Programmable Systems

The H41q and H51q System Families

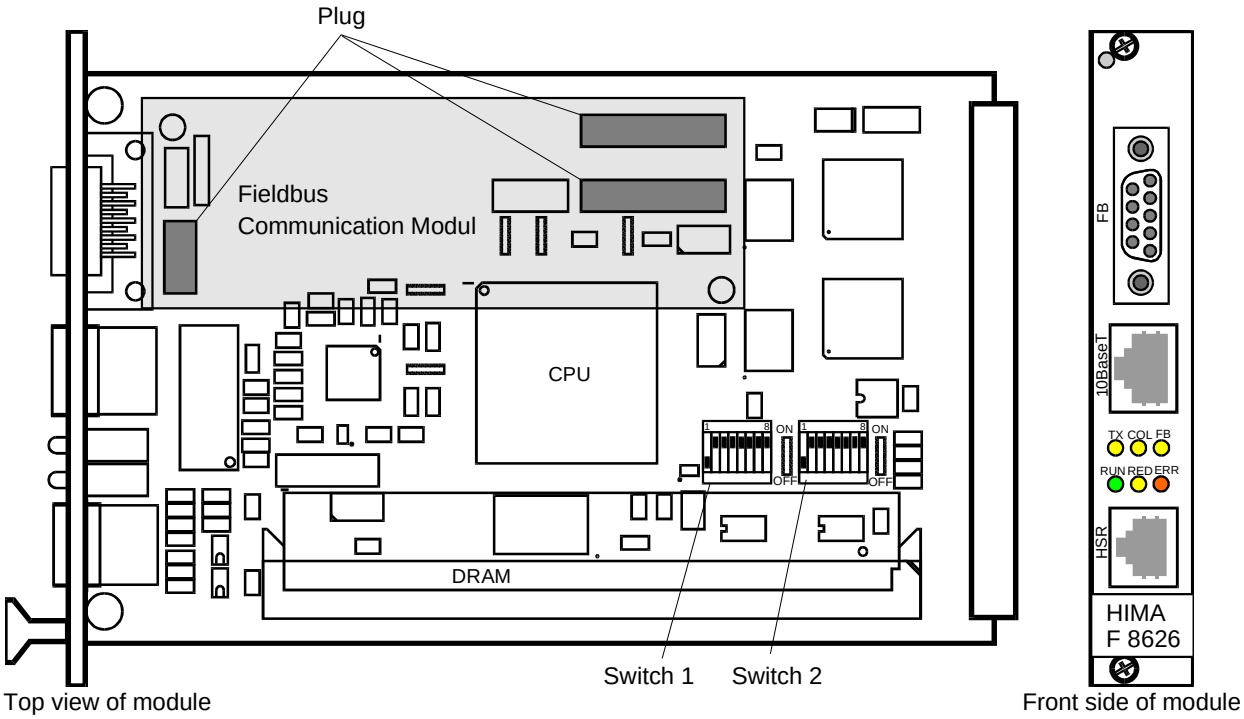
Data Sheet / Operating Instructions
for Module
F 8626

F 8626

F 8626: Communication Module for PROFIBUS-DP Communication

Useable with H51q PES with BS41q/51q from V7.0-7 (9835).
Baud rate to be set via switch 2 (for Operating System from V 1.15).

General



Top view of module

Front side of module

The communication module F 8626 provides a Fieldbus communication module (FB) with a PROFIBUS-DP slave.

Interfaces

- Serial interface FB with PROFIBUS-DP slave module.
  Connection via a 9-pole SUB-D plug
- Ethernet interface 10BaseT not used
- HSR (High Speed Redundancy) interface not used

Technical Data

Processor	32 Bit Motorola CPU with integrated RISC communication controller
Operating current	5 VDC / 1 A
Space required	3 HE (units high), 4 TE (units width)

Table 1: Technical Data

Display Readings During Operation at the Module Front

Top row LEDs

TX	COL	FB	Operating status
OFF	OFF	-	TX and COL are not used (always OFF)
-	-	OFF	No PROFIBUS-DP slave activities on the bus
-	-	Flashing	Slave waits for its configuration from PROFIBUS-DP master
-	-	ON	Data exchange between Slave and PROFIBUS-DP master

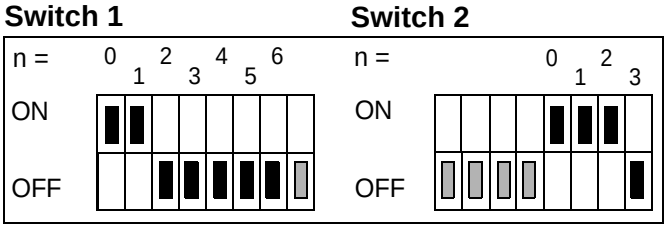
Table 2: Display readings during operation, top row

Bottom row LEDs

RUN	RED	ERR	Operating status
ON	-	OFF	PROFIBUS-DP communication protocol active
Flashing	-	OFF	PROFIBUS-DP communication protocol inactive
Flashing	-	Flashing	Booting of the communication module
OFF	-	ON	Fatal error in communication module. Module must be replaced.
OFF	-	Flashes 3-times	Saving error code in Flash-EPROM (required for repair purposes) ***Do not unplug communication module!***

Table 3: Display readings during operation, bottom row

Switches on the Communication Module



Example:
station address: 3
baud rate: 6 Mbit/s

ON = 2^n, OFF = 0
▯ = not used

Note:	The labels on the switches are not identical to the value "n".

