SIEMENS

SIPLUS CMS4000

Interface Node

SIPLUS CMS4000 ION SIMATIC S7 PN

6AT8000-0CA00-4XA0

Operating Instructions - English

Release 09/2011

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
SIPLUS CMS4000 ION SIMATIC S7 PN of the SIPLUS CMS4000 product line.

1.2 Basic Knowledge Required

In order to understand this manual, general knowledge of automation technology and software packages SIPLUS CMS4000 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 MS Windows XP.

1.3 Validity of this Document

This document is valid for the following software:

● SIPLUS CMS4000 ION SIMATIC S7 PN, V 01.00 and V 01.01

During the following pages, this software will be referred to by the term ION SIMATIC S7 PN.

2 Scope of Delivery

2.1 Scope of Delivery

What is shipped?

- CD SIPLUS CMS4000 ION SIMATIC S7 PN - Software & Documentation
- Certificate of License (CoL)
- Storage medium with License Key

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!

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3 Product Overview

3.1 What is SIPLUS CMS?

SIPLUS CMS is an industrial-suited Condition Monitoring System for technical and techno-logical services in industrial plants. SIPLUS CMS is a modular, scalable analysis and diag-nosis system. It is optimized for reaction less measurement of analog, binary and numerical data. SIPLUS CMS can be integrated in existing and new industrial plants.

SIPLUS CMS can be integrated into the TIA-Architecture.
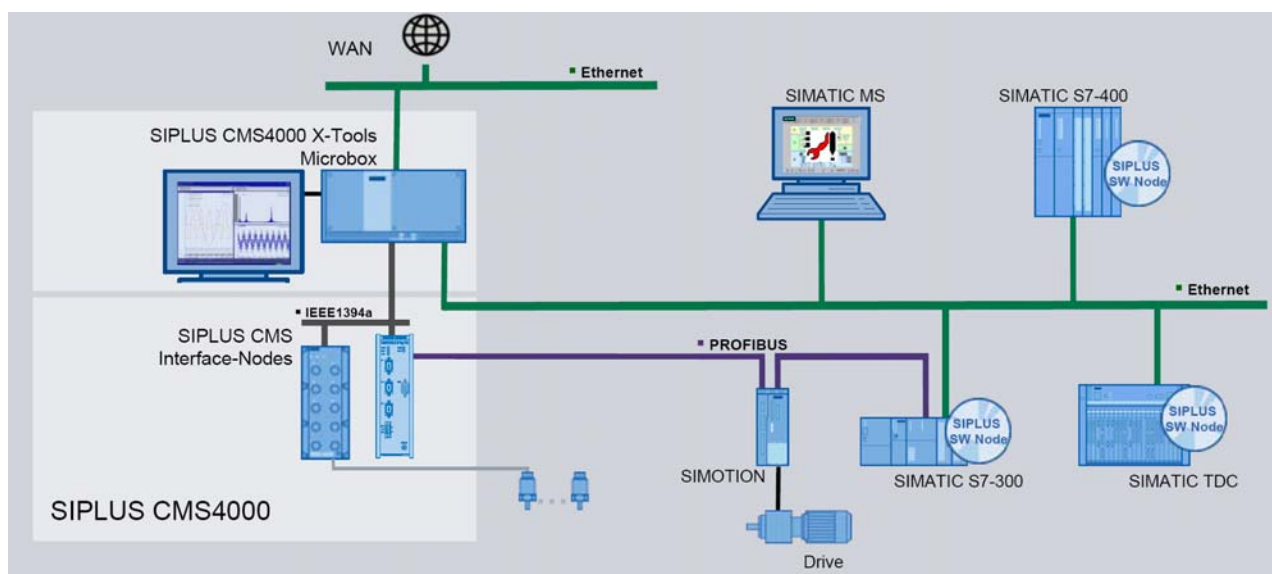
3.2 What is ION SIMATIC S7 PN?

