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# Project planning of the NTP time synchronization of a Process Historian and Information Server

SIMATIC PCS 7, SIMATIC Information Server 2014

<https://support.industry.siemens.com/cs/ww/en/view/66579062>

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# 1 Introduction

## NTP time synchronization

The Network Time Protocol (NTP) is a standard for synchronizing clocks in computer networks. The UDP port 123 is reserved for NTP. This example uses the NTP functionality of the operating system.

## Operator Station PC Station

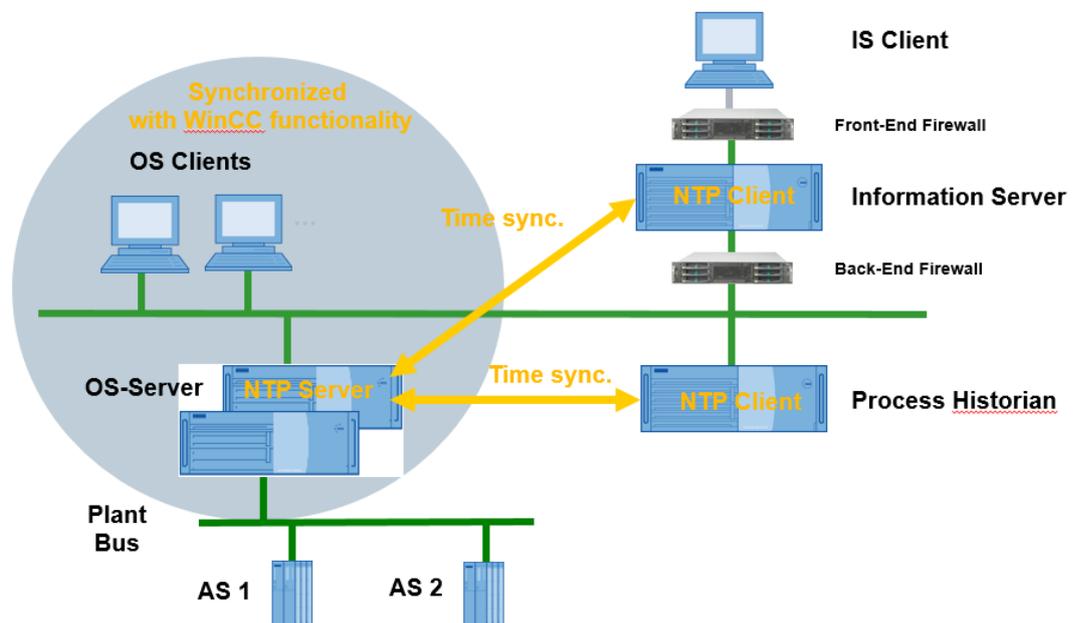
In PCS 7, an Operator Station with the "WinCC Time Synchronization" application has an integrated option of time synchronization. For clock synchronization of the PC station, you must configure the "WinCC Timesynchronization" application.

## Process Historian and Information Server

The Process Historian and Information Server do not have internal functionality for time synchronization. This description assumes that the time synchronization in the PCS 7 system, including the OS systems, is configured and functioning correctly. With the help of Microsoft Windows, the time of the PH and IS is synchronized with the OS Server.

## Overview

The overview below shows the PH and IS computers in the PCS 7 environment that are to be synchronized. The network is operated in a workgroup.



In this example, we will use the following computer names:

Process Historian = PH01 = Windows Server 2012 R2

Information Server = IS80 = Windows 10

OS Server1 = SV80A = Windows Server 2016 = IP 172.80.0.2

OS Server1 = SV80B = Windows Server 2016 = IP 172.80.0.3

In this document you will find instructions for clock synchronization in small PCS 7 systems without an external DCF77 time master and without a domain controller (DC).

**Note:**

An IS client can also be time-synchronized using the NTP procedure. The procedure is comparable to PH / IS time synchronization.

## 2 Time synchronization via the NTP method

All PC stations of a PCS 7 system can be synchronized via the NTP process. With the NTP procedure, the network components retrieve the time cyclically and actively from an NTP server. In devices without central system clock it is recommended to use a redundant OS server pair. An NTP server is configured using the Group Policy Objects (GPOs) settings at the appropriate PC station. This procedure is described step by step in the following sections. If the NTP server, which is configured on a non-redundant computer, fails, a project-specific solution must be worked out (e.g. synchronization via the Internet or another NTP server).

### 2.1 Requirements

- The service "Windows Time" (service name "W32Time") must be started on all computers to be synchronized.

The "Startup type" of the service must be "Automatic (Delayed Start)".

- In the Windows Firewall, create an incoming rule that allows connections for the UDP port "123".

### 3 Start the Windows time service

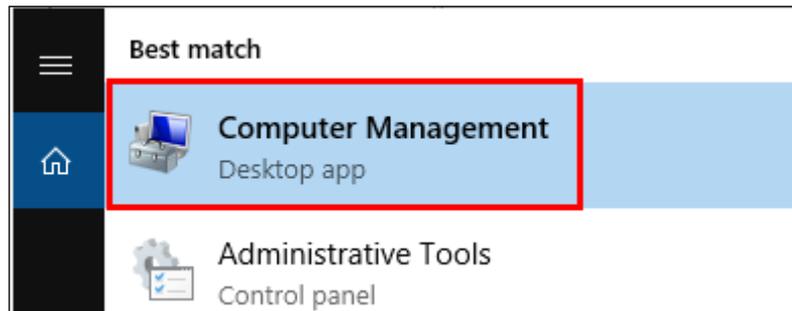
1. Click the "Find" icon in the taskbar.



