PMA Prozeß- und Maschinen-Automation GmbH



Modular Control System KS VARIO



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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
 - o Ping
 - o Arp
 - o 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	JM 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).

🖳 HW Konfig - [SIMATIC 300(1) (F	Konfiguration) Pr	ofinet De	emo]					
00 Station Bearbeiten Einfügen Ziels	ystem <u>A</u> nsicht E <u>x</u> tras	Eenster	Hilfe					- 8 ×
0 🗲 🏪 🗣 👫 🎒 🖻 💼	🕯 🛍 🚺 🗖	₩.						
EXAMPLE						<u>^</u>		- IX
	Ethernet(1):	PROFINET	-IO-System	(100)		Suchen	:	ntai
2 CPU 315.2 PN/DF X7 MP//DP X2 PN/X0 X2 PN/		1) KSvario-		<u></u>		Profit	Standard Wetere FELDGERÄTE Kovario-BK-PN Svario-BK-PN Virtual IO Virtual IO	128 Bv
(1) KSuario Station1						-	virtuelles Ausgabemodul, virtuelles Eingabemodul,	254 By 128 By
							WAGD-I/D-SYSTEM 750/753	254 Byte
Steck 🚺 Baugruppe Be	estellnummer	E-Adre	A-Adre	Diagno	Kommentar		SIMATIC 300	
0 🚡 KSvario-Station1 KS	SVC-101-00171-x00			2043*	^		🗀 C7	~
X1 Interface			0	2042**		<	and the second se	>
X1 F1 80t 1			0	2041*		KOVC 1	01 0017100	
1 virtuelles Ausgabemodu KS ¹	VC-101-00171-x00		256509			virtuelle	s Fingahemodul 254 Byte Daten	<u> </u>
2 virtuelles Eingabemodu KS 3	VC-101-00171-x00	256.509			~	GSDML	-V2.2-PMA-KS vario BK PN-20110727.xml	
ı Drücken Sie F1, um Hilfe zu erhalten.						2.0		Änd

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	Тур
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	any data of any channels
up to120	
from 121	Selected data (identical for all channels):
	all data channel 1
	all data channel 2
	all data channel 30
up to 736	

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

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
 - o e.g. CPU S7 315-2 PN/DP, new version
- Components
 - o KS VARIO BK PN (order no.: KSVC-101-00171-100)
 - o e.g. KS VARIO T8/UTH (order no.: KSVC-104-00441-000)
 - o 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.

		Neues Projekt
4.3	Create a new project in Step [®] 7	Anwenderprojekte Bibliotheken Multiprojekte Name Ablagepfad
	In this chapter, it is represented as a new project is created with step ® 7. New project: 	KS38demo C:\Programme\Siemens\Step7X57Pro C:\Programme\Siemens\Step7X57Pro C:\Programme\Siemens\Step7X57Pro Profinet C:\Programme\Siemens\Step7X57Pro Profinet_KSVar_ext_swich C:\Programme\Siemens\Step7X57pro Profinet_KSVar_int_swich C:\Programme\Siemens\Step7X57pro C:\Programme\Step7X57pro C:\Programe\Step7X57pro
		In aktuelles Multiprojekt einfügen Name: Ivp: Profinet Demo Variant V
	Create master station (S7 300):	Ablageort (Pfad) : EBbliothek [C:\Programme\Siemens\Step7\s7projurchsuchen]
	SIMATIC Manager - [Profinet Demo - C:VProgramme\Siemens\Step7\s7projProfin_8] Datei Bearbeken Enfugen Zelsystem Anskht Extern 1 SIMATIC 400-Station Subnetz - 2 SiMATIC 400-Station Stonetz - 2 SiMATIC 400-Station Stonetz - 2 SiMATIC 400-Station Sr-Software - 3 SIMATIC 40-Station Sr-Software - 5 Simere Station Symboltabele - 5 Simole Station Textboliothek - Externe Quelle Externe Quelle - 5 Simere Station Symboltabele - Station Textboliothek - Externe Quelle Externe Quelle - 5 Simere Station Symboltabele - 5 Simoltabele Textboliothek - 5 Simoltabele Externe Quelle - 5 Simoltabele Textboliothek - 5 Simoltabele Externe Quelle - 6 Simoltabele Simoltabele - 7 Simoltabele Textboliothek - 2 Simoltabele Externe Quelle - 6 Simere Simoltabele - 7 Simoltabele Simoltabele - 7 Simoltabele <t< th=""><th>Abbrechen Hille</th></t<>	Abbrechen Hille
	Drücken Sie F1, un Hilfe zu erhakten.	In verschiedenen Längen lefelbar