The ION SIMATIC S7 PN is used in order to acquire data from a SIMATIC S7 PN controller (S7-300 or S7-400) and to transmit the recorded data via Ethernet (UDP/IP) to a superior in-dustrial PC. After the engineering, the ION SIMATIC S7 PN is used for the transmission of measurement data to SIPLUS CMS4000 X-Tools (during the following pages referred as X-Tools) which is a software package that is able to visualize, analyse and store the data.

The usage of an ION SIMATIC S7 PN 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 sig-nals can be merged to a channel.

The ION SIMATIC S7 PN consists of a function block which must be engineered into a SIMATIC S7 PN controller with an integrated PROFINET interface.

3.3 Hard- and Software Requirements

Hardware

- PC with Windows XP Professional (≥ Service Pack 2)
    - o CPU with ≥ 1.2 GHz or multicore CPU
    - o working memory ≥ 512 MByte (2 GByte recommended)
    - o OpenGL / DirectX enabled graphic controller (from 1024x768 pixels, 1280x1024 pixels or more recommended)
    - o IEEE1394, Ethernet and USB interfaces
- SIMATIC S7-400 controller with integrated Ethernet / PROFINET interface
    - o CPU 41x-3 PN/DP
    - o CPU 31x-2 PN/DP
    - o CPU 319-3 PN/DP
- Ethernet connecting cables

Software

- SIPLUS CMS4000 X-Tools Standard or Professional (V 03.01 SP1 or higher)
- STEP7 (using V 5.4 + SP5 or higher)

3.4 Ordering Numbers

Article	Ordering Number (MLFB)
SIPLUS CMS4000 ION SIMATIC S7 PN	6AT8000-0CA00-4XA0
SIPLUS CMS4000 X-Tools Standard V 03.xx	6AT8000-0AB00-1BA0
SIPLUS CMS4000 X-Tools Professional V 03.xx	6AT8000-0AB00-2BA0

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 PN is used in order to acquire data from a SIMATIC S7 PN controller (S7-300 or S7-400) and to transmit the recorded data via Ethernet (UDP/IP) to a superior industrial PC. The ION SIMATIC S7 PN consists of a function block (FB) which must be engineered into a SIMATIC S7 PN controller with an integrated PROFINET interface. 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).

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 activated 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.
COMMAND_ID	INPUT	INT	ID for command connection (0x0001 … 0x0FFF).
DATA_ID	INPUT	INT	ID for data connection (0x0001 … 0x0FFF).
COMMAND_PORT	INPUT	WORD	Local UDP port for command connection (0x07D0 … 0x1388).
DATA_PORT	INPUT	WORD	Local UDP port for data connection (0x07D0 … 0x1388).
DEV_ID	INPUT	BYTE	Identifier for CPU type.
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.

Parameter	Declara-tion	Data type	Description
UIK0..UIK7	INPUT	BYTE	UIK of the ION SIMATIC S7 PN. See 5.6 for details.

4.3 Conditions

During projecting of the ION SIMATIC S7 PN the conditions of all used components have to be respected. The ION SIMATIC S7 PN 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 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 can be expected.

The ION SIMATIC S7 PN can transmit limited amount of data over the PROFINET 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 system is released for usage of one ION SIMATIC S7 PN per SIMATIC CPU.

Notice

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

5 Installation

5.1 Automation License Manager

To use ION SIMATIC S7 PN software, you require a product-specific license key (user rights). Starting with X-Tools V 03.02, this key is installed with the Automation License Manager.

The Automation License Manger is a software product from Siemens AG. It is used to manage the license keys (license modules) for all systems.

The Automation License Manger is located on the installation device of X-Tools starting with V 03.02. Details about installation and handling you can take from X-Tools User Manual.

