COMBIVERT

Instruction Manual **PROFINET Operator**

Translation of original manual		
Document	Part	Version
20098495	GBR	02

KEB

1. Introduction

1.1 Preface

First we would like to welcome you as a customer of the company Karl E. Brinkmann GmbH and congratulation to the purchase of this product. You have decided for a product on highest technical level.
The described hard- and software are developments of the Karl E. Brinkmann GmbH. The Karl E. Brinkmann GmbH have prepared the documentation, hardware and software to the best of their knowledge, however, no guarantee is given that the specifications will provide the efficiency aimed at by the user. The Karl E. Brinkmann GmbH reserves the right to change/adapt specifications and technical data without having to give prior notice to third parties.Errors excepted.
For a safe operation observe the safety and warning instructions in this instruction manual as well as in further documentation. The safety and warning instructions specified in this manual do not lay claim on completeness.
The pictographs used in this instruction manual have following meaning:

	**Danger**
	Warning
	Caution
	**Attention**
	strictly observe
	**Information**
	Aid
	Tip

The information contained in the technical documentation, as well as any user-specific advice in spoken and written and through tests, are made to best of our knowledge and information about the application. However, they are considered for information only without responsibility. This also applies to any violation of industrial property rights of a third-party.
Inspections of our units in view of their suitability for the intended use must be done generally by the user. Inspections are particularly required, if changes are executed, which serve for the further development or adaption of our products to the applications (hardware, software, or download lists). Tests must be repeated completely, even if only parts of hardware, software, or download lists have been modified.
The use of our units in the target products is beyond of our control and therefore exclusively the responsibility of the user.

1.2 Product description

The Karl E. Brinkmann GmbH develops, produces and sells static frequency inverters in the industrial field of application all over the world. The inverters of the type F5 can be equipped optionally with a PROFINET IO slave interface. The F5 PROFINET operator is integrated into the frequency inverter housing by plug-in and fits into all F5 devices. Here it concerns to a gateway, which controls the data transfer from PROFINET to the inverter control and reverse. Internally the data are transferred via the serial KEB own protocol with the name HSP5.

1.3 Order informations

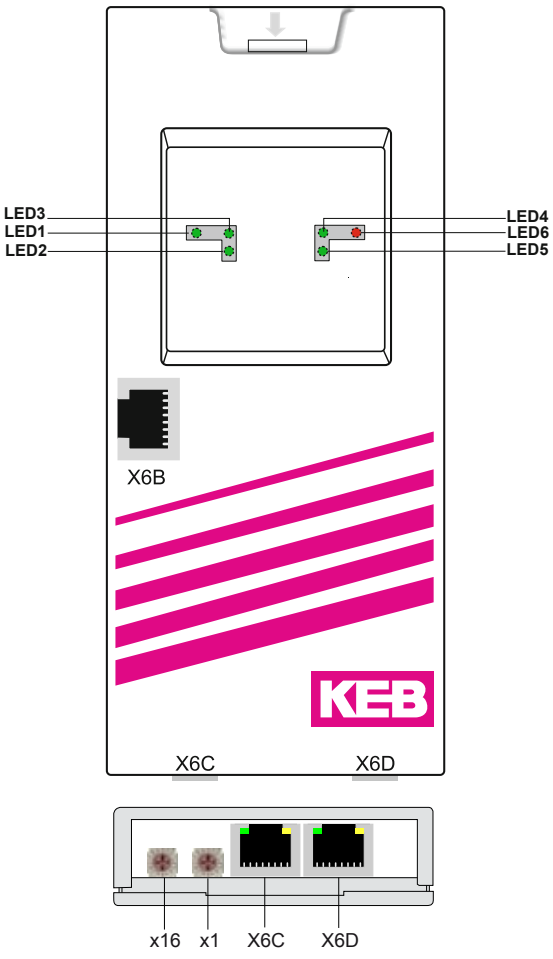
F5 PROFINET operator:	00F5060-L100
Accessories for the diagnostic interface (X6B):	
HSP5 cable between PC and F5 PROFINET operator:	00F50C0-0010
Adapter DSUB9 / Western:	00F50C0-0020

1.4 List of literature

[1]: Application Layer Protocol for decentralized periphery and distributed automation Specification for PROFINET V2.2
[2]: Application Layer Services for decentralized periphery and distributed automation Specification for PROFINET V2.2
[3]: Profile Drive Technology PROFIdrive Technical Specification for PROFIBUS and PROFINET V4.1
[4]: GSDML Specification for PROFINET IO V2.10
[5]: Application manual of the used frequency inverter control.
[6]: Profile Guidelines Part1 Identification and Maintenance Functions.

2. Hardware

2.1 Overview of the controls



LED1	PROFINET communication
LED2	Acyclic data access
LED3	Process data
LED4	PROFINET-Link
LED5	Identification
LED6	Error display
X6B	Diagnostic interface
x16	High-Nibble of the Node Switch
x1	Low-Nibble of the Node Switch
X6C	PROFINET, Port 0, Standard Ethernet-RJ45 socket in accordance with IEEE 802.3 100 Base-T
X6D	PROFINET, Port 1, Standard Ethernet-RJ45 socket in accordance with IEEE 802.3 100 Base-T

2.2 Meaning of the LED light pattern

<table>
<tr><td>LED1</td><td>
<table>
<tr><th>Flashing</th><th>Device condition</th></tr>
<tr><td>Double lightning (200ms ON/200ms OFF/200ms ON/1000ms OFF)</td><td>PROFINET firmware not ready</td></tr>
<tr><td>Constantly off</td><td>PROFINET firmware ready</td></tr>
<tr><td>Constantly on</td><td>PROFINET communication completely started, internal communication asynchronous</td></tr>
<tr><td>Flashing (500ms ON/500ms OFF)</td><td>PROFINET communication completely started, internal communication synchronous</td></tr>
</table>
</td></tr>
<tr><td>LED2</td><td>Acyclic data access</td></tr>
<tr><td>LED3</td><td>Lights up as long as a process data access to the frequency inverter is running. If both, the synchronous mode and the IRT communication are active, the LED flashes in the same pattern as LED1.</td></tr>
<tr><td>LED4</td><td>Lights up if a link is detected at PROFINET Port0 or Port1.</td></tr>
<tr><td>LED5</td><td>Serves as identification LED. This can be controlled by the PROFINET master via the Discovery and Configuration DCP set-service.
<table>
<tr><th>Flashing</th><th>Device condition</th></tr>
<tr><td>Constantly off</td><td>Idle mode</td></tr>
<tr><td>Flashing (500 ms ON/500 ms OFF) for 3 s</td><td>DCP-Set-service with signal = FLASH_ONCE</td></tr>
</table>
</td></tr>
<tr><td>LED6</td><td>
<table>
<tr><th>Flashing</th><th>Device condition</th></tr>
<tr><td>Constantly off</td><td>No voltage supply at the FI control circuit</td></tr>
<tr><td>Flashing (500 ms ON/500 ms OFF)</td><td>Frequency inverter control in error status</td></tr>
<tr><td>Flashing quickly (50 ms ON/50 ms OFF)</td><td>No information from the frequency inverter received</td></tr>
<tr><td>Double lightning (200 ms ON/200 ms OFF/200 ms ON/1000 ms OFF)</td><td>Fatal error occurred during initialization. No function of the operator!
Can occur e.g.:
- No valid KEB MAC address assigned
- Inconsistent configuration.</td></tr>
<tr><td>Constantly on</td><td>No error</td></tr>
</table>
</td></tr>
</table>

2.3 Diagnostic interface X6B (COMBIVIS)

RJ45 socket of the diagnostic interface.

To prevent a destruction of the PC interface, the diagnostic interface must be connected to the serial interface of the PC via a special HSP5 cable with voltage adaption only!

2.4 Node Switch (x16, x1)

Node Switch: Setting of a device address hexadecimal via two rotary coding switches. The left rotary switch (x16) presets the high nibble, the right rotary switch (x1) the low nibble of the device address. The actual adjusted value can be read off in the operator parameter ‚OS14 NodeSwitchVal'. Setting this value affects the active ProfiNet name and also special configurations can be preset by way (s. 7.1.10. ProfiNet name (DCP set)).

Info Device address = switch position (x16) * 16 + switch position (x1)

Example:

Switch postion x16:	9	->	$9*16^1$
			+
Switch postion x1:	5	->	$5*16^0$
			=
Device address:			149 (95 Hex)

NodeSwitchVal	Effect on PROFINET name	Effect on IP address, IP mask, IP Gateway
0…239 / 0… EFh	kebf5•n, where "n" is the decimal value of the node switch.	Last stored values.
240 / F0h	Last stored name.	Last stored values.
241 / F1h[1)] (reset to default)	empty	IP address: 0.0.0.0 IP mask: 0.0.0.0 IP Gateway: 0.0.0.0
242…253 / F2h…FDh	Last stored name.	Last stored values.
254 / FEh (KEB production test)	empty	IP address: 192.168.0.100 IP mask: 255.255.255.0 IP Gateway: 0.0.0.0
255 / FFh	Last stored name.	Last stored values.

[1)] Delivery status

2.5 Technical data

2.5.1 Operating conditions

		Standard	Standard/ class	Instructions
Definition acc.		EN 61800-2		Inverter product standard: **rated specifications**
		EN 61800-5-1		Inverter product standard: **general safety**
Ambient conditions during operation				
Climate	Temperature	EN 60721-3-3	3K3	extended to -10…45 °C (use frost protection for water cooling systems and temperatures below zero)
	Humidity		3K3	5…85 % (without condensation)
Mechanical	Vibration		3M1	
Contamination	Gas		3C2	
	Solids		3S2	
Ambient conditions during transport				
Climate	Temperature	EN 60721-3-2	2K3	Drain heat sink completely
	Humidity		2K3	(without condensation)
Mechanical	Vibration		2M1	
	Surge		2M1	max. 100 m/s²; 11 ms
Contamination	Gas		2C2	
	Solids		2S2	
Ambient conditions for the storage				
Climate	Temperature	EN 60721-3-1	1K4	Drain heat sink completely
	Humidity		1K3	(without condensation)
Mechanical	Vibration		1M1	
	Surge		1M1	max. 100 m/s²; 11 ms
Contamination	Gas		1C2	
	Solids		1S2	
Type of protection		EN 60529	IP20	
Environment		IEC 664-1		Pollution degree 2
EMC emitted interference according to inverter product standard: EMC (EN61800-3)				

3. Software

3.1 Fundamentals of the KEB PROFINET interface

The KEB F5 PROFINET interface contains a PROFINET slave controller for time-critical operations of the communication. By using this PROFINET interface it is guaranteed that basic communication is compatible to the PROFINET specification. The functionality of the KEB F5 ProfiNet operator is determined by:

- (Application) software (see value of the operator parameter OS00: Operator type)
- (ProfiNet) firmware (see value of the operator parameter OS11: NetX_FwVersion)

Technical data of the PROFINET interface connection:

Supported PROFINET protocol versions	PROFINET IO-RT (PROFINET IO-IRT*)

* The synchronous operating mode (IRT) is only possible when using an application software version > = 2.6 and a PROFINET firmware version from 3.x. For this see description of parameter Fb01: FBS Config.

3.1.1 PROFINET acyclic data (parameter channel) according to PROFIdrive

The KEB F5 PROFINET operator supports the coding of the acyclic services according to PROFIdrive profile also called Base Mode Parameter Access. However this applies only for the data transfer, not for the content or the coding. That means the KEB F5 PROFINET interface connection does not support parameters according to PROFIdrive profile, but only the transport mechanism. In the following only the essential information for the transport mechanism of the acyclic data according to Profidrive are listed. Complete specification is found in [3]. The acyclic parameter Request according to Profidrive provides a mechanism, whereby a list of maximally 39 parameters can be written or read with two PROFINET record accesses. The basic operation at PROFINET level is as follows:

1.Write-Record-Request of the master with Index = B02Eh, payload data = Parameter-request (see below)
2.Write-Response of the slave, no payload data
3.Read-Record-Request of the master with Index = B02Eh, no payload data
4.Read-Response of the slave, payload data = Parameter response (see below)

Parameter request:

Block-Definition	Byte n	Byte -+1	n
Request Header	Request Reference	Request ID	0
	Axis-No.	No. of parameters = n	2
1st parameter address	Attribute	No. of elements	4
	Parameter Number (PNU)		6
	Subindex		8
:	:		:
n th parameter address	Attribute	No. of elements	4 + 6 x (n-1)
	Parameter Number (PNU)		
	Subindex		
1st parameter value(s)	Format	No. of values	4 + 6 x n
	Values		
:	:		:
Nth parameter value(s)			

The parameter values are only contained in a request with request ID = 2.

