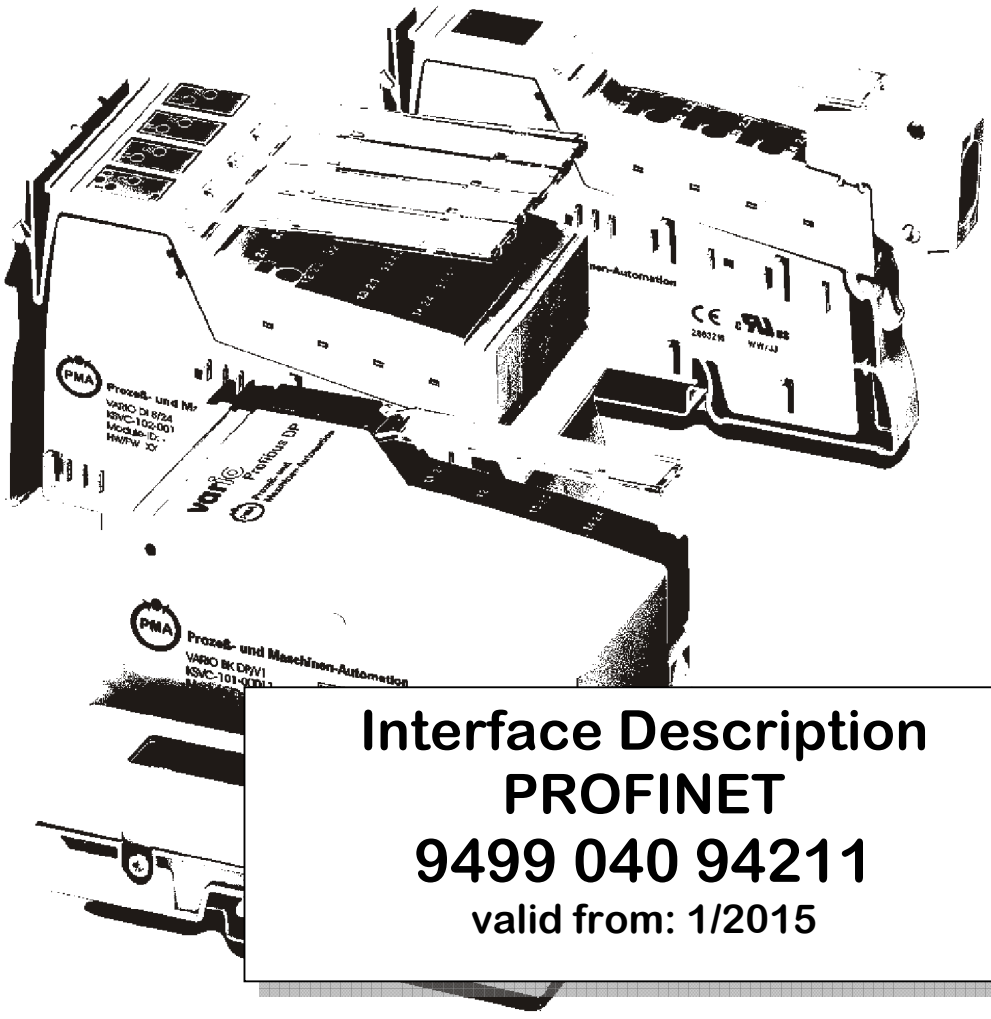
PMA Prozeß- und Maschinen-Automation GmbH

Modular Control System
KS VARIO



Interface Description
PROFINET
9499 040 94211
valid from: 1/2015

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1 General

Modular controller system KS vario permits connection of various fieldbus interfaces. For this purpose, the relevant bus coupler is used as a head station for a controller system.
Via one of these bus couplers, the ETHERNET (Modbus/TCP protocol) is supported by means of a front-panel interface (PJ45 connector). Hereby, transmission of all process, parameter and configuration data is possible.
This communication interface permits communication with supervisory systems, visualization tools, etc.
Another standard interface is provided on the KS vario controller modules. This full RS232 interface is used for connection of the 'BlueControl' tool, which runs on a PC.

