IBHsoftec

S7-SoftPLC PLC-416
PLC-315

Manual

Version 4.x

IBH*softec*
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Contents

1 IBH*softec S7-SoftPLC*

The IBHsoftec-S7-SoftPLC is a software that emulates a hardware-PLC with real-time behavior. The PLC programm is executed on the same way as it would be on a hardware-PLC. This provides the advantage, that the status of the programm can be displayed directly. Thereby the debugging of a PLC programm is facilitated, since it is possible to determine at any time, which command is executed.

The S7-SoftPLC 315/416 is compatible to a SIEMENS SIMATIC® 315/416 Hardware PLC.

The following additions are implemented to a standard PLC:

- Ethernet-CP 343/443 emulation
- Modbus on TCP Server/Client
- NVRAM support for retain data
- Interface for user configured FC/SFC

Drivers for:

Hilscher CIF-cards	AS-Interface-Master, CANopen-Slave/Master, DeviceNet-Slave/Master, InterBus-Slave/Master, PROFIBUS-DP-Slave-DP/FMS-Master, SERCOS
Beckhoff TwinCAT I/O	EtherCAT®, Lightbus, PROFIBUS DP/MC, Interbus, CANopen, SERCOS interface, DeviceNet, Ethernet, PC-Printer-Port, USB, SMB
SoftNet PN IO	PROFINET
Addi-Data Driver	ADDIPACK
PC-Hardwareports	ISA

2 Installation

The chapter installation is divided in the following sub chapters:

- System requirements
- Installation
- Uninstalling

2.1 System requirements

The *S7-SoftPLC* is executable under Windows® NT Version 4.0, Windows® 2000 Windows® XP and Windows® Vista of Microsoft Cooperation. OEM versions for Windows® CE and Windows® XP embedded are available on request.

2.2 Installing *S7-SoftPLC*

The installation programm executes all necessary steps for the installation of *S7-SoftPLC* on your hard drive.

To install *S7-SoftPLC*, the software must be unlocked with your personal PIN. You can find your personal PIN and the serial number on the product ID card attached to the registration card that comes with the installation-CD.

2.3 Uninstalling *S7-SoftPLC*

To uninstall *S7-SoftPLC* from your computer, please execute the following steps:

- From the Windows® control panel select "Software"
- In the menu „add/remove programs“ choose the *S7-SoftPLC* from the list of installed programs. Activate the „Add/Remove“-button.

3 Online

In this chapter, multiple options to access *S7-SoftPLC* online are described.

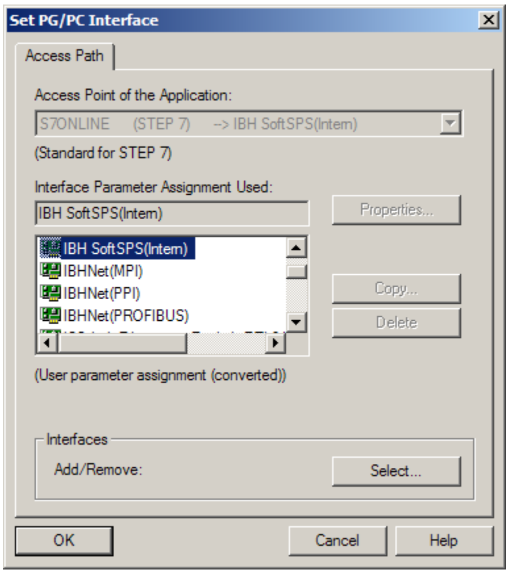
- General
- Step® 7
- *S7 for Windows®*
- Visualisization
- Data interface

3.1 *S7-SoftPLC* online functions

Online functions are available for *S7 for Windows*® and Siemens SIMATIC® Manager. If the programming system is installed on the same computer as *S7-SoftPLC*, the data exchange can be done over the internal PC memory. The necessary drivers are installed with *S7-SoftPLC*. Alternatively the data exchange can be done over a serial port. Therefore the programming unit can be connected via a zero modem cable. A PC adaptor with 38,4 kBaud on the programming unit has to be selected here. Furthermore online functions over TCP/IP Ethernet are provided via the *IBHNet* driver. The *IBHNet* driver can be freely downloaded from the IBH*softec* homepage. Via Siemens ISO-On-TCP (RFC1006) protocol online functions are also possible. Therefore the Ethernet CP-343/443 has to be integrated in the configuration.

If a Hilscher CIF30/50/60 Profibus card is used, *S7-SoftPLC* can be programmed over the connected Profibus. Operator panels can also be connected, if the card driver is configured correctly.

3.2 Online with STEP® 7



Set PG/PC Interface

Access Path

Access Point of the Application:

S7ONLINE (STEP 7) --> IBH SoftSPS(Intern)

(Standard for STEP 7)

Interface Parameter Assignment Used:

IBH SoftSPS(Intern)

- IBH SoftSPS(Intern)
- IBHNet(MPI)
- IBHNet(PPI)
- IBHNet(PROFIBUS)

(User parameter assignment (converted))

Accessing S7-SoftPLC directly with Step® 7

Over Step®7 a direct access is possible. *S7-SoftPLC* installs its own access point in the dialogue „Set PG/PC interface“.

Accessing S7-SoftPLC over IBHNet with Step® 7

If the *IBHNet* driver is installed on the PU, *S7-SoftPLC* can be programmed via Ethernet. The *IBHNet* protocol is always active on *S7-SoftPLC*, so that no configuration is necessary. In the *IBHNet* station, which is configured on the programming unit, only the IP-address of the computer, which is executing *S7-SoftPLC*, needs to be entered.

Accessing *S7-SoftPLC* over TCP/IP with Step® 7

The driver cpx43.dll must be integrated in the configuration file PLC43.INI. In the hardware configuration of the SIMATIC® Manager a CP has to be added to the hardware configuration. In the IP-address-field of the CP, the IP address of the computer with *S7-SoftPLC* must be set.

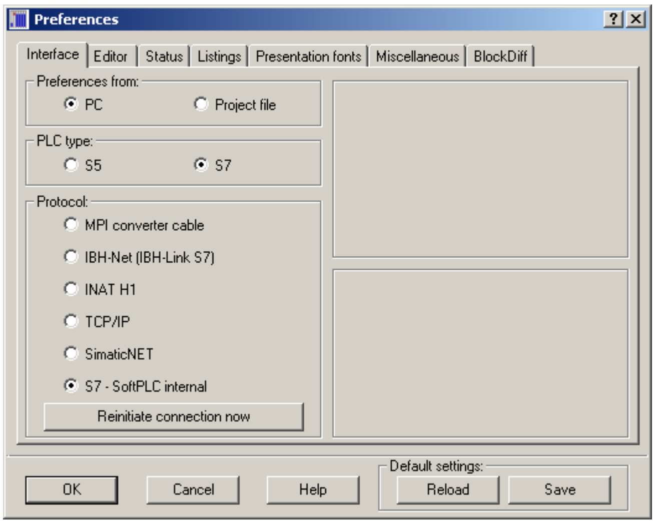
Accessing *S7-SoftPLC* over the serial port with Step® 7

The MPI® interface has to be assigned to a COM-port. Therefore you can access the PLC over a zero modem cable. Now the PG/PC-interface has to be set to a PC adapter with 38.400 Baud.

Accessing *S7-SoftPLC* over Profibus with Step® 7

It is a precondition, like at a hardware PLC, that the Profibus is configured over MPI® first. In the case of *S7-SoftPLC* this can happen direct, serial or via TCP/IP. If the Profibus is operational, it is possible to activate the option „OnlineDP“ in the driver configuration to allow an access to the PLC via Profibus.

3.3 Online with S7 for Windows®



Preferences from:
● PC ○ Project file

PLC type:
○ S5 ● S7

Protocol:
○ MPI converter cable
○ IBH-Net (IBH-Link S7)
○ INAT H1
○ TCP/IP
○ SimaticNET
● S7 - SoftPLC internal

Accessing *S7-SoftPLC* directly with S7 for Windows®

S7 for Windows® provides the possibility to access *S7-SoftPLC* directly to transfer progams. All *S7 for Windows®* online functions are available. The data exchange is carried out extremely fast.

If you own an older version of *S7 for Windows®* (e.g. < V 4.04), please order an update.

Accessing *S7-SoftPLC* over *IBHNet* with *S7 for Windows®*

Connecting *S7 for Windows®* via *IBHNet* with *S7-SoftPLC*.

Choose the protocol IBH-Net (*IBH-Link S7*) in the dialogue "Preferences" of *S7 for Windows®*. After a click on „Select connection“ choose the desired *IBHLink* connection. With a click on „Select PLC“ a S7 CPU-choice dialogue appears, in which the available MPI®-addresses are displayed. By confirming the dialogue, the PLC is chosen. Now establish the connection by clicking on „Reinitiate connection now“ and close the configuration dialogue by clicking „OK“. The connection to *S7-SoftPLC* has now been established.

Accessing *S7-SoftPLC* over TCP/IP with *S7 for Windows®*

Connecting *S7 for Windows®* via RFC1006 with *S7-SoftPLC*.

Choose the TCP/IP protocol in the dialogue „Preferences“ of *S7 for Windows®*. The dialogue „Select the Station via TCP/IP Network“, which does appear after a click on „Select connection“ allows to enter the IP-address of *S7-SoftPLC*. Now establish the connection by clicking on „Reinitiate connection now“ and close the configuration dialogue by clicking „OK“.

The connection to *S7-SoftPLC* has now been established.

Accessing *S7-SoftPLC* over the serial port with *S7 for Windows®*

Connecting *S7 for Windows®* via serial port with S7-SoftPLC.

Choose the protocol MPI® converter cable in the dialogue „settings" of *S7 for Windows®*. Choose the serial port that is connected with the computer running *S7-SoftPLC* and 38400 baud. After a click on the dialogue „Select PLC", a S7 CPU-choice dialogue appears in which the available MPI®-addresses are displayed. By confirming the dialogue, the PLC is selected. Now establish the connection by clicking on „Reinitiate connection now" and close the configuration dialogue by clicking „OK".

The connection to *S7-SoftPLC* has now been established.

3.4 Visualizations

Direct drivers

The following list shows a choice of HMI manufacturers, who offer direct drivers for IBH*softec S7-SoftPLC*

Producer	**Programm**	**S7-SoftSPS**	**IBHNet**	**RFC 1006**	**Fetch/ Write**	**Modbus on TCP**
Copa-Data GmbH	zenOn	yes	no	yes	yes	yes
EXOR		no	no	yes	yes	yes
GEFASOFT AG München	GraphPic®	yes	yes	yes	yes	yes
GTI-control Gesellschaft für technische Informationsverarbeitung mbH	PROCON-WIN	no	yes	yes	yes	yes
	ISIVIS	no	yes	yes	no	yes
INOSOFT AG	VisiWinNET®	yes	yes	optional*	optional*	optional*
Lenze Digitec Controls GmbH	VisiWinNET® (INOSOFT)	yes	yes	optional*	optional*	optional*
Pro-face		no	no	yes	yes	yes
Siemens	ProTool® / Pro	yes	yes	yes	yes	no
	WinCC® / flexible	yes	yes	yes	yes	yes
Sütron	TSwin.net	no	no	yes	no	yes
	zenOn (Copa-Data)	yes	no	yes	yes	yes
Wonderware	InTouch	no	no	yes	no	yes

* available on request at INOSOFT

IBHNet

The *S7-SoftPLC* can be accessed via the *IBHNet* driver, with every visualization software, that supports the *IBHNet* protocol. The *IBHNet* driver is available at http://www.ibhsoftec-sps.de/ as free download.

If an HMI package has implemented an own direct driver for the *IBHLink S7* (NetLink) protocol, it can access the *S7-SoftPLC* as well, since this protocol (NL_MPI) is supported by the *S7-SoftPLC* too.

In addition there is the possibility, that an own visualization (e.g. Visual® BASIC or other high level languages) can establish a communication via the *IBHNet*-object, which is installed with the *IBHNet* driver. Details on this are contained in the *IBHNet* documentation.

RFC1006

To connect a HMI package to *S7-SoftPLC* via RFC1006 is possible, if the Ethernet CP-343/443 emulation of the *S7-SoftPLC* has been started.

Accessing *S7-SoftPLC* over Profibus with operator panels

The use of Hilscher Profibus® Master Cards is required. The Profibus must be configured over MPI® like on an hardware PLC first. In the case of *S7-SoftPLC* this can happen direct, serial or via TCP/IP. If the Profibus is operational, the option „OnlineDP“ can be activated in the driver configuration, to allow access to the *S7-SoftPLC* via Profibus.

OPC Server

A connection to *S7-SoftPLC* from an HMI package with the IBH*softec OPC server* or other OPC servers, which support the mentioned protocols,is possible as well.

3.5 Data interface to *S7-SoftPLC*

S7-SoftPLC can be accessed directly by various high level languages (e.g. Visual Basic®, Visual C/C++® or Borland C++Builder®). The DLL required for this (PLC32.DLL) is installed with *S7-SoftPLC.* The PLC32.DLL is a 32 Bit application.

Below the available functions for a data exchange are described.

Data transmitting functions

Read a single value

Reads a value from S7-SoftPLC.

```
unsigned long int DLLexport ReadVal (unsigned long int type,

                                     unsigned long int no,

                                     unsigned long int DBNo,

                                     unsigned long int size,

                                     unsigned long int far * val);
```

parameter	description	comment
type	'I' = input	
	'Q' = output	
	'M' = flag	
	'C'= counter value	16-bit-access only
	'T' = timer value	16-bit-access only
	'D' = data word or double data word	depending on size
	'B' = data bit, word, double word on byte address	depending on size
		compatible to S7 only
	'P' = P_Parameter	S7 from version 3 only
no	address	Byte address of read in operand
DBNo	Number of data block	1 16383
size	Number of bits	
	0..7 = bit no 0 7	'I', 'Q', 'M' only
	8 = 1 byte	
	16 = 1 wort	
	32 = 1 double word	
val	Read value	Pointer to a valid variable in the user applications address space
return	0 on error	Error messages

Length of parameter list (Visual-C): 20 bytes.

Write a single value

Writes a value in *S7-SoftSPS*.

```
unsigned long int DLLexport WriteVal (unsigned long int type,
                                      unsigned long int no,
                                      unsigned long int DBNo,
                                      unsigned long int size,
                                      unsigned long int far * val);
```

parameter	description	comment
type	'I' = input 'Q' = output 'M' = flag 'C' = counter value 'T' = timer value 'D' = data word or double data word 'B' = data bit, byte, wort, doppelwort on byte address 'P' = P_Parameter	 16-bit-access only 16-bit-access only depending on size depending on size compatible to S7 only S7 from version 3 only
no	address	Byte address of operand to be written
DBNo	number of data block	1 16383
size	number of bits 0..7 = bit no 0 7 8 = 1 byte 16 = 1 wort 32 = 1 double word	 'I', 'Q', 'M' only
val	value to be written	
return	0 on error	Error messages

Length of parameter list (Visual-C): 20 bytes.

Read multiple values

Reads multiple values from *S7-SoftPLC*.

```
unsigned long int DLLexport ReadVals (unsigned long int type,
                                      unsigned long int no,
                                      unsigned long int DBNo,
                                      unsigned long int size,
                                      unsigned char  far * vals);
```

parameter	description	comment
type	'I' = input 'Q' = output 'M' = flag 'D' = data word 'B' = data byte on byte address	 S5 compatible compatible to S7 only
no	address	
DBNo	number of data block	1 16383
size	number of data bytes or data words	destination size in bytes for type 'I', 'Q', 'M' and 'B', destination size in data words for 'D'
vals	Value of byte	Pointer to a valid array in the user applications address space WARNING: ARRAY HAS TO BE BIG ENOUGH!
return	0 on error	Error messages

Length of parameter list (Visual-C): 20 bytes.

WARNING: FOR DATA BLOCKS (TYPE 'D') THE ARRAY HAS TO BE TWICE AS BIG, SINCE 2 BYTES ARE NECESSARY FOR EVERY DATA WORD!

Write multiple values

Writes multiple values to *S7-SoftPLC*.

```
unsigned long int DLLexport WriteVals (unsigned long int type,
                                       unsigned long int no,
                                       unsigned long int DBNo,
                                       unsigned long int size,
                                       unsigned char far * vals);
```

parameter	description	comment
type	'I' = input 'Q' = output 'M' = flag 'D' = data word 'B' = data byte on byte address	 S5 compatible compatible to S7 only
no	address	
DBNo	number of data block	1 16383
size	number of data bytes or data words 'I' 'Q' 'M' 'B' 'D'	 Destination size in bytes Destination size in bytes Destination size in bytes Destination size in bytes Destination size in data words
vals	value of byte	Pointer to a valid array in the user applications address space WARNING: ARRAY HAS TO BE BIG ENOUGH!
return	0 on error	Error messages

Length of parameter list (Visual-C): 20 bytes.

WARNING: FOR DATA BLOCKS (TYPE = D) THE ARRAY HAS TO BE TWICE AS BIG, SINCE 2 BYTES ARE NECESSARY FOR EVERY DATA WORD!

Read DB

Reads the content of a data block from *S7-SoftPLC*.

unsigned long int DLLexport ReadDB (unsigned long int no,

unsigned short int far * block,

unsigned long int far * size,

unsigned long int synchronous);

parameter	description	comment
no	number of data block	1..16383
block	pointer to data block content	pointer to a valid array in the user applications address space. WARNING: ARRAY HAS TO BE BIG ENOUGH!
size	number of words that are to be read from the data block	if the data block is smaller than the size, the size will be reduced automatically. Pointer to a valid variable in the user applications address space.
synchronous	always 0	irrelevant for S7
return	0 on error	Error messages

Length of parameter list (Visual-C): 16 bytes.

WARNING: WORD-ORIENTED READING, LOW- AND HIGH-BYTE ARE SWAPPED.

Write DB

Writes a data block to *S7-SoftPLC*.

```
unsigned long int DLLexport WriteDB (unsigned long int no,
                                     unsigned short int far * block,
                                     unsigned long int far * size,
                                     unsigned long int synchronous);
```

parameter	description	comment
no	number of data block	1..16383
block	pointer to data block content	Pointer to a valid array in the user applications address space WARNING: ARRAY HAS TO BE BIG ENOUGH!
size	number of words that are to be written into the block	if the data block is smaller than the size, the size will be reduced automatically. Pointer to a valid variable in the user applications address space.
synchronous	always 0	irrelevant for S7
return	0 on error	Error messages

Length of parameter list (Visual-C): 16 bytes.

WARNING: WORD-ORIENTED WRITING, LOW- AND HIGH-BYTE ARE SWAPPED.

Read S7 DB

Reads the content of a S7 data block from the PLC (byte oriented).

```
unsigned long int DLLexport ReadDB_S7  (unsigned long int no,
                                        unsigned char int far * block,
                                        unsigned long int far * size);
```

parameter	description	comment
no	number of data block	1..16383
block	pointer to data block content	Pointer to a valid array in the user applications address space WARNING: ARRAY HAS TO BE BIG ENOUGH!
size	number of bytes that are to be read into the block	if the data block is smaller than the size, the size will be reduced automatically. Pointer to a valid variable in the user applications address space.
return	0 on error	Error messages

Length of parameter list (Visual-C): 12 bytes.

Write S7 DB

Writes the content of a S7 data block in the PLC (byte-oriented).

```
unsigned long int DLLexport WriteDB_S7  (unsigned long int no,
                                         unsigned char int far * block,
                                         unsigned long int far * size);
```

parameter	description	comment
no	number of data block	1..16383
blcok	pointer to data block content	Pointer to a valid array in the user applications address space WARNING: ARRAY HAS TO BE BIG ENOUGH!
size	number of bytes that are to be written into the block	if the data block is smaller than the size, the size will be reduced automatically. Pointer to a valid variable in the user applications address space.
return	0 on error	Error messages

Length of parameter list (Visual-C): 12 bytes.

Functions for data conversion

FloatToMC5

Converts floating point numbers from IBM-PC-format into S7 double words.

```
void DLLexport FloatToMC5 (float FloatValue,

                                                            unsigned long far * MC5Val);
```

parameter	description	comment
FloatVal	floating point number in IEEE- or INTEL-format	
MC5Val	floating point number in Siemens-S7-format	

MC5ToFloat

Converts S7 double words into floating point numbers in IBM-PC-format.

```
void DLLexport MC5ToFloat (unsigned long far * MC5Val,

                                                  float FloatVal);
```

parameter	description	comment
MC5Val	floating point number in Siemens-S7-format	
FloatVal	floating point number in IEEE- or INTEL-format	

Accessing with a web server

If you are intending to access *S7-SoftPLC* with web applications(IIS), which should have access to the process data, please contact our support for examples. The *S7-SoftPLC* installs an object, which allows data access from script languages (VB Sript, J Script).

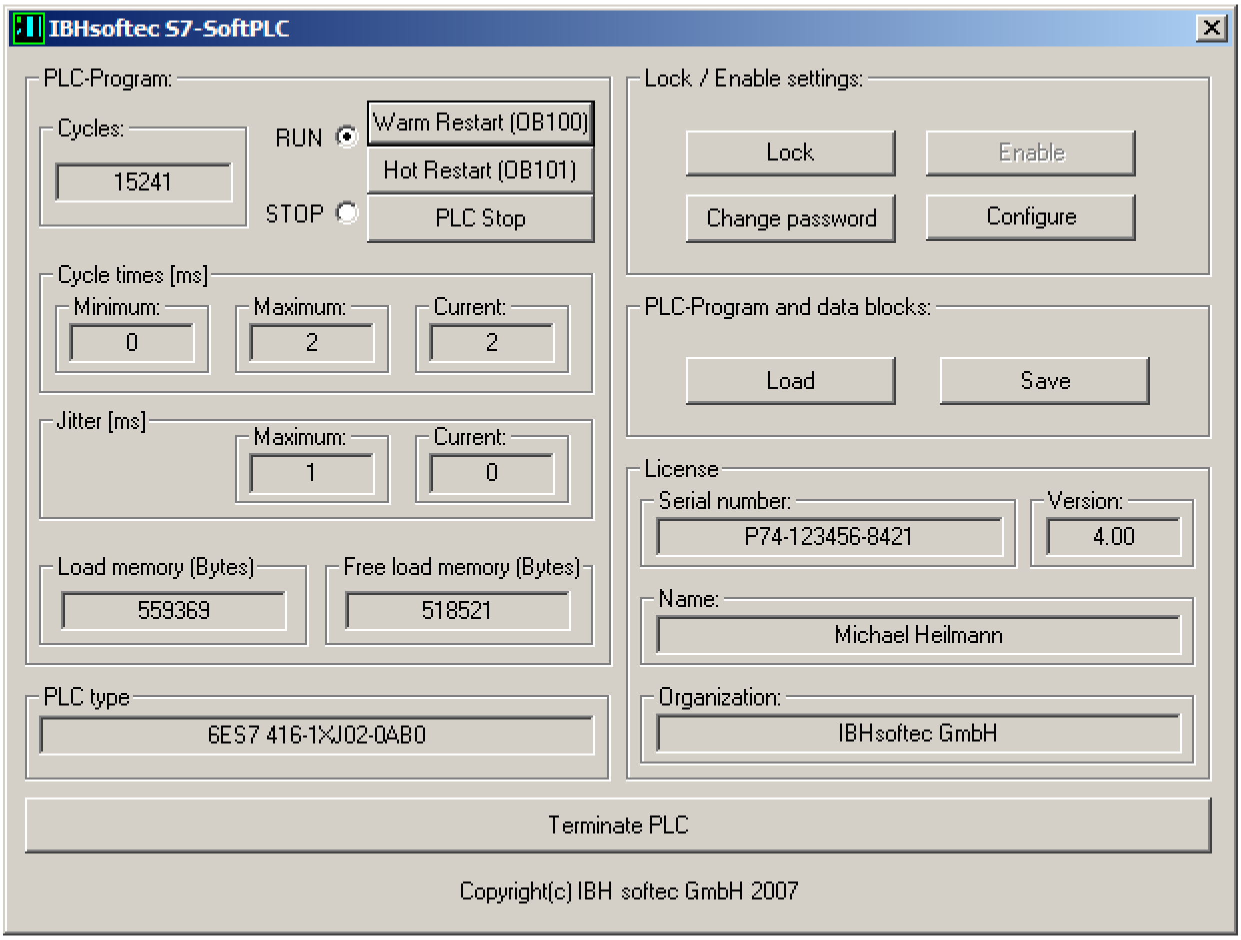
4 Interface and configuration

There are two different views of *S7-SoftPLC*.

The first, called classic view in the following text, shows cycle times and allows to switch *S7-SoftPLC* to RUN/STOP.

The second is called configuration interface and allows to choose the used interface driver and to alter *S7-SoftPLC* settings.

4.1 Classic View



PLC-Program:

Cycles: 15241

RUN ●

STOP ○

Cycle times [ms]: Minimum: 0 Maximum: 2 Current: 2

Jitter [ms]: Maximum: 1 Current: 0

Load memory (Bytes): 559369

Free load memory (Bytes): 518521

PLC type: 6ES7 416-1XJ02-0AB0

Lock / Enable settings:

PLC-Program and data blocks:

License

Serial number: P74-123456-8421

Version: 4.00

Name: Michael Heilmann

Organization: IBHsoftec GmbH

Copyright(c) IBH softec GmbH 2007

This is the standard view of IBHsoftec S7-SoftPLC. Here the number of cycles, as well as the cycle times and jitter of the actual PLC program can be seen. Available load memory, free load memory, PLC type, serial number, version, name and organization of the user are displayed as well. The classic view provides the possibility to restart, stop or close the S7-SoftPLC. Loading and saving the PLC-program into the installation folder, changing to the configuration view and locking the user interface to prevent unauthorised access is also possible.

Warm restart (OB100)

Activating the button „Warm restart“, starts the PLC-program. First the organisation block OB 100 is processed. After this the cyclic program-processing starts with OB1.This is similar to the start-up of a hardware PLC after a voltage-return.

Hot restart (OB101)

Activating the button „Hot restart“, starts the PLC-program. First the organisation block OB 101 is processed. After this the cyclic program-processing starts with OB1. This is similar to the start-up of a hardware PLC after manual switching from STOP to RUN.

PLC Stop

Activating the button „Stop“, stops the cyclic program-processing. In the operating mode "STOP" the PLC-program is not processed. The status of the process images, flags, counters and timers, remain in the current state.

Terminate PLC

Activating the button „Terminate PLC“, terminates the program. A restart of the *S7-SoftPLC* is possible at any time.

Cycles

The number of program-cycles is displayed here

Cycle times [ms]

The time a program-cycle needs is monitored continuously by *S7-SoftPLC*.

The minimum, maximum and current cycle time of the current PLC-program are displayed. The resolution of a cycle time-measurement is one millisecond.

The cycle time of a PLC depends on the program structure. At the end of a cycle *S7-SoftPLC* saves the result of the cycle time-measurement. This is the time, that has past between two OB1 calls.

The time of a cycle (OB1 Cycle time) can be read out with the PLC-program.

OB 1/LW6:	current cycle time in ms	(OB1_PREV_CYCLE)
OB 1/LW8:	maximum cycle time in ms	(OB1_MIN_CYCLE)
OB 1/LW10:	minimum cycle time in ms	(OB1_MAX_CYCLE)

Jitter

Jitter is the variation in the cycle time of the *S7-SoftPLC* caused by the system itself.

If an output pulse from a timer OB (e.g. OB 10, every 10 ms) is measured, differences may be found. Jitter is the variation in time between the current measurement, relative to the previously measured time. You will see jitter with hardware and software PLC’s.

With *S7-SoftPLC* the jitter may be caused by programmed program-interrupts such as process alarms and also may occur due to hard disk access, network access, etc (system activities).

The Jitter of the *S7-SoftPLC* is constantly measured. The maximum jitter and the actual jitter is displayed.

Load memory

The load memory is the maximum size in bytes, that a PLC-programm may use. The free load memory is the size, that is still available and can be used by additional blocks. If to few free load memory is available, the PU can not transmit new blocks to *S7-SoftPLC.*

Lock settings

A manipulation of *S7-SoftPLC* by the user can be prevented with a password.

To lock *S7-SoftPLC* activate the button „Lock settings“.

Now unauthorised access to the *S7-SoftPLC* is prevented.

NOTE: THE LOCKING HAS NO INFLUENCE ON THE PROGRAM SEQUENCE OF *S7-SOFTPLC*.

Enable settings

The locked *S7-SoftPLC* is enabled again.

To unlock *S7-SoftPLC* activate the button „Enable settings“.

The *S7-SoftPLC* user interface can now be used to alter *S7-SoftPLC* configuration.

Change password

Changes the password.

After activating the button „Change password“ a dialogue appears, where the old and two times the new password have to be entered to confirm the change.

The password has now been changed.

Configure

Switches the user interface to configuration mode.

After activating the button „Configure“ the interface changes its display into the configuration view. Here drivers can be chosen and parameterised. Inputs, outputs, flags and data blocks can be observed and basic settings can be altered.

