

# Manual

## **Absolute Encoder with Profibus DPV0**

Firmware revision number from 1.21

## Contents

	Page
<b>1</b>	<b>Introduction .....4</b>
1.1	Scope of delivery .....4
1.2	Product assignment .....4
<b>2</b>	<b>Safety and operating instructions .....5</b>
<b>3</b>	<b>Profibus-DP.....7</b>
<b>4</b>	<b>Encoder operating parameters .....8</b>
<b>5</b>	<b>Data exchange between Profibus-DP devices.....9</b>
5.1	Telegram structure .....9
5.2	Initialization, restarting and user data communication.....9
<b>6</b>	<b>Parameterization and configuration .....10</b>
6.1	Parameterization .....10
6.2	Configuration.....11
<b>7</b>	<b>Diagnostic messages .....12</b>
7.1	Description of the diagnosis data Slave_Diag .....12
7.2	Parameter values of the diagnosis data Slave_Diag.....14
7.3	User data.....15
7.4	Preset function .....15
<b>8</b>	<b>Entering parameters .....16</b>
<b>9</b>	<b>Terminal assignment and commissioning.....18</b>
9.1	Electrical connection.....18
9.2	Setting the user address .....18
9.3	Terminating resistor .....18
9.4	Connecting the bus cover .....19
9.5	Display elements (status display).....20
<b>10</b>	<b>Specifications Profibus cable .....20</b>

**Disclaimer of liability**

The present manual was compiled with utmost care, errors and omissions reserved. For this reason Baumer Germany GmbH & Co. KG rejects any liability for the information compiled in the present manual. Baumer Germany GmbH & Co. KG nor the author will accept any liability for direct or indirect damages resulting from the use of the present information.

At any time we should be pleased receiving your comments and proposals for further improvement of the present document.

**Registered trademarks**

SIEMENS<sup>®</sup>, SIMATIC<sup>®</sup>, Step7<sup>®</sup> und S7<sup>®</sup> are registered trademarks of Siemens AG. PROFIBUS, the PROFIBUS Logo and PROFIdrive are registered trademarks of the PROFIBUS user organisation respectively of PROFIBUS International (PI). These and other names applied in the present manual that at the same time are registered trademarks are not correspondingly marked. Having omitted the respective marking does not necessarily imply that the names are not registered trademarks or that there are no existing patents and protected patented designs.

## 1 Introduction

### 1.1 Scope of delivery

Please check the delivery upon completeness prior to commissioning.  
Depending on encoder configuration and part number delivery is including:

- Basic encoder or HEAG162SP with Profibus bus cover
- GSD file and manual available as download in the internet at <https://www.baumer.com/goto/q3QXK>

### 1.2 Product assignment

#### Shaft encoder

Product	GSD file	Product family
AMG 11 P 13	PB13DPV0.GSD	AMG 11 – Singleturn 13 bit
AMG 11 P 29	PB29DPV0.GSD	AMG 11 – Multiturn 29 bit
AMG 81 P 13	PB13DPV0.GSD	AMG 81 – Singleturn 13 bit
AMG 81 P 29	PB29DPV0.GSD	AMG 81 – Multiturn 29 bit
PMG10#-###.###P0.3000#.#	PB13DPV0.GSD	PMG 10 – Singleturn 13 bit
PMG10#-###.###P0.3600#.#	PB29DPV0.GSD	PMG 10 – Multiturn 29 bit

#### Hollow / Endshaft encoder

Product	GSD file	Product family
HMG 11 P 13	PB13DPV0.GSD	HMG 11 – Singleturn 13 bit
HMG 11 P 29	PB29DPV0.GSD	HMG 11 – Multiturn 29 bit
HMG10#-###.###P0.3000#.#	PB13DPV0.GSD	HMG 10 – Singleturn 13 bit
HMG10#-###.###P0.3600#.#	PB29DPV0.GSD	HMG 10 – Multiturn 29 bit

#### HEAG 162 converter

Product	GSD file	Product family
HEAG 162 SP 13	PB13DPV0.GSD	HEAG 162 converter 13 bit
HEAG 162 SP 18	PB18DPV0.GSD	HEAG 162 converter 18 bit
HEAG 162 SP 29	PB29DPV0.GSD	HEAG 162 converter 29 bit

## 2 Safety and operating instructions

### Supplementary information

- This manual is intended as a supplement to already existing documentation (catalogues, data sheets and assembly instructions). They can be downloaded at <https://www.baumer.com/goto/q3QXK>.
- The manual must be read without fail before initial commissioning of the equipment.

