Safe Torque Off (STO)
- Safe Stop 1 (SS1) with and without speed monitoring
- Safe Brake Control (SBC)
- Safely Limited Speed (SLS)
- Safe Direction (SDI)

Safe Speed Monitor (SSM)

• PROFIsafe communication to a higher-level control unit

Various **control methods** are available in order to meet the wide range of requirements in drive technology:

- U/f characteristic curves
- Flux current control
- Vector regulation with and without encoders

The following **special functions** can be used with this Control Unit:

• Basic positioning function with EPOS

• Energy recovery capability through Efficient Infeed Technology (only PM250 Power Modules)

Terminals with digital and analog as well as safe inputs and outputs are available.

4.2.2 Operator Panels

The Operator Panels are used to commission, diagnose and control the converter as well as to back up and transfer the converter settings.



The **Intelligent Operator Panel (IOP)** is available for snapping onto the Control Unit or as a hand-held unit with a connecting line to the Control Unit. The IOP enables operator control and diagnostics of the converter.



The **BOP-2** is an Operator Panel for snapping onto the Control Unit. The BOP-2 has a two-line display for diagnostics and operator control of the converter.

Note:

- For further information on the Operator Panels, please refer to the manuals:

4.2.3 Memory cards for Control Unit (optional)

The SD or MMC memory cards can be optionally used to back up the converter settings.

It is possible to store up to 100 parameter sets. This can be done by using the SINAMICS Startdrive software.

A firmware update/downgrade is only possible by using a memory card.

If you use the "Basic positioner" function or the extended safety functions, a memory card with a valid license has to be inserted into the Control Unit.

Note:

A memory card is not required during operation.

4.2.4 Brake Relay



The Brake Relay provides a switch contact (NO contact) to control the motor brake solenoid.

4.2.5 Safe Brake Relay



The Safe Brake Relay controls a 24-V motor brake and monitors the brake control for shortcircuits and wire breaks.

4.2.6 PM240-2 Power Modules

PM240-2 Power Modules have a brake chopper (four-quadrant applications) and are suitable for a wide range of applications in general mechanical engineering. The PM240-2 Power Modules are available without a filter or with integrated Class A line filter.



The PM240-2 Power Module is available for the following voltage and power range:

- 1-phase/3-phase 200 VAC ... 240 VAC 0.55 kW ... 4.0 kW
- 3-phase 200 VAC ... 240 VAC 5.5 kW ... 7.5 kW
- 3-phase 380 VAC ... 480 V 0.55 kW ... 250 kW
- 3-phase 500 VAC ... 690 VAC 11 kW ... 132 kW

Note:

 If frequency converters are not put into operation for a longer period, the DC link capacitors have to be formed in accordance with the specifications in the operating instructions.

4.2.7 PM250 Power Modules

PM250 Power Modules are suitable for identical applications as the PM240 Power Modules. Any brake energy occurring can be fed back directly into the power network (four-quadrant applications – no brake chopper required). The PM250 Power Modules are available without a filter or with integrated Class A line filter.



The PM250 Power Module is available for the following voltage and power range:

• 3-phase 380 VAC - 480 VAC ±10% 7.5 kW to 90 kW

Note:

 If frequency converters are not put into operation for a longer period, the DC link capacitors have to be formed in accordance with the specifications in the operating instructions.

4.2.8 Line filter



A line filter allows the converter to reach a higher radio interference category. An external filter is not required for converters with built-in line filter.

4.2.9 Line reactor



The line reactor supports overvoltage protection, flattens the harmonics in the power network and bridges commutation notches.

4.2.10 Output reactor



Output reactors reduce the voltage load of the motor windings as well as the load of the converter through capacitive charge/discharge currents in the lines. An output reactor is required for shielded motor lines greater than 50 m or unshielded motor lines greater than 100 m.

4.2.11 Sine-wave filter



The sine-wave filter at the output of the converter limits the voltage gradient and the peak voltages at the motor motor winding. The maximum permissible motor supply line length increases to 300 m. An output reactor becomes superfluous.

4.2.12 Braking resistor



The braking resistor allows rapid braking of loads with a high moment of inertia.

The Power Module controls the braking resistor through its integrated brake chopper.

4.3 Safety measures and warnings

The following safety information and warnings are to be observed before the installation and commissioning of the SINAMICS G120.

4.3.1 General

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).

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.

4.3.2 Transport and storage

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

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.

4.3.3 Commissioning

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.

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.

4.3.4 During operation

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).

4.3.5 Repair

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.

4.3.6 Disassembly 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:

It is assumed that a ready pre-assembled converter unit with induction motor is being used for the following operating steps and tasks. Observe the safety regulations and warnings of the manufacturers when carrying out the electrical installation. Instructions and directives for mounting and electrical installation can be found in the manuals of the SINAMICS G120.

4.4 Parameter assignment of the SINAMICS G120 frequency converter

There are two main types of parameters:

- Display parameters
- Adjustable parameters

4.4.1 Display parameters

Display parameters allow the reading of the internal measured quantities of the converter and motor. The Operator Panel and SINAMICS Startdrive represent the display parameters with a preceding "r". For example, r0027 is the parameter for the output current of the converter.

4.4.2 Adjustable parameters

Adjustable parameters are the parameters that you use to adjust the converter to your application. When you change the value of an adjustable parameter, you also change the behavior of the converter. Adjustable parameters are represented with a preceding "p". For example, p1082 is the parameter for adjusting the maximum speed of the motor.

The following section displays some particularly important adjustable parameters.

Note:

Further information on the parameters is available in the list manual.

4.4.3 P0010 Drive commissioning parameter filter

Parameter P0010 filters parameters so that only the parameters assigned to a specific function group can be selected. This means, for example, that the parameters required for quick commissioning are displayed in order. The following settings are available:

• P0010 = 0: Ready

In order to start up the converter, the P0010 has to be set to 0.

- P0010 = 1: Quick commissioning
- P0010 = 2: Power unit startup
- P0010 = 3: Motor startup
- P0010 = 4: Encoder startup
- P0010 = 5: Technological application/units
- P0010 = 11: Function modules
- P0010 = 15: Data records
- P0010 = 17: Basic positioning startup
- P0010 = 25: Position control startup
- P0010 = 29: Only Siemens-internal
- P0010 = 30: Parameter reset
- P0010 = 39: Only Siemens-internal
- P0010 = 49: Only Siemens-internal
- P0010 = 95: Safety Integrated startup

By setting p3900 unequal to 0, the quick commissioning is complete, and this parameter is set automatically to 0.

4.4.4 P0015 Macro drive unit

With the parameter P0015 you select command and setpoint sources of the converter by executing the corresponding macro files.

After the value has changed, the further changing of parameters is blocked as long as the macro is being executed. The status is displayed in r3996. Changing is not possible until r3996 = 0 again.

When a specific macro is executed, the correspondingly programmed settings are carried out and become effective.



For example, Macro 7: "Fieldbus with data record changeover"

Note:

 Information about further macros is available in the operating instructions of the respective Control Unit.

4.4.5 Changeability depending on the converter state

"P"-parameters can furthermore only be changed depending on the status of the converter.

For example, the parameter p1120 Ramp-function generator ramp-up time (with the attribute "C(1), U, T" in the parameter list) can only be changed in the quick commissioning "C", when P0010 = 1, in the ready state "T" or during operation "U".

Status	Description
C(*)	Quick commissioning (P0010 = *)
U	Operation (drive running)
Т	Drive ready-to-start

4.4.6 BICO technology

A converter corresponding to the latest state-of-the-art has to offer the possibility to freely interconnect internal and external signals (setpoints or actual values as well as control and status signals).

This interconnection has to offer a high degree of flexibility so that the converter can be easily adapted to new applications.

The BICO technology and macros are used to meet these requirements.

By using the BICO technology the process data can be interconnected freely while using the "default" parameter assignment of the converter.

Here all the values that can be interconnected freely are defined as "connectors", for example, frequency setpoint, actual frequency value, actual current value, etc.

All the digital signals that can be interconnected freely are defined as "binectors", for example, status of a digital input, ON/OFF, message function at limit violations, etc.

A converter contains numerous input and output variables as well as variables within the control system that can be interconnected. Therefore, it is possible to adapt the converter to the various requirements by using the BICO technology.

Binectors

A binector is a digital (binary) signal without any units that can have either the value 0 or 1. Binectors always reference functions. They are divided into binector inputs (BI) and binector outputs (BO).

The binector input is always identified with a "P"-parameter (for example, P0840 BI: ON/OFF1), whereas the binector output is always represented with an "r"-parameter (for example, r1025 BO: FF status).

Example

Combination of the command ON/OFF1 with selection of a fixed frequency.



Binector output (BO) \rightarrow Binector input (BI)

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

The source for the command ON/OFF1 is the parameter P0840 (default DI0). When the fixed frequency status bit is connected as the source for P0840 (P0840 = 1025), the converter starts by activating a fixed frequency and stops with OFF1 for deactivation of the fixed frequency.

Connectors

A connector (16 or 32 bits) has a value that can contain a normalized variable (dimensionless) or also a variable with assigned units.

Connectors always reference functions. They are divided into connector inputs (CI) and connector outputs (CO). In essence the same applies as for binectors: The connector inputs are identified by a "P"-parameter (for example P0771 CI: AO (analog output)), whereas the connector outputs are always represented with an "r"-parameter (for example r0021 CO: Actual frequency).

Example

Interconnection of the parameter r0755 (display analog input) with an internal value (main frequency setpoint). To this purpose the CO parameter r0755 (scaled analog input) has to be interconnected with the CI parameter P1070 (main setpoint).



Note:

- For further details please refer to the list manual.

4.4.7 Control Data Set (CDS) and Drive Data Set (DDS)

Drive engineering has applications in which simutaneous changeover of multiple parameters with external signals is needed during operation.

To enable this, certain parameters have been organized into groups. These so-called data sets are:

- Control Data Set (CDS)
- Drive Data Set (DDS)

Note:

- For more details, refer to the list manual and the operating instructions.

4.5 Commissioning of the SINAMICS G120 frequency converter

A converter of the type G120 always consists of the Power Module and the Control Unit. After the initial latching in of the Control Unit at the Power Module and switching on of the supply voltage, the Power Module is recognized by the Control Unit. If it is a compatible Power Module, the data are stored in the Control Unit.

Commissioning of the converter G120 is usually carried out in the following steps:

- Resetting to factory settings
- Basic commissioning
- Quick commissioning
- Calculation of the motor/control data
- Optimization of the speed control
- Further settings for commissioning
- Optional: Motor data identification
- Startup of the application
- Commissioning of fail-safe functions (only with fail-safe applications)

4.5.1 Restoring factory settings through a parameter reset

The factory setting can be effected via the SINAMICS Startdrive software, via a menu function in the Intelligent Operator Panel (IOP) or via a direct parameter input.

Procedure for "Reset parameters":

p0010 = 30

p0970 = 1

P0970 = 0 is automatically set at the end of the calculations.

Through a factory setting via P0970, the original values of all the converter parameters can be restored. These values are designated with "Factory Setting" in the list manual.

The following parameters remain unchanged after a reset to factory settings:

- P0014 Storage mode
- Communication parameters (for example PROFIBUS and PROFINET settings)
- Power-Module-dependent data

4.5.2 Basic commissioning

Basic commissioning should always be carried out by using the commissioning wizard via the SINAMICS Startdrive software or the Intelligent Operator Panel (IOP).

Alternatively, quick commissioning (P0010 = 1) can also be carried out by direct entry of the parameters. However, this procedure is not advisable.

Notes:

- Commissioning by using the commissioning wizard via the SINAMICS Startdrive software is described in Chapter 6 of this document.
- For information about carrying out commissioning by using the commissioning wizard via the Intelligent Operator Panel (IOP) please refer to the operating instructions of the IOP.

4.6 PROFINET interface of the SINAMICS G120, CU250S-2 PN Vector



The frequency converter can be integrated into an Ethernet network at the PROFINET interface X150 with the two ports P1 and P2. Now:

• The parameter assignment and diagnostics of the frequency converter via Ethernet can be carried out by using the SINAMICS Startdrive software in the TIA Portal.

• The converter can be integrated into a PROFINET network.

In PROFINET IO operation, the converter supports the following functions:

- IO-RT: Real-time communication (as used in this document.)
- IO-IRT: Isochronous real-time communication
- MRP: Media redundancy when used in a network with ring topology
- MRPD: Media redundancy requirement: IRT when used in a network with ring topology
- Diagnostic interrupts in accordance with the error classes specified in the PROFIdrive profile

4.6.1 Telegrams

Various telegrams, whose process data lengths and contents differ, are available for selection for IO-RT communication with the frequency converter.

The simplest telegram, set as the standard, is the Standard Telegram 1.

4.6.2 Assignment of the process data (PZD) for the SINAMICS G120 with Standard Telegram 1

Control words and setpoints (PLC -> SINAMICS) and status words and actual values (SINAMICS -> PLC) can be transferred with the process data. The structure of the PZD area is as follows for Telegram 1, for a coupling via PROFINET:

	PZD1	PZD2
Request telegram	Control word	Main setpoint
(PLC -> SINAMICS)	(STW1)	(NSOLL_A)
Response telegram	Status word	Main actual value
(SINAMICS -> PLC)	(ZSW1)	(NIST_A)

4.6.3 Control word 1 (STW1)

STW HSW

Bit Nr. 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Bit	Significance		Comments	Signal inter-
	Telegram 20	All other		connection
		telegrams		in the inverter
0	0 = OFF1		The motor brakes with the ramp-down time	P0840[0] =
			inverter switches off the motor at standstill.	12090.0
	$0 \rightarrow 1 = ON$		The inverter goes into the "ready" state. If, in	
			addition bit $3 = 1$, then the inverter switches on	
			the motor.	
1	0 = OFF2		Switch off the motor immediately, the motor then	P0844[0] =
			coasts down to a standstill.	r2090.1
	1 = No OFF2		The motor can be switched od (ON command).	
2	0 = Quick stop	(OFF3)	Quick Stopp: The motor brakes with the OFF3	P0848[0] =
			rampdown time p1135 don to standstill.	r2090.2
	1 No Outok S		The meter can be switched on (ON command)	
			me motor can be switched on (ON command).	
3	0 = Inhibit oper	ation	Immediately switch-off motor (cancel Pulses).	P0852[0]
				=r2090.3
	1 = Enable ope	eration	Switch-on motor (pulses can be enabled).	
4	0 = Disable RF	G sperren	The inverter immediately sets ist ramp-function	p1140[0] =
	1 – Do pot dica		The rame function generator can be enabled	12090.4
			The famp-function generator can be enabled.	
5	0 = Stop RFG		The output of the ramp-function generator	P1141[0]=
	-		Stopps at the actual value.	r2090.5
	1 = Enable RF	G	The output of the ramp-function generator follows	
6	0 – Inhihit ooto	oint	The setpoint.	D1142[0]_
0	0 = mmbit setp	OIIIt	down time p1121 of the ramp-function generator.	r02090.6
	1 = Enable set	point	Motor accelerates with the ramp-up time p1120	
			to the setpoint.	
7	$0 \rightarrow 1 = Acknord$	wledge faults	Acknowledge fault. If the ON command is still	p2103[0] =
			state	12139.7
8, 9	Reserved		Stato.	
10	0 = No control	via PLC	Inverter ignores the process data from the	P0854[0]=
			fieldbus.	r2090.10
	1 = Control via	PLC	Control via fieldbus, inverter accepts the process	
11	1 - Direction re	worool	data from the fieldbus.	p1112[0] _
		eveisai		r2090.11
12	Not used			
13	1)	1 = MOP up	Increase the setpoint saved in the motorized	P1035[0] =
		4 1405	potentiometer.	r2090.13
14	1)	T = MOP down	Reduce the setpoint saved in the motorized	P1036[0]= r2090 14
15	CDS bit 0	Reserved	Changes over between settings for different	P0810 =
			operation interfaces (command data sets).	r2090.15
1) If	you change	over from a	nother telegram to telegram 20, then	the assignment

of the previous telegram is kept.