Transfer rate: The PROFINET coupler works with a maximum transfer rate of 100Mbit.

Clients: The bus coupler permits communication with up to 4 clients via the TCP/IP protocol.

2 Hints for operation

2.1 Connecting the interface

Connect the Profinet to the front-panel RJ45 interface of the bus coupler.
10BaseT or 100BaseT are used as physical layer.

Physical connection is via Profinet using twisted two-wire cable (CAT5 cable, 8-pole in RJ-45 connection technology).

2.2 Properties of the bus coupler:

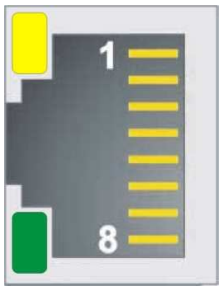
- The bus coupler includes an integrated 2-port switch.
- It meets the conformance class-A and all requirements of Conformance Class B, with exception from the Management Information Base (MIB-II) protocol. Thus, it provides no network statistics data available. Representation of the system topology and comfortable device swap-out are supported.
- Supported Ethernet services
  - Ping
  - Arp
  - LLDP
- Alarms
  - Maintenance alarms
- Port diagnosis
- Device replacement without PC

2.3 Pin allocation RJ-45

Connection is via an RJ-45 socket, with 2 integrated LEDs.

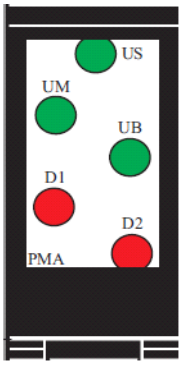
Green LED on: Connected to Profinet
Yellow LED on: Traffic on Profinet

Contakt	Signal	Description
1	TD +	Transmit +
2	TD -	Transmit -
3	RD +	Receive +
4	-	unused
5	-	unused
6	RD -	Receive -
7	-	unused
8	-	unused



2.4 Signification of indicator LEDs on the bus coupler

LED-no.	LED-colour	Function
US	green	24 V segment voltage provided
UM	green	24V main supply provided (presently not used)
UB	green	24V coupler voltage provided
D1	red	ON: no connection to Client OFF: Connection to Client faultless
D2	red	BLINKING: Communcation to KSVario faultily OFF: Communication to KSVario faultless



2.5 Forcing

Inputs

All physical inputs can be overwritten (configurable) via Profinet. Thus e.g. process value measurement via remote
I/O (e.g. VARIO I/O system) and entry via the bus are possible.

Outputs

With output forcing, the fail-safe function setting must be taken into account. If "zero" fail-safe behaviour was
adjusted, all outputs are set to zero in case of bus error or master stop, otherwise, their old value remains unchanged.

2.6 Fail-safe

User parameter setting ‘fail-safe’ determines the instrument behaviour in case of master bus failure or 'bus stop'.

Bus failure

In case of bus failure, the instrument operates according to the following rules:

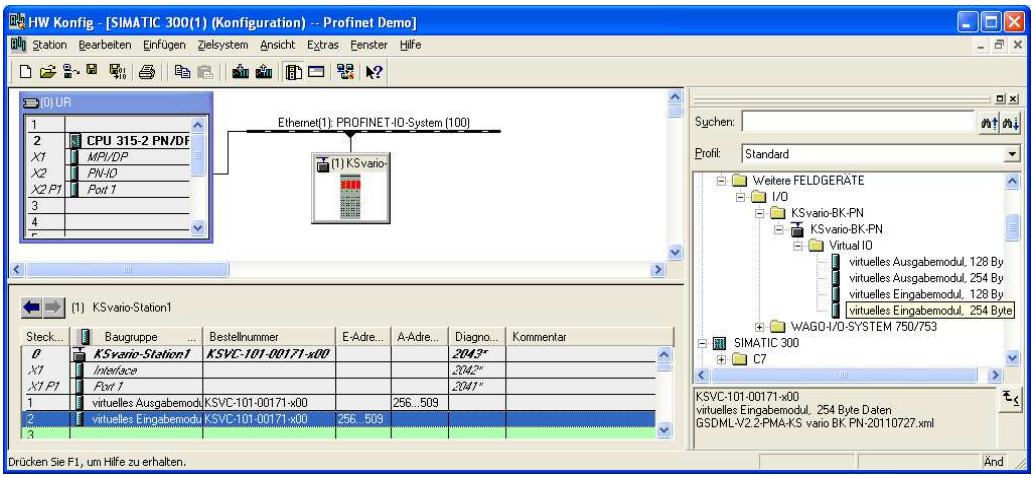
Fail-safe	Reaction in case of bus failure or master stop
Last value	Continue operation with the values sent last
	Forced analog inputs are set to FAIL
zero	Forced analog inputs are set to FAIL 1) .
	Forced digital inputs are set to zero
	Forced outputs are set to zero

