SIEMENS

SIMATIC

Automation System S7-300

Getting Started Collection

CPU 31x: Commissioning

CPU 31xC: Commissioning

CPU 314C: Positioning with Analog Output

CPU 314C: Positioning with Digital Output

CPU 31xC: Counting

CPU 31xC: PtP Connection

CPU 31xC: Controlling

CPU 317-2 PN/DP: Configuring the PROFInet Interface X2PN/DP

This manual is part of the documentation package with the order number:
6ES7398-8FA10-8BA0

Edition 12/2003
A5E00123662-04

Safety Guidelines

This manual contains notices intended to ensure personal safety, as well as to protect the products and connected equipment against damage. These notices are highlighted by the symbols shown below and graded according to severity by the following texts:

Danger
indicates that death, severe personal injury or substantial property damage will result if proper precautions are not taken.

Warning
indicates that death, severe personal injury or substantial property damage can result if proper precautions are not taken.

Caution
indicates that minor personal injury can result if proper precautions are not taken.

Caution
indicates that property damage can result if proper precautions are not taken.

Notice
draws your attention to particularly important information on the product, handling the product, or to a particular part of the documentation.

Qualified Personnel

Only **qualified personnel** should be allowed to install and work on this equipment. Qualified persons are defined as persons who are authorized to commission, to ground and to tag circuits, equipment, and systems in accordance with established safety practices and standards.

Correct Usage

Note the following:

Warning
This device and its components may only be used for the applications described in the catalog or the technical description, and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens.

This product can only function correctly and safely if it is transported, stored, set up, and installed correctly, and operated and maintained as recommended.

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SIEMENS

SIMATIC

Automation System S7-300
CPU 31x: Commissioning

Getting Started

Edition 06/2003
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Introduction

This guide takes you through a specific example to set up a working application. This way you will get to know the basic hardware and software functions of your CPU.

You should expect to spend between one and two hours on this example, depending on your level of experience.

Applicability:

This guide applies to the following CPUs:

CPU	Order no.	You will need a micro memory card (MMC) in order to use the following CPUs	As of version	
			Firmware	Hardware
312	6ES7 312-1AD10-0AB0	X	V2.0.0	01
312 IFM	6ES7 312-5AC02-0AB0 6ES7 312-5AC82-0AB0		V1.1.0 V1.1.0	01 01
313	6ES7 313-1AD03-0AB0		V1.1.0	01
314	6ES7 314-1AE04-0AB0 6ES7 314-1AE84-0AB0		V1.1.0 V1.1.0	01 01
314	6ES7 314-1AF10-0AB0	X	V2.0.0	01
314 IFM	6ES7 314-5AE10-0AB0		V1.1.0	01
315	6ES7 315-1AF03-0AB0		V1.1.0	01
315–2 DP	6ES7 315-2AG10-0AB0	X	V2.0.0	01
315–2 DP	6ES7 315-2AF03-0AB0 6ES7 315-2AF83-0AB0		V1.1.0 V1.1.0	01 01
316-2 DP	6ES7 316-2AG00-0AB0		V1.1.0	01
317-2 DP	6ES7 317-2AJ10-0AB0	X	V2.1.0	01
318-2 DP	6ES7 318-2AJ00-0AB0		V3.0.0	03

The following requirements must be fulfilled:

You need to have a basic understanding of electronics/electrical engineering, and have experience of working with Microsoft® Windows™.

Warning

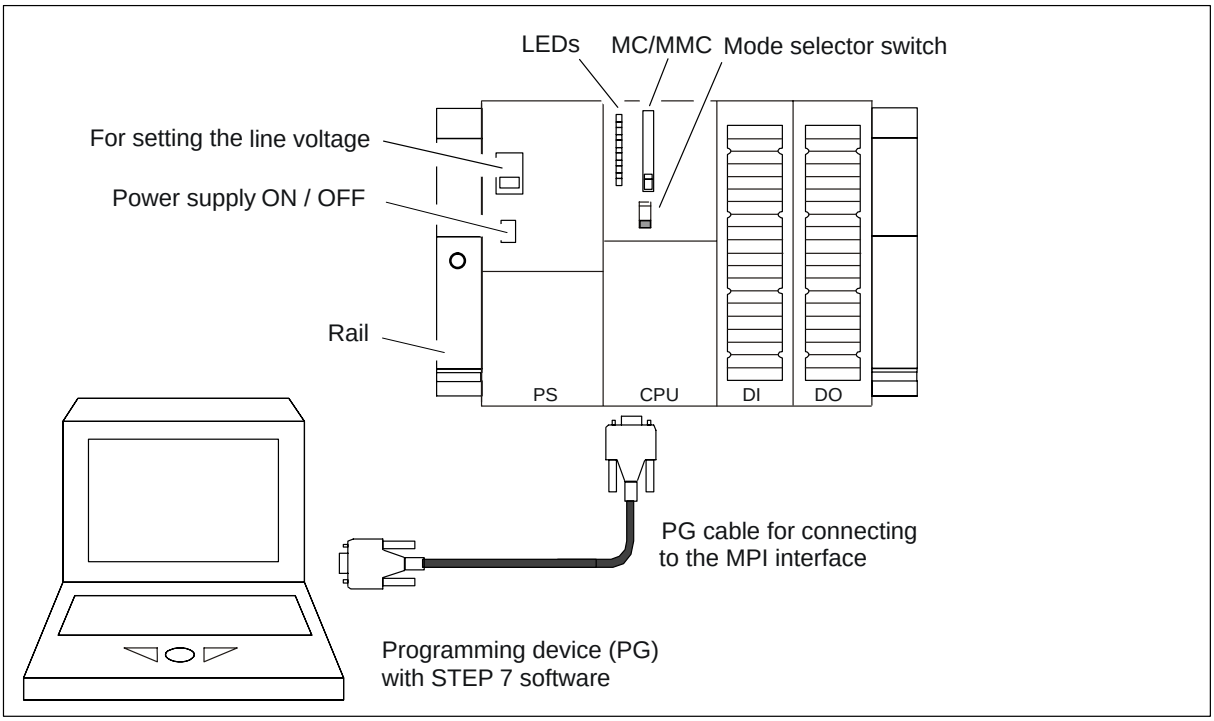
When using the S7–300 as a component of plants and systems, you may be required to follow certain rules and regulations according to the specific application. Please note the applicable safety and accident prevention regulations, such as IEC 204 (emergency stop systems).

Non-compliance with these regulations can result in serious injury and damage to both machinery and equipment.

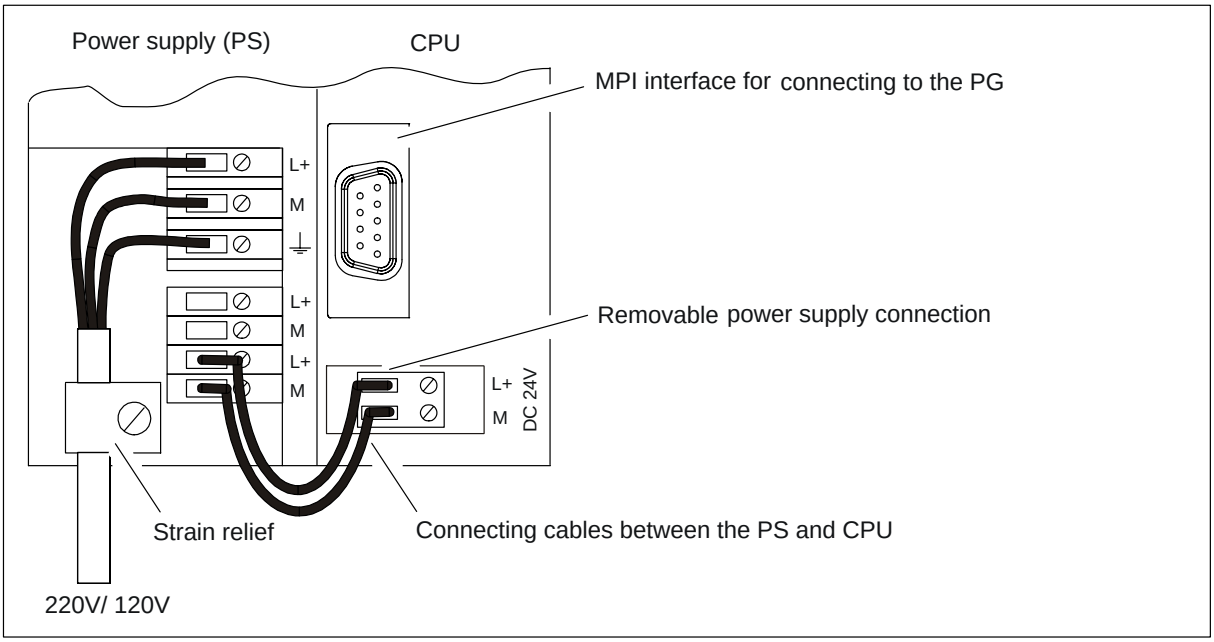
Materials and Tools Required

Quantity	Item	Order number (Siemens)
1	Rail	e.g. 6ES7 390-1AE80-0AA0
1	Power supply (PS)	e.g. 6ES7 307-1EA00-0AA0
1	Central processing unit (CPU)	e.g. 6ES7 312-1AD10-0AB0
1	Micro Memory Card (MMC) **Please note:** You must have an MMC in order to use certain CPUs (see Applicability)	e.g. 6ES7 953-8LL00-0AA0
1	Digital input module (DI) with bus connector	e.g. 6ES7 321-1BH02-0AA0
1	Digital output module (DO) with bus connector	e.g. 6ES7 322-1BH01-0AA0
2	Multipin front connector with screw-type contacts	e.g. 6ES7 392-1AM00-0AA0
1	• Programming device (PG) with MPI interface and **STEP 7** software version ≥ 5.1 + SP 4 installed and PG cable or • PC with suitable interface card	Depends on configuration
Various	M6 screws and nuts (length depends on installation location) with suitable screwdriver / wrench	Standard
1	Screwdriver with 3.5 mmblade	Standard
1	Screwdriver with 4.5 mmblade	Standard
1	Side cutter and cable stripper	Standard
1	Crimp tool	Standard
X m	Cable with 10 mm^2 cross-section for grounding the rail and suitable cable lug for M6 screw. Length of cable depends on local requirements.	Standard
Approx. 2 m	Flexible cable with 1 mm^2 cross-section and suitable ferrules with insulated collar, length 6 mm	Standard
X m	3-core flexible power cable (AC 230/120 V) with shock-proof plug; length dependant on local requirements, with suitable ferrules and insulating collar.	Standard
2	Single–pole ON switch (24 V)	Standard

Layout of the example



Sample layout (certain details of the CPUs may differ from the above illustration)



Wiring the power supply and CPU (front cover open)

Functionality of the example

The output cannot switch (i.e. so that the diode on the output module lights up) until the switches are pressed.

1. Installation

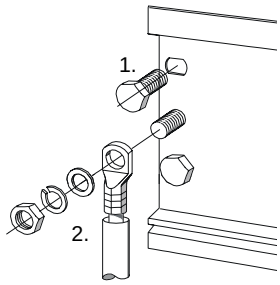
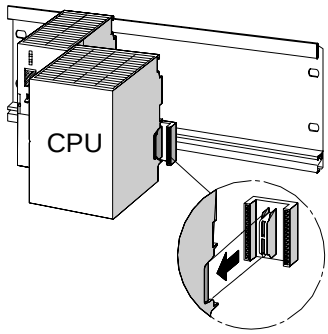
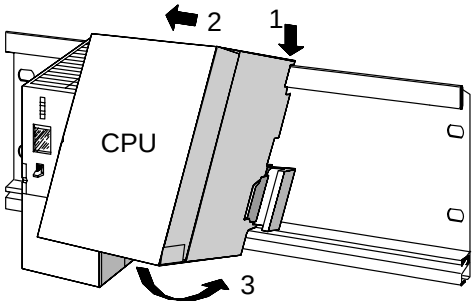
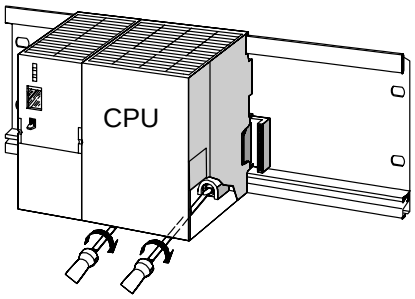
Figure	Installing and Grounding the Rail
	1. Screw the rail in position (screw size: M6). Make sure that there is a clearance of at least 40 mm above and below the rail. If you fasten the rail to a grounded metal plate or device support, make sure there is a low-resistance connection between the rail and the base. 2. Connect the rail to the protective conductor. There is an M6 protective conductor screw on the rail for this purpose. Minimum cross-section of the cable to the protective conductor: 10 mm^2.

Figure	Attaching the Modules on the Rail
	1. Attach the power supply. Push it to the left until it reaches the rail's grounding screw, and then screw in place. 2. Connect to the other modules by plugging a bus connector into the CPU (see detail).
	3. Attach the CPU (1). 4. Push it up against the module on the left (2) 5. and tip it downward (3).
	6. Screw the modules hand-tight onto the rail. 7. If you are using a CPU with an MMC, insert the memory card into the slot. 8. Now fit the digital input module and digital output module to the right of the CPU by repeating steps 1 to 6.

2. Wiring

Warning

You may come into contact with live wires that are connected to the power supply. Make sure that the S7-300 is completely disconnected before you start wiring.

Wiring the Power Supply and the CPU

Step	Wiring the power supply and CPU
1	Open the front panels of the power supply and the CPU.
2	Detach the strain relief clip from the power supply.
3	Strip the flexible power cable, crimp on the ferrules and connect them to the power supply. (Blue to terminal M, black to terminal L1, protective conductor to terminal PE)
4	Screw the strain relief clamp in place.
5	Now wire the power supply to the CPU using the 1 mm^2 cross-section flexible cable. Strip the ends to approx. 6 mm and crimp on the ferrules. Connect terminals L+ and M on the power supply to those on the CPU.
6	Check that the line voltage selector switch is set to the correct line voltage. The power supply is set at the factory to a line voltage of AC 230 V. To change the voltage, remove the protective cap with a screwdriver, set the switch to the required line voltage and replace the protective cap.

Wiring the Digital Input and Output Modules

Step	Wiring the Front Connectors of the DI and DO
1	Open the front panels of the digital input and output modules.
2	Push front connectors into the DI and the DO until they snap into position. The front connectors still stick out of the module, and thus have no contact with the module, in this wiring position.
3	Cut around 10 wires (1mm^2) to length (20 cm), and attach ferrules to the ends.
4	Wire the front connector for the digital input module as follows: Terminal L+ to terminal L+ on the power supply; terminal M to terminal M on the power supply Terminal 3 to the first connection of switch 1; Terminal 4 to the first connection of switch 2 Connect the two unassigned connections on switches 1 and 2 to L+ on the power supply.
5	Wire the front connector for the digital output module as follows: Terminal L+ to terminal L+ on the power supply; terminal M to terminal M on the power supply
6	Lead the wires downwards out of the front connectors.

Step	Wiring the Front Connectors of the DI and DO
7	Press the release button on the front connector at the top of the module. At the same time, push the front connector into the module until the release button snaps back into its initial position. Please note: If you are using 40-pin front connectors, they must also be fixed using the fixing screw in the center of the front connector.
8	Close the front panels of the digital input and output modules and the power supply.

3. Commissioning the Hardware

Step	Tasks	Result:
1	Connect the programming device to the CPU using the programming device cable. If you use a cable with PROFIBUS connectors, you will have to switch on the terminating resistors in the connectors. Close the front flap on the CPU and set the mode selector switch to *STOP.*	
2	Connect the power cable to the power supply and switch on the power supply module.	The *DC24V*-LED lights up on the power supply module. All the LEDs on the CPU light up briefly; the *SF* LED and the *DC5V* LED remain on. The *STOP* LED starts to flash slowly, prompting a memory reset.
3	Now insert either the micro memory card (MMC) or the back–up battery into your CPU, depending on the CPU type.	
4	Reset the CPU memory as follows: – Press the mode selector switch to *MRES*. Hold the switch in this position until the *STOP* LED lights up for the second time and stays on. Then release the mode selector switch. – Within 3 seconds, press the mode selector switch back to *MRES*. The *STOP* LED starts to flash rapidly and the CPU memory is reset. You can now release the mode selector. When the *STOP* LED lights up permanently again, the CPU memory reset is complete.	
5	Start up the programming device and start SIMATIC Manager from the Windows desktop.	A SIMATIC Manager window opens.
6	Activate switch 1.	The LED for the first input lights up.
7	Activate switch 2.	The LED for the second input lights up.

