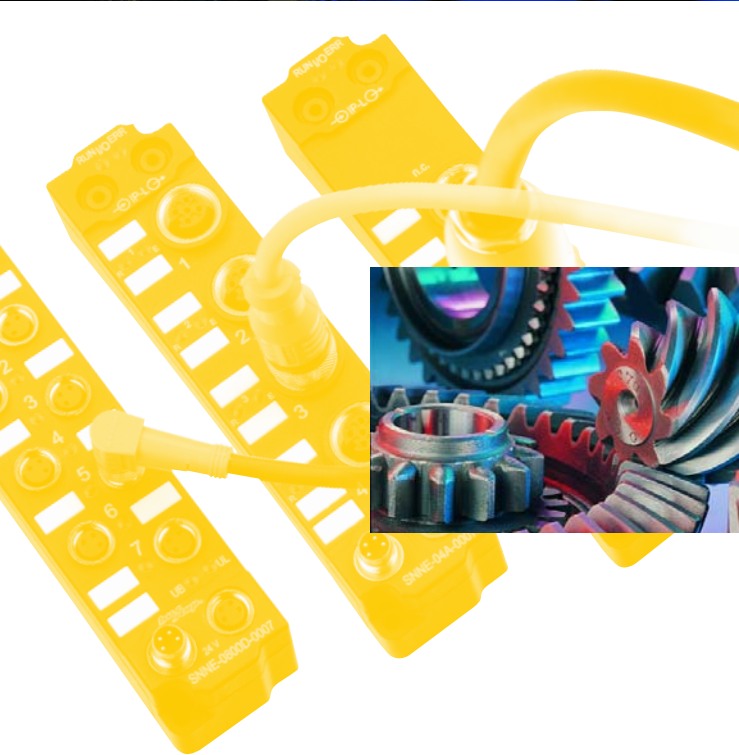


**TURCK**

Industrial  
Automation

***piconet*<sup>®</sup> -  
USER MANUAL  
FOR  
PROFIBUS-DP**



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Subject to alterations without notice.

## Prior to installation

- Disconnect the device from the power supply
- Protect against an accidental restart
- Verify safe isolation from the supply
- Cover or separate adjacent live components by a barrier.
- Follow the specific mounting instructions of the device
- Only appropriately qualified personnel according to EN 50 110-1/2- (VDC 0105 part 100) is permitted to work with the device/system.
- Please ensure that you are free of static charge prior to touching the device when carrying out installation.
- Connecting cables and signal lines must be installed in such a manner that inductive and capacitive interference do not impair the automation function.
- Install automation equipment and related operating elements in such a way that they are protected against unintentional operation.
- In order to ensure that a signal line or wire breakage cannot trigger an undefined state of the automation equipment, it is required to implement hard and software safety measures for reliable I/O interfacing.
- Safe electrical isolation of the low voltage for the 24 V supply must be ensured. Use power supply units compliant with IEC 60 364-4-41 or HD 384.4.41 S2 (VDE 0100 part 410) only.
- Fluctuations or deviations of the mains supply from the rated value may not exceed the tolerance limits specified in the technical data.
- Devices for cabinet or cubicle mounting as well as desktop or portable units may only be used and operated after enclosure.
- Measures have to be taken to ensure correct restart of a program which has been interrupted by voltage dips or failures. It must be ensured that such events cannot result in dangerous operating states, even if only present for a short time. If necessary, an emergency stop must be carried out.

- The electrical installation has to be carried out in compliance with the applicable regulations (e.g. concerning cable cross sections, fuses, PE connection etc.)
- Transport, installation, set-up and maintenance may only be carried out by qualified staff (observe IEC 60 364 or HD 384 or DIN VDE 0100 and national work safety regulations).
- It is required to keep all covers and doors closed during operation.

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## Introduction



---

### Attention

It is indispensable to read this section because the safety in dealing with electrical equipment should not be left to chance.

---

This manual contains all information pertaining to safe and proper operation of *piconet*<sup>®</sup> I/O modules for PROFIBUS-DP. It was specially edited for qualified staff with the required specialised knowledge.

### Correct usage to the intended purpose

---



### Warning

The devices described in this manual may only be used in such applications described in the technical sections of the manual and only in conjunction with certified external devices and components.

---

Correct and safe operation of the devices relies on appropriate transport and storage, correct set-up and installation as well as careful operation and maintenance.

### Projecting guidelines/Product installation

---



### Warning

It is indispensable to observe the applicable safety and accident prevention regulations of the specific application.

---

### Meaning of the symbols used



#### **Warning**

This sign is placed next to a warning indicating the presence of a hazard. This can relate to personal injury as well as to system damage (hardware and software).

The user should interpret this symbol as follows: exercise extreme caution.

---



#### **Attention**

This sign is placed next to a warning indicating a potential hazard. This can relate to personal injury as well as to system (hardware and software) and equipment damage.

---



#### **Note**

This sign is located next to general hints providing important information on individual or stepwise work procedures.

These hints may facilitate work and possibly help to avoid excess work resulting from faulty proceedings.

---

## **Release status and versions**

### **Documentation**

This documentation pertains to the hardware and firmware status at the time of editing this manual. The features of the *piconet*<sup>®</sup> systems are continuously developed and improved.

Changes in the documentation can be taken from Modification index of this manual.

### **Firmware and hardware status**

#### **Downward compatibility**

The modules of the *piconet*<sup>®</sup> series are downward compatible. Older module cannot, however, feature the same characteristics than newer module versions. However, existing characteristics have been retained so that older modules can always be replaced with new ones.

The documentation describes the differences between the modules.



The firmware and hardware status of the *piconet*<sup>®</sup> modules can be taken from the version number printed on the side of the module. The version number can be identified by the prefix "D".

Table 1:  
Firmware and hardware status

<b>Indication on module</b>	<b>Explanation</b>	<b>Example</b>
D. kkjjxyzu		D.22011501
kk	Calendar week	Calendar week 22
jj	Year	of the year 2001
x	Firmware bus board	Firmware bus, version 1
y	Hardware bus board	Hardware, version 5
z	Firmware I/O board	Firmware I/O, 0 (no firmware needed for this board)
u	Hardware I/O board	Hardware I/O, version 1

## List of Revisions

In comparison to the previous manual edition, the following changes/ revisions have been made:

<i>Table 2: List of revisions</i>	<b>Chapter</b>	<b>Subject/ Description</b>	<b>new</b>	<b>changed</b>
	4	– "Data mapping for SNNE-0016D-0001", page 4-4	X	
		– "8 digital combined inputs/outputs (IP20 terminals):", page 4-8		X



### **Note**

The publication of this manual renders all previous editions invalid.

# 1 The *piconet*<sup>®</sup> system

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## System overview

*piconet*<sup>®</sup>, the "smallest" bus system within the TURCK programme, offers I/O modules with dimensions of only 210/175/126 x 30 x 26.5 mm, ideally suited for application in serial machine engineering:

- the coupling modules as the interface between the fieldbus and the *piconet*<sup>®</sup> fibre-optic network,
- the extension modules connected to the coupling module as well as
- the stand-alone modules for direct connection to the fieldbus.

All connections are screw connections and feature protection degree IP67.



### **Coupling and stand-alone modules**

The stand-alone and coupling modules are connected directly to the respective fieldbus.

### **Extension network IP-Link**

Up to 120 I/O **extension modules** can be interconnected via a **coupling module** and via the **IP-Link**, an extremely reliable internal bus based on fibre-optic transmission, and integrated into the higher level fieldbus as a single unit. Thus the user can determine any kind of I/O configuration that matches his application.

### **Combined modules**

In order to obtain the highest flexibility, novel 16-channel digital combined I/O modules have been developed. The module channels can be used either as inputs or outputs. The separate circuitry ensures the isolated supply of the inputs and outputs. These combined modules enable precise modular construction of the system. The modules are powered via an M8 connector.



#### **Note**

A detailed description of the complete system, the individual *piconet*<sup>®</sup> modules and the extension network IP-Link is contained in the bus-independent manual "*piconet*<sup>®</sup> I/O Modules", document number: D300778.

---



## 2 PROFIBUS-DP

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## **System overview**

PROFIBUS is a manufacturer-independent and open fieldbus standard for a wide area of applications in factory and process automation. Manufacturer independence and openness are guaranteed by the international standards EN 50170 und EN 50254. PROFIBUS enables communication of devices of various manufacturers without requiring particular interface adaptations.

PROFIBUS-DP (Decentral Periphery) is designed for data transfer between the control and the input/output level. TURCK PDP stations and *piconet*<sup>®</sup> stations support PROFIBUS-DP.

PROFIBUS-DP is the speed-optimised PROFIBUS version, specially designed for communication between automation devices and decentralised peripheral devices. PROFIBUS-DP is suited to replace cost-intensive parallel signal transmission via digital and analogue sensors and actuators.

PROFIBUS-DP is based on DIN 19245, part 1 and part 4. During the course of European fieldbus standardisation, PROFIBUS-DP has been integrated into the European fieldbus standard EN 50170.

### **Master/Slave system**

PROFIBUS-DP is a master/slave system, which consists of a master (usually integrated in the PLC) and up to 31 slaves per segment. During operation, the master constantly scans the connected slave stations. Several masters may be connected within a single network; this would then be classified as a multimaster system. In this case they pass on their transmission permission (Token Passing).

PROFIBUS-DP uses a bit transmission layer (Physical Layer) based on the industrially proven RS485 standard.



### System configuration and device types

PROFIBUS-DP is suited for both mono-master or multi-master system configuration. Thus a high level of flexibility in system configuration is guaranteed. The network comprises 126 devices max. (master or slaves).

Configurable system parameters include the number of stations, the assignment of the station address to the I/O addresses, data consistence of I/O data, format of diagnostic messages and the bus parameters used. Every PROFIBUS-DP system consists of different types of devices.

One distinguishes between three device types:

- DP master class 1 (DPM1)

This is a central control, which exchanges data in a defined message cycle with the remote stations (slaves). Typical devices are, for instance, programmable logic controllers (PLCs) or PCs.

- DP master class 2 (DPM2)

Devices of this type are engineering, configuration or operating devices. They are used during set-up, maintenance and diagnosis, to configure the connected devices, to evaluate parameters and to scan the device status.

- DP slave

A PROFIBUS-DP slave is a peripheral device (I/Os, drives, transducers), which reads input data and provides output data to the periphery. Of course, there are also devices which provide only input or only output data. The input and output data volume depends on the specific device and may comprise up to 246 bytes input data and 246 bytes output data.

### **Single-Master systems**

With mono-master systems merely a single master on the bus is active during bus operation. The PLC is the central control component. The slaves are coupled decentrally to the PLC via the transmission medium. With this type of system configuration the shortest bus cycle times are achieved.

### **Multi-Master systems**

In multi-master operation there are several masters on the bus. These form independent sub-systems, consisting of one DPM1 each and the associated slaves, or additional configuration and diagnostic devices. The slave input and output data can be read by all DP masters. Writing of outputs is reserved to a single DP master (the assigned DPM1 during configuration). Multi-Master systems achieve an average bus cycle time. In time-critical applications you should monitor the bus cycle time via a connected diagnostic tool.

### **Topology**

PROFIBUS-DP communicates via a shielded 2-wire cable according to the RS485 standard. The network topology accords to a line structure with active bus terminators on both ends.

### Maximum system expansion

PROFIBUS-DP is suited for connection of a large number of I/O points. Up to 126 addressable bus nodes enable connection of thousands of analogue and digital I/O points within a network.

PROFIBUS-DP allows a maximum of 32 nodes per segment; please note that masters and repeaters always count as nodes. One segment is defined as the bus section between two repeaters. If no repeaters are used, the entire network corresponds to one segment. Segments must comply with the specified maximum length and the specified transmission rates. Up to nine repeaters, type "REP-DP0002" may be connected within a network. The maximum length of a bus line within a segment and the number of repeaters are listed in the following table.

<i>Table 3: Maximum System expansion PROFIBUS-DP</i>	<b>Communi- cation rate</b>	<b>Length of bus line</b>	<b>Max. no. of repeaters</b>	<b>Max. no. of nodes</b>
	9.6 kbps	1200 m	2	126
	19,2 kbps	1200 m	2	126
	93,75 kbps	1200 m	2	126
	187,5 kbps	1000 m	2	126
	500 kbps	400 m	4	126
	1.5 Mbps	200 m	6	126
	12 Mbps	100 m	9	126

### Attention

The maximum number of 32 bus nodes may not be exceeded without a repeater.

## Use of Drop lines

### Note

The length of drop lines may not exceed 6.6 m at a transmission speed of 1.5 Mbps. At a transmission speed of 12 Mbps it is not permitted to use drop lines.

### Transmission rate/Cycle times

The transmission rate set by the PROFIBUS-DP master determines the system's transmission speed. The transmission speed can be adjusted in a range of 9,6 kbps up to 12 Mbps.

The transmission rate is automatically detected by the TURCK stations. Special settings on the stations are not required.

At 12 Mbps the typical response time accords to < 1 ms per 1000 I/O points.

### Transmission cables

The bus nodes are interconnected via fieldbus cables, which accord to RS485 specifications and DIN19 245. The cables must thus have the following characteristics:

Table 4:  
Characteristics of  
PROFIBUS-DP  
transmission  
cables

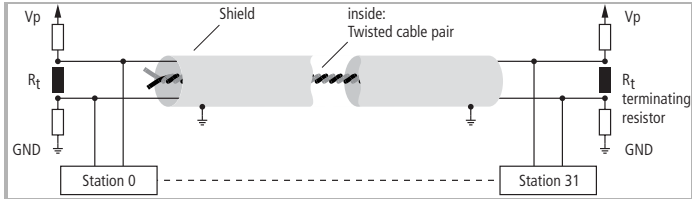
Parameters	Cable type A (DIN 19 245 part 3)
Wave resistance	- 35 to 165 $\Omega$ (3 to 20 MHz) - 100 to 130 $\Omega$ (f >100 kHz)
Capacitance	< 30 nF/km
Loop resistance	< 110 $\Omega$ /km
Conductor diameter	> 0.64 mm
Conductor cross section	> 0.34 mm <sup>2</sup>
Terminating resistors	220 $\Omega$



### Attention

The higher the transmission rate, the higher the number of bus nodes and the longer the transmission cables, the more important to observe these parameters.

Figure 1:  
Schematic  
PROFIBUS-DP  
cables



### Cable types

The bus cable of the PROFIBUS-DP network is a special shielded twisted data cable according to RS485 standards. The data transmission rate is 12 Mbps max.

The M12 bus connector of the station is shielded and mechanically reverse-keyed.

### Note

Premoulded PROFIBUS-DP cables simplify network installation, shorten set-up times and reduce wiring errors. TURCK offers an extensive and varied product spectrum for this purpose.

The ordering information on the available cable types can be taken from the respective product catalogue.

### Installation guidelines

When mounting the modules and routing the cables please observe the technical guidelines of the PROFIBUS user organisation concerning PROFIBUS-DP/FMS (see [www.profibus.com](http://www.profibus.com)).

### Checking the PROFIBUS cabling

A PROFIBUS cable (or the cable segment if repeaters are used) can be tested with a few resistance measurements. For this the cable should be disconnected from all stations:

- Resistance between "A" and "B" at the beginning of the cable: approx. 110  $\Omega$
- Resistance between "A" and "B" at the end of the cable: approx. 110  $\Omega$
- Resistance between "A" at the beginning and "A" at the end of the cable: approx. 0  $\Omega$
- Resistance between "B" at the beginning and "B" at the end of the cable: approx. 0  $\Omega$
- Resistance between shield at the beginning and shield at the end of the cable: approx. 0  $\Omega$

If these measurements are successful, then the cable can be used according to standards. However, if there are further disturbances on the bus, electromagnetic interference should be considered as cause. Please also observe the installation guidelines of the PROFIBUS user organisation ([www.profibus.com](http://www.profibus.com))



**Diagnostic functions**

The comprehensive diagnostic functions of PROFIBUS-DP allow fast error localisation.

The PROFIBUS-DP diagnosis is divided into three levels:

Table 5:  
PROFIBUS-DP  
diagnosis

Type of diagnosis	Description
station-related diagnostics	Messages concerning the general operational readiness of a bus node. Example: "Excessive temperature" or "under-voltage"
Module-related diagnostics	These messages indicate that there is a diagnostic message within the a certain I/O area (e.g. 8 bit output module) of a bus node.
Channel-related diagnostics	Here the error cause of a single input/output bit, i.e. relating to a single channel, is indicated. Example: "Short-circuit at output 2"

The PROFIBUS slaves of the *piconet*<sup>®</sup> series support the diagnostic functions of PROFIBUS-DP.

The evaluation of the diagnostic data via the control depends on the support of the master.



**Note**

Further information on diagnostics can be taken from the device descriptions of the master interfaces of the various manufacturers.

## **Sync and Freeze Mode**

In addition to the node-specific user data traffic, which is automatically controlled by the DPM1, the DP master has the possibility to send control commands to a slave, a group of slaves, or simultaneously to all DP slaves. These control commands are transmitted as multicast messages.

The Sync and Freeze mode for synchronisation of the DP slaves can be determined via the control commands. They enable event-controlled synchronisation of the DP slaves.

### **Sync Mode**

The DP slaves initiate the Sync mode upon receipt of a Sync control command from the assigned DP master. In this mode, all addressed DP slaves "freeze" their present output status.

During the following user data transfer cycles, the output data are stored by the DP slaves, while the output states are retained. Only after receipt of the next Sync control command from the master, the stored output data are switched through to the outputs.

The Sync mode is terminated upon an Unsync control command.

### **Freeze Mode**

The Freeze control command induces the addressed DP slaves to assume the Freeze mode. In this mode, the momentary values of the input states are "frozen". Input data will only be updated upon receipt of the next freeze command from the DP master by the affected devices.

The Freeze mode is terminated upon an Unfreeze control command.



### System performance

In order to achieve a relatively high level of device interchangeability, the PROFIBUS-DP system performance has also been standardised. It is largely determined by the operating status of the DPM1. This can be either controlled locally or via the bus from the configuration device.

One distinguishes between three major conditions:

Table 6:  
*Operating modes*

<b>Operating mode</b>	<b>Description</b>
Stop	There is no data transfer between the DPM1 and the DP slaves. The coupling module merely addresses the modules once after power-up (none of the I/O LEDs illuminate).
Clear	The DPM1 reads the input data of the DP slaves and retains the outputs of the DP slaves in the safe state (depending on the reaction to fieldbus errors, the green I/O LED illuminates and the outputs are set).
Operate	The DPM1 is in the data transfer phase. During cyclic data exchange the inputs of the DP slaves are read and the output information is transferred to the DP slaves (the green I/O LED illuminates).

The DPM1 sends its local status within a configurable time interval via a multimaster command to all assigned DP slaves. The system response to an error in the data transfer phase of the DPM1, e.g. a failure of a DP slave, is determined by the operating parameter "Auto-Clear". If this parameter is set to "True", then the DPM1 switches all outputs of the assigned DP slaves to the safe status, as soon as a DP slave is no longer capable of user data transfer. Then the DPM1 changes to the "Clear" state. If this parameter is set to "False", then the DPM1 will retain its operating condition also in the event of an error and the user can determine the system response.

### Data transfer between DPM1 and the DP slaves

Data exchange between the DPM1 and the assigned DP slaves is automatically controlled by the DPM1 in a determined fixed order. During configuration of the bus system, the user assigns the DP

slaves to the DPM1. It is also defined which DP slaves are to be included in or excluded from cyclic user data transfer.

Data exchange between DPM1 and the DP slaves can be divided into the phases parameterisation, configuration and data transfer.

Prior to including a DP slave in the data transfer phase, the DPM1 checks during the parameterisation and configuration phase, whether the programmed required configuration complies with the actual device configuration. This check is used to verify that the device type, the format and length information as well as the number of inputs and outputs accord. The user thus is securely protected against parameterisation errors. Additionally to the user data transfer, which is automatically effected by the DPM1, it is also possible to send new parameters to the DP slaves upon request of the user.