### Intended purpose of the equipment

- The encoder is a precision measurement device. It is used to determine angular positions and revolutions, and to prepare and supply measured values in the form of electrical output signals for control systems. It may only be used for this purpose.
- The HEAG is a signal converter which reads cyclically data words as ssi master. It provides the data words to transmit them via Profibus. The HEAG may only be used for this purpose.

### Commissioning

- The encoder/converter may only be installed and assembled by suitably qualified experts.
- Observe the operating instructions of the machine manufacturer.

### Safety remarks

- Prior to commissioning the equipment, check all electrical connections.
- If installation, electrical connection or any other work performed at the encoder or at the equipment is not correctly executed, this can result in a malfunction or failure of the encoder.
- Steps must be taken to exclude any risk of personal injury, damage to the plant or to the operating equipment as a result of encoder failure or malfunction by providing suitable safety precautions.
- Encoders must not be operated outside the limited values specified in the product information (see detailed product documentation).

---

*Failure to comply with the safety remarks can result in malfunctions, personal injury or damage to property.*

---

### Transport and storage

- Only ever transport or store encoders in their original packaging.
- Never drop encoders or expose them to major vibrations.

### Assembly

- Avoid impacts or shocks on the housing and shaft.
- Avoid any twist or torsion on the housing.
- Do not open the encoder or make any mechanical changes to it.

---

*The shaft, ball bearings, glass pane or electronic components can be damaged. In this case, safe and reliable operation cannot be guaranteed.*

---

**Electrical commissioning**

- Do not make any electrical changes at the encoder/converter.
- Do not carry out any wiring work when the encoder/converter is live.
- Never plug or unplug the electrical connection when the encoder/converter is live.
- Ensure that the entire plant is installed in line with EMC requirements. The installation environment and wiring affect the electromagnetic compatibility of the encoder/converter. Install the encoder/converter and supply cables separately or at a long distance from cables with high interference emissions (frequency converters, contactors etc.)
- When working with consumers which have high interference emissions, make available a separate power supply for the encoder/converter.
- Completely shield the encoder/converter housing and connecting cable.
- Connect the encoder to the protective earth (PE) conductor using shielded cable. The braided shield must be connected to the cable gland or plug. Ideally, aim at bilateral connection to protective earth (PE), the housing via the mechanical assembly, the cable shield via the downstream devices. In case of earth loop problems, earth on one side only as a minimum requirement.

---

*Failure to observe these instructions can result in malfunctions, material damage or personal injury.*

---

**Disposal**

- Encoder AMG 81 contains a battery.
- Dispose of encoder/converter in accordance with locally applicable legislation.

## 3 Profibus-DP

### General

Bus systems are connecting structures which generate communication between several components. The Profibus-DP is a manufacturer-independent open communication system for applications in the fields of production, process and building automation. It is broken down into three variants:

- Profibus FMS for data communication between control units on the production and process management level.
- Profibus PA for process engineering applications.
- Profibus DP for fast data exchange between control units and decentral peripherals in automation engineering applications.

The Profibus system comprises the following device types:

- DP master class 1 (DPM1) is a control system, which cyclically exchanges information with a DP slave.
- DP master class 2 (DPM2) are programming or project processing devices or controllers.
- DP slave is a peripheral device which receives output data and forwards input data to the programmable logic controller.

The Profibus system is broken down into a monomaster system and a multimaster system by the number of active masters in operation during the operating phase.

- In a monomaster system, only one master class 1 and the DP slaves are active in the bus.
- In a multimaster system, several masters and the DP slaves are active in the bus. The masters can optionally either belong to class 1 or class 2.

The Profibus DP is characterized by the following features:

- Short response times (1 ms with 32 users and 12 MBaud)
- Reliable transmission procedure (Hamming distance 4)
- Availability of a wide range of standardized system components
- Good diagnostic capability
- Simple handling and facility for upgrading
- User-oriented bus system
- Open system

Profibus-DP is standardized by standard EN 50170 Vol. 2. This standard defines the communication and user profiles. The user profile for the encoder/converter is profile 1.1. The user profile is differentiated depending on the number of supported functions according to device class 1 and 2. Device class 2 has a greater number and contains all the functions of class 1. Parameterisation and preset functions are supported only by class 2. The device supports classes 1 and 2.

### GSD file

The device master data file (GSD file) is a descriptive file which describes all the encoder/converter data required for operation. The data itself is filed in the ROM of the encoder/converter. The data can be subdivided into two sections.

- General definitions contain information such as the manufacturer's name, product designation, Ident. number, Profibus-specific parameters and baud rates.
- Application-related definitions include configuration possibilities, parameters, parameter descriptions, hardware and software status and diagnostic possibilities.