4. Configuring the Hardware in the STEP 7 Hardware Configuration Editor

Create a new project in STEP 7:

Step	Tasks	Result:
1	Select the **File > New...** menu command. Enter a name for your project and click on OK to confirm.	A new project is created

Add a new S7-300 station

Step	Tasks	Result:
1	Select the **Insert > Station > SIMATIC 300 Station** menu command.	The SIMATIC 300 (1) icon in the right-hand part of the window is highlighted.

Add a rail

Step	Tasks	Result:
1	In the right-hand part of the window, double-click first on the SIMATIC 300(1) icon and then on the Hardware icon.	The hardware configuration editor (HW Config) opens.
2	You can insert your hardware components from the hardware catalog in the left-hand part of the window. If no catalog is displayed, activate the catalog using the **View > Catalog** menu command. In the hardware catalog, navigate to Rack-300 via SIMATIC 300. Copy the rail by dragging and dropping it in the right-hand part of the window.	The rail is inserted in the right-hand part of the window

Add the power supply:

Step	Tasks	Result:
1	In the hardware catalog, navigate to PS-300. Drag your power supply and drop it into slot 1 on the rail. **Note:** You can click on the power supply to display its order number. The order number then appears in the box beneath the catalog.	The power supply module is inserted into slot 1.

Add the CPU:

Step	Tasks	Result:
1	In the hardware catalog, navigate to CPU-300. Drag your CPU and drop it into slot 2 on the rail.	The CPU is inserted into slot 2.

Add the digital input and output modules:

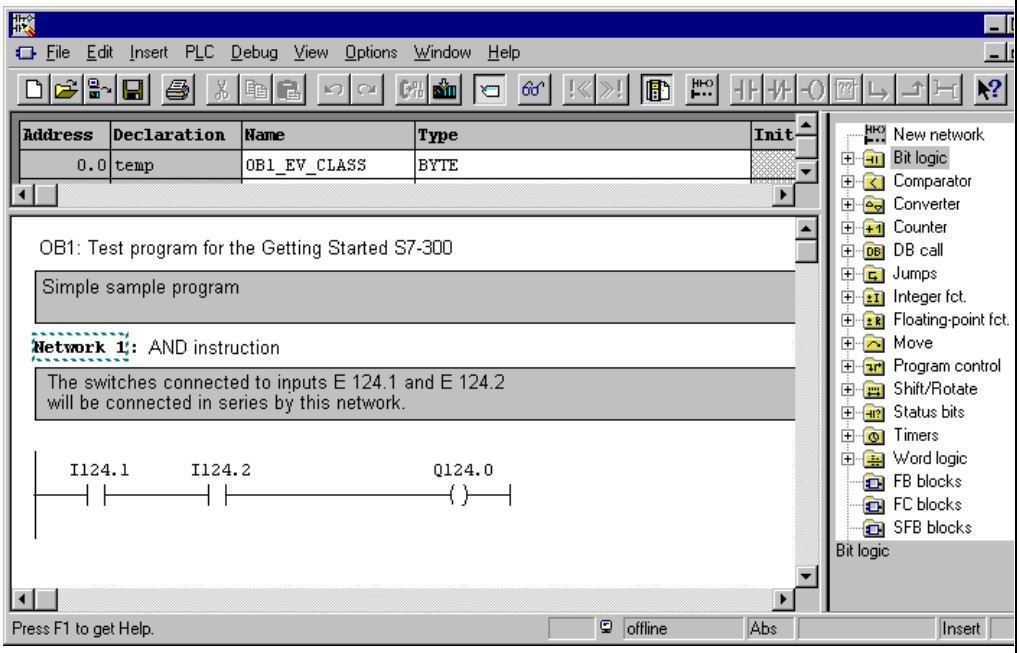
Step	Tasks	Result:
1	In the hardware catalog, navigate to DI-300 via SM-300 and select your digital input module. Drag the digital input module to the rail and drop it into slot 4.	The digital input module is inserted into slot 4.
2	In the hardware catalog, navigate to DO-300 via SM-300 and select your digital output module. Drag the digital output module to the rail and drop it into slot 5.	The digital output module is inserted into slot 5.

Save and compile your configuration:

Step	Tasks	Result:
1	Select the *Save and Compile* command from the *Station* menu.	The hardware configuration is compiled and saved.
2	Close the editor.	The editor is closed. The CPU now appears in the station in SIMATIC Manager.

5. Programming the Circuit

Step	Tasks	Result:
1	In the right-hand part of the window, first double-click on the CPU icon, then on the S7 program(1) icon, then on the Blocks icon and finally on the OB1 icon.	The “Properties” dialog for OB1 is displayed.
2	From the properties for the organizational block, select the ladder diagram development language. Click on OK to confirm.	The program editor opens.
3	From the properties for the organizational block, select the ladder diagram development language. Confirm with OK.	The program editor opens.
4	Carefully click on the horizontal line representing the current path.	The line is highlighted.
5	On the toolbar, click twice on the –||– icon (normally-open contact) and then once on the –( ) icon (coil).	The icons are inserted into the current path.
6	Click on the red question mark for the left-hand normally-open contact in the current path.	The normally-open contact is highlighted and the question mark is replaced with a text input box containing the cursor.
7	Enter *E124.1* and press *Return.*	The left-hand normally-open contact is now called *E124.1.*

Step	Tasks	Result:
8	Label the right-hand switch *E124.2* and the coil *A124.0* in the same way. 	
9	set the **File > Close** menu command to close the editor, and click *Yes* when you are prompted to save.	The editor is closed and OB 1 is saved.

6. Test Run

Step	Tasks	Result:
1	Navigate via SIMATIC 300 Station and *your CPU* to the S7 program. In SIMATIC Manager, click on Blocks in the right-hand part of the window.	*Blocks* is highlighted.
2	From the *Target System* menu, select *Download* to transfer the program and hardware configuration to the CPU. Click on *Yes* in every dialog box that appears.	The program and configuration are downloaded from the programming device to the CPU. The program stored on the micro memory card (in the download memory) is now protected, even in the event of a power failure or memory reset.
3	Switch the CPU mode selector to *RUN.*	The *STOP* LED goes out. The *RUN* LED starts flashing and then stays on.
4	Actuate the two switches alternately.	The LEDs of both inputs light up alternately.
5	Actuate the two switches simultaneously.	The LEDs of both inputs light up together. The LED of the first output lights up. This would switch on any connected actuator or indicator.

Diagnostics / Troubleshooting

Incorrect operation, wiring or hardware configuration can result in faults. The CPU indicates these faults after a memory reset with the group error LED *SF*.

The S7-300 Installation Manual describes how to diagnose these errors and messages.

Manuals for further details

For further information on Getting Started, we recommend that you read *Getting Started, First Steps and Exercises with* ***STEP 7*** *V5.1*.

Service & Support on the Internet

To supplement our documentation, you can access our complete knowledge base online on the Internet at:

http://www.siemens.com/automation/service&support

There you can find:

- the newsletter, which contains the latest information about your products.
- exactly the right documents for your needs via the search function in Service & Support.
- a forum that allows users and specialists around the world to swap their experiences.
- your local service partner for Automation & Drives in our Partner Database.
- information about on-site service, repairs and spare parts. This and much more can be found in the ”Services” section.

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SIMATIC

Automation System S7-300
CPU 31xC: Commissioning

Getting Started

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Introduction

This guide takes you through 6 commissioning steps to set up a functioning application by running through a concrete example. In this way you will get to know the basic hardware and software functions of your CPU 31xC.
You should expect to spend approximately 1.5 to 2 hours on this example, depending on the level of your experience.

Prerequisites

The following prerequisites must be fulfilled:

- You must be familiar with the fundamentals of electronic/electrical engineering and have experience of working with computers and Microsoft® Windows™ 95/98/NT.

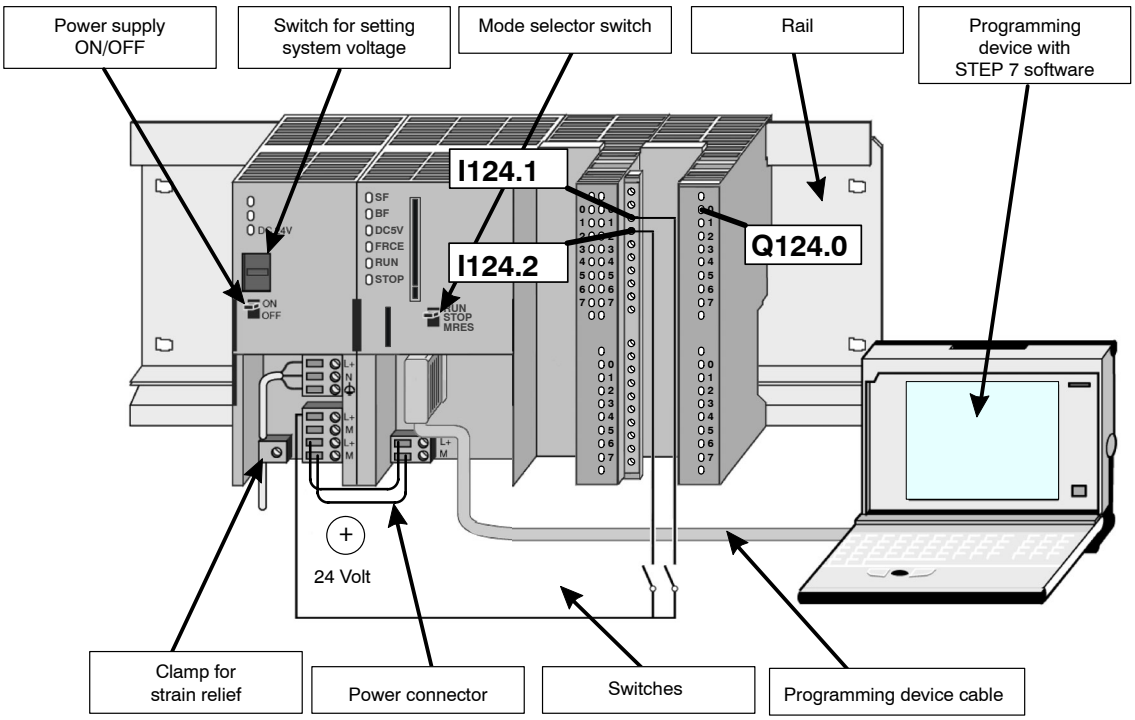
Warning

The S7-300 is used as a component in installations and systems that require you to comply with specific rules and regulations that vary depending on the application.
Please note the relevant safety and accident-prevention regulations, such as IEC 204 (emergency stop systems).
Non-compliance with these regulations can result in serious injury and damage to both machinery and equipment.

Materials and Tools Required

Quantity	Item	Order Number (SIEMENS)
1	Rail	e.g. 6ES7 390-1AE80-0AA0
1	PS 307 power supply (PS)	e.g. 6ES7 307-1EA00-0AA0
1	CPU 31xC, z. B. CPU 313C	e.g. 6ES7 313-5BE00-0AB0
1	SIMATIC Micro Memory Card (MMC)	e.g. 6ES7 953-8LL00-0AA0
2	40-pin front connector with screw-type contacts	6ES7 392-1AM00-0AA0
1	• Programming device (PG) with MPI interface and installed STEP 7 version ≥ 5.1 + SP 2 and PG cable or • PC with the corresponding interface card	Depends on configuration
X m	PROFIBUS-DP cable with bus connectors	Depends on type
Various	M6 screws and nuts (length depends on installation location) with appropriate screwdriver/wrench	Standard
1	Screwdriver with 3.5 mm blade	Standard
1	Screwdriver with 4.5 mm blade	Standard
1	Diagonal cutter and tool for insulation stripping	Standard
1	Tool for pressing on wire-end ferrules	Standard
X m	Cable for grounding the rail with 10 mm^2 cross-section with cable lug for M6, length dependent on local requirements	Standard
Approx. 2 m	Stranded wire with 1 mm^2 cross-section with appropriate wire-end ferrules (type A, length 6 mm)	Standard
X m	3-core power cable (AC 230/120 V) with shock-proof plug; length dependent on local requirements; correct wire-end	Standard
2	1-pin on switch (24 V)	Standard

Layout of the example



Overview of the layout of the example

Functionality of the Example

Output Q124.0 can only be switched (i.e. the Q124.0 diode lights up on the DO), if switches I124.1 **and** I124.2 are pressed.

Step 1: Installation

Installation sequence: from left to right: power module 307 – CPU 313C.
The picture shows the overview of the entire installation.

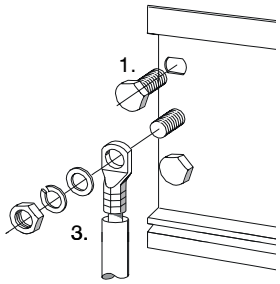
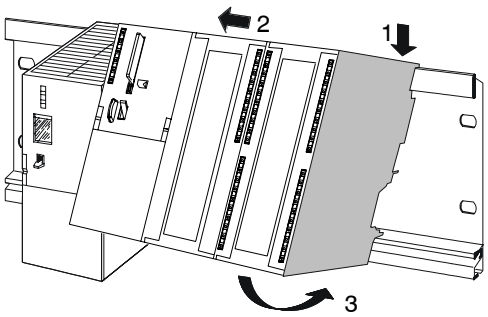
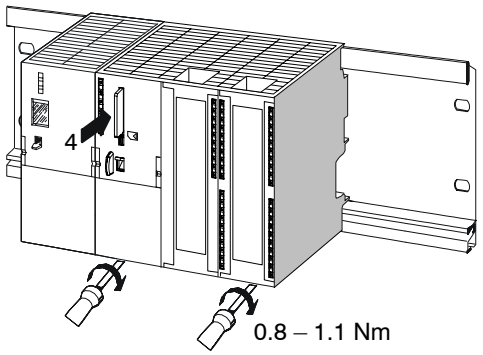
Figure	Installing and Grounding the Rail
	1. Put the rail in position and fasten (screw size: M6) so that there is at least 40 mm of space above and below the rail. 2. If you fasten the rail to a grounded metal plate or a grounded device support, make sure there is a low-resistance connection between the rail and the base.
	3. Connect the rail to the protective conductor. There is an M6 protective conductor screw on the rail for this purpose. Minimum cross-section of the cable to the protective conductor: 10 mm^2.

Figure	Mounting the Module on the Rack
	1. Attach the PS, push it up to the grounding screw of the rail and tighten it. 2. Attach the CPU (1), push it up to the module on the left (2) and tip it downward (3).
	3. Screw the CPU on tightly. 4. Insert the Micro Memory Card in the CPU (4). This is absolutely necessary for operation A Micro Memory Card with unknown content should be first deleted in the programming device.

Step 2: Wiring

Warning

You can come into contact with live wires if the PS 307 is switched on or the PS network cable is connected to the power.
Only wire the S7-300 in a deenergized state!

