LXM32M

Module Profibus DPV1
Fieldbus manual

V1.02, 12.2009

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www.schneider-electric.com

Important information

This manual is part of the product.

Carefully read this manual and observe all instructions.

Keep this manual for future reference.

Hand this manual and all other pertinent product documentation over to all users of the product.

Carefully read and observe all safety instructions and the chapter "Before you begin - safety information".

Some products are not available in all countries.
For information on the availability of products, please consult the catalog.

Subject to technical modifications without notice.

All details provided are technical data which do not constitute warranted qualities.

Most of the product designations are registered trademarks of their respective owners, even if this is not explicitly indicated.

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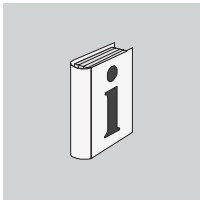
About this manual



This manual applies to the module Profibus DPV1 for LXM32M, module identification PDP.

The information provided in this manual supplements the product manual.

Source manuals

The latest versions of the manuals can be downloaded from the Internet at:

http://www.schneider-electric.com

Source EPLAN Macros

For easier engineering, macro files and product master data are available for download from the Internet at:

http://www.schneider-electric.com

Corrections and suggestions

We always try to further optimize our manuals. We welcome your suggestions and corrections.

Please get in touch with us by e-mail:
techcomm@schneider-electric.com.

Work steps

If work steps must be performed consecutively, this sequence of steps is represented as follows:

- ■ Special prerequisites for the following work steps
- ▶ Step 1
- ◁ Specific response to this work step
- ▶ Step 2

If a response to a work step is indicated, this allows you to verify that the work step has been performed correctly.

Unless otherwise stated, the individual steps must be performed in the specified sequence.

Making work easier

Information on making work easier is highlighted by this symbol:

Sections highlighted this way provide supplementary information on making work easier.

Parameters

In text sections, parameters are shown with the parameter name, for example `_IO_act`. A list of the parameters can be found in the product manual in the chapter Parameters.

SI units

SI units are the original values. Converted units are shown in brackets behind the original value; they may be rounded.

Example:
Minimum conductor cross section: 1.5 mm^2 (AWG 14)

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Inverted signals Inverted signals are represented by an overline, for example $\overline{\text{ST0\_A}}$ or $\overline{\text{ST0\_B}}$.

Glossary Explanations of special technical terms and abbreviations.

Index List of keywords with references to the corresponding page numbers.

Further reading

Recommended literature for further reading

- Profibus Specification (FMS, DP, PA); Profibus User Organization
- Popp, M: Profibus DP/DPV1; Grundlagen, Tipps und Tricks für Anwender; ISBN 3-7785-2781-9, Hüthig-Verlag Heidelberg
- Popp, M: Der neue Schnelleinstieg für Profibus; available via PNO Profibus User Association

Profibus User Association

Profibus-Nutzerorganisation e.V. (PNO)
Profibus User Association
Haid-und-Neu-Str. 7
D-76131 Karlsruhe

Profibus international on the Internet http://www.profibus.com

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1 Introduction

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Profibus is a serial fieldbus system in which products from different manufacturers can be networked without the need for special interface adaptation.

This manual describes online command processing for products in the Profibus DP-V1 fieldbus network.

1.1 Fieldbus devices on the Profibus DP network

Different Profibus fieldbus devices can be operated in the same fieldbus segment. Profibus DP provides a common basis for interchanging commands and data between the network devices.

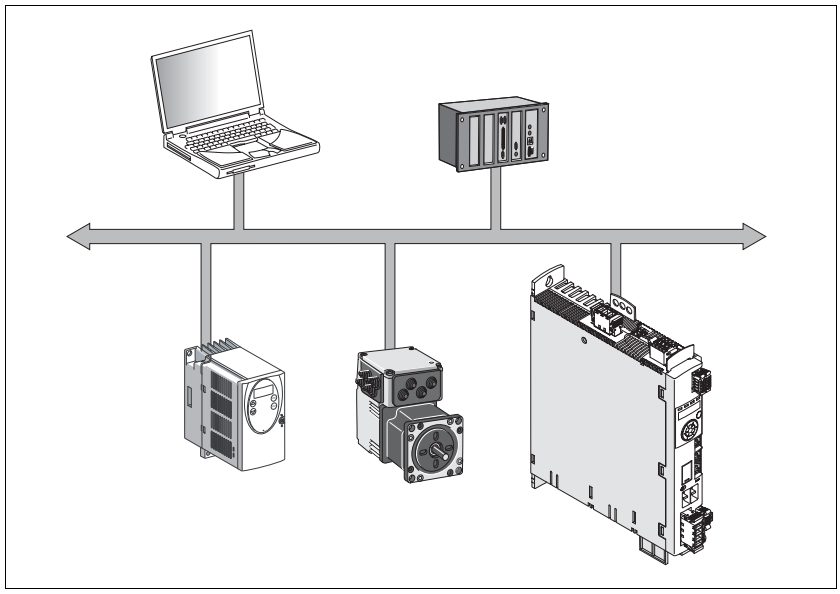

Figure 1.1 Fieldbus products on the network

Settings

The following settings can be made via the fieldbus:

- Reading and writing parameters
- Monitoring inputs and outputs
- Diagnostics and error monitoring functions

Networking the product

The product is connected to a Profibus DP network via RS-485 technology with two-wire cables.

The product operates as a slave, data is interchanged with the product with the master-slave method.

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2 Before you begin - safety information

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The information provided in this manual supplements the product manual. Carefully read the product manual before using the product.

2.1 Qualification of personnel

Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation are authorized to work on and with this product. In addition, these persons must have received safety training to recognize and avoid hazards involved. These persons must have sufficient technical training, knowledge and experience and be able to foresee and detect potential hazards that may be caused by using the product, by changing the settings and by the mechanical, electrical and electronic equipment of the entire system in which the product is used.

All persons working on and with the product must be fully familiar with all applicable standards, directives, and accident prevention regulations when performing such work.

2.2 Intended use

The functions described in this manual are only intended for use with the basic product; you must read and understand the appropriate product manual.

The product may only be used in compliance with all applicable safety regulations and directives, the specified requirements and the technical data.

Prior to using the product, you must perform a risk assessment in view of the planned application. Based on the results, the appropriate safety measures must be implemented.

Since the product is used as a component in an entire system, you must ensure the safety of persons by means of the design of this entire system (for example, machine design).

Operate the product only with the specified cables and accessories. Use only genuine accessories and spare parts.

Any use other than the use explicitly permitted is prohibited and can result in hazards.

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel.

The product must NEVER be operated in explosive atmospheres (hazardous locations, Ex areas).

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2.3 Hazard categories

Safety instructions to the user are highlighted by safety alert symbols in the manual. In addition, labels with symbols and/or instructions are attached to the product that alert you to potential hazards.

Depending on the seriousness of the hazard, the safety instructions are divided into 4 hazard categories.

⚠ DANGER

DANGER indicates an imminently hazardous situation, which, if not avoided, **will result** in death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation, which, if not avoided, **can result** in death, serious injury, or equipment damage.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation, which, if not avoided, **can result** in injury or equipment damage.

CAUTION

CAUTION used without the safety alert symbol, is used to address practices not related to personal injury (e.g. **can result** in equipment damage).

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2.4 Basic information

⚠ DANGER

UNINTENDED CONSEQUENCES OF EQUIPMENT OPERATION

When the system is started, the drives are usually out of the operator's view and cannot be visually monitored.

- Only start the system if there are no persons in the hazardous area.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are EMERGENCY STOP, overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical functions.
- System control paths may include communication links. Consideration must be given to the implication of unanticipated transmission delays or failures of the link.
- Observe the accident prevention regulations and local safety guidelines. [1)]
- Each implementation of the product must be individually and thoroughly tested for proper operation before being placed into service.

Failure to follow these instructions can result in death or serious injury.

1) For USA: Additional information, refer to NEMA ICS 1.1 (latest edition), Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control and to NEMA ICS 7.1 (latest edition), Safety Standards for Construction and Guide for Selection, Installation for Construction and Operation of Adjustable-Speed Drive Systems.

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2.5 Standards and terminology

Technical terms, terminology and the corresponding descriptions in this manual are intended to use the terms or definitions of the pertinent standards.

In the area of drive systems, this includes, but is not limited to, terms such as "safety function", "safe state", "fault", "fault reset", "failure", "error", "error message", "warning", "warning message", etc.

Among others, these standards include:

- IEC 61800 series: "Adjustable speed electrical power drive systems"
- IEC 61158 series: "Industrial communication networks - Fieldbus specifications"
- IEC 61784 series: "Industrial communication networks - Profiles"
- IEC 61508 series: "Functional safety of electrical/electronic/programmable electronic safety-related systems"

Also see the glossary at the end of this manual.

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3 Basics

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3.1 Profibus technology

3.1.1 Profibus transmission technology

Three Profibus versions are available that can be used for time-critical and complex communication tasks:

- Profibus FMS
- Profibus PA
- Profibus DP

Profibus FMS Profibus FMS (FMS: Fieldbus Message Specification) is a universal, flexible solution for communication tasks in general automation technology. For example, FMS is used for communication between manufacturing cells.

Profibus PA Profibus PA (PA: Process Automation) is primarily used in process technology, such as process automation. Profibus PA networks are characterized by their ability to use sensors and actuators in hazardous locations (Ex areas, explosive atmospheres), and to provide data communication and power to devices via the bus.

Profibus DP Profibus DP (DP: Decentralized Periphery) is the fast Profibus version which is specially designed for communication in production processes. Features include simple networking of new products in the bus and high transmission rates.

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3.1.2 Network topology

A Profibus DP network consists of one or more masters (active bus devices) and slaves (passive bus devices). All bus devices are connected via the Profibus DP network cable.