The format and content are defined in line with the EN 50170 standard.

The GSD file has the ident no. 059B for all the described products. This GSD file is an essential condition for parameterization and configuration of the encoder/converter with a configuration tool.

## 4 Encoder operating parameters

### Description of operating parameters

Parameter	Significance
Sense of rotation	AMG/HMG/PMG Behaviour of the output code depending on the sense of rotation of the shaft seen looking at the flange CW = Increasing values with clockwise rotation CCW = Increasing values with counterclockwise rotation  HEAG Behaviour of the Profibus position value depending on the SSI position value CW = Increasing Profibus position values at increasing SSI position values CCW = Increasing Profibus position values at decreasing SSI position values
Resolution	Number of steps per revolution, input in integral steps
Measurement range	Total resolution = number of steps per revolution x number of revolutions, input in integral steps
Preset value	A certain output value is assigned to the current position value (referencing)

### Description of operating parameter values

Parameter	Value range	Default setting	Data type	Info
Sense of rotation	CW/CCW	CW	Octet string	
Resolution	1 to 8192 (2000h)	8192	Unsigned 32	13 bit encoder/converter
	1 to 262144 (40000h)	262144		18 bit encoder/converter
	1 to 8192 (2000h)	8192		29 bit encoder/converter
Measurement range	1 to 8192 (2000h)	8192	Unsigned 32	13 bit encoder/converter
	1 to 262144 (40000h)	262144		18 bit encoder/converter
	1 to 536870912 (20000000h)	536870912		29 bit encoder/converter
Preset value	0 to (measurement range – 1)	0	Unsigned 32	

## 5 Data exchange between Profibus-DP devices

### 5.1 Telegram structure

The diagram illustrates the telegram structure.

#### Telegram structure

DP Master	Triggering telegram			DP Slave
	Footer info	Output data	Header info	
	Response telegram			
	Header info	Input data	Footer info	

### 5.2 Initialization, restarting and user data communication

Before an exchange of useful information between the master and slave, every slave is re-initialized. The master transmits parameterization and configuration data to the slave. Only when the parameterization and configuration data is in agreement with the data stored in the slave can user data be exchanged. This takes place in the following way:

#### Diagnostic request from the master

The master transmits a Diagnosis Request to a slave (Slave\_Diag), and the slave responds with a Slave Diagnosis Response.

The master uses this data to check whether the slave exists in the bus and is ready for parameterization and configuration.

#### Parameterization of the slave

The master transmits a Parameter Request to the slave (Set\_Prm).

The Slave receives information about the current bus parameters, surveillance times and slave-specific parameters via the parameterization data. The parameters are taken over during the project processing phase partially directly or indirectly from the GSD file. The slave compares this parameterization data with its own stored data.

#### Configuration of the slave

The master transmits a Check Configuration Request (Chk\_Cfg).

The master informs the slave of the scope (number of data bytes) and the structure (data consistency) of the input and output ranges to be exchanged. The slave compares this configuration with its own configuration.

#### Diagnosis request prior to data exchange

The master transmits another Slave Diagnosis Request (Slave\_Diag), the slave answers with a Slave Diagnosis Response.

The master now checks whether the parameterization and configuration agree with the data stored in the slave. If the data requested by the master is admissible and if no error exists, the slave signals its readiness for the transfer of user data by means of the diagnosis data.

#### Data Exchange

The slave now responds exclusively to the master which has parameterized and configured it.

The master transmits a user data request (Data\_Exchange), the slave answers with a user data response. In this response, the slave informs the master whether current diagnosis results are available. The slave only makes known the actual diagnosis and status information after the master's diagnosis telegram.

## 6 Parameterization and configuration

### 6.1 Parameterization

Parameterization refers to the transfer of information which the slave requires for exchanging process data. The information comprises Profibus-specific data (Octets 1 to 6) and user-specific information. The user-specific information can be entered via an input window during the project processing phase. The slave compares the data transmitted by the master with the data it has stored. However, the slave does not inform the master of the result until the diagnosis request following configuration.