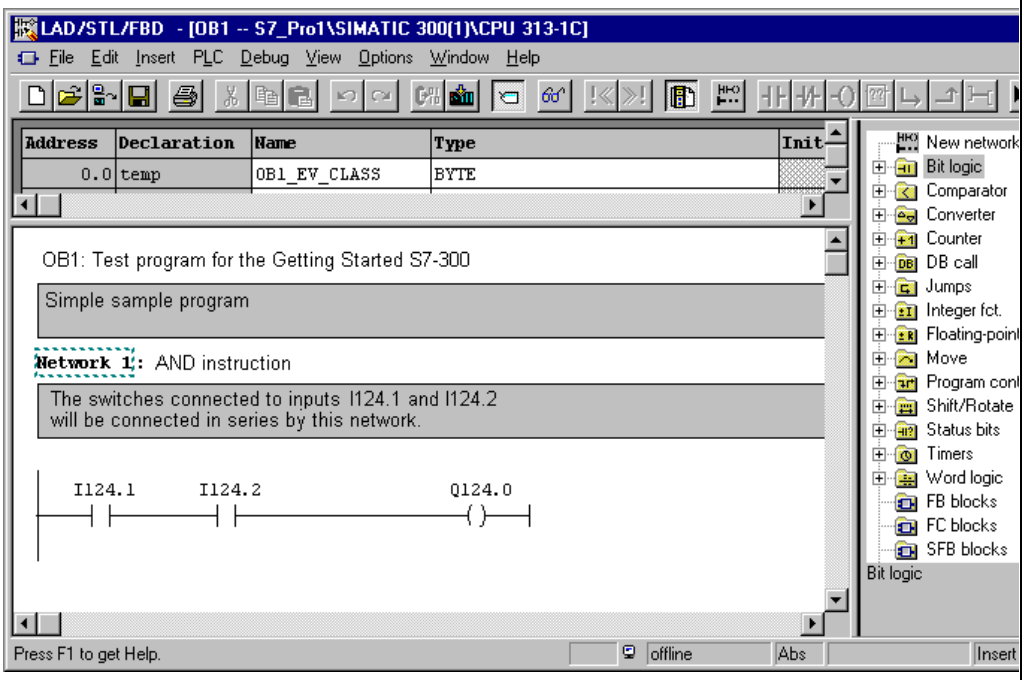
Stage	Wiring the Power Supply and the CPU
1	Open the front doors of the power module and the CPU.
2	Loosen the clamp for the power module strain relief (see the figure on page 3).
3	Strip the power cable, attach wire-end ferrules, if necessary (for multi-wire cables), and attach to the PS.
4	Tighten the clamp for the strain relief.
5	Insert two short connection cables between the power module and the CPU (see picture on page 3) and tighten it.
6	Check that the line voltage selector switch is set to your line voltage. The power module is set in the factory to a line voltage of AC 230 V. To change the voltage, proceed as follows: Remove the protective cap with a screwdriver, set the switch to the line voltage required and replace the protective cap.

Stage	Wiring the Front Connectors of the DI and DO
1	Open the front doors of the CPU 313C.
2	Position the front connectors so that you can wire them: To do this, push a front connector into the CPU until it snaps into position. The front connector still sticks out of the module in this position. A wired front connector has no contact with the module in the wiring position.
3	Strip 6 mm from the wire ends you want to insert in the front connector and attach appropriate wire-end ferrules.
4	Wire the front connector (DI side) as follows: Terminal 1: L+ of the power module; terminal 3: switch 1; terminal 4: switch 2; terminal 20: M of the popwer module.
5	Wire the front connector (DO side)as follows: Terminals 21 and 31: L+ of the power module; terminal 30: M of the power module.
6	Wire the free wire ends of the switches to L+ of the power module.
7	Lead the wires downward out of the front connectors.
8	Tighten the front connector (this sets the connection to the module).
9	Close the front cover of the power module and the front door of the CPU.

Step 3: Commissioning the Hardware

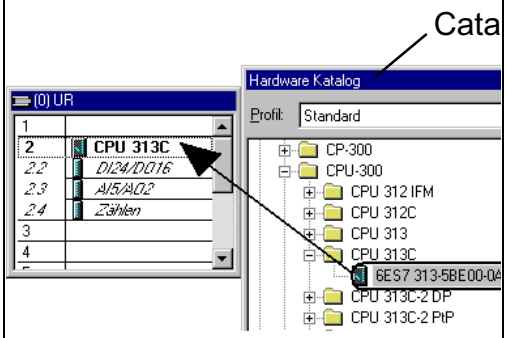
Stage	What to Do	Result
1	Connect the programming device to the CPU with the programming device cable. If you use a cable with PROFIBUS connectors, you will have to turn on the resistors in the connectors. Close the front door of the CPU and put the mode selector switch to *STOP*.	
2	Connect the power cable to the network and switch on the PS 307 power supply module.	The *DC24V* LED lights up on the PS. All the LEDs on the CPU come on briefly; the *SF* LED and the *DC5V* LED remain on. The *STOP* LED starts to flash slowly and requires memory reset (see 3).
3	Carry out a memory reset in the CPU as follows: – Press the mode selector switch to *MRES*. Keep the mode selector switch in this position until the *STOP* LED comes on for the second time and stays on (this takes 3 sec.). You can let go of the mode selector. – Within 3 sec. you must press the mode selector switch back to *MRES*. The *STOP* LED starts to flash rapidly and the CPU carries out a memory reset. You can let go of the mode selector. When the *STOP* LED comes on permanently again, the CPU has completed the memory reset.	
4	Raise the programming device and start SIMATIC Manager on the Windows desktop.	A SIMATIC Manager window appears.
5	Activate switch 1.	The I124.1 LED on the DI comes on. No LEDs light up on the DO.
6	Activate switch 2.	Die I124.2 LED on the DI comes on. No LEDs light up on the DO.

Step 4: Commissioning the Hardware

Stage	What to Do	Result
1	Follow the STEP 7 new project assistant on the programming device and create a new project with the following data: • CPU type: *CPU 313C*. • Block to be created: *OB1* • Project name: *S7_Pro1*	A two-part window with the title *S7_Pro1 --...* appears.
2	Double-click the *OB1* icon in the right-hand part of the window.	The editor for the OB1 block opens.
3	From the *View* menu, choose the *LAD* command to switch to the LAD programming language.	In the lower-left part of the window, a rung current path is displayed in the network.
4	Click exactly on the horizontal line of the rung current path.	The line is highlighted.
5	Double-click the –||– button (normally open contact) on the toolbar and then click the –( ) button once (coil).	The icons are inserted in the rung current path.
6	Click the red question mark of the normally open contact on the left in the rung current path.	The normally open contact is highlighted, and a text box with a cursor appears at the point of the question mark.
7	Enter *I124.1* and press *Return*.	The normally open contact on the left is assigned the designation I*124.1*.
8	Label the right button in the same way with I*124.2* and the coil with *Q124.0*. 	

Stage	What to Do	Result
9	Close the editor and confirm that you want to save with *Yes*.	The editor closes, and the OB1 is saved.

Step 5: Configuring the Hardware

Stage	Procedure	Result
1	In SIMATIC Manager, click SIMATIC 300 Station in the left-hand part of the window.	The buttons *Hardware* and *CPU 313 C* appear in the right-hand part of the window.
2	Double-click the *Hardware* button in the right-hand part of the window.	The hardware configuration editor opens.
3	• If a catalog is not displayed in the right-hand part of the window, activate the catalog by choosing the *Catalog* command from the *View* menu. • Navigate to DI-300 via SIMATIC 300 and SM-300. • Insert the *CPU 313C* with drag-and-drop to slot 2 (the upper or lower left-hand window). **Note:** You can find out the order number if you click a DI in the catalog. The order number of this DI then appears in the text box under the catalog.	
4	Check that the order number displayed for slot 2 in the lower left-hand part of the window corresponds to the order number on your CPU. If necessary, widen the order number column to display the whole order number	**If yes:** Continue from stage 5. **If no:** Navigate in the catalog via CPU 300 to CPU 313C and replace the CPU on slot 2 with the CPU with the correct order number from the catalog by dragging and dropping it.
5	Insert the *SM 322 DO16xDC24V/0.5A* whose order number corresponds to the order number on your DO by dragging and dropping it on slot 5.	
6	From the *Station* menu, choose the *Save and Compile* command.	The hardware configuration is compiled and saved.
7	Close the editor.	The editor is closed.

Step 6: Test Run

Stage	Procedure	Result
1	Navigate via SIMATIC 300 Station and CPU 314(1) to S7 Program. In SIMATIC Manager, click Blocks in the right-hand part of the window.	*Blocks* is highlighted.
2	From the *PLC* menu, choose the *Download* command to transfer the program and the hardware configuration to the CPU. Click *Yes* in all the dialog boxes that appear.	The program and configuration are downloaded from the programming device to the CPU. The program stored on the Micro Memory Card (in the Load Memory) is now protected against power failureand memory reset.
3	Switch the CPU mode selector to *RUN*.	The *STOP* LED goes out. The *RUN* LED starts flashing and then stays on.
4	Operate the two switches alternately.	The LEDs of the inputs I124.1 and I124.2 light up alternately. The LED of output Q124.0 does not light up.
5	Operate the two switches simultaneously.	The LEDs of inputs I124.1 and I124.2 light up together. The LED of output Q124.0 comes on. This would switch on a connected actuator or indicator.

Diagnosis/Debugging

Incorrect operation, incorrect wiring or incorrect hardware configuration can result in faults that the CPU indicates after a memory reset with the group error LED *SF*.

You can find out how to evaluate these errors and messages in the manuals: *Hardware and Installation* ; Section 10.4 and *Programming with STEP 7 V5.1* ; Chapter 21.

SIMATIC Documentation on the Internet

You can download all the manuals free of charge from the Siemens home page http://www.ad.siemens.de/support

The Knowledge Manager on this page helps you to find the documentation you need faster. You can exchange questions and comments about the documentation with other users on our forum.

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Bereich Automatisierungs- und Antriebstechnik
Geschaeftsgebiet Industrie-Automatisierungssysteme
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Siemens Aktiengesellschaft

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SIEMENS

SIMATIC

Automation System S7-300
CPU 314C: Positioning with Analog Output

Getting Started

Edition 10/2001
A5E00105537-01

Introduction

The sample in this manual takes you through five steps, showing you how to commission a fully functional application and run the drive subsequently. You are going to get acquainted with the basic hardware and software functions and learn how to determine and verify application-dependent parameters in this sample. The references to the manual should give you an initial overview of the information it contains.

Usually it should take no more than one or two hours to work through this sample, depending on experience.

Prerequisites

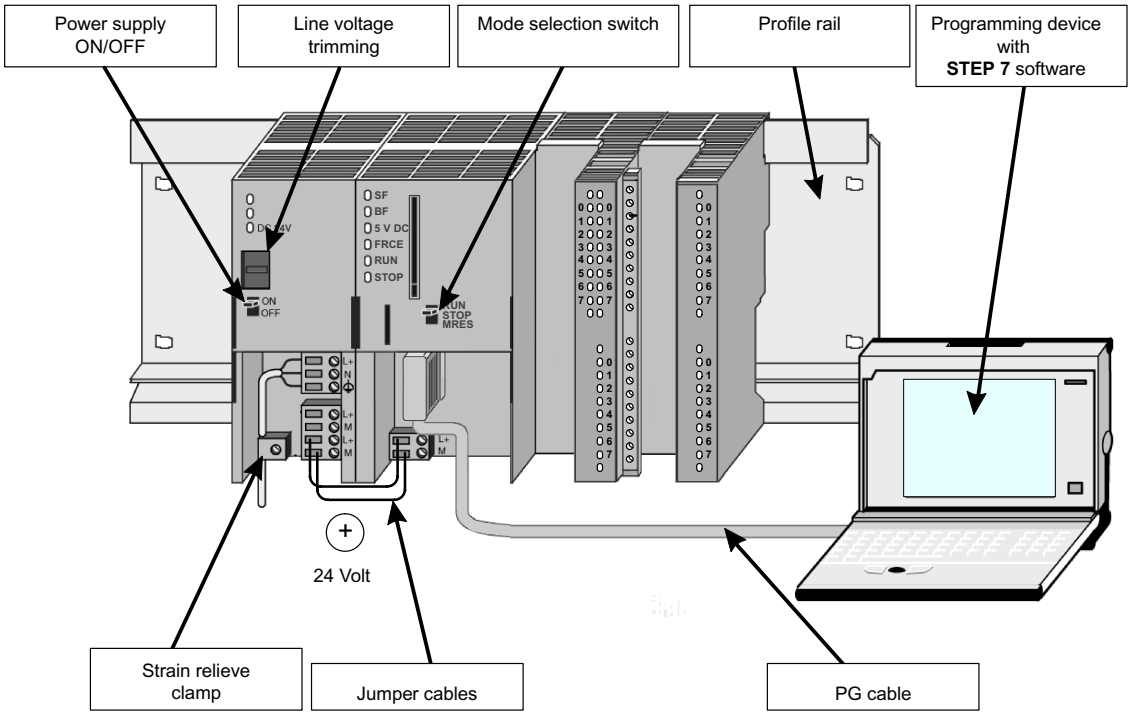
The conditions are that:

- You have installed an S7-300 station, consisting of a power supply module and a CPU 314C-2 DP/PtP.
- STEP 7 (>= V5.1 + Servicepack 2) is correctly installed on your PG.
- The sample projects are available, either on your CD or you have downloaded them from the Internet.
- You have created a project for the S7-300 station.
- The PG is connected to the CPU.
- You are set up with an external 24 V DC power supply, an encoder, a drive and the usual required accessories, e.g. front plug and wiring material.
- You have implemented hardware limit switches and EMERGENCY-OFF switches for protecting your operating staff and the system.
- The CPU is correctly connected to a power supply.

Warning

Depending on the field of application, your S7-300 as component in plants and systems requires special attention relating to specific rules and regulations.
Please pay attention to current regulations relating to safety and accident prevention, e.g. IEC 204 (EMERGENCY-OFF devices).
Serious injury as well as damage to machines and appliances is to be expected if you neglect these regulations.