The license of ION SIMATIC S7 PN is a floating license which is valid for an unlimited amount of time. For each started Device Profile (for each active ION SIMATIC S7 PN) a license key is required by X-Tools. The key is acquired during runtime and released when the Device Profile is stopped. More information for license management and handling of license key you can take from X-Tools User Manual

5.2 Installation of Library ION SIMATIC S7 PN

Insert the product-CD "ION SIMATIC S7 PN - Software & Documentation" 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 "ION SIMATIC S7 PN <current version>.zip" from the product CD. Finally choose the target directory and the storage path for the ION SIMATIC S7 PN library and confirm with OK.
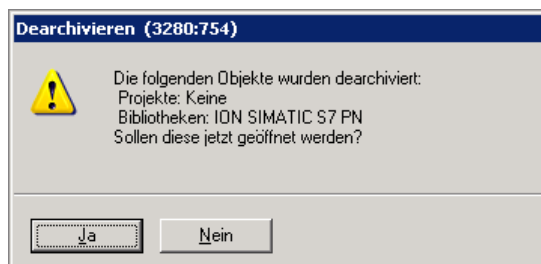
When de-archiving is finished apply the shown dialog on "Yes" to open the library. The library is installed properly. After successful installation, the engineering can begin.
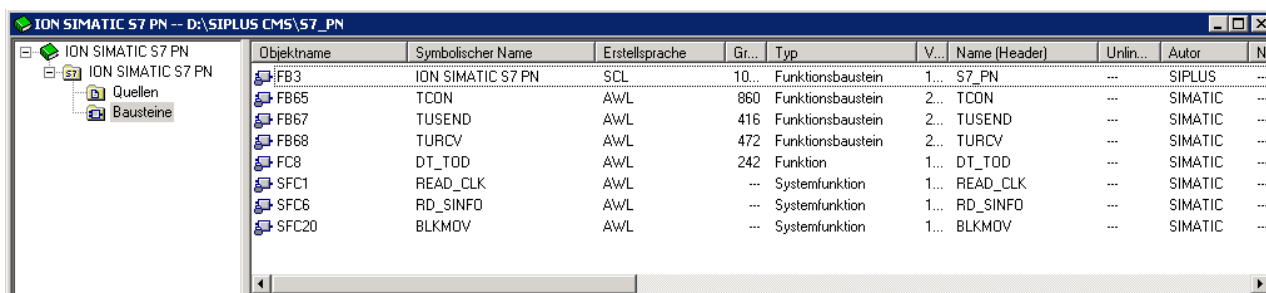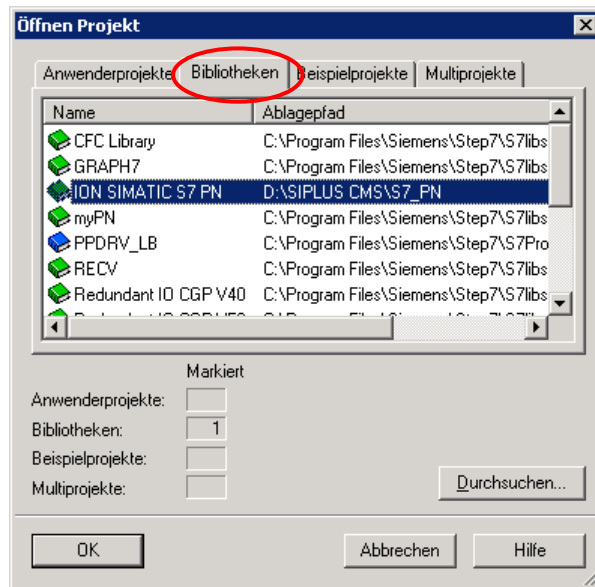
6 Engineering in AWL

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 PN. Afterwards confirm in the dialog with the "OK" button.

To copy the necessary components

Copy all SW components of the ION SIMATIC S7 PN. The SW components FB65, FB67, FB68, FC8, SFC6, SFC20 originate from the library "Standard Library" and can be copied from this source.