2. Enter "Computer Management".

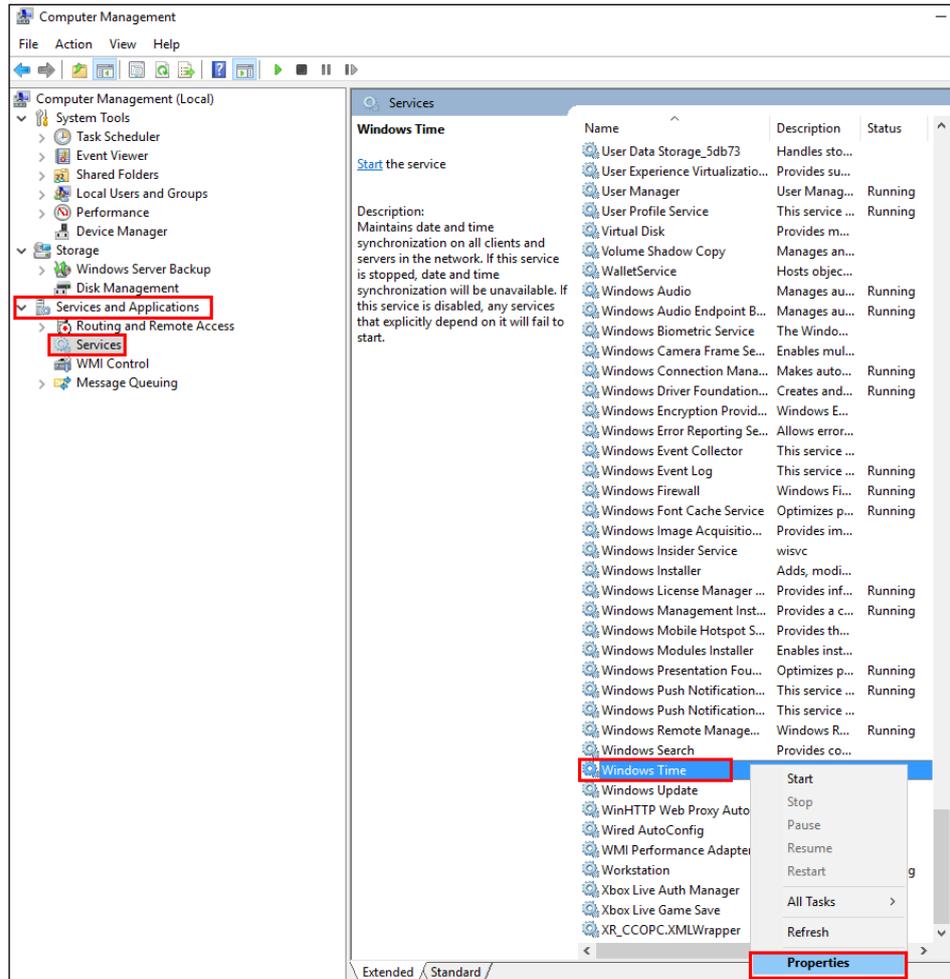


3. Start "Computer Management".



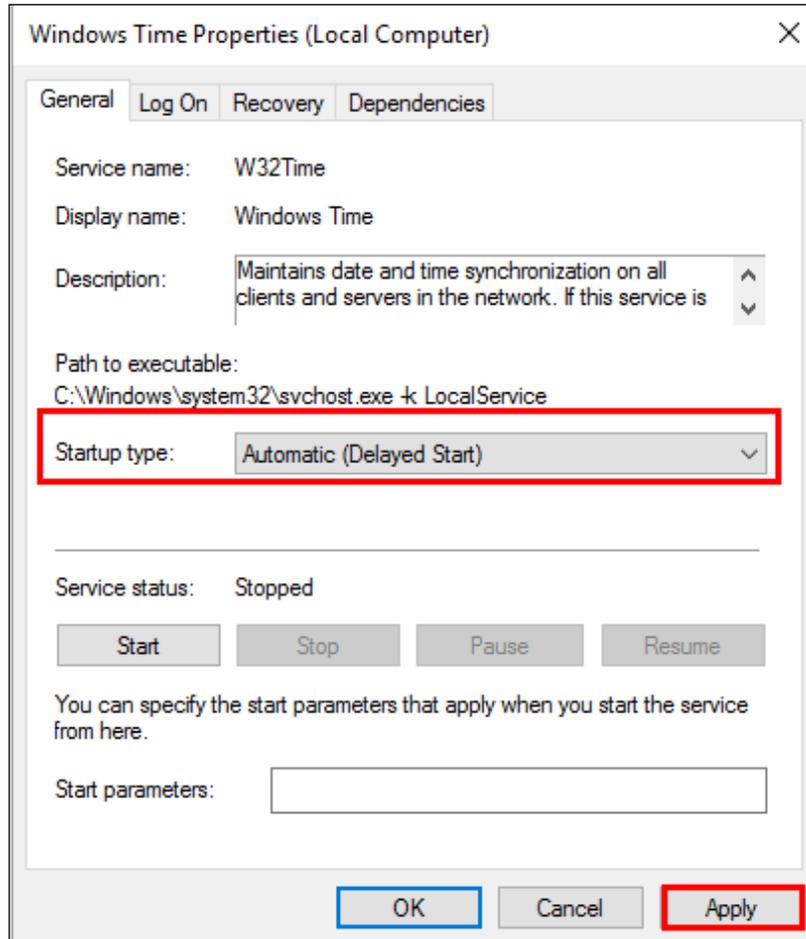
4. Navigate to the "Services and Applications > Services" folder.
5. Open the Properties object of the "Windows Time" service with a right mouse click.

### 3 Start the Windows time service

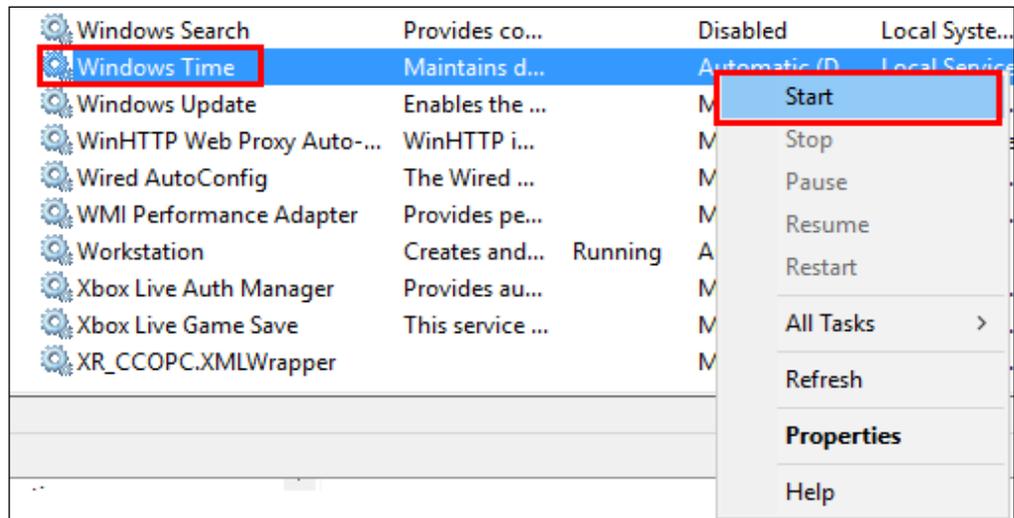


6. Configure the "Startup type" "Automatic (Delayed Start)" and click on the "Apply" button and then on the "OK" button.

### 3 Start the Windows time service

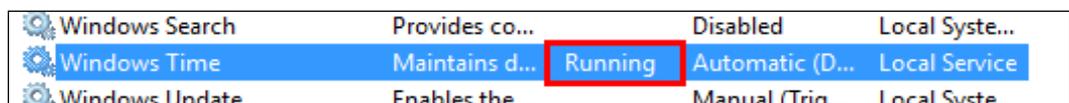


- Open the context menu of the service "Windows Time" with a right mouse click and click on "Start" to start the service.