Structure of the Sample

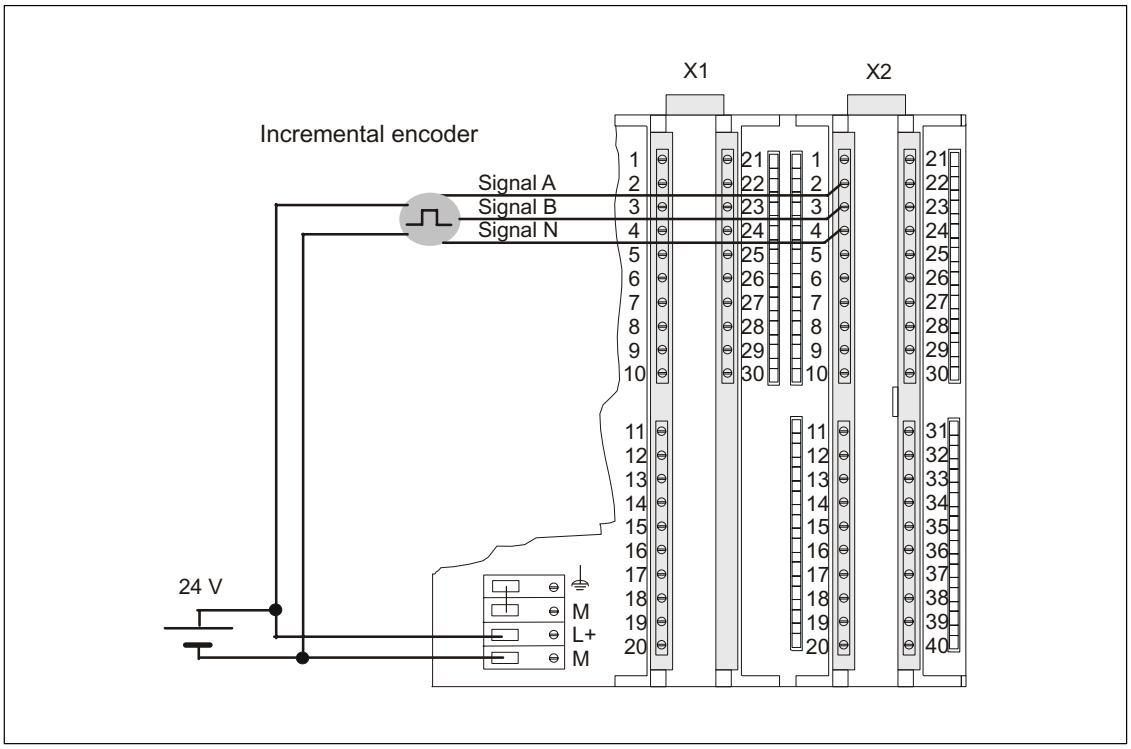


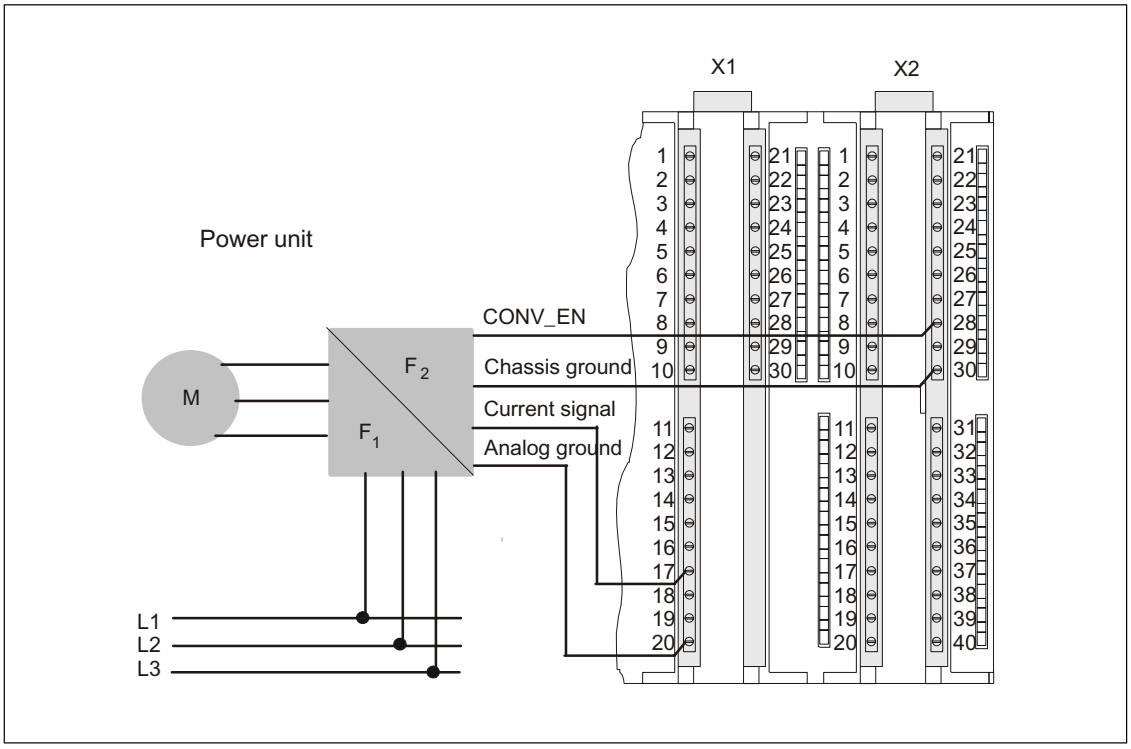
1st step: Wiring

Warning

You risk contact to live wires if the PS 307 power supply module is switched on or if the power line of the PS is connected to mains.
Wire the S7-300 only after you have switched off power!

Step	Wire the power supply to the CPU
1	Connect the wired front plug to the CPU and screw fasten it.
2	Connect the I/O voltage supply: • 24 V to X2, pin 1 and 21 • Ground to X2, pin 20 and 30
3	Connect the incremental encoder to the 24–V power supply.
4	Connect the encoder signals (X2, Pin 2 to 4).
5	Connect the power unit to the power supply.
6	Connect the power unit signal lines, using shielded cables (X1, Pin 16 or 17 and Pin 20, as well as X2, Pin 28 and 30).
7	Strip the cable insulation and connect the shielding to the shielding terminator. Use the shielding terminals.


X1
X2
Incremental encoder
Signal A
Signal B
Signal N
24 V
M
L+
M


X1
X2
Power unit
CONV_EN
Chassis ground
Current signal
Analog ground
M
F2
F1
L1
L2
L3

The pin-out below shows only the connections relevant for the respective positioning mode. The other connections are found in the Manual, Chapter “Wiring”.

CONNECTOR X1:

Pin	Name/Address	Function
16	AO 0 (V)	Voltage source, power unit
17	AO 0 (A)	Current source, power unit
20	Mana	Analog ground

CONNECTOR X2:

Pin	Name/Address	Function
1	1 L+	24 V supply voltage for the inputs
2	DI+0.0	Encoder signal A
3	DI+0.1	Encoder signal B
4	DI+0.2	Encoder signal N
5	DI+0.3	Length measurement
6	DI+0.4	Reference-point switch
20	1 M	Chassis ground
21	2 L+	24 V supply voltage for the outputs
28	DO+0.6	CONV_EN Power unit enable
30	2 M	Chassis ground

2nd step: Installing a sample project

You have two options of installing a sample project:

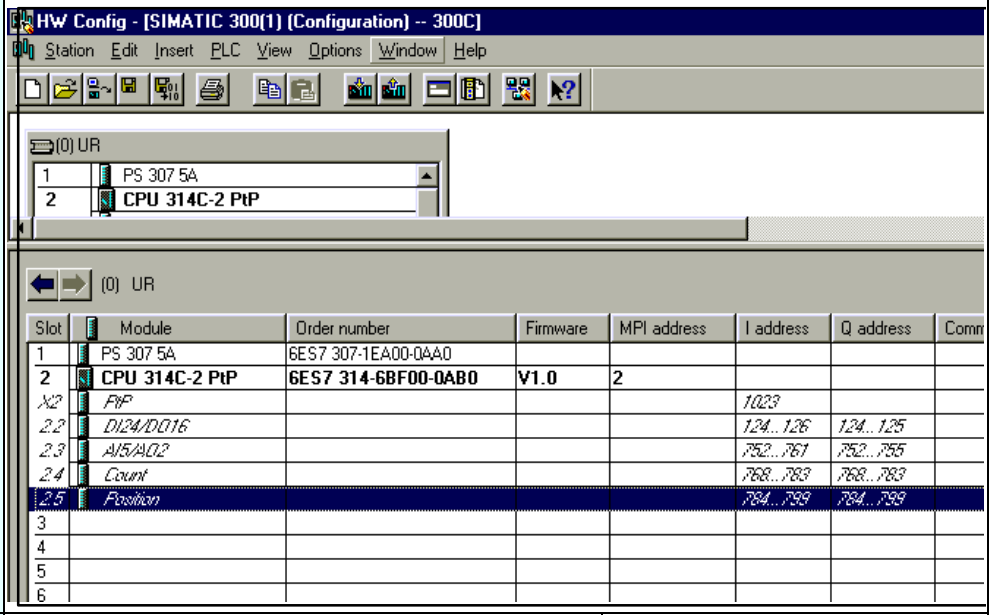
From CD:

Step	Action	Result
1	Start installation with a double-click on SETUP.EXE in the SETUP folder of your CD.	The installation program starts.
2	Follow the instructions on the screen.	

Download from the Internet:

Step	Action	Result
1	Open the sample project directory. Start the installation program per double-click on SETUP.EXE.	The installation program starts.
2	Follow the instructions on the screen.	

3rd Step: Assigning parameters

Step	Action	Result
1	Open your project in SIMATIC Manager.	A split window opens, showing in the header your project name.
2	In your project, call the configuration table HW Config. 	
3	Double-click on the submodule “AI5/AO”.	The “Properties AI5/AO2” dialog opens.
4	Disable analog output 0 per left–click on the “Output mode” field of the “Output” tab and select “disabled”. Close the dialog with OK.	Analog output 0 is enabled for controlling the motor power unit.
5	Double-click the “Positioning” submodule.	The “Positioning properties” dialog opens.
6	Select “Positioning with analog output”. In the drive, axis and encoder tabs, customize the properties according to your system.	
7	Confirm your entries with OK.	The “Positioning properties” dialog closes.
8	Save your configuration to your project with **Station > Save and compile**.	Your changes are now stored in your project.
9	While the CPU is in STOP state, download your configuration via **PLC > Load to module....**	Data are downloaded from the PG to your CPU.
10	Close HW Config with **Station > Close**.	You are returned to SIMATIC Manager.

4th step: Implementation in the user program

Step	Action	Result
1	In SIMATIC Manager, open the project “ZEn26_03_TF_____31xC_Pos” in the catalog \Siemens\STEP7\Examples via **File > Open... > Sample projects** .	A split window opens, showing in the header your project name.
2	Double-click the S7 program “Analog 1 First steps”.	The right window shows the “Sources”, “Function blocks” and “Symbols” folders.
3	Double-click on the “Function blocks” container.	You are shown all function blocks of the S7 program.
4	Select all function blocks and copy them to your project under **SIMATIC 300 Station > CPU3xx > S7 Program > Function blocks**.	

Function block	Name (in the symbol bar)	Description
OB1:	CYCLE_EXC	Cyclic program
OB100:	COMPLETE RESTART	Restart: Resetting the control signals
FC1:	GETST_A	Sample 1: ANALOG, first steps
SFB44:	ANALOG	SFB ANALOG
DB6:	DI_ANALOG	Instance DB to ANALOG
VAT_GETST_A:	VAT_GETST_A:	Variables table

Note: In the COMPLETE RESTART (OB 100) function block, optimize the values for speed, acceleration, deceleration and changeover/cut–off difference.

5	In SIMATIC Manager, select **SIMATIC 300 Station > CPU3xx > S7 Program > Function blocks** .	You are shown all function blocks of the S7 program.
6	Download all S7 function blocks contained to your CPU via **PLC > Download to CPU** (CPU in STOP state).	The program and configuration are downloaded from the PG to the CPU.

5th step: Test run

Step	Action	Result
1	In your project directory “Function blocks”, double–click on the VAT “VAT_GETST_A”.	You are shown the table of variables for monitoring and controlling.
2	Go Online via **PLC > Connect to > Configured CPU**.	The “STOP” status of the CPU pops up at the lower right.
3	Switch to monitoring mode via **Variable > Monitoring**.	The “Status value” column displays the actual values of the operands.
	Caution In the next two steps of the test you are going to start up the drive. You can stop the drive again by: • Resetting the direction control value to 0 and enabling it • Resetting the drive enable value to 0 and enabling it • Switch the CPU to STOP	

Step	Action	Result
4	Switch the CPU to RUN.	The “RUN” status of the CPU pops up at the lower right.
5	Now carry out these two tests. Validate the control values via **Variable > Enable control values**.	
	“Jogging” mode Make the following settings: MODE_IN = 1: Selects “Jogging” mode DRV_EN = 1: Drive enable SPEED: Speed in pulses/s Drive start: DIR_P = 1: Jogging into Plus direction DIR_M = 1: Jogging into Minus direction Note: Positioning mode is impossible if you have enabled the two variables DIR_P and DIR_M.	In the “Status value” column, you can monitor the following signal states: ST_ENBL = 1: Start enabled MOD_OUT = 1: Current operating mode: “Jogging” WORKING = 1: Running ACT_POS: Actual position value
	Operating mode “Relative incremental approach” Make these settings: MODE_IN = 4: Select “Relative incremental approach” DRV_EN = 1: Drive enable TARGET: Distance in pulses SPEED: Speed in pulses/s Drive start: DIR_P = 1: Relative incremental approach into Plus direction DIR_M = 1: Relative incremental approach into Minus direction	In the “Status value” column, you can monitor the following signal states: ST_ENBL = 1: Start enabled MOD_OUT = 4: Current operating mode: “Relative incremental approach” WORKING = 1: Running ACT_POS: Actual position value POS_RCD = 1: In position

Diagnostics/Troubleshooting

Errors can occur as a result of operator faults, incorrect wiring or configuration conflicts.
How to diagnose such errors and messages is described in the Manual, Chapter “Error handling and interrupts”.

Sample :

The “ZEn26_03_TF_____31xC_Pos” project contains further samples you can use for orientation. You can customize all samples according to your personal applications.

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SIMATIC

Automation System S7-300
CPU 314C: Positioning with Digital Output

Getting Started

Edition 10/2001
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Introduction

The sample in this manual takes you through five steps, showing you how to commission a fully functional application for running the drive. You are going to get acquainted with the basic hardware and software functions and learn how to determine and verify the application-dependent parameters in this sample. References to the manual should give you an initial overview of the information it contains.

Usually it is going to take no more than one or two hours to work through this sample, depending on experience.

Prerequisites

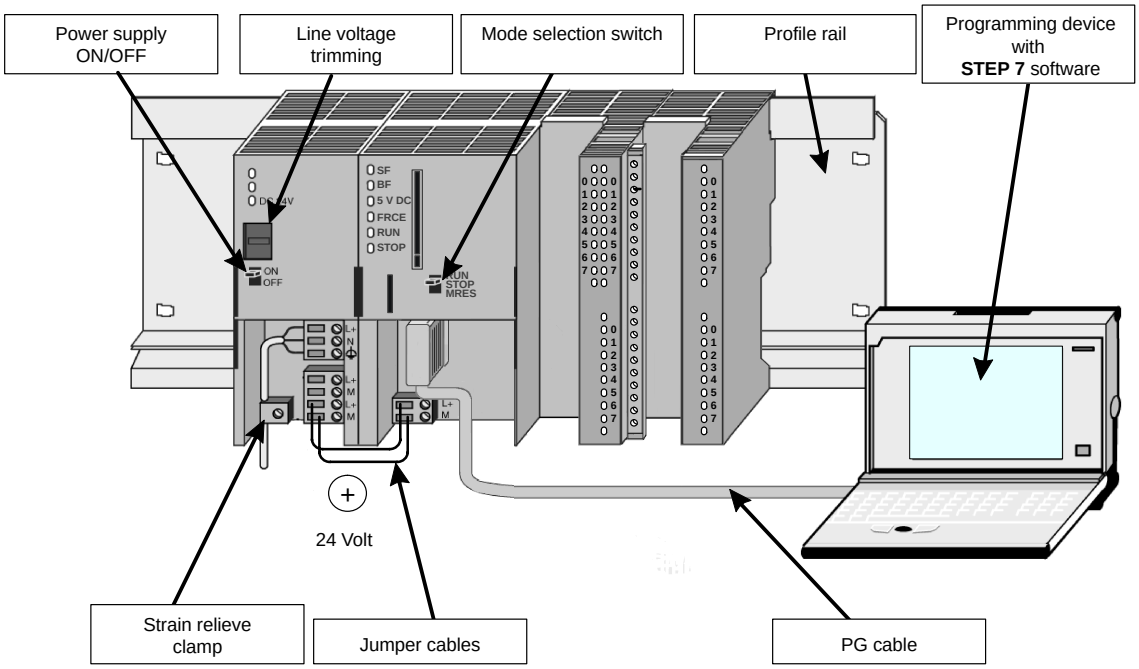
Condition is that:

- You have installed an S7-300 station, consisting of a power supply module and a CPU 314C-2 DP/PtP.
- STEP 7 (>= V5.1 + Servicepack 2) is correctly installed on your PG.
- The sample projects are available, either on your CD or you have downloaded them from the Internet.
- You have created a project for the S7-300 station.
- The PG is connected to the CPU.
- You are set up with an external 24 V DC power supply, an encoder, a drive and the usual required accessories, e.g. front plug and wiring material.
- You have implemented hardware limit switches and EMERGENCY–OFF switches for protecting your operating staff and the system.
- The CPU is correctly connected to a power supply.

Warning

Depending on the field of application, your S7-300 as component in plants and systems requires special attention relating to specific rules and regulations.
Please pay attention to current regulations on accident prevention and safety, e. g. IEC 204 (EMERGENC-OFF devices).
Serious injury as well as damage to machines and appliances can result if you neglect these regulations.

