SIEMENS

CMS X-TOOLS

User Manual - ION SIMATIC S7-400 T001

English

Release 2015-08

Safety Guidelines

This document contains notices which you should observe to ensure your own personal safety as well as to avoid property damage. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring to property damage only have no safety alert symbol.

Danger

indicates an **imminently** hazardous situation which, if not avoided, will result in death or serious injury.

Warning

indicates a **potentially** hazardous situation which, if not avoided, could result in death or serious injury.

Caution

used with the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

Caution

used without safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

Notice

used without the safety alert symbol indicates a potential situation which, if not avoided, may result in an undesirable result or state.

When several danger levels apply, the notices of the highest level (lower number) are always displayed. If a notice refers to personal damages with the safety alert symbol, then another notice may be added warning of property damage.

Qualified Personnel

The device/system may only be set up and operated in conjunction with this documentation. Only qualified personnel should be allowed to install and work on the equipment. Qualified persons are defined as persons who are authorized to commission, to earth, and to tag circuits, equipment and systems in accordance with established safety practices and standards.

Intended Use

Please note the following:

Warning

This device and its components may only be used for the applications described in the catalog or technical description, and only in connection with devices or components from other manufacturers approved or recommended by Siemens.

This product can only function correctly and safely if it is transported, stored, set up and installed correctly, and operated and maintained as recommended.

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Disclaimer of Liability

We have checked the contents of this document for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in the manual are reviewed regularly, and any necessary corrections will be included in subsequent editions. Suggestions for improvement are welcomed.

Table of Contents

1 Preface

1.1 Purpose of this Document

This document supports you when commissioning and using the software

- ***ION SIMATIC S7-400 T001***

of the CMS X-TOOLS product line.

1.2 Basic Knowledge Required

In order to understand this manual, general knowledge of automation technology and software packages ***CMS X-Tools*** (in the following, ***X-Tools***), STEP 7, S7-SCL, S7-CFC is required.

In addition, you must be familiar with network technology (UDP/IP) and with using computers with Windows.

1.3 Validity of this Document

This document is valid for the following software:

- CMS X-TOOLS ION SIMATIC S7-400 T001 V 03.07

During the following pages, this software will be referred to by the term ***ION SIMATIC S7-400 T001***.

1.4 Terms

The following terms are used within this document:

Definition	Description
CP	Communication Processor
DB	Data Block
FB	Function Block
ION	I/O-Node
OB	Organization Block
UIK	Universal Identification Key
SW	Software

2 Scope of Delivery

2.1 Scope of Delivery

What is shipped?

- CD

  CMS X-TOOLS ION SIMATIC S7-400 T001 - Software & Documentation

2.2 Unpacking and Checking

After unpacking, please check

- the packet for completeness and
- all parts for transport damage.

| Caution |
|---|
| Do not use any content / parts that show evidence of damage! |

3 Introducing the Product

3.1 What is CMS X-TOOLS?

CMS X-Tools is an industrial-suited Condition Monitoring System for technical and technological services in industrial plants. **X-Tools** is a modular, scalable analysis and diagnosis system. It is optimized for reaction less measurement of analog, binary and numerical data. **X-Tools** can be integrated in existing and new industrial plants.

X-Tools can be integrated into the TIA-Architecture:
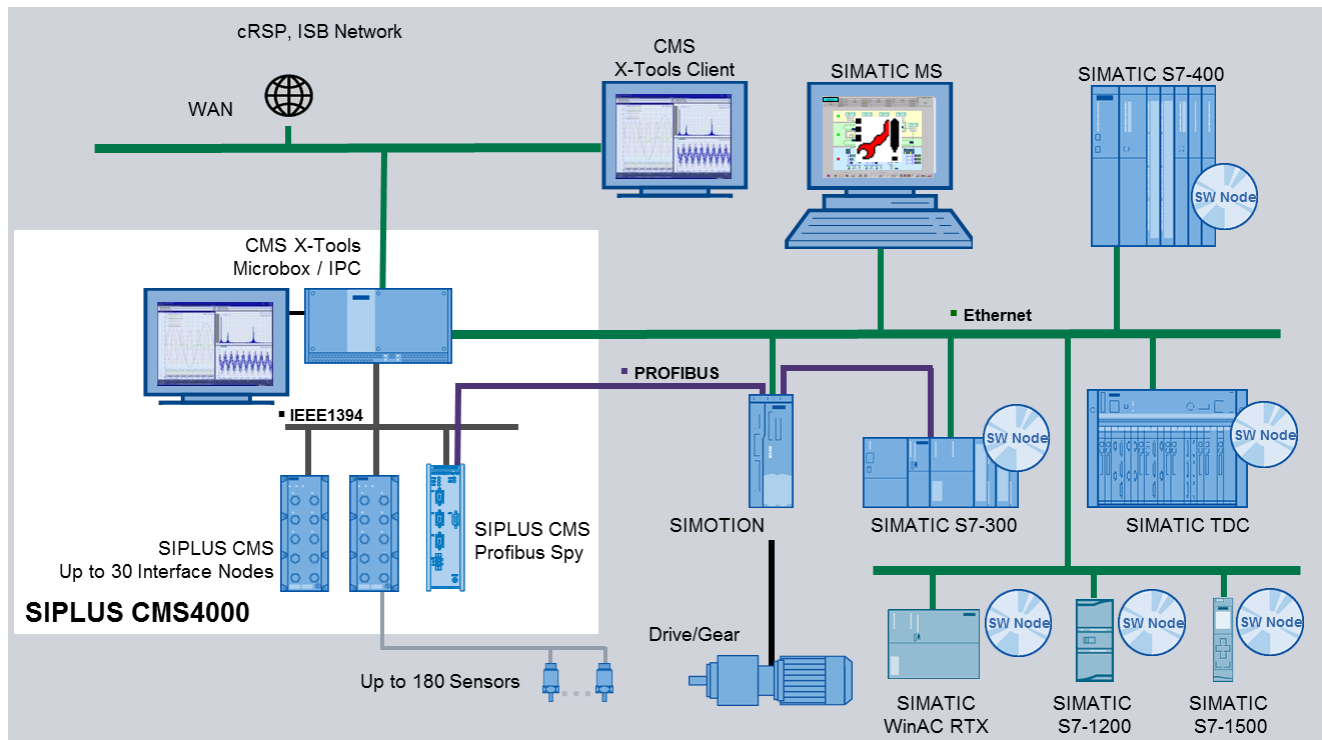
3.2 Introduction

