

# SIEMENS

## SIMATIC

### S7 300 PLC CPU 317T-2 DP: Controlling a physical axis

Getting Started

Introduction

1

Preparation

2

Learning units

3

Further information

4

## Safety Guidelines

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



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### Danger

indicates that death or severe personal injury **will** result if proper precautions are not taken.

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### Warning

indicates that death or severe personal injury **may** result if proper precautions are not taken.

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### Caution

with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

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### Caution

without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

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### Notice

indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

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

## Qualified Personnel

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

## Prescribed Usage

Note the following:



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### Warning

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

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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.

# Table of contents

<b>1</b>	<b>Introduction</b> .....	<b>1-1</b>
1.1	Introduction .....	1-1
<b>2</b>	<b>Preparation</b> .....	<b>2-1</b>
2.1	Requirements.....	2-1
<b>3</b>	<b>Learning units</b> .....	<b>3-1</b>
3.1	1. Step: Wiring.....	3-1
3.2	2. Step: Configuring the CPU 317T-2 DP in HW -Config .....	3-2
3.3	3. Step: Changing the transmission rate at the MPI/DP interface .....	3-4
3.4	4. Step: Vital settings in your DP (DRIVE) configuration .....	3-4
3.5	5. Step: Generating technology system data.....	3-5
3.6	6. Step: Configuring the drive with HW Config .....	3-6
3.7	7. Step: Configuring the axis(axis) with S7T Config .....	3-9
3.8	8. Step: Creating the technology DBs.....	3-15
3.9	9. Step: Configuring the drive with SimoComU .....	3-16
3.10	10. Step: Controlling the axis with the STEP 7 user program .....	3-19
3.11	11. Step: Trial run .....	3-20
<b>4</b>	<b>Further information</b> .....	<b>4-1</b>
4.1	Further information.....	4-1



# Introduction

## 1.1 Introduction

### Introduction

This Getting Started contains a practical example guiding you through eleven steps in commissioning a fully functional application, and showing you how to carry out motion commands. It is thus a valuable help in getting started with the basic functions of a CPU 317T-2 DP.

Depending on your degree of experience, working through the sample will take between one and two hours.

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#### Note

This Getting Started presumes that you have connected a SIMODRIVE 611 universal drive to the DP(DRIVE) interface of the CPU 317T-2 DP. In case you do not have a drive, we recommend you refer to the Getting started documentation "CPU 317T-2 DP: Controlling a virtual axis".

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# Preparation

## 2.1 Requirements

### Requirements

Requirements:

- An S7-300 station, consisting of:
  - Power supply module (PS), for example, 6ES7 307-1EA00-0AA0
  - 317T-2DP CPU with inserted MMC (4 MB or more).
  - Optional digital input module (DI) with bus connector, for example, 6ES7 321-1BH02-0AA0
  - Optional digital output module (DO) with bus connector, for example, 6ES7 322-1BH01-0AA0
  - Two optional front connectors for the digital modules
- A PG/PC with MPI interface and properly installed software packages and commissioning tools as listed below:
  - STEP 7 V5.3 SP3 and higher
  - S7-Technology V3.0
  - SimoCom U
- The PG/PC is connected to the CPU via the MPI/DP interface (transmission rate up to 12 Mbps; default 187.5 kbps).
- A SIMODRIVE 611U is interconnected with the CPU 317T-2 DP via DP(DRIVE) interface.
- The SIMODRIVE 611U modules:
  - Controller module, for example, 6SN1 118-0NH00-0AAx
  - Optional Motion Control module with PROFIBUS DP, 6SN1 114-0NB01-0AA0
  - Also required for operating the SIMODRIVE 611U:
    - A power unit, for example, 6SN1 12x-1Ax0x-0HAX
    - A motor, for example, 1FT6 031-xAK7x-xExx (rated speed 6000 rpm), for example, with one absolute value encoder

**Note**

For the example of a drive in Getting Started we use a SIMODRIVE 611 universal training case. This training case is available under the following order number:

- - 6ZB2420-0AB00 or
- - 6SN1182-0EA00-3DP0 or
- - 6AU1700-8AA00-0AA0

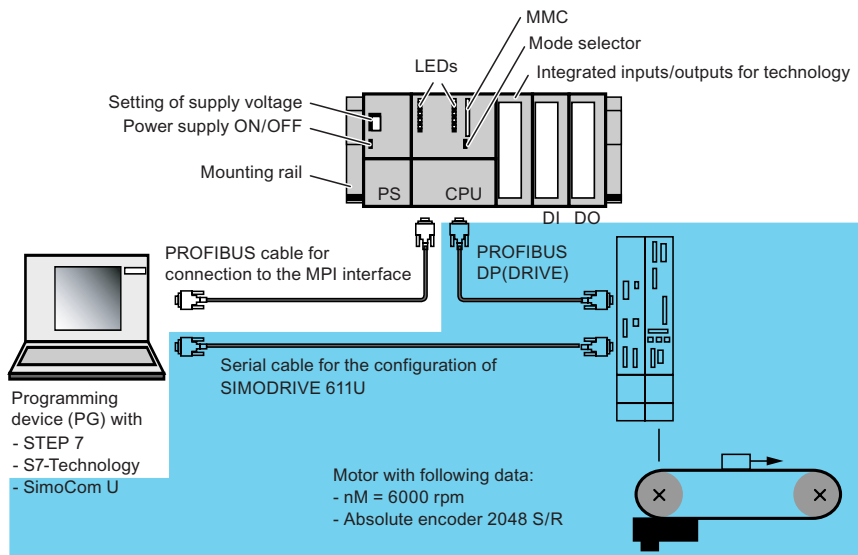
- The system is completely installed and wired. For information, refer to *Getting Started CPU 31x: Commissioning*.
- You provided hardware limit switches and EMERGENCY-OFF switches for safe and reliable operation of the system.



**Warning**

Operation of an S7-300 as part of plants or systems is subject to special rules and regulations, based on its field of application. Please note the current safety regulations for the prevention of accidents, e.g. IEC 204 (EMERGENCY-OFF equipment). You risk severe injury, or damage to machines and equipment if you ignore these directives.

**Example configuration**



**Task**

You configure an axis using HW Config, S7T Config and SimoCom U. You then operate this axis with the help of a STEP 7 user program.



## Learning units

### 3.1 1. Step: Wiring



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**Warning**

You may come into contact with live wires. Always switch off power before you start wiring the S7-300.

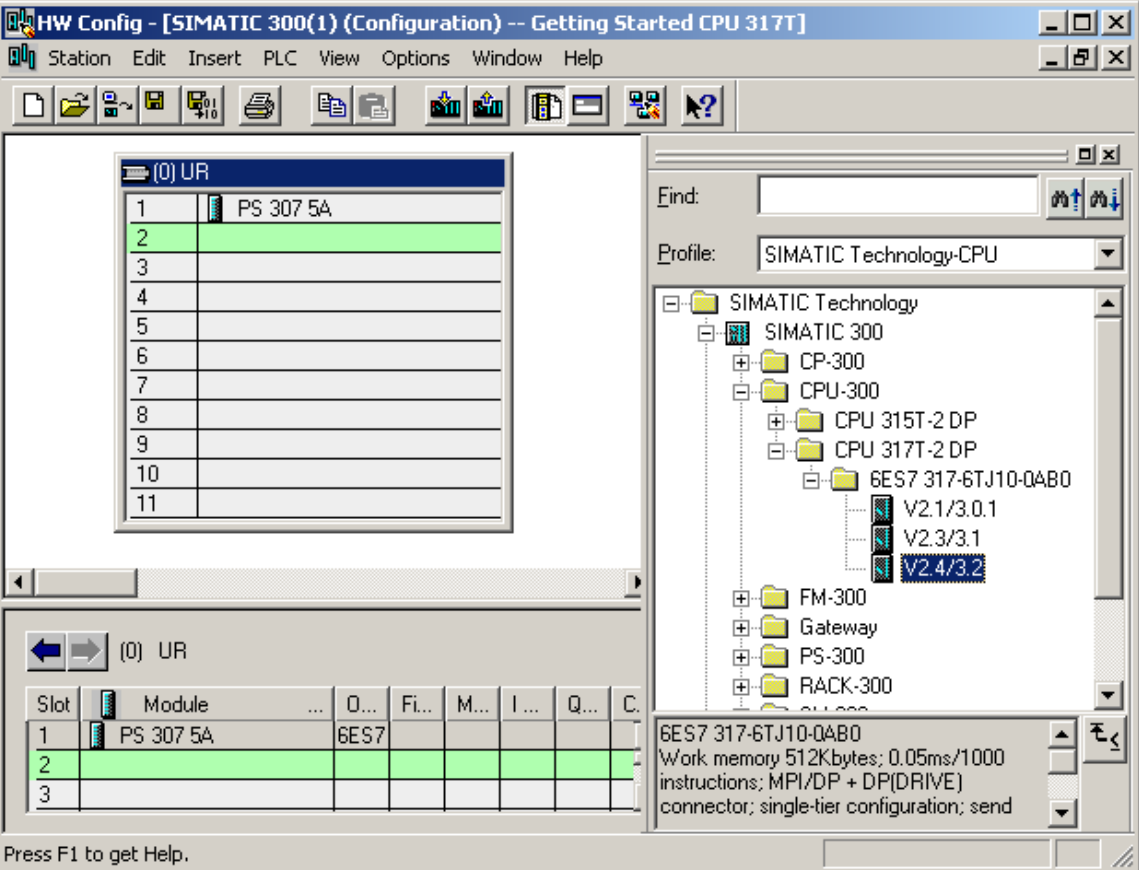
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**Procedure**