### **Protective mechanisms**

In the decentralised periphery it is required to provide the system with highly effective protective functions against faulty parameterisation or failure of the transmission devices. PROFIBUS-DP applies certain mechanisms to monitor the DP master and the DP slaves. These can be described as time monitoring functions. The monitoring interval is determined during system configuration.



*Table 7:  
Protective  
mechanisms*

<b>Protective mechanisms</b>	<b>Description</b>
Of the DP master	The DPM1 controls the user data transfer of the slaves via the Data_Control_Timer. Each assigned slaves has a monitoring timer of its own. The timer actuates if no user data data are transferred correctly during a certain time interval. In this case the user is informed on this condition. If automatic error response (Auto_Clear = True) is enabled, the DPM1 terminates the "Operate" status, switches the outputs of the assigned slaves into the safe status and returns to the operating status "Clear".
Of the DP slave	The slave carries out response monitoring to detect master or transmission errors. If there is no data exchange during the response monitoring interval with the associated master, the slave automatically switches the outputs into the safe status. In multimaster system operation, an additional access protection is required for the inputs and outputs of the slaves, in order to ensure that only the authorised master has direct access. The slaves provide an input and output image for all other masters so that this map can be read by any master, even without access token.

### **Ident. number**

Each DP slave and each DPM1 must have an individual ident. number. It is needed so that the DP master can identify the connected devices directly without creating significant protocol overhead. The master compares the ident. numbers of the connected DP devices with the ident. numbers registered in the configuration data of the DPM2. User data transfer will only be started, if the right device types with the right station addresses are connected to the bus. This provides additional protection against configuration errors. The manufacturer specific ident. nos. are determined and assigned by the PROFIBUS user organisation (PNO). The PNO governs the ident. nos. together with the GSD files.

### **GSD files**

Each PROFIBUS-DP module has a so-called GSD file (German abbr. for device data base file) that comprises detailed information on the module: I/O data volume, transmission rates, revision status etc. This GSD file is needed to configure the station within the PROFIBUS-DP system.

The GSD files can be downloaded via the TURCK website under [www.turck.com](http://www.turck.com).

### 3 Connection of *piconet*<sup>®</sup> to PROFIBUS-DP

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## Connection modes

### Fieldbus connection

The fieldbus connection of both stand-alone modules and coupling modules is established via reverse-keyed M12 x 1 connectors..

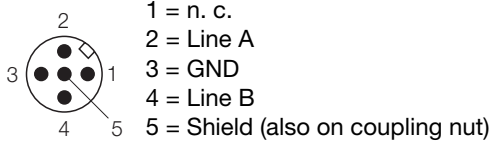


#### Note

The PROFIBUS-DP is routed forward either via an external T or Y piece, or, with the modules of new series (e.g.: SDPL-0404D-1003) via an integrated T piece.

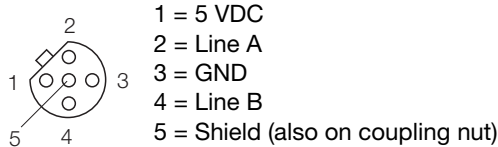
- M12 male connector for the in-coming bus line (bus-in):

Figure 2:  
M12 male  
connector,  
reverse-keyed



- M12 female connector for the outgoing bus line (bus-out):

Figure 3:  
M12 female  
connector,  
reverse-keyed



### Fieldbus termination

The bus is terminated via an external terminating resistor.

The *piconet*<sup>®</sup> modules are not capable of fieldbus termination.



#### Note

The bus termination must be accomplished externally via a connector with integrated terminating resistor (e.g. RSS4.5-PDP-TR, ident no.: 6601590 as passive terminating resistor or PDP-TRA, ident-nr.: 6825346 as active terminating resistor).

### Service interface

The service interface is the interface between the *piconet*<sup>®</sup> modules and the configuration and diagnostic software I/O-Assistant.

Alongside various offline functions (project planning, plausibility check of stations, detailed project documentation), the software offers many online functions for system set-up, diagnosis and trouble shooting.

### Nominal current consumption of *piconet*<sup>®</sup> modules connected to PROFIBUS-DP

It is important to consider the current consumption of the individual modules for power-feed through calculations, module protection and assessment of the voltage drop on the power cable.

The annex of the *piconet*<sup>®</sup> I/O module manual [TURCK documentation number: D300777 (German), D300778 (English)] contains tables with the nominal current consumption of the modules.

## ***piconet*<sup>®</sup> connection to the Siemens PLC, type S7**

In order to describe the connection of the *piconet*<sup>®</sup> modules to an S7 type Siemens controller, the software package "SIMATIC Manager", version 5.1. with Service Pack 6 from the company Siemens is used.

### **Importing the GSD file**

Prior to initial configuration of the *piconet*<sup>®</sup> system via the hardware configurator of the software, the *piconet*<sup>®</sup> GSD files must be imported into the software.

Two different procedures can be applied:

#### **Prior to starting the software**

- Copy the GSD/GSG files of the *piconet*<sup>®</sup> modules "TRCKFFxx.gsx" into the directory "Step7\S7data\GSD".
- Copy the Icon files (\*.bmp) to the directory "Step7\S7data\NSBMP".
- Start the software "SIMATIC Manager".

Upon correct installation of the files, the *piconet*<sup>®</sup> modules will be registered automatically in the hardware overview which can be called up under the menu item "Insert → Hardware Catalogue".

#### **After starting the software**

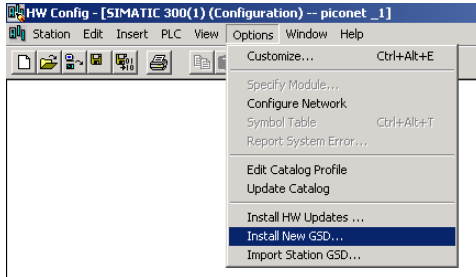
If you have started to the software, please proceed as follows to import the above mentioned GSx files:

- Please open a new or existing project.
- Open the hardware configurator.



- Copy the required GSx file to the software via the menu item "Extras → Install New GSD File...".

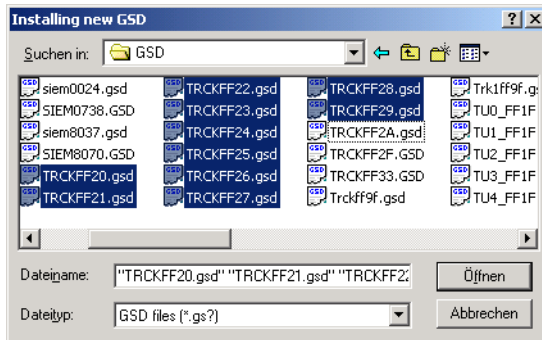
Figure 4:  
Importing a GSD file into the software via the menu item "Install New GSD File...".



3

- Select the GSD file from the according source directory.

Figure 5:  
Selection of the GSD file from the according source directory.



- After correct import and an update of the hardware catalogue via "Extras → Update catalogue", the modules will be displayed as separate entries in the hardware catalogue.

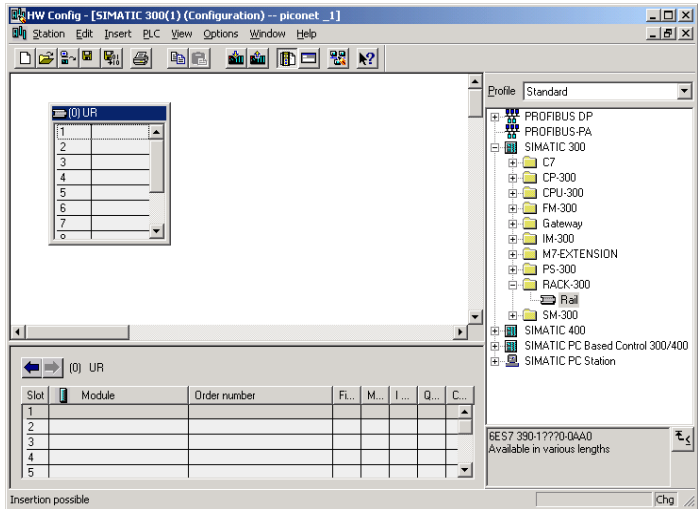
**i** **Note**

The exact configuration procedure can be taken from the operating manual which is supplied together with the software.

## Selection of a CPU

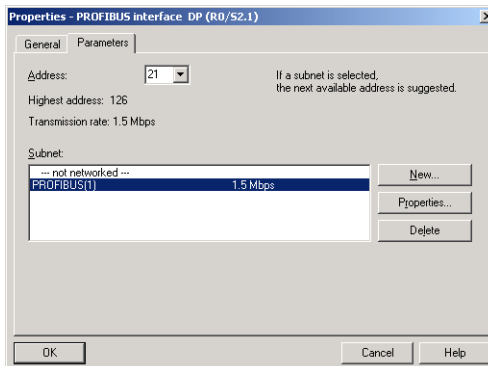
- First, please select a module rack. In this example the rack 300 is selected under "SIMATIC 300 → RACK 300".

Figure 6:  
Selection of a  
module rack



- Then the CPU type is determined.
- First enter the PROFIBUS address of the CPU and select the subnet "PROFIBUS" in the pop-up dialogue window. Via the button "Properties...." the subnet can be defined more precisely.

Figure 7:  
Selection of a  
subnet

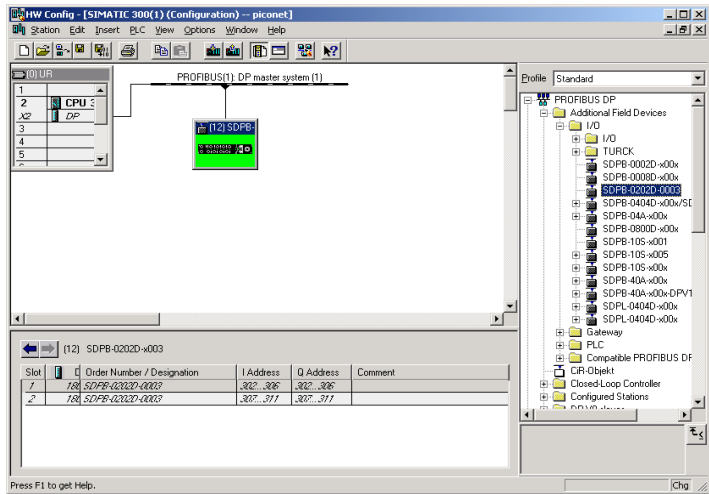




**Selection of the *piconet*® modules as slaves**

- To register the *piconet*® modules as slaves, select the required entries in the hardware catalogue under "Further field devices → I/O".

Figure 8:  
Selection of the *piconet*® module as a slave



**Configuration of the stand-alone modules**

*piconet*® stand-alone module can be moved via drag & drop from the hardware catalogue to the PROFIBUS master system in any order.

**IP-Link network configuration**

When setting up an IP-Link network, first the coupling module is configured.

Then the extension modules are added to the coupling module. First the byte-oriented *piconet*® modules, i.e. all analogue modules and all technology modules, of the IP-Link ring must be selected.

**i Note**

It must be ensured, that the order of the extension modules in the configuration software accords exactly to the physical order of the modules in the IP-Link network.

Table 8:  
Order in the  
IP-Link

## Module order

- 1 byte-oriented modules according to their physical order
- 2 digital input modules according to their physical order
- 3 digital output modules according to their physical order

After the byte-oriented modules have been configured, the digital modules are integrated into the IP-Link.

The input and output channels are always configured in steps of 8 to maintain a better overview and clearer assignment of the input and output bytes.



## Note

To configure the digital modules in steps of 8, the byte alignment of the coupling module must be activated.

Figure 9:  
IP-Link network  
configuration

Slot	D	D	Order Number / Designation	I Address	Q Address	Comment
1	161		SNNE 105 000x	256, 261	256, 261	
2	181		SNNE 105 000x	262, 267	262, 267	
3	178		SNNE 40A 000x 4x24 Bit In/Out	268, 270	268, 270	
4	178		→ SNNE 40A 000x 4x24 Bit In/Out	274, 276	274, 276	
5	178		→ SNNE 40A 000x 4x24 Bit In/Out	277, 279	277, 279	
6	178		→ SNNE 40A 000x 4x24 Bit In/Out	277, 279	277, 279	
7	178		SNNE 40A 000x 4x24 Bit In/Out	280, 282	280, 282	
8	178		→ SNNE 40A 000x 4x24 Bit In/Out	283, 285	283, 285	
9	178		→ SNNE 40A 000x 4x24 Bit In/Out	286, 288	286, 288	
10	178		→ SNNE 40A 000x 4x24 Bit In/Out	289, 291	289, 291	
11	180		SNNE 030D 0003	292, 296	292, 296	
12	180		→ SNNE 030D 0003	297, 301	297, 301	
13	8DE		??? 8 Bit Digitale Inputs	0		
14	8DE		??? 8 Bit Digitale Inputs	1		
15	8DA		??? 8 Bit Digitale Outputs	1	1	

### Consistent data transmission

The communication of the S7 controller with the *piconet*® modules in the complex mode requires consistent data transmission.

In order to ensure consistent data transmission, the Siemens function blocks SFC14 and SFC15 are used within an organisation block. These are standard program components of the Simatic Manager.

### Consistent data transmission via Siemens function blocks SFC14 and SFC15

The function blocks SFC14 and SFC15 must be copied to the project and called up via the organisation block.

In this example, the function blocks are added to the OB1 of the project.

With the help of these two function blocks, the data for register communication are read and written consistently.

#### SFC14

The SFC14 is needed to read the module-specific settings and parameters in the register communication.

---

Figure 10:  
Function  
block SFC14

```
CALL "DPRD_DAT"  
LADDR :=W#16#116  
RET_VAL:=MW10  
RECORD :=P#M 100.0 BYTE 6  
NOP 0
```

Call up the function block via the command *Call SFC14* .

Table 9:  
Parameters of the  
function block  
SFC14

Parameter name	Meaning	Notation
LADDR	Configured start address of the module from the input data memory of the controller.	The entry is written in an hexadecimal format. Example: W#16#14
RECORD	Target memory area of the CPU for the read user data. Here it is important to enter the data length of the user data (n byte).	Example: P#M 30.0 BYTE 3
RET_VAL	Target memory area of the CPU for a possible error code of the block.	e.g.: MW100

### SFC15

The SFC15 is needed to write the module-specific settings and parameters to the register communication.

Figure 11:  
Function  
block SFC15

```
CALL "DPWR_DAT"  
LADDR :=W#16#116  
RECORD :=P#M 110.0 BYTE 6  
RET_VAL:=MW12  
NOP 0
```

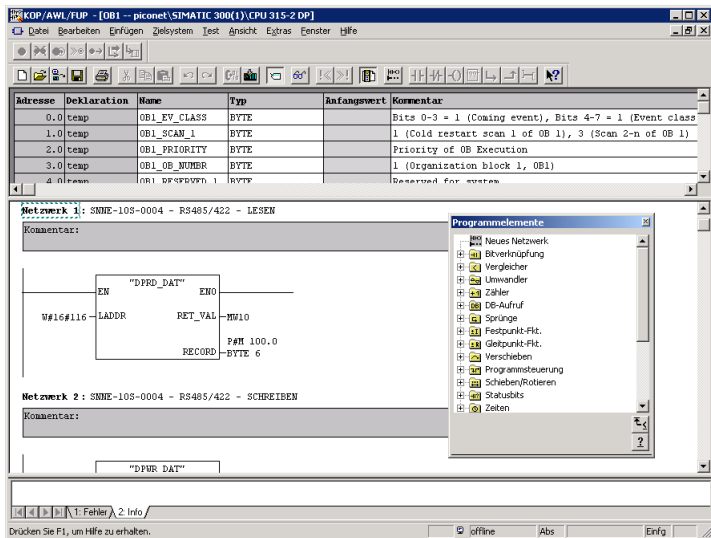


Call up the function block via the command *Call SFC14* .

Table 10:  
Parameters of the  
function block  
SFC15

Parameter name	Meaning	Notation
LADDR	Configured start address of the module from the output data memory of the controller.	The entry is written in a hexadecimal format.  Example: W#16#14
RECORD	Target memory area of the CPU for writing user data.  Here it is important to enter the data length of the user data (n byte).	Example: P#M 50.0 BYTE 3
RET_VAL	Target memory area of the CPU for the error code of the block.	e.g.: MW120

Figure 12:  
SFC14 in OB1



**Note**

The annex of this manual contains a detailed description of the connection of a *piconet*<sup>®</sup> network to the Siemens controller S7. The chapter explains configuration, set-up and parameterisation (via GSD file or register communication) of various modules using several application examples.

---

## 4 Data mapping of the *piconet*<sup>®</sup> modules

<b>Data mapping: Coupling modules</b> .....	<b>2</b>
Mapping of process data via byte alignment .....	2
<b>Data mapping: Stand-alone and extension modules</b> .....	<b>4</b>
Digital input modules .....	4
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Digital combined modules.....	7
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Analogue output modules .....	12
<b>Technology modules</b> .....	<b>15</b>
Sxxx-10S-0001, Incremental encoder interface.....	15
Sxxx-10S-0002, RS232 interface .....	16
Sxxx-10S-0004, RS422/485 interface.....	16
Sxxx-10S-0005, SSI interface .....	17
Sxxx-0002D-0002, pulse width output 24 VDC/ 2.5 A.....	19
Sxxx-0002D-0003, up/down counter 24 VDC.....	20

## Data mapping: Coupling modules

First all byte-oriented modules are registered in the process image. They are registered according to the order in which they are physically installed within the IP-Link ring. Next come the bit-oriented digital modules according to the order in which they are physically installed within the IP-Link ring.

### Mapping of process data via byte alignment

Byte alignment is activated and de-activated via the coupling module. It is permitted to map the user data as shown in the following tables.



#### Note

Byte alignment can only be activated for PROFIBUS-DP modules. For DeviceNet™ only the setting “not active” is admissible.

This function is offered by all SDPL-0404D-x00x modules with the software version "1" (Dwwxx1yzz). This setting refers to the entire modular extension network (coupling module SDPL-0404D-x00x including extensions SNNE-0404D-000x).

- Byte alignment not active** (Default setting):  
 The coupling module SDPL-0404D-x00x and the extension module SNNE-0404D-000x map 4 bits input and 4 bits output data each.

Table 11:  
Process image  
without  
byte alignment

#### Byte 0 Connection Bit no.

		7	6	5	4	3	2	1	0
IN	M8 x 1	Is used by the next bit-oriented extension module on the IP-Link.				C3P4	C2P4	C1P4	C0P4
	M12 x 1					C1P2	C1P4	C0P2	C0P4
OUT	M8 x 1					C7P4	C6P4	C5P4	C4P4
	M12 x 1					C3P2	C3P4	C2P2	C2P4



■ **Byte alignment active:**

The coupling module SDPL-0404D-x00x and the extension module SNNE-0404D-000x map 1 byte input and 1 byte output user data each.

Table 12:  
Process image  
with  
byte alignment

**Byte 0 Connection Bit no.**

		7	6	5	4	3	2	1	0
IN	M8 x 1	idle	idle	idle	idle	C3P4	C2P4	C1P4	C0P4
	M12 x 1	idle	idle	idle	idle	C1P2	C1P4	C0P2	C0P4
OUT	M8 x 1	C7P4	C6P4	C5P4	C4P4	idle	idle	idle	idle
	M12 x 1	C3P2	C3P4	C2P2	C2P4	idle	idle	idle	idle

C = female connector  
P = Pin  
idle = not used

## Data mapping: Stand-alone and extension modules

### Digital input modules

*Table 13:*  
*Input data in the process image*

Bit	7	6	5	4	3	2	1	0
M8 x 1	C7P4	C6P4	C5P4	C4P4	C3P4	C2P4	C1P4	C0P4
M12 x 1	C3P2	C3P4	C3P4	C1P2	C1P2	C1P4	C0P2	C0P4

C = female connector  
P = Pin

### Digital output modules

*Table 14:*  
*Output data in the process image*

Bit	7	6	5	4	3	2	1	0
M8 x 1	C7P4	C6P4	C5P4	C4P4	C3P4	C2P4	C1P4	C0P4
M12 x 1	C3P2	C3P4	C3P4	C1P2	C1P2	C1P4	C0P2	C0P4

C = female connector  
P = Pin

### Data mapping for SNNE-0016D-0001

- Compact mapping (Motorola format)  
Only the user data are mapped.