The **ION SIMATIC S7-400 T001** is used in order to acquire data from a SIMATIC S7-400 controller with Ethernet CP and to transmit the recorded data via Ethernet (UDP/IP) to a superior industrial PC. After the engineering, the **ION SIMATIC S7-400 T001** is used for the transmission of measurement data to **X-Tools**.

The usage of an **ION SIMATIC S7-400 T001** allows transmitting up to 712 byte of data. The data is divided into 178 channels and each channel consists of 32 bit (DWORD), where several signals can be merged to a channel.

The **ION SIMATIC S7-400 T001** consists of a function block which must be engineered into a SIMATIC S7-400 controller with an Ethernet CP.

3.3 Hard- and Software Requirements

Hardware

- PC
  - o the hardware demands of the PC are dependent to the used software
- SIMATIC S7-400 controller with Ethernet / PROFINET interface
  - o CPU 41x with CP443-1 (from version "EX11") / CP 443-1 Advanced
- Ethernet connecting cables

Software

- CMS X-Tools Professional (V 04.02 SP2 or higher)

- STEP7 (using V 5.4 + SP2 or higher)

3.4 Ordering Numbers

Article	Ordering Number (MLFB)
CMS X-Tools Professional V 04.02	9AE4160-1AB00

Further information is obtained from your local Siemens office and from the homepage
http://www.siemens.com/siplus-cms.

4   Block Description

4.1   Function

The **ION SIMATIC S7-400 T001** is used in order to acquire data from a SIMATIC S7-400 controller with Ethernet CP and to transmit the recorded data via Ethernet (UDP/IP) to a superior industrial PC. The **ION SIMATIC S7-400 T001** consists of a function block (FB) which must be engineered into a SIMATIC S7-400 controller with Ethernet CP. The communication protocol is UDP/IP.

The FB is called in a cyclic interrupt (e.g. OB35) and allows transmission of up to 712 byte of data each cycle. The data is divided into 178 channels and each channel consists of 32 bit (DWORD). The channels are filled with data in the S7 program. It is possible to merge several signals into one channel (e.g. two WORD signals).

A relative timestamp is automatically added to the transmitted data. Two different ways for the internal timestamp generation are possible. These can be selected by the input TIME_BASE. When using the system clock-based timestamp generation, the timestamp is directly calculated by reading the clock of the S7-CPU. In contrast to that, the timestamp is calculated out of the cycle time CYCLE_T in case of the counter-based time base.

Whenever the clock of the S7-CPU is synchronized (e.g. by NTP), the counter-based time base is recommended to avoid errors in the time domain check of **X-Tools**.

The FB is called in startup OB (OB100, OB101, OB102) for initialization. Therefore the parameter COM_RST is set to TRUE. During initialization the number of active channels is written, the cycle time is set and some other calculations for service are done.

Afterwards a phase begins, in which the FB runs along passive in the program. Only after announcing the **X-Tools** the FB is active and it takes place data exchange with **X-Tools**. Details for engineering in **X-Tools** you can find in the **X-Tools** User Manual.

When data transmission is started the signals are transmitted to **X-Tools**. Therefore the signals are buffered in two buffers. Each buffer can store 712 bytes. With 178 active channels one buffer is transmission buffer and one is the buffer for the current data. The buffers are alternating written and transmitted. If not all channels are active more cycles can be buffered. With 89 active channels each buffer can buffer two measurement cycles, the transmission is initialized after each two cycles. The communication load can be reduced.

4.2   Parameters

Parameter	Declaration	Data type	Description
COM_RST	INPUT	BOOL	With ‚True' on this signal a reset of the FB is forced. During runtime it should be ‚False'. The FB remains in initializing routine as long as COM_RST is set to ‚True'.
CYCLE_T	INPUT	INT	Cycle time of calling alert in ms.
LADDR	INPUT	WORD	Local address of CP. This can be found in HW config.
COMMAND_ID	INPUT	INT	ID for command connection (0x0001 … 0x0FFF).
DATA_ID	INPUT	INT	ID for data connection (0x0001 … 0x0FFF).
CURRENT_ CHANNELS	INPUT	INT	Number of channels which are transmitted to X-Tools each cycle (1 … 178).
CHANNEL	INPUT	ARRAY[0..177] OF DWORD	Array, which defines the channels which shall be transmitted to X-Tools. A reading of peripherals is not possible.
UIK0..UIK7	INPUT	BYTE	UIK of the ION SIMATIC S7-400 T001. See 6.4 for details.
TIME_BASE	INPUT	BYTE	Time base for timestamp generation (0=system clock-based; 1=counter-based)

4.3   Conditions

During projecting of the ***ION SIMATIC S7-400 T001*** the conditions of all used components have to be respected. ***The ION SIMATIC S7-400 T001*** must not be called in OB1.