3 Process data

For flexible realization of his requirements on transfer values, memory space and transfer time, the user can compose the process data transmission of a defined selection of modules. Configuration is via the relevant bus master configuration tool.

- ***Definition of cyclic data in BlueControl***

Which process data and parameter should be transferred cyclically via the PROFIBUS is absolutely free and can be defined with just a few mouse clicks in the BlueControl tool and loaded in the KSvario controller (see Chapter 3.2.1).



Process data and selected parameter data are written and read cyclically.
User input values are stored by the instrument only in case of value changing.

- ***Data format***

Values as e.g. process values and set-points are transmitted in 16-bit FixPoint format with one digit behind the decimal

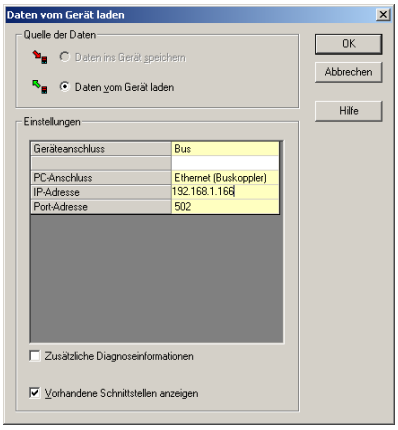
3.1 Configurable process data modules

For flexible realization of his requirements on transfer values, memory space and transmission time, the user can compose the process data transmission from a defined module selection. Configuration is via the relevant bus configuration tool of the bus master. Selection which process data and parameters are to be transmitted is via the BlueControl engineering tool.

Available modules
The following modules are offered:

No.	Description	Numb. bytes	Typ
1	Virtual output module, 128 Byte	128	Integer / Fix-Point1
2	Virtual output module, 16 Byte	16	Integer / Fix-Point1
3	Virtual output module, 254 Byte	254	Integer / Fix-Point1
4	Virtual output module, 32 Byte	32	Integer / Fix-Point1
5	Virtual output module, 64 Byte	64	Integer / Fix-Point1
6	Virtual input module, 128 Byte	128	Integer / Fix-Point1
7	Virtual input module, 16 Byte	16	Integer / Fix-Point1
8	Virtual input module, 254 Byte	254	Integer / Fix-Point1
9	Virtual input module, 32 Byte	32	Integer / Fix-Point1
10	Virtual input module, 64 Byte	64	Integer / Fix-Point1