The S7-SoftPLC can now be configured.

Load

The PLC-program currently saved in the file „S7.BIN“ in *S7-SoftPLC*'s installation folder will be loaded into *S7-SoftPLC*.

Save

The PLC-program currently loaded in *S7-SoftPLC* will be saved as „S7.BIN“ in the installation folder of *S7-SoftPLC*.

PLC type

Purchase order numbers compatible to *S7-SoftSPS*:

6ES7 315-1AF01-0AB0	*S7-SoftPLC 315* without Profibus
6ES7 315-2AG10-0AB0	*S7-SoftPLC 315* with Profibus
6ES7 416-1XJ02-0AB0	*S7-SoftPLC 416* without Profibus
6ES7 416-2XK02-0AB0	*S7-SoftPLC 416* with Profibus

Serial number

The serial number of the installed *S7-SoftPLC*

Version

Number of version fo the installed *S7-SoftPLC*

Name

Name of licence owner

Organisation

License owners organization/company name

4.2 Configuration view

In this view the user has the possibility to configure *S7-SoftPLC* parameters, choose and parameterise drivers and observe inputs, outputs, flags and data blocks.

Menu

The Menu offers the possibility to save and open configuration files. Furthermore the display can be switched back to the „Classic view“ or other setting windows can be displayed. This help file and the IBH*softec* GmbH contact informations are also available over the menu.

Toolbar

The tool bar provides quick access to often used menu item.

Config tree

The config tree shows an overview of selected drivers and the CPU Parameter view.

To get to the desired setting, mark a tree element with the mouse.

The chosen tree entry is now displayed in the setting window.

Setting window

Here the selected element can be edited.

Help window

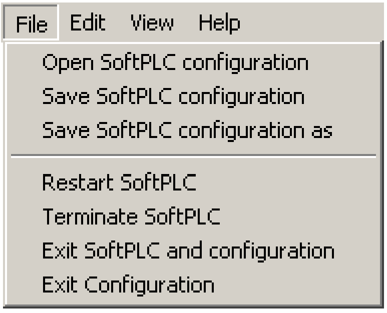
A short help for the current element is displayed here.

4.3 Menu

The menu is divided into the following four areas:

- File
- Edit
- View
- Help

4.3.1 File menu


File
Edit
View
Help
Open SoftPLC configuration
Save SoftPLC configuration
Save SoftPLC configuration as
Restart SoftPLC
Terminate SoftPLC
Exit SoftPLC and configuration
Exit Configuration

Open SoftPLC configuration

Shows an „Open file“-dialogue to choose the desired configuration file (PLC43.INI). It will be loaded to the user interface.

Save SoftPLC configuration

Saves the current *S7-SoftPLC* configuration into the installation folder of *S7-SoftPLC*.

Save SoftPLC configuration as

Opens a „Save file as“-dialogue to save the configuration file (PLC43.INI) in a different path.

Restart SoftPLC

Closes *S7-SoftPLC* and restarts it.

Terminate SoftPLC

Terminates *S7-SoftPLC*.

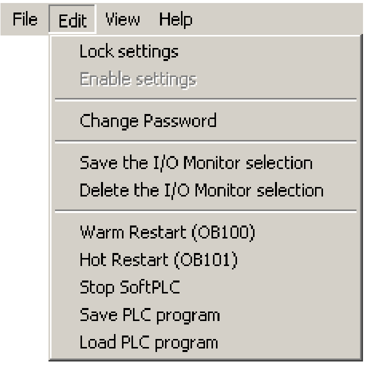
Exit SoftPLC and configuration

Terminates *S7-SoftPLC* and the user interface.

Exit configuration

Closes the user interface.

4.3.2 Edit menu



Lock settings

Locks the user interface after entering the password.

Enable settings

Enables the user interface after entering the password.

Change password

Changes the password to lock/enable the user interface.

Save I/O Monitor selection

Saves the current operand selection in the I/O monitor, so it is available after restarting the user interface.

Delete I/O Monitor selection

Deletes the current I/O operand selection, so that no operands are selected after restarting the user interface.

Warm restart (OB100)

Starts *S7-SoftPLC* with OB100.

Hot restart (OB101)

Starts *S7-SoftPLC* with OB101.

Stop SoftPLC

Switches *S7-SoftPLC* into STOP-mode.

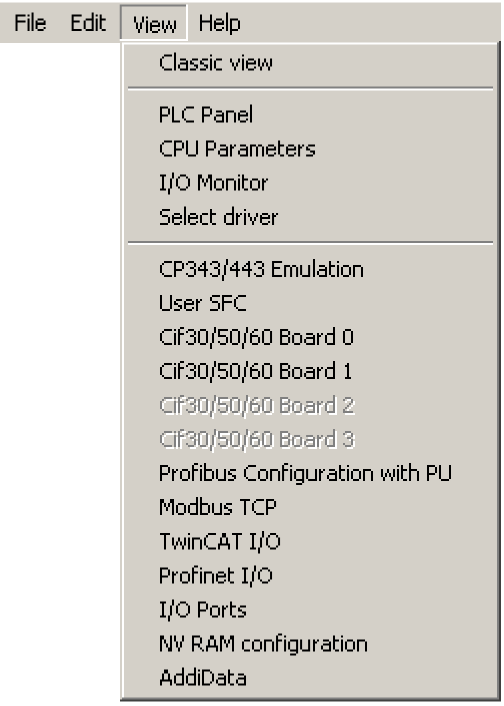
Save PLC-programm

Saves the current PLC-program of *S7-SoftPLC* into file „S7.BIN“ in the installation folder of *S7-SoftPLC*.

Load PLC-programm

Loads the program from the file „S7.BIN“ in the installation folder into *S7-SoftPLC*.

4.3.3 View menu

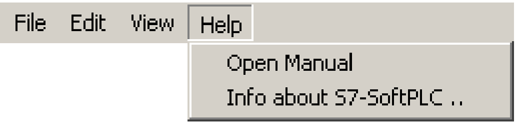


Classic view

Switches the interface from „Configuration“ to „Classic“.

The other entries select the view of the respective configuration window.

4.3.4 Help menu



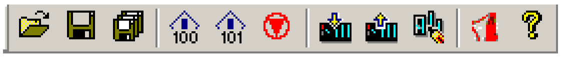
Open manual

Opens the *S7-SoftPLC* manual.

Info about S7-SoftPLC...

Opens an about box.

4.4 Toolbar



Open SoftPLC configuration

Shows an „Open file“-dialogue to choose the desired configuration file (PLC43.INI). It will be loaded to the user interface.

Save SoftPLC configuration

Saves the current *S7-SoftPLC* configuration into the installation folder of *S7-SoftPLC*.

Save SoftPLC configuration as

Opens a „Save file as“-dialogue to save the configuration file (PLC43.INI) in a different path.

Warm restart (OB 100)

Starts *S7-SoftPLC* with OB100.

Hot restart (OB101)

Starts *S7-SoftPLC* with OB101.

Stop SoftPLC

Switches *S7-SoftPLC* into STOP-mode.

Save SoftPLC binary file

Saves the current PLC-program of *S7-SoftPLC* into file „S7.BIN“ in the installation folder of *S7-SoftPLC*.

Load SoftPLC binary file

Loads the program from the file „S7.BIN“ in the installation folder into *S7-SoftPLC*.

Cold restart to accept changes in configuration

Terminates *S7-SoftPLC* and restarts it.

Open manual

Opens the *S7-SoftPLC* manual

About

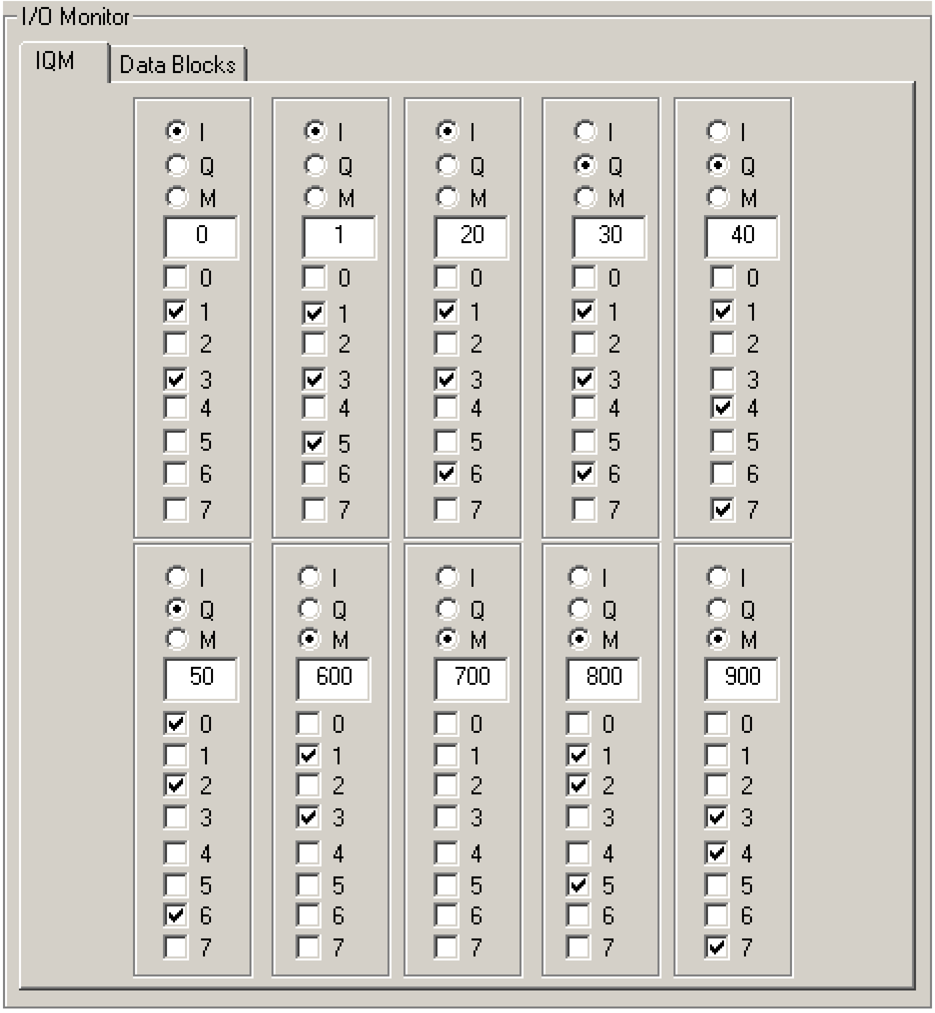
Opens a window in which the number of version of *S7-SoftPLC* and the IBH*softec* contact information are presented.

4.5 I/O monitor

This dialogue allows to observe data areas from *S7-SoftPLC*.

There are two (2) tabs, IQM for input, outputs, and flags and data blocks.

IQM



● I ○ Q ○ M 0 □ 0 ☑ 1 □ 2 ☑ 3 □ 4 □ 5 □ 6 □ 7

● I ○ Q ○ M 1 □ 0 ☑ 1 □ 2 ☑ 3 □ 4 ☑ 5 □ 6 □ 7

● I ○ Q ○ M 20 □ 0 ☑ 1 □ 2 ☑ 3 □ 4 □ 5 ☑ 6 □ 7

○ I ● Q ○ M 30 □ 0 ☑ 1 □ 2 ☑ 3 □ 4 □ 5 ☑ 6 □ 7

○ I ● Q ○ M 40 □ 0 ☑ 1 □ 2 □ 3 ☑ 4 □ 5 □ 6 ☑ 7

○ I ● Q ○ M 50 ☑ 0 □ 1 ☑ 2 □ 3 □ 4 □ 5 ☑ 6 □ 7

○ I ○ Q ● M 600 □ 0 ☑ 1 □ 2 ☑ 3 □ 4 □ 5 □ 6 □ 7

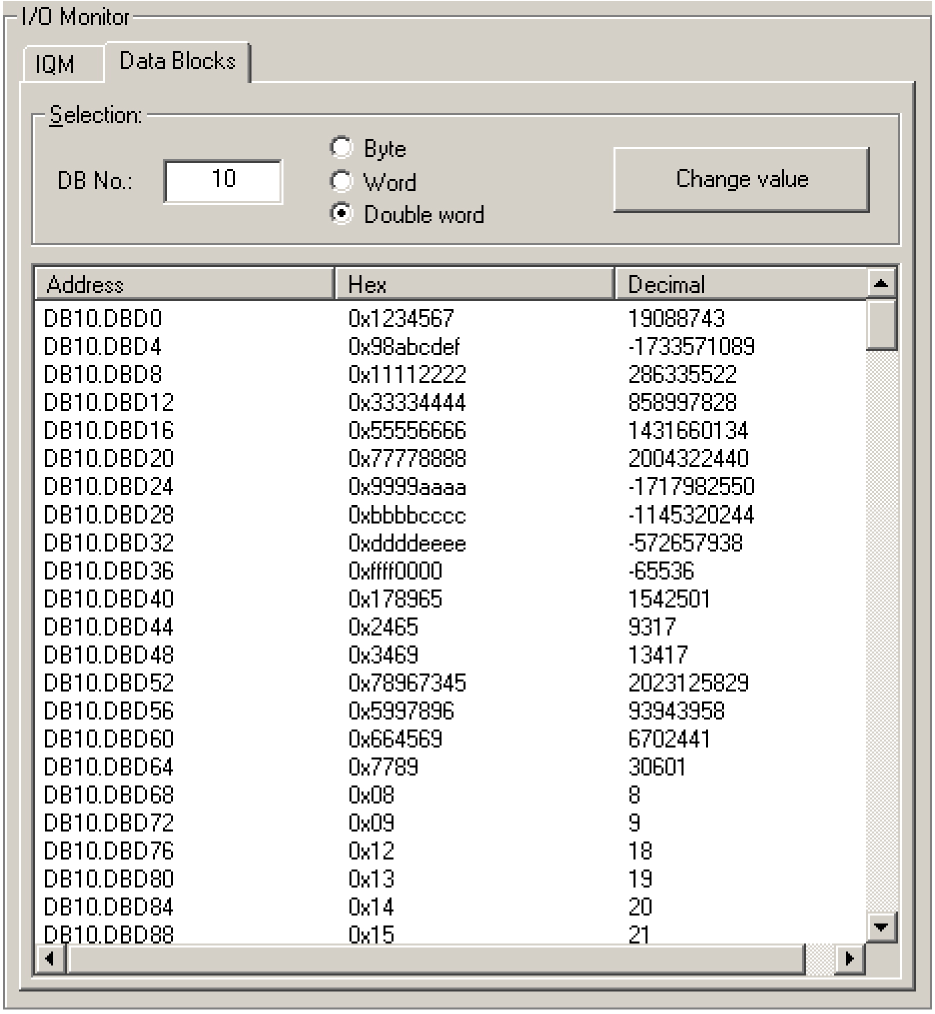
○ I ○ Q ● M 700 □ 0 □ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

○ I ○ Q ● M 800 □ 0 ☑ 1 ☑ 2 □ 3 □ 4 ☑ 5 □ 6 □ 7

○ I ○ Q ● M 900 □ 0 □ 1 □ 2 ☑ 3 ☑ 4 □ 5 □ 6 ☑ 7

The concurrent display of ten (10) byte is possible. By selecting a field, it is assigned to input-byte, output-byte or flag-byte. The checkboxes are to be understood as a switch with lamps. Chekced state indicates, that a byte is set (logical one). The button can be (re)set by the process (user program) or by clicking.

Data Blocks



Selection:

DB No.: 10

○ Byte
○ Word
● Double word

Address	Hex	Decimal
DB10.DBD0	0x1234567	19088743
DB10.DBD4	0x98abcdef	-1733571089
DB10.DBD8	0x11112222	286335522
DB10.DBD12	0x33334444	858997828
DB10.DBD16	0x55556666	1431660134
DB10.DBD20	0x77778888	2004322440
DB10.DBD24	0x9999aaaa	-1717982550
DB10.DBD28	0xbbbbcccc	-1145320244
DB10.DBD32	0xddddeeee	-572657938
DB10.DBD36	0xffff0000	-65536
DB10.DBD40	0x178965	1542501
DB10.DBD44	0x2465	9317
DB10.DBD48	0x3469	13417
DB10.DBD52	0x78967345	2023125829
DB10.DBD56	0x5997896	93943958
DB10.DBD60	0x664569	6702441
DB10.DBD64	0x7789	30601
DB10.DBD68	0x08	8
DB10.DBD72	0x09	9
DB10.DBD76	0x12	18
DB10.DBD80	0x13	19
DB10.DBD84	0x14	20
DB10.DBD88	0x15	21

Dynamic display of a data block and its content. The value of byte, word or double word can be changed decimal or hexadecimal with the button „Change value“.

5 Configuration

This chapter describes the *S7-SoftPLC* configuration.

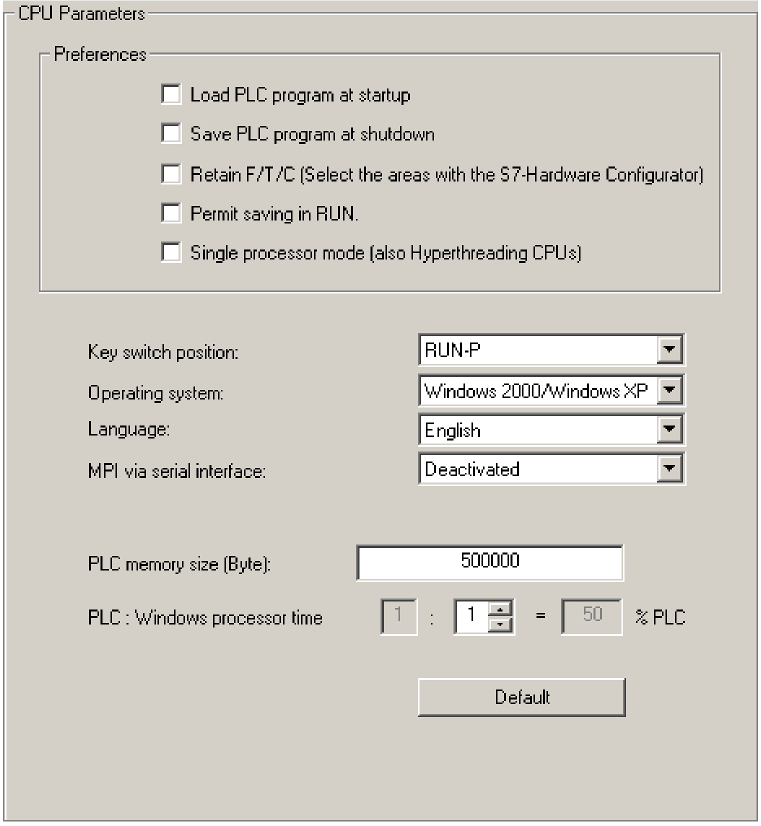
- CPU parameters
- Add/remove driver
- Addidata
- Beckhoff TwinCAT I/O
- CIF30/50/60
- CP343/CP443 emulation
- I/O Port
- Modbus on TCP
- NVRAM
- Softnet PN I/O
- User SFC

5.1 CPU parameters

Here the basic settings for *S7-SoftPLC* are performed.

- Configuration with the help of the user interface
- Configuration in the PLC43.INI

5.1.1 User Interface



CPU Parameters

Preferences

□ Load PLC program at startup

□ Save PLC program at shutdown

□ Retain F/T/C (Select the areas with the S7-Hardware Configurator)

□ Permit saving in RUN.

□ Single processor mode (also Hyperthreading CPUs)

Key switch position: RUN-P

Operating system: Windows 2000/Windows XP

Language: English

MPI via serial interface: Deactivated

PLC memory size (Byte): 500000

PLC : Windows processor time 1 : 1 = 50 % PLC

In this window the basic settings of *S7-SoftPLC* are performed.

Load PLC-program at startup

The currently saved PLC-program, stored in „S7.BIN" in the *S7-SoftPLC* installation folder, is loaded into *S7-SoftPLC*, as soon as it is started. The display of the jitter is reseted.

If the option „Load PLC program at startup" is selected, the PLC-program saved in the file „S7.BIN" is loaded into *S7-SoftPLC* when S7-SoftPLC is started. The starting conforms to the start-up of a hardware-PLC after a voltage-return. Therefor the organisation block OB 101 is processed first. After that the cyclic program-processing starts with OB 1. The signal states of flags(M), timers(T) and counters(C) are restored into *S7-SoftPLC*, if this is set in the hardware configuration.

If any problems should occur at the next start, delete the file „S7.BIN" in the installation directory of *S7-SoftPLC*. Such problems may occur, if the saving process has been disturbed. In such case the PLC-program has to be downloaded again with the programming unit. In such case the flags(M), timers(T) and counters(C) are in their initial state.

Save PLC programm at shutdown

The PLC-programm located in *S7-SoftPLC* is saved into the file „S7.BIN" in the *S7-SoftPLC* installation folder, as soon as *S7-SoftPLC* is terminated. The signal states of flags(M), timers(T) and counters(C) are saved as well.

Retain M/T/C (Select the areas with the S7-Hardware-Configurator)

The memory is kept remanent for M,T,C. (starting at byte 0 up to the value set with the hardware configuration)

Permit saving in RUN

Permits saving without stoping the PLC.

WARNING: IF THE PROGRAM IS SAVED DURING A RUNNING OPERATION, THE CYCLE TIME CAN RISE.

Single processor mode (also Hyperthreading CPUs)

Sets the single processor mode fixed. With real double or dual-core processors the PLC has got 25% of the possible computing time. This option should be activated with Hyperthreading processors, otherwise the processor capacity and the cycle time can vary.

Key switch position

RUN In this mode *S7-SoftPLC* processes the PLC-program.

RUN-P In this mode *S7-SoftPLC* processes the PLC-program. The PLC-program can be modified during operation.

Operating system

Selection of used operating system

Language

Selection of user interface language.

MPI via serial interface

The connection to *S7-SoftPLC* can be established over the selected port.

PLC memory size

The size of the *SoftPLC S7-416* load memory. The size of the *SoftPLC S7-315* load memory is limited to 256 kbyte.

PLC : Windows processor time (ms)

Partitioning of the PC-CPU processing time between *S7-SoftPLC* and Windows®.

Default

Restores the default settings.

5.1.2 CPU parameters of *S7-SoftPLC*

In this section the basic settings of *S7-SoftPLC* are entered.

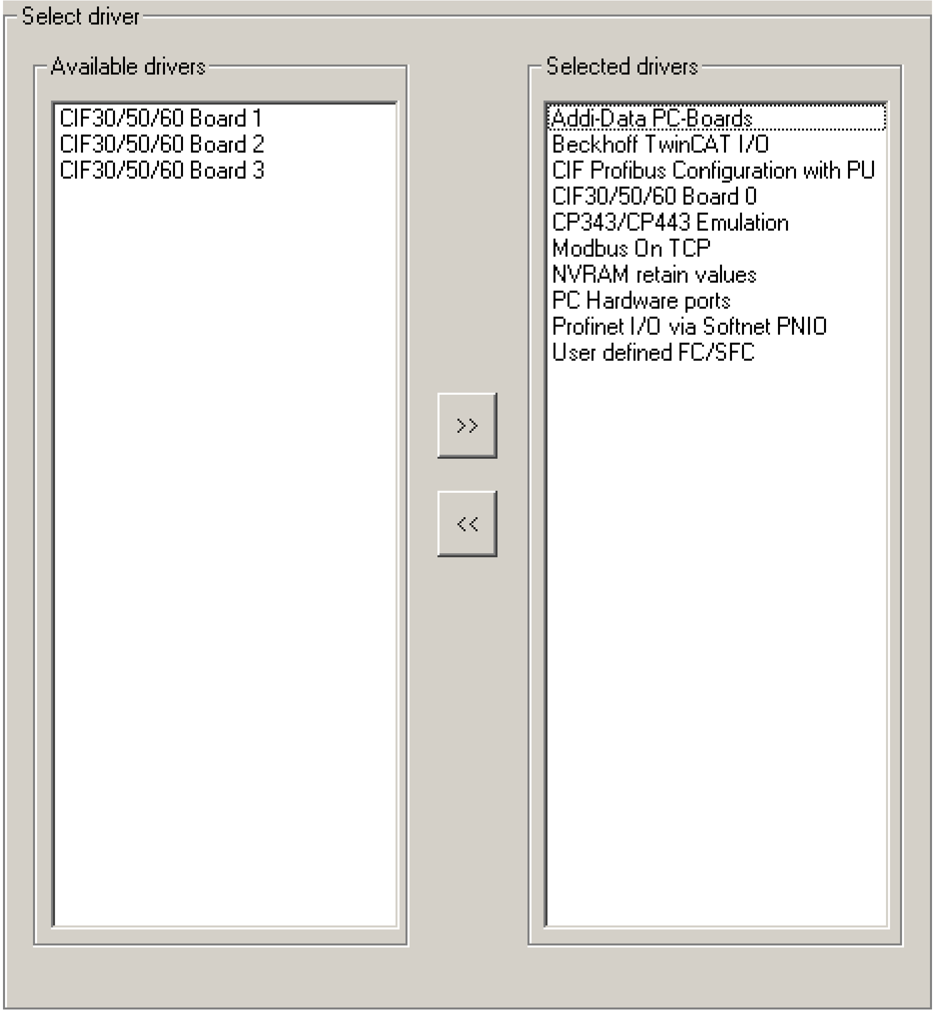
keyname	alues	default value	escription
OS	NT4 / W2K	W2K	Used operating system NT4 = WinNT4, W2K = Win2000/XP
LANGUAGE	DEU / ENG	DEU	user interface language of the *S7-SoftPLC* DEU = german, ENG = english
MPI	0 .. 4	0	Used port 0 = Internal, 1 = COM1, 2 = COM2, etc...
LOAD	0 / 1	0	0 = Do not load PLC program at start-up 1 = Load PLC program from S7.BIN at start-up
STORE	0 / 1	0	0 = Do not save PLC program at shut down 1 = Save PLC program in S7.BIN at shut down
S7_STORE	50000... end of PC memory	500000	Size of load memory in bytes The *S7-SoftPLC 315* has a limited load memory of 297225 byte
STORE_NO_STOP	0 / 1	0	1 = Save without stopping the PLC WARNING: IF THE PROGRAM IS SAVED DURING A RUNNING OPERATION, THE CYCLE TIME CAN RISE.
REM	0 / 1	0	1 = Memory is kept remanent for M,T,C (starting at byte 0 up to the value set with hardware configation).
KEY_SWITCH	1 / 2	2	1 = Signals the PU, that the key switch is set to RUN, no block downloading possible 2 = Signals the PU, that the key switch is set to RUN-P.
NOMP	0 / 1	0	1 = Sets the single processor mode fixed. With real double or dual-core processors the PLC has got 25% computing time. This option should be activated with hyperthreading processors, otherwise the processor load and the cycle time can vary.
WINTIME	1 .. 8	1	Reserved CPU processing time for Windows in ms 3 = 3 ms Windows and 1 ms PLC, which corresponds to 75% processing time for Windows and 25% for *S7-SoftPLC.*

5.2 Add/remove drivers

Here drivers are added or removed from *S7-SoftPLC*

- Add/remove drivers with the help of user interface
- Add/remove drivers in the PLC43.INI

5.2.1 Add/remove drivers...



Available drivers:

CIF30/50/60 Board 1
CIF30/50/60 Board 2
CIF30/50/60 Board 3

Selected drivers:

Addi-Data PC-Boards
Beckhoff TwinCAT I/O
CIF Profibus Configuration with PU
CIF30/50/60 Board 0
CP343/CP443 Emulation
Modbus On TCP
NVRAM retain values
PC Hardware ports
Profinet I/O via Softnet PNIO
User defined FC/SFC

Here the hardware drivers for S7-SoftPLC can be added/removed.

The available drivers are listed one the left side, the drivers currently assigned to *S7-SoftPLC* on the right side.

Add drivers

Select a driver for *S7-SoftPLC*.

Activate the „>>“-button and the highlighted driver moves to the right area (Selected drivers) and is therefore added to *S7-SoftPLC*.

After a restart of *S7-SoftPLC* the driver is now available.

Remove drivers

Remove a driver from the *S7-SoftPLC* configuration.

Activate the „<<“-button and the highlighted driver moves to the left area (Available drivers) and is therefore removed from *S7-SoftPLC*. The drivers can again be added to *S7-SoftPLC* at any time.

After a restart of *S7-SoftPLC* the driver is not available any more.

WARNING: IF A DRIVER WITH NON AVAILABLE HARDWARE IS SELECTED, FAILURES OF *S7-SOFTPLC* CAN OCCUR.

5.2.2 Add/remove drivers to *S7-SoftPLC*

In the section [OEM] the necessary hardware driver DLLs are listed. Up to 10 driver DLLs can be loaded.

