



SERVICE MANUAL E

SIGMA AIR MANAGER

SEND/RECEIVE

Part number: 7.7760.0

As at: 01.02.2004

File: BTL_SAM_SNDRCV_v018_E.doc

KAESER KOMPRESSOREN GmbH

96410 Coburg • PO Box 2143 • GERMANY • Tel. +49 (0)9561 6400 • Fax +49 (0) 9561 640130
<http://www.kaeser.com>

Contents

1	General	3
1.1	System Requirements.....	3
1.1.1	SIGMA AIR MANAGER	3
1.1.2	Communications peer	4
1.2	Limitations.....	4
2	Interfaces	5
2.1.1	SIGMA AIR MANAGER	5
2.1.2	Network card.....	5
2.1.3	CP 1613.....	5
2.2	Protocol handling.....	5
2.2.1	SIGMA AIR MANAGER	5
2.2.2	Network card and SOFTNET-S7	6
2.2.3	CP 1613 and S7-1613.....	7
2.3	Integration in Applications	8
2.3.1	SEND/RECEIVE programming interface	8
2.3.2	SEND/RECEIVE OPC server interface	8
2.3.3	OPC Scout.....	9
3	Start-up	10
3.1	SIGMA AIR MANAGER.....	10
3.2	Communications peer.....	10
3.2.1	Information and ordering from Siemens	10
3.2.2	Installation of the communications software	11
3.2.3	Planning the PC station and communication	11
3.2.4	Testing communication with OPC Scout	41
4	Data Interface	48
4.1	Monitoring the Link.....	48
4.2	Remote Control Functions	48
4.3	Process Data	50
Annex A: SIGMA AIR MANAGER Process Image		52
Annex B: SIGMA CONTROL Process Image		63
Annex C: OPC-Client Application in VBA (Excel)		76

1 General

The **SEND/RECEIVE option package** is conditional for the control of certain functions in SIGMA AIR MANAGER by networked peer to peer communications (remote control), for example by a PC, a workstation or a control centre. In addition, the compressed air system's process data are transferred to the networked communications peer via the SEND/RECEIVE interface and are available there for visualisation or monitoring.

The transfer of control and process data between SIGMA AIR MANAGER and the communications peer uses the SEND/RECEIVE communications protocol via an Ethernet TCP/IP network with RFC 1006 (ISO on TCP). The SEND/RECEIVE interface was developed by Siemens to communicate with an S5 automation system via Ethernet and is therefore S5 compatible.

To create the communications link the SEND/RECEIVE option must be enabled on SIGMA AIR MANAGER by entering the registration code provided by KAESER. When this has been done SEND/RECEIVE on SIGMA AIR MANAGER can be activated.

The Ethernet interface of the communications peer (PC) is configured and operated with communications software from SIMATIC NET (Siemens) that then emulates the SEND/RECEIVE protocol. PCs can then be linked using standard network cards available in the trade, or the SIMATIC NET CP 1613 communications module (better performance). To allow access to the control and process data of SIGMA AIR MANAGER in Windows, the communications software makes the SEND/RECEIVE interface available as a DLL (dynamic link library) and the OPC server interface available for SEND/RECEIVE.

The configuration of the SEND/RECEIVE communication between SIGMA AIR MANAGER and a networked PC in Microsoft Windows is described in detail in this document and explained with the aid of an example project.

1.1 System Requirements

1.1.1 SIGMA AIR MANAGER

The SEND/RECEIVE option package can only be used with SIGMA AIR MANAGER's Ethernet interface and not with the RS 232 or modem link.

SEND/RECEIVE can only run on SAM models 8/4, 8/8 and 16/8, not on SAM model 4/4, which is not fitted with an Ethernet interface.

A further condition for SEND/RECEIVE is that SIGMA AIR MANAGER is provided with certain software versions. Old software must be updated.

SEND/RECEIVE can only run if SIGMA AIR MANAGER's operating system is at least version 1.01 (109) and the KAESER software is at least version STEP5 v0.13. In addition, SEND/RECEIVE can only run through a standard network card with STEP5 v0.16 software and upwards (available from August 2003).

1.1.2 Communications peer

The communications peer (PC) must be networked with SIGMA AIR MANAGER via Ethernet and be in the same network. The standard system requirements for TCP/IP networks must be conformed with.

SIGMA AIR MANAGER represents a peer in TCP/IP networks. Its IP address, subnet mask and, if necessary, the IP address of a router can be set and therefore adapted to the existing network (see SIGMA AIR MANAGER service manual).

To allow the communications peer to run SEND/RECEIVE on TCP/IP, the corresponding communications software from SIMATIC NET (Siemens) must be installed and configured for SEND/RECEIVE (see 2.2).

At the moment, the communications software from SIMATIC NET is available for the operating systems for Microsoft Windows NT 4.0 workstation and server, Windows 2000 Professional and Server and Windows XP Professional (to date not for S7-1613, see below).

A **standard Ethernet network card** can be used as a hardware basis for SEND/RECEIVE, whereby the accompanying NDIS driver must be at least version 3.1. In this case, communications software **SOFTNET-S7** is needed. SOFTNET 7 emulates the SEND/RECEIVE protocol on the PC's CPU. This has the disadvantage that communication performance is dependent on the performance capability and workload on the PC used.

The second method of installing SEND/RECEIVE on PCs is the use of the SIMATIC NET **CP 1613** communications module. The CP 1613 is connected to the internal PCI bus. In this case, communications software **S7-1613** is needed. S7-1613 runs the SEND/RECEIVE protocol directly on the CP 1613, providing better communication performance because the PC's CPU is hardly loaded. At the present time, S7-1613 is not available for Windows XP Professional.

1.2 Limitations

The SEND/RECEIVE and KLink communication methods via PC modem or null modem cannot be run simultaneously on SIGMA AIR MANAGER. Which is why KLink via PC card modem or null modem is automatically deactivated when SEND/RECEIVE is activated and vice-versa. However, this limitation is hardly relevant in practice, because SEND/RECEIVE and KLink are not normally used simultaneously.

SEND/RECEIVE can only run through a standard network card in the PC from SIGMA AIR MANAGER with STEP5 v0.16 software and upwards (available from August 2003). The PC must be fitted with the CP 1613 for older software versions from STEP v0.13 upwards.

Only one SEND/RECEIVE link with a communications peer can be made simultaneously from SIGMA AIR MANAGER. Only when the existing link is disconnected (project planning setting), can another communications peer create a new link.

A **user data record of maximum 240 data bytes** (120 data words) is supported by SIGMA AIR MANAGER. In general, this limitation has to be respected by the communications peer, for example, during the execution of a FETCH command via the OPC server interface.

2 Interfaces

2.1.1 SIGMA AIR MANAGER

An 8-pole RJ 45 socket (see SIGMA AIR MANAGER service manual) is available on SIGMA AIR MANAGER (models 8/4 upwards, see 1.1.1) for the Ethernet connection. The maximum transfer rate is 10 Mbit/s. Standard network cable can be used for the link.

2.1.2 Network card

If a standard network card is used for the communications peer, then ensure that the NDIS driver is at least version 3.1. Information on the installation, connection and driver installation of the network card is found in the relevant technical documentation.

2.1.3 CP 1613

If the SIMATIC NET CP 1613 communications module (see 1.1.2) is chosen as a peer, then the following technical data apply:

- Installation: 1 PCI slot
- Interfaces:
 - RJ 45 socket, ITP (10/100 Mbit/s)
 - 15-pole SUB-D socket, AUI (10 Mbit/s)
- Power consumption:
 - 600 mA at DC 5 V
 - 500 mA at DC 12 V
- Power loss: 4 W
- Operating temperature: +5 °C to +40 °C
- Number of connections: 120 with SEND/RECEIVE (TCP/IP)

More details on the CP 1613 can be found in the accompanying technical documentation.

2.2 Protocol handling

2.2.1 SIGMA AIR MANAGER

SIGMA AIR MANAGER supports the SEND/RECEIVE communications protocol that uses the **Ethernet TCP/IP network with RFC 1006** (ISO on TCP) that was developed by Siemens for exchange of data with S5-compatible automation systems. The communications peer (PC) can access certain, released S5 data blocks from SIGMA AIR MANAGER; it can write to control data and read process data.

SIGMA AIR MANAGER represents a **passive participant** from a communications point of view that accepts and carries out communications commands (WRITE, FETCH) from active peers.

The ISO transport protocol is not supported by SIGMA AIR MANAGER.

2.2.2 Network card and SOFTNET-S7

If the SEND/RECEIVE protocol is to run with a standard Ethernet network card, then the SOFTNET-S7 communications software from SIMATIC NET is required.

SOFTNET-S7 contains (as does S7-1613) all the necessary project planning and configuration tools for the PC station and the SEND/RECEIVE link to SIGMA AIR MANAGER. These tools are integrated in the “Advanced PC Configuration” software package.

- The **Commissioning Wizard** guides the user through the individual configuration, planning and design stages up to the status of an operational PC station.
- The **Configuration Console** is the central tool for the configuration settings and diagnosis of the hardware components and software applications.
- With **NCM-PC**, the PC station can be designed and planned as in S7. A planning wizard for user guidance is also integrated.

The PC with its network card represents a **active participant** from a communications point of view that sends communications commands (WRITE, FETCH) to SIGMA AIR MANAGER.

SOFTNET S7 emulates the SEND/RECEIVE protocol on the PC's CPU (in contrast to S7-1613). This has the disadvantage that communication performance is dependent on the performance capability and workload on the PC used. The integration of a SOFTNET-S7 project within the ISO/OSI layers model for data communication is shown below. SOFTNET-S7 uses the network card ODI/NDIS driver (layer 2) that must be at least version 3.1 and makes the SEND/RECEIVE interface available for PC applications on layer 4 (programming interface and OPC server).

Layer	Function	Communications components
7	Application layer	User application
6	Presentation layer	
5	Session layer	SEND/RECEIVE interface
4	Transport layer	SEND/RECEIVE interface
3	Network layer	SOFTNET-S7-Project
2b	Link layer	(Emulation on PC-CPU)
2a		ODI/NDIS driver
1	Physical layer	Ethernet interface

2.2.3 CP 1613 and S7-1613

If the SEND/RECEIVE protocol on the PC is to run via the SIMATIC NET communications processor CP 1613, then communications software S7-1613 from SIMATIC NET (Siemens) is required.

S7-1613 contains (as does SOFTNET S7) all the necessary project planning and configuration tools to configure the PC station and the SEND/RECEIVE link to SIGMA AIR MANAGER. These tools are integrated in the “Advanced PC Configuration” software package.

- The **Commissioning Wizard** guides the user through the individual configuration, planning and design stages up to the status of an operational PC station.
- The **Configuration Console** is the central tool for the configuration settings and diagnosis of the hardware components and software applications.
- With **NCM-PC**, the PC station can be designed and planned as in S7. A planning wizard for user guidance is also integrated.

The PC with CP 1613 represents an **active participant** from a communications point of view that sends communications commands (WRITE, FETCH) to SIGMA AIR MANAGER.

Together with CP 1613, S7-1613 supports multi-protocol operation, i.e. simultaneous use of other types of link in the network as well as SEND/RECEIVE. Further details can be found in the technical documentation supplied.

S7-1613 runs the SEND/RECEIVE protocol directly on the CP 1613. This has the advantage that communications performance is to a large degree independent of the workload on the PC used. The integration of an S7-1613 project within the ISO/OSI layer model for data communications is shown below. S7-1613 loads the S7-1613 project in the CP 1613. Layers 1 to 4 then run directly on the CP 1613. In layer 4, the SEND/RECEIVE interface (programming interface and OPC server) is available for PC applications.

Layer	Function	Communications components
7	Application layer	User application
6	Presentation layer	
5	Session layer	SEND/RECEIVE interface
4	Transport layer	SEND/RECEIVE interface
3	Network layer	S7-1613 project (run on CP 1613)
2b	Link layer	
2a		
1	Physical layer	Ethernet interface

2.3 Integration in Applications

2.3.1 SEND/RECEIVE programming interface

A SEND/RECEIVE programming interface for integration in its own applications program under Windows is included in the two SOFTNET-S7 and S7-1613 communications software packages as a **DLL** (Dynamic Link Library). Their functions can be integrated in any source code program and allow access to SIGMA AIR MANAGER's released control and process data independent of the programming language used. This allows certain functions to be controlled and SIGMA AIR MANAGER's operational status and process data on the online compressors to be read out, visualised and monitored.

Appropriate **example programs** are included in the communications software's scope of delivery. They are written in "C" (programming language) and are intended to clarify the working principle of the SEND/RECEIVE programming interface.

A **task library** is still used. It is written in "C" and can be integrated directly into one's own C-programs. The tasks can then be used directly.

Multi-device operation is possible with the SEND/RECEIVE programming interface. One or more application programs can simultaneously address one or more network cards in one's own PC. And, every network card can be addressed through one or more "application access points".

The procedure for integrating the functions of the DLL in one's own program is described in detail in the SEND/RECEIVE programming interface manual supplied.

2.3.2 SEND/RECEIVE OPC server interface

A SEND/RECEIVE OPC server interface is contained in the two SOFTNET-S7 and S7-1613 communications software packages to allow easy integration of the active SEND/RECEIVE data from SIGMA AIR MANAGER into Windows applications, for example in Microsoft Office applications (Excel, Access) with Visual Basic (VBA). Further SIMATIC NET OPC server interfaces, e.g. for S7-compatible communication, are irrelevant as far as SIGMA AIR MANAGER is concerned, but can be used as well if required (multi-protocol operation).

OPC is short for **OLE for Process Control** and is a **manufacturer-independent standard** interface for accessing process data for communication in automation technology. OPC is based on the standard OLE2 from Microsoft. The basis for all OLE mechanisms is **COM**, the **Component Object Model** from Microsoft. COM defines the creation of objects as complete units in Windows. These COM objects can be integrated into any development environment or programming language and are principally available for all applications under Windows, even external to computer limits, i.e. within a network.

In line with the basic OPC specification for **OPC data access**, the **SIMATIC NET OPC server** makes methods available with the help of a class model that allow read, write and the definition of process variables. **OPC Alarms & Events**, the OPC specification for handling events is **not available** for SEND/RECEIVE communication (only for S7-compatible communication).

Client applications that are based on a script language such as **Visual Basic or VBA** (MS Office) have to use the so-called **Automation Interface** of the SIMATIC NET OPC server. The automation interface allows data access according to OPC Data Access, but not event handling according to OPC Alarms & Events, which is generally sufficient for most applications. Applications in C/C++ can use the higher performance **Custom Interface** that supports both specifications. The OPC server class model, its allocated characteristics and

SEND/RECEIVE with SIGMA AIR MANAGER

methods (interfaces) for data access and appropriate application examples are included in the SIMATIC NET OPC manual supplied. In addition, some example programs for client applications in Visual Basic and C++ are included.

For communication between an OPC client, e.g. the OPC Scout supplied or an own Visual Basic application and SIGMA AIR MANAGER, the **SEND/RECEIVE OPC server interface** is used. From the point of view of communication with SIGMA AIR MANAGER, this interface has the following features:

- Supports the WRITE command (SEND with WRITE function)
- Supports the FETCH command (readout of process data)
- Access to data packets (data areas in SIGMA AIR MANAGER)
- Definition of variables within a data packet
- Display and monitoring of the link status
- Browser functionality with reference to defined variables
- Saving of communications parameters in a text file

Further information on the planning of the SEND/RECEIVE server, especially with regard to the construction of the text file (link parameters, access points, symbolic variables) can be found in the SIMATIC NET OPC server manual supplied.

In view of minimum possible system loading by the OPC server it is imperative that variables (items) are meaningfully integrated in OPC groups during the creation of own OPC client applications and that no individual variables (items) are accessed in read or write but only in groups (OPC groups).

An OPC client application for SIGMA AIR MANAGER in Visual Basic (VBA) is included in Annex C as an example for use of the SEND/RECEIVE OPC server interface.

2.3.3 OPC Scout

A complete OPC client with a graphic user interface is included in the two SOFTNET-S7 and S7-1613 communications software packages. This program example is a Visual Basic application and can be used to test communication with the help of the communications peer via the OPC server interface (see 3.2.4). The OPC Scout offers the following:

- Creation of OPC groups (meaningful integration of OPC items)
- Addition of OPC items (process variables) to OPC groups
- Read/write of OPC items

3 Start-up

3.1 SIGMA AIR MANAGER

First, the SEND/RECEIVE option package must be registered at KAESER. To do this, the "Release Code Request" form supplied is to be filled out fully by the customer and faxed or e-mailed to KAESER. KAESER then registers SEND/RECEIVE and grants a single license for the customer's SIGMA AIR MANAGER according to the license conditions attached in that KAESER provides the customer with the **registration code** (release code). The Registration code is needed to unlock the SEND/RECEIVE software on SIGMA AIR MANAGER. System requirements must be borne in mind (see 1.1.1).

The registration code is to be entered in SIGMA AIR MANAGER once only. The appropriate menu option is accessed through "Main menu" ► Settings ► System ► Communication ► "SEND/RECEIVE". When the registration code has been entered correctly, SEND/RECEIVE can be activated in the same menu option. In needed, SEND/RECEIVE can be deactivated here as well at any time.

As communication via SEND/RECEIVE is based on Ethernet and TCP/IP, SIGMA AIR MANAGER and the communications peer (PC) must be networked in Ethernet and lie in the same TCP/IP network. In addition, SIGMA AIR MANAGER's IP address, subnet mask and, if required, the IP address of a router can be set up. The appropriate menu option is accessed through "Main menu". ► Settings ► System ► Interfaces ► Ethernet.

SIGMA AIR MANAGER must be restarted to activate the SEND/RECEIVE and the TCP/IP settings that were made.

Turn off the power supply to SIGMA AIR MANAGER and then turn it on again (using the cut-out in the control cabinet or the user's power switch).

The remote control functions via SEND/RECEIVE are only effective when SIGMA AIR MANAGER is running in remote control mode. If remote control mode is ended, the current mode (OFF/ON, Manual/Automatic, Clock OFF/ON) is kept and the local settings are effective again.

Remote control mode is switched on or off with the REMOTE key and indicated by the LED (see SIGMA AIR MANAGER service manual).

3.2 Communications peer

A standard Ethernet network card or the SIMATIC NET communications module CP 1613 can be used as the hardware basis for SEND/RECEIVE in PCs. The planning of the PC station and the communication is carried out with the SOFTNET S7 or S7-1613 software package. Both software packages are similarly structured and have the same tools (see 2.2.2 and 2.2.3).

3.2.1 Information and ordering from Siemens

Current and detailed information on CP 1613 as well as the software packages SOFTNET-S7 and S7-1613 are to be found in the Siemens online catalogue under <https://mall.ad.siemens.com/de/guest/guiRegionSelector.asp>.

SEND/RECEIVE with SIGMA AIR MANAGER

Current valid ordering information is shown below:

- For standard network cards:

SOFTNET-S7 for 64 links (6GK1704-1CW61-3AA0) or
SOFTNET-S7 LEAN for 8 links (6GK1704-1LW61-3AA0)

Bestellnr.	Beschreibung
6GK1704-1CW61-3AA0	SIMATIC NET IE SOFTNET-S7/V6.1 SW F. S7-,S5-KOMP.-KOMM.,OPC PG/OP-KOMM.,NCM PC,BIS 64 VERB. SINGLE LICENSE F.1 INSTALLATION R-SW, SW + ELEKTR. HB AUF CD LICENSE KEY AUF FD, KLASSE A 2-SPRACHIG (D,E); FUER 32BIT WINDOWS XP PROFESSIONAL; INKL. V6.0 F.32BIT WINDOWS NT4.0WS/SV ,2000 PRO/SV;REF.HW:CP1512/1612
6GK1704-1LW61-3AA0	SIMATIC NET IE SOFTNET-S7 LEAN/ V6.1;SW F.S7-,S5-KOMP.KOMM.,OPC PG/OP-KOMM.,NCM PC,BIS 8 VERB. SINGLE LICENSE F.1 INSTALLATION R-SW, SW + ELEKTR. HB AUF CD LICENSE KEY AUF FD, KLASSE A 2-SPRACHIG (D,E); FUER 32BIT WINDOWS XP PROFESSIONAL 2000 PRO/SV; INKL. V6.0 F.32BIT WIN 2000 PRO/SV REF. HW: CP1512/1612

- Communications module CP 1613:

Communications module **CP 1613** (6GK1161-3AA00) and
communications software **S7-1613** (6GK1716-1CB61-3AA0)

Bestellnr.	Beschreibung
6GK1161-3AA00	SIMATIC NET, IE, CP 1613 PCI-KARTE ZUM ANSCHLUSS AN IND. ETHERNET (10/100MBIT/S) MIT ITP UND RJ 45-ANSCHLUSS UEBER S7-1613, TF-1613, PG-1613 UND S7-REDCONNECT. INKL. TREIBER F. MS WINDOWS (32BIT) NT 4.0 WS/SERVER,2000PRO/SERVER
6GK1716-1CB61-3AA0	SIMATIC NET IE S7-1613 / V6.1 SW F. S7-,S5-KOMP.-KOMM.,OPC PG/OP-KOMM.,NCM PC,BIS 120 VERB SINGLE LICENSE F.1 INSTALLATION R-SW, SW + ELEKTR. HB AUF CD LICENSE KEY AUF FD, KLASSE A 2-SPRACHIG (D,E); FUER 32BIT WINDOWS XP PROFESSIONAL; INKL. V6.0 F. 32BIT WINDOWS NT4.0 WS/ SV, 2000 PRO/SV; FUER CP1613

3.2.2 Installation of the communications software

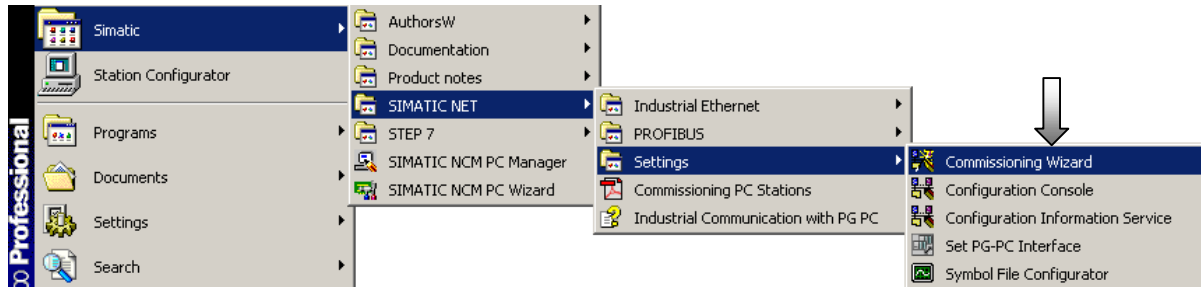
Installation of the SOFTNET-S7 and S7-1613 software packages is user-guided. The relevant installation instructions must be observed. Product authorisation is to be transferred with the authorisation program "AuthorsW" (Windows start button ► Simatic ► AuthorsW) from the authorisation disk to the PC.

3.2.3 Planning the PC station and communication

The procedure described below is a non-binding example of the configuration of a SEND/RECEIVE link to SIGMA AIR MANAGER. It refers to a PC with CP 1613 and the S7-1613 communications software. The planning of a PC with a standard Ethernet network card with the help of SOFTNET-S7 can be carried out in the same way as in the example shown. Settings that lie within the judgement of the user are not explained further in this example.

SEND/RECEIVE with SIGMA AIR MANAGER

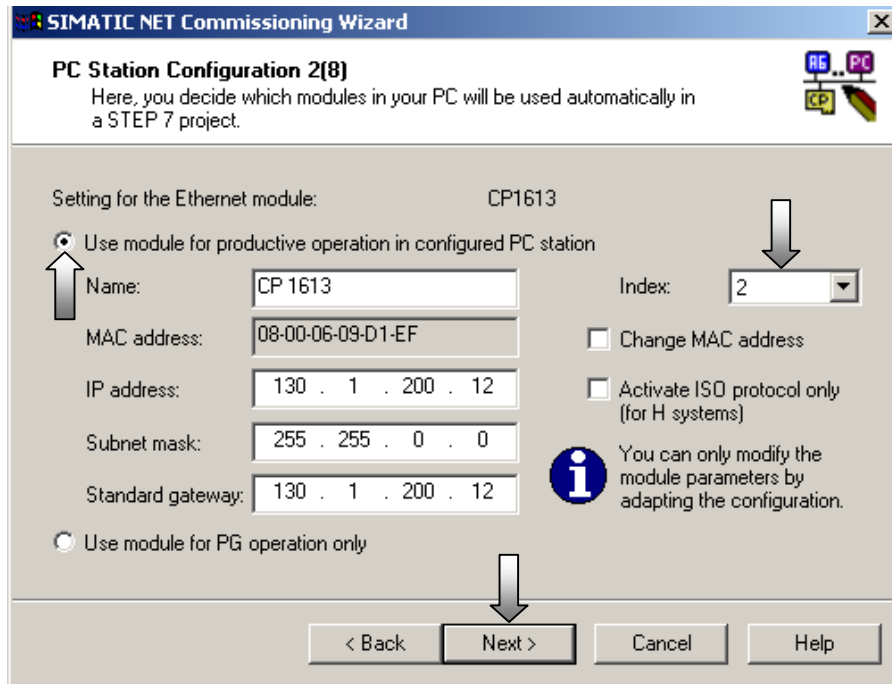
The SIMATIC NET **Commissioning Wizard** will guide the user through the individual planning steps up to the status of an operational PC station. It can be called up in the Windows Start menu.