The minimum cycle time of the calling OB as the number of channels which can be transmitted properly in this time are specific for each project and hardly depending on SIMATIC S7-400 CPU type and network usage. The used configuration has to be checked for stability and must not operate at the limit, because in case of errors (e.g. BUS errors) a higher CPU load must be expected.

The ***ION SIMATIC S7-400 T001*** can transmit limited amount of data over the Ethernet interface. When the capacity of the interface is insufficient data is lost, in this case proper system behaviour can not be guaranteed. The internal counter "Drops1" counts the number of packets which could not be transmitted properly. It can be supervised in the Variable Table.

The user has to check the compatibility of CPU and CP.

The system is released for usage of one ***ION SIMATIC S7-400 T001*** per SIMATIC CPU

Notice

Wrong project engineering can lead to errors or stop of the CPU.

5   Installation

5.1   Installation of the Library

Insert the product-CD "CMS X-Tools" into the drive of your PC. Start the SIMATIC Manager and open via **File > Retrieve...** the dialog for de-archiving of projects and libraries. Choose the path to your CD-drive and open the archive file "CMS X-Tools - ION SIMATIC S7-400 T001 V 03.07.EN.0000.zip" from the product CD. Finally choose the target directory and the storage path for the *ION SIMATIC S7-400 T001* library and confirm with OK.
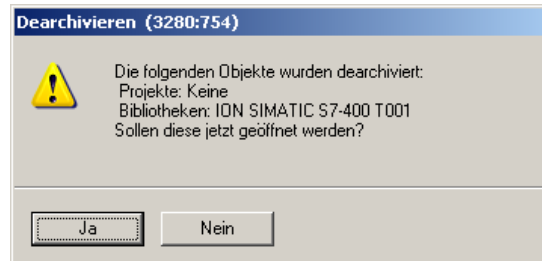
When de-archiving is finished apply the shown dialog on "Yes" to open the library. The library is installed properly. After successful installation, the engineering can begin.
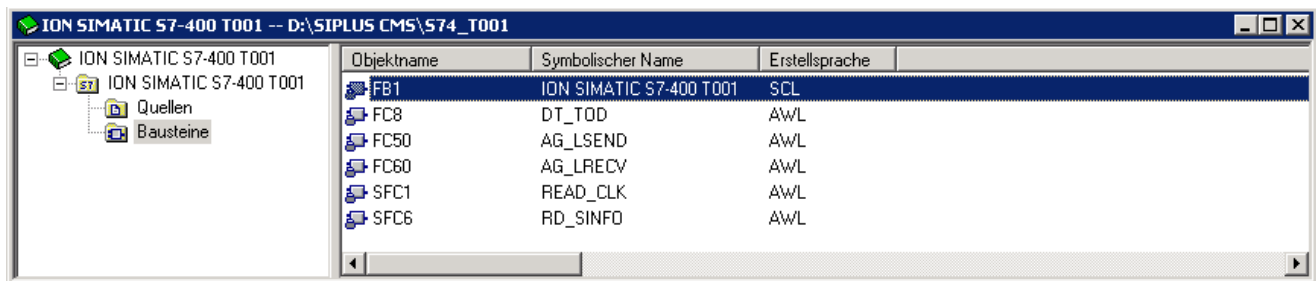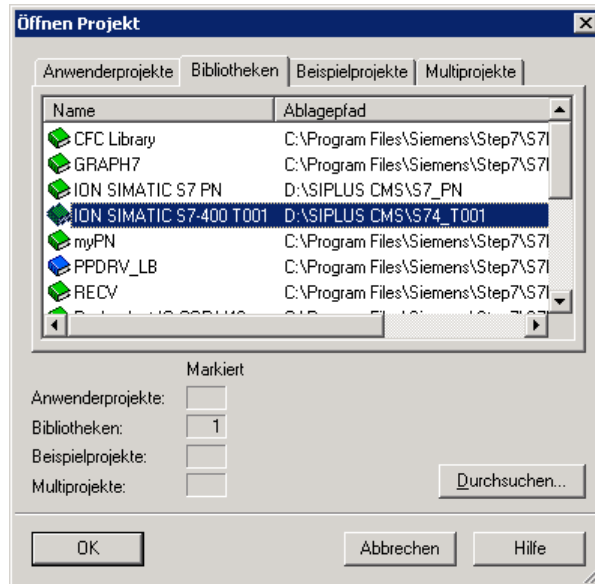
6 Engineering in AWL

6.1 Copying the necessary SW components

Opening of the Library

If the library was not opened automatically, go to the SIMATIC Manager and choose **File > Open**. In the next dialog select the tab Libraries and choose the library **ION SIMATIC S7-400 T001**. Afterwards confirm in the dialog with the "OK" button.