4.6.4 Status word 1 (ZSW1)

ZSW HIW

Bit Nr. 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Bit	Significance		Comments	Signal inter-				
	Telegram 20	All other		connection				
		telegrams		in the inverter				
0	1 = Ready to start		Power supply switched on; electronics initialized;	P2080[0] =				
	-		pulses locked.	r0899.0				
1	1 = Ready		Motor is switched on (ON/OFF1 = 1), no fault is	p2080[1] =				
			active. With the command "Enable operation"	r0899.1				
			(STW1.3), the inverter switches on the motor					
2	1 = Operation ena	bled	Motor follows setpoint. See control word 1, bit 3	p2080[2] =				
				r0899.2				
3	1 = Fault active		The inverter has a fault. Acknowledge fault using	p2080[3] =				
			STW1.7.	r2139.3				
4	1 = OFF2 inactive		Coast down to standstill is not active.	p2080[4] =				
				10899.4				
5	1 = OFF3 inactive		Quick Stopp is not active	p2080[5] =				
<u> </u>		ut a attice		n0099.0				
o		li active	OFF1 followed by ON	$p_{2080[6]} = r_{0899.6}$				
7	1 – alarm active		Motor remains switched on: no	n2080[7] -				
l '			acknowledgement is necessary.	r2139.7				
8	1 = Speed d	eviation within the	Setpoint/actual value deviation within the	p2080[8] =				
Ũ	tolerance range		tolerance range.	r2197.7				
9	1 = Master control	requested	The automation system is requested to accept	p2080[9] =				
			the inverter control.	r0899.9				
10	1 = Comparison	speed reached or	Speed is greater than or equal to the	p2080[10] =				
	exceeded		corresponding maximum speed.	r2199.1				
11	1 = current or	1 = torque limit	Comparison value for current or torque has been	p2080[11] =				
	torque limit	reached	reached or exceeded.	r0056.13/				
	reached			11407.7				
12	1)	1 = Holding brake	Signal to open and close a motor holding brake.	p2080[12] =				
		open		r0899.12				
13	0 = Alarm, motor of	overtemperature	—	p2080[13] =				
4.4	A Matan	O Matan natata	laters all suggests a studie sheet of	12133.14				
14	1 = MOTOR rotates	0 = Motor rotates	Internal Inverter actual value > 0	p2080[14] = r2197 3				
	clockwise	counterclockwise	Internal inverter actual value < 0	12107.0				
15	1 = CDS display	0 = Alarm, inverter		p2080[15] =				
		thermal overload		r0836.0/				
				r2135.15				

2) If you change over from another telegram to telegram 20, then the assignment of the previous telegram is kept.

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4.6.5 Main setpoint (HSW/NSOLL_A; 16-bit)



The main setpoint is a 16-bit word in which the required speed is transferred to the converter.

The setpoint is transferred as an integer with preceding sign (-32768 to 32767). The value 16384 (4000 Hex) corresponds to +100%.

The value 100% is defined at a particular rotary speed by means of the parameter P2000 (reference speed). The speed that is to correspond to a setpoint of 100% via the interface is entered in this parameter.

The speed of the converter is calculated as follows:

n= (HSW x P2000)/16384

Note:

 The parameter P2000 (reference speed) is automatically calculated for Drive Data Set 0 during motor startup and set to the value of parameter P1082 (maximum speed).

4.6.6 The main actual value (HIW/NIST_A; 16-bit)



The main actual value is a 16-bit word through which the actual speed of the converter is transferred. The normalization of this value corresponds to that of the setpoint.

n= (HIW x P2000)/16384

Note:

 The parameter P2000 (reference speed) is automatically calculated for Drive Data Set 0 during motor startup and set to the value of parameter P1082 (maximum speed).

4.6.7 Layout of the request telegram in double-word format

The request telegram is sent to the SINAMICS G120 in double-word format.

The layout of the bits is shown in the table.

	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
	QB 256 QB 257							QB 258 QB 259							59																
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

4.6.8 Layout of the response telegram in double-word format

The response telegram is returned by the SINAMICS G120 in double-word format.

The layout of the bits is shown in the table.

	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
	IB 256 IB 257							IB 258 IB 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:

 A data block in which the data are stored temporarily is used for the request telegram and for the response telegram in the control program. The telegrams are mapped there respectively in a structure that is created by means of the PLC data types.

4.7 SINAMICS Startdrive commissioning tool for SINAMICS G120

The most recent version of the SINAMICS Startdrive commissioning software can be downloaded from the Website:

support.industry.siemens.com .

SINAMICS Startdrive is a tool integrated in TIA Portal and corresponds to the familiar TIA Portal in its structure and handling.

The SINAMICS Startdrive extension contains the data and views for the SINAMICS G120 frequency converters already supported there.

This enables easy parameter assignment and commissioning of the frequency converters. A wide range of functions and aids are available for diagnostics and troubleshooting.

4.7.1 Resetting frequency converters and setting the IP address

A new IP address can be directly assigned to the Control Unit of the frequency converter with SINAMICS Startdrive in TIA Portal. The Control Unit can now be reset.

 \rightarrow To do so select the Totally Integrated Automation Portal, which is opened with a double-click. (\rightarrow TIA Portal V13)



 \rightarrow Then select the item \rightarrow "Online & Diagnostics" and open the \rightarrow "Project view".



→ In the project tree select the network card of your computer under → "Online access". When you click → "Update accessible devices", you see the IP address (if already set) or the MAC address (if the IP address has not yet been assigned) of the Control Unit of the connected SINAMICS G120 frequency converter→. Select → "Online & diagnostics".



→ Before you reassign the IP address, we recommend that you first reset the PROFINET interface parameters. To do so select the function → "Resetting the PROFINET interface parameters" and click → "Reset".

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Devices		
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	Diagnostics	
▼ Im Online access	▼ Eunctions	Resetting the PROFINET interface parameters
Display/hide interfaces	Assign name	
COM [RS232/PPI multi-master cable]	Assign IP address	
 Intel(R) Ethernet Connection I217-LM 	Posotting the PPOEINET interface parameters	
Update accessible devices	Packing up/reset	MAC address: 00 - 1F - F8 - E0 - 4E - 5E
Image: Comparison of the second se	backing upreset	IP address: 192.168.0 .6
 drive-g120 [192.168.0.6] 		PROFINET device name: drive-g120
🔐 Parameter	•	
🕺 Commissioning		Reset
🗓 Online & diagnostics	-	
Dell Wireless 1550 802.11ac		
PC Adapter [MPI]		
PC internal [Local]		
PLCSIM [PN/IE]	۶.	
PLCSIM S7-1200/S7-1500 [PN/IE]	2	
 USB [S7USB] 	80	
TeleService [Automatic protocol detection]		
Card Reader/USB memory		Properties Linfo Diagnostics
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 \rightarrow Answer the prompt whether you really want to reset with \rightarrow "Yes".



 \rightarrow Successful resetting can be checked in the messages in the \rightarrow "Info" window \rightarrow "General".

	🖳 Prop	erties	🔄 🛄 Inf	Dia	gnostics		•
G	General Cross-references Compile						
3	▲ 🚺 Show all messages						
1	Message	Go to	?	Date	Time		
0	Scanning for devices completed for interface Intel(R) Ethernet Connection I21	7		8/31/2016	1:02:46 PM		^
	The device was reset.			8/31/2016	1:04:09 PM		
							¥
<	111					>	

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→ Then once again select → "Update accessible devices" and then → "Online & diagnostics" of your frequency converter. To assign the IP address, select the function → "Assign IP address". Enter the following IP address at this point: → IP address: 192.168.0.6 → Subnet mask: 255.255.255.0. Click → "Assign IP address" and this new address is assigned to the Control Unit of your frequency converter.

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cpu1516f.profinet interface 1 [192.168.0.1	1	Resetting the PROFINET Interface paramet	IPaddress: 192 168 0 6
Accessible device [00-1F-F8-E0-4E-5E]	1		
V Online & diagnostics		•	Subnet mask: 255.255.255.9
Dell Wireless 1550 802.11ac			Use router
PC Adapter [MPI]		-	Pouter address: 0 0 0 0
PC internal [Local]			Router address: 0 . 0 . 0 . 0
PLCSIM [PN/IE]	-2		Assign IP address
PLCSIM S7-1200/S7-1500 [PN/IE]	-2		
USB [S7USB]			
TeleService [Automatic protocol detection]			
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→ The successful assignment of the IP address is shown again as a message in the window → "Info" → "General".

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📀 🛛 The p	arameters were transferred	successfully.				8/31/20	16 1:11:00 PM	^
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→ Before you can now carry out resetting of the frequency converter to the factory setting you have to once again select → "Update accessible devices" and the → "Online & Diagnostics" of your frequency converter. In order to reset the frequency converter to factory settings, select → "Restore factory resetting" under → "Backing up/reset" and click → "Start".

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→ Select the option I "Save factory setting in EEPROM" so that the parameters of the factory setting are loaded from the EEPROM into the RAM of the device after switching off and on - and not the data of an old project. Confirm the prompt whether you really want to reset with → "OK".



Note:

 The communication settings such as the IP address and the subnet mask are retained when the frequency converter is set to the factory setting.

5 Task

In the following section the project from the chapter "SCE_EN_032-600_Global_Data_Blocks" is to be supplemented by a frequency converter G120 with Control Unit CU250S-2 PN.

Controlling of the belt motor via analog values is now replaced by the controlling of the frequency converter via PROFINET. Monitoring of the actual speed value is also effected via PROFINET.

6 Planning

The conveyor belt driven by an induction motor will now be controlled via a frequency converter with a variable speed.

This frequency converter has to be created, configured and commissioned in the project.

The parameter assignment of the frequency converter is done offline with the SINAMICS Startdrive software, whereby the commissioning wizard is used.

Here the motor data of the induction motor are taken from the rating plate of the motor and entered manually.

In this project the following induction motor is wired in Delta mode and operated single-phase with 230V.



Figure 1: Rating plate of induction motor

A diagram of the two connection types can be found on the inside of the terminal box cover of most motors:

- Star connection (Y)
- Delta connection (Δ)



Figure 2: Star connection/delta connection

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The frequency converter SINAMICS G120 receives the start command and speed specification in the following via PROFINET from the SIMATIC S7-1500. The actual speed value is also read out of the SINAMICS G120 frequency converter via PROFINET and is monitored for the high and low limits in the SIMATIC S7-1500.

A "Frequency converter" data block [DB4] is created in the control program in which the data are stored temporarily for the request telegram and the response telegram. The telegrams are created there by means of the PLC data types and are mapped respectively in a structure.

In the "Main" organization block [OB1] you copy the actual values from the converter into the "Frequency converter" data block [DB4] and the setpoints from the data into the converter.

Finally, the data created in the "Frequency converter" data block [DB4] can be accessed when calling up the functions and function blocks.

6.1 Technology schematic diagram

At this point you see the technology schematic diagram for the task.



Figure 3: Technology schematic diagram

Schalter der Sortieranlage		Automatikbetrieb		Handbetrieb / Manual mode
Switches of sorting station		Automatic mode		-S3 Tippbetrieb -M1 vorwärts/
-P1 ein/on		-P5 gestartet/started		Manual -M1 forwards
-Q0 Hauptschalter/Main switch		-S1 Start/start		-S4 Tippbetrieb -M1 rückwärts/
-P4 aktiviert/active				Manual -M1 backwards
-A1 NOTHALT/Emergency stop		-S2 Stopp/stop		-P7 ausgefahren/extended
				-S6 Zylinder -M4 ausfahren/
-P2 Ratio/manual -P5 Autorauto				-P6 eingefahren/retracted
-so betriebsary operating mode				cylinder -M4 retract
	JL			<u> </u>

Figure 4: Operator panel

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6.2 Reference table

DI	Туре	ID	Function	NC/NO
1 0.0	BOOL	-A1	Return signal emergency stop ok	NC
I 0.1	BOOL	-K0	Main switch "ON"	NO
I 0.2	BOOL	-S0	Mode selector manual (0)/automatic (1)	Manual = 0
I 0.3	BOOL	-S1	Pushbutton automatic start	NO
I 0.4	BOOL	-S2	Pushbutton automatic stop	NC
I 0.5	BOOL	-B1	Sensor cylinder -M4 retracted	NO
I 1.0	BOOL	-B4	Sensor part at slide	NO
l 1.3	BOOL	-B7	Sensor part at end of conveyor	NO
ID256	STRUCT	PZD_IN_G120_01	Telegram 1 receive process data from G120 conveyor1	

The following signals are required as global operands for this task.

DO	Туре	ID	Function	
OD256	STRUCT	PZD_OUT_G120_01	Telegram 1 send process data to G120 conveyor1	

Legend for reference list

AI

- DI Digital input DO Digital output
 - Analog input AO Analog output
- I Input O Output
- NC Normally Closed
- NO Normally Open
7 Structured step-by-step instructions

You can find instructions on how to perform planning below. If you already have a good understanding of everything, it is sufficient to focus on the numbered steps. Otherwise, simply follow the steps of the instructions illustrated below.