#### Description of parameters for the parameterization function (Set\_Prm)

Device class	Parameter	Octet no.	Significance
1	Station status	1	Definition of Profibus-specific data <ul style="list-style-type: none"> <li>• Sync mode/freeze mode active</li> <li>• Response monitoring active</li> <li>• Master assigned</li> </ul>
1	Response monitoring time	2 to 3	Recognition of master failure, master must respond within this period
1	Min. station delay responder (tsdr)	4	Minimum time which the slave must wait until it may respond to a request by the master
1	Ident_number	5 to 6	Device identifier which must be unique for each type of device, saved and reserved by the PNO
1	Group_ident_number	7	Profibus-specific data
1	Operating parameter	8	Profibus-specific data
1	Operating parameter	9	Definition of application-specific data <ul style="list-style-type: none"> <li>• Counting direction</li> <li>• Functional scope of the encoder, defined in appliance class 1 and 2</li> <li>• Scaling function</li> </ul>
2	Singleturn resolution	10 to 13	Definition of the number of measurement steps per revolution
2	Total resolution in steps	14 to 17	Definition of the total resolution in steps Total resolution is the number of measurement steps x the number of revolutions

**Value of parameters of the parameterization function (Set\_Prm)**

Device class	Parameter	Data type	Octet no.	Value range	Default value in the GSD file
1	Station status	Octet string	1		<ul style="list-style-type: none"> <li>• Sync and freeze mode supported</li> <li>• Supported baud rates</li> </ul>
1	Response monitoring time	Octet string	2 to 3		Profibus-specific data
1	Minimum Station Delay Responder	Octet string	4		Baud rate dependent
1	Ident-Number	Octet string	5 to 6		059B
1	Group Ident Nr.	Octet string	7		00
1	Operating parameter	Octet string	8		Profibus-specific data
1	Operating parameter	Octet string	9	<ul style="list-style-type: none"> <li>• Bit 0 = 0/1 CW/CCW</li> <li>• Bit 1 = 0/1 Device class 2 off/on</li> <li>• Bit 3 = 0/1 Scaling function off/on</li> </ul>	<ul style="list-style-type: none"> <li>• CW</li> <li>• Class 2 Device class 2 on</li> <li>• Scaling function on</li> </ul>
2	Singleturn resolution	Unsigned 32	10 to 13	Octet 10 is MSB 1 to 8192 1 to 262144 1 to 8192	8192 (2000h) 13 bit encoder/converter 262144 (40000h) 18 bit encoder/converter 8192 (2000h) 29 bit encoder/converter
2	Total resolution in steps	Unsigned 32	14 to 17	Octet 14 is MSB 1 to 8192 1 to 262144 1 to 536870912	8192 (2000h) 13 bit encoder/converter 262144 (40000h) 18 bit encoder/converter 536870912 (20000000h) 29 bit encoder/converter

## 6.2 Configuration

Configuration refers to the definition of type, length and data direction of the process data, as well as the way in which the data is further processed. The type stipulates the data type and whether the data is contiguous (consistent). The length determines the number of data bytes available for use. The data direction defines whether data is transferred from master to slave or vice versa. The encoder/converter is able to read preset values or transmit position values. The length is optionally 1 or 2 words, and the data is consistent in both cases. The configuration is compared with the configuration stored in the slave. The slave informs the master of the result in the following diagnosis request.

Position values of the encoder from the view point of the master are input data, preset values and output data.

### Admissible configurations

Device class	Configura-tion	Significance
1	D1h	2 words input data with data consistency for position values up to max. 29 bit
2	F1h	2 words output data with data consistency for preset value up to max. 29 bit 2 words input data with data consistency
1	D0h	1 word input data with data consistency for position values to max. 15 bit
2	F0h	1 word output data with data consistency for preset value up to max. 15 bit 1 word input data with data consistency

## 7 Diagnostic messages

Diagnostic messages contain data relating to the respective status of the encoder. The diagnostic signals comprise Profibus-relevant information and device-specific information. The master controls communication with the slave using this information, or forwards it to the higher-level system.

The master requests diagnosis data both prior to parameterization and after configuration of the slave. This ensures that the slave is present in the bus and that the data stored in the control system software is in agreement with the data stored in the slave. The slave can also register a diagnosis event in the Data\_Exchange mode. The master then requests the diagnosis data. The user-specific information is defined in the EN 50170 standard under Encoder profile 1.1.

The display element integrated in the bus cover (dual red/green LED) indicates part of this information.