To copy the necessary components

Copy all SW components of the **ION SIMATIC S7-400 T001**. The SW components FC50, FC60, FC8, SFC1, SFC6 originate from the library "Standard Library" and can be copied from this source.
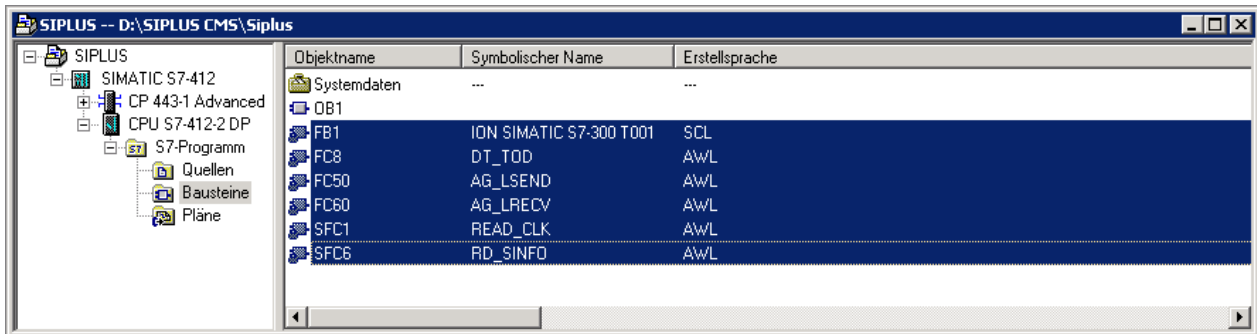
6.2   Insert New Connections

For the communication with X-Tools two connections of type unspecified UDP-Connection are used, the command- and the data-connection.