Key name	Value area	Default value	Description
DLL0	CIF30D0.DLL	---	When using a Hilscher CIF-card
DLL1	CIFCFG.DLL	---	The driver CIFCFG.DLL is needed to configure the Profibus with the Siemens SIMATIC® Manager or S7 for Windows® hardware configuration. This driver provides the online functions via Profibus and DPV1 services as well. The driver can only be used together with the first CIF-card.
DLL2 .. DLL9	---	---	More card drivers

There are 2 possibilities to configure the field bus components:

If a Profibus® master-station is supposed to be configured over the S7 for Windows® hardware configuration or the Step7® hardware configuration, the following driver entries in the section [OEM] are to be selected:

```
[OEM]
DLL0=CIF30D0.DLL
DLL1=CIFCFG.DLL
```

These entries assure, that the Profibus® configuration, created with the S7 for Windows® hardware configuration or the Step7® hardware configuration, is analysed and that the CIF module (Profibus® only) is configured automatically during start-up.

If multiple Profibus®-cards are supposed to run in one PC, only the first card can be automatically configured. All other cards must be parameterised with the Hilscher System Configurator SyCon.

If other CIF field bus cards (e.g. Interbus, CAN) are to be used, always the Hilscher System Configurator SyCon has to be used, because the S7 for Windows® hardware configurat ion or the Step7® hardware configuration do not support the other bus systems.

Furthermore the following system parameters have to be set in the System Configurator SyCon under “setup”:

- Controlled release of communication by the application program
- Byte addresses
- Little Endian (LSB-MSB)
- Buffered, host controlled

In the section [OEM] the following has to be selected:

```
[OEM]
DLL0=CIF30D0.DLL
```

For compatibility reasons to existing applications, the classic driver cif30x0.dll, as used in version 2.x of S7-SoftPLC for a long time, is still being delivered and installed, but not integrated by default. Applications that did not use the diagnostic blocks SFB210 and SFB252, can change to the driver Cif30D(n).dll without any problems. If this change is too complex, the classic driver can still be used.

5.3 Addidata

With the help of the ADDIPACK driver *S7-SoftPLC* can access Addidata I/O cards

- Accessing Addidata I/O cards in the PLC-program
- Configuring the driver with the help of the user interface
- Configuring the driver in the PLC43.INI

5.3.1 ADDI-DATA configuration

The ADDI-DATA-driver allows to access Digital I/O and Analog I/O cards from the PLC-program of S7-SoftPLC. With the ADDI-PACK software the physical IO-cards are mapped into a single virtual card. It can be accessed over functions (FC-blocks), which need to be called from the PLC-program. A cyclic data exchange over the process image does not make sense, due to the ADDI-DATA functions infrastructure.

Requirements

- The interface card has to be installed on the computer.
- The adequate drivers of ADDI-DATA have to be installed.
- The software ADDIPACK has to be installed and correctly licenced.
- The interface card has to be configured in the ADDI-PACK. (if there are any problems, please contact the ADDI-DATA documentation and/or the ADDI-DATA support.)
- The „ADDI-DATA PC-Card“ driver has to be selected in *S7-SoftPLC*.

Accessing the I/O card

The FC-blocks, installed by the driver in *S7-SoftPLC,* represent functions of the ADDIDATA.DLL provided by ADDI-DATA. These functions are transparently mapped as FC-blocks into the PLC-program. For detailed information please read the adequate documentation of ADDI-DATA. The parameter „dw_DriverHandle“ described in the ADDI-DATA documentation is not required, because the *S7-SoftPLC* driver takes care of opening and closing the ADDI-DATA driver as well as passing the "dw_DriverHandle" to the ADDI-DATA functions.

Read8DigitalInputs:

corresponds to the function „b_ADDIDATA_Read8DigitalInputs (DWORD dw_DriverHandle, BYTE b_Port, PBYTE pb_PortValue)“.

Request:

```
CALL       FC 100
  IN0      := B#16#0          //b_Port
  RET_VAL  := MW 0            //RET_VAL error code
  OUT1     := MB 2            //pb_PortValue
```

The parameter IN0 corresponds to the ADDI-DATA parameter b_Port. The parameter OUT1 corresponds to the ADDI-DATA parameter pb_PortValue. The driver itself takes care of the dw_DriverHandle. The result of the function is returned in RET_VAL. This scheme applies to every driver function.

Read16DigitalInputs:

corresponds to the function „b_ADDIDATA_Read16DigitalInputs(DWORD dw_DriverHandle, BYTE b_Port, PWORD pw_PortValue)“.

Request:

```
CALL       FC 101
  IN0      := B#16#0          //b_Port
  RET_VAL  := MW 0            //RET_VAL error code
  OUT1     := MW 2            //pw_PortValue
```

Read32DigitalInputs:

corresponds to the function „b_ADDIDATA_Read32DigitalInputs(DWORD dw_DriverHandle, BYTE b_Port, PDWORD pdw_PortValue)“.

Request

```
CALL       FC 102
  IN0      := B#16#0          //b_Port
  RET_VAL  := MW 0            //RET_VAL error code
  OUT1     := MD 2            //pdw_PortValue
```

Set8DigitalOutputs:

corresponds to the function „b_ADDIDATA_Set8DigitalOutputsOn(DWORD dw_DriverHandle, BYTE b_Port, BYTE b_PortValue)“.

Request:

```
CALL       FC 103
  IN0      := B#16#0          //b_Port
  IN1      := B#16#0          //b_PortValue
  RET_VAL  := MW 0            //RET_VAL error code
```

Set16DigitalOutputs:

corresponds to the function „b_ADDIDATA_Set16DigitalOutputsOn(DWORD dw_DriverHandle, BYTE b_Port, WORD w_PortValue)“.

Request:

```
CALL       FC 104
  IN0      := B#16#0          //b_Port
  IN1      := W#16#0          //w_PortValue
  RET_VAL  := MW 0            //RET_VAL error code
```

Set32DigitalOutputs:

corresponds to the function „b_ADDIDATA_Set32DigitalOutputsOn(DWORD dw_DriverHandle, BYTE b_Port, DWORD dw_PortValue)“.

Request:

```
CALL       FC 105
  IN0      := B#16#0          //b_Port
  IN1      := DW#16#0         //dw_PortValue
  RET_VAL  := MW 0            //RET_VAL error code
```

InitAnalogInput:

corresponds to the function „b_ADDIDATA_InitAnalogInput(DWORD dw_DriverHandle, WORD w_Channel, pstr_InitAnalogInput ps_InitParameters, DWORD dw_StructSize)“.

This function expects a data structure for the initialisation of an input (see card documentation). The structure is passed to the FC with an ANY-pointer of the type byte (ps_InitParameters). A seperate parameter for length of the structure (dw_StructSize) is not neccessary, it is taken from the ANY-pointer.

Request:

```
CALL       FC 106
  IN0      := W#16#0          //w_Channel
  IN1      := P#M 8.0 BYTE 10 //ANY-pointer to structure
  RET_VAL  := MW 0            //RET_VAL error code
```

ReleaseAnalogInput:

corresponds to the function „b_ADDIDATA_ReleaseAnalogInput(DWORD dw_DriverHandle, WORD w_Channel)“.

Request

```
CALL       FC 107
  IN0      := W#16#0          //w_Channel
  RET_VAL  := MW 0            //RET_VAL error code
```

InitAnalogOutput:

corresponds to the function „b_ADDIDATA_Init1AnalogOutput(DWORD dw_DriverHandle, WORD w_Channel, BYTE b_VoltageMode, BYTE b_Polarity)“.

Request:

```
CALL       FC 108
  IN0      := W#16#0          //w_Channel
  IN1      := B#16#0          //b_VoltageMode
  IN2      := B#16#0          //b_Polarity
  RET_VAL  := MW 0            //RET_VAL error code
```

ReadAnalogInput:

corresponds to the function „b_ADDIDATA_Read1AnalogInput(DWORD dw_DriverHandle, WORD w_Channel, DWORD dw_ConvertingTime, BYTE b_ConvertingTimeUnit, BYTE b_InterruptFlag, PDWORD pdw_ChannelValue)“.

The function expects a pointer to the return value (see card documentation). The structure is passed to the FC with an ANY-Pointer of the type dword (pdw_ChannelValue). Please notice, that the ANY-Pointer always has to have the length of DWORD 3 (12 byte).

The parameter b.InterruptFlag is not used, because it runs in Polling-mode only.

Request:

```
CALL       FC 109
  IN0      := W#16#0          //w_Channel
  IN1      := DW#16#0         //dw_ConvertingTime
  IN2      := B#16#0          //b_ConvertingTimeUnit
  IN3      := P#M4.0 DWORD 3  //ANY-pointer to result
  RET_VAL  := MW 0            //RET_VAL error code
```

WriteAnalogOutput:

corresponds to the function „b_ADDIDATA_Write1AnalogOutput(DWORD dw_DriverHandle, WORD w_Channel, dw_ValueToWrite)“.

Request:

```
CALL       FC 110
  IN0      := W#16#0          //w_Channel
  IN1      := DW#16#0         //dw_ValueToWrite
  RET_VAL  := MW 0            //RET_VAL error code
```

Return values:

On success RET_VAL = 0 is returned.

If an error has occurred, the error code from ADDIDATA.DLL is passed through, if possible.

If it should not be possible, the following error codes are returned:

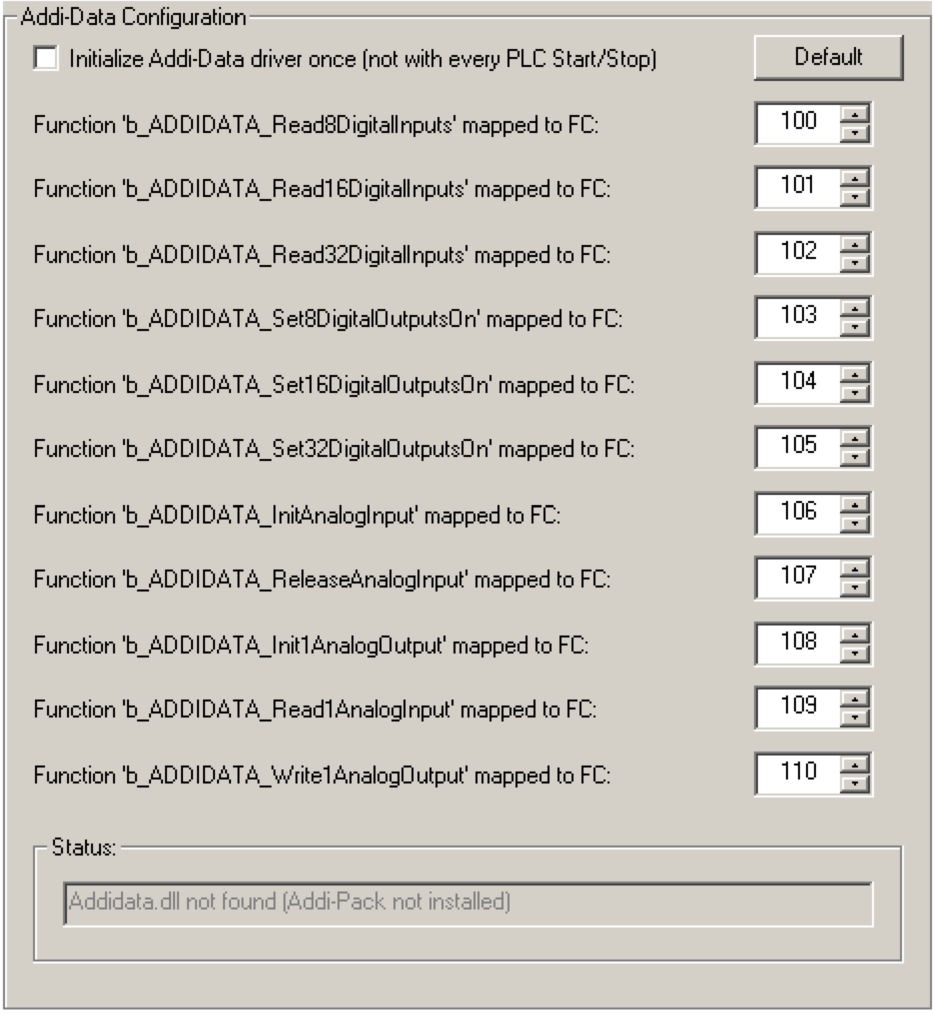
Error code	Reason
0x807F	DriverHandle not available
0x8042	Error reading input
0x8043	Error writing output
0x8003	Wrong ANY-Pointer type
0x8023	ANY-Pointer does not point to a valid area or does not have the correct length

PLC switches to STOP:

If *S7-SoftPLC* is switched to STOP by the driver, an error code is inserted into the diagnostic buffer, which can be read out with the programming unit (*S7 für Windows*®, STEP® 7).

Error code	Reason
0xA140	An error has occured at “i_ADDIDATA_OpenWin32Driver”. The error number of ADDIDATA.DLL is following in the next diagnostic buffer entry.

5.3.2 Configuring the ADDI-DATA driver



Addi-Data Configuration

☐ Initialize Addi-Data driver once (not with every PLC Start/Stop)

Function 'b_ADDIDATA_Read8DigitalInputs' mapped to FC: 100

Function 'b_ADDIDATA_Read16DigitalInputs' mapped to FC: 101

Function 'b_ADDIDATA_Read32DigitalInputs' mapped to FC: 102

Function 'b_ADDIDATA_Set8DigitalOutputsOn' mapped to FC: 103

Function 'b_ADDIDATA_Set16DigitalOutputsOn' mapped to FC: 104

Function 'b_ADDIDATA_Set32DigitalOutputsOn' mapped to FC: 105

Function 'b_ADDIDATA_InitAnalogInput' mapped to FC: 106

Function 'b_ADDIDATA_ReleaseAnalogInput' mapped to FC: 107

Function 'b_ADDIDATA_Init1AnalogOutput' mapped to FC: 108

Function 'b_ADDIDATA_Read1AnalogInput' mapped to FC: 109

Function 'b_ADDIDATA_Write1AnalogOutput' mapped to FC: 110

Status:

Addidata.dll not found (Addi-Pack not installed)

Initialise ADDI-DATA driver once (not with every PLC Start/Stop)

Initialise the ADDI-DATA driver at first start of *S7-SoftPLC*, not at every RUN/STOP transition.

FC-numbers can be assigned to the ADDI-DATA functions. (It must be pointed out, that a unique number is assigned to every FC-block!)

Function "b_ADDIDATA_FunctionName" mapped to FC:

Number of the FC, that corresponds to the ADDIPACK function "b_ADDIDATA_funktion name".

Status:

Shows the ADDI-DATA driver status of the computer.

5.3.3 ADDI-DATA driver for *S7-SoftPLC*

In order to activate the driver, the driver is included in the form dll0=addi_data.dll in the section [OEM].

The driver expects the section [addi_data], in which further parameters can be defined.

Name of parameter	Default value	Description
Read8FC	100	Number of FC Read8DigitalInputs
Read16FC	101	Number of FC Read16DigitalInputs
Read32FC	102	Number of FC Read32DigitalInputs
Set8FC	103	Number of FC Set8DigitalOutputs
Set16FC	104	Number of FC Set16DigitalOutputs
Set32FC	105	Number of FC Set32DigitalOutputs
InitAnaInpFC	106	Number of FC InitAnalogInput
RelAnaInpFC	107	Number of FC ReleaseAnalogInput
InitAnaOutFC	108	Number of FC InitAnalogOutput
ReadAnaInpFC	109	Number of FC ReadAnalogInput
WriteAnaOutFC	110	Number of FC WriteAnalogOutput
NoStop	0	0 = Driver is initialised at every PLC-START 1 = Driver is initialised once

It must be pointed out, that a unique number is assigned to every FC-block!

Example:

```
[OEM]
dll0=addi_data.dll

[addi_data]
Read8FC=100
Read16FC=101
Read32FC=102
Set8FC=103
Set16FC=104
Set32FC=105
InitAnaInpFC=106
RelAnaInpFC=107
InitAnaOutFC=108
ReadAnaInpFC=109
WriteAnaOutFC=110
NoStop=0
```

5.4 Beckhoff TwinCAT I/O

With the Beckhoff TwinCAT I/O driver, every fieldbus system supported by Beckhoff, can be accessed from *S7-SoftPLC*.

- Creating a task in the TwinCAT System Manager
- Accessing a task (peripherals) from S7-SoftPLC
- Configuring driver with the help of the user interface
- Configuring driver in the PLC43.INI

5.4.1 Beckhoff TwinCAT I/O configuration

The driver allows to exchange I/O data with *S7-SoftPLC* via the Beckhoff TwinCAT I/O driver. With the TwinCAT I/O driver every I/O component supported by Beckhoff can be accessed, so that this driver is independent from the used fieldbus.

To access the Beckhoff peripheral components with *S7-SoftPLC*, the TwinCAT I/O driver from Beckhoff has to be installed and licensed on the computer.

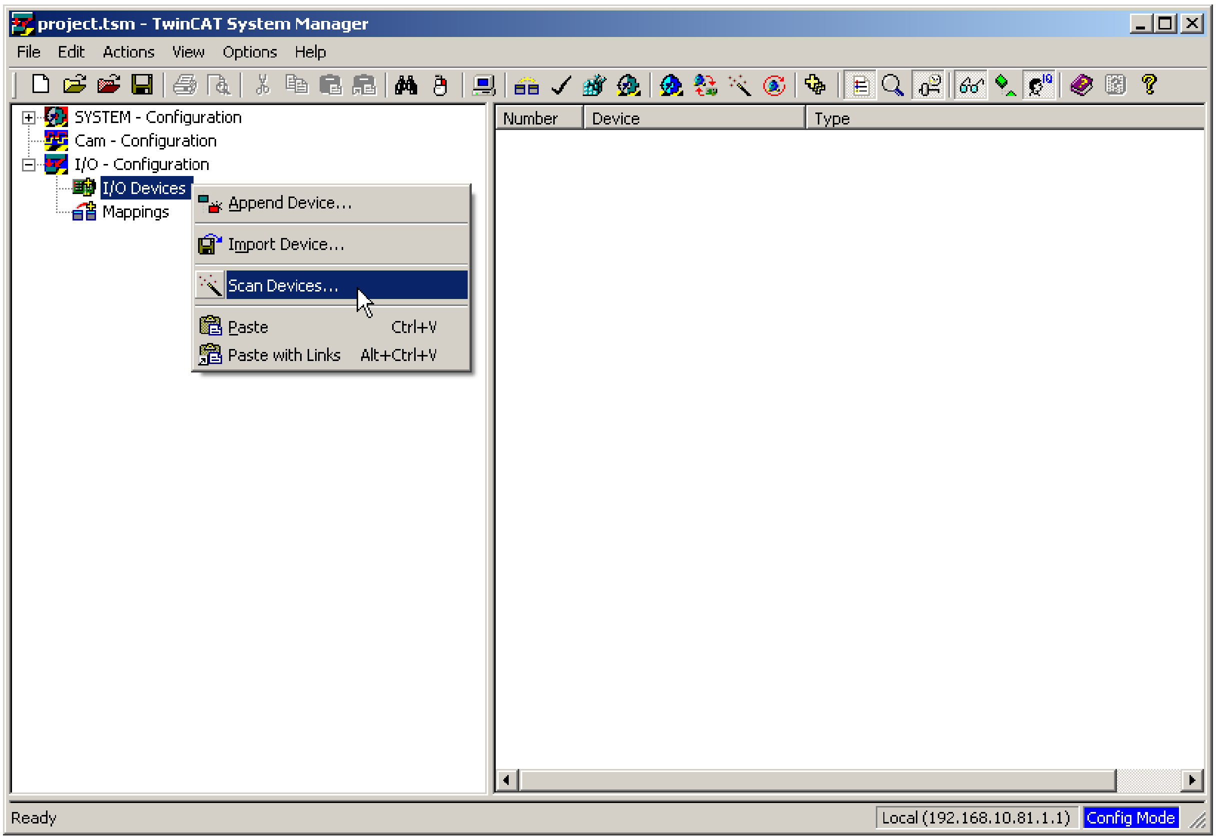
The I/O tasks, that are supposed to be used with *S7-SoftPLC*, must be configured with the Beckhoff TwinCAT System Manager.

The TwinCatIO.dll maps the process images to the Beckhoff I/O components. Acyclic accesses via peripheral commands are as well possible as the acyclic access with a SFC/FC.

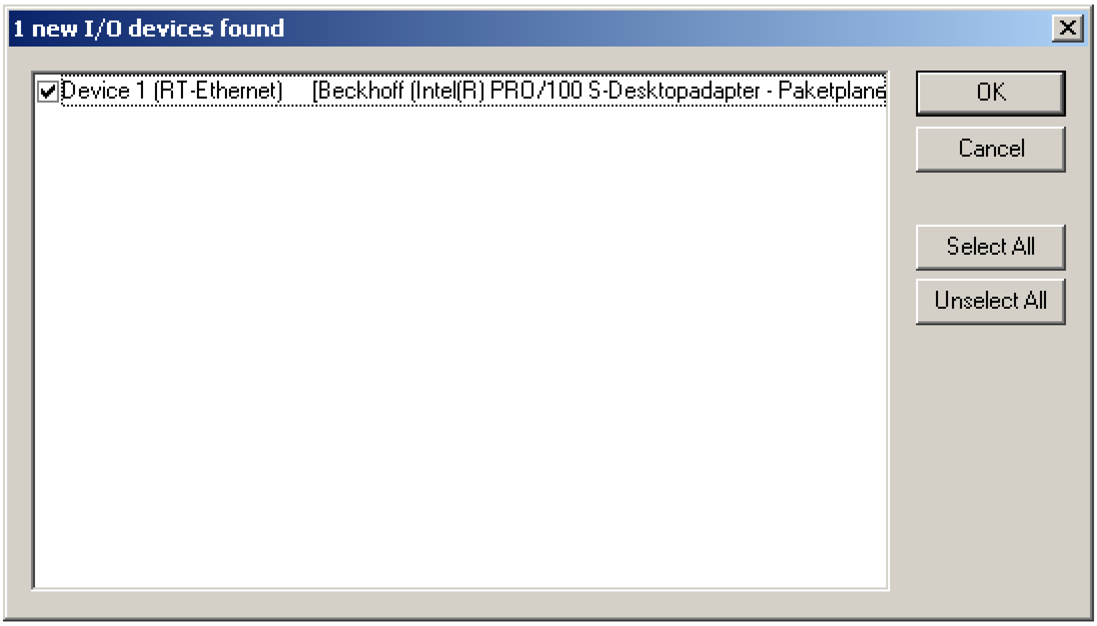
In order to use the driver, the following steps are necessary:

- Inserting a station in TwinCAT System Manager
- Creating a task in TwinCAT System Manager
- Accessing ADS-functions from the PLC-program

Inserting a station in TwinCAT System Manager

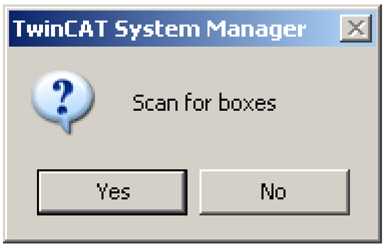


With a right-click on I/O Devices >> Scan Devices... a dialogue appears in which an I/O component can be selected (if it is available in the net).


1 new I/O devices found

☑ Device 1 (RT-Ethernet) [Beckhoff (Intel(R) PRO/100 S-Desktopadapter - Paketplane

After having selected the desired device, TwinCAT System Manager asks, whether to scan for new boxes.

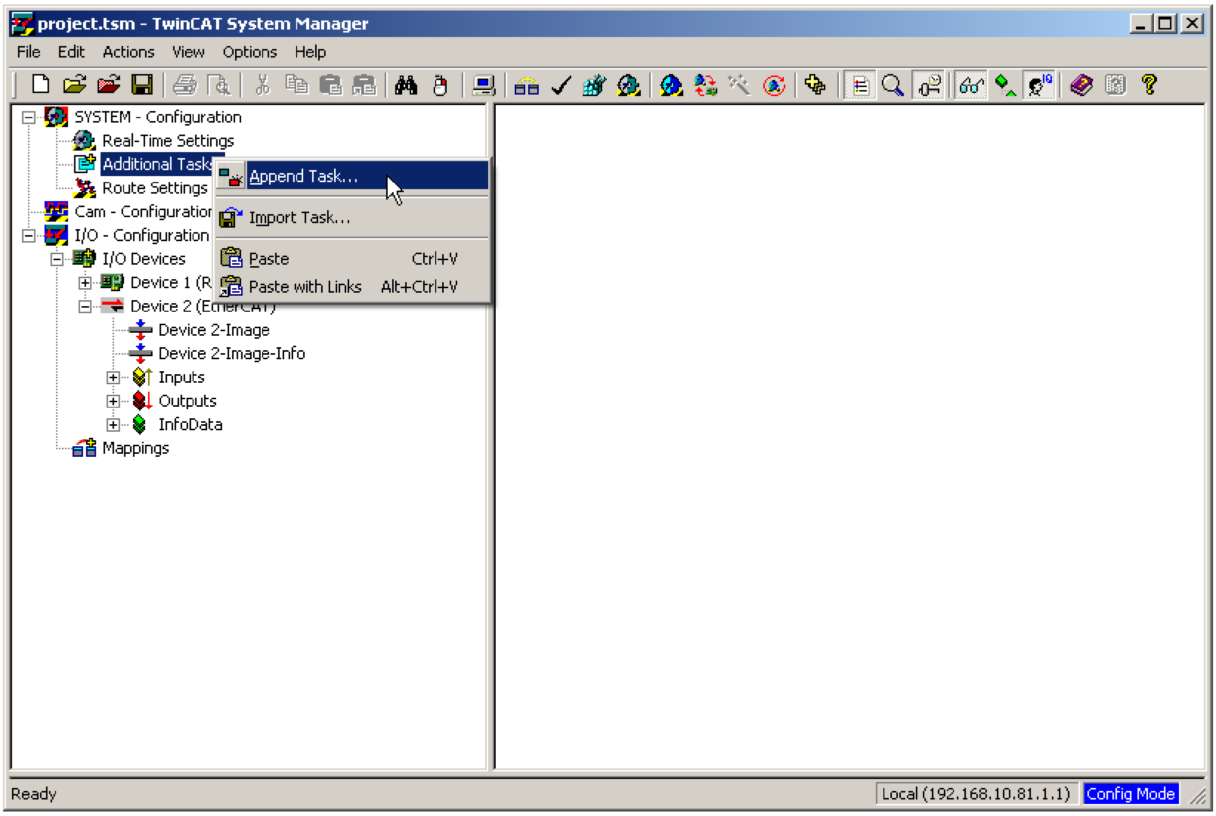


TwinCAT System Manager

Scan for boxes

If agreed, all available I/O components will be scanned. The I/O components are now known to the TwinCAT I/O and can be accessed.

Creating a task in the TwinCAT System Manager



With a right-click on Additional Tasks >> Append Task... a new task is created. The task represents the S7-SoftPLCs process images.

Important task settings

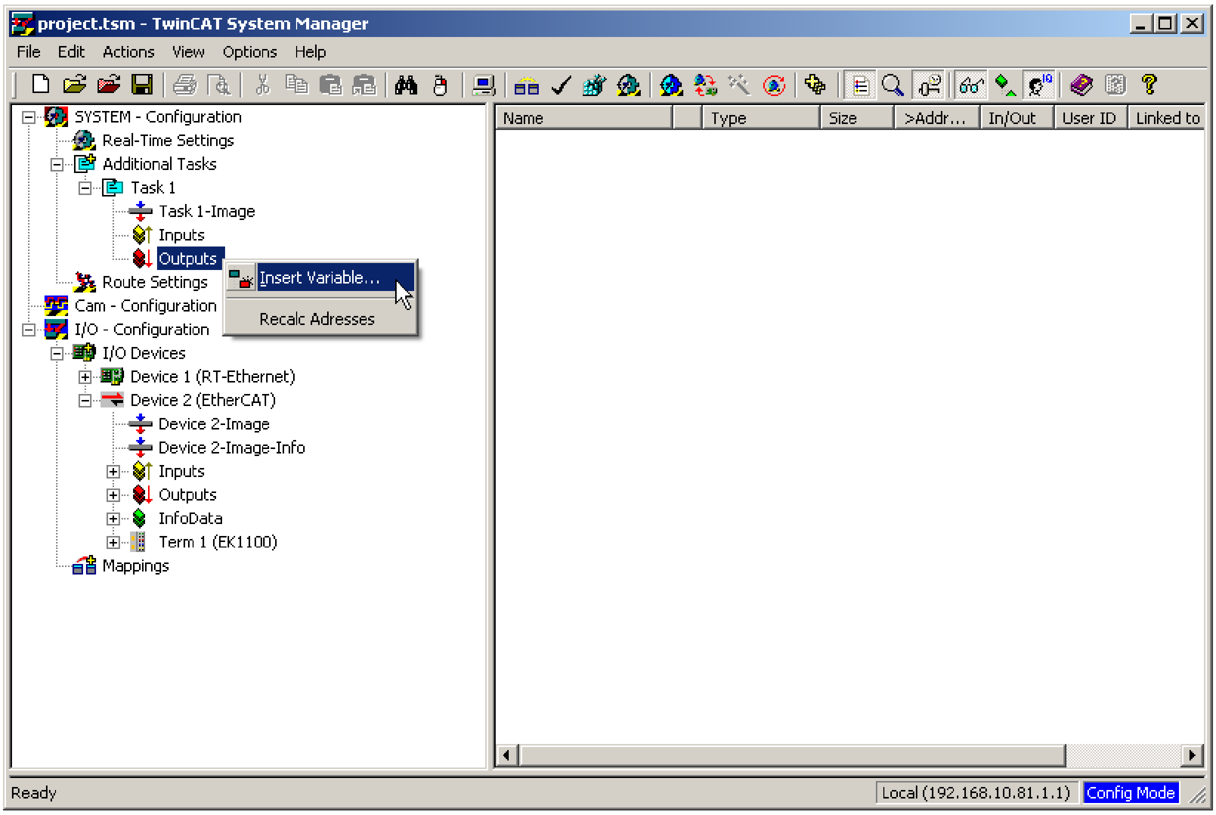
Port: The port with the number 301 normally serves as process image for *S7-SoftPLC*. It is also accessible over a SFC/FC.