Switch 1
To set the station address (1...127)

Binary 2^n	2^0	2^1	2^2	2^3	2^4	2^5	2^6	▯
Decimal	1	2	4	8	16	32	64	0

▯ = not used
ON = 2^n, OFF = 0
Example: ON = $2^0 + 2^1 = 3$ ➨ station adress 3

Switch 2
To set the baud rate for the PROFIBUS-DP slave.
For Operating System from V 1.15
(Switch 2 is not used up to OS V 1.14).

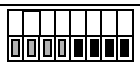
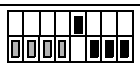
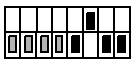
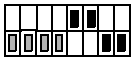
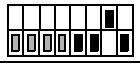
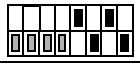
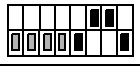
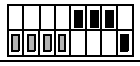
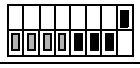
Value	Switch 2	Baud rates
0		9,6 kBit/s
1		19,2 kBit/s
2		93,75 kBit/s
3		187,5 kBit/s
4		500 kBit/s
5		1,5 MBit/s
6		3 MBit/s
7		6 MBit/s
8		12 MBit/s
9-15		not used

Tabelle 4: Baud rate settings with switch 2

Serial Communication (Fieldbus)

Name Definition Table

To give an overview of and explain the terms used in the various standards.

	ELOP II (variables, data types)	Communication module	Data processing basis
Digital	Bool	Bool	1 Bit
Analog	Word (SINT USINT INT UINT)	Word	2 Byte

Table 5: Name definitions

In ELOP II, Word variables stand for all types of data which can be configured as 16 bit variables in the BUSCOM serial communication.

Note: The resource name under ELOP II must consist of 8 characters, and the last two must be numbers. Numbers between 01 and 64 are permissible.

Caution: 

The mixed operation of safety-related communication via a coprocessor module F 8621A and a PROFIBUS-DP communication module F 8626 in parallel is only allowed in conjunction with the software function block HK-COM-3 and proper parameterisation (from ELOP II V 3.5 BS 41q/51q V 7.08 (0214)).

Data Imaging in the Communication Module

To transmit data in the Fieldbus format, the data of the central module of the PES are imaged into the communication module.

In ELOP II, the data to be transmitted are configured as BUSCOM variables in the context menu "HW Allocation".
A distinction is made between export and import variables.

The internal memory of the communication module contains two data pools into which the BUSCOM variables are copied.
Data pool 1 of the communication module reflects the export variables and data pool 2 reflects the import variables.
Within one data pool the individual variable is described by its identity number.

Within one range of the central unit, the Boolean data and the Word data are stored separately, but they may be stored under the same BUSCOM address (Table 6).

Ranges	Bool (BUSCOM addresses)	Word (BUSCOM addresses)
Import range 0 (IR-0000)	0000 to 2047	0000 to 2047
Import range 1 (IR-4096)	4096 to 8191	4096 to 8191
Export range 0 (ER-0000)	0000 to 2047	0000 to 2047
Export range 1 (ER-4096)	4096 to 8191	4096 to 8191

Table 6: BUSCOM variable ranges in the central unit

The **Word** variables from BUSCOM address 0 on begin with the identity number 0 (Figure 1), then they proceed in ascending order up to the Word variable with the highest address in range 0. The Word variables from BUSCOM address 4096 (range 1) on begin with identity number of the highest Word variable following (range 0) and then proceed in ascending order up to the Word variable with the highest address.

The **Boolean variables** having basis address 0 begin with the identity number following the identity number of the highest Word variable and then proceed in ascending order up to the Boolean variable with the highest address in the range 0 of the central unit (Figure 1). The Boolean variables from BUSCOM address 4096 (range 1) on begin with the identity number of the highest Boolean variable in range 0 following and then proceed in ascending order up to the Boolean variable with the highest address.
If only Boolean variables exist, they begin with identity number 0 corresponding to the Word variables (Figure 2).

This scheme of conversion of BUSCOM variables to identity numbers is used for import and export variables in the same way.

The sequence of the BUSCOM variables is determined by ELOP II and can be programmed by the user with setting the base address and relative address.

The BUSCOM addresses of the central unit is calculated as follows:

Base address + Relative address = BUSCOM address

The BUSCOM address must be in the same range as the belonging base address.
The blanks in the BUSCOM addresses of a data type of one range remain with the data type also in the data pool of the communication module.

Examples of Address Imaging (Export Range - Data Pool 1)