6.2 Calling the Function Block – Startup OBs (OB100, OB101 and OB102)

Description

The component ION SIMATIC S7 PN 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**.
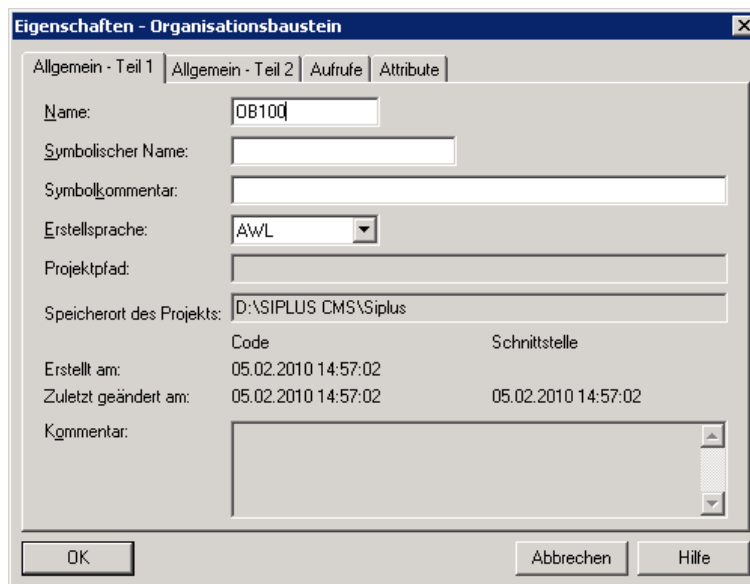
Open the OB100 via a double click and add a call of FB3. The assigned instance database can be freely selected (select any free number, in the example DB3). Afterwards confirm in the dialog with the "Yes" button and the DB is automatically generated by the SIMATIC manager.

```
OB100 :   "Complete Restart"

Kommentar:


Netzwerk 1 : Titel:

Kommentar:


CALL FB3, DB3
```

Calling FB2 in the OB100

Now you must set the parameter COM_RST with TRUE to initialize the ION SIMATIC S7 PN. For the parameter DEV_ID you must insert the identifier for your CPU according to the following table:

317-2 PN/DP	B#16#2
319-3 PN/DP	B#16#3
414-3 PN/DP	B#16#5
416-3 PN/DP	B#16#5

Afterwards save and close the component.

```
OB100 :   "Complete Restart"

Kommentar:


Netzwerk 1 : Titel:

Kommentar:


     CALL  "ION SIMATIC S7 PN" , DB3              FB3
      COM_RST         :=TRUE
      CYCLE_T         :=
      COMMAND_ID      :=
      DATA_ID         :=
      COMMAND_PORT    :=
      DATA_PORT       :=
      DEV_ID          :=B#16#5
      CURRENT_CHANNELS:=
      CHANNEL         :=
      UIK0            :=
      UIK1            :=
      UIK2            :=
      UIK3            :=
      UIK4            :=
      UIK5            :=
      UIK6            :=
      UIK7            :=
```

Initialized parameter list of the ION SIMATIC S7 PN in the OB100

6.3 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 about 100 ms, it must not be above 300 ms.

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 PN. 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 "DB3.CHANNEL [*index*].

b) All data can be written into an array which can be set to the input CHANNEL of the FB3 during block call.

```
OB35 :  "Cyclic Interrupt"

Kommentar:


Netzwerk 1: Titel:

Kommentar:


        L     DW#16#19801224
        T     DB3.CHANNEL[0]
```

```
OB35 :  "Cyclic Interrupt"

Kommentar:


Netzwerk 1: Titel:

Kommentar:


        L     DW#16#19801224
        T     DB3.DBD   16
```

Write data into the Transmission Channel

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

```
OB35 :  "Cyclic Interrupt"

Kommentar:



Netzwerk 1: Titel:

Kommentar:



      L     DW#16#19801224
      T     DB3.DBD   16



Netzwerk 2: Titel:

Kommentar:



      CALL  "ION SIMATIC S7 PN" , DB3          FB3
      COM_RST        :=FALSE
      CYCLE_T        :=#OB35_EXC_FREQ
      COMMAND_ID     :=25
      DATA_ID        :=26
      COMMAND_PORT   :=W#16#800
      DATA_PORT      :=W#16#801
      DEV_ID         :=B#16#5
      CURRENT_CHANNELS:=16
      CHANNEL        :=
      UIK0           :=
      UIK1           :=
      UIK2           :=
      UIK3           :=
      UIK4           :=
      UIK5           :=
      UIK6           :=
      UIK7           :=
```

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 port numbers. 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). Enter for the parameter COMMAND_PORT a UDP port for the command connection (0x07D0…0x1388). As in the example port 2048 which can be selected freely. Enter for the parameter DATA_PORT a UDP port for the data link (0x07D0…0x1388). As in the example port 2049 which can be selected freely.