AutoStart: *S7-SoftPLC* triggers the fieldbus and thus informs the TwinCAT driver, that it is still operational. The option AutoStart normally must not be chosen.

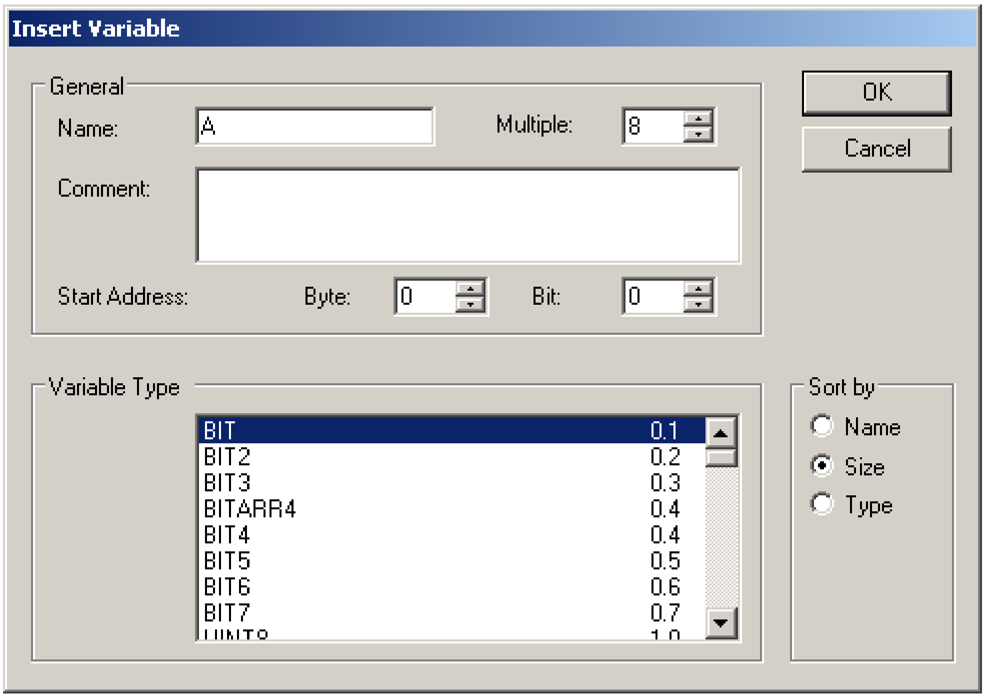
If this option is selected, the TwinCAT I/O driver has to be configured in such a way, that it can independently detect, whether the PLC is still operational, in order to switch the outputs of the I/O components into a defined state, if necessary.

Configuring a task

To be able to access the I/O components, the I/O points have to be linked with the task. With a right-click on Inputs or Outputs >> Insert Variable... the I/O points can be assigned to the task.



Depending on the available I/O point an adequate type of variable has to be selected.



General

Name: A   Multiple: 8

Comment:

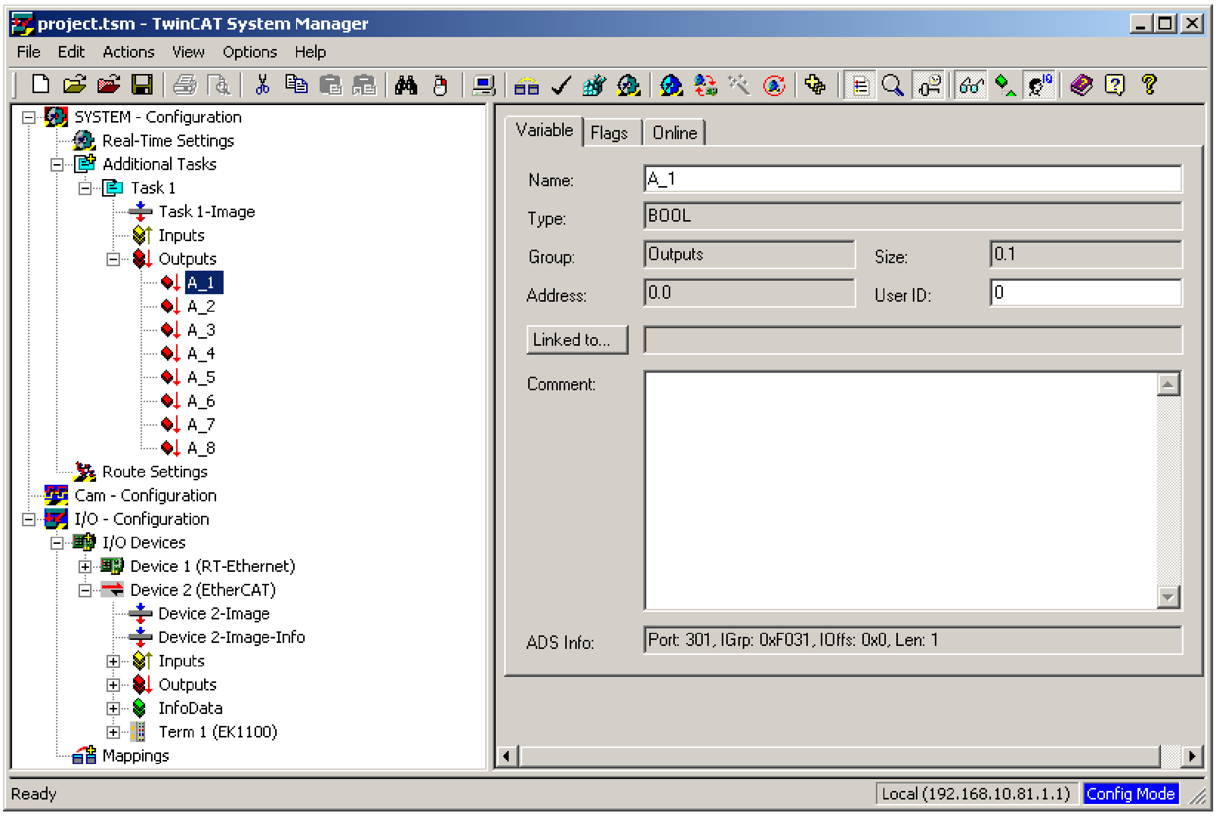
Start Address: Byte: 0   Bit: 0

Variable Type

BIT	0.1
BIT2	0.2
BIT3	0.3
BITARR4	0.4
BIT4	0.4
BIT5	0.5
BIT6	0.6
BIT7	0.7
UINT8	1.0

Sort by: ○ Name ● Size ○ Type

If the variable is declared, it has to be linked with the I/O component. For this activate the button Linked to...to create a link between the variable and the I/O-point.



Name: A_1

Type: BOOL

Group: Outputs

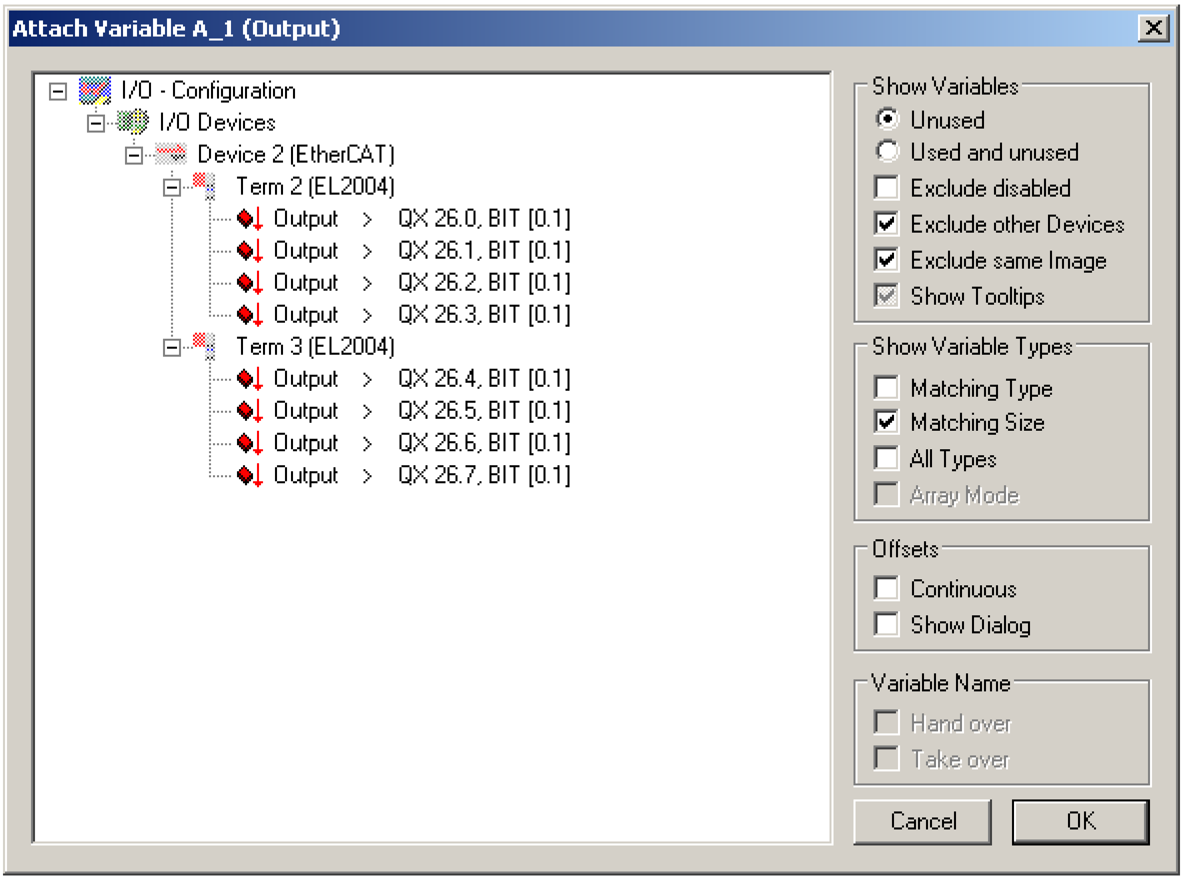
Size: 0.1

Address: 0.0

User ID: 0

Comment:

ADS Info: Port: 301, IGrp: 0xF031, IOffs: 0x0, Len: 1



```
Output  >  QX 26.0, BIT [0.1]
Output  >  QX 26.1, BIT [0.1]
Output  >  QX 26.2, BIT [0.1]
Output  >  QX 26.3, BIT [0.1]
Output  >  QX 26.4, BIT [0.1]
Output  >  QX 26.5, BIT [0.1]
Output  >  QX 26.6, BIT [0.1]
Output  >  QX 26.7, BIT [0.1]
```

Show Variables
- ● Unused
- ○ Used and unused
- ☐ Exclude disabled
- ☑ Exclude other Devices
- ☑ Exclude same Image
- ☑ Show Tooltips

Show Variable Types
- ☐ Matching Type
- ☑ Matching Size
- ☐ All Types
- ☐ Array Mode

Offsets
- ☐ Continuous
- ☐ Show Dialog

Variable Name
- ☐ Hand over
- ☐ Take over

If the set of variables is linked with the task, the configuration has to be activated. Thereafter the TwinCAT I/O-task is ready for use, as soon as it is switched into Run-Mode.

Calling special functions and ADS functions from the PLC-program

SFC 14

Via the SFC "DPRD_DAT" inputs can be read out of the TwinCAT I/O task

```
CALL       SFC/FC 14
  LADDR    := W#16#100            //INPUT WORD
  RET_VAL  := MW 0                //RESULT INT
  RECORD   := P#M 100.0 BYTE 1    //OUTPUT ANY
```

Parameter	Type of Data	Description
LADDR	WORD	Start address of inputs to be read
RET_VAL	INT	0 on success
RECORD	ANY	ANY-Pointer to readout data

SFC 15

Via the SFC "DPWR_DAT" outputs can be written into the TwinCAT I/O task

```
CALL       SFC/FC 15
  LADDR    := W#16#100            //INPUT WORD
  RECORD   := P#M 102.0 BYTE 1    //INPUT ANY
  RET_VAL  := MW 0                //RESULT INT
```

Parameter	Type of data	Description
LADDR	WORD	Start address of outputs to be written
RECORD	ANY	ANY-Pointer on data to be written
RET_VAL	INT	0 on success

ControlSFC

Via the SFC "CONTROL" any TwinCAT I/O task can be accessed

```
CALL       SFC/FC 1000
  IN0      := FALSE               //INPUT BOOL
  IN1      := 301                 //INPUT INT
  IN2      := P#M 104.0 BYTE 1    //INPUT ANY
  RET_VAL  := MW 0                //RESULT INT
```

Parameter	Type of data	Description
IN0	BOOL	false = Read data from any TwinCAT I/O task true = Write data into any TwinCAT I/O task
IN1	INT	Port number of the I/O-task
IN2	ANY	ANY-Pointer to data to be read/written with adequate length (ANY-pointer of type byte are permitted only)
RET_VAL	INT	0 = success, otherwise the returned values of the TwinCAT I/O driver are transparently passed through. 0x0057= ERROR_INVALID_PARAMETER - one of the passed parameters is invalid

GetDeviceIdentification

The SFB "GETDEVID" allows it to read out the device identification data

```
CALL       SFB/FB 1001, DB 1001
  EXEC     := M0.0                  //INPUT BOOL
  TMOUT    := TIME#0D_0H_0M_1S_0MS //INPUT TIME
  BUSY     := M 0.1                 //OUTPUT BOOL
  ERR      := M 0.2                 //OUTPUT BOOL
  ERRID    := MD 4                  //OUTPUT DWORD
  DEVID    := P#M 10.0 BYTE 214     //IN_OUT ANY
```

Parameter	Type of data	Description
IN0	BOOL	TRUE starts the command
IN1	TIME	Not used, because underlying ADS function timeout is used
OUT2	BOOL	The data are read from the device. After error-free execution, the data is ready when BUSY = FALSE.
OUT3	BOOL	Becomes TRUE, as soon as an error occurs
OUT4	DWORD	Delivers the error number if ERR is set
IO5	ANY	ST_CxDeviceIdentification (length 214 Byte)

AdsRead

The SFB "ADSREAD" allows the execution of an ADS-reading command, to request data from an ADS-device.

```
CALL       SFB/FB 1002, DB 1002
  NETID    := #stringvar            //INPUT STRING
  PORT     := W#16#0                //INPUT WORD
  IDXGRP   := DW#16#0               //INPUT DWORD
  IDXOFFS  := DW#16#0               //INPUT DWORD
  LEN      := DW#16#0               //INPUT DWORD
  DESTADDR := P#M 10 BYTE 1         //INPUT ANY
  READ     := M0.0                  //INPUT BOOL
  TMOUT    := TIME#0D_0H_0M_1S_0MS //INPUT TIME
  BUSY     := M 0.1                 //OUTPUT BOOL
  ERR      := M 0.2                 //OUTPUT BOOL
  ERRID    := MD 4                  //OUTPUT DWORD
```

Parameter	Type of data	Description
NETID	STRING	It is a string providing the AMS network identification of the target device, the ADS-command targets.
PORT	WORD	Contains the port number of the ADS-service
IDXGRP	DWORD	Contains the index group number (32bit, unsigned) of the requested ADS-service. This value can be extracted from the ADS-chart of the addressed device.

IDXOFFS	DWORD	Contains the index offset number (32bit, unsigned) of the requested ADS-service. This value can be extracted from the ADS-chart of the addressed device.
LEN	DWORD	Contains the number of data to be read in bytes.
DESTADDR	ANY	Pointer to the destination buffer. The buffer needs to be big enough to record LEN bytes. The buffer can be a single variable, an array or a structure.
READ	BOOL	On TRUE ADS-command is executed
TMOUT	TIME	Timeout
BUSY	BOOL	This output is TRUE as long as a ADS command is executed. Resetted by timeout or success. While BUSY=TRUE, no new command is accepted.
ERR	BOOL	This output is TRUE, if an error has occurred during the execution of an ADS command. The command-specific error code is contained in "ERRID". If a timeout has occured, "ERR" = TRUE and "ERRID" = 1861 (hexadecimal 0x745). A new command resets "ERR".
ERRID	DWORD	Contains the command-specific error code of the last executed command. A new command resets "ERRID"

AdsWrite

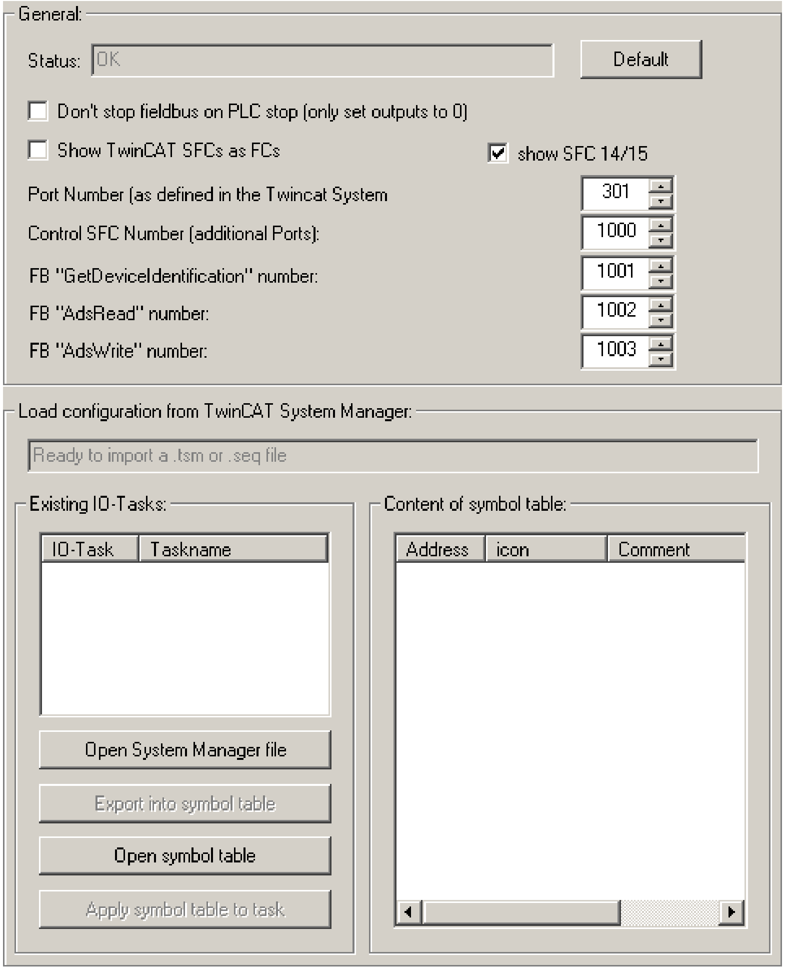
The SFB "ADSWRITE" allows the execution of an ADS-writing command, to transmit data to an ADS-device.

```
CALL       SFB/FB 1003, DB 1003
  NETID    := #stringvar           //INPUT STRING
  PORT     := W#16#0               //INPUT WORD
  IDXGRP   := DW#16#0              //INPUT DWORD
  IDXOFFS  := DW#16#0              //INPUT DWORD
  LEN      := DW#16#0              //INPUT DWORD
  SRCADDR  := P#M 10.0 BYTE 1      //INPUT ANY
  WRITE    := M0.0                 //INPUT BOOL
  TMOUT    := TIME#0D_0H_0M_0S_0MS //INPUT TIME
  BUSY     := M 0.1                //OUTPUT BOOL
  ERR      := M 0.2                //OUTPUT BOOL
  ERRID    := MD 4                 //OUTPUT DWORD
```

Parameter	Type of data	Description
NETID	STRING	It is a string providing the AMS network identification of the target device, the ADS-command targets.
PORT	WORD	Contains the port number of the ADS-service
IDXGRP	DWORD	Contains the index group number (32bit, unsigned) of the requested ADS-service. This value can be extracted from the ADS-chart of the addressed device.
IDXOFFS	DWORD	Contains the index group number (32bit, unsigned) of the requested ADS-service. This value can be extracted from the ADS-chart of the addressed device.
LEN	DWORD	Contains the number of data to be written in bytes.

SRCADDR	ANY	Pointer to the source buffer. The buffer needs to be big enough to hold LEN bytes. The buffer can be a single variable, an array or a structure.
WRITE	BOOL	On TRUE ADS-command is executed
TMOUT	TIME	Timeout
BUSY	BOOL	This output is TRUE as long as a ADS command is executed. Resetted by timeout or success. While BUSY=TRUE, no new command is accepted.
ERR	BOOL	This output is TRUE, if an error has occurred during the execution of an ADS command. The command-specific error code is contained in "ERRID". If a timeout has occured, "ERR" = TRUE and "ERRID" = 1861 (hexadecimal 0x745). A new command resets "ERR".
ERRID	DWORD	Contains the command-specific error code of the last executed command. A new command resets "ERRID"

5.4.2 Configuring TwinCAT I/O drivers



General:

Status: OK

□ Don't stop fieldbus on PLC stop (only set outputs to 0)

□ Show TwinCAT SFCs as FCs

☑ show SFC 14/15

Port Number (as defined in the Twincat System: 301

Control SFC Number (additional Ports): 1000

FB "GetDeviceIdentification" number: 1001

FB "AdsRead" number: 1002

FB "AdsWrite" number: 1003

Load configuration from TwinCAT System Manager:

Ready to import a .tsm or .seq file

Existing IO-Tasks:

IO-Task	Taskname

Content of symbol table:

Address	icon	Comment

Default

Resets the default values.

Don't stop fieldbus on PLC stop (only set outputs to 0)

Instead of stoping the fieldbus at PLC STOP completely, all outputs are set to 0.

Show TwinCAT SFCs as FCs

Defines, whether blocks should be displayed as FCs or SFCs in *S7-SoftPLC.*

Show SFC 14/15

Shows SFC 14/15.

Port Number (as defined in the Twincat System Manager)

Port number of the TwinCAT I/O task, normally 301.

Control SFC Number (additional Ports)

Block number of the Control SFC to read or write data from/to additional tasks.

FB "GetDeviceIdentification" Number

Block number of the FB "GetDeviceIdentification".

FB "AdsRead" Number

Block number of the FB "AdsRead".

FB "AdsWrite Number

Block number of the FB "AdsWrite".

Load configuration from TwinCAT System Manager

In order to avoid double documentation and to be able to reuse symbols, a converter exits, that allows to covert Step® 7 symbols from symbolic table (*.SEQ) data into I/O-tasks. And to inversely convert symbols from I/O-tasks into symbolic tables.

Existing symbolic tables can be applied to existing tasks with multiple options.

Export symbolic tables out of the symbol editor with Step® 7.

- Open symbolic table in Step® 7 symbol editor.
- Select menu item "Table -> export".
- Select "Allocation map (*.SEQ)" format in the following dialogue.

Import symbolic tables with Step® 7 symbol editor.

- Open symbolic table in Step® 7 symbol editor.
- Select menu item "Table -> import".
- Select "Allocation map (*.SEQ)" format in the following dialogue.
- *S7 for Windows*® projects generally work with SEQ files. Therefore a symbol file with the same name has to be generated only, to be exchanged via the Windows® Explorer.

Existing IO Tasks

In this window, I/O tasks and loaded System Manager files (.tsm) are displayed.

By highlighting an I/O task, it is loaded, so that it can be exported into a symbolic table.

Open System Manager file

Loads a System Manager file (.tsm) into the dialogue, to export the available symbols into a symbolic table.

Export into symbolic table

Exports the loaded I/O task into a symbolic table (.seq).

Open symbolic table

Loads a symbolic table (.seq) into the dialogue, to export the contained symbols into a I/O task.

Apply symbolic table to task

Exports the loaded symbols into a System Manager file (.tsm.).

Content of symbolic table

Shows the loaded symbols of a System Manager file (.tsm) or a symbolic table (.seq).

Using a Beckhoff EtherCAT®->Profibus coupler

The Beckhoff EtherCAT®->Profibus coupler has got a fixed 100ms-KBus-watchdog. Without this fixed setting the Profibus would not clock correctly any more. Minimum cycle is < 100ms, if BKs/KLs are used.

That means there has to be one task, that is quicker than 100ms and has the highest priority, because the task with the highest priority triggers the Profibus®.

5.4.3 Configuring TwinCAT I/O with PLC43.INI

To activate the driver it must be included in the section [OEM]. The required entry is for example:

```
[OEM]
dll0=TwinCatIO.dll
```

In the PLC43.INI the following parameters must be defined in the section [TwinCatIO].

Parameter	Defaultvalue	Description
PortNumber	301	Set port of I/O-task in TwinCAT System Manager. If PortNumber=0 the exchange of process images is disabled. Access is possible via SFC/FC only. If the port number does not match the TwinCAT I/O task, *S7-SoftPLC* switches to STOP.
SFC14	1	Show SFC 14
SFC15	1	Show SFC 15
ControlSFC	1000	Number of Control SFC
NoStop	0	Do not stop fieldbus at PLC Stop
TypeFC	0	Show SFCs as FCs
FB_CxGetDevice-Identification	1001	Number of GetDeviceIdentification FB
FB_AdsRead	1002	Number of AdsRead FB
FB_AdsWrite	1003	Number of AdsWrite FB

Example:

```
[OEM]
dll0=TwinCatIO.dll

[TWINCATIO]
PortNumber=301
SFC14=1
SFC15=1
ControlSFC=1000
NoStop=0
TypeFC=0
FB_CxGetDeviceIdentification=1001
FB_AdsRead=1002
FB_AdsWrite=1003
```

5.5 CIF 30/50/60 configuration

Configuration of Hilscher CIF 30/50/60-cards.

- Basic configuration
- Profibus® configuration with *S7 for Windows®* and Step® 7

5.5.1 Basic configuration

The basic configuration features of the CIF-cards are set here.

If no Profibus is used, the configuration has to be executed with the System Configurator SyCon of the Hilscher company.

- Configuring the CIF-card with the System Configurator

How the driver is integrated into *S7-SoftPLC* is part of these instructions:

- Configuration via user interface
- Configuration in PLC43.INI

Using Status and Control SFC

Querying CIF-status

To query the CIF-status the status SFC has to be called cyclically (e.g. from the OB 1). The SFC contains the following parameters:

Name	Sort	Type	Function
HostFlags	OUT	BYTE	HostFlags
DevFlags	OUT	BYTE	DeviceFlags

```
CALL   SFC 252
  OUT0 :=MB10         // HostFlags
  OUT1 :=MB11         // DeviceFlags
```

The HostFlags and DeviceFlags are described exactly in the section Control-SFC function 141 and function 142, as well as in the Hilscher document tke.pdf on page 8.

Control-SFC

The Control SFC is used to execute special functions of the CIF-card.

The control block is called in the following way:

```
L       #Value
T       MD 20
CALL    SFC 210
  IN0  := 142         // INPUT Function number.
  IN1  := 0           // INPUT Data block number (on DB operationen, else
0).
```

```
  IO2  := MD 20       // IN_OUT Parameter of function / Result.
  OUT3 := MW 24       // OUTPUT Default 80xx Error codes, 0 on success.
```

When succeeded, the BR bit is set as well.

Control-SFC functions overview

Function number	Function description
102	Set number of digital in/outputs
108	Set number of analog in/outputs
125	Read process inputs
126	Write process outputs
130	Read global diagnostic bits
131	Read bus status
132	Read incorrect bus address
133	Read error number
134	Read status bits
135	Read diagnostic bits
136	Read dual-port memory
137	Write dual-port memory
140	Trigger watchdog
141	Read HostFlags
142	Read DevFlags
150	Call DevGetTaskState and provide result in DB
151	Call DevGetInfo and provide result in DB
152	Call DevGetTaskParameter and provide result in DB

Function 102 Set number of digital in/outputs

With this function the number of the digital in/outputs can be set. 512 byte digital in/outputs are presetted in *S7-SoftPLC*. With this function the the number of digital in/outputs can be reduced. That causes an acceleration of *S7-SoftPLC*.