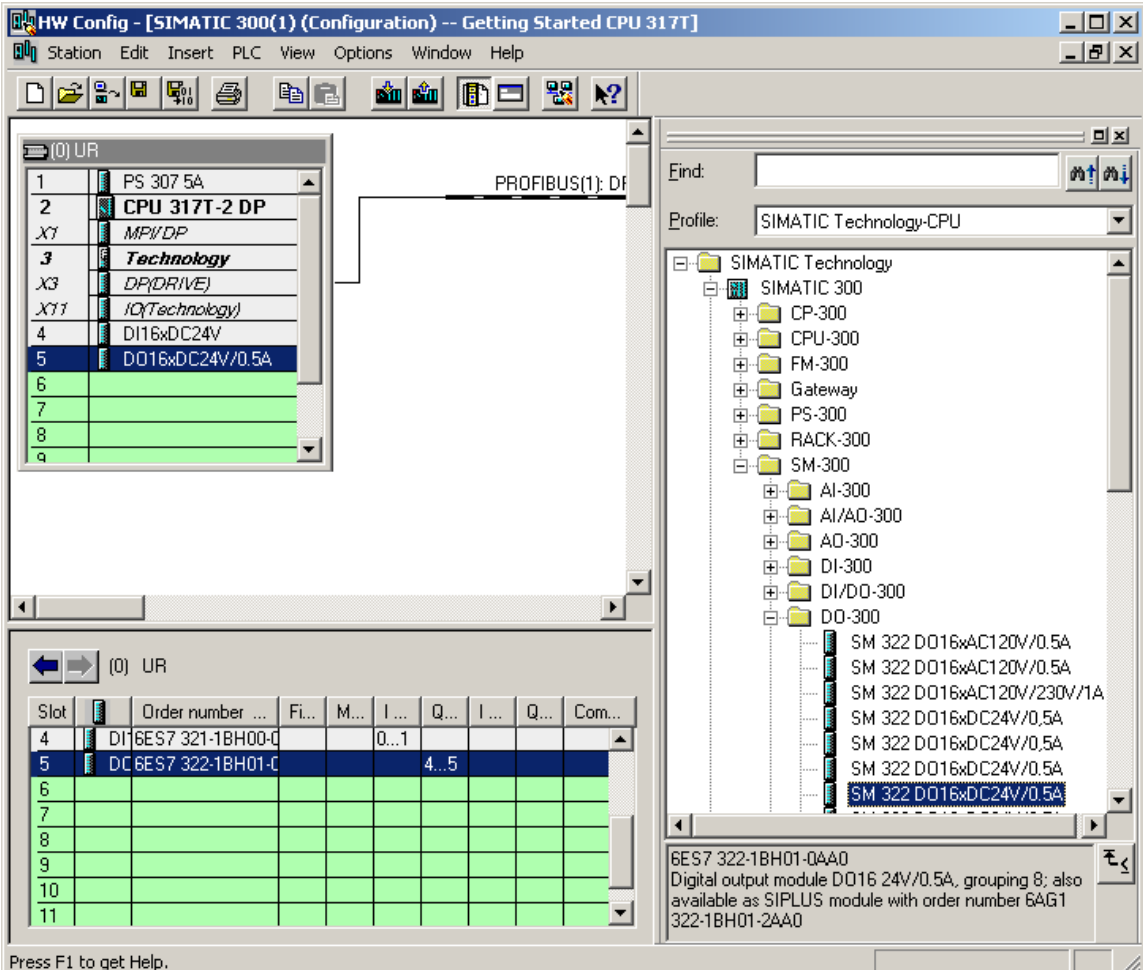
A description of the installation and wiring of your 317T-2DP CPU is found in the *Getting Started Collection S7-300 PLC: CPU 31x: Commissioning*.

## 3.2 2. Step: Configuring the CPU 317T-2 DP in HW -Config

### Procedure

Step	Activity	Result
1	Create a new project in SIMATIC Manager (for example, "Getting Started CPU 317T"). Add a SIMATIC 300 station.	The SIMATIC 300 station appears in SIMATIC Manager.
2	Open HW Config by selecting the "SIMATIC 300" station and double-clicking "Hardware."	HW Config opens.
3	Open the "Hardware Catalog" and select the "SIMATIC Technology CPU" hardware profile in the "Profile" drop-down list.	
4	Insert a mounting rail using drag-and-drop in the station window of HW Config.	This creates a mounting rail.
5	Drag-and-drop the "PS 307 5A" power supply module onto the mounting rail.	The power supply module appears on the mounting rail.
6	Add the Technology CPU to the mounting rail by means of drag-and-drop.	A message box appears.
7	You change the transmission rate in the next step. Confirm the message box with "OK."	In the next dialog box, you can set the PROFIBUS properties at DP(DRIVE).
8	Confirm the default settings of the PROFIBUS configuration with "OK."	

3.2.2. Step: Configuring the CPU 317T-2 DP in HW-Config

Step	Activity	Result
9	<p>Add a digital input module and a digital output module. You now have this layout:</p> 	

### 3.3 3. Step: Changing the transmission rate at the MPI/DP interface

**Procedure**

Sequence	Activity	Result
1	Open the MPI/DP interface (X1) in HW Config with double-click.	The "Properties - MPI/DP" dialog box opens.
2	Click "Properties".	The "Properties – MPI interface MPI/DP" dialog box opens.
3	Click MPI(1), then click "Properties".	The "Properties - MPI" dialog box opens.
4	Select the "Network settings" tab and select a transmission speed of "1.5 Mbps".	
5	Confirm all open dialog boxes with "OK".	You have now increased the configured transmission speed of the MPI interface at the CPU in order to accelerate data transfer.
6	When the CPU is in STOP, select <b>PLC &gt; Download to module</b> to download the configuration. Select the CPU and confirm with "OK".	The "Select node address" dialog box opens.  The default transmission rate of the MPI interface is 187 kbps, i.e. the PG/PC interfaces must be set up as described earlier in the requirements section.
7	Confirm with "OK".	The data are now downloaded from the PG/PC to the CPU.