Request Reference: 1 ... FFh: Serial number for differentiation of the different requests
Request ID:

Value	Meaning
01h	Request parameter (Read)
02h	Change parameter (Write)

Axis-No. = 0, since the F5 PROFINET operator represents an 1:1 gateway.
No. of parameters: 1…39 (max. 39 parameters can be read or written via request)
Attribute:

Value	Meaning
10h	Value
20h	Description (not supported here)
30h	Text (not supported here)

No. of elements: =1
Parameter number (PNU): Addressing of the parameter (see below)

Format:

Value	Meaning
1	Boolean
2	Integer8
3	Integer16
4	**Integer32**
5	Unsigned8
6	Unsigned16
7	Unsigned32
41h	Byte
42h	Word
43h	DWord
44h	Error

The F5 PROFINET operator returns all parameters during reading with format = 4.
Also the master can preset all parameters during writing with format = 4.

No. of values: =1
Parameter response:

Block-Definition	Byte n	Byte n+1	n
Response header	Request reference mirrored	Response ID	0
	Axis-No. mirrored	No. of parameters = n	2
1st parameter value(s)	Format	No. of values	4 + 6 x n
	Values		
:	:		:
Nth parameter value(s)			

The parameter values are contained in response only at response ID = 1 or 81h or 82h (*3).

(*3) The change, that a negative write-response (response ID = 82h) also contains parameter values, the F5-PROFINET software supports beginning with V3.1.

Response ID:

Value	Meaning
01h	Request parameter ok (read)
02h	Change parameter ok (write)
81h	Request parameter with error (read)
82h	Change parameter with error (write)

If an error has occurred during the read access to a parameter, the response ID = 81h is set. Furthermore, the format = 44h (error) is set for this parameter value and the error value is set as 16-bit value as follows:

Value	Description
11h	Timeout on access to the parameter or frequency inverter busy
14h	Inverter busy (*4)
00h	Invalid parameter address or password
17h	Data invalid
65h	Error in internal communication (BCC error)
66h	Error in internal communication (invalid service or invalid operation)
67h	Invalid password.
68h	Error in internal communication (invalid telegram)
69h	Error in internal communication (parity error)
03h	Invalid parameter set (subindex)
6Bh	Error in internal communication (invalid operation) (*5)

(*4) The error code „inverter busy“ was changed in the software version V3.1 from 11h to 14h.

(*5) The error code „invalid operation“ was changed in the software version V3.1 from 66h to 6Bh.

(to *3) Free from error requests are listed in a negative Write-response (Response-ID = 82h) with format = 40h (Zeror) and No of Values = 0.

3.1.1.1 Parameter addressing with 16-Bit PNU plus 16 Bit Subindex (PROFIdrive)

1. PNU	Last PNU	Description
0000h	FFFFh	Parameters of the frequency inverter control and the operator with PNU = KEB-Parameter-Address (*1). KEB uses the subindex for set-addressing. Parameters of the operator always start at PNU = XX80h

(*1) The KEB parameter address can be found here or in [5]. It is also possible to display the KEB parameter address in the KEB start-up software COMBIVIS (more information see annex).

3.1.1.2 Set-addressing with subindex

The PROFINET subindex is used for set-addressing for all KEB parameters. A parameter that contains more than one value is called set-programmable at KEB. These parameters have always eight different values. The 1st value is addressed via set 0 and the last value via set 7.

The conversion from PROFINET-subindex to set selection can be adjusted with parameter FBS Config. Bit6 from software version 2.9.

Subindex	Description for FBS config. Bit6 = 0 (subindex bit-coded)
0	Indirect set-addressing: The addressed set is determined by the appropriate set indicator. Parameter Fr.09 is valid for parameters of the frequency inverter control. The operator has no set indicator parameter, therefore access with sub index = 0 corresponds to access with sub index = 1
1	Direct set-addressing of set 0
2	Direct set-addressing of set 1
4	Direct set-addressing of set 2
8	Direct set-addressing of set 3
16/10h	Direct set-addressing of set 4
32/20h	Direct set-addressing of set 5
64/40h	Direct set-addressing of set 6
128/80h	Direct set-addressing of set 7

By this bit coding it is generally possible to address several sets with one command. However this should not be used during a read access, since an error code is returned if not all values in the addressed sets are the same. This multiple set-addressing can be used without problems for writing of set-programmable parameters.

Subindex	Description for FBS config. Bit6 = 1 (subindex linear)
0	Indirect set-addressing: The addressed set is determined by the appropriate set indicator. Parameter Fr.09 is valid for parameters of the frequency inverter control.
1	Direct set-addressing of set 0
2	Direct set-addressing of set 1
3	Direct set-addressing of set 2
4	Direct set-addressing of set 3
5	Direct set-addressing of set 4
6	Direct set-addressing of set 5
7	Direct set-addressing of set 6
8	Direct set-addressing of set 7

This coding of the PROFINET subindex is compatible to the coding of the new PROFINET-PD mapping parameters (see description of parameter Fb28).

3.1.1.3 Error codes of the acyclic communication

The error code, which is returned at acyclic communication, is a 32 bit value, which consists of four components: ErrorCode, ErrorDecode, ErrorCode1, ErrorCode2. Currently, no own error codes are output by the application of the F5-PROFINET operator. Consequently all values ! = 0 are always generated by the used PROFINET stack. The meaning of these error codes can be taken from the PROFINET specification.

3.1.2 Differences between normal and synchronous mode

The KEB F5 PROFINET operator supports the synchronous mode from software version 2.6. This is a special communication between operator and frequency inverter control and is completely independent of the PROFINET communication. However, an active synchronous mode is the precondition for a synchronization of PROFINET-IRT communication and internal control software. In synchronous mode communication between operator and frequency inverter control is strictly cyclical in a fixed time pattern (see ComCycle).From software version 2.6 the operator always tries to change into the synchronous communication mode.

The communication mode can be identified by parameter Fb00 ComCycle. The synchronous mode is active if the value of this parameter is unequal zero. The value of the parameter indicates the cycle time in µs.

There are the following conditions for the change into the synchronous mode:

- Bit SyncMode_Enable in parameter FBS Config is set
- The PROFINET communication is completely started (RT or IRT)
- The connected frequency inverter control supports the HSP5 service 56

Feature	Normal mode	Synchronous mode
Maximum PD transfer rate at 8 Byte PD data (*1)	1000 µs(*2)	2000 µs(*3)
Maximum PD transfer rate at 16 Byte PD data (*1)	2000 µs(*2)	2000 µs(*3)
Acyclic ProfiNet communication	fully supported	fully supported
Diagnosis via the diagnostic interface (X6B)	fully supported	fully supported
Diagnosis via TCP/UDP via the ProfiNet interface	fully supported	fully supported
Support by FI controls	all	Not all
Flexibility of the process data assignment	restricted	almost in any order
Parameter group in the FI for setting the PD assignment	SY	Pd

(*1) Here it concers to the internal process data transfer rate between the operator and frequency inverter control. There are higher transfer rates possible to the PROFINET.

(*2) Theoretically possible, non-guaranteed transfer rate, depends at acyclic organized communication strongly on the general communication load between operator and frequency inverter.

(*3) Guaranteed, strictly cyclical.

3.1.3 Process data communication (general)

By means of process data communication new process output data (PDOUT) can be sent to the KEB PROFINET slave and the actual process input data (PDIN) can be determined. Which parameters concern to the data is determined by the process data mapping in the frequency inverter control.

Currently a maximum of 16byte process data for each data direction can be transferred.
The KEB F5 PROFINET operator expects PDOUT1 data on PROFINET in network byte order. For a combined mapping of 1x32 bit and 2x16 bit (PDOUT1Hsp5Service = 50) the following transmission sequence results:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Value 0				Value 1		Value 2	
MS Byte			LS Byte	MS Byte	LS Byte	MS Byte	LS Byte

MS ByteMost significant Byte (most significant byte)
LS Byte: Least significant Byte (least significant byte)
Analog applies for the transmission sequence of the PDIN data, if PDIN1Hsp5Service = 50.

3.1.4 Process data communication (synchronous mode)

All communication tasks between operator and frequency inverter control are strictly cyclical processed with only one internal PDO (Process Data Object). Minimum cycle time is 2000 µs (see ComCycle).The process data assignment is determined here by parameters of the pd-group in the frequency inverter control.

Operator parameters

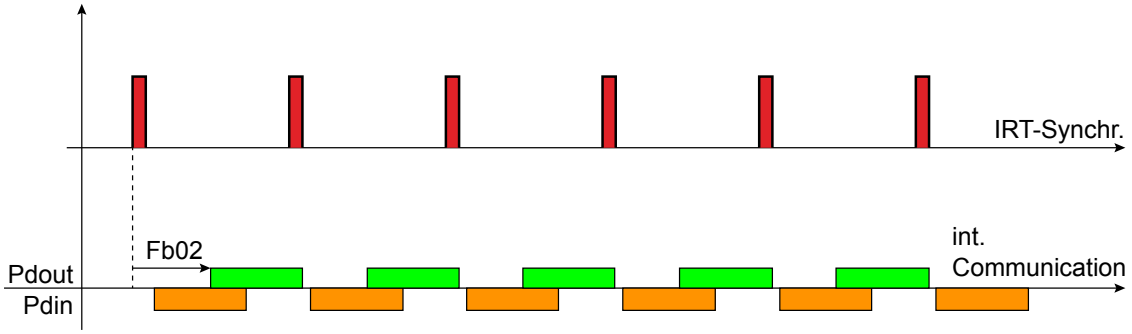
- Fb05 PDOUT1_Hsp5Service
- Fb06 PDIN1_Hsp5Service
- Fb07 PDIN1_Cycle
- Fb08 PDOUT2_Hsp5Service
- Fb09 PDIN2_Hsp5Service

are not significant. The real number of process data bytes to be exchanged is determined also by the setting of parameters CfgNrPdins and CfgNrPdouts.

3.1.5 PROFINET-IRT communication and synchronous mode

The internal synchronous mode and the PROFINET-IRT communication are independent from each other. The PROFINET-IRT communication makes sense only in synchronous mode. The synchronous mode operates timer-controlled independent of external synchronization signals. If the synchronous mode is active and also the PROFINET-IRT communication, the KEB F5 PROFINET operator receives a synchronization signal (start of red phase/outputs valid) on which the operator tries to synchronize. The required time interval between IRT-synch signal and the following start of the internal synchronous communication cycle is adjustable via parameter Fb02: DelayTimeSyncToAppIrq.

The operator determines the cycle time of the synchronization signal and indicates it in the value of parameter Fb03: RealSyncCycleTime (see below).



3.1.6 Process data communication (normal mode)

The process data assignment is determined by the parameters of the sy-group in the frequency inverter control. In normal mode only 8 bytes process data can be transferred in one telegram. One internal PDO is required for 8 byte process data, two internal PDOs for 16 bytes process data. Thus the configuration parameters for process data communication are double available:

- PDOUT1_Hsp5Service determines the internal communication service for the first 8 bytes of PDOUT data.
- PDOUT2_Hsp5Service is the appropriate parameter for the second 8 bytes PDOUT data.

The same applies for parameters: PDIN1_Hsp5Service and PDIN2_Hsp5Service.

Parameters CfgNrPdins and CfgNrPdouts configure the required number of active PDIN / PDOUT units and therefore the required process data length. How many PDOs are active for each data direction can be read in parameters ActiveNrPdins and ActiveNrPdouts. Not all inverter controllers support two internal PDOs for each data direction.