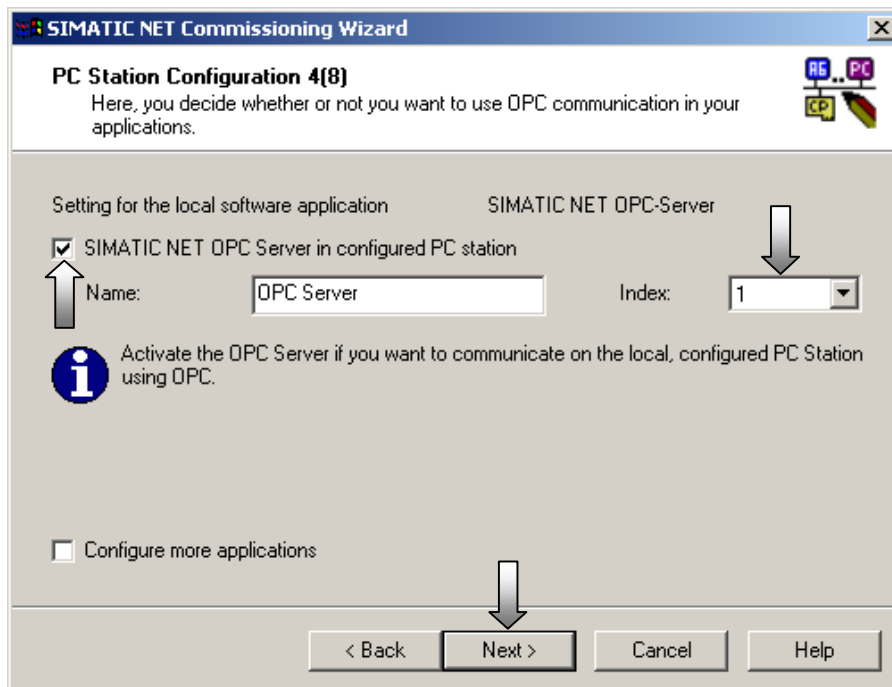
The next step is selected in step 1 of the Commissioning Wizard.



In step 2 the productive operation mode for the CP 1613 and a fictive slot index (same as S7) - here for example "2" - is set.

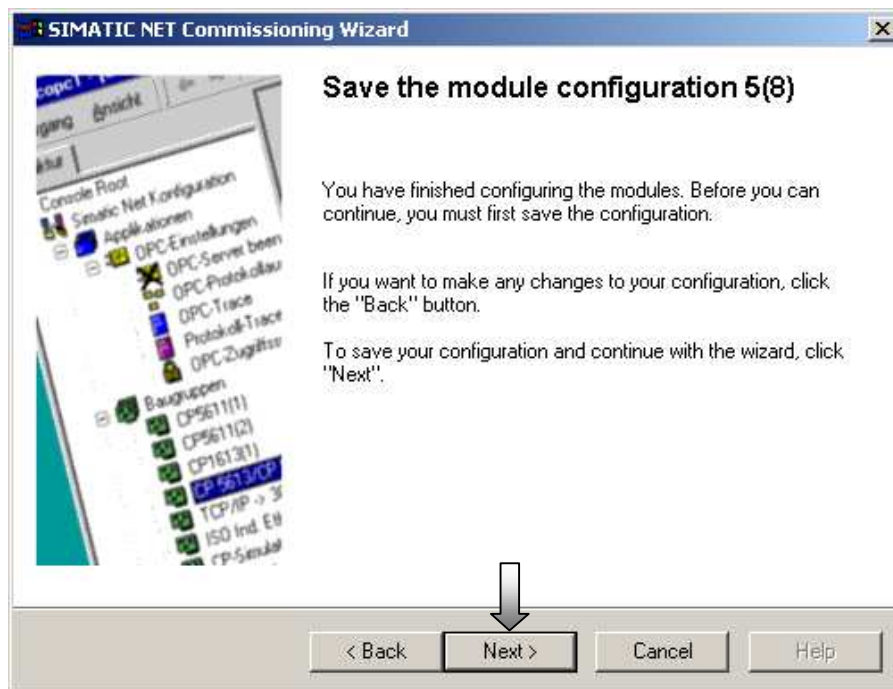


In step 4 the SIMATIC NET OPC server is activated and a fictive slot index - here for example "1" - is set.

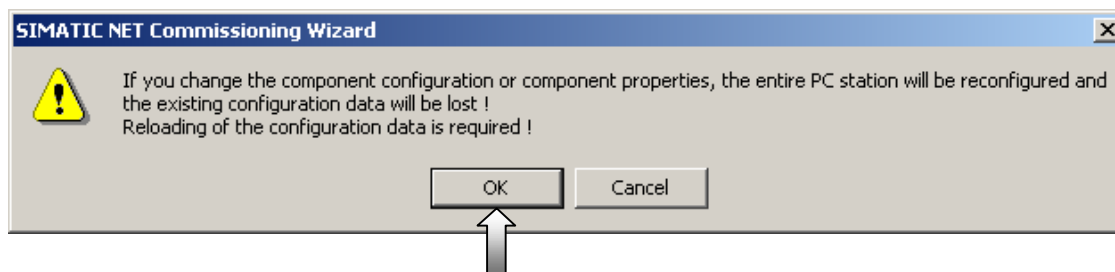


SEND/RECEIVE with SIGMA AIR MANAGER

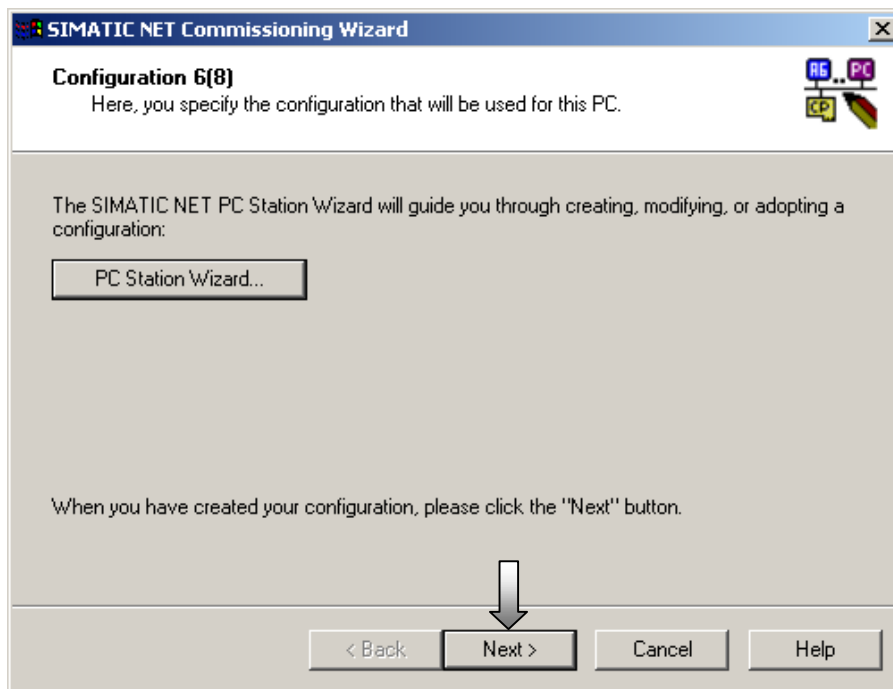
In step 5 pressing the "Next" button saves the module configuration.



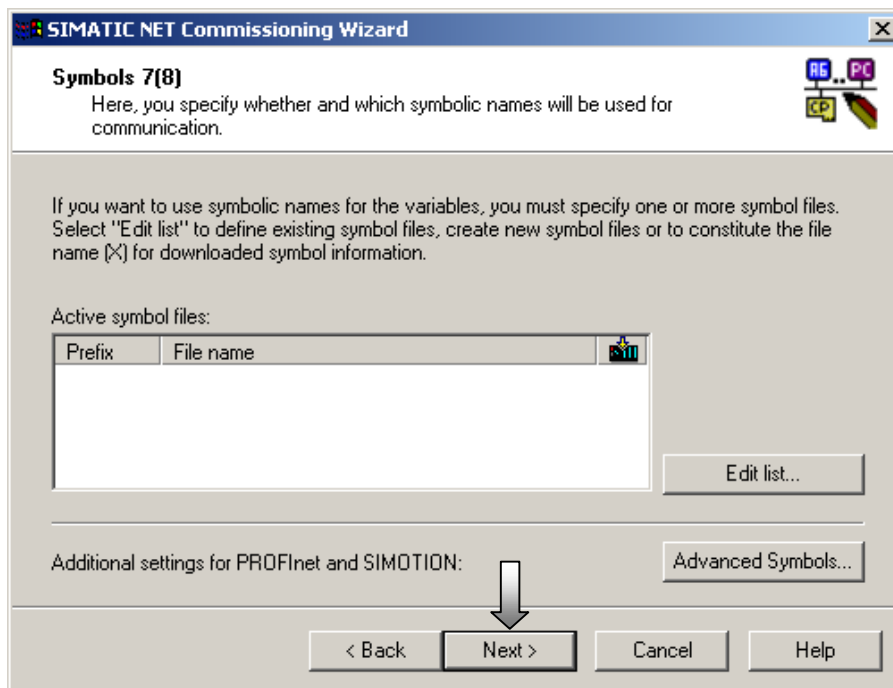
Press the OK button in the following note.



The next step is selected in step 6 of the Commissioning Wizard.

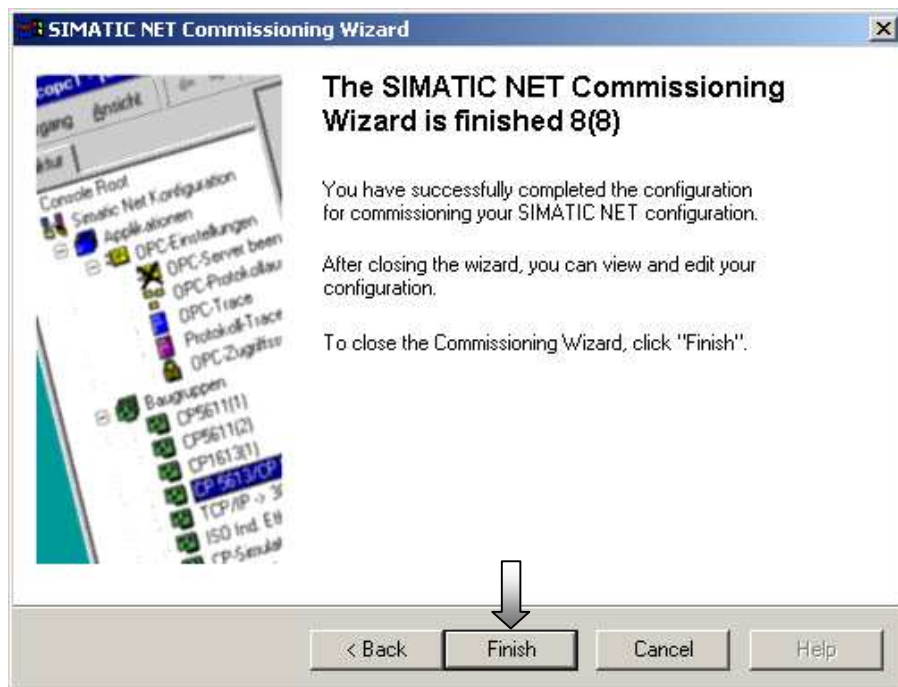


In step 7 no symbol file is specified. The next step is selected.



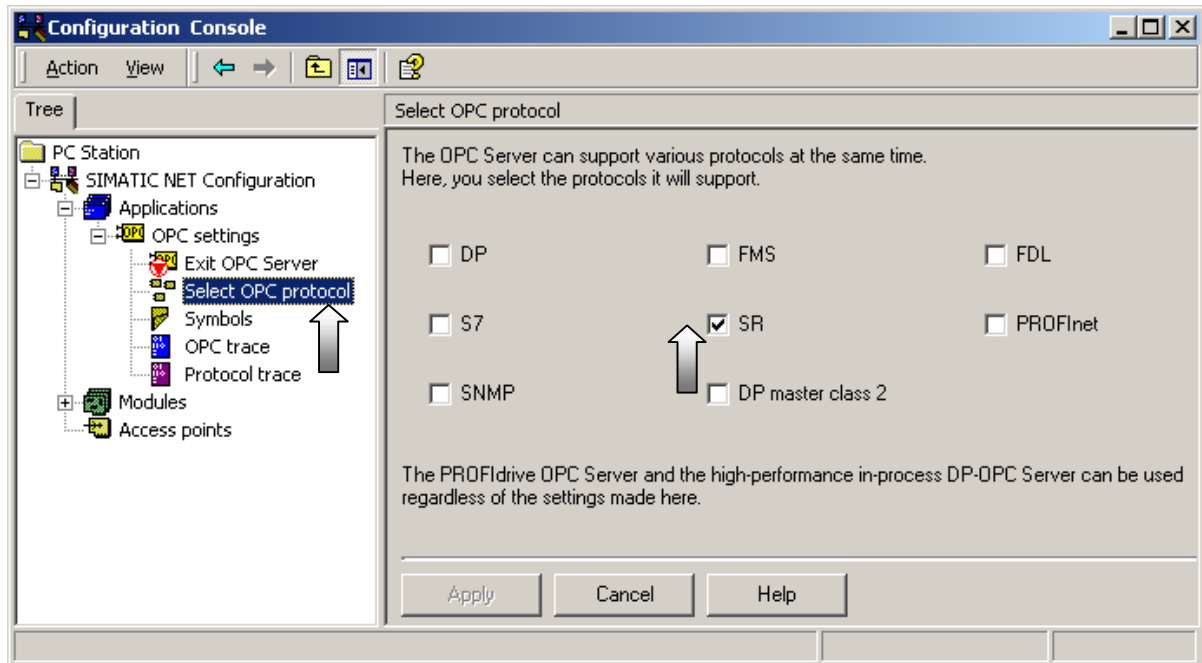
SEND/RECEIVE with SIGMA AIR MANAGER

In step 7 startup of the PC station is initially finalised.



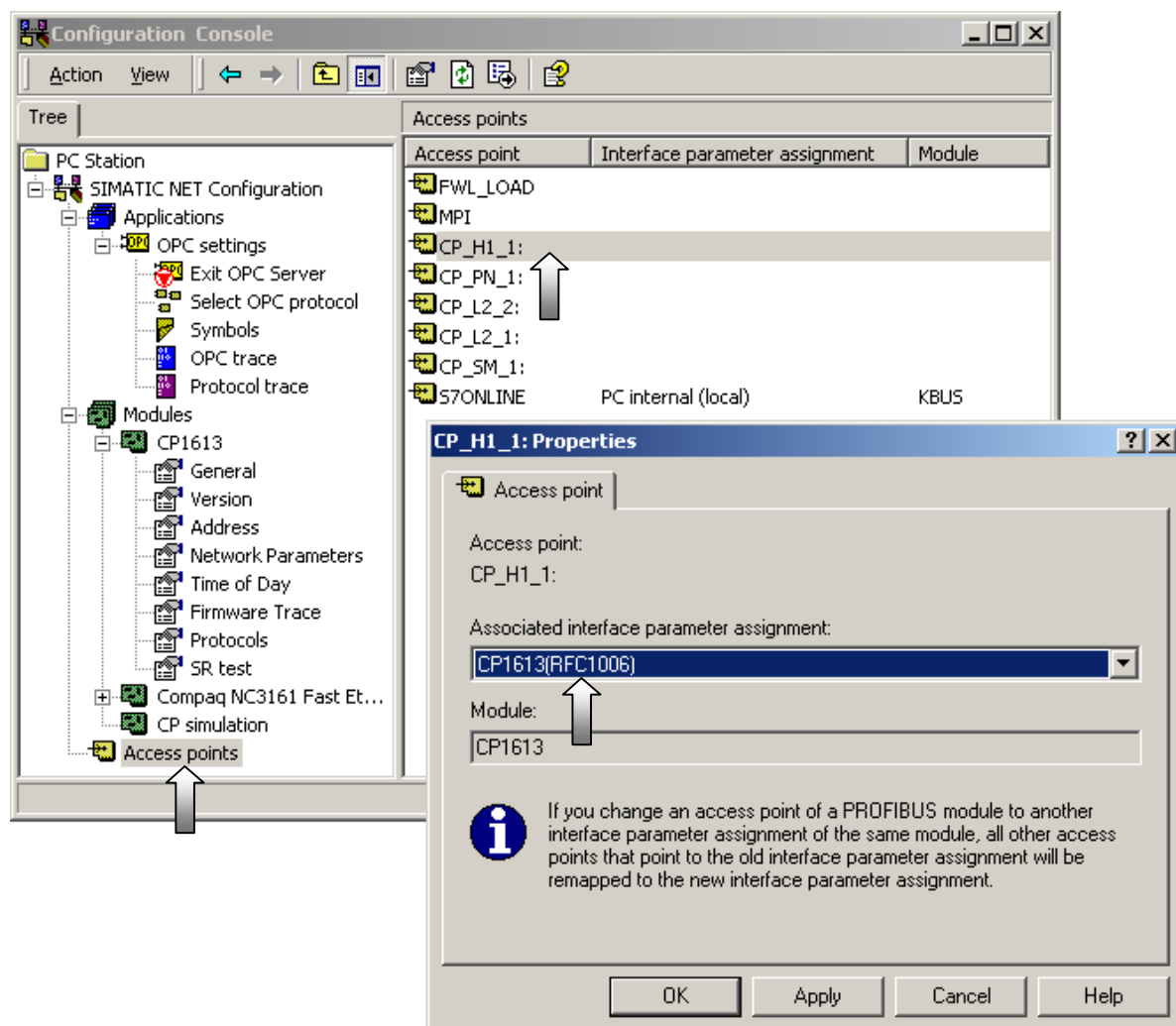
SEND/RECEIVE with SIGMA AIR MANAGER

After closing down the Commissioning Wizard the **Configuration Console**, in which the settings for the PC station (hardware and software) can be checked or changed, opens. In "Select OPC protocol", "SR" must be selected for the SEND/RECEIVE link to SIGMA AIR MANAGER. Protocols that are not needed should be deselected.



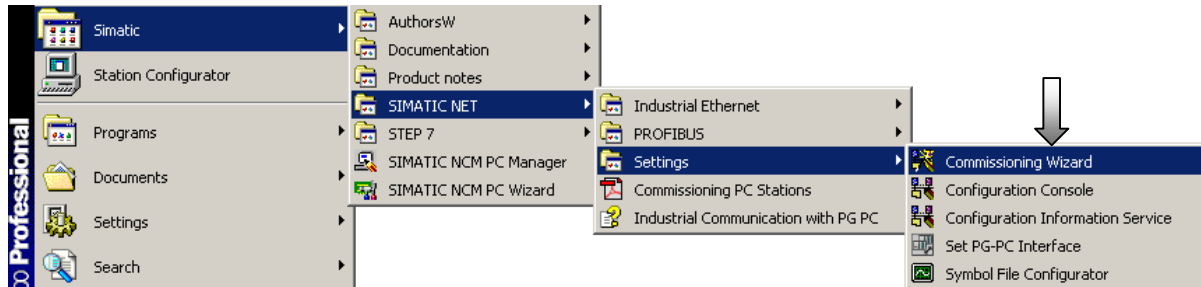
SEND/RECEIVE with SIGMA AIR MANAGER

In access point “CP_H1_1” the “CP1613(RFC1006)” interface parameter assignment must be selected for the CP 1613 module. The Configuration Console can then be closed.

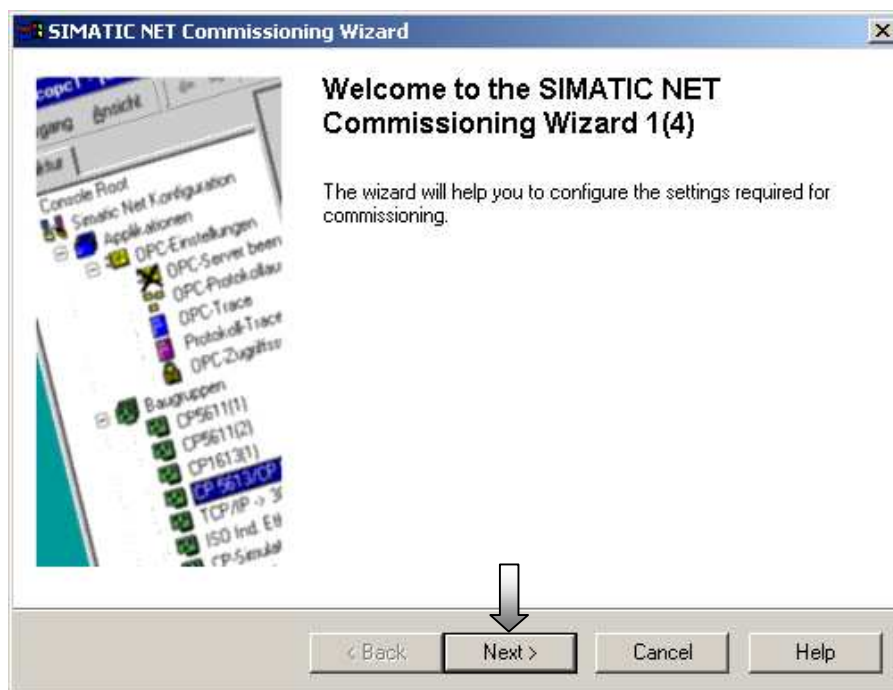


SEND/RECEIVE with SIGMA AIR MANAGER

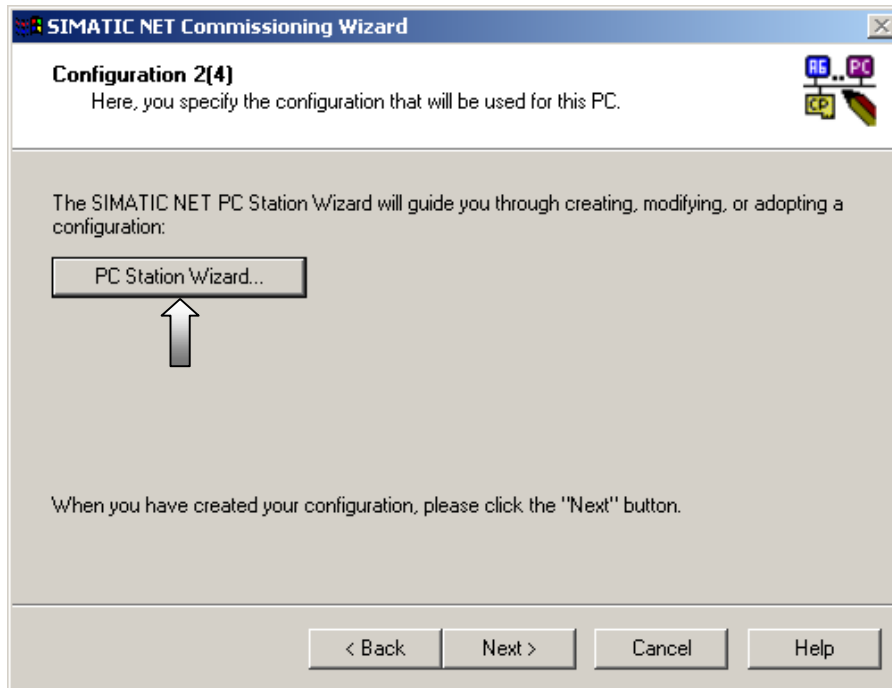
The PC station is then configured further as for S7 with SIMATIC NCM PC Config (module addresses, networking, connections). The associated SIMATIC NCM PC Station Wizard is selected from the Commissioning Wizard.



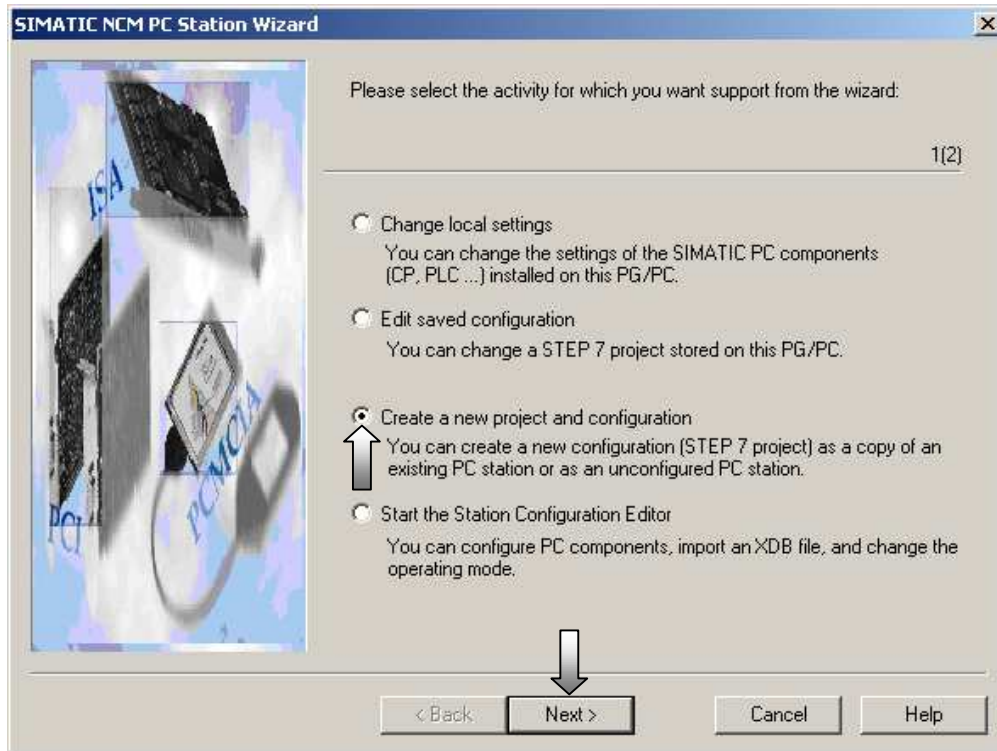
The next step is selected in step 1 of the Commissioning Wizard.



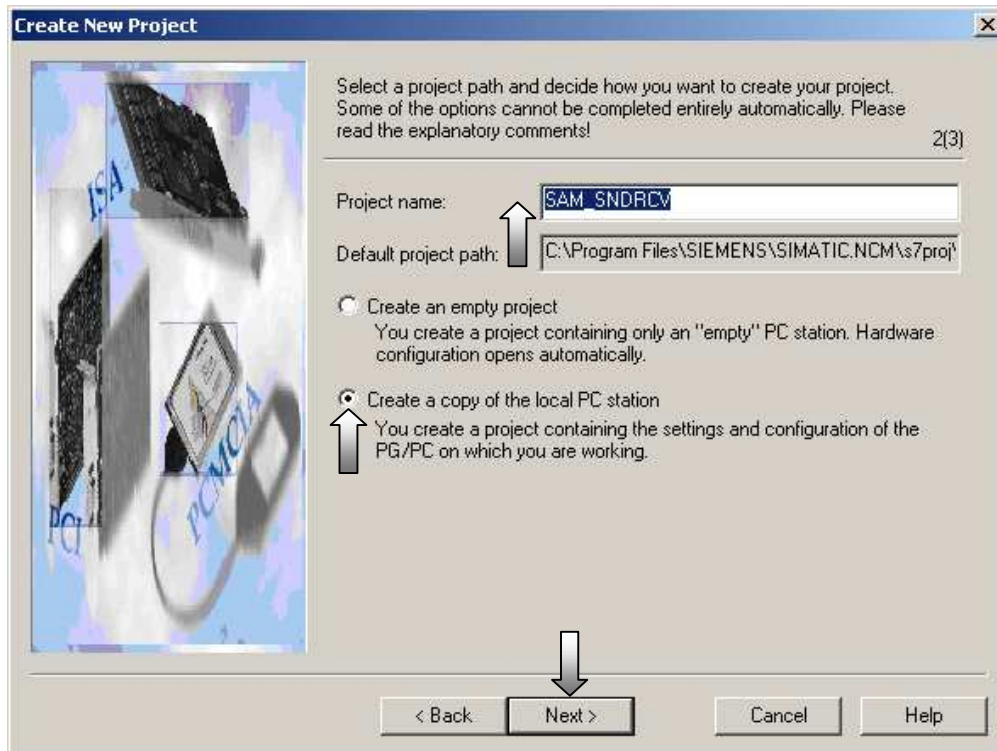
In step 2 the **PC Station Wizard** is selected.