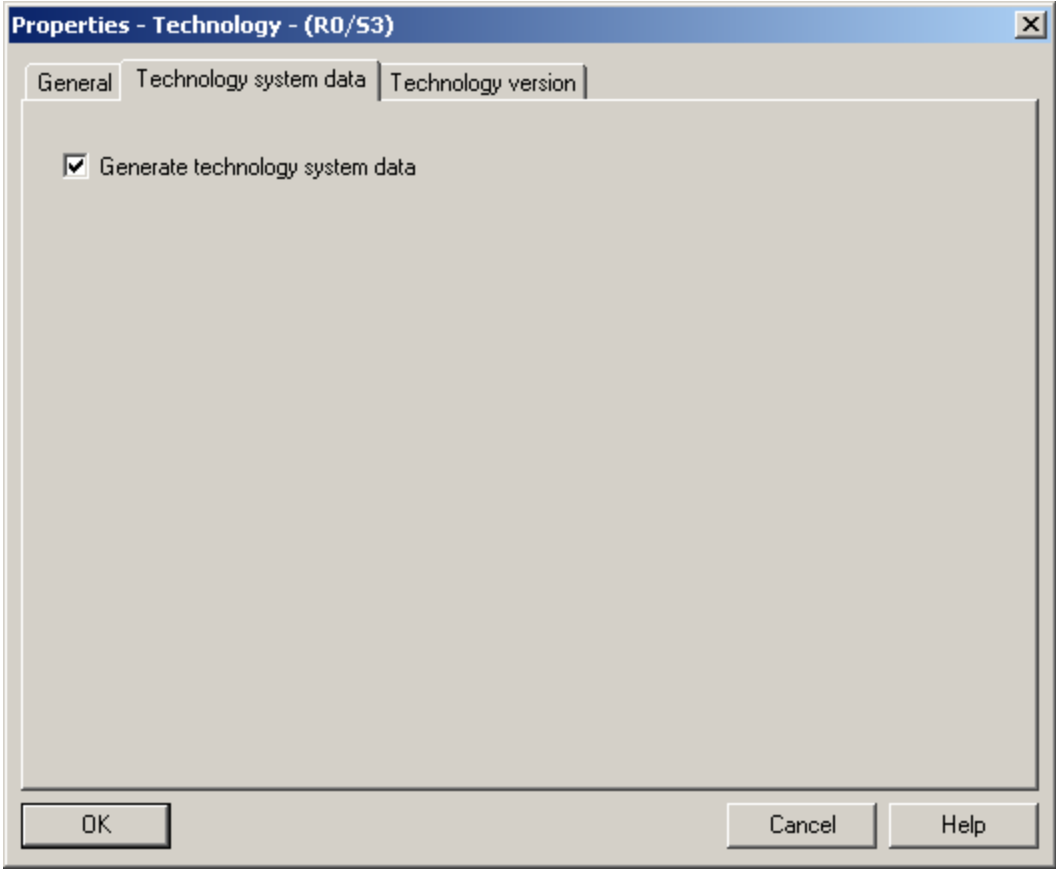
### 3.4 4. Step: Vital settings in your DP (DRIVE) configuration

**Procedure**

Sequence	Activity	Result
1	In HW Config, double-click X3 DP (DRIVE).	The "Properties – DP (DRIVE)" dialog box opens.
2	Click the "Properties" button.	The "Properties – PROFIBUS interface DP (DRIVE)" dialog box opens.
3	Enter PROFIBUS address "2".	
4	Click "New" to create a new PROFIBUS subnet.	The "Properties – New PROFIBUS subnet" dialog box opens.
5	In the "Network settings" tab of the next dialog box, set the transmission rate of the PROFIBUS network. Enter a rate of 12 Mbps.  Maintain the "DP" profile setting of the subnet.	
6	Click "OK" to confirm all open dialog boxes of HW Config.	

## 3.5 5. Step: Generating technology system data

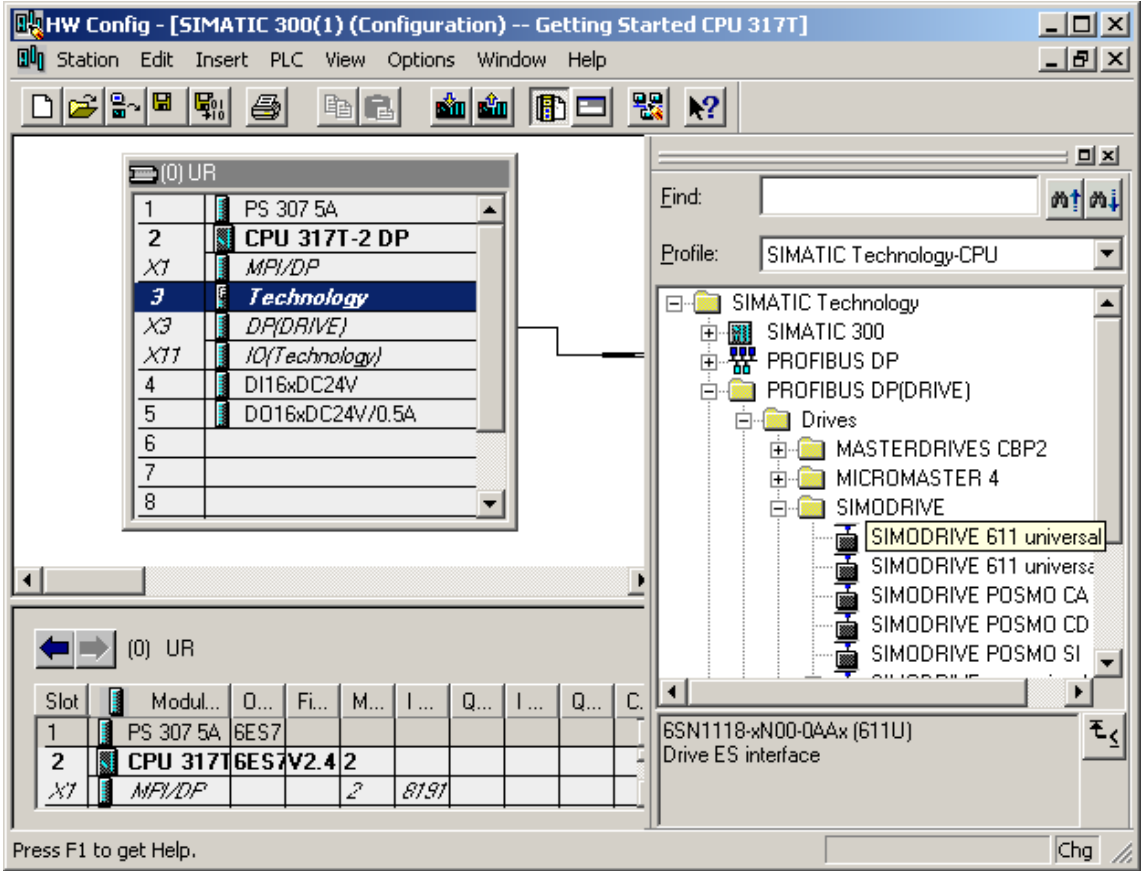
### Procedure

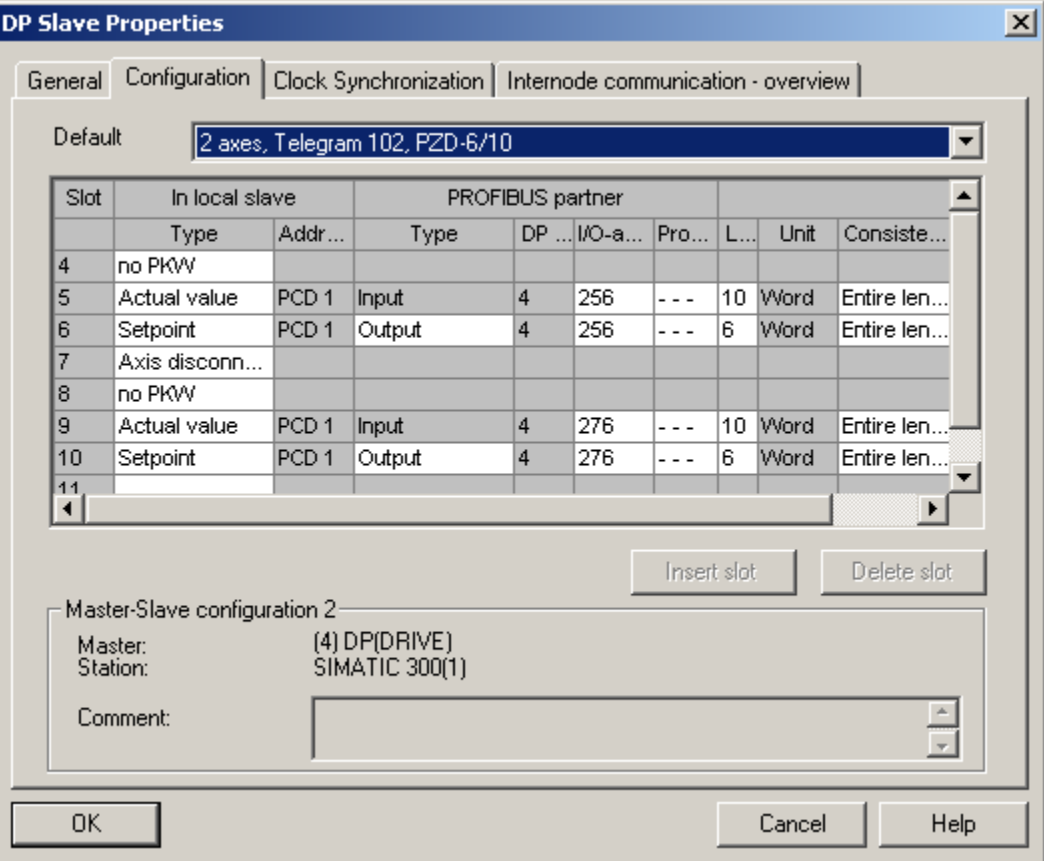
Sequence	Activity	Result
1	Double-click "Technology" on the mounting rail.	The "Properties - Technology" dialog box opens.
2	Select the "Technology system data" tab, then set the "Generate technology system data" check box. Confirm with "OK".	 <p><b>Result:</b> When you download these data to the PLC later on in this Getting Started, the system also generates the technology system data and includes these in the download to your CPU 317T-2 DP.</p> <p><b>Note:</b> If you do not activate the check box, then the technology system data is also not generated.</p>

