

How do you configure time synchronization using the NTP procedure (without SICLOCK) for small PCS 7 plants?

SIMATIC PCS 7

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Caution

The functions and solutions described in this article confine themselves predominantly to the realization of the automation task. Furthermore, please take into account that corresponding protective measures have to be taken in the context of Industrial Security when connecting your equipment to other parts of the plant, the enterprise network or the internet. Further information can be found in Entry ID: !50203404!.

<http://support.automation.siemens.com/WW/view/en/50203404>

Question

How do you configure time synchronization using the NTP procedure (without SICLOCK) for small PCS 7 plants?

Answer

In order to implement time synchronization in a PCS 7 plant it is always recommended to use a central plant clock (as described in the manual "[SIMATIC Process Control System PCS 7 Time synchronization \(V8.0\)](#)").

Generally, it is also possible to synchronize a small PCS 7 plant (e.g. test configuration) with operating system means. To do so, please see the following instruction.

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1 Introduction

This document includes instructions for configuring time synchronization in small PCS7 plants without an external time receiver (DCF77 -> SICLOCK, for example) and without Domain Controller (DC).

Detailed information on the topic of "Time Synchronization" is available in the following documents:

- [SIMATIC Process Control System PCS 7 Time synchronization \(V8.0\)](#)
- [SIMATIC Process Control System PCS 7 PCS 7 Readme V8.0 including Update 1](#)

The procedures described in this entry and the screenshots were created on the basis of Windows 7 / Windows Server 2008 R2, but are also applicable for Windows XP SP3 / Windows Server 2003 (R2).

2 Time Synchronization Using the NTP Procedure

All the PC stations of a PCS 7 plant can be synchronized using the NTP procedure. With the NTP procedure the network components fetch the time cyclically and actively from an NTP server.

In plants without a central plant clock it is recommended to implement a redundant OS server pair (in this example PC 1a and redundant PC 1b).

A NTP server is configured through the settings of the Group Policy Objects (GPOs) and WinCC "Time Synchronization" at the respective PC station. This procedure is described step-by-step in the following chapters.

In the case of failure of the NTP server which is configured on a non-redundant PC, a project-specific solution must be organized (synchronization over the internet or another NTP server, for example).

2.1 General configuration

- The service "Windows Time" (name of service "W32time") has to be started. The Startup type has to be "Automatic (Delayed Start)".
- In Windows Firewall create a new Inbound Rule that allows incoming connections on port "123"

2.2 Configuration of the NTP Server (PC 1a)

Proceed as follows to configure a PC station (PC 1a) as NTP server and thus synchronize other PC stations with it.

1. Log on as a user with administrator rights.
2. Open the Windows command line by clicking "Start > Run..." or with the key combination "Windows key + R".
3. Enter the command "gpedit.msc" in the "Open" input field.
4. In the tree view you select the folder "Policies for local computer > Computer configuration > Administrative templates > System > Windows Time Service".