Enter for the parameter DEV_ID the identifier for your SIMATIC S7 CPU according to the following list:

317-2 PN/DP	B#16#02
319-3 PN/DP	B#16#03
414-3 PN/DP	B#16#05
416-3 PN/DP	B#16#05

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 178 channels.

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

6.4 UIK

Description

Each ION SIMATIC S7 PN 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 PN. The device name, which is shown by default in X-Tools, consists of the device type and the UIK. Example: ION SIMATIC S7 PN (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"

Kommentar:

Netzwerk 1: Titel:

Kommentar:

        L    DW#16#19801224
        T    DB3.DBD    16

Netzwerk 2: Titel:

Kommentar:

        CALL "ION SIMATIC S7 PN" , DB3                FB3
          COM_RST         :=FALSE
          CYCLE_T         :=#OB35_EXC_FREQ
          COMMAND_ID      :=25
          DATA_ID         :=26
          COMMAND_PORT    :=W#16#800
          DATA_PORT       :=W#16#801
          DEV_ID          :=B#16#5
          CURRENT_CHANNELS:=16
          CHANNEL         :=
          UIK0            :=B#16#0    Null Bytes
          UIK1            :=B#16#0
          UIK2            :=B#16#8
          UIK3            :=B#16#0
          UIK4            :=B#16#6    MAC Adresse
          UIK5            :=B#16#1
          UIK6            :=B#16#0
          UIK7            :=B#16#0
```

Assignment of the UIK

If multiple ION SIMATIC S7 PN 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.

6.5 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 PN. Now the connection to X-Tools can be initiated.

7 Engineering in CFC

7.1 Modification of the ION_PN

Description

The component ION SIMATIC S7 PN cannot be directly placed in a CFC-plan. Instead a covering block ION_PN (FB600) is placed in the CFC-plan and therefore calls the component ION SIMATIC S7 PN internally. The SCL source of the ION_PN is delivered as a component of the library. Thus making it possible to project-specifically adapt the interface to the transmitted data.

Modifying the SCL File

Open the library ION SIMATIC S7 PN and select in the folder Sources the SCL-Source ION_PN. Open the SCL source per double click.
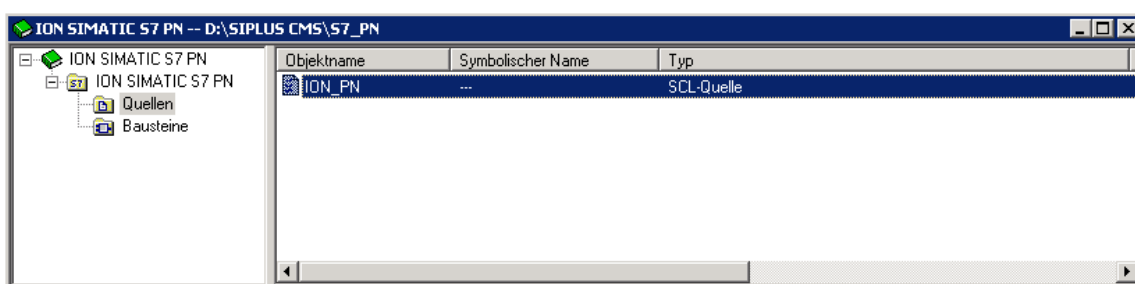
Modifying the SCL Code

1. The initial parameter **DUMMY** may not be changed, deleted, shifted or renamed.