### 3.6 6. Step: Configuring the drive with HW Config

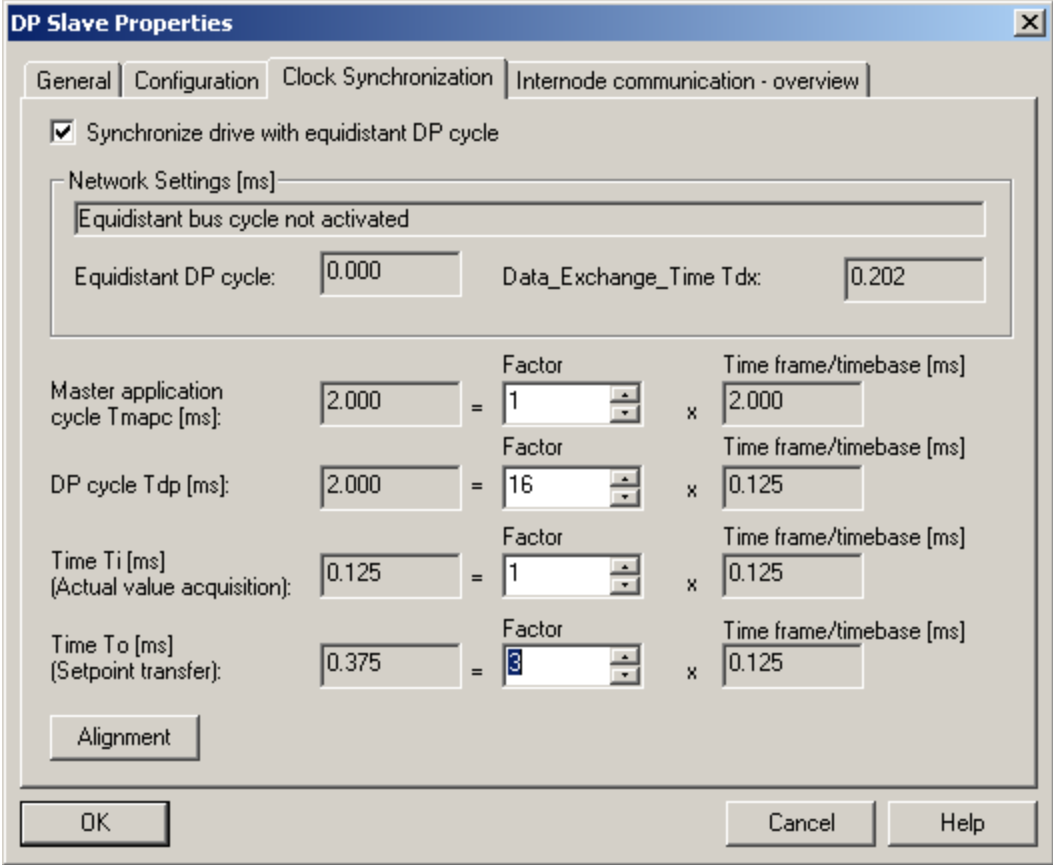
**Procedure**

Sequence	Activity	Result
1	In the HW catalog, open the tree structure <b>SIMATIC Technology &gt; PROFIBUS DP (DRIVE) &gt; Drives &gt; SIMODRIVE.</b>	
2	Select the drive component "SIMODRIVE 611 universal" from the tree structure of the HW Catalog.	
3	Drag-and-drop this component to the master system of the DP (DRIVE).	The "Properties – PROFIBUS interface SIMODRIVE 611 U DP2, DP3" dialog box opens.
4	Enter PROFIBUS address "4", then confirm with "OK."	The "Properties - Drive" dialog box opens.
5	Close the dialog box with "OK".	The "DP Slave Properties" dialog box opens.



Sequence	Activity	Result
6	<p>On the "DP Slave Properties" dialog box, select the "Configuration" tab. Select telegram type "2 axes, Telegram 102, PZD-6/10."</p> <p>Note: If your actual configuration only contains one axis, select "1 axis, Telegram 102, PZD-6/10" (the SIMODRIVE 611 universal demo cases use double-axis modules.)</p> 	
7	Select the "Clock Synchronization" tab.	The "Clock Synchronization" dialog box opens.

3.6 6. Step: Configuring the drive with HW Config

Sequence	Activity	Result
8	<p>Set the "Synchronize drive with equidistant DP cycle", then set the time coefficients as shown below.</p> 	
9	Click "Alignment."	<p>The following components are calibrated to the set values:</p> <ul style="list-style-type: none"> <li>• DP cycle in the DP -master system</li> <li>• all drive components of the same family (here: SIMODRIVE) are calibrated based on the same values.</li> </ul>
10	Confirm with "OK."	
11	Finalize your HW configuration by calling the <b>Station &gt; Save and compile</b> command.	The system compiles your project, and adds the "Technological Objects" object to the project window in SIMATIC Manager.