Structure of the Sample

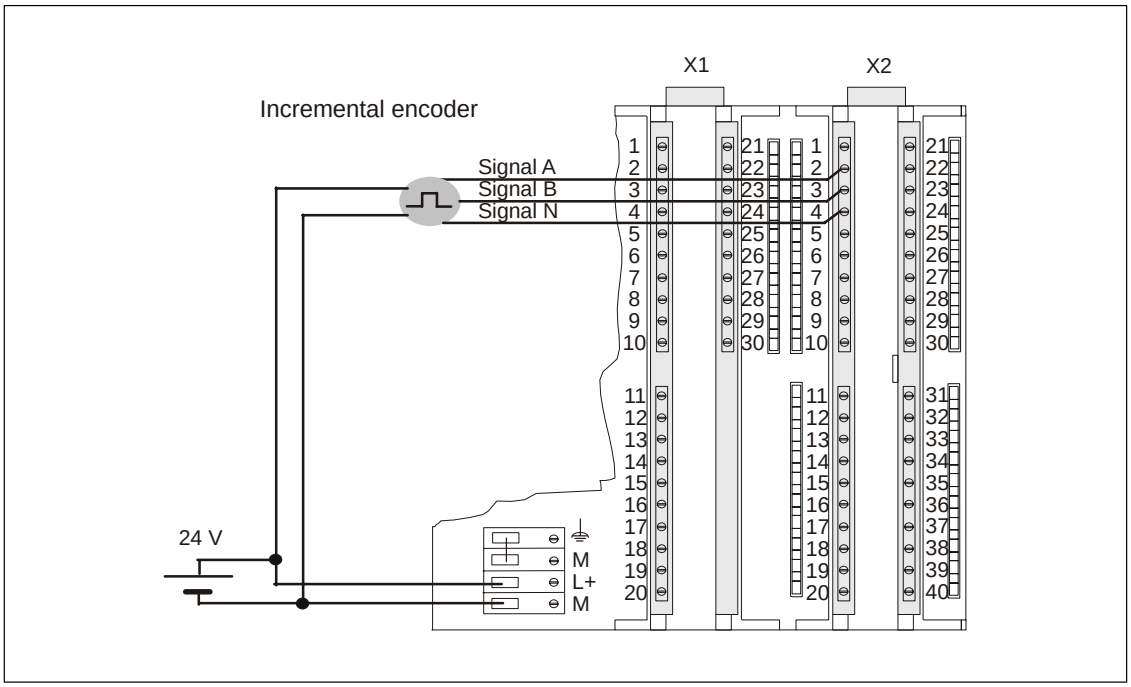


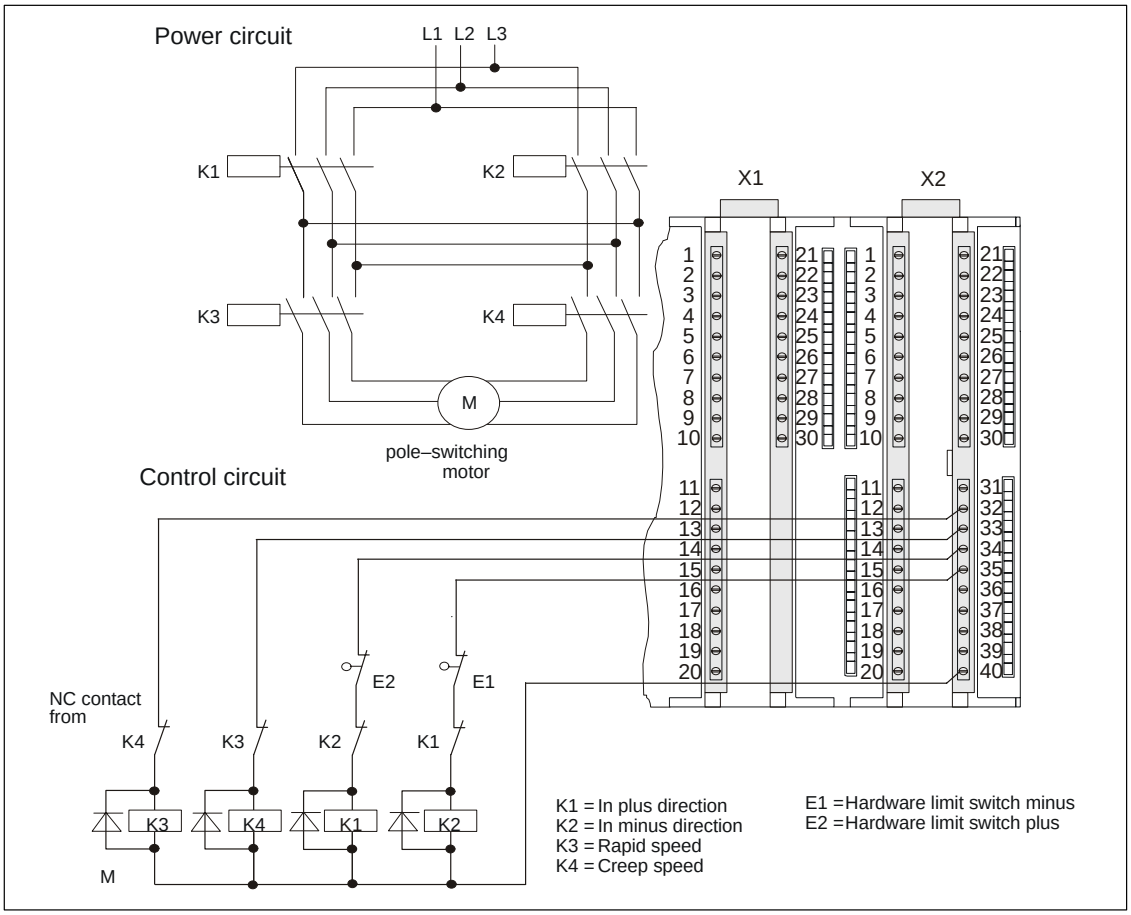
1st step: Wiring

Warning

You risk contacting live wires if the PS 307 power supply module is switched on or if the power supply line of the PS is connected to mains.
Wire the S7-300 only after you have switched off power!

Step	Wire the power supply to the CPU
1	Connect the wired front plug to the CPU and screw fasten it.
2	Connect the voltage supply of the digital I/O: • 24 V to X2, pin 1 and 31 • Ground to X2, pin 20 and 40
3	Connect the incremental encoder to the 24–V power supply.
4	Connect the encoder signals (X2, pin 2 ... 4).
5	Connect the relay circuit to the power supply.
6	Connect all lines of the relay circuit (X2, pin 32 to 35 and pin 40).
7	Strip the cable insulation and connect the shielding to the shielding terminator. Use shielding terminals.


Incremental encoder
X1
X2
Signal A
Signal B
Signal N
24 V
M
L+
M


Power circuit
L1 L2 L3
K1
K2
K3
K4
M
pole–switching motor
X1
X2
Control circuit
NC contact from
E2
E1
K4
K3
K2
K1
K3
K4
K1
K2
M
K1 = In plus direction
K2 = In minus direction
K3 = Rapid speed
K4 = Creep speed
E1 = Hardware limit switch minus
E2 = Hardware limit switch plus

The pin-out below shows only the connections relevant for the respective positioning mode. The other connections are found in the Manual, Chapter “Wiring”.

CONNECTOR X2:

Pin	Name/Address	Function
1	1 L+	24 V supply voltage for the inputs
2	DI+0.0	Encoder signal A
3	DI+0.1	Encoder signal B
4	DI+0.2	Encoder signal N
5	DI+0.3	Length measurement
6	DI+0.4	Reference-point switch
20	1 M	Chassis ground
31	3 L+	24 V supply voltage for the outputs
32	DO+1.0	Digital output Q0
33	DO+1.1	Digital output Q1
34	DO+1.2	Digital output Q2
35	DO+1.3	Digital output Q3
40	3 M	Chassis ground

2nd step: Installing a sample project

You have two options of installing a sample project:

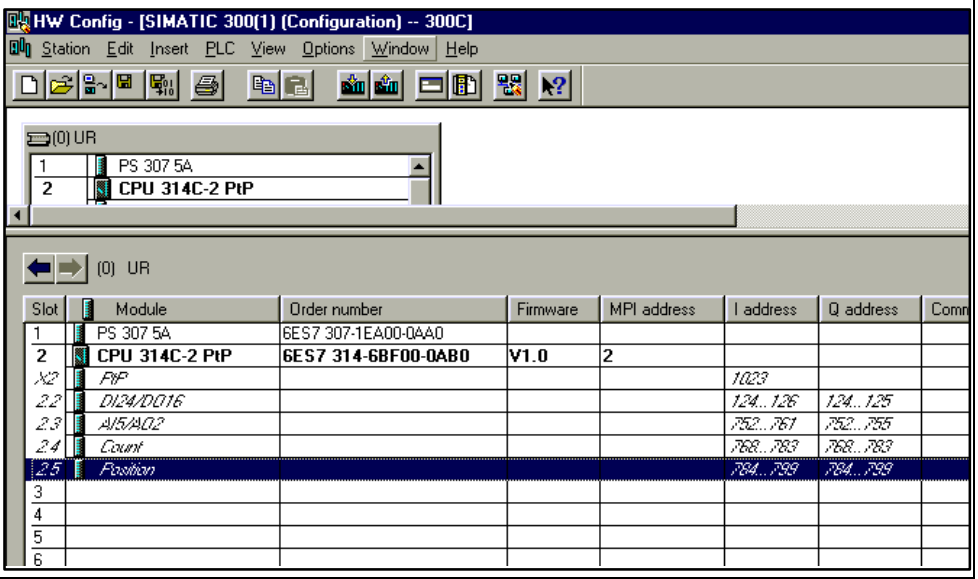
From CD:

Step	Action	Result
1	Double-click on SETUP.EXE in the SETUP folder of your CD.	The installation program starts.
2	Follow the on–screen instructions.	

Download from the Internet:

Step	Action	Result
1	Open the sample project directory. Double-click on SETUP.EXE.	The installation program starts.
2	Follow the on-screen instructions.	

3rd step: Assigning parameters

Step	Action	Result
1	Open your project in SIMATIC Manager.	A split window opens, showing in the header your project name.
2	In your project, call the configuration table HW Config. 	
3	Double-click on the “Positioning” submodule.	The “Positioning properties” dialog opens.
4	Select “Positioning with digital outputs”. In the drive, axis and encoder tabs, customize the components according to your system.	
5	Confirm your entries with OK.	The “Positioning properties” dialog closes.
6	Save your configuration to your project with **Station > Save and compile**.	Your changes are now stored in your project.
7	While the CPU is in STOP state, download this configuration via **PLC > Load to module....**	Data are downloaded from the PG to your CPU.
8	Close HW Config with **Station > Close**.	You are returned to SIMATIC Manager.

4th step: Implementation in the user program

Step	Action	Result
1	In SIMATIC Manager, open the project “ZEn26_03_TF_____31xC_Pos” in the catalog \Siemens\STEP7\Examples via **File > Open... > Sample projects** .	A split window opens, showing your project name in the header.
2	Double-click the S7 program “Digital 1 First steps”.	The right window shows the “Sources”, “Function blocks” and “Symbols” folders.
3	Double-click on the “Function blocks” container.	You are shown all function blocks of the S7 program.
4	Select all function blocks and copy them to your project directory **SIMATIC 300 Station > CPU3xx > S7 Program > Function blocks**. **Function block** / **Name (in the symbol bar)** / **Description** OB1: CYCLE_EXC: Cyclic program OB100: COMPLETE RESTART: Restart: Resetting the control signals FC 1: GETST_D: DIGITAL, First steps SFB46: DIGITAL: SFB POS DIGITAL DB6: DI_DIGITAL: Instance DB to SFB DIGITAL VAT_GETST_A: VAT_GETST_A: Variable table Note: In the COMPLETE RESTART (OB 100) function block, customize the values for the changeover/cut-off difference.	
5	In SIMATIC Manager, select **SIMATIC 300 Station > CPU3xx > S7 Program > Function blocks** .	You are shown all function blocks of the S7 program.
6	Download all S7 function blocks contained to your CPU with **PLC > Download to CPU** (CPU in STOP state).	The program and configuration are downloaded from the PG to the CPU.

5th step: Test run

Step	Action	Result
1	In your project directory “Function blocks”, double-click on the VAT “VAT_GETST_A”.	You are shown the table of variables for monitoring and controlling.
2	Go Online via **PLC > Connect to > Configured CPU**.	The “STOP” status of the CPU pops up at the lower right.
3	Switch to monitoring mode via **Variable > Monitoring**.	The “Status value” column displays the actual values of the operands.
	Caution In the next two steps of your test you are going to start up the drive. You can stop the drive again by: • Resetting the direction control value to 0 and enabling it • Resetting the drive enable value to 0 and enabling it • Switch the CPU to STOP	
4	Switch the CPU to RUN.	The “RUN” status of the CPU pops up at the lower right.

Step	Action	Result
5	Make the following tests. Validate the control values via **Variable > Enable control values**.	
	“Jogging” mode Customize as follows: MODE_IN = 1: Select “Jogging” mode DRV_EN = 1: Drive enable SPEED: Speed, 0 = Creep, 1 = Rapid Drive start: DIR_P = 1: Jogging into Plus direction DIR_M = 1: Jogging into Minus direction Note: Positioning mode is impossible if you enable the two variables DIR_P and DIR_M.	In the “Status value” column, you can monitor the following signal states: ST_ENBL = 1: Start enabled MOD_OUT = 1: Current operating mode: “Jogging” WORKING = 1: Running ACT_POS: Actual position value
	Operating mode “Relative incremental approach” Make these settings: MODE_IN = 4: Select “Relative incremental approach” DRV_EN = 1: Drive enable TARGET: Distance in pulses SPEED: Speed, 0 = Creep, 1 = Rapid Drive start: DIR_P = 1: Relative incremental approach into Plus direction DIR_M = 1: Relative incremental approach into Minus direction	In the “Status value” column, you can monitor the following signal states: ST_ENBL = 1: Start enabled MOD_OUT = 4: Current operating mode: “Relative incremental approach” WORKING = 1: Running ACT_POS: Actual position value POS_RCD = 1: In position

Diagnostics/Fault elimination

Errors can occur as a result of operator faults, incorrect wiring or configuration conflicts.
How to diagnose such errors and messages is described in the manual, Chapter “Error handling and interrupts”.

Sample :

The “ZEn26_03_TF_____31xC_Pos” project contains more samples you can use for orientation. You can customize all samples according to your personal applications.

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Automation System S7-300
CPU 31xC: Counting

Getting Started

Edition 10/2001
A5E00105536-01

Introduction

The sample in this manual takes you through five steps, showing you how to commission a fully functional counter application. You are going to get acquainted with the basic hardware and software functions and learn how to operate the counting function.
The references to the manual should give you a first overview of the information it contains. Additional notes relating to frequency measurement and pulse width modulation applications are found on the sample project CD.

It should take no more than one or two hours to work through this sample, depending on experience.

Prerequisites

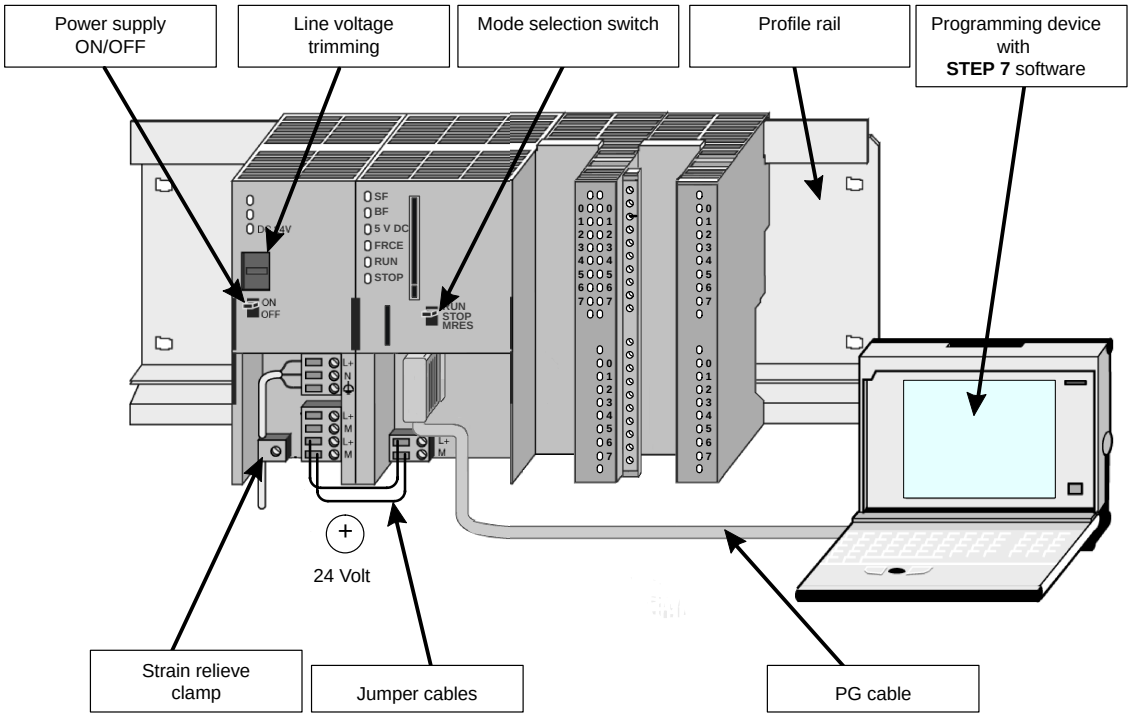
Conditions are that:

- You have installed an S7-300 station, consisting of a power supply module and a CPU 31xC.
- STEP 7 (>= V5.1 + Servicepack 2) is correctly installed on your PG.
- The sample projects is available, either on your CD or you have downloaded them from the Internet.
- You have created a project for the S7-300 station.
- The PG is connected to the CPU.
- You are set up with all accessories required, e.g. front plug and wiring material.
- The CPU is connected correctly to a power supply.

