

SIEMENS

SIMATIC

S7-300

S7-300 Automation System:

Getting Started CPU 31x: Commissioning

Getting Started

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Legal information

Warning notice system

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

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


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

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

 WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

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Disclaimer of Liability

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

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Introduction

Contents of this Getting Started Manual

Using a specific example, this "Getting started" manual guides you through six commissioning steps to implement a functional application. While working through the example, you will learn the basic hardware and software functions of your CPU 31x.

This process will take one to two hours, depending on your experience.

Preparation

Scope


These instructions apply to the following CPUs:

CPU	SIMATIC Micro Memory Card required for operation?	As of firmware version
312	yes	V3.3
314	yes	V3.3
315-2 DP	yes	V3.3
317-2 DP	yes	V3.3
315-2 PN/DP	yes	V3.2
317-2 PN/DP	yes	V3.2
319-3 PN/DP	yes	V3.2

The order number can be found in the manuals, e.g. the operating instructions CPU 31xC and CPU 31x: Installation (<http://support.automation.siemens.com/WW/view/en/13008499>).

Requirements

You need to have a basic understanding of electronics/electrical engineering. You must also be familiar with the Microsoft® Windows™ operating system.

 WARNING
<p>Operation of an S7-300 as part of plants or systems is subject to special rules and regulations, which depend on its field of application. Please make sure that you adhere to the applicable safety and accident prevention regulations, for example IEC 204 (emergency stop systems).</p> <p>You risk severe injury, or damage to machines and equipment if you ignore these regulations.</p>

Material and tools required

Quantity	Item	Order number (Siemens)
1	Mounting rail	e.g. 6ES7390-1AE80-0AA0
1	Power supply (PS) module	e.g. 6ES7307-1EA01-0AA0
1	CPU 31x, e.g. CPU 317-2 PN/DP	e.g. 6ES7317-2EK14-0AB0
1	SIMATIC Micro Memory Card Note: The SIMATIC Micro Memory Card is required for operation of certain CPUs (see Scope).	e.g. 6ES7953-8LL20-0AA0
1	Digital input module (DI) with bus connector	e.g. 6ES7321-1BH02-0AA0
1	Digital output module (DO) with bus connector	e.g. 6ES7322-1BH01-0AA0
2	Multipin front connector with screw-type contacts	e.g. 6ES7392-1AM00-0AA0
1	<ul style="list-style-type: none"> Programming device (PG) with MPI interface and STEP 7 software as of V5.5 + SP 1 or V5.5 with HSP 199 installed and PG cable or PC with suitable interface card 	depending on the configuration
Various	M6 screws and nuts (lengths depend on place of installation) and matching wrench / screwdriver	commonly available
1	Screwdriver with 3.5 mm blade	commonly available
1	Screwdriver with 4.5 mm blade	commonly available
1	Side cutter and cable stripper	commonly available
1	Crimp tool for wire ferrules	commonly available
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.	commonly available
Approx. 2 m	Flexible cable with 1 mm ² cross-section and suitable ferrules with insulated collar, length 6 mm	commonly available
X m	3-wire flexible power cable (230/120 V AC) with "Schuko" plug; length to suit local requirements with suitable wire-end ferrules with shrouded contacts.	commonly available
2	Single-pole ON button (24 V)	commonly available