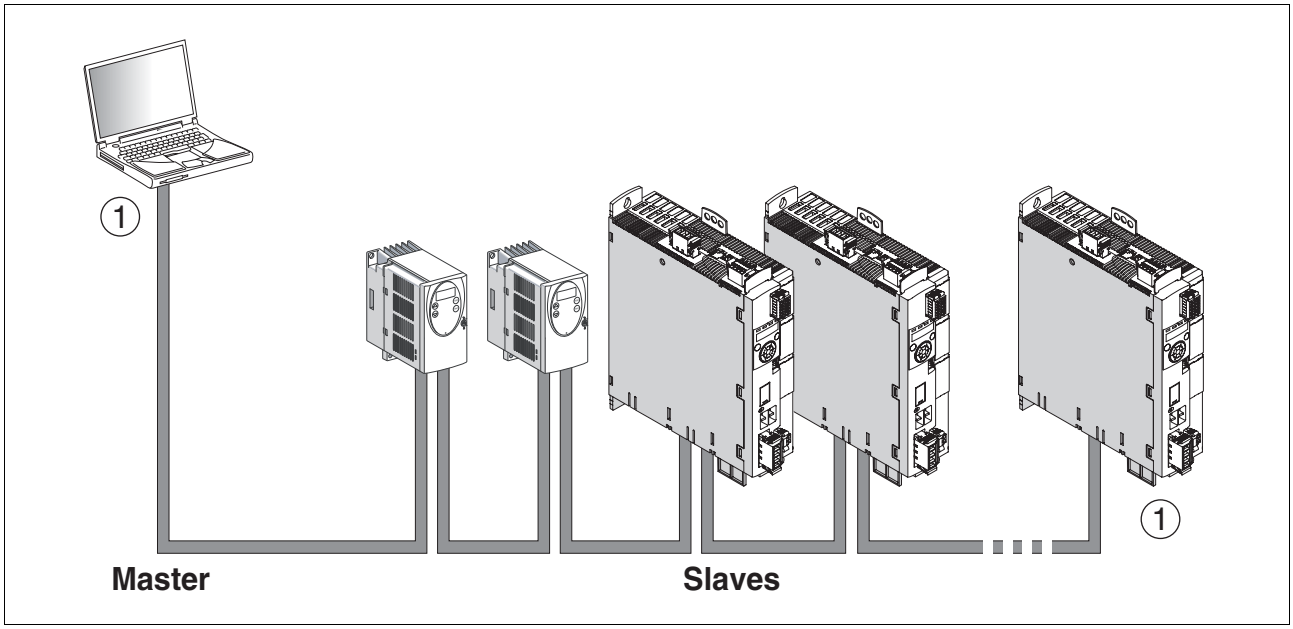

Figure 3.1 Devices on the fieldbus network

(1) Both ends of the fieldbus must be terminated with a terminating resistor.

Master The master controls the data traffic on the network. Examples of masters:

- Automation devices, for example, PLCs
- PCs
- Programming devices.

Slave Slaves receive control commands and supply data to the master. Examples of slaves:

- Input/output modules
- Drive systems
- Sensors and actuators.

3.1.3 Transmission technology in the network

Profibus DP networks can be set up with optical fiber cables or with RS-485 technology.

RS-485 technology RS-485 is a simple method of transmission via two-wire twisted-pair cables. This technology allows for transmission rates between 9.6 kBit/s and 12 MBit/s.

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3.1.4 Device identification

Generic Station Description GSD

The specific features of a Profibus product are described in the Generic Station Description file (GSD file). The GSD file is provided by the manufacturer of the product and must be read using the configuration tool of the master.

The GSD file contains information on the operation of the product on the Profibus DP network. This includes manufacturer information, product designation, supported baud rate, level and meaning of the connector signals as well as time intervals for monitoring times. The GSD file also contains product-specific values for network devices such as settings for inputs and outputs. The GSD file for this product is available for download from the Internet.

Ident number

A master device uses the Ident number to identify the device class of the connected slave. The Ident number is a unique number assigned to a specific device class by the Profibus user organization.

Slave address

Each device on the network must be assigned a unique address between 1 and 126; slaves normally use the address range 3 ... 126. The master (normally address 0 ... 2) can communicate with each slave via this address. Details on setting the address can be found in chapter 5 "Commissioning".

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3.2 Profibus communication

3.2.1 Profibus DP-V0 communication

Profibus DP-V0 provides functionality for cyclic data exchange, station-specific, module-specific and channel-specific diagnostics and various alarm types for diagnostics as well as processes for hot-plugging bus devices.

Master-slave relationship

The master cyclically writes transmit data to the slaves and cyclically reads the receive data provided by the slaves. Receive and transmit data for one slave are transmitted as one unit in one message cycle.

Command processing: Transmit data and receive data

The master sends a command to the product (slave) to start operating modes and functions, execute a motion command or request information from the slave. The slave executes the command and acknowledges it with a confirmation.

The exchange of data follows a fixed pattern:

- Transmit data to the slave: The master places a command in the transmit data memory. From there, it is transmitted to the slave and executed.
- Receive data from the slave: The slave acknowledges the execution status of the command in the receive data. If the command was correctly executed, the master receives an acknowledgement without an error message.

The master device can send new commands as soon as it has received acknowledgement concerning the current command. Acknowledgement information and error messages are included in the transmitted data in bit-coded form.

Due to the cyclical fieldbus transmission, the master device automatically receives current receive data from the slave device with every cycle. The acknowledgement information allows the master to detect whether the receive data was status information from the slave or the response to a previously transmitted command. The slave also uses the acknowledgement mechanism to recognize a new command.

Commands

The master transmits control commands and action commands with the transmit data.

- After a control command the master receives a feedback message from the slave indicating whether the command could be successfully executed and processing be completed.
- In the case of an action command, the slave only signals whether it was possible to successfully start an action or a motion command.

The master must then continuously monitor for completion of the processing command by evaluating the receive data of the slave.

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3.2.2 Profibus DP-V1 communication

The Profibus DP-V1 protocol is an extension to the Profibus DP-V0 protocol. In addition to cyclical data exchange, Profibus DP-V1 allows for acyclical exchange of data between master and . Acyclical data exchange is considerably slower than cyclical communication, however, it , enables the change of parameters during operation.

The product supports acyclical data exchange for DP-V1 as per Profibus specification for MS0, MS1 and MS2 communication.

3.2.3 Data structure

In addition to command and control information, transmit and receive data also contain network administration data. The administration data is provided by the application program of the master.

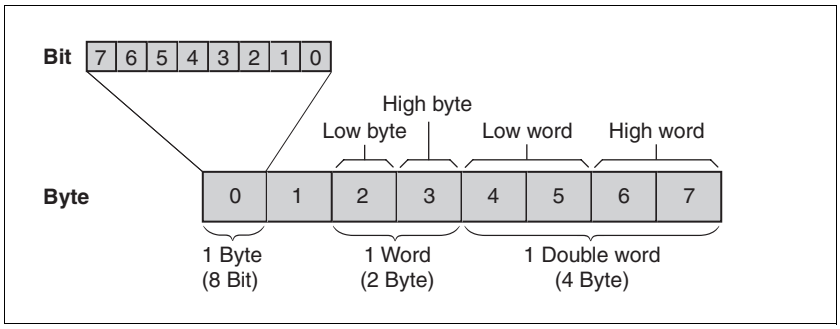

Figure 3.2 General data structure from the bit to the double word

Index and subindex in the descriptions of the parameters are shown in hexadecimal notation. Index and subindex in the descriptions of the parameters are shown in decimal notation. The data telegram with transmit data and receive data as well as byte, word and double word values are shown in hexadecimal notation. Hexadecimal values are indicated as such by means of an "h" behind the numerical value, for example, "31_h", decimal values have no special identification.

NOTE: Note the different counting format of bits (0 ... 7, right to left) and bytes (1-xx, left to right).

Word order: Big Endian format

Profibus data is transmitted in Big Endian format, i.e. numerical values over one byte are treated as in the decimal system. Example: the index value is transmitted in bytes 3 and 4, the index 21h102h is thus represented as 0021h0102h.

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3.2.4 Parameter channel and process data channel

Communication between master and slave is based on the data telegram of the Profidrive profile of the PNO user organization. The content of the data does not correspond to the Profidrive profile. The data telegram consists of n bytes. If the profile uses a cyclic parameter channel, 8 bytes are used for parameter transmission, the following bytes (bytes 9 ... n) transmit the process data. The bytes are interpreted depending on the operating mode.

Parameter channel				Process data channel					
Bytes 1-2	Bytes 3-4	Bytes 5-6	Bytes 7-8	Bytes 9-10	Bytes 11-12	Bytes 13-14	Bytes 15-16	Bytes 17-18	Bytes 19-n
PKE	IDX	PWE	PWE	PZD1	PZD2	PZD3	PZD4	PZD5	PZD...

Meaning of the abbreviations

PKE	Parameter identifier	2 bytes
IDX	Index of parameter (parameter number)	2 bytes
PWE	Parameter value	4 bytes
PZD	Process data	n bytes [1)]

1) Number of bytes can be defined

Index, subindex

The index uses bytes 3 and 4 of the data telegram; the subindex corresponds to byte 2.

In the case of this family of devices, the parameter address corresponds to the index. The value of the subindex is 0.

The parameters are addressed using a 16 bit index and an 8 bit subindex. A data field consists of the value of a subindex entry. The individual data fields of a parameter are shown in decimal notation and may have to be converted into hexadecimal format. In the case of the family of devices described, the subindex is 00. The index corresponds to the parameter address. The following example shows index and subindex entries for jog configuration.

Index	**Subindex**	**Parameter**	**Meaning**
10504	00	`JOGv_slow`	Velocity for slow jog
10506	00	`JOGv_fast`	Velocity for fast jog
10510	00	`JOGstep`	Jog distance before continuous movement
10512	00	`JOGtime`	Waiting time prior to continuous movement

Table 3.1 Examples of index and subindex entries

See the product manual for a list of the parameters.

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3.2.5 Parameter channel cyclical data exchange DP V0

3.2.5.1 Overview

The master can request a parameter value from the slave or change a parameter value via the parameter channel. Each parameter can be uniquely addressed via the index and subindex.

Not all Profibus profiles use the parameter channel. If the parameter channel is employed, it uses 8 bytes of the data telegram.

3.2.5.2 Structure of the parameter channel

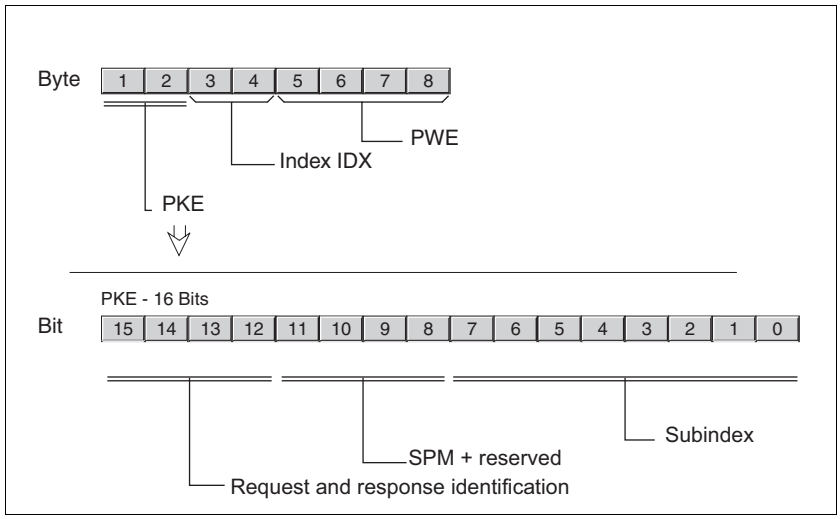

Figure 3.3 Parameter channel: Parameter identifier in bytes 1 and 2

The following abbreviations are used for the parameter channel:

Bytes 1 and 2: PKE as parameter identifier (request identifier and subindex)

Bytes 3 and 4: IDX for index of parameter (parameter number)

Bytes 5 ... 8: PWE for parameter value

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Parameter identifier PKE

The first two bytes (parameter identifier PKE) contain the request identifier and the response identifier as well as the subindex of the parameter. In the case of this device family, the subindex is 0. Bytes 3 and 4 contain the index (IDX). The parameter value is contained in bytes 5 ... 8 (PWE

The request identifier and response identifier (bits 12 ... 15) indicate the fields of the parameter channel to be evaluated

Request identifier	**Function**	**Response identifier**	
		positive	**negative**
0	No request	0	7
1	Request parameter value (word)	1	7
1	Request parameter value (double word)	2	7
2	Change parameter value (word)	1	7
3	Change parameter value (double word)	2	7

Table 3.2 Request identifier and response identifier

NOTE: Write requests (change parameter value) are only executed by the slave if the value of the request identifier changes from 0 to 2 or 3. Read requests are only executed by the slave if the value of the request identifier changes from 0 to 1.