7.1 Retrieving an existing project

→ Before we can extend the project "SCE_EN_032-600_Global_Data_Blocks_R1508.zap13" from the chapter "SCE_EN_032-600_Global_Data_Blocks", we have to retrieve it. To retrieve an existing project, you have to select the respective archive in the project view under → Project → Retrieve. Confirm your selection with Open. (→ Project → Retrieve → Selection of a .zap archive → Open)

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→ Next, the target directory in which the retrieved project is to be stored can be selected. Confirm your selection with "OK". (→ Target directory → OK) → Save the opened project under the name 062-101 Frequency converter G120 and S7-1500. (→ Project → Save as ... → 062-101 Frequency converter G120 and S7-1500 → Save)

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Creating a frequency converter in the TIA Portal 7.2

→ In order to network the Control Unit of the SINAMICS G120 with the CPU1516F-3 PN/DP you have to change to the 'Network view'. At this point the desired 'CU250S-2 PN Vector' dragged-and-dropped into can be the network view. (\rightarrow Devices & networks \rightarrow Network view \rightarrow Drives & starters \rightarrow SINAMICS drives \rightarrow SINAMICS G120 \rightarrow Control units \rightarrow CU250S-2 PN Vector \rightarrow Article No.: $6SL3246-0BA22-1FA0 \rightarrow Version 4.7$).

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PLC alarms		a	an CU240E-2 PR-F	ľ
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→ Connect the Ethernet interfaces of the Control Unit of the G120 and the CPU1516F-3 PN

with the mouse. (\rightarrow \blacksquare Ethernet \rightarrow \blacksquare Ethernet)

M Siemens - D:\00_TIA_Portal\062-101Frequ	ency Converter G120 PN S7-1500/062-101 Frequeny Converter G120 PN S7-1500		_ □ >
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Devices	🛃 Topology view 🛛 🛔 Network view	Device view	Options
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🕺 🃩 Devices & networks	CPU1516F Drive 1	-	Filter
CPU1516F [CPU 1516F-3 PN/DP]	G120 C025		PC systems
Device configuration			▼ Drives & starters
Online & diagnostics	Not assigned		SIRIUS motor starters and soft
Program blocks			 SINAMICS drives
Technology objects	PN/IE_1		SINAMICS G110M
External source files			▼ SINAMICS G120
PLC tags			
E PLC data types			a CU240B-2
Watch and force tables			1 CU240B-2 DP
Image:			🚛 CU240E-2
Traces			🏭 CU240E-2 PN 🔬
Program info		- 5	🚛 CU240E-2 DP 🔬 🖓
Device proxy data			1 CU240E-2 F
PLC alarms			🚛 CU240E-2 PN-F
Text lists			4 CU240E-2 DP-F
Local modules			CU250S-2 Vector
Drive_1 [G120 CU250S-2 PN Ve			E CU250S-2 CAN Vector
Unassigned devices			SCU250S-2 PN Vector
Common data			< III >
Documentation settings			✓ Information
Languages & resources			
Online access			Device:
Card Reader/USB memory			÷**
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> Details view	🖳 Properties 🔂 Info 🔒 🕓 Diag	nostics 🛛 🗆 🛋	CU250S-2 PN Vector
Portal view Overview	h Devices & ne	6	Project D:\00 TIA Portal\032-600 Glob

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→ an IP address suitable for the CPU in the properties of the 'PROFINET interface [X1]' of the 'G120'. (→ G120 CU250S-2 PN Vector → PROFINET interface [X1] → Properties → Ethernet addresses → IP protocol → IP address: 192.168.0.6)



 \rightarrow The device name is entered under 'General'. (\rightarrow General \rightarrow Name: Drive_G120_conveyor)

Ma Siemens - D:\00_TIA_Portal\062-101 Frequ	encyConverter G120 PN S7-1500\062-10	1 Frequeny Converter G120 PN S7-15	00			_ _
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▼ 1 062.101ErequencyConverter 6120 P		+ 10 system	1. CPUTSTOP.PROFINET IO-System (100)		• Catalog	
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	CPU 1516F	G120 (CU25	1 8	PC systems	~ G
Device configuration				Ξ¥		
Online & diagnostics		CPU15	165		SIRIUS motor starters	s 🛛 😺
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External source files		er er brief in her in bei		1.0	 SINAMICS G120 	ne
PIC tags			\$ 100%	\sim	👻 🌄 Control units	_ 6
PLC data types	< m		2 100%	-	CU240B-2	
Watch and force tables	Drive_1 [G120 CU250S-2 PN Vector]	🖳 Proj	perties 🗓 Info 📱 Diagnostics		4 CU240B-2 C	DP
Online backups	General				CU240E-2	
Traces	- General	Π		•	CU240E-2 F	PN a
Program info	Catalog information	General			- CU240E-2 D	DP 🔄 👸
Device proxy data	▼ PROFINET interface [X1]				CU240E-2 F	F
PLC alarms	General	Namo	Drive G130 conveyed		■ CU240E-2	L
Text lists	Ethernet addresses	Name:	Drive_d120_conveyor	_	₩ CU240E-2	
Local modules	Cyclic data exchange	Author:	Michael Dziallas	_	4 CU2505-2 \	V Tar
Distributed I/O	Actual value	Comment:		^	a CU2505-2 C	C 0
Drive_1 [G120 CU250S-2 PN Ve	Setpoint				■ CU2505-2 F	P 🗸
Common data	 Advanced options 				<	>
Documentation settings	Media redundancy	•			✓ Information	
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Online access	IO cycle	•		\sim	Device:	
Card Reader/USB memory	Synchronization				-9-	=
	Port [X1 P1]	Catalog information		_		
	Port [X1 P2]					
	Diagnostics addresses					
	Module parameter	Short designation:	CU25US-2 PN Vector		CU2505-2 PN	Vec
	HW identifier	Description:	Control Unit type: CU250S-2 PN Vector	^		
< III >			Analog inputs: 2		Article no.: 6SL3246-0BA2	22-1F
> Details view	1	<		>	<	>
Portal view Overview	Bevices & ne			Project D	0:100 TIA Portal1032-600 Glob	
				a sequence		

Note:

 This name is applied automatically as the PROFINET device name under the 'PROFINET' point for the 'PROFINET interface' of the 'G120 CU250S-2 PN-Vector'. → Settings for the 'IO cycle' such as the 'Update time' and 'Watchdog time' can also be set for this device. (→ Advanced options → Real time settings → IO cycle → Update time → Watchdog time)



→ The 'Standard Telegram 1' is specified for the 'Cyclic data exchange' between the PLC and the frequency converter. (→ PROFINET interface [X1] → Cyclic data exchange → Actual value: Standard Telegram 1→ Setpoint: Standard Telegram 1)

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	Network	connection 🔽 🐯 🛄	€ ±		
*			± 10	system: CPU1516E.PROF	INFT IO-System (100)
062-101FrequencyConverter G120 F				-,	= 7
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Program blocks					9
 Technology objects 		CPU1516F.PROFINE			
External source files					~ to
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Program info	Catalog information	Cyclic data exchange			
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PLC alarms	General	Drive object Link Tel	egram Length	Extension	Partner Partner data
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Online access	IO cycle				
Card Reader/USB memory	Synchronization				
	Port [X1 P1]	<			
	 Port [X1 P2] 				
	Diagnostics addresses	 Actual value 			
< III >	Module parameter				
Details view	Hwidentifier				*
Portal view Overview	h Devices & ne			Project D:\	00 TIA Portall032-600 Glob

→ For the address ranges, select 'I 256...259' and 'O 256 ... 259'. (\rightarrow PROFINET interface [X1] \rightarrow Cyclic data exchange \rightarrow Actual value \rightarrow Start address I 256 \rightarrow Setpoint \rightarrow Start address O 256)



→ Change to the 'Device view' from 'Drive_G120_conveyor'. There the used Power Module, for example 'PM240-2 IP20 FSA U 1/3 AC200 0.75kW', is selected and assigned to the 'Drive_G120_conveyor'.



(\rightarrow Device view \rightarrow Drive_G120_conveyor \rightarrow PM 240-2 IP20 FSA U 1/3 AC200 0.75kW)

 \rightarrow Save the project with the existing settings. (\rightarrow



→ Download the device configuration with the frequency converter G120 as the device to the 'CPU_1516F [CPU1516F-3 PN/DP]' by clicking the Download to device' icon. $(\rightarrow$ CPU_1516F [CPU1516F-3 PN/DP] \rightarrow III)



→ The device name still has to be assigned to the frequency converter G120 as an IO device of the CPU_1516F. To do so, select the 'PN/IE_1' network and select 'Assign device name'.
 (→ PN/IE_1 → Assign device name)

M Siemens - D:\00_TIA_Portal\062-101Freque	ncy Converter G120 PN S7-1500\062-101 Frequen	y Converter G120 PN S7-1500		_ 🗆 ×
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Online & diagnostics		CPU15165		🕨 🕅 SIRIUS motor starters an
Program blocks			z	 SINAMICS drives
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PLC data types		🛅 Paste Ctrl+V	· · · · · · · · · · · · · · · · · · ·	a CU240B-2
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Drive_G120_conveyor [G12.			ignosaes	Device:
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Portal view Overview	Bevices & ne		🗸 Projec	t D:\00_TIA_Portal\032-600_Glob

→ In the subsequent dialog, the "PG/PC interface' can be selected, before we select the 'Drive_G120_conveyor' and 'Assign name'. (→ PROFINET device name: Drive_G120_conveyor → SINAMICS G120 CU250S → Assign device name)

Assign PROFINET device	e name.						×
		Configured	PROFIN	IET dev			
		PROFINET devic	e name:	drive a120 a	conveyor		-
		Dev	ice type:	CU250S-2 PN \	Vector		
		Online acco					
		Type of the PG/PC i	ss nterface:	PN/IE			
		PG/PC i	nterface:	Intel(R) Ethe	ernet Connect	ion I217-LM	-
		Device filter					
		🛃 Only show	devices of	the same type			
		Only show	devices wi	th bad paramete	er settings		
		Only show	devices wi	thout names			
	Accessible devi	ces in the network:					
	IP address	MAC address	Device	PROFINET dev	vice name	Status	
	192.168.0.6	00-1F-F8-E0-4E-5	SINAMICS	5	1	No device r	name assigned
FlashUED							
	<						>
					Upd	ate list	Assign name
Online status information:							
 Search completed. 	1 of 2 devices we	ere found.					
 Search completed. 	. 1 of 2 devices we	ere found.					
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Assign PROFINET device	a name.						Close
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Note:

 If several IO devices exist in the network, the device can be identified on the basis of the imprinted MAC address. → If too many components are displayed, the view can be filtered by clicking on 'Only show devices of the same type'. If the device name was assigned successfully, this is indicated by 'OK' in the status. (→ Close)

Assign PROFINET device name.				×
-	Configured Pl	ROFINET dev		
	PROFINET device	name: drive g120 g	onvevor	•
	Device	e type: CU250S-2 PN V	/ector	
	Type of the PG/PC inte	S erface: <mark></mark> PN/IE		
	PG/PC inte	erface: 🚺 Intel(R) Ethe	ernet Connection I217-LM	- 💿 💽
	Device filter			
	🗹 Only show de	evices of the same type		
	Only show de	evices with bad paramete	er settings	
	Only show de	evices without names		
Accessible	devices in the network:		PROFINIT device serves	Chattan
192 168	0.6 00.1E-E8-E0-4E-51 9	SINAMICS G120 CU250	drive g120 conveyor	
152.100.		114/10/10/120 C0250	unve_grzo_conveyor	
Flash LED				
			Lindate list	Accian name
			Opdate list	Assign name
Online status information:				
Search completed. 1 of 2 device	es were found.			
 Search completed. 1 of 2 device 	es were found.			
The PROFINET device name "d	rive_g120_conveyor" was su	ccessfully assigned to M	AC address "00-1F-F8-E0)-4E-5E".
<				>
				Class
				Close

- 7.3 Assigning parameters of the frequency converter with the commissioning wizard
 - → To assign the parameters of the frequency converter, double-click 'Parameter' of 'Drive_G120_conveyor' to open the parameters and start the 'Commissioning Wizard'.
 (→ Drive_G120_conveyor → Parameter → Commissioning Wizard)

Project Edit View Insert Online Options Tools	Window Help Totally Integra	ated Automation PORTAL
Project tree 🔲 🖣	/ Converter G120 PN \$7-1500 > Drive_G120_conveyor [G120 CU250S-2 PN Vector] > Parameter 📃 🖬 🗮 🗙	Tasks 🔳 🗊 🕨
Devices	Wizards Functional View Parameter View	Options 😨
B O O E E E E E E E E E E E E E E E E E		Tas
	▼ Commissioning	✓ Find and re
	Drive connected to a SIMATIC motion control Commissioning Without	Find: Whole words Match case Find in substr Find in hidder Use regular es Whole docum
Online access		From current
Card Reader/USB memory	Drive_G120_conveyor [G120 CU250S-2 PN Vector] Properties Linfo Diagnostics Cu250S-2 PN Vector]	 Selection Down Up
Image: Constraint of the second se	Media redundancy > Setpoint Real time settings	Fir Replace with: V Canguages

→ In the subsequent dialog, select 'U/f control with linear characteristic' as the control type.
 Keep the default selection for the function modules. (→ U/f control with linear characteristic
 → Next)

Commissioning Wizard	? X
	Open-loop/closed-loop control type Specification of the open-loop/closed-loop control type according to the load characteristic and open-loop/closed-loop control task
 Open-loop/closed-lo Defaults of the setpo Drive setting Motor Important parameters Drive functions Encoders Summary 	Function modules: Techn controller Basic positioner Extended messages/monitoring Free function blocks Setpoint Control type: [0] Ulf control with linear characteristic (0] Ulf control with linear characteristic (0) Ulf control with linear characteristic
	< <back next="">> Finish Cancel</back>

→ For selection of the setpoint and command source, select the macro 7 'Fieldbus with data set changeover'. (\rightarrow [7] Fieldbus with data set changeover)