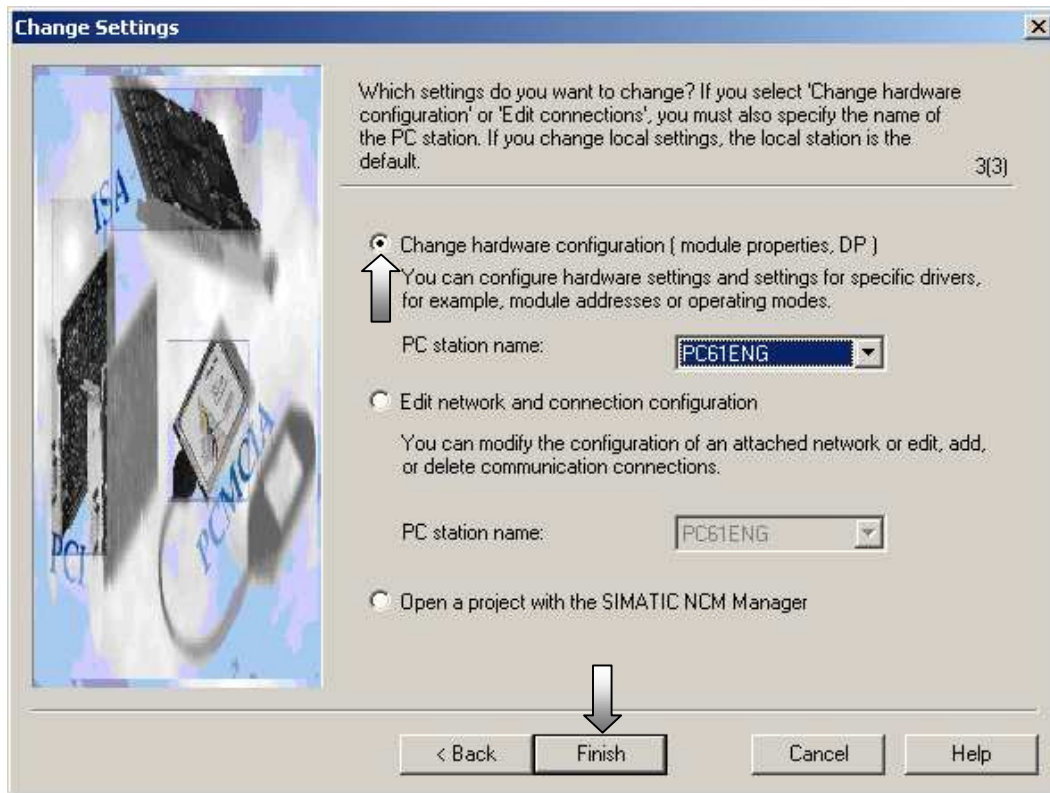
The menu option for creation of a new project is selected.



The project name is entered. The previously made settings are accepted in that a copy of the local PC station is saved.

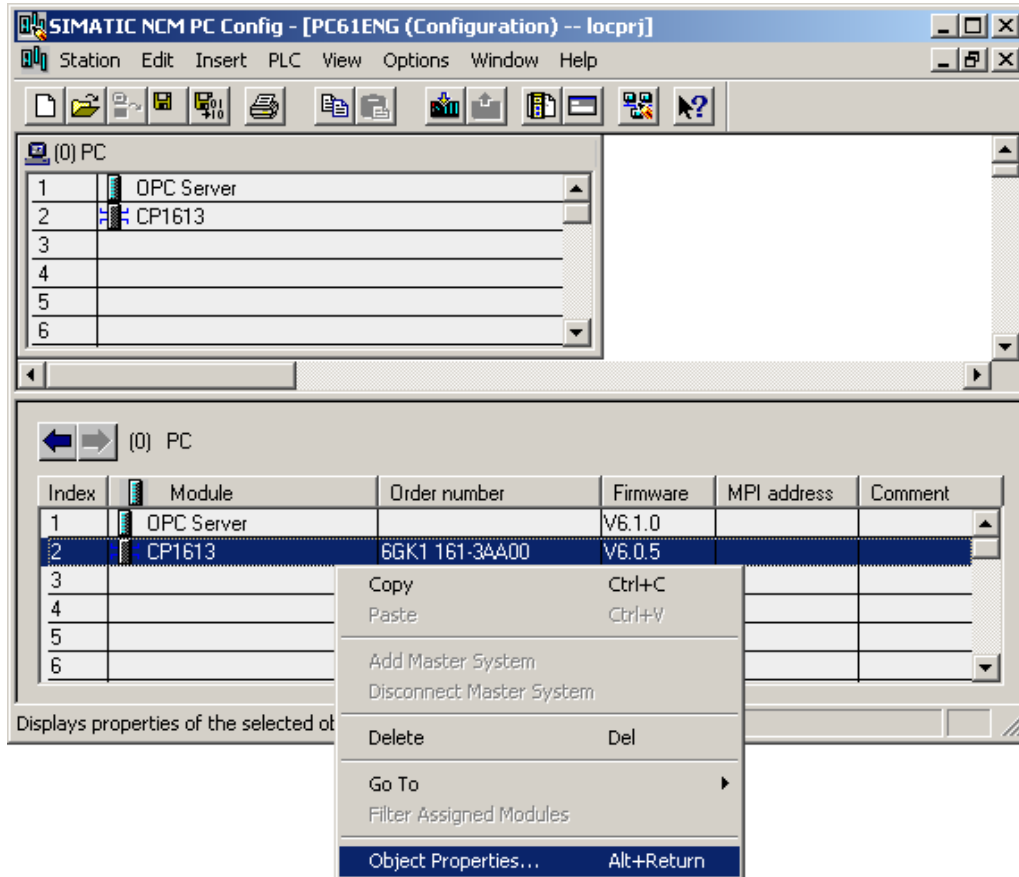


The menu selection changing the hardware configuration based on the local PC station is made here and these initial settings are entered.

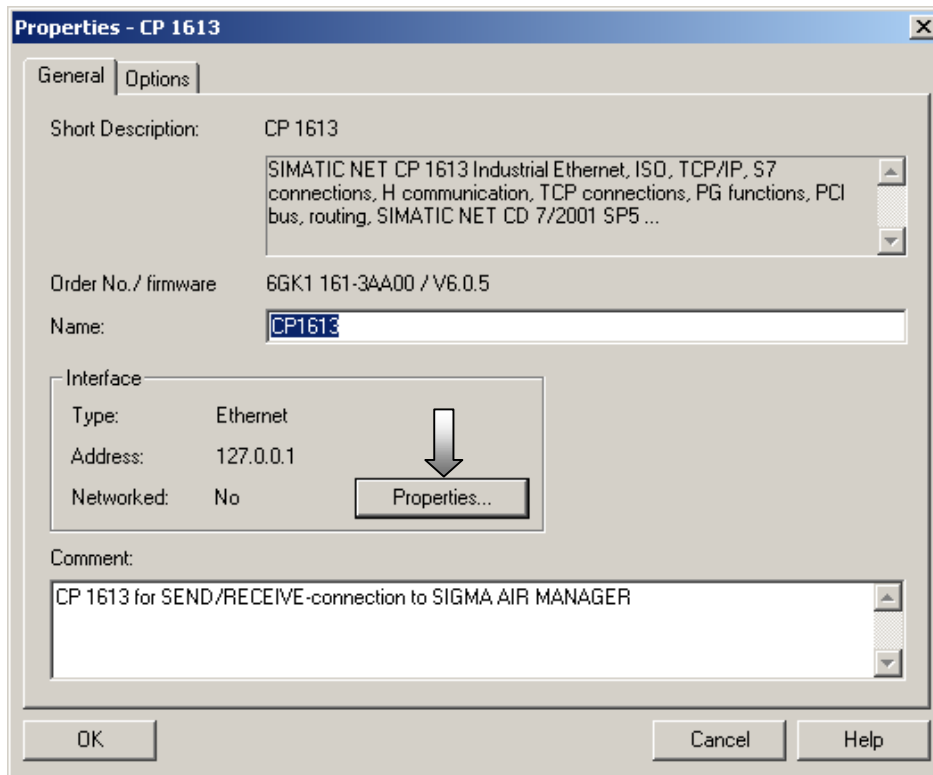


SEND/RECEIVE with SIGMA AIR MANAGER

When the PC Station Wizard has closed, SIMATIC NCM PC Config opens with the previous PC station settings. Here the required object properties of the modules (IP addresses, networking) are set - in the example initially for the CP 1613.

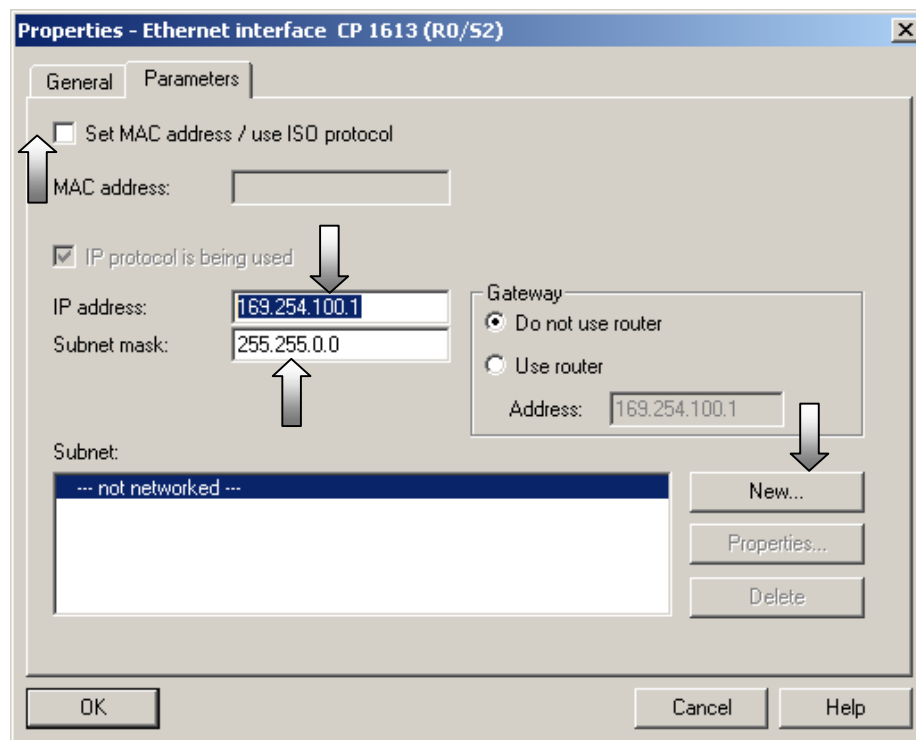


The CP 1613 can be renamed and a comment inserted. Afterwards, the properties of the Ethernet interface (IP addresses, networking) have to be parameterised.

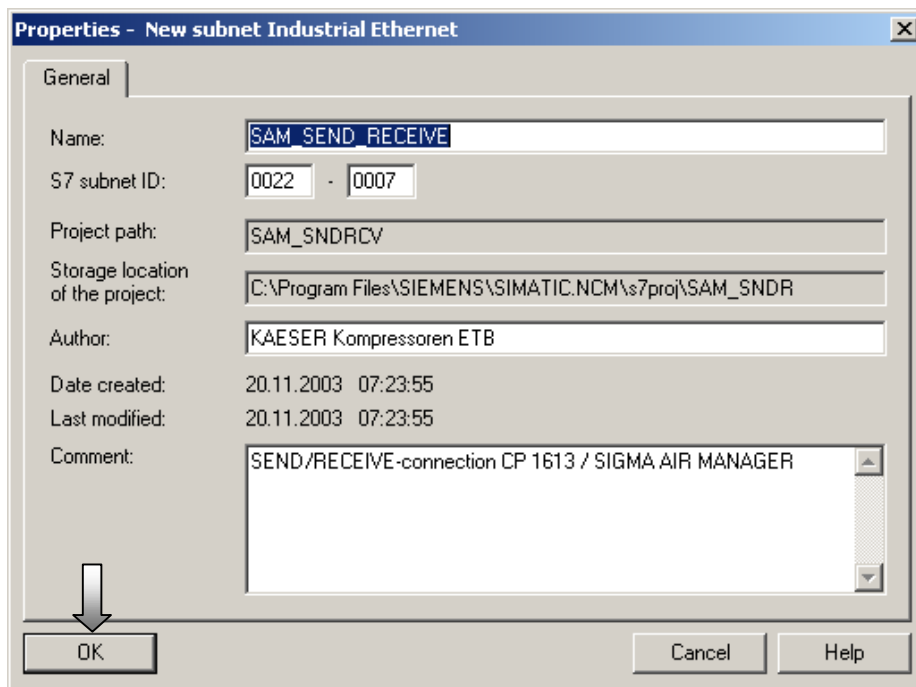


SEND/RECEIVE with SIGMA AIR MANAGER

The setting for the MAC address must be deactivated. The IP address and the subnet mask have to be entered for the existing network and/or SIGMA AIR MANAGER (common TCP/IP network). Afterwards, a new subnet must be created to allow the CP1613 to be networked with SIGMA AIR MANAGER.

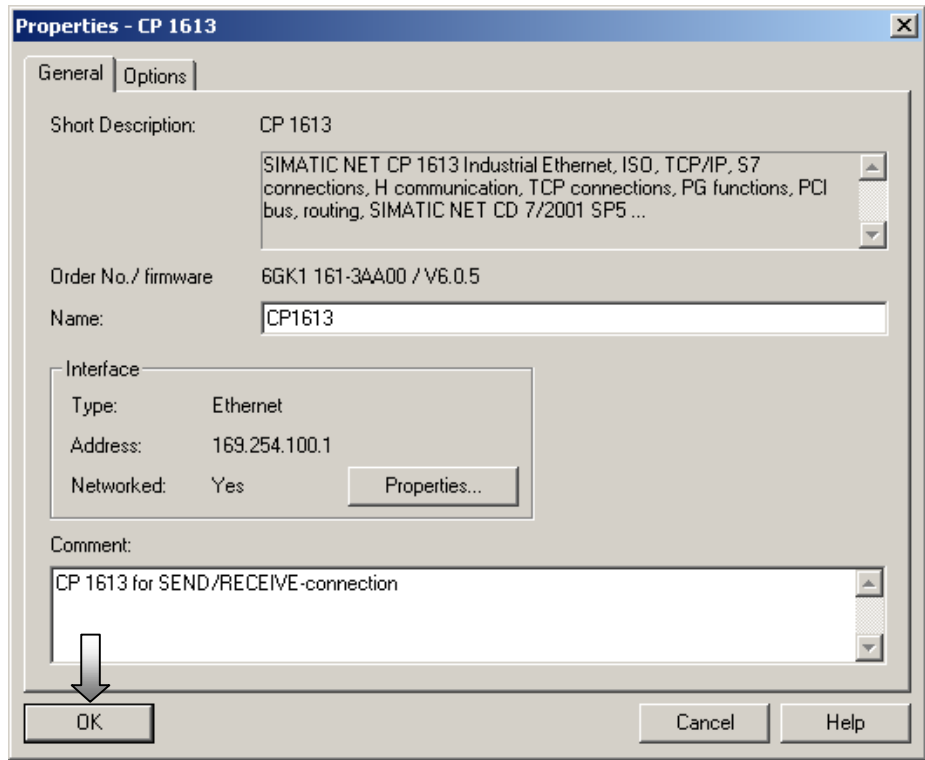
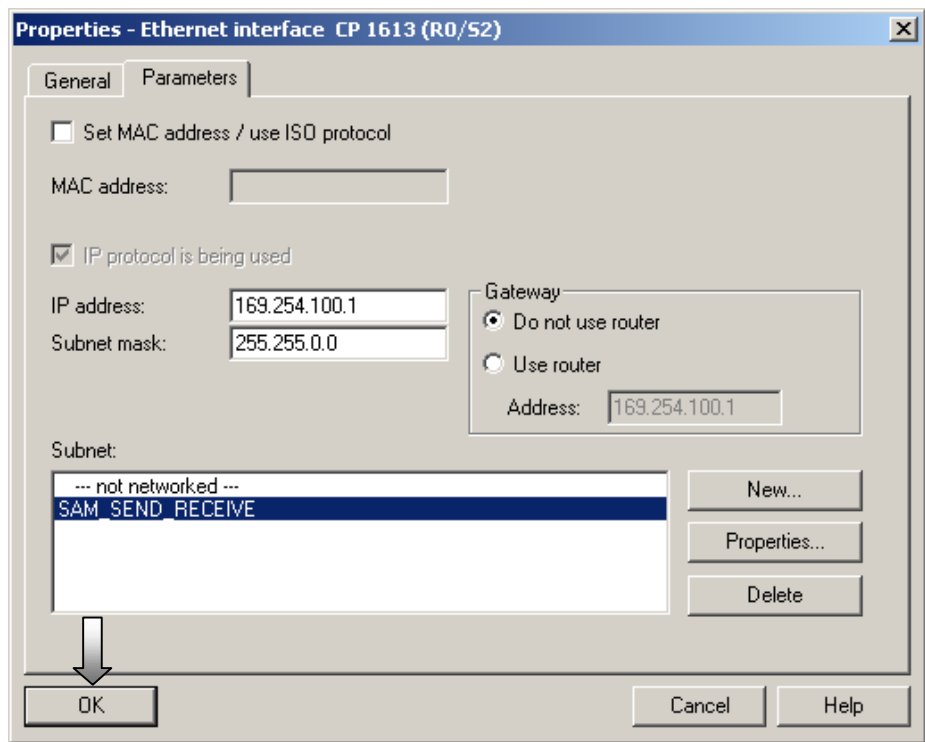


The new subnet can be renamed and a comment made. Confirm the settings with OK.



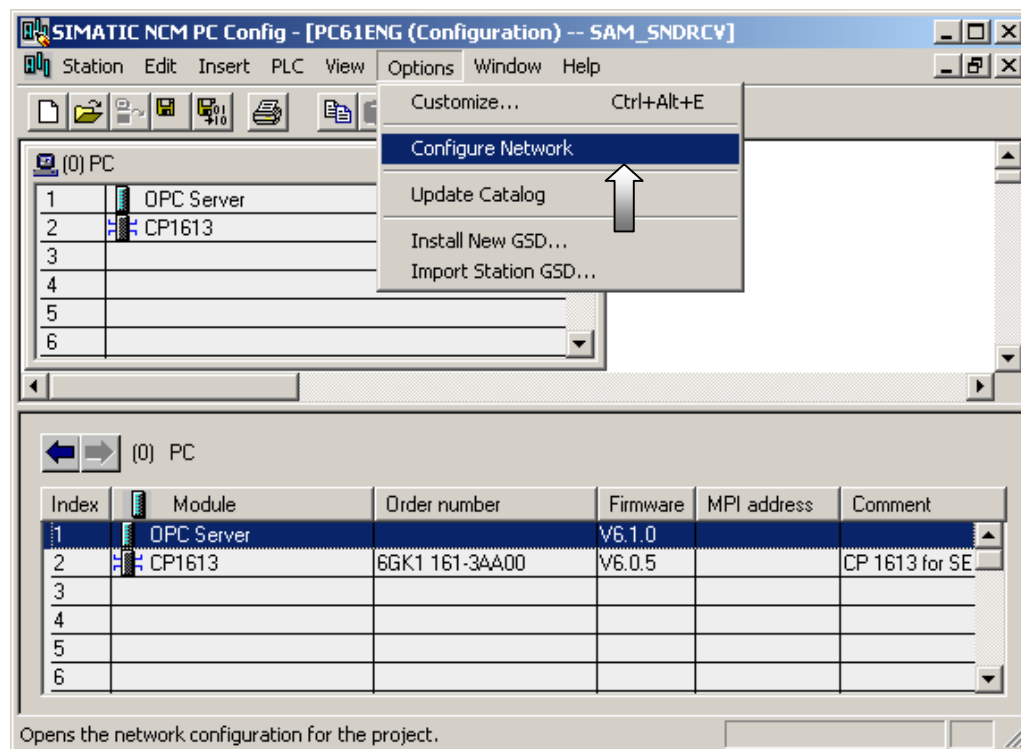
SEND/RECEIVE with SIGMA AIR MANAGER

The Ethernet interface is now parameterised. All the settings are confirmed again by clicking OK twice.



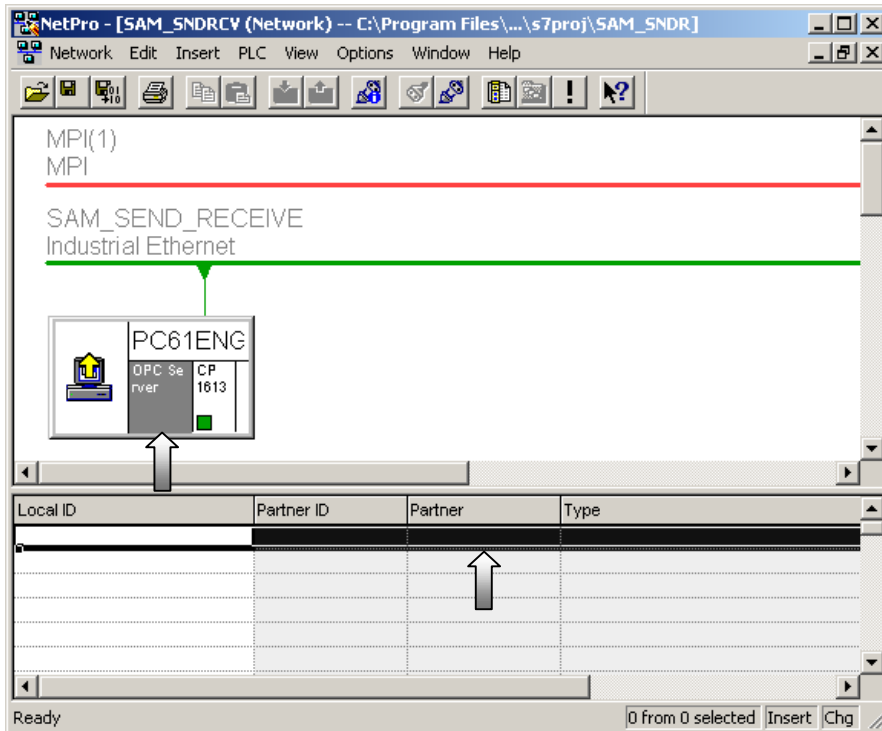
SEND/RECEIVE with SIGMA AIR MANAGER

NetPro (network configuration) is now started from SIMATIC NCM PC Config to create two ISO-on-TCP connections (TCP/IP with RFC1006) for the OPC server and to parameterise them as required to allow active WRITE and FETCH access to SIGMA AIR MANAGER's control and process data.

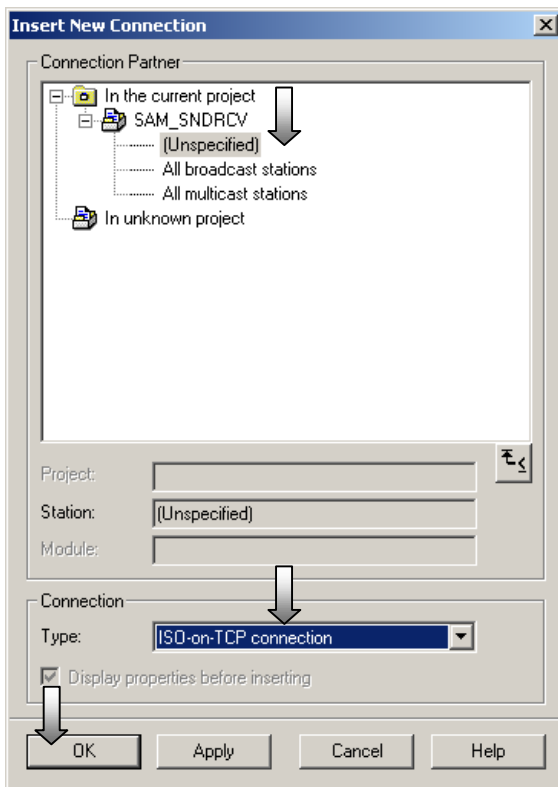


SEND/RECEIVE with SIGMA AIR MANAGER

A new connection is created by marking the OPC server in the PC station block diagram and then double-clicking an empty line in the lower window (list of connections).

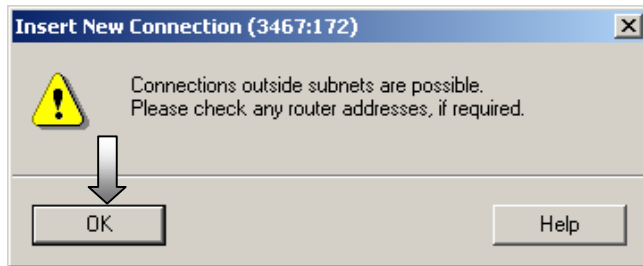


The connection partner must be “(Unspecified)” and “ISO-on-TCP connection” selected. Confirm the settings with OK.