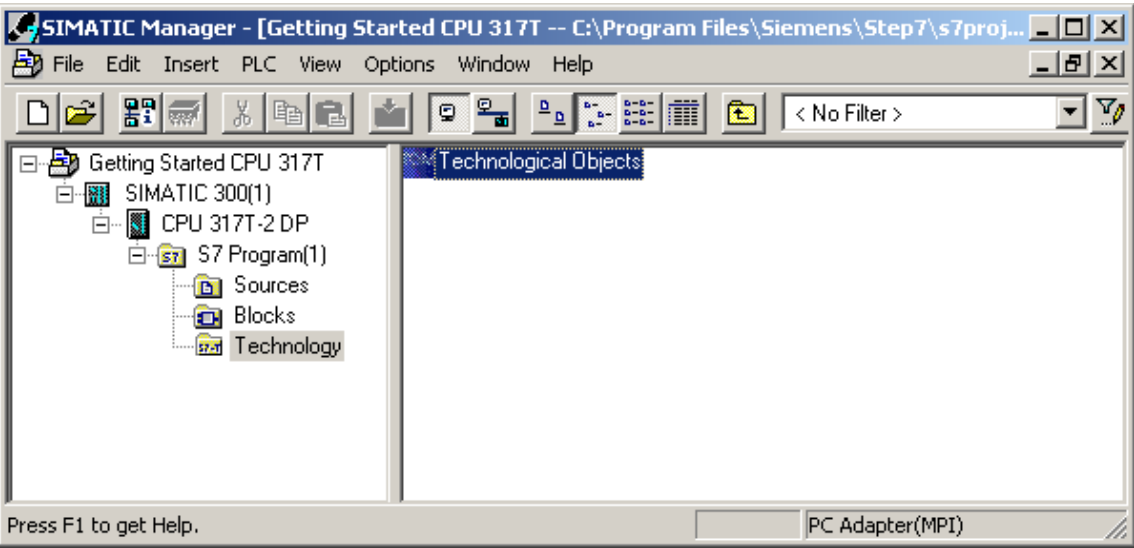


## 3.7 7. Step: Configuring the axis(axis) with S7T Config

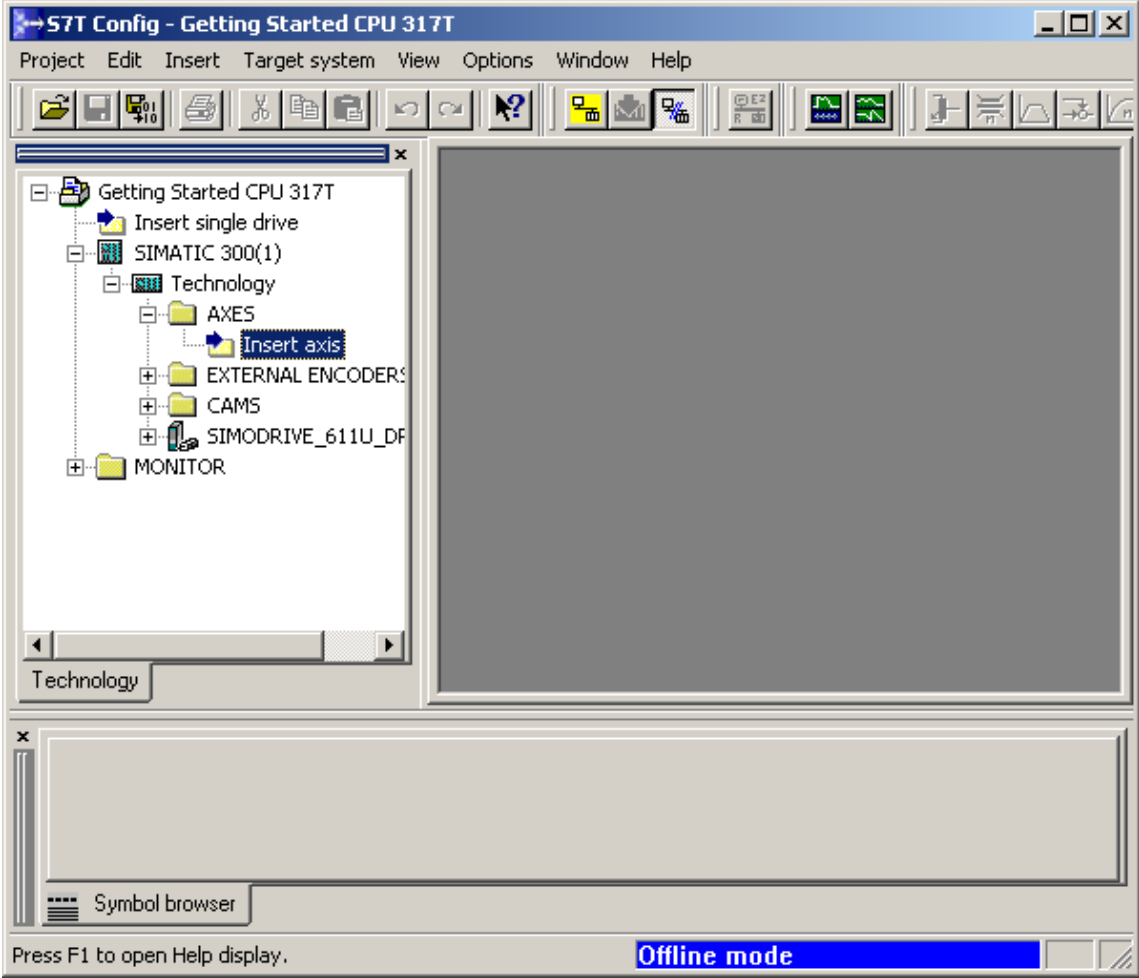
### Important information

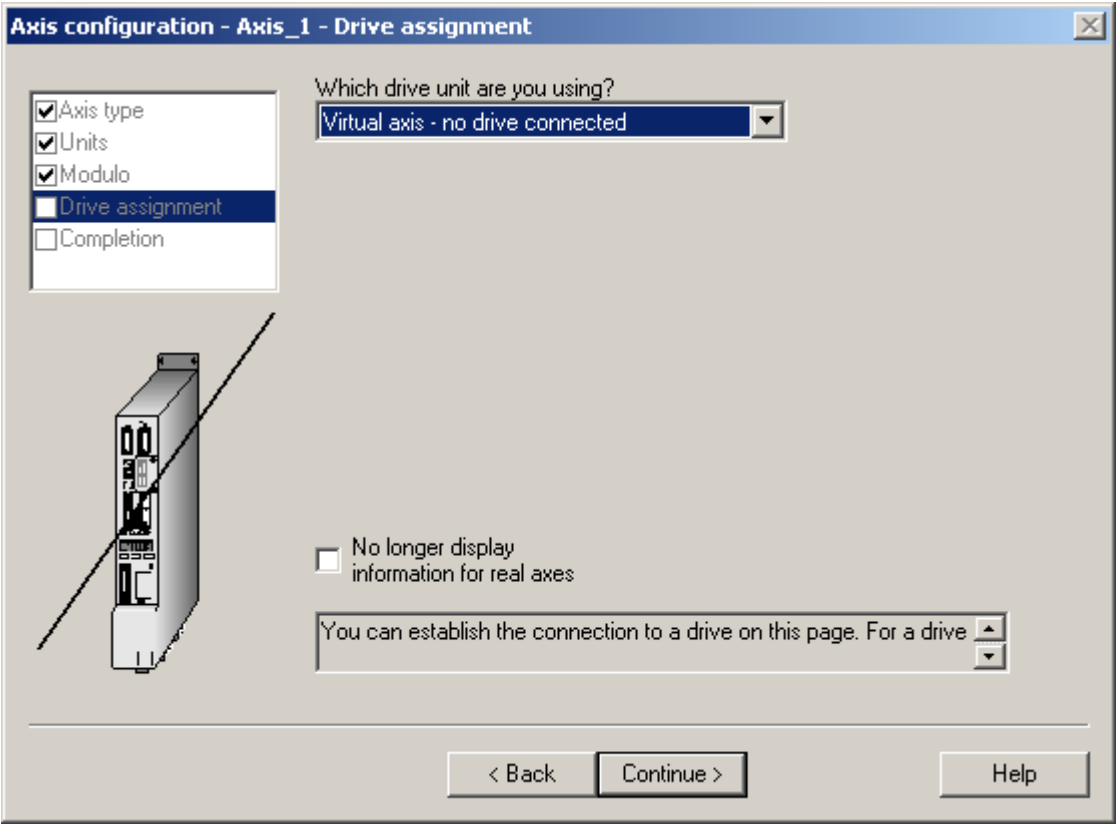
In this step, you create your technology objects (e.g. axes) with S7T Config. Use "Technology Objects Management" to generate a technology DB for each TO. Do not copy the technology DBs in order to ensure a defined assignment between the technology DB and its TO.

### Procedure

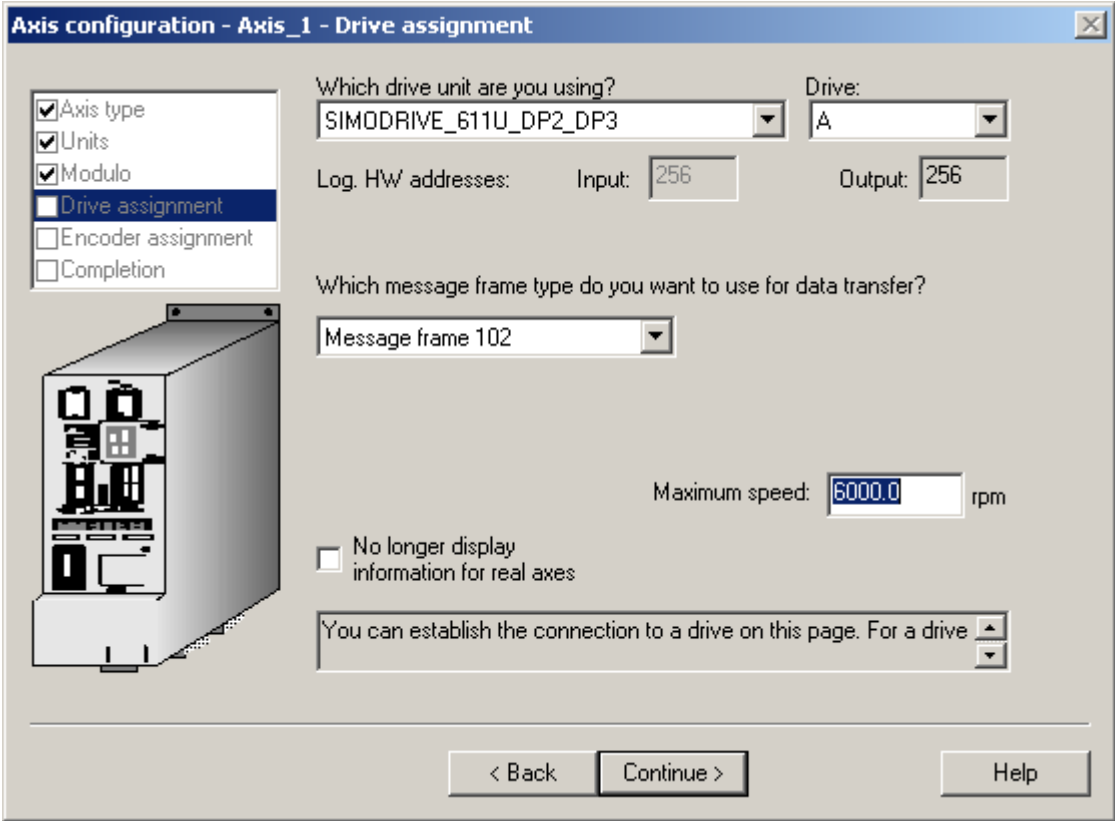
Step	Activity	Result
1	<p>In SIMATIC Manager, double-click "Technological Objects" to open S7T Config.</p>  <p>The screenshot shows the SIMATIC Manager interface. The title bar reads 'SIMATIC Manager - [Getting Started CPU 317T -- C:\Program Files\Siemens\Step7\s7proj...'. The menu bar includes File, Edit, Insert, PLC, View, Options, Window, and Help. The toolbar contains various icons for file operations and project management. The main window is divided into two panes. The left pane shows a project tree with the following structure: 'Getting Started CPU 317T' (expanded) contains 'SIMATIC 300(1)' (expanded), which contains 'CPU 317T-2 DP' (expanded), which contains 'S7 Program(1)' (expanded). Under 'S7 Program(1)', there are four sub-items: 'Sources', 'Blocks', and 'Technology' (selected), and an empty folder icon. The right pane is titled 'Technological Objects' and is currently empty. At the bottom of the window, there is a status bar with the text 'Press F1 to get Help.' and 'PC Adapter(MPI)'.</p>	<p><b>Result:</b> "Technological Objects Management" opens. The system automatically runs S7T Config if you have not configured any technology objects yet, as in this example.</p> <p>You may also run S7T Config without using "Technology Objects Management." Select the "Technology Objects" object and then select the <b>Options &gt; Configure technology</b> menu command.</p>

