

SIPROTEC

Bay control unit 6MD662/3/4

Communication module

PROFIBUS DP
Bus mapping

Preface

Table of contents

Redundant PROFIBUS DP interface **1**

Data of the PROFIBUS DP messages **2**

Standard mappings 3-1 and 3-3 **3**

Standard mapping 3-2 **4**

Standard mapping 3-4 **5**

Index

Edition: July 2010

C53000-L1840-B011-03

Document Version: V02.10.01

Liability statement

We have checked the contents of this manual against the hardware and software described. Exclusions and deviations cannot be ruled out; we accept no liability for lack of total agreement.

The information in this manual is checked periodically, and necessary corrections will be included in future editions.

We appreciate any suggested improvements.

We reserve the right to make technical improvements without notice.

Document version: V02.10.01

Copyright

Copyright © Siemens AG 2010. All rights reserved.

Dissemination or reproduction of this document, or evaluation and communication of its contents, is not authorized except where expressly permitted. Violations are liable for damages.

All rights reserved, particularly for the purposes of patent application or trademark registration.

Registered trademarks

SIPROTEC®, SIMATIC®, SIMATIC NET®, SINAUT®, SICAM® and DIGSI® are registered trademarks of Siemens AG.

Other designations in this manual may be trademarks that if used by third parties for their own purposes may violate the rights of the owner.

Preface

Purpose of this manual

This manual describes the data in the PROFIBUS DP messages of the SIPROTEC device 6MD662/3/4 and is divided into the following topics:

- Redundant PROFIBUS DP interface → Chapter 1,
- Data of the PROFIBUS DP messages → Chapter 2,
- Standard mappings 3-1 and 3-3 → Chapter 3,
- Standard mapping 3-2 → Chapter 4,
- Standard mapping 3-4 → Chapter 5.

General details about the function, operation, assembly and commissioning of the SIPROTEC devices you find in the

- SIPROTEC4 System Manual, order no. E50417–H1176–C151.

PROFIBUS DP communication profile documentation

The following additional manual informs you about the data types, bus specific parameters, DIGSI parameterization and hardware interface of the PROFIBUS DP slave modul of the SIPROTEC devices:

Manual	Order number
SIPROTEC Communication module, PROFIBUS DP - Communication profile	C53000-L1840-B001-03

You can download this manual

from Internet <http://www.siprotec.com>

or please contact your Siemens representative.

PROFIBUS DP specification

The PROFIBUS DP specification and the structure of the PROFIBUS DP messages are defined in the International Standards:

- IEC 61158
“Digital data communications for measurement and control -
Fieldbus for use in industrial control systems”
Communication profile type 3
- IEC 61784
“Digital data communications for measurement and control”
Communication profile family CPF3/1

Validity

This manual is valid for the SIPROTEC device:

- 6MD662/3/4 (firmware version V4.20 or higher),
- 6MD662/3/4 (firmware version V4.70 or higher)
 - at use of the PROFIBUS DP redundancy function (ref. to chap. 1)

with

- PROFIBUS DP communication module, firmware version 03.00.03 or higher,
- PROFIBUS DP communication module, firmware version 04.50.02 or higher
 - at use of the PROFIBUS DP redundancy function (ref. to chap. 1).

For device parameterization have to be used:

- DIGSI 4.21 considering the preconditions explained in the manual “SIPROTEC Communication module, PROFIBUS DP - Communication profile” (ref. to page 3),
- DIGSI 4.30 or higher,
- DIGSI 4.40 or higher at use of
 - Transformer tap change commands (ref. to chap. 4.1.2) and
 - Transformer tap position indications (ref. to chap. 4.2.4),
- DIGSI 4.71 or higher at use of
 - the PROFIBUS DP redundancy function (ref. to chap. 1),
- PROFIBUS DP standard mappings 3-1 to 3-n (n = device type dependent number of standard mappings).

Additional Support

For questions regarding SIPROTEC4 devices, please contact your Siemens representative.

Training courses

Individual course offerings may be found in our Training Catalog and questions can be directed to our Training Centre. Please contact your Siemens representative.

Target audience

Protection engineers, commissioning engineers, personnel concerned with adjustment, checking and service of selective protective equipment, automatic and control facilities and personnel of electrical facilities and power plants.



Warning!

Hazardous voltages are present in this electrical equipment during operation. Non-observance of the safety rules can result in severe personal injury or property damage.

Only qualified personnel shall work on and around this equipment after becoming thoroughly familiar with all warnings and safety notices of this and the associated manuals as well as with the applicable safety regulations.

The successful and safe operation of this device is dependent on proper transport and storage, proper handling, installation, operation, and maintenance by qualified personnel under observance of all warnings and hints contained in this and the associated manuals.

In particular the general erection and safety regulations (e.g. IEC, EN, DIN, VDE, or other national and international standards) regarding the correct use of high-voltage installations must be observed. Non-observance can result in death, personal injury or substantial property damage.

QUALIFIED PERSONNEL

For the purpose of this manual and product labels, a qualified person is one who is familiar with the installation, construction and operation of the equipment and the hazards involved. In addition, he has the following qualifications:

- Is trained and authorized to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety practices.
- Is trained in the proper care and use of protective equipment in accordance with established safety practices.
- Is trained in rendering first aid.

Typographic and graphical conventions

The following text formats are used to identify concepts giving device information described by the text flow:

Parameter names, or identifiers for configuration or function parameters that appear in the device display or on the screen of a PC (with DIGSI) are shown in mono-script (same point size) bold text. This also applies to header bars for selection menus.

Parameter conditions, or possible settings of parameters that appear in the device display or on the screen of a PC (with DIGSI), are additionally shown in italic style. This also applies to selection items for selection menus.

„Indications“, or identifiers for information produced by the device or required by other devices or from the switchgear is shown in mono-script (same point size) and placed into quotation marks.

For diagrams in which the identifier type results from the representation itself, text conventions may differ from the above-mentioned.



Revision index

Listing of the changes between the editions of this manual:

Modified chapters / pages	Edition	Reasons of modification
	1.00	First edition, Doc.-No.: C53000-L1840-B011-03 Sept. 27 th , 2002
Chap. 1	2.00	<ul style="list-style-type: none">• new chapter "Redundant PROFIBUS DP interface"; the following chapter numbers moved up• new Standard mapping 3-3 (for the redundancy function) March 15 th , 2006
general Chap. 5	2.10	<ul style="list-style-type: none">• Standard mappings 3-1 and 3-2 also valid for 6MD662• new Standard mapping 3-4 (for redundancy function with 6MD663 and 6MD664) July 27 th , 2010



Table of contents

Preface	3
Revision index	7
1 Redundant PROFIBUS DP interface	13
1.1 Hardware requirements, Order options and Firmware compatibility	14
1.2 Redundancy concept.....	16
1.3 Parameterization	18
1.3.1 DIGSI.....	18
1.3.1.1 Procedure.....	18
1.3.1.2 Bus specific parameters	19
1.3.2 Module status indications	20
1.3.2.1 Error system interface	20
1.3.2.2 Assignable status indications	21
1.3.3 PROFIBUS DP master	21
1.4 Data areas and Diagnosis	22
1.4.1 Cyclic input and output data	22
1.4.1.1 Control_I byte	22
1.4.1.2 Control_I_1 byte	23
1.4.1.3 Control_O byte	24
1.4.1.4 Control_O_1 byte	24
1.4.2 Extended Slave_Diag diagnosis data.....	26
1.5 Module-specific information at the device display	28
1.5.1 Block 5: Status of the event list via PROFIBUS DP	28
1.5.2 Block 5: Redundancy status and Toggle bit timer	28
1.6 Redundancy behavior	33
1.6.1 Redundancy start-up	33
1.6.2 Redundancy switchover	34
1.6.3 Event list at redundancy	36
2 Data of the PROFIBUS DP messages	39
2.1 Explanations.....	40
2.2 Messages in output direction: PROFIBUS DP master to the SIPROTEC device	42

2.3	Messages in input direction: SIPROTEC device to the PROFIBUS DP master.....	43
2.3.1	Indications	43
2.3.2	Measured values	43
2.3.3	Metered measurands (Counters).....	45
2.3.3.1	Metering values	45
2.3.3.2	Impulse counters	46
2.4	Configuration data of the standard mappings.....	47
2.5	Notes to SIPROTEC objects.....	51
2.5.1	Control mode REMOTE	51
2.5.2	Stop data transmission	52
3	Standard mappings 3-1 and 3-3.....	53
3.1	Message in output direction.....	54
3.1.1	Event list	54
3.1.2	Double commands.....	54
3.1.3	Single commands and taggings.....	55
3.1.4	Control mode	57
3.2	Message in input direction.....	58
3.2.1	Indications	58
3.2.1.1	Double-point indications	58
3.2.1.2	Single-point indications and taggings	59
3.2.1.3	Device.....	60
3.2.1.4	Control Authority.....	61
3.2.2	Measured values	61
3.2.3	Metered measurands.....	61
3.2.4	Event list.....	62
4	Standard mapping 3-2	63
4.1	Message in output direction.....	64
4.1.1	Double commands.....	64
4.1.2	Transformer tap change commands.....	65
4.1.3	Single commands and taggings.....	65
4.1.4	Control mode	66
4.2	Message in input direction.....	67
4.2.1	Indications	67
4.2.1.1	Double-point indications	67
4.2.1.2	Single-point indications and taggings	68
4.2.1.3	Device.....	70
4.2.1.4	Control Authority.....	70
4.2.2	Measured values	71
4.2.3	Metered measurands.....	71
4.2.4	Transformer tap position indications.....	71

5	Standard mapping 3-4	73
5.1	Message in output direction.....	74
5.1.1	Event list.....	74
5.1.2	Single commands and taggings	74
5.1.3	Control mode.....	77
5.2	Message in input direction.....	78
5.2.1	Indications	78
5.2.1.1	Single-point indications and taggings.....	78
5.2.1.2	Device	80
5.2.1.3	Control Authority.....	81
5.2.2	Measured values	81
5.2.3	Metered measurands.....	81
5.2.4	Event list.....	82
	Glossary	83
	Index	85

Redundant PROFIBUS DP interface

6MD663 and 6MD664 devices can be equipped with a redundant PROFIBUS DP interface.

This chapter describes the hardware and software requirements necessary for it and explains the implemented redundancy concept as well as the data between the PROFIBUS DP master and slave which are required for the redundancy function.



Note:

The description of the redundant PROFIBUS DP interface requires knowledge of the SIPROTEC devices' standard PROFIBUS DP slave functions.

You find information about this in the manual "SIPROTEC Communication module, PROFIBUS DP - Communication profile" (ref. to page 3 for order number and sources of supply).

1.1	Hardware requirements, Order options and Firmware compatibility	14
1.2	Redundancy concept	16
1.3	Parameterization	18
1.4	Data areas and Diagnosis	22
1.5	Module-specific information at the device display	28
1.6	Redundancy behavior	33

1.1 Hardware requirements, Order options and Firmware compatibility

Two PROFIBUS communication modules are used for the redundant PROFIBUS DP slave of the 6MD663 and 6MD664 devices.

These two modules are installed on port B and port D of the SIPROTEC device (ref. to Figure 1-1).

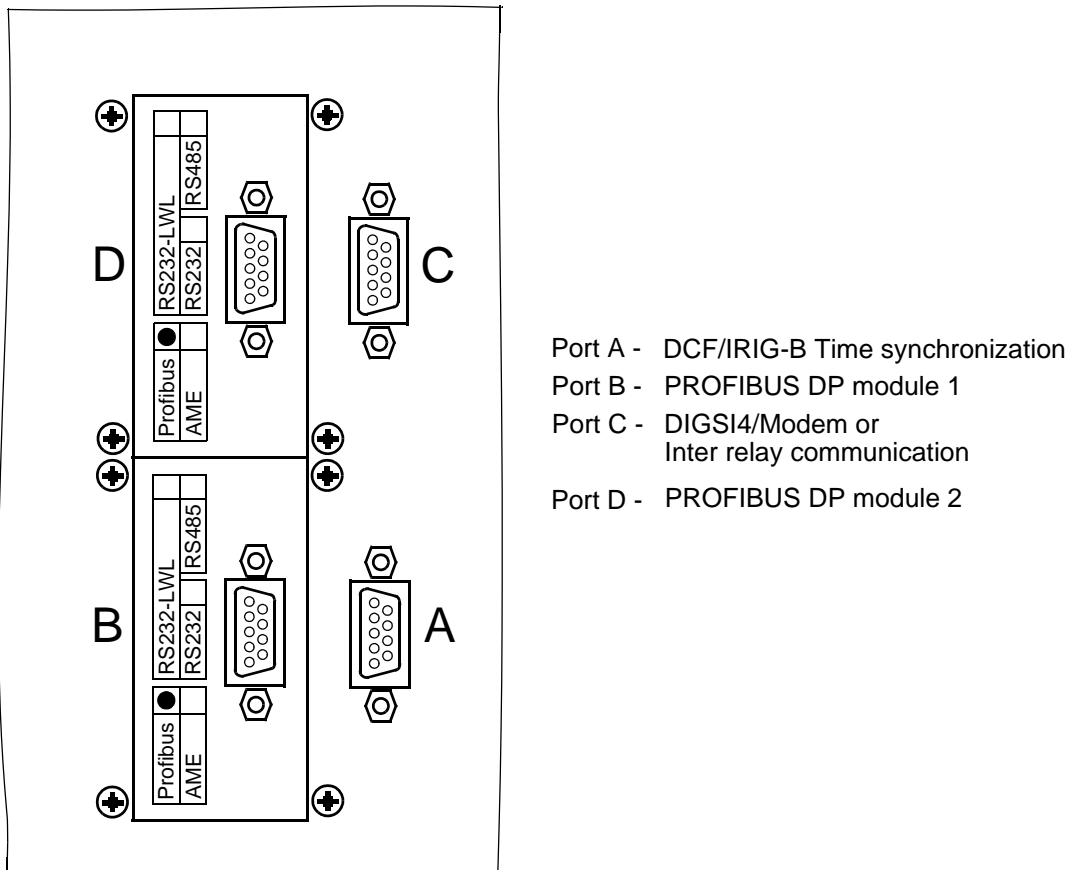


Figure 1-1 Communication interfaces at the rear panel of a device with redundant PROFIBUS DP RS485



Note:

The functionality of the redundant PROFIBUS DP interface only is possible with PROFIBUS communication modules from HW revision 4.

If devices with an already built-in PROFIBUS communication module HW revision 2 shall be retrofitted with a redundant PROFIBUS DP interface then this existing module also has to be replaced by a HW revision 4 module.

Additional information about the hardware releases of the communication modules you find in the manual "SIPROTEC Communication module, PROFIBUS DP - Communication profile".

Order options

Communication		11 th MLFB position	MLFB extension
PROFIBUS DP Standard	PROFIBUS DP Slave RS485 (PROFIBUS Module on Port B)	9	+L0A
	PROFIBUS DP Slave LWL 820 nm (PROFIBUS Module on Port B)	9	+L0B
PROFIBUS DP Redundancy	PROFIBUS DP Slave redundant RS485 (PROFIBUS Module on Port B and Port D)	9	+L1A
	PROFIBUS DP Slave redundant LWL 820 nm (PROFIBUS Module on Port B and Port D)	9	+L1B

Table 1-1 Order options for PROFIBUS DP communication

Example

MLFB (order number) for a 6MD664 device with the interfaces:

- PROFIBUS DP redundant RS485 (Port B and D; 11th MLFB position = 9 and MLFB extension = +L1A),
- Inter relay communication (Port C; 12th MLFB position = 4):
6MD6641-2EA**94**-0AA4 **+L1A**



Note:

Please ref. to the order code table of the 6MD66 devices for a description of the further MLFB positions.