2. Behind the initial parameter **DUMMY** are the initial parameters for the values which can be transferred. Designations and data types of the variables may be project-specifically adapted. It is highly recommended in this case to provide the initial parameters with comments for the PCS7 attributes (e.g. to assign **S7_visible = ‚false')**.

3. Make sure that the parameters projected behind the input variable **DUMMY** occupy a storage area at least by **CURRENT_CHANNELS** x 4 byte per channel. **CURRENT_CHANNELS** can be changed for the instance. Since the max. number of channels amounts to 178, the initial parameters should occupy 712 byte.

The remaining SCL code should not be changed!

Translate the Block

Translate the component in the SCL editor over file → translating.

Notice

If it is not possible to translate the CFC block check whether FB600 is listed in symbols as "ION_PN".

Notice

If the FB600 should be already present, before translating the existing FB600 must be deleted from the library ION SIMATIC S7 PN and the symbolic name ION_PN must be assigned to a free module number. Secure the changed SCL source ION_PN from ION SIMATIC S7 PN for later adjustments.

SCL source of the covering block

7.2   Projecting of the covering component in the CFC

Project the adapted component ION_PN in the CFC-Plan and insert the ION_PN in a cyclic interrupt (OB3x). The installation of the component into the OB100 takes place automatically; likewise the supply of the entrance SAMPLE_T with the cycle time of the used cyclic interrupt is necessary.

Configure the inputs COMMAND_ID, DATA_ID, COMMAND_PORT, DATA_PORT and CURRENT_CHANNELS of the ION_PN. Configure the inputs UIK0..UIK7 in CFC.

Finally the CPU must once be restarted (STOP, →RUN) thereby that ION SIMATIC S7 PN is initialized and a connection to X-Tools can be established.
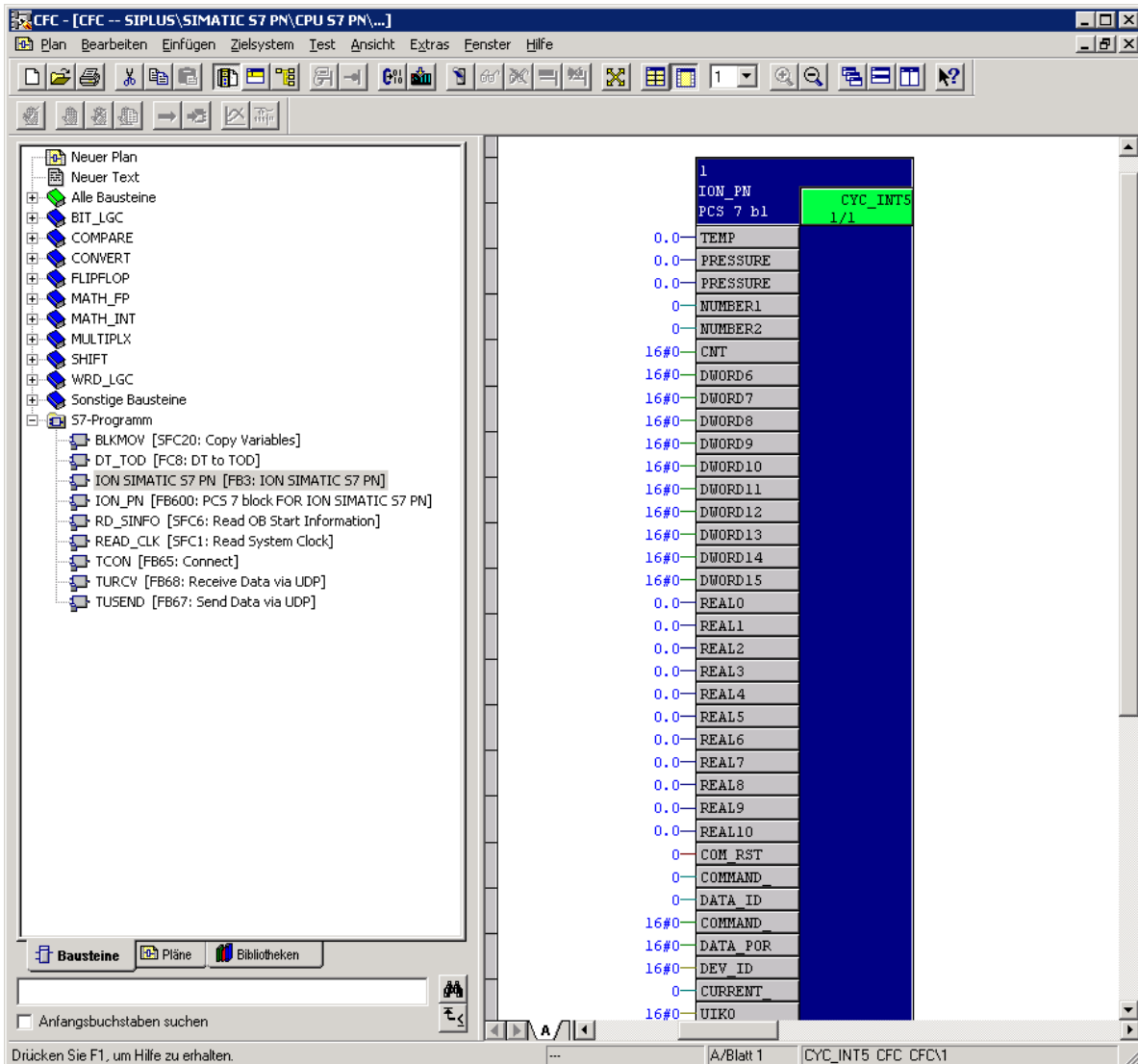
Call of the adapted CFC BLOCK S7 PN of covering component in the CFC

8 Tips and Tricks

8.1 Reset the Function Block

The ION SIMATIC S7 PN 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 PN at any moment easily.

8.2 Engineering during Runtime

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

8.3 Changing the Number of the Function Block