If the function was not executed successfully, the BR is not set. The return value contains the standard 80xx error codes.

Error code:

0x8222 = size to big

Example:

```
L      50              // 50 digital I/Os necessary only
T      MD20            // set number of digital I/Os
CALL   SFC 210
  IN0  := 102          // function 102
  IN1  := 0            // no DB
  IO2  := MD 20        // size
  OUT3 := MW 24        // error code
```

Function 108 Set number of analog in/outputs

With this function the number of the analog in/outputs can be set. The maximum size of the dualport RAM, found during the initialization of the card, is presetted in *S7-SoftPLC*. With this function the number of analog in/outputs can be reduced to the required number. It is counted from byte 0 of the dualport. If the function was not executed successfully, the BR is not set. The return value contains the standard 80xx error codes.

Fehlercode:

0x8222 = Size to big

Example:

```
L      100              // 100 analog I/Os necessary only
T      MD20             // set number of analog I/Os
CALL   SFC 210
  IN0  := 108           // function 108
  IN1  := 0             // no DB
  IO2  := MD 20         // size
  OUT3 := MW 24         // error code
```

Function 125 Read process inputs

With this function the process inputs can be read into a data block. Herewith every available peripheral byte can be accessed.

The function writes asynchronous. With word oriented inputs no data consistence exists and the function can only be used with byte oriented inputs.If the function was not executed successfully, the BR is not set. The return value contains the standard 80xx error codes.

Error codes:

0x813A = data block not available

0x8222 = size of data block bigger than size of source area

0x8042 = READY or COM missing

0x807F = internal driver access error

Example:

```
L      W#16#0100        // process input start address
T      MD20
CALL   SFC 210
  IN0  := 125           // function 125
  IN1  := 300           // DB 300
  IO2  := MD 20         // process input start address
  OUT3 := MW 24         // error code
```

Function 126 Write process outputs

With this function a data block can be written into the process outputs. Herewith every available peripheral byte can be accessed. The function writes asynchronous. With word oriented outputs no data consistence exists and the function can only be used byte oriented. If the function was not executed successfully, the BR is not set. The return value contains the standard 80xx error codes.

Error codes:

0x813A = data block not available

0x8222 = size of data block bigger than size of source area

0x8042 = READY or COM missing

0x807F = internal driver access error

Example:

```
L      W#16#0100       // process output start address
T      MD20
CALL   SFC 210
  IN0  := 126          // function 126
  IN1  := 300          // DB 300
  IO2  := MD 20        // process output start address
  OUT3 := MW 24        // error code
```

Function 130 Read global diagnostic bits

With this function global diagnostic bits can be read.

Bit	Profibus message
0	Parameter error
1	Component branched because of bus error in Auto_Clear_Modus
2	At least one slave is not transferring data or reports a fatal error
3	Fatal bus error, further data transferring impossible
4	Short circuit on the bus
5	Host not ready
6	reserved
7	reserved
Bit	Interbus message
0	Parameter error
1	System error occured
2	At least one slave reports module error
3	At least one defective W1-port
4	At least one defective W2-port
5	reserved
6	reserved
7	reserved

If the function was not executed successfully, the BR is not set. The return value contains the standard 80xx error codes.

Error codes:

0x807F = Internal driver access error

Example:

```
CALL   SFC 210
  IN0  := 130          // function 130
  IN1  := 0            // no DB
  IO2  := MD 20        // diagnostic bits
  OUT3 := MW 24        // error code
```

Function 131 Read bus status

With this function the bus status can be read.

Bit	Interbus message
0	Bus segment turned off
1	reserved
2	reserved
3	reserved
4	reserved
5	reserved
6	reserved
7	reserved

If the function was not executed successfully, the BR is not set. The return value contains the standard 80xx error codes.

Error codes:

0x807F = Internal driver access error

Example:

```
CALL   SFC 210
  IN0  := 131          // function 131
  IN1  := 0            // no DB
  IO2  := MD 20        // bus status
  OUT3 := MW 24        // error code
```

Function 132 Read incorrect bus address

With this function the incorrect bus address can be read. If the function was not executed successfully, the BR is not set. The return value contains the standard 80xx error codes.

Error codes:

0x807F = Internal driver access error

Example:

```
CALL   SFC 210
  IN0  := 132          // function 132
  IN1  := 0            // no DB
  IO2  := MD 20        // incorrect bus address
  OUT3 := MW 24        // error code
```

Function 133 Read error number

With this function the error number can be read. If the function was not executed successfully, the BR is not set. The return value contains the standard 80xx error codes.

Error codes:

0x807F = Internal driver access error

Example:

```
CALL   SFC 210
  IN0  := 133          // function 133
  IN1  := 0            // no DB
  IO2  := MD 20        // error number
  OUT3 := MW 24        // error code
```

Function 134 Read status bits

With this function the status bits can be read. Before the call the status byte number (0..15) must be selected. After the function call, the selected status byte is returned. If a bit in status byte is 1, the corresponding slave is active, if it is 0, it is inactive. If the function was not executed successfully, the BR is not set. The return value contains the standard 80xx error codes.

Error codes:

0x807F = Internal driver access error

Example:

```
L      W#16#03         // byte number 3
T      MD20
CALL   SFC 210
  IN0  := 134          // function 134
  IN1  := 0            // no DB
  IO2  := MD 20        // before calling status byte nummer, after calling
the content of the status byte
  OUT3 := MW 24        // error code
```

Function 135 Read diagnostic bits

With this function the diagnostic bits can be read. Before the call the diagnostic byte number (0..15) must be selected. After the function call, the selected diagnostic byte is returned. If a bit in the diagnostic byte is 1, the status of the corresponding slave has changed (from active to inactive or vice versa). If the function was not executed successfully, the BR is not set. The return value contains the standard 80xx error codes.

Error codes:

0x807F = Internal driver access error

Example:

```
L       W#16#03         // byte number 3
T       MD 20
CALL    SFC 210
  IN0   := 134          // function 134
  IN1   := 0            // no DB
  IO2   := MD 20        // before calling diagnostic byte number, after
calling the content of diagnostic byte
  OUT3 := MW 24         // error code
```

Fkt 136 Read dual-port memory

With this function an area from the dual-port memory of the CIF-card can be written into a data block. Basically it begins with the first byte in the data block. The length is passed in the I/O-parameter low word and the relative address in the dual-port memory in the I/O-parameter high word. If the function was not executed successfully, the BR is not set. The return value contains the standard 80xx error codes.

Error codes:

0x813A = data block not available

0x8222 = size of data block to small

0x8224 = range overflow

0x8042 = READY or COM missing

0x807F = Internal driver access error

Example:

```
L       DW#16#0100000A  // copy 10 bytes from the relative address 100H
T       MD20
CALL    SFC 210
  IN0   := 136          // function 136
  IN1   := 60           // DB 60
  IO2   := MD 20        // 10 bytes are read from the relative address
0x100H
  OUT3 := MW 24         // error code
```

Function 137 Write dual-port memory

With this function an area from the data block can be written into the dual-port memory of the CIF-card. Basically it begins with the first byte in the data block. The length is passed in the I/O-parameter low word and the relative address in the dual-port memory in the I/O-parameter high word. If the function was not executed successfully, the BR is not set. The return value contains the standard 80xx error codes.

Error codes:

0x813A = data block not available

0x8222 = size of data block to small

0x8224 = range overflow

0x8042 = READY or COM missing

0x807F = Internal driver access error

Example:

```
L       D#16#0100000A   // copy 10 bytes into the relatice address 100H
T       MD20
CALL    SFC 210
  IN0   := 137          // function 137
  IN1   := 60           // DB 60
  IO2   := MD 20        // 10 bytes are written into the relative address
0x100H
  OUT3 := MW 24         // error code
```

Function 140 trigger watchdog

This function is needed, if very long PLC cycles occur. If the function was not executed successfully, the BR is not set. The return value contains the standard 80xx error codes.

Error codes:

None

Example:

```
CALL    SFC 210
  IN0   := 140          // function 140
  IN1   := 0            // no DB
  IO2   := MD 20        // no function code
  OUT3 := MW 24         // error code
```

Function 141 Read HostFlags

With this function HostFlags can be read.

Bit	HostFlag message
0	HostCom: Handshake of the receive mailbox
1	DevAck: Handshake of the send mailbox
2	PdAck: Handshake of the process image
3	ERR: communication error to one network device
4	PdExtAck: extended handshake of the pcrocess image
5	COM: I/O exchange to one network device established
6	RUN: DEVICE is communicating, configuration valid
7	READY: DEVICE is running, end of initialisation

If the function was not executed successfully, the BR is not set. The return value contains the standard 80xx error codes.

Error codes:

0x807F = Internal driver access error

Example:

```
CALL SFC 210
  IN0  := 141          // function 141
  IN1  := 0            // no DB
  IO2  := MD 20        // returns the HostFlags
  OUT3 := MW 24        // error code
```

Function 142 Read DevFlags

With this function DevFlags can be read.

Bit	DeviceFlag message
0	HostCom: Handshake of the receive mailbox
1	DevCom: Handshake of the send mailbox
2	PdCom: Handshake of the process image
3	Reserved
4	PdExtCom: extended handshake of the pcrocess image
5	NotRdy: HOST program not ready
6	Init: Initialisation with parameter from dual-port memory
7	Reset: Reset DEVICE

If the function was not executed successfully, the BR is not set. The return value contains the standard 80xx error codes.

Error codes:

0x807F = Internal driver access error

Example:

```
CALL SFC 210
  IN0  := 142          // function 142
  IN1  := 0            // no DB
  IO2  := MD 20        // returns the DevFlags
  OUT3 := MW 24        // error code
```

Function 150 Execute DevGetTaskState

With this function the global diagnostic infomation, reported from the CIF-module, can be read. The structure contains information about the bus condition and the condition of several slaves. The information is stored in bit-fields. In this way information about the master and the condition of the fieldbus is available. Furthermore it can be read, which slaves are configured and in use, which slaves are active and inactive and which slaves contain diagnostic information.

The driver function DevGetTaskState is called internally. The result is written into a DB. To be able to use the function, the information to the function should be extracted from the Hilscher manual dpm_pie.pdf. The DB should correspond to the DPM_DIAGNOSTICS structure described there. If the function was not executed successfully, the BR is not set. The return value contains the standard 80xx error codes.

Error codes:

0x813A = data block not available

0x8222 = size of data block to small

0x8225 = range overflow

0x807F = internal driver access error

Example:

```
L      DW#16#2
T      MD20            // task 2
CALL   SFC 210
  IN0  := 150          // function 150
  IN1  := 300          // DB 300
  IO2  := MD 20        // task number
  OUT3 := MW 24        // error code
```

Adequate DB example:

```
DATA_BLOCK DB 300
TITLE=DIAG
VERSION : 0.1
STRUCT
bGlobalBits : BYTE;
bDPM_state : BYTE;
tError : STRUCT
bErr_Rem_Adr : BYTE;
bErr_Event : BYTE;
```

```
END_STRUCT;
usBus_Error_Cnt : WORD;
usTime_Out_Cnt : WORD;
abReserved : ARRAY[0..7] OF BYTE;
abSl_cfg : ARRAY[0..15] OF BYTE;
abSl_state : ARRAY[0..15] OF BYTE;
abSl_diag : ARRAY[0..15] OF BYTE;
END_STRUCT;
BEGIN
END_DATA_BLOCK
```

Function 151 Execute DevGetInfo

With DevGetInfo various information can be read from the dual-port of the CIF-card. These are:

DW#16#1 GET_DRIVER_INFO Driver status information

DW#16#2 GET_VERSION_INFO version information of the CIF

DW#16#3 GET_FIRMWARE_INFO version of the CIF firmware

DW#16#4 GET_TASK_INFO Task information

DW#16#5 GET_RCS_INFO CIF specific operating system information

DW#16#6 GET_DEV_INFO Device information

DW#16#7 GET_IO_INFO Device I/O information

DW#16#8 GET_IO_SEND_DATA Device I/O send data

The driver function DevGetInfo is called internally. The result is written into a DB. To be able to use the function, the information to the function should be extracted from the Hilscher manual devdrv.pdf. The DB should correspond to the structures described there. If the function was not executed successfully, the BR is not set. The return value contains the standard 80xx error codes.

Error codes:

0x813A = data block not available

0x8222 = data block size to small

0x8225 = not an available function number

0x807F = internal driver access error

Example:

```
L      DW#16#1           // function GET_DRIVER_INFO
T      MD20
CALL   SFC 210
  IN0 := 151             // function 151
  IN1 := 300          // DB 300
  IO2 := MD 20        // function number
  OUT3 := MW 24       // error code
```

Function 152 Execute DevGetTaskParameter

With this function the global settings, as for example the transfer rate of the bus, the watchdog time etc. can be read from the CIF-card. The driver function DevGetTaskParameter is called internally. The result is written into a DB. To be able to use the function, the information to the function should be extracted from the Hilscher manual devdrv.pdf. The DB should correspond to the structure described there. If the function was not executed successfully, the BR is not set. The return value contains the standard 80xx error codes.

Error codes:

0x813A = data block not available

0x8222 = data block size to small

0x8225 = not an available function number

0x807F = internal driver access error

Example:

```
L      DW#16#2        // tTask 2
T      MD20
CALL   SFC 210
  IN0  := 152         // function 152
  IN1  := 300         // DB 300
  IO2  := MD 20       // function number
  OUT3 := MW 24       // error code
```

Function 153 Read slave diagnostics of a specific slave

With this function the standard diagnostic data of a DP-slave can be read. The information is returned in DPM_SLAVE_SINGLE_DIAGNOSTICS format. This function may not be used in conjunction with the driver CIFCFG.DLL (Profibus® with CIF-card). In this case the SFC 13 (as hardware PLC), provided by the driver CIFCGF.DLL, has to be used instead. Details can be extracted from the Hilscher Manual dpm_pie.pdf, section DDLM_Slave_Diag. The DB should correspond to the structure described there. If the function was not executed successfully, the BR is not set. The return value contains the standard 80xx error codes.

Error codes:

0x813A = data block not available

0x8222 = dize of data block to small

0x8225 = range overflow

0x807F = internal driver access error

Example:

```
L DW#16#2B              // Profibus address of the slave (here : 11dec)
T MD20
CALL   SFC 210
  IN0  := 153           // function 153
  IN1  := 300           // DB 300
  IO2  := MD 20         // function number
  OUT3 := MW 24         // error code
```

Adequate DB example:

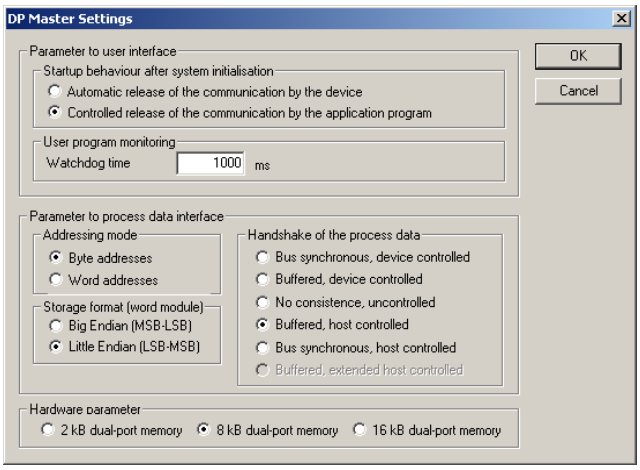
```
DATA_BLOCK DB 300
TITLE=
VERSION : 0.1
STRUCT
DPM_SLAVE_DIAG : STRUCT
Stationsstatus_1 : BYTE;
Stationstatus_2 : BYTE;
Stationstatus_3 : BYTE;
bMaster_Add : BYTE;                    // corresponding master address
usIdent_Number : WORD;                 // ident number, big endian
(motorola format)
abExt_Diag_Data : ARRAY[0..99] OF BYTE; // extended diagnostic field
END_STRUCT;
END_STRUCT;
BEGIN
END_DATA_BLOCK
```

5.5.2 Configuring the CIF-card with the SyCon System Configurator

Before the field bus components can be accessed, they have to be configured. If no Profibus® is used or the configuration can, because of other reasons, not be created with the *S7 for Windows® hardware configuration* or the Step® 7 hardware configuration, the CIF configuration must be created with the Hilscher System Configurator. If the default start addresses have not been changed via the special settings, the following assignments are valid.

The addresses of the digital peripheral are located in the CIF-address area of 0..511. Furthermore the following system parameters have to be set in the System Configurator Master Settings:

- Controlled release of communication by the application program
- Byte addresses
- Little Endian (LSB-MSB)
- Buffered, host controlled



Parameter to user interface

Startup behaviour after system initialisation
○ Automatic release of the communication by the device
● Controlled release of the communication by the application program

User program monitoring
Watchdog time 1000 ms

Parameter to process data interface

Addressing mode
● Byte addresses
○ Word addresses

Storage format (word module)
○ Big Endian (MSB-LSB)
● Little Endian (LSB-MSB)

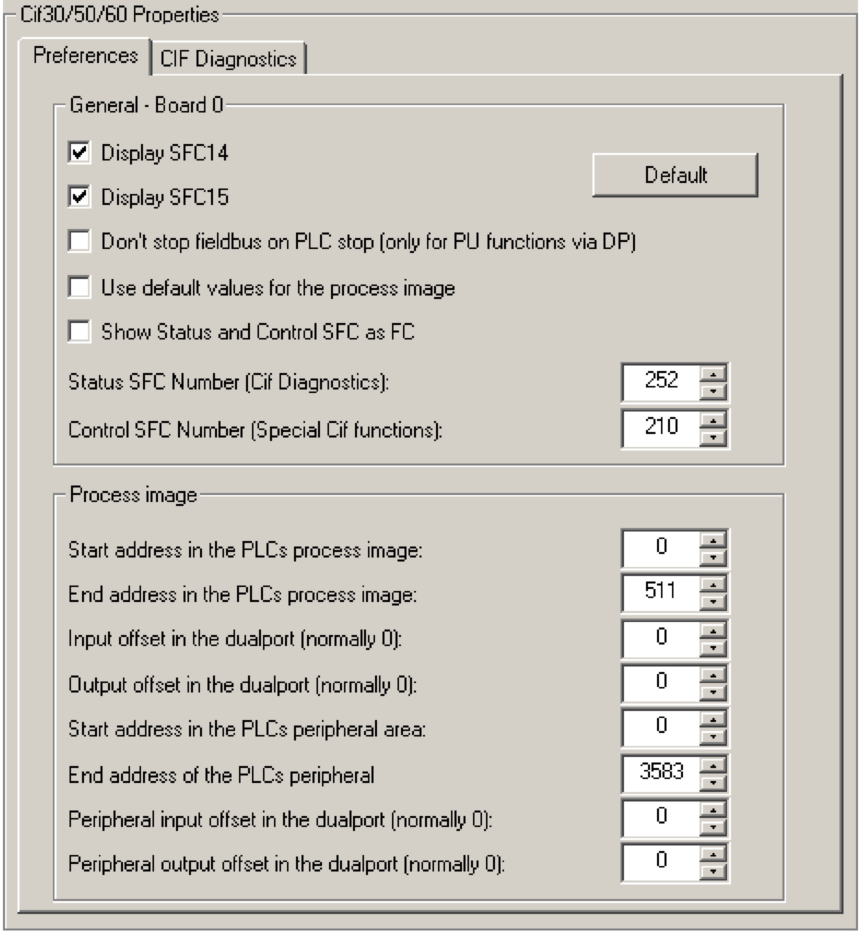
Handshake of the process data
○ Bus synchronous, device controlled
○ Buffered, device controlled
○ No consistence, uncontrolled
● Buffered, host controlled
○ Bus synchronous, host controlled
○ Buffered, extended host controlled

Hardware parameter
○ 2 kB dual-port memory ● 8 kB dual-port memory ○ 16 kB dual-port memory

5.5.3 CIF 30/50/60 Settings

The dialog consists of two tabs, which configure the driver for the Hilscher CIF-cards.

Preferences



Cif30/50/60 Properties

Preferences | CIF Diagnostics

General - Board 0

☑ Display SFC14

☑ Display SFC15

☐ Don't stop fieldbus on PLC stop (only for PU functions via DP)

☐ Use default values for the process image

☐ Show Status and Control SFC as FC

Status SFC Number (Cif Diagnostics): 252

Control SFC Number (Special Cif functions): 210

Process image

Start address in the PLCs process image: 0

End address in the PLCs process image: 511

Input offset in the dualport (normally 0): 0

Output offset in the dualport (normally 0): 0

Start address in the PLCs peripheral area: 0

End address of the PLCs peripheral 3583

Peripheral input offset in the dualport (normally 0): 0

Peripheral output offset in the dualport (normally 0): 0

In this window the specific settings for the Hilscher cards (ISA, PCI, PCMCIA) are conducted. If several Hilscher cards are installed in the PC, the according drivers have to be integrated into S7-SoftPLC. Care must be taken, that the areas in the process image of the PLC do not overlap each other. This means, that if multiple CIF-cards are used, the settings for BitStart, BitEnd etc. have to be taken with great care.

Default

Sets all settings back to default values.

Display SFC14

Displays SFC14.

Display SFC15

Displays SFC15.

WARNING: IF MULTIPLE CIF-CARDS ARE RUNNING ON ONE SYSTEM, THE SFC 14 AND 15 OF ONLY ONE CIF-CARD ARE ALLOWED TO BE SHOWN!

Don't stop fieldbus on PLC stop (only for PU functions via DP)

Prevents, that the bus is stopped at PLC Stop by the watchdog. The outputs are programed set to 0. The Hilscher card is initialized when starting the PLC or changing the system data. At RUN/STOP, no further initialization is performed. If online functions are used over Profibus® with *S7 for Windows*® or Step® 7, this option has to be activated.

Use default values for the process image

End address in the process image in the PLC: 511

End address of the PLC periphery area: 8192

All other values: 0

Show Status and Control SFC as FC

Defines, whether the StatusSFC and the ControlSFC appear as SFC or FC in the block directory. This has the advantage that empty blocks in the PLC-program can be created and the parameters can be given reasonable names. When creating a block header care must be taken, that the data types and the IN/OUT areas are identical with the PLC blocks. When the blocks (FC) are transferred to the PLC via PU, the PLC keeps the internal blocks.

Status SFC Number (CIF Diagnostics)

Defines the number of the Status SFC.

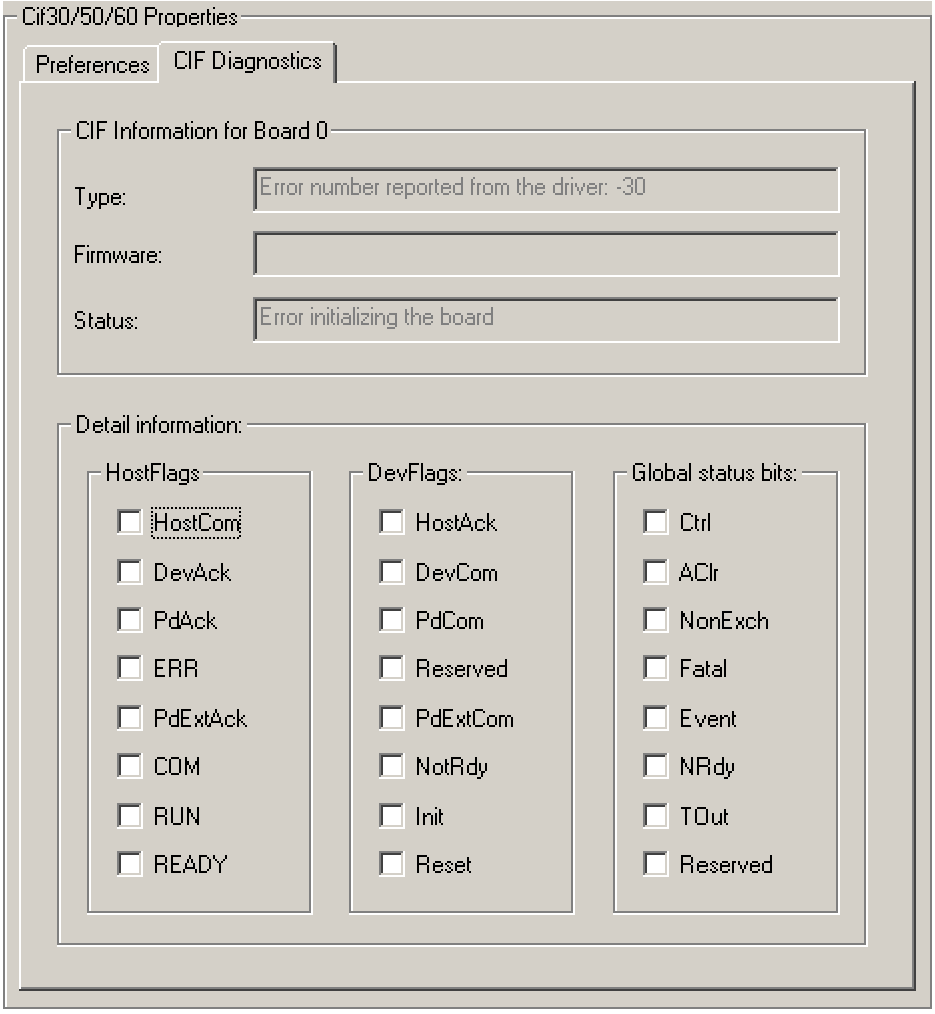
Control SFC Number (CIF Special CIF functions)

Defines the number of the Control SFC.

Process image

To define the values for the process image manually, the option standard values for the process image has to be deactivated.

Diagnostics



CIF Information for Board 0

Type: Error number reported from the driver: -30

Firmware:

Status: Error initializing the board

Detail information:

HostFlags

- □ HostCom
- □ DevAck
- □ PdAck
- □ ERR
- □ PdExtAck
- □ COM
- □ RUN
- □ READY

DevFlags:

- □ HostAck
- □ DevCom
- □ PdCom
- □ Reserved
- □ PdExtCom
- □ NotRdy
- □ Init
- □ Reset

Global status bits:

- □ Ctrl
- □ AClr
- □ NonExch
- □ Fatal
- □ Event
- □ NRdy
- □ TOut
- □ Reserved

CIF Information for Board n

Shows type, company version and status of the selected Hilscher card.

Detail information

See documentation for the corresponding Hilscher card.

5.5.4 CIF 30/50/60 settings of *S7-SoftPLC*

In the section [CIF30Dn] the specific settings of the nth CIF-card (ISA, PCI, PCMCIA) are performed.

Key name	Value range	Default value	Description
BoardNumber	0 .. 3	0	Board number reported by the Hilscher „CIF Device Driver Setup“ 0 = Board 0, 1 = Board 1, etc.
StatusSFC	100 .. 255	252	Defines the number of the Status SFC.
ControlSFC	100 .. 255	210	Defines the number of the Control SFC.
TypeFC	0 / 1	0 (SFC)	Defines, whether the Status SFC and the Control SFC are shown as SFC or FC in the block directory of the PLC. TypeFC=1 shows the blocks as FC. This has the advantage that empty blocks in the PLC-program can be created and the parameters can be given reasonable names. When creating a block header care must be taken, that the data types and the IN/OUT areas are identical with the PLC blocks. When the blocks (FC) are transferred to the PLC via PU, the PLC keeps the internal blocks.
BitStart	0 .. 511	0	Start address of the process image to be copied
BitEnd	0 .. 511	511	End address of the process image to be copied
BitIn	0 .. maximum dual-port size	0	Offset of the inputs in the dual-port
BitOut	0 .. maximum dual-port size	0	Offset of the outputs in the dual-port
PhStart	0 .. maximum dual-port size	BitStart	Start address of the peripheral area
PhEnd	0 .. maximum dual-port size	maximum dual-port size reported by the driver	End address of the peripheral area
PhIn	0 .. maximum dual-port size	BitIn	Offset of the peripheral inputs in the dual-port
PhOut	0 .. maximum dual-port size	BitOut	Offset of the peripheral outputs in the dual-port
SFC14	0 / 1	1	1=Show SFC14 from this driver diagnostic capabilities = general errors
SFC15	0 / 1	1	1=Show SFC15 from this driver diagnostic capabilities = general errors
NoStop	0 / 1	0	1=Prevents, that the bus is stopped at PLC Stop by the watchdog. The outputs are programed set to 0. The Hilscher card is initialized when starting the PLC or changing the system data. At Run/Stop, no further initialization is performed. Must be enabled when using the driver CIFCFG.DLL in its section as well.