Insert New Connection

Open NetPro, chose the current CPU and create a new connection of type unspecified UDP connection.
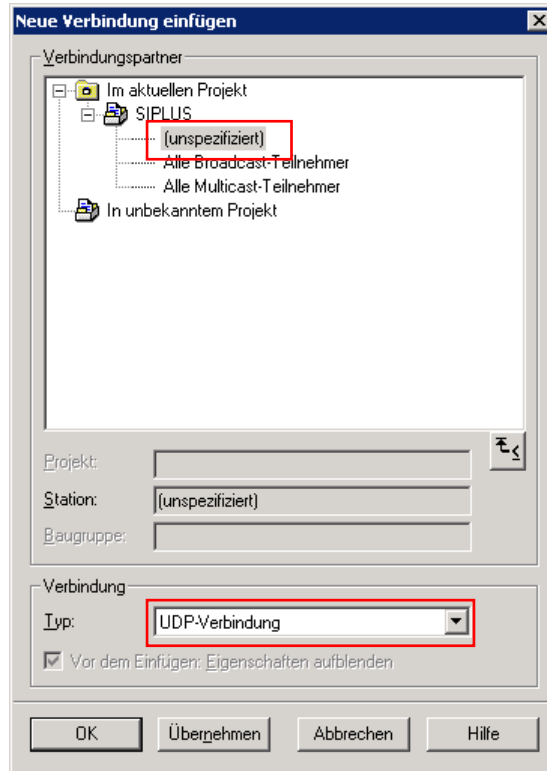
Edit the configuration according to the following figure. The ID (Hex) can be chosen free. It must be entered in the function call. The ID and the local address (LADDR) you need for function call later on.
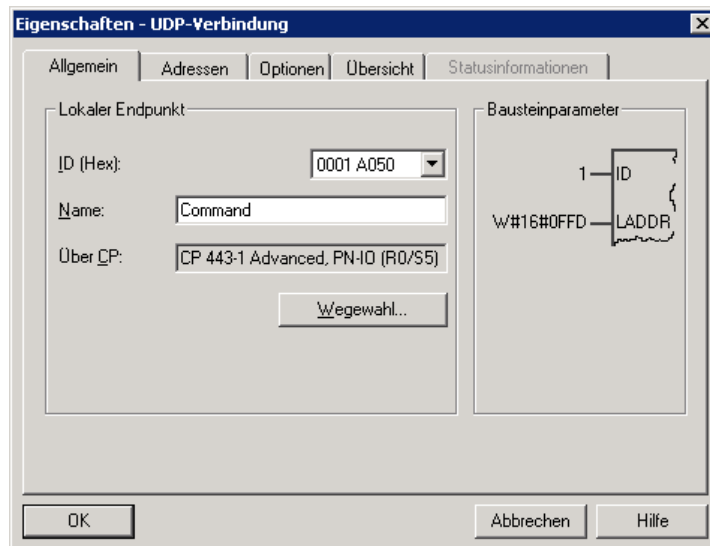
Change to the addresses and configure the port according to the following image. The port number can be chosen free. It must be entered in the X-Tools configuration.
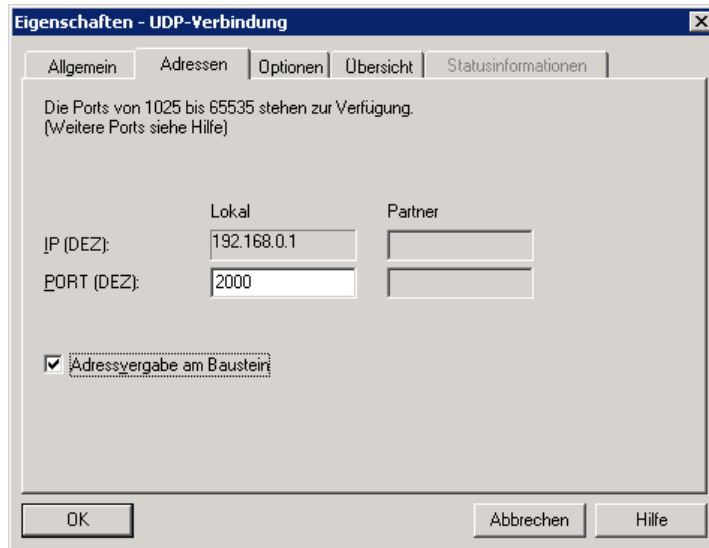
Take care that the address assignment is done in the block. Set the according marker. Close the dialog via "OK" and create another connection according to the following figure.
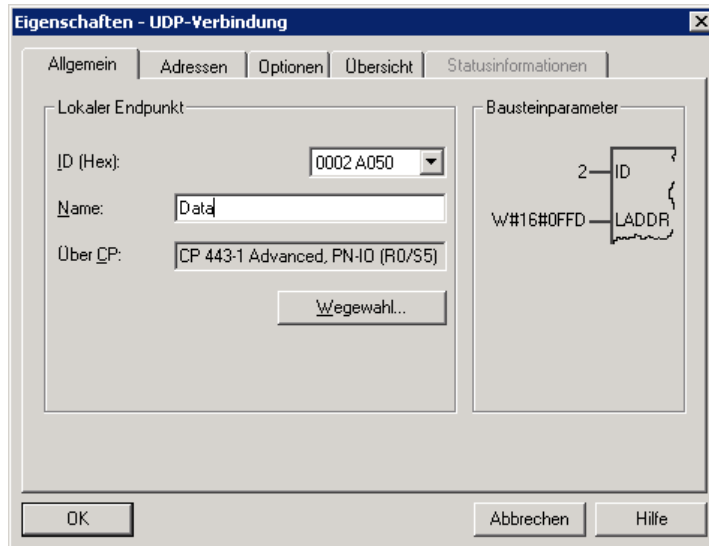
Select the ID for the data connection. The local address is equal to the local address of the command connection. Set a proper port and set the marker for the address assignment at block.
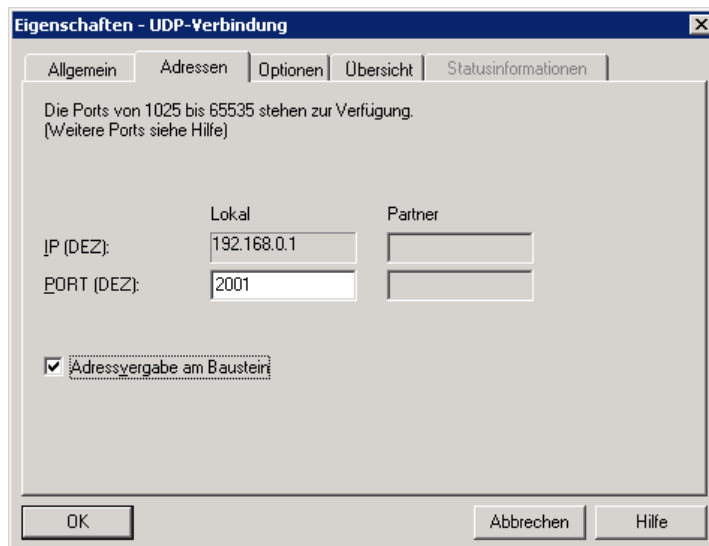
Note the current configuration. For the projecting the local endpoint of the CP (here: LADDR = W#16#0FFD) and the connection IDs (here: command = 1 and data = 2) are needed. Store and compile the configuration and load the connections into your PLC *PLC -> Download to Current Project -> Connections and Gateways*.
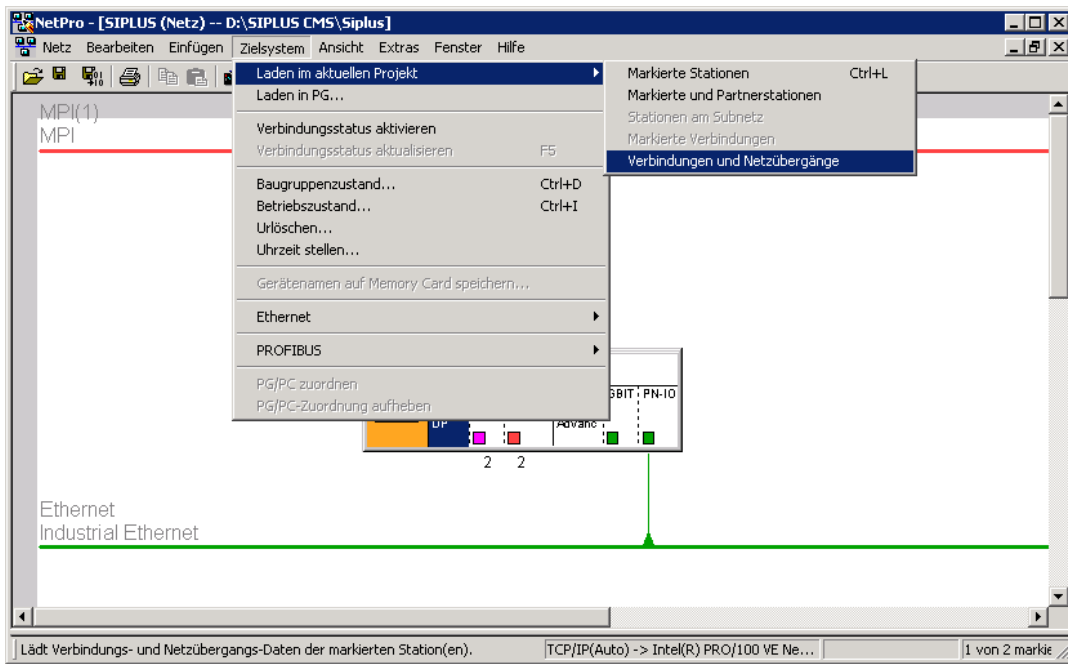
6.3   Calling the Function Block - Startup OBs (OB100, OB101 and OB102)

Description

The component **ION SIMATIC S7 -400 T001** must be connected in the Startup OBs, to allow a system restart when the CPU initiates the restart.

The following table shows the available Startup OB types:

Type of Startup	Corresponding OB
Hot restart	OB 101
Warm restart	OB 100
Cold restart	OB 102

Check which Startup OBs are used by your CPU and which Startup OBs your application needs for proper initialization in all states. Maybe you need to implement more than one Startup OB. In the following part the implementation of OB100 is shown as example.