As long as the response identifier to a request is 0, the slave has not yet completed the request. The slave signals to the master that the request has been successfully executed via response identifier 1 or 2 (positive response identifier). The slave signals to the master that an error has occurred via response identifier 7 (negative response identifier). In the case of a negative response identifier, bytes 5 ... 8 (parameter value) contains the error number; bytes 5 and 6 contain the value 0 and bytes 7 and 8 a 16 bit value.

Only one request can be processed at a time. The slave provides the response until the master sends a new request. If a response includes parameter values, the slave responds with the current value in the case of a repetition (cyclic processing).

Bits 8 ... 11 (reserved) must be 0.

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Example: Reading a parameter

In the example, the program number of the product is to be read. The program number is stored in parameter _prgNoDEV (index 258;subindex 00). The master sends a read request to the slave. After processing, the slave provides the requested data in bytes 5 ... 8 (parameter value PWE). The parameter value read has the decimal value 9120 which corresponds to $23A0_h$. If the slave can identify and process the request, the response data contains the positive response identifier 1.

The master sends the following transmit data to the slave (values that are not relevant for the example are represented by x):

Transmit data: index: $258=102_h$, subindex: 00

Parameter	PKE, 1st byte request identifier	PKE, 2nd byte (Sdx)	Idx	Data	Description
Tx 0102_h:00_h	10_h	00_h	0102_h	xxxx xxxx	Reading the program number. The data has no significance.

The 4 data bytes have no significance for a read request.

Receive data:

Parameter	PKE, 1st bye response identifier	PKE, 2nd byte (Sdx)	Idx	Data	Description
Rx 0102_h:00_h	10_h	00_h	0102_h	0000 $23A0_h$	Data 23A0 correspond to the program number.

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Example: Writing of an invalid parameter

After the master has read the information from the above example, you must first reset the slave reset with the request identifier "No request" (PKE:00).

The slave is then ready to execute new request. In this example, the value of a non-existent parameter is to be changed. The value of the parameter with the index 101 = 00h 65_h and the subindex 00 is to be changed to 222 = DE_h.

Index: 101=0065_h

Subindex: 00 = 00_h

Value: 222 = 0000 $00DE_h$

Parameter	PKE, 1st byte request identifier	PKE, 2nd byte (Sdx)	Idx	Data	Description
Tx 0065_h:00_h	30_h	00_h	0065_h	0000 $00DE_h$	Writing a non-existent parameter

Since the slave cannot address the parameter, an error message is returned; the parameter value in this case is 0000 $B30A_h$. Error messages in the parameter channel are referred to as synchronous errors because they are processed during regular cyclic data exchange.

Parameter	PKE, 1st bye response identifier	PKE, 2nd byte (Sdx)	Idx	Data	Description
Rx 0065_h:00_h	70_h	00_h	0065_h	0000 $B30A_h$	The error message 0000$B30A_h$ is returned = Parameter does not exist

See chapter 53 for information on synchronous errors. See the product manual for information on the error numbers.

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3.2.6 Process data channel

3.2.6.1 Overview

The process data channel is used for realtime data exchange, for example the current position or the current velocity. Transmission is very fast because the data is sent without additional administration data and data transmission acknowledgement from the recipient is not required.

The master can control the operating states of the slave via the process data channel, for example:

- Enabling and disabling the power stage
- Activating operating modes
- Triggering and resetting a Quick Stop
- Acknowledging errors

Changing operating states and activating operating modes must be done separately. An operating mode can usually only be activated if the operating state is already "OPERATION-ENABLE".

NOTE: A new operating mode and a new acceleration value can only be set if the motor is at a standstill. Acceleration values are accepted in the process data channel during motor movements, but the value is only set during the next motion command. The other values can be changed while the operating mode is active.

In the process data channel, 2 bytes (1 word, 16 bits) are grouped together and referred to as PZD1...PZDn.

3.2.6.2 Structure of the transmit data (master to slave)

Transmit data format (master to slave)

Depending on the profile, the transmit data in the process data channel has the following tasks:

- Setting the operating state and the operating mode in "dmControl" 16 bits, available in all profiles
- Setting 32 bit reference values with "RefA32" und "RefB32", 32 bits, assignment depends on operating mode
- Setting user-selectable parameters via "mapping", 16 or 32 bits

See chapter 5.2 "Drive profiles", page 31 for additional information on the structure of the protocols.

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3.2.6.3 Structure of the receive data (slave to master)

Receive data format (slave to master)

Depending on the profile, the receive data in the process data channel has the following tasks:

- Indication of the current operating state with "driveStat", 16 bits, available in all profiles. "driveStat" also provides information on the state of the current operating mode and warning bits.
- Indication of the current operating mode and special functions with "mfStat" (Mode and function status), 16 bits, available in all profiles.
- Indication of the current state of the movement with "motionStat", 16 bits.
- Indication of the current state of the inputs and outputs with "driveInput", 16 bits.
- Indication of the current position data with "32Bit actual Position", 32 bits.
- Indication of the current velocity with "32Bit actual Velocity", 32 bits.
- Indication of user-selectable parameters (mapping), 16 or 32 bits.

See chapter 5.2 "Drive profiles", page 31 for additional information on the structure of the protocols.

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3.2.6.4 Handshake with the "Mode Toggle" bit

Mode Toggle

Synchronized processing can be carried out with the transmit data in the word "dmControl", bit "Mode Toggle" and the receive data in byte "mfStat", bit "ModeError" and bit "Mode Toggle". Synchronized processing means that the master waits for feedback messages from the slave so it can respond appropriately.

Example 1: Positioning

The master starts a positioning movement at point in time t_0. At points in time t_1, t_2 ..., the master checks the responses from the slave. It waits for the end of positioning. The end is identified by "x_end" = 1.

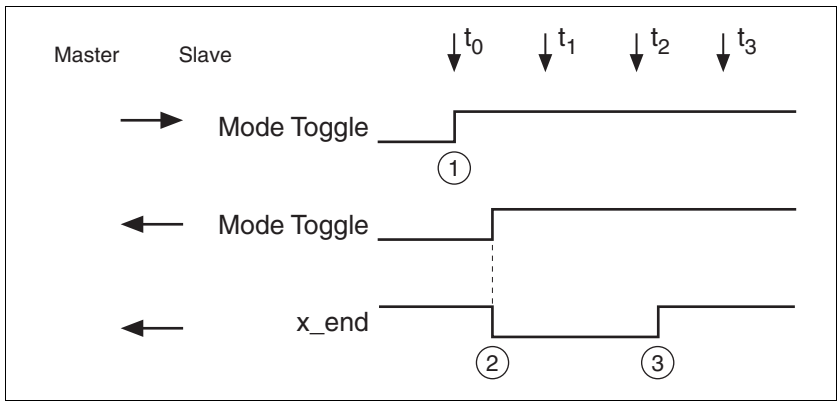

Figure 3.4 Mode Toggle Handshake

(1) Master starts positioning with "Mode Toggle" = 1
(2) Slave signals that positioning is active with "Mode Toggle" = 1 and simultaneously with "x_end" = 0
(3) Slave signals end of positioning with "x_end" = 1

Example 2: Short-time positioning

The master starts a positioning movement at point in time t_0 that will only take a very short time. The duration is shorter than the request cycle of the master. At point in time t_1 the movement is already complete. Bit "x_end" does not allow the master to detect whether the movement is already complete or has not yet been started. However, it can identify this with the "Mode Toggle" bit.

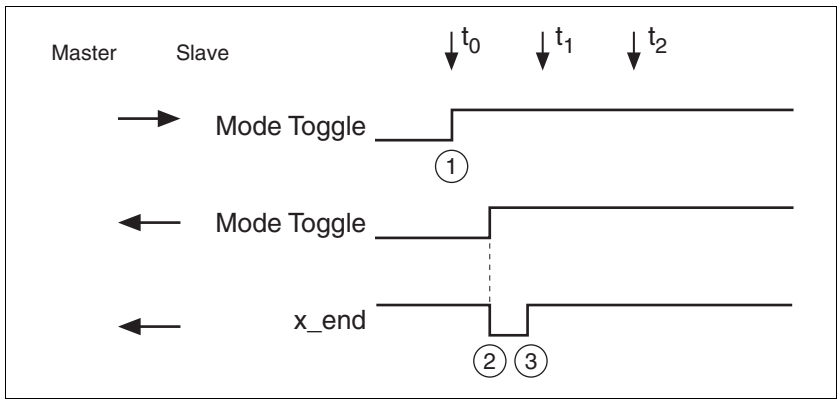

Figure 3.5 Mode Toggle Handshake, short movement

(1) Master starts positioning with "Mode Toggle" = 1
(2) Slave signals that positioning is active with "Mode Toggle" = 1 and simultaneously with "x_end" = 0
(3) Slave signals end of positioning with "x_end" = 1

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4 Installation

4

⚠ WARNING

SIGNAL AND DEVICE INTERFERENCE

Signal interference can cause unexpected responses of device.

- Install the wiring in accordance with the EMC requirements.
- Verify compliance with the EMC requirements.

Failure to follow these instructions can result in death, serious injury or equipment damage.

CAUTION

DESTRUCTION DUE TO ESD

Electrostatic discharge (ESD) can cause immediate or later destruction of the module or the device.

- Use suitable ESD measures (IEC 61340-5-2) when handling the module.
- Do not touch any internal components.

Failure to follow these instructions can result in equipment damage.