Running several cards

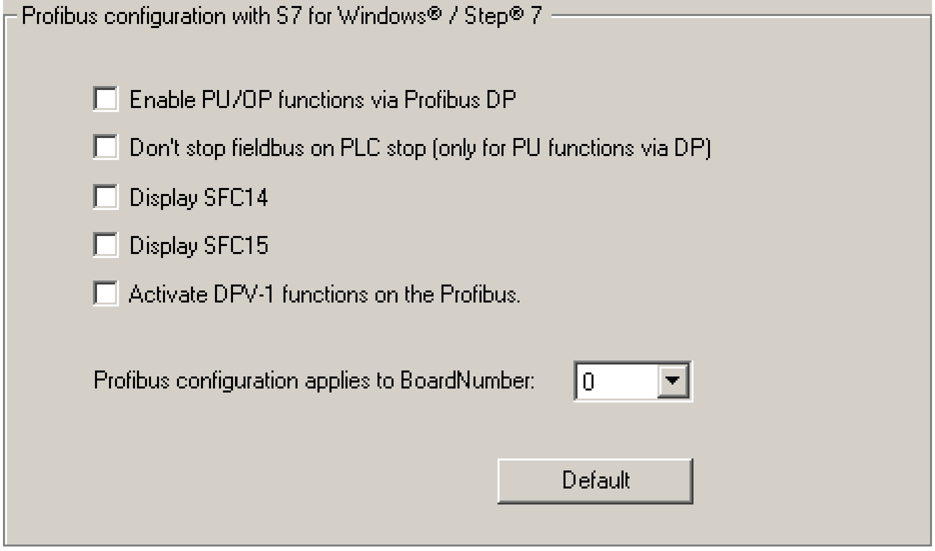
If several Hilscher cards are installed in the PC, the according drivers have to be integrated into *S7-SoftPLC*. Care must be taken, that the areas in the process image of the PLC do not overlap each other. This means, that if multiple CIF-cards are used, the settings for BitStart, BitEnd etc. have to be taken with great care. The SFC 14 and 15 are only allowed to be shown from one driver-DLL as well. No more than 4 Hilscher cards can be integrated.

5.5.5 Profibus® configuration via *S7 for Windows®*/Step® 7

Profibus® specific settings are conducted here. The settings are necessary, if the bus configuration is to be created with the *S7 for Windows® hardware configuration* or the Step® 7 hardware configuration.

- Configuration via user interface
- Configuration in PLC43.INI

5.5.6 Profibus configuration via *S7 for Windows®*/Step® 7



Profibus configuration with S7 for Windows® / Step® 7

□ Enable PU/OP functions via Profibus DP

□ Don't stop fieldbus on PLC stop (only for PU functions via DP)

□ Display SFC14

□ Display SFC15

□ Activate DPV-1 functions on the Profibus.

Profibus configuration applies to BoardNumber: 0

Enable PU/OP functions via Profibus® DP

Allows a PU-communication via the Profibus® to *S7-SoftPLC*. Some OP's (as e.g. OP3) use PU-communication for data exchange with the PLC, so that these panels can be used as well.*

Don't stop fiedbus on PLC stop (only for PU functions via DP)

Prevents, that the bus is stopped at PLC Stop by the watchdog. The outputs are programed set to 0. The Hilscher card is initialised when starting the PLC or changing the system data. At RUN/STOP, no further initialisation is performed. If online functions are used over Profibus® with *S7 for Windows®* or Step® 7, this option has to be activated.

Display SFC14

Displays SFC14.

Display SFC15

Displays SFC15.

Activate DPV-1 functions on the Profibus

Allows sending and receiving DPV1 functions to DPV1 slaves. SFB52 and SFB53 are available for DPV1 services. *

Profibus® configuration applies to BoardNumber:

The Profibus® configurated system data applies to the CIF card number listed here.

Default

Sets all settings back to their default values.

* The bus configuration has to be created with S7 for Windows® hardware configuration or Step® 7 hardware configuration.

5.5.7 Profibus configuration via *S7 for Windows®*/Step® 7

In the section [CIFCFG] Profibus® specific settings are conducted. The settings are necessary, if the bus configuration is to be created with the *S7 for Windows® hardware configuration* or the Step®7 hardware configuration.

Keyname	Value range	Default value	Description
BoardNumber	0 .. 3	0	Board number reported by the Hilscher driver 0=Board 0, 1=Board 1 etc.
OnlineDP	0 / 1	0	1=Allows a PU-communication via the Profibus® to *S7-SoftPLC*. Some OP's (as e.g. OP3) use PU-communication for data exchange with the PLC, so that these panels can be used as well. *
SFC14	0 / 1	0	1=Show SFC14 from this driver diagnostic capabilities = every slave (detailed diagnostics). *
SFC15	0 / 1	0	1=Show SFC14 from this driver diagnostic capabilities = every slave (detailed diagnostics). *
DPV1	0 / 1	0	1=Allows sending and receiving DPV1 functions to DVP1 slaves. SFB52 and SFB53 are available for DPV1 services. *
NoStop	0 / 1	0	Prevents, that the bus is stopped at PLC Stop by the watchdog. The outputs are programed set to 0. At RUN/STOP, no further initialisation is performed. Activating this parameter prevents, that a running PU-connection is disrupted when stopping the PLC. Has to be switched on in CIF30Dn.DLL driver section as well.

* The bus configuration has to be created with *S7 for Windows® hardware configuration* or Step® 7 hardware configuration.

5.6 CP343/CP443 emulation

The settings for the CP343/CP443 emulation are conducted here.

- General
- Configuration via user interface
- Configuration in PLC43.INI

5.6.1 Configuring CP343/CP443 emulation

The CP functionality of S7-SoftPLC supports the ISO on TCP (RFC 1006; Port 102) protocol for incoming PU connections. Send/Receive functions are supported for the protocols ISO on TCP, TCP/IP and UDP. Via ISO on TCP and TCP/IP Fetch/Write passive is supported as well.

In the hardware configuration of a S7-SoftPLC 416 CP443 with the purchase order number 6GK7 443-1EX11-0XE0 should be chosen , since it supports the TCP/IP protocol only.

The ISO protocol, that is used by 6GK7 443-1EX11-0XE0 for example, would require special ISO network controller drivers. Therefore a connection via ISO protocol can not be established, this is possible via ISO on TCP only. The selection of the network controller of the PU station has to begin with „TCP/IP -> your network controller".

Operating mode

At the start of S7-SoftPLC a configuration for the CP343/CP443 emulation is searched. The selected blocks for the communication appear in the block list of the PLC.

The following protocols are supported:

Iso-On-TCP	PU-channel	
Iso-On-TCP	Send/Receive	passive
Iso-On-TCP	Send/Receive	aktive
Iso-On-TCP	Fetch/Write	passive
TCP	Send/Receive	passive
TCP	Send/Receive	aktive
TCP	Fetch/Write	passive
UDP	Send/Receive	

Differences to hardware-PLC

- The local IP-address is taken from the Windows® computer network settings and is not overwritten by system data.
- FC5 and FC50 both behave like FC50 (AG_LSEND)
- FC6 and FC60 both behave like FC60 (AG_LRECV)
- FC10 only supports the commands NOP, CN_STATUS, CN_STATUS_ALL and CN_RESET_ALL.
- FB55 for configuration via DB must only be called in OB100/OB101.

Modbus on TCP Server

The CP emulation also supports the Modbus on TCP-protocol per default.

The following Modbus functions are supported:

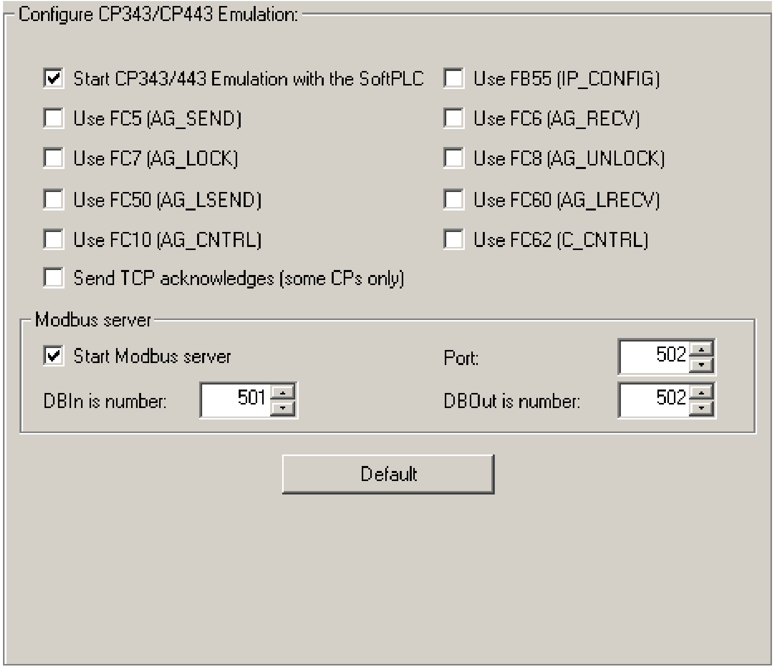
Funktion	Datenbereich	Erklärung
0x01	Out	Read bits
0x02	In	Read bits
0x03	Out	Read words
0x04	In	Read words
0x05	Out	Write bit
0x06	Out	Write word
0x0F	Out	Write bits
0x10	Out	Write words

The Modbus telegram types, normally accessing the input area, are read from a data block, that can be freely defined by the user.

The Modbus telegram types, normally accessing the output area, are read or written from another data block, that can be freely defined by the user.

That provides the possibility to access the process data of S7-SoftPLC with any HMI or Control Panels, which support the Modbus on TCP-protocol.

5.6.2 Configure the CP343/CP443 emulation via user interface



Configure CP343/CP443 Emulation:

☑ Start CP343/443 Emulation with the SoftPLC
□ Use FB55 (IP_CONFIG)
□ Use FC5 (AG_SEND)
□ Use FC6 (AG_RECV)
□ Use FC7 (AG_LOCK)
□ Use FC8 (AG_UNLOCK)
□ Use FC50 (AG_LSEND)
□ Use FC60 (AG_LRECV)
□ Use FC10 (AG_CNTRL)
□ Use FC62 (C_CNTRL)
□ Send TCP acknowledges (some CPs only)

Modbus server

☑ Start Modbus server
Port: 502
DBIn is number: 501
DBOut is number: 502

The basic settings of the CP343/CP443 emulation are conducted here.

Start CP343/443 Emulation with the *S7-SoftPLC*

Starts the CP emulation automatically, if *S7-SoftPLC* is starting.

Use FB55 (IP_CONFIG)

Shows the FB55 in the block list of *S7-SoftPLC.*

Use FC5 (AG_SEND)

Shows the FC5 in the block list of *S7-SoftPLC.*

Use FC6 (AG_RECV)

Shows the FC6 in the block list of *S7-SoftPLC.*

Use FC7 (AG_LOCK)

Shows the FC7 in the block list of *S7-SoftPLC.*

Use FC8 (AG_UNLOCK)

Shows the FC8 in the block list of *S7-SoftPLC.*

Use FC10 (AG_CNTRL)

Shows the FC10 in the block list of *S7-SoftPLC.*

Use FC50 (AG_LSEND)

Shows the FC50 in the block list of *S7-SoftPLC.*

Use FC60 (AG_LRECV)

Shows the FC60 in the block list of *S7-SoftPLC.*

Use FC62 (C_CNTRL)

Shows the FC62 in the block list of *S7-SoftPLC.*

Send TCP acknowledges (some CPs)

Sends TCP acknowledges.

Start Modbus server

Starts the Modbus Server when starting the CP343/443.

Port

Assigns the defined port to the Modbus Server. A Modbus Server listens to Port 502 per default.

DBIn is Number

Data block number of the In-area.

DBOut is Number

Data block number of the Out-area.

Default

Sets all settings back to their default value.

5.6.3 Configuring CP343/443 emulation in PLC43.INI

The basic settings of the CP343/443 emulation are conducted here. *S7-SoftPLC* expects a section named [CPX43], in which the following keys are being used:

KeyName	Defaultwert	Beschreibung
StartWithPlc	1	Start CP343/443 Emulation with *S7-SoftSPS*
FB55	0	Use FB55 (IP_CONFIG)
FC5	0	Use FC5 (AG_SEND)
FC6	0	Use FC6 (AG_RECV)
FC7	0	Use FC7 (AG_LOCK)
FC8	0	Use FC8 (AG_UNLOCK)
FC10	0	Use FC10 (AG_CNTRL)
FC50	0	Use FC50 (AG_LSEND)
FC60	0	Use FC60 (AG_LRECV)
FC62	0	Use FC62 (C_CNTRL)
SendAcknowledge	0	Send TCP acknowledges (some CPs)
ModbusPort	502	Port of the Modbus TCP server If = 0 Modbus server does not start.
ModbusDBIn	501	Data block number of the In-area
ModbusDBOut	502	Data block number of the Out-area

Example:

Starts the emulation with the PLC and uses FC 50, 60 as well as the Modbus Server.

```
[CPX43]
StartWithPlc=1
SendAcknowledge=0
FB55=0
FC5=0
FC6=0
FC7=0
FC8=0
FC10=0
FC50=1
FC60=1
FC62=0
ModbusPort=502
ModbusDBIn=501
ModbusDBOut=502
```

5.7 I/O Port

The computer hardware ports, that should be mapped in the PII/PIQ, are set here.

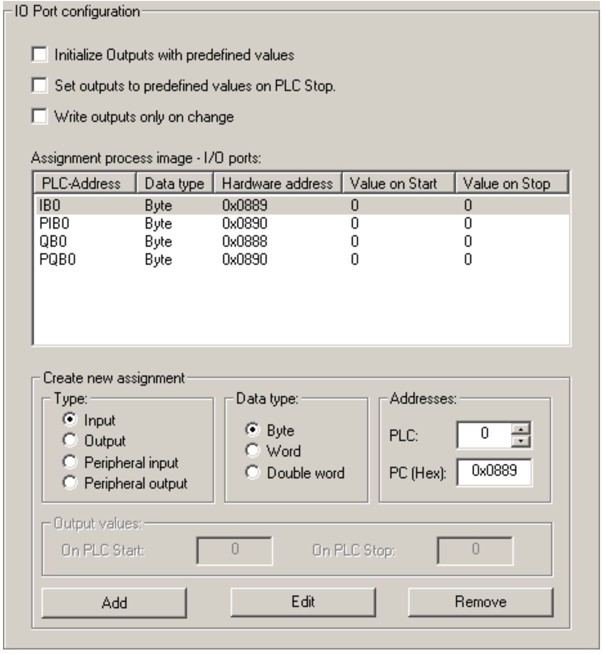
- Basics
- Configuring the I/O Ports via user interface
- Configuring the I/O Ports in PLC43.INI

5.7.1 Configuring PC hardware ports

Bytes, words and double words of the process image can be assigned to hardware I/O addresses here. Hardware addresses in the first 64k segment of the PC can be addressed only (ISA-bus). The process image of the inputs is refreshed directly before the OB1 with the values from the input ports. At the end of the OB1 the values of the PIQ are written into the configured output ports. Additionally the peripheral inputs and peripheral outputs can be assigned to ports as well. These are refreshed only, when using these addresses in the PLC-program.

5.7.2 Setting PC hardware port with user interface

Configuration



IO Port configuration

□ Initialize Outputs with predefined values
□ Set outputs to predefined values on PLC Stop.
□ Write outputs only on change

Assignment process image - I/O ports:

PLC-Address	Data type	Hardware address	Value on Start	Value on Stop
IB0	Byte	0x0889	0	0
PIB0	Byte	0x0890	0	0
QB0	Byte	0x0888	0	0
PQB0	Byte	0x0890	0	0

Create new assignment

Type: ● Input ○ Output ○ Peripheral input ○ Peripheral output

Data type: ● Byte ○ Word ○ Double word

Addresses: PLC: 0 PC (Hex): 0x0889

Output values: On PLC Start: 0 On PLC Stop: 0

If the I/O configuration is activated, all theoretical possible I/O addresses are searched in the configuration file PLC43.INI of S7-SoftPLC. Because this can take up to 45 seconds, the areas should be limited to the necessary. The outputs can be preset as well with initial values, as with safe values, that are set by the driver at PLC Stop. Bytes, words and double words can be configured. To avoid double assignments the first found entry has priority. If for example an IW4 is found, afterwards there is no search for an IB5, but for an IB6. That applies to double words as well. Overlapping between inputs and peripheral inputs, outputs and peripheral outputs are possible, because inputs and outputs can be, depending on the used hardware, on the same I/O address.

Warning: Please note, that through false configuration, non-suiting values can be written into hardware components. This can cause damage to the PC hardware. Please note as well, that the hardware port access is requested from the operating system when starting *S7-SoftPLC.* Therefore the ports have to be in a coherent, free area and must not be in conflict with existing hardware.

5.7.3 Setting PC hardware ports with PLC43.INI

Installation

The driver DLL IOPORT.DLL must be available in the installation folder of *S7-SoftPLC.* It has to be entered in the file PLC43.INI, section [OEM], where the drivers of *S7-SoftPLC* are parameterised.

```
[OEM]
dll0=ioport.dll
```

Configuration

If the I/O configuration is activated, all theoretical possible I/O addresses are searched in the configuration file PLC43.INI of S7-SoftPLC. Because this can take up to 45 seconds, the areas should be limited to the necessary. The outputs can be preset as well with initial values, as with safe values, that are set by the driver at PLC Stop. Bytes, words and double words can be configured. To avoid double assignments the first found entry has priority. If for example an IW4 is found, afterwards there is no search for an IB5, but for an IB6. That applies to double words as well. Overlapping between inputs and peripheral inputs, outputs and peripheral outputs are possible, because inputs and outputs can be, depending on the used hardware, on the same I/O address.

Entries

The following section must be contained in the configuration file PLC43.INI:

```
[ioportdll]
;the following entries are possible (n = consecutive number):
;preset outputs with initial values. Default: 0=No
InitOutputs=0

;set outputs to safe values at Stop. Default: 0=No
SafeOutputs=0

;Outputs only to be written into the hardware when changed. Default: 0=No
BufferOutputs=0

;Limit the area of the entries searched for to reduce scan time.
;area input/output byte from ... Default=0
MinByte=0
;... up to input/output byte. Default=4095
MaxByte=10

;Configuration of the inputs (syntax: start address=I/O Port number):
EBn=Portnumber(Dez)
EWn=Portnumber(Dez)
EDn=Portnumber(Dez)

;Configuration of the peripheral inputs (syntax: start address=I/O Port
number):
PEBn=Portnumber(Dez)
```

```
PEWn=Portnumber(Dez)
PEDn=Portnumber(Dez)

;Configuration of the outputs (syntax: output address=I/O Port number):
ABn=Portnumber(Dez)
AWn=Portnumber(Dez)
ADn=Portnumber(Dez)

;initialize I/O Ports with values (at InitOutputs=1)
InitABn=Value(Dez)
InitAWn=Value(Dez)
InitADn=Value(Dez)

;set I/O Ports to safe values at PLC Stop (at SafeOutputs=1)
SafeABn=Value(Dez)
SafeAWn=Value(Dez)
SafeADn=Value(Dez)

;Configuration of peripheral outputs (syntax: peripheral output address=I/O
Port number):
PABn=Portnumber(Dez)
PAWn=Portnumber(Dez)
PADn=Portnumber(Dez)

;initialize I/O Ports with values (at InitOutputs=1)
InitPABn=Value(Dez)
InitPAWn=Value(Dez)
InitPADn=Value(Dez)

;set I/O Ports to safe values at PLC Stop (at SafeOutputs=1)
SafePABn=Value(Dez)
SafePAWn=Value(Dez)
SafePADn=Value(Dez)
```

WARNING: PLEASE NOTE, THAT THROUGH FALSE CONFIGURATION, NON-SUITING VALUES CAN BE WRITTEN INTO HARDWARE COMPONENTS. THIS CAN CAUSE DAMAGE TO THE PC HARDWARE. PLEASE NOTE AS WELL, THAT THE HARDWARE PORT ACCESS IS REQUESTED FROM THE OPERATING SYSTEM WHEN STARTING *S7-SOFTPLC.* THEREFORE THE PORTS HAVE TO BE IN A COHERENT, FREE AREA AND MUST NOT BE IN CONFLICT WITH EXISTING HARDWARE.

Example

To demonstrate a possible configuration, the printer port of a PC is mapped to the process image of the PLC. The output port Q (0x378hex = 888dec) is assigned to the QB0, the input port B (0x379hex = 889dec) to the IB0. The output port Q (0x37Ahex = 890dec), from which only five bits are available on the printer port, is assigned to the peripheral input byte PIB10 and the peripheral output byte PQB10. An initialisation is not made.

```
[OEM]
dll0=ioport.dll

[ioportdll]
InitOutputs=0
SafeOutputs=0
BufferOutputs=0
MinByte=0
MaxByte=10
EB0=889
PEB10=890
AB0=888
InitAB0=0
SafeAB0=0
PAB10=890
InitPAB0=0
SafePAB0=0
```

Changes

If required the source code of this driver is available at our support. Because newer components are normally build on the basis of the PCI bus, these components can not be accessed over this driver. Usually hardware manufacturers deliver drivers and access-DLL's. The source code of the IO-port driver can serve as an example to write an own driver.

5.8 Modbus on TCP

A Modbus on TCP master is configured here, which can cyclically exchange data from I/O modules into the PII/PIQ.

- Calling the Control SFC
- Configuring the driver via the user interface
- Configuring the driver with PLC43.INI

5.8.1 Modbus on TCP configuration

This driver allows to connect local I/O with the *S7-SoftPLC* via Ethernet / Modbus on TCP. The driver supports the Modbus on TCP function codes listed in the chart below. If a slave is supposed to run with the *S7-SoftPLC*, it should be verified, that it supports the listed Modbus functions. If possible the Modbus function Read/Write Registers (0x17) should be used, since it executes reading and writing in one frame. If a slave does not support this funciton, it has to be created as two slaves. The first configuration reads the inputs, the second writes the outputs. Since this isn't very efficient, the function Read/Write should be preferred. Additionally the driver installs a Status SFC/FC, to monitor the status of the Modbus on TCP connection.

Status SFC/FC

```
CALL      SFC/FC 193
  IN0     := 1       //INPUT INT
  RET_VAL := MW 0    //RESULT INT
  OUT1    := MW 2    //OUTPUT INT
  OUT2    := MD 4    //OUTPUT DWORD
  OUT3    := MW 8    //OUTPUT INT
  OUT4    := MD 10   //OUTPUT DWORD
```

Parameter	Datentyp	Bedeutung
IN0	INT	Slave number format: 0,1,2,3,...this corresponds to the slave index number, as configured
RET_VAL	INT	Returns 0 if a parametrisation does exist. Otherwise 0x8090
OUT1	INT	Bit 0 = 1 connection established Bit 1 = 1 Error Bit 2...7 reserved Bit 8...15 PLC cycles since last I/O module answer (resetted by Status SFC/FC)
OUT2	DWORD	Parametrised IP address
OUT3	INT	Parametrised port
OUT4	DWORD	Windows-Error-Code

Most important Windows(32-Bit) network-error messages

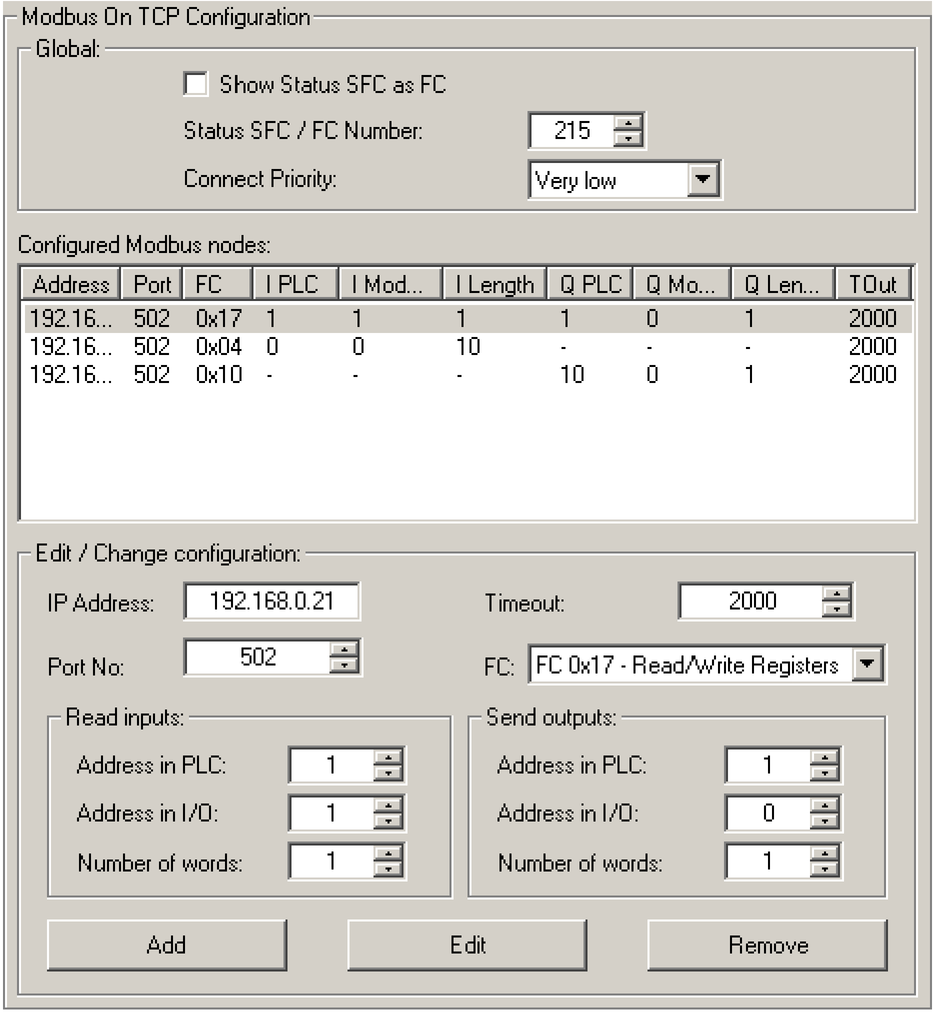
0x271D / 10013d	Permission denied – Indicates restricted rights or a firewall.
0x2745 / 10053d	Software caused connection abort – Probably defective network connection or no slave available at given address.
0x2746 / 10054d	Connection reset by peer. The slave has disconnected the connection.
0x274C / 10060d	Connection timed out. Timeout on network connection.
0x274D / 10061d	Connection refused. The slave (or a router in-between) has refused the connection.
0x2751 / 10065d	No route to host. The connection to the aimed network can not be established. Network settings and gateway/router settings have to be checked.

Status word

If succeeded the BR of the status word is set, OR, STA and /FC are zero.

If failed the BR, OR, STA and /FC of the status word are zero.

5.8.2 Configuring Modbus on TCP with the user interface



Modbus On TCP Configuration

Global:

□ Show Status SFC as FC

Status SFC / FC Number: 215

Connect Priority: Very low

Configured Modbus nodes:

Address	Port	FC	I PLC	I Mod...	I Length	Q PLC	Q Mo...	Q Len...	TOut
192.16...	502	0x17	1	1	1	1	0	1	2000
192.16...	502	0x04	0	0	10	-	-	-	2000
192.16...	502	0x10	-	-	-	10	0	1	2000

Edit / Change configuration:

IP Address: 192.168.0.21

Timeout: 2000

Port No: 502

FC: FC 0x17 - Read/Write Registers

Read inputs:

Address in PLC: 1

Address in I/O: 1

Number of words: 1

Send outputs:

Address in PLC: 1

Address in I/O: 0

Number of words: 1

Show Status SFC as FC

Configures whether the Modbus driver installs an FC or a SFC in the block list of *S7-SoftPLC*.

Status SFC / FC Number

Configures which SFC/FC number is assigned. Care should be taken, that the given number is not already used in the PLC or in the PLC program.

Connect Priority

Sets Connect-Thread priority

Configured Modbus nodes

Configured Modbus devices can be created, configured and removed. The number of parameters, that can be assigned for a Modbus device depends on the used Modbus function.

5.8.3 Configuring Modbus on TCP with PLC43.INI

Setting the slaves

Syntax for setting the slaves:

01_parameter phrase for the first Modbus slave

02_parameter phrase for the second Modbus slave

...

10_parameter phrase for the tenth and last Modbus slave

The parameter phrases of the slaves must be numbered consecutively, otherwise reading the parameters is stopped at the gap.

Example:

```
01_IPAdr=192.168.0.80
02_IPAdr=192.168.0.81
06_IPAdr=192.168.0.84
```

The sequence is stopped at 03_. In this case, only the settings for the slaves from 01_ to 02_ are read.