Function Block call

If the OB100 is not available jet you must insert it into your program. For this, right Mouse click on the component folder and select **Insert new Object > Organization Block**.
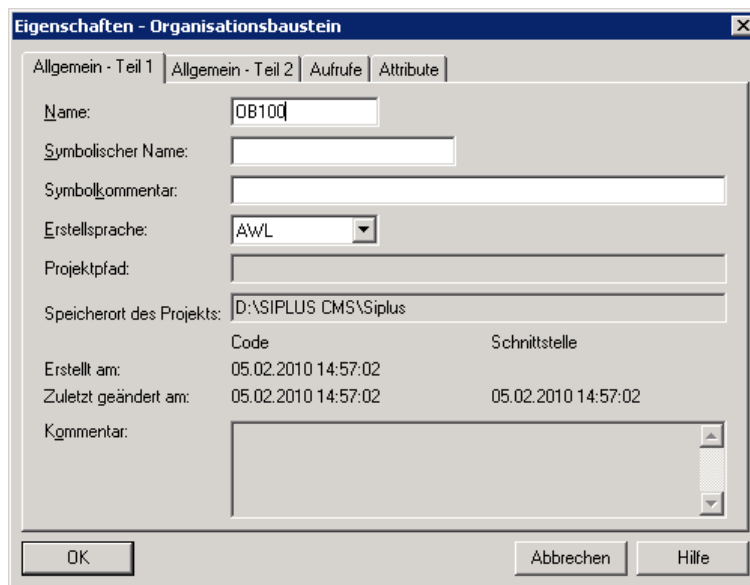
Open the OB100 via a double click and add a call of FB1. The assigned instance database can be freely selected (select any free number, in the example DB1). Afterwards confirm in the dialog with the "Yes" button and the DB is automatically generated by the SIMATIC manager.
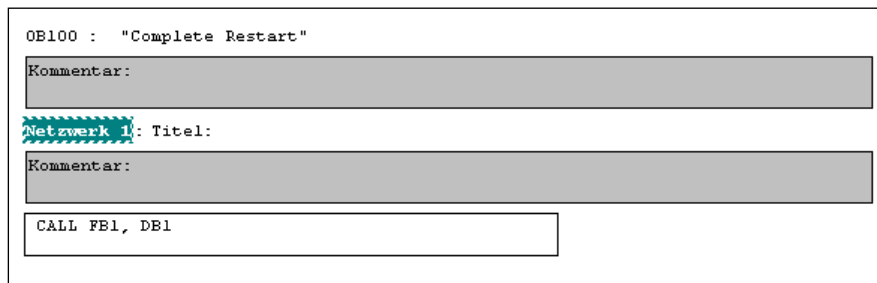
Calling FB1 in the OB100

Now you must set the parameter COM_RST with TRUE to initialize the ***ION SIMATIC S7-400 T001***. Afterwards save and close the component.

```
OB100 :  "Complete Restart"

Comment:


⊟ Network 1 : Title:

        CALL  "ION SIMATIC S7-400 T001" , DB1     FB1
         COM_RST           :=TRUE
         CYCLE_T           :=
         LADDR             :=
         COMMAND_ID        :=
         DATA_ID           :=
         CURRENT_CHANNELS:=
         CHANNEL           :=
         UIK0              :=
         UIK1              :=
         UIK2              :=
         UIK3              :=
         UIK4              :=
         UIK5              :=
         UIK6              :=
         UIK7              :=
         TIME_BASE         :=
```

Initialized parameter list of the ION SIMATIC S7-400 T001 in the OB100

6.4 Calling the Function Block - OB3x Cyclic Interrupts

Description

The acquisition and transmission of measurement data is done via a function call in a cyclic interrupt (OB3x). The sample time matches the cycle time of this OB. It can be configured in HW Config. It is recommended to use a cycle time between 10ms and 100ms.

Write data into the Transmission Channel

Insert new cyclic interrupt-OB into your program, or work on an existing one in your program. In the following example OB35 is used.

The channels which can be observed will be supplied. There exists of up to 178 channels each having 4 bytes per channel for a total of 712 bytes. The channels up to 178 are sent cyclically to the PC via the X-Tools once connected with the *ION SIMATIC S7-400 T001*. The current measuring data is determined by the configuration of these up to 178 channels. For the beginning you must fill the data block. Therefore you have two options:

a) Load the data and transfer it directly into the destination channel in the DB. The editor produces the database addresses automatically via input of the channel numbering in the format "DB1.CHANNEL [*index*].

b) All data can be written into an array which can be set to the input CHANNEL of the FB1 during block call.

```
OB35 :  "Cyclic Interrupt"

Kommentar:


Netzwerk 1: Titel:

Kommentar:


        L    DW#16#19801224
        T    DB1.CHANNEL[0]
```

```
OB35 :  "Cyclic Interrupt"

Kommentar:


Netzwerk 1: Titel:

Kommentar:


        L    DW#16#19801224
        T    DB1.DBD    12
```

Provisioning for Channel

Write data into the Transmission Channel

When the channels are filled with data you can add an additional network and project you
ION SIMATIC S7-400 T001 as follows:

```
OB35 :  "Cyclic Interrupt"

Comment:


□ Network 1 : Title:
      L     DW#16#19801224
      T     DB1.DBD   12


□ Network 2 : Title:
      CALL  "ION SIMATIC S7-400 T001" , DB1    FB1
       COM_RST           :=FALSE
       CYCLE_T           :=#OB35_EXC_FREQ        #OB35_EXC_FREQ    -- Frequency of ex
       LADDR             :=W#16#FFC
       COMMAND_ID        :=1
       DATA_ID           :=2
       CURRENT_CHANNELS:=178
       CHANNEL           :=
       UIK0              :=
       UIK1              :=
       UIK2              :=
       UIK3              :=
       UIK4              :=
       UIK5              :=
       UIK6              :=
       UIK7              :=
       TIME_BASE         :=B#16#1
```

Component call in the OB35

In the cyclic interrupt COM_RST must be set to FALSE during runtime of the block. Enter for the parameter CYCLE_T the temporary component variable OB3x_EXC_FREQ. This setting defines the cycle time of the interrupt OB3x.