### 7.1 Description of the diagnosis data Slave\_Diag

Device class	Diagnosis data	Octet no.	Significance
1	Station status 1	1	Status of <ul style="list-style-type: none"> <li>• Parameterization</li> <li>• Configuration</li> <li>• Diagnostic data (Diag.ext. bit and Diag.stat. bit in case of alarm and warning signals)</li> </ul>
1	Station status 2	2	Status of <ul style="list-style-type: none"> <li>• Response monitoring</li> <li>• Freeze or Sync mode</li> </ul>
1	Station status 3	3	Not supported
1	Diag_Master	4	Address of the master which first parameterized the slave
1	Ident_number	5 to 6	Device identifier <ul style="list-style-type: none"> <li>• Unique for each device type</li> <li>• Reserved and stored with the PNO</li> </ul>
1	Extended diagnosis header	7	Length of the encoder diagnosis including diagnosis header byte in the case of extended diagnosis
1	Alarm signals	8	Display of malfunctions which could lead to incorrect position values. Triggered by <ul style="list-style-type: none"> <li>• Code consistency error or inadmissible preset value</li> <li>• Preset value is outside the admissible value range.</li> </ul>
1	Operating status	9	Indication of supported user-specific data <ul style="list-style-type: none"> <li>• Counting direction</li> <li>• Functional scope of the encoder, defined in device class 1 and 2</li> <li>• Extended diagnosis</li> <li>• Scaling function</li> </ul>
1	Encoder type	10	Indication of encoder type
1	Steps per revolution	11 to 14	Maximum resolution per revolution of the encoder
1	Number of revolutions	15, 16	Maximum number of revolutions of the encoder
2	Additional alarm signals	17	Not supported
2	Supported alarm signals	18	Indication of which alarm is supported <ul style="list-style-type: none"> <li>• Incorrect position value</li> </ul>

Continued on the next page.

**Description of diagnosis Slave\_Diag (contd.)**

Device class	Diagnosis data	Octet no.	Significance
2	Warnings	20, 21	Indicates when parameters are not within the admissible tolerance. In contrast to alarm signals, these events do not result in incorrect position values. <ul style="list-style-type: none"> <li>Voltage of the lithium cell has dropped below the critical value (only AMG 81 P 29)</li> </ul>
2	Supported warning signals	22, 23	Indicates which warning signal is supported <ul style="list-style-type: none"> <li>Voltage of the lithium cell has dropped below the prescribed value (only AMG 81 P 29)</li> </ul>
2	Profile version	24, 25	Profile version of the encoder profile in revision number and index
2	Software version	26, 27	Indicates the software version in revision number and index, identical to the indication on the rating plate of the encoder.
2	Operating hours counter	28 to 31	Not supported
2	Offset value	32 to 35	Indicates the offset value stored in the EEPROM after a preset
2	Manufacturer offset	36 to 39	Not supported, reserved for servicing purposes
2	Steps per revolution	40 to 43	Indicates the programmed steps per revolution of the encoder
2	Total resolution in steps	44 to 47	Indicates the programmed total resolution in steps of the encoder
2	Serial number	48 to 57	Not supported
2	Reserved	58, 59	Not supported, reserved for servicing purposes


**Alarm signal position error**

The alarm signal is triggered by two events:

- Code consistency error due to a malfunction in the optoelectronic/magnetic system or in the attached encoder
- Preset value outside the admissible value range

**AMG/HMG/PMG**

The angular position of the shaft is sampled cyclically via the encoded glass panel. Two consecutive position values are compared to each other. If the value change exceeds a certain number of steps, the last position value is implausible. The encoder sets the Ext\_diag. bit and bit 0 to the alarm signal status.

**HEAG**

Via the ssi interface data words are read cyclically from the attached slave. Two consecutive position values are compared to each other. If the value change exceeds a certain number of steps, the last position value is implausible. The encoder sets the Ext\_diag. bit and bit 0 to the alarm signal status.

In case of a code consistency error, the Ext\_diag. bit is automatically reset after 2.5 s. If a further event occurs during this time, the period is automatically extended by 2.5 s.

In the event of an inadmissible preset value, the Ext\_diag bit remains set until the master has transmitted the correct value.

Code consistency errors and inadmissible preset values are indicated by the display element in the bus cover.