4.1 Installation of the module

▶ Install the module according to the instructions in the product manual.

Description	Order no.
PDP, PROFIBUS DP fieldbus module with D9-SUB (female) connection	VW3A3607

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4.2 Electrical installation

Cable specifications

Shield:	Required, both ends grounded
Twisted Pair:	Required
PELV:	Required
Cable composition:	6*0.34 mm^2 (6*AWG 22, 2*AWG24)
Max. cable length:	See Table 4.1 The maximum length depends on the baud rate and the signal propagation delay. The higher the baud rate, the shorter the bus cable needs to be.
Special features:	-

The maximum cable length depends on the baud rate and the signal propagation delay. The higher the baud rate, the shorter the bus cable needs to be.

Baud rate [kBaud]	**Max. cable length [m]**
9.6	1200
19.2	1200
45.45	1200
93.75	1200
187.5	1000
500	400
1500	200
3000	100
6000	100
12000	100

Table 4.1 The cable length depends on the baud rate

- ▶ Use equipotential bonding conductors, see product manual.
- ▶ Use pre-assembled cables to reduce the risk of wiring errors.
- ▶ Verify that wiring, cables and connected interfaces meet the PELV requirements.

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Terminating resistor

Both ends of the entire bus system must be terminated with a terminating resistor, see Figure 3.1.

Profibus connectors are available with integrated terminating resistors. See chapter Accessories in the product manual.

The diagram below shows the integrated terminating resistor combination.

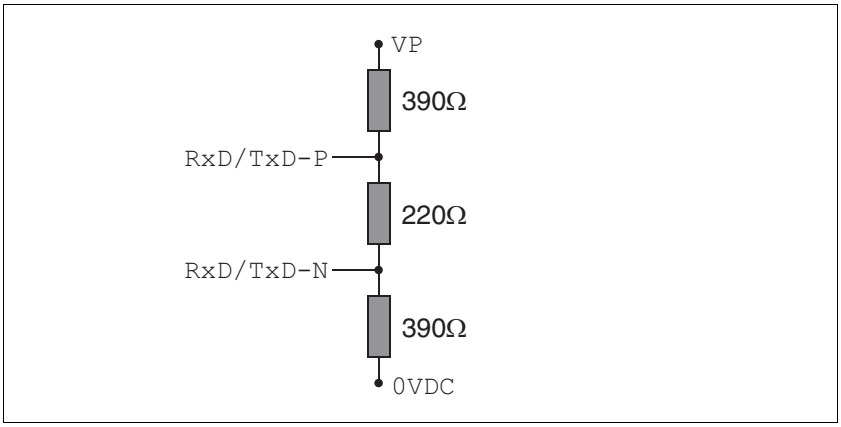

Figure 4.1 Terminating resistor Profibus

▶ If the device is at the end of the network, use a Profibus connector with terminating resistor.

Pin assignment

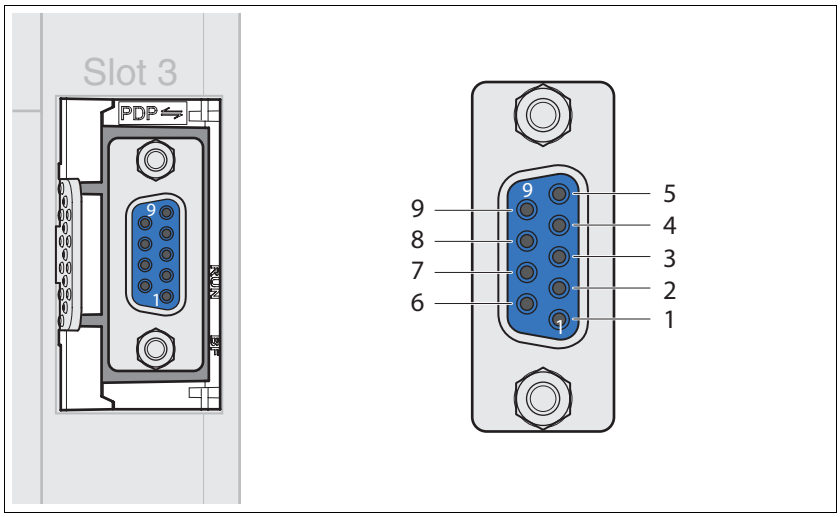

Figure 4.2 Pin assignment

Pin	Signal	Meaning	Color	I/O
6	VP	Supply voltage	-	O
3	RxD/TxD-P	Data wire B	Red	RS485 level, I/O
8	RxD/TxD-N	Data wire A	Green	RS485 level, I/O
9	-	Reserved	-	-
4	RTS	Transmit request	-	RS485 level, O
5	0VDC	Reference potential	-	-

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Connecting Profibus

Use only approved Profibus connectors. The Profibus connectors are suitable for connecting the bus signal.

- ▶ Connect the Profibus signals as per Figure 4.2.
- ▶ If the device is at the end of the network, use a Profibus connector with terminating resistor.
- ▶ Fasten the cables to the cable guide. The cable guide is not a strain relief.

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5 Commissioning

5

This chapter describes how to commission the product.

⚠ WARNING

UNINTENDED OPERATION

- Do not write values to reserved parameters.
- Do not write values to parameters unless you fully understand the function.
- Run initial tests without coupled loads.
- Verify that the system is free and ready for the movement before changing parameters.
- Verify the use of the word sequence with fieldbus communication.
- Do not establish a fieldbus connection unless you have fully understood the communication principles.

Failure to follow these instructions can result in death, serious injury or equipment damage.

5.1 Prerequisites for commissioning

The following components are required for commissioning:

- Product with fieldbus interface
- GSD file (can be downloaded from the Internet at: http://www.schneider-electric.com)
- Product manual and fieldbus manual
- Profibus master

▶ Carefully read and understand the manuals before commissioning and follow the safety instructions!

Using the library considerably facilitates controlling the device. The library is available for download from the Internet.
http://www.schneider-electric.com

5.2 Drive profiles

Drive profile

The product supports the following drive profiles:

- Profile 104: "Drive Profile Lexium 1" (vendor-specific)
- Profile 105: "Drive Profile Lexium 2" (vendor-specific)

NOTE: The structure of the transmit data and the receive data in the case of an alarm is described in chapter 7.2 "Error messages", page 53.

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5.2.1 Structure of the transmit data

The transmit data is used to transmit requests of the master to the slave.

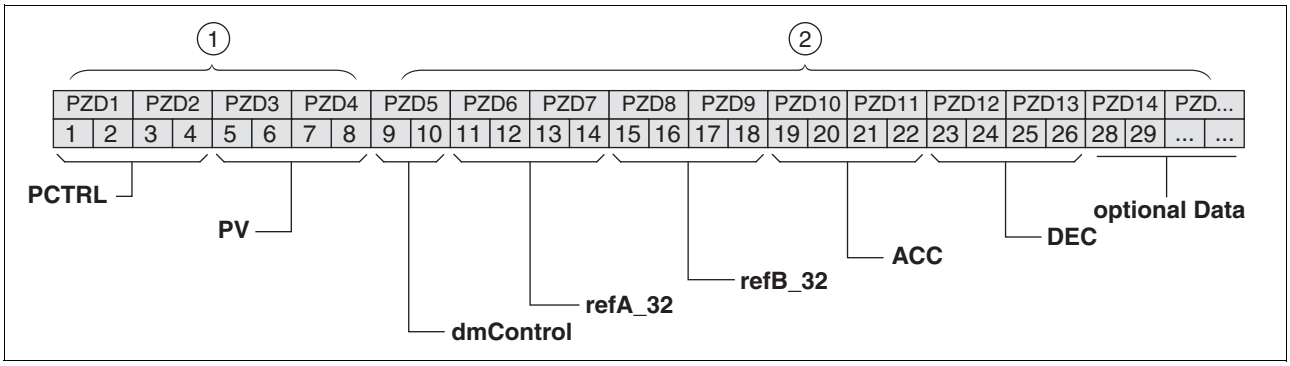

Figure 5.1 Transmit data "Drive Profile Lexium 1", profile 104

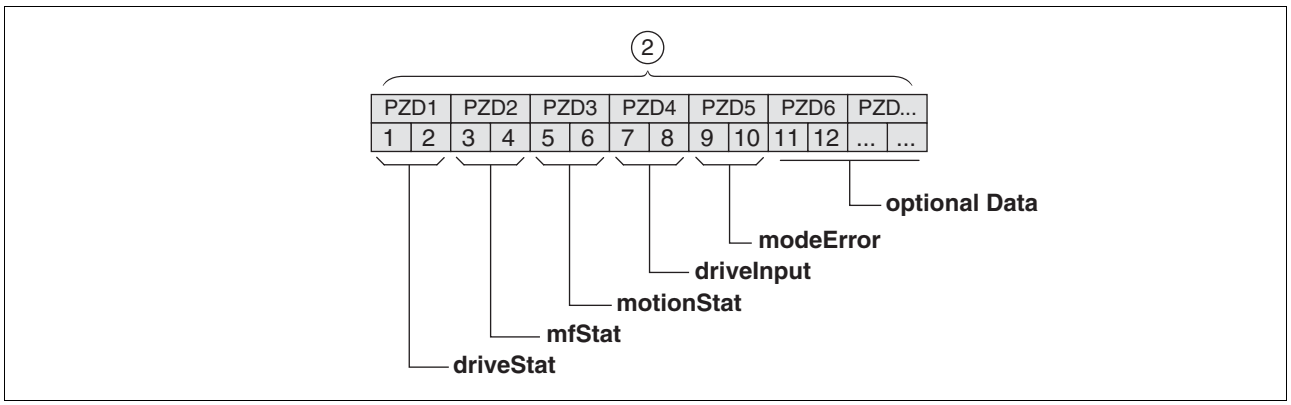

Figure 5.2 Transmit data "Drive Profile Lexium 2", profile 105

(1) Corresponds to the parameter channel
(2) Corresponds to the process data channel

PCTRL The double word PCTRL (parameter control) consists of the parameter identifier PKE and the index, see chapter 3.2.5 "Parameter channel cyclical data exchange DP V0", page 19.

PV The double word PV is used to set the value of the parameter (PWE), see chapter 3.2.5 "Parameter channel cyclical data exchange DP V0", page 19.

dmControl The word "dmControl" is used to set the operating state and the operating mode.

See chapters 6.1.1 "Indication of the operating state" and 6.2.2 "Starting and changing an operating mode" for a detailed description of the bits.

RefA32, RefB32 The two double words "RefA32" and "RefB32" are used to set two values for the operating mode. The meaning depends on the operating mode; it is described in the chapters on the individual operating modes.

ACC/DEC The double word "ACC/DEC" is used to set the acceleration and deceleration. The value corresponds to the parameter `RAMPaccdec`.