Layout of the example

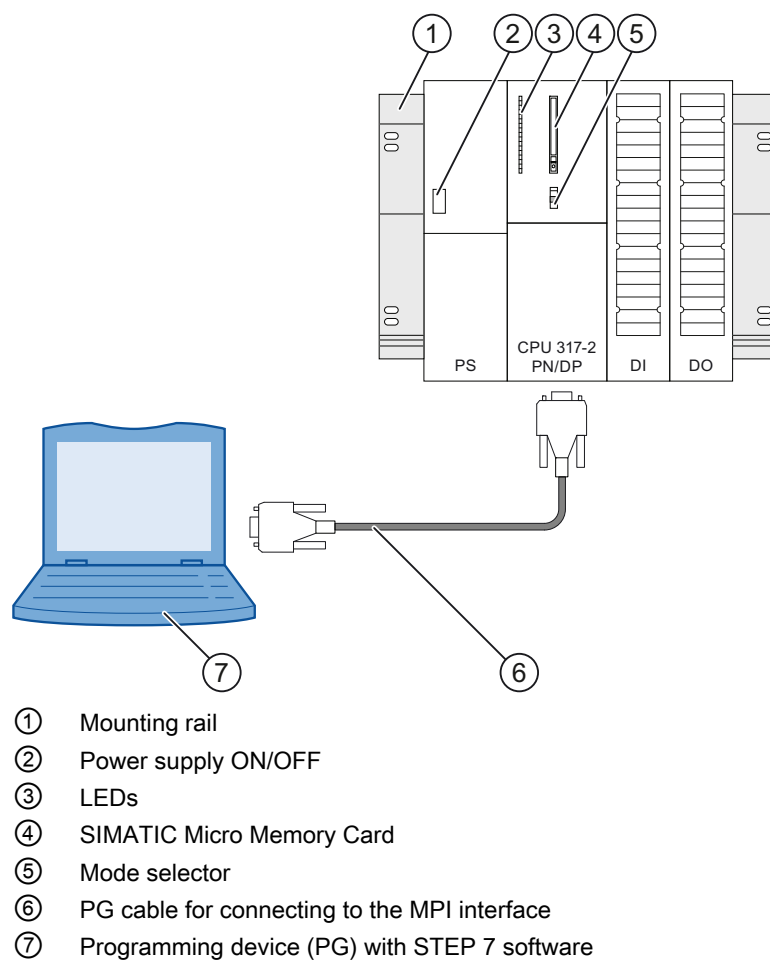
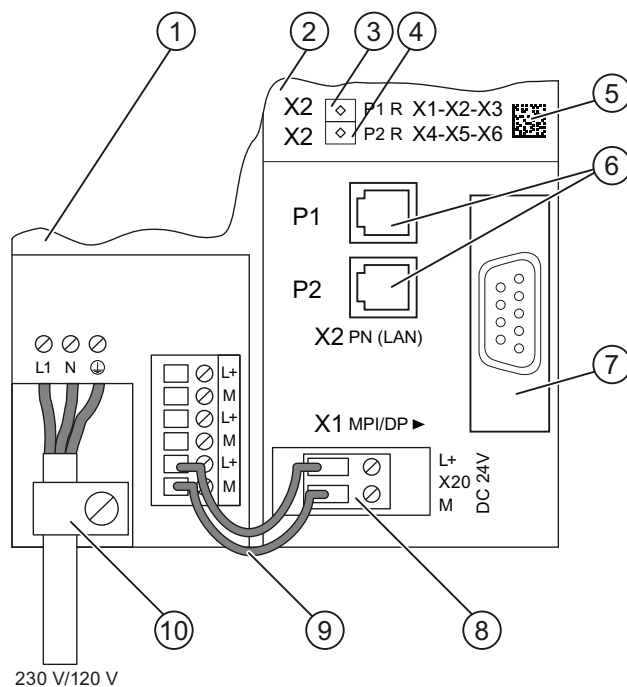


Figure 2-1 Sample layout (certain details of the CPUs may differ from the above illustration)



- ① Power supply (PS) module
- ② CPU 317-2 PN/DP
- ③ PROFINET port 1
Port 1 status is signaled by a two-colored LED (green/yellow):
 - LED lights up green: LINK to a partner is active
 - LED changes to yellow: Active data traffic (RX/TX)
 R: Ring port for setting up a ring topology with media redundancy
- ④ PROFINET port 2
Port 2 status is signaled by a two-colored LED (green/yellow):
 - LED lights up green: LINK to a partner is active
 - LED changes to yellow: Active data traffic (RX/TX)
 R: Ring port for setting up a ring topology with media redundancy
- ⑤ MAC address and 2D bar code
- ⑥ 2. Interface X2 (PN), with dual-port switch
- ⑦ 1. Interface X1 (MPI/DP)
- ⑧ Power supply connection
- ⑨ Connecting cables between PS and CPU
- ⑩ Strain relief

Figure 2-2 Wiring the power supply and CPU (front cover open)

Functionality of the example

The output can be switched by pressing the buttons when the diode on the output module is lit.