For the communication you need to specify connection IDs and the local CP address. Enter for the parameter COMMAND_ID a connection ID for the command connection (0x0001…0x0FFF) and for the parameter DATA_ID a connection ID for the data link (0x0001…0x0FFF). These IDs were specified during creation of the connections. Enter the local CP address for LADDR.

Enter for the parameter CURRENT_CHANNELS the channels to be transmitted per cycle (1…178). Attention, also empty channels are transmitted.

For the parameter CHANNEL it is optional to enter a field which contains the measurement data. This is valid only for 16 channels.

For the last inputs you have to configure the UIK of the ION SIMATIC S7-400 T001. Regard the following chapter for details.

6.5   UIK

Description

Each **ION SIMATIC S7-400 T001** must possess a system wide defined number, the UIK. The UIK is used by the X-Tools for the clear identification of the **ION SIMATIC S7-400 T001**. The device name, which is shown by default in X-Tools, consists of the device type and the UIK. Example:
ION SIMATIC S7-400 T001 (000008-00-06010000).

Assigning the UIK

It is formed under normal conditions via 2 zero bytes and the MAC address of the hardware.

Entering the parameters UIK0 and UIK1 contain a zero byte (B#16#0) in each case. Enter from UIK2 byte wise the MAC address (must be in hexadecimal representation). In the following example the MAC address 08-00-06-01-00-00 is used.

```
OB35 :  "Cyclic Interrupt"

Comment:


⊟ Network 1 : Title:
        L     DW#16#19801224
        T     DB1.DBD   12


⊟ Network 2 : Title:
        CALL  "ION SIMATIC S7-400 T001" , DB1     FB1
         COM_RST          :=FALSE
         CYCLE_T          :=#OB35_EXC_FREQ        #OB35_EXC_FREQ    -- Frequency of e
         LADDR            :=W#16#FFC
         COMMAND_ID       :=1
         DATA_ID          :=2
         CURRENT_CHANNELS:=178
         CHANNEL          :=
         UIK0             :=B#16#0        Null Bytes
         UIK1             :=B#16#0
         UIK2             :=B#16#8
         UIK3             :=B#16#0
         UIK4             :=B#16#6
         UIK5             :=B#16#1        MAC Adresse
         UIK6             :=B#16#0
         UIK7             :=B#16#0
         TIME_BASE        :=B#16#1
```

Assignment of the UIK

If multiple **ION SIMATIC S7-400 T001** are to be operated on a single hardware unit (over one IP-address), it must be ensured that the UIK is individual. Use in addition the first two bytes (UIK0 and UIK1) as example for a sequential numbering of the blocks - must be in hexadecimal representation - as a defined entry for a clear UIK.

6.6   Loading Components

When you have finished you implementation mark / highlight all blocks of your project. Then select in the menu **PLC > Download** or click on the appropriate symbol to load the marked / highlighted components into the CPU. Then the CPU must be restarted (STOP →RUN) to initialize the *ION SIMATIC S7-400 T001*. Now the connection to X-Tools can be initiated.
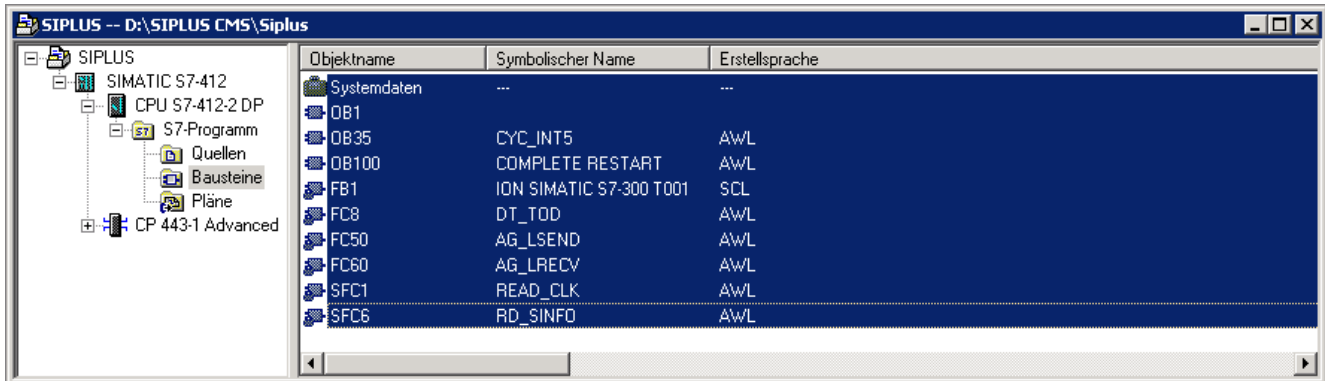
7　　　Tips and Tricks

7.1　Reset the Function Block

The *ION SIMATIC S7-400* T001 can be reset by COM_RST. This input can be connected to a bit memory which makes it possible to reset the *ION SIMATIC S7-400 T001* at any moment easily.