Optional Data The "Optional Data" is used to append additional parameters to the profile that can be selected by the user (mapping). See chapter 5.3 "Settings with the configuration tool of the master", page 34 for additional information on mapping.

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5.2.2 Structure of the receive data

The receive data is used to transmit information from the slave to the master.

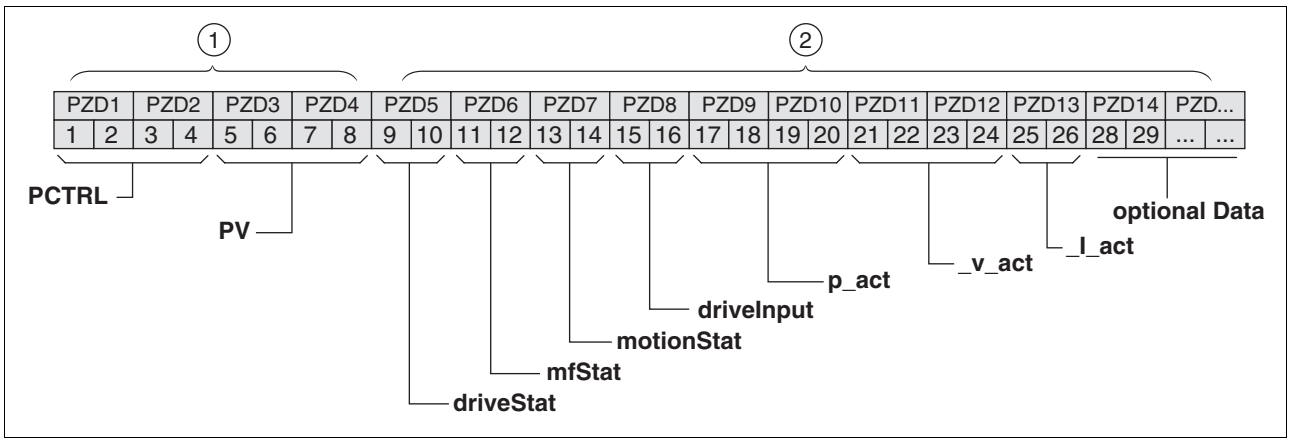

Figure 5.3 Receive data "Drive Profile Lexium 1", profile 104

Receive data "Drive Profile Lexium 2", profile 105

(1) Corresponds to the parameter channel
(2) Corresponds to the process data channel

PCTRL The double word PCTRL (parameter control) consists of the parameter identifier PKE and the index, see chapter 3.2.5 "Parameter channel cyclical data exchange DP V0", page 19.

PV The double word PV is used to read the value of the parameter (PWE), see chapter 3.2.5 "Parameter channel cyclical data exchange DP V0", page 19.

driveStat The current operating state is indicated with the "driveStat" word.

For a detailed description of the bits, see chapter 6.1.1 "Indication of the operating state".

mfStat The word "mfStat" is used to indicate the current operating mode.

For a detailed description of the bits, see chapter 6.2.1 "Indicating and monitoring the operating mode".

motionStat The word "motionStat" is used to provide information on the motor and profile generator.

Bit	Meaning
0 ... 5	Reserved
6	MOTZ: Motor at a standstill
7	MOTP: Motor movement in positive direction
8	MOTN: Motor movement in negative direction
9	PWIN: Motor within position window
10	Reserved
11	TAR0: Profile generator at standstill
12	DEC: Profile generator decelerates
13	ACC: Profile generator accelerates
14	CNST: Profile generator moves at constant velocity
15	Reserved

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driveInput The word "driveInput" is used to indicate the status of the digital signal inputs.

bit	Signal	Factory setting
0	DI0	Signal input function Freely Available
1	DI1	Signal input function Reference Switch (REF)
2	DI2	Signal input function Positive Limit Switch (LIMP)
3	DI3	Signal input function Negative Limit Switch (LIMN)
4	DI4	Signal input function Freely Available
5	DI5	Signal input function Freely Available
6 ... 15	-	Reserved

_p_act The double word "_p_act" is used to provide information on the current motor position. The value corresponds to the parameter _p_act.

_v_act The double word "_v_act" is used to provide information on the current velocity. The value corresponds to the parameter _v_act.

_I_act The word "_I_act" is used to provide information on the current total motor current. The value corresponds to the parameter _I_act.

ModeError The word "ModeError" is used to provide the vendor-specific error code that caused the ModeError to be set. The ModeError bit relates to MT-dependent parameters. The value corresponds to the parameter _ModeError.

Optional Data The "Optional Data" is used to append additional parameters to the profile that can be selected by the user (mapping). See chapter 5.3 "Settings with the configuration tool of the master", page 34 for additional information on mapping.

5.3 Settings with the configuration tool of the master

The GSD file must be read with the configuration tool of the master. The device is then known to the network.

Profile selection The configuration tool of the master lets you select the profile to be used. See chapter 5.2 "Drive profiles", page 31 for the supported profiles.

DP-V0 or DP-V1 The configuration tool of the master lets you select whether to access the devices as Profibus DP-V0 or as Profibus DP-V1.

Deactivating alarms for DP-V1 The configuration tool of the master lets you deactivate alarms if the device is operated as Profibus DP-V1 and the alarm function is not required.

Mapping of optional data The configuration tool of the master lets you set the additional parameters to be transmitted in the " Optional Data" of the transmit and receive data.

NOTE: It is possible to map up to 8 optional parameters; the total length of the telegram must not exceed 40 bytes.

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5.4 "First Setup"

The GSD file is read by the master. The device is then known to the network.

A "First Setup" is required when the controller supply voltage is switched on for the first time or after the factory settings have been restored.

After the initialization of the device, the Profibus interface must be configured. You must assign a unique network address (node address) to each device. The transmission rate (baud rate) on the network is detected automatically; it must be the same for all devices on the network.

▶ Enter the network address. The network address is stored in the parameter PBadress (PbAd).

It is also possible to set the network address by means of the DP-V0 service "Change station address" (Set_Slave_Add).

The transmission rate can be read from the parameter_PBbaud (Pbbd).

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5.5 Starting operation on the network

Operation on the network is started via a master. This master can be a PLC or a PC with the appropriate application software that allows you to send commands and receive data.

⚠ WARNING

LOSS OF CONTROL

Even if data link monitoring is active, it may not be possible to stop a running movement due to an error in the master controller.

- Suitable redundant control paths must be provided for critical functions.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Activating the watchdog at the master starts monitoring of the Profibus data links to the slaves. In special cases, the monitoring function can be deactivated for a single slave only via the configuration tool of the master.

Steps for troubleshooting

Test all functions that are relevant for your system. Run initial tests without coupled loads. Also check the response of the system to power outage.

If the slave does not send a response, check the following:

- Did you switch on the product and start the master for operation on the network?
- Are all cable connections ok (electrically and mechanically)?
- Did you set the correct address and baud rate?

See chapter 7 "Diagnostics and troubleshooting", page 51 for additional information.

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6 Operation

6

⚠ WARNING

UNINTENDED OPERATION

- Do not write values to reserved parameters.
- Do not write values to parameters unless you fully understand the function.
- Run initial tests without coupled loads.
- Verify that the system is free and ready for the movement before changing parameters.
- Verify the use of the word sequence with fieldbus communication.
- Do not establish a fieldbus connection unless you have fully understood the communication principles.

Failure to follow these instructions can result in death, serious injury or equipment damage.

The chapter "Operation" describes the basic operating states, operating modes and functions of the product.

Using the library considerably facilitates controlling the device. The library is available for download from the Internet.
http://www.schneider-electric.com

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6.1 Operating states

6.1.1 Indication of the operating state

Fieldbus: with "driveStat"

In the process data channel, status information is transmitted via the receive data (slave to master).

The current operating state is indicated with the "driveStat" word.

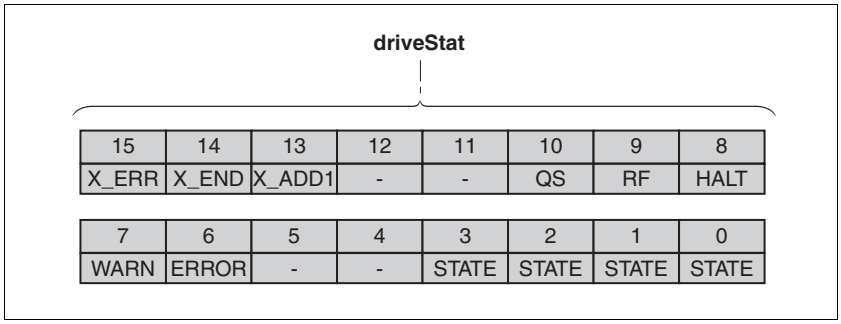

Figure 6.1 Structure of driveStat

Bit	Name	Meaning
0 ... 3	STATE	Current operating state (binary coded)
4 ... 5	-	Reserved
6	ERROR	An error has occurred (error classes 1 ... 3)
7	WARN	A warning has occurred (error class 0)
8	HALT	"Halt" is active
9	RF	Homing valid
10	QS	"Quick Stop" is active
11 ... 12	-	Reserved
13	X_ADD1	Operating mode-dependent
14	X_END	Operating mode terminated
15	X_ERR	Operating mode terminated with error

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6.1.2 Changing the operating state

Fieldbus: with "dmControl"

In the process data channel, transmit data (master to slave) is used to make settings to the slave.

Bits 8 ... 15 of the word "dmControl" are used to set the operating state.

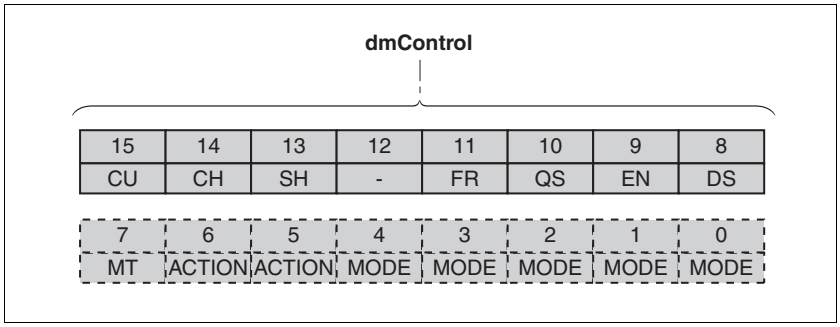

Figure 6.2 Structure dmControl bits 8 ... 15

Bit	Name	Meaning	Operating state
8	DS	Disable power stage	**6** Operation Enabled -> **4** Ready To Switch On
9	EN	Enable power stage	**4** Ready To Switch On -> **6** Operation Enabled
10	QS	Executing a "Quick Stop"	**6** Operation Enabled -> **7** Quick Stop Active
11	FR	Execute "Fault Reset"	**7** Quick Stop Active -> **6** Operation Enabled **9** Fault -> **4** Ready To Switch On
12	-	Reserved	Reserved
13	SH	Execute "Halt"	**6** Operation Enabled
14	CH	Clear "Halt"	**6** Operation Enabled
15	CU	Resume operating mode interrupted by "Halt"	**6** Operation Enabled

In the case of an access, the bits respond to a 0->1 change to trigger the corresponding function.