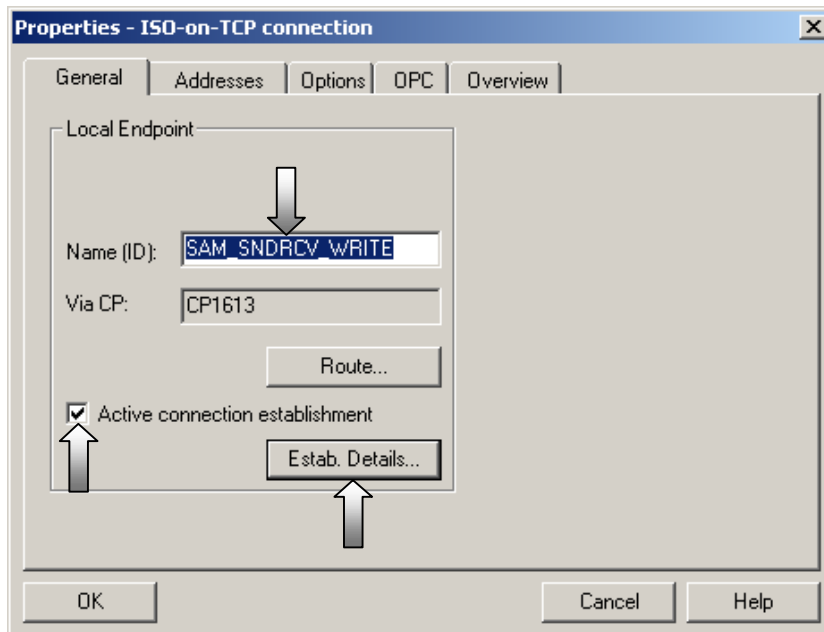


SEND/RECEIVE with SIGMA AIR MANAGER

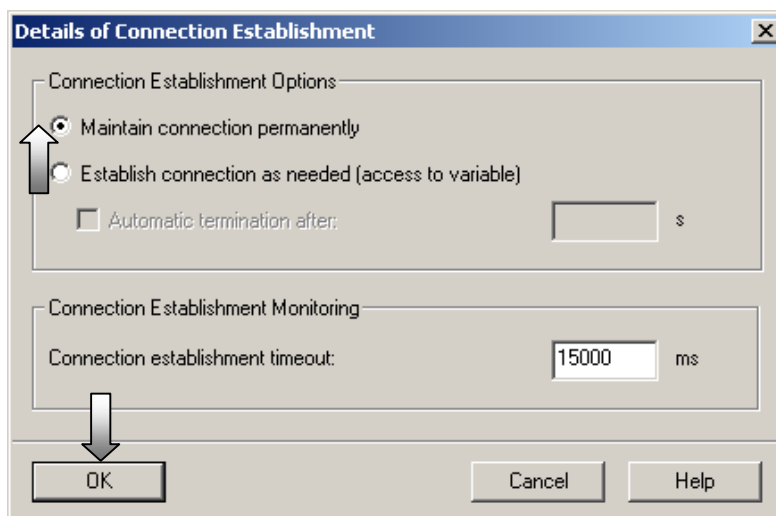
Press the OK button in the following note.



The new connection can be renamed. The connection must be actively established via the OPC server. After which the establishment details are determined.

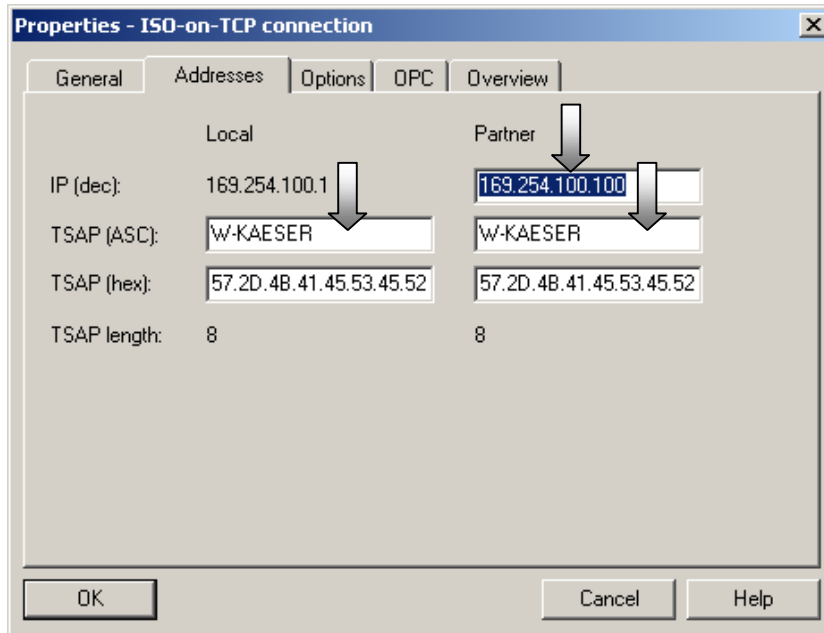


The connection must be selected as a permanent connection. Confirm this setting with OK.

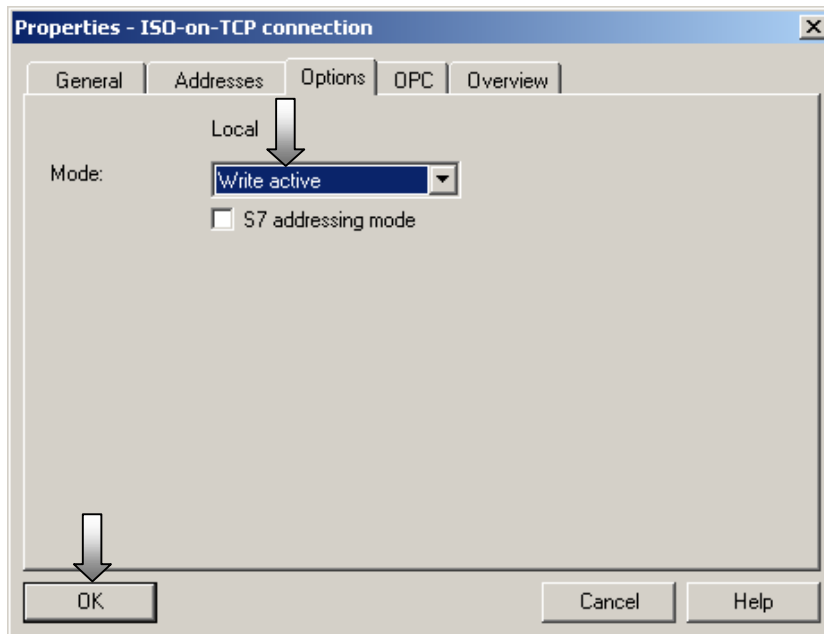


SEND/RECEIVE with SIGMA AIR MANAGER

The IP address of the partner is SIGMA AIR MANAGER's IP address. As the local TSAP and the partner's TSAP must be entered "W-KAESER" to allow write access (WRITE active).

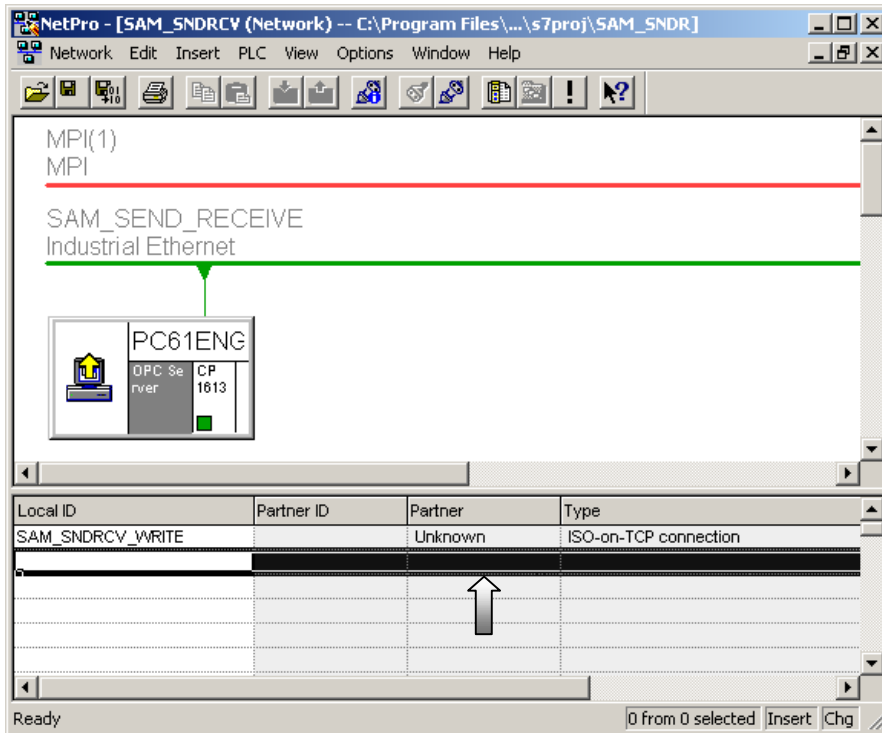


"Write active" connection mode must be selected to allow write access. The WRITE connection is now parameterised sufficiently. All the settings are confirmed with OK.

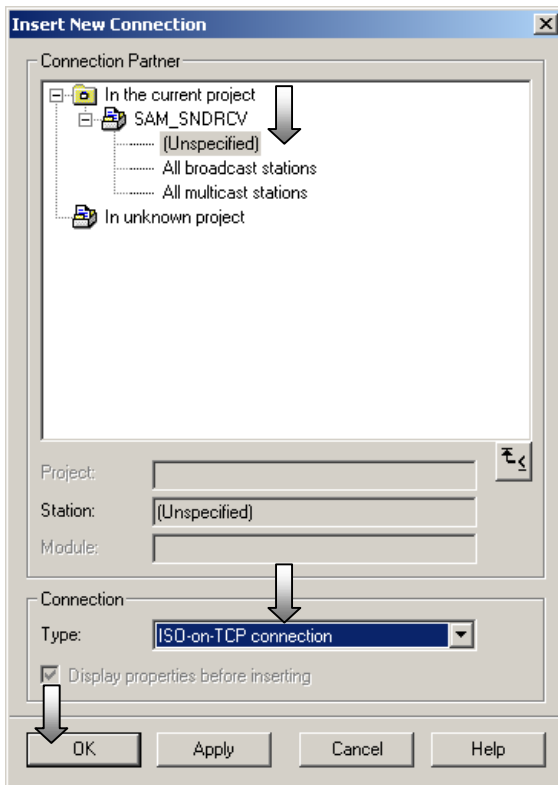


SEND/RECEIVE with SIGMA AIR MANAGER

The completed WRITE connection is shown in the lower window (list of connections). Another new connection is now created by double-clicking on a vacant line.

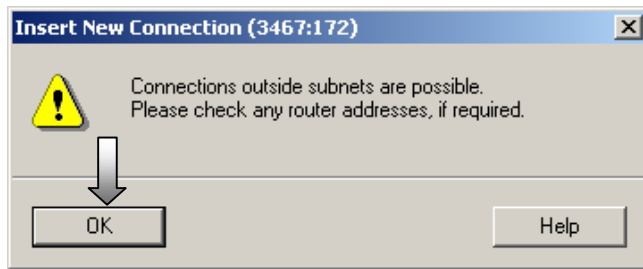


The connection partner must be “(Unspecified)” and “ISO-on-TCP connection” selected. Confirm the settings with OK.

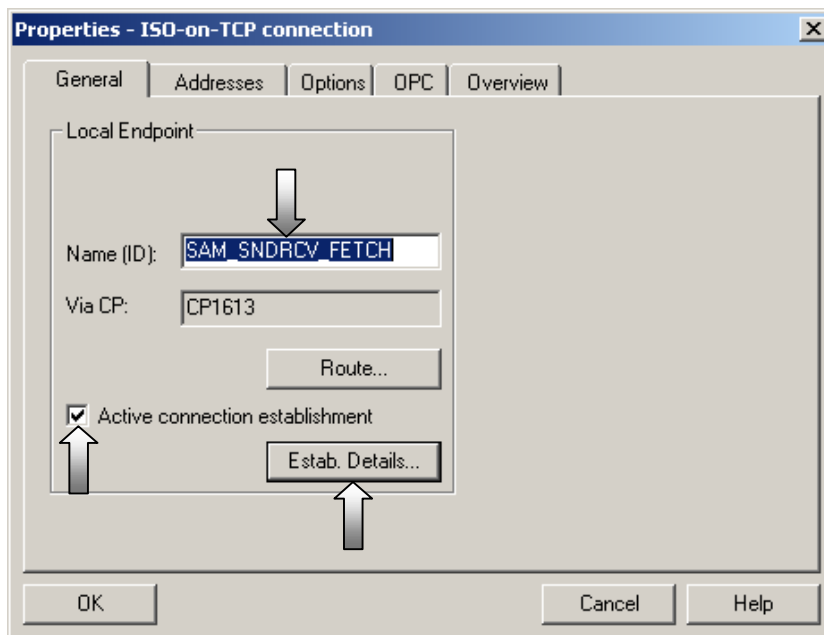


SEND/RECEIVE with SIGMA AIR MANAGER

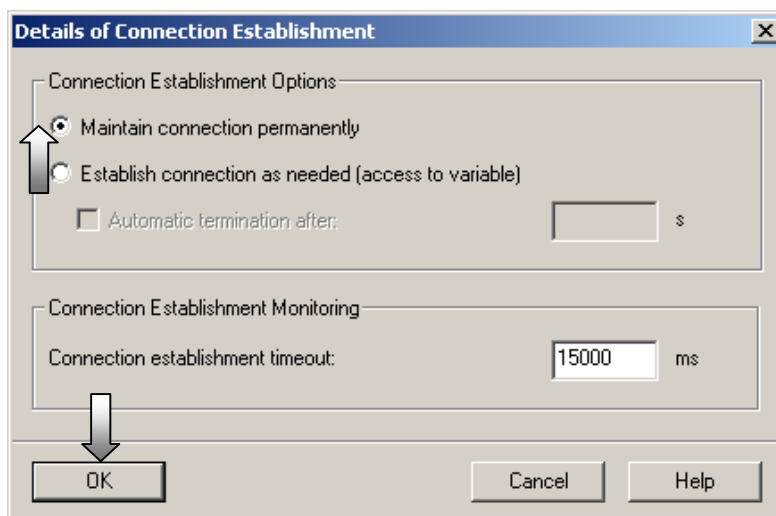
Press the OK button in the following note.



The new connection can be renamed. The connection must be actively established via the OPC server. After which the establishment details are determined.

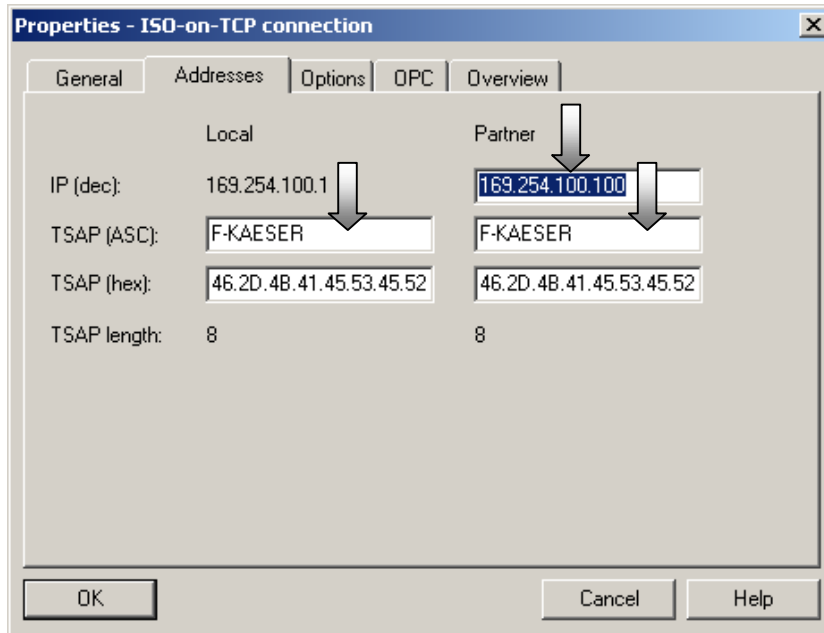


The connection must be selected as a permanent connection. Confirm this setting with OK.

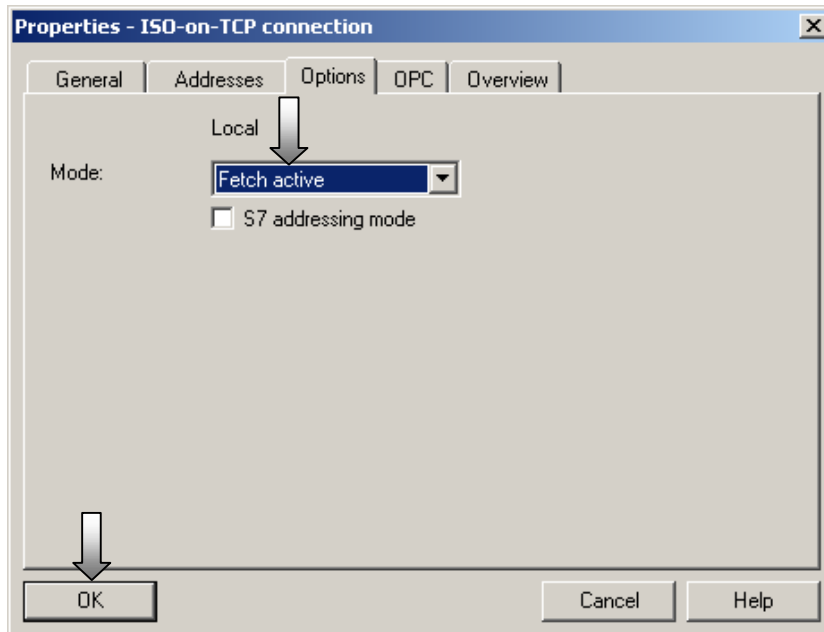


SEND/RECEIVE with SIGMA AIR MANAGER

The IP address of the partner is SIGMA AIR MANAGER's IP address. As the local TSAP and the partner's TSAP must be entered "F-KAESER" to allow fetch access (FETCH active).

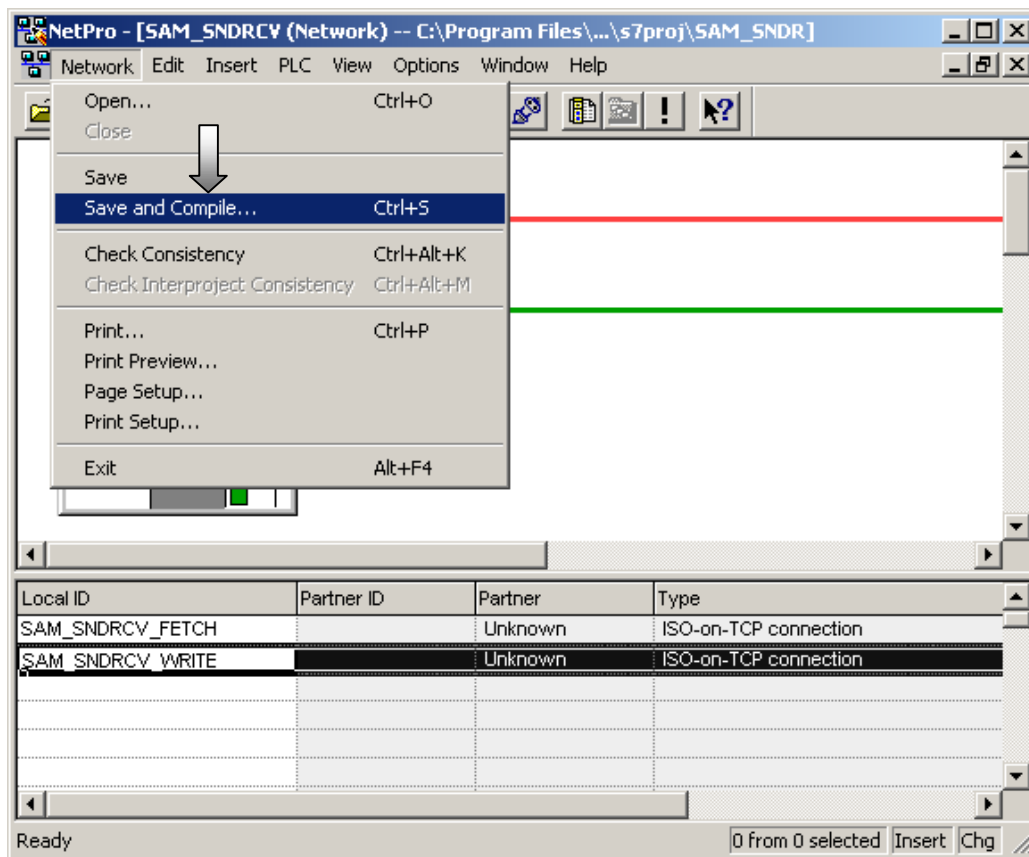


"Fetch active" connection mode must be selected to allow read access. The FETCH connection is now parameterised sufficiently. All the settings are confirmed with OK.

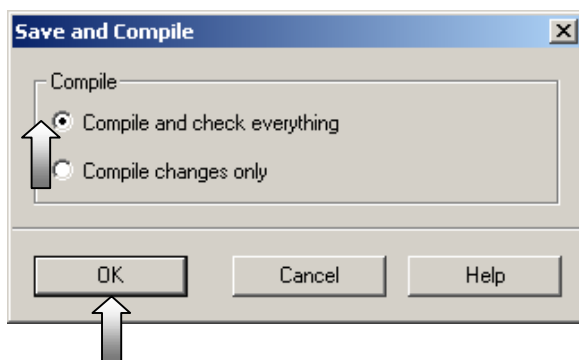


SEND/RECEIVE with SIGMA AIR MANAGER

The completed FETCH connection is shown in the lower window (list of connections). This network configuration is now saved and compiled.

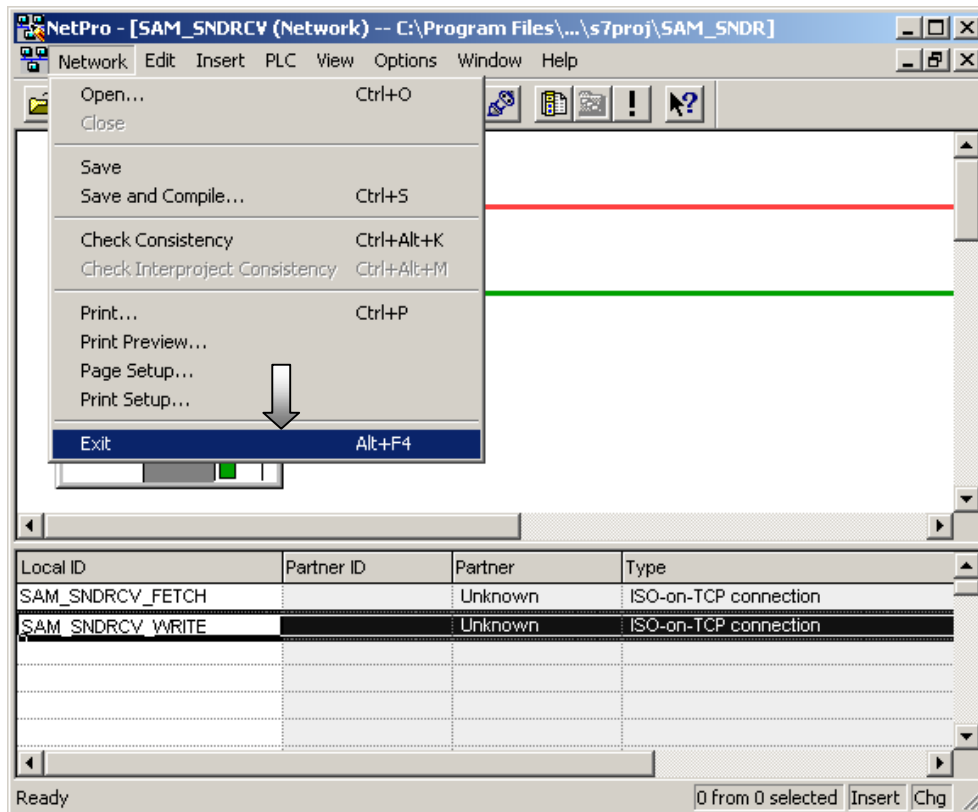


The complete network configuration should be compiled. Confirm this setting with OK.

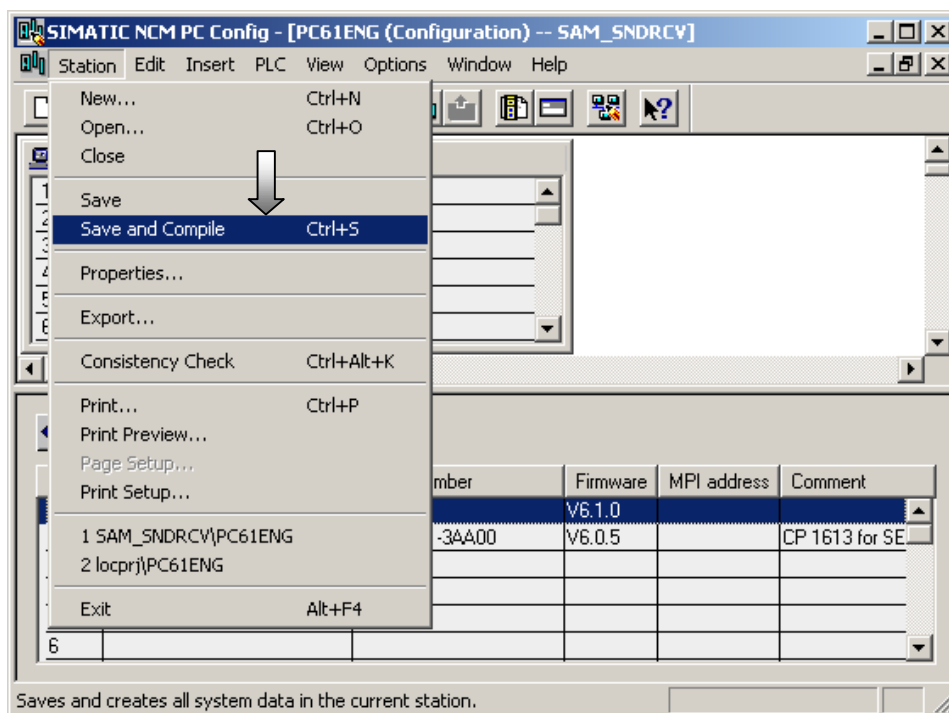


SEND/RECEIVE with SIGMA AIR MANAGER

When the compilation has been correctly executed, NetPro is closed, returning to SIMATIC NCM PC Config.