The following MLFB options can not be ordered if the device shall be equipped with redundant PROFIBUS DP (PROFIBUS module on port B and port D):

- DIGSI 4, 820 nm LWL, Port D (12th MLFB position = 3 or 5)

Firmware compatibility

As minimal firmware versions for devices with redundant PROFIBUS DP are required:

- 6MD663/4 firmware version from V4.70,
- PROFIBUS DP communication firmware version from 04.50.02.

1.2 Redundancy concept

6MD663 and 6MD664 devices with redundant PROFIBUS DP interface are intended for use in a PROFIBUS DP communication system with system redundancy.

The remarkable features of system redundancy are:

- Redundant PROFIBUS DP master devices.
- Redundant field bus lines.
- Bay controller with redundant PROFIBUS DP slave interfaces.

System redundancy

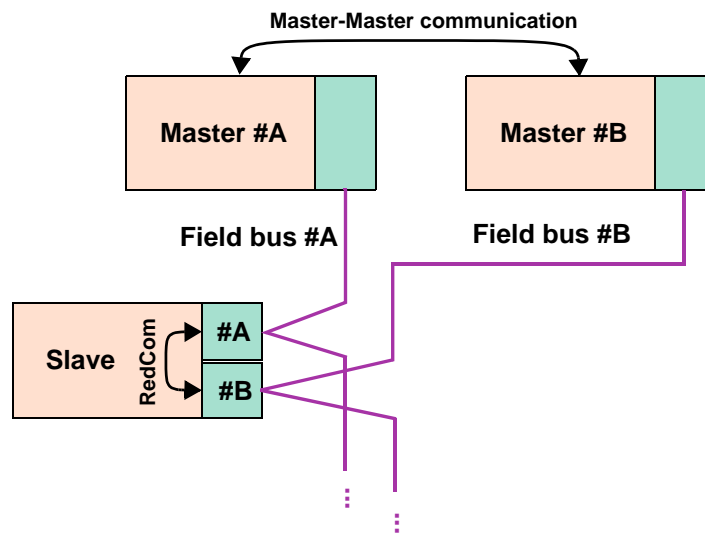


Figure 1-2 Components of a system-redundant communication system

During operation, one of the subsystems shown in Figure 1-2

- Master #A - Field bus #A - Slave interface #A or
- Master #B - Field bus #B - Slave interface #B

is in state PRIMARY (or process-controlling) whereas the other subsystem has the state BACKUP (or standby).

PRIMARY

The PRIMARY subsystem is the active one and has full access to the process.

Beside reading access, the PRIMARY master also can send output data to the bay unit as well as to the process, e.g.:

- command outputs and set-point values,
- time synchronization of the slave devices by the master,
- acknowledgment of read event list entries.

All these information and commands are evaluated by the PRIMARY slave interface and passed on to the bay unit or the process outputs.

BACKUP

In the BACKUP subsystem, the master device behaves passive in process direction.

Only read access of process data is possible for the BACKUP master.

All data in the output messages are rejected by the BACKUP slave interface.

A Master-Master communication¹ servers for comparison of the process images in the master devices and for mutual supervision.

In case of a failure of components in the current PRIMARY subsystem, the BACKUP system can take process control and become PRIMARY for its part (redundancy switchover).

Redundant slave

A redundant PROFIBUS DP slave (e.g. 6MD663 or 6MD664) which can be connected to the system-redundant communication as shown in Figure 1-2 has the following characteristics:

- The redundant slave consists of two independent PROFIBUS communication interfaces (which are redundant with respect to the protocol firmware and the hardware interface).
- It exists an internal communication channel (independent from PROFIBUS) between the two PROFIBUS communication interfaces of the redundant slave. This communication channel is described as RedCom subsequently and serves for exchanging of status information as well as for mutual supervision.
- Both slave interfaces have identical PROFIBUS addresses.
- One of the both slave interfaces works as PRIMARY, the other as BACKUP. Output data of the master device are only evaluated in PRIMARY state.

The decision if a slave interface can become PRIMARY depends on various factors:

- Communication status with the master device (“in data exchange” or “not connected”).
- PRIMARY/BACKUP state of the master device.
The master device must inform the slave about its state via PROFIBUS communication. In the implementation of the redundant slave of the SIPROTEC devices a byte in the data area of the cyclic data exchange message is used for that (ref. to chap. 1.4.1.4).
- Operating status of the partner module (partner interface) in the redundant slave. This contains both the current redundancy state (PRIMARY/BACKUP) and the hardware state (“operational” or “error”).
RedCom communication is used to determine the state of the partner module.

The behavior of the redundant slave of the SIPROTEC devices in case of redundancy start-up and redundancy switchover is described in chap. 1.6.

1. An arbitrary communication connection between the master devices.
Also a superordinated control system can do this task.

1.3 Parameterization

1.3.1 DIGSI

1.3.1.1 Procedure

Prerequisites For the parameterization of a 6MD663 or 6MD664 with redundant PROFIBUS DP have to be used:

- DIGSI 4.71 or higher,
- 6MD663/4 PROFIBUS DP standard mapping 3-3 or 3-4 (with redundancy support, ref. to chap. 3 and 5 for data size)

Module selection Figure 1-3 shows the system interface selection when a new device with redundant PROFIBUS DP RS485 (according to the device MLFB order number) is created in DIGSI.
Changing the system interface in DIGSI to redundant PROFIBUS DP for already existing devices is also possible considering the prerequisites discussed in chap. 1.1.

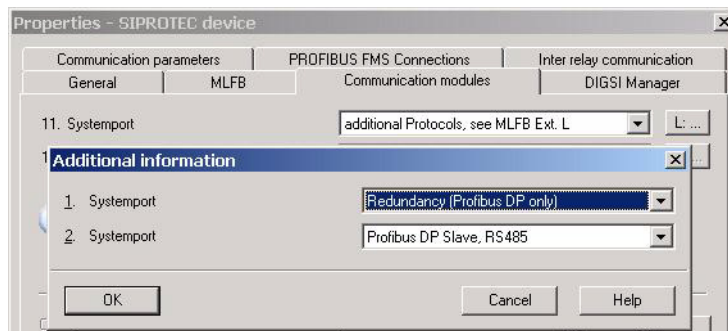


Figure 1-3 Selection of PROFIBUS DP RS485 redundant as system interface

Mapping file and allocation

The parameterization of a redundant PROFIBUS DP system interface does not differ from the steps which must be executed for a non-redundant PROFIBUS DP system interface. This includes the mapping file selection and the allocation of data objects as “Source system interface” and “Destination system interface”.

Please ref. to the manual “SIPROTEC Communication module, PROFIBUS DP - Communication profile”, chap. “PROFIBUS DP - Parameterization in DIGSI”, regarding information about the mapping file selection and the allocation of data objects.

During the device start-up, the SIPROTEC device firmware ensures that in case of a redundant PROFIBUS DP interface the parameter data (allocations and bus specific parameters) are loaded onto the two PROFIBUS DP modules. Both PROFIBUS DP interfaces of the redundant slave always have identical parameters with that.

The communication redundancy itself is transparent for the SIPROTEC device. All redundancy tasks are carried out by the PROFIBUS DP modules using the PRIMARY/BACKUP principle (ref. to chap. 1.2). Data from the device are transferred to both modules simultaneously. Commands to the device come only from the module which has the PRIMARY state.

1.3.1.2 Bus specific parameters

The chap. "Bus specific parameters" in the manual "SIPROTEC Communication module, PROFIBUS DP - Communication profile" describes the common settings for the serial PROFIBUS DP communication.
 In addition to this, further parameters are available if 6MD663/4 standard mapping 3-3 or 3-4 is selected.

PNO identification number

GlobalSection.DP_IdentNo

Here, the PNO identification number of the redundant PROFIBUS DP slave of the SIPROTEC devices has to be entered: 0x8138.

This must correspond to the GSD file which is used for parameterization in the PROFIBUS DP master (ref. to chap. 1.3.3).

Float to integer conversion for measured values

GlobalSection.DP_CountersWithStatus

Beside the activation of the status bits for counters (ref. to "SIPROTEC Communication module, PROFIBUS DP - Communication profile", chap. "Metered measurands"), this parameter also determines how the measured values are converted from the SIPROTEC internal float format to the integer format used for PROFIBUS DP.

The following table shows the valid values for this parameter.

Please ref. to the manual "SIPROTEC Communication module, PROFIBUS DP - Communication profile", chap. "Scaling of measured values", for general information about the conversion and scaling of measured values.

DP_CountersWithStatus	Status bit for counters	Float to integer conversion after multiplication with scaling factor
0	no	without rounding of the measured value
1	yes	without rounding of the measured value
16	no	with rounding of the measured value
17	yes	with rounding of the measured value

Table 1-2 Parameter DP_CountersWithStatus

The default value is 1.

Toggle bit timer reload value

GlobalSection.DP_Ttoggle

Reload value (in 100 ms) for the supervision timer of the Toggle bit mechanism (ref. to chap. 1.4.1.4).

The value 0 disables the Toggle bit mechanism.

If the reload value for the Toggle bit timer is less than the reload value for the PROFIBUS DP response monitoring timer¹ then the reload value of the Toggle bit timer is set equal to the reload value of the response monitoring timer in the module firmware.

The default value is 30 which corresponds to 3 seconds.

1. Response monitoring: PROFIBUS DP standard mechanism for communication supervision. The reload value for the response monitoring timer in the slave is calculated by the PROFIBUS DP master with the network size, the baud rate etc. This reload value then is sent as part of the Set_Prm telegram to the slave.

Maximum value of Start-up time

GlobalSection.DP_Red_TsprimMax

During the redundancy start-up until the initial PRIMARY/BACKUP decision by the PROFIBUS DP master, both modules have alternating the state S_PRIMARY and S_WAITING (ref. to chap. 1.6.1).

A state change between the modules is carried out after the time Tsprimary. Tsprimary starts at 2 s and will be increased by 2 s after each state change until the configured maximum value TsprimMax.

TsprimMax is entered in 100 ms steps.

If a value is entered which is not divisible by 2 seconds then TsprimMax is rounded up or down to the next 2 second value by the module firmware. All values less than 2 seconds (including 0) are treated as 2 seconds.

The default value is 20 which corresponds to 2 seconds.

Because this is equal to the Tsprimary start value, all 2 seconds a state change between S_PRIMARY and S_BACKUP is executed with the TsprimMax default value.

1.3.2 Module status indications

1.3.2.1 Error system interface

If PROFIBUS DP is selected as system interface then the tagging "SysIntErr" (Error System interface) is available in the device parameter set to signal a communication error to the PROFIBUS DP master.

The reaction of the SIPROTEC device to a communication interruption using the tagging "SysIntErr" is described in the manual "SIPROTEC Communication module, PROFIBUS DP - Communication profile", chap. "Communication interruption".

A redundant PROFIBUS DP slave differs from this behavior by the fact that only a communication error of both modules leads to set the tagging "SysIntErr":

	Module B Communication OK	Module B Communication error
Module D Communication OK	"SysIntErr" = OFF OK	"SysIntErr" = OFF OK
Module D Communication error	"SysIntErr" = OFF OK	"SysIntErr" = ON Error

Table 1-3 Tagging "SysIntErr"



Note:

If the Toggle bit mechanism is activated (Toggle bits, ref. to chap. 1.4.1.4) then a communication error also will be signaled (despite correct PROFIBUS DP data exchange):

- as long as the Toggle bit mechanism was not started by the master device,
- when the Toggle bit timer expires.

1.3.2.2 Assignable status indications

Redundant PROFIBUS DP modules provide the following additional status indications:

Indication	Byte offset	Bit mask
OLM status indication channel A from module on port B	65535	01(hex)
OLM status indication channel B from module on port B	65535	02(hex)
OLM status indication channel A from module on port D	65535	04(hex)
OLM status indication channel B from module on port D	65535	08(hex)
Module on port B is PRIMARY	65535	10(hex)
Module on port D is PRIMARY	65535	20(hex)

Table 1-4 Assignable module status indications

OLM status indications are only relevant if PROFIBUS DP modules with fibre-optical interface in ring topology are used.

If these indications have the value ON then a line-break in the optical channel to the neighboring devices is detected.

For the evaluation of the status indications shown in Table 1-4 they must be assigned to user-defined taggings in DIGSI.

The procedure to do this is described as an example for the OLM status indications from the module on port B in the manual "SIPROTEC Communication module, PROFIBUS DP - Communication profile", chap. "Signalling of line-breaks in a redundant fibre-optical ring".

1.3.3 PROFIBUS DP master

The following GSD file has to be used for the parameterization of the SIPROTEC devices with redundant PROFIBUS DP slave in the PROFIBUS DP master:

- GSD file "siem8138.gsd"
 - PNO identification number: 0x8138
 - Model name: "SIPROTEC4 DP Redundant".

Configuration data for the standard mappings 3-3 and 3-4 as well as the associated parameterization in the PROFIBUS DP master are described in chap. 2.4.

1.4 Data areas and Diagnosis

1.4.1 Cyclic input and output data

The cyclic messages of a redundant PROFIBUS DP slave interface of the SIPROTEC devices always contain (beside the current values of the input and output data) an event list for transmission of indications with time stamp (ref. to chap. 1.6.3).

The structure of a PROFIBUS DP telegram with event list is described in the manual “SIPROTEC Communication module, PROFIBUS DP - Communication profile”, chap. “Structure of a PROFIBUS DP telegram with event list” and is also valid for messages of the SIPROTEC devices with redundant PROFIBUS DP.

For the redundancy function, the before reserved “SPARE” bytes are used and now called “Control_I_1” as well as “Control_O_1” subsequently.

The meaning of the individual bits of the handshake and redundancy control bytes in output and input direction are summarized again in this chapter.

1.4.1.1 Control_I byte

Handshake byte for the event list.

Reference

Standard mappings 3-1 and 3-3, ref. to chap. 3.2.4
 Standard mapping 3-4, ref. to chap. 5.2.4

Bit assignment

Control_I							
7	6	5	4	3	2	1	0
Message block number				Buffer overflow	Message lost	reserved = 0	

 Bit position

 Meaning

Figure 1-4 Handshake byte “Control_I” (input direction)

Message block number

- With each transmission of the message blocks (entries from the event list, max. 3 entries per telegram), the message block number is increased sequentially by 1, starting with 1 (0001_{bin}) up to 15 (1111_{bin}), and thereafter starting with 1 again.
- The message block number only has the (initial) value 0 if following the initial or reboot of the SIPROTEC device no entries are available in the event list yet. After transmission of the first entry in the event list and the associated increment of the message block number, this number never assumes the value 0 again (unless another initial or reboot takes place).
- If the telegram contains none or less than 3 entries in the event list then the unused message blocks are completely filled up with zeros.

- If no indication changes were transmitted in the event list during a number of bus cycles then the message block number remains unchanged in its value during this time.
The same last transmitted message block number is transferred repeatedly until new entries in the event list also effect changes to the message blocks that are transferred, thereby incrementing the message block number.

Buffer overflow

A set bit indicates an overflow of the event list buffer.

The buffer overflow bit is reset following acknowledgement of the current transmitted message blocks if no new buffer overflow occurred in the meantime.

Message lost

This bit is only used with activated redundancy function (otherwise always = 0).

If a reset of one of the PROFIBUS DP modules occurs then the module restarts with an empty event list. If entries were contained before in the event list of this module then after the module restart there exists an inconsistency between the event lists of the two PROFIBUS DP modules in the device.

Also during the device start-up it may happen that one of the modules is updated and operational before the other one and just at this time an indication change is transmitted to the modules. But this indication change then only is entered in the event list of the already operational module.

Such an inconsistency of the event lists is recognized during module start-up using inter-module communication (RedCom).

If there are event list entries on the partner module which are not contained in the own event list then the bit "Message lost" is set.

This bit automatically is reset if

- the PROFIBUS DP master connected to this module is in PRIMARY state and has read and acknowledged an event list entry,
- both event lists are consistent again because all additional entries of the partner module were read.

1.4.1.2 Control_I_1 byte

Control byte for the redundancy function.

