

SIEMENS

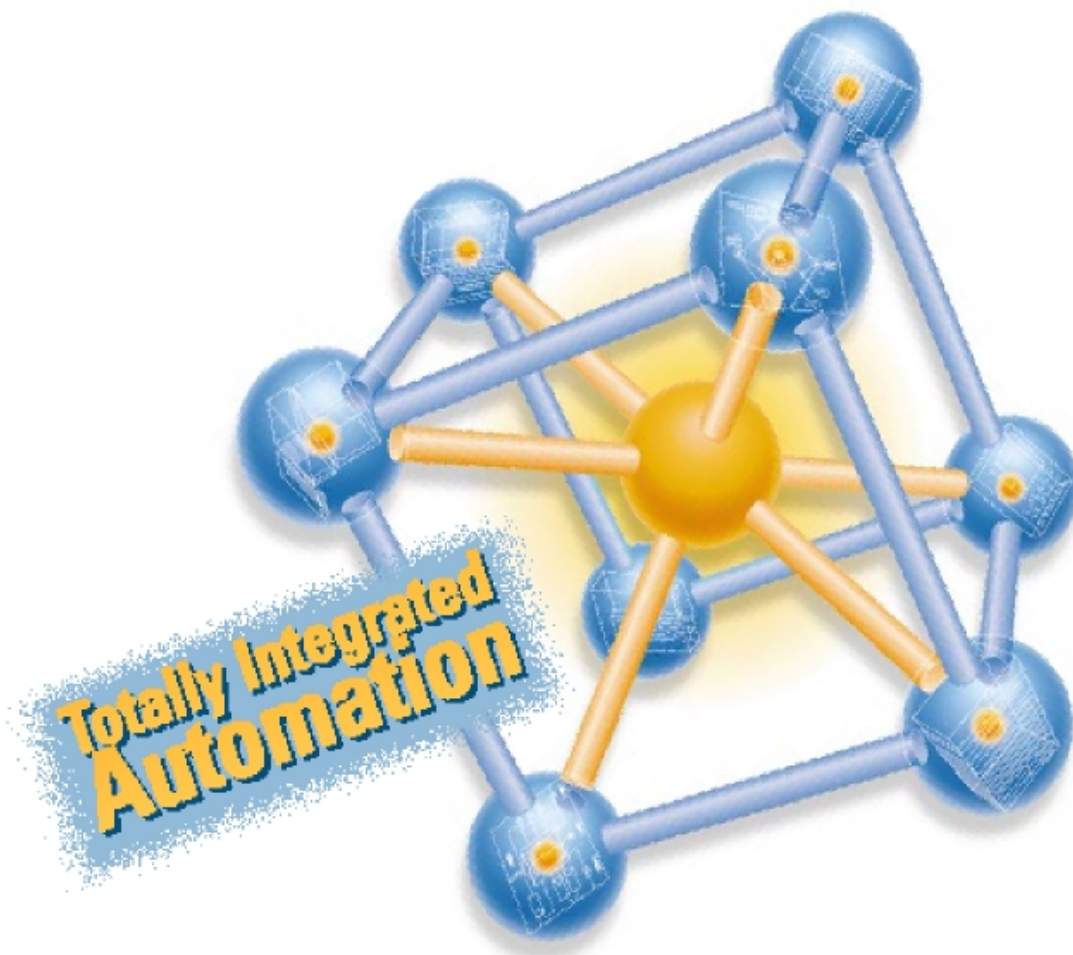
SIMATIC

Automation System S7-300

Getting Started

Edition 10/2001

Commissioning, First Steps CPU 31xC: Counting



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:

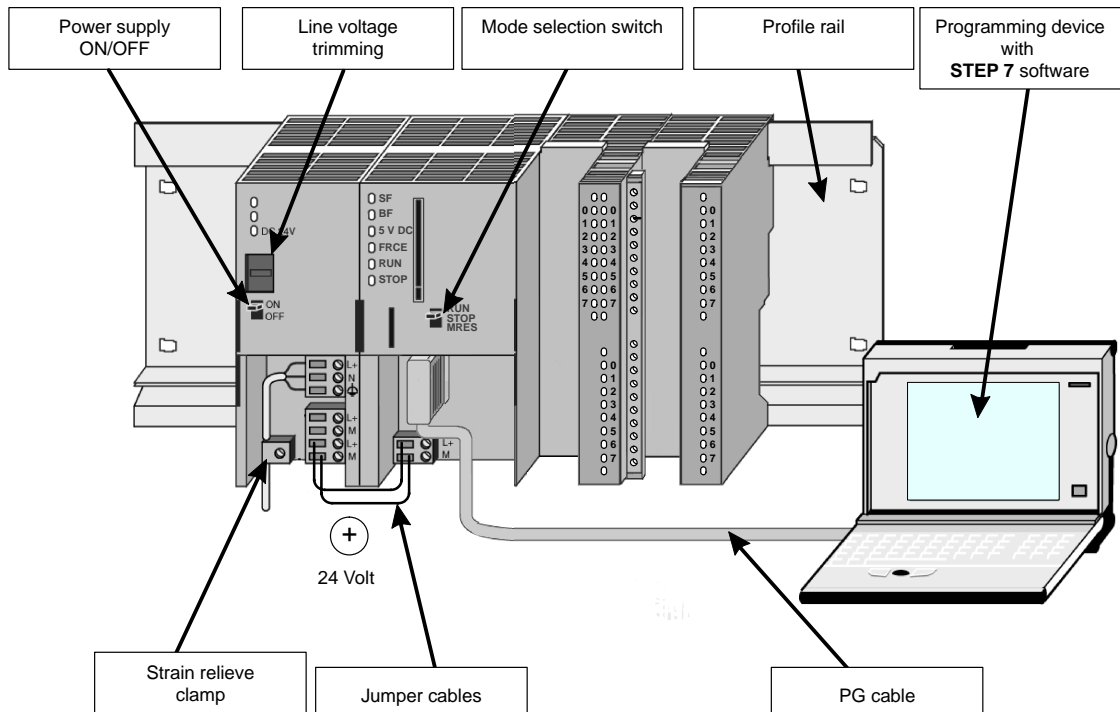
- You have installed an S7-300 station, consisting of a power supply module and a CPU 31xC.
- STEP 7 (\geq V5.1 + Servicepack 2) is correctly installed on your PG.
- The sample projects is available, either on your CD or you have downloaded them from the Internet.
- You have created a project for the 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!