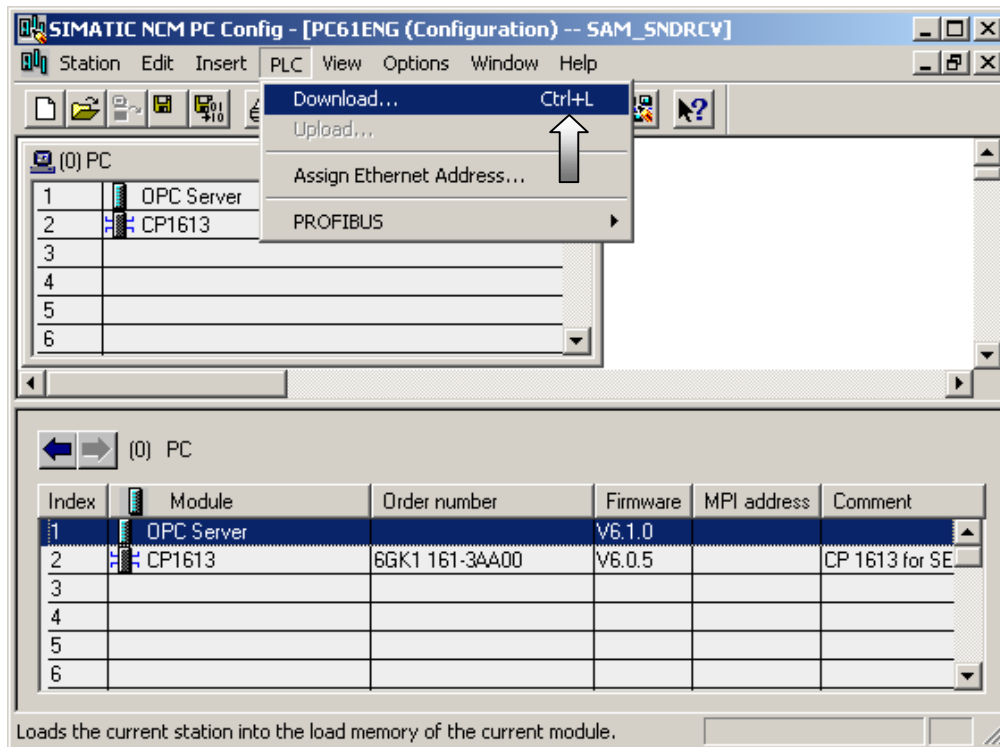


The complete PC configuration is now saved and compiled.

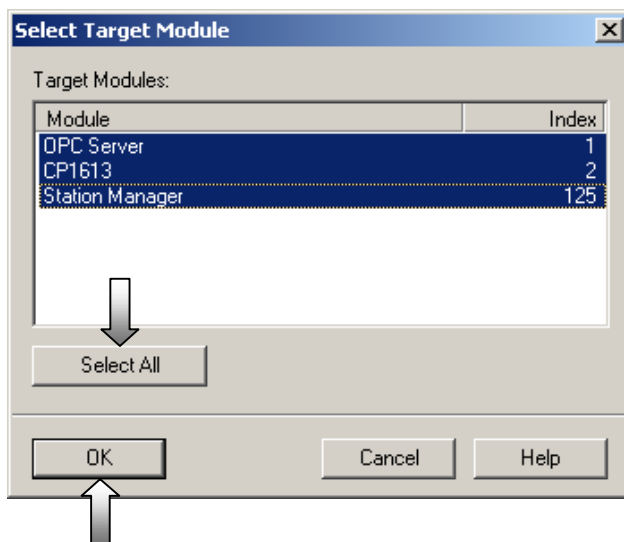


SEND/RECEIVE with SIGMA AIR MANAGER

The compiled PC configuration is loaded into the participating modules the same as for S7 projects.

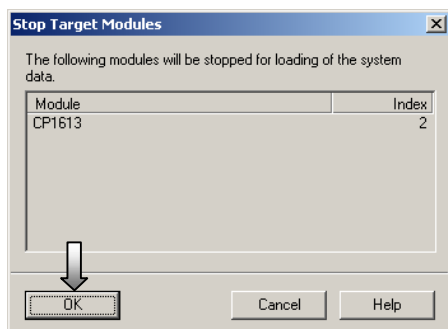
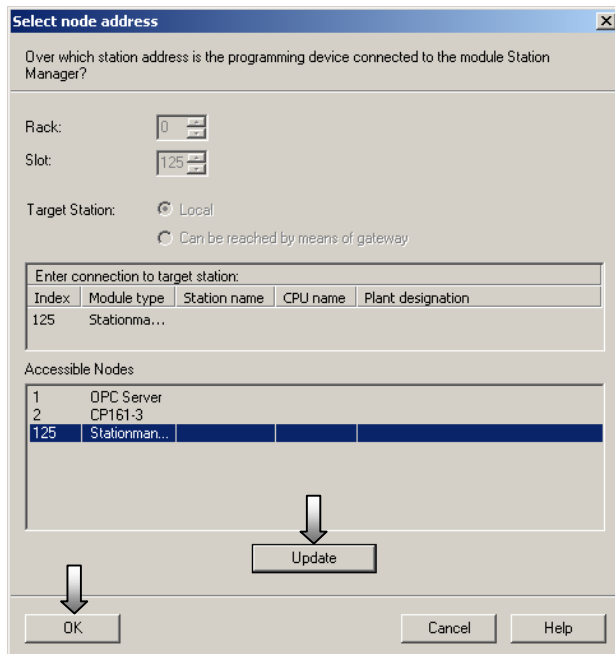
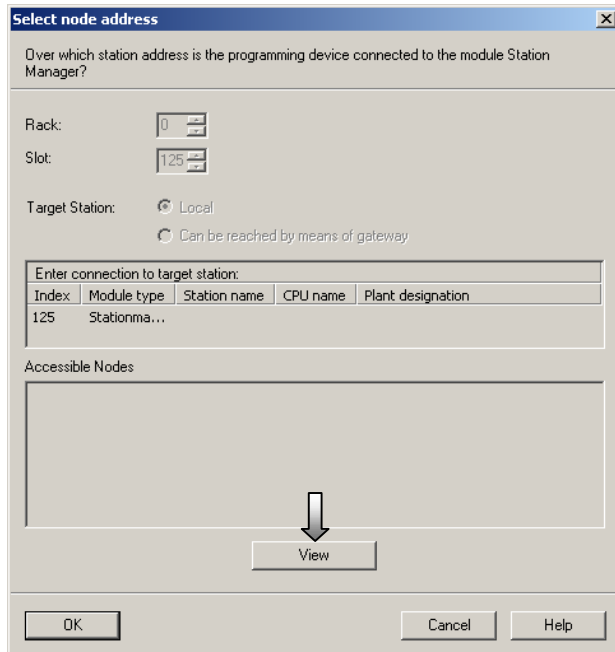


All participating modules are selected for the download.



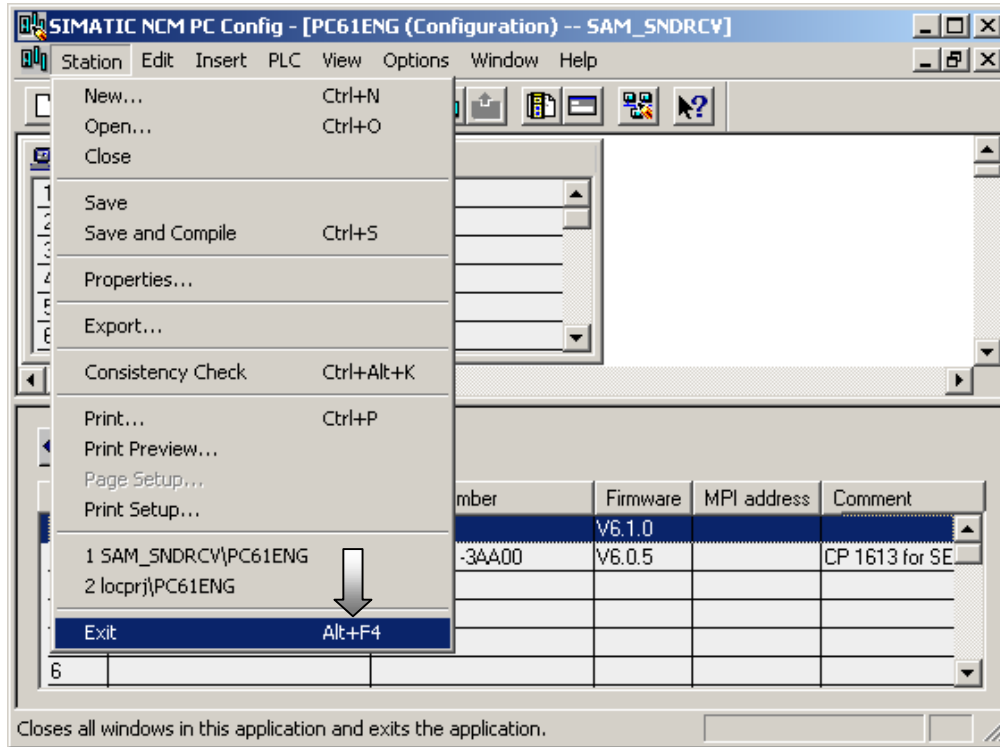
SEND/RECEIVE with SIGMA AIR MANAGER

The next windows are confirmed the same as for S7 projects.

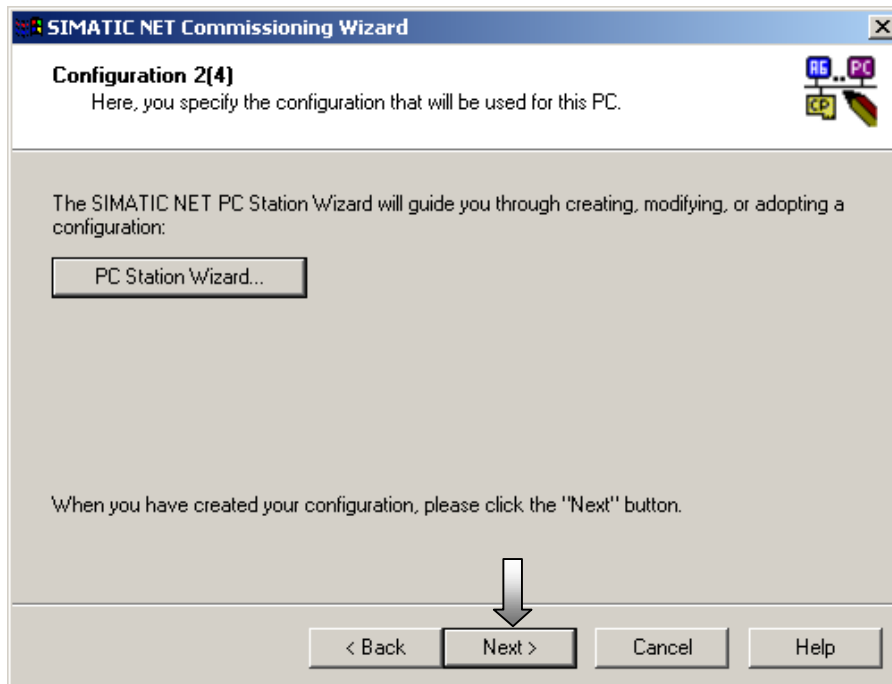


SEND/RECEIVE with SIGMA AIR MANAGER

The PC station is now configured and prepared for SEND/RECEIVE communication with SIGMA AIR MANAGER. SIMATIC NCM PC Config and the PC Station Wizard now close and the Commissioning Wizard starts again.

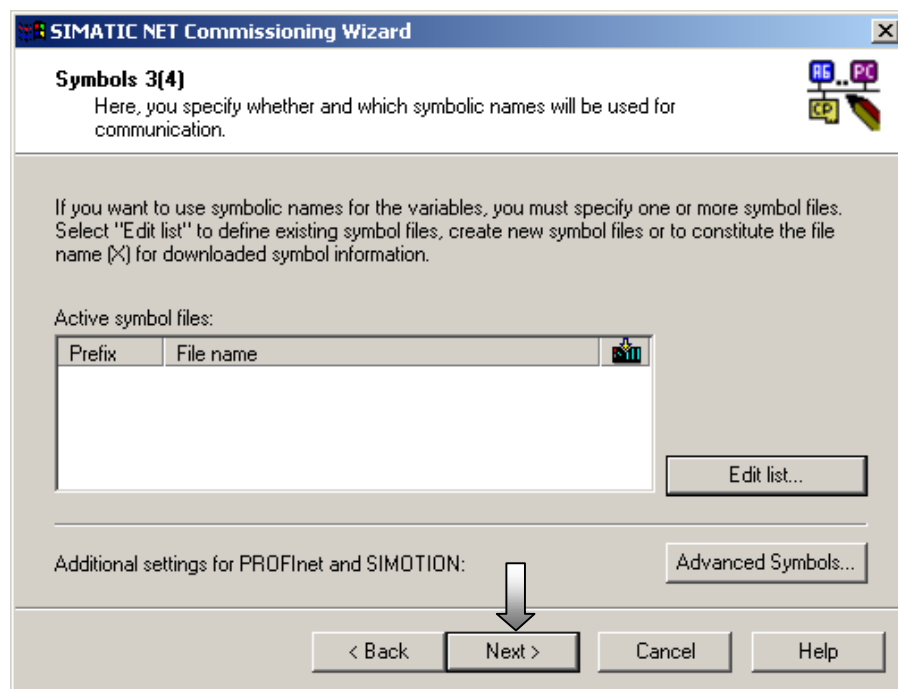


Now move to the next step in the Commissioning Wizard.

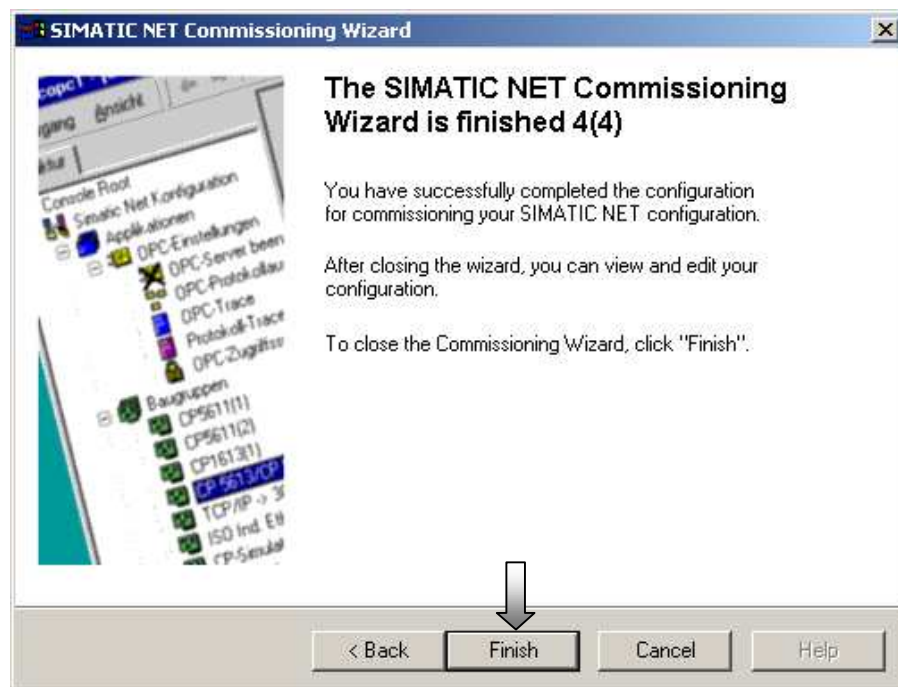


SEND/RECEIVE with SIGMA AIR MANAGER

The next step is selected in step 3 of the Commissioning Wizard.



In step 4 the commissioning of the PC station is finalised.

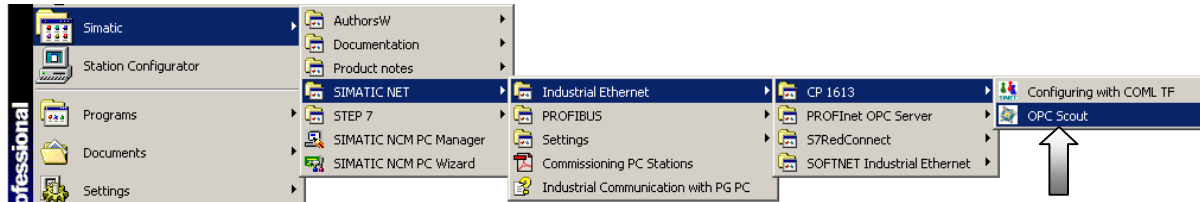


SEND/RECEIVE with SIGMA AIR MANAGER

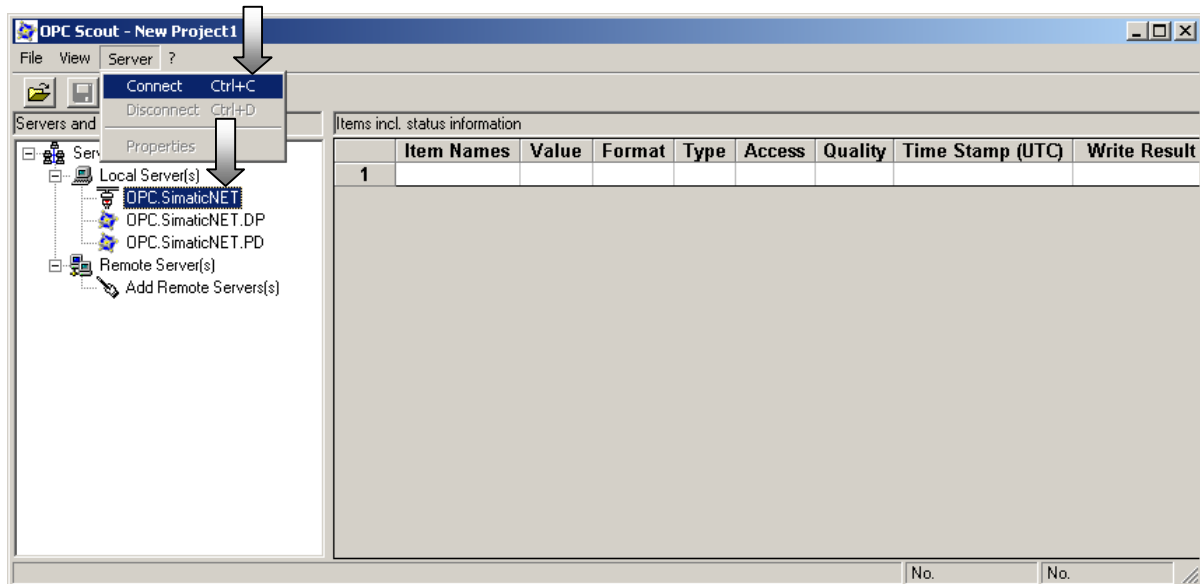
Testing communication with OPC Scout

The procedure described below is a general test of an established SEND/RECEIVE connection using the OPC Scout, a graphic OPC client supplied with SEND/RECEIVE.

The **OPC Scout** can be called up in the Windows Start menu.

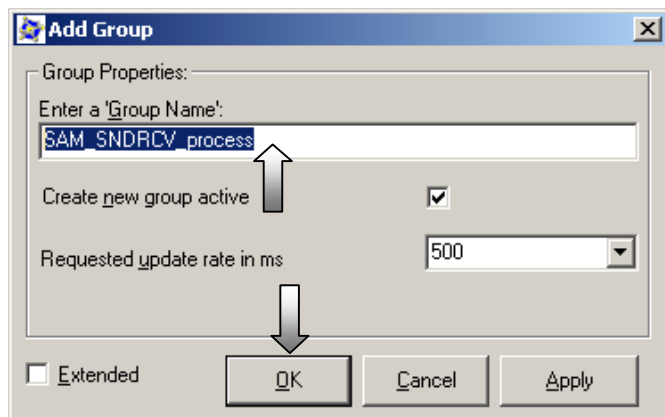


The SIMATIC NET OPC Server is marked in the list of local servers and the connection to this server is made.

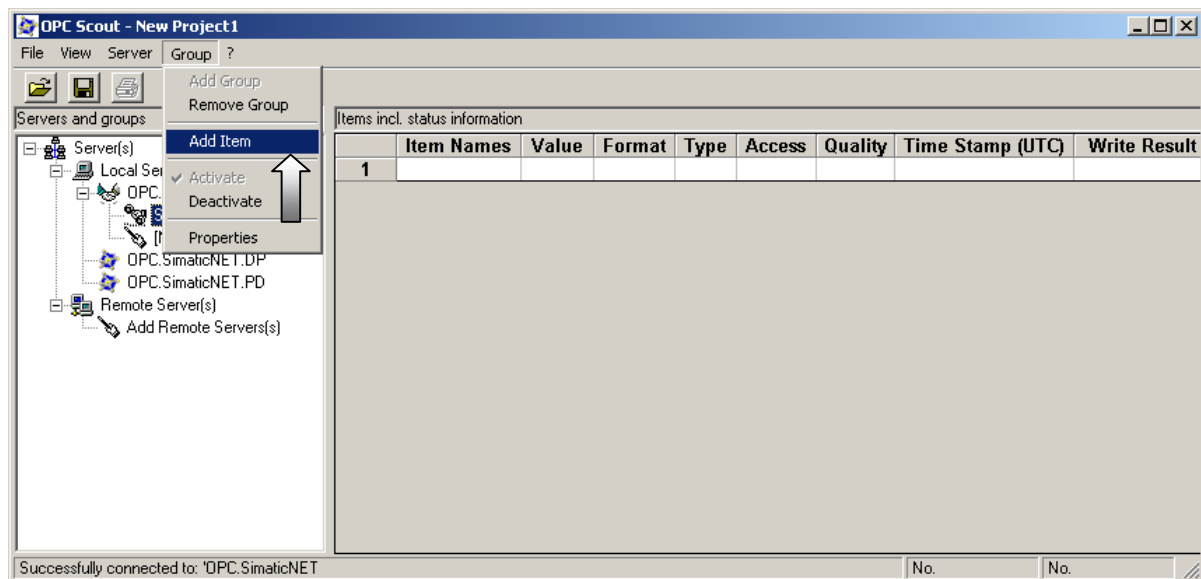


SEND/RECEIVE with SIGMA AIR MANAGER

In the following dialog window the name of a new OPC group and the associated update rate is entered. Confirm the settings with OK.

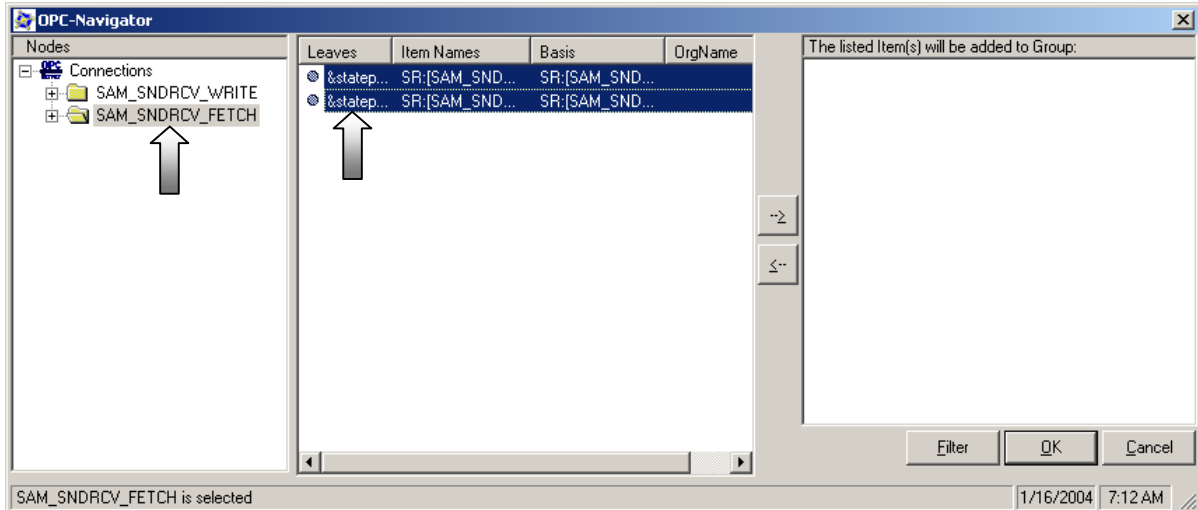


The new OPC group now appears under the SIMATIC NET OPC server. Mark the group and add your items (process variables).

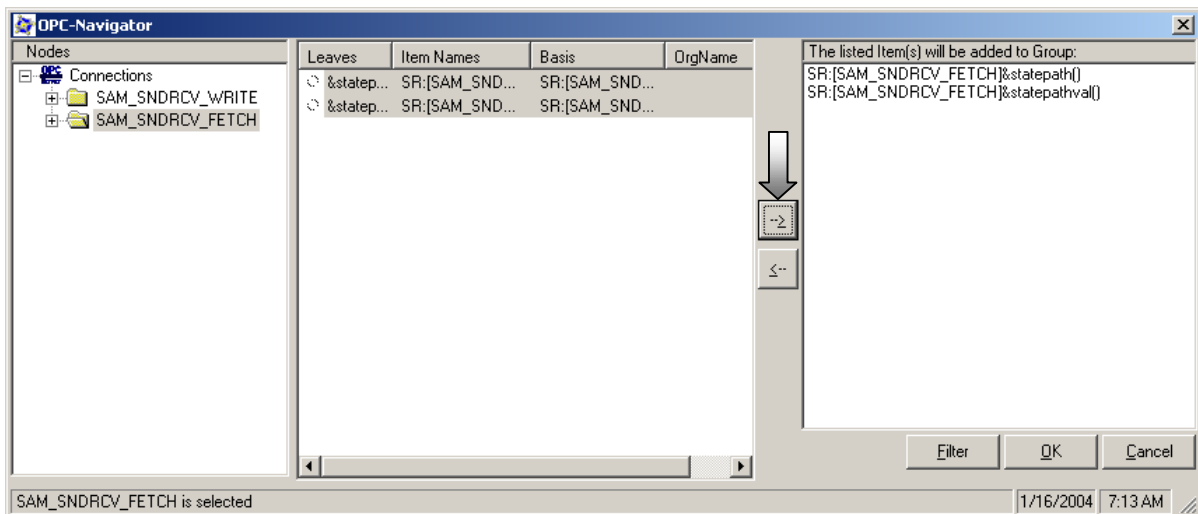


SEND/RECEIVE with SIGMA AIR MANAGER

The OPC Navigator opens and shows a list of the links that have been planned with NetPro (see 3.2.3) – here, for example, a FETCH and a WRITE connection to SIGMA AIR MANAGER. First the FETCH connection and then the two corresponding standard items are marked in the centre window.