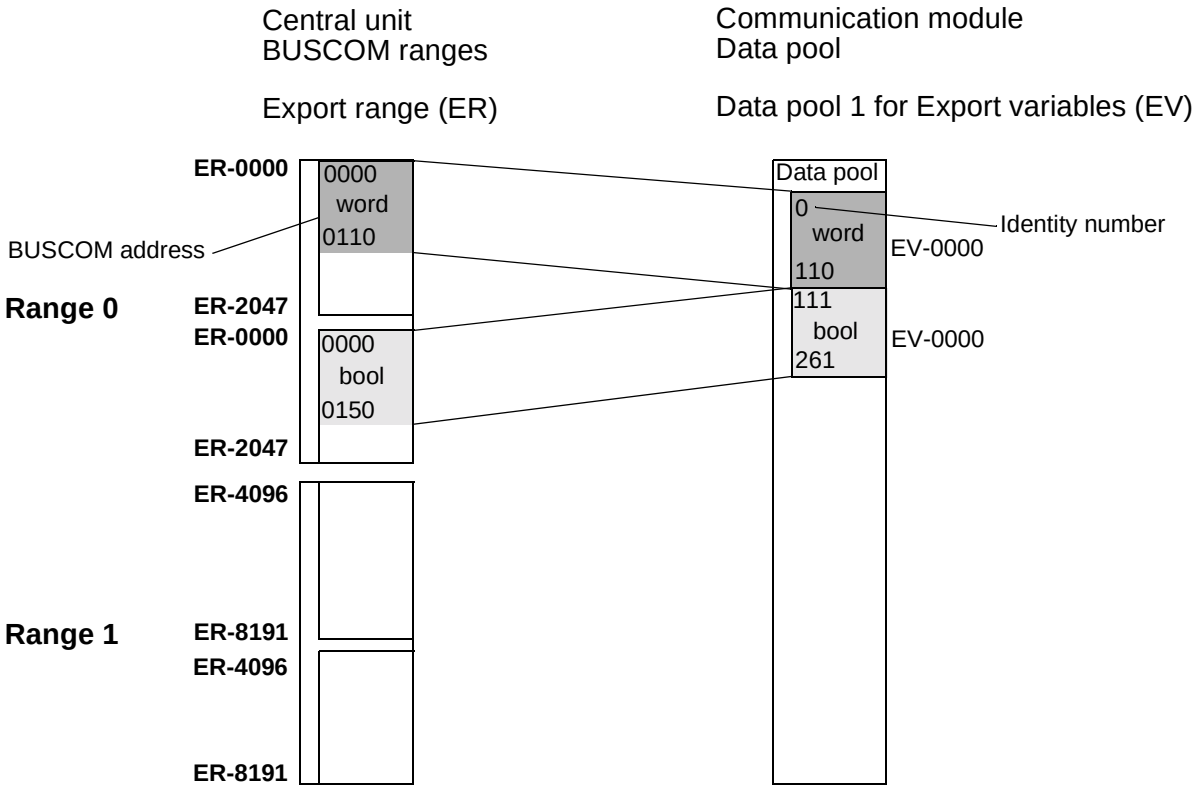


Figure 1: Example of address imaging for Word und Boolean export variables from the range 0 (ER-0000)

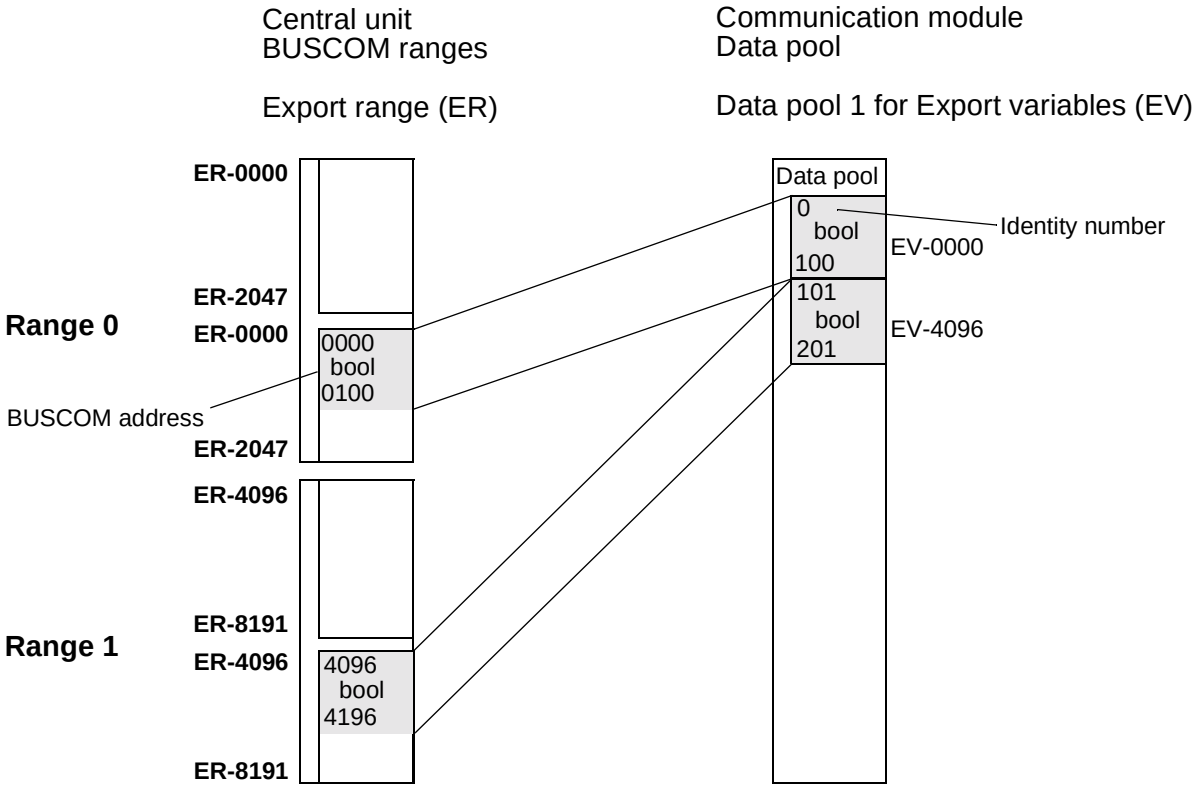


Figure 2: Example of address imaging for Boolean export variables from both ranges (ER-0000 and ER-4096)

The Boolean variables from BUSCOM address 0 on (range 0) begin at identity number 0 in the data pool. The Boolean variables from BUSCOM address 4096 (range 1) on begin with the identity number of the highest Boolean variable in range 0 following and then proceed in ascending order up to the Boolean variable with the highest address.