Commissioning Wizard		? X
	Defaults of the setpoints/command sources Selection of a predefined interconnection of the inputs/outputs and, if required, the field telegram. Can be changed later user-specifically.	bus
𝞯 Open-loop/closed-lo	Current I/O configuration:	
Defaults of the setpo	[7] Fieldbus with data set changeover Select the default of the I/O configuration:	
Drive setting	[7] Fieldbus with data set changeover [1] Conveyor technology with 2 fixed frequencies	-
Motor	 [2] Conveyer technology with Basic Safety [3] Conveyor technology with 4 fixed frequencies [4] Conveyor technology with fieldbus 	
Important parameters	[5] Conveyor technology with fieldbus and Basic Safety [7] Fieldbus with data set changeover [8] MOP with Basic Safety [9] Standard I/O with MOP	
Encoders	 [12] Standard I/O with analog setpoint [13] Standard I/O with analog setpoint and safety [14] Process industry with fieldbus 	
) Summary	[15] Process industry D0 0: r52.3 CO/B0: Status word 1::Fault present D0 1: r52.7 CO/B0: Status word 1::Alarm present A0 0: r21 CO: Actual speed smoothed A0 1: r27 CO: Absolute actual current smoothed	
	Selected telegram configuration: [1] Standard telegram 1, PZD-2/2	~
	<< Back Next >> Finish Canc	el

→ The selection of the macro '[7] Fieldbus with data set changeover' still has to be confirmed with 'Accept'. (→ Accept)



 \rightarrow The current interconnections of the IO terminals for the Macro 7 are now displayed. (\rightarrow Next)

Commissioning Wizard	? X
	Defaults of the setpoints/command sources Selection of a predefined interconnection of the inputs/outputs and, if required, the fieldbus telegram. Can be changed later user-specifically.
Open-loop/closed-lo Defaults of the setpo	Current I/O configuration: [7] Fieldbus with data set changeover Select the default of the I/O configuration:
Drive setting	No change
e Motor	Note: If changed, all the existing drive-internal interconnections to the I/O terminals are deleted and reconnected in accordance with the selected I/O configuration.
Important parameters	Accept
	Current interconnections of the I/O terminals:
 Drive functions Encoders Summary 	DI 0: p1055[1] BI: Jog bit 0 DI 1: p1055[1] BI: Jog bit 1 DI 2: p2103[1] BI: 1. Acknowledge faults p2104[0] BI: 2. Acknowledge faults DI 3: p810 BI: Command data set selection CDS bit 0 DI 4: - DI 5: - DI 6: - DI 6: - DI 11: - DI 12: - DI 16: - DI 16: - DI 16: -
	DO 0: r52.3 CO/BO: Status word 1::Fault present DO 1: r52.7 CO/BO: Status word 1::Alarm present DO 2: r52.2 CO/BO: Status word 1::Operation enabled
	<pre><< Back Next >></pre>

→ For the drive settings, select the 'IEC-Motor (50 Hz, SI units)' and 'Load duty cycle with high overload for vector drives'. (→ IEC-Motor (50 Hz, SI units) → Load duty cycle with high overload for vector drives → Next)

Commissioning Wizard	?	×
	Drive setting Selection of motor standard and load cycle	
 Open-loop/closed-lo Defaults of the setpo Drive setting 	Standard: [0] IEC-Motor (50 Hz, SI units) Drive unit line supply voltage: 230 V	
Motor	Power unit application:	
Important parameters	[0] Load duty cycle with high overload for vector drives ▼ p205: Power unit application	
 Drive functions Encoders Summary 	The duty cycles can be overloaded provided that the drive converter is operated with its base load current before and after the overload. This is based on a load duty cycle of 300 s. 200 Default value: [0] Load duty cycle with 150 - high overload for vector drives [0] Load duty cycle with high overload for vector drives [1] Load duty cycle with high overload for vector drives [1] Load duty cycle with high overload for vector drives [1] Load duty cycle with low overload for vector drives [2] Load duty cycle with low overload for vector drives [3] Z40 	
	Help for the parameter << Back Next>> Finish Cancel	

Note:

 Further information about the settings is available in the tool tip text, the online help or in the list manual. → In the subsequent dialog, select 'Induction motor' as the motor type and enter the motor data in accordance with the specifications of the rating plate of the motor (→ Enter motor data → Induction motor → Connection type: Delta → ... → Next)

Commissioning Wizard				? X
	Motor Specification of	motor type and motor data		
 Open-loop/closed-lo Defaults of the setpo Drive setting 	Motor configura Enter motor da Select motor tyj [1] Induction m	ttion ta pe otor		•
Motor	Select the conn Delta	ection type for your motor and 87 Hz oper	ation:	z operation
Important parameters	Motor data			
 Drive functions Encoders Summary 	Parameter p304[0] p305[0] p307[0] p308[0] p310[0] p311[0] p335[0]	Parameter text Rated motor voltage Rated motor current Rated motor power Rated motor power factor Rated motor frequency Rated motor speed Motor cooling type	Value 230 0.73 0.12 0.750 50.00 1350.0 0] Non-ventil	Unit Vrms Arms kW Hz rpm
	Parallel moto	or connection	N Finish	umber: 1

Note:

- Alternatively, SIEMENS motors can also be selected directly via the order numbers.
- \rightarrow The following screenshot shows an example for the parameters for the current/speed limiting and for the ramp-function generator.(\rightarrow Next)

Commissioning Wizard	? ×
	Important parameters Specification of the most important dynamic response data
𝒞 Open-loop/closed-lo	Set the values for the most important parameters:
Solution of the setpo	Current limit: 1.10 Arms
	Minimum speed: 0.000 rpm
🧐 Motor	Maximum speed: 500.000 rpm Ramp-function generator
Important parameters	ramp-up time: <u>3.000</u> s Ramp-function generator
Drive functions	ramp-down time: 3.000 s
Encoders	OFF3 ramp-down time: 1] s
Summary	
	<< Back Next >> Finish Cancel

→ Select 'Standard drive' for the Technology application. Set the motor identification to 'Inhibited', and select 'Complete calculation' for calculating the motor parameters based on parameter values from before. (→ Standard drive → Motor identification: Inhibited → Complete calculation → Next)

Commissioning Wizard		? X
	Drive functions Specification of the method to measure the motor data	
 Open-loop/closed-lo Defaults of the setpo Drive setting Motor Important parameters Drive functions Encoders Summary 	Technology application [0] Standard drive A motor identification is recommended for the first commissioning. Stationary measurement is recommended for VIf and vector control. Stationary measurement and rotating measurement are recommended for vector control (only rotating measurement is not sufficient). Motor identification: [0] Inhibited Calculation of the motor parameters No calculation Image: Complete calculation Image: Complete calculation Image: Complete calculation of the motor, open-loop control and closed-loop control parameters depending on the entered motor data.	T
	< <back next="">> Finish Can</back>	cel

 $\rightarrow~$ Do not select an encoder at this point. (\rightarrow Next)

Commissioning Wizard		? X
	Encoders	
	Encoder selection	
	Encoder 1 Encoder 2	
🮯 Motor		
Important parameters		
Orive functions		
Encoders		
Summary		
	<< Back Next>> Finish Cancel	

 \rightarrow In the subsequent summary, all the settings are shown once more for checking. These are applied by using the 'Finish' button. (\rightarrow Finish)



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sce-062-101-frequency-converter-g120-pn-s7-1500-r0909-en.docx

→ In the subsequent dialog, select 'PN/IE' as the PG/PC interface type, select the previously set network adapters as the PG/PC interface and select 'PN/IE_1' as the connection of the CPU to the subnet. Click 'Start search'. (→ Type of the PG/PC interface: PN/IE → PG/PC interface: → Connection to interface/subnet: PN/IE_1 → Start search)

	Configured access nod	es of "Drive_G120_	convey	or"		
	Device	Device type	Slot	Туре	Address	Subnet
	Drive_G120_conveyo			S7USB		
		CU250S-2 PN Vec.	0 X1	PN/IE	192.168.0.6	PN/IE_1
		ing of the DC/DC into	da sa .			
	ı y	pe of the PG/PC inte	nace:	PINIE		
		PG/PC inte	rface:	Intel(R) Et	hernet Connection I217-	-LM 🔽 🛡 [
	Conne	ection to interface/su	ibnet:	PN/IE_1		
		1st gate	eway:			- 💎 💎
	Device	Device type	Туре		Address	Target device
	Device	Device type	PN/IE		Access address	Target device
100						
Flash LED						
Flash LED						
Flash LED						<u>S</u> tart search
Flash LED	ation:					<u>Start search</u>
Flash LED	ation:					<u>S</u> tart search
Flash LED	ation:					<u>S</u> tart search
Flash LED	ation:					<u>S</u> tart search
Flash LED	ation:					<u>S</u> tart search

→ You should now see your 'SINAMICS drive' and be able to select it as the target device. Click 'Load''. (\rightarrow SINAMICS drive \rightarrow Load)

	Device		Device type	Slot	Type	Address	Subnet
	Drive G120	convevo	bence type	JIOC	STUSE		Subilet
	bive_dizo_	_conveyo	CU250S-2 PN Vec	0 X1	PN/IE	192.168.0.6	PN/IE_1
		Ту	pe of the PG/PC inte	rface:	PN/IE		-
			PG/PC inte	rface:	💹 Intel(R) Eth	ernet Connection I217-LN	1 💌 🖲
		Conne	ction to interface/su	ubnet:	PN/IE_1		•
			1st gat	eway:			- (*
	Compatible de Device	evices in Device ty	arget subnet: pe		Туре 🔺	Show all compatible Address	e devices Target dev
	Compatible de	evices in Device to	arget subnet:		Type	Show all compatible	e devices
	Compatible de Device Antrieb_G1	evices in Device ty G120 C	arget subnet: pe J250S-2 PN Vector	V4.7	Type 🔺 PN/IE	Address 192.168.0.6	e devices Target dev
	Compatible de Device Antrieb_G1	evices in 1 Device ty G120 C	target subnet: pe J2505-2 PN Vector	V4.7	Type PN/IE PN/IE	Show all compatible Address 192.168.0.6 Access address	e devices Target dev
	Compatible de Device Antrieb_G1	evices in 1 Device ty G120 Cl	target subnet: pe J2505-2 PN Vector	V4.7	Type PN/IE PN/IE	Show all compatible Address 192.168.0.6 Access address	e devices Target dev
7	Compatible de Device Antrieb_G1	evices in 1 Device ty G120 C	target subnet: .pe J250S-2 PN Vector	V4.7	Type PN/IE PN/IE	Show all compatible Address 192.168.0.6 Access address	e devices Target dev
	Compatible de Device Antrieb_G1	evices in 1 Device ty G120 Cl 	target subnet: pe J250S-2 PN Vector	V4.7	Type PN/IE PN/IE	Show all compatible Address 192.168.0.6 Access address	e devices Target dev
sh LED	Compatible de Device Antrieb_G1	evices in 1 Device ty G120 C	target subnet: ipe J250S-2 PN Vector	V4.7	Type PN/IE PN/IE	Show all compatible Address 192.168.0.6 Access address	e devices Target dev
ish LED	Compatible de Device Antrieb_G1	evices in 1 Device ty G120 C	arget subnet: pe J2505-2 PN Vector	V4.7	Type PN/IE PN/IE	Show all compatible Address 192.168.0.6 Access address	e devices Target dev Start sear
sh LED	Compatible de Device Antrieb_G1	evices in Device ty G120 Cl	arget subnet: pe J2505-2 PN Vector	V4.7	Type PN/IE PN/IE	Show all compatible Address 192.168.0.6 Access address	e devices Target dev Start sear
tus informatio completed. 1	Compatible device Antrieb_G1	evices in 1 Device ty G120 Cl 	arget subnet: ipe J2505-2 PN Vector	V4.7	Type PN/IE PN/IE	Show all compatible Address 192.168.0.6 Access address	e devices Target dev Start sear
tus informatio completed. 1 ving device in	Compatible device Antrieb_G1 on: compatible device formation	evices in 1 Device ty G120 C	arget subnet: ipe J2505-2 PN Vector	V4.7 und.	Type PN/IE PN/IE	Show all compatible Address 192.168.0.6 Access address	e devices Target dev Start sear
ash LED tatus informatio n completed. 1 rieving device in n and informatio	Compatible de Device Antrifeb_G1 	evices in 1 Device ty G120 Cl 	arget subnet: pe J2505-2 PN Vector	V4.7 und.	Type PN/IE PN/IE	Show all compatible Address 192.168.0.6 Access address	e devices Target dev Start sear

→ The configuration is compiled automatically and is displayed once more in an overview so that you can check the steps to be carried out before loading. Now select ' \blacksquare Save the parameterization in the EEPROM' and click 'Load'. (→ \blacksquare Save the parameterization in the EEPROM → Load)

oad pr	evie	w		
? 0	Check	before loading		
Status	1	Target	Message	Action
+ ∎	0	 Drive_G120_conveyor 	Ready for loading.	
	0	 Parameter assign 	Please note the following information:	
	•	EEPROM	Save the parameterization in the EEPROM after the download	Save the parameterization in the EEPROM
	Ŭ			the EE Now
<			III	
				Refresh
			Finish	Load Cancel

Note:

 It is advisable to back up the parameters in the EEPROM as well, so that these are retained in the case of a voltage drop

7.4 Testing and commissioning of frequency converters with control panel

→ In order to test the current parameter assignment without PLC program, open the 'Control panel' from the 'Commissioning' menu of the 'Drive_G120_conveyor'. Finally, click '
✓ Go online'. (→ Drive_G120_conveyor → Commissioning → Control panel) (→ ✓ Go online).

M Siemens - D:100_TIA_Portal1062-101 Frequency Converter G	120 PN \$7-1500\062-1	01 Frequeny Converter G120 PN S7-1500		_ ¤ ×
Project Edit View Insert Online Options Tools Wind	ow Help			Totally Integrated Automation
📑 🎦 🔚 Save project 📇 🐰 🗐 🗐 🗙 🍤 🛨 (주 🛎 🗍	🗓 🚹 🖳 🞇 💋 Go	online 🖉 Go offline 🛔 🖪 🖉 🧩 🚽 🛄		PORTAL
Project tree 🔲 🖣	062-101 Frequence	nline verter G120 PN S7-1500 > Drive_G120_conveyor (G120 Cl	J250S-2 PN Vector] > Commissioning	_ # # × 🚺
Devices				
				Tast
1062-101FrequencyConveter G120 PN 57-1500 Add new device Add new device	 Commissioning Commissioni Control parts Motor opti Backing up/ 	Control penel Master control: Master control: Control penel Sectivate Drive enables: Speed: Speed: Prive status: Ready for switching on Operation enabled	C Preset Operating mode: Operating mo	M. current: Arms
		Fault Active fault Activoxiedge faults		Hz Hz
	< III >	<	П	>
> Details view			🔍 Properties 🔛	Info 🛽 Diagnostics 🗖 = 🔶
✓ Portal view III Overview III Parameter	R Commissioni		Act	ion canceled before download.