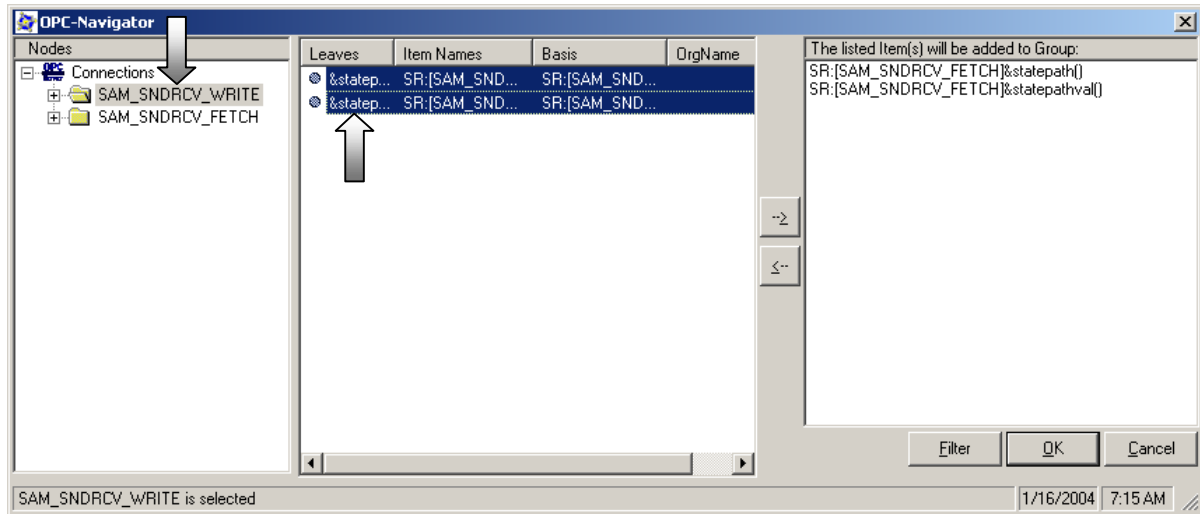


The two marked standard items are added to the new OPC group by clicking on the upper arrow button.

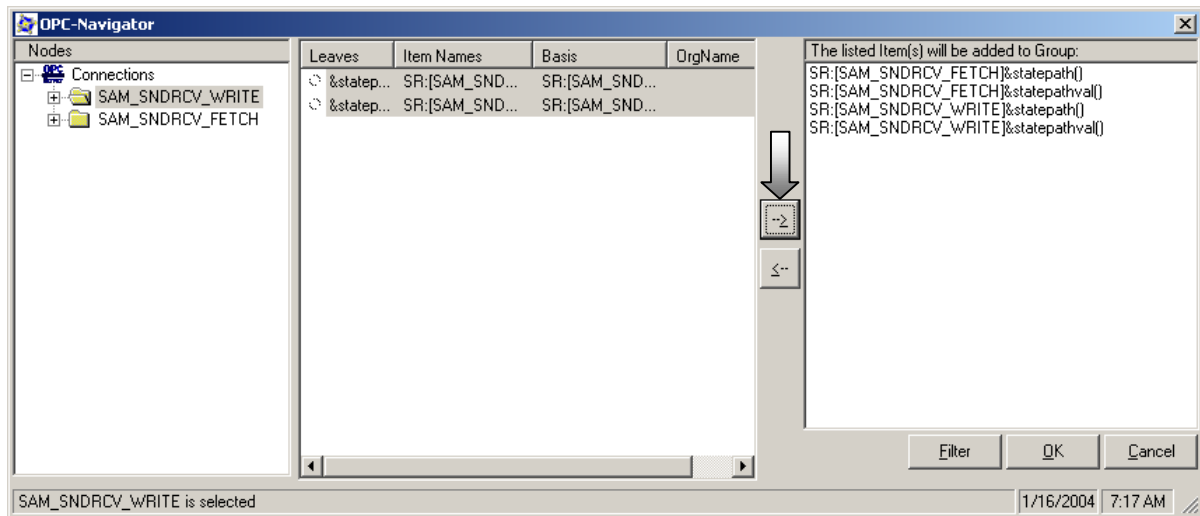


SEND/RECEIVE with SIGMA AIR MANAGER

Now the WRITE connection and then the two corresponding standard items are marked in the centre window.

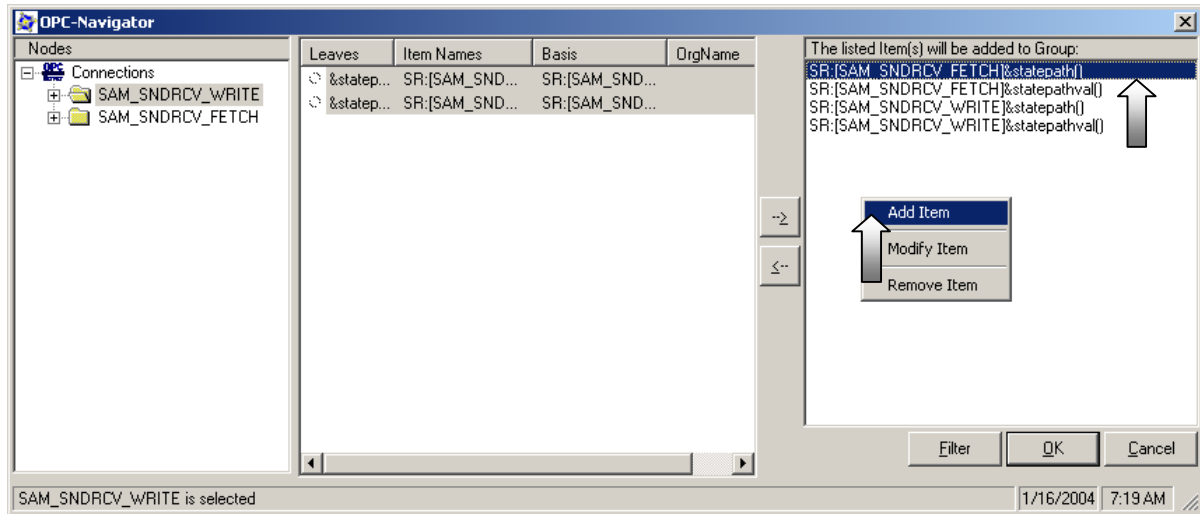


The two marked standard items are added to the new OPC group by clicking on the upper arrow button.

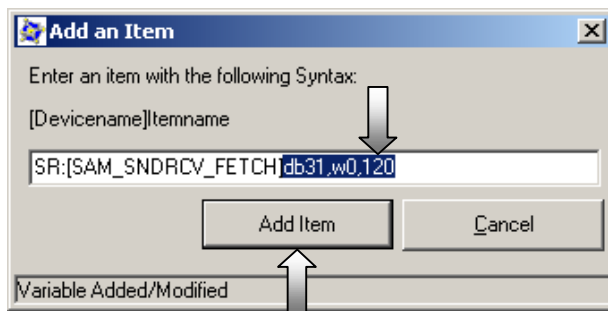


SEND/RECEIVE with SIGMA AIR MANAGER

One FETCH standard item in the OPC group is marked with the right mouse button and "Add Item" is selected in the context menu.

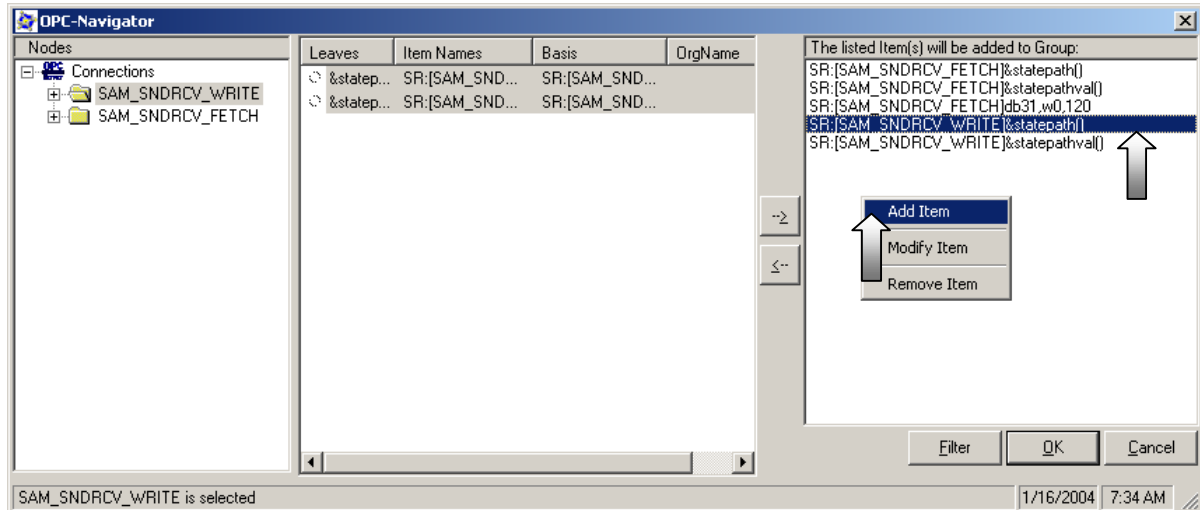


The variable name (Item ID) is then given as per the syntax rules (db.,w.,*wordnum*) and as a result the process variable(s) to be read are selected. Afterwards, this variable (Item) is added to the OPC group.

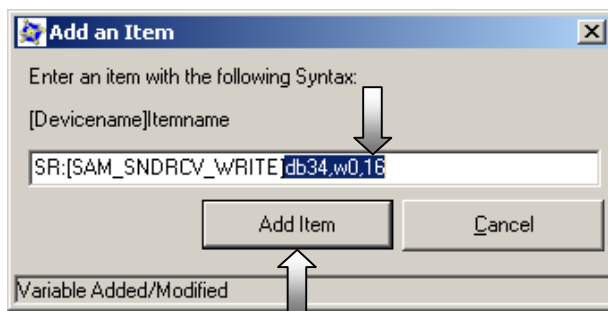


SEND/RECEIVE with SIGMA AIR MANAGER

The added FETCH variable (FETCH item) now appears in the item list (right-hand window). Now; one WRITE standard item in the OPC group is marked with the right mouse button and “Add Item” is selected in the context menu.

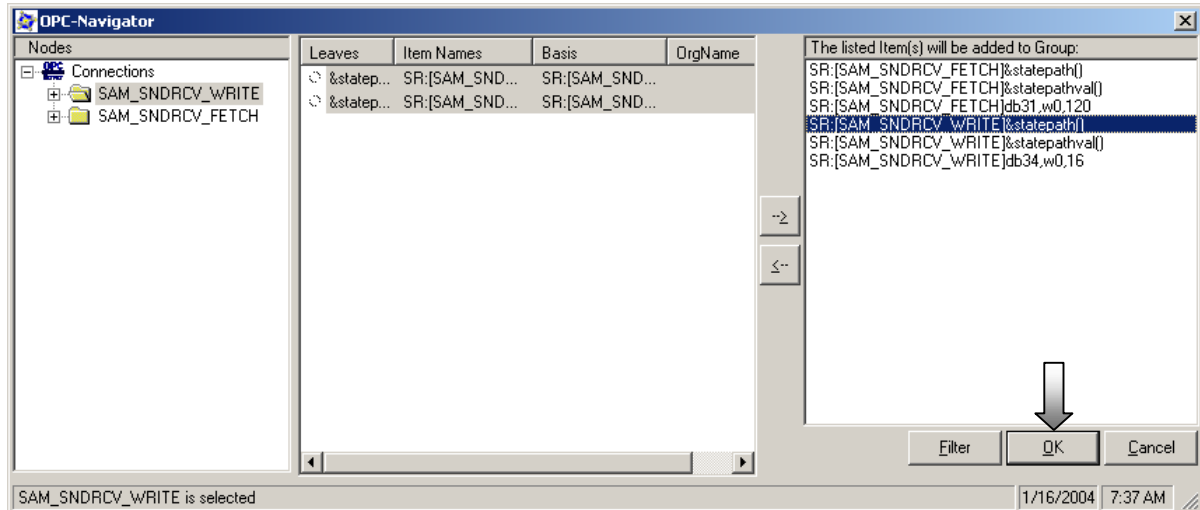


The variable name (Item ID) is then given as per the syntax rules (db...,w...,wordnum) and as a result the process variable(s) to be read are selected. Afterwards, this variable (Item) is added to the OPC group.

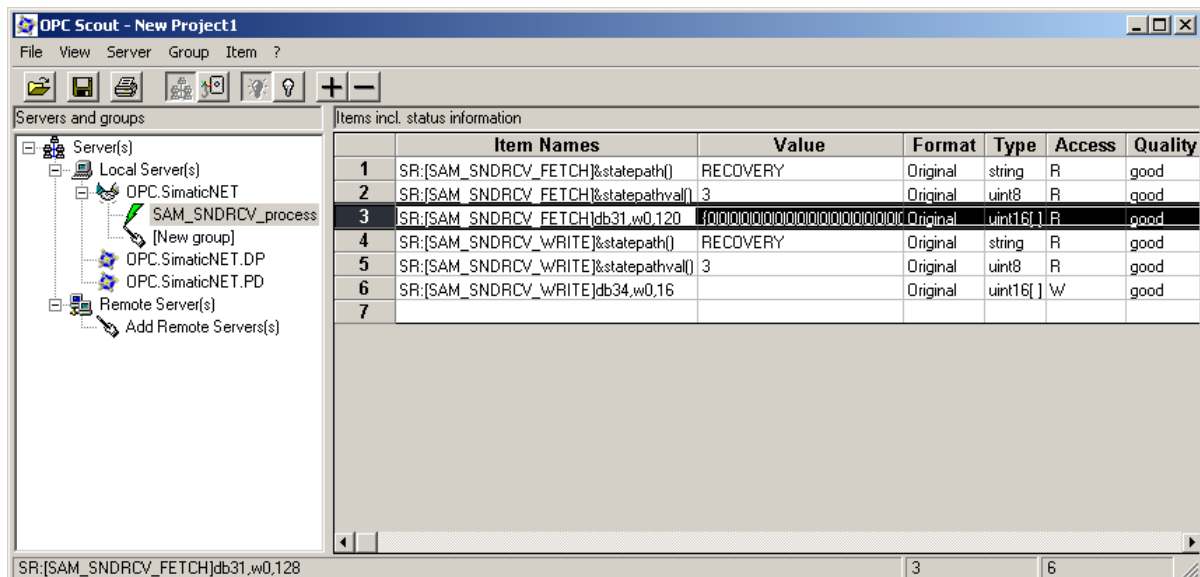


SEND/RECEIVE with SIGMA AIR MANAGER

The added WRITE variable (WRITE item) now appears in the item list (right-hand window). In this way, a concrete FETCH item and a concrete WRITE item are added to the OPC group. Then the OPC Navigator is closed.



All the items and their values in the OPC group are shown in the OPC Scout, especially the transfer quality via the SEND/RECEIVE connection. Values can be given to writeable items (WRITE items, access rights) and transferred to the partner. The OPC Scout can be closed if no longer needed.



4 Data Interface

4.1 Monitoring the Link

The SEND/RECEIVE link between SIGMA AIR MANAGER and the communications peer (PC) can be monitored in remote control mode. This is made possible by a **handshake** program that is stored in SIGMA AIR MANAGER and activated and used by the communications peer. The parameters for the handshake program are the activating bit, the handshake bit and the handshake period that can all be preset via SEND/RECEIVE. The related S5 addresses (datablock, dataword) are quoted in the table of all available remote control functions (see 4.2). The handshake period is 10 to 9990 seconds.

When handshake is activated (activating bit), the communications peer must set the handshake bit cyclically in, for example, an OPC client application. SIGMA AIR MANAGER resets the handshake bit and at the same time starts the handshake period. The handshake bit must be recognised as being set again before the period expires. Otherwise SIGMA AIR MANAGER reports a SEND/RECEIVE fault, closes down all SEND/RECEIVE functions and reverts back to LOCAL settings (SAM-internal settings).

4.2 Remote Control Functions

The requirements for the remote control of SIGMA AIR MANAGER functions are that SEND/RECEIVE is activated and then restarted again, and that remote control mode is activated.

SEND/RECEIVE control functions have a higher priority than corresponding operative functions on SIGMA AIR MANAGER or input functions (control by digital inputs).

If, for example, the command "System ON" is sent, then the air system cannot be switched off, neither by pressing the OFF key on SIGMA AIR MANAGER nor via the activated "Remote OFF/ON" input function. A corresponding remark is displayed on SIGMA AIR MANAGER every time the operator presses the deactivated ON/OFF key. To switch off the air system on SIGMA AIR MANAGER, stop remote control mode by pressing the REMOTE key and then switch off the system by pressing the ON/OFF key.

The following remote control functions are available as well as the handshake function for link monitoring (see 4.1):

- **Compressed air system OFF/ON function**
- **Toggling between "Manual" and "Automatic" modes**
- **Clock mode ON/OFF**
- **Reset of current alarms, service and warning messages**
- **Selection and de-selection of online compressors (each compressor)**
- **Selection and de-selection of standby compressors (each group)**

SEND/RECEIVE with SIGMA AIR MANAGER

- Preset of pressure setpoint (in millibar)
- Preset of group sequence

SEND/RECEIVE control data that have been released are in S5 data block 34 and are listed below. Other data may not be overwritten. If other data are overwritten the internal data structure will be damaged and function errors or failure of SIGMA AIR MANAGER will occur. KAESER will not accept any liability or provide any warranty for such damage.

There is an **activating bit** for every SEND/RECEIVE function and one or more **control bits** or **control values**. The activating bit activates the respective function and deactivates the respective local setting (SAM-internal setting). The control bits and control values control the function itself. The available SEND/RECEIVE functions with their related S5 addresses are listed in the table below (DB = data block, DW = data word, Bit = bit number):

Function	Activation			Control		
	DB	DW	Bit	DB	DW	Bit
Link monitoring handshake	34	0	0	34	0	1
Handshake period in seconds (10...9990)				34	1 (KF-count)	
Air system: 0 = OFF / 1 = ON	34	2	0	34	2	1
Air system: 0 = manual / 1 = automatic	34	2	2	34	2	3
Clock mode: 0 = OFF / 1 = ON	34	2	4	34	2	5
Message reset: 0 ► 1 (positive flank) = reset	34	2	6	34	2	7
Compressor 1: 0 = deselect / 1 = select	34	4	0	34	5	0
Compressor 2: 0 = deselect / 1 = select	34	4	1	34	5	1
Compressor 3: 0 = deselect / 1 = select	34	4	2	34	5	2
Compressor 4: 0 = deselect / 1 = select	34	4	3	34	5	3
Compressor 5: 0 = deselect / 1 = select	34	4	4	34	5	4
Compressor 6: 0 = deselect / 1 = select	34	4	5	34	5	5
Compressor 7: 0 = deselect / 1 = select	34	4	6	34	5	6
Compressor 8: 0 = deselect / 1 = select	34	4	7	34	5	7
Compressor 9: 0 = deselect / 1 = select	34	4	8	34	5	8
Compressor 10: 0 = deselect / 1 = select	34	4	9	34	5	9
Compressor 11: 0 = deselect / 1 = select	34	4	10	34	5	10
Compressor 12: 0 = deselect / 1 = select	34	4	11	34	5	11
Compressor 13: 0 = deselect / 1 = select	34	4	12	34	5	12
Compressor 14: 0 = deselect / 1 = select	34	4	13	34	5	13
Compressor 15: 0 = deselect / 1 = select	34	4	14	34	5	14
Compressor 16: 0 = deselect / 1 = select	34	4	15	34	5	15

Function	Activation			Control		
	DB	DW	Bit	DB	DW	Bit
Standby compressor group A: 0 = no / 1 = yes	34	6	0	34	6	8
Standby compressor group B: 0 = no / 1 = yes				34	6	9
Standby compressor group C: 0 = no / 1 = yes				34	6	10
Standby compressor group D: 0 = no / 1 = yes				34	6	11
Pressure setpoint in millibar. The internal pressure setpoint is selected when the set, permitted area is exited.	34	6	4	34	7 (KF-count)	
Group sequence 1. priority: 0 = "blank" / 1 = A / 2 = B / 3 = C / 4 = D	34	6	6	34	8 (KF-count)	
Group sequence 2. priority: 0 = "blank" / 1 = A / 2 = B / 3 = C / 4 = D				34	9 (KF-count)	
Group sequence 3. priority: 0 = "blank" / 1 = A / 2 = B / 3 = C / 4 = D				34	10 (KF-count)	
Group sequence 4. priority: 0 = "blank" / 1 = A / 2 = B / 3 = C / 4 = D				34	11 (KF-count)	
Group sequence 5. priority: 0 = "blank" / 1 = A / 2 = B / 3 = C / 4 = D				34	12 (KF-count)	
Group sequence 6. priority: 0 = "blank" / 1 = A / 2 = B / 3 = C / 4 = D				34	13 (KF-count)	
Group sequence 7. priority: 0 = "blank" / 1 = A / 2 = B / 3 = C / 4 = D				34	14 (KF-count)	

4.3 Process Data

It is conditional for readout of SIGMA AIR MANAGER's process data that SEND/RECEIVE is activated and then restarted. Remote control mode does not have to be activated in order to read out data.

The process data are continually actualised (PLC-cyclic) and contain all the relevant operational states and process values of SIGMA AIR MANAGER and the online compressors. The following process data are available:

- **Process image of SIGMA AIR MANAGER in the S5 data block 31 (see Annex A)**
- **Process images of the online SIGMA CONTROL compressors in the S5 data blocks 64 to 79 (see Annex B)**
- **Status bits for monitoring SEND/RECEIVE communication**

The process images of SIGMA AIR MANAGER and the SIGMA CONTROL compressors and the related S5 addresses are shown in the tables in Annexes A and B.

SEND/RECEIVE with SIGMA AIR MANAGER

Principally, the process images provide all the data needed that can also be visualised by SIGMA AIR CONTROL basic. The status bits for monitoring SEND/RECEIVE communication are listed in the table below (DB = data block, DW = data word, bit = bit number):

Meaning	status		
	DB	DW	Bit
SEND/RECEIVE is activated on SIGMA AIR MANAGER (activated in the menu option).	36	56	0
SEND/RECEIVE is activated on SIGMA AIR MANAGER (after restart, application loaded, read allowed).	36	56	2
SIGMA AIR MANAGER is running in remote control mode.	36	56	3
SIGMA AIR MANAGER is ready for execution of SEND/RECEIVE remote control functions. (SEND/RECEIVE and remote control mode active)	36	56	4
The handshake for link monitoring is active.	36	56	8
The handshake for link monitoring is running correctly.	36	56	10
Handshake error: the handshake bit was not recognised (local settings are operative).	36	56	11
Handshake error: the handshake period is inadmissible (local settings are operative).	36	56	12

Annex A: SIGMA AIR MANAGER Process Image

All relevant status bits and/or status values of SIGMA AIR MANAGER together with their corresponding S5 addresses are listed and described (DB = data block, DW = data word, bit = bit number) in the table below (valid for version v0.14).