Basically the two PDOUT units are realized separately from each other. The KEB-F5-PROFINET-RT operator executes the necessary process data communication to the frequency inverter control one after another, since this communication must be done via the internal serial connection. The normal communication sequence for two active PDOs for each data direction is as follows:

- Writing of PDOUT1 data to the frequency inverter control
- Writing of PDOUT2 data to the frequency inverter control
- Reading of PDIN1 data of the frequency inverter control
- Reading of PDIN2 data of the frequency inverter control

The cyclic reading of PDIN1/PDIN2 data of the frequency inverter control is configured by parameter PDIN1_Cycle.

⚠	At PDOUT1_Hsp5Service = PDIN1_Hsp5Service = 50 respectively PDOUT2_Hsp5Service = PDIN2_HSP5Service = 53. This configuration represents a special case, since there are no half duplex counterparts for this full duplex services. That means that PDIN data can only be determined if PDOUT data has still been received from the PROFINET controller.

3.1.7 Process data mapping

The process data mapping is preset in the frequency inverter control via the appropriate parameters of the SY group (normal mode) or parameters of the pd-group (synchronous mode).
The structure of the process data (see below) is additionally adjusted in the operator via parameters PDOUT1_Hsp5Service, PDOUT2_Hsp5Service and PDIN1_Hsp5Service as well as PDIN2_Hsp5Service (see below). These parameters have no meaning in synchronous mode.

From Software V2.9 the F5 PROFINET operator offers the possibility to store the process data mapping in the operator. This function is activated by the value of bit5 in parameter Fb01 FBS Config.This function is deactivated in delivered condition. The exact specification of the new PD mapping parameters can be found in this description (see Fb28 to Fb31).The new parameters provide the user an uniform programming interface of the PD mapping for the normal and synchronous mode. This leads to restrictions in the settings since both, the mapping of the parameters of the SY group (normal mode) and the mapping of the parameters of the PD group must be possible. The adjustable operator process data mapping does not support gaps. A multiple mapping of a process data value in several parameter sets is not possible here.

In order to clarify the complex issue of the PD mapping a little more, this document contains an annex with sample mapping settings.

3.1.8 Fieldbus watchdog

The fieldbus watchdog serves to bring the inverter controlled into failure status if a cyclically arising event on the fieldbus suddenly disappears. The function is realized in the PROFINET operator. Currently, the fieldbus watchdog is not configurable on the PROFINET operator. The fieldbus watchdog is parameterized by the parameters pn.05 and pn.06 at inverter control side. The fieldbus watchdog becomes active, as soon as PROFINET communication starts running. As soon as the communication is affected in any way, the PROFINET operator releases the watchdog process after expiration of the watchdog time (pn.06) in the frequency inverter control. The reaction of the frequency inverter to this is depending on the adjustments of parameters pn.05 and pn.06 in the inverter control.

3.1.9 PROFINET alarms

The KEB-F5-PROFINET operator supports alarms (from software V2.9). This functionality is switched off by default and can be activated via parameter Fb01 FBS Config.Bit7 (if necessary). The operator monitors the value of the inverter parameter ru00 inverter status when the alarm is activated. If there is an error in the inverter (ru00 value < 64) the operator outputs a process alarm with high priority and displays the actual value of parameter ru00. Also if the error does not longer exist the operator outputs a process alarm. The differentiation, whether it is an appearing or disappearing error can be read from the User-Struct-ID of the alarm. The following table summarizes this functionality:

ru00 value	Alarm type	Priority	User-Struct-Id	User-Struct-Value	Meaning
<64	Process alarm	High	1	16 bit value of ru00	Error occurred
0 or ≥ 64	Process alarm	High	2	16 bit value of ru00	Error is no longer present.

3.1.10 PROFINET-Name (DCP-Set)

The PROFINET name (NameOfStation) is determined by the adjustment of the node address switch (NodeSwitchVal) at the front side of the operator. If this value is < 240 the ProfiNet-name is defined as follows: kebf5-n whereby „n“ is the decimal value of the Node switch. Examples:

NodeSwitchVal = 1 →Profinet-Name = kebf5-1
NodeSwitchVal = 11 →Profinet-Name = kebf5-11
NodeSwitchVal = 123 →Profinet-Name = kebf5-123

If the switch position is > = 240, then the non-volatile stored name becomes active.
The name can be changed by the master via service DCP set. Then this name is non-volatile stored. On next switching on the PROFINET slave logs in with the stored name, if NodeSwitchVal > = 240. The maximum supported length of the PROFINET name is currently 128 digits.

3.1.11 Identification of a device by flashing LED (DCP-set)

PROFINET defines a special service for easy find out of a special device. This belongs to the Discovery and basic Configuration (DCP) protocol. The flashing of a LED on the device in a predefined flash patterns can be started and stopped via the DCP set service. The device is addressed via its MAC address (OS10). At KEB F5 PROFINET operator the LED5 serves to this end.

4. Diagnosis

The KEB F5 PROFINET operator offers two possibilities with the start-up tool KEB COMBIVIS to have access to the parameters of the operator and the connected frequency inverter.

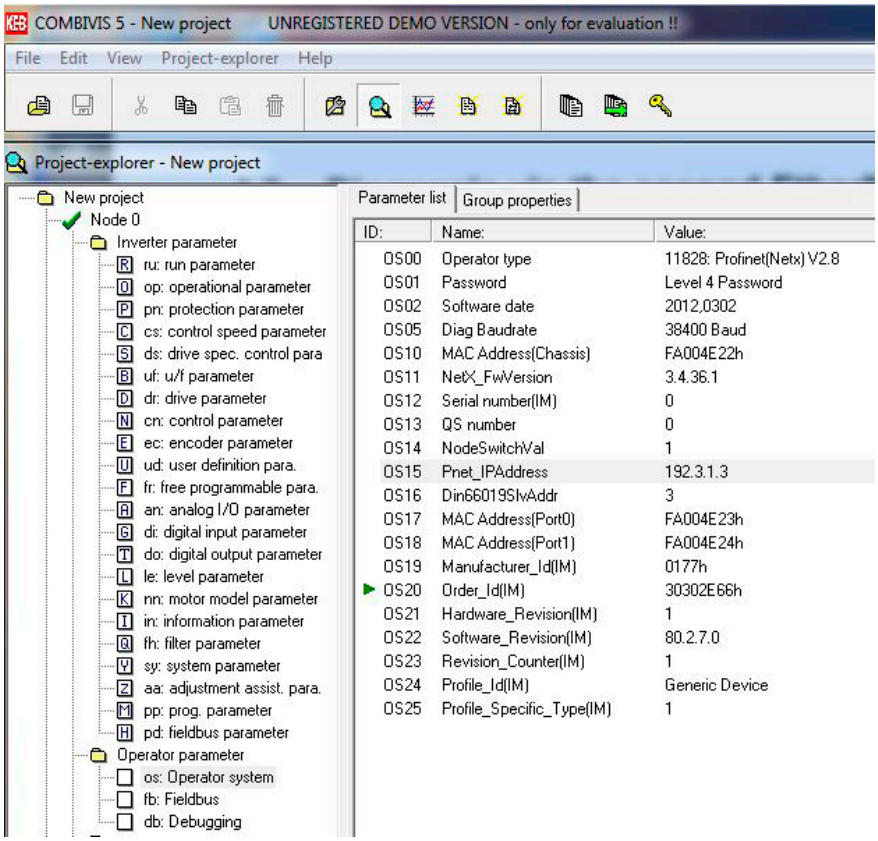
4.1 Diagnosis via the diagnostic interface (X6B)

Here the serial interface of a PC is connected with the diagnostic interface (X6B) of the KEB F5 PROFINET operator with a special HSP5 cable (see order data). All parameters of the inverter control and the operator can be responded with the start-up software KEB COMBIVIS.

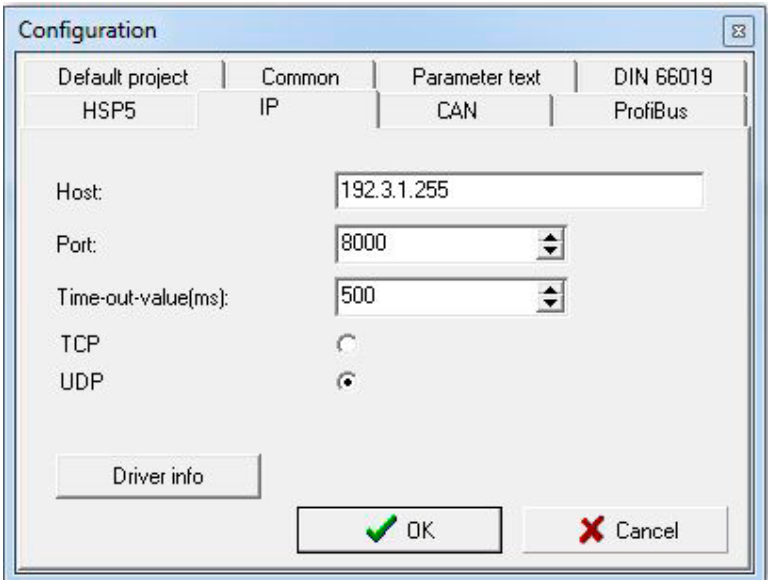
4.2 Diagnosis via the second EtherNet port parallel to PROFINET (X6C/X6D)

If one of the both PROFINET ports (X6C or X6D) is not assigned by the PROFINET wiring this port can be connected with the EtherNet interface of a computer via EtherNet cable. Then KEB COMBIVIS can communicate via this port with the PROFINET slave.
The following must be considered at configuration of COMBIVIS:

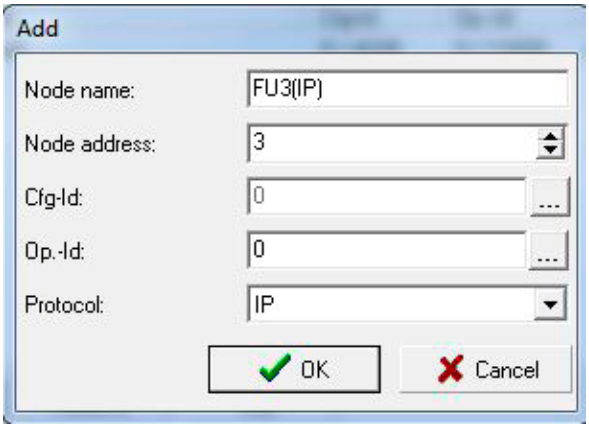
The IP address of the PROFINET slave must be entered at host in the menu Edit → Configuration → IP. This address is preset by the PROFINET master. The value can be read in the operator parameters as OS15Pnet_IPAddress.



By setting the last digit of the host IP address to value = 255 in the IP configuration of COMBIVIS one ensures that COMBIVIS can address several connected IP devices whose IP address is in the range 192.10.1.x.



If configured that way COMBIVIS addresses the devices via the IP address 192.10.1.x, where x corresponds to the configured node address. The used node address by COMBIVIS for addressing the unit must agree with the adjusted value of parameter Din66019SlvAddr.Please observe from software V2.5 of the F5 PROFINET operator the Din66019SlvAddr is linked to the Pnet_IPAddress by way that Din66019SlvAddr = last digit of Pnet_IPAddress.



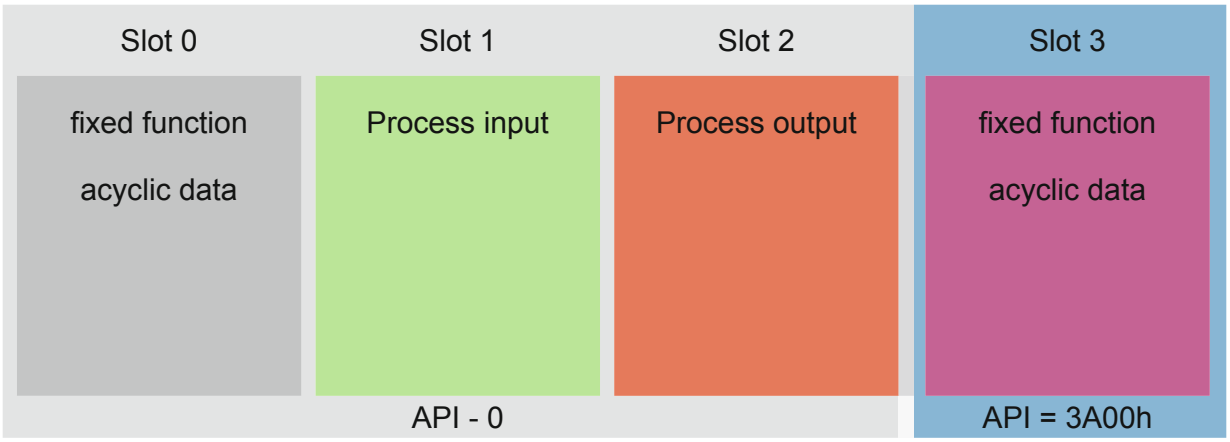
5. Project Design and Device Description with GSDML File

A GSDML file is specified as technical manual for PROFINET (see [4]). KEB provides such a technical manual file for the PROFINET slaves. This file is in most cases necessary for a PROFINET configuring tool. The actual version of the KEB F5 PROFINET GSDML file contains no object dictionary and therefore it is not frequency inverter unit-type dependent.