3.2 Settings in the KSVario

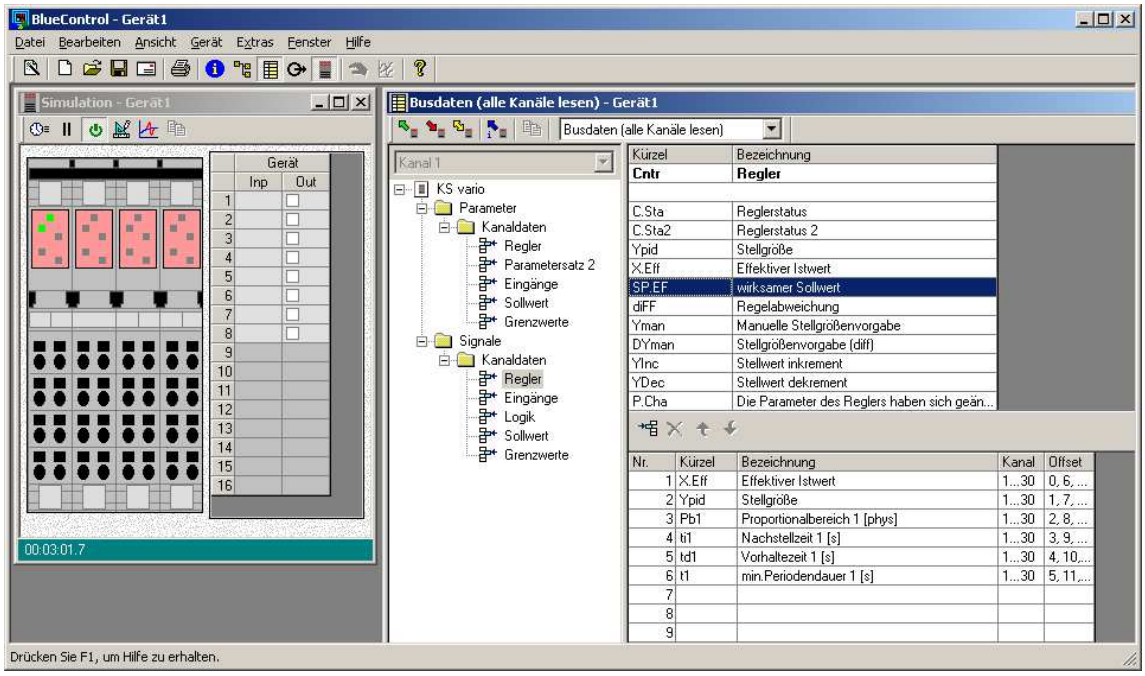


The KSVario is configured with the BlueControl® software. It is accessed either via the programming interface (RS232 / interface in the KSVario) or via PROFINET with the corresponding IP address (see adjacent picture).

3.2.1 Definition of values to be transmitted in the "BlueControl" engineering tool

BlueControl offers 2 selection modes for the data to be transmitted:

- Max.120 parameters and process data from any channels for writing and max. 120 for reading. The order of transmission is determined by the module position.
- Additionally or alternatively, parameter and process data of any type can be selected in common for all channels. E.g. the process values of all channels (max. 30) can be transmitted by selecting one datum. In total, up to 736 write and 736 read data can be defined.



These selected data (max. 736 write and 736 read data) are available in the bus coupler as cache memories in the order defined in BlueControl. The indexes or offsets of the data are displayed or can be printed out via the BlueControl tool.

3.2.2 Structure of the data cache memory in the bus coupler

The process data include a range of data from each 736 Word data in the write- and read cache.

Index Read-Cache	Contend
1 **up to120**	any data of any channels
from 121 **up to 736**	Selected data (identical for all channels): all data channel 1 all data channel 2 ... all data channel 30

Index Write-Cache	Contend
1 **bis max.120**	any data of any channels
ab max. 121 **bis max. 736**	Selected data (identical for all channels): all data channel 1 all data channel 2 ... all data channel 30

4 Quick entrance, at the example of SIMATIC® S7

4.1 Test environment

For the example test set-up, the following components are required:

- Programming unit or PC with PC adaptor
- Programming tool STEP7® V5.4
- Automation unit
  - e.g. CPU S7 315-2 PN/DP, new version
- Components
  - KS VARIO BK PN (order no.: KSVC-101-00171-100)
  - e.g. KS VARIO T8/UTH (order no.: KSVC-104-00441-000)
  - Ethernet Switch with patch-cable

4.2 Test environment example:

Task:

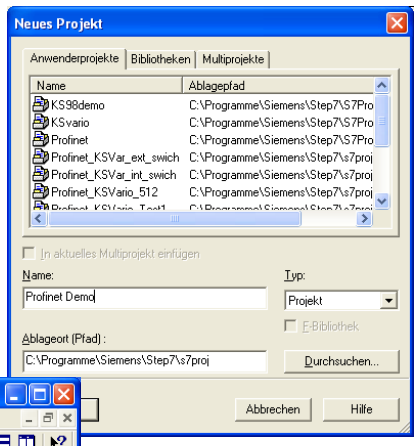
- A KS VARIO with IP 192.168.1.166 and the name "KSvario Station1" to be connected to a CPU315-2 PN / DP via Profinet.
- It should the process value, set point, heating current, control output as well as some status messages and controll-word of some channels can be shown or given. To do this, 17 process data are required for reading and 17 for writing. Select the data with the engineering tool BlueControl.
- For this can be used virtual input / output modules with 128 byte or 254 bytes.