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Data words 0...3: Communication alarms			
Alarm message 16...1: Compressor 16...1 bus alarm (diagnosis) (A) <i>The bus master (SAM) detected a slave bus fault (SC).</i>	31	0	15...0
Alarm message 32...17: Compressor 16...1 bus alarm (from SC) (A) <i>SC reports a SAM fault or toggle bit error.</i>	31	1	15...0
Alarm message 33: Bus expander slave 20 bus alarm (diagnosis) (A)	31	2	0
Alarm message 34: Bus expander slave 21 bus alarm (diagnosis) (A)	31	2	1
Alarm message 35: Bus expander slave 22 bus alarm (diagnosis) (A)	31	2	2
Alarm message 36: Bus expander slave 23 bus alarm (diagnosis) (A)	31	2	3
Alarm message 37: Bus expander slave 24 bus alarm (diagnosis) (A)	31	2	4
Alarm message 38: Bus expander slave 25 bus alarm (diagnosis) (A)	31	2	5
Alarm message 39: Bus expander slave 26 bus alarm (diagnosis) (A)	31	2	6
Alarm message 40: Bus expander slave 27 bus alarm (diagnosis) (A)	31	2	7
Alarm message 41: Bus expander slave 28 bus alarm (diagnosis) (A)	31	2	8
Alarm message 42: Bus expander slave 32 bus alarm (diagnosis) (A)	31	2	9
Alarm message 43: Bus expander slave 36 bus alarm (diagnosis) (A)	31	2	10
Alarm message 44: Bus expander slave 44 bus alarm (diagnosis) (A) <i>The bus master (SAM) detected a slave bus fault (I/O slave).</i>	31	2	11...0
Alarm message 49: Profibus DP not running (A) <i>The bus master (SAM) is in STOP (not ready for operation). Manual mode!</i>	31	3	0
Alarm message 50: Profibus DP planning error (A) <i>The data blocks required are not configured. Manual mode!</i>	31	3	1
Alarm message 57: SMS couldn't be transmitted (code) (A) <i>An SMS couldn't be transmitted on both channels.</i>	31	3	8
Alarm message 58: SAC plus group fault (code) (A) <i>The function unit for SAC plus reports an error (error code).</i>	31	3	9
Alarm message 59: SND/RCV alarm (A) <i>The handshake bit was not sent back by SND/RCV.</i>	31	3	10

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Data words 4...9: Compressor alarms / Diverse alarms			
Alarm message 80...65: Compressor 16...1 group alarm (A) <i>Error bit from SC (bus data) or input signal from conventional compressor.</i>	31	4	15...0
Alarm message 96...81: Compressor 16...1 does not switch to load (A) <i>Compressor does not switch to load within specified period after load signal.</i>	31	5	15...0
Alarm message 100: Summer/winter changeover system error (A) <i>Error occurred during RTC (system clock setting).</i>	31	6	3
Alarm message 101: EEPROM read error (A) <i>Error occurred during EEPROM data readout.</i>	31	6	4
Alarm message 102: EEPROM write error (A) <i>Error occurred when writing data to EEPROM.</i>	31	6	5
Alarm message 113: Pressure transducer 1 open circuit (A) <i>Analog 4...20 mA pressure less than limit (3 mA). Transducer 2 or manual.</i>	31	7	0
Alarm message 114: Pressure transducer 1 short circuit (A) <i>Analog 4...20 mA pressure greater than limit (21 mA). Transducer 2 or manual.</i>	31	7	1
Alarm message 115: Pressure transducer 2 open circuit (A) <i>Analog 4...20 mA pressure less than limit (3 mA). Change to transducer 1.</i>	31	7	2
Alarm message 116: Pressure transducer 2 short circuit (A) <i>Analog 4...20 mA pressure greater than limit (21 mA). Change to transducer 1.</i>	31	7	3
Alarm message 117: Pressure lower than minimum (A) <i>Pressure lower than minimum pressure setpoint.</i>	31	7	4
Alarm message 118: None of pressure transducers activated (A) <i>No analog input to a pressure transducer is activated. Manual mode!</i>	31	7	5
Alarm message 119: Speed from variable speed compressor open cct (A) <i>Analog speed value from variable speed compressor less than limit (3 mA).</i>	31	7	6
Alarm message 120: Speed from variable speed compressor short cct (A) <i>Analog speed value from variable speed compressor greater than limit (21 mA).</i>	31	7	7
Alarm message 121: Pressure setpoint from AI open circuit (A) <i>Analog pressure setpoint from AI less than limit (3 mA).</i>	31	7	8
Alarm message 122: Pressure setpoint from AI short circuit (A) <i>Analog pressure setpoint from AI greater than limit (21 mA).</i>	31	7	9

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Alarm message 130: System FLASH error (A) <i>Checksum error from FLASH memory test. Manual mode!</i>	31	8	1
Alarm message 131: System RAM error (A) <i>Error during read/write test of the RAM. Manual mode!</i>	31	8	2
Alarm message 132: System temperature too high (A) <i>Equipment internal temperature too high. Manual mode!</i>	31	8	3
Alarm message 133: System temperature too low (A) <i>Equipment internal temperature too low. Manual mode!</i>	31	8	4
Alarm message 135: System HEAP error (A) <i>The system memory is overloaded. Manual mode!</i>	31	8	6
Alarm message 136: System TRAP error (A) <i>The system interrupt is overloaded. Manual mode!</i>	31	8	7
Alarm message 137: System PC card slots deactivated (A) <i>PC card slots deactivated (over/under temperature). Restart!</i>	31	8	8
Alarm message 139: System application error (A) <i>An online application reports an error. No manual mode!</i>	31	8	10
Alarm message 140: System application error (A) <i>An online application reports an error. Manual mode!</i>	31	8	11
Alarm message 141: System output test, card 1 error (A) <i>Overcurrent, overload or short cct on 1st I/O card. Manual mode!</i>	31	8	12
Alarm message 142: System output test, card 2 error (A) <i>Overcurrent, overload or short cct on 2nd I/O card. Manual mode!</i>	31	8	13
Alarm message 143: System output test, card 3 error (A) <i>Overcurrent, overload or short cct on 3rd I/O card. Manual mode!</i>	31	8	14
Alarm message 144: System output test, card 4 error (A) <i>Overcurrent, overload or short cct on 4th I/O card. Manual mode!</i>	31	8	15
Data words 10..0.11: Freely definable alarms			
Alarm messages 176...161: Text freely definable (A) <i>As per input signal from external sensor (connection, level, time can be set).</i>	31	10	15...0
Data words 12...15: Predefined alarms			
Alarm messages 208...193: Centrifugal separator 16...1 condensate drain (A) <i>As per input signal from external sensor (connection, level, time can be set).</i>	31	12	15...0

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Alarm messages 216...209: Dryer 8...1 high dew point (A) <i>As per input signal from external sensor (connection, level, time can be set).</i>	31	13	7...0
Alarm messages 216...209: Dryer 8...1 high dew point (A) <i>As per input signal from external sensor (connection, level, time can be set).</i>	31	13	7...0
Alarm messages 224...217: Dryer 8...1 alarm (A) <i>As per input signal from external sensor (connection, level, time can be set).</i>	31	13	15...8
Alarm message 225: Dryer 1 condensate drain 1 (A)	31	14	0
Alarm message 226: Dryer 1 condensate drain 2 (A)	31	14	1
Alarm message 227: Dryer 2 condensate drain 1 (A)	31	14	2
Alarm message 228: Dryer 2 condensate drain 2 (A)	31	14	3
Alarm message 229: Dryer 3 condensate drain 1 (A)	31	14	4
Alarm message 230: Dryer 3 condensate drain 2 (A)	31	14	5
Alarm message 231: Dryer 4 condensate drain 1 (A)	31	14	6
Alarm message 232: Dryer 4 condensate drain 2 (A)	31	14	7
Alarm message 233: Dryer 5 condensate drain 1 (A)	31	14	8
Alarm message 234: Dryer 5 condensate drain 2 (A)	31	14	9
Alarm message 235: Dryer 6 condensate drain 1 (A)	31	14	10
Alarm message 236: Dryer 6 condensate drain 2 (A)	31	14	11
Alarm message 237: Dryer 7 condensate drain 1 (A)	31	14	12
Alarm message 238: Dryer 7 condensate drain 2 (A)	31	14	13
Alarm message 239: Dryer 8 condensate drain 1 (A)	31	14	14
Alarm message 240: Dryer 8 condensate drain 2 (A)	31	14	15
<i>As per input signal from external sensor (connection, level, time can be set).</i>	31	14	15...0
Alarm message 241: Air receiver 1 condensate drain (A) <i>As per input signal from external sensor (connection, level, time can be set).</i>	31	15	0
Alarm message 242: Air receiver 2 condensate drain (A) <i>As per input signal from external sensor (connection, level, time can be set).</i>	31	15	1
Alarm messages 250...243: Filter 8...1 condensate drain (A) <i>As per input signal from external sensor (connection, level, time can be set).</i>	31	15	9...2
Alarm messages 256...251: Condensate treatment 6...1 (A) <i>As per input signal from external sensor (connection, level, time can be set).</i>	31	15	15...10

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Data words 18..23: Compressor service / various service routines			
Service message 272...257: Compressors 16...1 Group maintenance (S) <i>At least one service message bit from SC (bus data) is set.</i>	31	18	15...0
Service message 288...273: Compressors 16...1 Group maintenance (S) <i>SAM's service hours counter is active and empty (<= 0).</i>	31	19	15...0
Service message 289: Change SAM system buffer battery (S) <i>The buffer battery in SAM is empty and must be changed.</i>	31	20	0
Data words 24...25: Predefined service routines			
Service message 369: Filter 1 Differential pressure 1 (S)	31	25	0
Service message 370: Filter 1 Differential pressure 2 (S)	31	25	1
Service message 371: Filter 2 Differential pressure 1 (S)	31	25	2
Service message 372: Filter 2 Differential pressure 2 (S)	31	25	3
Service message 373: Filter 3 Differential pressure 1 (S)	31	25	4
Service message 374: Filter 3 Differential pressure 2 (S)	31	25	5
Service message 375: Filter 4 Differential pressure 1 (S)	31	25	6
Service message 376: Filter 4 Differential pressure 2 (S)	31	25	7
Service message 377: Filter 5 Differential pressure 1 (S)	31	25	8
Service message 378: Filter 5 Differential pressure 2 (S)	31	25	9
Service message 379: Filter 6 Differential pressure 1 (S)	31	25	10
Service message 380: Filter 6 Differential pressure 2 (S)	31	25	11
Service message 381: Filter 7 Differential pressure 1 (S)	31	25	12
Service message 382: Filter 7 Differential pressure 2 (S)	31	25	13
Service message 383: Filter 8 Differential pressure 1 (S)	31	25	14
Service message 384: Filter 8 Differential pressure 2 (S)	31	25	15
<i>As per input signal from external sensor (connection, level, time can be set).</i>	31	25	15...0
Data words 26...29: Compressor warnings / Various warnings			
Warning 400...385: Compressor 16...1 Group warning (W) <i>At least one warning message bit from SC (bus data) is set.</i>	31	26	15...0
Warning 416...401: Compressor 16...1 not in REMOTE mode (W) <i>SC is not switched on or not in remote mode.</i>	31	27	15...0
Warning 432...417: Compressor 16...1 Data incomplete (W) <i>FAD and/or power consumption data have not been entered.</i>	31	28	15...0

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Data words 30...31: Freely definable service / Alarm messages			
Service/warning messages 488...481: Message text freely enterable (S/W) <i>As per input signal from external sensor (connection, level, time can be set.)</i>	31	30	7...0
Data words 32...36: Binary signals			
"SYSTEM OFF" = Current system operating mode <i>All online compressors are switched to idle/OFF mode.</i>	31	32	0
"SYSTEM MANUAL" = Current system operating mode <i>All online compressors are switched to manual (own control) mode.</i>	31	32	1
"SYSTEM AUTO" = Current system operating mode <i>All online compressors are switched to remote (automatic) mode.</i>	31	32	2
"START DELAY" = Current system operating mode <i>All online compressors switched to idle/OFF mode until the start delay period has expired.</i>	31	32	3
"MAINS CHARGING" = Current system operating mode <i>The number of on load compressors is limited until the mains charging period has expired.</i>	31	32	4
Clock mode is on or preselected. <i>Pressure setpoint and group sequence from current switching point data.</i>	31	33	0
Remote mode switched on. <i>Several functions can be controlled via input functions or SEND/RECEIVE.</i>	31	33	8
"OFF/ON" (input) signal from control room. <i>Switches Off/On when input function "REMOTE OFF/ON" and remote mode are active.</i>	31	34	8
The "REMOTE OFF/ON" input function is activated on SAM. <i>SAM must be in remote mode to execute this function.</i>	31	34	9
"MANUAL/AUTO" (input) signal from control room. <i>Switches man/auto if input function "REMOTE MANUAL/AUTO" and remote mode are active.</i>	31	34	10
The "REMOTE MANUAL/AUTO" input function is activated on SAM. <i>SAM must be in remote mode to execute this function.</i>	31	34	11
"CLOCK OFF/ON" (input) signal from control room. <i>Switches clock mode Off/On, when input function "REMOTE CLOCK" and remote mode are active.</i>	31	34	12
The "REMOTE CLOCK" input function is activated on SAM. <i>SAM must be in remote mode to execute this function.</i>	31	34	13

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
System is switched off via SEND/RECEIVE from the control room.	31	35	0
System is switched on via SEND/RECEIVE from the control room.	31	35	1
Manual mode is preselected via SEND/RECEIVE from the control room.	31	35	2
Automatic mode is preselected via SEND/RECEIVE from the control room.	31	35	3
Clock mode is switched off via SEND/RECEIVE from the control room.	31	35	4
Clock mode is switched on via SEND/RECEIVE from the control room.	31	35	5
Pulse bit from SEND/RECEIVE for acknowledgement of actual alarms.	31	35	7
A standby compressor is required for group A via SEND/RECEIVE.	31	35	8
A standby compressor is required for group B via SEND/RECEIVE.	31	35	9
A standby compressor is required for group C via SEND/RECEIVE.	31	35	10
A standby compressor is required for group D via SEND/RECEIVE.	31	35	11
The standby compressors are selected via SEND/RECEIVE.	31	35	12
The pressure setpoint is set via SEND/RECEIVE from the control room.	31	35	13
The group sequence is selected via SEND/RECEIVE from the control room.	31	35	14
<i>Remote mode and SEND/RECEIVE are active.</i>	31	35	14...0
Data word 37: LED status			
Status bit for LED "SYSTEM ON". <i>0 = LED off, 1 = LED flashes or lights permanently.</i>	31	37	0
Status bit for LED "SYSTEM ON". <i>0 = LED off or flashes, 1 = LED lights permanently.</i>	31	37	1
Status bit for LED "AUTOMATIC". <i>0 = LED off, 1 = LED flashes or lights permanently.</i>	31	37	2
Status bit for LED "AUTOMATIC". <i>0 = LED off or flashes, 1 = LED lights permanently.</i>	31	37	3
Status bit for LED "CLOCK MODE". <i>0 = LED off, 1 = LED flashes or lights permanently.</i>	31	37	4
Status bit for LED "CLOCK MODE". <i>0 = LED off or flashes, 1 = LED lights permanently.</i>	31	37	5
Status bit for LED "REMOTE MODE". <i>0 = LED off, 1 = LED flashes or lights permanently.</i>	31	37	6
Status bit for LED "REMOTE MODE". <i>0 = LED off or flashes, 1 = LED lights permanently.</i>	31	37	7

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Status bit for LED "GENERAL ALARM". <i>0 = LED off, 1 = LED flashes or lights permanently.</i>	31	37	8
Status bit for LED "GENERAL ALARM". <i>0 = LED off or flashes, 1 = LED lights permanently.</i>	31	37	9
Status bit for "COMMUNICATION ALARM". <i>0 = LED off, 1 = LED flashes or lights permanently.</i>	31	37	10
Status bit for "COMMUNICATION ALARM". <i>0 = LED off or flashes, 1 = LED lights permanently.</i>	31	37	11
Status bit for LED "PRESSURE LOW WARNING". <i>0 = LED off, 1 = LED flashes or lights permanently.</i>	31	37	12
Status bit for LED "PRESSURE LOW WARNING". <i>0 = LED off or flashes, 1 = LED lights permanently.</i>	31	37	13
Status bit for LED "SERVICE/WARNING" <i>0 = LED off, 1 = LED flashes or lights permanently.</i>	31	37	14
Status bit for LED "SERVICE/WARNING" <i>0 = LED off or flashes, 1 = LED lights permanently.</i>	31	37	15
Data words 38...57: Compressor operational status			
Compressor 16...1 (remote) on and no alarm, online	31	38	15...0
Compressor 16...1 (remote) off or alarm, existing	31	39	15...0
Compressor 16...1 Group maintenance	31	40	15...0
Compressor 16...1 Group warning	31	41	15...0
Compressor 16...1 Local mode	31	42	15...0
Compressor 16...1 Controller switched on	31	43	15...0
Compressor 16...1 Motor running	31	44	15...0
Compressor 16...1 Idle mode	31	45	15...0
Compressor 16...1 On load	31	46	15...0
Compressor 16...1 Load control	31	47	15...0
Compressor 16...1 Can be cut in at the moment	31	48	15...0
Compressor 16...1 Preselect via the select key	31	49	15...0
Compressor 16...1 Preselect via the clock	31	50	15...0
Compressor 16...1 Preselect via the control centre	31	51	15...0
Compressor 16...1 Standby compressors	31	52	15...0
Compressor 16...1 Existing	31	53	15...0

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Compressor 16...1 Online	31	54	15...0
Compressor 16...1 On Profibus	31	55	15...0
Compressor 16...1 Frequency controlled	31	56	15...0
Data words 58...63 Digital inputs to SAM			
Inputs DI 1.7 – DI 0.0	31	58	15...0
Inputs DI 2.7 – DI 2.0	31	59	7...0
Inputs DI 5.7 – DI 4.0	31	60	15...0
Inputs DI 6.7 – DI 6.0	31	61	7...0
Inputs DI 9.7 – DI 8.0	31	62	15...0
Inputs DI 10.7 – DI 10.0	31	63	7...0
Data words 64...65 Digital outputs from SAM			
Outputs DO 4.7 - 4.0 / 0.7 - 0.0	31	64	15...0
Outputs DO 12.7 -12.0 / 8.7 -8.0	31	65	15...0
Data words 66...73 Analog inputs to SAM			
System pressure [mbar]	31	66	KF count
Analog inputs AI 1, 0-20mA [0...3276]	31	67	KF count
Analog inputs AI 16, 0-20mA [0...3276]	31	68	KF count
Analog inputs AI 17, 0-20mA [0...3276]	31	69	KF count
Analog inputs PT 0, PT100 [0.1 °C]	31	70	KF count
Analog inputs PT 1, PT100 [0.1 °C]	31	71	KF count
Analog inputs PT 8, PT100 [0.1 °C]	31	72	KF count
Analog inputs PT 9, PT100 [0.1 °C]	31	73	KF count
Data words 74...75 Analog outputs from SAM			
Analog output AO 0, 0-20mA [0...4095]	31	74	KF count
Analog output AO 8, 0-20mA [0...4095]	31	75	KF count
Data words 76...77: Extreme pressure values			
Maximum pressure since last reset [mbar]	31	76	KF count
Minimum pressure since last reset [mbar]	31	77	KF count
Data word 78 Pressure low warning			
Pressure low limit p-low [mbar]	31	78	KF count
Data words 79...91: Pressure band control			
Switching point po2 [mbar]	31	79	KF count

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Switching point po1 [mbar]	31	80	KF count
Switching point pu1 [mbar]	31	81	KF count
Switching point pu2 [mbar]	31	82	KF count
Pressure setpoint p-set [mbar]	31	83	KF count
Switching differential dph [mbar]	31	84	KF count
Delay period to2 [seconds]	31	85	KF count
Delay period to1 [seconds]	31	86	KF count
Delay period tu1 [seconds]	31	87	KF count
Delay period tu2 [seconds]	31	88	KF count
No. of cycles of tu2/to2 at pu2/po2	31	89	KF count
Data words 92...95: Group allocation			
Compressors 16...1 in group A	31	92	15...0
Compressors 16...1 in group B	31	93	15...0
Compressors 16...1 in group C	31	94	15...0
Compressors 16...1 in group D	31	95	15...0
Data words 96...97: Group sequence			
Current group sequence, priority 1 / 2 / 3 / 4 [0=# / 1=A / 2=B / 3=C / 4=D]	31	96	KH count
Current group sequence, priority 5 / 6 / 7 / - [0=# / 1=A / 2=B / 3=C / 4=D]	31	97	KH count
Data words 98...101 Date and time			
Current time: - / hours [- / 0...23]	31	98	KH count
Current time: minutes / seconds [0...59 / 0...59]	31	99	KH count
Current date: weekday / day [Mo...Su = 1...7 / 1...31]	31	100	KH count
Current date: month / year [Jan...Dec = 1...12 / 2000...2099 = 0...99]	31	101	KH count
Data words 102...119: System operational data			
Free air delivery HIGH-word [0.001 m ³ /min x 65536]	31	102	32-Bit- KF-count
Free air delivery LOW-word [0.001 m ³ /min]	31	103	
Power consumption HIGH-word [0.001 kW x 65536]	31	104	32-Bit- KF-count
Power consumption LOW-word [0.001 kW]	31	105	
Overall free air delivery HIGH-Word [m ³ x 65536]	31	106	32-Bit- KF-count
Overall free air delivery LOW-Word [m ³]	31	107	
Overall free air delivery since - / hours [- / 0...23]	31	108	KY count

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Overall free air delivery since: minutes / seconds [0...59 / 0...59]	31	109	KY count
Overall free air delivery since: weekday / day [Mo...Su = 1...7 / 1...31]	31	110	KY count
Overall free air delivery since: month / year [Jan...Dec = 1...12 / 2000...2099 = 0...99]	31	111	KY count
Overall power consumption HIGH-Word [kWh x 65536]	31	112	32-Bit- KF-count
Overall power consumption LOW-word [kWh]	31	113	
Overall power consumption since [- / 0...23]	31	114	KY count
Overall power consumption since: minutes / seconds [0...59 / 0...59]	31	115	KY count
Overall power consumption since: weekday / day [Mo...Su = 1...7 / 1...31]	31	116	KY count
Overall power consumption since: month / year [Jan...Dec = 1...12 / 2000...2099 = 0...99]	31	117	KY count
Duty cycle [0.1%]	31	118	KF count
Load power [0.1%]	31	119	KF count

Annex B: SIGMA CONTROL Process Image

All SIGMA CONTROL's relevant status bits and status values **compressors 1 to 16** are stored in the **S5 data blocks 64 to 79**, i.e. compressor 1 in DB 64, compressor 2 in DB 65 and so on. They are listed in the table below (valid for v72.08) and explained (DB = data word, bit = bit number).

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Data words 0...3: Control from SIGMA AIR MANAGER			
Load run ON (when D 64/0/1 = 1)	64	0	1
Load control via Profibus ON	64	0	2
Compressor ON from the "I" key	64	1	0
Compressor ON from the "I" key and timer	64	1	1
Compressor ON from the "I" key and external contact	64	1	4
Compressor ON from the "I" key and Profibus	64	1	6
Compressor ON (when D 64/1/6 = 1)	64	1	7
Control mode: DUAL	64	1	8
Control mode: QUADRO 3	64	1	9
Control mode: VARIO 1	64	1	10
Control mode: continuous	64	1	12
Load control from external contact ON	64	2	4
Load control via Profibus ON	64	2	6
Load run ON (when D 64/2/2 = 1)	64	2	7
p1/p2 control: p1 permanent	64	2	8
p1/p2 control: p2 permanent	64	2	9
p1/p2 changeover: from timer	64	2	10
p1/p2 changeover: from timer	64	2	11
p1/p2 changeover: from external contact	64	2	13
p1/p2 changeover: from RS 485	64	2	14
Enable "Clock" key	64	3	0
Enable "Remote" key	64	3	1
Enable "Idle" key	64	3	2
Automatic restart after return of power ON	64	3	3
Reserved (initial dryer run)	64	3	4
Message reset via Profibus ON	64	3	6

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Message reset signal (if D 64/3/7 = 1)	64	3	7
Accept signal for time	64	3	15
Data words 4...3: Control from SIGMA AIR MANAGER			
Setpoint pressure p1 [mbar]	64	4	KF count
Switching differential for p1 [mbar]	64	5	KF count
Setpoint pressure p2 [mbar]	64	6	KF count
Switching differential for p2 [mbar]	64	7	KF count
Time: - / hours [- / 0...23]	64	8	KY count
Time: minutes / seconds [0...59 / 0...59]	64	9	KY count
Date: weekday / day [Mo...Su = 1...7 / 1...31]	64	10	KY count
Date: month / year [Jan...Dec = 1...12 / 2000...2099 = 0...99]	64	11	KY count
Compressor start delay period [seconds]	64	12	KY count
Actual pressure (for variable speed drive) [mbar]	64	13	KF count
Reserved (password)	64	18	KF count
Message header (master)	64	19	KY count
Oil separator service interval [h]	64	20	KF count
Oil change service interval [h]	64	21	KF count
Oil filter service interval [h]	64	22	KF count
Air filter service interval [h]	64	23	KF count
V belts change service interval [h]	64	24	KF count
V belts tension service interval [h]	64	25	KF count
Motor bearing change service interval [h]	64	26	KF count
Electrical equipment service interval [h]	64	27	KF count
Motor bearings service interval [h]	64	28	KF count
Message footer (master)	64	31	KY count
Data words 32...36: Alarms			
Alarm 1: Airend rotation <i>Direction of drive motor rotation wrong.</i>	64	32	0
Alarm 2: Motor T ▲ <i>Permissible drive motor temperature exceeded (PTC, PT100).</i>	64	32	1
Alarm 3: pRV ▲ <i>TÜV check: Opening pressure of the pressure relief valve exceeded by 1.5 bar</i>	64	32	2

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Alarm 4: Emergency stop <i>Emergency stop button pressed.</i>	64	32	3
Alarm 5: Oil separator T ▲ <i>Permissible oil separator temperature exceeded.</i>	64	32	4
Alarm 6: Start T ▼ <i>Airend temperature too low for a compressor start (below +2 °C).</i>	64	32	5
Alarm 7: Electrical mains monitor <i>Power supply fault (separate network monitoring module).</i>	64	32	6
Alarm 8: Oil carry-over ▲ <i>Permissible oil content exceeded.</i>	64	32	7
Alarm 9: Sigma Control T ▲ <i>Sigma Control housing temperature above 70 °C.</i>	64	32	8
Alarm 10: Blow-off protection ▲ <i>Blow-off protection pressure exceeded.</i>	64	32	9
Alarm 11: Fan M2 ▲ <i>Fan M2: Overload trip.</i>	64	32	10
Alarm 12: Access doors <i>Access doors open.</i>	64	32	11
Alarm 13: Motor I ▲ <i>Drive motor: overload trip.</i>	64	32	12
Alarm 14: Fan M3 I ▲ <i>Fan M3: Overload trip.</i>	64	32	13
Alarm 15: ADT ▲ <i>Permissible airend discharge temperature exceeded.</i>	64	32	14
Alarm 16: Fan M4 I ▲ <i>Fan M4: Overload trip.</i>	64	32	15
Alarm 17: AI3 no cont <i>No continuity on analog input 3.</i>	64	33	0
Alarm 18: AI4 no cont <i>No continuity on analog input 4.</i>	64	33	1
Alarm 19: AI7 no cont <i>No continuity on analog input 7.</i>	64	33	2

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Alarm 20: AI8 no cont <i>No continuity on analog input 8.</i>	64	33	3
Alarm 21: KT T ▼ <i>Refrigeration dryer: Compressed air temperature too low. Risk of freezing.</i>	64	33	4
Alarm 22: Oil separator dp ▲ <i>Oil separator cartridge heavily clogged.</i>	64	33	5
Alarm 23: Motor bearings <i>Drive motor bearing defective.</i>	64	33	6
Alarm 24: Cooling water low <i>Not enough cooling water.</i>	64	33	7
Alarm 25: AI1 no cont <i>No continuity on analog input 1.</i>	64	33	8
Alarm 26: AI2 no cont <i>No continuity on analog input 2.</i>	64	33	9
Alarm 27: AI5 no cont <i>No continuity on analog input 5.</i>	64	33	10
Alarm 28: AI6 no cont <i>No continuity on analog input 6.</i>	64	33	11
Alarm 29: Sh. cct. AI3 <i>Short circuit on analog input 3.</i>	64	33	12
Alarm 30: Sh. cct. AI4 <i>Short circuit on analog input 4.</i>	64	33	13
Alarm 31: Sh. cct. AI7 <i>Short circuit on analog input 7.</i>	64	33	14
Alarm 32: Sh. cct. AI8 <i>Short circuit on analog input 8.</i>	64	33	15
Alarm 33: Oil p ▼ <i>Oil pressure too low.</i>	64	34	0
Alarm 34: Mains cont. on? <i>Mains contactor not pulling in.</i>	64	34	1
Alarm 35: Fan M7 I ▲ <i>Control cabinet fan M7: overload trip.</i>	64	34	2