#### Result:

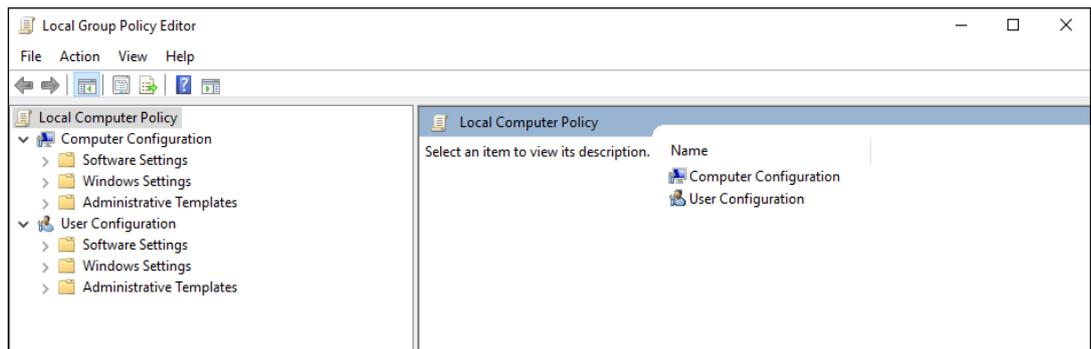
The Windows Time service is started.



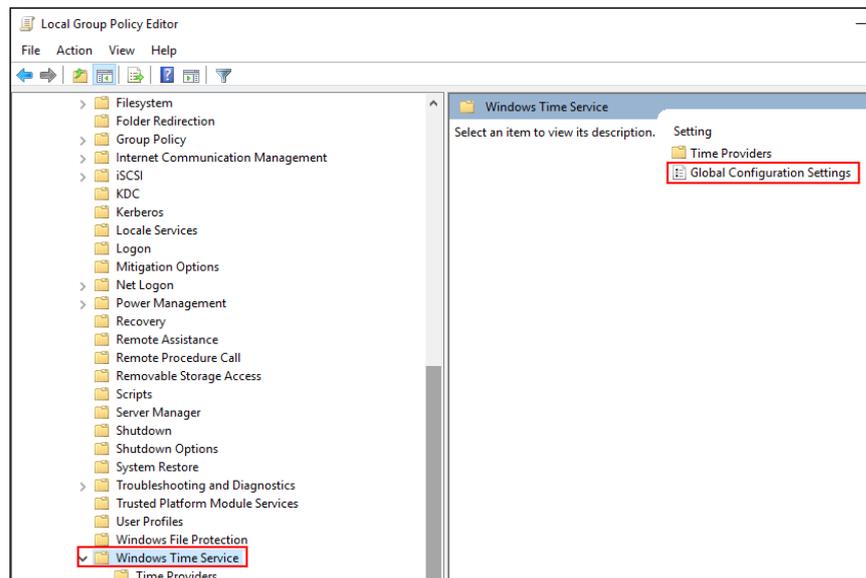
## 4 Configuring the NTP Master on the OS Server SV80A (OS Master)

To configure a PC station (SV80A computer) as an NTP server and thus to synchronize other PC stations with it, proceed as follows:

1. Log in with a user with administrative rights.
2. Open the Windows command line by pressing the key combination "Windows key + R".
3. Enter the command "gpedit.msc" in the input field "Open". This opens the "Local Group Policy Editor" dialog.

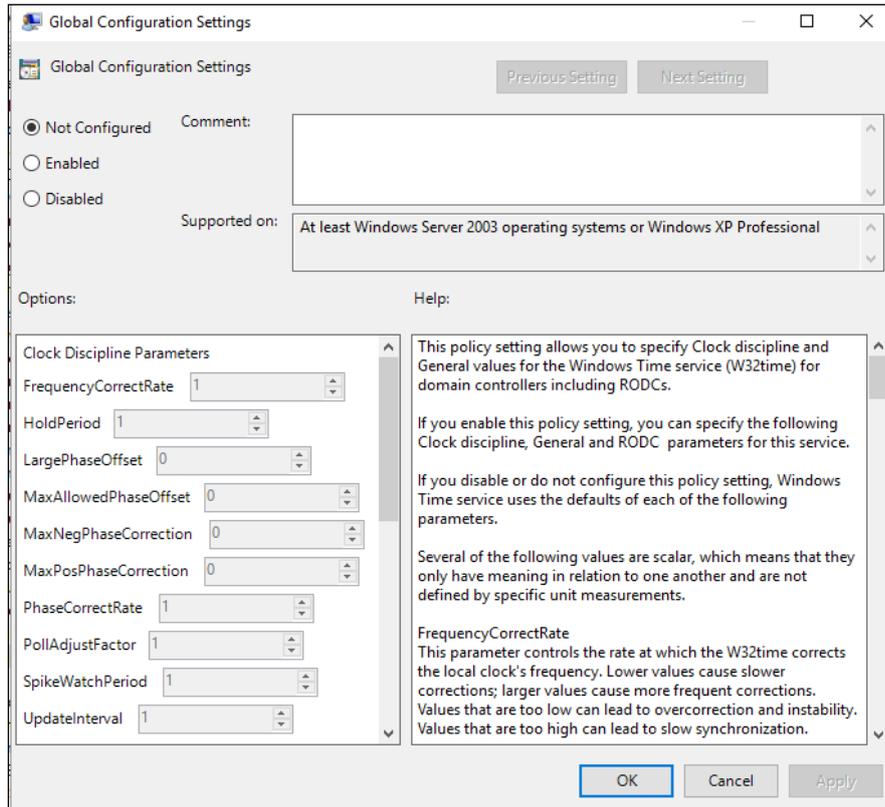


4. In the tree view, select the folder "Local Computer Policy > Computer Configuration > Administrative Templates > System > Windows Time Service".
5. Double-click on the "Global Configuration Setting" object in the details window.