At PROFINET all slaves contain slots and these slots have one or more subslots. Module/submodule combinations can be plugged into these slots/subslot combinations. The project design in case of the F5 PROFINET operator applies as follows:

Slot0 (Slot0)	Is always available and can not be changed. Acyclic parameter accesses (among other things) are processed via this slot.
Slot1 (Slot1)	Process input data: only an input module with • a submodule for 8 byte process input data (4x16bit inputs) or • a submodule for 16 byte process input data (8x16bit inputs) can be plugged into this slot
Slot2 (Slot2)	Process output data: only an output module with • a submodule for 8 byte process output data (4x16bit outputs) or • a submodule for 16 byte process output data (8x16bit outputs) can be plugged into this slot

Slot3 (Slot3), new from SW V2.8:
This slot is necessary in order that a standard Siemens PLC with PROFINET controller allows the acyclic parameter access to PROFIDRIVE-profile to this unit. This functionality is already available in slot0, but is duplicated in slot 3 (see reasons above). The module that can be plugged into this slot and allows the acyclic communication to PROFIDRIVE Base Mode Parameter Access is named PROFIDRIVE_PAP (ProfiDrive Parameter Access Point).



6. Operator Parameters

6.1 Parameter overview

The operator parameters are managed by the F5 PROFINET operator. No transmission to the frequency inverter control is necessary on access to these parameters. Only the parameters which are interesting for the user are listed here. All not listed parameters should not be changed by the user. Each parameter is described via the name or a short identifier (ID). The parameters are organized in parameter groups such as the inverter parameters. The ID is made up of the code for the parameter group and the serial number of the parameter. Currently the following parameter groups are available in the F5 PROFINET operator:

- Operator system (OS)
- Fieldbus (Fb)
- Debugging (Db)

The following is valid for all operator parameters and inverter parameters: PNU = COMBIVIS parameter address

PNU	Sub-Index	ID	Name	Internal data type	Meaning
0180h	0	OS00:	OS00: Operator type	Uint32	Operator type + software-version
0181h	0	OS01:	Password	Int16	Read: actual password level Write: Password value
0182h	0	OS02:	Software date	Uint16	Software date in terms of: Year,MMDD
0185h	0	OS05:	Diag Baud rate		Transmission speed of the diagnostic interface
018Ah	0	OS10:	MAC Address (Chassis)	Uint32	Least significant 32-bit MAC address of the operator
018Bh	0	OS11:	NetX_FwVersion	Uint32	Firmware version of the PROFINET-Asics
018Ch	0	OS12:	Serial Number	Uint32	Serial number of the operator
018Dh	0	OS13:	QS number	Uint16	KEB internal
018Eh	0	OS14:	NodeSwitchVal	Uint8	Value of the two hex coding switches at the front of the operator
018Fh	0	OS15:	Pnet_IPAddress	Uint32	From PROFINET master preset IP-address of the operator
0190h	0	OS16:	Din66019SlvAddr	Uint8	Slave address of the operator for the addressing via UDP/IP
0191h	0	OS17	MAC Address (Port0)	Uint32	Less significant 32-Bit of the MAC address for Port0 (X6C) of the operator
0192h	0	OS18:	MAC Address (Port1)	Uint32	Less significant 32-Bit of the MAC address for Port1 (X6D) of the operator
0193h	0	OS19:	Manufacturer_Id(IM)	Uint16	Manufacturer-ID
0194h	1,2,4,8,16	OS20:	Order_Id (IM)	String[20]	Order number of the operator
0195h	0	OS21:	Hardware_Revision (IM)	Uint16	Hardware revision of the operator
0196h	0	OS22:	Software_Revision (IM)	Uint32	Software revision of the operator
0197h	0	OS23:	Revision_Counter (IM)	Uint16	Revision counter
0198h	0	OS24:	Profile_Id (IM)	Uint16	Profile-ID
0199h	0	OS25:	Profile_Specific_Type (IM)	UInt16	Profile specific type
0280h	0	Fb00	InternComCycle	Uint32	Cycle time in synchronous mode in µs
(*1) Please note that the use of the sub-index is depending on the actual setting of bit6 in parameter Fb01 FBS Config, see chapter "3.1.1.2 addressing with subindex". „3.1.1.2 Satzadressierung mittels Subindex“					

PNU	Sub-Index	ID	Name	Internal data type	Meaning
0281h	0	Fb01	FBS Config	Uint16	Collection of some configuration settings
0282h		Fb02	DelayTimeSyncToApplIrq	Uint16	Delay time between IRT synchsignal and internal synchronous communication in µs
0283h	0	Fb03	RealSyncCycleTime	Uint16	The real cycle time of the IRT synchsignal in µs determined by the operator
0284h	0	Fb04	FBS Command	Uint16	Setting of certain commands to the F5 PROFI-NET operator.
0285h	0	Fb05	PDOUT1_Hsp5Service	Uint8	Service number for the KEB internal protocol for reading the first 8 bytes PDOUT data
0286h	0	Fb06	PDIN1_Hsp5Service	Uint8	Service number for the KEB internal protocol for reading the first 8 bytes PDIN data
0287h	0	Fb07	PDIN_Cycle	Uint16	Cycle time in ms for reading the PDIN data
0288h	0	Fb08	PDOUT2_Hsp5Service	Uint8	Service number for the KEB internal protocol for reading the second 8 byte PDOUT data
0289h	0	Fb09	PDIN2_Hsp5Service	Uint8	Service number for the KEB internal protocol for reading the second 8 byte PDIN data
028Ah	0	Fb10	CfgNrPDINS	Uint8	Required number of PDIN units
028Bh	0	Fb11	CfgNrPDOUTS	Uint8	Required number of PDOUT units
028Ch	0	Fb12	ActiveNrPDINS	Uint8	Number of active PDIN units
028Dh	0	Fb13	ActiveNrPDOUTS	Uint8	Number of active PDOUT units
028Eh	0	Fb14	PdoutEvCnt	Uint32	Counts the events of received PDOUT data
028Fh	0	Fb15	Pdout_DW1	Uint32	Actual PDOUT data bytes 0…3
0290h	0	Fb16	Pdout_DW2	Uint32	Actual PDOUT data bytes 4…7
0291h	0	Fb17	Pdout_DW3	Uint32	Actual PDOUT data bytes 8…11
0292h	0	Fb18	Pdout_DW4	Uint32	Actual PDOUT data bytes 12…15
0293h	0	Fb19	PdinEvCnt	Uint32	Counts the events of updated PDIN data
0294h	0	Fb20	Pdin_DW1	Uint32	Actual PDIN data bytes 0…3
0295h	0	Fb21	Pdin_DW2	Uint32	Actual PDIN data bytes 4…7
0296h	0	Fb22	Pdin_DW3	Uint32	Actual PDIN data bytes 8…11
0297h	0	Fb23	Pdin_DW4	Uint32	Actual PDIN data bytes 12…15
0298h	0	Fb24	ProjSyncCycleTime	Uint32	By the controller proj.cycle time of the IRT-synchsignal in µs
0299h	0	Fb25	ProjDiffTimePDIN	Uint32	Set-up time for reading the PDIN data in µs
029Ah	0	Fb26	ProjDiffTimePDOUT	Uint32	Delay time to accept the PDOUT data in µs
029Bh	0	Fb27	IRTCycleCnt	Uint16	IRT cycle counter
029Ch	1	Fb28	1st PDOUT map.set0	Uint32	1. Pdout mapping parameter
029Ch	2	Fb28	1st PDOUT map.Satz1	Uint32	2. Pdout mapping parameter
029Ch	4	Fb28	1st PDOUT map.Satz2	Uint32	3. Pdout mapping parameter
029Ch	8	Fb28	1st PDOUT map.Satz3	Uint32	4. Pdout mapping parameter
029Ch	16	Fb28	1st PDOUT map.Satz4	Uint32	5. Pdout mapping parameter
029Ch	32	Fb28	1st PDOUT map.Satz5	Uint32	6. Pdout mapping parameter
029Ch	64	Fb28	1st PDOUT map.Satz6	Uint32	7. Pdout mapping parameter
029Ch	128	Fb28	1st PDOUT map.Satz7	Uint32	8. Pdout mapping parameter
029Dh	0	Fb29	1st PDOUT map count	Uint8	Number of active Pdout mapping parameter
(*1) Please note that the use of the sub-index is depending on the actual setting of bit6 in parameter Fb01 FBS Config, see chapter "3.1.1.2 addressing with subindex". „3.1.1.2 Satzadressierung mittels Subindex“					

PNU	Sub-Index	ID	Name	Internal data type	Meaning
029Eh	1	Fb30	1st PDIN map.set0	Uint32	1. Pdin mapping parameter
029Eh	2	Fb30	1st PDIN map.Satz1	Uint32	2. Pdin mapping parameter
029Eh	4	Fb30	1st PDIN map.Satz2	Uint32	3. Pdin mapping parameter
029Eh	8	Fb30	1st PDIN map.Satz3	Uint32	4. Pdin mapping parameter
029Eh	16	Fb30	1st PDIN map.Satz4	Uint32	5. Pdin mapping parameter
029Eh	32	Fb30	1st PDIN map.Satz5	Uint32	6. Pdin mapping parameter
029Eh	64	Fb30	1st PDIN map.Satz6	Uint32	7. Pdin mapping parameter
029Eh	128	Fb30	1st PDIN map.Satz7	Uint32	8. Pdin mapping parameter
029Fh	0	Fb31	1st PDIN map count	Uint8	Number of active Pdin mapping parameter
(*1) Please note that the use of the sub-index is depending on the actual setting of bit6 in parameter Fb01 FBS Config, see chapter "3.1.1.2 addressing with subindex". „3.1.1.2 Satzadressierung mittels Subindex“					

6.2 Parameter description

ID:	**OS00:**
Name:	**Operator type**
Meaning	Indicates the operator type and the software version.
Parameter number (PNU):	0180h
Subindex:	0
Data type:	Uint32
Coding:	11800 + software version as two-digit decimal number with 1 decimal place in the least significant two decimal places.
Standard value:	Depending on actual software version
Note:	Example: 11828: F5 PROFINET operator with software V2.8.

ID:	**OS01:**
Name:	**Password**
Meaning	Indicates the actual adjusted password level of the operator software.
Parameter number (PNU):	0181h
Subindex:	0
Data type:	Int16
Coding:	KEB internal
Standard value:	Level4 password
Note:	Written and countercheck value are not identical. Currently the password level has no effect on the functionality of the operator and thus has no importance for the user.

ID:	**OS02:**
Name:	**Software date**
Meaning	Indicates the software date of the actual software.
Parameter number (PNU):	0182h
Subindex:	0
Data type:	Uint32
Coding:	First 4 decimal places = year Next 2 decimal places = month Last 2 decimal places = day
Standard value:	Depending on the actual software version date
Note:	Example: Value = 20120503 : 03.05.2012 is displayed in COMBIVIS as plain-text as ‚2012,0503‘:

ID:	**OS05:**
Name:	**Diag Baud rate**
Meaning	Indicates the adjusted transmission speed of the diagnostic interface (X6B).
Parameter number (PNU):	0185h
Subindex:	0
Data type:	Uint8
Coding:	0: 1200 Bit/s 1: 2400 Bit/s 2: 4800 Bit/s 3: 9600 Bit/s 4: 19200 Bit/s 5: 38400 Bit/s 6: 55500 Bit/s
Standard value:	5: 38400 Bit/s
Note:	A changed value is stored immediately active and non-volatile.