→ The first step is to 'Activate master control' in the control panel. The communication between the PC and the converter will then be monitored It is necessary that successful communication takes place at least every 10000 ms. Otherwise the motor stops and the enables are reset. (→Master control: [®] Activated → 10000 ms → ^{Continue})



→ The drive enables first have to be set in order to start the motor \checkmark Set . As a rule, this happens automatically. The drive can then be switched on \blacksquare . (→ Switch on \blacksquare)

Ma Siemens - D:\00_TIA_Portal\062-101Frequency Converter G120 PN S7-15	500/062-101 Frequeny Converter G120 PN S7-1500	_ ¤ X
Project Edit View Insert Online Options Tools Window Help		Totally Integrated Automation
📑 📑 🖬 Save project 🚐 🐰 🏥 🕮 🗙 🍤 ± (주 ± 🗟 🛄 🔟 🗒	🛃 🚿 Go online 🚀 Go offline 🛔 🖪 📳 🛠 😑 🛄	PORTAL
Project tree 🛛 🗸 062-101Fr	requencyConverter G120 PN S7-1500 ▶ Drive_G120_conveyor [G120 CU250S-	2 PN Vector] 🔸 Commissioning 🛛 📃 🖬 🖬 🗙 📢
Devices		5
1900 III -		- Ia
O62-101FrequencyConverter G120 PN 57-1500 O62-101FrequencyConverter G120 PN 57-1500 Office Add new device Devices 8 networks Office Contraction Office Contrac	ioning issiona opti gup/ Master control: Master control: Mast	Ver:Stop with specebar Operating mode: Switch on: Switch on: Switch on: Switc
Gard Reader/USB memory	, Drive status: Act	ual values:
	Ready for switching on Operation enabled	Speed: 0.0 rpm M. current: 000 Arms
	C Fault Cur Active faults Cur Acknowledge faults Cur	put frequency smoothed
< III > < III		
> Details view		🖳 Properties 🚺 Info 🕦 🗓 Diagnostics 💷 🗕 🔶
Portal view Portal view Portal view Portal view	missioni	Connected to Drive_G120_conveyor, a

→ Now the motor can be run at the selected speed Forward or Backward $(\rightarrow \text{Speed: } 44 \rightarrow \text{Forward})$

TA Siemens - D:100_TIA_Portal1062-101 FrequencyConverter G	120 PN S7-1500/062-1	01 Frequeny Converter G120 PN 57-1500	۵×
Project Edit View Insert Online Options Tools Wind Project Edit View Insert Online Options Tools Wind Save project 📇 🔏 🖽 🖹 🛣 🗙 🕾 C [±] ± 🚮 [ow Help	online 🖉 Go offline 👬 🕼 🕼 🛪 🖃 🛄 Totally Integrated Automation PORTA	AL.
Project tree	062-101 Frequency	/Converter G120 PN S7-1500 🔸 Drive_G120_conveyor (G120 CU250S-2 PN Vector) 🔸 Commissioning 📃 🖬 🗮	< (
Devices			
1 O O I I I I I I I I I I I I I I I I I			Task
Add new device Add new device Devices & networks Conveyor (C120 CU2505 2 PNUP) Cu2505 CPU 1516-3 PNUP) Cu2505 CPU 1516-3 PNUP) Cu2505 2 PNU Planmeter Convessioning Curves a diagnostics Curves a diagnostics Cur	Commissioning Commissioni Control panel Motor opti Backing up/	Control panel Master control: Control panel active: Stop with spacebar Operating mode: Switch on: Control panel active: Stop with spacebar Master control: Control panel active: Stop with spacebar Operating mode: Switch on: Control panel active: Stop with spacebar Master control: Control panel active: Stop with spacebar Operating mode: Switch on: Control panel active: Stop with spacebar Operating mode: Switch on: Control panel active: Stop with spacebar Operating mode: Switch on: Control panel active: Stop with spacebar Operating mode: Switch on: Control panel active: Stop with spacebar Operating mode: Switch on: Control panel active: Stop with spacebar Operating mode: Switch on: Control panel active: Stop with spacebar Operating mode: Switch on: Control panel active: Stop with spacebar Operating mode: Switch on: Control panel active: Stop with spacebar Operating mode: Switch on: Control panel active: Stop with spacebar Operating mode: Switch on: Control panel active: Stop with spacebar Operating mode: Switch on: Control panel active: Stop with spacebar Operating mode: Switch on: Control panel active: Stop with spacebar Operating mode	ks 🔁 Libraries
Tag Drilne access Tag Card ReadenUSB memory		Drive status: Actual values: Ready for switching on Operation enabled Fault Curput frequency smoothed Active fault: Output frequency smoothed Active values: Output frequency smoothed	~
< III >	< III >		
> Details view		🖾 Properties 🚺 Info 🔒 💹 Diagnostics 👘 🖻 🖻	
🔹 Overview 🔛 Parameter	Commissioni	✓ Connected to Drive_G120_conveyor, a 📗	

→ The drive can be switched off by clicking ' \Box '. After completion of the test, it is necessary to \Box Deactivate the master control. (→ \Box → \Box Deactivate)

062-101Frequenc	зуCo	onverter G120 PN S7-1500 🔸 Drive_G120_conveyor [G120 CU250S-2 PN Vector] 🔸 Commissioning
- Commissioning		
Commissioning	С	control panel
Control panel		
Motor opti Backing up/		A Control panel active: stop with spacebar
backing up		Master control: Drive enables: Operating mode: Switch on:
		Activated Deactivate Steed Speed Specification
		Modifier
		Speed: 44 C rpm
		Gg backward Dog forward Implication
	-	Drive status: Actual values:
		Ready for switching on Operation enabled Speed: 0.0 rpm M. current: 0.28 Arms
		G Fault
		Active fault: Output frequency smoothed V 0.0 Hz
		Acknowledge faults Output voltage smoothed
< III >	<	

 \rightarrow Confirm the prompt for deactivation with 'Continue'. (\rightarrow Continue)

W	Siemens - D:\00_TIA_Portal\062-101 FrequencyConverter G	120 PN \$7-1500\062-	101 Frequeny Converter G120 PN S7-1500 E	×
P	roject Edit View Insert Online Options Tools Wind	ow Help	Totally Integrated Automation	
E	🍄 📑 🔚 Save project 📇 🐰 🏦 🗐 🗙 🏷 호 (주호 🗟 🛽	🛛 🖬 🖳 🖉 🖬	o online 🖉 Go offline 🛔 🖪 🖪 🗴 🖃 💷 PORTAL	
	Project tree 🔲 🖣		yConverter G120 PN 57-1500 🔸 Drive_G120_conveyor [G120 CU2505-2 PN Vector] 🕨 Commissioning 🛛 🗛 🖬 🖬 🗙	٩,
	Devices			9
	B 0 0 B B			1 as
Start	062-101FrequencyConverter G120 PN 57-1500 Add new device Devices & networks CPUTS16F3 PNVDP] Drive, G120, G120 G12505-2 PNV Drive, G120, G120 G120 G120 G120 Drive, G120, G120 G120 G120 Drive, G120, G120 G120 Common G1a Gunguages & resources	Commissioning Commissioni Control panel Motor opti Backing up/	Control panel	ks 🛛 🔁 Libraries
		<u>{</u> <u> </u>		
	A Portal view Proveniew St Parameter	1 Commissioni		
-	Portal view and overview a Parameter	10 commissioni.	Connected to Drive_G120_conveyor, a	

 \rightarrow Finally, ' Go offline' and save the project again ' Save project'. (\rightarrow Go offline' \rightarrow Save project)

M Siemens - D:00_TIA_Portal062-101 FrequencyConverter G120 PN \$7-1500062-101 Frequeny Converter G120 PN \$7-1500 Z										
Project Edit View Insert Online Options Tools Window Help	Totally Integrated Automation									
🕒 💁 🔚 Save project 🍶 🐰 🏥 🛅 🗙 🌑 🗄 📜 🚰 🗒 🔝 🔛 🔛 🔛 🖉 Go online 🌌 Go online 🖉 Go online 🖉 Go online 🖉	PORTAL									
Project tree 062-101 FrequencyConverter G120 PM 57-1500 > Drive_G120_conveyor [G120 CU250S-2 PN Vector] > Commissioni	ing 💶 🖬 🖬 🗙 📢									
Devices Goomme	3									
	Tas									
Control panel Co	inde: iffcation * Switch on:									
Wolfry: Modify: Image: Speed: Image: Speed: Image: Speed: Image: Speed: Speed: Image: Speed: Image: Speed: Sp	-									
Drive status: Ready for switching on Operation enabled Speed: 00 rpm	M. current: 0.00 Arms									
Fault Active fault: Active fault: Acknowledge faults Output frequency smoothed Output voltage smoothed Utput voltage smoothed										
> Details view	ies 📜 Info 😮 🛛 Diagnostics 📄 = 🔶									
✓ Portal view	Connected to Drive_G120_conveyor, a									

7.5 Creating a program for controlling the frequency converter

→ Before you adapt the program so that it can control the frequency converter, two 'PLC data types' have to be created that correspond to the structure of the send and receive Telegram
 1. (→ PLC data types → Add new data type)



→ Change the name of the PLC data type to 'FU_Receive_Telegram1' and open it by doubleclicking it. (→ FU_Receive_Telegram1)



 \rightarrow Create the tags shown below the same as in a data block. (\rightarrow FU_Receive_Telegram1)

062	-10	1 Frequency Converter	G120 PN S	7-1500 ▸ Ci	PU1516F [CP	U 1516F-3	PN/DP] •	PLC data types FU_RECEIVE_Telegram1 _	∎∎×
*	*	🗞 🛃 🎼 🖪 🕾	B⇒ E Ik	00h ⊳					
F	υ_	RECEIVE_Telegram1							
	1	Name	Data type	Default value	Accessible f	Visible in	Setpoint	Comment	
1 -	•	Speed_OK	Bool 🔳	false				Setpoint / actual speed deviation within the tolerance range (1)	
2 -	•	Control_requested	Bool	false				The automation system is requested to accept the inverter control(1)	
3	-	Max_speed_reached	Bool	false				Speed is greater than or equal to the maximum speed (1)	
4 -		Warn_torque_limit	Bool	false				Comparison value for current torque has been reached or exceeded (1)	
5		Holding_brake	Bool	false				Holding brake open(1)	
6 -		Motor_temperature	Bool	false				Alarm motor overtemperature(0)	
7 -	1	Direction	Bool	false				Motor rotates clockwise(1) / counterclockwise(0)	
8 -	11	PM_overload	Bool	false				Alarm inverter PM thermal overload (0)	
9		Ready_to_Start	Bool	false				Power supply switched on; electronics initialized; pulses locked(1)	
10 -		Ready	Bool	false				Motor is switched on (ON/OFF1 = 1), no fault is active(1)	
11 -		Operation_EN	Bool	false				Operation enabled Motor follows setpoint(1)	
12 -	1	Fault	Bool	false				Fault active(1)	
13	-	No_OFF2	Bool	false				Coast down to standstill is not active(1)	
14		No_OFF3	Bool	false				Quick stop is not active(1)	
15		Lockout	Bool	false				Closing lockout active(1)	
16 -		Alarm	Bool	false				Alarm active(1)	
17 -		XIST_A	Int	0				Actual speed value process data (PZD) word2	
	<								>

 $\rightarrow~$ Create an additional PLC data type called 'FU_Send_Telegram1' and the tags shown below.

 $(\rightarrow FU_Send_Telegram1)$



06	2-10	1 Frequency Converte	r G120 PN	I S7-1500 →	CPU1516F	CPU 1516F	-3 PN/DP]	▶ PLC data types ▶ FU_SEND_Telegram1	×
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	FU_	SEND_Telegram1							
	-	Name	Data type	Default value	Accessible	Visible in	Setpoint	Comment	
1	-	reserved_8	Bool	false		~		not in use	
2		reserved_9	Bool	false		\sim		not in use	
3	-	Control_via_PLC	Bool	TRUE		~		Control via fieldbus, inverter accepts the process data from fieldbus(1)	
4	-00	Rev_direction	Bool	false				Invert setpoint in the inverter(1)	
5	-	reserved_12	Bool	false				not in use	
6	-	MOP_up	Bool	false		~		Increase the setpoint saved in the motorized potentiometer(1)	
7	-	MoP_down	Bool	false				Reduce the setpoint saved in the motorized potentiometer(1)	
8	-	reserved_15	Bool	false				not in use	
9	-	ON_OFF1	Bool	false				ON(1) / OFF(0) with the ramp-function generator	
10	-	ON_OFF2	Bool	TRUE				Switch OFF (0); Switch off the motor immediately, the motor coasts down to standst	ill
11	-00	ON_OFF3	Bool	TRUE				Switch OFF (0); Quick stop, the motor brakes with the OFF3 ramp-down time	
12	-	EN_operation	Bool	TRUE				Enable operation; Switch-on motor (pulses can be enabled) (1)	
13	-	EN_ramp	Bool	TRUE				Enable ramp-function (1) / Reset ramp-function generator output to 0 (0)	
14	-	Continue_freeze_ramp	Bool	TRUE				Enable ramp-function (1) / Freeze ramp-function generator (0)	
15	-	Enable_setpoint	Bool	TRUE				Enable setpoint(1) / Inhibit setpoint(0)	
16	-	Acknowledge	Bool 🔳	false				Acknowledge faults (1)	
17	-	NSOLL_A	Int	0				Setpointl speed process data (PZD) word2	
									-
	5								>

Note:

 For some enable bits, the start value is already set to TRUE so that these do not have to be set additionally in the program.