## 7.2 Parameter values of the diagnosis data Slave\_Diag

Device class	Diagnostic data	Data type	Octet no.	Value range
1	Station status	Octet string	1 to 3	Profibus-specific data
1	Diag_master	Octet string	4	Profibus-specific data
1	Ident_number	Octet string	5 to 6	059B
1	Extended diagnosis	Octet string	7	16 byte with class 57 byte with class 2
1	Alarm signals	Octet string	8	Bit 0 = 1 position error
1	Operating status	Octet string	9	Bit 0 = 0 CW Bit 0 = 1 CCW Bit 1 = 1 (Encoder supported Class 2 functionality) Bit 3 = Scaling function on/off
1	Encoder type	Octet string	10	01h = Multiturn / 00h = Singleturn
1	Singleturn resolution	Unsigned 32	11 to 14	Octet 11 is MSB 8192 (2000h) 13 bit encoder/converter 262144 (40000h) 18 bit encoder/converter 8192 (2000h) 29 bit encoder/converter
1	Max. number of revolutions	Unsigned 16	15, 16	Octet 15 is MSB 0 (00h) 13 bit encoder/converter 0 (00h) 18 bit encoder/converter 65535 (FFFFh) 29 bit encoder/converter
2	Additional alarm signals	Octet string	17	Not supported
2	Supported alarm signals	Octet string	18, 19	Octet 19 Bit 0 = 1 Position error supported
2	Warnings	Octet string	20, 21	Octet 21 Bit 5 = 1 Lithium cell voltage drops below specified value (only AMG 81 P 29)
2	Supported warning signals	Octet string	22, 23	Octet 22 is MSB Bit 5 = 1 lithium cell voltage (only AMG 81 P 29)
2	Profile version	Octet string	24, 25	Encoder profile 1.10
2	Software version	Octet string	26, 27	Stored on the rating plate
2	Hours-run counter	Octet string	28 to 31	Not supported
2	Offset value	Octet string	32 to 35	Dependent on preset value
2	Manufacturer offset	Octet string	36 to 39	Not supported
2	Steps per revolution	Unsigned 32	40 to 43	Octet 40 is MSB 1 to 8192 (2000h) 13 bit encoder/converter 1 to 262144 (40000h) 18 bit encoder/converter 1 to 8192 (2000h) 29 bit encoder/converter
2	Total resolution in steps	Unsigned 32	44 to 47	Octet 44 is MSB 1 to 8192 (2000h) 13 bit encoder/converter 1 to 262144 (40000h) 18 bit encoder/converter 1 to 536870912 (20000000h) 29 bit encoder/converter
2	Serial number	ASCII string	48 to 57	Not supported "2Ah"
2	Reserved	Octet string	58, 59	Reserved for servicing purposes

### 7.3 User data

Conversely to diagnostic data, user data is data which refers to the process being monitored or controlled. In the case of this encoder, this data takes the form of the position and where applicable the speed which the Profibus transmits to the control system (master), and in the other direction a preset value with which the encoder (slave) can be pre-set to a certain position value.

User data is exchanged in the Data\_Exchange mode. The framework conditions for the exchange (e.g. encoder resolution, word length) are previously defined in the configuration.

The slave can also indicate the presence of a diagnosis event during data exchange. The master then requests diagnostic and status information by means of a diagnosis request.

In order to set a preset, the master transmits the preset value (depending on the configuration either 16 or 32 bit) to the slave (see "preset function").

In the "Data Exchange" status, the dual LED lights up continuously in green on the bus cover.

### 7.4 Preset function

The preset function is only available in the encoder's "Class2" operating mode.

The control system can transmit a preset value to the encoder and so set the encoder, given a prescribed mechanical position, to a certain position value. The preset value must lie within the programmed overall measurement range.

To ensure optimum coordination between the mechanical position and the preset value, the preset value should only be set when the encoder is at a standstill. However, where the requirements are not particularly stringent, this can also be performed during rotary movement.

In order to set a preset, the control system transmits the preset value twice to the encoder: Once with the most significant bit (MSB) set and then again with the MSB reset. In this way, the MSB acts in a certain manner as a "clock" bit. For this reason, the transmitted preset value is limited to the value range up to 15 bit (encoder class 2, 16 bit) or 31 bit (encoder class 2, 32 bit).

The first transmission is authoritative in determining the time of acceptance.

Example: Zeroing the encoder (preset value = 0, encoder class 2, 32 bit)

Step 1: Control transmits 8000 0000h (preset adoption)

Step 2: Control transmits 0000 0000h (control bit return)

The encoder calculates an offset value for internal purposes from the differential between the current position and preset value. This value generally has no bearing on the application, but can be read out if required among the diagnostic data.

The offset value is stored on a non-volatile basis in an EEPROM chip. The EEPROM is capable of at least 1 million write cycles. However, despite the high number of possible write cycles, frequent program or event-controlled preset setting could mean reaching the service life limit. A certain degree of care is therefore called for when designing the control software at this point.

## 8 Entering parameters

The following parameter data is stored in the GSD file in the form of 32-bit values (double words, format "unsigned32"):

- Steps per revolution
- Total resolution

Many configuration programs for Profibus masters (including also Step7® from SIEMENS) do not support this word length during parameter input. The upper and lower 16 bits of these parameters ("hi" and "low" block) must accordingly be entered separately, and in decimal form.

In the case of parameters smaller than 65535 (16 bit), all that is necessary is to enter the block "hi" = 0 and the parameter itself is entered directly in the "lo" block.

Parameters greater than 65535 (16 bit), must be separated beforehand using the formula described below and then recalculated. A calculator with hexadecimal function of the type provided among the "Windows accessories" is helpful here.

