Preface

Table of Contents

Asynchronous communication modules1Introduction2Parametrization in DIGSI® 43Hardware interface4Glossary

Communication Database

Communication module

SIPROTEC

DNP 3.0

Index

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Liability statement

We have checked the contents of this manual against the described hardware and software. Nevertheless, deviations may occur so that we cannot guarantee the entire harmony with the product.

The contents of this manual will be checked in periodical intervals, corrections will be made in the following editions. We look forward to your suggestions for improvement.

We reserve the right to make technical improvements without notice. 3.00.01

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Preface

Aim of This Manual	The manual is devided into the following topics:
	Asynchronous communication modules
	Introduction
	Parametrization in DIGSI [®] 4
	Hardware interface
	General information about design, configuration, and operation of SIPROTEC [®] devices are laid down in the SIPROTEC [®] 4 system manual, order no. E50417-H1176-C151.
Target Audience	Protection engineers, commissioning engineers, persons who are involved in setting, testing and service of protection, automation, and control devices, as well as operation personnel in electrical plants and power stations.
DNP V3.0	The DNP V3.0 specification and the structure of the DNP messages are defined in:
Specification	 DNP V3.00 Subset Definitions Edition 2.00, November 1995 DNP Users Group Document Nr.: P009-OIG.SUB
	 DNP V3.00 Data Object Library Edition 0.02, July 1997 DNP Users Group Document Nr.: P009-OBL
	 DNP V3.00 Data Link Layer Edition 0.02, May 1997 DNP Users Group Document Nr.: P009-OPD.DL
	 DNP V3.00 Application Layer Edition 0.03, May 1997 DNP Users Group Document Nr.: P009-OPD.APP
	 DNP V3.00 Transport Functions Edition 0.01, May 1997 DNP Users Group Document Nr.: P009-OPD.TF

3

Applicability of this	This manual is valid for
Manual	• SIPROTEC [®] 4 devices,
	 DNP communication module up to hardware revision 3 and DNP 3.0 communication firmware version 02.00.01 or higher,
	 DNP communication module from hardware revision 4 and DNP 3.0 communication firmware version 04.00 or higher
2	Note:
	The DNP protocol is not for all SIPROTEC [®] devices available. Check the manual of the device or contact your Siemens representative.
	For device parameterization DIGSI [®] 4 version 4.3 or higher and DNP standard mappings 3-1 to 3-n (n = device type dependent number of standard mappings) have to be used.
Additional Support	Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purpose, the matter should be referred to the local Siemens representative.
Training Courses	Individual course offerings may be found in our Training Catalogue, or questions may be directed to our training center. Please contact your Siemens representative.
Instructions and Warnings	The warnings and notes contained in this manual serve for your own safety and for an appropriate lifetime of the device. Please observe them!
	The following terms are used:
	DANGER indicates that death, severe personal injury or substantial property damage <u>will</u> result if proper precautions are not taken.
	Warning indicates that death, severe personal injury or substantial property damage <u>can</u> result if proper precautions are not taken.
	Caution indicates that minor personal injury or property damage can result if proper precau- tions are not taken. This particularly applies to damage on or in the device itself and consequential damage thereof.
	<i>Note</i> indicates information about the device or respective part of the instruction manual which is essential to highlight.





Warning!

Hazardous voltages are present in this electrical equipment during operation. Failure to observe these precautions can result in death, personal injury, or serious material damage.

Only qualified personnel shall work on and in the vicinity of this equipment. The personnel must be thoroughly familiar with all warnings and maintenance procedures of this manual as well as the safety regulations.

Successful and safe operation of the device is dependent on proper transportation, storage, mounting and assembly and the observance of the warnings and instructions of the unit manual.

Of particular importance are the general installation and safety regulations for work in a high-voltage environment (for example, VDE, IEC, EN, DIN, or other national and international regulations). These regulations must be observed.

QUALIFIED PERSONNEL

For the purpose of this instruction 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 Symbol Conventions

The following text formats are used when literal information from the device or to the device appear in the text flow:

Parameter names, i.e. designators of configuration or function parameters which may appear word-for-word in the display of the device or on the screen of a personal computer (with operation software DIGSI[®] 4), are marked in bold letters of a monospace type style.

Parameter options, i.e. possible settings of text parameters, which may appear word-for-word in the display of the device or on the screen of a personal computer (with operation software DIGSI[®] 4), are written in italic style, additionally.

"Annunciations", i.e. designators for information, which may be output by the relay or required from other devices or from the switch gear, are marked in a monospace type style in quotation marks.

Deviations may be permitted in drawings when the type of designator can be obviously derived from the illustration.