Warning

Depending on the field of application, your S7-300 as component in plants and systems requires special attention relating to specific rules and regulations.
Please pay attention to current regulations relating to safety and accident prevention, e.g. IEC 204 (EMERGENCY–OFF devices).
Serious injury as well as damage to machines and appliances is to be expected if you neglect these regulations.

Structure of the Sample



1st step: Wiring

Warning

You risk contacting live wires if the PS 307 power supply module is switched on or if the power line of the PS is connected to mains.
Wire the S7-300 only after you have switched off power!

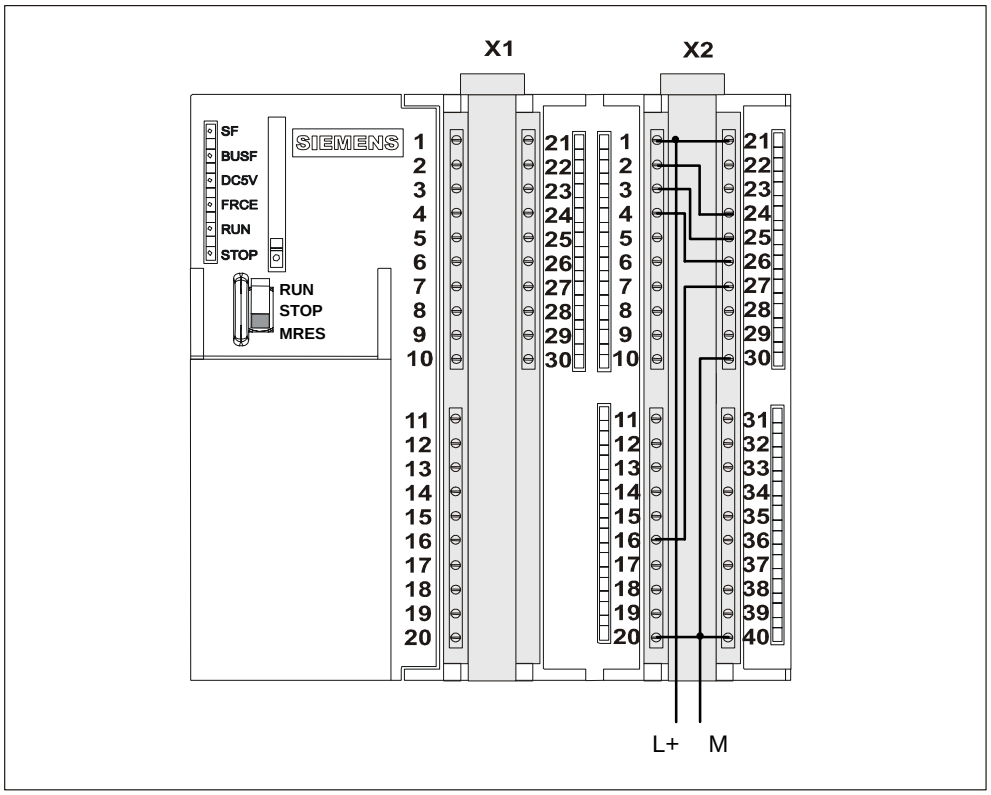
Step	Wire the power supply to the CPU
1	Connect the wired front plug to the CPU and screw fasten it.
2	Wire the connections for the “Count 1 First steps” as follows:

The pin–out below shows only the connections relevant for the respective positioning mode. The other connections are found in the Manual, Chapter “Wiring”.

CPU 312C connection: X1	**Name/Address**	**Sample function**
2	DI+0.0	Pulse input
3	DI+0.1	Direction bit
4	DI+0.2	Hardware gate
8	DI+0.6	Latch input
12	2 M	Reference potential of the supply voltage
13	1 L+	24 V DC supply voltage
16	DO+0.2	Simulation: Pulse input -> connect to DI+0.0
17	DO+0.3	Simulation: Direction bit -> connect to DI+0.1
18	DO+0.4	Simulation: Hardware gate -> connect to DI+0.2
19	DO+0.5	Simulation: Latch input -> connect to DI+0.6
20	1 M	Reference potential of the supply voltage

Pin CPU 313C-2 DP/PtP: X1 **CPU 313C, 314C-2 DP/PtP: X2**	**Name/Address**	**Function**
1	1 L+	24 V supply voltage for the inputs
2	DI+0.0	Pulse input
3	DI+0.1	Direction bit
4	DI+0.2	Hardware gate
16	DI+1.4	Latch input
20	1 M	Reference potential of the supply voltage
21	2 L+	24 V supply voltage for the outputs
24	DO+0.2	Simulation: Pulse input -> connect to DI+0.0
25	DO+0.3	Simulation: Direction bit -> connect to DI+0.1
26	DO+0.4	Simulation: Hardware gate -> connect to DI+0.2
27	DO+0.5	Simulation: Latch input -> connect to DI+1.4+1.4
30	2 M	Reference potential of the supply voltage

The figure shows, as an example, the CPU 314C with a standard plug arrangement for CPUs with two connectors (X1 and X2).



2nd step: Installing a sample project

You have two options of installing a sample project:

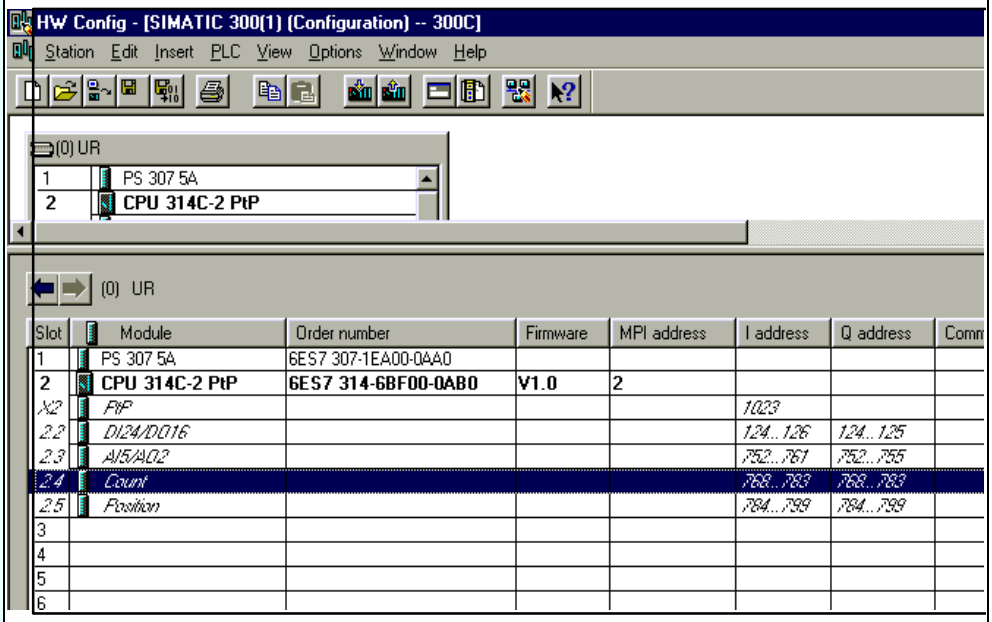
From CD:

Step	Action	Result
1	Double-click on SETUP.EXE in the SETUP folder of your CD.	The installation program starts.
2	Follow the on–screen instructions.	

Download from the Internet:

Step	Action	Result
1	Open the sample project directory and double-click on SETUP.EXE.	The installation program starts.
2	Follow the on-screen instructions.	

3rd step: Assigning parameters

Step	Action	Result
1	Open your project in SIMATIC Manager.	A split window opens, showing in the header your project name.
2	In your project, call the configuration table HW Config. 	
3	Double–click on the “Counting” submodule.	The “Counting properties” dialog opens.
4	Select channel 0 and “Infinite count” mode. Make the following settings in the parameter assignment screen forms (Since not required for commissioning, do not modify any other settings): • **Input**: Hardware gate • **Output reaction**: Counter value >= Comparison value	
5	Confirm your entries with OK.	The “Counting properties” dialog is closed.
6	Save your project configuration with **Station > Save and compile**.	Your changes are now stored in your project.
7	While the CPU is in STOP state, download this configuration via **PLC > Load to module....**	Data are downloaded from the PG to your CPU.
8	Close HW Config with **Station > Close**.	You are returned to SIMATIC Manager.

4th step: Implementation in the user program

Step	Action	Result
1	In SIMATIC Manager, open the project “ZEn26_02_TF_____31xC_Cnt” in the catalog \Siemens\STEP7\Examples via **File > Open... > Sample projects** .	A split window opens, showing your project name in the header.
2	Double-click the S7 program“ Count 1 First steps”.	The right window shows the “Source”, “Function blocks” and “Symbols” folders.

<table>
<tr><th>Step</th><th>Action</th><th>Result</th></tr>
<tr><td>3</td><td>Double-click on the “Function blocks” container.</td><td>You are shown all function blocks of the S7 program.</td></tr>
<tr><td>4</td><td colspan="2">Copy all function blocks to your project under
SIMATIC 300 Station > CPU3xx > S7 Program > Function blocks.

Function block | Name (in the symbol bar) | Description
OB1: | CYCLE_EXC | Cyclic program
FB11: | GETST_C | Sample 1: COUNT, First steps
DB11: | DI_GETST_C | Instance DB to GETST_C
SFB47: | COUNT | SFB COUNT
DB16: | DI_COUNT | Instance DB to SFB COUNT
VAT: | VAT_GETST_C | Variable table</td></tr>
<tr><td>5</td><td>Copy the symbol table to your project under SIMATIC 300 Station > CPU3xx > S7 Program.</td><td>The symbol table is stored in your project.</td></tr>
<tr><td>6</td><td>In SIMATIC Manager, select SIMATIC 300 Station > CPU3xx > S7 Program > Function blocks .</td><td>You are shown all function blocks of the S7 program.</td></tr>
<tr><td>7</td><td>Download all S7 function blocks contained to your CPU with PLC > Download to CPU (CPU in STOP state).</td><td>The program and configuration are downloaded from the PG to the CPU.</td></tr>
</table>

5th step: Test run

Step	Action	Result
1	In your project directory “Function blocks”, double–click on the VAT “VAT_GETST_C”.	You are shown the table of variables for monitoring and controlling.
2	Go Online via **PLC > Connect to > Configured CPU**.	The “STOP” status of the CPU pops up at the lower right.
3	Switch to monitoring mode via **Variable > Monitoring**.	The “Status value” column displays the actual values of the operands.
4	Switch the CPU to RUN.	The “RUN” status of the CPU pops up at the lower right.
5	In the variable S_IMP_H of the VAT, select the count pulse source: • S_IMP_H = 0: The pulse source is a programmable SW clock generator. Its frequency is adjustable via T_PULSE variable. The clock is connected to the pulse input via a digital output (see 1st step: Wiring) • S_IMP_H = 1: Specify the count pulses by manually setting and resetting the S_IMP_T variable in the VAT.	

Step	Action	Result
6	You can make the following tests. • Starting/Stopping the counter: – Start the counter by setting the variables SW_GATE (SFB parameter SW gate) and S_HWT (Simulation HW gate) in the VAT to 1 (logical AND). – Stop the counter by resetting S_HWT or SW_GATE to zero.	• You can monitor the actual counter value at the SFB output parameter COUNTVAL. You can view the status of the SW or HW gate in the variables STS_GATE or STS_STRT.
	• Loading a count value to the counter: – JOB_ID = 01 hex (“Write counter directly”) – JOB_VAL = Count value (-2^{31} to $+2^{31}-1$) – JOB_REQ = 1, job initiates at the positive edge	• You can view the count value loaded at the SFB output parameter COUNTVAL. If no load error has occurred, the status at the output parameters JOB_DONE = 1 and JOB_ERROR = 0.

Diagnostics/Fault elimination

Errors can occur as a result of operator faults, incorrect wiring or configuration conflicts.
How to diagnose such errors and messages is described in the manual, Chapter “Error handling and interrupts”.

Samples

The “ZEn26_02_TF_____31xC_Cnt” project contains more samples you can use for orientation. You can customize all samples according to your personal applications.

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SIMATIC

Automation System S7-300
CPU 31xC: PtP Connection

Getting Started

Edition 10/2001
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Introduction

The sample in this manual takes you through four steps, showing you how to commission a fully functional application. You are going to get acquainted with the basic hardware and software functions and learn how to transfer data via serial interface. The references to the manual should give you a first overview of the information it contains.

It should take no more than one or two hours to work through this sample, depending on experience.

Prerequisites

Condition are that:

- You have an S7-300 station, consisting of a power supply module and a CPU 31C-2 PtP. The serial connection is established via the 15-pole sub-D socket at the right side.
- STEP 7 (>= V5.1 + Servicepack 2) is correctly installed on your PG.
- The sample projects are available, either on your CD or you have downloaded them from the Internet.
- You have created a project for the S7-300 station.
- The PG is connected to the CPU.
- You have prepared your connection partner for data transfer and connected the required patch cord.
- The CPU is correctly connected to a power supply.

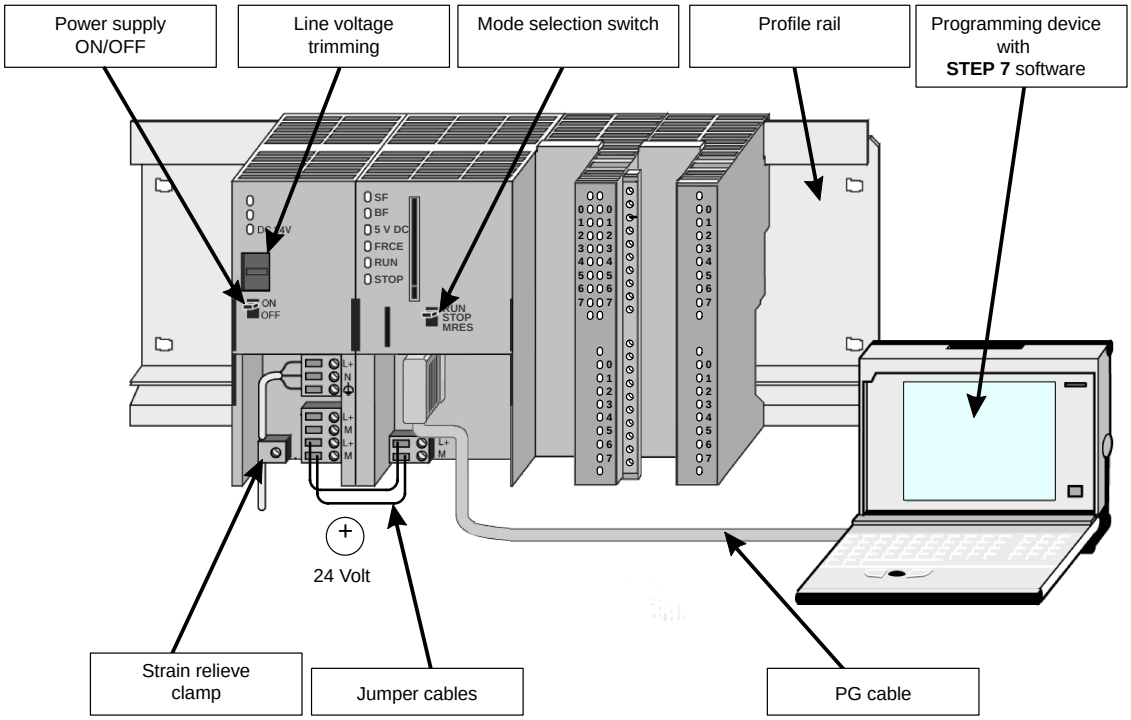
Warning

Depending on the field of application, your S7-300 as component in plants and systems requires special attention relating to specific rules and regulations.
Please pay attention to current regulations on safety and for the prevention of accidents, e.g. IEC 204 (EMERGENCY–OFF devices).
Serious injury as well as damage to machines and appliances is to be expected if you neglect these regulations.