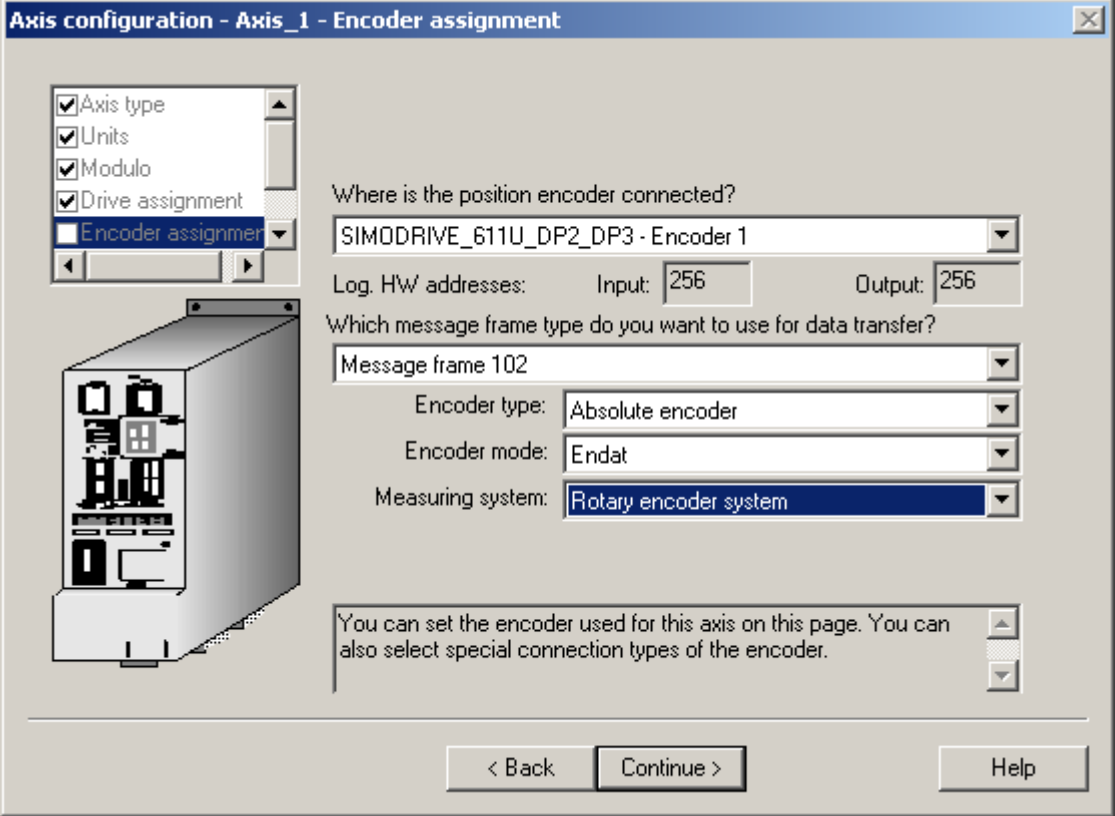
3.7 7. Step: Configuring the axis(axis) with S7T Config

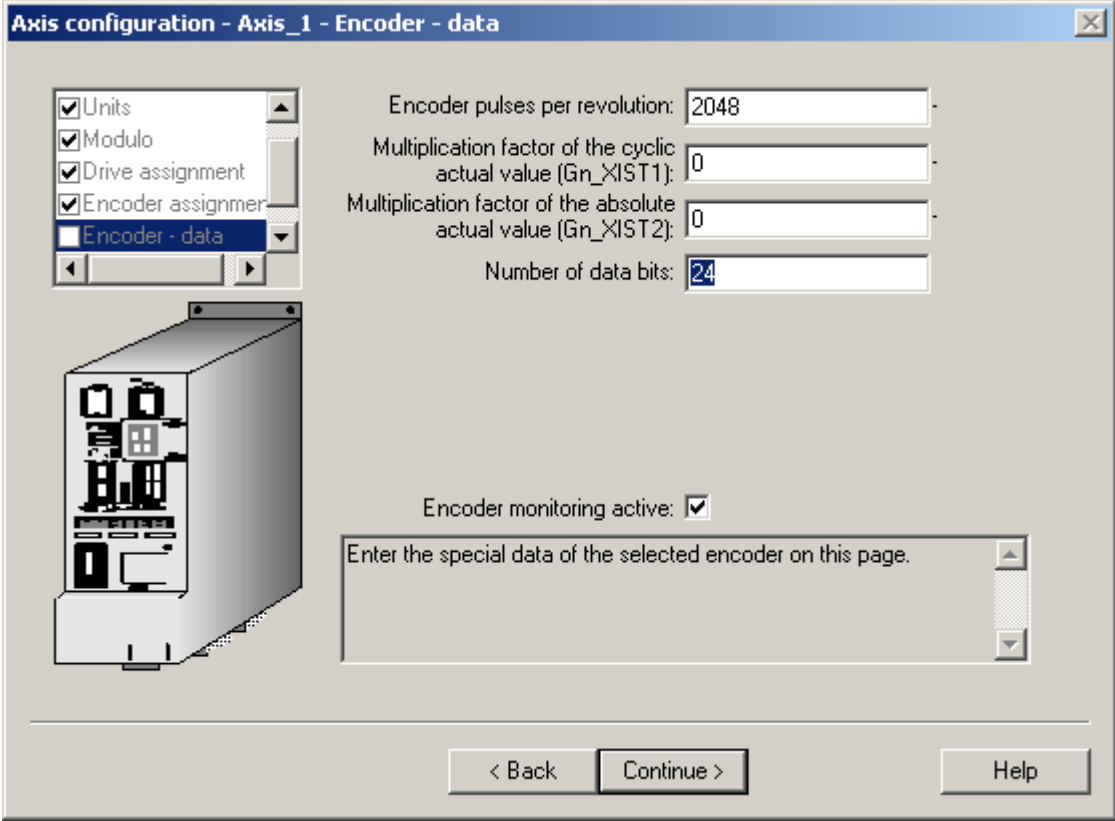
Step	Activity	Result
2	<p>In the project navigator, open the tree structure <b>SIMATIC 300(1) &gt; Technology &gt; AXES</b>. Double-click "Insert axis" to start the axis wizard.</p> 	
3	<p>Confirm the default technology selection (speed control, positioning) with "OK."</p>	<p>The "Axis configuration - Axis_1 – Axis type" dialog box opens.</p>
4	<p>Accept the "Axis type: Linear, electric" and "Motor type: standard motor". Confirm with "Continue."</p>	<p>The "Axis configuration - Axis_1 - Units" dialog box opens.</p>
5	<p>Confirm with "Continue."</p>	<p>The "Axis configuration - Axis_1 - Modulo" dialog box opens.</p>

Step	Activity	Result
6	Confirm with "Continue." <b>Result:</b> The "Axis configuration - Axis_1 - Drive assignment" dialog box opens.	
7	Select your <b>physical axis (SIMODRIVE 611U)</b> .	