*Table 15:*  
*Compact mapping (Motorola format)*

Word	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Output n	Low	C0P8	C0P7	C0P6	C0P5	C0P4	C0P3	C0P2	C0P1
	High	C0P16	C0P15	C0P14	C0P13	C0P12	C0P11	C0P10	C0P9

C = Connector  
P = Pin  
SCx = short circuit ch.x



- Complex mapping (Motorola format), Word-Alignment not active, data are mapped with control and status byte (24DI/24DO).

**Table 16:**  
Complex mapping (Motorola format)

C = Connector  
P = Pin  
SCx = short circuit  
ch.x  
x = reserved

	Word	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	n	Low	RA	ERR	UV	OCG2	OCG1	-	DS	-
		High	SC8	SC7	SC6	SC5	SC4	SC3	SC2	SC1
	n + 1	Low	SC16	SC15	SC14	SC13	SC12	SC11	SC10	SC9
		-	-	-	-	-	-	-	-	-
Output	n	Low	RA	RE	SDS	-	-	-	-	-
		High	C0P8	C0P7	C0P6	C0P5	C0P4	C0P3	C0P2	C0P1
	n + 1	-	C0P16	C0P15	C0P14	C0P13	C0P12	C0P11	C0P10	C0P9
		-	-	-	-	-	-	-	-	-

4

- Complex mapping (Motorola format), Word-Alignment active, data are mapped with control and status byte (32DI/32DO).

**Table 17:**  
Complex mapping (Motorola format)

C = Connector  
P = Pin  
SCx = short circuit  
ch.x  
idle = reserved

	Word	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	n	Low	RA	ERR	UV	OCG2	OCG1	-	DS	-
		High	SC8	SC7	SC6	SC5	SC4	SC3	SC2	SC1
	n + 1	Low	SC16	SC15	SC14	SC13	SC12	SC11	SC10	SC9
		idle								
Output	n	Low	RA	RE	SDS	-	-	-	-	-
		High	RA	RE	SDS	-	-	-	-	-
	n + 1	-	C0P8	C0P7	C0P6	C0P5	C0P4	C0P3	C0P2	C0P1
		idle								

### **Status byte**

DS = Default Status

The outputs have assumed the default status as defined in register R33.

OCGx = Over Current Group x

Short circuit on one of the outputs of group x. The output concerned is indicated in the input byte .



### **Note**

The fault display must be reset when the fault is rectified by resetting bit 6 of the control byte.

---

UV = Under voltage

Load voltage  $U_L < 18\text{ V}$ , UL-LED lit red, the outputs remain switched off

Error = error bit

Fault has occurred

RA = Register Access

Acknowledgement for the process data operation.

### **Control byte**

SDS = Set Default Status

Sets the output to the predefined default status defined in register R33

RE = Reset Error

Resets the indicated faults in the status byte.

RA = Register Access

Register communication switched off (Process data operation)



**Digital combined modules**

- 4 digital inputs and 4 digital outputs

- 1 Module parameter "byte alignment" = not active (default) and previous byte fully used.  
4 bits input and 4 bits output data are mapped:

*Table 18:  
Data in the process image*

C = female connector  
P = Pin

		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	Byte 0 (M8 x 1)	Is used by the next bit-oriented extension module on the IP-Link.				C3P4	C2P4	C1P4	C0P4
	Byte 0 (M12 x 1)					C1P2	C1P4	C0P2	C0P4
Output	Byte 0 (M8 x 1)					C7P4	C6P4	C5P4	C4P4
	Byte 0 (M12 x 1)					C3P2	C3P4	C2P2	C2P4

- 2 Module parameter "byte alignment" = not active (default) and byte half used.  
4 bits input and 4 bits output data are mapped:

*Table 19:  
Data in the process image*

C = female connector  
P = Pin

		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	Byte 0 (M8 x 1)	C3P4	C2P4	C1P4	C0P4	Is used by the physically preceding bit-oriented extension module on the IP-Link.			
	Byte 0 (M12 x 1)	C1P2	C1P4	C0P2	C0P4				
Output	Byte 0 (M8 x 1)	C7P4	C6P4	C5P4	C4P4				
	Byte 0 (M12 x 1)	C3P2	C3P4	C2P2	C2P4				

- 3** Module parameter "Byte alignment" = active.  
1 byte input and 4 bits output data are mapped:

*Table 20:  
Data in the  
process image*

C = female  
connector  
P = Pin

		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	Byte 0 (M8 x 1)	idle	idle	idle	idle	C3P4	C2P4	C1P4	C0P4
	Byte 0 (M12 x 1)	idle	idle	idle	idle	C1P2	C1P4	C0P2	C0P4
Output	Byte 0 (M8 x 1)	C7P4	C6P4	C5P4	C4P4	idle	idle	idle	idle
	Byte 0 (M12 x 1)	C3P2	C3P4	C2P2	C2P4	idle	idle	idle	idle

- 8 digital combined inputs/outputs (M8):

*Table 21:  
Data in the  
process image*

C = female  
connector  
P = Pin

		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	Byte 0	C7P4	C6P4	C5P4	C4P4	C3P4	C2P4	C1P4	C0P4
Output	Byte 0	C7P2	C6P2	C5P2	C4P2	C3P2	C2P2	C1P2	C0P2

- 8 digital combined inputs/outputs (IP20 terminals):

*Table 22:  
Data in the  
process image*

C = female  
connector  
P = Pin

		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	Byte 0	C0P8	C0P7	C0P6	C0P5	C0P4	C0P3	C0P2	C0P1
Output	Byte 0	C1P8	C1P7	C1P6	C1P5	C1P4	C1P3	C1P2	C1P1



**Analogue input modules**

**i Note**

The data mapping of all analogue input modules is identical.

- Compact evaluation in the MOTOROLA format (Default mapping)

4

*Table 23: Compact evaluation; MOTOROLA format*

	Address	Input data		Output data	
		High Byte	Low Byte		
	Word			-	-
	0	Channel 1/ DB 0	Channel 1/ DB 1	-	-
<i>DB = Data byte</i>	1	Channel 2/ DB 0	Channel 2/ DB 1	-	-
	2	Channel 3/ DB 0	Channel 3/ DB 1		
	3	Channel 4/ DB 0	Channel 4/ DB 1	-	-

- Compact evaluation in the INTEL format

*Table 24: Compact evaluation, INTELINTEL format*

	Address	Input data		Output data	
		High Byte	Low Byte		
	Word			-	-
	0	Channel 1/ DB 1	Channel 1/ DB 0	-	-
<i>DB = Data byte</i>	1	Channel 2/ DB 1	Channel 2/ DB 0	-	-
	2	Channel 3/ DB 1	Channel 3/ DB 0		
	3	Channel 4/ DB 1	Channel 4/ DB 0	-	-

■ Complex evaluation in the MOTOROLA format

*Table 25:  
Complex  
evaluation;  
MOTOROLA  
format*

	<b>Address</b>	<b>Input data</b>		<b>Output data</b>	
	Word	High Byte	Low Byte	High Byte	Low Byte
	0	Channel 1/ DB 1	SB/ Channel 1/	Channel 1/ DB 1	CB/ Channel 1
	1	SB/ Channel 2/	Channel 1/ DB 0	CB/ Channel 2	Channel 1/ DB 0
	2	Channel 2/ DB 0	Channel 2/ DB 1	Channel 2/ DB 0	Channel 2/ DB 1
	3	Channel 3/ DB 1	SB/ Channel 3	Channel 3/ DB 1	CB/ Channel 3
	4	SB/ Channel 4	Channel 3/ DB 0	CB/ Channel 4	Channel 3/ DB 0
	5	Channel 4/ DB 0	Channel 4/ DB 1	Channel 4/ DB 0	Channel 4/ DB 1

*DB = Data byte  
SB = Status Byte  
CB = Control Byte*



■ Complex evaluation in the INTEL format

*Table 26:  
Complex  
evaluation;  
INTEL format*

Address	Input data		Output data	
	High Byte	Low Byte	High Byte	Low Byte
0	Channel 1/ DB 0	SB/ Channel 1	Channel 1/ DB 0	CB/ Channel 1
1	SB/ Channel 2	Channel 1/ DB 1	CB/ Channel 2	Channel 1/ DB 1
2	Channel 2/ DB 1	Channel 2/ DB 0	Channel 2/ DB 1	Channel 2/ DB 0
3	Channel 3/ DB 0	SB/ Channel 3	Channel 3/ DB 0	CB/ Channel 3
4	SB/ Channel 4	Channel 3/ DB 1	CB/ Channel 4	Channel 3/ DB 1
5	Channel 4/ DB 1	Channel 4/ DB 0	Channel 4/ DB 1	Channel 4/ DB 0

*DB = Data byte  
SB = Status Byte  
CB = Control Byte*

## Analogue output modules



### Note

The data mapping of all analogue output modules is identical.

- Compact evaluation in the MOTOROLA format (default mapping)

Table 27:  
Compact  
evaluation,  
INTEL format

	Address	Input data		Output data	
	Word	-	-	High Byte	Low Byte
DB = Data byte	0	-	-	Channel 1/ DB 1	Channel 1/ DB 0
	1	-	-	Channel 2/ DB 1	Channel 2/ DB 0
	2	-	-	Channel 3/ DB 1	Channel 3/ DB 0
	3	-	-	Channel 4/ DB 1	Channel 4/ DB 0

- Compact evaluation in the INTEL format

Table 28:  
Compact  
evaluation,  
INTEL format

	Address	Input data		Output data	
	Word	-	-	High Byte	Low Byte
DB = Data byte	0	-	-	Channel 1/ DB 1	Channel 1/ DB 0
	1	-	-	Channel 2/ DB 1	Channel 2/ DB 0
	2	-	-	Channel 3/ DB 1	Channel 3/ DB 0
	3	-	-	Channel 4/ DB 1	Channel 4/ DB 0



■ Complex evaluation in the MOTOROLA format

*Table 29:  
Complex  
evaluation;  
MOTOROLA  
format*

Address	Input data		Output data	
	High Byte	Low Byte	High Byte	Low Byte
0	Channel 1/ DB 1	SB/ Channel 1	Channel 1/ DB 1	CB/ Channel 1
1	SB/ Channel 2	Channel 1/ DB 0	CB/ Channel 2	Channel 1/ DB 0
2	Channel 2/ DB 0	Channel 2/ DB 1	Channel 2/ DB 0	Channel 2/ DB 1
3	Channel 3/ DB 1	SB/ Channel 3	Channel 3/ DB 1	CB/ Channel 3
4	SB/ Channel 4	Channel 3/ DB 0	CB/ Channel 4	Channel 3/ DB 0
5	Channel 4/ DB 0	Channel 4/ DB 1	Channel 4/ DB 0	Channel 4/ DB 1

*DB = Data byte  
SB = Status Byte  
CB = Control Byte*

■ Complex evaluation in the INTEL format

*Table 30:  
Complex  
evaluation;  
INTEL format*

Word	Input data		Output data	
	High Byte	Low Byte	High Byte	Low Byte
0	Channel 1/ DB 0	SB/ Channel 1	Channel 1/ DB 0	CB/ Channel 1
1	SB/ Channel 2	Channel 1/ DB 1	CB/ Channel 2	Channel 1/ DB 1
2	Channel 2/ DB 1	Channel 2/ DB 0	Channel 2/ DB 1	Channel 2/ DB 0
3	Channel 3/ DB 0	SB/ Channel 3	Channel 3/ DB 0	CB/ Channel 3
4	SB/ Channel 4	Channel 3/ DB 1	CB/ Channel 4	Channel 3/ DB 1
5	Channel 4/ DB 1	Channel 4/ DB 0	Channel 4/ DB 1	Channel 4/ DB 0

*DB = Data byte  
SB = Status Byte  
CB = Control Byte*



Technology modules

**Sxxx-10S-0001, Incremental encoder interface**

This module can only be operated in the complex mode.

- Complex evaluation in the MOTOROLA format (Default mapping)

*Table 31: Complex evaluation in the MOTOROLA format*

	Address	Input data		Output data	
		High Byte	Low Byte	High Byte	Low Byte
	0	DB 1	SB	Reg 1	CB
	1	DB 2	DB 0	reserved	Reg 0
	2	DB 3	DB 4	reserved	reserved

*DB = Data byte  
SB = Status Byte  
CB = Control Byte*

- Complex evaluation in the INTEL format

*Table 32: Complex evaluation in the INTEL format*

	Address	Input data		Output data	
		High Byte	Low Byte	High Byte	Low Byte
	0	DB 0	SB	Reg 0	CB
	1	DB 2	DB 1	reserved	Reg 1
	2	DB 4	DB 3	reserved	reserved

*DB = Data byte  
SB = Status Byte  
CB = Control Byte*

Data byte 0:

least significant byte of the counter word (read/set)

Data byte 1:

most significant byte of the counter word (read/set)

Data byte 2:

Status of A, B, C (latch), gate and latch input

Data byte 3:

least significant byte of the latch word (read)/least significant byte of the period

Data byte 4:

most significant byte of the latch word (read)/ most significant byte of the period

Reg0:

least significant byte for register communication

Reg1:

most significant byte for register communication

**Sxxx-10S-0002, RS232 interface**

This module can only be operated in the complex mode.

- Complex evaluation in the INTEL/MOTOROLA format

*Table 33:  
Complex evaluation;  
INTEL/  
MOTOROLA  
format*

Address	Input data		Output data	
	High Byte	Low Byte	High Byte	Low Byte
0	DB 0	SB	DB 0	CB
1	DB 2	DB 1	DB 2	DB 1
2	DB 4	DB 3	DB 4	DB 3

*DB = Data byte  
SB = Status Byte  
CB = Control Byte*

**Sxxx-10S-0004, RS422/485 interface**

This module can only be operated in the complex mode.

- Complex evaluation in the INTEL/MOTOROLA format

*Table 34:  
Complex evaluation;  
INTEL/  
MOTOROLA  
format*

Address	Input data		Output data	
	High Byte	Low Byte	High Byte	Low Byte
0	DB 0	SB	DB 0	CB
1	DB 2	DB 1	DB 2	DB 1
2	DB 4	DB 3	DB 4	DB 3

*DB = Data byte  
SB = Status Byte  
CB = Control Byte*



**Sxxx-10S-0005, SSI interface**

- Compact evaluation in the MOTOROLA format (default mapping)

*Table 35:  
Compact evaluation in the MOTOROLA format*

	Address	Input data		Output data	
		High Byte	Low Byte		
	Word	High Byte	Low Byte	-	-
	0	DB 2	DB 3	-	-
	1	DB 0	DB 1	-	-

*DB = Data byte*

- Compact evaluation in the INTEL format

*Table 36:  
Compact evaluation in the INTEL format*

	Address	Input data		Output data	
		High Byte	Low Byte		
	Word	High Byte	Low Byte	-	-
	0	DB 1	DB 0	-	-
	1	DB 3	DB 2	-	-

*DB = Data byte*

- Complex evaluation in the MOTOROLA format

*Table 37:  
Complex evaluation in the MOTOROLA format*

	Address	Input data		Output data	
		High Byte	Low Byte	High Byte	Low Byte
	Word	High Byte	Low Byte	High Byte	Low Byte
	0	DB 3	SB	Reg 1	CB
	1	DB 1	DB 2	reserved	Reg 0
	2	reserved	DB 0	reserved	reserved

*DB = Data byte  
SB = Status Byte  
CB = Control Byte*

■ Complex evaluation in the INTEL format

*Table 38:  
Complex  
evaluation in the  
MOTOROLA  
format*

	Address	Input data		Output data	
		High Byte	Low Byte	High Byte	Low Byte
	0	DB 0	SB	Reg 0	CB
	1	DB 2	DB 1	reserved	Reg 1
	2	reserved	DB 3	reserved	reserved

*DB = Data byte  
SB = Status Byte  
CB = Control Byte*

Data bytes 0 to 3:

Contain the data of the encoder

Reg0:

least significant byte for register communication

Reg1:

most significant byte for register communication



**Sxxx-0002D-0002, pulse width output 24 VDC/ 2.5 A**

This module can only be operated in the complex mode.

- Complex evaluation in the MOTOROLA format  
(Default mapping)

*Table 39:  
Complex evaluation;  
MOTOROLA format*

Address	Input data		Output data	
	High Byte	Low Byte	High Byte	Low Byte
0	Channel 1/ Reg 1	SB/ Channel 1	Channel 1/ DB 1	CB/ Channel 1/
1	SB/ Channel 2	Channel 1/ Reg 0	CB/ Channel 2/	Channel 1/ DB 0
2	Channel 2/ Reg 0	Channel 2/ Reg 1	Channel 2/ DB 0	Channel 2/ DB 1

*DB = Data byte  
SB = Status Byte  
CB = Control Byte*

- Complex evaluation in the INTEL format

*Table 40:  
Complex evaluation;  
INTEL format*

Address	Input data		Output data	
	High Byte	Low Byte	High Byte	Low Byte
0	Channel 1/ Reg 0	SB/ Channel 1	Channel 1/ DB 0	CB/ Channel 1
1	SB/ Channel 2	Channel 1/ Reg 1	CB/ Channel 2	Channel 1/ DB 1
2	Channel 2/ Reg 1	Channel 2/ Reg 0	Channel 2/ DB 1	Channel 2/ DB 0

*DB = Data byte  
SB = Status Byte  
CB = Control Byte*

Channel x Reg0:

Channel x, least significant byte for register communication

Channel x Reg1:

Channel x, most significant byte for register communication

### Sxxx-0002D-0003, up/down counter 24 VDC

This module can only be operated in the complex mode.

- Complex evaluation in the MOTOROLA format  
(Default mapping)

*Table 41:  
Complex  
evaluation;  
MOTOROLA  
format*

*DB = Data byte  
SB = Status Byte  
CB = Control Byte*

<b>Address</b>	<b>Input data</b>		<b>Output data</b>	
	High Byte	Low Byte	High Byte	Low Byte
Word	High Byte	Low Byte	High Byte	Low Byte
0	Channel 1/ DB 3	SB/ Channel 1	Channel 1/ DB 3	CB/ Channel 1
1	Channel 1/ DB 1	Channel 1/ DB 2	Channel 1/ DB 1	Channel 1/ DB 2
2	SB/ Channel 2	Channel 1/ DB 0	CB/ Channel 2	Channel 1/ DB 0
3	Channel 2/ DB 2	Channel 2/ DB 3	Channel 2/ DB 2	Channel 2/ DB 3
4	Channel 2/ DB 0	Channel 2/ DB 1	Channel 2/ DB 0	Channel 2/ DB 1



■ Complex evaluation in the INTEL format

*Table 42:  
Complex  
evaluation;  
INTEL format*

Address	Input data		Output data	
	High Byte	Low Byte	High Byte	Low Byte
0	Channel 1/ DB 0	SB / Channel 1	Channel 1/ DB 0	CB/ Channel 1
1	Channel 1/ DB 2	Channel 1/ DB 1	Channel 1/ DB 2	Channel 1/ DB 1
2	SB/ Channel 2	Channel 1/ DB 3	CB/ Channel 2	Channel 1/ DB 3
3	Channel 2/ DB 1	Channel 2/ DB 0	Channel 2/ DB 1	Channel 2/ DB 0
4	Channel 2/ DB 3	Channel 2/ DB 2	Channel 2/ DB 3	Channel 2/ DB 2

*DB = Data byte  
SB = Status Byte  
CB = Control Byte*



## 5 Error treatment and diagnostics

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## Error diagnosis via LEDs

With the *piconet*® system, one distinguishes between the following kind of errors:

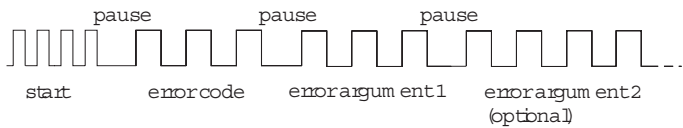
- PROFIBUS errors
- IP-Link or local module errors  
Please read the descriptions of the LED diagnostics of IP-Link errors and module errors in the *piconet*® I/O Manual. (Document numbers: German, D300777; English, D300778).