Before using the test environment in operation, make sure, that the automation device contains no other user software.

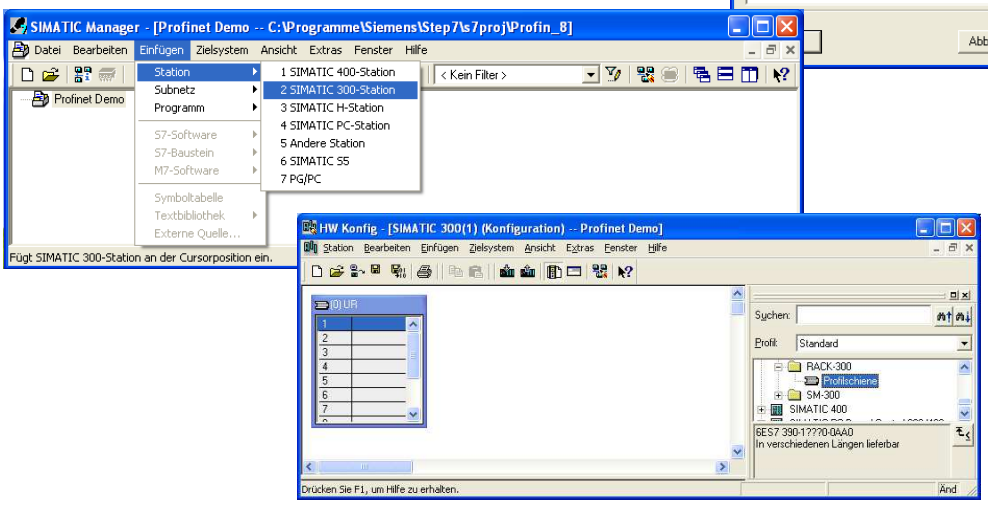
4.3 Create a new project in Step® 7

In this chapter, it is represented as a new project is created with step ® 7.

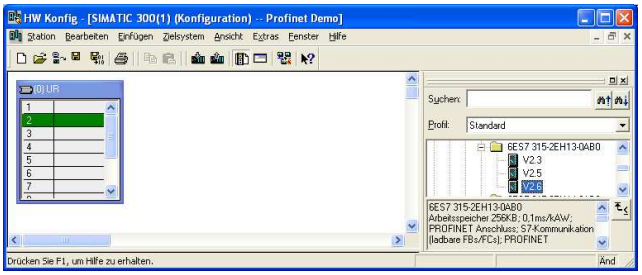
- New project:

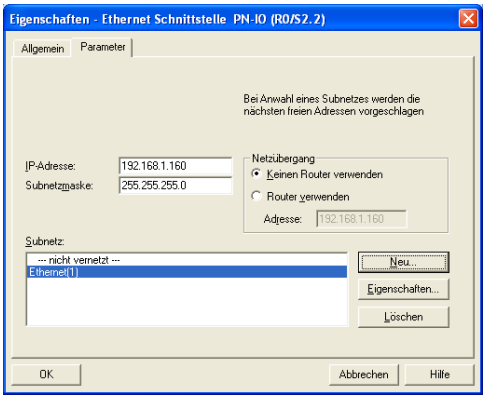


- Create master station (S7 300):