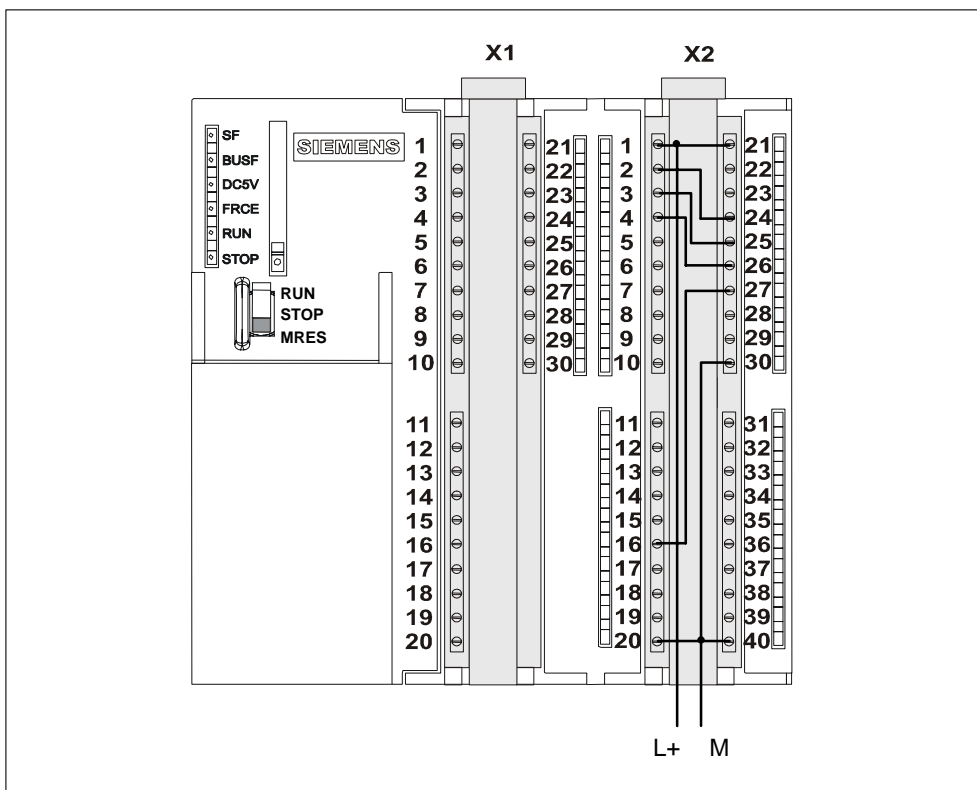
Step	Wire the power supply to the CPU
1	Connect the wired front plug to the CPU and screw fasten it.
2	Wire the connections for the "Count 1 First steps" as follows:

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:

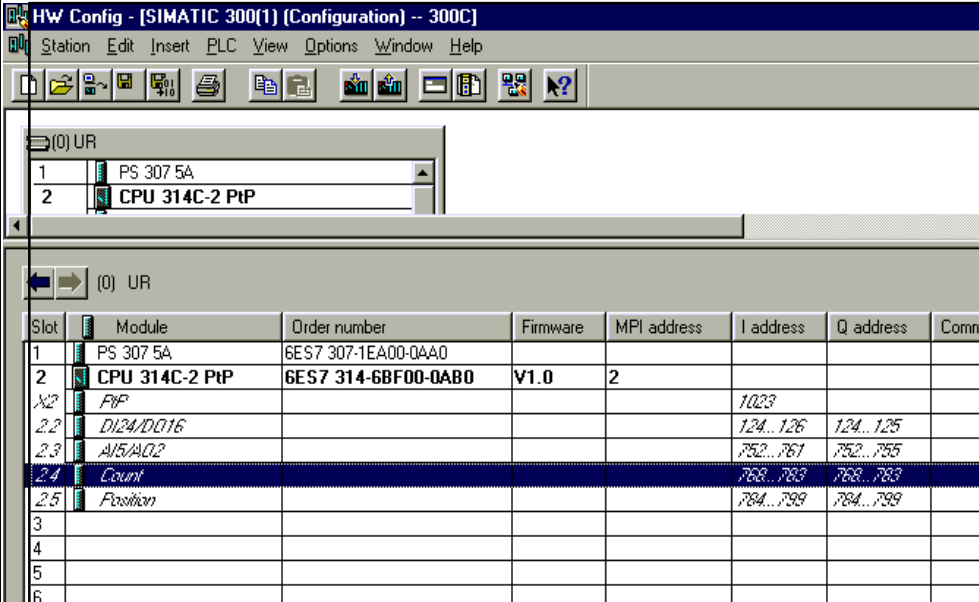
From CD:

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.  <p>The screenshot shows the HW Config window for a SIMATIC 300 station. It displays a rack configuration table with the following data:</p> <table border="1"> <thead> <tr> <th>Slot</th> <th>Module</th> <th>Order number</th> <th>Firmware</th> <th>MPI address</th> <th>I address</th> <th>Q address</th> <th>Comm</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>PS 307 5A</td> <td>6ES7 307-1EA00-0AA0</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>CPU 314C-2 PtP</td> <td>6ES7 314-6BF00-0AB0</td> <td>V1.0</td> <td>2</td> <td></td> <td></td> <td></td> </tr> <tr> <td>2.1</td> <td>PtP</td> <td></td> <td></td> <td></td> <td>1023</td> <td></td> <td></td> </tr> <tr> <td>2.2</td> <td>DI24/DO16</td> <td></td> <td></td> <td></td> <td>124...126</td> <td>124...125</td> <td></td> </tr> <tr> <td>2.3</td> <td>AI5/AO2</td> <td></td> <td></td> <td></td> <td>752...761</td> <td>752...755</td> <td></td> </tr> <tr> <td>2.4</td> <td>Count</td> <td></td> <td></td> <td></td> <td>768...769</td> <td>768...769</td> <td></td> </tr> <tr> <td>2.5</td> <td>Position</td> <td></td> <td></td> <td></td> <td>784...799</td> <td>784...799</td> <td></td> </tr> <tr> <td>3</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>4</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>5</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>6</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>7</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>8</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Slot	Module	Order number	Firmware	MPI address	I address	Q address	Comm	1	PS 307 5A	6ES7 307-1EA00-0AA0						2	CPU 314C-2 PtP	6ES7 314-6BF00-0AB0	V1.0	2				2.1	PtP				1023			2.2	DI24/DO16				124...126	124...125		2.3	AI5/AO2				752...761	752...755		2.4	Count				768...769	768...769		2.5	Position				784...799	784...799		3								4								5								6								7								8								
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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): <ul style="list-style-type: none"> • 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.

Step	Action	Result																					
3	Double-click on the "Function blocks" container.	You are shown all function blocks of the S7 program.																					
4	<p>Copy all function blocks to your project under SIMATIC 300 Station > CPU3xx > S7 Program > Function blocks.</p> <table border="1"> <thead> <tr> <th>Function block</th> <th>Name (in the symbol bar)</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>OB1:</td> <td>CYCLE_EXC</td> <td>Cyclic program</td> </tr> <tr> <td>FB11:</td> <td>GETST_C</td> <td>Sample 1: COUNT, First steps</td> </tr> <tr> <td>DB11:</td> <td>DI_GETST_C</td> <td>Instance DB to GETST_C</td> </tr> <tr> <td>SFB47:</td> <td>COUNT</td> <td>SFB COUNT</td> </tr> <tr> <td>DB16:</td> <td>DI_COUNT</td> <td>Instance DB to SFB COUNT</td> </tr> <tr> <td>VAT:</td> <td>VAT_GETST_C</td> <td>Variable table</td> </tr> </tbody> </table>	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	
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SFB47:	COUNT	SFB COUNT																					
DB16:	DI_COUNT	Instance DB to SFB COUNT																					
VAT:	VAT_GETST_C	Variable table																					
5	Copy the symbol table to your project under SIMATIC 300 Station > CPU3xx > S7 Program.	The symbol table is stored in your project.																					
6	In SIMATIC Manager, select SIMATIC 300 Station > CPU3xx > S7 Program > Function blocks .	You are shown all function blocks of the S7 program.																					
7	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_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	<p>In the variable S_IMP_H of the VAT, select the count pulse source:</p> <ul style="list-style-type: none"> • 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	<p>You can make the following tests.</p> <ul style="list-style-type: none"> • Starting/Stopping the counter: <ul style="list-style-type: none"> – 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. • Loading a count value to the counter: <ul style="list-style-type: none"> – JOB_ID = 01 hex (“Write counter directly”) – JOB_VAL = Count value (-2³¹ to +2³¹-1) – JOB_REQ = 1, job initiates at the positive edge 	<ul style="list-style-type: none"> • 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. • 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.