3.7.7. Step: Configuring the axis(axis) with S7T Config

Step	Activity	Result
8	<p>Accept the telegram configured in the hardware configuration and merely confirm it on this dialog box Enter the maximum motor speed as "Rated speed" (see motor type plate). Set a maximum motor rpm of 6000 1/min for our example. Confirm your settings with "Continue."</p> 	<p>Result: A message box appears.</p>
9	<p>Close the message box with "OK."</p>	<p>The "S7T Config Help" Online Help system opens.</p>
10	<p>Close the Online Help.</p>	<p>The "Axis configuration - Axis_1 – Encoder assignment" dialog box opens.</p>

Step	Activity	Result
11	<p>Select the encoder type and mode, and the measuring system. Settings for the first axis in our example:</p> <ul style="list-style-type: none"> <li>• "Encoder type" is an "Absolute encoder"</li> <li>• "Encoder mode" is "Endat"</li> <li>• "Measuring system" is "Rotary encoder system"</li> </ul> <p>Confirm with "Continue."</p> 	<p>Result: The "Axis Configuration - Axis_1 - Encoder - data" dialog box opens.</p>

Step	Activity	Result
12	<p>Enter the resolution specified on your motor rating plate. The resolution of the encoder in our example is 2048.</p>  <p>Confirm your settings with "Continue."</p> <p><b>Result:</b> The "Axis Configuration - Axis_1 - Completion" dialog box opens, showing the data you configured.</p>	
13	Close the axis configuration with "Finish."	A message box appears.
14	Close the message box with "OK."	The "S7T Config Help" Online Help system opens.
15	Close the Online Help.	You completed the axis configuration in S7T Config.
16	Select <b>Project &gt; Save and compile all</b> to save the configuration in S7T Config.	The system now compiles the axis configuration data.

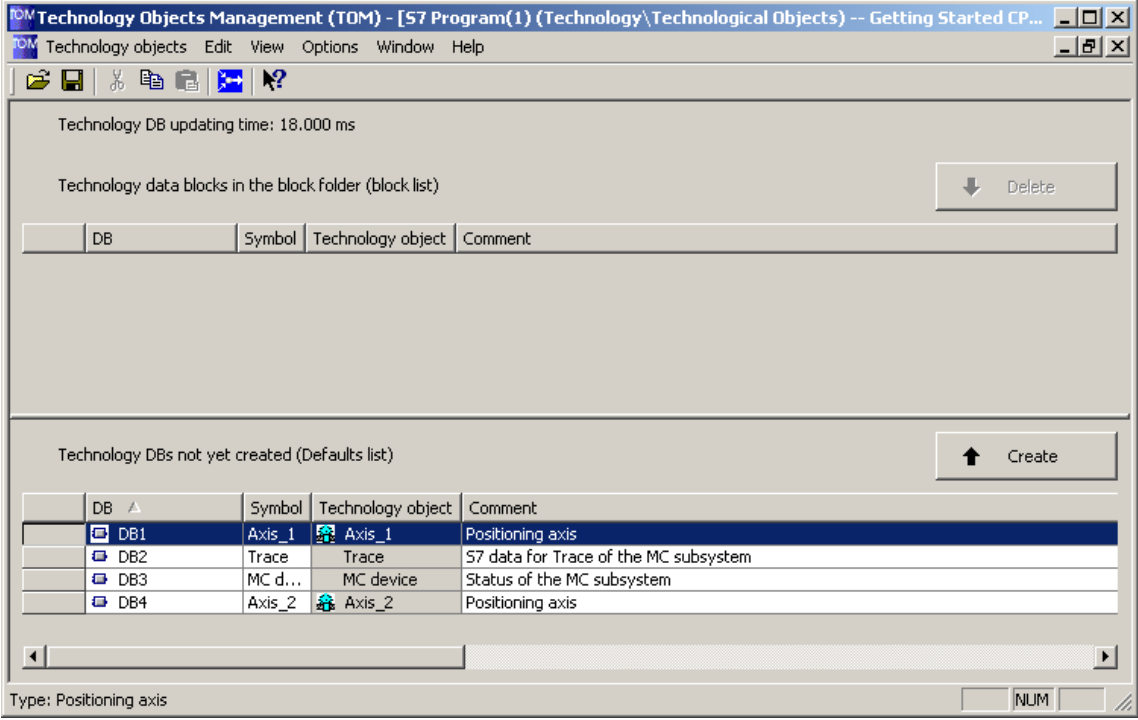
**Note**

Repeat sequence 2 to 16 in step number 7 if you are using a second axis.

With a double-axis module, you can only perform the trial run if you have also configured the second axis.

## 3.8 8. Step: Creating the technology DBs

### Procedure

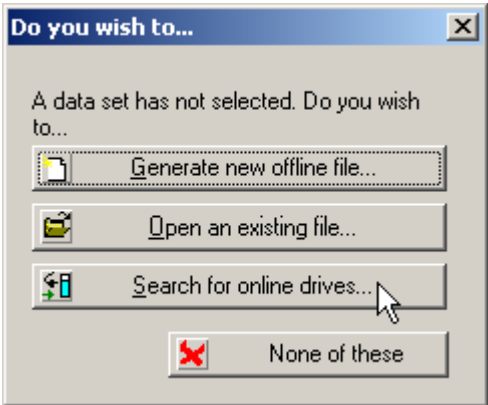
Sequence	Activity	Result
1	<p>Change to "Technological Objects Management". Confirm the first message box with "OK," and the second with "Yes."</p> <p>If you are not running the "Technology Objects Management" application yet, you can open it by double-clicking "Technological Objects" in the "Technology" folder in SIMATIC Manager (see also "Step 5: Configuring the axis(axis) with S7-Technology").</p> <p><b>Result:</b> The "Technology Objects Management" opens.</p> 	
	<p>Edit the DB numbers as shown in the figure in order to adapt these for use in our example.</p>	
2	<p>Create the technology DBs listed below by clicking "Create":</p> <ul style="list-style-type: none"> <li>• Axis_1</li> <li>• Axis_2 (if this exists)</li> <li>• Trace</li> <li>• MCDevice</li> </ul>	<p>The system generates the technology DB1, DB2, DB3, or DB4.</p>
3	<p>Close "Technology Objects Management."</p>	
4	<p>In SIMATIC Manager, change the MPI transmission rate to 1.5 Mbps by selecting <b>Options &gt; Set PG/PC interface</b>. Confirm with "OK".</p>	
5	<p>In SIMATIC Manager, select <b>CPU 317T-2 DP &gt; S7 program &gt; Blocks</b>.</p>	

3.9 9. Step: Configuring the drive with SimoComU

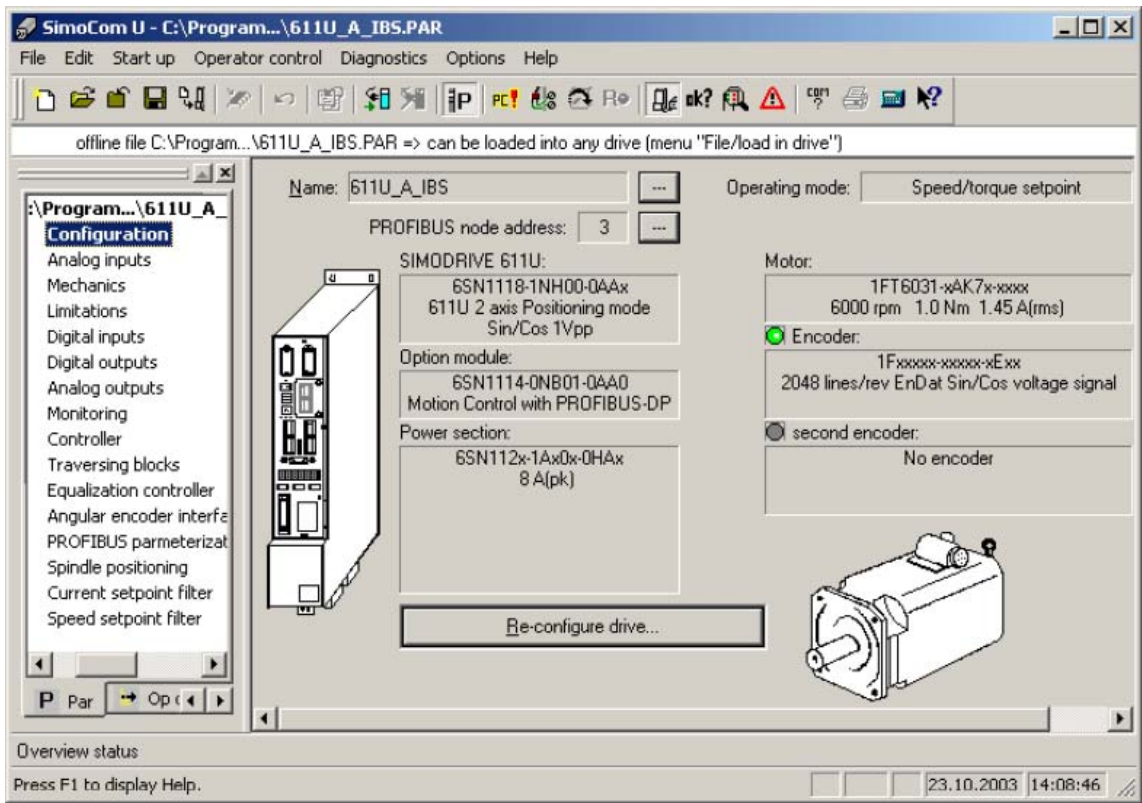
Sequence	Activity	Result
6	Select <b>PLC &gt; Download</b> to download the blocks and the system data to the CPU.	
7	Confirm the message box <ul style="list-style-type: none"> <li>• Download system data</li> <li>• Overwrite existing system data</li> </ul>	The system data blocks are downloaded to the CPU. The initial download of your SDBs may take longer (up to a few minutes), because of their larger data volume.