Units

3.1 1. Step: Installing and Grounding the Rail

Installation sequence

From left to right: Power supply PS 307 - CPU 317-2 PN/DP.

The configuration diagram gives you an overview of the overall configuration.

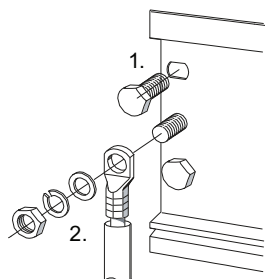
Install and ground the mounting rail

1. Screw on the mounting rail (screw size: M6). Make sure to maintain a minimum clearance of 40 mm above and below the mounting rail.

When mounting it on a grounded metal panel or on a grounded equipment mounting panel, make sure you have a low-impedance connection between the mounting rail and the mounting surface.

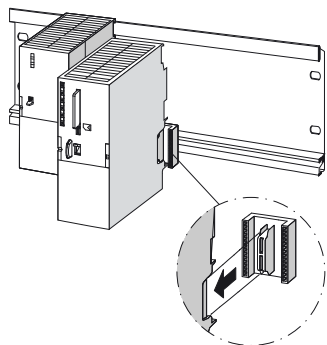
2. Connect the rail to the protective conductor. An M6 protective conductor screw is provided on the mounting rail for this purpose.

Stipulated cross-section of the cable connection to the protective conductor: at least 10 mm².

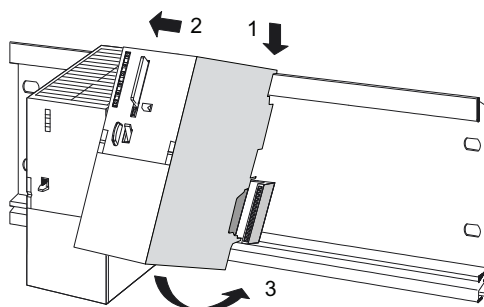


Installing modules on the mounting rail

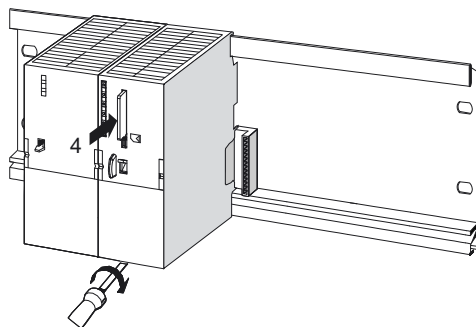
1. First of all, insert the power supply module. Slide it to the left as far as the grounding screw of the mounting rail. Fasten the power supply module.
2. To connect further modules, insert a bus connector into the CPU.



3. Hang in the CPU (1).
4. Slide it up to the left-hand module (2).
5. Now you can swivel the CPU down (3).



6. Tighten the modules with a torque of 0.8 to 1.1 Nm.



7. Insert a SIMATIC Micro Memory Card into the CPU (4).
Delete the content of a SIMATIC Micro Memory Card with unknown content before you use it in the programming device.
8. You also need to install digital input and output modules to the right of the CPU. To do this, repeat steps 2 to 6 as applicable.

3.2 2. Step: Wiring modules

WARNING

Ensure the S7-300 is completely disconnected before wiring!

You may come into contact with live wires if the S7-300 is connected to the power supply.

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.
4. Correctly crimp on wire-end ferrules.
5. Connect the ferrules to the power supply (blue to terminal M, black to terminal L1, protective conductor to terminal PE).
6. Screw the strain relief clamp in place.
7. Next, wire the power supply to the CPU. Use flexible cable with a conductor cross-section of 1 mm².