Warning

You risk contacting live wires if the PS 307 power supply module is switched on or if the power line of the PS is connected to mains.
Wire the S7-300 only after you have switched off power!

Structure of the Sample



1st step: Installing a sample project

You have two options of installing a sample project:

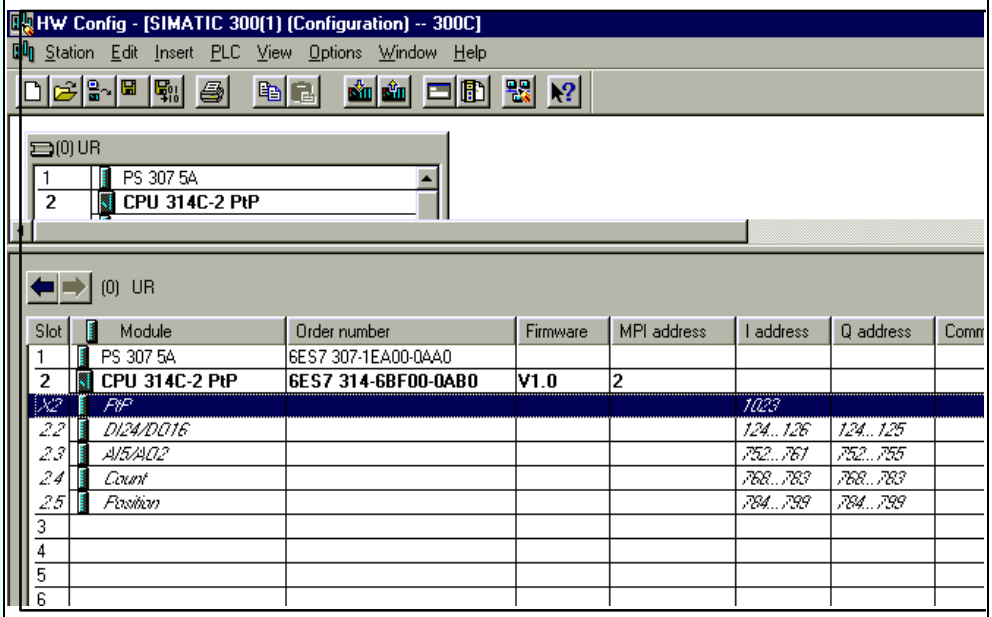
From CD:

Step	Action	Result
1	Double–click on SETUP.EXE in the SETUP folder of your CD.	The installation program starts.
2	Follow the on–screen instructions.	

Download from the Internet:

Step	Action	Result
1	Open the sample project directory and double-click on SETUP.EXE.	The installation program starts.
2	Follow the on–screen instructions.	

2nd step: Assigning parameters

Step	Action	Result
1	Open your project in SIMATIC Manager.	A split window opens, showing your project name in the header.
2	In your project, call the configuration table HW Config. 	
3	Double–click on the “PtP” submodule.	The “PtP properties” dialog opens.
4	Select the “ASCII” protocol and enter the default settings in the parameter masks with a click on OK: • 9600 bits/s, 8 data bits, 1 stop bit, even parity.	
5	Confirm your entries with OK.	The “PtP properties” dialog is closed.
6	Save your project configuration with **Station > Save and compile**.	Your changes are now stored in your project.
7	While the CPU is in STOP state, download this configuration via **PLC > Load to module....**	Data are downloaded from the PG to your CPU.
8	Close HW Config with **Station > Close**.	You are returned to SIMATIC Manager.

3rd step: Implementation in the user program

Step	Action	Result
1	In SIMATIC Manager, open the project “ZEn26_01_TF_____31xC_PtP” in the catalog \Siemens\STEP7\Examples via **File > Open... > Sample projects** .	A split window opens, showing your project name in the header.
2	Double–click on the station “CPU 31xC ASCII”.	Your station is opened.
3	Open the S7 program for the station CPU and double–click on the “Function blocks” container.	You are shown all function blocks of the S7 program.
4	With the exception of system data, select all function blocks and copy them to your project under **SIMATIC 300 Station > CPU3xx > S7 Program > Function blocks**. **Function block** / **Name (in the symbol bar)** / **Description** OB1: CYCLE: Cyclic program processing OB100: RESTART: Startup processing Restart DB21: SEND IDB: Instance DB to SFB SEND_PTP DB22: RCV IDB: Instance DB to SFB RCV_PTP DB40: SEND WORK DB: Work DB for SFB SEND_PTP DB41: RCV WORK DB: Work DB for SFB RCV_PTP DB42: SEND SRC DB: Send DB DB43: RCV DST DB: Receive DB SFB60: SEND_PTP: Send SFB for data SFB61: RCV_PTP: Receive SFB for data FB21: SEND: Send data FB22: RECEIVE: Receive data VAT1: -: VAT1	
5	In SIMATIC Manager, select **SIMATIC 300 Station > CPU3xx > S7 Program > Function blocks** .	You are shown all function blocks of the S7 program.
6	Download all S7 function blocks contained to your CPU with **PLC > Download to CPU** (CPU in STOP state).	The program and configuration are downloaded from the PG to the CPU.

4th step: Test run

Step	Action	Result
1	In your project directory “Function blocks”, double–click on the table of variables “VAT1”.	You are shown the table of variables for monitoring and controlling.
2	Go Online via **PLC > Connect to > Configured CPU**.	The “STOP” status of the CPU pops up at the lower right.

Step	Action	Result
3	Switch to monitoring mode via **Variable > Monitoring**.	The “Status value” column displays the actual values of the operands.
4	Switch the CPU to RUN.	The “RUN” status of the CPU pops up at the lower right. Data transfer is started. You can view the number of transmissions at the operand “DB42.DBW0” (Send counter). “DB41.DBW18” (Receive counter) indicates receiving of data.

Diagnostics/Fault elimination

Errors can occur as a result of operator fault, incorrect wiring of the serial interface or configuration conflicts.
How to diagnose such errors and messages is described in the manual, Chapter “Error handling and interrupts”.

Sample :

The “ZEn26_01_TF_____31xC_PtP” project contains more samples you can use for orientation. You can customize all samples according to your personal applications.

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SIMATIC

Automation System S7-300
CPU 31xC: Controlling

Getting Started

Edition 10/2001
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Introduction

The practical sample in this manual takes you through four steps, showing you how to commission a fully functional application. You are going learn how determine and configure application dependent data and how to operate a control circuit. The references to the manual should give you a first overview of the information it contains.

Usually it should take no more one or two hours to work through this sample, depending on experience.

Prerequisites

Conditions ar that:

- You have installed an S7-300 station, consisting of a power supply module and a CPU 313C or 314C.
- STEP 7 (>= V5.1 + Servicepack 2) is correctly installed on your PG.
- The sample projects are available, either on your CD or you have downloaded them from the Internet.
- You have created a project for the S7-300 station.
- The PG is connected to the CPU.
- The CPU is correctly connected to a power supply.
- I/O wiring is not required for this sample.

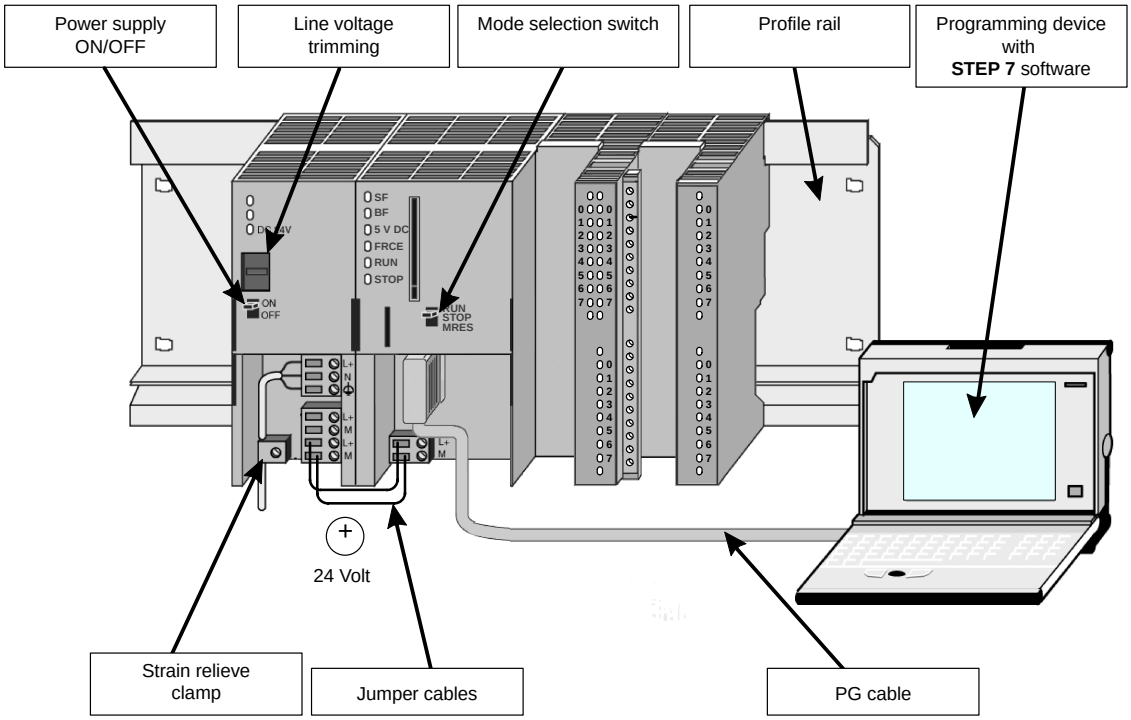
Warning

Depending on the field of application, your S7-300 as component in plants and systems requires special attention relating to specific rules and regulations.
Please pay attention to current regulations on safety and the prevention of accidents,
e.g. IEC 204 (EMERGENCY–OFF devices).
Serious injury as well as damage to machines and appliances is to be expected if you neglect these regulations.

Warning

You risk contacting live wires if the PS 307 power supply module is switched on or if the power line of the PS is connected to mains.
Wire the S7-300 only after you have switched off power!

Structure of the Sample



1. step: Installing a sample project

You have two options of installing a sample project:

From CD:

Step	Action	Result
1	Double-click on SETUP.EXE in the SETUP folder of your CD.	The installation program starts.
2	Follow the on-screen instructions.	

Download from the Internet:

Step	Action	Result
1	Open the sample project directory and double–click on SETUP.EXE.	The installation program starts.
2	Follow the on–screen instructions.	

2nd step: Implementation in the user program

Step	Action	Result
1	In SIMATIC Manager, open the project “ZEn26_04_TF_____31xC_PID” in the catalog \Siemens\STEP7\Examples via **File > Open... > Sample projects** .	A split window opens, showing your project name in the header.
2	Double-click the S7 program “Controlling 2 CONT_C”.	The right window shows the “Source”, “Function blocks” and “Symbols” folders.
3	Double–click on the “Function blocks” container.	You are shown all function blocks of the S7 program.
4	With the exception of system data, select all function blocks and copy them to your project directory **SIMATIC 300 Station > CPU3xx > S7 Program > Function blocks**.	

Function block	Name (in the symbol bar)	Description
OB100:	RESTART	Restart OB
OB35:	CYC_INT5	Time controlled OB: 100 ms
SFB41:	CONT_C	Continuous PID controller
FB100:	PROC_C	Control circuit for the continuous controller
DB100:	DI_PROC_C	Instance DB to PROC_C
DB101	DI_CONT_C	Instance DB to CONT_C
VAT1:	VAT 1	Variable table

3rd step: Assigning parameters

Step	Action	Result
1	Start the parameter assignment screen form via SIMATIC / STEP7 / Configure PID Control.	The input dialog “PID Control” is displayed.
2	In PID control, open your project with **File > Open**. Select instance DB101 for SFB 41 and confirm the dialog with OK.	You are returned to the parameter assignment screen form. The configured parameters are displayed. Changes to this sample program are not required.
3	Close the parameter assignment screen form with **File > Close**.	The parameter assignment screen form is closed.
4	In SIMATIC Manager, select **SIMATIC 300 Station > CPU3xx > S7 Program > Function blocks** .	You are shown all function blocks of the S7 program.
5	Download all S7 function blocks contained to your CPU with **PLC > Download to CPU** (CPU in STOP state).	The program and configuration are downloaded from the PG to the CPU.

4th step: Test run

Step	Action	Result
1	In your project directory “Function blocks”, double–click on the table of variables “VAT1”.	You are shown the table of variables for monitoring and controlling.
2	Go Online via **PLC > Connect to > Configured CPU**.	The “STOP” status of the CPU pops up at the lower right.
3	Switch to monitoring mode via **Variable > Monitoring**.	The “Status value” column displays the actual values of the operands.
4	Switch the CPU to RUN.	The “RUN” status of the CPU pops up at the lower right. The controller is started.
5	Modify the setpoint “SP_INT”	You can monitor the output value “OUTV” that is proportional to the setpoint “SP_INT”.
6	Call the STEP 7 tool PID Control (see step 3). Select IDB101 and click on “Online” mode. In the “Test” menu, select and start the curve plotter function.	You can view the graphic profile of some of the control variables (actual value, setpoint, control offset etc.).

Diagnostics/Fault elimination

Errors can occur as a result of operator faults or configuration conflicts. How to diagnose such errors and messages is described in the manual, Chapter “Error handling and interrupts”.

Sample :

The “ZEn26_04_TF_____31xC_PID” project contains further samples you can use for orientation. You can customize all samples according to your personal applications.

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Automation System S7-300
CPU 317-2 PN/DP:
Configuring the PROFInet Interface X2PN/DP

Getting Started

A5E00268410-01

Edition 12/2003

Introduction

In this sample project, you will configure the CPU 317-2 PN/DP PROFInet interface X2. You should expect to spend between one and two hours on this example, depending on your level of experience.

Area of Validity

CPU	Order no.	Is MMC required for operation?	As of version	
			Firmware	Hardware
317-2 PN/DP	6ES7317-2EJ10-0AB0	Yes	V2.2.0	01

Requirements

- You are familiar with the basics of electronics/electrical engineering,
- Idealy, you already have some knowledge in the network technolgy field.
- You have already worked with the STEP7 programming software.
- We expect that you have experience working with Microsoft® Windows™.