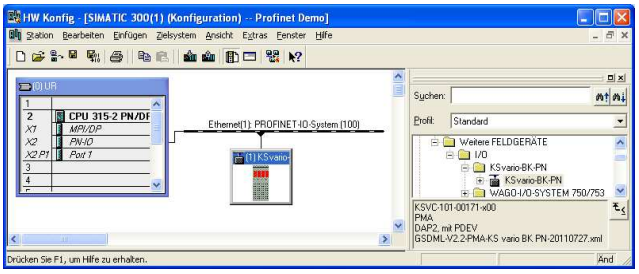


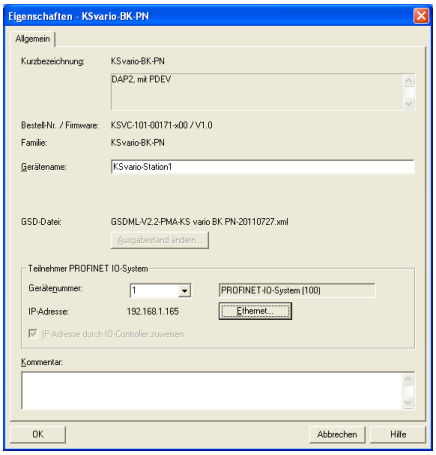
- Select CPU and assign IP address



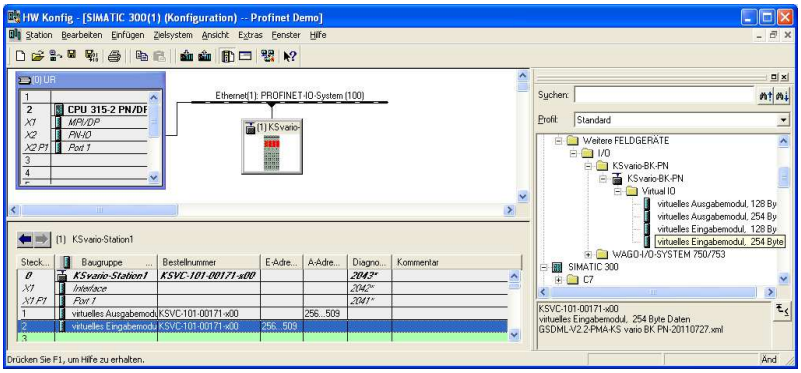


- select KSVario and addressing

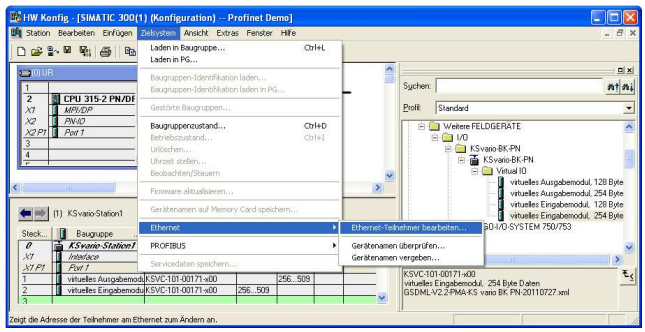


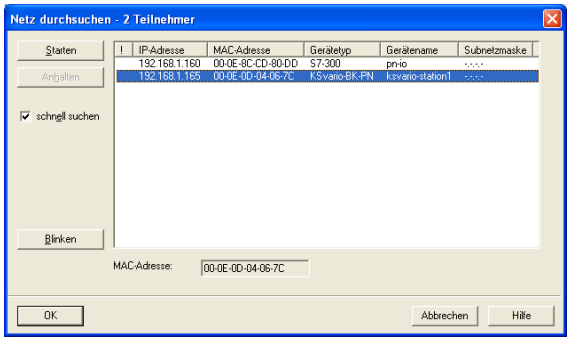


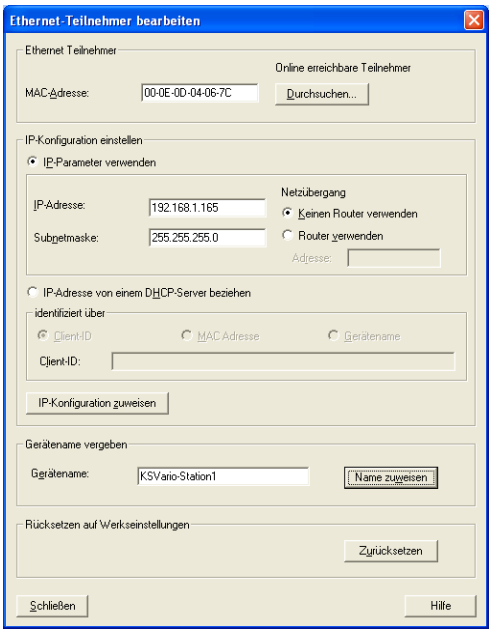
- Define virtual data module for data exchange:
  in our example, 254 byte read and write. We could communicate so 126 process values with the KSVario. If more data are needed, several of these data modules can be selected, up to maximum 736 data.