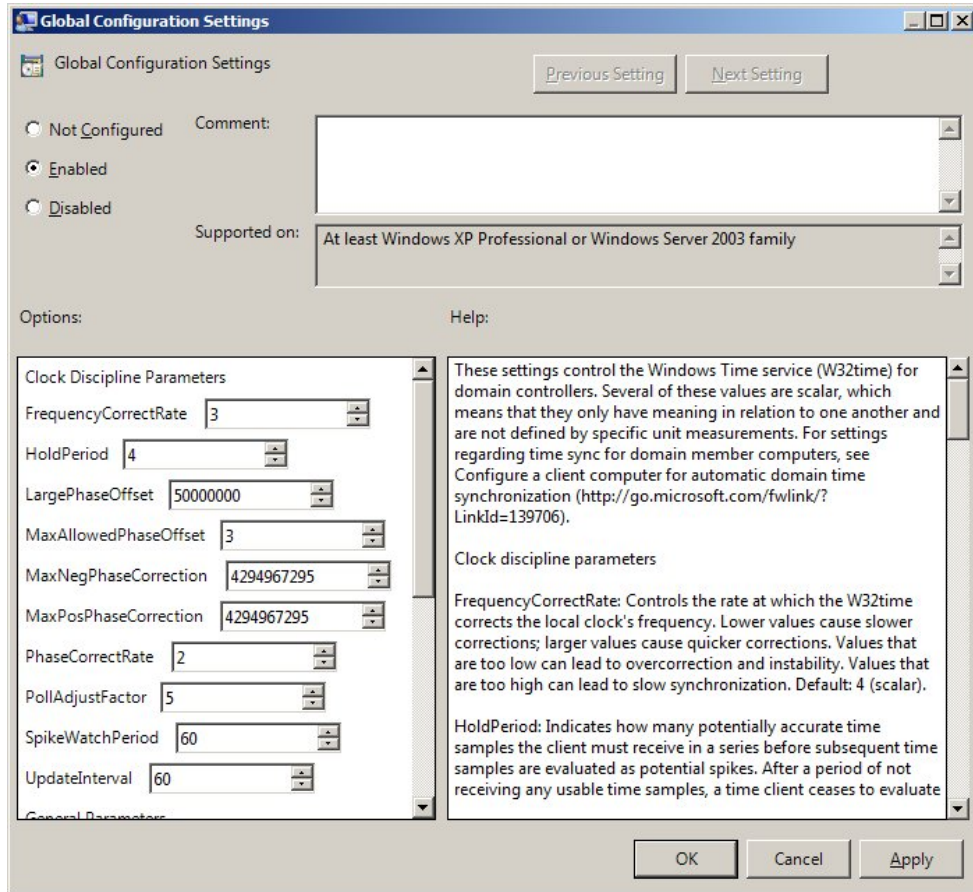
For Windows XP:

"Policies for local computer > Computer configuration > Administrative templates > System > Windows Time Service".

5. In the detail window you double-click the "Global Configuration Settings" object.
The "Global Configuration Settings" dialog opens.

6. Activate the "Enabled" option.

Figure 2-1



7. Make the following settings.

Table 2-1

| Field | Value |
|-----------------------|-----------------------------|
| FrequencyCorrectRate | 3 |
| HoldPeriod | 4 |
| LargePhaseOffset | 50000000 |
| MaxAllowedPhaseOffset | 3 |
| MaxNegPhaseCorrection | 4294967295 (max. value) (*) |
| MaxPosPhaseCorrection | 4294967295 (max. value) (*) |
| PhaseCorrectRate | 2 |
| PollAdjustFactor | 5 |
| SpikeWatchPeriod | 60 |
| UpdateInterval | 60 |
| AnnounceFlags | 5 |

| Field | Value |
|----------------------|-------|
| EventLogFlags | 2 |
| LocalClockDispersion | 10 |
| MaxPollInterval | 10 |
| MinPollInterval | 10 |

(*) In Windows XP and 2003 you can enter the value 0. The maximum value is set automatically after you hit the lower arrow key.

8. Leave all the other values in the standard settings.
9. Click on the "OK" button.
10. In the tree view of the "Editor for local group policies" you select the folder "Policies for local computer > Computer configuration > Administrative templates > System > Windows Time Service > Time Providers". The associated objects are displayed in the detail window.

For Windows XP:
 "Policies for local computer > Computer configuration > Administrative templates > System > Windows Time Service".

11. Make the following settings.

Table 2-2

| Object | Setting |
|------------------------------|---|
| Enable Windows NTP Client | Double-click the object and enable the "Disabled" option. |
| Configure Windows NTP Client | Double-click the object and enable the "Disabled" option. |
| Enable Windows NTP Server | Double-click the object and enable the "Enabled" option. |

12. Start the Windows input prompt as administrator.

For this you click "Start" in the taskbar and enter "cmd" in the "Search programs and files" field.

The search now displays the "cmd.exe" program as a result. Start the program with "Right-click > Run as administrator".

13. In the Window prompt you enter the following commands (replace "IP Address Server1" and "IP Address Server2" with the IP addresses of the two servers and please note the space in front of the secon IP Address):

w32tm /config /manualpeerlist:"<IP Address Server1>,0x1 <IP Address Server2>,0x1" /syncfromflags:manual /reliable:YES /update

Example:

w32tm /config /manualpeerlist:"192.168.178.201,0x1192.168.178.202,0x1" /syncfromflags:manual /reliable:YES /update

14. After changing the NTP service (W32time is the service, W32tm is the application for the service) you must restart it. You do this by restarting the computer.