### Flash codes

Table 43:  
LED flash codes

Flash sequence	Meaning
Fast flashing	Start
First slow sequence	Error code
Second slow sequence	Error argument
Third slow sequence (optional)	Error argument with more than 20 extensions

Figure 13:  
Flash codes





**Diagnostic LEDs for PROFIBUS**

Table 44:  
LEDs for  
PROFIBUS-DP

LED			Description	Remedy:
<b>GreenRed I/O RUN</b>				
ON	ON	None Meaning	Module is waiting for communication	<ul style="list-style-type: none"> <li>– Baud rate detected</li> <li>– Start communication</li> <li>– Possibly the wrong ident. number</li> </ul>
OFF	ON	None Meaning	module in baud rate search mode	<ul style="list-style-type: none"> <li>– Start PROFIBUS</li> <li>– Connect and check bus line</li> </ul>
OFF	OFF	None Meaning	Module is waiting for cyclic communication	<ul style="list-style-type: none"> <li>– Start cyclic PROFIBUS communication</li> </ul>
ON	Flash- ing	None Meaning	Baud rate detected, Start-up error	<ul style="list-style-type: none"> <li>– Parameter or configuration error (see flash code)</li> </ul>
ON	OFF	OFF	DP start-up okay, but still no Data_Exchange message	<ul style="list-style-type: none"> <li>– Start cyclic PROFIBUS communication</li> </ul>
ON	OFF	ON	Module is exchanging data	<ul style="list-style-type: none"> <li>– No error</li> </ul>

## Parameter data errors

### ■ Error code 1

The reserved and fixed User\_Prm\_Data have a wrong value.  
→ The error argument indicates the wrong byte (byte 0 starts with error argument 1).

### ■ Error code 3

The combination of some functions, via the User\_Prm\_Data, is not admissible.  
→ The error argument provides detailed information:

Table 45:  
Error arguments  
parameter error  
code 3

Argument	Description
1	In the Synchronous Mode it is not permitted to set the response to PROFIBUS errors to "retain outputs". The watchdog of the sub-bus system responds faster than the PROFIBUS watchdog.
2 to 7	reserved
8	The Synchronous Mode is not permitted if there are no outputs.
9 to 11	reserved
12	The Fast-FreeRun Mode is not admissible if the Synchronous Mode is activated

### ■ Error code 9

Error code 9 describes start-up errors

Table 46:  
Error arguments  
parameter error  
code 9

Argument	Description
1	DP input data too long
2	DP output data too long
3	DP CfgData data too long
4	Extension module type not recognised
5	Configuration data of the DP interface are faulty



**Configuration data errors**

- **Error code 2**  
 Error during comparison of configuration data.  
 → The error argument indicates the first faulty byte (starting with "1").
- **Error code 5**  
 Error in the length of the digital output data.  
 → The error argument indicates the expected number of bytes.
- **Error code 6**  
 Error in the length of the digital input data.  
 → The error argument indicates the expected number of bytes.
- **Error code 7**  
 Error code 7 describes CfgData errors

Table 47:  
 Error arguments  
 parameter error  
 code 7

Argument	Description
1	Length of CfgData not correct
2	Syntax of CfgData not correct
3	Length of input data too long
4	Length of output data too long

## Trouble shooting

Should you have problems with the module, the Status LEDs will give information on the probable error cause.

### Avoidance of typical errors

#### 1 Checking the PROFIBUS cabling

A PROFIBUS cable (or the cable segment if repeaters are used) can be tested with a few resistance measurements.

For this the cable should be disconnected from all stations:

Table 48:  
Checking the  
PROFIBUS  
cabling

Measuring points	Typical resistance
between "A" and "B" at the beginning of the cable	approx. 110 $\Omega$
between "A" and "B" at the end of the cable	approx. 110 $\Omega$
between "A" at the beginning and "A" at the end of the cable	approx. 0 $\Omega$
between "B" at the beginning and "B" at the end of the cable	approx. 0 $\Omega$
between shield at the beginning and shield at the end of the cable	approx. 0 $\Omega$

## i

### Note

If these measurements are successful, the cable is error-free.

Should there be further bus errors, these can usually be ascribed to EMI.

Please also observe the installation guidelines of the PROFIBUS user organisation ([www.profibus.com](http://www.profibus.com))

#### 2 Configuration sequence

When configuring the IP-Link network with digital and analogue modules, first register the analogue modules according to their physical order within the IP-Link in the control software. Then enter the digital modules in accordance to their physical order within the IP-Link. Then the inputs and outputs are mapped.

#### 3 Configuration errors with the PROFIBUS coupling module

With *piconet*<sup>®</sup> modules with less than 8 bits process data, the process data are rounded off to 8 bits. These modules thus occupy 8 bits in the respective process data area.



### Note

To configure the digital modules in steps of 8, the byte alignment of the coupling module must be activated.

**Please note, that 4 inputs and 4 outputs must configured, for instance, for the module SxxB-0404D-xxxx.**

5

### 4 IP-Link errors

If the IP-Link error LED illuminates or flashes irregularly, there is no message transmission or the telegrams are faulty. The modules amplify every telegram but they cannot correct an error occurred once. The error must thus be traced backward from the last module to the first error-free module. The connection from this module to the next module is the source of error.

This error is usually due to IP-Link lines with too high damping. A possible cause could be the faulty assembly of cables and connectors.



### Note

The most simple test is visual inspection:  
When held against a not too bright light source, the respective connector surface should provide a uniformly lightened image (check both sides).

In case of doubt, re-assemble the connector. Please take care not to grind the optical fibre too far down (see also: D300778) *piconet*<sup>®</sup> I/O Manual, chapter 2, section “IP-Link connector”).

**Note**

During connector assembly please ensure that the specifications on insulation stripping are observed.

---

The assembled cable can be tested simply when connected between coupling and extension module. If the cable is correctly connected, there will be no faulty telegrams.



Error diagnosis via software

**General information**

In the event of an error, the *piconet*<sup>®</sup> modules automatically send diagnostic data to the DP master.



**Note**

Please note, that the parameter "IP module diagnostics" of the diagnostic-capable modules must be enabled.

Generally, DP masters have the possibility to check whether diagnostic data have changed via a flag in the PLC.

Diagnostic data can then be read via a function block. If more diagnostic data apply than can be transferred, then this will be indicated by the diagnostic data.

**General structure of diagnostic messages**

Table 49:  
Structure of the  
diagnostic  
message

<b>Diagnostic bytes</b>	<b>Diagnostic contents</b>
0 to 5	Standard PROFIBUS-DP diagnosis (according to PROFIBUS-DP standard)
6 to 61	Manufacturer-specific diagnosis
- 6 and 7	Length of diagnostic data Diagnostic code (defined by PROFIBUS-DP standard)
- 8 to 15	reserved
- 16 to 61	Channel-specific diagnostics

## Diagnostic telegram of the stand-alone modules

### ■ DP diagnosis accord. to DP standard

Table 50:  
DP diagnosis  
Stand-alone  
modules

Byte	Bit	Description
0	0	No slave response (set internally by the DP master)
	1	Slave in start-up mode (evaluation of parameters and configuration)
	2	Configuration error
	3	Ext_Diag_Data present (from byte 6 on)
	4	Function is not supported
	5	Faulty slave response (set internally by the DP master)
	6	Parameterisation error
	7	Slave is exchanging data with other master (set internally by the DP master)
1	0	Slave must be re-parameterised
	1	Slave with static diagnostics
	2	1 (accord. to PNO specification)
	3	DP watchdog is active
	4	Slave is in Freeze Mode
	5	Slave is in Sync Mode
	6	reserved
	7	Slave is de-activated (set internally by the DP master)
2	0-6	reserved
	7	Too many Ext_Diag_Data
3		Station address of master with which data are transferred
4, 5		Ident. number



■ **Manufacturer-specific diagnosis**

*Table 51:  
Manufacturer-specific diagnosis  
Stand-alone modules*

Byte	Bit	Description
6		Length of Ext_Diag_Data including length byte
7		0x81 (code DPV1 diagnostic format)
8 to 15		0x00

5

■ **Channel-specific diagnostics**

*Table 52:  
Channel-specific diagnostics  
Stand-alone modules*

Byte	Bit	Description
16	0-5	0x00
	6/ 7	Faulty channel number: – 0x00 = error in channel 0 – 0x40 = error in channel 1 – 0x80 = error in channel 2 – 0xC0 = error in channel 3
17	0-5	Status byte of channel
	6	General error bit (set in the event of an error)
18	0-5	Bit assignment analogous to byte 16 for another
	6-7	faulty channel
19	0-5	Bit assignment analogous to byte 17 for another
	6-7	faulty channel
...		
60	0-5	Bit assignment analogous to byte 16 for another
	6-7	faulty channel
61	0-5	Bit assignment analogous to byte 17 for another
	6	faulty channel



### **Note**

The status byte is transferred from the module to the controller in the complex mapping mode. It contains various status bits depending on the module type (e.g. process data smaller/larger limit value x, over-range, under-range etc.)

---

### **Diagnostic message of the coupling modules**

The DP master usually enables polling of a diagnostic data change via a flag in the PLC.

Diagnostic data can then be read via a function block. With the Siemens controller S5 the diagnostic data are read with the function module FB IM308C and with the Siemens controller S7 with the function block SFC13.

If more diagnostic data apply than can be transferred, then this will be indicated by the diagnostic data.



■ DP diagnosis accord. to DP standard

Table 53:  
DP diagnosis  
coupling modules

DP diagnosis		
Byte	Bit	Description
0	0	No slave response (set internally by the DP master)
	1	Slave in start-up mode (evaluation of parameters and configuration)
	2	Configuration error
	3	Ext_Diag_Data present (from byte 6 on)
	4	Function is not supported
	5	Faulty slave response (set internally by the DP master)
	6	Parameterisation error
	7	Slave is exchanging data with other master (set internally by the DP master)
1	0	Slave must be re-parameterised
	1	Slave with static diagnostics
	2	1 (accord. to PNO specification)
	3	DP watchdog is active
	4	Slave is in Freeze Mode
	5	Slave is in Sync Mode
	6	reserved
	7	Slave is de-activated (set internally by the DP master)
2	0-6	reserved
	7	Too many Ext_Diag_Data
3		Station address of master with which data are transferred
4, 5		Ident. number

■ **Manufacturer-specific diagnosis**



**Note**

The values in bytes 6 to 10 and bytes 14 and 15 are presented in a hexadecimal format. The values in byte 11 to byte 13 are decimal.

Table 54:  
Manufacturer-  
specific diagnosis  
Coupling modules

Byte	Bit/ Value	Description
6		Length of Ext_Diag_Data including length byte
7		0xA1
8 to 10		0x00
11	0	No error
	1	Start IP-Link error diagnostics
	32	General IP-Link error
12	0	No error
	3	IP-Link: Interruption – Error argument: Fault location → In case of wire-break: against counting direction Fibre-optic cabling.
	4	IP-Link: Timeout errors – Error argument: Fault location
	5	Error when reading the register of the complex modules – Error argument: Problematic module
	11	Extension module is not processing the synchronisation telegram – Error argument: Problematic module
	12	More than 120 modules connected – Error argument: Number of modules connected in excess
	13	Module type is not supported – Error argument: Problematic module



Byte	Bit/ Value	Description
13	0 to 120	– Error argument: IP-Link error (e.g. wire break ) behind the (n-) extension module. Counting begins with <b>n = 1</b> with the last connected extension module against the direction of the fibre-optic cabling <b>backwards</b> in direction of the coupling module – Error argument <b>n = 0</b> accords to IP-Link error between the last coupling module and the last connected extension module.
14	0x00	
15	0x00	

## ■ Channel-specific diagnostics



### Note

Channel-specific diagnostics are only available for coupling modules with firmware status "D.kkjj2yzu" (firmware "B3")!

Table 55:  
Channel-specific  
diagnostics  
Coupling modules

**A** During connection of a valve terminal of the company Festo please observe the following note!

Byte	Bit	Description
16	0 - 7	Faulty extension module number (1-120 only complex modules are counted in the counting direction "with the light")
17	A 0 - 5	Status byte of channel
	6 - 7	Faulty channel number (0-3)
18	0-7	Bit assignment analogous to byte 16 for another faulty module
19	0-5	Bit assignment analogous to byte 17 for another
	6-7	faulty module
...		
60	0-7	Bit assignment analogous to byte 16 for another faulty module
61	0-5	Bit assignment analogous to byte 17 for another
	6-7	faulty module



### Attention

When connecting a Festo valve terminal please observe the following:

If byte 16 indicates a valve terminal error via indication of the extension module number

this always signals an under-voltage of  $U_L$  ( $U_L < 20.4$  V). Byte 17 is always = 0!

Please check the load voltage of the valves.

## 6 User parameters of the *piconet*<sup>®</sup> modules

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Sxxx-10S-0004, RS422/485 interface.....	19
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Sxxx-0002D-0002, pulse width output 24 VDC/ 2.5 A.....	20
Sxxx-0002D-0003, up/down counter 24 VDC.....	21

## Introduction

The chapter describes the bus-specific bit assignment of the user parameters of the individual *piconet*<sup>®</sup> modules



---

### Attention

Alongside the parameter, which are defined via the GSD file of the modules and that can be modified with the configuration software, many modules have parameters that can only be changed via the register communication.

---

In this case the parameters are contained in the register descriptions of the respective modules in the I/O Module Manual of the product series *piconet*<sup>®</sup> – TURCK document number: D300777 (German), D300778 (English) –.



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### Note

A more detailed description of the individual parameters, their settings and their impact on the system is contained in the annex of the I/O Module Manual, – TURCK document number: D300777 (German), D300778 (English) –.

---



Module-independent user parameters

The following parameters are identical for all PROFIBUS-DP nodes of the *piconet*<sup>®</sup> system:

		Byte	Bit	Parameters
<i>Table 56: Module-independent parameters</i>	7		1	– IP module diagnosis
				0 = is not active <b>A</b>
				1 = is active
<b>A</b> Default setting	9		3 to 0	– Data format
				0011 = INTEL
				1011 = MOTOROLA <b>A</b>
	6 and 5			– Updating of process image
				01 = Synchron
				11 = FreeRun <b>A</b>
10	1 and 0			– Reaction on DP error
				00 = IL-cycle stopped <b>A</b>
				01 = IL outputs to 0
				11 = Outputs remain equal

## IP-Link coupling module, SDPL-0404D-x00x

The modules feature the following module-specific parameters:

<i>Table 57: Parameters</i>			
	<b>Byte</b>	<b>Bit</b>	<b>Parameters</b>
<i>SDPL-0404D-x00x</i>	10	3 and 2	– <i>IP-Link error reaction</i>
<b>A</b> <i>Default setting</i>			00 = leave DataExchange <b>A</b>
			01 = DP inputs to 0
			10 = DP inputs remain equal
		5	– <i>SDPL-0404D-xxxx BYTE-Align</i>
			0 = is not active <b>A</b>
			1 = is active
	7	0	– Behavior on IP-Link error
			manual reset
			automatic reset

### Digital stand-alone modules



#### Note

The digital stand-alone modules of the *piconet*<sup>®</sup> systems do not have any other adjustable parameters in addition to the module-independent parameters.

### Digital extension modules



#### Note

The digital extension modules of the *piconet*<sup>®</sup> system are not parameterisable.

## Analogue input modules Sxxx-40A-000x

### Sxxx-40A-0004

The modules feature the following module-specific parameters:

Table 58: Parameters Sxxx-40A-0004	<b>Byte</b>	<b>Bit</b>	<b>Parameters</b>
<b>A</b> Default setting	0	0	– Cold junction compensation <hr/> 0 = each channel individual <b>A</b> <hr/> 1 = channel 1 for all channels
	1	0 to 3	– Channel 1 thermocouple <hr/> 0000 = thermocouple type L <hr/> 0001 = thermocouple type K <b>A</b> <hr/> 0010 = thermocouple type J <hr/> 0011 = thermocouple type E <hr/> 0100 = thermocouple type T <hr/> 0101 = thermocouple type N <hr/> 0111 = thermocouple type B <hr/> 1000 = thermocouple type R <hr/> 1001 = thermocouple type S <hr/> 1010 = reserved <hr/> 1011 = reserved <hr/> 1100 = reserved <hr/> 1101 = -30...+30 mV <hr/> 1110 = -60...+60 mV <hr/> 1111 = -120...+120 mV



Byte	Bit	Parameters	
1	5	– Channel 1 Siemens additional bit	
		0 = is not active <b>A</b> 1 = is active	
	6	– Channel 1 Reference junction	
		0 = is active 1 = is not active <b>A</b>	
2	0 to 6	Parameters of channel 2	Bit assignment identical to channel 1
3	0 to 6	Parameters of channel 3	Bit assignment identical to channel 1
4	0 to 6	Parameters of channel 4	Bit assignment identical to channel 1

## Sxxx-40A-0005

The modules feature the following module-specific parameters:

Table 59:  
Parameters  
Sxxx-40A-0005

**A** Default  
setting

Byte	Bit	Parameters
1	4	– Channel 1 overflow offset
		0 = is not active
		1 = is active <b>A</b>
6	6	– Channel 1 threshold 1
		0 = is not active <b>A</b>
		1 = is active
7	7	– Channel 1 threshold 2
		0 = is not active <b>A</b>
		1 = is active
2		Bit assignment of channel 2 identical to channel 1
3		Bit assignment of channel 3 identical to channel 1
4		Bit assignment of channel 4 identical to channel 1
6, 7		– Channel 1/ threshold 1      Entry of threshold 1
8, 9		– Channel 1 threshold2      Entry of threshold 2
10, 11		– Channel 2/ threshold 1      Entry of threshold 1
12, 13		– Channel 2/ threshold 2      Entry of threshold 2
14, 15		– Channel 3/ threshold 1      Entry of threshold 1



Byte	Bit	Parameters
16, 17		– Channel 3/ threshold 2
18, 19		– Channel 4/ threshold 1
20, 21		– Channel 4/ threshold 2

## Sxxx-40A-0007

The modules feature the following module-specific parameters.

Table 60:  
Parameters  
Sxxx-40A-0007

**A** Default  
setting

Byte	Bit	Parameters
1	0	– Channel 1 current modulus
		0 = 0...20 mA <b>A</b> 1 = 4...20 mA
	4	– Channel 1 overflow offset
		0 = is not active 1 = is active <b>A</b>
6	– Channel 1 threshold 1	
	0 = is not active <b>A</b> 1 = is active	
7	– Channel 1 threshold 2	
	0 = is not active <b>A</b> 1 = is active	
2		Bit assignment of channel 2 identical to channel 1
3		Bit assignment of channel 3 identical to channel 1
4		Bit assignment of channel 4 identical to channel 1
6, 7		– Channel 1/ threshold 1      Entry of threshold 1
8, 9		– Channel 1/ threshold 2      Entry of threshold 2



Byte	Bit	Parameters
10, 11		– Channel 2/ threshold 1      Entry of threshold 1
12, 13		– Channel 2/ threshold 2      Entry of threshold 2
14, 15		– Channel 3/ threshold 1      Entry of threshold 1
16, 17		– Channel 3/ threshold 2      Entry of threshold 2
18, 19		– Channel 4/ threshold 1      Entry of threshold 1
20, 21		– Channel 4/ threshold 2      Entry of threshold 2

## Sxxx-40A-0009

The modules feature the following module-specific parameters:



### Note

The adjustments, which are made in byte 1, apply to all other channels of the module.