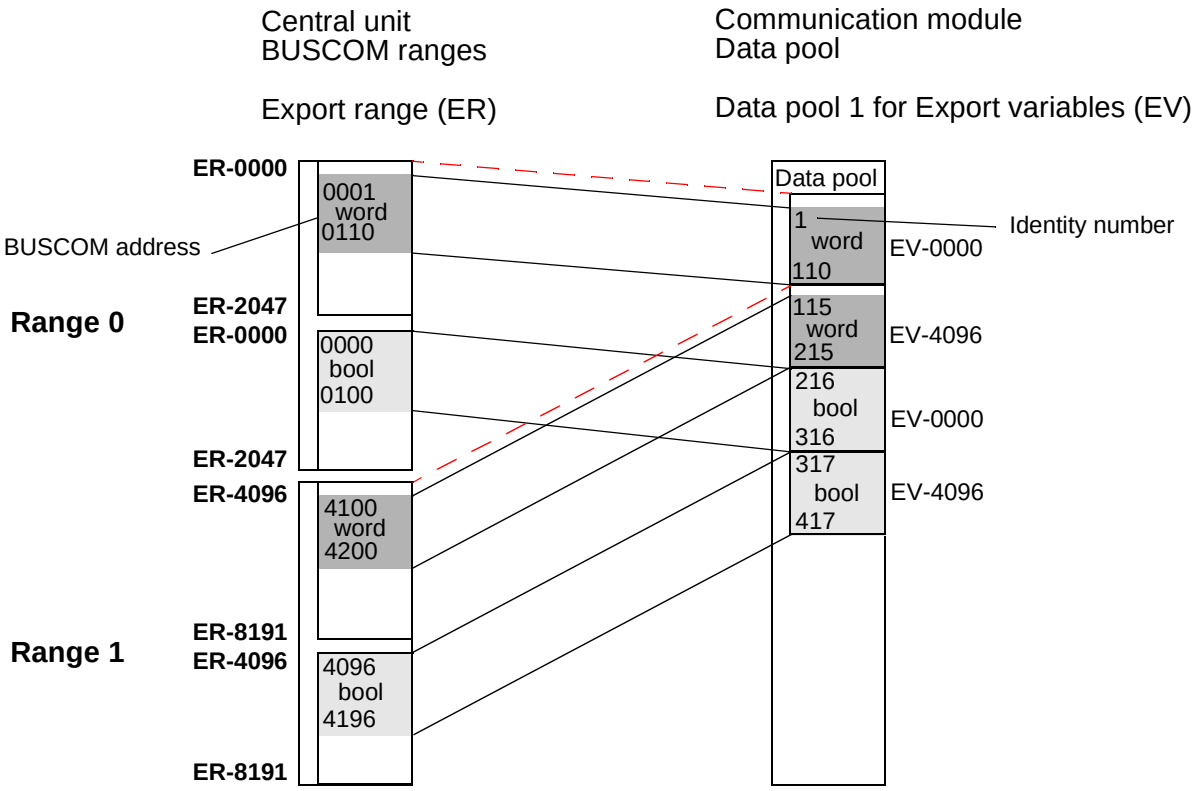


Figure 3: Example of address imaging for Word and Boolean export variables from both ranges

Beginning variables not at the top of an range will be complemented the part in the data pool of the communication module with dummies.

Address imaging of import variables in data pool 2 of the communication module has the same corresponding structure.

The HIMA PROFIBUS-DP Slave Fieldbus Communication Module
Profibus is an international, open Fieldbus standard which was standardized in the EN 50170 Fieldbus standard.

For further information, please contact your regional Profibus user organization (PNO) or go to Internet site **http://www.profibus.com**.

The HIMA PROFIBUS-DP Slave meets the requirements of this standard and is certified by the PNO.

Specifications of the HIMA PROFIBUS-DP Slave

Range	Sizes	Comments
PNO ident number	0x00EA	Assigned by the PNO
GSD file	HIMA00EA.GSD	Device master data file
HIMA PROFIBUS-DP station address	To be set via switch 1	Permissible station address from 1 to 127
Baud rates	9.6 kBit/s 19.2 kBit/s 93.75 kBit/s 187.5 kBit/s 500 kBit/s 1500 kBit/s 3000 kBit/s 6000 kBit/s 12000 kBit/s	Baud rate to be set via switch 2
Transmission	RS 485	Most frequently used transmission mode for Profibus, often referred to as H2
Input max.	240 Byte	Inputs + outputs maximum number 256
Output max.	240 Byte	Inputs + outputs maximum number 256
Min. slave Interval	3 ms	
Accuracy of PROFIBUS-DP watchdog monitoring	+/- 10 ms	
Modes of connecting the HIMA PROFIBUS-DP slave	According to the international EN 50170 Profibus standard	Cable lengths, terminating resistors etc. have to be considered

Table 7: Specifications of the HIMA PROFIBUS-DP Slave

The Fundamental Characteristics of the RS 485 Transmission Technology

Range	Sizes	Comments
Network topology	Linear bus, active bus termination on either end	Spur lines are only permissible up to baud rates of 1500 kBit/s
Medium	Shielded, twisted cable	Depending on the ambient conditions the shield may be dispensed with
Number of stations	32 stations in each segment without repeater	May be extended to max. 127 stations with repeater
Plug-in connectors	9-pole SUB-D connector	