ID:	**OS10:**
Name:	**MAC Address (Chassis)**
Meaning	
Parameter number (PNU):	018Ah
Subindex:	0
Data type:	Uint32
Coding:	1
Standard value:	FAXXXXXXh
Note:	The complete value of the MAC address (chassis) is the result from this value plus prefix of 0008h.

ID:	OS11:
Name:	**NetX_FwVersion**
Meaning	Indicates the actual loaded firmware version of the installed ProfiNet Asics.
Parameter number (PNU):	018Bh
Subindex:	0
Data type:	Uint32
Coding:	1
Standard value:	Depending on the delivered PROFINET firmware version
Note:	

ID:	OS12:
Name:	**Serial number (IM)**
Meaning	Indicates the serial number of the F5 ProfiNet operator.
Parameter number (PNU):	018Ch
Subindex:	0
Data type:	Uint32
Coding:	1
Standard value:	0
Note:	The suffix (IM) in the parameter name indicates that this value is part of the identification and maintenance parameters.

ID:	OS14:
Name:	**NodeSwitchVal**
Meaning	Indicates the actual adjustment at the two hex-coded node address switches.
Parameter number (PNU):	018Eh
Subindex:	0
Data type:	Uint8
Coding:	1
Standard value:	Depending on switch position.
Note:	The value of this parameter affects the PROFINET name.

ID:	OS15:
Name:	**Pnet_IPAddress**
Meaning	Indicates the actual IP address of the F5 PROFINET operator.
Parameter number (PNU):	018Fh
Subindex:	0
Data type:	Uint32
Coding:	4-byte IP address
Standard value:	0.0.0.0
Note:	The last assigned IP address by the PROFINET controller is stored non-volatile and remains active at the next start-up.

ID:	OS16:
Name:	**Din66019SlvAddr**
Meaning	Slave address of the F5 PROFINET operator for communication via KEB COMBIVIS with TCP/UDP
Parameter number (PNU):	0190h
Subindex:	0
Data type:	Uint8
Coding:	1
Standard value:	Depending on the setting in OS15
Note:	This parameter is write protected in the actual software. The value is determined by the least significant byte of the Pnet_IPAddress (OS15).

ID:	OS17
Name:	**MAC Address (Port0)**
Meaning	MAC address of Port0 (X6C) of the PROFINET interface
Parameter number (PNU):	0191h
Subindex:	0
Data type:	Uint32
Coding:	see OS10
Standard value:	FAXXXXXXh
Note:	see OS10

ID:	OS18:
Name:	**MAC Address (Port1)**
Meaning	MAC address of Port1 (X6D) of the PROFINET interface
Parameter number (PNU):	0192h
Subindex:	0
Data type:	Uint32
Coding:	see OS10
Standard value:	FAXXXXXXh
Note:	see OS10

ID:	OS19:
Name:	**Manufacturer_Id (IM)**
Meaning	The assigned manufacturer-ID by the PROFIBUS consortium for KEB.
Parameter number (PNU):	0193h
Subindex:	0
Data type:	Uint16
Coding:	1
Standard value:	177h
Note:	This value is constant.

ID:	OS20:
Name:	**Order_Id (IM)**
Meaning	The order number of the KEB F5 PROFINET operator as long character string (20 characters). Divided into five 32-bit values, each with 4 characters.
Parameter number (PNU):	0194h
Subindex:	1: Character 1 to 4 2: Character 5 to 8 4: Character 9 to 12 8: Character 13 to 16 16: Character 17 to 20
Data type:	Uint32
Coding:	Ascii
Standard value:	00F5060-L100
Note:	This value is constant.

ID:	OS21:
Name:	**Hardware_Revision (IM)**
Meaning	Hardware revision of the F5 PROFINET operator
Parameter number (PNU):	0195h
Subindex:	0
Data type:	Uint16
Coding:	1
Standard value:	1
Note:	This value is constant.

ID:	OS22:			
Name:	**Software_Revision (IM)**			
Meaning	Software revision of the F5 PROFINET operator			
Parameter number (PNU):	0196h			
Subindex:	0			
Data type:	Uint32			
Coding:	in accordance with [6]			
	b31…b24	b23…b16	b15…b8	b7…b0
	Type	X	Y	Z
	‚V‘(= 86): Released version ‚P‘(= 80): Prototype ‚U‘(= 85): in test ‚T‘(= 84): Test equipment	Upper decimal place of the operator software version (see OS.00)	Lower decimal place of the operator software version (see OS.00)	Here always = 0
Standard value:	Depending on software version			
Note:	This value is constant.			

ID:	OS23:
Name:	**Revision_Counter (IM)**
Meaning	Revision counter of the F5 PROFINET operator
Parameter number (PNU):	0197h
Subindex:	0
Data type:	Uint16
Coding:	1
Standard value:	1
Note:	This value is constant 1

ID:	OS24:
Name:	**Profile_Id (IM)**
Meaning	Profile-ID of the F5 PROFINET operator. Although the KEB F5 PROFINET operator operates with respect to the acyclic communication to the PROFIDRIVE profile, it is assigned to the group of Generic device units, because it does not support any parameters according to PROFIDRIVE specification.
Parameter number (PNU):	0198h
Subindex:	0
Data type:	Uint16
Coding:	1
Standard value:	F600h: Generic device
Note:	This value is constant.

ID:	OS25:
Name:	**Profile_Specific_Type (IM)**
Meaning	The profile specific type of the F5 PROFINET operator
Parameter number (PNU):	0199h
Subindex:	0
Data type:	Uint16
Coding:	1
Standard value:	0001h: Standard Controller
Note:	This value is constant.

ID:	OS26
Name:	**Pnet_IPMask**
Meaning	Indicates the actual IP mask of the F5 PROFINET operator.
Parameter number (PNU):	019Ah
Subindex:	0
Data type:	Uint32
Coding:	4-byte IP-Mask
Standard value:	0.0.0.0
Note:	The last assigned IP mask by the PROFINET controller is stored non-volatile and remains active at the next start-up.From software V3.2 the value of this parameter can also be written via diagnostic interface. A new value is stored non-volatile, but active only at the next switch on.

ID:	OS27
Name:	**Pnet_IPGateway**
Meaning	Indicates the actual IP Gateway of the F5 PROFINET operator
Parameter number (PNU):	0198h
Subindex:	0
Data type:	Uint32
Coding:	4-byte IP-Gateway
Standard value:	0.0.0.0
Note:	The last assigned IP Gateway adjustment by the PROFINET controller is stored non-volatile and remains active at the next start-up.From software V3.2 the value of this parameter can also be written via diagnostic interface. A new value is stored non-volatile, but active only at the next switch on.

ID:	Fb00
Name:	**InternComCycle**
Meaning	Indicates whether the internal communication is cyclic or acyclic.
Parameter number (PNU):	0280h
Subindex:	0
Data type:	Uint16
Coding:	0: Internal communication is acyclic Otherwise: Internal communication is cyclic with cycle time = Fb00 in µs
Standard value:	0
Note:	

ID:	Fb01							
Name:	**FBS Config**							
Meaning	Some configuration settings of the F5 PROFINET operator							
Parameter number (PNU):	0281h							
Subindex:	0							
Data type:	Uint16							
Coding:	b15…b7	b6	b5	b4	b3	b2	b1	b0
	xxx	Pnet_ SubIdx_ Linear	Enable_ PDMap	Use_Default_ PDMap	PDAPI_ Disable	Disable_ NetX_ Reset	Sync-Mode_ Enable	IRT_ Enable
	bit0 = 1	IRT_Enable: In preparation						
	bit1 = 1	SyncMode_Enable: Enables the internal cyclic communication.						
	bit2 = 1	Disable NetX-Reset: At fundamental problems when starting the PROFINET firmware, the CPU of the PROFINET operator can carry out a hardware reset of the PROFINET ASIC (NetX). This function can be disabled via this bit.						
further on next side								

	bit3 = 1	PDAPI_Disable: For the function to be able to exchange acyclic data with a standard Siemens S7 PROFINET controller to PROFIDRIVE Base Mode Parameter Access, the F5 PROFINET operator has a second API with value = 3A00h. The module with the name ‚ProfiDrive_PAP' is assigned to this API. Via this bit the complete functionality of the API = 3A00h can be disabled with the module ‚ProfiDrive_PAP'. In this case the acyclic communication to PROFIDRIVE Base Mode-Parameter-Access can be executed also via the standard API with value = 0.
	bit4 = 1	The default PD mapping is written when starting the software to the frequency inverter, if bit5 = 1.
	bit4 = 0	The non-volatile stored PD mapping in the operator (see Fb28 to Fb31) is written to the frequency inverter at boot-up, if bit5 = 1.
	bit5 = 0	Writing the PD mapping to the frequency inverter control is deactivated at boot-up.
	bit5 = 1	Writing the PD mapping to the frequency inverter control is activated at boot-up.
	bit6 = 1	When addressing the parameters to PROFINET acyclic data the subindex is not bit-coded, but linearly coded.
	bit7 = 1	Activation of the PROFINET alarm signals. When the alarm is activated, the operator monitors the value of the inverter parameter ru00 „inverter state“ (see chapter 3.11).
Standard value:	0	
Note:	A new value is stored non-volatile, but only active at the next switch on.	

ID:	**Fb02**
Name:	**DelayTimeSyncToAppIIrq**
Meaning	Is only relevant for the synchronous communication mode (PROFINET IO/IRT). This parameter defines the delay time between PROFINET-Sync-Signal and communication interrupt.
Parameter number (PNU):	0282h
Subindex:	0
Data type:	Uint16
Coding:	1 µs
Standard value:	500 µs
Note:	A changed value is stored immediately active and non-volatile.

ID:	Fb03
Name:	**RealSyncCycleTime**
Meaning	Specifies the determined synchronous cycle time of the F5 PROFINET operator. The calculation of this time is updated with each Sync signal.
Parameter number (PNU):	0283h
Subindex:	0
Data type:	Uint16
Coding:	1 µs
Standard value:	
Note:	This parameter is read-only.

ID:	Fb04
Name:	**FBS Command**
Meaning	Certain commands in the F5 PROFINET operator can be requested via this parameter. After execution of the command the operator sets bit 15 of the value to 1.
Parameter number (PNU):	0284h
Subindex:	0
Data type:	Uint16
Coding:	0: no command 1: Sets all non-volatile stored parameters of the operator to default values.
Standard value:	0
Note:	

ID:	Fb05
Name:	**PDOUT1_Hsp5Service**
Meaning	The adjustment of this parameter is only relevant for the normal mode. Indicates the service code for the KEB internal protocol HSP5 to output the first 8 PDOUT data-byte from the operator to the frequency inverter control. The value must be suitable adjusted to the PDOUT mapping in the frequency inverter.
Parameter number (PNU):	0285h
Subindex:	0
Data type:	Uint8
Coding:	16: PDOUT assignment only with 32 bit values 17: PDOUT assignment only with 16 bit values 48: PDOUT assignment only with 32 bit values, full duplex(*1) 49: PDOUT assignment only with 16 bit values, full duplex(*1) 50: PDOUT assignment with 1 32-bit- and 1-2 16-bit values, full duplex (*1)
Standard value:	17
Note:	A changed value is stored immediately active and non-volatile.This parameter is write protected, if Fb01 FBS Config.Bit5 is 1.

ID:	Fb06
Name:	**PDIN1_Hsp5Service**
Meaning	The adjustment of this parameter is only relevant for the normal mode. Indicates the service code for the KEB internal protocol HSP5 to read the first 8 PDIN data-byte from the operator to the frequency inverter control. The value must be suitable adjusted to the PDIN mapping in the frequency inverter.
Parameter number (PNU):	0286h
Subindex:	0
Data type:	Uint8
Coding:	16: PDIN assignment only with 32 bit values 17: PDIN assignment only with 16 bit values 48: PDIN assignment only with 32 bit values, full duplex (*1) 49: PDIN assignment only with 16 bit values, full duplex (*1) 50: PDIN assignment with 1 32-bit- and 1-2 16-bit values, full duplex (*1)
Standard value:	17
Note:	A changed value is stored immediately active and non-volatile.This parameter is write protected, if Fb01 FBS Config.Bit5 is 1.