Reference

Standard mapping 3-3, ref. to chap. 3.2.4
Standard mapping 3-4, ref. to chap. 5.2.4

Bit assignment

Control_I_1							
7	6	5	4	3	2	1	0
reserved = 0				Slave Primary	Slave Backup	Toggle bits confirmation	

--- Bit position ---
--- Meaning ---

Figure 1-5 Control byte "Control_I_1" (input direction)

Slave Primary / Slave Backup

Bits 2 and 3 of the "Control_I_1" byte signal the redundancy state of the slave module to the PROFIBUS DP master. The following bit combinations are valid:

- Bit 3 = 0 and bit 2 = 1: Module is BACKUP or in redundancy start-up
- Bit 3 = 1 and bit 2 = 0: Module is PRIMARY

Toggle bit confirmation

The Toggle bits which were sent to the slave in the "Control_O_1" byte by the PROFIBUS DP master (ref. to chap. 1.4.1.4) are mirrored back in these bits.

1.4.1.3 Control_O byte

Handshake byte for the event list

Reference

Standard mapping 3-1 and 3-3, ref. to chap. 3.1.1
 Standard mapping 3-4, ref. to chap. 5.1.1

Bit assignment

Control_O							
7	6	5	4	3	2	1	0
Message block no.				reserved = 0			

 Bit position

 Meaning

Figure 1-6 Handshake byte "Control_O" (output direction)

Message block number

Acknowledgement of reception and evaluation of the message blocks.
 After evaluation of the message blocks, the PROFIBUS DP master copies the message block number from the handshake byte "Control_I" of the input telegram to the handshake byte "Control_O" of the output telegram.

1.4.1.4 Control_O_1 byte

Control byte for the redundancy function

Reference

Standard mapping 3-3, ref. to chap. 3.1.1
 Standard mapping 3-4, ref. to chap. 5.1.1

Bit assignment

Control_O_1							
7	6	5	4	3	2	1	0
reserved = 0				Master Primary	Master Backup	Toggle bits	

 Bit position

 Meaning

Figure 1-7 Control byte "Control_O_1" (Output direction)

**Master Primary /
Master Backup**

The PROFIBUS DP master sends its redundancy state to the slave using these two bits. This can initiate a redundancy switchover if it corresponds to the current state of the slave module.

- Bit 3 = 0 and bit 2 = 1: Master is BACKUP
- Bit 3 = 1 and Bit 2 = 0: Master is PRIMARY

If both bits are set identically (both equal 0 or both equal 1) then this is treated as “Master is BACKUP” by the slave.

Toggle bits

A watchdog timer in the PROFIBUS DP slave is used as the default mechanism for the supervision of the PROFIBUS DP communication.

This timer is loaded the first time¹ if the slave enters data exchange with the PROFIBUS DP master and will be re-triggered every time a telegram to the slave is received.

The watchdog timer expires in case of a communication interruption.

With that, the PROFIBUS DP slave can detect a communication failure and react on it if necessary.

An (optional) communication supervision on application level is implemented in the redundant PROFIBUS DP slave of the SIPROTEC devices in addition to the above mentioned response monitoring mechanism with the watchdog timer.

For this, the two Toggle bits in each of the bytes “Control_O_1” and “Control_I_1” are used.

These bits have to be toggled (from '10' to '01' or vice versa) at least ones in a pre-defined time period by the PROFIBUS DP master or the program in the PLC.

If an invalid bit combination '11' or '00' is received in the Toggle bits then this is treated as “not toggled”.

The slave mirrors the Toggle bits which were received in “Control_O_1” byte from the PROFIBUS DP master back to the master in the “Control_I_1” byte.

The time period within which the Toggle bits have to be changed can be set up during configuration of the bus specific parameters in DIGSI (ref. to chap. 1.3.1.2).

If no Toggle bit change to a valid bit combination is detected within the configured time period then this is treated as a communication failure:

- The slave leaves data exchange and expects new parameterization and configuration from the master.
- A redundancy switchover to BACKUP is executed if the module was PRIMARY till now.
- A communication failure is signaled to the device for this module.
The tagging “SysIntErr” will be set to ON in the device if the partner module also has communication interruption to its PROFIBUS DP master (ref. to chap. 1.3.2.1).

The Toggle bit supervision starts when after entering data exchange with the master a changeover from a valid Toggle bit combination to the other valid Toggle bit combination is detected by the PROFIBUS DP slave.

As long as the Toggle bit supervision is not started in the slave, a communication failure is signaled to the device for this module.

1. The reload value for this watchdog timer (response monitoring timer) is calculated by the PROFIBUS DP master with the network size, the baud rate etc. This reload value then is sent as part of the Set_Prm telegram to the slave.

1.4.2 Extended Slave_Diag diagnosis data

“Red_State” diagnosis

Every redundant PROFIBUS DP interface of the SIPROTEC devices provides six bytes standard diagnosis and additionally eight bytes extended diagnosis data.

The structure of this extended diagnosis data is defined as “Red_State” diagnosis in the PROFIBUS DP diagnosis Status Model and these data are sent with every Slave_Diag message to the PROFIBUS DP master.

Figure 1-8 shows the contents of the “Red_State” diagnosis structure. This structure contains information about the current status of the slave module which is connected to the PROFIBUS DP master as well as of the partner module in the redundant slave.

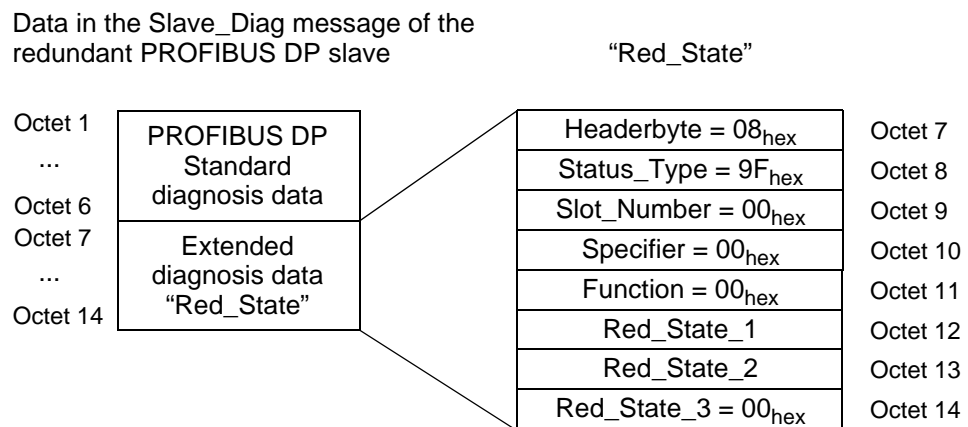


Figure 1-8 Data in the Slave_Diag message of the redundant slave of the SIPROTEC devices

- Octet 7: Headerbyte

Bits 7 and 6 indicate with the value '00' that it is a Device Related Diagnosis. Bits 5 to 0 contain the diagnosis block length including the Headerbyte (8 bytes).

- Octet 8: Status_Type

Bits 7 indicates with a '1' that it is a Status Model Diagnosis. The value 1F_{hex} in the bits 6 to 0 defines a “Red_State” diagnosis.

- Octet 9 to 11: Slot_Number, Specifier and Function

These three bytes are not used in the implementation of the redundant slave for SIPROTEC devices and always set to 00_{hex}.

- Octets 12 and 13: Red_State_1 and Red_State_2

Red_State_1 contains status information of the slave interface (PROFIBUS DP module) which sends the diagnosis data. Red_State_2 contains status information from the partner module in the SIPROTEC device.

The meaning of the individual bits in this byte are explained in Figure 1-9.

- Octet 14: Red_State_3

This application-specific byte is not used in the implementation of the redundant slave for SIPROTEC devices and always set to 00_{hex}.

Red_State_1 / Red_State_2							
7	6	5	4	3	2	1	0
reserved (= 0)	not used (= 0)	Baudrate found	Master_State_Clear	Data_Exchange	HW-Defect	Primary	Backup

- - - - -
 Bit position
 - - - - -
 - - - - -
 Meaning
 - - - - -

Figure 1-9 Red_State_1 and Red_State_2 bytes

- Backup and Primary

During the redundancy start-up, these two bits remain '00' until the initial PRIMARY/BACKUP decision has taken place (ref. to chap. 1.6.1).

Then, depending on the redundancy state of the slave interface, the bit "Primary" is sent as '1' and "Backup" as '0' or vice versa.

A set bit for "Backup" means that the slave interface is neither in redundancy start-up nor in the PRIMARY state. The module then is in one of the Backup states (BACKUP, PB_Switchover, ...).

The value '1' will never be sent for the two bits at the same time.

- HW-Defect

If an error in the RedCom communication between the both PROFIBUS DP modules in the SIPROTEC device is recognized then this bit is set in the Red_State_2 byte. This also includes a failure of the partner module itself.

When this bit is set then all other bits in Red_State_2 are irrelevant.

- Data_Exchange

A set bit indicates that the slave interface is in data exchange with the PROFIBUS DP master.

- Master_State_Clear

The bit has the value '1' if the PROFIBUS DP master sends Clear_Data.

- Baudrate found

The baud rate (data transmission rate) of the PROFIBUS DP master was recognized.

1.5 Module-specific information at the device display

The display of module-specific information is accessible with the following menu items or buttons:

- Module B**
- MENU
 - Test/Diagnose → 5
 - Modulinfos → 5
 - Port B → 1

- Module D**
- MENU
 - Test/Diagnose → 5
 - Modulinfos → 5
 - Port D → 3

General module-specific information blocks are described in the manual “SIPROTEC Communication module, PROFIBUS DP - Communication profile”, chap. “Display of module-specific information at the SIPROTEC device”.

1.5.1 Block 5: Status of the event list via PROFIBUS DP

EvEntr In addition to the number of event list entries, the status “Message lost” (ref. to chap. 1.4.1.1) is shown in this line, e.g.:

EvEntr: 12/3, ELost

1.5.2 Block 5: Redundancy status and Toggle bit timer

In addition to the module information blocks 1 to 5, a new block 6 is available for each module in a device with redundant PROFIBUS DP to show redundancy status and Toggle bit timer information.

RedSta: PRIMARY	
RedMSt: PRIMARY	
RedDia: 2Ah, 29h	
RedCoT: Chk.req	56
RedCoR: Chk.cnf	56
RedTrc: 0.30s,0	N
RedTsp: 2s,46	R
Ttogg1: 3.0s,0	R

Block 6:
Redundancy status and Toggle bit timer
Block 6 is available only for devices with redundant PROFIBUS DP slave.

Figure 1-10 Module-specific information - Redundancy status and Toggle bit timer

RedSta

Redundancy state of the PROFIBUS DP module:

State	Explanation
S_PRIMARY	State during redundancy start-up (ref. to chap. 1.6). The module can become the PRIMARY one and waits for the PRIMARY state from the PROFIBUS DP master. If the master does not send PRIMARY then the module state changes to S_WAITING after expiring of Tsprimary (see below, RedTsp). The partner module then changes to the S_PRIMARY state and is ready for the time Tsprimary to become the PRIMARY one.
S_WAITING	State during redundancy start-up (ref. to chap. 1.6). The module waits for a telegram from the partner module via RedCom to either become S_PRIMARY or BACKUP. If the PROFIBUS DP master of the partner module became PRIMARY then the module changes to BACKUP after receiving the telegram, otherwise to S_PRIMARY.
BACKUP	The PROFIBUS DP slave module can be in data exchange with the master but there is no evaluation of output data from the master device.
PRIMARY	The PROFIBUS DP slave module is in data exchange with the master and receives the PRIMARY state from the master device. All data in the output telegram from the master are evaluated and passed on to the SIPROTEC device.
PB_Switchov	State during redundancy switchover from PRIMARY to BACKUP. The module shall change to BACKUP but the state PRIMARY is still received from the master (e.g. if both master devices are PRIMARY).
PB_PartnAck	State during redundancy switchover from PRIMARY to BACKUP. The module shall change to BACKUP, has sent a Switchover.req telegram (ref. to Table 1-7) via RedCom to the partner module and now is waiting for a response (Switchover.cnf) from the partner module.
BP_Switchov	State during redundancy switchover from BACKUP to PRIMARY. The module shall change to PRIMARY but the state BACKUP is still received from the master (e.g. if both master devices are BACKUP).
BP_PartnAck	State during redundancy switchover from BACKUP to PRIMARY. The module shall change to PRIMARY, has sent a Switchover.req telegram (ref. to Table 1-7) via RedCom to the partner module and now is waiting for a response (Switchover.cnf) from the partner module.

Table 1-5 Redundancy states of a PROFIBUS DP slave interface

**Note:**

Output data and time synchronization messages from the master device are only evaluated by the PROFIBUS DP slave in PRIMARY state.

RedMSt

Redundancy state of the PROFIBUS DP master.

The redundancy state of the PROFIBUS DP master comes from the "Control_O_1" byte in the output telegram (ref. to chap. 1.4.1.4).

State	Explanation
UNKNOWN	The state can not be determined because PROFIBUS DP master and slave are not in data exchange (communication interruption or the like).
UNDEFINED	The redundancy state bits of the master in "Control_O_1" are undefined. (bit 3 = 0 and bit 2 = 0 or bit 3 = 1 and bit 2 = 1)
PRIMARY	PROFIBUS DP master is PRIMARY. (bit 3 = 1 and bit 2 = 0 in "Control_O_1") If the Toggle bit mechanism was activated in the parameterization then also the first changeover from a valid Toggle bit combination to the other valid Toggle bit combination was recognized and the Toggle bit timer is running.
BACKUP	PROFIBUS DP master is BACKUP. (bit 3 = 0 and bit 2 = 1 in "Control_O_1")
T_PRIMARY	PROFIBUS DP master is PRIMARY. (bit 3 = 1 and bit 2 = 0 in "Control_O_1") The Toggle bit mechanism was activated in the parameterization but is still not started (first changeover from a valid Toggle bit combination to the other one is still not recognized). The slave remains in BACKUP although the master sends PRIMARY.

Table 1-6 Redundancy state of the PROFIBUS DP master

RedDia

The bytes "Red_State_1" and "Red_State_2" which belong to the "Red_State" diagnosis data are shown.

The meaning of the individual bits in these bytes is explained in chap. 1.4.2.

RedCoT

The last telegram which was sent via RedCom communication to the partner module is shown.

A byte value at the end of this line counts the number of telegrams sent via RedCom. This telegram counter is increased by 1 after each telegram up to the value 255 and then starts again with 0.

Telegram type	Explanation
SwO.req	Switchover.req (Switchover request) Redundancy switchover request to the partner module (ref. to chap. 1.6).
SwO.cnf	Switchover.cnf (Switchover confirmation) Confirmation from partner module that a redundancy switchover of the PROFIBUS DP slave can be executed.
Chk.req	Check.req (Check request) Telegram to the partner module for RedCom communication check and inter-module supervision.
Chk.cnf	Check.cnf (Check confirmation) Response from the partner module to a Check.req. RedCom is OK.

Telegram type	Explanation
Red.sta	Red State Changed One or more status information which are part of the extended "Red_State" diagnosis data (e.g. "Baudrate found" or "Master_State_Clear", ref. to chap 1.4.2) have changed. The changed status information is transferred with this RedCom telegram to the partner module in order to update the "Red_State_2" byte of the "Red_State" diagnosis.
EvL.Del	Event List Delete Entry Event list entries on the PRIMARY module of the PROFIBUS DP slave have been read, acknowledged by the master and deleted from the event list. An identification number of the read entries is sent to the BACKUP module with this telegram in order to delete these entries in the event list of the BACKUP module too (ref. to chap. 1.6.3).
EvL.SqN	Event List Sequence Number If a module becomes PRIMARY then it sends the sequence number which is used in the next transmission of event list entries to the PROFIBUS DP master for the comparison to the partner module.

Table 1-7 RedCom telegram types

RedCoR

The last telegram which was received via RedCom communication from the partner module is shown.

A byte value at the end of this line counts the number of telegrams received via RedCom. This telegram counter is increased by 1 after each telegram up to the value 255 and then starts again with 0.