Table 8: Fundamental characteristics of the RS 485 transmission technology

Range in Dependence of the Transmission Rate

Baud rate	Range / Segment
9.6 kBit/s	1200 m
19.2 kBit/s	1200 m
93.75 kBit/s	1200 m
187.5 kBit/s	1000 m
500 kBit/s	400 m
1500 kBit/s	200 m
3000 kBit/s	100 m
6000 kBit/s	100 m
12000 kBit/s	100 m

Table 9: Range in dependence of the transmission rate

The data indicating the cable length in Table 9 refer to cable type A with the following parameters:

- Surge impedance 135 W bis 165 W
- Capacitance per unit length < 30 pf / m
- Loop resistance 110 W / km
- Core diameter 0,64 mm
- Core cross-section > 0,34 mm²

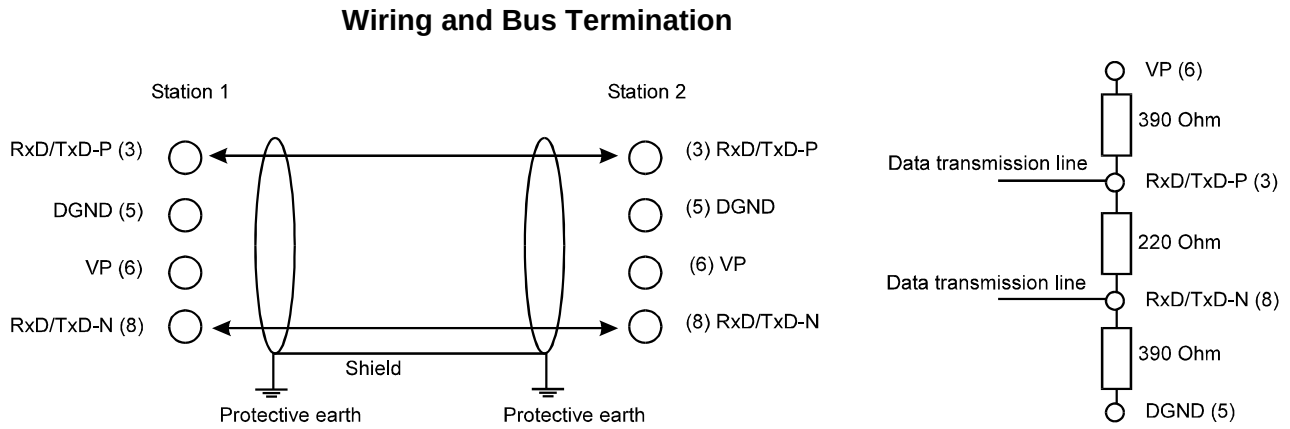


Figure 4: Wiring and bus termination for PROFIBUS-DP, pin allocation of the FB interface

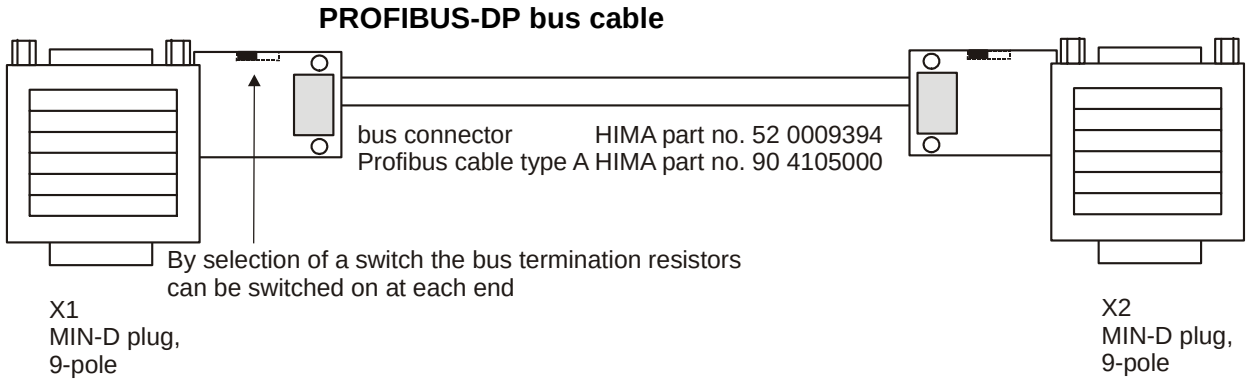


Figure 5: PROFIBUS-DP bus cable with bus connector and Profibus cable type A

Configuration of the PROFIBUS-DP Slave by the PROFIBUS-DP Master "Slave Configuration"

Via the FB interface, the HIMA PROFIBUS-DP slaves allows the connection of a PES to a PROFIBUS-DP.

This function enables a PROFIBUS-DP master to read and write BUSCOM variables.

To configure the HIMA PROFIBUS-DP slave, the HIMA PROFIBUS-DP master must have the PROFIBUS-DP configuration software. This software may look like that displayed in Figure 6.

The user has the possibility of defining variable windows. There are four windows each for reading and writing. These windows are to be configured in the PROFIBUS-DP configuration software of the master in the parameter range (parameter data), see Figure 8.