• Select CPU and assign IP address

00 UR	^	Sychem		 nt
2 3 4 5 6 7		Profil:	Standard 6ES7 315-2EH V2.3 V2.5 V2.5 V2.6	13-0AB0
	~	6ES7 31 Arbeitssp PROFIN (ladbare	5-2EH13-0AB0 eicher 256KB; 0,1ms/kAV ET Anschluss; S7-Kommur FBs/FCs]; PROFINET	/; ikation

Eigenschaften - Ethernet Schnittstelle	PN-10 (R0/S2.2)
Allgemein Parameter	1
JP-Adresse: 192.168.1.160 Subnetzgaske: 255.255.0	Bei Anwahl eines Subnetzes werden die nächsten freien Adressen vorgeschlagen Netzübergang © Keinen Router verwenden © Router verwenden
<u>S</u> ubnetz:	Adjesse: 192.168.1.160
nicht vernetzt Ethemet(1)	Neu
	Eigenschaften
	Löschen
OK	Abbrechen Hilfe

• select KSVario and addressing

Station Bearbeiten Einfügen Zelsystem Ansicht Extras Eenster Hilfe	- 6
DIDUR Ethemet(1) PROFINE T-IO System (100) X2 PI Pevr 7 Pevr 7 3 Pevr 7 Pevr 7	Supter: Pott: Standard Pott: Standard Vetere FELDGERATE District Standard Standa

genschaften - KSva	rio-BK-PN	E
Vigemein		
Kurzbezeichnung:	KSvario-BK-PN	
	DAP2, mit PDEV	
Bestell-Nr. / Firmware:	KSVC-101-00171-x00 / V1.0	
Familie:	KSvario-BK-PN	
Gerätename:	KSvario-Station1	
GSD-Datei:	GSDMLV2.2-PMAKS vario BK PN-20110727.xml	
Gerätenummer:	1 PROFINET-IO-System (100)	
IP-Adresse:	192.168.1.165 Ethemet	
P-Adresse durch	10-Controller zuweisen	
Kommentar:		
		~
		~

• 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.

B HW Konfig - [SIMATIC 300(1) (Konfigur B Station Bearbeiten Einfügen Zielsystem A	ration) Profinet Den nsicht Extras Fenster	no] Hilfe					- 8 x
D 😹 🏪 🗣 🖓 🎒 🗞 🖻 🛍 🏜							
10 UR				~			
	Ethernet(1): PROFINET-I	D-System (100)	-	-	Sychen		nt mi
2 CPU 315-2 PN/DF X7 MPI/DP =	TI KSvario-				Profit Standar	d	•
X2 PN-N0 X2 PT Pot T 3 4 					E C Weite	re FELDGERÄTE D KSvario-BK-PN M KSvario-BK-PN E- 10 Virtual IO	
<u>×</u>				X		virtuelles Au virtuelles Au	igabernodul, 128 By Igabernodul, 254 By
(1) KSvario-Station1						virtuelles Ein virtuelles Ein	gabemodul, 128 By gabemodul, 254 Byte
Steck Baugruppe Bestellnumm	ner E-Adre	A-Adre Diagno.	. Kommentar	1		I WAGO-1/O-SYSTEM 75	0/753
0 🚡 KSvario-Station1 KSVC-101-	-00171-x00	2043*		~			×
X1 Interface		2042**			<		>
X1F1 Port 1		2041*		_	KCVC 101 00171	-00	
1 virtuelles Ausgaberrodi KSVC-101-00	0171-x00 2	56509			vituelles Eingaber	nodul. 254 Bute Daten	τ <u>í</u>
2 virtuelles Eingaberrodu KSVC-101-00	7171-x00 256 509			~	GSDML-V2.2-PM/	KS vario BK PN-2011072	7.xml
l Drücken Sie F1, um Hilfe zu erhalten.		- 21				ſ	Änd

• 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.