If a request for changing the operating state is not successful, this request is ignored. There is no error response.

Ambivalent bit combinations are treated in accordance with the following priority list (highest priority bit 8, lowest priority bit 14 and bit 15):

- Bit 8 (disable power stage) prior to bit 9 (enable power stage)
- Bit 10 ("Quick Stop") prior to bit 11 ("Fault Reset")
- Bit 13 (execute "Halt") prior to bit 14 (clear "Halt") and bit 15 (resume operating mode interrupted by "Halt")

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6.2 Operating modes

⚠ WARNING

UNINTENDED OPERATION

- Note that any changes to the values of these parameters are executed by the drive controller immediately on receipt of the data set.
- Verify that the system is free and ready for movement before changing these parameters.

Failure to follow these instructions can result in death, serious injury or equipment damage.

If operating mode, reference position and reference velocity are simultaneously transmitted via the process data channel, the data must be consistent. Therefore, operating mode data is only evaluated if MT(bit 7) has been toggled. "Mode Toggle" means that since the last transmission a change from 0 to 1 or from 1 to 0 has been detected for this bit.

MT (bit 7) is mirrored in the receive data set which allows the master to determine that the data has been accepted by the slave.

For more information on the toggle flag see chapter 3.2.6.4 "Handshake with the "Mode Toggle" bit", page 25.

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6.2.1 Indicating and monitoring the operating mode

The word "mfStat" is used to indicate the current operating mode.

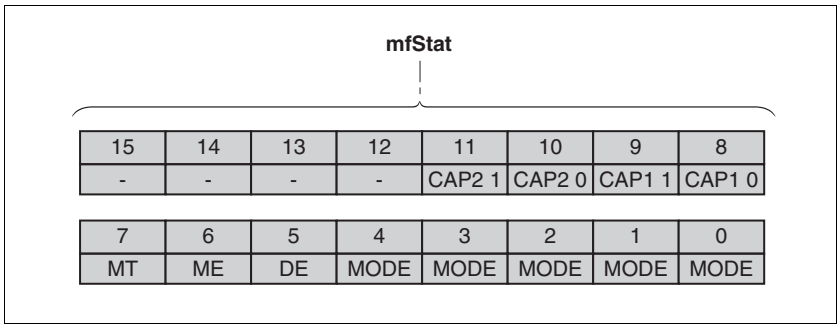

Figure 6.3 Structure mfStat

bit	Name	Description
0 ... 4	MODE	Indicates the current operating mode Value 01_h: Profile Position Value 03_h: Profile Velocity Value 04_h: Profile Torque Value 06_h: Homing Value $1F_h$: Jog Value $1E_h$: Electronic Gear Value $1D_h$: Motion Sequence
5	DE	The "DE" bit relates to parameters that are independent of "Mode Toggle" (MT). The "DE" bit is set if a data value in the process data channel is invalid.
6	ME	The "ME" bit relates to parameters that are dependent on "Mode Toggle" (MT). The "ME" bit is set if a request from a master (starting an operating mode) was rejected.
7	MT	Handshake via "Mode Toggle"
8 ... 9	CAP1	Bit 0 and bit 1 of parameter `_Cap1Count`
10 ... 11	CAP2	Bit 0 and bit 1 of parameter `_Cap2Count`
12 ... 15	-	Reserved

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6.2.2 Starting and changing an operating mode

Fieldbus: with "dmControl"

In the process data channel, transmit data (master to slave) is used to make settings to the slave.

Bits 0 ... 7 in the word "dmControl" are used to set the operating mode.

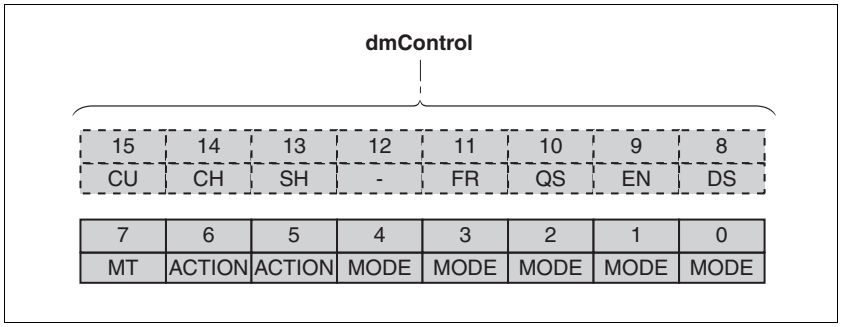

Figure 6.4 Structure dmControl bits 0 ... 7

bit	Name	Description
0 ... 4	MODE	Operating mode Value 01_h: Profile Position Value 03_h: Profile Velocity Value 04_h: Profile Torque Value 06_h: Homing Value $1F_h$: Jog Value $1E_h$: Electronic Gear Value $1D_h$: Motion Sequence
5 ... 6	ACTION	Operating mode-dependent
7	MT	Handshake via Mode Toggle

The operating modes can be changed during operation. For this purpose, the current process must be completed or explicitly canceled. The motor must be at a standstill.

The master must enter the following values to activate an operating mode or to change reference values:

- Reference values, depending on desired operating mode
- Operating mode in "dmControl", bits 0 ... 4 (MODE).
- Action for this operating mode in bit 5 and bit 6 (ACTION)
- Toggle bit 7 (MT)

The following chapters describe the possible operating modes, functions and the corresponding reference values.

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6.2.3 Operating mode Jog

Availability

The operating mode is only available with the drive profile "Drive Profile Lexium".

Starting the operating mode

The operating mode is set and started in the process data channel with the transmit data (master to slave).

dmControl Bits 0 ... 6 MODE+ACTION	**Reference value RefA32**	**Reference value RefB32**
$1F_h$	Value 0: No movement Value 1: Slow movement in positive direction Value 2: Slow movement in negative direction Value 3: Fast movement in positive direction Value 3: Fast movement in negative direction	-

Status information

The word "driveStat" provides information on the operating mode.

bit	**Name**	**Meaning**
13	X_ADD1	Reserved
14	X_END	0: Operating mode started 1: Operating mode terminated
15	X_ERR	0: No error 1: Error

Terminating the operating mode

The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Value 0 RefA
- Stop caused by "Halt" or "Quick Stop"
- Stop caused by an error

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6.2.4 Operating mode Electronic Gear

Starting the operating mode

The operating mode is set and started in the process data channel with the transmit data (master to slave).

Method	dmControl Bits 0 ... 6 MODE+ACTION	Reference value RefA32	Reference value RefB32
Position synchronization without compensation movement	$1E_h$	As GEARdenom	As GEARnum
Position synchronization with compensation movement	$3E_h$	As GEARdenom	As GEARnum
Velocity synchronization	$5E_h$	As GEARdenom	As GEARnum

Status information

The word "driveStat" provides information on the operating mode.

bit	Name	Meaning
13	X_ADD1	1: Reference velocity reached [1)]
14	X_END	0: Operating mode started 1: Operating mode terminated
15	X_ERR	0: No error 1: Error

1) Only with method Velocity synchronization and with active velocity window.

Terminating the operating mode

The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Stop caused by "Halt" or "Quick Stop"
- Stop caused by an error

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6.2.5 Operating mode Profile Torque

Starting the operating mode

The operating mode is set and started in the process data channel with the transmit data (master to slave).

dmControl Bits 0 ... 6 MODE+ACTION	Reference value RefA32	Reference value RefB32
24_h	As PTtq_target	As RAMP_tq_slope

Status information

The word "driveStat" provides information on the operating mode.

bit	Name	Meaning
13	X_ADD1	0: Target torque not reached 1: Target torque reached
14	X_END	0: Operating mode started 1: Operating mode terminated
15	X_ERR	0: No error 1: Error

Terminating the operating mode

The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Stop caused by "Halt" or "Quick Stop"
- Stop caused by an error

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6.2.6 Operating mode Profile Velocity

Starting the operating mode

The operating mode is set and started in the process data channel with the transmit data (master to slave).

dmControl Bits 0 ... 6 MODE+ACTION	Reference value RefA32	Reference value RefB32
23_h	As PVv_target	-

Status information

The word "driveStat" provides information on the operating mode.

bit	Name	Meaning
13	X_ADD1	0: Target velocity not reached 1: Target velocity reached
14	X_END	0: Operating mode started 1: Operating mode terminated
15	X_ERR	0: No error 1: Error

Terminating the operating mode

The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Stop caused by "Halt" or "Quick Stop"
- Stop caused by an error

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6.2.7 Operating mode Profile Position

Starting the operating mode

The operating mode is set and started in the process data channel with the transmit data (master to slave).

Method	dmControl Bits 0 ... 6 MODE+ACTION	Reference value RefA32	Reference value RefB32
absolute	01_h	As `PPv_target`	As `PPp_target`
Relative with reference to the currently set target position	21_h	As `PPv_target`	As `PPp_target`
Relative with reference to the current motor position	41_h	As `PPv_target`	As `PPp_target`

Status information

The word "driveStat" provides information on the operating mode.

bit	Name	Meaning
13	X_ADD1	0: Target position not reached 1: Target position reached
14	X_END	0: Operating mode started 1: Operating mode terminated
15	X_ERR	0: No error 1: Error

Terminating the operating mode

The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Target position reached
- Stop caused by "Halt" or "Quick Stop"
- Stop caused by an error

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6.2.8 Operating mode Homing

Starting the operating mode

The operating mode is set and started in the process data channel with the transmit data (master to slave).

Method	dmControl Bits 0 ... 6 MODE+ACTION	Reference value RefA32	Reference value RefB32
Position setting	06_h	-	As `HMp_setP`
Reference movement	26_h	As `HMmethod`	-

Status information

The word "driveStat" provides information on the operating mode.

bit	Name	Meaning
13	X_ADD1	Reserved
14	X_END	0: Operating mode started 1: Operating mode terminated
15	X_ERR	0: No error 1: Error

Terminating the operating mode

The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Homing successful
- Stop caused by "Halt" or "Quick Stop"
- Stop caused by an error

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6.2.9 Operating mode Motion Sequence

Starting the operating mode

The operating mode is set and started in the process data channel with the transmit data (master to slave).