### 3.9 9. Step: Configuring the drive with SimoComU

Procedure

Sequence	Activity	Result
1	Connect SIMODRIVE 611U to the serial interface of your PG/PC.	
2	Run SimoCom U. <b>Result:</b> The dialog box shown below opens: 	



Sequence	Activity	Result
3	<p>Click "Search for online drives."</p> <p><b>Result:</b> SimoCom U automatically searches for the connected drive.</p> <p>The configuration is opened.</p>	
		
4	<p>Click "Re-configure drive", then proceed with the steps in menu controlled commissioning. Note these items:</p> <p>Enter the PROFIBUS address you assigned in HW Config to SIMODRIVE 611U.</p> <p>Select the motor and the encoder according to the specification on the motor rating plate.</p> <p>Finalize the configuration by clicking "Calculate and save controller data."</p>	<p>The PG/PC transfers the data to the drive.</p> <p>Reconnect the drive in the next dialog box.</p>
5	Confirm with "OK."	The data are now stored in SIMODRIVE 611U.
6	Select <b>Operator control &gt; Master control with PC</b> to assign control priority to your PG/PC.	The "Master control" window opens. You now control the drive directly at your PG/PC.
7	Confirm with "OK."	The "Continue with..." dialog box opens.
8	Click "None of these."	The drive has now received all enable signals from your PG/PC.
9	Select "Controller", then click "Execute automatic speed controller setting..."	The "Automatic speed controller setting" dialog box opens.
10	Click "Execute steps 1 to 4."	The PG/PC automatically adjusts the speed controller at the drive.

3.9 9. Step: Configuring the drive with SimoComU

Sequence	Activity	Result
11	Click "Save new settings to drive (EEPROM)."	The new data are saved to the drive.
12	Select <b>Start up &gt; Parameterization views &gt; PROFIBUS parameterization</b> and enter message frame "102" under "Message frame selection".	You have now entered the telegram type you have previously set in HW Config.
13	Change to <b>Start up &gt; Additional parameters &gt; Expert list</b> and enter the rated speed of your motor at parameter 880.	You have now stored the rated speed data of your motor.
14	Select <b>Operator control &gt; Master control with PC</b> to return control priority to the drive.	The drive is now no longer controlled directly at your PG/PC.
15	Select <b>File &gt; Save in drive</b> to save your data in the drive.	
16	Select <b>File &gt; Save as file</b> to save the data to a file.	
17	Repeat steps 4 to 16 for an existing second axis.	

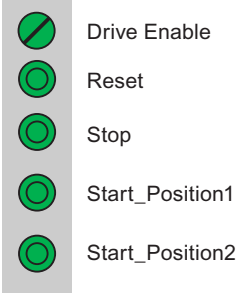
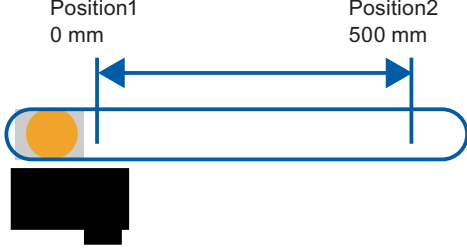
## 3.10 10. Step: Controlling the axis with the STEP 7 user program

### Procedure

Sequence	Activity	Result
1	<p>In SIMATIC Manager, open the sample project "Examples\PROJECT-CPU317T". Copy the blocks listed below to your project:</p> <ul style="list-style-type: none"> <li>• OB1</li> <li>• FB 100 (SimplePositioning)</li> <li>• FB401 (MC_Power)</li> <li>• FB402 (MC_Power)</li> <li>• FB405 (MC_Halt)</li> <li>• FB410 (MC_MoveAbsolute)</li> <li>• DB 100 (IDB_SimplePositioning)</li> <li>• AxisData (variable table for axis control)</li> </ul> <p>Confirm the message "The object 'OB1' already exists. Do you want to overwrite it?" with "Yes".</p> <p>Also copy the inputs, outputs and flags from the example symbol table to the project, so that the symbols are displayed completely in the variable table.</p> <p><b>Important:</b> The sample program does not contain DB1 to DB4! Create these technology DBs in STEP 7 (see the step "Creating the technology DBs"), in order to maintain consistency between the user program and the technology objects.</p>	The sample program is copied to the project.
2	You can edit the sample program in the LAD/STL/FBD Editor. To do so, click FB 100, then right-click to select "Open object".	The LAD/STL/FBD editor opens.
3	Select these settings: <ul style="list-style-type: none"> <li>• View &gt; LAD,</li> <li>• View &gt; Overviews, and</li> <li>• View &gt; Details.</li> </ul>	You have now opened an extended and clear view for editing the STEP 7 user program.
4	In SIMATIC Manager, load the entire user program to the CPU with <b>Target system &gt; Load user program to memory card</b> .	
5	Confirm the message box with "Yes".	The STEP 7 user program is now stored in the CPU. This download of your SDBs may take longer (up to a few minutes), because of their larger data volume.

### 3.11 11. Step: Trial run

#### Procedure

Sequence	Activity	Result
1	In the "Blocks" folder of your project, double-click the "AxisData" variable table.	The variable table is opened for monitoring.
2	Select <b>PLC &gt; Connect to &gt; Configured CPU</b> to go online.	The CPU "STOP" status is indicated on the bottom right.
3	Select <b>Variable &gt; Monitor</b> to set monitoring mode.	The "Status value" column shows the actual values of the addresses. Use the variable table to monitor the control and status bits of the application, and the status of the axis.
<p><b>Caution</b> You start the drive in the next two steps. To stop the drive again: Set input I0.2 (Stop) to "1" Switch the CPU to STOP.</p>		
4	Switch the CPU to RUN.	The CPU "RUN" status is indicated on the bottom right.
5	<p>Perform the following trials: Monitor the relevant output values.</p> <ul style="list-style-type: none"> <li>• Enable the axis by setting I0.0 = "1" (DriveEnable)</li> <li>• Move the axis into position 2 (500 mm) by setting I0.4 (StartPosition2)</li> <li>• Move the axis into position 1 (0 mm) by setting I0.3 (StartPosition1)</li> <li>• Stop the moving axis with a signal at I0.2 (Stop)</li> <li>• Acknowledge all queued errors of the axis with I0.1 (Reset)</li> </ul> <p>Terminal strip:</p>  <p>Velocity: Axis 1: v = 100 mm/s</p> 	

## Further information

### 4.1 Further information

#### Diagnostics / correction of errors

Incorrect operator input, faulty wiring or inconsistent configuration data may lead to errors. For information on how to analyze such errors and messages, refer to the *S7-Technology* manual.

#### Service and support on the Internet

In addition to our documentation, we offer a comprehensive online knowledge base on the Internet at:

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

There you will find:

- The newsletter that provides you with latest information relating to your product
- Your appropriate documentation, using our Service & Support search engine
- A bulletin board in which users and specialists worldwide exchange their know-how
- Your local Siemens partner for Automation & Drives in our Partner database
- Information about local service, repairs, and spare parts. You will find much more under "Services".