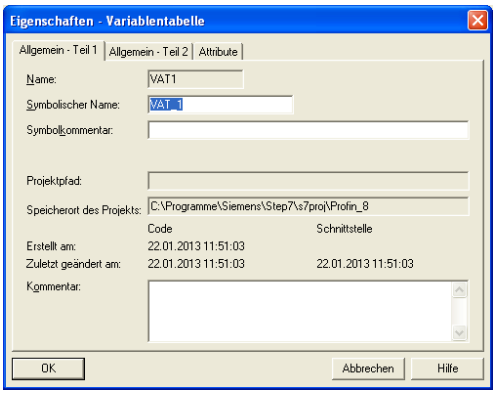
- Assign IP address and device name
  To assign the IP address and the name of the device with a KSVario, a participant search is launched from "Target system"--> "Ethernet"--> "Ethernet device edit".
  After selection of the KSVario, the IP and the device name can now be assigned to this.

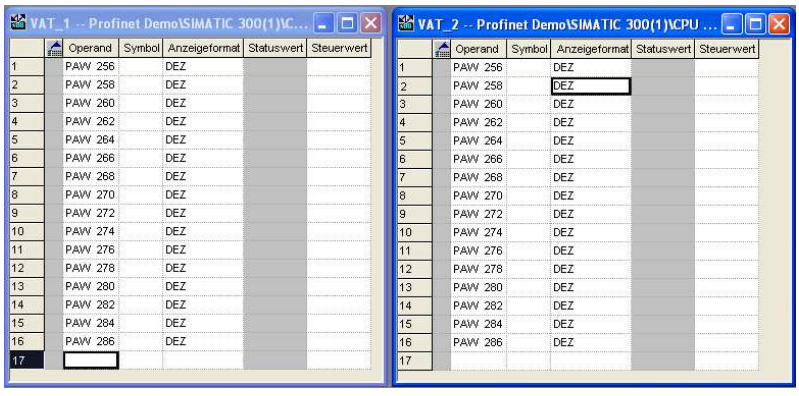






- Define variable table and testing communications-data

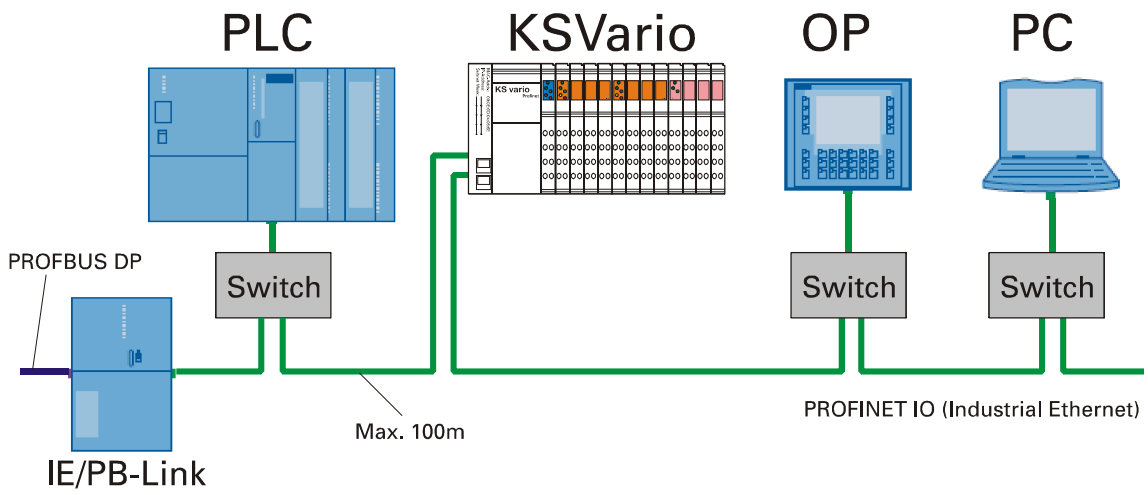




5 Notes

5.1 Building a PROFINET IO network

The following image shows the typical structure of a PROFINET IO network.
Existing PROFIBUS DP slaves can be integrated via an IE/PB-link.