(*1): In case of full duplex services the PDOUT data are transferred in Request to the frequency inverter control and Response contains the PDIN data. PDOUT data and PDIN data are independently transferred at non-full duplex services. The outcome of this at full duplex services is that the values for PDOUT_Hsp5Service/ PDOUT2_Hsp5Service and PDIN_Hsp5Service/ PDIN2_Hsp5Service must be identical.

ID:	Fb07
Name:	**PDIN_Cycle**
Meaning	The adjustment of this parameter is only relevant for the normal mode. The contents of the PDIN data are read cyclically in normal communication mode. The value of this parameter preset the cycle time in ms.
Parameter number (PNU):	0287h
Subindex:	0
Data type:	Uint16
Coding:	1ms
Standard value:	25ms
Note:	A changed value is stored immediately active and non-volatile.

ID:	Fb08
Name:	**PDOUT2_Hsp5Service**
Meaning	The adjustment of this parameter is only relevant for the normal mode. Indicates the service code for the KEB internal protocol HSP5 to output the second 8 PDOUT data-byte from the operator to the frequency inverter control, if activated. The value must be suitable adjusted to the PDOUT mapping in the frequency inverter.
Parameter number (PNU):	0288h
Subindex:	0
Data type:	Uint8
Coding:	19: PDOUT assignment only with 32 bit values 20: PDOUT assignment only with 16 bit values 51: PDOUT assignment only with 32 bit values, full duplex(*1) 52: PDOUT assignment only with 16 bit values, full duplex(*1) 53: PDOUT assignment with 1 32-bit- and 1-2 16-bit values, full duplex (*1)
Standard value:	20
Note:	A changed value is stored immediately active and non-volatile.This parameter is write protected, if Fb01 FBS Config.Bit5 is 1.

ID:	Fb09
Name:	**PDIN2_Hsp5Service**
Meaning	The adjustment of this parameter is only relevant for the normal mode. Indicates the service code for the KEB internal protocol HSP5 to read the second 8 PDIN data-byte from the operator to the frequency inverter control, if activated. The value must be suitable adjusted to the PDIN mapping in the frequency inverter.
Parameter number (PNU):	0289h
Subindex:	0
Data type:	Uint8
Coding:	19: PDIN assignment only with 32 bit values 20: PDIN assignment only with 16 bit values 51: PDIN assignment only with 32 bit values, full duplex (*1) 52: PDIN assignment only with 16 bit values, full duplex (*1) 53: PDIN assignment with 1 32-bit- and 1-2 16-bit values, full duplex (*1)
Standard value:	20
Note:	A changed value is stored immediately active and non-volatile.This parameter is write protected, if Fb01 FBS Config.Bit5 is 1.

ID:	Fb10
Name:	**CfgNrPDINS**
Meaning	This parameter has two meanings. In mormal mode, the value of this parameter indicates how many PDIN units are activated internally. Each internal PDIN unit transfer 8 bytes PDIN data in normal mode. Additionally the parameter determines which PDIN submodule is configured in slot1. The adjustment of this parameter must agree with the project design in the PROFINET controller.
Parameter number (PNU):	028Ah
Subindex:	0
Data type:	Uint8
Coding:	1 (corresponds to 8 byte PDIN data) 2 (corresponds to 16 byte PDIN data)
Standard value:	1
Note:	A changed value is stored non-volatile, but active only at the next switch on. This parameter is write protected, if Fb01 FBS Config.Bit5 is 1.

ID:	Fb11
Name:	**CfgNrPDOUTS**
Meaning	This parameter has two meanings. In mormal mode, the value of this parameter indicates how many PDOUT units are activated internally. Each internal PDOUT unit transfer 8 bytes PDOUT data in normal mode. Additionally the parameter determines which PDOUT submodule is configured in slot2. The adjustment of this parameter must agree with the project design in the PROFINET controller.
Parameter number (PNU):	028Bh
Subindex:	0
Data type:	Uint8
Coding:	1 (corresponds to 8 byte PDOUT data) 2 (corresponds to 16 byte PDOUT data)
Standard value:	1 (corresponds to 8 byte PDOUT data)
Note:	A changed value is stored non-volatile, but active only at the next switch on. This parameter is write protected, if Fb01 FBS Config.Bit5 is 1.

ID:	Fb12
Name:	**ActiveNrPDINS**
Meaning	Indicates the number of active PDIN units in normal mode.The value of this parameter usually corresponds to the value of FB10. The cause that the two parameter values differ is that the connected frequency inverter control supports only one PDIN unit.
Parameter number (PNU):	028Ch
Subindex:	0
Data type:	Uint8
Coding:	1 (corresponds to 8 byte PDIN data) 2 (corresponds to 16 byte PDIN data)
Standard value:	1 (corresponds to 8 byte PDIN data)
Note:	The value of this parameter can only be read.

ID:	Fb13
Name:	**ActiveNrPDOUTS**
Meaning	Indicates the number of active PDOUT units in normal mode.The value of this parameter usually corresponds to the value of FB11. The cause that the two parameter values differ is that the connected frequency inverter control supports only one PDOUT unit.
Parameter number (PNU):	028Dh
Subindex:	0
Data type:	Uint8
Coding:	1 (corresponds to 8 byte PDOUT data) 2 (corresponds to 16 byte PDOUT data)
Standard value:	1 (corresponds to 8 byte PDOUT data)
Note:	The value of this parameter can only be read.

ID:	Fb14
Name:	**PdoutEvCnt**
Meaning	Counts the events that new PDOUT data are received from ProfiNet.
Parameter number (PNU):	028Eh
Subindex:	0
Data type:	Uint32
Coding:	1
Standard value:	0
Note:	The value of this parameter can only be read.

ID:	Fb15
Name:	**Pdout_Dw1**
Meaning	Displays the last received first double word (32 bit) of the PDOUT data.
Parameter number (PNU):	028Fh
Subindex:	0
Data type:	Uint32
Coding:	1
Standard value:	0
Note:	The value of this parameter can only be read.

ID:	Fb16
Name:	**Pdout_Dw2**
Meaning	Displays the last received second double word (32 bit) of the PDOUT data.
Parameter number (PNU):	0290h
Subindex:	0
Data type:	Uint32
Coding:	1
Standard value:	0
Note:	The value of this parameter can only be read.

ID:	Fb17
Name:	**Pdout_Dw3**
Meaning	Displays the last received third double word (32 bit) of the PDOUT data.
Parameter number (PNU):	0291h
Subindex:	0
Data type:	Uint32
Coding:	1
Standard value:	0
Note:	The value of this parameter can only be read.

ID:	Fb18
Name:	**Pdout_Dw4**
Meaning	Displays the last received 4th double word (32 bit) of the PDOUT data.
Parameter number (PNU):	0292h
Subindex:	0
Data type:	Uint32
Coding:	1
Standard value:	0
Note:	The value of this parameter can only be read.

ID:	Fb19
Name:	**PdinEvCnt**
Meaning	Counts the events that new PDIN data to the PROFINET have been updated.
Parameter number (PNU):	0293h
Subindex:	0
Data type:	Uint32
Coding:	1
Standard value:	0
Note:	The value of this parameter can only be read.

ID:	Fb20
Name:	**Pdin_Dw1**
Meaning	Displays the last transmitted first double word (32 bit) of the PDIN data.
Parameter number (PNU):	0294h
Subindex:	0
Data type:	Uint32
Coding:	1
Standard value:	0
Note:	The value of this parameter can only be read.

ID:	Fb21
Name:	**Pdin_Dw2**
Meaning	Displays the last transmitted second double word (32 bit) of the PDIN data.
Parameter number (PNU):	0295h
Subindex:	0
Data type:	Uint32
Coding:	1
Standard value:	0
Note:	The value of this parameter can only be read.

ID:	Fb22
Name:	**Pdin_Dw3**
Meaning	Displays the last transmitted third double word (32 bit) of the PDIN data.
Parameter number (PNU):	0296h
Subindex:	0
Data type:	Uint32
Coding:	1
Standard value:	0
Note:	The value of this parameter can only be read.

ID:	Fb23
Name:	**Pdin_Dw4**
Meaning	Displays the last transmitted 4th double word (32 bit) of the PDIN data.
Parameter number (PNU):	0297h
Subindex:	0
Data type:	Uint32
Coding:	1
Standard value:	0
Note:	The value of this parameter can only be read.

ID:	Fb24
Name:	**ProjSyncCycleTime**
Meaning	Indicates the master projected Sync cycle time in µs at active PROFINET IO/IRT communication.
Parameter number (PNU):	0298h
Subindex:	0
Data type:	Uint32
Coding:	1 µs
Standard value:	0 µs
Note:	The value of this parameter can only be read.

ID:	Fb25
Name:	**ProjDiffTimePDIN**
Meaning	Indicates at active PROFINET IO/IRT communication the master projected set-up time where the PDIN data shall be determined.
Parameter number (PNU):	0299h
Subindex:	0
Data type:	Uint32
Coding:	1 µs
Standard value:	0 µs
Note:	The value of this parameter can only be read.

ID:	Fb26
Name:	**ProjDiffTimePDOUT**
Meaning	Indicates at active PROFINET IO/IRT communication the master projected set-up time where the PDOUT data shall be accepted.
Parameter number (PNU):	029Ah
Subindex:	0
Data type:	Uint32
Coding:	1 µs
Standard value:	0 µs
Note:	The value of this parameter can only be read.

ID:	Fb27
Name:	**IRTCycleCnt**
Meaning	Indicates the IRT cycle counter value at active PROFINET IO/IRT communication.
Parameter number (PNU):	029Bh
Subindex:	0
Data type:	Uint16
Coding:	1
Standard value:	0
Note:	The value of this parameter can only be read.

ID:	**Fb28**			
Name:	**1st PDOUT map**			
Meaning	Specifies the PDOUT mapping. The parameter is set-programmable.			
Parameter number (PNU):	029Ch			
Subindex:	Subindex		Meaning	
	Bit-coded	Linear		
	FBS Config.Bit6 = 0	FBS Config.Bit6 = 1		
	0	0	addressed the 1th mapping	
	1	1	addressed the 1th mapping	
	2	2	addressed the 2nd mapping	
	4	3	addressed the 3rd mapping	
	8	4	addressed the 4th mapping	
	16	5	addressed the 5th mapping	
	32	6	addressed the 6th mapping	
	64	7	addressed the 7th mapping	
	128	8	addressed the 8th mapping	
Data type:	Uint32			
Coding:	b31…b24	b23…b16	b15…b8	b7…b0
	PNU		Subindex	Bit length
	Pnu: Parameter address of the mapped parameter Subindex:Parameter subindex of the mapped parameter			
	Subindex = 0	→	Parameter is mapped in set0	
	Subindex = 1	→	Parameter is mapped in set0	
	Subindex = 2	→	Parameter is mapped in set1	
	Subindex = 3	→	Parameter is mapped in set2	
	Subindex = 4	→	Parameter is mapped in set3	
	Subindex = 5	→	Parameter is mapped in set4	
	Subindex = 6	→	Parameter is mapped in set5	
	Subindex = 7	→	Parameter is mapped in set6	
	Subindex = 8	→	Parameter is mapped in set7	
	Multiple mappings are not possible.			
	Bit length: The mapped data length in bit, only the values = 16.32 are permissible here			
Standard value:	0			
Note:	A changed value is immediately stored non-volatile.A changed mapping entry furthermore causes the shutdown of the corresponding mapping and the setting of parameter 1st PDOUT map cout = 0. Gaps are not supported by this structure, i.e. there is no way to declare a mapping inactive.			

ID:	Fb29
Name:	**1st PDOUT map count**
Meaning	Indicates how much PDOUT mapping entries shall be activated in 1st PDOUT1 map.
Parameter number (PNU):	029Dh
Subindex:	0
Data type:	Uint8
Coding:	1
Standard value:	
Note:	A changed value is stored immediately active and non-volatile.