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→ Create the global data block 'FREQUENCY_CONVERTER' for the request and response telegram. (→ Add new block → DB → Global DB → FREQUENCY_CONVERTER → OK)



 \rightarrow Create the tag 'Send_G120_01' and select 'FU_SEND_Telegram1' as the data type. (\rightarrow Send_G120_01 \rightarrow "FU_SEND_Telegram1")

Mi Siemens - D:\00_TIA_Portal\062-101 Frequency C	onverter G12	0 PN \$7-1500\062-101 Fre	equency Converter G120 Pl	N \$7-1500					_ 🗆 X
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2	FREC	DUENCY CONVERTER							ks
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CPU1516F [CPU 1516F-3 PN/DP]	3 .	<add new=""></add>	USInt	^					P.
Device configuration			WChar						es
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🔻 🛃 Program blocks			Word						
🚔 Add new block			"FU_RECEIVE_Telegram1"						
🔹 Main [OB1]			"FU_SEND_Telegram1"						
MOTOR_SPEEDCONTROL [FC10]	_								
MOTOR_SPEEDMONITORING [FC11				~					
MOTOR_AUTO [FB1]									
FREQUENCY_CONVERTER [DB4]									
MAGAZINE_PLASTIC [DB3]									
MOTOR_AUTO_DB [DB1]									
SPEED_MOTOR [DB2]									
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→ Create an additional tag 'Receive_G120_01' and select 'FU_RECEIVE_Telegram1' as the data type. Provide comments for the two tags. (→ Receive_G120_01 → 'FU_ RECEIVE_Telegram1')

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Project tree 🔲 🖣	062-101 Frequency Conver	ter G120 PN S7-1500	CPU1516F [CP	J 1516F-3 PI	WDP] • Pro	ogram bl	ocks ▶ FREQUENCY_CONVERTER [DB4]	- # = × <	
Devices								1	
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▼ B 062 101 Erequency Converter 6120 E	FREQUENCT_CONVERTER	Data tuna	Startualue Datain	Accossible f	Visible in	Cotopiet	Comment		
Add now device	1 Ctatic	Data type	Start value Retain	Accessible I.	visible in	setpoint	comment		
Devices & networks	2 4 Send 6120 01	"ELL SEND Telegram1"					Send telegram frequency converter G120 conveyor 1	F	
CPU1516E [CPU1516E-3 PN/DP]	3 (1 + Receive G120_01	"ELL RECEIVE Telegram1					Receive telegram frequency converter G120 conveyor	or 1	
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MAGAZINE_PLASTIC [DB3]									
MOTOR_AUTO_DB [DB1]									
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Technology objects									
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 \rightarrow The data block can be created quickly and efficiently by using the PLC data types 'FU_SEND_Telegram1' and 'FU_RECEIVE_Telegram1', see representation.

THEQUENC	Y_CONVERTER							
Name		Data type	Start value	Retain	Accessible f	Visible in	Setpoint	Comment
🛥 💌 Static								
📲 🍷 Se	nd_G120_01	"FU_SEND_Telegram1"						Send telegram frequency converter G120 conveyor 1
	reserved_8	Bool	false			\checkmark		not in use
	reserved_9	Bool	false			V		not in use
	Control_via_PLC	Bool	TRUE			V		Control via fieldbus, inverter accepts the process data from fieldbus(1)
- 0	Rev_direction	Bool	false			\checkmark		Invert setpoint in the inverter(1)
- 10	reserved_12	Bool	false			V		not in use
11 •	MOP_up	Bool	false		\checkmark	V		Increase the setpoint saved in the motorized potentiometer(1)
•	MoP_down	Bool	false		\checkmark	V		Reduce the setpoint saved in the motorized potentiometer(1)
• •	reserved_15	Bool	false		\checkmark	V		not in use
•	ON_OFF1	Bool	false		V	V		ON(1) / OFF(0) with the ramp-function generator
- 10	ON_OFF2	Bool	TRUE		V	V		Switch OFF (0); Switch off the motor immediately, the motor coasts down to
- 10	ON_OFF3	Bool	TRUE			V		Switch OFF (0); Quick stop, the motor brakes with the OFF3 ramp-down time
•	EN_operation	Bool	TRUE			\checkmark		Enable operation; Switch-on motor (pulses can be enabled) (1)
- 10	EN_ramp	Bool	TRUE		\checkmark	\checkmark		Enable ramp-function (1) / Reset ramp-function generator output to 0 (0)
	Continue_freez	Bool	TRUE		 Image: A start of the start of			Enable ramp-function (1) / Freeze ramp-function generator (0)
	Enable_setpoint	Bool	TRUE		 Image: A start of the start of			Enable setpoint(1) / Inhibit setpoint(0)
	Acknowledge	Bool	false		 Image: A start of the start of	V		Acknowledge faults (1)
	NSOLL_A	Int	0			V		Setpointl speed process data (PZD) word2
📲 🍷 Re	ceive_G120_01	"FU_RECEIVE_Telegram1						Receive telegram frequency converter G120 conveyor 1
	Speed_OK	Bool	false					Setpoint / actual speed deviation within the tolerance range (1)
	Control reques	Bool	false					The automation system is requested to accept the inverter control(1)
	Max speed rea.	Bool	false					Speed is greater than or equal to the maximum speed (1)
	Warn torque li	Bool	false					Comparison value for current torque has been reached or exceeded (1)
	Holding brake	Bool	false					Holding brake open(1)
	Motor tempera	Bool	false					Alarm motor overtemperature(0)
-00 =	Direction	Bool	false					Motor rotates clockwise(1) / counterclockwise(0)
-00 =	PM overload	Bool	false					Alarm inverter PM thermal overload (0)
-	Ready to Start	Bool	false					Power supply switched on: electronics initialized: pulses locked(1)
	Ready	Bool	false					Motor is switched on (ON/OFF1 = 1), no fault is active(1)
	Operation EN	Bool	false					Operation enabled Motor follows setpoint(1)
	Fault	Bool	false					Fault active(1)
	No OFF2	Bool	false					Coast down to standstill is not active(1)
	No. OFF3	Bool	false					Ouick stop is not active(1)
	Lockout	Bool	falso					Closing lockout active(1)
-	Alarm	Pool	falso					Alarmactive(1)
-	VICT A	lat	0					Actual speed value process data (PZD) uprd2

→ The global PLC tags are created in a new tag table for the communication with the frequency converter. (→ Add new tag table)



→ Change the name of the tag table to 'Tag_table_G120' and specify, as shown, two structure tags 'PZD_IN_G120_01' and 'PZD_OUT_G120_01' using the PLC data types 'FU_RECEIVE_Telegram1' and 'FU_SEND_Telegram1'. (→ PZD_IN_G120_01 → 'FU_RECEIVE_Telegram1' → PZD_OUT_G120_01 → 'FU_SEND_Telegram1')



 \rightarrow The tags have been created in accordance with their structures by the use of the PLC data types 'FU_SEND_Telegram1' and 'FU_RECEIVE_Telegram1'. Open the 'Main' block [OB1]. $(\rightarrow Main [OB1])$

oject Edit View Insert Online Option	ns T		Window	Help	A Go offling	v = m					Totally Integrated Automatio	n TA
		062-1	01 Erect				6E-9 D			tage >	Tag table C120 [2]	X
		002-1	lorneq	dency converter dra	0 FN 37-1300 7 CF0 1310	or tero ion	01-51	NUCE	· FLC	wys /		
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		Та	g table_	G120								
 062-101 Frequency Converter G120 F 	^		Name		Data type	Address		Retain	Visibl	Acces	Comment	
💣 Add new device	1	1	🕣 🔻 PZI	D_IN_G120_01	"FU_RECEIVE_Telegram1"	%1256.0						1
Devices & networks		2	-00	Speed_OK	Bool	%1256.0			V	V	Setpoint / actual speed deviation within the tolerance ra	
CPU1516F [CPU 1516F-3 PN/DP]	1	3	-00	Control_requested	Bool	%1256.1				V	The automation system is requested to accept the inve	
Device configuration	= '	4	-00	Max_speed_reached	Bool	%1256.2				V	Speed is greater than or equal to the maximum speed (
Online & diagnostics	1	5	-00	Warn_torque_limit	Bool	%1256.3			V	V	Comparison value for current torque has been reached	
🔻 🛃 Program blocks		6	-00	Holding_brake	Bool	%1256.4			V	V	Holding brake open(1)	
📑 Add new block		7	-00	Motor_temperature	Bool	%1256.5			V	V	Alarm motor overtemperature(0)	
💶 Main [OB1]		8	-00	Direction	Bool	%1256.6			V	V	Motor rotates clockwise(1) / counterclockwise(0)	
MOTOR_SPEEDCONTROL [F.	1	9 ·	-00	PM_overload	Bool	%1256.7			V	V	Alarm inverter PM thermal overload (0)	
MOTOR_SPEEDMONITORIN.		10 ·	-00	Ready_to_Start	Bool	%1257.0			V	V	Power supply switched on; electronics initialized; pulses	
MOTOR_AUTO [FB1]		11	-00	Ready	Bool	%1257.1				V	Motor is switched on (ON/OFF1 = 1), no fault is active(1	
FREQUENCY_CONVERTER [C		12	-00	Operation_EN	Bool	%1257.2				V	Operation enabled Motor follows setpoint(1)	
MAGAZINE_PLASTIC [DB3]		13	-00	Fault	Bool	%1257.3				V	Fault active(1)	
MOTOR_AUTO_DB [DB1]		14	-00	No_OFF2	Bool	%1257.4				V	Coast down to standstill is not active(1)	
SPEED_MOTOR [DB2]		15	-00	No_OFF3	Bool	%1257.5				V	Quick stop is not active(1)	
Technology objects	1	16	-00	Lockout	Bool	%1257.6			V	V	Closing lockout active(1)	
External source files		17	-00	Alarm	Bool	%1257.7			V	V	Alarm active(1)	
🔻 🔚 PLC tags		18	-00	XIST_A	Int	%IW258				1	Actual speed value process data (PZD) word2	
line and the second sec		19	🛥 🝷 PZI	D_OUT_G120_01	"FU_SEND_Telegram1"	%Q256.0	-					
📑 Add new tag table		20 ·	-00	reserved_8	Bool	%Q256.0				V	not in use	
💥 Default tag table [61]		21		reserved_9	Bool	%Q256.1				V	not in use	
light table_G120 [2]		22	-00	Control_via_PLC	Bool	%Q256.2				V	Control via fieldbus, inverter accepts the process data f	
😼 Tao table_sorting station [30	~ .	22	<	Day direction	Deel	N 0756 7	In				Invest consist in the investor(1)	>
			•					_	-			
Details view										🔤 🖳 Pr	operties 🛛 🕒 Info 😃 🔂 Diagnostics	-

→ Insert two new networks at the beginning of the Main [OB1]. Drag-&-drop the 'Move' command from the "Instructions' under the 'Move operations' item into these networks. . 🐇 . 🎎 (

$\rightarrow \mathbf{k}$	» →	\mapsto	Instructions \rightarrow I	Move operations	$\rightarrow N$	love \rightarrow	Move))
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Add new device		Name Des
Devices & networks	▼ Block title: "Main Program Sweep (Cycle)"	Ceneral
CPU1516F [CPU 1516F-3 PN/DP]	Comment	Bit logic operations
Device configuration	=	Timer operations
Solution Continue & diagnostics	Network 1: Receive process data from frequency converter G120 conveyor1 (telegram1)	Counter operations
 Program blocks 	Comment	Comparator operations
Add new block		Math functions
📲 Main [OB1]	MOVE	Move operations
MOTOR_SPEEDCONTROL [FC10]		E MOVE Move 8
MOTOR_SPEEDMONITORING [FC11]		Deserialize Deseri
MOTOR_AUTO [FB1]		E Serialize Seriali
FREQUENCY_CONVERTER [DB4]		E MOVE BLK Move
MAGAZINE_PLASTIC [DB3]		MOVE BLK VARIANT Move
MOTOR_AUTO_DB [DB1]		I UMOVE BLK Move
SPEED_MOTOR [DB2]	Send process data to frequency converter G120 conveyor1 (telegram1)	FILL BLK Fill blo
Technology objects	Comment	E UEIL BLK Fill blo
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🖛 🔁 PLC tags	MOVE	Array DB
a Show all tags		Variant *
🚔 Add new tag table		< m >
🗳 Default tag table [61]		Extended instructions
🔩 Tag table_G120 [2]		> Technology
🖏 Tag table_sorting station [30]		Communication
PLC data types		
Details view	🖳 Properties 📲 Diagnostics 👘 🗆 🛆	Optional packages
 Portal view Overview Tag tag 	ble_G 🥵 Main 💙 Th	e project 062-101 Frequency Conver

 \rightarrow Select the 'Tag_table_G120' in the project navigation. Now you can drag-&-drop the two tags 'PZD_IN_G120_01' and 'PZD_OUT_G120_01' directly from the details view onto the connections of the Move instructions. (\rightarrow Tag_table_G120 \rightarrow PZD_IN_G120_01 \rightarrow PZD_OUT_G120_01)

M Siemens - D:\00_TIA_Portal\062-101 Frequency Converter G120 PN	S7-1500/062-101 Frequency Converter G120 PN S7-1500	_ _ ×
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 CPU1516F [CPU 1516F-3 PN/DP] 	& >=1 <u>1??</u> [-1 -0 → -1=]	Name Descript
Provide Configuration	▼ Block title: "Main Program Sweep (Cycle)"	🕨 📴 General
Coline & diagnostics	Comment	Bit logic operations
Program blocks	• · · · · · · · · · · · · · · · · · · ·	O Timer operations
Add new block	Wetwork 1: Receive process data from frequency converter G120 conveyor1 (telegram1)	Counter operations
Main [OB1]	Comment	 Comparator operatio
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	— EN —	E MOVE Move va
		🗉 Deserialize Deseriali 🕫
MAGAZINE_PLASTIC [DB3]	P#256.0	🗉 Serialize 🛛 📃 🔤
		MOVE_BLK Move bl
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External course files		UMOVE_BLK Move bl B.
		FILL_BLK Fill block
Showall tans	Network 2: Send process data to frequency converter G120 conveyor1 (telegram1)	UFILL_BLK Fill bloc
Add new tag table	Comment	SWAP Swap
Mod new ag able		Array DB
Tag table G120 [2]	MOVE	Variant
Tag table sorting station [30]	P#0256.0	Legacy
		Conversion operation:
	- = = 0.071 - 6120.01"	Program control ope
		 Forderer de la forderer alle en
Name Data type Details Comme	KIII - ENO	Extended Instructions
PZD_IN_G120_01 "FU_RECEIVE_T. %I256.0	×	Technology
PZD_OUT_G120_01 "FU_SEND %Q256.0 ▼	✓ III > 100%	> Communication
< III >	🖳 Properties 🔄 🗓 Info 🚺 🗓 Diagnostics 👘 💷 🍝	> Optional packages
🖣 Portal view 🔛 Overview 🖳 Tag table_G 🔹	Main 🔗 The	project 062-101 Frequency Conver