The "Global Configuration Setting" dialog opens.

#### 4Configuring the NTP Master on the OS Server SV80A (OS Master)

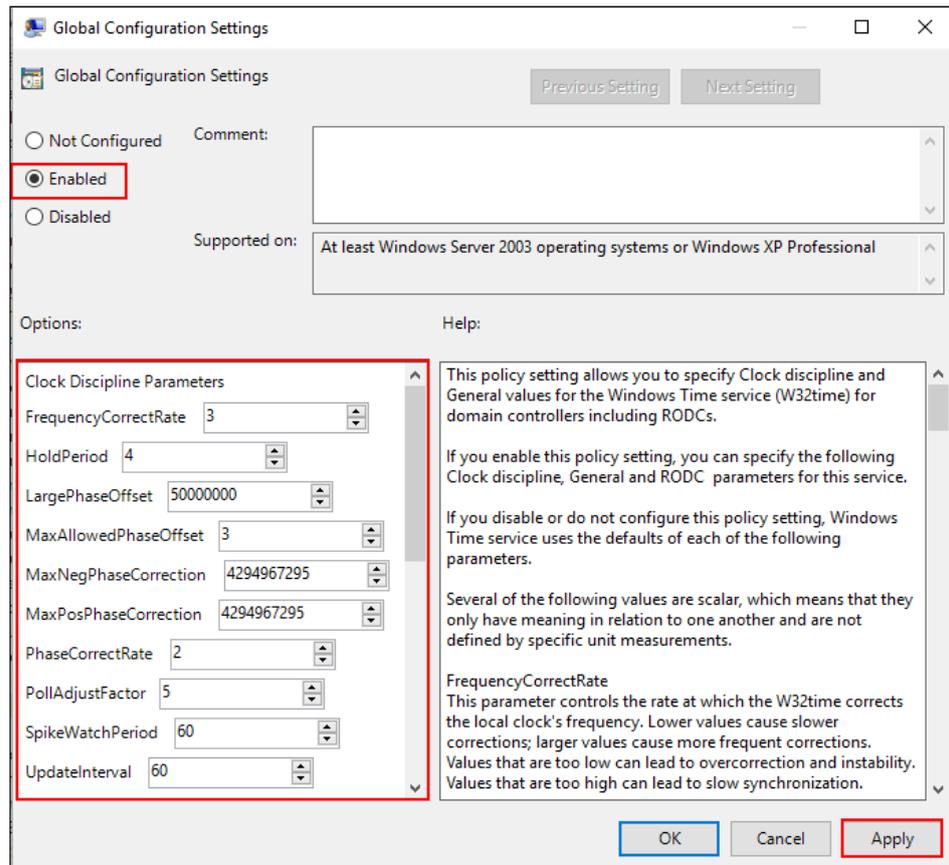


6. Activate the option "Enabled".
7. Make the following settings:

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
EventLogFlags	2
LocalClockDispersion	10
MaxPollInterval	10
MinPollInterval	10

8. Leave all other values at the default setting.
9. Click the "Apply" button.

#### 4Configuring the NTP Master on the OS Server SV80A (OS Master)



10. Click on the "OK" button.
11. In the tree view of the editor "Local Group Policy Editor" select the folder "Local Computer Policy > Computer Configuration > Administrative Templates > System > Windows Time Service > Time Provider". The corresponding objects are displayed in the detail window.
12. Make the following settings:

Object	Setting
Activate Windows NTP Client	Double-click the object and activate the option "Disabled".
Configuring the Windows NTP Client	Double-click the object and activate the option "Disabled".
Activate Windows NTP Server	Double-click the object and activate the option "Enabled".

13. Close the "Local Group Policy Editor" dialog.
12. start the Windows command prompt as administrator.  
To do this, click the "Find" icon in the taskbar and type "cmd". The search result now shows the "Command Prompt" program. Start the program with a right click as "Run as administrator".
13. At the Windows command prompt, type the following commands (replace "IP address Server1" and "IP address Server2" with the IP addresses of the two servers and note the space before the second IP address):

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

### Example:

```
w32tm /config /manualpeerlist:"172.80.0.2,0x1 172.80.0.3,0x1"  
/syncfromflags:manual /reliable:YES /update
```

```
C:\Users\Administrator>w32tm /config /manualpeerlist:"172.80.0.2,0x1 172.80.0.3,0x1" /syncfromflags:manual /reliable:YES  
/update  
The command completed successfully.  
C:\Users\Administrator>
```

14. after changes to the NTP service (W32time is the service, W32tm the Application to Service) it must be restarted. You achieve this via a computer restart.

Alternatively, you can run the following commands at the command prompt:

1. gpupdate /force
2. w32tm /config /update

Starting and stopping the service:

3. net stop w32time
4. net start w32time

```
C:\Users\Administrator>gpupdate /force  
Updating policy...  
  
Computer Policy update has completed successfully.  
User Policy update has completed successfully.  
  
C:\Users\Administrator>w32tm /config /update  
The command completed successfully.  
  
C:\Users\Administrator>net stop w32time  
The Windows Time service is stopping.  
The Windows Time service was stopped successfully.  
  
C:\Users\Administrator>net start w32time  
The Windows Time service is starting.  
The Windows Time service was started successfully.
```

## 5 Configuring NTP Master on OS Server SV80B (OS Standby)

To configure a PC station (computer SV80B) as a redundant NTP server, proceed as follows:

1. Perform steps 1 to 6 described in section 1.4 "Configuring the NTP Master on the OS Server SV80A (OS Master)".
2. Make the following settings in the "Global Configuration Settings" dialog:

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
<b>AnnounceFlags</b>	<b>10</b>
EventLogFlags	2
LocalClockDispersion	10
MaxPollInterval	10
MinPollInterval	10

5. Leave all other values at the default setting.

## 5Configuring NTP Master on OS Server SV80B (OS Standby)

**Global Configuration Settings**

Global Configuration Settings

Previous Setting Next Setting

Not Configured Comment:   
 Enabled   
 Disabled

Supported on: At least Windows Server 2003 operating systems or Windows XP Professional

Options: Help:

**Clock Discipline Parameters**

FrequencyCorrectRate 3

HoldPeriod 4

LargePhaseOffset 50000000

MaxAllowedPhaseOffset 3

MaxNegPhaseCorrection 4294967295

MaxPosPhaseCorrection 4294967295

PhaseCorrectRate 2

PollAdjustFactor 5

SpikeWatchPeriod 60

UpdateInterval 60

**General Parameters**

AnnounceFlags 10

EventLogFlags 2

LocalClockDispersion 10

MaxPollInterval 10

MinPollInterval 10

RequireSecureTimeSyncRequests 0

UtilizeSslTimeData 1

ChainEntryTimeout 16

ChainMaxEntries 128

ChainMaxHostEntries 4

ChainDisable 0

ChainLoggingRate 30

This policy setting allows you to specify Clock discipline and General values for the Windows Time service (W32time) for domain controllers including RODCs.