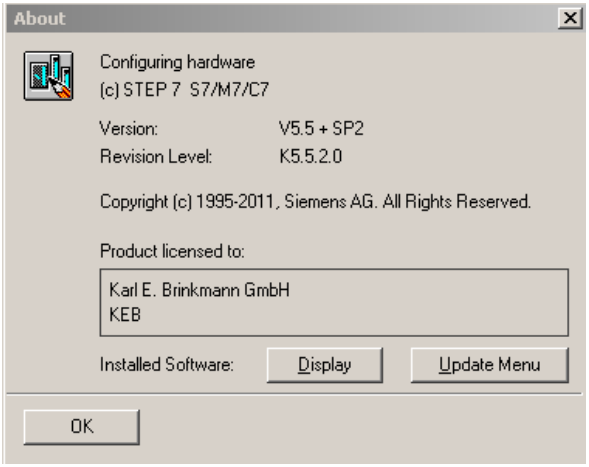
ID:	Fb30
Name:	**1st PDIN map**
Meaning	Specifies the Pdin mapping. The parameter is set-programmable.
Parameter number (PNU):	029Eh
Subindex:	see Fb28
Data type:	Uint32
Coding:	see Fb28
Standard value:	0
Note:	A changed value is immediately stored non-volatile.A changed mapping entry furthermore causes the switch off of the corresponding mapping and setting of parameter 1st PDIN map cout = 0. Gaps are not supported by this structure, i.e. there is no way to declare a mapping inactive.

ID:	Fb31
Name:	**1st PDIN map count**
Meaning	Indicates how much PDOUT mapping entries shall be activated in 1st map.
Parameter number (PNU):	029Fh
Subindex:	0
Data type:	Uint8
Coding:	1
Standard value:	
Note:	A changed value is stored immediately active and non-volatile.

7. Instructions for F5 PROFINET operator at Simatic S7

Simatic is a product group of Siemens AG. This short overview make no claim to be exhaustive, nor replace the original documents of the company Siemens to this issue!

Please note in particular the issue project design of the clock synchronization (PROFINET IO) in the S7 help. The project design of a synchronous PROFINET communication (PROFINET IO-IRT) is more extensive than the project design for a PROFINET IO-RT communication. The following example is used to specify the steps for the project design of such IRT communication. All pictures are screenshots of a Siemens Step7-Simatic-Manager software with the version.

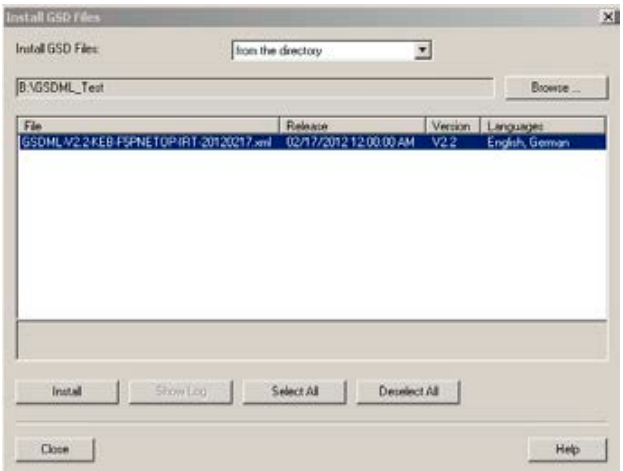


7.1 Standard project design

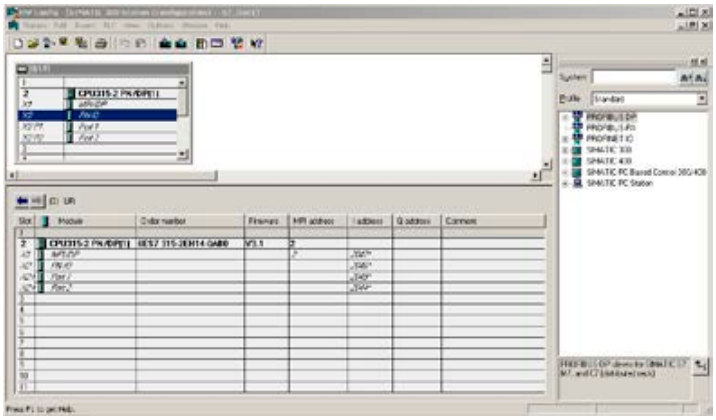
From software V2.8 of the F5 PROFINET operator the following communication functions are possible:

- Exchange acyclic data (parameter channel) complying to PROFIDRIVE profile
- Exchange cyclic data (process data channel) with PROFINET IO-RT or PROFINET IO-IRT

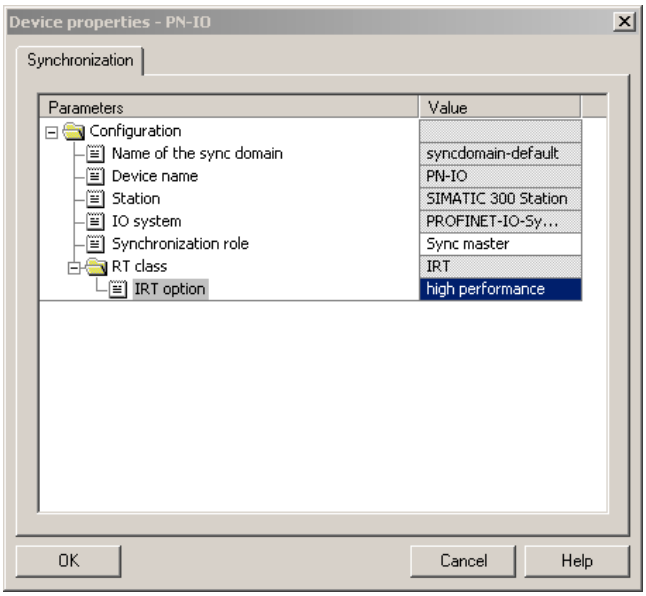
All informations about the available functions of a PROFINET device the PROFINET controller gets out ouf the device‘s device description file (GSDML) of this slave. Therefore first it is necessary to import the device description file of the slave into the control system. At the Siemens Simatic S7 this is done via HW Config at the menu item Options →GSD-files install…



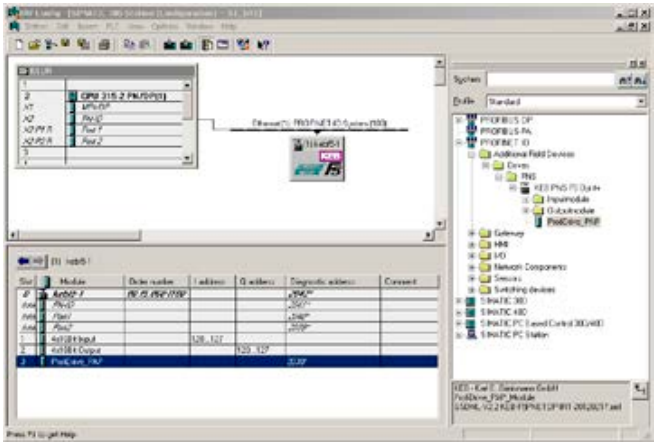
If you create a new project in the Simatic-Manager (e.g. via file → Assistent New Project...) first select the desired S7-CPU. Then change to hardware configuration and paste by right click to the PN_IO interface of the CPU and insert selection PROFINET IO-system ... a PROFINET system.



If the synchronous communication (PROFINET IO-IRT) shall be used, the PN-IO interface of the CPU can be configured by right-clicking on the PN-IO interface of the CPU and select object properties as a sync master:



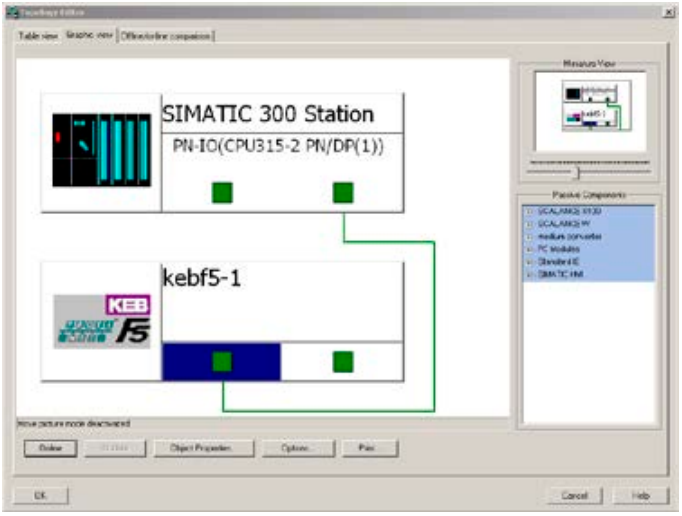
Then in the right part of the HW Config window of PROFINET-IO → additional field instruments → ....the KEB F5 PROFINET operator selected and appended with the mouse to the PROFINET System in the left pane. It is important that the PROFIDRIVE_PAP module is placed into slot 3:



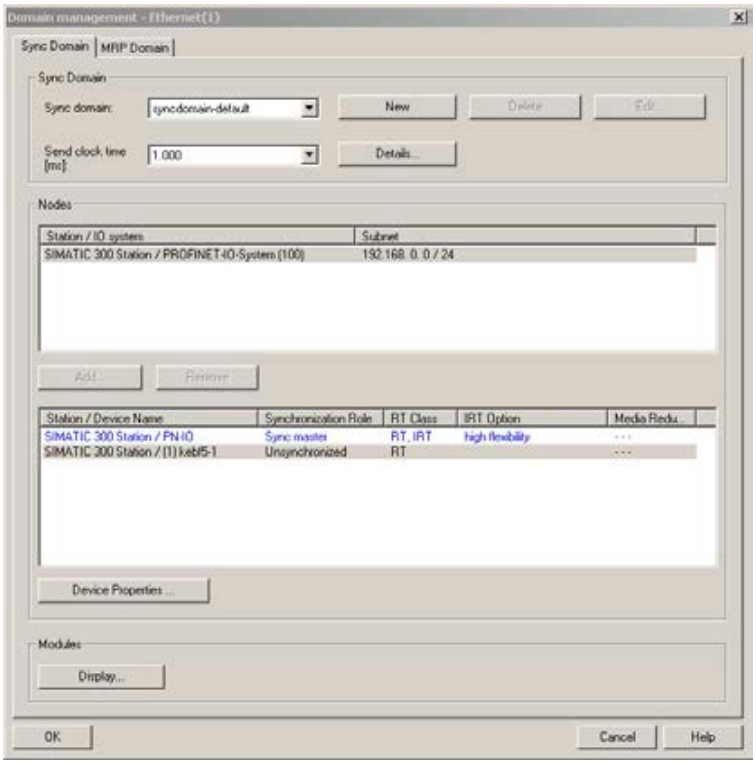
As standard one 4x16 bit input module and one 4x16 bit output module are automatically inserted for the KEB F5 unit. If required, these can be replaced by one 8x16 bit input module or 8x16 bit output module. The standard project design is used in this example. Thereby 8 byte cyclic data can be transferred from the control to the slave and the same quantity cyclic data can be transferred from the slave to the control. The project design is completed herewith if no synchronous communication is required (PROFINET IO-IRT).

7.2 Additional project design for synchronous communication according PROFINET IO-IRT

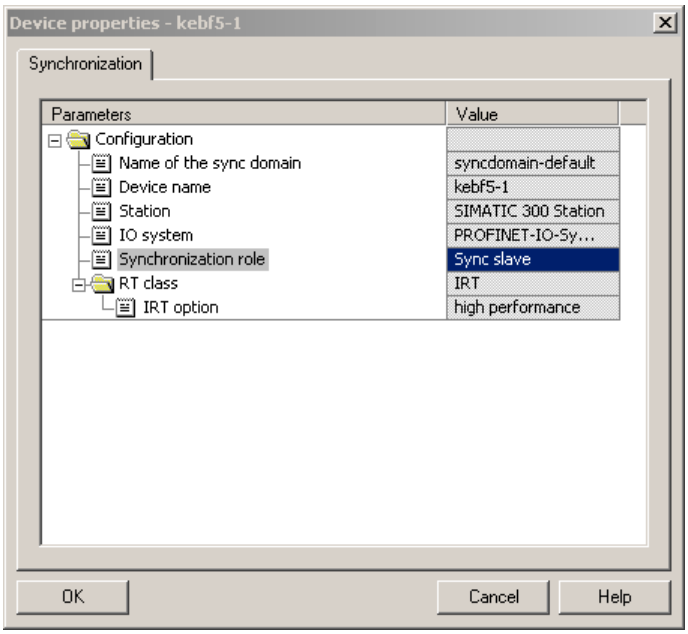
Additional settings must also be made for the slave if PROFINET IO-IRT shall be activated. First, the exact topology of the PROFINET network must be specified for synchronous communication. This is done by right click on the PROFINET IO system and selection of PROFINET IO topologi. The following picture shows the graphical view. This gives the best overview. In this example Port2 was selected for the PROFINET communication on control side and Port1on slave side, since the communication with the programming unit is done via Port1 of the control CPU.