→ Select the "FREQUENCY_CONVERTER [DB4]' data block in the project tree. You can again drag-&-drop the two structure tags 'Send_G120_01' and 'Receive_G120_01' directly from the details view onto the connections of the Move instructions. (→ Send_IN_G120_01 → Receive_OUT_G120_01)

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du Devices & networks		✓ Basic instructions
CPU1516F [CPU 1516F-3 PN/DP]	& >=1 1221 → -01 → -1=]	Name Descript
P Device configuration	▼ Block title: "Main Program Sweep (Cycle)"	Ceneral
E Online & diagnostics	Comment	Bit logic operations
🗧 🔻 🛃 Program blocks		Timer operations
📑 Add new block	 Network 1: Receive process data from frequency converter G120 conveyor1 (telegram1) 	Counter operations
🛥 Main (OB1)	Comment	Comparator operatio
MOTOR_SPEEDCONTROL [FC10]		Math functions
MOTOR_SPEEDMONITORING [FC11]	MOVE	Move operations
MOTOR_AUTO [FB1]	inove.	IT MOVE Move va
FREQUENCY_CONVERTER [DB4]	"FREQUENCY_	Deserialize Deseriali.
MAGAZINE_PLASTIC [DB3]	— EN CONVERTER".	E Serialize Serialize
MOTOR_AUTO_DB [DB1]	P#256.0 Receive_G120_	I MOVE BLK Move bl
SPEED_MOTOR [DB2]	"PZD IN OUT1 - 01	MOVE BLK VARI Move bl
E Technology objects	G120.01" IN _ ENO	T IMOVE PLK Move bl
 External source files 	IN LING	
PLC tags		
a Show all tags	 Notwork 2: Sand process data to frequency converter G130 converget (telescent). 	E SWAP Swap
📑 Add new tag table	· Network 2. Send process data to nequency converter dr20 conveyor (delegianity)	Array DR
🍯 Default tag table [61]	Comment	Variant
Sector 20 (2) Tag table_G120 [2]		
Tag table_sorting station [30]	MOVE	Conversion operation
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💣 Add new data type 👻	000000	Word logic operations
× Details view	"FREQUENCY "PRQ256.0	Shift and rotate
	CONVERIER". PZD_001_	
		> Extended instructions
Name Offset Data type Accessible		
Send_G120_01 FU_SEN I True	×	> Technology
Receive_G120_01 FU_RECEIV True	 ✓ III > 100% ✓ 	Communication
¢ III >	🖳 Properties 🛛 🗓 Info 😩 💆 Diagnostics 👘 🗖 🗕 🔶	> Optional packages
🕨 Portal view 🔛 Overview 🖳 Tag table_G 🐲	Main 🔗 The	project 062-101 Frequency Conver

→ Open the structure of the tag 'Receive_G120_01' in the details view and from there drag-&drop the tag 'Receive_G120_01.XIST_A' to the connection 'Actual_speed_Al' of the block 'MOTOR_SPEED_MONITORING'. (→ Receive_G120_01.XIST_A)

VA Sie	emens - D:\00_TIA_Porta	l\062-101 Freque	ency Converter G	120 PN S7-1500\062-101	Frequency Converter (G120 PN S7-1500				_ L
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	MOTOR_SPEE	DCONTROL [FC10	1	 Network 3: Spe 	ed monitoring conveyor n	notor			Bit logic operations	
í.	MOTOR_SPEE	DMONITORING [FO	C11]	Comment				_	Timer operations	
	MOTOR_AUT	D [FB1]							Counter operations	
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-	Send_G120_01	"F	U_SEND_T. True	CONVERTE	R".				Serialize	Serialize
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	Speed_OK	B	ool True	01.XIST_	- ^A — Al		MOTOR"		MOVE_BLK_VARI.	. Move bl
-00	Control_requested	B	ool True				Positive Speed.		UMOVE_BLK	Move bl
-00	Max_speed_reache	d B	ool True	"SPEED)_	Error may	Error		FILL_BLK	Fill block
-00	Warn_torque_limit	B	ool True	MOTO	R".	Elloi_lilax			UFILL_BLK	Fill bloc
	Holding_brake	B	ool True	Positive_Spee	d. Speed_limit_		"SPEED		SWAP	Swap
	Motor_temperature	B	ool True	Threshold_En	error_max		MOTOR".		Array DB	
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	PM_overload	B	ool True	"SPEED)_	Warning max-	Warning		🕨 🛅 Legacy	_
	Ready_to_Start	B	ool True	MOTO	e.				🕨 🏧 Conversion operation	e i i i
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	Operation_EN	В	ooi Irue	Warni	Speed_limit_		MOTOR".		Word logic operations	
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4	Portal view	Overview	Tag table G	🔁 Main				🗸 The	project 062-101 Erequency Co	inver

 \rightarrow Drag the tag 'Send_G120_01.NSOLL_A' to the connection 'Setpoint_speed' of the block 'MOTOR_SPEEDCONTROL'. (\rightarrow Send_G120_01.NSOLL_A)

🐴 Sier	mens - D:\00_TIA_Porta	al\062-101 Fr	requency Co	nverter G	120 PN	\$7-1500\062-10	1 Freq	quency Converter G1	20 PN \$7-1500						- 5
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		CONVERTER	[DP4]		Ľ '	Network 1. Net	ceive p	nocess data nomineq	dency converter dr20	Conveyorr (telei	panni)		End Counter operations		
			וייטען	*	l I	Network 2: Se	nd pro	cess data to frequency	converter G120 con	veyor1 (telegram	1)	-	 Comparator operatio. 		
~	Details view				b	Network 3: Sp	eed m	onitoring conveyor mo	tor			-	Math functions		
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	reserved_8		BOOI	True				%FC	:10				MOVE_BLK	Move bl.	
	Control uin DLC		BOOI	True				"MOTOR_SPEE	DCONTROL"				MOVE_BLK_VARI.	Move bl.	
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	Rev_direction		Bool	True						#Motor_spee	ed_		FILL_BLK	Fill block	ĸ
	NOP up		Bool	True						monitoring_i	tet_		UFILL_BLK	Fill bloc.	
	Mor_up		Bool	True					Ret_Val	Vai			SWAP	Swap	
	mor_down		Bool	True						TEREO LIENC	/		Array DB		
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			Bool	True					Manipulated_	Send G120	· · · · ·		Legacy		
			Bool	True		"SPEE	D_		speed AO	01.NSOLL A			Conversion operation	12	
	EN operation		Rool	True		MUTOR Spee	a_ int		speed_AO				 Program control ope 		
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-	Enable_setpoint		Bool	True									<	,	>
-	Acknowledge		Bool	True	- I	Network 5: Co	ntrol co	onveyor motor forward	ls in automatic mode				Extended instruction	ons	
-	NSOLL A		Int	True	0	omment						~	> Technology		
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									Q Propertie	s 11 Info G	Diagnostics		> Ontional packages	_	
										- 1.34 mil 0	- Diagnostics		· optional packages		

→ As the activation command, drag the tag 'Send_G120_01.ON_OFF1' to the connection 'Conveyor_motor_automatic_mode' of the block 'MOTOR_AUTO'. (\rightarrow Send_G120_01.ON_OFF1)

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MA Sie	emens - D:\00_TIA_F	Portal\062-101	Frequency Co	nverter G1:	20 PN S7-1500\062-	101 Frequ	iency Converter G1	20 PN S7-1500	_	_		_	_ 🗆 X
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2	MOTOR_	SPEEDCONTROL	L [FC10]		0.5		"-S2" -	 Stop 				Bit logic operations	- <u>V</u>
ž	MOTOR_	SPEEDMONITOR	RING [FC11]	=	31" — #			Enable_OK				Timer operations	Tee
	MOTOR_	AUTO [FB1]										Counter operations	ti-
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	MAGAZI	NE_PLASTIC [DB	3]				2-1					The second	-
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	Technology	objects			#Motor sp	eed						Deserialize	S
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	Name	Offset	Data type								=	E SWAP	
-00	 Send_G120_01 		"FU_SENI	D_T ^			%1.0					Array DB	
	reserved_8		Bool				"-B4" -	Sensor slide	Conveyor_	"FREQUENCY_		🕨 🛅 Variant	
	reserved_9		Bool	=				Sensor_side	motor_	CONVERTER .		🕨 🛅 Legacy	
	Control_via_PL	.C	Bool				%11.3	Sensor_end_	automatic_	01 ONL OFF1		🕨 😽 Conversion operatio	in:
	Rev_direction		Bool				B7"	 of_conveyor 	moue_			Program control ope.	
	reserved_12		Bool					e	Actual Value	"MAGAZINE		Word logic operation	ns
-00	MOP_up		Bool				THAC A ZINE	Setpoint_	Magazine	PLASTIC".Plastic		Shift and rotate	~
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7.6 Loading the program in SIMATIC S7 CPU 1516F-3 PN/DP

 \rightarrow Save the project once more before downloading the modified and created 'Program blocks' to

the CPU 1516F ' \square '. ($\rightarrow \square$ Save project \rightarrow Program blocks $\rightarrow \square$)

Siemens - D:\00_TIA_Portal\062-101 Frequency Con	verter G120 PN S7-1500/062-101 Frequency Converter G120 PN S7-1500	_ 🗆 X
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CPU1516F [CPU 1516F-3 PN/DP]	Comment	Bit logic operations
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Program blocks	Comment	Comparator operations
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🛥 Main [OB1]	MOVE	Maurifunctions
MOTOR_SPEEDCONTROL [FC10]	NOVL.	
MOTOR_SPEEDMONITORING [FC11	"FREQUENCY_	
MOTOR_AUTO [FB1]	EN CONVERTER".	El Serialize
FREQUENCY_CONVERTER [DB4]	Receive_G120_	
MAGAZINE_PLASTIC [DB3]		
MOTOR_AUTO_DB [DB1]		
SPEED_MOTOR [DB2]		
Technology objects		
External source files	 Network 2: Send process data to frequency converter G120 conveyor1 (telegram1) 	E SWAP
PLC tags		Array DB
lange Show all tags	Comment	Variant
Add new tag table		Legacy
🍯 Default tag table [61]	MOVE	Conversion operation:
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Tag table_sorting station [30]	P#0256.0	Mard logic operations
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FU_RECEIVE_Telegram1		> Technology
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7.7 Diagnostics of SIMATIC S7 CPU 1516F-3 PN/DP

→ The block Main [OB1] can be monitored to diagnose the control of the converter from the program. Monitoring is activated and deactivated by clicking the icon.
 (→ Main [OB1] →)

M Siemens - D:\00_TIA_Portal\062-101 Frequency Conv	erter G120 PN \$7-1500\062-101 Frequency Converter G120 PN \$7-1500	_ = ×		
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Devices		Options ::		
2	Block interface	✓ CPU operator panel		
▼ 🗋 062-101 Frequency Converter G120 PN S: 🗹 🔺		CPU1516F (CPU 1516F-3 PN/DP)		
Add new device		RUN/STOP RUN		
CPU1516F [CPU 1516F-3 PN/DP]	Network 3: Speed monitoring conveyor motor	FRROR STOP		
Device configuration	Comment			
Online & diagnostics	PLEC11	MAINI MIKES		
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Add new block	"MOTOR_SPEEDMONITORING"	< III >		
🖶 Main [OB1]	— EN	✓ Call environment		
MOTOR_SPEEDCONTROL [FC10]		No condition defined.		
The motor_speedmonitoring [FC	0	l l l l l l l l l l l l l l l l l l l		
AUTOR_AUTO [FB1]	"FREQUENCY_	Change		
FREQUENCY_CONVERTER [DB4]	CONVERTER".			
MAGAZINE_PLASTIC [DB3]	Receive_G120_ Actual_speed_ "SPEED	E E		
MOTOR_AUTO_DB [DB1]	MOTOR".	rar		
SPEED_MOTOR [DB2]	Positive_Speed.	ies		
Technology objects	16.0 Error max - Error			
External source files	"SPEED_			
PLC tags	MOTOR".			
<	< III > 100% •	 Breakpoints 		
> Details view	🖳 Properties 🚺 Info 🖳 Diagnostics 👘 🗖 🗖 📥	> Call hierarchy		
🖣 Portal view 🔛 Overview 🤹 Main	2 👔	earch completed. 1 of 2 devices were		

→ The complete send and receive data of the communication with the converter (control words/status words/setpoint/actual value) are visible in the 'FREQUENCY_CONVERTER [DB4]' data block. Monitoring can be activated and deactivated at this point as well by clicking the ^{IIII} icon. (→ FREQUENCY_CONVERTER [DB4] → ^{IIII})

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.Ē			F	REQU	ENCY_CONVERTER	► Man	itorall				 Find and replace
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ē	Add new device		1 <	• • •	Static	_				^	Find:
2	Devices & networks	_	2 -		 Send_G120_01 	"FU_SEND_Teleg					
5	 CPU1516F [CPU 1516F-3 PN/DP] 	_	3		reserved_8	Bool	false	FALSE			Whole words only
ᆋ	Device configuration		4 -		reserved_9	Bool	false	FALSE			Match case %
	Second Se		5 -		Control_via_PLC	Bool	TRUE	TRUE		5	
	Program blocks	• =	6 <		Rev_direction	Bool	false	FALSE		1	Find in substructures
	Add new block		7 -		reserved_12	Bool	false	FALSE			Find in hidden texts
	- Main [OB1]	•	8 <		MOP_up	Bool	false	FALSE		5	Use wildcards
	MOTOR_SPEEDCONTROL [FC10]		9 <		MoP_down	Bool	false	FALSE			Use regular expressions
	MOTOR_SPEEDMONITORING (FC		10 -		reserved_15	Bool	false	FALSE		5	
	MOTOR_AUTO [FB1]		11 -		ON_OFF1	Bool	false	FALSE			O Whole document
	FREQUENCY_CONVERTER [DB4]		12 -		ON_OFF2	Bool	TRUE	TRUE			From current position
	MAGAZINE_PLASTIC [DB3]		13 -		ON_OFF3	Bool	TRUE	TRUE			Onter
	MOTOR_AUTO_DB [DB1]		14 -		EN_operation	Bool	TRUE	TRUE			Selection
	SPEED_MOTOR [DB2]	•	15 -		EN_ramp	Bool	TRUE	TRUE			Down
	Technology objects		16 -		Continue_freeze_r	Bool	TRUE	TRUE			Olla
	External source files		17 \prec		Enable_setpoint	Bool	TRUE	TRUE			С ор
	PLC tags		18 -		Acknowledge	Bool	false	FALSE			Find
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	 Watch and force tables 		20 <		Receive_G120_01	"FU_RECEIVE_Teleg					incplace with
	Online backups		21 -		Speed_OK	Bool	false	TRUE			
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	Program info		23 -		Max_speed_reache	Bool	false	FALSE			
	Device proxy data		24 -		Warn_torque_limit	Bool	false	TRUE		L L	
	PLC alarms		25 <		Holding_brake	Bool	false	FALSE			
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	🖣 Portal view 🔠 Overview 📲	- Main			FREQUENCY					🪺 s	earch completed. 1 of 2 devices were