If you enable this policy setting, you can specify the following Clock discipline, General and RODC parameters for this service.

If you disable or do not configure this policy setting, Windows Time service uses the defaults of each of the following parameters.

Several of the following values are scalar, which means that they only have meaning in relation to one another and are not defined by specific unit measurements.

**FrequencyCorrectRate**  
This parameter controls the rate at which the W32time corrects the local clock's frequency. Lower values cause slower corrections; larger values cause more frequent corrections. Values that are too low can lead to overcorrection and instability. Values that are too high can lead to slow synchronization. Default: 4 (scalar).

**HoldPeriod**  
This parameter indicates how many potentially accurate time samples the client computer must receive in a series before subsequent time samples are evaluated as potential spikes. After a period of not receiving any usable time samples, a time client ceases to evaluate time samples for spikes as soon as the first potentially accurate time sample is received. When a series of time samples (as indicated by HoldPeriod) is received, the time client evaluates subsequent time samples for spikes. A time sample is considered to be a spike when the time difference between a time sample and the client computer's local clock is greater than that of the LargePhaseOffset value. Default: Five time samples.

**LargePhaseOffset**  
This parameter specifies the time variation from the client computer's local clock (phase offset) that a time sample must have to be considered a spike. Time samples that have time variations larger than the LargePhaseOffset value are considered spikes. Default: 50,000,000 100-nanosecond units (ns), which is five seconds.

**MaxAllowedPhaseOffset**  
This parameter controls how W32time corrects the clock based on the size of the calculated time variation between the time sample and the client computer's local clock. If a response is received that has a time variation that is larger than this value, W32time sets the client computer's local clock immediately to the time that is accepted as accurate from the Network Time Protocol (NTP) server. If the time variation is less than this value, the client computer's local clock is corrected gradually. Default: 300 seconds.

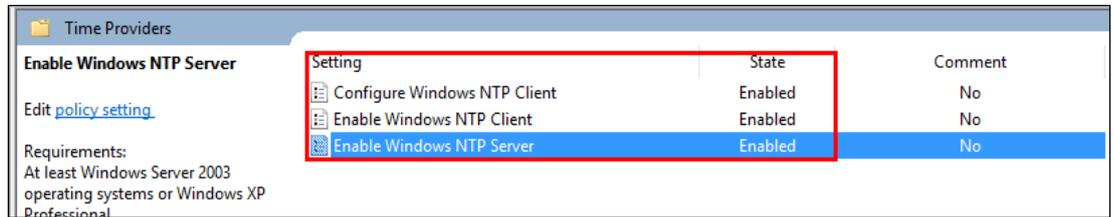
OK Cancel Apply

4. click on the "OK" button.
6. In the tree view of the editor " Local Group Policy Editor " select the folder "Local Computer Policy > Computer Configuration > Administrative Templates > System > Windows Time Service > Time Provider". The corresponding objects are displayed in the detail window.
7. Make the following settings:

Object	Setting
Activate Windows NTP Client	Double-click the object and activate the option "Enabled".
Configuring the Windows NTP Client	Double-click the object and activate the option "Enabled".

## 5Configuring NTP Master on OS Server SV80B (OS Standby)

Object	Setting
Activate Windows NTP Server	Double-click the object and activate the option "Enabled".



7. Start the Windows command prompt as administrator (section 1.4, Step 12).

8. At the Windows command prompt, type the following commands (replace "IP-Address Server1" and "IP-Address Server2" with the IP Addresses of both servers):

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

### Example:

w32tm /config /manualpeerlist:"172.80.0.2,0x1 172.80.0.3,0x1"  
/syncfromflags:manual /reliable:YES /update

9. after changes to the NTP service (W32time is the service, W32tm the Application to Service) it must be restarted. You achieve this via a computer restart.

Alternatively, you can run the following commands at the command prompt:

1. gpupdate /force
2. w32tm /config /update
3. w32tm /resync

Starting and stopping the service:

4. net stop w32time
5. net start w32time

```
Administrator: Command Prompt
Microsoft Windows [Version 10.0.14393]
(c) 2016 Microsoft Corporation. All rights reserved.

C:\Users\Administrator>w32tm /config /manualpeerlist:"172.80.0.2,0x1 172.80.0.3,0x1" /syncfromflags:manual /reliable:YES /update
The command completed successfully.

C:\Users\Administrator>gpupdate /force
Updating policy...

Computer Policy update has completed successfully.
User Policy update has completed successfully.

C:\Users\Administrator>w32tm /config /update
The command completed successfully.

C:\Users\Administrator>w32tm /resync
Sending resync command to local computer
The computer did not resync because no time data was available.

C:\Users\Administrator>net stop w32time
The Windows Time service is stopping.
The Windows Time service was stopped successfully.

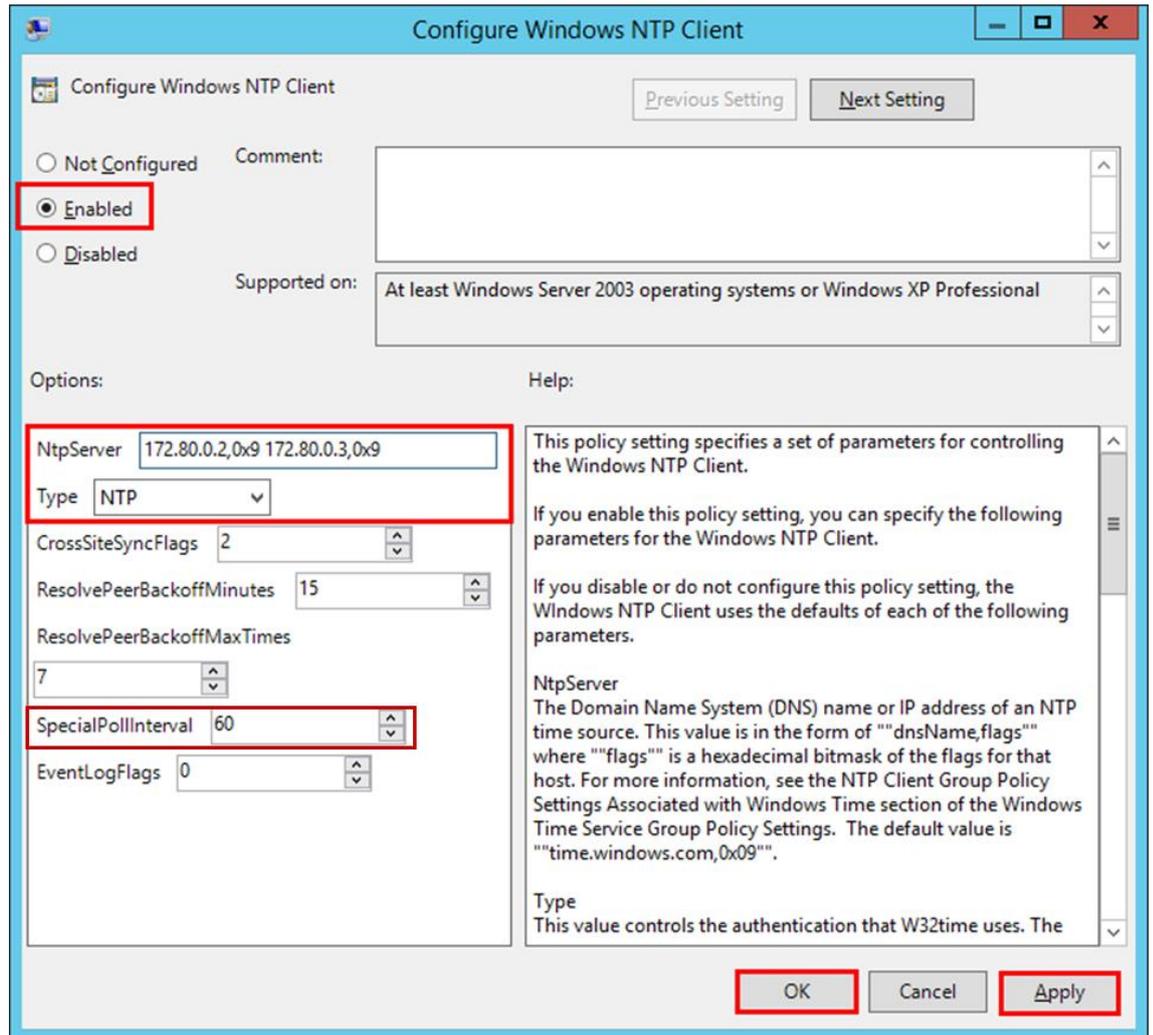
C:\Users\Administrator>net start w32time
The Windows Time service is starting.
The Windows Time service was started successfully.

C:\Users\Administrator>
```

## 6 Configuring the NTP Client

### 6.1 NTP Client on the PH configuration

1. Log in with a user with administrative rights.
2. Enter the command "gpedit.msc" into the Windows command line.
3. In the tree view of the editor " Local Group Policy Editor " select the folder "Local Computer Policy > Computer Configuration > Administrative Templates > System > Windows Time Service > Time Provider".
4. Double-click on the "Enable Windows NTP Client" object in the detail window of the editor.
5. Activate the "Enable" option.
6. Click on the "Apply" button and then on the "OK" button.
7. Double-click on the "Configure Windows NTP Client" object in the details window.
8. Activate the "Enable" option.
9. Select the following settings:
  - Enter the IP address of the NTP server in the "NtpServer" input field. as follows: "<IP-Adresse Server1>,0x9" (e.g. *172.80.0.2,0x9*).
  - For redundant servers, also enter the IP address of the second NTP server, separated by spaces: "<IP-Adresse Server1>,0x9 <IP-Adresse Server2>,0x9" (e.g. *172.80.0.2,0x9 172.80.0.3,0x9*).
  - Select the entry "NTP" from the dropdown list "Type".
  - Enter the value "60" in the input field "SpecialPollInterval".
  - For all other settings take the default values.
10. Click on the "Apply" button and then on the "OK" button.



11. Start the Windows command prompt as administrator (section 1.4, Step 12).

At the Windows command prompt, type the following commands (replace "IP-Address Server1" and "IP-Address Server2" with the IP Addresses of both servers):

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

Example:

```
w32tm /config /manualpeerlist:" 172.80.0.2,0x1 172.80.0.3,0x1"
/syncfromflags:manual /reliable:YES /update
```

12. after changes to the NTP service (W32time is the service, W32tm the Application to Service) it must be restarted. You achieve this via a computer restart.

Alternatively, you can run the following commands at the command prompt:

1. gpupdate /force
2. w32tm /config /update
3. w32tm /resync

Starting and stopping the service:

4. net stop w32time
5. net start w32time

### **Note**

If you want to configure the NTP client functionality on several computers, then it makes sense to use the commands in a batch file.

## **6.2 NTP Client on the IS configuration**

You can perform the NTP client configuration on the IS analogously to the configuration in section 1.6.1.

## 7 To check the time synchronization

### 7.1 Read out the computer time with the command "net time"

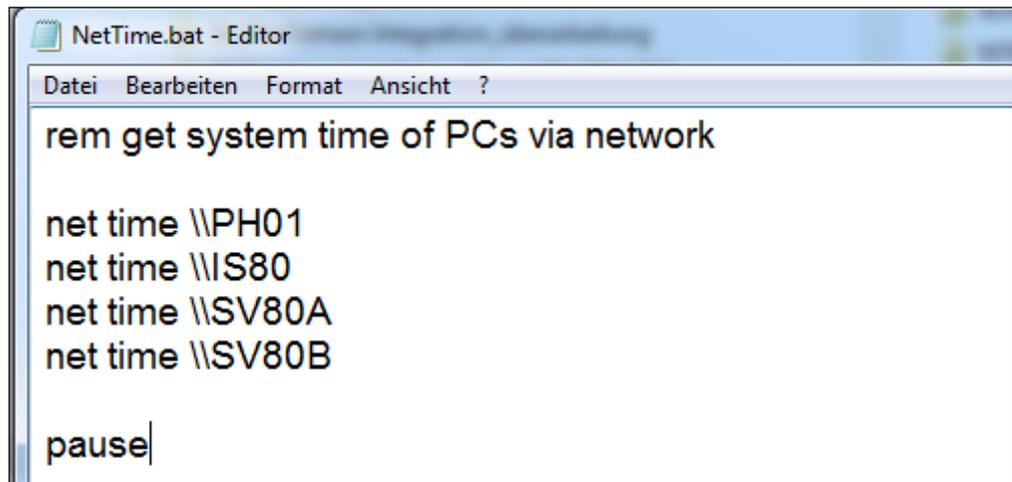
You can determine the time of different computers in the network with the command "net time *Error! Link reference invalid.*>".