Warning

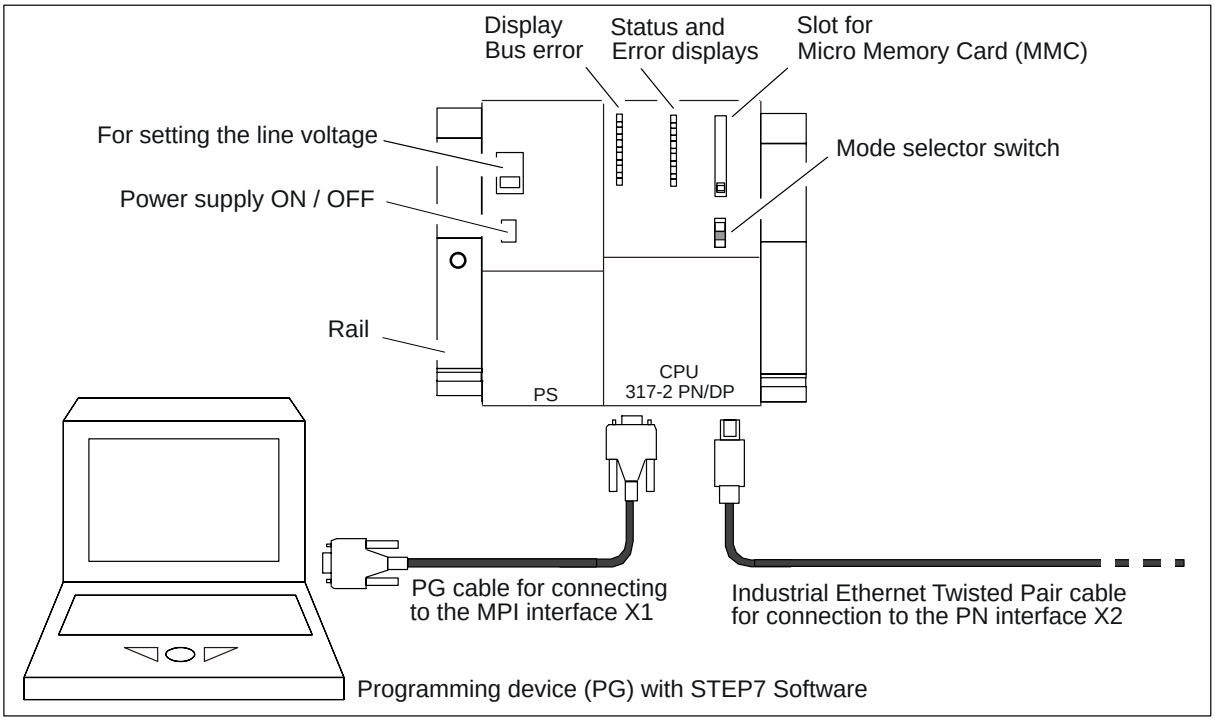
When using the S7-300 as a component of plants and systems, you may be required to follow certain rules and regulations according to the specific application. Please note the applicable safety and accident prevention regulations, such as IEC 204 (emergency stop systems).

Non-compliance with these regulations can result in serious injury and damage to both machinery and equipment.

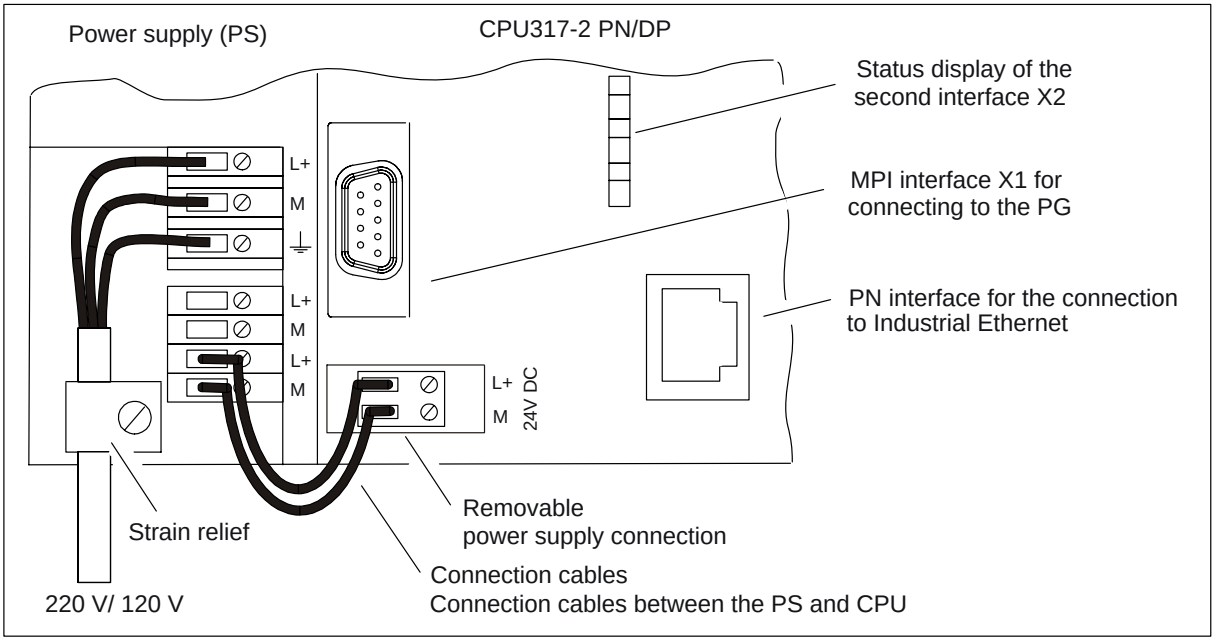
Materials and Tools Required

Quantity	Item	Order number (Siemens)
1	Rail	e.g. 6ES7 390-1AE80-0AA0
1	Power supply (PS)	e.g. 6ES7 307-1EA00-0AA0
1	CPU317-2 PN/DP	6ES7317-2EJ10-0AB0
1	Micro Memory Card (MMC) **Note:** The MMC mandatory for the operation of the CPU .	e.g. 6ES7 953-8LL00-0AA0
1	• Programming device (PG) or PC with a corresponding MPI slot card • PG cable • installed Software **STEP 7,** Firmware version 5.3.	Depends on configuration
1	Industrial Ethernet Twisted Pair cable (Cat5) with RJ45 connectors (Patch cable TP Cord RJ45/RJ45, length 6 m)	For example, 6XV1 850-2GH60
Various	M6 screws and nuts (length depends on installation location) with suitable screwdriver / wrench	Standard
1	Screwdriver with 3.5 mm blade	Standard
1	Screwdriver with 4.5 mm blade	Standard
1	Side cutter and cable stripper	Standard
1	Crimp tool	Standard
X m	Cable with 10 mm^2 cross-section for grounding the rail and suitable cable lug for M6 screw. Length of cable depends on local requirements.	Standard
X m	3-core flexible power cable (AC 230/120 V) with shock-proof plug; length dependant on local requirements, with suitable ferrules and insulating collar.	Standard

Configuration



Configuration with CPU 317-2 PN/DP



Wiring the power supply and CPU (front cover open).

1. Installation

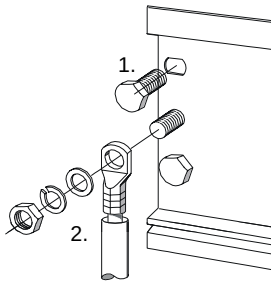
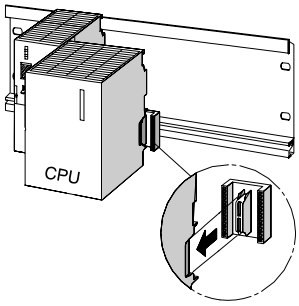
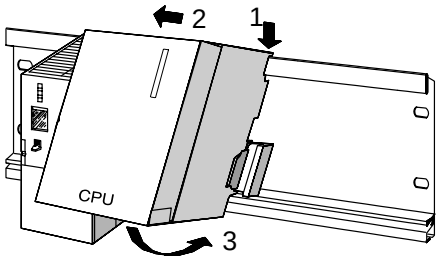
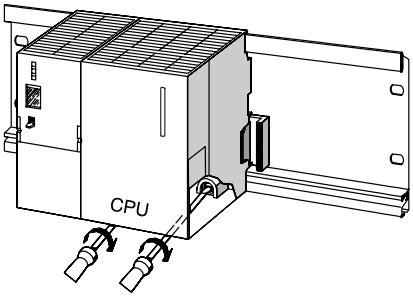
Figure	Installing and Grounding the Rail
	1. Screw the rail in position (screw size: M6). Make sure that there is a clearance of at least 40 mm above and below the rail. If you fasten the rail to a grounded metal plate or device support, make sure there is a low-resistance connection between the rail and the base. 2. Connect the rail to the protective conductor. There is an M6 protective conductor screw on the rail for this purpose. Minimum cross-section of the cable to the protective conductor: 10 mm^2.

Figure	Attaching the Modules on the Rail
	1. Attach the power supply. Push it to the left until it reaches the rail's grounding screw, and then screw in place. 2. Connect to the other modules by plugging a bus connector into the CPU (see detail).
	3. Attach the CPU (1). 4. Push it up against the module on the left (2) 5. and tip it downward (3).
	6. Screw the modules hand-tight onto the rail. 7. Insert the MMC into the module slot of the CPU: The MMC mandatory for the operation! **Note:** **If you want to use an MMC with unknown contents, you should delete the contents on the PG first.**

2. Wiring

Warning

You may come into contact with live wires that are connected to the power supply. Make sure that the S7-300 is completely disconnected before you start wiring.

Wiring the Power Supply and the CPU

Step	Wiring the power supply and CPU
1	Open the front panels of the power supply and the CPU.
2	Detach the strain relief clip from the power supply.
3	Strip the flexible power cable, crimp on the ferrules and connect them to the power supply. (Blue to terminal M, black to terminal L1, protective conductor to terminal PE)
4	Screw the strain relief clamp in place.
5	Now wire the power supply to the CPU using the 1 mm^2 cross-section flexible cable. Strip the ends to approx. 6 mm and crimp on the ferrules. Connect terminals L+ and M on the power supply to those on the CPU.
6	Check that the line voltage selector switch is set to the correct line voltage. The power supply is set at the factory to a line voltage of AC 230 V. To change the voltage, remove the protective cap with a screwdriver, set the switch to the required line voltage and replace the protective cap.

3. Commissioning the Hardware

Step	Tasks	Result:
1	Interconnect the PG/PC and the CPU via the PG cable. If you use a cable with PROFIBUS connectors, you will have to switch on the terminating resistors in the connectors.	PG/PC is connected to the CPU.
2	Connect PROFInet interface X2 of your CPU to Industrial Ethernet. Use the Twisted Pair cable with the RJ45 connectors to do this.	CPU is connected to the Industrial Ethernet.
3	Close the front flap on the CPU and set the mode selector switch to *STOP.*	
4	Connect the power cable to the power supply and switch on the power supply module.	The *DC24V*-LED lights up on the power supply module. All LEDs on the CPU flash briefly; *SF* LED and the *DC5V*-LED remain lighted. The*STOP* LED then flashes quickly, whereby the CPU automatically performs a memory reset. The STOP LED then goes on.
5	Start up the PG/PC and start SIMATIC Manager from the Windows desktop.	A SIMATIC Manager window opens.

4. Configuring the Hardware in the STEP 7 Hardware Configuration Editor

Create a new project in STEP 7:

Step	Tasks	Result:
1	Select the **File > New...** menu command. Enter a name for your project and click on OK to confirm.	A new project is created

Add a new S7-300 station

Step	Tasks	Result:
1	Select the **Insert > Station > SIMATIC 300 Station** menu command.	The SIMATIC 300(1) icon in the right-hand part of the window is highligh-ted.

Add a rail

Step	Tasks	Result:
1	In the right-hand part of the window, double-click first on the SIMATIC 300(1) icon and then on the Hardware icon.	The hardware configuration editor (HW Config) opens.
2	You can insert your hardware components from the hardware catalog in the left pane of the window. If no catalog is displayed, activate the catalog using the **View > Catalog** menu command. Navigate to the hardware catalog first via SIMATIC 300 to Rack 300. Using Drag&Drop, drag the profile rail to the upper part of the HW config window	The profile rails are inserted in the upper part of the HW config window.

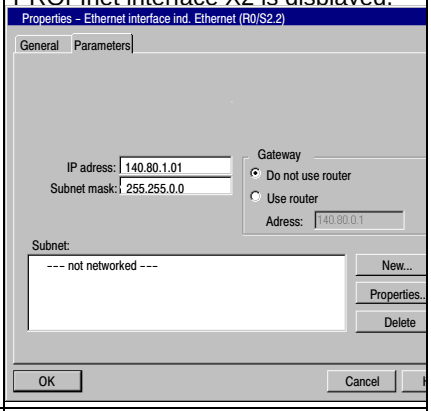
Add the power supply:

Step	Tasks	Result:
1	Navigate to PS-300 in the hardware catalog. Drag the your power supply to the rail and drop it into slot 1. **Note:** You can click on the power supply to display its order number. The order number then appears in the box beneath the catalog.	The power supply module is inserted into slot 1.

Insert CPU 317-2 PN/DP and assign an IP address:

Each node in an Ethernet network is identifiable via a unique address.
The manufacturer assigns the so-called MAC address by default and you cannot change it.

In the following steps, you will assign an IP address to this physical address in the Ethernet.

Step	Tasks	Result:
1	Navigate to PS-300 in the CPU-300 hardware catalog. Insert CPU 317-2 PN/DP into slot 2 of the profile rail using Drag&Drop.	The CPU 317-2 PN/DP is inserted in slo and the Propert window of PROFInet interface X2 is displayed. 
2	Specify the IP address and the subnet mask. Your network administrator will provide you with this information.	
3	If you want to establish connection via a router, you will have to specify the address of the router in addition. Your network administrator will provide you with this information.	
4	Click on the “New...” button and specify a name for a new Industrial Ethernet subnet. Then click on the “Ok” button.	You have created a new Industrial Ethernet subnet.

Step	Tasks	Result:
5	Click on the “Ok” button.	The PROFInet interface X2 Property window of CPU 317-2 PN/DP is closed.
6	You can now set the options for the PROFInet interface in the In HW config: In the CPU 317-2 PN/DP HW config, double-click PROFInet interface X2. If applicable, navigate to the Options tab, you can make certain individual network settings here according to your requirements. By default, “Automatic Settings” is selected and this guarantees a problem-free communication under normal circumstances. If problems occur during communication (for example, if connections are not established or if network failures occur frequently), this may be because the selected or automatic network setting is unsuitable. Select one of the network settings adjusted to your network configuration.	You can perform individual network settings in the HW config.

Save and compile your configuration:

Step	Tasks	Result:
1	Select the menu command **Station > Save and Compile**	The hardware configuration is compiled and saved.
2	Close the editor.	The editor is closed. The CPU now appears in the station in SIMATIC Manager.
3	Use the **File > Close** menu command to close the editor, and click *Yes* when you are prompted to save.	The editor is closed.

6. Commissioning

Step	Tasks	Result:
1	In Simatic Manager navigate to CPU 317-2 PN/DP and then to the S7 program via 300 station. In the right window pane, click on blocks.	*Blocks* is highlighted.
2	If your PG is connected to the CPU online via the PG/DP cable, download the hardware configuration directly to the CPU. • In STEP 7, in the **"Options" menu> Set PG/PC interface,** set the interface of your PG/PC to MPI if necessary. • Select the menu command **PLC > Download**. Click on *Yes* in every dialog box that appears. You cannot write the hardware configuration on the PG to the MMC until you go offline. Then insert the MMC into the CPU.	The programming device downloads the configuration to the CPU.
3	Switch the CPU mode selector to *RUN.*	The *STOP* LED goes out. The *RUN* LED starts flashing and then stays on. During a physical connection to the Ethernet the LINK-LED flashes. If data is sent of recieved via Ethernet, the RX/TX-LED goes on or flashes.

Result:

You have configured the PROFInet interface X2 of your CPU 317-2 PN/DP in STEP 7.

- The CPU is now available to other nodes on your Ethernet subnet.
- Configuration/reconfiguration is now also possible via the integrated PROFInet interface of the CPU.

Reference

Your will find detailed information on assigning addresses in PROFInet Interface in the STEP 7 Online Help.

Diagnostics / Troubleshooting

Incorrect operation, wiring or hardware configuration can result in faults. The CPU indicates these faults after a memory reset with the group error LED *SF*.

Refer to the CPU 31xC und CPU 31x Operating Instructions for how to diagnose such errors and messages.

Manuals for further details

- Getting Started*: Working with* ***STEP 7*** *V5.2*.
- Manual: *SIMATIC NET: Twisted-Pair and Fiber-Optic Networks*
- Manual: *Communication with SIMATIC*

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To supplement our documentation, you can access our complete knowledge base online on the Internet at:

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