Thus the PROFIBUS-DP master is provided with the possibility of addressing data in conformance with the standards. The user data length of the PROFIBUS-DP telegrams results from the definition of the windows. The PROFIBUS-DP master must then parameterize and configure these telegrams for the HIMA PROFIBUS-DP slave as a modular slave according to the standard (via HIMA GSD file).

The HIMA PROFIBUS-DP slave is a modular slave. Therefore, modules are provided in the GSD file of the communication module (HIMA00EA.GSD). They are used to set the number of input and output bytes so that they correspond to the total of the parameterized windows (Figure 9).

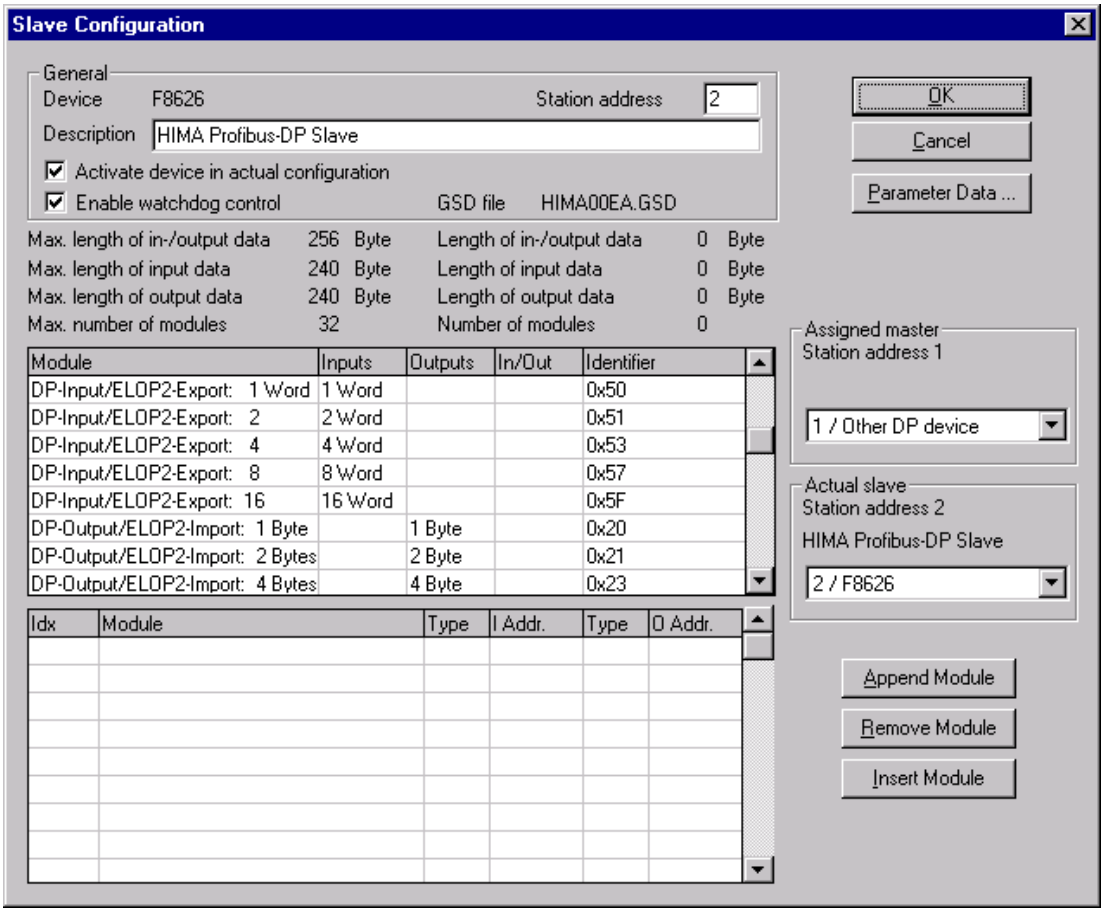


Figure 6: Representation of the slave configuration of the HIMA00EA.GSD file in a PROFIBUS-DP master with a selection of available modules

Data Formats

The following description concerns only the user data of the telegram. For the other data of the telegram we refer to the EN 50 170 standard.

The BUSCOM data type **WORD** in a telegram appears as 2 subsequent bytes in big-endian format.

The BUSCOM data type **BOOL** is compressed so that up to 8 subsequent variables defined in the import/export range are packed in one byte. The TRUE value hereby corresponds to 1, and the FALSE value corresponds to 0. The numbering of the Boolean BUSCOM variables in the bits of the byte begins at bit 0 and ends at bit 7. This then corresponds to Boolean variable [a] to Boolean variable [a+7]. If in one range/data pool integer multiples of 8 subsequent Boolean variables have not been defined, the remaining bits of the last byte will remain undefined.
If Word variables follow a row of Boolean variables, the Word variables begin in the subsequent byte.

Addressing

The BUSCOM variables are addressed by their identity number. This address replaces the BUSCOM address.

The definition of the windows for Profibus INPUT and OUTPUT looks as follows:

Range	Parameters	Profibus INPUT	Profibus OUTPUT
Export 1	[0,1] = Start identity number [2,3] = Number of variables	**X**	
Export 2	[4,5] = Start identity number [6,7] = Number of variables	**X**	
Export 3	[8,9] = Start identity number [10,11] = Number of variables	**X**	
Export 4	[12,13] = Start identity number [14,15] = Number of variables	**X**	
Import 1	[16,17] = Start identity number [18,19] = Number of variables		**X**
Import 2	[20,21] = Start identity number [22,23] = Number of variables		**X**
Import 3	[24,25] = Start identity number [26,27] = Number of variables		**X**
Import 4	[28,29] = Start identity number [30,31] = Number of variables		**X**

Table 10: Definition of the windows for PROFIBUS-DP INPUT and OUTPUT

The parameter range (parameter data in the PROFIBUS-DP configuration software of the master) consists of 32 byte initialized with 00 hex. In the PROFIBUS-DP master they are adjusted to their values (Figure 8).