#### Procedure:

1. Create a text file and name the file "NetTime.bat".

Copy the following code into the batch file:

```
rem get system time of PCs via network
net time \\PH01
net time \\S80
net time \\SV80A
net time \\SV80B
pause
```

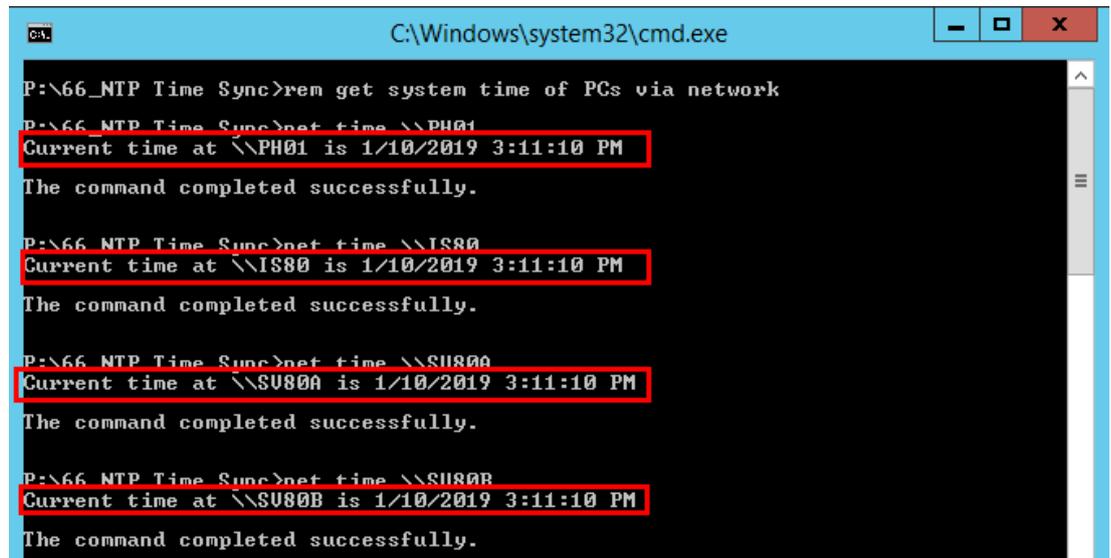


2. Adapt the host names to your installation.
3. Double-click on "NetTime.bat".
4. Click on the "Run" button.



**Result:**

This allows you to judge whether the systems are working "to the second" synchronously.



```
C:\Windows\system32\cmd.exe
P:\66_NTP Time Sync>rem get system time of PCs via network
P:\66_NTP Time Sync>net time \\PH01
Current time at \\PH01 is 1/10/2019 3:11:10 PM
The command completed successfully.
P:\66_NTP Time Sync>net time \\IS80
Current time at \\IS80 is 1/10/2019 3:11:10 PM
The command completed successfully.
P:\66_NTP Time Sync>net time \\SU80A
Current time at \\SU80A is 1/10/2019 3:11:10 PM
The command completed successfully.
P:\66_NTP Time Sync>net time \\SU80B
Current time at \\SU80B is 1/10/2019 3:11:10 PM
The command completed successfully.
```

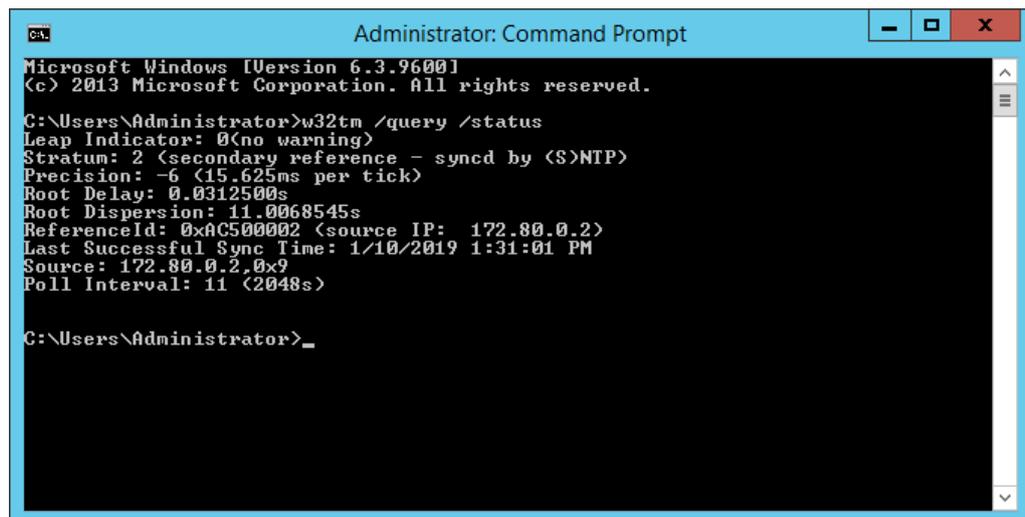
## 7.2 Querying a local computer with the command "w32tm /query /status"

If you want to check a higher accuracy than one second, you can use the command "w32tm /query /status".

**Procedure:**

1. Open the application "cmd" on the computer you want to check.
2. Type the command "w32tm /query /status".
3. Press the "Enter" button.