Table of Contents

	Preface	e	3
	Table o	of Contents	7
	List of	Tables	9
	List of	Figures	11
1	Asyncl	nronous communication modules	13
	1.1	Communication module types and hardware revisions	14
	1.1.1	Communication module types	14
	1.1.2	Hardware revisions	14
	1.1.3	Compatibility of the communication module hardware with DNP 3.0 firmware versions a mapping files	and 15
	1.2	Display of module-specific information at the SIPROTEC device	17
	1.2.1	Block 1: Status and parameters of the DNP 3.0 slave	19
	1.2.2	Block 2: Status and diagnosis	19
	1.2.3	Block 3: Firmware versions and mapping file	20
	1.2.4	Block 4: Module hardware information and boot firmware version	21
2	Introdu	iction	23
	2.1	DNP object types	24
	2.2	Response time	26
3	Parame	etrization in DIGSI [®] 4	27
	3.1	Protocol specific parameters	28
	3.2	Protocol assignment and mapping files	31
	3.2.1	Standard mappings 3-1 to 3-n	31
	3.2.2	Compatibility with standard mappings of previous versions	31
	3.2.3	Interface selection and mapping selection in DIGSI 4.21	32
	3.2.4	Interface selection and mapping selection in DIGSI 4.3 or higher	35
	3.3	Customization of the allocation	38



7

	3.4	Scaling of measured values	41
	3.4.1	Measurement conversion	41
	3.4.2	Number representation in dependence of the parametrization	42
	3.4.3	Parametrization of scaling values in $DIGSI^{\textcircled{R}}$ 4	44
	3.5	Time synchronisation	45
4	Hardw	are interface	47
	4.1	Technical data of the RS485 modul	48
	4.2	Technical data of the fiber-optical modul	49
	Glossa	ıry	51
	Index		53



List of Tables

Table 1-1	Hardware revisions and firmware versions	. 15
Table 1-2	Communication module hardware types	. 21
Table 4-1	Technical data of the connection via the RS485 module	. 48
Table 4-2	Assignment of the bus connection at the device (D-SUB outlet)	. 49
Table 4-3	Technical data of the connection via fibre-optical module	. 49



List of Figures

Figure 1-1	HW revisions of the communication moduls, labelling of the mounting brackets
Figure 1-2	Display of module-specific information at the device
Figure 3-1	DIGSI [®] 4.21: DNP 3.0 protocol assignment
Figure 3-2	DIGSI 4.21: Mapping file selection and bus specific parameters
Figure 3-3	DIGSI 4.3: DNP 3.0 protocol assignment
Figure 3-4	DIGSI [®] 4.3: Mapping file selection and bus specific parameters
Figure 3-5	DIGSI [®] 4 Configuration matrix with columns for system interface routing
Figure 3-6	Pop-up menu in DIGSI [®] 4 Configuration matrix
Figure 3-7	Definition of the position of an information in the DNP point list
Figure 3-8	Pop-up menu in the "Object properties" dialog window 40
Figure 3-9	Scaling settings of a measured value 44
Figure 3-10	Source of time synchronisation 45





1

Asynchronous communication modules

This chapter shows the hardware and software necessary for DNP 3.0 communication with SIPROTEC[®] devices and describes the display of module-specific information at the device.

1.1	Communication module types and hardware revisions	14
1.2	Display of module-specific information at the SIPROTEC device	17



1.1 Communication module types and hardware revisions

1.1.1 Communication module types

	Two communication modules are available for the connection of DNP 3.0 to the SIPROTEC $^{\textcircled{B}}$ devices:
RS485	Asynchronous module with isolated RS-485 interface.
bus interface	This module also is called AME module (a synchronous communication m odule e lectrical) subsequently.
Fibre-optical	Asynchronous module with fibre-optical interface.
bus interface	This module also is called AMO module (a synchronous communication m odule fibre- o ptical) subsequently.
Technical data	The technical data of the above-mentioned asynchrone communication modules are summarized in chap. 4.

1.1.2 Hardware revisions

There exist two different hardware revisions for asynchronous communication modules:

- up to HW revision 3: delivery up to the end of year 2004
- from HW revision 4: replacement for modules up to HW revision 3, delivery from beginning of 2005

The communication modules from HW revision 4 are function compatible to the modules up to HW revision 3.

Please note the dependency of the DNP 3.0 firmware versions with the HW revisions described in chap. 1.1.3.

The hardware revision of the asynchrone communication modules is also recognizable in build-in condition at the rear of the SIPROTEC[®] device at the labelling of the communication module mounting bracket:

- up to HW revision 3: identification table starts with "P-Slave"
- from HW revision 4: identification table starts with "Profibus"



Asynchronous module RS-485 (AME module)





up to HW revision 3

from HW revision 4

Asynchronous module fibre-optical (AMO module)



Figure 1-1 HW revisions of the communication moduls, labelling of the mounting brackets

General details about the assembly of communication modules as well as the setting of the terminating resistors on the AME moduls you find in the SIPROTEC4 System Manual (ref. to page 3).