Strip the ends to a length of approx. 6 mm. Crimp wire-end ferrules to the ends. Connect power supply terminals L+ and M to the terminals on the CPU.

Wiring the Digital Input and Output Modules

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 connector still protrudes from the module in this wiring position, and is not yet connected to the module.
3. Cut around 10 wires (1mm²) 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+ of the power supply
 - Terminal M: To terminal M of the power supply
 - Terminal 3: To the first connection of button 1
 - Terminal 4: with the first connection to button 2Connect the two unassigned connections on buttons 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+ of the power supply
 - Terminal M: To terminal M of the power supply
6. Lead the wires downwards out of the front connectors.

3.3 3. Step: Commissioning the Hardware

7. Push in the front connector release button on the top of the module and push the front connector into the module. The front connector is in place when the release button snaps back into its initial position.

Note

Please note: If you are using a 40-pin front connector, it 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.

3.3 3. Step: Commissioning the Hardware

Procedure

1. Use the PG cable to connect the programming device to the CPU. When using a cable with PROFIBUS connectors, remember to switch on the integrated terminating resistors. Close the front panel cover of the CPU, then set the mode selector switch on the CPU to *STOP*.
2. Connect mains, then switch on the power supply module.
The *DC24V* LED on the power supply is lit.
All LEDs on the CPU light up briefly. The *SA* LED and the *5V DC* LED stay on. The *STOP* LED then flashes slowly and requires a CPU memory reset.
3. Insert your SIMATIC Micro Memory Card into the CPU.
4. Perform a CPU memory reset:
 - Turn the mode switch to *MRES*. Hold the mode switch in this position until the *STOP* LED lights up for the second time and remains on. Then release it.
 - You then have 3 seconds in which to turn the mode switch back to *MRES*. The *STOP* LED begins to flash rapidly. The CPU performs a memory reset. You can now release the mode switch. The CPU has completed the memory reset when the *STOP* LED remains permanently lit again.
5. Start your programming device, then run SIMATIC Manager from your Windows Desktop.
A window opens with SIMATIC Manager.
6. Select button 1.
The LED for the first input lights up.
7. Select button 2.
The LED for the second input lights up.

3.4 4. Step: Configuring hardware in HW-Configuration of STEP 7

Create a new project in STEP 7:

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

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

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:

1. In the hardware catalog, navigate to PS-300. Drag your power supply and drop it into slot 1 on the rail.

Note

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:

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:

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:

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.