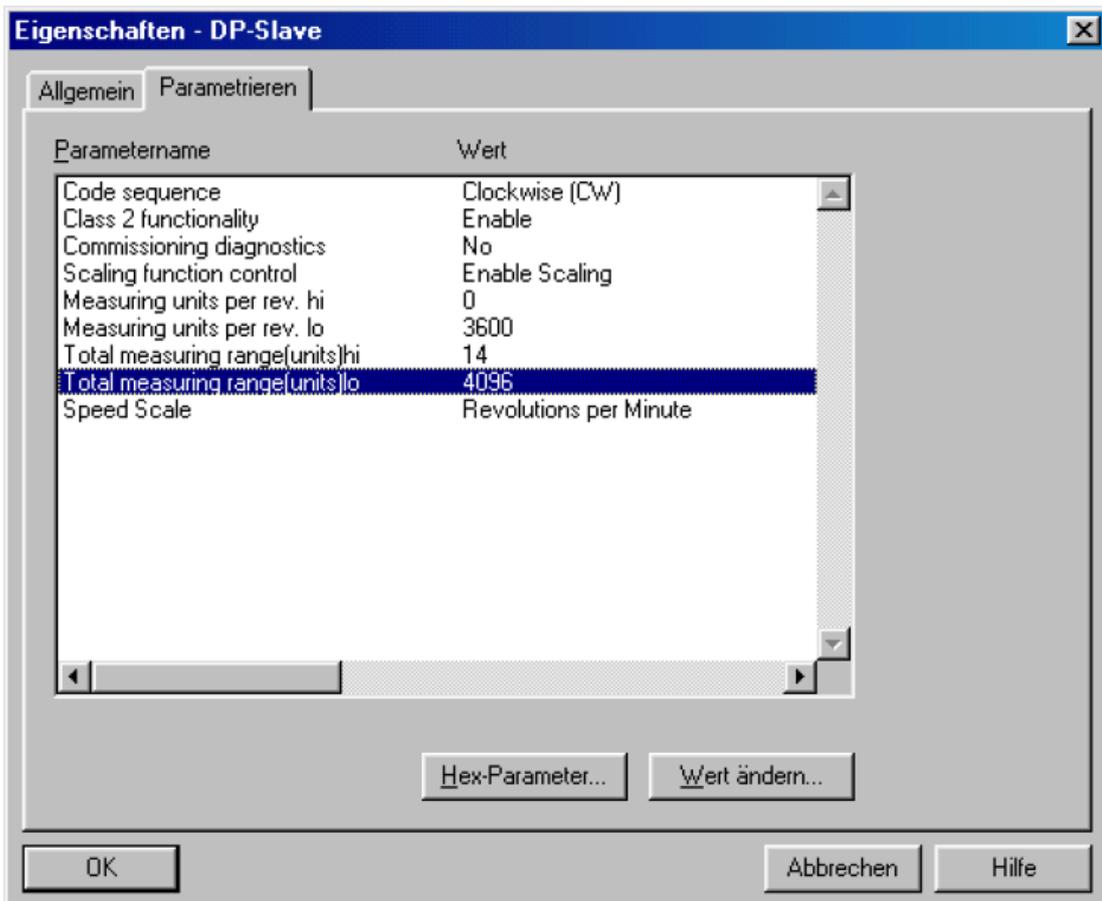
- Conversion of the required parameter value from the decimal format into hexadecimal format
- Subdivision of the hexadecimal value into two blocks, "hi" and "lo". The block length in each case is two words
- Conversion of the hexadecimal format of the two blocks "hi" and "lo" back into decimal format
- Input into the input mask using the decimal format

### Example

Total resolution	= 3600 steps per revolution x 256 revolutions	= 921600
Conversion into hexadecimal format		= E1000h
Subdivision into "hi"		= 000Eh
Conversion into decimal format		= 14
Subdivision into "lo"		= 1000h
Conversion into decimal format		= 4096
Total measuring range (units) hi		= 14
Total measuring range (units) lo		= 4096
Steps per revolution	= 3600 steps	= 3600
Measuring units per rev. hi		= 0
Measuring units per rev. lo		= 3600



## Example for entering parameters



## 9 Terminal assignment and commissioning

### 9.1 Electrical connection

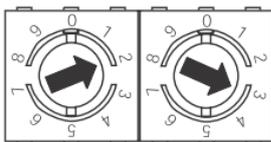
Terminal	Explanation
A	Negative serial data line, pair 1 and pair 2
B	Positive serial data line, pair 1 and pair 2
UB	Supply voltage 10 - 30 VDC
GND	Ground terminal for UB

Terminals with the same designation are connected to each other internally (A and B are each isolated with 100 nH inductivity for 12 Mbaud operation).