Table 61:  
Parameters  
Sxxx-40A-0009

**A** Default  
setting

Byte	Bit	Parameters
1	3 ... 0	– Channel 1 RTD <b>A</b> 0000 = Pt 100 0001 = Ni 100 0010 = Pt 1000 0011 = Pt 500 0100 = Pt 200 0101 = Ni 1000 0110 = Ni 120 0111 = RSNE1000 1000 = 10-5000 Ohm 1001 = 10-1200 Ohm
4		– Channel 1 Siemens additional bit 0 = is not active <b>A</b> 1 = is active
5		– Channel 1 overrange protection 0 = is not active 1 = is active <b>A</b>
6		– Channel 1 3-wire 0 = is not active <b>A</b> 1 = is active
7		– Channel 1 2-wire 0 = is not active <b>A</b> 1 = is active



Byte	Bit	Parameters
2		Bit assignment of channel 2 identical to channel 1
3		Bit assignment of channel 3 identical to channel 1
4		Bit assignment of channel 4 identical to channel 1

## Analogue output modules Sxxx-04A-000x

### Sxxx-04A-0007

The modules feature the following module-specific parameters:

<i>Table 62: Parameters Sxxx-04A-0007</i>	<b>Byte</b>	<b>Bit</b>	<b>Parameters</b>
<b>A</b> Default setting	0	3	– Channel 1 watchdog
			0 = is active <b>A</b> 1 = is not active
	1	3	– Channel 2 watchdog
			0 = is active <b>A</b> 1 = is not active
2	3	– Channel 3 watchdog	
		0 = is active <b>A</b> 1 = is not active	
3	3	– Channel 4 watchdog	
		0 = is active <b>A</b> 1 = is not active	



**Sxxx-04A-0009**

The modules feature the following module-specific parameters:

<i>Table 63: Parameters Sxxx-04A-0009</i>	<b>Byte</b>	<b>Bit</b>	<b>Parameters</b>
<b>A</b> <i>Default setting</i>	0	3	– Channel 1 watchdog <hr/> 0 = is active <b>A</b> <hr/> 1 = is not active
		5	– Current mode for all channels <hr/> 0 = 0...20 mA <b>A</b> <hr/> 1 = 4...20 mA
	1	5	– Channel 2 watchdog <hr/> 0 = is active <b>A</b> <hr/> 1 = is not active
	2	6	– Channel 3 watchdog <hr/> 0 = is active <b>A</b> <hr/> 1 = is not active
	3	7	– Channel 4 watchdog <hr/> 0 = is active <b>A</b> <hr/> 1 = is not active

## Technology modules

### **Sxxx-10S-0001, Incremental encoder interface**

This module cannot be clear-text parameterised via the GSD file at present.

The module must be parameterised via the register communication of via the software "I/O ASSISTANT". For this, please refer to chapter 3 of the *piconet*<sup>®</sup> I/O module manual – TURCK documentation number: D300777 (German), D300778 (English) –.

### Sxxx-10S-0002, RS232 interface

The modules feature the following module-specific parameters:

Table 64:  
Parameters  
Sxxx-10S-0002

Byte	Bit	Parameters
0	2, 1, 0	– Baud rate
		000 = reserved 001 = reserved 010 = reserved 011 = 1200 Baud 100 = 2400 Baud 101 = 4800 Baud 110 = 9600 Baud <b>A</b> 111 = 19200 Baud
1	2, 1, 0	– Data structure
		000 = reserved 001 = 7 data, even 010 = 7 data, odd 011 = 8 data, no <b>A</b> 100 = 8 data, even 101 = 8 data, odd 110 = reserved 111 = reserved
	3	– Stop bits
		0 = 1 stop bit <b>A</b>
		1 = 2 stop bits
2		reserved
3	2	– Status one cycle later
		0 = is not active <b>A</b> 1 = is active

<b>Byte</b>	<b>Bit</b>	<b>Parameters</b>
3	3	– XON/ XOFF send
		0 = is not active <b>A</b>
	1 = is active	
4	4	– XON/ XOFF receive
		0 = is not active <b>A</b>
	1 = is active	
5		reserved
6	6	– send 16 byte
		0 = is not active <b>A</b>
	1 = is active	

### Sxxx-10S-0004, RS422/485 interface

The modules feature the following module-specific parameters:

Table 65: Parameters Sxxx-10S-0002		Byte	Bit	Parameters
<b>A</b> Default setting	0	2, 1, 0	– Baud rate	000 = reserved 001 = reserved 010 = reserved 011 = 1200 Baud 100 = 2400 Baud 101 = 4800 Baud 110 = 9600 Baud <b>A</b> 111 = 19200 Baud
	1	2, 1, 0	– Data structure	000 = reserved 001 = 7 data, even 010 = 7 data, odd 011 = 8 data, no <b>A</b> 100 = 8 data, even 101 = 8 data, odd 110 = reserved 111 = reserved
		3	– Stop bits	0 = 1 stop bit <b>A</b> 1 = 2 stop bits
	2		reserved	
	3	0	– Half duplex	0 = is not active <b>A</b> 1 = is active
		2	– State one cycle later	0 = is not active <b>A</b> 1 = is active

Byte	Bit	Parameters
3	3	– XON/ XOFF send
		0 = is not active <b>A</b>
		1 = is active
4	4	– XON/ XOFF receive
		0 = is not active <b>A</b>
		1 = is active
5	5	– RS422 mode
		0 = is not active <b>A</b>
		1 = is active
6	6	– send 16 bytes
		0 = is not active <b>A</b>
		1 = is active

### **Sxxx-10S-0005, SSI interface**

This module cannot be clear-text parameterised via the GSD file at present.

The module must be parameterised via the register communication of via the software "I/O ASSISTANT". For this, please refer to chapter 3 of the *piconet*<sup>®</sup> I/O module manual – TURCK documentation number: D300777 (German), D300778 (English) –.

### **Sxxx-0002D-0002, pulse width output 24 VDC/ 2.5 A**

This module cannot be clear-text parameterised via the GSD file at present.

The module must be parameterised via the register communication of via the software "I/O ASSISTANT". For this, please refer to chapter 3 of the *piconet*<sup>®</sup> I/O module manual – TURCK documentation number: D300777 (German), D300778 (English) –.

### Sxxx-0002D-0003, up/down counter 24 VDC

The modules feature the following parameters:

Table 66:  
Parameters  
Sxxx-10S-0002

**A** Default  
setting

Byte	Bit	Parameters
<b>Channel 1</b>		
20	0	– Channel 1 watchdog 0 = is active <b>A</b> 1 = is not active
	1	– Channel 1 set counter 0 = positive signal <b>A</b> 1 = positive edge
	2	– Channel 1 set output 0 = is not active <b>A</b> 1 = is active
	3	– Channel 1 reset output 0 = is not active <b>A</b> 1 = is active
	4	– Channel 1 reset counter 0 = is not active <b>A</b> 1 = is active
	5	– Channel 1 pulse mode 0 = is not active <b>A</b> 1 = is active
	6	– Channel 1 disable counter 0 = Gate 0 <b>A</b> 1 = Gate 1

**B** *Parameter setting identical to channel 1 of the module*

Byte	Bit	Parameters
20	7	Channel 1 timer basis
		0 = 1 $\mu$ s/ Digit 250 $\mu$ s – 65 ms <b>A</b>
		1 = 64 $\mu$ s/ Digit 10 $\mu$ s – 4 ms
21	0	– Channel 1 set back with reset
		0 = is not active <b>A</b>
		1 = is active
24 to 27		– Channel 1 power-on level
28 to 31		– Channel 1 power-off/pulse
32 to 35		– Channel 1 reset level
<b>Channel 2</b>		
22 and 23		The assignment of the parameter bytes 22 and 23 of the module accords to the assignment of the parameter bytes 20 and 21 for channel 1 of the module.
36 to 39		The assignment of the parameter bytes 36 to 39 of the module accords to the assignment of the parameter bytes 24 to 27 for channel 1 of the module.
40 to 43		The assignment of the parameter bytes 40 to 43 of the module accords to the assignment of the parameter bytes 28 to 31 for channel 1 of the module.
44 to 47		The assignment of the parameter bytes 44 to 47 of the module accords to the assignment of the parameter bytes 32 to 35 for channel 1 of the module.

## 7 Application example: *piconet*<sup>®</sup> with S7

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## General information

The following chapter contains a detailed description of the connection of a *piconet*<sup>®</sup> network to the controller S7.

The Siemens controller Simatic S7 together with the CPU 315-2AG10-0AB0 and the Simatic Manager V 5.1, Service Pack 6. is used in our example.

The *piconet*<sup>®</sup> network contains the following modules:

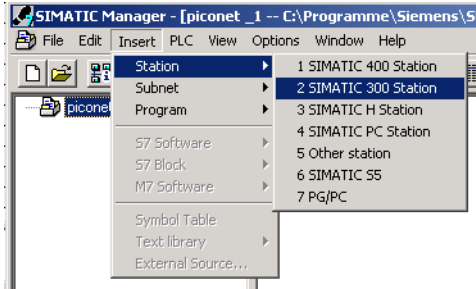
Table 67:  
Model network

<b>Module</b>	<b>DP address</b>	<b>Designation</b>	<b>Function</b>
<b>A</b>	11	SDPL-0404D-x00x	4DI/ 4 DO, coupling module for PROFIBUS-DP
<b>A_1</b>	(IP-Link)	SNNE-10S-0004	RS422/485-Interface, extension module
<b>A_2</b>	(IP-Link)	SNNE-10S-0002	RS232 interface, extension module
<b>A_3</b>	(IP-Link)	SNNE-40A-0009	Pt100, extension module
<b>A_4</b>	(IP-Link)	SNNE-40A-0004	Thermoelement, extension module
<b>A_5</b>	(IP-Link)	SNNE-0202D-0003	Up/down counter, extension module
<b>A_6</b>	(IP-Link)	SNNE-0808D-0001	8 DI / 8 DO, Extension module
<b>A_7</b>	(IP-Link)	SNNE-0008D-0001	8 DO, Extension module
<b>B</b>	12	SDPB-0202D-0003	Up/down counter, stand-alone module
<b>C</b>	13	SDPB-10S-0004	RS422/485-Interface, Stand-alone module
<b>D</b>	14	SDPB-0002D-0002	PWM module, Stand-alone module
<b>E</b>	15	SDBP-10S-0005	SSI encoder interface, Stand-alone module
<b>F</b>	16	SDBP-10S-0001	incremental encoder interface, Stand-alone module

## Creating a new Simatic project

- 1 Create a new project in the Simatic Manager "File → New..."
- 2 Select a Simatic station via „Insert → Station". In our example a Simatic 300 station is used.

Figure 14:  
Selection of the  
Simatic station



## Importing the GSD file

Prior to initial configuration of the *piconet*<sup>®</sup> system via the hardware configurator of the software, the *piconet*<sup>®</sup> GSx files must be imported into the software.

Two different procedures can be applied:

### Prior to starting the software

- Copy the GSx files of the *piconet*<sup>®</sup> modules into the directory "Step7\57data\GSD".
- Copy the Icon files (\*.bmp) to the directory "Step7\57data\NSBMP".
- Start the software "SIMATIC Manager".

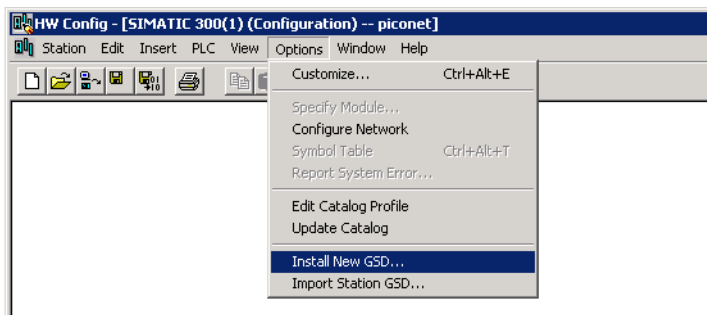
Upon correct installation of the files, the *piconet*<sup>®</sup> modules will be registered automatically in the hardware overview which can be called up under the menu item "Insert → Hardware Catalogue".

### After starting the software

If you have started to the software, please proceed as follows to import the above mentioned GSx files:

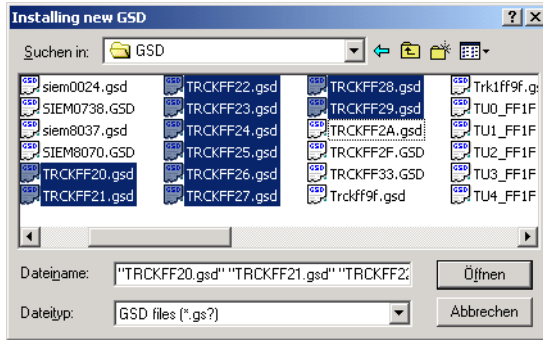
- Please open a new or existing project.
- Open the hardware configurator.
- Copy the required GSx file to the software via the menu item "Extras → Install New GSD File...".

Figure 15:  
Importing a GSD  
file into the  
software via the  
menu item "Install  
New GSD File...".



- Select the GSD file from the according source directory.

Figure 16:  
Selection of the  
GSD file from the  
according source  
directory



- After correct import and an update of the hardware catalogue via "Extras → Update catalogue", the modules will be displayed as separate entries in the hardware catalogue.

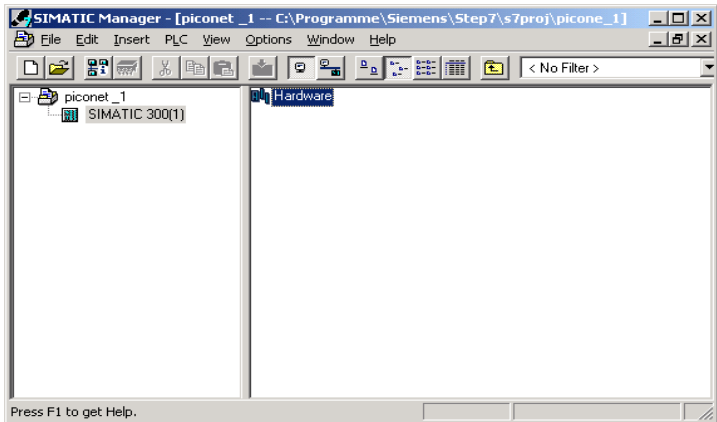
**i** **Note**

The exact configuration procedure can be taken from the operating manual which is supplied together with the software.

## Hardware configuration

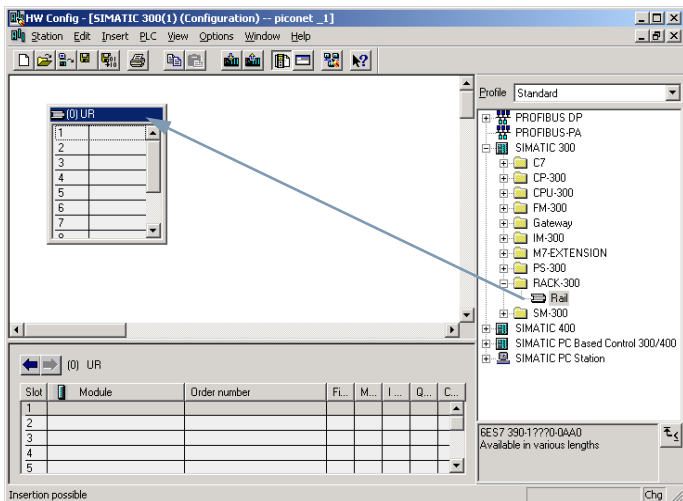
- 1 Open the hardware configuration via the folder "Hardware".HW Config) of the project.

Figure 17:  
Opening the  
hardware  
Configuration



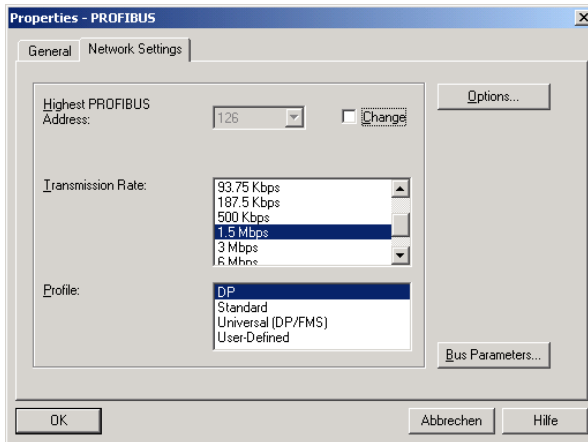
- 2 In the hardware catalogue first select „Simatic 300 → RACK-300“ to select the type of rack. Simply drag it to the upper part of the station window.

Figure 18:  
Selection of the  
Mounting rack



- 3 Then the CPU type is determined. In our example a CPU 315-2AG10-0AB0 is used. Drag the according entry from the hardware catalogue to the 2nd position of the mounting rack in the station window.
- 4 In the pop-up dialogue window "Properties - PROFIBUS interface DP" please define the PROFIBUS address of your control system and then select the subnet. Possibly a new subnet must be added via the button "New...".
- 5 The characteristics of the subnet, such as the transmission speed and profile, can be determined via "Properties..." in the window "Properties - PROFIBUS". These can differ system-specifically from the specifications made here:

Figure 19:  
Properties of the  
subnet



### **Configuration of a *piconet*<sup>®</sup> network**

- 1 After selecting the CPU and configuring the PROFIBUS-DP, the fieldbus nodes are configured. These will now appear after correct installation of the GSD files under "Additional field devices → I/O" in the hardware catalogue.

### **Configuration of the IP-Link**

- 2 The first module in our model network is the coupling module with the hardware address 11.
- 3 Then the extension modules are added to the coupling module.
- 4 First the byte-oriented *piconet*<sup>®</sup> modules, i.e. all analogue modules and all technology modules, of the IP-Link ring must be selected.



#### **Attention**

It must be ensured, that the order of the extension modules in the configuration software accords exactly to the physical order of the modules (see Table 67: "Model network") in the IP-Link network!

---

- 5 After the byte-oriented modules have been configured, the digital modules are integrated into the IP-Link.
- 6 Then the input and output channels of the modules are configured in steps of 8.



#### **Note**

To configure the digital modules in steps of 8, the byte alignment of the coupling module must be activated.

---



#### **Note**

When configuring the digital inputs and outputs, please include the 4 inputs and 4 outputs of the coupling module.