Method	dmControl Bits 0 ... 6 MODE+ACTION	Reference value RefA32	Reference value RefB32
Start sequence	$1D_h$	Data set number	Value 1: Use data set number
Start individual data set	$3D_h$	Data set number	-

Status information

The word "driveStat" provides information on the operating mode.

bit	Name	Meaning
13	X_ADD1	1: End of a sequence
14	X_END	0: Operating mode started 1: Operating mode terminated
15	X_ERR	0: No error 1: Error

Terminating the operating mode

The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Individual data set terminated
- Individual data set of a sequence terminated (waiting for transition condition to be fulfilled)
- Sequence terminated
- Stop caused by "Halt" or "Quick Stop"
- Stop caused by an error

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6.3 PLC as a fieldbus master

The fieldbus master provides each connected slave with its own memory for transmit data and receive data. Data can be exchanged between PLC memory and fieldbus master via the peripheral equipment range or the process image range.

Fieldbus transmission and the application program's read and write accesses to transmit and receive data are asynchronous. Therefore, it is possible that the fieldbus master reads the data from the PLC memory before the PLC was able to completely update the data.

⚠ CAUTION

INCORRECT CONTROL COMMANDS

If a PLC is used as the master device, the exchange of data can lead to inconsistent transmit data since fieldbus and PLC cycles do not operate synchronously.

- Observe all notes concerning operation with a PLC.

Failure to follow these instructions can result in injury or equipment damage.

Note the following when using a master PLC:

- Copy data from high addresses first, toggle MT in the word "dmControl" last
- During data exchange via the process image, the transmit data must be copied from the memory for the process image to the memory of the fieldbus master. This copy process must not create inconsistent data on the fieldbus.

Data exchange via the peripheral memory

In the case of data exchange via the peripheral memory, the data is consistent if MT in the word "dmControl" is entered last. The product ignores the transmitted data as long as this bit is equal to the MT in the word "mfStat".

Data exchange via process image memory

Data consistency during data exchange via the process image memory can only be achieved if there is no bus access to the data in the peripheral memory during the copy process between image and peripheral memory in the direction from a low to a high address.

Inconsistent data is generated if MT ("dmControl", bit 7) has already been transmitted via the bus before the slave has received the remaining correct data. As soon as MT is transmitted, the slave detects the state transition when checking the bit and interprets this as a new command, which is executed immediately.

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7 Diagnostics and troubleshooting

7

7.1 Fieldbus communication error diagnostics

A properly operating fieldbus is essential for evaluating status and error messages.

Checking connections

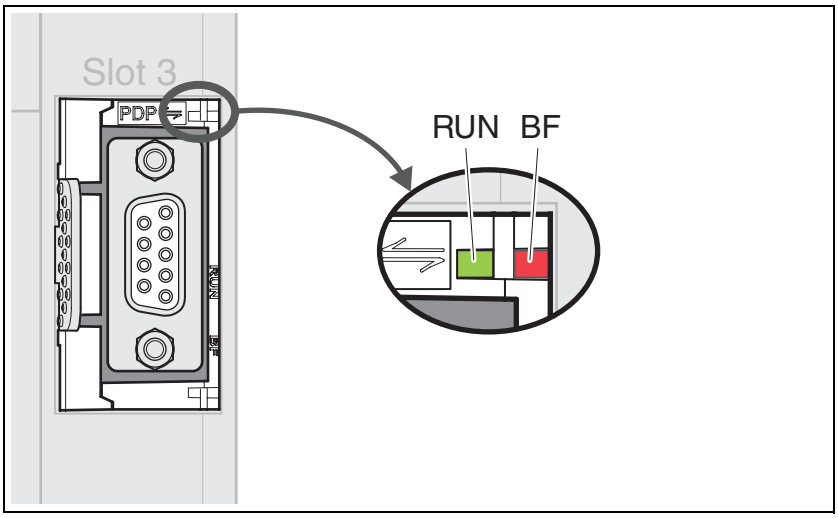
If the product cannot be addressed via the fieldbus, first check the connections.

Check the following connections:

- System power supply
- Supply connections
- Fieldbus cables and wiring
- Fieldbus connection

LEDs for Profibus

The fieldbus status can be checked using the two LEDs.



LED "RUN" (green)	LED "BF" (red)	Meaning
Off	Off	Fieldbus communication inactive
Lights	Off	Fieldbus communication active
Off	Lights	Fieldbus error (e.g. watchdog)
Off	Flashes	Incorrect parameterization

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Fieldbus function test

If the connections are correct, check the settings for the fieldbus addresses. After correct configuration of the transmission data, test fieldbus mode.

In addition to the master that knows the product via the data in the GSD file and the address, a bus monitor should be installed that, as a passive device, displays messages.

▶ Switch the supply voltage of the drive system off and on.

▶ Observe the network messages shortly after switching on the drive system. A bus monitor can be used to record the elapsed time between telegrams and the relevant information in the telegram.

Possible errors: Addressing, parameterization, configuration

If it is impossible to connect to a device, check the following:

- Addressing: The address of the network device must be between 1 and 126. Each network device must have a unique address.
- Parameterization: The parameterized Ident number and the user parameters must match the values stored in the GSD file.
- Configuration: The data length in input and output direction must be identical to the length specified in the GSD file.

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7.2 Error messages

Error messages generated when the network is in operation are received by the master via the fieldbus.

The following error messages are possible:

- Synchronous errors
- Asynchronous errors
- Errors during operating mode control via process data channel.

7.2.1 Synchronous errors

Error message in parameter channel

If a command cannot be processed in the parameter channel, the master receives a synchronous error message from the slave.

The error message is generated as a response to a parameter transmission error. The cause of the error is output in the PWE as error code in bytes 5…8.

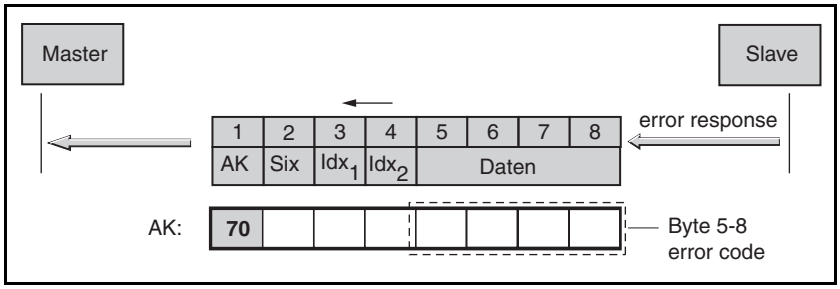

Figure 7.1 Error message in parameter channel

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Errors in the process data channel

You can start and change operating modes via the process data channel. If the request cannot be processed, bit 6 (ModeError, ME) is set in the receive data (slave to master) in the word "mfStat".

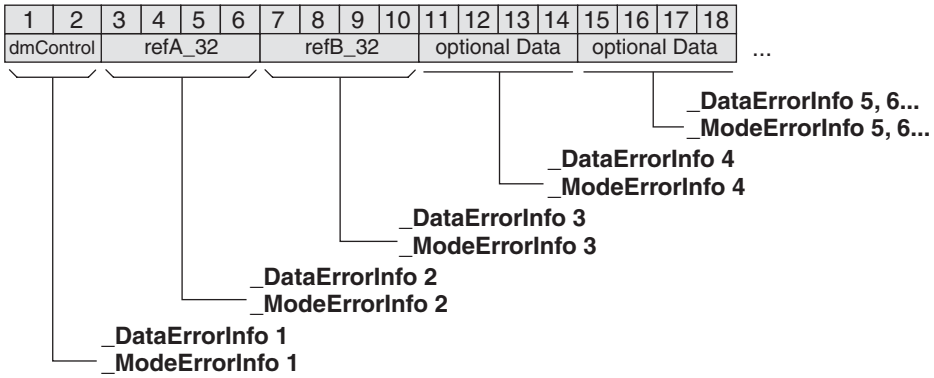
Data such as position and velocity is transmitted via the process data channel. If the data is not accepted (for example, if the value is outside of the permissible range), bit 5 (DataError, DE) is set in the receive data (slave to master) in the word "mfStat".

Bit	Name	Description
5	DE	The DataError bit relates to parameters that are independent of "Mode Toggle" (MT). It is set if a data value in the process data channel is invalid.
6	ME	The ModeError bit relates to parameters that are dependent on "Mode Toggle" (MT). Is set if a request from a master (starting an operating mode) was rejected

Table 7.1 Receive data excerpt, word "mfStat"

If DE or ME are set, this does not interrupt the current process. To determine the cause of the error, the master can read the error number from the parameters `_DataError, 6966:00` and `_ModeError, 6962:00`. See the product manual for a list of the error numbers.

In order to detect the parameter that has caused the DE bit or the ME bit to be set, the master can read the position of the parameter from the parameters `_DataErrorInfo, 6970:00` and `_ModeErrorInfo, 6968:00`.



The error message is reset when the next valid data telegram is transmitted.

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7.2.2 Asynchronous errors

Asynchronous errors are triggered by internal monitoring (for example, temperature) or by external monitoring (for example, limit switch).

Asynchronous errors are indicated in the following way:

- Transition to operating state 7 (Quick Stop) or operating state 9 (Fault). The transition is indicated in the receive data telegram in "driveStat", bits 0 ... 3.
- Setting of:
  - "driveStat", bit 6 (error)
  - "driveStat", bit 7 (warning)
  - "driveStat", bit 15 (operating mode terminated by error)

The error bits have the following meaning:

- Bit 6
  Error message (for example, caused by limit switch)
  The exact cause is contained in parameter `_LastError, 7178:00` in a bit-coded way.
- Bit 7
  Warning (for example, overtemperature warning)
  The error information is contained in parameter `_ERR_number, 15362:00` in a bit-coded way.
- Bit 15
  Indicates whether the operating mode was terminated by an error.

The cause of the last error is contained in the parameter `_LastError, 7178:00` in the form of an error number.

For a list of error numbers and their meanings see the chapter "Diagnostics and Troubleshooting" in the product manual.

For more information on parameters, error classes and troubleshooting see the chapter "Diagnostics and Troubleshooting" in the product manual.