PLC43.INI parameterisation

The parameterisation fo the PLC43.INI can be conducted manually or with the help of the user inteface.

```
[OEM]
;Name of I/O driver
DLL0=ilbeth24.dll

[ILBETH24]
;general settings
TypeFC=0 ;create as FC 0= no (SFC), 1 = yes (FC) (default = 0)
StatusSFC=193 ;SFC/FC Number (default = 193)
Prio=251 ;Priority of Connect-Thread (default = 251)

;first Slave
01_IPAdr=192.168.0.21 ;IP address of connection 01
01_Port=502 ;Port of connection 01 (default = 502)
01_ModbusFC=0x17 ;ModbusFunctionCode of connection 01 (default = 0x17)
01_Timeout=2000 ;Timeout of connection in Milliseconds
01_AdrPLC_AW=1 ;output word in process image of the PLC of connection 01
01_AdrI/O_AW=2 ;output word of I/O-module of connection 01
01_Count_AW=1 ;number of output words of connection 01
01_AdrPLC_EW=1 ;input word in process image of the PLC of connection 01
```

```
01_AdrI/0_EW=0 ;input word of I/O-module of connection 01
01_Count_EW=1 ;number of output words of connection 01

;second slave
02_IPAdr=192.168.0.22
02_ModbusFC=0x04
02_AdrPLC_EW=0
02_AdrI/O_EW=0
02_Count_EW=10

;third slave
03_IPAdr=192.168.0.23
03_ModbusFC=0x06
03_AdrPLC_AW=10
03_AdrI/O=0
```

…

The number of parameters, that are to be generated for one slave, depends on the used Modbus function (see chart).

To be able to query the current connection status from the PLC program, the driver installs the SFC 193 (as parameterised in PLC43.INI) into the block list of *S7-SoftPLC.* This block can be called from the PLC-program, to monitor the hardware status.

5.9 NVRAM configuration

Driver to store retain data of *S7-SoftPLC*. Intended for use with an ADS-TEC PCI-card, a network drive or a hardware simulating a filesystem.

- General and controlling via SFC
- Configuration via user interface
- Configuration in PLC43.INI

5.9.1 NVRAM configuration

The NVRAM configuration allows a remanent behavior of *S7-SoftPLC*. The NVRAM configuration builds a file to save the retain data. Depending on the capabilities of your filesystem and the size of the parameterised values, the saving process will take some time, so that the process does not occur in real-time.

It is not possible to store retain data on local hard drives, because Microsoft Windows® writes buffered only and does not store data on the hard drive, because of the high access rates. Thats why the saving of retain data can only be performed on network drives (or similar).

If PC-plug-in cards are being used, that emulate a hard drive via battery buffered RAM, it must be ensured, that the used driver overrides the data buffering of the Microsoft Windows® operating system and that the data is written onto the emulated hard drive immediately.

Remanence checking with STATUS SFC/FC

The STATUS SFC/FC returns two information:

OUT0 (DOWRD) returns the interval of the last saving process.

RET_VAL (INT) see chart:

RET_VAL(INT)	Description
0	Everything operational
-1	NVRamDll not longer in memory
-2	Unable to open data file
-3	No write access
-4	Unable to close data file

Calling the STATUS SFC/FC:

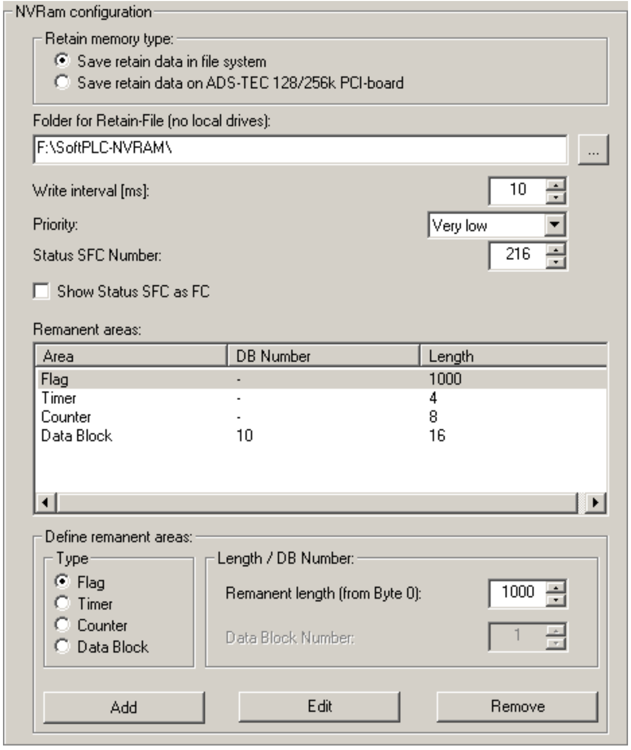
```
CALL      SFC 212
  OUT0    := MD 0 //OUTPUT DWORD
  RET_VAL := MW 4 //RESULT INT
```

Comment on file systems

It is not possible to store retain data on local hard drives, because Microsoft Windows® writes buffered only and does not store data on the hard drive, because of the high access rates. Thats why the saving of retain data can only be performed on network drives (or similar).

If PC-plug-in cards are being used, that emulate a hard drive via battery buffered RAM, it must be ensured, that the used driver overrides the data buffering of the Microsoft Windows® operating system and that the data is written onto the emulated hard drive immediately.

5.9.2 NVRAM configuration with the user interface



NVRam configuration

Retain memory type:

● Save retain data in file system

○ Save retain data on ADS-TEC 128/256k PCI-board

Folder for Retain-File (no local drives): F:\SoftPLC-NVRAM\

Write interval [ms]: 10

Priority: Very low

Status SFC Number: 216

□ Show Status SFC as FC

Remanent areas:

Area	DB Number	Length
Flag	-	1000
Timer	-	4
Counter	-	8
Data Block	10	16

Define remanent areas:

Type

● Flag

○ Timer

○ Counter

○ Data Block

Length / DB Number:

Remanent length (from Byte 0): 1000

Data Block Number: 1

Retain memory type:

Determines whether an ADS-TEC PCI-card or a file system is to be used.

Folder for Retain-File (no local drives):

Path to retain data.

Write inteval (ms):

Sequence, the remanent data is supposed to be saved in.

Priority:

Priority of the thread, that saves the data.

Status SFC Number:

Block number of the Status SFC.

Show Status SFC as FC

Shows Status SFC as FC in *S7-SoftPLC*.

Remanent areas:

Areas that are being kept remanent.

5.9.3 NVRAM configuration with the PLC43.INI

The NVRAM driver allows a remanent behavior of *S7-SoftPLC*.

The driver creates a file for the retain data. Depending on the capabilities of the used file system and the size of the parameterised values, the saving process will take some time, so that the process does not take place in real-time.

See "comment on file systems"

Settings in configuration file PLC43.INI

To activate the driver, the entry DLLn=NVRAMDLL.dll in section [OEM] must be made.

The driver expects the section [IBHNVRAM] where further parameters are defined.

Name of parameters	Default value	Description
RemFolder(required)		Full qualified path to retain data
WriteInterval(optional)	10	Time interval in milliseconds for the saving thread
WritePrio(optional)	THREAD_PRIORITY_IDLE	Windows thread priority for the saving thread
ShowFC(optional)	0	Show status block as FC 0 = SFC, 1 = FC.
SFCNo(optional)	212	Status block number
The sign '#' is a wild-card for a number between 0 an 99		
TYP#		Remanent type; M=Flag, D=data block, T=Timer, Z=Counter
LEN#		Length of data that is kept remanent starting from address 0
DBNR#		Data block number – must be given at TYP = D only

Example with 1000 flagbytes, 4 counters, 8 timers and 16 bytes from DB10:

```
[OEM]
dll0=NVRamDll.dll

[IBHNVRAM]
RemFolder=F:\SoftPLC-NVRAM\
TYP0=M
LEN0=1000
TYP1=Z
LEN1=4
TYP2=T
LEN2=8
TYP3=D
LEN3=16
DBNR3=10
```

5.10 Softnet PN IO

Driver to use Siemens Softnet PN IO from *S7-SoftPLC*

- General configuration
- Configuration via user interface
- Configuration with PLC43.INI

5.10.1 Softnet PN IO configuration

To be able to use *S7-SoftPLC* with PROFINET® IO via SoftNet PN IO 2006, the following steps have to be made.

- SoftNet must be installed and licenced on the computer.
- The computer must have a static IP address.

Station Configuration Editor

- In the Station Configuration Editor an application is inserted on index 1.

WARNING: THE STATION NAME MUST BE IDENTICAL WITH THE NAME OF THE COMPUTER.

- On index 3 a component of the type „IE general“ is inserted. In the parameterisation, the network controller for use with PROFINET® has to be selected.
- In the dialog „component properties“ verify the network settings. (The box „Activate ISO protocol only“ must be unchecked.)

Simatic Manager (Step® 7 v5.4 SP1 or better)

- The PG/PC port must be set to TCP/IP.
- A SIMATIC PC-station is inserted into the project.

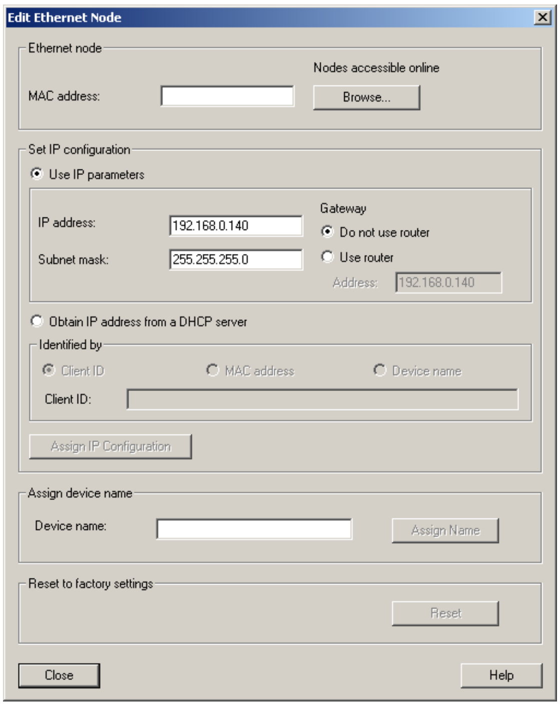
WARNING: THE STATION NAME MUST BE IDENTICAL WITH THE NAME OF THE COMPUTER.

- Start the hardware configuration.
- An object is inserted on index 1.
  Right-click on index1 >> Insert object >> User application >> Application >> SW V6.3
- An object is inserted on index 3.
  Right-click on index 3 >> Insert object >> CP Industrial Ethernet >> IE general >> SW V6.2 SP1...
- In the dialog „Properties – Ethernet port IE general“ the computers static IP must be entered and networked with the new subnet.
- With a right-click on IE general >> Insert PROFINET® I/O system a new PROFINET® network is created.

Add I/O nodes to PROFINET® IO network

- With a right-click on IE general >> Edit Ethernet nodes, the following dialog appears.
- The button „Browse...“ allows to search for available PROFINET® nodes.
- A unique name has to be assigned to every PROFINET® node. After a node was loaded into the dialog via „Browse...“, a name for the node can be entered in the text field „Device name“ and can be assigned to the node by clicking on „Assign name“.

Warning: This name has to be unique in PROFINET® network. The name is needed later during configuration.



Edit Ethernet Node

Ethernet node

MAC address:

Set IP configuration

● Use IP parameters

IP address: 192.168.0.140

Subnet mask: 255.255.255.0

Gateway

● Do not use router

○ Use router

Address: 192.168.0.140

○ Obtain IP address from a DHCP server

Identified by

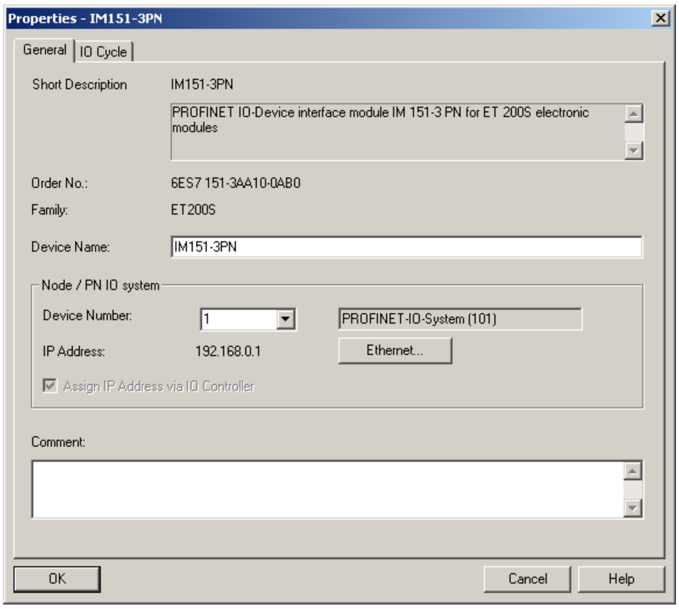
● Client ID ○ MAC address ○ Device name

Client ID:

Assign device name

Device name:

Reset to factory settings



Properties - IM151-3PN

Short Description: IM151-3PN

PROFINET IO-Device interface module IM 151-3 PN for ET 200S electronic modules

Order No.: 6ES7 151-3AA10-0AB0

Family: ET200S

Device Name: IM151-3PN

Node / PN IO system

Device Number: 1 — PROFINET-IO-System (101)

IP Address: 192.168.0.1

☑ Assign IP Address via IO Controller

Comment:

- Now a PROFINET® node can be assigned to the PROFINET® network. The node is added from the catalog to the network via drag & drop.
- After a right-click on the node >> object properties, the following dialog appears:
- In "Device name" the same name has to be set, as it was assigned in "Edit Ethernet member".

Warning: The name of the device has to be identical with the assigned node name from above.

- The individual I/O slices of the node must be configured correctly, otherwise no communication to the node can be established.

Completing the hardware configuration

- The hardware configuration must now be compiled and downloaded into the PC-Station.

Note: The bus starts after 30sec, when the I/O's are triggered by the application.

Avoid unnecessary CPU load:

SoftNet PN I/O is a software driver that needs system resources. In order to get the system to high-performance, the following should be noted.

- Close not needed services
- Set SIMATIC NET IEPG Help Service to „Deactivated“ from control panel services
- Remove the station manager from the StartUp (Start menu)

The service „Simatic Net Station Manager (s7wnsmsk.exe)“ has reserved the port 102 (iso-tsap) for itself, so SoftNet PN IO can not be run in combination with CP343/443 Emulation (Cpx43), because it needs the port 102 as well. If the service "Simatic Net Station Manager (s7wnsmsk.exe)" is deactivated, PROFIBUS® IO will not work anymore.

Typical errors:

- Siemens "Station Configuration Editor" looses the network controller.

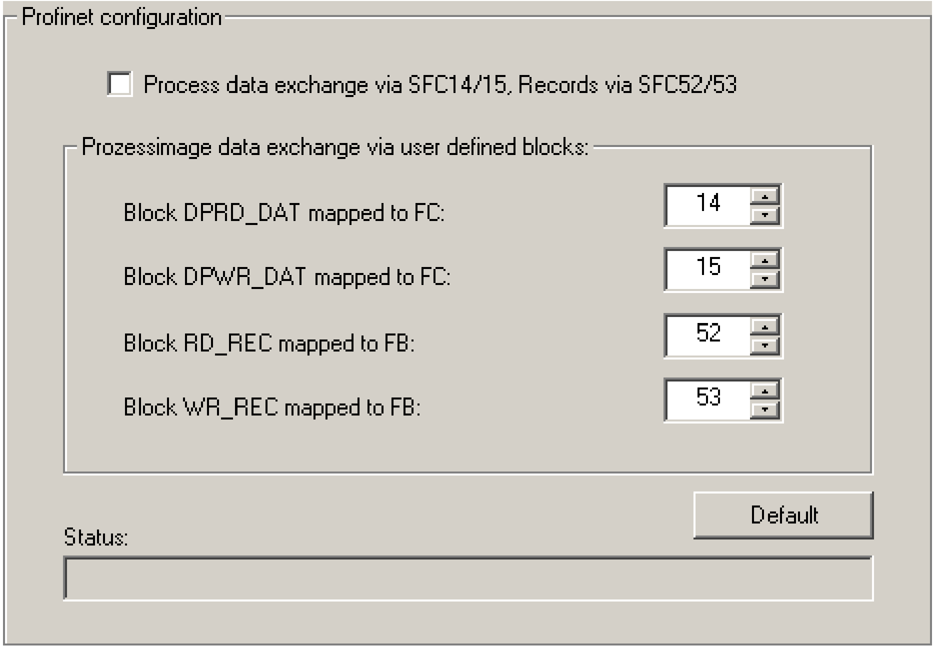
Help:

- Start the Station Configuration Editor
- Insert the network controller
- Close the Station Configuration Editor
- Start the Station Configuration Editor again
- Remove the network controller (now it knows, that the controller is no longer available)
- Insert the network controller again (The controller is ready now)
- Close the Station Configuration Editor
- Reload the configuration with SIMATIC NCM PC Manager

Using SoftNet PN IO in S7-SoftPLC

SoftNet PN IO can be accessed from the PLC-program via SFC14/15 SFB52/53 only. The parameters LADDR, ID and INDEX do correspond to the PROFINET® address from the hardware configuration.

5.10.2 Configuring SoftNet with the user interface



Profinet configuration

□ Process data exchange via SFC14/15, Records via SFC52/53

Prozessimage data exchange via user defined blocks:

Block DPRD_DAT mapped to FC: 14

Block DPWR_DAT mapped to FC: 15

Block RD_REC mapped to FB: 52

Block WR_REC mapped to FB: 53

Process data exchange via SFC14/15, Records via SFC52/53

Uses the standard SFC/SFB for data exchange.

Block "Function name" is FC:

Block number of the function "Function name".

Default

Sets all settings back to their default values.

5.10.3 Configuring SoftNet PN IO with PLC43.INI

The driver allows to exchange data from the PLC-program via SFC 14/15 with PROFINET® IO slaves over PROFINET® IO SoftNet®.

Furthermore the SFB 52/53 are available for diagnostic functions as well as reading and writing records to the PROFINET® IO device.

Parameterisation of PnioSn.dll with PLC43.INI

The PnioSn.dll must be integrated in the section [OEM].

```
[OEM]
dll0=pniosn.dll
```

Furthermore the PnioSn.dll expects a section [PNIOSN], with the following parameters:

Parameter	Default value, possible values	Description
SlotNumber	3	Port number set in SoftNet
TypeFC	0, 1	Use standard SFC/SFB
SFC14	14, 1 ... 255	Block DPRD_DAT is FC Nr
SFC15	15, 1 ... 255	Block DPWR_DAT is FC Nr
SFB52	52, 1 ... 255	Block RDREC is FC Nr
SFB53	53, 1 ... 255	Block WRREC is FC Nr

The following example uses the application in the PC-Station on SlotNumber 3, function blocks as FC/FB and uses the FC/FB numbers equivalent to the SFC/SFB numbers:

```
[PNIOSN]
SlotNumber=3
TypeFC=1
SFC14=14
SFC15=15
SFB52=52
SFB53=53
```

5.11 User SFC

Userdefined SFC's/FC's can be loaded into *S7-SoftPLC.*

- User SFC's/FC'S basics
- Configuration of User SFC's/FC's with the help of the user interface
- Configuration of User SFCs/FCs in the PLC43.INI

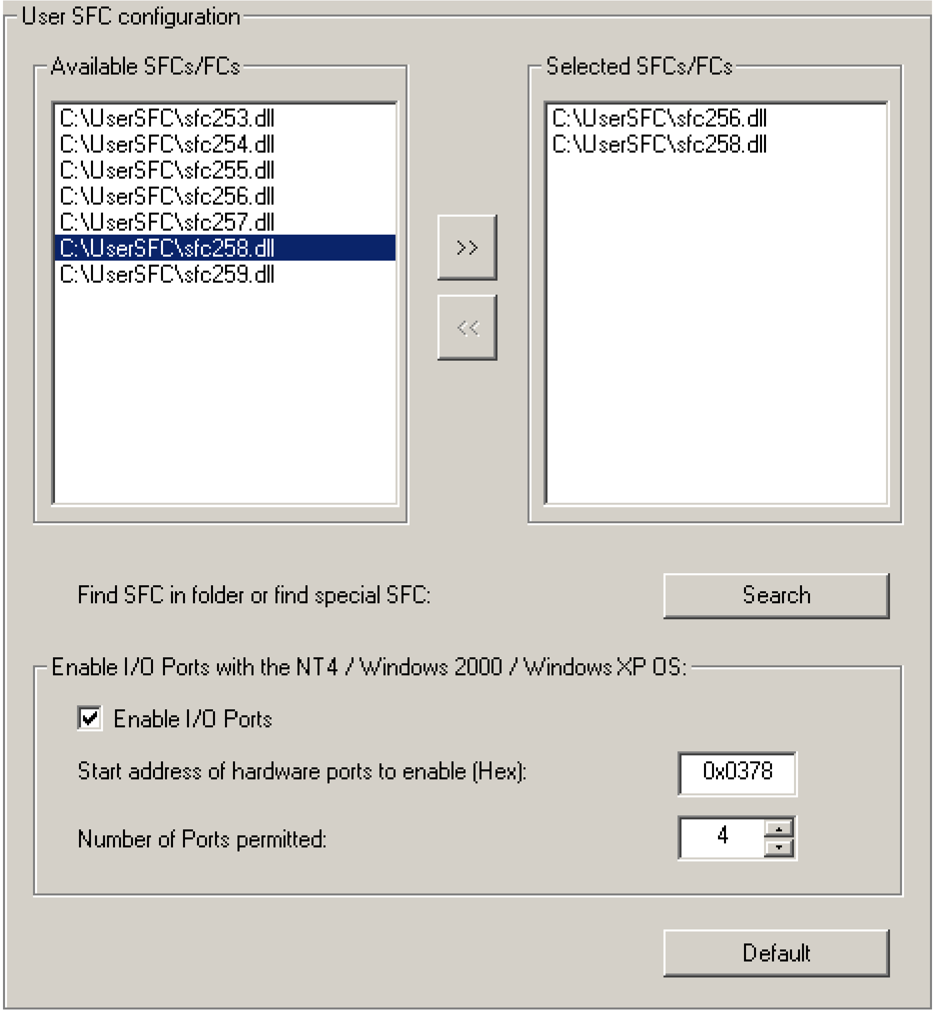
5.11.1 User SFC configuration

There is the possibility to add user defined SFC's/SFB's to *S7-SoftPLC*. *S7-SoftPLC* allows the user to use up to 100 DLLs with user defined system functions (SFC) or functions (FC). Every DLL can contain multiple SFCs or FCs. These SFC/FC can be created by the user in C++, if a certain specification is kept.

By integrating own SFC/FC, the function pool can be expanded by own application specific code parts (technology functions, know-how protection, special hardware components). If the blocks are transferred with the PU to the PLC, the PLC keeps the C++ created internal blocks.

Examples for creating own SFC/FC-DLLs are available at the IBH*softec* support.

5.11.2 Setting the User SFC's/FC's within the user interface



User SFC configuration

Available SFCs/FCs

C:\UserSFC\sfc253.dll
C:\UserSFC\sfc254.dll
C:\UserSFC\sfc255.dll
C:\UserSFC\sfc256.dll
C:\UserSFC\sfc257.dll
C:\UserSFC\sfc258.dll
C:\UserSFC\sfc259.dll

Selected SFCs/FCs

C:\UserSFC\sfc256.dll
C:\UserSFC\sfc258.dll

Find SFC in folder or find special SFC:

Enable I/O Ports with the NT4 / Windows 2000 / Windows XP OS:

☑ Enable I/O Ports

Start address of hardware ports to enable (Hex): 0x0378

Number of Ports permitted: 4

Available SFCs/FCs

The available SFC/FC-DLLs are listed here. SFC/FC-DLLs can be added with the „Search“-button. By activating the „>>“-button, the selected SFC/FC-DLL is moved into the right filed (Selected SFCs/FCs) and therefore added to *S7-SoftPLC*.

Selected SFCs/FCs

The SFC/FC-DLLs currently assigned to *S7-SoftPLC* are listed here. By activating the „<<“-button, the selected SFC/FC-DLL is moved into the left field (Available SFCs/FCs) and therefore removed from *S7-SoftPLC*. The SFC/FC-DLLs can be added to *S7-SoftPLC* at any time

Search

With the „Search“-button user defined SFC/FC-DLLs can be added to the „Available SFC/FC-DLLs“-field.

Enable I/O Ports with NT4 / Windows 2000 / Windows XP:

If a user SFC/FC accesses a hardware port of the PC directly, it has to be mentioned, that no direct access of the PC hardware is allowed with Windows® NT4, Windows® 2000 and Windows® XP.

To allow direct hardware access, the drivers of *S7-SoftPLC* can obtain the permission from the operating system.

5.11.3 Setting the User SFC's/FC's within the PLC43.INI

In the section [SF] there is the possibility to add user defined SFC's/SFB's to *S7-SoftPLC*. *S7-SoftPLC* allows the user to use up to 100 DLLs with user defined system functions (SFC) or functions (FC). Every DLL can contain multiple SFCs or FCs. These SFC/FC can be created by the user in C++, if a certain specification is kept.

By integrating own SFC/FC, the function pool can be expanded by own application specific code parts (technology functions, know-how protection, special hardware components). If the blocks are transferred with the PU to the PLC, the PLC keeps the C++ created internal blocks.

Examples for creating own SFC/FC-DLLs are available at the IBH*softec* support.

Keyname	Value area	Default value	Description
SF00	SFCnnn.DLL	---	File name of user defined SFC/FC
SF01	SFCnnn.DLL	---	File name of user defined SFC/FC
SF02	SFCnnn.DLL	---	File name of user defined SFC/FC
….			
SF99	SFCnnn.DLL	---	File name of user defined SFC/FC

Enable hardware ports

If a user SFC/FC accesses a hardware port of the PC directly, it has to be mentioned, that no direct access of the PC hardware is allowed with Windows® NT4, Windows® 2000 and Windows® XP. To allow direct hardware access, the drivers of *S7-SoftPLC* can obtain the permission from the operating system. To do so, the section [IO-PORTS] has to be added in the file PLC43.INI.

Below, beginning with the address 0x0378, normally the printer port, 4 ports are enabled for direct port access.

```
[IO-PORTS]
378=4
```

For the serial port COM1, normally at address 0x03F8 with a lenght of 8 bytes, the entry would look like this:

```
[IO-PORTS]
3F8=8
```

Alternatively the I/O-port driver (ioport.dll) can be used as well.

6 Technical data

This chapter contains the technical data of *S7-SoftPLC*

- Technical datal
- Instruction set
- Diagnostic buffer entries
- Differences
- AppStarter
- Zero modem cable

6.1 Technical data

	Windows NT 4.x/2000/XP	
	PLC S7 315	PLC S7 416
Load memory	256 kByte	adjustable
RAM	256 kByte	adjustable
Blocks	16.384	16.384
Flags (Bit)	16.384	131.072
Timer	256	2048
Counter	256	2048
Digital I/O	1.024 Bit	32.768 Bit
Analog I/O	2.048 Byte	8.192 Byte
	Processing times*)	
Pentium III 600 MHz	100 µs	100 µs
Pentium IV 1,1 GHz	50 µs	50 µs
Pentium IV 2,6 GHz	28 µs	28 µs

*) Time setting 50% PLC-time : 50% Windows-time; 1024 mixed instructions (50% binary, 50% digital)

6.2 Instruction set

The *S7-SoftPLC 315* has the complete instruction set of the Simatic® S7-315 CPU.

The *S7-SoftPLC 416* has the complete instruction set of the Simatic® S7-416 CPU.