**Result:**



```
Administrator: Command Prompt
Microsoft Windows [Version 6.3.9600]
(c) 2013 Microsoft Corporation. All rights reserved.

C:\Users\Administrator>w32tm /query /status
Leap Indicator: 0(no warning)
Stratum: 2 (secondary reference - synced by (S)NTP)
Precision: -6 (15.625ms per tick)
Root Delay: 0.0312500s
Root Dispersion: 11.0068545s
ReferenceId: 0xAC500002 (source IP: 172.80.0.2)
Last Successful Sync Time: 1/10/2019 1:31:01 PM
Source: 172.80.0.2,0x9
Poll Interval: 11 (2048s)

C:\Users\Administrator>_
```

## 7.3 Query the NTP server with the command "w32tm /stripchart"

### Procedure:

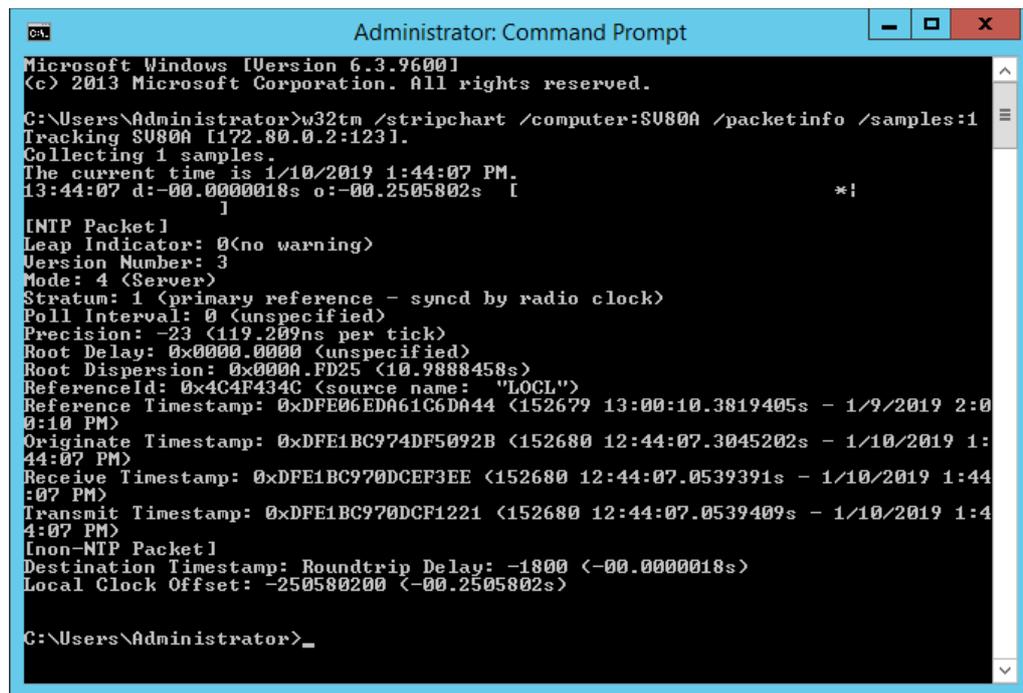
1. Open the application "cmd" on a computer in the network.
2. Give the command "w32tm /stripchart /computer:<computername> /packetinfo /samples:1".

### Example:

```
w32tm /stripchart /computer:SV80A /packetinfo /samples:1
```

3. Press the "Enter" button.

### Result:



```
Administrator: Command Prompt
Microsoft Windows [Version 6.3.9600]
(c) 2013 Microsoft Corporation. All rights reserved.

C:\Users\Administrator>w32tm /stripchart /computer:SV80A /packetinfo /samples:1
Tracking SV80A [172.80.0.2:123].
Collecting 1 samples.
The current time is 1/10/2019 1:44:07 PM.
13:44:07 d:-00.0000018s o:-00.2505802s [ *!
]
[NTP Packet]
Leap Indicator: 0(no warning)
Version Number: 3
Mode: 4 (Server)
Stratum: 1 (primary reference - synced by radio clock)
Poll Interval: 0 (unspecified)
Precision: -23 (119.209ns per tick)
Root Delay: 0x0000.0000 (unspecified)
Root Dispersion: 0x000A.FD25 (10.9888458s)
ReferenceId: 0x4C4F434C (source name: "LOCL")
Reference Timestamp: 0xDFE06EDA61C6DA44 (152679 13:00:10.3819405s - 1/9/2019 2:00:10 PM)
Originate Timestamp: 0xDFE1BC974DF5092B (152680 12:44:07.3045202s - 1/10/2019 1:44:07 PM)
Receive Timestamp: 0xDFE1BC970DCEF3EE (152680 12:44:07.0539391s - 1/10/2019 1:44:07 PM)
Transmit Timestamp: 0xDFE1BC970DCF1221 (152680 12:44:07.0539409s - 1/10/2019 1:44:07 PM)
[non-NTP Packet]
Destination Timestamp: Roundtrip Delay: -1800 (-00.0000018s)
Local Clock Offset: -250580200 (-00.2505802s)

C:\Users\Administrator>_
```

## 8 Appendix

### 8.1 Service and support

#### Industry Online Support

Do you have any questions or need assistance?

Siemens Industry Online Support offers round the clock access to our entire service and support know-how and portfolio.

The Industry Online Support is the central address for information about our products, solutions and services.

Product information, manuals, downloads, FAQs, application examples and videos – all information is accessible with just a few mouse clicks:

<https://support.industry.siemens.com/>

#### Technical Support

The Technical Support of Siemens Industry provides you fast and competent support regarding all technical queries with numerous tailor-made offers – ranging from basic support to individual support contracts. Please send queries to Technical Support via Web form:

[www.siemens.com/industry/supportrequest](http://www.siemens.com/industry/supportrequest)

#### SITRAIN – Training for Industry

We support you with our globally available training courses for industry with practical experience, innovative learning methods and a concept that's tailored to the customer's specific needs.

For more information on our offered trainings and courses, as well as their locations and dates, refer to our web page:

[www.siemens.com/sitrain](http://www.siemens.com/sitrain)

#### Service offer

Our range of services includes the following:

- Plant data services
- Spare parts services
- Repair services
- On-site and maintenance services
- Retrofitting and modernization services
- Service programs and contracts

You can find detailed information on our range of services in the service catalog web page:

<https://support.industry.siemens.com/cs/sc>

#### Industry Online Support app

You will receive optimum support wherever you are with the "Siemens Industry Online Support" app. The app is available for Apple iOS, Android and Windows Phone:

<https://support.industry.siemens.com/cs/ww/en/sc/2067>.

## 8.2 Links and literature

Table 8-1

No.	Topic
\1\	Siemens Industry Online Support <a href="https://support.industry.siemens.com">https://support.industry.siemens.com</a> .
\2\	Link to this entry page of this application example <a href="https://support.industry.siemens.com/cs/ww/en/view/66579062">https://support.industry.siemens.com/cs/ww/en/view/66579062</a>
\3\	

## 8.3 Change documentation

Table 8-2

Version	Date	Modifications
V1.0	01/2019	First version