RedTrc

Tredcom supervision time.

Tredcom is started with each telegram which was sent to the partner module via RedCom. When the reply from the partner module is received, Tredcom is stopped and reloaded again.

The Tredcom reload value is 0.3 seconds (not changeable).

This module information line shows:

- the current Tredcom timer value,
- a counter of Tredcom expiries and
- an indication whether Tredcom is currently running (N = not running, R = running).

If the expiring counter is not equal to 0 then this indicates an error in the internal RedCom communication.

RedTsp

During redundancy start-up:

- Start-up time $T_{sprimary}$, i.e. the timer period within which a slave interface keeps the S_PRIMARY state (ref. to chap. 1.6.1).
 $T_{sprimary}$ starts at 2 s and will be increased by 2 s after each state change until the configured maximum value $T_{sprimMax}$. $T_{sprimMax}$ can be selected during set up of bus specific parameters in DIGSI (ref. to chap. 1.3.1.2).

After redundancy start-up:

- Time until the next Check.req telegram is sent for supervision of the RedCom communication and the partner module .
The reload value for the timer of Check.req. telegrams is 5 seconds (not changeable).

This module information line shows:

- the current timer value,
- an expiring counter,
- an indication whether the timer is currently running (N = not running, R = running).

Unlike RedTrc (see above), the expiring counter in the RedTsp line should be incremented cyclically. This shows that the next action (e.g. switchover to S_BACKUP or sending of a Check.req telegram) is executed.

Ttoggl

Supervision time of the Toggle bit mechanism.

Every changeover of the Toggle bits in the output telegram to a valid bit combination re-triggers the Toggle bit timer.

This module information line shows:

- the current timer value,
- an expiring counter,
- an indication whether the timer (i.e. the Toggle bit mechanism) is currently running (N = not running, R = running).

Please ref. to chap. 1.4.1.4 for a description of the Toggle bit mechanism.

If the Toggle bit mechanism is deactivated, then this is shown in this line as:

Ttoggl: OFF

1.6 Redundancy behavior

1.6.1 Redundancy start-up

After switching on or reset the SIPROTEC device and after the bus specific parameters and data assignments were transferred to the PROFIBUS DP modules (ref. to chap. 1.3.1.1), the redundant slave is in the redundancy start-up.

During the redundancy start-up, the slave interfaces have alternating the state S_PRIMARY and S_WAITING. The module on port B always starts with S_PRIMARY and the module on port D with S_WAITING.

A start-up timer with the time Tsprimary is started on the module which has the S_PRIMARY state.

After expiry of Tsprimary, a switchover of the redundancy state is executed via Red-Com communication (ref. to chap. 1.2).

The module, which now became S_PRIMARY, starts again the start-up timer and a further redundancy state switchover will be executed after Tsprimary expires.

Tsprimary starts at 2 s and is increased by 2 s after each state change until the configured maximum value TsprimMax.

TsprimMax can be selected during set up of bus specific parameters in DIGSI (ref. to chap. 1.3.1.2).

It is the aim of this procedure to make the decision which module becomes PRIMARY first.

Only if the following prerequisites are fulfilled, the redundancy start-up will be finished and a module becomes the PRIMARY one:

- The PROFIBUS DP communication start-up between the master device and the slave interface was completed successfully. Master and slave are in data exchange.
- The PROFIBUS DP master is PRIMARY and it sends the PRIMARY state via "Control_O_1" to the slave interface (ref. to chap. 1.4.1.4).
- The PROFIBUS DP module currently has the state S_PRIMARY.

An (simplified) example for a redundancy start-up is shown in Figure 1-11.

As the result in this example the PROFIBUS DP module on port D becomes PRIMARY and the module on port B becomes BACKUP.

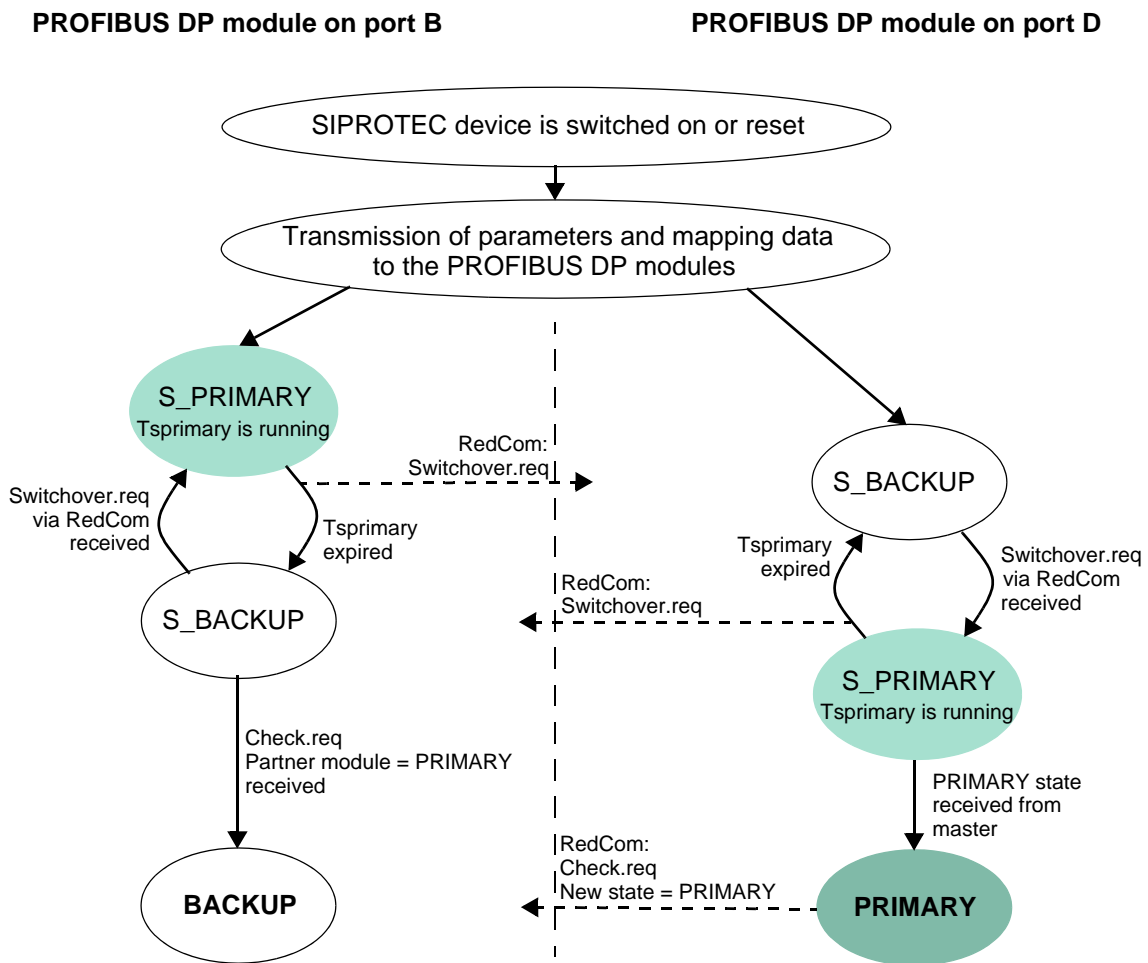


Figure 1-11 Example of a redundancy start-up with the result: Module D becomes PRIMARY

1.6.2 Redundancy switchover

The following conditions lead to a redundancy switchover of the slave interface:

1. Switchover request from the PROFIBUS DP master
 - The master signals in "Control_O_1" (ref. to chap. 1.4.1.4) a redundancy state change.
2. Communication interruption of the PRIMARY module to the master
 - An error in the PROFIBUS DP master device or in the communication line (line-break or the like).
 - The slave interface recognizes this situation by expiry of the response monitoring timer or the Toggle bit timer (Toggle bits, ref. to chap. 1.4.1.4).
3. Error in the PRIMARY slave interface
 - An internal error in the PROFIBUS DP module which currently is PRIMARY. This situation is recognized by the PROFIBUS DP master as a communication interruption and leads (depending on the master) to a redundancy switchover request.

Every redundancy switchover always includes an internal communication via Red-Com between the both modules of the redundant slave in order to ensure that both modules never become PRIMARY at the same time.

Beside PRIMARY and BACKUP, the slave interfaces pass at least one intermediate state during a redundancy switchover.

In these intermediate states

- PB_Switchover or PB_Partner_Ack during switchover from PRIMARY to BACKUP
- BP_Switchover or BP_Partner_Ack during switchover from BACKUP to PRIMARY

the modules wait for a response to a switchover request which was sent to the partner module via RedCom or for a state change of the master device.

There is no evaluation of output data from the PROFIBUS DP master in the intermediate states, i.e. they behave like the BACKUP state.

The current redundancy states of the PROFIBUS DP modules on port B and port D are shown in the module-specific information at the device display (ref. to chap. 1.5). All possible redundancy states are described in Table 1-5.

Figure 1-12 shows a simplified state diagram of the redundancy switchover.

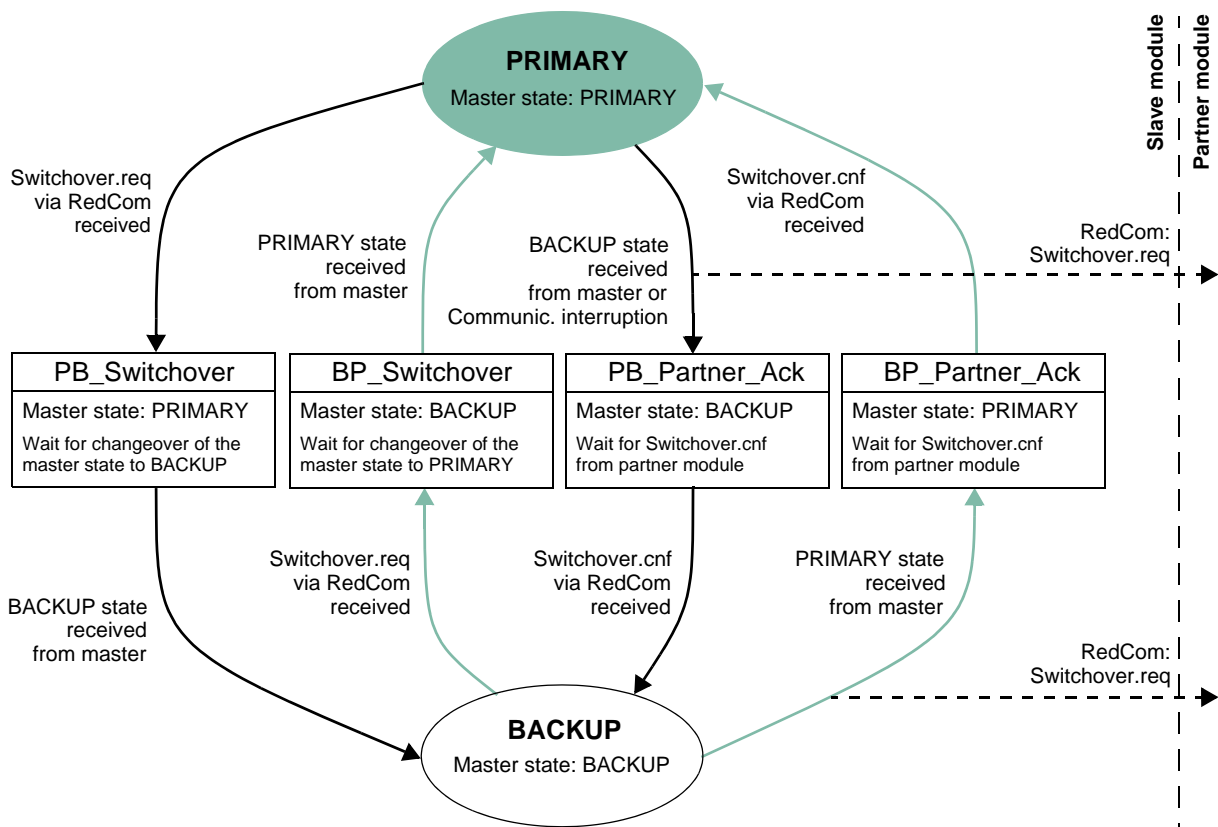


Figure 1-12 Redundancy switchover state diagram (simplified)



Note:

- The PRIMARY state from the master can only be received by the slave if PROFIBUS DP master and slave are in data exchange because the master state is transmitted in the cyclic data messages (byte "Control_O_1", ref. to chap. 1.4.1.4). This also means:
 - A slave module never can become PRIMARY if it is not in data exchange with the master.
 - A communication interruption of the PRIMARY channel always includes a redundancy switchover to BACKUP because the PRIMARY state from the master then is not received any more.
 - Only one slave module has the PRIMARY state even if both PROFIBUS DP masters are PRIMARY at the same time.
 - When a slave module after a redundancy switchover becomes PRIMARY then the output data at this time are regarded as changed and will be passed on to the SIPROTEC device.
 - If there is an error in the RedCom communication, then both slave modules behave independently and both modules also can become PRIMARY. An error in the RedCom communication or in one of the modules can be detected by the master using extended diagnosis data (ref. to chap. 1.4.2, bit "HW-Defect").
-

1.6.3 Event list at redundancy

Every redundant PROFIBUS DP of the SIPROTEC devices also contains an event list for transmission of indications with time stamp.

The mechanism for reading event list entries as well as the event list data types are described in the manual "SIPROTEC Communication module, PROFIBUS DP - Communication profile", chap. "Event list via PROFIBUS DP".

This chapter contains additional information which has to be observed if the event list is used in redundant communication systems.

Summary of the event list's principle

The event list is a ring buffer¹ which exists on each module. Every change of an indication which has to be transmitted via PROFIBUS DP also is entered with an identification, the current value and the time stamp into the event list buffer.

In the cyclic input telegram to the master, an area for the transmission of three event list entries is reserved.

If there are entries in the event list ring buffer then the (max. three) oldest entries are copied in the input telegram and the sequence number in the "Control_I" byte (ref. to chap. 1.4.1.1) is incremented.

The master now recognizes with the new sequence number that new event list entries were sent. After that, it evaluates the entries and acknowledges the reading by copying the sequence number in the "Control_O" byte of the output telegram (ref. to chap. 1.4.1.3).

1. The size of the ring buffer (max. number of entries in the event list) can be defined in the range of 10 to 1000 during configuration of the bus specific parameters in DIGSI. The default value is 500.

The read entries then will be deleted from the event list buffer on the PROFIBUS DP module and the next (max. three) entries can be copied to the input telegram and sent to the master with an incremented sequence number.

Two PROFIBUS DP modules

Two event lists (one on each module) exist in a redundant PROFIBUS DP slave with two PROFIBUS DP communication modules in a SIPROTEC device. Indication changes are transferred to both modules and there are entered in the event list as well as in the input telegram to the master (including an incremented sequence number).

But only one module can evaluate the confirmation that the master has read the event list entries because (according PRIMARY/BACKUP concept)

- only one of the PROFIBUS DP modules has the PRIMARY state,
- output data from the master are only evaluated in PRIMARY state.

Therefore, an additional internal acknowledgement way exists from the PRIMARY module to the BACKUP module via RedCom for event list entries which were read by the PRIMARY master.

Event list mechanism and redundancy

The behavior of the event list mechanism in a redundant system is explained in the following.

To this we assume as a starting point that the event lists on the two modules do not contain any entries.