→ The online network view lends itself to diagnostics of the PROFINET connection between the CPU 1516F controller and the frequency converter. (→ Devices & networks → Network view → Ø Go online)

ang Stements - D. too_ntA_rotan to 22-101 Prequency Project Edit View Insert Online Options T 과 🎦 🕞 💭 Save project 📕 🔏 🏥 ն 🗙 🖄 초 (Is Window Help	ally Integrated Automation PORTAL
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O 62-101 Frequency Converter G120 PN 5 Add new device Devices & networks Origonation Device configuration Device configur	CPU1516F CPU1516F PN/IE_1	
Gail Watch and force tables		
Caraces Program info Program info Carace proxy data PLC alarms	General Cross-references Compile	
Text lists Text lists Text lists Text lists	Message Go to ? Connected to Drive_G120_conveyor, address IP=192.168.0.6.	Date Time 8/31/2016 5:04:37 PM ^
> Details view	() II	>

7.8 Diagnostics with SINAMICS Startdrive for frequency converter G120

→ The "Control/status words' can also be monitored in the frequency converter. This is available under 'Online & Diagnostics' (→ Drive_G120_conveyor → Online & diagnostics → Diagnostics → Control/status word → ^G Go online)

Missionens - D:00_TIA_Portal/062-101 Frequency C Project Edit View Insert Online Options To If Max Issue project Image: A set and the set and t	Converter G120 PN S7-150000 bols Window Help = ± 🚮 🔃 🖬 🖳 🚿	62-101 Frequency Converter G120 PN 57-1500 Go online 🧖 Go offline 🗼 🖪 🖪 🔭 🗶 🖃 💷		_ □ × Totally Integrated Automation PORTAL
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✓ 062-101 Frequency Converter G120 Pk ✓ 062-101 Frequency Converter G120 Pk ✓ Ovices & networks ✓ Ovices & networks ✓ Ovices & networks ✓ Ovice for Convergence (G120 CUC) ✓ Ovice G120 convergence (G120 CUC) ✓ Ovi	Online access	Control/status word The signals actually evaluated or used by the controller are displayed here. Where the signals come from, can be seen in the individual parameter screen forms. The communication screen forms show the communication interconnections. I showhide texts Control word 1	owfhide texts	
Cardian Common data Common data Documentation settings Canguages & resources Concentration of the concentratio	Backing up/reset	O → ONIOFF1 [0=No, 1=Yes] OC / OFF2 [0=No, 1=Yes] OC / OFF3 [0=No, 1=Yes] Oc / OFF3 [0=No, 1=Yes] Operation enable [0=No, 1=Yes] Operation enable [0=No, 1=Yes] Operatione rampile (D=No, 1=Yes] Operatione rampile (D=No, 1=Yes] Operatione rampile (D=No, 1=Yes] Operatione rampile (D=No, 1=Yes] Opilt 1 [0=No, 1=Yes] Odot Dentificatione reversal (D=No, 1=Yes] Odot Dentificatione (D=No, 1=Yes] Motorized potentiometer raise [0=No, 1=Yes] Motorized potentiometer raise [0=No, 1=Yes] Motorized potentiometer raise [0=No, 1=Yes] Opic 10 [0=No, 1=Yes] Motorized potentiometer raise [0=No, 1=Yes] Motorized potentiometer raise [0=No, 1=Yes]	0 2 3 4 5 8 9 11 12 13 4 15 5	Fixed setp bit 0 [0–No, 1–Yes] Fixed setp bit 1 [0–No, 1–Yes] Fixed setp bit 2 [0–No, 1–Yes] Fixed setp bit 3 [0–No, 1–Yes] DDS select. bit 1 [0–No, 1–Yes] DDS select. bit 1 [0–No, 1–Yes] Technology controller enable [0–No, 1–Yes] Droop enable [0–No, 1–Yes] Torque control active [0–No, 1–Yes] External fault 1 (F07860) [0–Yes, 1–No] CDS bit 1 [0–No, 1–Yes]
< II >		K III		>
Details view Portal view Details view	Online & dia		🔍 Properties	Connected to CPU1516E, address IP=1

 \rightarrow Under 'Drive enable signals' you also see the missing enables in order to be able to start the motor. (\rightarrow Drive enable signals)

M Siemens - D:\00_TIA_Portal\062-101 Frequen	cy Converter G120 PN S7-1500\0	62-101 Frequency Converter G120 PN S7-1500	_ - ×
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Project tree	✓ …rter G120 PN S7-1500 →	Drive_G120_conveyor [G120 CU250S-2 PN Vector] > Online & diagnostics	_ 🖬 🖬 🗙 ∢
Devices O62-101 Frequency Converter G120 PN PAd new device	DDS: O (Active CDS: Online access Diagnostics Diagnostics general Active messanes	O (Active Drive enable signals	Tasks 🕞 Lib
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Comparison Details view Portal view Details view	>	Properties	

→ Under 'Active messages' you see pending faults and warnings. You can click the ' \bigcirc ' icon to acknowledge these. (→ Active messages → \bigcirc)

Kiemens - D:\00_TIA_Portal\062-101 Frequency Cor	verter G120 PN S7-1500\062-10	Freque	ency Converter G120	PN \$7-1500			_ ¤ ×
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	DDS: 0 (Active CDS: Online access Diagnostics general Active messages Message history Controllstatus word Drive enable signals Safety diagnostics Functions Backing up/reset) (Active Active Fa 1 1 2 5 6 6 7 8 Al 1 1	ve messages aults Fault buffer Fault 1 Fault 2 Fault 3 arms Alarm buffer	Fault code 8501 8501 8501 8501	Message PROFINET: Setpo PROFINET: Setpo PROFINET: Setpo	sint timeout int timeout int timeout	Libraries
> Details view		-		d	Properties 7	Info Diagnostics	
Portal view Portal view Overview Overview Overview	ne & dia				Co	onnection to CPU1516F termina	ited.

 \rightarrow The values can also be monitored online in the 'Functional View' of 'Parameter'. (\rightarrow Parameter \rightarrow Functional View)

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7.9 Archiving the project

→ Finally, the complete project will be archived. In the menu item → 'Project', select → 'Archive...'. Open a folder in which you want to archive your project and save your project as the file type 'TIA Portal project archive'. (→ Project → Archive → TIA Portal project archives → SCE_EN_062-101 Frequency Converter G120 and S7-1500.... → Save)

Siemens - D:\00_TIA_Portal\062-101 Freque	ency C	Converter G120 PN S7-1500\0	62-1	01 Frequency Converter G120 PN	\$7-1500		_ ¤ ×
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Portal view Overview	<u></u> 0	nline & dia				Connection to Drive_G120_conve	yor te

7.10 Checklist – step-by-step instructions

The following checklist helps trainees/students to independently check whether all steps of the step-by-step instruction have been carefully completed and enables them to successfully complete the module on their own.

No.	Description	Checked
1	Frequency converter SINAMICS G120 with Control Unit CU250S-PN Vector created as distributed IO of the CPU1516F- 3 PN/DP.	
2	Device configuration with the frequency converter G120 as device loaded successfully into the CPU1516F-3 PN/DP.	
3	Device name of the Control Unit CU250S-PN Vector assigned.	
4	SINAMICS G120 frequency converter with induction motor parameterized in SINAMICS Startdrive.	
5	Parameter assignment successfully loaded from SINAMICS Startdrive into the SINAMICS G120 frequency converter.	
6	Induction motor tested successfully in operation with SINAMICS G120 frequency converter via control panel.	
7	Data block 'FREQUENCY_CONVERTER' [DB4] created.	
8	Program changes carried out in Main [OB1].	
9	Compiling and downloading of the program blocks is successful and without error message.	
10	Switch on system (-K0 = 1) Cylinder retracted/feedback activated (-B1 = 1) EMERGENCY STOP (-A1 = 1) not activated AUTOMATIC mode (-S0 = 1) Automatic stop pushbutton not actuated (-S2 = 1) Briefly actuate automatic start pushbutton (-S1 = 1) Sensor part at slide activated (-B4 = 1) Then the induction motor is switched on via the frequency converter and remains active \rightarrow Motor ON	
11	Sensor at conveyor end activated (-B7 = 1) \rightarrow Motor OFF (after 2 seconds)	
12	Briefly actuate automatic stop pushbutton (-S2 = 0) \rightarrow Motor OFF	
13	Activate EMERGENCY STOP (-A1 = 0) \rightarrow Motor OFF	
14	Operating mode manual (-S0 = 0) \rightarrow Motor OFF	
15	Switch off system (-K0 = 0) \rightarrow Motor OFF	
16	Cylinder not retracted (-B1 = 0) \rightarrow Motor OFF	
17	Project archived successfully.	

8 Exercise

8.1 Task - exercise

The maximum speed of the motor was limited to 500.00 1/min by the parameter assignment Adjust the normalization in both blocks "MOTOR_ SPEEDCONTROL" [FC10] and "MOTOR_SPEEDMONITORING" [FC11] correspondingly so that calculation can be carried out with the suitable physical values.

8.2 Technology schematic diagram

At this point you see the technology schematic diagram for the task.



Figure 5: Technology schematic diagram

Schalter der Sortieranlage Switches of sorting station	Automatikbetrieb Automatic mode -P5 gestartet/started	Handbetrieb / Manual mode -S3 Tippbetrieb -M1 vorwärts/ Manual -M1 forwards	
Q0 Hauptschalter/Main switch	-S1 Start/start	-S4 Tippbetrieb -M1 rückwärts/ Manual -M1 backwards	
-P4 aktiviertactive	-S2 Stopp/stop	-P7 ausgefahren/extended -S6 Zylinder -M4 ausfahren/ cylinder -M4 extend -P6 eingefahren/retracted	
So Betriebsart/operating mode		-S5 Zylinder -M4 einfahren/ cylinder -M4 retract	

Figure 6: Operator panel

sce-062-101-frequency-converter-g120-pn-s7-1500-r0909-en.docx
8.3 Reference table

DI	Туре	ID	Function	NC/NO
1 0.0	BOOL	-A1	Return signal emergency stop ok	NC
I 0.1	BOOL	-K0	Main switch "ON"	NO
I 0.2	BOOL	-S0	Mode selector manual (0)/automatic (1)	Manual = 0
I 0.3	BOOL	-S1	Pushbutton automatic start	NO
I 0.4	BOOL	-S2	Pushbutton automatic stop	NC
I 0.5	BOOL	-B1	Sensor cylinder -M4 retracted	NO
I 1.0	BOOL	-B4	Sensor part at slide	NO
I 1.3	BOOL	-B7	Sensor part at end of conveyor	NO
ID256	STRUCT	PZD_IN_G120_01	Telegram 1 receive process data from G120 conveyor1	

The following signals are required as global operands for this task.

DO	Туре	ID	Function	
OD256	STRUCT	PZD_OUT_G120_01	Telegram 1 send process data to G120 conveyor1	

Legend for reference list

- DI Digital input DO Digital output
- AI Analog input AO Analog output
- I Input O Output
- NC Normally Closed
- NO Normally Open

8.4 Planning

Plan the implementation of the task by yourself

8.5 Checklist – exercise

The following checklist helps trainees/students to independently check whether all steps of the exercise have been carefully completed and enables them to successfully complete the module on their own.

No.	Description	Checked
1	Program changes carried out in MOTOR_SPEEDCONTROL" [FC10].	
2	Program changes carried out in MOTOR_ SPEED_MONITORING" [FC11].	
3	Compiling and downloading of the program blocks is successful and without error message.	
4	Switch on system (-K0 = 1) Cylinder retracted/feedback activated (-B1 = 1) EMERGENCY STOP (-A1 = 1) not activated AUTOMATIC mode (-S0 = 1) Automatic stop pushbutton not actuated (-S2 = 1) Briefly actuate automatic start pushbutton (-S1 = 1) Sensor part at slide activated (-B4 = 1) Then the induction motor is switched on via the frequency converter and remains active. \rightarrow Motor ON The speed corresponds to the speed setpoint in the range of +/- 50 1/min	
5	Sensor at conveyor end activated (-B7 = 1) \rightarrow Motor OFF (after 2 seconds).	
6	Briefly actuate automatic stop pushbutton (-S2 = 0) \rightarrow Motor OFF	
7	Activate EMERGENCY STOP (-A1 = 0) \rightarrow Motor OFF	
8	Operating mode manual (-S0 = 0) \rightarrow Motor OFF	
9	Switch off system (-K0 = 0) \rightarrow Motor OFF	
10	Cylinder not retracted (-B1 = 0) \rightarrow Motor OFF	
11	Speed > Speed limit fault max. \rightarrow Motor OFF	
12	Speed < Speed limit fault min. \rightarrow Motor OFF	
13	Project archived successfully.	

sce-062-101-frequency-converter-g120-pn-s7-1500-r0909-en.docx

9 Additional information

More information for further practice and consolidation is available as orientation, for example: Getting Started, videos, tutorials, apps, manuals, programming guidelines and trial software / firmware, under the following link:

siemens.com/sce/drives

Preview "Additional information" - In preparation

Further information

Siemens Automation Cooperates with Education siemens.com/sce

SCE Learn-/Training Documents siemens.com/sce/documents

SCE Trainer Packages siemens.com/sce/tp

SCE Contact Partners siemens.com/sce/contact

Digital Enterprise siemens.com/digital-enterprise

Industrie 4.0 siemens.com/future-of-manufacturing

Totally Integrated Automation (TIA) siemens.com/tia

TIA Portal siemens.com/tia-portal

SIMATIC Controller siemens.com/controller

SIMATIC Technical Documentation siemens.com/simatic-docu

Industry Online Support support.industry.siemens.com

Product catalogue and online ordering system Industry Mall **mall.industry.siemens.com**

Siemens Digital Industries, FA P.O. Box 4848 90026 Nuremberg Germany

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