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DP-V1: Acyclical alarm with MS1 communication

If the device is operated as a Profibus DP-V1 device and transitions to state 8 or state 9 (Fault) of the state diagram, the slave sends a vendor-specific telegram to the master:

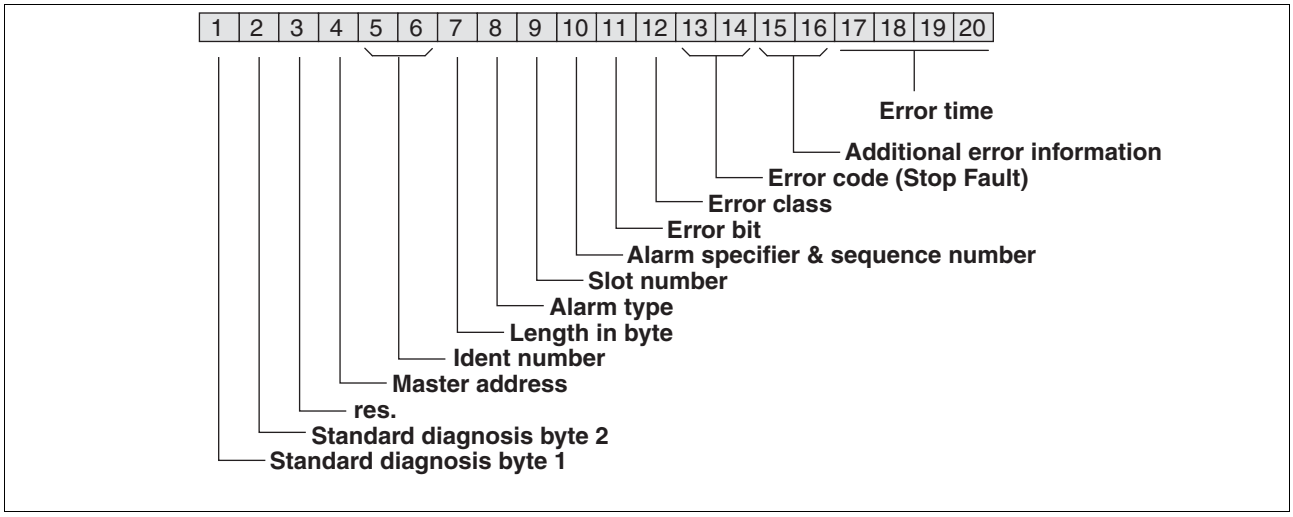

Figure 7.2 Acyclical error message with MS1 communication (slave to master)

The master sends an Acknowledge telegram in response to this telegram:

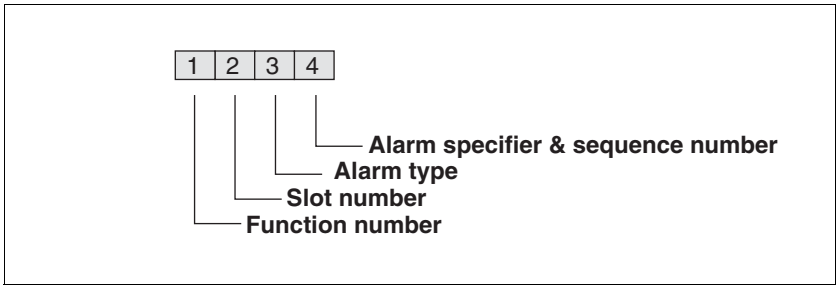

Figure 7.3 Acyclical Acknowledgement Telegram with MS1 communication (master to slave)

It is possible to inhibit transmission of error telegrams. Use the configuration tool of the master to do so. See also chapter 5.3 "Settings with the configuration tool of the master", page 34.

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8 Glossary

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8.1 Units and conversion tables

The value in the specified unit (left column) is calculated for the desired unit (top row) with the formula (in the field).

Example: conversion of 5 meters [m] to yards [yd]
5 m / 0.9144 = 5.468 yd

8.1.1 Length

	in	ft	yd	m	cm	mm
in	-	/ 12	/ 36	* 0.0254	* 2.54	* 25.4
ft	* 12	-	/ 3	* 0.30479	* 30.479	* 304.79
yd	* 36	* 3	-	* 0.9144	* 91.44	* 914.4
m	/ 0.0254	/ 0.30479	/ 0.9144	-	* 100	* 1000
cm	/ 2.54	/ 30.479	/ 91.44	/ 100	-	* 10
mm	/ 25.4	/ 304.79	/ 914.4	/ 1000	/ 10	-

8.1.2 Mass

	lb	oz	slug	kg	g
lb	-	* 16	* 0.03108095	* 0.4535924	* 453.5924
oz	/ 16	-	* $1.942559*10^{-3}$	* 0.02834952	* 28.34952
slug	/ 0.03108095	/ $1.942559*10^{-3}$	-	* 14.5939	* 14593.9
kg	/ 0.45359237	/ 0.02834952	/ 14.5939	-	* 1000
g	/ 453.59237	/ 28.34952	/ 14593.9	/ 1000	-

8.1.3 Force

	lb	oz	p	dyne	N
lb	-	* 16	* 453.55358	* 444822.2	* 4.448222
oz	/ 16	-	* 28.349524	* 27801	* 0.27801
p	/ 453.55358	/ 28.349524	-	* 980.7	* $9.807*10^{-3}$
dyne	/ 444822.2	/ 27801	/ 980.7	-	/ $100*10^{3}$
N	/ 4.448222	/ 0.27801	/ $9.807*10^{-3}$	* $100*10^{3}$	-

8.1.4 Power

	HP	W
HP	-	* 746
W	/ 746	-

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8.1.5 Rotation

	min^{-1} (RPM)	**rad/s**	**deg./s**
min^{-1} (RPM)	-	* π / 30	* 6
rad/s	* 30 / π	-	* 57.295
deg./s	/ 6	/ 57.295	-

8.1.6 Torque

	lb·in	**lb·ft**	**oz·in**	**Nm**	**kp·m**	**kp·cm**	**dyne·cm**
lb·in	-	/ 12	* 16	* 0.112985	* 0.011521	* 1.1521	* $1.129*10^6$
lb·ft	* 12	-	* 192	* 1.355822	* 0.138255	* 13.8255	* $13.558*10^6$
oz·in	/ 16	/ 192	-	* $7.0616*10^{-3}$	* $720.07*10^{-6}$	* $72.007*10^{-3}$	* 70615.5
Nm	/ 0.112985	/ 1.355822	/ $7.0616*10^{-3}$	-	* 0.101972	* 10.1972	* $10*10^6$
kp·m	/ 0.011521	/ 0.138255	/ $720.07*10^{-6}$	/ 0.101972	-	* 100	* $98.066*10^6$
kp·cm	/ 1.1521	/ 13.8255	/ $72.007*10^{-3}$	/ 10.1972	/ 100	-	* $0.9806*10^6$
dyne·cm	/ $1.129*10^6$	/ $13.558*10^6$	/ 70615.5	/ $10*10^6$	/ $98.066*10^6$	/ $0.9806*10^6$	-

8.1.7 Moment of inertia

	lb·in^2	**lb·ft^2**	**kg·m^2**	**kg·cm^2**	**kp·cm·s^2**	**oz·in^2**
lb·in^2	-	/ 144	/ 3417.16	/ 0.341716	/ 335.109	* 16
lb·ft^2	* 144	-	* 0.04214	* 421.4	* 0.429711	* 2304
kg·m^2	* 3417.16	/ 0.04214	-	* $10*10^3$	* 10.1972	* 54674
kg·cm^2	* 0.341716	/ 421.4	/ $10*10^3$	-	/ 980.665	* 5.46
kp·cm·s^2	* 335.109	/ 0.429711	/ 10.1972	* 980.665	-	* 5361.74
oz·in^2	/ 16	/ 2304	/ 54674	/ 5.46	/ 5361.74	-

8.1.8 Temperature

	°F	**°C**	**K**
°F	-	(°F - 32) * 5/9	(°F - 32) * 5/9 + 273.15
°C	°C * 9/5 + 32	-	°C + 273.15
K	(K - 273.15) * 9/5 + 32	K - 273.15	-

8.1.9 Conductor cross section

AWG	1	2	3	4	5	6	7	8	9	10	11	12	13
mm^2	42.4	33.6	26.7	21.2	16.8	13.3	10.5	8.4	6.6	5.3	4.2	3.3	2.6

AWG	14	15	16	17	18	19	20	21	22	23	24	25	26
mm^2	2.1	1.7	1.3	1.0	0.82	0.65	0.52	0.41	0.33	0.26	0.20	0.16	0.13

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8.2 Terms and Abbreviations

See chapter 2.5 "Standards and terminology" for information on the pertinent standards on which many terms are based. Some terms and abbreviations may have specific meanings with regard to the standards.

AK	Request/response identifier
Address	Storage which can be accessed by its unique number. See also Slave address.
Big Endian format	Method of storing data; the highest-value byte of a data word is at the first position (big end first).
DE	DataError-Bit. The DataError bit relates to parameters that are independent of "Mode Toggle" (MT). It is set if a data value in the process data channel is invalid.
DP	Decentralized periphery
Direction of rotation	Rotation of the motor shaft in a positive or negative direction of rotation. Positive direction of rotation is when the motor shaft rotates clockwise as you look at the end of the protruding motor shaft.
EMC	Electromagnetic compatibility
Error	Discrepancy between a computed, observed or measured value or condition and the specified or theoretically correct value or condition.
Error class	Classification of errors into groups. The different error classes allow for specific responses to errors, for example by severity.
FMS	Fieldbus Message Specification
Factory setting	Factory settings when the product is shipped
Fatal error	In the case of fatal error, the product is no longer able to control the motor so that the power stage must be immediately disabled.
Fault	Fault is a state that can be caused by an error. Further information can be found in the pertinent standards such as IEC 61800-7, ODVA Common Industrial Protocol (CIP).
Fault reset	A function used to restore the drive to an operational state after a detected error is cleared by removing the cause of the error so that the error is no longer active.
GSD file	A file provided by the vendor; contains specific information on a Profibus device and is required for commissioning the device
I/O	Inputs/outputs
Idx	Index: Parameters are accessed via index and subindex, abbreviated as Idx and Sdx.
LED	Light Emitting Diode
Limit switch	Switches that signal overtravel of the permissible range of travel.
Little Endian format	Method of storing data; the lowest-value byte of a data word is at the first position (little end first).
ME	ModeError-Bit. The ModeError bit relates to parameters that are dependent on "Mode Toggle" (MT). Is set if a request from a master (starting an operating mode) was rejected
MT	Mode Toggle, toggling a bit from 0 -> 1 or 1 -> 0

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Master	Active bus device that controls the data traffic on the network.
PKE	Parameter identifier
PLC	Programmable logic controller
PNO	Profibus user organization
PWE	Parameter value
PZD	Process data
Parameter	Device data and values that can be read and set (to a certain extent) by the user.
Profibus	Standardized open fieldbus as per EN 50254-2 which allows drives and other devices from different manufacturers to communicate.
Quick Stop	Function which can be used for fast deceleration of the motor via a command or in the event of an error.
Six	Subindex value of a parameter
Slave	Passive bus device that receives control commands and provides data to the master.
Slave address	Communication between master and slave is only possible after the assignment of unique addresses.
Toggle	See MT, Mode Toggle
Warning	If the term is used outside the context of safety instructions, a warning alerts to a potential problem that was detected by a monitoring function. A warning is not an error and does not cause a transition of the operating state.

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