1. An indication change is transferred to both PROFIBUS DP modules by the SIPROTEC device.
Every indication gets an unique (internal) identification number before transmission which also is transmitted to the modules.
2. The PROFIBUS DP modules enter the indication change into the event list buffer, copy it in the associated area of the input telegram and increment the sequence number.
3. Both PROFIBUS DP masters recognize that a new event list entry is transmitted. They read the entry and copy the sequence number in the output telegram.
4. After the sequence number receipt from the master is received, the PRIMARY slave module deletes the entry from its event list buffer.
Because the BACKUP slave module does not evaluate the output data from the master, the entry there remains in the event list buffer and in the input telegram.
5. The PRIMARY module now sends via RedCom a receipt to the BACKUP module that this event list entry was read and evaluated in the PRIMARY sub-system and therefore also can be deleted in the BACKUP sub-system (Event List Delete, ref. to Table 1-7).
In the RedCom telegram, the (internal) identification numbers serve as references.
6. The BACKUP slave module now deletes the entry which was indicated in the RedCom telegram from its event list buffer.
7. PRIMARY and BACKUP modules now check whether further entries exist in their event list. The next (max. three) entries then can be copied in the input telegram (including incrementing of the sequence number).

The described mechanism does not presuppose that the BACKUP master gives a receipt for reading the event list entries (see above, point 3.).
It is also possible that the BACKUP master behaves passively or that there is not a communication with the BACKUP master.



Note:

If a BACKUP slave module becomes PRIMARY because of a redundancy switchover and it has not got a receipt via RedCom to the event list entries which currently are being sent to the master then the same event list entries are sent again to the master with a new incremented sequence number.

This ensures that no event list entries are lost during a redundancy switchover.

If the BACKUP module can not find the entries in its event list which are contained in the RedCom telegram from the PRIMARY module then the bit "Message lost" in the "Control_" byte of the input telegram is set.

Possible reasons for this and conditions to reset the bit are explained in chap. 1.4.1.4.



Data of the PROFIBUS DP messages

This chapter delivers explanations to the data descriptions of the standard mappings as well as notes for evaluation of selected SIPROTEC objects and for the configuration of the standard mapping in the PROFIBUS DP master.

2.1	Explanations	40
2.2	Messages in output direction: PROFIBUS DP master to the SIPROTEC device	42
2.3	Messages in input direction: SIPROTEC device to the PROFIBUS DP master	43
2.4	Configuration data of the standard mappings	47
2.5	Notes to SIPROTEC objects	51

2.1 Explanations



Note:

The examples shown in this chapter 2.1 do not necessarily correspond to the real allocation of the objects in the bus mapping.

Chapter 3 to 5 define the data area of the PROFIBUS DP messages for data transfer between the PROFIBUS DP slave of the SIPROTEC device 6MD662/3/4 and the PROFIBUS DP master.

The columns "Designation of the SIPROTEC objects" contain the texts of the SIPROTEC objects for "US English" device language.

The listed SIPROTEC objects in the PROFIBUS DP messages' data area are sorted after byte offset, beginning with 0.

Variables with data type greater than or equal to 1 byte

The offset defines the start of the most significant byte in the message, e.g.:

Offset	Designation of the SIPROTEC objects	Comments	Scaling (32767 corresponds to...)	Internal object no.
10	3P1_V1 =	3P1 Phase to Earth Voltage V1	3276.7	-

The measured value "3P1_V1" is assigned to data byte 10 (most significant byte of the measured value) and data byte 11 (least significant byte of the measured value) in the PROFIBUS DP message

Bit variables (SP/SC, DP/DC)

The offset indicates the byte which contains the bit value and the position of bit 0 of the bit variable, e.g. (input message):

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
0 / 0	Q0 OFF	Circuit breaker Q0	-
0 / 1	Q0 ON		

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
9 / 5	Cntrl Auth	Control Authority (0 = Remote, 1 = Local)	-

The checkback signal from the circuit breaker (as double-point indication) is located in data byte 0, bit position 2^0 (bit 0) and 2^1 (bit 1).

The single-point indication "Cntrl Auth" is located in byte 9, bit position 2^5 .



Note:

In the manual "SIPROTEC Communication module, PROFIBUS DP - Communication profile" (ref. to page 3) you find:

- Definition of the data types (single-point indication, double-point indication, measured value etc.),
 - Description of the event list via PROFIBUS DP (handshake bytes, message blocks etc.),
 - Notes for parameterization in DIGSI.
-

2.2 Messages in output direction: PROFIBUS DP master to the SIPROTEC device

The messages in PROFIBUS DP output direction (ref to chap. 3.1, 4.1 and 5.1) allow:

- command outputs through the output relays of the SIPROTEC devices (external commands),
- manipulation of taggings (internal commands).



Note:

- The allocation of the output relays to the switching devices and to the output channels is defined during parameterization of the SIPROTEC devices.
 - Depending on the device composition there may be less than indicated output relays (and corresponding PROFIBUS DP message positions) available in the SIPROTEC device.
-

2.3 Messages in input direction: SIPROTEC device to the PROFIBUS DP master

The messages in PROFIBUS DP input direction (ref. to chap. 3.2, 4.2 and 5.2) allow:

- Interrogation of switchgear status and binary inputs,
- Transmission of indications, measured values and counters (metering values) to the PROFIBUS DP master.

2.3.1 Indications



Note:

- The allocation of the input channels to the binary inputs is defined during parameterization of the devices.
- Depending on the device composition and version (ordering code) not all of the indicated binary inputs or indications (and corresponding PROFIBUS DP message positions) may be available in the SIPROTEC device.

2.3.2 Measured values



Note:

- Depending on the device composition, the version (ordering code) and the selected transducer modules not all of the indicated analog inputs (and corresponding PROFIBUS DP message positions) may be available in the SIPROTEC device.

Scaling

The following must be entered when applying the settings for a measured value in DIGSI:

- Dimension, Conversion factor and the Number of decimal places after the decimal point in the dialog window **Measured value description** for conversion of the measured value to a primary value,
- Additionally: Type, Scaling factor and Zero offset are determined by selection of the Scaling index if the measured value is transmitted as "Destination system interface" (for a description of the routing and allocation to the system interface refer to "SIPROTEC Communication module, PROFIBUS DP - Communication profile").

Measured values are transmitted via PROFIBUS DP as 16-bit integer values (range: +/- 32767).

The selection of Type determines whether the measured value is transmitted as primary, secondary or percentage value via PROFIBUS DP.

When transmitted as primary value, the Conversion factor indicated in the **Measured value description** is used to calculate the primary value.

Only few measured values (e.g. measured values obtained via transducer input) can be transmitted as secondary values. The conversion factor is determined automatically.

In order to transmit also fractional digits in the 16-bit integer value via PROFIBUS DP, a `Scaling factor` (a multiple of 10) is used. During the conversion from the internal IEEE-Float format used in the SIPROTEC devices to the 16-bit integer value a multiplication with the `Scaling factor` takes place.

The PROFIBUS DP master must consider the chosen `Scaling factor` when evaluating the received measured value.

Example

The following is set in the **Measured value description** for "3P1_V1":

- Dimension: kV
- Conversion factor (100 % correspond to): 63.5085
- No. of decimal places: 2

The number of decimal places is used for displaying the value on the device display and is of no consequence for the transmission via PROFIBUS DP.

A selection of the `Scaling factor` (see below) determines the number of decimal places significant for transfer via PROFIBUS DP.

Measured value dimensions are not transmitted via PROFIBUS DP.

The selected dimension (in this case: kV) must be indicated to the PROFIBUS DP master for each measured value.

When allocating the measured value as "Destination system interface", the following was selected:

- `Scaling index`: 1

which implies:

- Type: Primary value
- `Scaling factor`: 10
- Zero offset: 0

For transmission of "3P1_V1" via PROFIBUS DP this means:

- The measured value is transmitted as a primary value. The above mentioned conversion factor of "100 % correspond to 63.5085" is used in the conversion.
- In the 16-bit integer value that is transmitted via PROFIBUS DP, one decimal place is implied as a result of the `Scaling factor` equal 10 used in this example.

If for example 87.3 % of the nominal voltage (100 % value) is present, then the PROFIBUS DP master receives the following value:

$$(0.873 * 63.5085 * 10)_{\text{integer}} = (554.41)_{\text{integer}} = 554$$

which based on the above mentioned settings is to be interpreted as:

55.4 kV

**Note:**

- Changes to the routing and scaling of measured values are possible for adaption to the actual requirements in the substation.
For information in this regard refer to the manual "SIPROTEC Communication module, PROFIBUS DP - Communication profile" (on page 3).
- If measured values other than the pre-defined default values are to be transmitted via PROFIBUS DP, then the position of the measured value that is not required in the PROFIBUS-DP telegram must be made available by removing the cross ("X") in the associated column "Destination system interface" of the **DIGSI configuration matrix**.
- Further information regarding configuration of measured values may be found in the 6MD662/3/4 device manual.

2.3.3 Metered measurands (Counters)

2.3.3.1 Metering values

In the 6MD662/3/4 the metering values (e.g. Wp+, Wq+, Wp-, Wq-) must be:

- Entered and allocated in the **DIGSI configuration matrix** to:
 - a measured value (e.g. "3P1_P"),
 - "Destination system interface" and if required
 - "Metered value window".

Furthermore, associated parameters (Conversion factor, Restore trigger and Energy flow direction) must be set in the dialog window **Object properties** of the metered value.

Scaling

The scaling of the metered values which are derived from measured values are based on:

60000 impulse per hour corresponds to

$$V = V_{100\%} \text{ and } I = I_{100\%} \text{ or}$$

$$P = P_{100\%} \text{ or } Q = Q_{100\%}$$

$V_{100\%}$, $I_{100\%}$ = 100 % value of the measured current in voltage,

$P_{100\%}$, $Q_{100\%}$ = 100 % value of the real or reactive power.

Conversion factor

Metered values are transmitted via PROFIBUS DP as "pulse counts" based on the above mentioned scaling.

A conversion factor must be indicated to the PROFIBUS DP master with which the number of pulse counts are converted to energy values (e.g. MWh).

This conversion factor which is set during the configuration of the metered values in DIGSI is used for displaying the metered values in the 6MD662/3/4 and must also be used for the conversion in the PROFIBUS DP master.

Example

The 100 % values for currents and voltages in a substation are as follows:

$$I_{100\%} = 20 \text{ kA and } V_{PhPh/100\%} = 110 \text{ kV}$$

The 100 % value of the real power "3P1_P" therefore is:

$$I_{100\%} * V_{PhPh/100\%} * \sqrt{3} = 3810.5 \text{ MW}$$

A metered value "Wp+" (energy flow direction = forward) is created in DIGSI and allocated to "3P_1P".

This metered value provides 60000 pulses per hour if, during this time, 100 % of "3P_1P" is present.

One counter impulse therefore corresponds to:

$$"3P_1P"_{100\%} / 60000 \text{ imp./h} = 3810.5 \text{ MW} / 60000 \text{ imp./h} = 0.06351 \text{ MWh/imp.}$$

This factor has to be entered in DIGSI in the **Measured value description** as **Conversion factor** and to be used for the conversion of the metered measurand in the PROFIBUS DP master.

If the PROFIBUS DP master receives e.g. the value 43768 then this corresponds to:

$$43768 \text{ imp.} * 0.06351 \text{ MWh/imp.} = 2779.6 \text{ MWh}$$

Restore trigger mode

The **Restore trigger mode** (cyclic, with or without erasing) and **Time interval** must be set for the counters with DIGSI.

For transmitting counters via PROFIBUS DP the following is recommended:

- **Restore trigger:** cyclic,
- **Restore type:** without deleting,
- **Time interval:** 1 min.

2.3.3.2 Impulse counters

Scaling of the counter values derived via binary input (impulse counters) is dependent on the external source of the impulses.



Note:

Refer to the 6MD662/3/4 device manual for further information regarding configuration of the counters.

2.4 Configuration data of the standard mappings

There are three standard mappings (standard mapping 3-1 to standard mapping 3-4) available for the SIPROTEC device 6MD662/3/4 which differ in the available data size of the PROFIBUS DP messages.

If the 6MD663 or 6MD664 is used with a redundant PROFIBUS DP interface (ref. to chap. 1) then standard mapping 3-3 or 3-4 has to be selected.

Standard mapping 3-1

The standard mapping 3-1 contains:

Output direction:

- Handshake byte for event list via PROFIBUS DP
- 11 Double commands
- 37 Single commands

Input direction:

- 11 Double-point indications
- 58 Single-point indications
- 10 Measured values (integer)
- 4 Metered measurands (counters, unsigned long)
- Handshake byte and three message blocks for event list via PROFIBUS DP

Standard mapping 3-2

The standard mapping 3-2 contains:

Output direction:

- 14 Double commands
- 24 Single commands
- 2 Transformer tap change commands

Input direction:

- 14 Double-point indications
- 84 Single-point indications
- 13 Measured values (integer)
- 4 Metered measurands (counters, unsigned long)
- 2 Transformer tap position indications

**Standard mapping
3-3**

Standard mapping 3-3 is used together with the redundant PROFIBUS DP interface of the devices 6MD663 or 6MD664 (ref. to chap. 1). It contains the same data size as standard mapping 3-1. The additional control bytes for the redundancy function are arranged on byte offsets which are reserved in standard mapping 3-1.

The standard mapping 3-3 contains:

Output direction:

- Handshake byte for event list via PROFIBUS DP
- Control byte for the redundancy function
- 11 Double commands
- 37 Single commands

Input direction:

- 11 Double-point indications
- 58 Single-point indications
- 10 Measured values (integer)
- 4 Metered measurands (counters, unsigned long)
- Handshake byte and three message blocks for event list via PROFIBUS DP
- Control byte for the redundancy function

**Standard mapping
3-4**

Standard mapping 3-4 is used together with the redundant PROFIBUS DP interface of the devices 6MD663 or 6MD664 (ref. to chap. 1).

The standard mapping 3-4 contains:

Output direction:

- Handshake byte for event list via PROFIBUS DP
- Control byte for the redundancy function
- 48 Single commands

Input direction:

- 80 Single-point indications
- 10 Measured values (integer)
- 4 Metered measurands (counters, unsigned long)
- Handshake byte and three message blocks for event list via PROFIBUS DP
- Control byte for the redundancy function

Configuration data*Standard mapping 3-1: 1FH 1FH 1DH DFH 2DH*

(78 bytes input-, 14 bytes output direction)

Standard mapping 3-2: 1FH 1FH 1FH 19H 29H

(58 bytes input-, 10 bytes output direction)

Standard mapping 3-3: 1FH 1FH 1DH DFH 2DH

(78 bytes input-, 14 bytes output direction)

Standard mapping 3-4: 1FH 1FH 1DH DFH 2DH

(78 bytes input-, 14 bytes output direction)

PROFIBUS DP master

At the configuration of a PROFIBUS DP slave of the SIPROTEC devices in the parameterization system of the PROFIBUS DP masters are to select the following modules for the 6MD662/3/4 standard mappings and to allocate associated addresses in the I/O addressing range of the PROFIBUS DP master:

Standard mapping 3-1:

Module	Order number	Input address	Output address
0	Input - 16 Bytes	Adr_lx	
1	Input - 16 Bytes	Adr_lx + 16	
2	Input - 14 Bytes	Adr_lx + 32	
3	Input - 16 Words, consistent	Adr_lx + 46	
4	Output - 14 Bytes		Adr_Ox

Standard mapping 3-2:

Module	Order number	Input address	Output address
0	Input - 16 Bytes	Adr_lx	
1	Input - 16 Bytes	Adr_lx + 16	
2	Input - 16 Bytes	Adr_lx + 32	
3	Input - 10 Bytes	Adr_lx + 48	
4	Output - 10 Bytes		Adr_Ox

Standard mapping 3-3:

Module	Order number	Input address	Output address
0	Input - 16 Bytes	Adr_lx	
1	Input - 16 Bytes	Adr_lx + 16	
2	Input - 14 Bytes	Adr_lx + 32	
3	Input - 16 Words, consistent	Adr_lx + 46	
4	Output - 14 Bytes		Adr_Ox

Standard mapping 3-4:

Module	Order number	Input address	Output address
0	Input - 16 Bytes	Adr_Ix	
1	Input - 16 Bytes	Adr_Ix + 16	
2	Input - 14 Bytes	Adr_Ix + 32	
3	Input - 16 Words, consistent	Adr_Ix + 46	
4	Output - 14 Bytes		Adr_Ox

Adr_Ix and Adr_Ox indicate arbitrary (as a rule even) addresses in the I/O addressing range of the PROFIBUS DP master.