The first 16 bytes (byte 0 to 15) describe the windows of the export variables; the last 16 bytes (byte 16 to 31) describe the windows of the import variables of the communication module.
Export variables in ELOP II correspond to Profibus input variables and import variables in ELOP II correspond to Profibus output variables (modules in Figure 9).

The data in the parameter range (parameter data) each consist of 2 bytes forming a big-endian coded 16 bit word.
The start identity number corresponds to an identity number in the corresponding data pool of the communication module. The number of variables determines the number of variables to be transmitted from the start identification number on.
The size of window always comprises integer bytes and is determined by the data types defined by the window and the number of data types (compressed or uncompressed).
The total of the sizes of the 4 export windows determines the user data length of the Profibus INPUT telegram. The total of the sizes of the 4 import windows determines the length of the OUTPUT telegram.
The user data length of INPUT and OUTPUT combined must not exceed 256 bytes. With this e.g. 2048 Boolean variables may be transmitted.

For INPUT or OUTPUT a maximum of 240 bytes may be configured according to the limit value of the Profibus EN 50170 standard (i. e. up to 1920 Boolean variables in one direction).
The start identity number must have a value valid for the corresponding data pool of the communication module, i.e. a variable having this identity number must have been defined in this data pool. Also, beginning with this variable, a number of further variables must have been defined.
A window may comprise a sequence of variables of different types (i.e. both Bool and Word). Data are only compressed for the variables within one window.
If you do not want to use a window definition, enter 0 for the start identification number and the number of variables.

Addressing Example

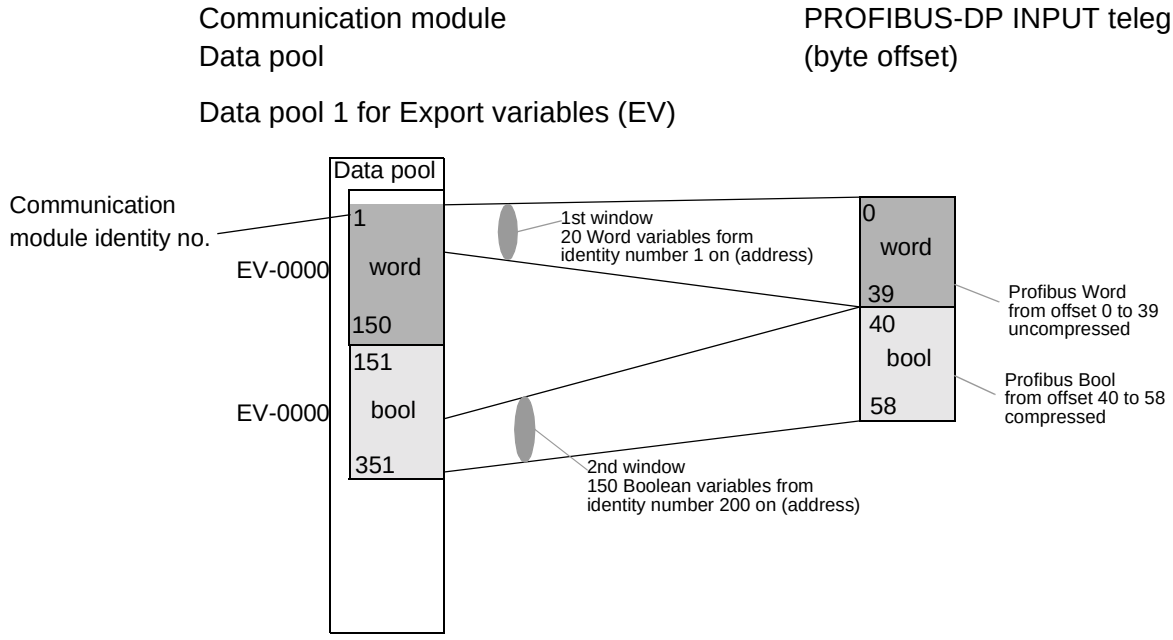


Figure 7: Example of address imaging for export variables from PROFIBUS-DP (accordingly for import variables)

The two export variable windows from data pool 1 are laid transparently onto the PROFIBUS-DP. The PROFIBUS-DP INPUT telegram has a user data length of 59 bytes (0 to 58). It has the following structure:

- 1st window: begin of the variables from identity no. 1 on. (1 dec = 0001 hex in big-endian format); number of variables: 20 (20 dec = 0014 hex).
  From identity no. 1 to 20, there are Word variables which cannot be compressed. Each word variable requires 2 bytes. A user data length of 40 bytes is generated (byte 0 to 39).
- 2nd window: begin of the variables from identity no. 200 on (200 dec = 00C8 hex); number of variables: 150 (150 dec = 0096 hex).
  From identity no. 200 to 349 there are Boolean variables which can be compressed into bytes (150 / 8 = 18,75). A user data length of 19 bytes is generated. (offset by 1st window, bytes 40 to 58)