Alternatively you can execute the commands below in the input prompt:

- **gpupdate /force**
- **w32tm /config /update**
- To stop and start the service:
 1. **net stop w32time**
 2. **net start w32time**

2.3 Configuration of a Redundant NTP Server (PC 1b)

Proceed as follows to configure a PC station (PC 1b) as a redundant NTP server:

1. Perform the steps 1 to 6 as in the section "Configuration of the NTP Server (PC 1a)".
2. Make the following settings in the "Global Configuration Settings" dialog.

Table 2-3

| Field | Value |
|-----------------------|-------------------------|
| FrequencyCorrectRate | 3 |
| HoldPeriod | 4 |
| LargePhaseOffset | 50000000 |
| MaxAllowedPhaseOffset | 3 |
| MaxNegPhaseCorrection | 4294967295 (max. value) |
| MaxPosPhaseCorrection | 4294967295 (max. value) |
| PhaseCorrectRate | 2 |
| PollAdjustFactor | 5 |
| SpikeWatchPeriod | 60 |
| UpdateInterval | 60 |
| AnnounceFlags | 10 |
| EventLogFlags | 2 |
| LocalClockDispersion | 10 |
| MaxPollInterval | 10 |
| MinPollInterval | 10 |

3. Leave all the other values in the standard settings.
4. Click the "OK" button.
5. In the tree view of the "Editor for local group policies" you select the folder "Policies for local computer > Computer configuration > Administrative templates > System > Windows Time Service > Time Providers". The associated objects are displayed in the detail window.
6. Make the following settings.

Table 2-4

| Object | Setting |
|------------------------------|---|
| Enable Windows NTP Client | Double-click the object and enable the "Enabled" option. |
| Configure Windows NTP Client | Double-click the object and enable the "Enabled" option. Settings see chapter 2.4, step 9. |
| Enable Windows NTP Server | Double-click the object and enable the "Enabled" option. |

7. Start the Windows input prompt as administrator (chapter 2.2, step 12).
8. In the Window prompt you enter the following commands (replace "IP Address Server1" and "IP Address Server2" with the IP addresses of the two servers):

```
w32tm /config /manualpeerlist:"<IP Address Server1>,0x1 <IP Address Server2>,0x1" /syncfromflags:manual /reliable:YES /update
```

9. After changing the NTP service (W32time is the service, W32tm is the application for the service) you must restart it. You do this by restarting the computer.

Alternatively you can execute the commands below in the input prompt:

- **gpupdate /force**
- **w32tm /config /update**
- **w32tm /resync**
- To stop and start the service:
 1. **net stop w32time**
 2. **net start w32time**

2.4 Configuration of the NTP Client

Proceed as follows to configure your local computer as NTP Client.

1. Log on as a user with administrator rights.
2. Enter the command "gpedit.msc" in the Windows command line.
3. In the tree view of the editor you mark the folder "Policies for local computer > Computer configuration > Administrative templates > System > Windows Time Service > Time Providers".
4. In the detail window of the editor you double-click the "Enable Windows NTP Client" object.
5. Enable the "Enabled" option.
6. Click the "OK" button.
7. In the detail window you double-click the "Configure Windows NTP Client" object.
8. Enable the "Enabled" option.
9. Make the following settings
 - In the "NtpServer" input field you enter the IP address of the NTP server: "<IP Address Server1>,0x9" (for example 192.168.178.201,0x9).
 - For redundant servers you enter in addition the IP address of the second NTP server separated by a space: "<IP Address Server1>,0x9 <IP Address Server2>,0x9" (for example 192.168.178.201,0x9 192.168.178.202,0x9).
 - Select the "NTP" entry from the "Type" drop-down list.
 - Enter the value "60" in the "SpecialPollInterval" input field.
10. Click the "OK" button.
11. Start the Windows input prompt as administrator (chapter 2.2, step 12).
12. In the Window prompt you enter the following commands (replace "IP Address Server1" and "IP Address Server2" with the IP addresses of the two servers):

w32tm /config /manualpeerlist:"<IP Address Server1>,0x1 <IP Address Server2>,0x1" /syncfromflags:manual /update

Example:

```
w32tm /config /manualpeerlist:"192.168.178.201,0x1192.168.178.202,0x1" /syncfromflags:manual /reliable:YES /update
```

13. After changing the NTP service (W32time is the service, W32tm is the application for the service) you must restart it. You do this by restarting the computer.