Adr_Ix (base address of the inputs) is identical with offset 0 of the PROFIBUS DP message data of the SIPROTEC device in input direction (ref. to chap. 3.2, 4.2 and 5.2).

Adr_Ox (base address of the outputs) is identical with offset 0 of the PROFIBUS DP message data of the SIPROTEC device in output direction (ref. to chap. 3.1, 4.1 and 5.1).

2.5 Notes to SIPROTEC objects

This chapter contains notes for the use and evaluation of certain SIPROTEC objects.



Note:

- The description of the standard mappings (ref. to chap. 3 to 5) contains the pre-allocation of the mapping files at delivery or at first assignment of a mapping in DIGSI to the SIPROTEC device.
- Changes of the allocation and the scaling of the measured values are possible in adaptation to the concrete installation environment.
You find information about this in the manual "SIPROTEC Communication module, PROFIBUS DP - Communication profile" (ref. to page 3).

2.5.1 Control mode REMOTE

Control mode with control authority is REMOTE, option of unlocked control with PROFIBUS DP.

- Changing the "Control mode REMOTE" to UNLOCKED permits one unlocked control operation via PROFIBUS DP.
After execution of the command, the "Control mode REMOTE" in the SIPROTEC device will automatically be reset to LOCKED.
- A programmed test "Switch in position" for unlocked control operations will always be executed.
- If, after changing the "Control mode REMOTE" to UNLOCKED, no command is received via PROFIBUS DP for a period of 5 minutes, then the "Control mode REMOTE" is automatically reset to LOCKED.
- If the "Control mode REMOTE" was automatically reset to LOCKED by the SIPROTEC device then this status can be recognized by the corresponding bit in the PROFIBUS DP input message.
In this case the status of "Control mode REMOTE" in output direction has to be updated by the PROFIBUS DP master.

References

Standard mapping 3-1: ref. to chap. 3.1.4

Standard mapping 3-2: ref. to chap. 4.1.4

Standard mapping 3-3: ref. to chap. 3.1.4

Standard mapping 3-4: ref. to chap. 5.1.3

2.5.2 Stop data transmission

The functionality "Stop data transmission" is not supported via PROFIBUS DP communication.

If "Stop data transmission" is active, nevertheless data via PROFIBUS DP will be transmitted furthermore.

The indication "DataStop" signals the activation of "Stop data transmission" however and can be evaluated correspondingly in the PROFIBUS DP master.

References

Standard mapping 3-1: ref. to chap. 3.2.1.3

Standard mapping 3-2: ref. to chap. 4.2.1.3

Standard mapping 3-3: ref. to chap. 3.2.1.3

Standard mapping 3-4: ref. to chap. 5.2.1.2



Standard mappings 3-1 and 3-3

This chapter describes the data in the PROFIBUS DP messages between the PROFIBUS DP master and the SIPROTEC device 6MD662/3/4 if standard mapping 3-1 or 3-3 is selected.

Standard mapping 3-3 has to be used together with the redundant PROFIBUS DP interface of the devices 6MD663 or 6MD664 (ref. to chap. 1).

It contains the same data size as standard mapping 3-1.

The additional control bytes for the redundancy function are arranged on byte offsets which are reserved in standard mapping 3-1.

3.1	Message in output direction	54
3.2	Message in input direction	58

3.1 Message in output direction

3.1.1 Event list

- Information regarding the handshake bytes as well as the retrieval methods of the event list via PROFIBUS DP can be found in the manual “SIPROTEC Communication module, PROFIBUS DP - Communication profile”.
- Ref. to chap. 1.4.1.4 for notes regarding the redundancy function control byte.

Offset	Designation	Comments	Internal object no.
0	Control_O	Handshake byte for event list via PROFIBUS DP	-
1	SPARE Control_O_1	Standardmapping 3-1: reserved for future use (the value at this position is ignored) Standard mapping 3-3: Control byte for redundancy function	-

3.1.2 Double commands

- Double commands can be routed on these positions as “Source system interface” using the **DIGSI Configuration matrix**.

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
2 / 0	<user-defined> OFF	not pre-allocated	-
2 / 1	<user-defined> ON		
2 / 2	<user-defined> OFF	not pre-allocated	-
2 / 3	<user-defined> ON		
2 / 4	<user-defined> OFF	not pre-allocated	-
2 / 5	<user-defined> ON		
2 / 6	<user-defined> OFF	not pre-allocated	-
2 / 7	<user-defined> ON		
3 / 0	<user-defined> OFF	not pre-allocated	-
3 / 1	<user-defined> ON		
3 / 2	<user-defined> OFF	not pre-allocated	-
3 / 3	<user-defined> ON		
3 / 4	<user-defined> OFF	not pre-allocated	-
3 / 5	<user-defined> ON		
3 / 6	<user-defined> OFF	not pre-allocated	-
3 / 7	<user-defined> ON		

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
4 / 0	<user-defined> OFF	not pre-allocated	-
4 / 1	<user-defined> ON		
4 / 2	<user-defined> OFF	not pre-allocated	-
4 / 3	<user-defined> ON		
4 / 4	<user-defined> OFF	not pre-allocated	-
4 / 5	<user-defined> ON		

3.1.3 Single commands and taggings

- Single commands and taggings can be routed on these positions as “Source system interface” using the **DIGSI Configuration matrix**.

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
4 / 6	<user-defined> OFF	not pre-allocated	-
4 / 7	<user-defined> ON		
5 / 0	<user-defined> OFF	not pre-allocated	-
5 / 1	<user-defined> ON		
5 / 2	<user-defined> OFF	not pre-allocated	-
5 / 3	<user-defined> ON		
5 / 4	<user-defined> OFF	not pre-allocated	-
5 / 5	<user-defined> ON		
5 / 6	<user-defined> OFF	not pre-allocated	-
5 / 7	<user-defined> ON		
6 / 0	<user-defined> OFF	not pre-allocated	-
6 / 1	<user-defined> ON		
6 / 2	<user-defined> OFF	not pre-allocated	-
6 / 3	<user-defined> ON		
6 / 4	<user-defined> OFF	not pre-allocated	-
6 / 5	<user-defined> ON		
6 / 6	<user-defined> OFF	not pre-allocated	-
6 / 7	<user-defined> ON		
7 / 0	<user-defined> OFF	not pre-allocated	-
7 / 1	<user-defined> ON		
7 / 2	<user-defined> OFF	not pre-allocated	-
7 / 3	<user-defined> ON		
7 / 4	<user-defined> OFF	not pre-allocated	-
7 / 5	<user-defined> ON		

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
7 / 6	<user-defined> OFF	not pre-allocated	-
7 / 7	<user-defined> ON		
8 / 0	<user-defined> OFF	not pre-allocated	-
8 / 1	<user-defined> ON		
8 / 2	<user-defined> OFF	not pre-allocated	-
8 / 3	<user-defined> ON		
8 / 4	<user-defined> OFF	not pre-allocated	-
8 / 5	<user-defined> ON		
8 / 6	<user-defined> OFF	not pre-allocated	-
8 / 7	<user-defined> ON		
9 / 0	<user-defined> OFF	not pre-allocated	-
9 / 1	<user-defined> ON		
9 / 2	<user-defined> OFF	not pre-allocated	-
9 / 3	<user-defined> ON		
9 / 4	<user-defined> OFF	not pre-allocated	-
9 / 5	<user-defined> ON		
9 / 6	<user-defined> OFF	not pre-allocated	-
9 / 7	<user-defined> ON		
10 / 0	<user-defined> OFF	not pre-allocated	-
10 / 1	<user-defined> ON		
10 / 2	<user-defined> OFF	not pre-allocated	-
10 / 3	<user-defined> ON		
10 / 4	<user-defined> OFF	not pre-allocated	-
10 / 5	<user-defined> ON		
10 / 6	<user-defined> OFF	not pre-allocated	-
10 / 7	<user-defined> ON		
11 / 0	<user-defined> OFF	not pre-allocated	-
11 / 1	<user-defined> ON		
11 / 2	<user-defined> OFF	not pre-allocated	-
11 / 3	<user-defined> ON		
11 / 4	<user-defined> OFF	not pre-allocated	-
11 / 5	<user-defined> ON		
11 / 6	<user-defined> OFF	not pre-allocated	-
11 / 7	<user-defined> ON		
12 / 0	<user-defined> OFF	not pre-allocated	-
12 / 1	<user-defined> ON		
12 / 2	<user-defined> OFF	not pre-allocated	-
12 / 3	<user-defined> ON		

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
12 / 4	<user-defined> OFF	not pre-allocated	-
12 / 5	<user-defined> ON		
12 / 6	<user-defined> OFF	not pre-allocated	-
12 / 7	<user-defined> ON		
13 / 0	<user-defined> OFF	not pre-allocated	-
13 / 1	<user-defined> ON		
13 / 2	<user-defined> OFF	not pre-allocated	-
13 / 3	<user-defined> ON		
13 / 4	<user-defined> OFF	not pre-allocated	-
13 / 5	<user-defined> ON		

3.1.4 Control mode

- Ref. to chap. 2.5.1 for notes regarding "Control mode REMOTE".

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
13 / 6	ModeREMOTE LOCKED	Control mode REMOTE = LOCKED	-
13 / 7	ModeREMOTE UNLOCKED	Control mode REMOTE = UNLOCKED	

3.2 Message in input direction

3.2.1 Indications

3.2.1.1 Double-point indications

- Double-point indications (e.g. checkback signals of double commands) can be routed on these positions as “Destination system interface” using the **DIGSI Configuration matrix**.

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
0 / 0	<user-defined> OFF	not pre-allocated	-
0 / 1	<user-defined> ON		
0 / 2	<user-defined> OFF	not pre-allocated	-
0 / 3	<user-defined> ON		
0 / 4	<user-defined> OFF	not pre-allocated	-
0 / 5	<user-defined> ON		
0 / 6	<user-defined> OFF	not pre-allocated	-
0 / 7	<user-defined> ON		
1 / 0	<user-defined> OFF	not pre-allocated	-
1 / 1	<user-defined> ON		
1 / 2	<user-defined> OFF	not pre-allocated	-
1 / 3	<user-defined> ON		
1 / 4	<user-defined> OFF	not pre-allocated	-
1 / 5	<user-defined> ON		
1 / 6	<user-defined> OFF	not pre-allocated	-
1 / 7	<user-defined> ON		
2 / 0	<user-defined> OFF	not pre-allocated	-
2 / 1	<user-defined> ON		
2 / 2	<user-defined> OFF	not pre-allocated	-
2 / 3	<user-defined> ON		
2 / 4	<user-defined> OFF	not pre-allocated	-
2 / 5	<user-defined> ON		

3.2.1.2 Single-point indications and taggings

- Single-point indications and taggings can be routed on these positions as “Destination system interface” using the **DIGSI Configuration matrix**.

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
2 / 6	<user-defined>	not pre-allocated	-
2 / 7	<user-defined>	not pre-allocated	-
3 / 0	<user-defined>	not pre-allocated	-
3 / 1	<user-defined>	not pre-allocated	-
3 / 2	<user-defined>	not pre-allocated	-
3 / 3	<user-defined>	not pre-allocated	-
3 / 4	<user-defined>	not pre-allocated	-
3 / 5	<user-defined>	not pre-allocated	-
3 / 6	<user-defined>	not pre-allocated	-
3 / 7	<user-defined>	not pre-allocated	-
4 / 0	<user-defined>	not pre-allocated	-
4 / 1	<user-defined>	not pre-allocated	-
4 / 2	<user-defined>	not pre-allocated	-
4 / 3	<user-defined>	not pre-allocated	-
4 / 4	<user-defined>	not pre-allocated	-
4 / 5	<user-defined>	not pre-allocated	-
4 / 6	<user-defined>	not pre-allocated	-
4 / 7	<user-defined>	not pre-allocated	-
5 / 0	<user-defined>	not pre-allocated	-
5 / 1	<user-defined>	not pre-allocated	-
5 / 2	<user-defined>	not pre-allocated	-
5 / 3	<user-defined>	not pre-allocated	-
5 / 4	<user-defined>	not pre-allocated	-
5 / 5	<user-defined>	not pre-allocated	-
5 / 6	<user-defined>	not pre-allocated	-
5 / 7	<user-defined>	not pre-allocated	-
6 / 0	<user-defined>	not pre-allocated	-
6 / 1	<user-defined>	not pre-allocated	-
6 / 2	<user-defined>	not pre-allocated	-
6 / 3	<user-defined>	not pre-allocated	-
6 / 4	<user-defined>	not pre-allocated	-
6 / 5	<user-defined>	not pre-allocated	-
6 / 6	<user-defined>	not pre-allocated	-
6 / 7	<user-defined>	not pre-allocated	-

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
7 / 0	<user-defined>	not pre-allocated	-
7 / 1	<user-defined>	not pre-allocated	-
7 / 2	<user-defined>	not pre-allocated	-
7 / 3	<user-defined>	not pre-allocated	-
7 / 4	<user-defined>	not pre-allocated	-
7 / 5	<user-defined>	not pre-allocated	-
7 / 6	<user-defined>	not pre-allocated	-
7 / 7	<user-defined>	not pre-allocated	-
8 / 0	<user-defined>	not pre-allocated	-
8 / 1	<user-defined>	not pre-allocated	-

3.2.1.3 Device

- Ref. to chap. 2.5.2 for notes regarding "Stop data transmission".

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
8 / 2	<user-defined>	not pre-allocated	-
8 / 3	<user-defined>	not pre-allocated	-
8 / 4	<user-defined>	not pre-allocated	-
8 / 5	<user-defined>	not pre-allocated	-
8 / 6	<user-defined>	not pre-allocated	-
8 / 7	<user-defined>	not pre-allocated	-
9 / 0	<user-defined>	not pre-allocated	-
9 / 1	<user-defined>	not pre-allocated	-
9 / 2	DataStop	1 = "Stop data transmission" is active	-
9 / 3	Test mode	1 = Test mode is active	-
9 / 4	Data valid	1 = Data in the PROFIBUS DP message are valid. (This indication is created by the PROFIBUS DP slave; not available in DIGSI and not relocatable.)	-

3.2.1.4 Control Authority

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
9 / 5	Cntrl Auth	Control authority (0 = REMOTE, 1 = LOCAL)	-
9 / 6	ModeLOCAL	Control mode LOCAL (0 = LOCKED, 1 = UNLOCKED)	-
9 / 7	ModeREMOTE	Control mode REMOTE (0 = LOCKED , 1 = UNLOCKED)	-

3.2.2 Measured values

- Ref. to chap. 2.3.2 for notes regarding scaling of measured values.

Offset	Designation of the SIPROTEC objects	Comments	Scaling (32767 corresponds to ...)	Transmission as
10	3P1_V1 =	3P1 Phase to Earth Voltage V1	3276.7	Primary value
12	3P1_V2 =	3P1 Phase to Earth Voltage V2	3276.7	Primary value
14	3P1_V3 =	3P1 Phase to Earth Voltage V3	3276.7	Primary value
16	3P1_I1 =	3P1 Phase Current I1	3276.7	Primary value
18	3P1_I2 =	3P1 Phase Current I2	3276.7	Primary value
20	3P1_I3 =	3P1 Phase Current I3	3276.7	Primary value
22	3P1_P =	3P1 Active Power Three Phase	3276.7	Primary value
24	3P1_Q =	3P1 Reactive Power Three Phase	3276.7	Primary value
26	3P1_f =	3P1 Frequency	3276.7	Primary value
28	3P1_cosPhi =	3P1 Active Power Factor Three Phase	32.767	Primary value

3.2.3 Metered measurands

- Ref. to chap. 2.3.3 for notes regarding routing and scaling of metered measurands.