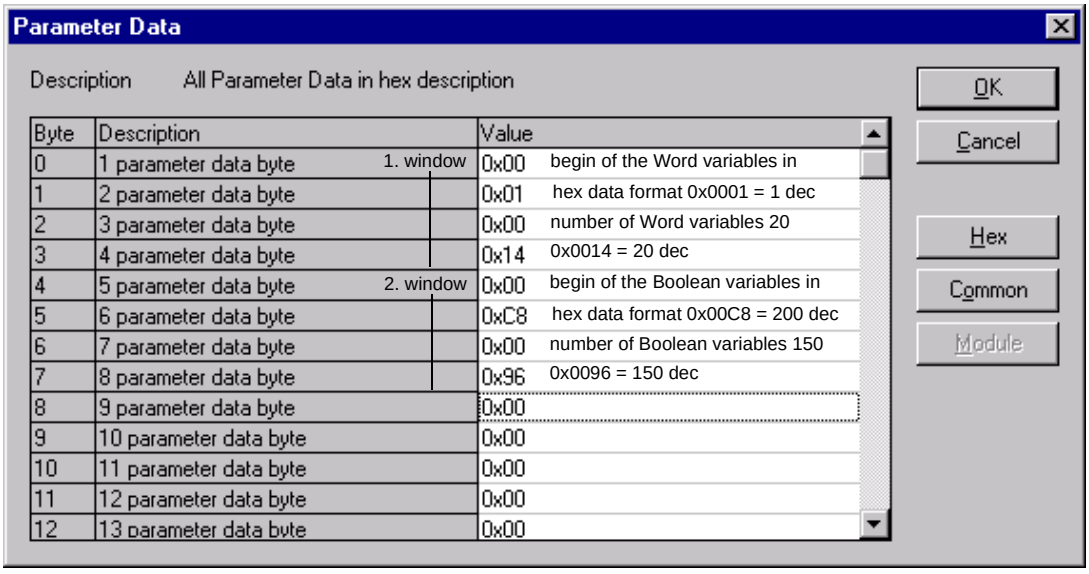


Figure 8: Example of address imaging of the export parameter data in the PROFIBUS-DP master

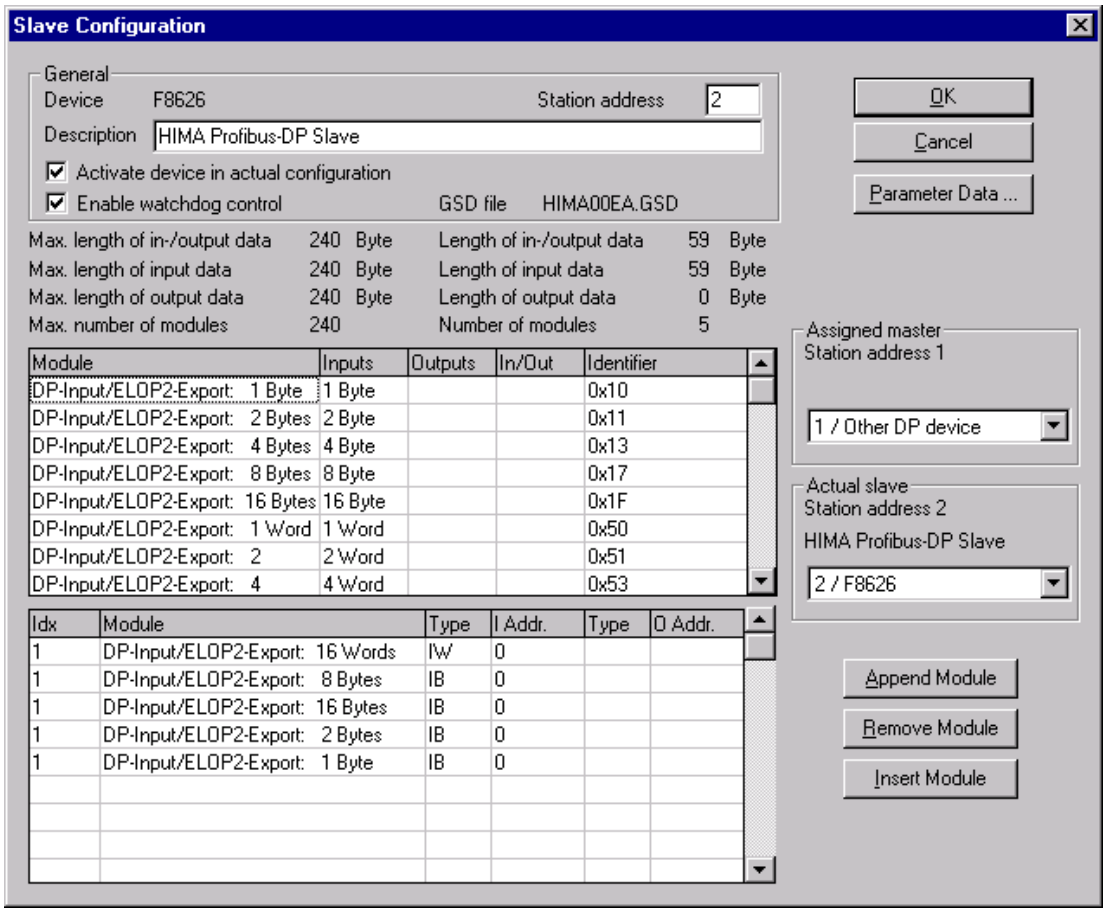


Figure 9: Example of address imaging of the PROFIBUS-DP input telegram, user data length of 59 bytes in 5 modules

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