---



Figure 20:  
Configuration  
of the model  
network

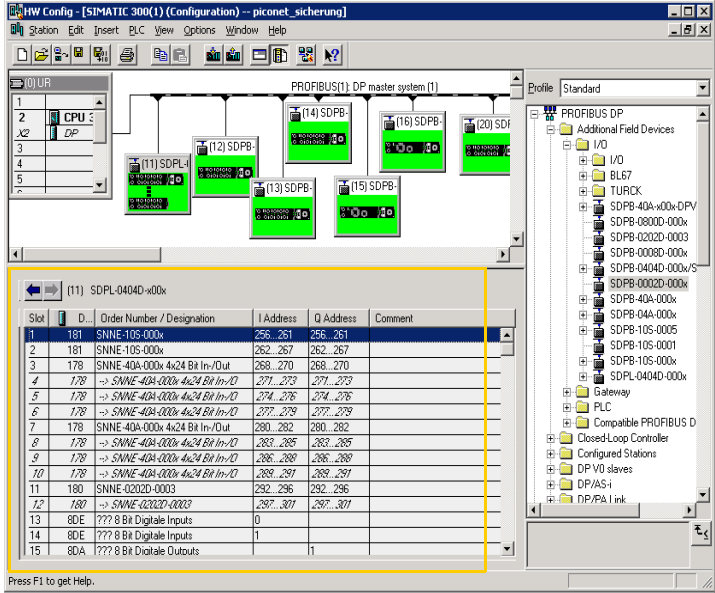


Figure 21:  
Configuration of the  
digital modules in  
steps of 8

Slot	D...	Order Number / Designation	I Address	Q Address	Comment
1	181	SNNE-10S-000x	256...261	256...261	
2	181	SNNE-10S-000x	262...267	262...267	
3	178	SNNE-40A-000x 4x24 Bit In-/Out	268...270	268...270	
4	178	→ SNNE-40A-000x 4x24 Bit In-/O	271...273	271...273	
5	178	→ SNNE-40A-000x 4x24 Bit In-/O	274...276	274...276	
6	178	→ SNNE-40A-000x 4x24 Bit In-/O	277...279	277...279	
7	178	SNNE-40A-000x 4x24 Bit In-/Out	280...282	280...282	
8	178	→ SNNE-40A-000x 4x24 Bit In-/O	283...285	283...285	
9	178	→ SNNE-40A-000x 4x24 Bit In-/O	286...288	286...288	
10	178	→ SNNE-40A-000x 4x24 Bit In-/O	289...291	289...291	
11	180	SNNE-0202D-0003	292...296	292...296	
12	180	→ SNNE-0202D-0003	297...301	297...301	
13	8DE	??? 8 Bit Digitale Inputs	0		
14	8DE	??? 8 Bit Digitale Inputs	1		
15	8DA	??? 8 Bit Digitale Outputs		1	

This results in the following allocation of the process data bytes in the IP-Link network of the sample station (compare Figure 21:).

Table 68:  
Process data  
bytes of the IP-  
Link

IP-Link network			Process data	
Module	physical order in the IP-Link	Designation	Input bytes (no.)	Output bytes (no.)
<b>A</b>		SDPL-0404D-x00x	0	0
<b>A_1</b>	1	SNNE-10S-0004	256 ... 261	256 ... 261
<b>A_2</b>	2	SNNE-10S-0002	262 ... 267	262 ... 267
<b>A_3</b>	3	SNNE-40A-0009	268 ... 279	268 ... 279
<b>A_4</b>	4	SNNE-40A-0004	280 ... 291	280 ... 291
<b>A_5</b>	5	SNNE-0202D-0003	292 ... 301	292 ... 301
<b>A_6</b>	6	SNNE-0808D-0001	1	1
<b>A_7</b>	7	SNNE-0008D-0001	-	2



### Attention

Only if the parameter „SDPL-0404-xxxx Byte-Align“ is activated in the coupling module, all digital modules will occupy a full byte input or output data.

Please also read Chapter 4, section „Mapping of process data via byte alignment“.



■ Data mapping without byte alignment

Table 69:  
Process image  
without  
byte alignment

Byte Input data	
	7    6    5    4    3    2    1    0
0	<b>A_6,</b> <b>A_6,</b> <b>A_6,</b> <b>A_6,</b> <b>A,</b> <b>A,</b> <b>A,</b> <b>A,</b> Bit 3 Bit 2 Bit 1 Bit 0 Bit 3 Bit 2 Bit 1 Bit 0
1	-    -    -    - <b>A_6,</b> <b>A_6,</b> <b>A_6,</b> <b>A_6,</b> Bit 7 Bit 6 Bit 5 Bit 4
Output data	
0	<b>A_6,</b> <b>A_6,</b> <b>A_6,</b> <b>A_6,</b> <b>A,</b> <b>A,</b> <b>A,</b> <b>A,</b> Bit 3 Bit 2 Bit 1 Bit 0 Bit 3 Bit 2 Bit 1 Bit 0
1	<b>A_7,</b> <b>A_7,</b> <b>A_7,</b> <b>A_7,</b> <b>A_6,</b> <b>A_6,</b> <b>A_6,</b> <b>A_6,</b> Bit 3 Bit 2 Bit 1 Bit 0 Bit 7 Bit 6 Bit 5 Bit 4
2	<b>A_7,</b> <b>A_7,</b> <b>A_7,</b> <b>A_7,</b> Bit 7 Bit 6 Bit 5 Bit 4

7

■ Data mapping with byte alignment

For this please activate the parameter  
"SDPL-0404D-xxxx Byte Align" in the coupling module.

Figure 22:  
Activation of the  
byte alignment

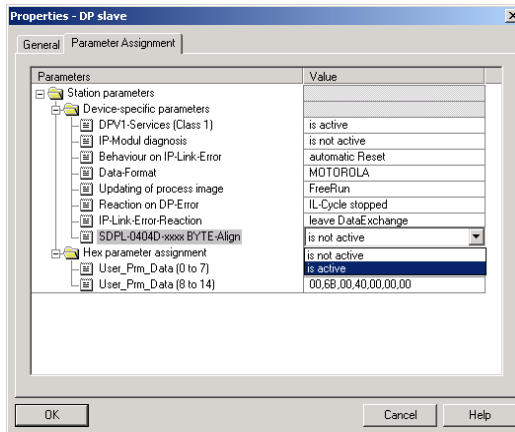
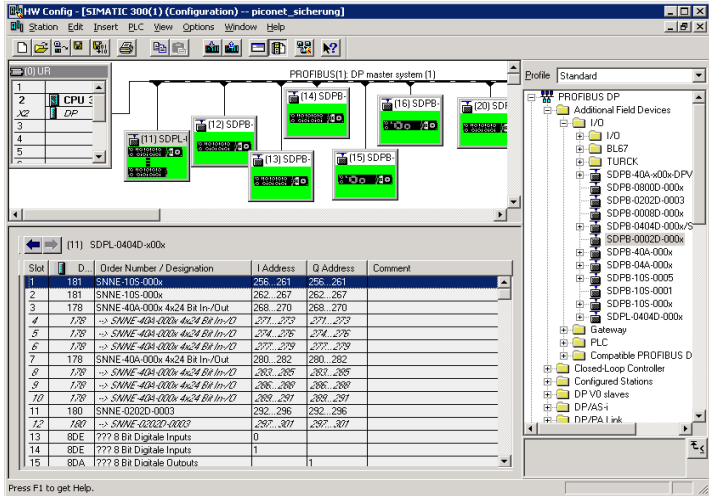


Table 70:  
Process image  
with  
byte alignment

		<b>Byte Input data</b>							
		<b>7</b>	<b>6</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>0</b>
0		<b>idle</b>	<b>idle</b>	<b>idle</b>	<b>idle</b>	<b>A,</b> Bit 3	<b>A,</b> Bit 2	<b>A,</b> Bit 1	<b>A,</b> Bit 0
1		<b>A_6,</b> Bit 7	<b>A_6,</b> Bit 6	<b>A_6,</b> Bit 5	<b>A_6,</b> Bit 4	<b>A_6,</b> Bit 3	<b>A_6,</b> Bit 2	<b>A_6,</b> Bit 1	<b>A_6,</b> Bit 0
		<b>Output data</b>							
0		<b>A,</b> Bit 3	<b>A,</b> Bit 2	<b>A,</b> Bit 1	<b>A,</b> Bit 0	<b>idle</b>	<b>idle</b>	<b>idle</b>	<b>idle</b>
1		<b>A_6,</b> Bit 7	<b>A_6,</b> Bit 6	<b>A_6,</b> Bit 5	<b>A_6,</b> Bit 4	<b>A_6,</b> Bit 3	<b>A_6,</b> Bit 2	<b>A_6,</b> Bit 1	<b>A_6,</b> Bit 0
2		<b>A_7,</b> Bit 7	<b>A_7,</b> Bit 6	<b>A_7,</b> Bit 5	<b>A_7,</b> Bit 4	<b>A_7,</b> Bit 3	<b>A_7,</b> Bit 2	<b>A_7,</b> Bit 1	<b>A_7,</b> Bit 0

- 7 All other modules of the network are configured according to the coupling module on PROFIBUS-DP.

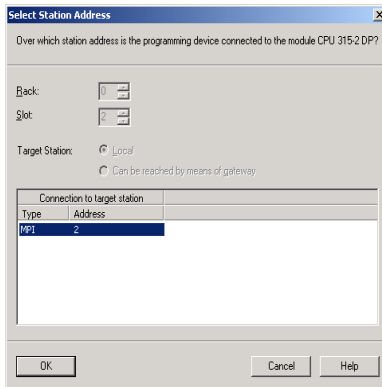
Figure 23:  
Model network



- 8 After having completed the network configuration it is stored and loaded to the controller via the command "PLC → Download".

- For this select the destination station in the pop-up window and in the following window the node address for connection to the destination station. In this case it is the MPI with the node address 2.

*Figure 24:*  
*Connection to the destination station*



- The destination station must be stopped and restarted to load the data.

**Consistent data transmission**

The communication of the S7 controller with the *piconet*<sup>®</sup> modules in the complex mode requires consistent data transmission.

In order to ensure consistent data transmission, the Siemens function blocks SFC14 and SFC15 are used within an organisation block. These are standard program components of the Simatic Manager.

**Consistent data transmission via Siemens function modules SFC14 and SFC15**

The function blocks SFC14 and SFC15 must be copied to the project and called up via the organisation block.

With the help of these two function blocks, the data for register communication are read and written consistently.

In this example, the function blocks are added to the OB1 of the project.

**SFC14**

The SFC14 is needed to read the module-specific settings and parameters in the register communication.

7

Figure 25:  
Function  
block SFC14

```
CALL "DPRD_DAT"
LADDR :=W#16#116
RET_VAL:=MW10
RECORD :=P#M 100.0 BYTE 6
NOP 0
```

Call up the function block via the command *Call SFC14* .

Table 71:  
Parameters of the  
function block  
SFC14

<b>Parameter name</b>	<b>Meaning</b>	<b>Notation</b>
LADDR	Configured start address of the module from the input data memory of the controller.	The entry is written in an hexadecimal format.  Example: W#16#14
RECORD	Target memory area of the CPU for the read user data.  Here it is important to enter the data length of the user data (n byte).	Example: P#M 30.0 BYTE 3
RET_VAL	Target memory area of the CPU for a possible error code of the block.	e.g.: MW100



**SFC15**

The SFC15 is needed to write the module-specific settings and parameters to the register communication.

Figure 26:  
Function  
block SFC15

```
CALL "DPWR_DAT"
LADDR :=W#16#116
RECORD :=P#M 110.0 BYTE 6
RET_VAL:=MW12
NOP 0
```

Call up the function block via the command *Call SFC14* .

Table 72:  
Parameters of the  
function block  
SFC15

Parameter name	Meaning	Notation
LADDR	Configured start address of the module from the output data memory of the controller.	The entry is written in an hexadecimal format.  Example: W#16#14
RECORD	Target memory area of the CPU for writing user data.  Here it is important to enter the data length of the user data (n byte).	Example: P#M 50.0 BYTE 3
RET_VAL	Target memory area of the CPU for the error code of the block.	e.g.: MW120

The function blocks are stored in OB1 for each module. Here the "I addresses" and the "O addresses" are assigned to certain MBs in the memory of the PLC.

The example (Figure 27:) shows the call-up for the first extension module, Modul A\_1 (SNNE-10S-0004), in the IP-Link with the start address 256 dec. or 100 hex. in the input (I address) and output data area (O address) of the PLC.

Figure 27:  
SFC14 und  
SFC 15 for the  
module  
SNNE-10S-0004

Slot	Module / ...	Order number	I Address	Q Address
0	181	SNNE-10S-000x	256..261	256..261
1	181	SNNE-10S-000x	262..267	262..267
2	178	SNNE-40A-000x 4x24 Bit In-/O...	268..270	268..270
3	178	-> SNNE-40A-000x 4x24 Bit In...	271..272	271..272
4	178	-> SNNE-40A-000x 4x24 Bit In...	273..276	273..276
5	178	-> SNNE-40A-000x 4x24 Bit In...	277..279	277..279
6	178	SNNE-04A-000x 4x24 Bit In-/O...	280..282	280..282
7	178	-> SNNE-04A-000x 4x24 Bit In...	283..285	283..285
8	178	-> SNNE-04A-000x 4x24 Bit In...	286..288	286..288
9	178	-> SNNE-04A-000x 4x24 Bit In...	289..291	289..291
10	180	SNNE-020D-000D	292..296	292..296
11	180	-> SNNE-020D-000D	297..301	297..301
12	8DE	??? 8 Bit Digitale Inputs	0	
13	8DE	??? 8 Bit Digitale Inputs	1	
14	8DA	??? 8 Bit Digitale Outputs	1	0
15	8DA	??? 8 Bit Digitale Outputs		1

The 6 input data bytes of the module are written to the flag area from MB 50.0 on (MB 50 up to MB 55), whereas the 6 output data bytes are written to the flag area from MB 60.0 on (MB 60 to MB 65).

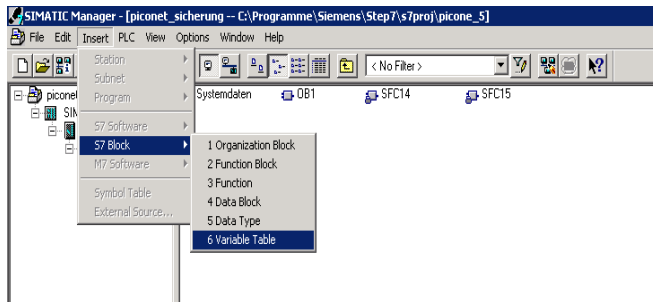
### Module access via a table of variables

The variables, which are to be monitored and controlled (incl. the associated format specifications), are arranged in a table of variables.

This table enables direct monitoring and control of the network modules.

- 1 Click on „Insert → S7 block" in the Simatic Manager to add a variable table to your project:

Figure 28:  
Inserting a  
table of variables



- 2 The structure of the variable table enables call-up, control and monitoring of all module data bytes.

- The first flag word in the areas “//Read” and “//Write” of our example always contains the error word “RET\_VAL” of the function blocks SFC 14 and SFC15. The first MB in the “//Read” area is always the status byte, whereas the first MB in the “//Write” area always contains the control byte of the respective module. Then come the input and output data of the modules.

Figure 29:  
SFCs in OB1 and  
in the table of  
variables

The screenshot displays the SIMATIC Manager interface. The main window shows the OB1 program 'Main Program Sweep (Cycle)' with two networks. Network 1 is labeled 'read: SNNE-105-0004, RS485/422' and contains a 'DPRD\_DAT' function block. Network 2 is labeled 'write: SNNE-105-0004, RS485/422' and contains a 'DPPWR\_DAT' function block. Both function blocks have 'RET\_VAL' outputs connected to M10 and M12 respectively. A variable table window titled '@VAT\_1' is overlaid on the right, showing the memory layout for the variable. The table has columns for Address, Symbol, Disp, Status value, and Modify value. It lists addresses from 1 to 18, with symbols like '//SNNE-105-0004, RS422/485', '//read', and '//write'. Memory addresses 4-9 are marked as M50-M55 (HEX), and 11-17 are marked as M60-M65 (HEX). The status values for M50-M55 are '2B0000\_0000' and for M60-M65 are 'E8168000'. A 'RUN' button is visible at the bottom right of the software interface.

Address	Symbol	Disp	Status value	Modify value
1	//SNNE-105-0004, RS422/485			
2	//read			
3	MW 10	HEX	w#16#8090	
4	MB 50	BIN	2B0000_0000	
5	MB 51	HEX	E8168000	
6	MB 52	HEX	E8168000	
7	MB 53	HEX	E8168000	
8	MB 54	HEX	E8168000	
9	MB 55	HEX	E8168000	
10	//write			
11	MW 12	HEX	w#16#8090	
12	MB 60	BIN	2B0000_0000	
13	MB 61	HEX	E8168000	
14	MB 62	HEX	E8168000	
15	MB 63	HEX	E8168000	
16	MB 64	HEX	E8168000	
17	MB 65	HEX	E8168000	
18				

### Parameterisation of the modules

The *piconet*<sup>®</sup> coupling module and most stand-alone modules allow clear-text parameterisation via the hardware configurator of the Simatic software with the help of the GSx files.

Some few byte-oriented stand-alone modules as well as all byte-oriented extension modules can only be parameterised via the control byte and/or the register communication or the software "I/O-ASSISTANT".



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#### Attention

Generally parameterisation via GSx files has priority over parameterisation via register communication.

Following a power reset, the parameters set via register communication are overwritten by the PLC with the parameters from the GSx files.

Modules that enable clear-text parameterisation via GSx files should thus not be parameterised via register communication.

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7



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#### Note

The *piconet*<sup>®</sup> I/O module manual – TURCK document number D300777 (German) and D300778 (English) – contains a detailed description of the register communication as well as precise specifications of the register allocation of the individual *piconet*<sup>®</sup> modules.

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## Application example: counter module

In the following example, a *piconet*<sup>®</sup> counter module is to fulfil the following functions:

- Upwards counting
- Setting the output after 25 counted pulses
- Resetting the output after 50 counted pulses
- Resetting the counter to 0 after 100 counted pulses

### Parameterisation of a counter as a stand-alone module via GSx file

The counter can be parameterised as a stand-alone module via clear-text parameterisation in the hardware configurator and the GSx file parameters.



#### Attention

Modules that enable clear-text parameterisation via GSx files should thus not be parameterised via register communication. See Page 7-23: "Parameterisation of the modules".

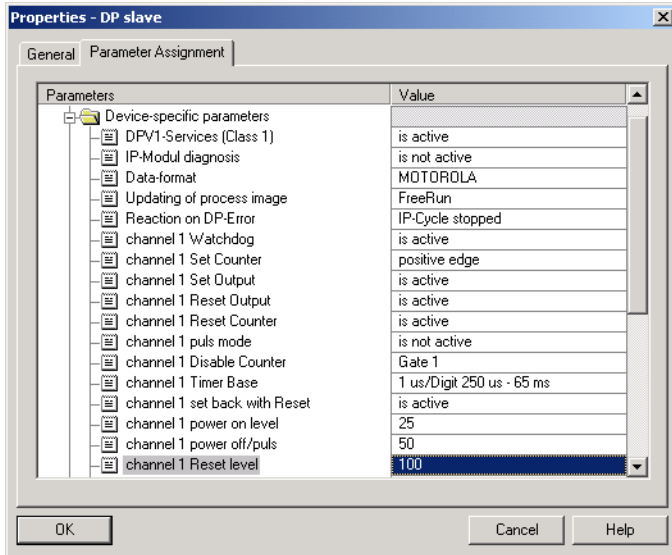
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#### Procedure

- 1 Double-click on the module to open the dialogue "Properties DP slave". In the register "Parameterisation" you will find the device-specific parameters of the module.

2 The following parameter settings are made:

Figure 30:  
Parameterisation  
via the hardware  
configurator



7

3 After having completed module configuration, store and load the modified parameters to the controller via the command "PLC → Download".

### Parameterisation of a counter as an extension module via register communication

The module must be parameterised via the register communication or via the software "I/O ASSISTANT". All settings are made directly in the pre-defined registers.

Access to the registers of the *piconet*<sup>®</sup> modules is enabled via an upload of the register communication, a write or read command and the entry of the register number in the control byte of the respective module.

#### Writing a password to register 31

The password 0x1235 is written to register 31 of the counter module. The command to write to the register and thus to enable register communication via entry of the password is given by the control byte of the module.

Table 73:  
Writing the  
register 31  
(control byte)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	1	0	1	1	1	1	1

- Bit 7 = 1 → Register communication is activated
- Bit 6 = 1 → Register is written
- Bit 5 up to Bit 0 = 31 (dec.) → Register number



The data bytes of the output data map contain the values which are to be transmitted to the respective register.

The password 0x1235 is written to data byte 0 (in our example: MB 119) and data byte 1 (in our example: MB 118) of the module. Data byte 0 presents the least significant byte and data byte 1 the most significant byte.

In our example 0x12 is written to MB 118 (data byte 1) and 0x35 to MB 119 (data byte 0).