Offset	Designation of the SIPROTEC objects	Comments	Scaling ($2^{31}-1$ corresponds to ...)	Internal object no.
30	<user-defined>	not pre-allocated	$2^{31}-1$ impulses	-
34	<user-defined>	not pre-allocated	$2^{31}-1$ impulses	-
38	<user-defined>	not pre-allocated	$2^{31}-1$ impulses	-
42	<user-defined>	not pre-allocated	$2^{31}-1$ impulses	-

3.2.4 Event list

- Information regarding the handshake bytes as well as the retrieval methods of the event list via PROFIBUS DP can be found in the manual “SIPROTEC Communication module, PROFIBUS DP - Communication profile”.
- Ref. to chap. 1.4.1.2 for notes regarding the redundancy function control byte.

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
46	Control_I	Handshake byte for event list via PROFIBUS DP	-
47	SPARE Control_I_1	Standardmapping 3-1: reserved for future use (the value 0 is transferred at this position) Standard mapping 3-3: Control byte for redundancy function	-
48	Message block #1	Identification #1	-
49		Value #1	
50		Time stamp #1	
57			
58	Message block #2	Identification #2	-
59		Value #2	
60		Time stamp #2	
67			
68	Message block #3	Identification #3	-
69		Value #3	
70		Time stamp #3	
77			



Standard mapping 3-2

This chapter describes the data in the PROFIBUS DP messages between the PROFIBUS DP master and the SIPROTEC device 6MD662/3/4 if standard mapping 3-2 is selected.

4.1	Message in output direction	64
4.2	Message in input direction	67

4.1 Message in output direction

4.1.1 Double commands

- User-defined double commands can be routed on the positions <user-defined> as “Source system interface” using the **DIGSI Configuration matrix**.

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
0 / 0	Q0 OFF	Circuit breaker Q0	-
0 / 1	Q0 ON		
0 / 2	Q1 OFF	Bus disconnecter Q1	-
0 / 3	Q1 ON		
0 / 4	Q2 OFF	Bus disconnecter Q2	-
0 / 5	Q2 ON		
0 / 6	Q8 OFF	Earthing isolator Q8	-
0 / 7	Q8 ON		
1 / 0	Q9 OFF	Feeder disconnecter Q9	-
1 / 1	Q9 ON		
1 / 2	<user-defined> OFF	not pre-allocated	-
1 / 3	<user-defined> ON		
1 / 4	<user-defined> OFF	not pre-allocated	-
1 / 5	<user-defined> ON		
1 / 6	<user-defined> OFF	not pre-allocated	-
1 / 7	<user-defined> ON		
2 / 0	<user-defined> OFF	not pre-allocated	-
2 / 1	<user-defined> ON		
2 / 2	<user-defined> OFF	not pre-allocated	-
2 / 3	<user-defined> ON		
2 / 4	<user-defined> OFF	not pre-allocated	-
2 / 5	<user-defined> ON		
2 / 6	<user-defined> OFF	not pre-allocated	-
2 / 7	<user-defined> ON		
3 / 0	<user-defined> OFF	not pre-allocated	-
3 / 1	<user-defined> ON		
3 / 2	<user-defined> OFF	not pre-allocated	-
3 / 3	<user-defined> ON		

4.1.2 Transformer tap change commands

- Transformer tap change commands can be routed on these positions as “Source system interface” using the **DIGSI Configuration matrix**.

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
3 / 4	<user-defined> LOWER	not pre-allocated	-
3 / 5	<user-defined> RAISE		
3 / 6	<user-defined> LOWER	not pre-allocated	-
3 / 7	<user-defined> RAISE		

4.1.3 Single commands and taggings

- Single commands and taggings can be routed on these positions as “Source system interface” using the **DIGSI Configuration matrix**.

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
4 / 0	<user-defined> OFF	not pre-allocated	-
4 / 1	<user-defined> ON		
4 / 2	<user-defined> OFF	not pre-allocated	-
4 / 3	<user-defined> ON		
4 / 4	<user-defined> OFF	not pre-allocated	-
4 / 5	<user-defined> ON		
4 / 6	<user-defined> OFF	not pre-allocated	-
4 / 7	<user-defined> ON		
5 / 0	<user-defined> OFF	not pre-allocated	-
5 / 1	<user-defined> ON		
5 / 2	<user-defined> OFF	not pre-allocated	-
5 / 3	<user-defined> ON		
5 / 4	<user-defined> OFF	not pre-allocated	-
5 / 5	<user-defined> ON		
5 / 6	<user-defined> OFF	not pre-allocated	-
5 / 7	<user-defined> ON		
6 / 0	<user-defined> OFF	not pre-allocated	-
6 / 1	<user-defined> ON		
6 / 2	<user-defined> OFF	not pre-allocated	-
6 / 3	<user-defined> ON		
6 / 4	<user-defined> OFF	not pre-allocated	-
6 / 5	<user-defined> ON		

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
6 / 6	<user-defined> OFF	not pre-allocated	-
6 / 7	<user-defined> ON		
7 / 0	<user-defined> OFF	not pre-allocated	-
7 / 1	<user-defined> ON		
7 / 2	<user-defined> OFF	not pre-allocated	-
7 / 3	<user-defined> ON		
7 / 4	<user-defined> OFF	not pre-allocated	-
7 / 5	<user-defined> ON		
7 / 6	<user-defined> OFF	not pre-allocated	-
7 / 7	<user-defined> ON		
8 / 0	<user-defined> OFF	not pre-allocated	-
8 / 1	<user-defined> ON		
8 / 2	<user-defined> OFF	not pre-allocated	-
8 / 3	<user-defined> ON		
8 / 4	<user-defined> OFF	not pre-allocated	-
8 / 5	<user-defined> ON		
8 / 6	<user-defined> OFF	not pre-allocated	-
8 / 7	<user-defined> ON		
9 / 0	<user-defined> OFF	not pre-allocated	-
9 / 1	<user-defined> ON		
9 / 2	<user-defined> OFF	not pre-allocated	-
9 / 3	<user-defined> ON		
9 / 4	<user-defined> OFF	not pre-allocated	-
9 / 5	<user-defined> ON		

4.1.4 Control mode

- Ref. to chap. 2.5.1 for notes regarding “Control mode REMOTE”.

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
9 / 6	ModeREMOTE LOCKED	Control mode REMOTE = LOCKED	-
9 / 7	ModeREMOTE UNLOCKED	Control mode REMOTE = UNLOCKED	

4.2 Message in input direction

4.2.1 Indications

4.2.1.1 Double-point indications

- Double-point indications (e.g. checkback signals of double commands) can be routed on these positions as “Destination system interface” using the **DIGSI Configuration matrix**.

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
0 / 0	Q0 OFF	Circuit breaker Q0	-
0 / 1	Q0 ON		
0 / 2	Q1 OFF	Bus disconnecter Q1	-
0 / 3	Q1 ON		
0 / 4	Q2 OFF	Bus disconnecter Q2	-
0 / 5	Q2 ON		
0 / 6	Q8 OFF	Earthing isolator Q8	-
0 / 7	Q8 ON		
1 / 0	Q9 OFF	Feeder disconnecter Q9	-
1 / 1	Q9 ON		
1 / 2	<user-defined> OFF	not pre-allocated	-
1 / 3	<user-defined> ON		
1 / 4	<user-defined> OFF	not pre-allocated	-
1 / 5	<user-defined> ON		
1 / 6	<user-defined> OFF	not pre-allocated	-
1 / 7	<user-defined> ON		
2 / 0	<user-defined> OFF	not pre-allocated	-
2 / 1	<user-defined> ON		
2 / 2	<user-defined> OFF	not pre-allocated	-
2 / 3	<user-defined> ON		
2 / 4	<user-defined> OFF	not pre-allocated	-
2 / 5	<user-defined> ON		
2 / 6	<user-defined> OFF	not pre-allocated	-
2 / 7	<user-defined> ON		
3 / 0	<user-defined> OFF	not pre-allocated	-
3 / 1	<user-defined> ON		
3 / 2	<user-defined> OFF	not pre-allocated	-
3 / 3	<user-defined> ON		

4.2.1.2 Single-point indications and taggings

- Single-point indications and taggings can be routed on these positions as “Destination system interface” using the **DIGSI Configuration matrix**.

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
3 / 4	<user-defined>	not pre-allocated	-
3 / 5	<user-defined>	not pre-allocated	-
3 / 6	<user-defined>	not pre-allocated	-
3 / 7	<user-defined>	not pre-allocated	-
4 / 0	<user-defined>	not pre-allocated	-
4 / 1	<user-defined>	not pre-allocated	-
4 / 2	<user-defined>	not pre-allocated	-
4 / 3	<user-defined>	not pre-allocated	-
4 / 4	<user-defined>	not pre-allocated	-
4 / 5	<user-defined>	not pre-allocated	-
4 / 6	<user-defined>	not pre-allocated	-
4 / 7	<user-defined>	not pre-allocated	-
5 / 0	<user-defined>	not pre-allocated	-
5 / 1	<user-defined>	not pre-allocated	-
5 / 2	<user-defined>	not pre-allocated	-
5 / 3	<user-defined>	not pre-allocated	-
5 / 4	<user-defined>	not pre-allocated	-
5 / 5	<user-defined>	not pre-allocated	-
5 / 6	<user-defined>	not pre-allocated	-
5 / 7	<user-defined>	not pre-allocated	-
6 / 0	<user-defined>	not pre-allocated	-
6 / 1	<user-defined>	not pre-allocated	-
6 / 2	<user-defined>	not pre-allocated	-
6 / 3	<user-defined>	not pre-allocated	-
6 / 4	<user-defined>	not pre-allocated	-
6 / 5	<user-defined>	not pre-allocated	-
6 / 6	<user-defined>	not pre-allocated	-
6 / 7	<user-defined>	not pre-allocated	-
7 / 0	<user-defined>	not pre-allocated	-
7 / 1	<user-defined>	not pre-allocated	-
7 / 2	<user-defined>	not pre-allocated	-
7 / 3	<user-defined>	not pre-allocated	-
7 / 4	<user-defined>	not pre-allocated	-
7 / 5	<user-defined>	not pre-allocated	-

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
7 / 6	<user-defined>	not pre-allocated	-
7 / 7	<user-defined>	not pre-allocated	-
8 / 0	<user-defined>	not pre-allocated	-
8 / 1	<user-defined>	not pre-allocated	-
8 / 2	<user-defined>	not pre-allocated	-
8 / 3	<user-defined>	not pre-allocated	-
8 / 4	<user-defined>	not pre-allocated	-
8 / 5	<user-defined>	not pre-allocated	-
8 / 6	<user-defined>	not pre-allocated	-
8 / 7	<user-defined>	not pre-allocated	-
9 / 0	<user-defined>	not pre-allocated	-
9 / 1	<user-defined>	not pre-allocated	-
9 / 2	<user-defined>	not pre-allocated	-
9 / 3	<user-defined>	not pre-allocated	-
9 / 4	<user-defined>	not pre-allocated	-
9 / 5	<user-defined>	not pre-allocated	-
9 / 6	<user-defined>	not pre-allocated	-
9 / 7	<user-defined>	not pre-allocated	-
10 / 0	<user-defined>	not pre-allocated	-
10 / 1	<user-defined>	not pre-allocated	-
10 / 2	<user-defined>	not pre-allocated	-
10 / 3	<user-defined>	not pre-allocated	-
10 / 4	<user-defined>	not pre-allocated	-
10 / 5	<user-defined>	not pre-allocated	-
10 / 6	<user-defined>	not pre-allocated	-
10 / 7	<user-defined>	not pre-allocated	-
11 / 0	<user-defined>	not pre-allocated	-
11 / 1	<user-defined>	not pre-allocated	-
11 / 2	<user-defined>	not pre-allocated	-
11 / 3	<user-defined>	not pre-allocated	-
11 / 4	<user-defined>	not pre-allocated	-
11 / 5	<user-defined>	not pre-allocated	-
11 / 6	<user-defined>	not pre-allocated	-
11 / 7	<user-defined>	not pre-allocated	-
12 / 0	<user-defined>	not pre-allocated	-
12 / 1	<user-defined>	not pre-allocated	-

4.2.1.3 Device

- Ref. to chap. 2.5.2 for notes regarding "Stop data transmission".

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
12 / 2	Device OK	1 = Update of the device replica in the SIPROTEC device completed after initial start or restart	51
12 / 3	Settings Calc.	1 = Settings calculation is running	70
12 / 4	Error PwrSupply	1 = Error power supply	147
12 / 5	Fail Battery	1 = Failure: Battery empty	177
12 / 6	<user-defined>	not pre-allocated	-
12 / 7	<user-defined>	not pre-allocated	-
13 / 0	<user-defined>	not pre-allocated	-
13 / 1	<user-defined>	not pre-allocated	-
13 / 2	DataStop	1 = "Stop data transmission" is active	-
13 / 3	Test mode	1 = Test mode is active	-
13 / 4	Data valid	1 = Data in the PROFIBUS DP message are valid. (This indication is created by the PROFIBUS DP slave; not available in DIGSI and not relocatable.)	-

4.2.1.4 Control Authority

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
13 / 5	Cntrl Auth	Control authority (0 = REMOTE, 1 = LOCAL)	-
13 / 6	ModeLOCAL	Control mode LOCAL (0 = LOCKED, 1 = UNLOCKED)	-
13 / 7	ModeREMOTE	Control mode REMOTE (0 = LOCKED , 1 = UNLOCKED)	-

4.2.2 Measured values

- Ref. to chap. 2.3.2 for notes regarding scaling of measured values.

Offset	Designation of the SIPROTEC objects	Comments	Scaling (32767 corresponds to ...)	Transmission as
14	3P1_V1 =	3P1 Phase to Earth Voltage V1	3276.7	Primary value
16	3P1_V2 =	3P1 Phase to Earth Voltage V2	3276.7	Primary value
18	3P1_V3 =	3P1 Phase to Earth Voltage V3	3276.7	Primary value
20	3P1_I1 =	3P1 Phase Current I1	3276.7	Primary value
22	3P1_I2 =	3P1 Phase Current I2	3276.7	Primary value
24	3P1_I3 =	3P1 Phase Current I3	3276.7	Primary value
26	3P1_P =	3P1 Active Power Three Phase	3276.7	Primary value
28	3P1_Q =	3P1 Reactive Power Three Phase	3276.7	Primary value
30	3P1_f =	3P1 Frequency	3276.7	Primary value
32	3P1_cosPhi =	3P1 Active Power Factor Three Phase	32.767	Primary value
34	3P1_V0 =	3P1 Zero Sequence Voltage	3276.7	Primary value
36	Td1 =	Transducer 1 (0...20 mA)	327.67	Secondary value
38	Td2 =	Transducer 2 (0...20 mA)	327.67	Secondary value

4.2.3 Metered measurands

- Ref. to chap. 2.3.3 for notes regarding routing and scaling of metered measurands.

Offset	Designation of the SIPROTEC objects	Comments	Scaling ($2^{31}-1$ corresponds to ...)	Internal object no.
40	<user-defined>	not pre-allocated	$2^{31}-1$ impulses	-
44	<user-defined>	not pre-allocated	$2^{31}-1$ impulses	-
48	<user-defined>	not pre-allocated	$2^{31}-1$ impulses	-
52	<user-defined>	not pre-allocated	$2^{31}-1$ impulses	-

4.2.4 Transformer tap position indications

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
56	<user-defined>	not pre-allocated	-
57	<user-defined>	not pre-allocated	-



Standard mapping 3-4

This chapter describes the data in the PROFIBUS DP messages between the PROFIBUS DP master and the SIPROTEC device 6MD662/3/4 if standard mapping 3-4 is selected.

Standard mapping 3-4 has to be used together with the redundant PROFIBUS DP interface of the devices 6MD663 or 6MD664 (ref. to chap. 1).

5.1	Message in output direction	74
5.2	Message in input direction	78

5.1 Message in output direction

5.1.1 Event list

- Information regarding the handshake bytes as well as the retrieval methods of the event list via PROFIBUS DP can be found in the manual “SIPROTEC Communication module, PROFIBUS DP - Communication profile”.
- Ref. to chap. 1.4.1.4 for notes regarding the redundancy function control byte.