5.2 Terms

- ***Bus***
  Common transmission path, to which all participants are connected; two has defined ends. At KSVario, the bus is a two-wire line.

- ***Bus connector***
  Physical connection between bus subscriber and bus line.

- ***GSD-file***
  A GSD file (generic station description) describes the properties of a PROFINET device that contains all of the necessary information for the design. As well as in Profibus, you can incorporate a PROFINET device via a GSD file in STEP 7.
  The GSD file in XML format exists for PROFINET IO. The structure corresponds to ISO 15734, the worldwide standard for device descriptions.

- ***Device name***
  Before an IO device can be addressed by an IO controller, it must have a device name, because the IP address is firmly assigned to the device name. In conjunction with this procedure has been chosen, because names are easier to handle than complex IP addresses.
  Assigning a device name for a specific IO device is to compare with setting the PROFIBUS address with a DP Slave.
  In the delivery State, an IO device has not a device name. Only after the assignment of a device name with the IO supervisor/PC an IO device for an IO controller is addressable, E.g. for designing data transfer (including the IP address) in the start-up or for commercial data exchange in the cyclic operation.

- ***Device swap-out without removable media/PC***
  IO devices are easily interchangeable with this function:
  - No removable media (such as Simatic memory card) with stored device name required
  - The device name must not be assigned with the PG
  The substitute IO device receives the device name from the IO controller, no longer from the removable device or the PC.
  The IO controller uses the projected topology and neighborhood relations established by the IO devices. The projected target topology must match to the real topology.

- ***MAC address***
  While the production, a globally unique device ID is already assigned to the PROFINET device. This 6-byte device identification is the MAC address.
  The MAC address is divided in:
  - 3 byte vendor identifier and
  - 3 byte device ID (serial number).
  The MAC address is readable on the device, for example: 08-00-06-6 B-80 C0

- ***PROFIBUS international***
  Technical Committee that defines the Profibus and PROFINET standard and further developed.
  Also known as the PROFIBUS user organisation e. V.(PNO).
  Homepage: www.profibus.com

- ***Priorisierter ramp-up***
  Priorisierter ramp-up (FSU) referred to the PROFINET functionality to speed up the start of IO devices in a PROFINET IO system with RT and IRT communication. Need the corresponding projected IO devices in the following cases to get back in the cyclic process data exchange shortens the functions:
  - When power is restored
  - following resumption of the station
  - After activation of IO devices.

- ***PROFINET***
  In the context of totally integrated automation (TIA), PROFINET is the consistent continuation of:
  - PROFIBUS DP, the established field bus, and
  - Industrial Ethernet, the communication bus to the cell level.
  The experience of both systems had been being integrated in PROFINET.
  PROFINET as Ethernet-based automation standard PROFIBUS International (formerly the PROFIBUS user organisation e. V.) thus defines a manufacturer-comprehensive communication, automation and engineering model. PROFINET is part of the IEC 61158 standard since 2003. See PROFIBUS international.

- ***Switch***
  PROFIBUS is a line-shaped network. The communication participants are connected by a passive line (the bus).
  In contrast, the industrial Ethernet consists of point to-point connections; each participant of the communication is directly connected with exactly a communication party.
  A communication participant should be connected with multiple communication participants this communication participant is connected to an active network component (the switch). More communication participants (also switches) can be connected to the other ports of the switch. The connection between the participants of a communication and the switch continues to be a point-to point connection.
  A switch has the task to regenerate signals received and distribute. The switch "learns" the Ethernet-Address of a PROFINET device or other switches and forwards only the signals which are intended for the connected PROFINET device or the connected switch.
  A switch has a certain number of ports. Connect up a PROFINET device or an additional switch to each port.

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