Figure 31:  
Password in  
register 31

- A** Register 31
- B** Data byte 1
- C** Data byte 0

	Address	Disp	Status value	Modify value
78	//SDPB-0202D-0003, Counter, Channel 1			
79	//read			
80	MW 30	HEX	W#16#0000	
81	MB 120	HEX	B#16#00	
82	MB 121	HEX	B#16#00	
83	MB 122	HEX	B#16#00	
84	MB 123	HEX	B#16#00	
85	MB 124	HEX	B#16#00	
86	//write			
87	MW 32	HEX	W#16#0000	
88	MB 125	BIN	2#0000_0000	2#1101_1111
89	MB 126	HEX	B#16#00	
90	MB 127	HEX	B#16#00	
91	MB 128	HEX	B#16#00	B#16#12
92	MB 129	HEX	B#16#00	B#16#35
93				



**Note**

The mapping tables in Chapter 4 of the manual show the assignment of the input and output data to the data bytes.

## Activation of the switch-on, switch-off and reset thresholds

The counter function to set and reset the output and to reset the counter is activated in the feature register (register 32) of the module – see register assignment of the counter: chapter 12, "Technology modules" in the *piconet*® I/O module manual, TURCK document number: D300777 (German), D300778 (English) – .

## Writing the feature register (register 32)

The parameters in register 32 are transferred to the module via the control byte as follows:

Table 74:  
Writing the  
register 32  
(control byte)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	1	1	0	0	0	0	0

Bit 7 = 1 → Register communication is activated  
 Bit 6 = 1 → Register is written  
 Bit 5  
 up to Bit 0 = 32 (dec.) → Register number

In our example, the configuration of the feature register of the counter module results in the following settings:

- Low byte → Data byte 0 (in the example MB 119):  
Value: 0x78

Table 75:  
Register 32,  
low byte

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1	1	1	1	0	0	0

Bit 7 = 0 → Pulse mode is activated.  
 Bit 6 = 1 → Function to reset counter active  
 Bit 5 = 1 → Function to reset output active  
 Bit 4 = 1 → Function to set output active  
 Bit 3 = 1 → The counter is set upon a positive edge from CNT\_SET Bit in the control byte



Bit 2 = 0 → Watchdog active

Bit 1, Bit 0 = 0 → reserved

- High byte → Data byte 1 (in the example MB 118):  
Value: 0x01

Table 76:  
Register 32,  
High byte

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
0	0	0	0	0	0	0	1

Bit 15

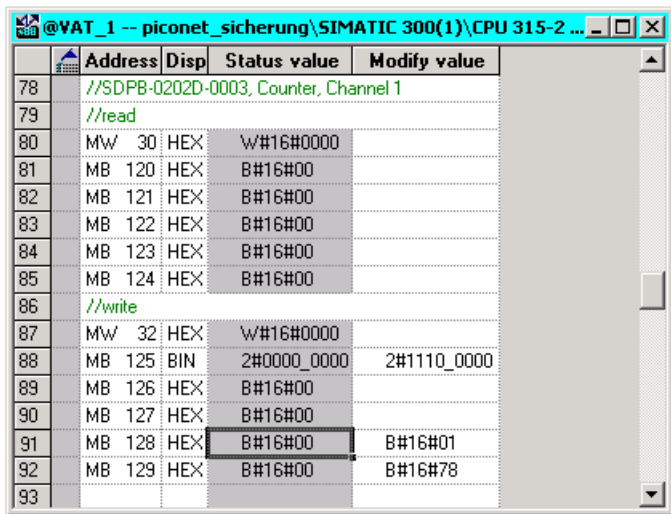
up to Bit 11 = 0 → reserved

Bit 10 = 0 → Reset of output upon counter reset

Bit 9 = 0 → Timer basis (pulse length register 41)  
: 1 µs/digit (250 µs – 65 ms)

Bit 8 = 1 → counter is inhibited if input gate  
= high (1)

Figure 32:  
Writing the  
register 32



**Note**

The settings made in register 32 are only activated after a power reset of the module.

**Setting the switch-on, switch-off and reset thresholds**

The threshold values are set in registers 35 to 40. The thresholds are stored permanently in the EEPROM of the module.

**Note**

Important for threshold value selection:

Switch-on threshold < Switch-off threshold < Reset threshold

Table 77:  
Threshold  
register

<b>Register</b>	<b>Designation</b>	<b>Memory</b>
R0	Switch-on threshold, least significant word	RAM
R1	Switch-on threshold, most significant word	RAM
R2	Switch-off threshold, least significant word	RAM
R3	Switch-off threshold, most significant word	RAM
R4	Reset threshold, least significant word	RAM
R5	Reset threshold, most significant word	RAM
....		
R35	Switch-on threshold, least significant word	EEPROM
R36	Switch-on threshold, most significant word	EEPROM
R37	Switch-off threshold, least significant word	EEPROM
R38	Switch-off threshold, most significant word	EEPROM
R39	Reset threshold, least significant word	EEPROM
R40	Reset threshold, most significant word	EEPROM
....		



**Note**

The settings in register 35 to 40 will only be activated after a power reset of the module and stored in the RAM of the module and thus in registers 0 to 5.



**Attention**

The threshold values should not be entered directly in registers 0 to 5.

In case of a power reset of the module, the actual changes in the RAM could be overwritten by invalid values of registers 35 to 40 stored in the EEPROM.

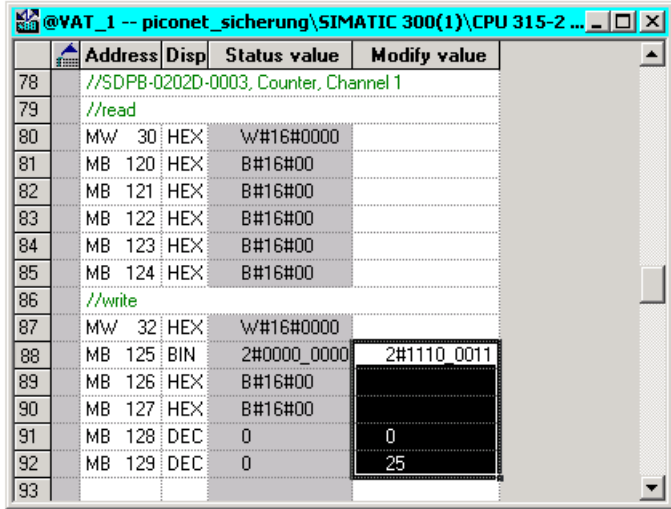
■ **Switch-on threshold** (25 pulses):

Table 78: Writing the register 35 (control byte)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	1	1	1	0	0	0	1	1

→ Data byte 0 (MB 119) = 25 dec. (0x19 hex.)

Table 79: Data byte 0 (MB 119)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	0	0	0	1	1	0	0	1

Figure 33:  
Switch-on  
threshold



■ **Switch-off threshold** (50 pulses):

Table 80:  
Writing the  
register 37  
(control byte)

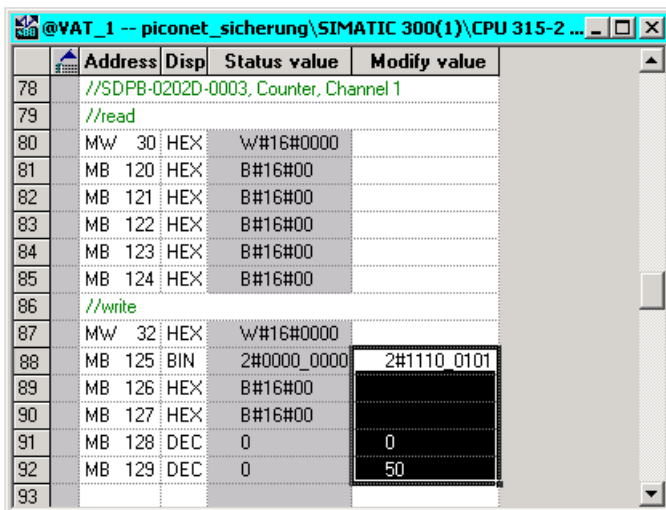
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	1	1	0	0	1	0	1

→ Data byte 0 (MB 119) = 50 dec. (0x32 hex.)

Table 81:  
Data byte 0 (MB  
119)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	1	1	0	0	1	0

Figure 34:  
Switch-off  
threshold



	Address	Disp	Status value	Modify value
78	//SDPB-0202D-0003, Counter, Channel 1			
79	//read			
80	MW 30	HEX	W#16#0000	
81	MB 120	HEX	B#16#00	
82	MB 121	HEX	B#16#00	
83	MB 122	HEX	B#16#00	
84	MB 123	HEX	B#16#00	
85	MB 124	HEX	B#16#00	
86	//write			
87	MW 32	HEX	W#16#0000	
88	MB 125	BIN	2#0000_0000	2#1110_0101
89	MB 126	HEX	B#16#00	
90	MB 127	HEX	B#16#00	
91	MB 128	DEC	0	0
92	MB 129	DEC	0	50
93				

■ **Reset threshold** (100 pulses):

Table 82:  
Writing the  
register 39  
(control byte)

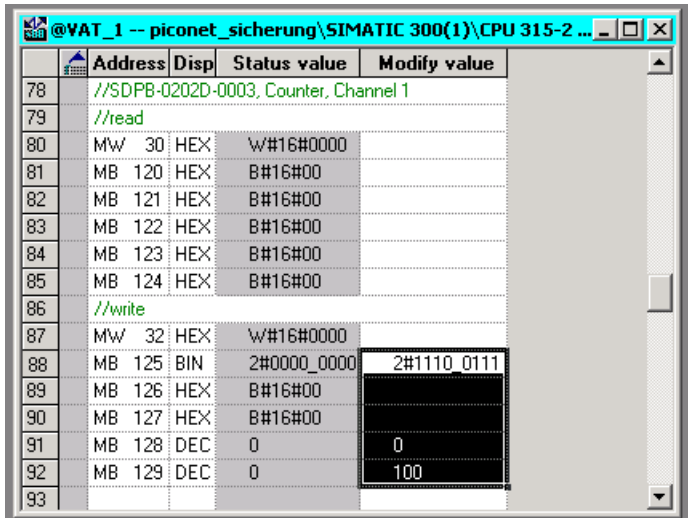
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	1	1	0	0	1	1	1

→ Data byte 0 (MB 119) = 100 dec. (0x64 hex.)

Table 83:  
Data byte 0 (MB  
119)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1	1	0	0	1	0	0

Figure 35:  
Reset threshold



**Attention**

Carry out a power reset to transfer settings from registers 35 to 40 to registers 0 to 5 of the module!



### Enabling the internal counter functions

- 1 Prior to taken the counter in operation, the internal functions of the counter, i.e. the parameter settings, must first be enabled via the enable bit „EN\_A“, bit 0 in the control byte.
- 2 For this the control byte is overwritten via the table of variables with 2#0000\_0001.

Figure 36:  
Enable via bit 0 of  
the control byte

	Address	Disp	Status	value	Modify value
78	//SDPB-0202D-0003, Counter, Channel 1				
79	//read				
80	MW 30	HEX		W#16#0000	
81	MB 120	HEX		B#16#00	
82	MB 121	HEX		B#16#00	
83	MB 122	HEX		B#16#00	
84	MB 123	HEX		B#16#00	
85	MB 124	HEX		B#16#00	
86	//write				
87	MW 32	HEX		W#16#0000	
88	MB 125	BIN		2#0000_0000	2#0000_0001
89	MB 126	HEX		B#16#00	
90	MB 127	HEX		B#16#00	
91	MB 128	HEX		B#16#00	
92	MB 129	HEX		B#16#00	
93					

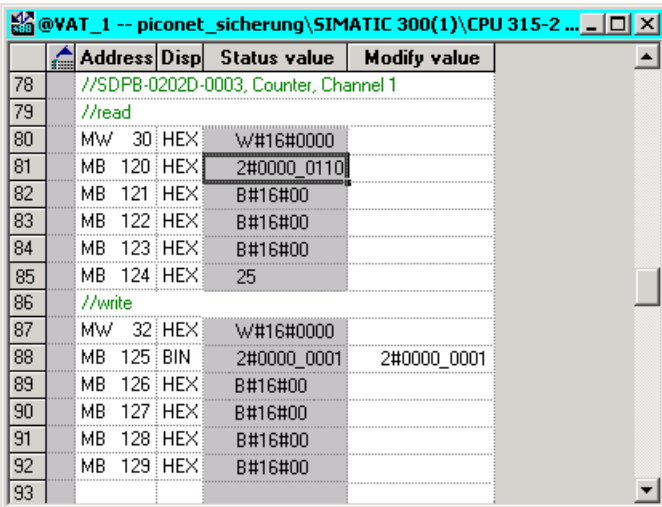
## Monitoring the counting procedure via the table of variables

The counter counts upwards. The counted pulses are indicated in data byte 0 of the counter, in this case MB 124.

### Reaching the switch-on threshold

- 1 The counter counts up to 25 as pre-set and sets the output.
- 2 The LED Q1 at the connector "D" of the counter module illuminates green.
- 3 Bit 2 of the status byte (in our example: MB 120) is set.

Figure 37:  
Setting the  
output



	Address	Disp	Status	value	Modify value
78	//SDPB-0202D-0003, Counter, Channel 1				
79	//read				
80	MW 30	HEX		W#16#0000	
81	MB 120	HEX		2#0000_0110	
82	MB 121	HEX		B#16#00	
83	MB 122	HEX		B#16#00	
84	MB 123	HEX		B#16#00	
85	MB 124	HEX		25	
86	//write				
87	MW 32	HEX		W#16#0000	
88	MB 125	BIN		2#0000_0001	2#0000_0001
89	MB 126	HEX		B#16#00	
90	MB 127	HEX		B#16#00	
91	MB 128	HEX		B#16#00	
92	MB 129	HEX		B#16#00	
93					



**Reaching the switch-off/pulse value**

- 4 The counter continues to count as pre-set. After 50 counted pulses the output is reset.
- 5 The LED Q1 at the connector "D" of the counter module turns off.
- 6 Bit 2 is reset again in the status byte (MB120).

Figure 38:  
Resetting the  
output

	Address	Disp	Status	value	Modify value
78	//SDPB-0202D-0003, Counter, Channel 1				
79	//read				
80	MW 30	HEX		W#16#0000	
81	MB 120	HEX		2#0000_0010	
82	MB 121	HEX		B#16#00	
83	MB 122	HEX		B#16#00	
84	MB 123	HEX		B#16#00	
85	MB 124	HEX		50	
86	//write				
87	MW 32	HEX		W#16#0000	
88	MB 125	BIN		2#0000_0001	2#0000_0001
89	MB 126	HEX		B#16#00	
90	MB 127	HEX		B#16#00	
91	MB 128	HEX		B#16#00	
92	MB 129	HEX		B#16#00	
93					

7

**Reaching the reset threshold**

- 7 After 100 counted pulses the count in data byte 0 (here: MB 124) is reset to "0".
- 8 The counter starts counting upwards from "0" on.

## Application example: SSI module

The SSI module must be parameterised via the register communication or via the software "I/O ASSISTANT".

The multiturn encoders cannot be parameterised directly via the *piconet*<sup>®</sup> module. Configuration can only be carried out, e.g. für Kübler encoders, by the free "parameterisation tool for multiturn encoders", i.e. the software Ezturm<sup>®</sup>.



### Note

When using the *piconet*<sup>®</sup> SSI module Sxxx-10S-x005, please ensure that the settings of the communication parameters (output format, single-/ or multi-turn, baud rate, data length etc) of the module and the used SSI encoder accord with each other.

---

This applies to all parameter settings of the feature register (register 32, the baud rate register (register 33) and the data length register (register 34).



### Note

Detailed information on the module register assignment is contained in chapter 12 of the *piconet*<sup>®</sup> I/O module manual. „*piconet*<sup>®</sup> I/O Modules“, – TURCK document number: D300777 (German), D300778 (English) – .

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**Application example: Incremental encoder**

In the following example the *piconet*<sup>®</sup> incremental encoder module is to fulfil the following functions:

- Setting the counter value to "0"
- Storing the count with an activated latch input,
- Inhibiting the counter with a low level at the gate input
- Switching from encoder interface mode to counter mode.

**Parameterisation of an incremental encoder via GSx file**

The incremental encoder cannot be parameterised via the GSx file at present.

The module can be parameterised either via the control byte and/or register communication or via the software "/I/O-ASSISTANT".

## Parameterisation of an incremental encoder via the control byte

In many cases the incremental encoder can be parameterised directly via the control byte. Parameterisation via register communication is thus not necessary.

Certain parameters must, however, be set by the register communication. All settings are made directly in the pre-defined registers.

### Setting the counter value

The counter is set with a rising edge of the bit "CNT\_SET", Bit 2 in control word" of the module to the value, which is determined by the process data in Reg0 and Reg1 (see "Mapping" in the bus-specific *piconet*<sup>®</sup> manual).

### Setting the bit "CNT\_SET"

This bit is set without register access simply via the control byte:

Table 84: Control byte	Bit 7	6	5	4	3	2	1	0
Name	RegAccess	-	-	-	-	CNT_SET	EN_LAT_EXT/ RD_PERIOD	EN_LATC

Table 85: Setting "CNT_SET"	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	0	0	0	0	0	1	0	0

The value set in Reg 0 (MB 192) and Reg 1 (MB 191), in our example "0" is accepted.

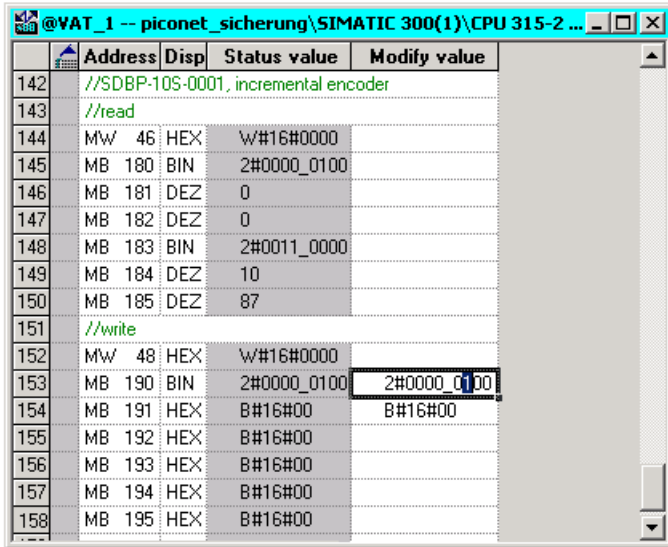


### Note

Please note that the bit "CNT\_SET" requires a reset prior to re-activation.



Figure 39:  
Setting the  
counter



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The module counts from "0" on upwards or downwards, depending on the rotary direction of the connected encoder.

**Data byte D2**

The status of the input channels A, B and C as well as the inputs "Gate" and "Latch" is shown in data byte D2:

Table 86:  
Data byte D2

Bit	7	6	5	4	3	2	1	0
Name	-	-	INPUT_A	INPUT_B	INPUT_C	INPUT_ERR	LATCH	Gate

Table 87:  
Description

Name	Description
INPUT_A	Status of input channel A
INPUT_B	Status of input channel B
INPUT_C	Status of input channel C
INPUT_ERR	Status of alarm channel
LATCH	Status of LATCH input at M12 connector
GATE	Status of GATE input at M12 connector

### Storing the counter value

Data bytes D3 and D4 store the actual counter value upon activation of the external latch input.

Bit 1 „EN\_LAT\_EXT“ of the control byte is set to activate the external latch input.

Upon receipt of the first external latch pulse at the latch input and a valid "EN\_LAT\_EXT" bit the counter value is saved. The following pulses have no influence on the latch register if the bit is set.