The number of ION SIMATIC S7 PN (FB3) can be changed user-defined. It is just necessary to adapt the Symbol Table. It is possible to change the numbers of FB65/FB67/FB68 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.

8.4 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 PN.

8.5 Multi-Instancing of ION SIMATIC S7 PN

It is possible to call multiple instances of the ION SIMATIC S7 PN in one SIMATIC CPU. This is necessary when the required amount of data is more than 712 Byte per cycle.

Each instance of the ION SIMATIC S7 PN must be called in OB100 with COM_RST = TRUE to initialize the FB. For each instance a separate data block and a dedicated connection pair (command and data connection) is required. The connections are identified by COMMAND_ID, DATA_ID, COMMAND_PORT und DATA_PORT. The parameters COMMAND_ID and DATA_ID can be taken from 0x0001 to 0x0FFF. Each ID must be used for one connection only.

The UIK must be unique for each ION SIMATIC S7 PN. The bytes UIK2...UIK7 shall be set to the MAC address of the used PROFINET interface. To keep unique UIKs for each ION SIMATIC S7 PN in the bytes UIK0 and UIK1 can be numbered sequential.

The number of usable instances is limited by capacity of CPU. If multiple instances are called in one controller the memory usage and cycle time of the CPU have to be checked.

Each active ION SIMATIC S7 PN needs a software license key.

9 Appendix

9.1 Other Documentation

- Manual: SIPLUS CMS4000 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

9.2 Service & Support in the Internet

In addition to our documentation pool we offer our complete knowledge base on the Internet:

www.siemens.com/automation/service&support

There you find:

- The newsletter, which is constantly updated to provide you with the latest information about your products.
- The right documents via our search function under Service & Support.
- The bulletin board, a worldwide knowledge exchange for users and experts.
- Your local representative for Industry Automation & Drives Technologies via our representatives database.
- Information about on-site services, repairs, spare parts, and lots more you will find under "Support".

9.3 Contact Information

Address

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90766 Fuerth

Germany

Internet

http://www.siemens.com/siplus-cms

9.4   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