7.2　Engineering during Runtime

Because of the possibility to initialize the *ION SIMATIC S7-400 T001* via input COM_RST you can add it to you project during runtime. It is no STOP → RUN of the CPU necessary.

7.3　Changing the Number of the Function Block

The number of *ION SIMATIC S7-400 T001* (FB1) can be changed user-defined. It is just necessary to adapt the Symbol Table. It is possible to change the numbers of FC50/FC60 by STEP 7 option "Rewire". When you plan to rewire the blocks it is recommended to do this in an empty project and add just the rewired blocks into you working project.

7.4　Analyzing of Connection-Problems

If the interface is not able to transmit all data (OB-cycle to fast or communication too high) the variable "Dummy1" in the corresponding DB is rising. This can be supervised by variable table or it can be transmitted to X-Tools via the *ION SIMATIC S7-400 T001*.

7.5 Configuration of windows firewall

If the firewall does not allow X-Tools server application then the communication will not start between the automation system and CMS X-Tools. Please verify the configuration as follow.

1. Open „Allow a program through Windows Firewall" from the "Control Panel\System and Security" window
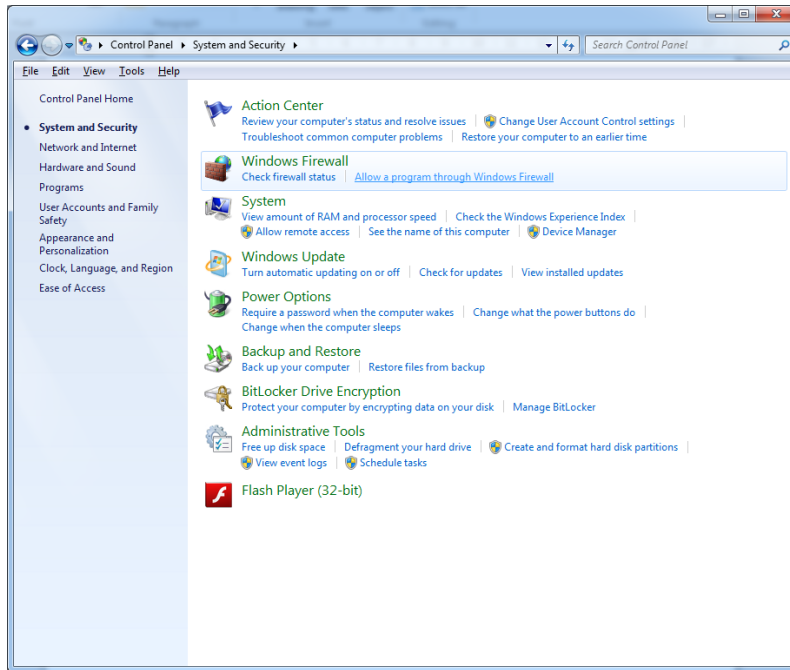
2. Allow a program through Windows Firewall
   a. Add X-Tools in the list of exception in order to allow X-Tools through Windows Firewall for public and Home/Work(Private) Networks
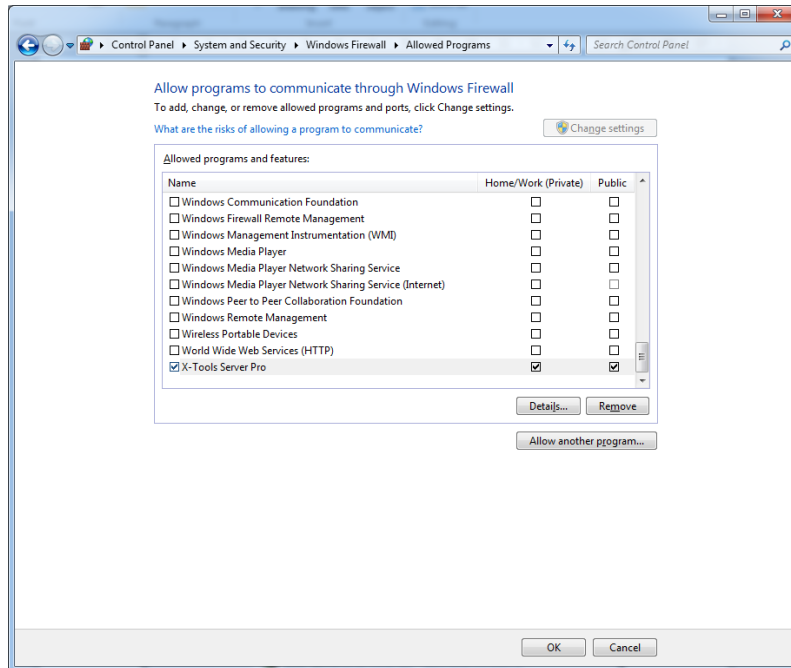
8　References

8.1　Other Documentation

- Manual: CMS X-TOOLS X-Tools User Manual
- Reference Manual: SIMATIC System Software for S7-300/400 Systen and Standard Functions
- Manual: SIMATIC Programming with STEP 7
- http://www.siemens.com/siplus-cms

9 Contact Information

Should you have any questions concerning the software application, please refer to the Industry Sector Technical Support.

Department
Siemens AG
Industry Sector

Phone
+49 (0) 911 895 7222 (Monday to Friday, 09:00 am to 05:00 pm CET/CEST)
Fax
+49 (0) 911 895 7223

Internet
www.siemens.de/automation/service&support

Thank you for using one of the above mentioned contacts to ensure your inquiry is registered and can be processed.