Alternatively you can execute the commands below in the input prompt:

- ***gpupdate /force***
- ***w32tm /config /update***
- ***w32tm /resync***
- To stop and start the service:
 1. ***net stop w32time***
 2. ***net start w32time***

2.5 Resetting the W32time Service

Proceed as follows to reset the W32time service.

Start the Windows input prompt as administrator (chapter 2.2, step 12) and execute the following command:

1. ***w32tm /config /update***
2. ***net stop w32time***
3. ***w32tm /unregister***
4. ***w32tm /register***
5. ***net start w32time***

2.6 Configuration of an AS for the NTP Procedure

Information about how to configure an AS for the NTP procedure is available in the manual "[SIMATIC Process Control System PCS 7 Time Synchronization \(V8.0\)](#)".

The automation system in this case is configured as time master for the time synchronization.

2.7 Configuration of IE Switches

IE switches (depending on the type used) provide the option of synchronizing the system time with external clocks.

Entries in the Event Log table are given a uniform time stamp throughout the plant. In this way events can be sorted chronologically, which helps find the cause of failures faster.

Please refer to the product-specific manuals for information about enabling and disabling synchronization of the IE switch system time over an SNTP server in the network.

Note

You must ensure that each network only contains one time master for providing the time. Separate message frame traffic between the networks.

Use the switch to transfer only the time signals from the central plant clock to the relevant network. The function for separating message frame traffic is dependent on the components used for connecting the networks.

- For SCALANCE Switches (for example SCALANCE X414-3E)
> Function "Access Control"
- For OSM /ESM
> Function "Port Lock"

Bidirectional communication is disabled if the corresponding function is activated.

You can find further information and basics in the following sources:

- Manual "SIMATIC Process Control System PCS 7 Time synchronization" in the chapter "Network environment of a PCS 7 plant"
- [SICLOCK web page](#), for example "App_Note_0002.pdf"
- Manual "Industrial Communication; Industrial Ethernet Switches; SCALANCE X-300; SCALANCE X-400"
- Manual "SIMATIC NET; Industrial Ethernet OSM/ESM; Industrial Ethernet OSM/ESM"

3 Diagnostics

3.1 Checking the Time Synchronization

Proceed as follows to check the time synchronization:

1. Start the Windows input prompt as administrator (chapter 2.2, step 12).
2. You can use the command below to query the time servers currently set.
Windows 7: **w32tm /query /configuration** and **w32tm /query /status**
Windows XP: **net time /queryntp**
3. Use the command below to display a diagram showing the time difference between the computer currently being used and the time server <computer name>.

w32tm /stripchart /computer:<Computername>

Example:

Command: **w32tm /stripchart /computer:DC1**

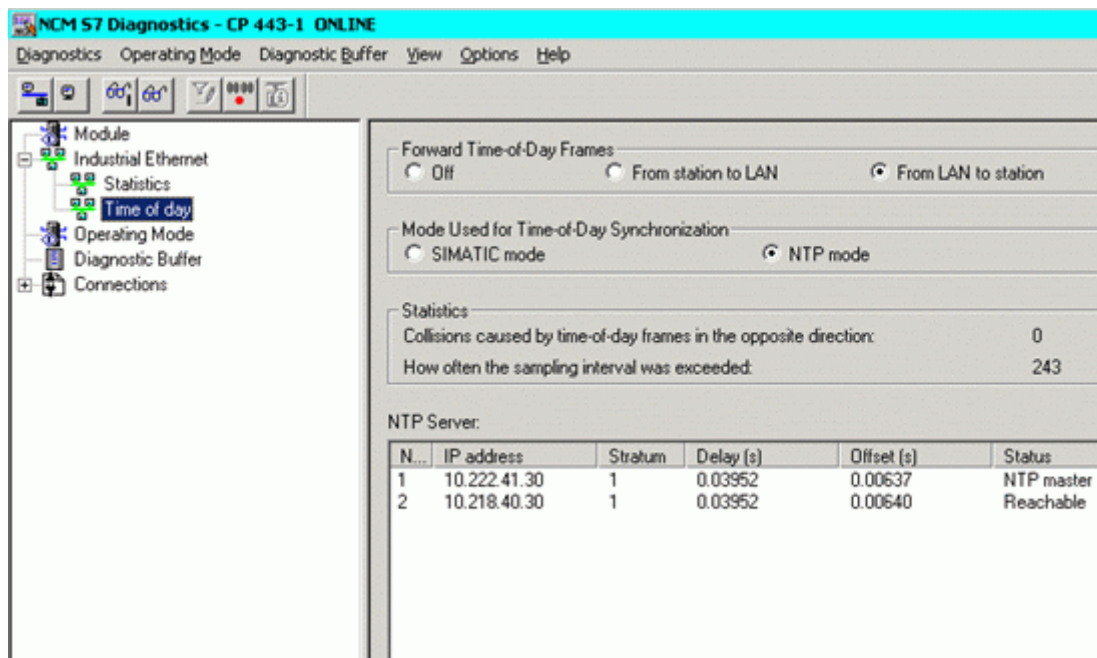
You now get the time difference between the computer currently being used and the domain controller "DC1".

3.2 NCM S7 Diagnostics

You can call the NCM S7 Diagnostics with the command "Windows > SIMATIC -> STEP 7 -> NCM S7 -> Diagnostics".

Alternatively you can also open the NCM S7 Diagnostics with the SIMATIC Manager. For this, in the pop-up menu of the IE CP you select the command "PLC -> Module status" and in the "General" tab you click the "Special diagnostics" button.

Figure 3-1



The configured NTP servers (max. 4) are displayed in the "NTP Server" area of the diagnostics dialog. The NTP servers are addressed by the CP and their reply messages evaluated. The NTP server with the greatest precision is chosen. This ensures that the station with the most precise time is synchronized.

The NTP servers can have the following statuses:

- NTP master
The display appears for the NTP server that has the greatest accuracy and which is selected by the CP as NTP server.
- Reachable
The configured NTP server can be reached and also sends time-of-day messages. The time is not used for synchronizing the station.
- Not reachable
The configured NTP server does not reply to the NTP queries sent.

If all the configured NTP servers can be reached, but none of them is displayed as NTP master, this might be due to the following:

- The time of the NTP server is evaluated as imprecise. In the CP's firmware there are checks that are defined in the corresponding RFCs (Internet Standard).
- There are multiple time stamps in the NTP message. If an NTP server is not synchronized externally, this is noted accordingly in the time stamps in the messages. The consequence is that the time-of-day of these NTP servers is not accepted.

If no NTP master is displayed among the reachable NTP servers, in addition, the "How often the sampling interval was exceeded" counter is increased by 1 after expiry of the sampling interval.

Note

All CPs that have a firmware version older than installed on the modules do not react to the reply message of an NTP server if the server does not have an even-numbered NTP version, V2.x or V4.x, for example.

In this case, you must upgrade the module with the latest firmware version. All more recent modules that support time-of-day synchronization by means of NTP also accept reply messages from other NTP server versions.

4 Additional Information

For more information, go to:

- Siemens:
 - [SIMATIC Process Control System PCS 7 Time synchronization \(V8.0\)](#)
 - [SIMATIC Process Control System PCS 7 Time synchronization \(V7.1\)](#)

- Microsoft:
 - <http://technet.microsoft.com/en-us/library/cc773013%28WS.10%29.aspx>
 - <http://support.microsoft.com/kb/816042>
 - [http://technet.microsoft.com/en-us/library/cc773263\(WS.10\).aspx](http://technet.microsoft.com/en-us/library/cc773263(WS.10).aspx)