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Alarm 36: O0.6/O0.7 I▲ <i>Short circuit on binary outputs O0.6/O0.7.</i>	64	34	3
Alarm 37: O1.6/O1.7 I▲ <i>Short circuit on binary outputs O1.6/O1.7.</i>	64	34	4
Alarm 38: PD T▼ <i>Permissible air outlet temperature too low.</i>	64	34	5
Alarm 39: PD T▲ <i>Permissible air outlet temperature exceeded.</i>	64	34	6
Alarm 40: mains cont. off? <i>Mains contactor not dropping out.</i>	64	34	7
Alarm 41: Mains voltage▼ <i>Power supply failure: The drive motor shut down.</i>	64	34	8
Alarm 42: Back pressure <i>Back pressure from the oil separator.</i>	64	34	9
Alarm 43: ADT dT/dt▲ <i>Permissible rate of rise of airend discharge temperature exceeded.</i>	64	34	10
Alarm 44: No press. buildup <i>Internal pressure does not reach 3.5 bar within a preset period.</i>	64	34	11
Alarm 45: ADT↓ <i>Airend discharge temperature does not reach min. value within preset period.</i>	64	34	12
Alarm 46: VFD <i>Variable frequency drive compressor fault.</i>	64	34	13
Alarm 48: HT cell <i>Fault in the high tension cell.</i>	64	34	15
Alarm 49: Sh. cct. AI1 <i>Short circuit on analog input 1.</i>	64	35	0
Alarm 50: Sh. cct. AI2 <i>Short circuit on analog input 2.</i>	64	35	1
Alarm 51: Sh. cct. AI5 <i>Short circuit on analog input 5.</i>	64	35	2
Alarm 52: Sh. cct. AI6 <i>Short circuit on analog input 6.</i>	64	35	3

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Alarm 57: Model <i>Model indistinct.</i>	64	35	8
Alarm 58: Condensate drain <i>Condensate drain defective.</i>	64	35	9
Alarm 59: V-belts broken <i>V-belts parted.</i>	64	35	10
Alarm 60: Softstarter <i>Softstarter defective.</i>	64	35	11
Alarm 62: RD compr. p▲ <i>Refrigeration dryer: Pressure switch protecting refrigerant compressor operated.</i>	64	35	13
Alarm 73: Ext. message 0	64	36	8
Alarm 74: Ext. message 1	64	36	9
Alarm 75: Ext. message 2	64	36	10
Alarm 76: Ext. message 3	64	36	11
Alarm 77: Ext. message 4	64	36	12
Alarm 78: Ext. message 5	64	36	13
Alarm 79: Neutral pressure switch	64	36	14
Alarm 80: Neutral temperature switch	64	36	15
<i>Message text can be selected as required on Sigma Control.</i>	64	36	15...8
Data words 37...41: Warning messages (service)			
Warning 1: Flash memory <i>System error: Flash memory defective.</i>	64	37	0
Warning 2: Motor T↑ <i>Initial warning: Permissible drive motor temperature reached soon (PTC, PT100).</i>	64	37	1
Warning 3: V-belt tension <i>V-belts too loose.</i>	64	37	2
Warning 4: Oil separator dp↑ <i>Oil separator cartridge clogged.</i>	64	37	3
Warning 5: Restart inhibit <i>Restart inhibit for compressor activated.</i>	64	37	4
Warning 6: Oil carry-over↑ <i>Initial warning: permissible oil content soon reached.</i>	64	37	5

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Warning 7: Motor bearings <i>Drive motor bearings defective.</i>	64	37	6
Warning 8: ADT↑ <i>Initial warning: permissible aircend discharge temperature soon reached.</i>	64	37	7
Warning 9: Error SMS	64	37	8
Warning 10: Buffer battery <i>System error: buffer battery discharged.</i>	64	37	9
Warning 11: Oil filter dp↑ <i>Oil filter clogged.</i>	64	37	10
Warning 12: Modem problem	64	37	11
Warning 13: Air filter dp▲ <i>Air filter clogged.</i>	64	37	12
Warning 14: Access doors <i>Access doors open.</i>	64	37	13
Warning 15: Bus error <i>Profibus connection error.</i>	64	37	14
Warning 16: RAM <i>System error: RAM defective.</i>	64	37	15
Warning 17: RDx T↓ <i>Refrigeration dryer: Compressed air temperature too low.</i>	64	38	0
Warning 25: Separator h▲ <i>Oil separator service interval exceeded.</i>	64	38	8
Warning 26: Oil change h▲ <i>Oil change service interval exceeded.</i>	64	38	9
Warning 27: Oil filter h▲ <i>Oil filter service interval exceeded.</i>	64	38	10
Warning 28: Air filter h▲ <i>Air filter service interval exceeded.</i>	64	38	11
Warning 29: V-belts h▲ <i>V-belts change service interval exceeded.</i>	64	38	12
Warning 30: Belt tension h▲ <i>V-belts tensioning service interval exceeded.</i>	64	38	13

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Warning 31: M bearing h ▲ <i>Motor bearings service interval exceeded.</i>	64	38	14
Warning 32: E-comp h ▲ <i>Electrical equipment check service interval exceeded.</i>	64	38	15
Warning 34: PD T ↓ <i>Initial warning: Lowest permissible package discharge temperature almost reached.</i>	64	39	1
Warning 35: PD T ↑ <i>Initial warning: Highest permissible package discharge temperature almost reached.</i>	64	39	2
Warning 36: Motor starts /h ▲ <i>Drive motor: Number of permissible starts per hour exceeded.</i>	64	39	3
Warning 37: Motor starts /d ▲ <i>Drive motor: Number of permissible starts per day exceeded.</i>	64	39	4
Warning 38: Blowoff prot. ↑ <i>Initial warning: Blow-off protection pressure soon reached.</i>	64	39	5
Alarm 41: Mains voltage ↓ <i>Power supply failure: Compressor was restarted automatically.</i>	64	39	8
Warning 42: TRAP interrupt ↑ <i>System message: TRAP interrupt.</i>	64	39	9
Warning 43: Ext. load signal <i>External load signal indistinct: Increased cut-out pressure exceeded.</i>	64	39	10
Warning 44: Oil T ↓ <i>Warning: Oil too cold for compressor to be put on load.</i>	64	39	11
Warning 45: Set output! <i>"Set output" function active.</i>	64	39	12
Warning 46: System press. ↓ <i>System pressure too low (compressor only).</i>	64	39	13
Warning 47: No press. build-up <i>No pressure build-up after compressor start.</i>	64	39	14
Warning 48: Bearings h ▲ <i>Motor bearings greasing interval exceeded.</i>	64	39	15

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Warning 49: Annual maint <i>Appears one year after last maintenance.</i>	64	40	0
Warning 58: RS485err <i>RS485 transmission error.</i>	64	40	9
Warning 59: Start T↓↓ <i>Airend temperature too low for compressor operation (below -10°C).</i>	64	40	10
Warning 60: Start T↓ <i>Airend temperature too low for a compressor start (below +2 °C).</i>	64	40	11
Warning 63: FC DM mains <i>Power failure to variable frequency drive (FC) compressor.</i>	64	40	14
Warning 66: Air filter dp↑ <i>Initial warning: Air filter clogged.</i>	64	41	1
Warning 67: System press.↑ <i>System pressure too high (compressor only).</i>	64	41	2
Warning 68: Condensate drain <i>Condensate drain defective.</i>	64	41	3
Warning 69: RD compr. p▲ <i>Refrigeration dryer: Refrigerant compressor pressure relief switch triggered.</i>	64	41	4
Warning 70: RD T↑ <i>Refrigeration dryer: Compressed air temperature too high.</i>	64	41	5
Warning 71: Oil level↓ <i>Oil level below minimum.</i>	64	41	6
Warning 73: Ext. message 0	64	41	8
Warning 74: Ext. message 1	64	41	9
Warning 75: Ext. message 2	64	41	10
Warning 76: Ext. message 3	64	41	11
Warning 77: Ext. message 4	64	41	12
Warning 78: Ext. message 5	64	41	13
Warning 79: Neutral pressure switch	64	41	14
Warning 80: Neutral temperature switch	64	41	15
<i>Message text can be selected as required on Sigma Control.</i>	64	41	15...8

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Data words 42...44: Operational messages			
Operational message 1: Load control p1 <i>Load control mode with setpoint pressure p1.</i>	64	42	0
Operational message 2: Load control p2 <i>Load control mode with setpoint pressure p2.</i>	64	42	1
Operational message 3: Load control RC <i>Load control from external contact.</i>	64	42	2
Operational message 4: Load control RB <i>Load control via Profibus (remote bus).</i>	64	42	3
Operational message 4: Operational <i>Drive motor ready to go on load.</i>	64	42	4
Operational message 6: Idle <i>Compressor in idle mode.</i>	64	42	5
Operational message 7: On load <i>Compressor in load control mode.</i>	64	42	6
Operational message: Off <i>Drive motor switched off.</i>	64	42	7
Operational message 9: Package on <i>Drive motor ready to start or is running.</i>	64	42	8
Operational message 10: Controller on <i>Sigma Control is switched on.</i>	64	42	9
Operational message 11: Mode ON/OFF: tmr <i>ON/OFF control from timer.</i>	64	42	10
Operational message 12: Mode ON/OFF: RC <i>ON/OFF control from remote (external) contact.</i>	64	42	11
Operational message 13: Mode ON/OFF: RB <i>ON/OFF control from Profibus (remote bus signal).</i>	64	42	12
Operational message 14: Mode ON/OFF: key <i>ON/OFF control from "I" key.</i>	64	42	13
Operational message 17: Ext. message 0	64	43	0
Operational message 18: Ext. message 1	64	43	1
Operational message 19: Ext. message 2	64	43	2
Operational message 20: Ext. message 3	64	43	3

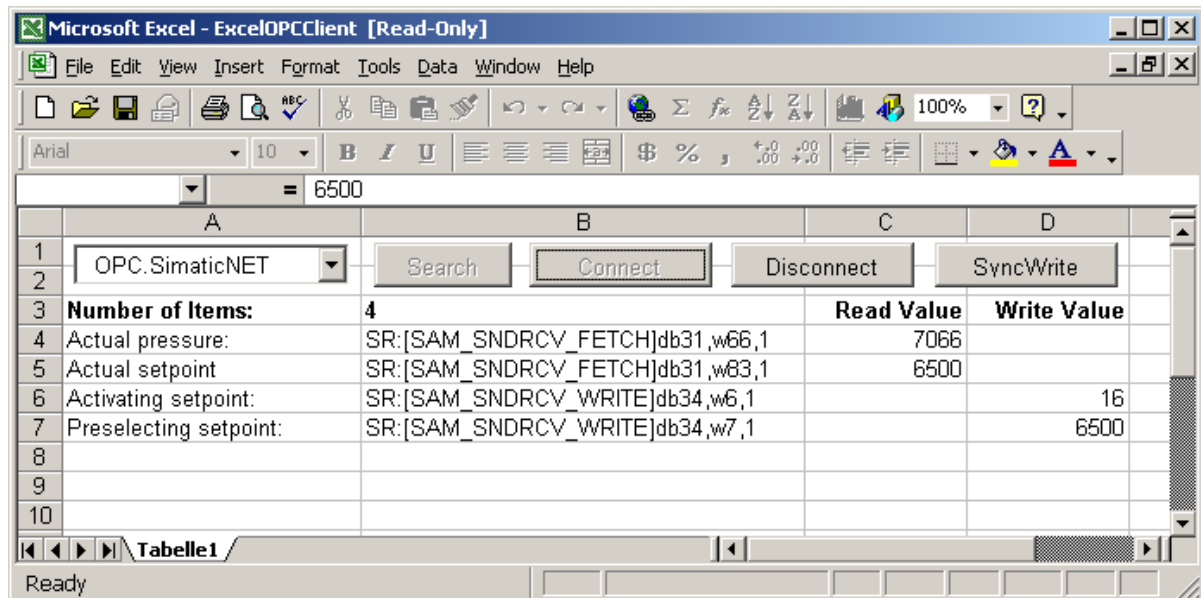
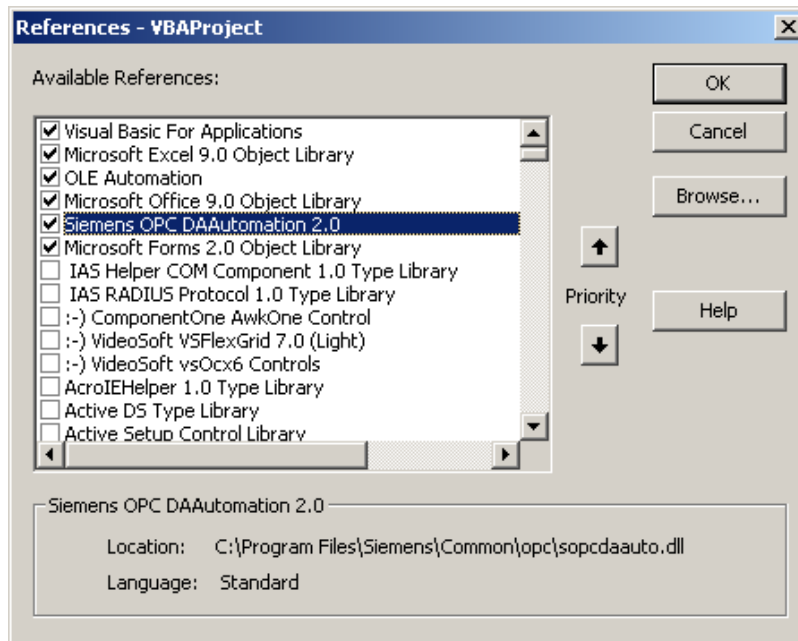
Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Operational message 21: Ext. message 4	64	43	4
Operational message 22: Ext. message 5	64	43	5
Operational message 23: Neutral pressure switch	64	43	6
Operational message 24: Neutral temperature switch	64	43	7
<i>Message text can be selected as required on Sigma Control.</i>	64	43	7...0
Operational message 25: System pressure setting p1 <i>System pressure setting p1 selected for control of load.</i>	64	43	8
Operational message 26: System pressure setting p2 <i>System pressure setting p2 selected for control of load.</i>	64	43	9
Operational message 33: SMS report <i>Monthly report of compressor status.</i>	64	44	0
Data words 45...48: Binary signals			
Remote control mode active from Profibus and no alarm	64	45	0
Drive motor running	64	45	1
Compressor in load control mode	64	45	2
Compressor in idle mode	64	45	3
Local mode selected	64	45	4
SIGMA CONTROL switched on	64	45	5
Group alarm active	64	45	6
Group warning active	64	45	7
ON/OFF control from "I" key	64	46	0
ON/OFF control from "I" key and timer	64	46	1
ON/OFF control from "I" key and remote (external) contact	64	46	4
ON/OFF control from "I" key and remote (external) contact	64	46	4
ON/OFF control from "I" key and Profibus	64	46	6
ON/OFF control preset via Profibus (remote bus signal)	64	46	7
Control mode DUAL	64	46	8
Control mode QUADRO 3	64	46	9
Control mode VARIO 1	64	46	10
Control mode continuous	64	46	12
Control mode preset via Profibus	64	46	15
Load control from external contact	64	47	4
Load control via Profibus (remote bus)	64	47	6

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Load control mode preset via Profibus	64	47	7
p1/p2 control: p1 permanent	64	47	8
p1/p2 control: p2 permanent	64	47	9
p1/p2 changeover: from timer	64	47	10
p1/p2 changeover from external contact	64	47	11
p1/p2 changeover from RS 485	64	47	13
“Clock” key enabled	64	48	0
“Remote” key enabled	64	48	1
“Idle” key enabled	64	48	2
Automatic restart after return of power enabled	64	48	3
Reserved (initial dryer run)	64	48	4
System pressure from external transducer activated	64	48	5
Message reset via Profibus activated	64	48	7
Time accepted	64	48	15
Data words 49...95: Operational values			
Inputs DI 1.3 – DI 0.0	64	49	11...0
Inputs DI 3.3 – DI 2.0	64	50	11...0
Outputs DO 1.7 - DO 0.0	64	51	15...0
System pressure p_N from internal transducer [mbar]	64	52	KF count
Internal pressure p_i [mbar]	64	53	KF count
Airend discharge temperature ADT [0.1 °C]	64	54	KF count
Analog input AI 4, PT100 [0.1°C]	64	55	KF count
Analog input AI 5, 0-20mA [0...3276]	64	56	KF count
Analog input AI 6, 0-20mA [0...3276]	64	57	KF count
Analog input AI 7, PT100 [0.1°C]	64	58	KF count
Analog input AI 8, PT100 [0.1°C]	64	59	KF count
Analog output AO 1 [0.1 mA]	64	60	KF count
Differential pressure across oil separator [mbar]	64	61	KF count
System pressure p_N from external transducer [mbar]	64	62	KF count
Current motor starts/h	64	63	KF count
Total hours [h x 1000]	64	64	KF count
Total hours [h x 1]	64	65	KF count
Load hours [h x 1000]	64	66	KF count

Meaning (message) <i>Explanation</i>	Status		
	DB	DW	Bit
Load hours [h x 1]	64	67	KF count
Setpoint pressure p1 [mbar]	64	68	KF count
Switching differential for p1 [mbar]	64	69	KF count
Setpoint pressure p2 [mbar]	64	70	KF count
Switching differential for p2 [mbar]	64	71	KF count
Nominal package pressure (vacuum package [mbar]	64	72	KF count
Pressure increase (vacuum package [mbar]	64	73	KF count
Remaining drive motor idle time [seconds]	64	74	KY count
Current time: - / hours [- / 0...23]	64	75	KY count
Current time: minutes / seconds [0...59 / 0...59]	64	76	KY count
Current date: weekday / day [Mo...Su = 1...7 / 1...31]	64	77	KY count
Current date: month / year [Jan...Dec = 1...12 / 2000...2099 = 0...99]	64	78	KY count
Message header (slave)	64	79	KY count
Remaining oil separator service life [h]	64	80	KF count
Remaining interval to oil change [h]	64	81	KF count
Remaining interval to oil filter change [h]	64	82	KF count
Remaining interval to air filter change [h]	64	83	KF count
Remaining interval to V-belts change [h]	64	84	KF count
Remaining interval to V-belts tensioning [h]	64	85	KF count
Remaining interval to motor bearing change [h]	64	86	KF count
Electrical equipment service interval [h]	64	87	KF count
Motor bearings service interval [h]	64	88	KF count
Cut-out pressure p1 (p2) [mbar]	64	89	KF count
PLC software status (B&B)	64	90	KY count
Compressor model / slave address	64	91	KY count
Compressor start delay period [seconds]	64	92	KY count
Duty cycle [0.1%]	64	93	KF count
Minimum cut-in pressure (vacuum package) [mbar]	64	94	KF count
Message footer (slave)	64	95	KY count

Annex C: OPC-Client Application in VBA (Excel)

The VBA application described below is a non-binding example of an OPC client. It contains the most important steps in the creation and removal of a client-server link and principally shows the procedure for access to SIGMA AIR MANAGER's system data via the SIMATIC NET OPC Server's (DLL with OPC Server object structure) **automation interface** (and how this interface is connected). All program steps are explained by a comment line (in italics). The commands "Find OPC server" / Connect" / "Disconnect" / "SyncWrite" are initiated by buttons.



SEND/RECEIVE with SIGMA AIR MANAGER

```
Private Sub Workbook_Open()  
    Tabelle1.cmdSearch.Enabled = True  
    Tabelle1.cmdConnect.Enabled = False  
    Tabelle1.cmdDisconnect.Enabled = False  
    Tabelle1.cmdSyncWrite.Enabled = False  
End Sub
```

```
Option Explicit  
Option Base 1
```

```
'Declare variable of OPC server object type  
Private myOPCServer As OPCServer  
'Declare variable of OPC group object type  
Private WithEvents myOPCGroup As OPCGroup  
'Size the cell for server handles  
Dim ServerHandles() As Long  
'Size the variable for item count  
Dim NumItems As Long
```

```
'Procedure ("Search" command button) for finding the locally registered OPC server  
'and entry of the OPC server name in the ComboBox (list of OPC servers)
```

```
Private Sub cmdSearch_Click()  
'Size the cell for the OPC server name  
Dim ServerNames() As String  
'Variant element for For-Each-Next loop  
Dim ServerName As Variant  
'Go to on runtime errors  
    On Error GoTo errorhandler  
'New OPC server object type entity  
    Set myOPCServer = New OPCServer  
'Delete the ComboBox (list of OPC servers) content  
    Call cmbServerNames.Clear  
'Determine OPC server and save OPC server name  
    ServerNames() = myOPCServer.GetOPCServers()  
'Enter OPC server name in the ComboBox (list of OPC servers)  
    For Each ServerName In ServerNames  
        cmbServerNames.AddItem (ServerName)  
    Next ServerName  
'Enable, block other procedures (Command Buttons)  
    cmdConnect.Enabled = True  
Exit Sub  
'Display dialog window (message box) if runtime error occurs  
errorhandler:  
    Call MsgBox(Err.Description, vbCritical)  
End Sub
```

```
'The procedure ("Connect" command button) for connecting to the selected OPC server  
'and for the creation of an OPC group (object) with several items
```

```
Private Sub cmdConnect_Click()  
'Variable for the selected OPC server name  
Dim strServerName As String  
'Size the fields required for the items  
Dim ItemIDs() As String  
Dim CltHandels() As Long  
Dim Errors() As Long  
'Size the loop variable  
Dim i As Long  
'Go to on runtime errors
```

SEND/RECEIVE with SIGMA AIR MANAGER

```
    On Error GoTo errorHandler
'Connect to selected OPC server
    strServerName = cmbServerNames.Text
    If strServerName = "" Then Exit Sub
    Call myOPCServer.Connect(strServerName)
'Set the update rate for new OPC groups to 1000 ms
    myOPCServer.OPCGroups.DefaultGroupUpdateRate = 1000
'Create new OPC group on the OPC server
    Set myOPCGroup = myOPCServer.OPCGroups.Add("MyGroup")
'Deactivate creation of events (value change)
    myOPCGroup.IsActive = False
'Size cells for items according to number of items (table cell)
    NumItems = Cells(3, 2)
    ReDim ItemIDs(NumItems)
    ReDim CltHandels(NumItems)
'Read in item IDs from the table cells and number the client handles
    For i = 1 To NumItems
        ItemIDs(i) = Cells(3 + i, 2)
        CltHandels(i) = i
    Next
'Add items with the read-in item IDs (identification of process variables)
    Call myOPCGroup.OPCItems.AddItem(NumItems, ItemIDs, CltHandels,
ServerHandles, Errors)
'If an error occurs display dialog window (message box) with corrupt item ID and error string
    For i = 1 To NumItems
        If Errors(i) <> 0 Then
            Call MsgBox(ItemIDs(i) & ": " &
myOPCServer.GetErrorString(Error(i)), vbCritical)
        End If
    Next
'Delete cell with error codes
    Erase Errors
'Activate creation of events (value change)
    myOPCGroup.IsActive = True
    myOPCGroup.IsSubscribed = True
'Enable, block other procedures (command buttons)
    cmdSearch.Enabled = False
    cmdConnect.Enabled = False
    cmdDisconnect.Enabled = True
    cmdSyncWrite.Enabled = True
Exit Sub
'Display dialog window (message box) if runtime error occurs
errorhandler:
    Call MsgBox(Err.Description, vbCritical)
End Sub
```

*'Procedure (command button "Disconnect") for disconnecting the selected OPC server
'for deleting all OPC groups (objects) and items*

```
Private Sub cmdDisconnect_Click()
'Go to on runtime errors
    On Error GoTo errorHandler
'Delete cell with server handles
    Erase ServerHandles
'Delete all OPC groups and items on the OPC server, cancel object reference
    Call myOPCServer.OPCGroups.RemoveAll
    Set myOPCGroup = Nothing
'Disconnect selected OPC server, cancel object reference
    Call myOPCServer.Disconnect
    Set myOPCServer = Nothing
```

SEND/RECEIVE with SIGMA AIR MANAGER

'Enable, block other procedures (command buttons)

```
cmdSearch.Enabled = True
cmdConnect.Enabled = False
cmdDisconnect.Enabled = False
cmdSyncWrite.Enabled = False
```

Exit Sub

'Display dialog window (message box) if runtime error occurs

errorhandler:

```
Call MsgBox(Err.Description, vbCritical)
```

End Sub

'Procedure (command button "SyncWrite") for synchronising the writing of values for certain created items (default values in the table) of the OPC group

Private Sub cmdSyncWrite_Click()

'Size the variable for the number of items to be written (default value in the table)

```
Dim myNum As Long
```

'Size the cell for server handles for the items to be written (default value in the table)

```
Dim SrvHandles() As Long
```

'Size the cell for the values to be written

```
Dim Values() As Variant
```

'Size the cell for error codes

```
Dim Errors() As Long
```

'Size the loop variable

```
Dim i As Long
```

'Go to on runtime errors

```
On Error GoTo errorhandler
```

'Size cells for items according to number of items (table cell)

```
ReDim Values(NumItems)
```

```
ReDim SrvHandles(NumItems)
```

'Determine the number of items with default value, read in the values from the table cells and integrate the appropriate server handles from all server handles

```
myNum = 0
```

```
For i = 1 To NumItems
```

```
    If Cells(3 + i, 4) <> "" Then
```

```
        myNum = myNum + 1
```

```
        SrvHandles(myNum) = ServerHandles(i)
```

```
        Values(myNum) = Cells(3 + i, 4)
```

```
    End If
```

```
Next
```

'Synchronised write of the values read in for corresponding items (server handles)

```
If myNum > 0 Then
```

```
    Call myOPCGroup.SyncWrite(myNum, SrvHandles, Values, Errors)
```

'If an error occurs display dialog window (message box) with error string

```
For i = 1 To myNum
```

```
    If Errors(i) <> 0 Then
```

```
        Call MsgBox(myOPCServer.GetErrorString(Errors(i)),
```

```
vbCritical)
```

```
    End If
```

```
Next
```

'Delete cell with error codes

```
Erase Errors
```

```
End If
```

Exit Sub

'Display dialog window (message box) if runtime error occurs

errorhandler:

```
Call MsgBox(Err.Description, vbCritical)
```

End Sub

'Procedure (event controlled) for reading in the created items of the OPC group

```
Private Sub myOPCGroup_DataChange(ByVal TransactionID As Long, ByVal  
NumItems As Long, ClientHandles() As Long, ItemValues() As Variant,  
Qualities() As Long, TimeStamps() As Date)
```

'Size the loop variable

```
Dim i As Long
```

'Go to on runtime errors

```
On Error GoTo errorhandler
```

'Write the values read in to the table cells

```
For i = 1 To NumItems
```

```
Cells(3 + ClientHandles(i), 3) = ItemValues(i)
```

```
Next
```

```
Exit Sub
```

'Display dialog window (message box) if runtime error occurs

errorhandler:

```
Call MsgBox(Err.Description, vbCritical)
```

```
End Sub
```