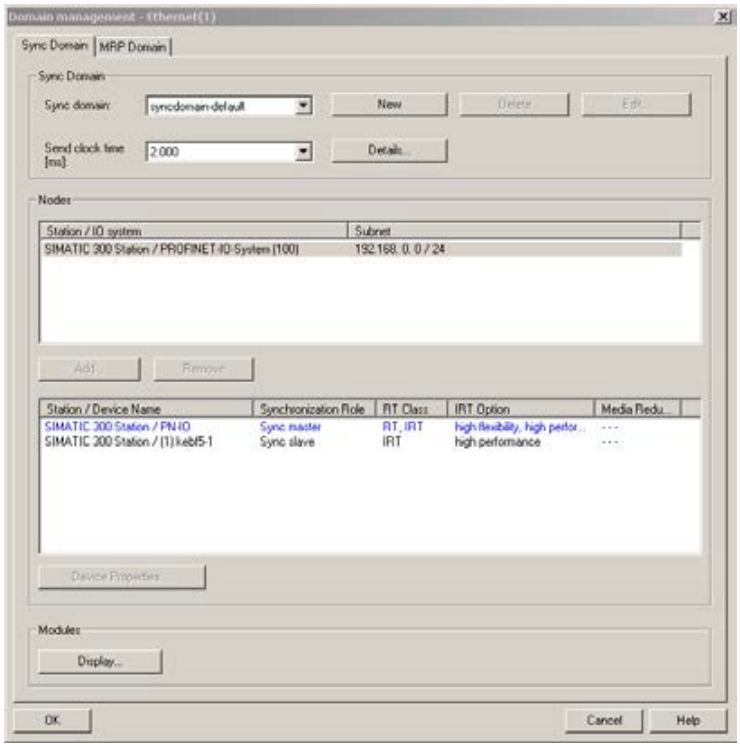
Then the KEB slave must be configured as sync slave via right-click to the PROFINET IO system and selection of PROFINET domain management.



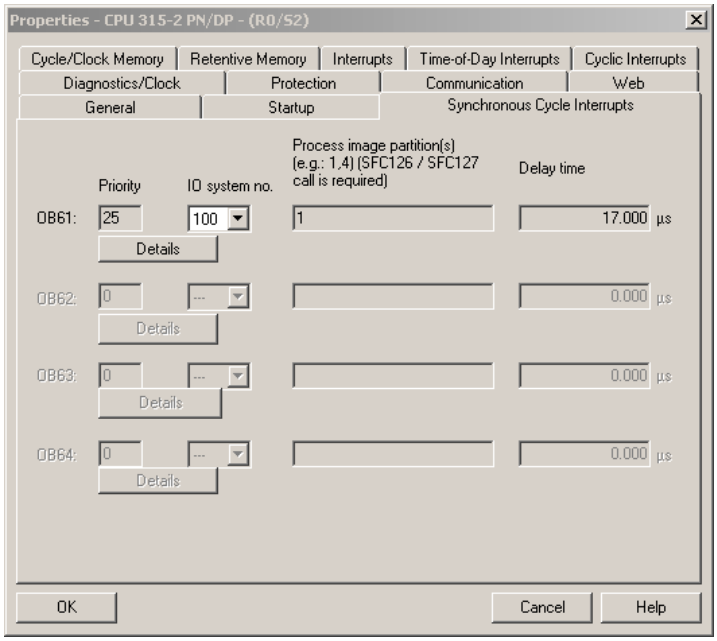
It makes sense to set the transmit clocking to 2ms, because this corresponds to the minimum setting of the KEB F5 PROFINET slave. Furthermore the KEB slave is selected here (click on ‚kebf5-1') and configured as follows via clicking the button ‚unit characteristics':



Then the domain management is configured as follows:

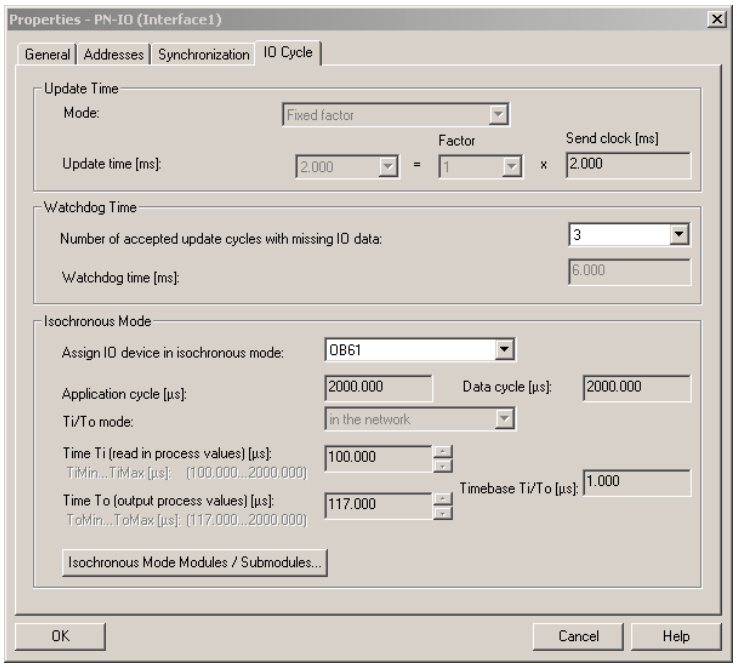


The Siemens S7 plc provides synchronous alarms for synchronous communication. The exchange of synchronous, cyclic data is programmed in this alarm modules. The OB61 is activated for it in the example. This is done by right click to the CPU and selection of ‚object characteristics'. Page ‚synchronous alarm' is seleted in the opening window.



The detail adjustments must be done via the button 'details' of the selected OB.

Finally the slave is assigned to OB61 by right click to the PN-IO interface of the slave and the selection ‚object characteristics'. Page ‚IO-Cycle' is selected in the opening window.



7.3 Step7 Software

7.3.1 Acyclic communication (parameter channel)

The system function blocks SFB53 ("WRREC") and SFB52 ("RDREC") can be used for the realization of acyclic communication according PROFIDrive.The basic process of an acyclic parameter access is described as follows:

- Send the acyclic request by calling SFB53 ("WRREC")
- Calling SFB53 must be repeated until SFB53-OUTPUT ‚DONE' is 1.
- Calling SFB52 ("RDREC") until SFB52-OUTPUT ‚VALID' is 1.

Important transfer parameters for the SFB53/52 calls:

- ‚ID': This input parameter must be set with the diagnosis address of the ProfiDrive_PAP module (see HW-config).In the example above this is 2038 (07F6h).
- ‚INDEX' this input parameter defines the data set type which is transacted hereby. For reasons of backward compatibility there are several possible values which are treated internally the same by the KEB F5 ProfiNet operator:
  - -20434 (= B02EH): Base Parameter Mode Access – Local
  - -20433 (=B02FH): Base Parameter Mode Access – Global
  - 47: Base Parameter Mode Access – Global

7.3.2 Cyclic communication (process data)

Access to the cyclical data of the slave is very simple. Access to entered I/O addresses of a slave defined by the hardware configuration can be done via the following commands:

```
L     PIW    X // Loading the peripheral input word with offset X in ACCU1
T     PQW    Y // Transfer the content of ACCU 1 into the peripheral output word with offset Y
```

Depending on the organization of the cyclic data also the byte or double-word commands can be used (L PID X, T PQD Y or L PIB X, T PQB Y).

This is valid for the synchronous data exchange at PROFINET IO-IRT in a synchronous alarm block (e.g. OB61) as well as for the non-synchronous data exchange at PROFINET IO-RT.

8. Examples for the setting of PD mappings

8.1 Mixed mapping (special case)

A mixed mapping of 32 bit and 16 bit is a very special PD mapping. In this example the PDOUT data shall be assigned as follows:

B0	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15
MSB			LSB	MSB	LSB	MSB	LSB	MSB			LSB	MSB	LSB	MSB	LSB
Sy43				Sy52		In22		PS24				PS25		In23	

Fb28	1st PDOUT map.Set0	= 002B0120h	Sy43	(32-Bit)
Fb28	1st PDOUT map.Set1	= 00340110h	Sy52	(16-Bit)
Fb28	1st PDOUT map.Set2	= 0E160110h	In22	(16-Bit)
Fb28	1st PDOUT map.Set3	= 13180120h	PS24	(32-Bit)
Fb28	1st PDOUT map.Set4	= 13190110h	PS25	(16-Bit)
Fb28	1st PDOUT map.Set5	= 0E160110h	In22	(16-Bit)
Fb29	1st PDOUT map count	= 6		

Assignment of the Pdin data analog:

B0	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15
MSB			LSB	MSB	LSB	MSB	LSB	MSB			LSB	MSB	LSB	MSB	LSB
Sy44				Sy53		In22		ru54				PS25		In23	

Fb30	1st PDIN map.Set0	= 002B0120h	Sy44	(32-Bit)
Fb30	1st PDIN map.Set1	= 00340110h	Sy53	(16-Bit)
Fb30	1st PDIN map.Set2	= 0E160110h	In22	(16-Bit)
Fb30	1st PDIN map.Set4	= 02360120h	ru54	(32-Bit)
Fb30	1st PDIN map.Set5	= 02000110h	ru00	(16-Bit)
Fb30	1st PDIN map.Set6	= 0E160110h	In22	(16-Bit)
Fb31	1st PDIN map count	= 6		

8.2 2 x 32-Bit Pdout plus 4 x 16-Bit Pdin

The following example is used to demonstrate that PDOUT data and PDIN data may have a different structure:

Pdout data:

B0	B1	B2	B3	B4	B5	B6	B7
MSB			LSB	MSB			LSB
Sy43				oP63			

Fb28	1st PDOUT map.Set0	= 002B0120h	Sy43	(32-Bit)
Fb28	1st PDOUT map.Set1	= 0033F120h	oP63	(32-Bit)
Fb29	1st PDOUT map count	= 2		

PDIN data:

B0	B1	B2	B3	B4	B5	B6	B7
MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB
Sy42		Sy51		ru00		ru15	

Fb30	1st PDIN map.Set0	= 002B0110h	Sy42	(16-Bit)
Fb30	1st PDIN map.Set1	= 00330110h	oP63	(16-Bit)
Fb30	1st PDIN map.Set2	= 0E200110h	ru00	(16-Bit)
Fb30	1st PDIN map.Set3	= 020F0110h	ru15	(16-Bit)
Fb31	1st PDIN map count	= 4		

Please observe in all examples that the addressing of different sets is dependent on the setting of bit6 in Operator-Parameter Fb01 FBS config (see parameter description Fb28).

9. Annex

9.1 F5 Operator internal error messages

Error	Communication error during initialisation
o_Flo	Overflow in value calculation
t_out	Timeout, control board doesn't answer
IDAtA	Data invalid
rOnly	Parameter Read_Only
E_Bcc	Communication error: wrong checksum
Busy	Inverter busy
ISruc	Communication error: Invalid service
No PA	Parameter locked by password
I_FrA	Communication error: Invalid character
E_PAr	Communication error: wrong parity
I_SEt	Invalid set
I_Adr	Invalid parameter address
I_OPE	Invalid operation
E xx	xx=error code in hex: all other errors
EEEPX	with X = 1,2,3..: fatal error during test of serial eeprom
EEEPR	fatal error during test of serial eeprom

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