B HW Konfig - [SIMATIC 300(1) (K	Configuration) Profinet Demo]				
🕼 Station Bearbeiten Einfügen Zelsy	Ansicht Extras Fenster Hilfe		_ 8 ×		
	iden in Baugruppe Ctrl+L		Ethernet-Te	ilnehmer bearbeiten	X
OUR Box 1 CPU 315-2 PN/DF X2 CPU 315-2 PN/DF X2 PW00 X2 PP1 Pws17 3 ur 4 ur	wgruppen-Identifikation laden wgruppen-Identifikation laden http://www.internationality.com/ wgruppen/waterial Wgruppen/waterial Kitchen	Sychem Point Standard Point Standard Poin	■× n†ni Ethernet Te MAC- <u>A</u> dres	inehmer e: 00-0E-0D-04-06-7C	Online erreichbare Teilnehmer
Ee Fin	nobachten/Steuern mware aktualisieren Riteramen auf Memory Cord speichern	Vituel IO Vitueles Ausgabemodul, 128 vitueles Eingabemodul, 254 vitueles Eingabemodul, 254	18 Byte 14 Byte 18 Byte 14 Byte 14 Byte	lion einstellen neter verwenden	
Steck Baugruppe Ett 0 KSvario-Station1 PR X7 Natwr/aca	Acrist Contract Contr	Teihehmer bezebeiten A04/0-SYSTEM 750/753 amen überprüfen amen vergeben	P-Adress	× 192.168.1.165	Netzübergang ⓒ Keinen Router verwenden
X1 P1 Fail 1 Fail 1 1 virtuelles Ausgabemodu KSV 2 virtuelles Eingabemodu KSV	Arcedaton spechem AC-101-00171-x00 256509 AC-101-00171-x00 256509	KSVC-101-00171-x00 virtuelles Eingabernodul, 254 Byte Daten GSDML-V2.2-PMA-KS vario BK PN-20110727.xml	₹ <u>≺</u> Sub <u>n</u> etma	iske: 255.255.255.0	C Router verwenden
Zeigt die Adresse der Teiheitmer am Etherne Netz durchsuchen – 2 Teiln Statten 1 IP-Ac 1821 Arrigelten 1921	it zun Andern an. iehmer desse MAC-Adlesse Gerabletyp 168:1160 00-0E-80-CD-80-DD \$7-300 168:1165 00-0E-0D-0H-0F-7C KS-vano-BK-PN	Gerölename Subnetzmaske prio totot kavariostation totot	C IP-Adre identifizie Cjien-ID	se von einem D <u>H</u> CP-Server beziehen tüber 4D C <u>M</u> AC Adresse	C Gerätename
⊽ schnġil suchen			IP-Konfig Gerätenam Ggrätenar	uration guweisen vergeben ie: KSVario-Station1	Name zuweisen
<u>B</u> linken MAC-Adres	sse: 00-0E-0D-04-06-7C		Rücksetzer	auf Werkseinstellungen	Zyrücksetzen
ОК		Abbrechen Hilfe	<u>S</u> chließen		Hilfe

• Define variable table and testing communications-data

Eigenschaften - Varial	blentabelle			Bereich einfügen			
Allgemein - Teil 1 Allgem <u>N</u> ame: <u>S</u> ymbolischer Name:	ein - Teil 2 Attribute VAT1 VAT1			Ab <u>O</u> perand: <u>A</u> nzahl: Anzeigeformat:	PEW 256	*	
Symbol <u>k</u> ommentar: Projektpfad: Speicherort des Projekts	C:\Programme\Siemens\Step7	\s7proj\Profin_8 Schnittstelle		, nego onen	DEZ ZEICHEN BIN DATUM SIMATIC_ZEIT ZÄHLER		
Erstellt am: Zuletzt geändert am:	22.01.2013 11:51:03 22.01.2013 11:51:03	22.01.2013 11:51:03		Steuer <u>w</u> ert:			
K <u>o</u> mmentar:			<	ОК		Abbrechen	Hilfe
ОК		Abbrechen	Hilfe				

	1	Operand	Symbol	Anzeigeformat	Statuswert	Steuerwert		1	Operand	Symbol	Anzeigeformat	Statuswert	Steuerwert
1	21112	PAW 256		DEZ			1		PAW 256		DEZ		
2		PAW 258		DEZ			2		PAW 258		DEZ		
3		PAW 260		DEZ			3		PAW 260		DEZ		
4		PAW 262		DEZ			4	ĵ I	PAW 262		DEZ		
5		PAWV 264		DEZ			5		PAW 264		DEZ		
6		PAW 266		DEZ			6		PAW 266		DEZ		
7		PAW 268		DEZ			7		PAW 268		DEZ		
8		PAW 270		DEZ			8		PAW 270		DEZ		
9		PAW 272		DEZ			9		PAW 272		DEZ		
10		PAW 274		DEZ			10		PAW 274		DEZ		
11		PAWV 276		DEZ			11		PAW 276		DEZ		
12		PAW 278		DEZ			12		PAW 278		DEZ		
13		PAW 280		DEZ			13		PAW 280		DEZ		
14		PAW 282		DEZ			14		PAW 282		DEZ		
15		PAW 284		DEZ			15		PAW 284		DEZ		
16		PAW 286		DEZ			16		PAW 286		DEZ		
17							17						

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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