3.5 5. Step: Programming a circuit

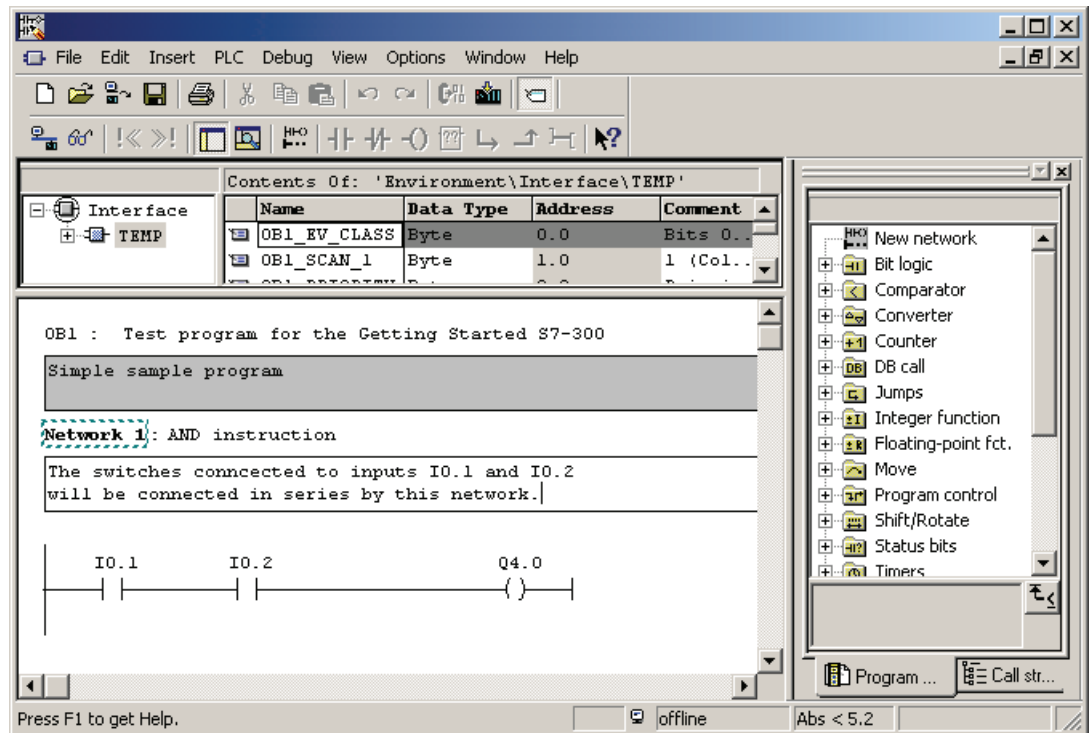
Procedure

1. In the right-hand section of the window, double-click on the CPU icon, then on the S7 Program icon, then on the Blocks icon and finally on the OB 1 icon.
The "Properties" dialog for OB 1 is displayed.
2. From the properties of the organizational block, select the programming language LAD.
Click on OK to confirm.
The program editor opens.
3. Carefully click on the horizontal line representing the current path.
The line is highlighted.
4. 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.
5. Click on the red question mark for the left-hand normally- open contact in the current path.
The normally-open contact is highlighted. The question mark is replaced with a text input box containing the cursor.

6. Enter *E0.1* and press *Return*.

The left-hand normally-open contact is now called *E0.1*.

7. Label the right-hand button in the same way with *E0.2* and the coil with *A4.0*.



8. Close the editor with the menu command "File > Close". Answer the save prompt with *Yes*.

The editor is closed and OB 1 is saved.

3.6 6. Step: Test Run

Procedure

1. Use the SIMATIC 300 station and *your CPU* to browse to the S7 program.
In SIMATIC Manager, click on Blocks in the right-hand part of the window.
Blocks will now be highlighted.
2. Select "Download" from the "Target system" menu to transfer the program and hardware configuration to the CPU. Confirm all windows with *Yes*.
The program and configuration are downloaded from the programming device to the CPU. The program is now stored on the Micro Memory Card (in the load memory), where it is unaffected by power failures and resets.
3. Set the CPU's mode switch to *RUN*.
The *STOPLED* is switched off. The *RUNLED* starts to flash and then assumes a continuous signal.
4. Press each of the buttons alternately.
The LEDs of each input will light up in turn.
5. Press both buttons simultaneously.
The LEDs of both inputs will light up at the same time.
The LED for the first output lights up.
This equates to connection of a connected final controlling element or display.

Further Information

Diagnostics/Correction of Errors

Wrong operation, faulty wiring or a faulty hardware configuration may cause errors which the CPU indicates with the *SF* group error LED after a CPU memory reset.

For information on how to diagnose such errors and alarms, please refer to the operating instructions, CPU 31xC and CPU 31x: Installation (<http://support.automation.siemens.com/WW/view/en/13008499>).

Manuals containing further information

For more in-depth Getting Started information, we recommend Getting Started and Exercises with STEP 7 (<http://support.automation.siemens.com/WW/view/en/45531551>).

Service & Support on the Internet

In addition to our documentation, we offer a comprehensive knowledge base on the Internet (<http://www.siemens.com/automation/service&support>).

There you can find:

- A newsletter containing the latest information on your Siemens products.
- The documents you need using the search engine in Service & Support.
- the bulletin board, a worldwide knowledge exchange for users and experts.
- Your local contact for Automation & Drives in our contact database.
- Information about on-site services, repairs and spare parts. You will find much more under "Services".