Bit logic instructions

Instruction	Operand	Description
A AN O ON X XN		AND with a scan to "1" AND with a scan to "0" OR with scan to "1" OR with scan to "0" Exclusive-OR with a scan to "1" Exclusive-OR with a scan to "0"
	I Q M L T C DBX DIX	of an input of an output of a memory of a local data bit of a timer of a counter of a data bit of an instant data bit
==0 <>0 >0 >=0 <0 <=0 UO OV OS BR		result equal zero result unequal zero result greater than zero result greater or equal zero result less than zero result less or equal zero invalid result overflow overflow (saving) binary result

Other boolean logic instructions

Operation	Operand	Description
A(AN(		AND left parenthesis AND NOT left parenthesis
O(ON(		OR left parenthesis OR NOT left parenthesis
X(XN(		Exclusive OR left parenthesis Exclusive OR NOT left parenthesis
)		Right parenthesis
O		OR-ing AND operations
NOT		Negate RLO
SET		Set RLO to "1"
CLR		Set RLO to "0"
SAVE		Save RLO to the BR bit

Operation	Operand	Description
=		Assign value of RLO
S		Set
R		Reset
FP		Positive edge detection
FN		Negative edge detection
	I	of an input bit
	Q	of an output bit
	M	of a memory bit
	L	of a local data bit
	DBX	of a data bit
	DIX	of a instance data bit

Master Control Relay

Operation	Operand	Description
MCRA		Activate MCR
MCRD		Deactivate MCR
MCR(		Open MCR zone
)MCR		Close MCR zone

Load / Transfer instructions

Operation	Operand	Description
L		Load operand
T		Transfer operand
	IB	Input byte
	IW	Input word
	ID	Input double word
	QB	Output byte
	QW	Output word
	QD	Pouput double word
	MB	Memory byte
	MW	Memory word
	MD	Memory double word
	LB	Local data byte
	LW	Local data word
	LD	Local data double word
	DBB	Data block byte
	DBW	Data block word
	DBD	Data block double word
	DIB	Instance data block byte
	DIW	Instance data block word
	DID	Instance data block double word
	STW	Status word
L	Const	Load constant value
L	#Pointer	Load pointer
L	T	Timer
LC	T	Timer (BCD coded)
L	C	Counter
LC	C	Counter (BCD coded)
L	DBNO	Data block number
L	DBLG	Data block length
L	DINO	Instance data block number
L	DILG	Instance data block length

Peripheral access instructions

Operation	Operand	Description
L	PIB	Load peripheral input byte
L	PIW	Load peripheral input word
L	PID	Load peripheral input double word
T	PQB	Transfer peripheral output byte
T	PQW	Transfer peripheral output word
T	PQD	Transfer peripheral output double word

Accumulator instructions

Operation	Operand	Description
PUSH		Push accumulators upwards
POP		Push accumulators dowwards
ENT		Push accumulators (without A1) A2->A3, A3->A4
LEAVE		Push accumulators (without A1) A4->A3, A3->A2
TAK		Change ACCU1 with ACCU2
CAW		Change ACCU1 bytes 0 and 1
CAD		Change ACCU1 bytes 0 and 3, 1 and 2

Shift and rotating instructions

Operation	Operand	Description
SLW		Shift ACCU1-L left (word shift)
SLD		Shift ACCU1 left (double word shift)
SRW		Shift ACCU1-L right (word shift)
SRD		Shift ACCU1 right (double word shift)
SSI		Shift ACCU1-L right (word shift with sign)
SSD		Shift ACCU1 right (double word shift with sign)
RLD		Rotate ACCU1 left (double word)
RLDA		Rotate ACCU1 left through CC1
RRDA		Rotate ACCU1 right through CC1
RRD		Rotate ACCU1 right (double word)
	konst	Number of places to shift/rotate
	-	Number of places to shift/rotate located in ACCU2

Timer instructions

Operation	Operand	Description
SP	T	Start as impulse
SE	T	Start as extendet impulse
SD	T	Start as ON-delay
SS	T	Start as saving ON-delay
SF	T	Start as OFF-delay
R	T	Reset timer
FR	T	Enable timer

Counter instructions

Operation	Operand	Description
CU	C	Count up (increment)
CD	C	Count down (decrement)
S	C	Set counter
R	C	Reset counter
FR	C	Enable counter

Word instructions

Operation	Operand	Description
AW AD OW OD XOW XOD		AND ACCU1-L (AND word) AND ACCU1 (AND double word) OR ACCU1-L (OR word) OR ACCU1 (OR double word) Exclusive-OR ACCU (XOR word) Exclusive-OR ACCU (XOR double word)
	const -	with a word or double word constant with ACCU2

Arithmetic instructions

Operation	Operand	Description
==I		Integer values equal
<>I		Integer values unequal
>I		Integer values greater
>=I		Integer values greather or equal
<I		Integer values less
<=I		Integer values less or equal
==D		Double integer values equal
<>D		Double integer values unequal
>D		Double integer values greater
>=D		Double integer values greater or equal
<D		Double integer values less
<=D		Double integer values less or equal
==R		Real values equal
<>R		Real values unequal
>R		Real values greater
>=R		Real values greater or equal
<R		Real values less
<=R		Real values less or equal
SIN		Sine of a real value
COS		Cosine of a real value
TAN		Tangent of a real value
ASIN		Arcsine of a real value
ACOS		Arccosine of a real value
ATAN		Arctanget of a real value
SQR		Square a real value
SQRT		Square root a real value
EXP		e to the power of a real value
LN		Natural logarithm of a real value
+I		Integer addition
-I		Integer subtraction
*I		Integer multiplication
/I		Integer division
+D		Double integer addition
-D		Double-integer subtraction
*D		Double-integer multiplication
/D		Double-integer division
+R		Real addition
-R		Real subtraction
*R		Real multiplication

/R		Real division
MOD		Double integer dicision (modulo)
+	const	Add a constant
+P#	const	Add a pointer
DEC		dekrement ACCU1-LL (one byte)
INC		inkrement ACCU1-LL (one byte)

Data type conversion instructions

Operation	Operand	Description
ITD		Convert integer to double integer
ITB		Convert integer to BCD
DTB		Convert double integer to BCD
DTR		Convert double integer to real
BTI		Convert BCD to integer
BTD		Convert BCD to double integer
RND		Convert real to double integer (round)
RND+		Convert real to double integer (round up)
RND-		Convert real to double integer (round down)
TRUNC		Convert reeal to double integer (truncate)
INVI		Invert ACCU1-L (integer)
INVD		Invert ACCU1 (double integer)
NEGI		Negate ACCU1-L (integer)
NEGD		Negate ACCU1 (double integer)
NEGR		Negate ACCU1 (real)
ABS		Absolute value (real)

Jump instructions

Operation	Operand	Description
JU	Ziel	Jump unconditional
JC	Ziel	Jump if RLO = 1
JCB	Ziel	Jump if RLO = 1 (save RLO)
JCN	Ziel	Jump if RLO = 0
JNB	Ziel	Jump if RLO = 0 (save RLO)
JBI	Ziel	Jump if BR = 1
JNBI	Ziel	Jump if BR = 0
JZ	Ziel	Jump if compare result = 0
JN	Ziel	Jump if compare result ≠ 0
JP	Ziel	Jump if compare result > 0
JPZ	Ziel	Jump if compare result >= 0
JM	Ziel	Jump if compare result < 0
JMZ	Ziel	Jump if compare result <= 0
JUO	Ziel	Jump if compare result "Unordered Math Instruction"
JO	Ziel	Jump on overflow
JOS	Ziel	Jump on saving overflow
JL	Ziel	Jump distributor
LOOP	Ziel	Loop programming (decrement ACCU1-L and jump if ≠ 0

Block call instructions

Operation	Operand	Funktionsbeschreibung
CALL FB		Unconditional call of an FB with parameter transfer
CALL FC		Unconditional call of an FC with parameter transfer
CALL SFB		Unconditional call of an SFB with parameter transfer
CALL SFC		Unconditional call of an SFC with parameter transfer
UC FB		Unconditional call of an FB without parameter transfer
CC FB		Conditional call of an FB without parameter transfer
UC FC		Unconditional call of an FC without parameter transfer
CC FC		Conditional call of an FC without parameter transfer
BEU		End block unconditionally
BEC		End block conditionally (RLO = 1)
BE		End block
OPN		
	DB	Open data block
	DI	Open instance data block
TDB		Exchange data block registers

Indirect adressing instructions

Operation	Operand	Description
LAR1/LAR2		Load AR1/AR2
	MD	with memory double word
	LD	with local data double word
	DBD	with datablock double word
	DID	with instance data block double word
LAR1	-	Load AR1 with ACCU1
LAR2	-	Laod AR2 with ACCU1
LAR1	AR2	Load AR1 with AR2
LAR1	P#	Load AR1 with pointer
LAR2	P#	Load AR2 with pointer
TAR1/TAR2		Transfer in AR1/AR2
	MD	in memory double word
	LD	in local data double word
	DBD	in datablock double word
	DID	in instance data block double word
TAR1	-	Transfer AR1 in ACCU1
TAR2	-	Transfer AR2 in ACCU1
TAR1	AR2	Transfer AR1 in AR2
TAR		Swap AR1 with AR2
+AR1		Add ACCU1 to AR1
+AR2		Add ACCU1 to AR2
+AR1	P#	Add pointer to AR1
+AR2	P#	Add pointer to AR2

Program display and null operation instructions

Operation	Operand	Description
NOP	0	Null operation instruction
NOP	1	Null operation instruction
BLD	konst	Program display instruction (null operation)

Layout of *S7-SoftPLC* memory

The memory of *S7-SoftPLC 315* and *S7-SoftPLC 416* is compatible to the memory of Simatic®-control S7-315 or S7-416.

Please note, that low-order byte has to be changed with the high-order byte when accessing this memory with Windows programs.

Layout of SoftPLC system data

The layout of the system data in the system data is compatible to the system data of Simatic®-control S7-315 or S7-416.

Integrated organisation blocks

The organisation blocks, listed in the chart below, are executed, if they are programmed:

OB no	Short description
OB 1	Main programm
OB 10 – OB 17	Time alarm
OB 20 – OB 23	Delay alarm
OB 30 – OB 38	Time blocks (cyclic call)
OB 80 – OB 87	Error blocks
OB 90	Background execution
OB 100/OB 101	Warm or hot restart
OB 121/OB 122	Programming faults

Integrated system functions

All system functions (SFC) relevant for a Software PLC are integrated in *S7-SoftPLC*.

The chart below shows the available SFCs(in numeric listing)

SFC no	SFC name	Short description
SFC 0	SET_CLK	Set system clock
SFC 1	READ_CLK	Read system clock
SFC 5***	GADR_LGC	Detect the logic basis address of a component
SFC 6	RD_SINFO	Read out start information of actual OBs
SFC 13*	DPNRM_DG	Slave-Diagnosis of a DP-slave
SFC 14**	DPRD_DAT	Read consistent data of a DP-norm slave
SFC 15**	DPWR_DAT	Write data consistent on DP-norm slave
SFC 20	BLKMOV	Copy PLC-variable in target-area
SFC 21	FILL	Preoccupy PLC-variable in target-area
SFC 22	CREAT_DB	Create data block
SFC 23	DEL_DB	Delete data block
SFC 24	TEST_DB	Test attributes of a data block
SFC 25	COMPRESS	Compress load memory
SFC 28	SET_TINT	Set time alarm
SFC 29	CAN_TINT	Stop time alarm (do not execute)
SFC 30	ACT_TINT	Enable time alarm
SFC 31	QRY_TINT	Status of time alarm
SFC 32	SRT_DINT	Start delay alarm
SFC 33	CAN_DINT	Stop delay alarm
SFC 34	QRY_DINT	Status query of delay alarm
SFC 36	MSK_FLT	Mask a synchron error occurrence
SFC 37	DMSK_FLT	Demask a synchron error occurrence
SFC 38	READ_ERR	Read out the occurrence status register
SFC 39	DIS_IRT	Locking the asynchron and alarm error processing
SFC 40	EN_IRT	Enable the asynchron and alarm error processing
SFC 41	DIS_AIRT	Delay high-priority asynchron and alarm error processing
SFC 42	EN_AIRT	Enable high-priority asynchron and alarm error processing
SFC 43	RE_TRIGR	Retrigger the Watchdog
SFC 46	STP	CPU operating state STOP
SFC 49***	LGC_GADR	Detect the solt of a logic address
SFC 50***	RD_LAGADR	Detect all logic addresses of a component
SFC 51	RDSYST	Read out system status list (SSL)
SFC 64	TIME_TCK	Timer Tick
SFC 81	UBLKMOV	Block Move, that can not be stopped

*The SFC 13 is available only, if the driver Cifcfg.dll is loaded. Furthermore it can only return valid results, if the Profibus® configuration has been created via the *S7 for Windows® hardware configuration* or the Step® 7 hardware configuration. This is only possible when using the driver CIFCFG.DLL.

**The SFC 14 and SFC 15 are available only, if are loaded via the driver CIF30D0.DLL or the driver CIFCFG.DLL.

*** The SFCs can only return valid results, if the Profibus® configuration has been created via the *S7 for Windows® hardware configuration* or the Step® 7 hardware configuration. This is only possible when using the driver CIFCFG.DLL.

Integrated system blocks

The system blocks (SFB) relevant for a software PLC are integrated in *S7-SoftPLC*.

The following system function blocks are supported:

SFB no	SFB name	Short description
SFB 0	CTU	Count up
SFB 1	CTD	Count down
SFB 2	CTUD	Count up and down
SFB 3	TP	Generate pulse
SFB 4	TON	Generate ON-delay
SFB 5	TOF	Generate OFF-delay
SFB 32	DRUM	Implement sequencer
SFB 52****	RDREC_DP	Read data record
SFB 53****	WRREC_DP	Write data record

****The SFB 52 and SFB 53 are only available if the driver CIFCFG.DLL is loaded and the entry DPV1=1 is set.

6.3 Diagnostic buffer entries

The chart below shows the differences to S7-hardware PLC diagnostic buffer entries:

Diagnostic buffer entries	Driver	Description
0xA000	CIF PROFIBUS®	CIF-PROFIBUS®-card could not be initialized.
0xA001	CIF PROFIBUS®	Timeout during warm start.
0xA002	CIF PROFIBUS®	Parameter inappropriate for CIF-Task
0xA003	CIF PROFIBUS®	Timeout during hot start
0xA004	CIF PROFIBUS®	Error when reading CIF-Firmware info
0xA005	CIF PROFIBUS®	Error when reading CIF-driver status
0xA006	CIF PROFIBUS®	Error when writing a message into the CIF-card
0xA007	CIF PROFIBUS®	Error when writing a message from the CIF-card
0xA008	CIF PROFIBUS®	Error at PROFIBUS® Diagnostics (PU) CIF-error code
0xA009	CIF PROFIBUS®	Error at PROFIBUS® Diagnostics (SFC/SFB) CIF-error code
0xA010	CIF PROFIBUS®	No CIF-driver installed
0xA011	CIF PROFIBUS®	CIF-PROFIBUS®-card could not be initialized
0xA012	CIF PROFIBUS®	CIF-PROFIBUS®-card not available
0xA013	CIF PROFIBUS®	Bus parameters for slaves could not be set
0xA014	CIF PROFIBUS®	Parameterisation of the CIF-PROFIBUS®-card with SDB-Daten failed
0xA015	MPI®	MPI®-telegramm error
0xA016	CIF PROFIBUS®	Error in PU communication via PROFIBUS®
0xA017	CIF PROFIBUS®	Error in PU communication via PROFIBUS®
0xA018	CIF PROFIBUS®	Error in PU communication via PROFIBUS®
0xA019	CIF PROFIBUS®	Timeout in input data exchange with the CIF-card during SFC DPRD_DAT
0xA020	CIF PROFIBUS®	Error in input data exchange with the CIF-card during SFC DPRD_DAT

0xA021	CIF PROFIBUS®	Timeout in output data exchange with the CIF-card during SFC DPWR_DAT
0xA022	CIF PROFIBUS®	Error in output data exchange with the CIF-card during SFC DPWR_DAT
0xA023	CIF PROFIBUS®	CIF-PROFIBUS®-card could not be detected
0xA024	CIF PROFIBUS®	CIF-PROFIBUS®-card could not be initialized
0xA025	MPI®	MPI®-telegramm error
0xA050	CIF 30/50/60	No CIF-driver installed
0xA051	CIF 30/50/60	CIF-card could not be initialized
0xA052	CIF 30/50/60	CIF-card not available
0xA053	CIF 30/50/60	Timeout during warm start
0xA054	CIF 30/50/60	Application could not be set to operational mode "READY"
0xA055	CIF 30/50/60	Error in I/O-data exchange with the CIF-card during PII/PIQ update
0xA056	CIF 30/50/60	Error in input data exchange with the CIF-card during T PI
0xA057	CIF 30/50/60	Error in output data exchange with the CIF-card during T PQ
0xA058	CIF 30/50/60	Error reading CIF-Task-mode
0xA060	CIF 30/50/60	Error reading CIF-Task-mode
0xA061	CIF 30/50/60	Error accessing the watchdog
0xA062	CIF 30/50/60	CIF-driver not in operational mode "COM"
0xA064	CIF 30/50/60	Error reading CIF-driver status
0xA065	CIF 30/50/60	Error reading CIF-driver status
0xA069	CIF 30/50/60	Timeout in I/O-data exchange with the CIF-card during PII/PIQ update
0xA070	CIF 30/50/60	Timeout in input data exchange with the CIF-card during L PI
0xA071	CIF 30/50/60	Timeout in output data exchange with the CIF-card during T PQ
0xA072	CIF 30/50/60	Timeout in input data exchange with the CIF-card during SFC DPRD_DAT
0xA073	CIF 30/50/60	Error in input data exchange with the CIF-card during SFC DPWR_DAT
0xA074	CIF 30/50/60	Timeout in input data exchange with the CIF-card during SFC DPRD_DAT
0xA075	CIF 30/50/60	Error in output data exchange with the CIF-card
0xA080	CIF 30/50/60	CIF-driver not ready
0xA081	CIF 30/50/60	CIF-driver not in mode "RUN"
0xA082	CIF 30/50/60	CIF-driver not in mode "COM"
0xA100	TwinCAT I/O	Port number from PLC43.INI, not available in TwinCAT task Subsequent value is returned from TCatIoOpen
0xA101	TwinCAT I/O	Error in PLC43.INI Periphery start < byte start
0xA102	TwinCAT I/O	PII/PIQ update failed
0xA103	TwinCAT I/O	Error in PLC43.INI Periphery < process image
0xA104	TwinCAT I/O	Timeout when connecting to TwinCAT driver Subsequent value is returned from the last function

0xA105	TwinCAT I/O	TwinCAT driver not in RUN Subsequent value is returned from the function TCatGetState()
0xA106	TwinCAT I/O	TwinCAT driver update ClearOutputs failed (driver not in RUN anymore) Subsequent value is returned from the function TCatIoOutputUpdate
0xA107	TwinCAT I/O	TwinCAT driver update PII failed (driver not in RUN anymore) Subsequent value is retured from the function TCatIoInputUpdate
0xA108	TwinCAT I/O	TwinCAT driver update PIQ failed (driver not in RUN anymore) Subsequent value is returned from the function TCatIoOutputUpdate
0xA109	TwinCAT I/O	TwinCAT driver update LoadPI failed (driver not in RUN anymore) Subsequent value is returned from the function TCatIoInputUpdate
0xA110	TwinCAT I/O	TwinCAT driver update StorePQ failed (driver not in RUN anymore) Subsequent value is returned from the function TCatIoOutputUpdate
0xA111	TwinCAT I/O	TCatIoGetInputPtr failed
0xA112	TwinCAT I/O	TCatIoGetOutputPtr failed
0xA113	TwinCAT I/O	ADS communication thread could not get local address and was closed; No ADS communication possible Next value is returned from the function __AdsGetLocalAddress,if value is 0, then __AdsPortOpen has failed
0xA120	Softnet PN IO	Softnet error code of function PNIO_set_mode followed by the Softnet error code
0xA121	Softnet PN IO	Softnet error code of function PNIO_controller_open followed by Index of controller, then Softnet error code
0xA122	Softnet PN IO	Callback-error code for "mode change confirmation" followed by the Softnet error code
0xA123	Softnet PN IO	Callback-error code for "device activate confirmation" followed by the Softnet error code
0xA124	Softnet PN IO	Softnet error code of function PNIO_close followed by the Softnet error code
0xA126	Softnet PN IO	Error in initialising of the Softnet PN IO driver
0xA127	Softnet PN IO	Softnet error code of function PNIO_set_mode operate followed by the Softnet error code
0xA128	Softnet PN IO	Driver needs too much time to get into operate mode during initialization
0xA140	ADDI-DATA	Addidata error code Subsequent value is returned from an ADDIPACK function
0xA200	I/O Port	No I/O Port access permitted by OS

6.4 Differences between *S7-SoftPLC* and Hardware-PLC

In contrast to a conventional hardware-based control *S7-SoftPLC* does not have own hardware. It always has to be integrated in an existing computer system with a Windows® operating system.

Since *S7-SoftPLC* runs within a Windows® operating system, other Windows® applications such as EXCEL® or ACCESS® can access PLC-operands directly and fast without hardware wiring.

In contrast to a hardware-PLC the size of *S7-SoftPLC 416* load memory can be changed flexibly (up to the maximum available memory size of the PC).

Differences between *S7-SoftPLC 315* and *S7-SoftPLC 416*

The difference between *S7-SoftPLC 315* and *S7-SoftPLC 416* is a different number of flags, timers and counters according to the hardware-PLC.

The differences comply to the differences between the Siemens hardware PLC 315 and 416. The load memory of *S7-SoftPLC 315* ist limited to 256 kByte, while the load memory of *S7-SoftPLC 416* can be configured freely.

Non available features in *S7-SoftPLC*

Since there are physical differences between a hardware-PLC and a Windows computer, it is not possible to implement every feature of the CPU S7-315 resp. CPU S7-416 in *S7-SoftPLC*. However, existing programs should be executable on *S7-SoftPLC* with small changes.

The following organisation blocks are not supported:

- OB 60: multiple processor alarm
- OB 40 – OB 47: processor alarm 0 - 7

Time OBs are not terminated by Windows®, which means those OBs are not allowed to have long cycle times(<1ms).

Furthermore SFBs and SFCs, that do not make sense on a PC platform, are not implemented. There is the possibility to extend S7-SoftPLC with user defined SFC's written in C++.

Diagnostic buffer

In addition to normal diagnostic buffer entries, which are recorded within the diagnostic buffer while starting or in the event of programming errors, area transgressions or missing modules, there are additional entries.

Those are created by the hardware-drivers of *S7-SoftPLC* and giving exact informations about the cause of an eventually occurred problem. Before contacting our support, please save an extract of the diagnostic buffer by using the programming unit. This way an eventual problem can be located easily.

Starting *S7-SoftPLC* as service

In order to prevent accesses of non privileged users, PLC can be started as service. For this purpose *S7-SoftPLC* must be enlisted in the service list. Therefore open the command line and go to the installation folder of *S7-SoftPLC*.

Enter the following command in the command line interface:

```
C:\SoftSPS>plc416.exe –Service
```

An error message must not appear. *S7-SoftPLC* is now enlisted in the service list. Via "Control panel - Management - Services" the service "CPUS7" can now be found in the list. The start up can be set to "automatic", so that *S7-SoftPLC* starts without an user logged in on the computer. It is also possible, that user accounts with limited rights can use *S7-SoftPLC*.

Delete *S7-SoftPLC* from the "Control panel - Management - Services", that it can be executed as normal application

```
C:\SoftSPS>plc416.exe –RegServer
```

NOTE: ADMINISTRATIVE RIGHTS ARE REQUIRED

UPS operation

The most UPS programs provide the possibility to have certain operations executed before shutting down the PC. In most cases programs or batch files to be executed before the shut-down can be configured.

If the application "PlcStop.exe"(in the *S7-SoftPLC* installation directory) is configured here, the PLC saves the program and *S7-SoftPLC* is closed correctly thereafter.

Unauthorised accesses

In order to prevent unauthorized access to the computer, *S7-SoftPLC* can of course not provide any security mechanisms.

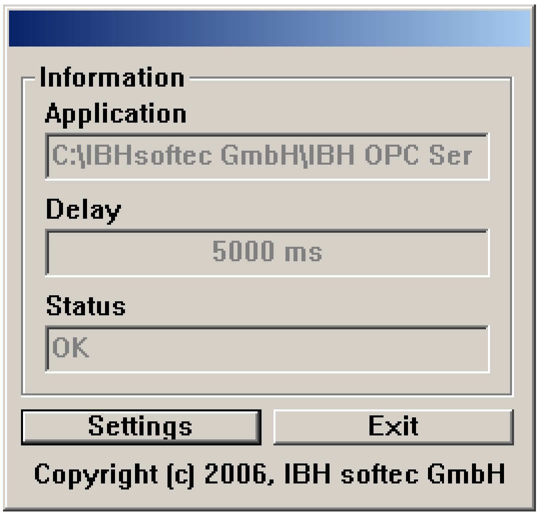
Appropriate actions, customized to the application, have to be taken by the user.

6.5 AppStarter

With the application starter it is possible to start software applications, such as the *S7-SoftPLC* or an OPC server, in a defined order and delay, determined by the user. The application starter is started with the "AppStarter.exe" file from the installation folder of the *S7-SoftPLC*.

WARNING: THE APPLICATION STARTER REQUIRES A WINDOWS USER LOGIN WITH ADMINISTRATIVE RIGHTS FOR CONFIGURATION.

As soon as App.Starter.exe is executed, the infomation dialog appears.


Information

Application: C:\IBHsoftec GmbH\IBH OPC Ser

Delay: 5000 ms

Status: OK

Copyright (c) 2006, IBH softec GmbH

Application

Shows which application is started next.

Delay

Shows the remaining time until the start of the next application in milliseconds.

Status

Shows the status of the last started application.

Settings

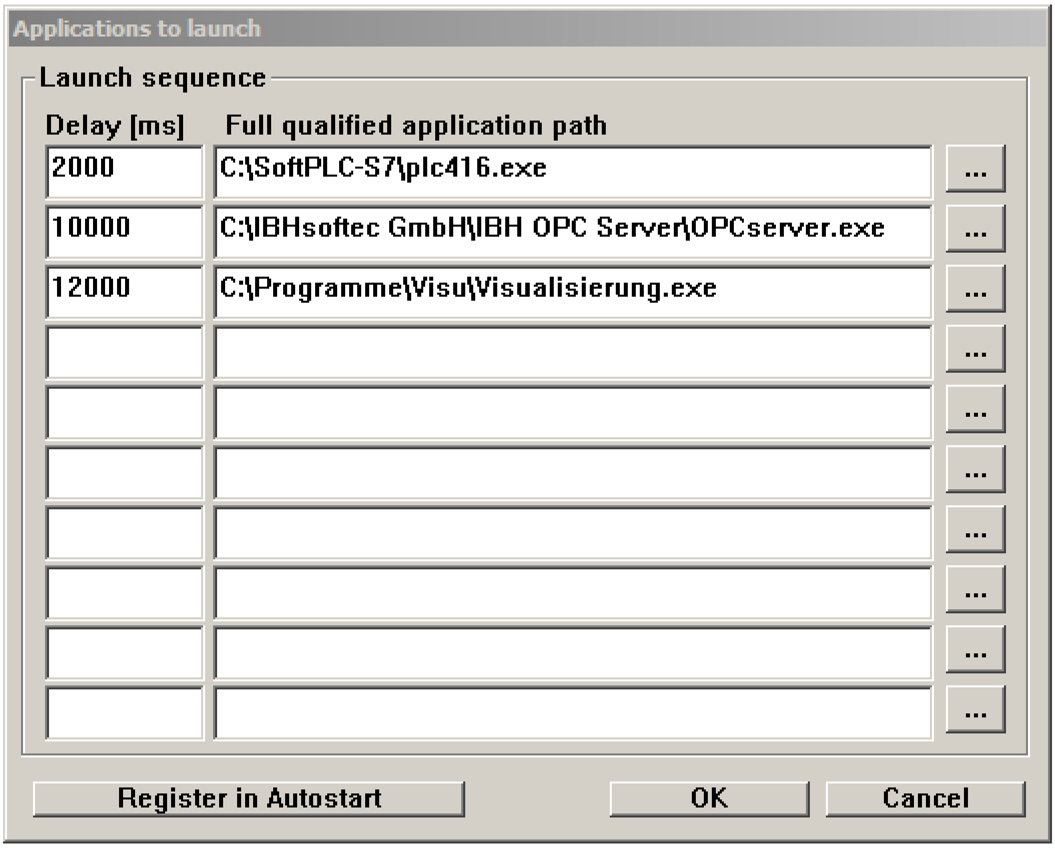
Opens the settings dialog.

Exit

Closes the application starter.

Setting up AppStarter

The application starter is configured in the setting dialog.



Applications to launch

Launch sequence

Delay [ms]	Full qualified application path
2000	C:\SoftPLC-S7\plc416.exe
10000	C:\IBHsoftec GmbH\IBH OPC Server\OPCserver.exe
12000	C:\Programme\Visu\Visualisierung.exe

Launch sequence

The "Launch sequence" lists the sequence of applications to be started. The applications are started, beginning from top, in the sequence as shown.

Delay [ms]

Time in milliseconds until the start of the application. The time until the start of the first application elapses, as soon as the application starter is started. The time until the start of the next application elapses, as soon as the previous application is started.

Full qualified application path

Full qualified path and file, that is to be executed, in order to start the application.

...

Browsing function for the file, that is to be executed.

OK

Adopts the settings and closes the setting dialog.

Cancel

Discards the changes and closes the setting dialog.

NOTE: "REGISTER IN AUTOSTART“ AND "REMOVE FROM AUTOSTART“ IS PERFORMED DIRECTLY AND INDEPENDENTLY OF OK/CANCEL.

Register in Autostart

The settings are saved in the Windows® registry. After starting Windows, the application starter and therefore the listed applications are started.

Remove from Autostart

The auto start settings are removed from the Windows® registry. The application starter is not automatically executed.

Windows® registry entry:

```
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\Run
```

6.6 Zero modem cable

Sub.-D case			Sub.-D case	
Connector			Connector	
9 Pin	25 Pin		9 Pin	25 Pin
1	-----	-------- no connection -------	1	-----
2	3	-----------------------------------	3	2
3	2	-----------------------------------	2	3
4	20	-----------------------------------	6	6
5	7	-----------------------------------	5	7
6	6	-----------------------------------	4	20
7	4	-----------------------------------	8	5
8	5	-----------------------------------	7	4
9	-----	-------- no connection -------	9	-----
housing	housing	------------- shield -------------	housing	housing