Offset	Designation	Comments	Internal object no.
0	Control_O	Handshake byte for event list via PROFIBUS DP	-
1	Control_O_1	Control byte for redundancy function	-

5.1.2 Single commands and taggings

- Single commands and taggings can be routed on these positions as “Source system interface” using the **DIGSI Configuration matrix**.

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
2 / 0	<user-defined> OFF	not pre-allocated	-
2 / 1	<user-defined> ON		
2 / 2	<user-defined> OFF	not pre-allocated	-
2 / 3	<user-defined> ON		
2 / 4	<user-defined> OFF	not pre-allocated	-
2 / 5	<user-defined> ON		
2 / 6	<user-defined> OFF	not pre-allocated	-
2 / 7	<user-defined> ON		
3 / 0	<user-defined> OFF	not pre-allocated	-
3 / 1	<user-defined> ON		
3 / 2	<user-defined> OFF	not pre-allocated	-
3 / 3	<user-defined> ON		
3 / 4	<user-defined> OFF	not pre-allocated	-
3 / 5	<user-defined> ON		
3 / 6	<user-defined> OFF	not pre-allocated	-
3 / 7	<user-defined> ON		
4 / 0	<user-defined> OFF	not pre-allocated	-
4 / 1	<user-defined> ON		

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
4 / 2	<user-defined> OFF	not pre-allocated	-
4 / 3	<user-defined> ON		
4 / 4	<user-defined> OFF	not pre-allocated	-
4 / 5	<user-defined> ON		
4 / 6	<user-defined> OFF	not pre-allocated	-
4 / 7	<user-defined> ON		
5 / 0	<user-defined> OFF	not pre-allocated	-
5 / 1	<user-defined> ON		
5 / 2	<user-defined> OFF	not pre-allocated	-
5 / 3	<user-defined> ON		
5 / 4	<user-defined> OFF	not pre-allocated	-
5 / 5	<user-defined> ON		
5 / 6	<user-defined> OFF	not pre-allocated	-
5 / 7	<user-defined> ON		
6 / 0	<user-defined> OFF	not pre-allocated	-
6 / 1	<user-defined> ON		
6 / 2	<user-defined> OFF	not pre-allocated	-
6 / 3	<user-defined> ON		
6 / 4	<user-defined> OFF	not pre-allocated	-
6 / 5	<user-defined> ON		
6 / 6	<user-defined> OFF	not pre-allocated	-
6 / 7	<user-defined> ON		
7 / 0	<user-defined> OFF	not pre-allocated	-
7 / 1	<user-defined> ON		
7 / 2	<user-defined> OFF	not pre-allocated	-
7 / 3	<user-defined> ON		
7 / 4	<user-defined> OFF	not pre-allocated	-
7 / 5	<user-defined> ON		
7 / 6	<user-defined> OFF	not pre-allocated	-
7 / 7	<user-defined> ON		
8 / 0	<user-defined> OFF	not pre-allocated	-
8 / 1	<user-defined> ON		
8 / 2	<user-defined> OFF	not pre-allocated	-
8 / 3	<user-defined> ON		
8 / 4	<user-defined> OFF	not pre-allocated	-
8 / 5	<user-defined> ON		
8 / 6	<user-defined> OFF	not pre-allocated	-
8 / 7	<user-defined> ON		

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
9 / 0	<user-defined> OFF	not pre-allocated	-
9 / 1	<user-defined> ON		
9 / 2	<user-defined> OFF	not pre-allocated	-
9 / 3	<user-defined> ON		
9 / 4	<user-defined> OFF	not pre-allocated	-
9 / 5	<user-defined> ON		
9 / 6	<user-defined> OFF	not pre-allocated	-
9 / 7	<user-defined> ON		
10 / 0	<user-defined> OFF	not pre-allocated	-
10 / 1	<user-defined> ON		
10 / 2	<user-defined> OFF	not pre-allocated	-
10 / 3	<user-defined> ON		
10 / 4	<user-defined> OFF	not pre-allocated	-
10 / 5	<user-defined> ON		
10 / 6	<user-defined> OFF	not pre-allocated	-
10 / 7	<user-defined> ON		
11 / 0	<user-defined> OFF	not pre-allocated	-
11 / 1	<user-defined> ON		
11 / 2	<user-defined> OFF	not pre-allocated	-
11 / 3	<user-defined> ON		
11 / 4	<user-defined> OFF	not pre-allocated	-
11 / 5	<user-defined> ON		
11 / 6	<user-defined> OFF	not pre-allocated	-
11 / 7	<user-defined> ON		
12 / 0	<user-defined> OFF	not pre-allocated	-
12 / 1	<user-defined> ON		
12 / 2	<user-defined> OFF	not pre-allocated	-
12 / 3	<user-defined> ON		
12 / 4	<user-defined> OFF	not pre-allocated	-
12 / 5	<user-defined> ON		
12 / 6	<user-defined> OFF	not pre-allocated	-
12 / 7	<user-defined> ON		
13 / 0	<user-defined> OFF	not pre-allocated	-
13 / 1	<user-defined> ON		
13 / 2	<user-defined> OFF	not pre-allocated	-
13 / 3	<user-defined> ON		
13 / 4	<user-defined> OFF	not pre-allocated	-
13 / 5	<user-defined> ON		

5.1.3 Control mode

- Ref. to chap. 2.5.1 for notes regarding "Control mode REMOTE".

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
13 / 6	ModeREMOTE LOCKED	Control mode REMOTE = LOCKED	-
13 / 7	ModeREMOTE UNLOCKED	Control mode REMOTE = UNLOCKED	

5.2 Message in input direction

5.2.1 Indications

5.2.1.1 Single-point indications and taggings

- Single-point indications and taggings can be routed on these positions as “Destination system interface” using the **DIGSI Configuration matrix**.

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
0 / 0	<user-defined>	not pre-allocated	-
0 / 1	<user-defined>	not pre-allocated	-
0 / 2	<user-defined>	not pre-allocated	-
0 / 3	<user-defined>	not pre-allocated	-
0 / 4	<user-defined>	not pre-allocated	-
0 / 5	<user-defined>	not pre-allocated	-
0 / 6	<user-defined>	not pre-allocated	-
0 / 7	<user-defined>	not pre-allocated	-
1 / 0	<user-defined>	not pre-allocated	-
1 / 1	<user-defined>	not pre-allocated	-
1 / 2	<user-defined>	not pre-allocated	-
1 / 3	<user-defined>	not pre-allocated	-
1 / 4	<user-defined>	not pre-allocated	-
1 / 5	<user-defined>	not pre-allocated	-
1 / 6	<user-defined>	not pre-allocated	-
1 / 7	<user-defined>	not pre-allocated	-
2 / 0	<user-defined>	not pre-allocated	-
2 / 1	<user-defined>	not pre-allocated	-
2 / 2	<user-defined>	not pre-allocated	-
2 / 3	<user-defined>	not pre-allocated	-
2 / 4	<user-defined>	not pre-allocated	-
2 / 5	<user-defined>	not pre-allocated	-
2 / 6	<user-defined>	not pre-allocated	-
2 / 7	<user-defined>	not pre-allocated	-
3 / 0	<user-defined>	not pre-allocated	-
3 / 1	<user-defined>	not pre-allocated	-
3 / 2	<user-defined>	not pre-allocated	-
3 / 3	<user-defined>	not pre-allocated	-
3 / 4	<user-defined>	not pre-allocated	-

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
3 / 5	<user-defined>	not pre-allocated	-
3 / 6	<user-defined>	not pre-allocated	-
3 / 7	<user-defined>	not pre-allocated	-
4 / 0	<user-defined>	not pre-allocated	-
4 / 1	<user-defined>	not pre-allocated	-
4 / 2	<user-defined>	not pre-allocated	-
4 / 3	<user-defined>	not pre-allocated	-
4 / 4	<user-defined>	not pre-allocated	-
4 / 5	<user-defined>	not pre-allocated	-
4 / 6	<user-defined>	not pre-allocated	-
4 / 7	<user-defined>	not pre-allocated	-
5 / 0	<user-defined>	not pre-allocated	-
5 / 1	<user-defined>	not pre-allocated	-
5 / 2	<user-defined>	not pre-allocated	-
5 / 3	<user-defined>	not pre-allocated	-
5 / 4	<user-defined>	not pre-allocated	-
5 / 5	<user-defined>	not pre-allocated	-
5 / 6	<user-defined>	not pre-allocated	-
5 / 7	<user-defined>	not pre-allocated	-
6 / 0	<user-defined>	not pre-allocated	-
6 / 1	<user-defined>	not pre-allocated	-
6 / 2	<user-defined>	not pre-allocated	-
6 / 3	<user-defined>	not pre-allocated	-
6 / 4	<user-defined>	not pre-allocated	-
6 / 5	<user-defined>	not pre-allocated	-
6 / 6	<user-defined>	not pre-allocated	-
6 / 7	<user-defined>	not pre-allocated	-
7 / 0	<user-defined>	not pre-allocated	-
7 / 1	<user-defined>	not pre-allocated	-
7 / 2	<user-defined>	not pre-allocated	-
7 / 3	<user-defined>	not pre-allocated	-
7 / 4	<user-defined>	not pre-allocated	-
7 / 5	<user-defined>	not pre-allocated	-
7 / 6	<user-defined>	not pre-allocated	-
7 / 7	<user-defined>	not pre-allocated	-
8 / 0	<user-defined>	not pre-allocated	-
8 / 1	<user-defined>	not pre-allocated	-

5.2.1.2 Device

- Ref. to chap. 2.5.2 for notes regarding "Stop data transmission".

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
8 / 2	<user-defined>	not pre-allocated	-
8 / 3	<user-defined>	not pre-allocated	-
8 / 4	<user-defined>	not pre-allocated	-
8 / 5	<user-defined>	not pre-allocated	-
8 / 6	<user-defined>	not pre-allocated	-
8 / 7	<user-defined>	not pre-allocated	-
9 / 0	<user-defined>	not pre-allocated	-
9 / 1	<user-defined>	not pre-allocated	-
9 / 2	DataStop	1 = "Stop data transmission" is active	-
9 / 3	Test mode	1 = Test mode is active	-
9 / 4	Data valid	1 = Data in the PROFIBUS DP message are valid. (This indication is created by the PROFIBUS DP slave; not available in DIGSI and not relocatable.)	-

5.2.1.3 Control Authority

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
9 / 5	Cntrl Auth	Control authority (0 = REMOTE, 1 = LOCAL)	-
9 / 6	ModeLOCAL	Control mode LOCAL (0 = LOCKED, 1 = UNLOCKED)	-
9 / 7	ModeREMOTE	Control mode REMOTE (0 = LOCKED , 1 = UNLOCKED)	-

5.2.2 Measured values

- Ref. to chap. 2.3.2 for notes regarding scaling of measured values.

Offset	Designation of the SIPROTEC objects	Comments	Scaling (32767 corresponds to ...)	Transmission as
10	3P1_V1 =	3P1 Phase to Earth Voltage V1	3276.7	Primary value
12	3P1_V2 =	3P1 Phase to Earth Voltage V2	3276.7	Primary value
14	3P1_V3 =	3P1 Phase to Earth Voltage V3	3276.7	Primary value
16	3P1_I1 =	3P1 Phase Current I1	3276.7	Primary value
18	3P1_I2 =	3P1 Phase Current I2	3276.7	Primary value
20	3P1_I3 =	3P1 Phase Current I3	3276.7	Primary value
22	3P1_P =	3P1 Active Power Three Phase	3276.7	Primary value
24	3P1_Q =	3P1 Reactive Power Three Phase	3276.7	Primary value
26	3P1_f =	3P1 Frequency	3276.7	Primary value
28	3P1_cosPhi =	3P1 Active Power Factor Three Phase	32.767	Primary value

5.2.3 Metered measurands

- Ref. to chap. 2.3.3 for notes regarding routing and scaling of metered measurands.

Offset	Designation of the SIPROTEC objects	Comments	Scaling ($2^{31}-1$ corresponds to ...)	Internal object no.
30	<user-defined>	not pre-allocated	$2^{31}-1$ impulses	-
34	<user-defined>	not pre-allocated	$2^{31}-1$ impulses	-
38	<user-defined>	not pre-allocated	$2^{31}-1$ impulses	-
42	<user-defined>	not pre-allocated	$2^{31}-1$ impulses	-

5.2.4 Event list

- Information regarding the handshake bytes as well as the retrieval methods of the event list via PROFIBUS DP can be found in the manual “SIPROTEC Communication module, PROFIBUS DP - Communication profile”.
- Ref. to chap. 1.4.1.2 for notes regarding the redundancy function control byte.

Offset	Designation of the SIPROTEC objects	Comments	Internal object no.
46	Control_I	Handshake byte for event list via PROFIBUS DP	-
47	Control_I_1	Control byte for redundancy function	-
48	Message block #1	Identification #1	-
49		Value #1	
50 - 57		Time stamp #1	
58	Message block #2	Identification #2	-
59		Value #2	
60 - 67		Time stamp #2	
68	Message block #3	Identification #3	-
69		Value #3	
70 - 77		Time stamp #3	



Glossary

CFC	Continuous Function Chart
DC	Double command
GSD file	<p>The GSD file contains the General Slave Description (technical characteristics) of the PROFIBUS DP communication module.</p> <p>This file is required for configuration of the PROFIBUS DP master and is supplied together with DIGSI.</p>
DIGSI	Parameterization system / parameterization software for SIPROTEC devices
DP	Double-point indication
Input data / Input direction	Data from the PROFIBUS DP slave to the PROFIBUS DP master.
MLFB	Order number for SIPROTEC devices
Octet	One octet corresponds to 8 bits.
OLM	Optical Link Module
Output data / Output direction	Data from the PROFIBUS DP master to the PROFIBUS DP slave.
PLC	Programmable Logic Controller
PNO	PROFIBUS Nutzerorganisation (PROFIBUS International Organization)
PROFIBUS DP	PROFIBUS - Decentralized Peripherals
PSE	PROFIBUS interface module with (electrical) isolated RS485 interface for the SIPROTEC devices from Siemens.
PSO	PROFIBUS interface module with fibre-optical interface for the SIPROTEC devices from Siemens.

RedCom Internal communication channel between the two slave interface modules of a redundant slave device.

SC Single command

SP Single-point indication



Index

C

Configuration data 47
Counters 45

D

Double commands 54, 64
Double-point indications 58, 67

E

Event list
 Handshake byte
 Input direction 62, 82
 Output direction 54, 74
 Message blocks 62, 82
 Redundancy 36

G

GSD file 21

I

Impulse counters 46
Indications 43

M

Measured values 43, 61, 71, 81
Metered measurands 45, 61, 71, 81
Module status indications 20
Module-specific information 28

P

PROFIBUS DP
 Configuration data 47
 Configuration in the master system 49
 Message in input direction 58, 67, 78
 Message in output direction 54, 64, 74

Q

Qualified personnel (definition) 5

R

Redundancy behavior
 Redundancy start-up 33
 Redundancy switchover 34
Redundancy concept
 BACKUP 17, 35
 PRIMARY 16, 35
Redundancy function
 "Red_State" diagnosis 26
 Control byte
 Input direction 22, 62, 82
 Output direction 24, 54, 74
 Parameterization 21
 Start-up time 20
Redundancy state 29
Redundant slave

Characteristic 17
Firmware compatibility 15
Order options 15
PNO identification number 19

S

Single commands 55, 65, 74
Single-point indications 59, 68, 78
System redundancy 16

T

Taggings 55, 59, 65, 68, 74, 78
Target audience 4
Toggle bit timer 32
 Reload value 19
Transformer tap change commands 65
Transformer tap position indications 71
Tredcom 31
Tsprimary 20, 31, 33
TsprimMax 20, 31, 33
Typographic conventions 5

V

Validity of the manual 4