This bit is set without register access simply via the control byte in process data operation:

Table 88:  
Control byte

Bit	7	6	5	4	3	2	1	0
Name	RegAccess	-	-	-	-	CNT_SET	EN_LAT_EXT/ RD_PERIOD	EN_LATC

Table 89:  
Setting  
"EN\_LAT\_EXT"

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	0	0	1	0



If an edge change from "0" to "1" takes place at the external latch input during the counting procedure, the actual counter value is written to data bytes D3 and D4.

Bit 1 "LATCH" in data byte D2 (see Page 7-41) is set for a short moment to indicate activation of the latch input.

Figure 40:  
Storing the  
counter value

Address	Disp	Status value	Modify value
142		//SDBP-10S-0001, incremental encoder	
143		//read	
144	MW 46	HEX	W#16#0000
145	MB 180	BIN	2#0000_0010
146	MB 181	DEZ	92
147	MB 182	DEZ	53
148	MB 183	BIN	2#0011_0010
149	MB 184	DEZ	92
150	MB 185	DEZ	53
151		//write	
152	MW 48	HEX	W#16#0000
153	MB 190	BIN	2#0000_0010 2#0000_0010
154	MB 191	HEX	B#16#00 B#16#00
155	MB 192	HEX	B#16#00
156	MB 193	HEX	B#16#00
157	MB 194	HEX	B#16#00
158	MB 195	HEX	B#16#00

## Parameterisation of an incremental encoder via register communication

In order to parameterise the module via register communication the password for register access must first be written to register 31 of the module.

### Writing a password to register 31

The password 0x1235 is written to register 31 of the incremental encoder. The command to write to the register and thus to enable register communication via entry of the password is given by the control byte of the module.

Table 90:  
Writing the  
register 31  
(control byte)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	1	0	1	1	1	1	1

Bit 7 = 1 → Register communication is activated

Bit 6 = 1 → Register is written

Bit 5  
up to Bit 0 = 31 (dec.) → Register number

The data bytes of the output data map contain the values which are to be transmitted to the respective register.

The password 0x1235 is written to Reg 0 (in our example: MB 192) and Reg 1 (in our example: MB 191) of the module, while Reg 0 presents the least significant byte and Reg 1 the most significant byte.

In our example 0x12 is written to MB 191 (Reg 1) and 0x35 to MB 192 (Reg 0).



### Note

The mapping tables in Chapter 4, „Data mapping of the *piconet*<sup>®</sup> modules” show the assignment of the input and output data to the data bytes.



Figure 41:  
Password in  
register 31

- A Register 31
- B Reg 1
- C Reg 0

Address	Disp	Status value	Modify value
142		//SDBP-10S-0001, incremental encoder	
143		//read	
144	MW 46	HEX	W#16#0000
145	MB 180	BIN	2#0000_0000
146	MB 181	DEZ	0
147	MB 182	DEZ	0
148	MB 183	BIN	2#0000_0001
149	MB 184	DEZ	0
150	MB 185	DEZ	0
151		//write	
152	MW 48	HEX	W#16#0000
153	MB 190	BIN	2#0000_0000
154	MB 191	BIN	2#0000_0000
155	MB 192	BIN	2#0000_0000
156	MB 193	HEX	B#16#00
157	MB 194	HEX	B#16#00
158	MB 195	HEX	B#16#00

7

### Disabling the counter

The counter of the incremental encoder can be disabled either via a high or a low level at the gate input, depending on parameterisation.

In our example the counter is to be inhibited with a low level at the gate input.

The module is parameterised via the feature register (R32).

Access to the registers of the module is enabled via call-up of the register communication, a write or read command and entry of the register number in the control byte of the respective module.

### Writing the feature register (register 32)

The parameters in register 32 are transferred to the module via the control byte as follows:

Table 91:  
Writing the  
register 32  
(control byte)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	1	1	0	0	0	0	0

Bit 7 = 1 → Register communication is activated

Bit 6 = 1 → Register is written

Bit 5  
up to Bit 0 = 32 (dec.) → Register number



In our example, the configuration of the feature register of the incremental encoder results in the following settings:

- Low byte → Data byte 0 (in the example MB 119):  
Value: 0x02

<i>Table 92: Register 32, low byte</i>	<b>Bit 7</b>	<b>Bit 6</b>	<b>Bit 5</b>	<b>Bit 4</b>	<b>Bit 3</b>	<b>Bit 2</b>	<b>Bit 1</b>	<b>Bit 0</b>
	0	0	0	0	0	0	1	0

- Bit 7 = 0 → reserved
- Bit 6, Bit 5 = 0 → reserved
- Bit 4 = 0 → External latch function active
- Bit 3, Bit 2 = 0 → Status input (active low) is inserted in the status byte, bit 5
- Bit 1 = 1 → Counter is inhibited with a **low level** at the gate input
- Bit 0 = 0 → reserved

- High byte → Reg 1 (in the example MB 191):  
Value: 0x80

<i>Table 93: Register 32, High byte</i>	<b>Bit 15</b>	<b>Bit 14</b>	<b>Bit 13</b>	<b>Bit 12</b>	<b>Bit 11</b>	<b>Bit 10</b>	<b>Bit 9</b>	<b>Bit 8</b>
	1	0	0	0	0	0	0	0

- Bit 15 = 0 → Encoder interface
- Bit 14 up to Bit 12 = 0 → reserved
- Bit 11, Bit 10 = 0 → 4-fold evaluation of the encoder signals A, B, C
- Bit 9, Bit 8 = 1 → reserved

Figure 42:  
Writing the  
register 32

	Address	Disp	Status value	Modify value
142	//SDBP-10S-0001, incremental encoder			
143	//read			
144	MW 46	HEX	W#16#0000	
145	MB 180	BIN	2#0000_0000	
146	MB 181	DEZ	0	
147	MB 182	DEZ	0	
148	MB 183	BIN	2#0000_0001	
149	MB 184	DEZ	0	
150	MB 185	DEZ	0	
151	//write			
152	MW 48	HEX	W#16#0000	
153	MB 190	BIN	2#0000_0000	2#1110_0000
154	MB 191	BIN	2#0000_0000	2#0000_0000
155	MB 192	BIN	2#0000_0000	2#0000_0010
156	MB 193	HEX	B#16#00	
157	MB 194	HEX	B#16#00	
158	MB 195	HEX	B#16#00	

**i Note**

The settings made in register 32 will only be activated after a power reset of the module, which will then return to the process data exchange mode.

The counter is inhibited until a high level applies to the gate input.

After a new signal change at the input from "High" → to "Low" the counter is re-inhibited.



**Switching from: Encoder interface mode to counter mode**

Changing from the encoder interface mode to the counter mode is also accomplished via the feature register (R32) of the module.

**Writing the feature register (register 32)**

The parameters in register 32 are transferred to the module via the control byte as follows:

<i>Table 94: Writing the register 32 (control byte)</i>	<b>Bit 7</b>	<b>Bit 6</b>	<b>Bit 5</b>	<b>Bit 4</b>	<b>Bit 3</b>	<b>Bit 2</b>	<b>Bit 1</b>	<b>Bit 0</b>
	1	1	1	0	0	0	0	0

7

- Bit 7 = 1 → Register communication is activated
- Bit 6 = 1 → Register is written
- Bit 5 up to Bit 0 = 32 (dec.) → Register number

In our example, the configuration of the feature register of the incremental encoder results in the following settings:

- Low byte → Data byte 0 (in the example MB 119):  
Value: 0x00

<i>Table 95: Register 32, low byte</i>	<b>Bit 7</b>	<b>Bit 6</b>	<b>Bit 5</b>	<b>Bit 4</b>	<b>Bit 3</b>	<b>Bit 2</b>	<b>Bit 1</b>	<b>Bit 0</b>
	0	0	0	0	0	0	0	0

- Bit 7 = 0 → reserved
- Bit 6, Bit 5 = 0 → reserved
- Bit 4 = 0 → External latch function active
- Bit 3, Bit 2 = 0 → Status input (active low) is inserted in the status byte, bit 5
- Bit 1 = 0 → Counter is inhibited with a high level at the gate input
- Bit 0 = 0 → reserved

- High byte → Reg 1 (in the example MB 191):  
Value: 0x80

Table 96:  
Register 32,  
High byte

<b>Bit 15</b>	<b>Bit 14</b>	<b>Bit 13</b>	<b>Bit 12</b>	<b>Bit 11</b>	<b>Bit 10</b>	<b>Bit 9</b>	<b>Bit 8</b>
1	0	0	0	0	0	0	0

Bit 15 = 1 → Counter mode

Bit 14

up to Bit 12 = 0 → reserved

Bit 11, Bit 10 = 0 → 4-fold evaluation of the encoder signals  
A, B, C

Bit 9, Bit 8 = 1 → reserved



Figure 43:  
Writing the  
register 32

	Address	Disp	Status value	Modify value
142	//SDBP-10S-0001, incremental encoder			
143	//read			
144	MW 46	HEX	W#16#0000	
145	MB 180	BIN	2#1010_0000	
146	MB 181	DEZ	0	
147	MB 182	DEZ	0	
148	MB 183	BIN	2#0000_0000	
149	MB 184	DEZ	0	
150	MB 185	DEZ	106	
151	//write			
152	MW 48	HEX	W#16#0000	
153	MB 190	BIN	2#1110_0000	2#1110_0000
154	MB 191	BIN	2#1000_0000	2#1000_0000
155	MB 192	BIN	2#0000_0000	2#0000_0000
156	MB 193	HEX	B#16#00	
157	MB 194	HEX	B#16#00	
158	MB 195	HEX	B#16#00	

7

**i Note**

The settings made in R32 will only be activated after a power reset of the module, which will then return to process data exchange and the counter will continue to count.



## 8 Glossary of terms

### A

#### **Acknowledge**

Acknowledgement of the receiver to confirm receipt of the signal.

#### **Address**

A number for identification, e.g. for a memory location, a system or a module within a network.

#### **Addressing**

Allocation or setting of an address, e.g. for a module within a network.

#### **Active conductive part**

Conductor or conductive component that is energized during operation.

#### **Analogue**

A value – e.g. a voltage - that is infinitely proportional. With analogue signals the value of the signal can assume any value within certain limits.

#### **Automation device**

A device for connection of inputs and outputs, which is connected within a technical process. Programmable logic controllers (PLC) belong to a certain category of automation devices.

### B

#### **Baud**

Unit of measure for the transmission speed of data. One baud accords to one step per second. If one bit is transferred per step, then the baud rate is identical to the transmission rate in bit per second.

#### **Baud rate**

see "Baud"

#### **Bidirectional**

Working in both directions.

## **Binary code**

Coding method with which the contents to be coded is reproduced in form of logical binary characters (0 and 1) or character strings. Binary codes are suited for coding of numerical and alpha-numerical characters.

## **Bus**

A group signal line for data transfer, e.g. between the central processing unit (CPU), memory and I/O level. A bus can consist of several parallel lines for data transfer, addressing, control and power supply.

## **Bus cycle time**

The time interval in which the master addresses and communicates with all slaves within the bus system, i.e. the time in which the master writes the slave outputs and reads the slave inputs.

## **Bus line**

Smallest unit connected to the bus; consisting of a PLC, a coupling element to couple the modules to the bus and a module.

## **Bus system**

The entirety of components that communicate via a bus.

**C**

## **Capacitive coupling**

A capacitive (electrical) coupling occurs between two conductors with different potentials. Typical sources of interference are, for example, parallelly routed signal lines, contactors and static discharge.

## **Coding element**

A two-part component for clear assignment of electronic and base module.

## **Command-capable modules**

Command-capable modules are modules with an internal command routine, which are capable of executing certain commands (e.g. output of substitute values).

## **Configuration**

Systematic arrangement of the I/O modules of a station.

**CPU**

The abbreviation for "Central Processing Unit". Central unit for data processing, the core component of the computer.

**D****Digital**

A value – e.g. of a voltage – which can only assume a certain condition, usually defined as 0 and 1.

**DIN**

The abbreviation for "Deutsches Institut for Normung e.V."

**E****Earth**

An electrotechnical term used to signify conductive earth whose electrical potential is always zero. The electrical potential of the earth can be unequal zero in the proximity of earthing systems. In this case the term "ground reference plane" would be used.

8

**Earth electrode**

One or several components which are in direct and good contact with the earth.

**EIA**

The abbreviation for "Electronic Industries Association". An association of companies belonging to the electronic industries in the USA.

**Electrical equipment**

All devices that are used for generation, conversion, transmission, distribution and use of electrical energy, such as conductors, cables, machines, control devices etc.

**EMC**

The abbreviation for "Electromagnetic Capability". The term EMC describes the capability of an electrical apparatus to function correctly within a certain environment without having a negative influence on the environment.

**Equipotential bonding**

Adaptation of the electrical levels of the frame of electrical apparatus and external conductive components via an electrical connection.

## **ESD**

The abbreviation for "Electro Static Discharge".

## **Exposed conductive part**

An exposed conductive part is electrically isolated from the active conductive part but can become energised in the event of an error.

## **F**

### **Fieldbus**

Data network at the sensor/actuator level. The fieldbus connects the field devices. The fieldbus is characterised by the high transmission reliability and real time performance.

### **Field supply**

Supply of voltage to power the field devices as well as the signal voltage.

### **Force mode**

A software mode, in which it is possible to set certain fixed variables of input and output modules to simulate certain system conditions.

### **Full duplex**

Also called duplex. Physical or logical connection of two terminal points to establish a data transmission channel. Data can be sent or received simultaneously in both directions. Full duplex cables have two wires. In full duplex operation either both channels or only one channel are used. If data are transferred via a single channel, this takes place in the multiplex mode. That means that data are transferred alternately but with a very high frequency so that the impression of simultaneous data transfer is given.

## **G**

### **Galvanic coupling**

Galvanic coupling generally occurs if two current circuits share a common line. Typical interference sources are, for example, starting motors, static discharge, clocked devices and a potential difference between component housings and the mutual power supply.

## **GND**

The abbreviation for "Ground" (zero potential).

## **Gray-Code**

Binary code for reproduction of integers. Two consecutive values only differ in a single bit.

## **Ground**

All linked inactive parts of an electrical apparatus, which will not assume a touch voltage even in the event of an error.

## **Ground reference plane**

Ground potential in the proximity of earthing systems. In contrast to the "earth", whose potential is always zero, it can have a different potential than zero.

8

## **Grounding strip**

Usually a flexible braided conductor that connects the inactive parts of the electrical equipment, e.g. the door of a switching cabinet with the switching cabinet corpus.

## **Grouping**

A power supply module forms a new potential group. Thus the load and sensor supply can be fed separately.

## **GSD**

The German term for device data base file (DDBF). The GSD file contains standardised descriptions of PROFIBUS modules. GSD files are used to simplify configuration of the DP master and the DP slaves.

## **H**

## **Half duplex**

Physical or logical connection of two terminal points to establish a data transmission channel. In contrast to full duplex operation, data can be transferred in both directions but, however, not simultaneously. Both terminal stations are equipped with a switch to toggle between sending and receiving data.

## **Hexadecimal**

Numerical system with 16 as basis. One counts from 0 to 9 and then continues with the letters A, B, C, D, E and F.

## **Hysteresis**

An encoder can stop at a certain point and then "swing" around this position. This will lead to a fluctuation of the count at a certain value. If a reference value is within this range of fluctuation, the associated output will switch on and off in the rhythm of the oscillation.

## **I I/O**

The abbreviation for "Input/Output".

## **Impedance**

The resistance of a component or a circuit of several components for an AC current of a certain frequency.

## **Inductive coupling**

An inductive (magnetic) coupling between two current-carrying conductors. The magnetic effect caused by the currents induces an interference voltage. Typical sources of interference are, for example, transformers, motors, parallelly routed power cables and high-frequency signal lines.

## **L Lightning protection**

All measures, that can help protect a system against damage caused by excessive voltages due to lightning.

## **Low impedance connection**

Connection with a low AC resistance.

## **LSB**

The abbreviation for "Least Significant Bit". The bit with the lowest significance.

## **M Master**

A bus station or a bus node which controls the communication between the other bus devices.

### **Master Slave Mode**

An operating mode in which one station or node controls the communication over the bus as a master.

### **Mode**

The operating mode of a system, component etc.

### **Module bus**

The module bus is the internal bus of a BL67 station. The BL67 modules communicate via the module bus with the gateway. It is independent of the fieldbus.

### **MSB**

The abbreviation for "Most Significant Bit". The bit with the highest significance.

8

### **Multimaster Mode**

An operating mode in which all stations or node have equal rights to communicate over the bus.

## **N**

### **NAMUR**

The abbreviation for "Normen-Arbeitsgemeinschaft für Mess- und Regeltechnik". NAMUR sensors are special versions of 2-wire sensors. Due to their special construction, i.e. low internal resistance, only very few components, short housings, Namur initiators are particularly interference immune and provide a high level of operational safety.

## **O**

### **Overhead**

System administration time required by the the system for each transmission cycle.

## **P**

### **Parameterisation**

Determination of parameters of the individual bus stations, or their modules via the configuration software of the DP master.

## **PLC**

The abbreviation for "Programmable Logic Controller"

### **Potential-free**

Galvanic isolation of the reference potentials of the control and load current circuits of I/O modules.

### **Potential-bound**

Electrical connection of the reference potentials of the control and load current circuits of I/O modules.

## **PROFIBUS-DP**

PROFIBUS bus system with DP protocol. DP stands for "Decentralised Periphery"

The PROFIBUS-DP is based on DIN 19245 part 1+4 and was integrated in the European fieldbus standard EN 50170.

It is designed for fast cyclic data transfer between the central DP master and the remote peripheral components, i.e. the DP slaves. Consistent usage is realised by a multimaster concept.

### **PROFIBUS-DP address**

Every PROFIBUS-DP module has a unique address via which it can be addressed by the master.

### **PROFIBUS-DP Master**

As the central bus component, the PROFIBUS-DP master controls the access of all PROFIBUS-DP slaves to the PROFIBUS.

### **PROFIBUS-DP Slave**

PROFIBUS-DP slaves are addressed by the PROFIBUS-DP master and exchange data with the master upon receipt of a master poll request.

### **Protective earth conductor**

A conductor needed for protection against dangerous shock currents, signified by the abbreviation PE for "Protective Earth".

## **R**

### **Radiated coupling**

Radiative coupling occurs if an electromagnetic wave meets a conductor structure. The wave will induce currents and voltages in the conductor. Typical

sources of interference are, for instance, sparking gaps (sparking plugs, collectors of electro-motors) and emitters (e.g. radio interference), which are operated near the affected conductor structure.

### **Reference potential**

Potential, which serves as a reference for the measurement or assessment of the voltage of all connected circuits.

### **Response time**

In a bus system this term is used to define the time interval between sending a read command and the receipt of a response. If referring to an input module, it describes the time interval between a signal change at the module input and the signal output to the bus system.

### **Repeater**

Amplifier for signals transferred via the bus.

### **RS 485**

Serial interface according to EIA standards for fast data transfer via several transmitters.

### **S**

### **Shield**

This term is used to describe the conductive sheath of cables, casings and cabinets.

### **Shielding**

The entirety of all measures and equipment used to connect the system parts to the shield.

### **Serial**

This term is used to define a data transmission mode with which data are transferred consecutively - bit by bit - via a cable.

### **Short-circuit proof**

Property of electrical apparatus. A short-circuit proof apparatus withstands the thermal and dynamic stress which can occur at its place of installation due to

a short-circuit.

### **Slave**

A bus station or a bus node that is subordinate to the master.

### **Station**

A functional unit or module assembly consisting of several components.

**T**

### **Terminating resistor**

Resistor on both ends of the bus line to prevent disturbing signal reflections and to adjust bus lines. Terminating resistors must always be the physically last unit at the end of a bus segment.

### **Topology**

Geometric construction of a network or arrangement of circuits.

**U**

### **UART**

The abbreviation for "Universal Asynchronous Receiver/Transmitter". UART is a logic circuit which is used to transform an asynchronous serial data string into a bit parallel data string or vice versa.

### **Unidirectional**

Working in one direction.

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