### 9.2 Setting the user address

The user address is set decimally using two rotary switches in the bus cover. The maximum number of users is 99. The address is read in once during power-up.

- Set the user address decimally using the two rotary switches 1 and 2 (default setting 02).



Example: 23

### 9.3 Terminating resistor

If the connected encoder is the last one in the bus line, the bus must be terminated with a resistor. The resistors are integrated in the bus cover and are connected using a two-pole DIP switch.

- The internal terminating resistors must be set to "ON" in the last user with the two-pole DIP switch (default setting ON).



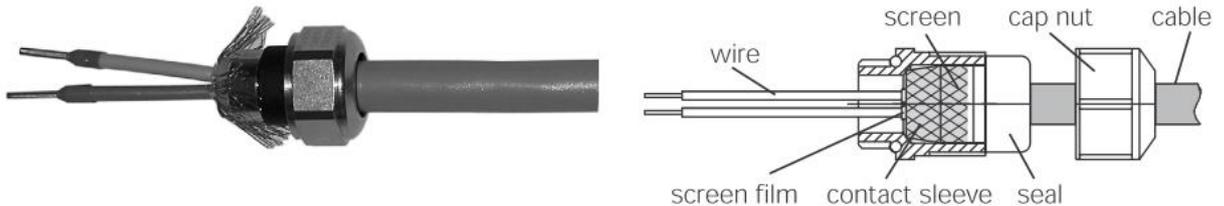
both ON = final user  
both OFF = all other users

Clamp	Resistance
A to GND	390 Ohm
B to +5 V	390 Ohm
A to B	220 Ohm

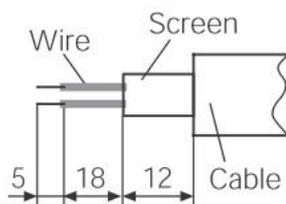
## 9.4 Connecting the bus cover

The bus cover must rest fully against the housing and be firmly screwed in place.

- Release both fastening screws of the bus cover.
- Carefully loosen the bus cover and lift off in the axial direction.
- Terminals with the same designation must be internally connected to each other.
- For the separately fed supply voltage, only use cable gland 3.  
For the bus lines, either cable gland 1 or 2 may be used.  
Please observe the admissible cable cross-sections.
- Guide the cores the shortest way from the cable gland to the terminal strip.
- Seal up the unused cable gland using a sealing bolt (included in the delivery).
- Mounting of the cable
  - Release the cap nut of the cable gland.
  - Push the cap nut and seal insert with contact sleeve onto the cable sheath.
  - Strip the cable sheath and cores, shorten the shield film where this exists (see Fig.)
  - Bend over the braided screen by appr. 90°.
  - Push the sealing insert with contact sleeve along as far as the braided shield. Insert the sealing insert with contact sleeve and cable flush into the cable gland and tighten the cap nut.
  - Insert the cores into the terminal strip and screw tight, observing the admissible core cross-section. In the case of flexible cores, use isolated ferrules.



### For standard encoder



- Carefully plug the bus cover onto the D-SUB plug of the basic encoder/converter, then press only via the sealing rubber, taking care not to tilt it. The bus cover must rest fully against the basic encoder.
- Tighten both the fastening screws firmly in the same direction.

---

*The encoder housing/converter and braided shield of the connecting cable are only ideally connected if the bus cover is resting fully on the basic encoder/converter (positive locking).*

---

## 9.5 Display elements (status display)

There is a dual LED integrated on the back of the bus cover.

Colour	Status
Green continuous	Encoder/converter in "Data_Exchange" mode
Yellow continuous	Encoder/converter ramping up
Red continuous, 2.5 s	Wrong position value, caused by code consistency error
Red flashing, 1 Hz	Parameterization error
Red flashing, 5 Hz	Transmitted preset value in inadmissible value range

## 10 Specifications Profibus cable

EN 50170 specifies two types of cable, A and B. Cable type B is obsolete and should no longer be used for new applications. With cable type A, all transmission rates up to 12 MBaud can be used.

**Table 13: Technical features of the Profibus cable**

Features	Data
Shaft resistance in Ohm	135 to 165 at 3 to 20 MHz
Operating capacity (pF/m)	Less than 30
Loop resistance (Ohm/km)	Less than 110
Core diameter (mm)	Greater than 0.64
Core cross section (mm)	Greater than 0.34

### Transmission speed depending on cable length

Baud rate in kBaud	9.6	19.2	93.75	187.5	500	1500	3000	12000	
Cable length in m	1200	1200	1200	1000	400	200	100	100	