1.1.3 Compatibility of the communication module hardware with DNP 3.0 firmware versions and mapping files

Hardware and
firmwarePlease note the following listed compatibility between the hardware revisions of the
communication modules and the DNP 3.0 firmware versions:

Hardware revision	Firmware version to be used
up to HW revision 3	up to DNP 3.0 firmware V02
from HW revision 4	from DNP 3.0 firmware V04

Table 1-1Hardware revisions and firmware versions

The DNP 3.0 firmware for communication modules from HW revision 4 is:

- function compatible with firmware versions for modules up to HW revision 3 (i.e. contains all there contained functionalities),
- offers additional functionalities, e.g.:
 - display of module-specific information at the device (ref. to chap. 1.2),
 - additional baud rate support (ref. to chap. 3.1),
 - reading of device information via DNP (object number 0),
 - reading of device date and time via DNP (object 51, variation 1),
 - reading object 30 with variation 4 and object 20 with variation 6.



9	Note:
	If, during loading of the DNP 3.0 firmware on the communication module, a non-com- patible hardware revision is recognized, then the firmware update is cancelled.
	Please, in case of an abort of loading the DNP 3.0 communication firmware, check first the dependencies indicated in Table 1-1.
	After attempting to load a DNP 3.0 firmware version on a non-compatible hardware revision, the SIPROTEC [®] device remains in the loader mode (display = empty, LED 5 = ON, LED 6 flashing) and loading of a correct firmware version or an initial reset is expected.
	If no firmware shall be loaded in this situation, then the device must be switched off and (after at least 3 sec.) switched on again. The previous firmware configuration is then used furthermore.
Hardware and mapping files	There is no compatibility reduction between DNP 3.0 mapping files of the SIPROTEC [®] devices and the hardware revision of the communication modules, i.e.:
	 the known DNP 3.0 mapping files for SIPROTEC[®] devices, offered in DIGSI and used so far, are used for parameterization furthermore,
	• existing parameterizations can be used further, even if a communication module up to HW revision 3 is replaced by a communication module from HW revision 4 (considering the firmware compatibility in Table 1-1).

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1.2 Display of module-specific information at the SIPROTEC device

Note:

The following prerequisites are necessary for using the functionality "Display of module-specific information at the SIPROTEC[®] device":

- Asynchronous communication module from HW revision 4 with DNP 3.0 firmware from V04.00,
- SIPROTEC[®] device firmware which supports this function, e.g.:
 - 7SJ61...7SJ64, 6MD63 device firmware from V4.50,
 - 7SA522, 7SA6 device firmware from V4.50.

Changing parameters for the DNP 3.0 slave of the SIPROTEC[®] device is exclusively possible using the DIGSI parameterization system.

If the display of module-specific information is not supported by the firmware of the used SIPROTEC[®] device then the below-mentioned menu items are not offered for selection.

If an asynchronous communication module up to HW revision 3 is used, then in a SIPROTEC[®] device with above-mentioned firmware V4.50 the following text is displayed in case of selecting the menu item for display of module-specific information:

**** LIST EMPTY ****

The values in the display of module-specific information are actualized every 500 ms. It is therefore possible that short-time changes of information are not displayed.

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

- MENU
- Test/Diagnosis $\rightarrow 5$
- Modulinfo \rightarrow 5
- Port $B \rightarrow 1$



The maximum number of displayed information, separated in four blocks, is shown in Figure 1-2.

The data in the individual information blocks are explained in the following chap. 1.2.1 to 1.2.4.

PORT B - - - - - - -DNP3.0 Block 1: Slave : 2 Status and parameters of the DNP 3.0 slave. Baudr.: 19200 Bit/s StopB.: 1 Parity: NONE Unsol.: YES RxTxBy: 4893, 2843 Block 2: FmPyEr: 4, 0 Status and diagnosis. CrToEr: 2, 0 DNP SW: V04.00.06 Block 3: MapNo.: 3-1 DNP 3.0 firmware version as well as number and MapRev: V01.00.05 version of the selected mapping file. Module: AME-GEN Block 4: HWCode: 09hex Module hardware information and version number of HWRev.: 04 the boot firmware. BF-No.: 03110431131 Ld Jmp: V01.00.05 ****** END *******

Figure 1-2 Display of module-specific information at the device



Note:

During a request of a large amount of data points (e.g. class 0 data) it can happen, that the display of the module specific information isn't cyclically updated.



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1.2.1 Block 1: Status and parameters of the DNP 3.0 slave

Block 1 of the module-specific information shows parameterization data of the DNP 3.0 slave of the SIPROTEC[®] device (ref. to chap. 3.1).

i	Note:
	If no DNP 3.0 mapping file was selected during parameterization in DIGSI then all entries of Block 1 are marked with the sign '-':
	Slave : - Baudr.: -
Slave	Display of the slave address which was entered during parameterization in DIGSI for GlobalSection.Slave_Addr.
Baudr.	Display of the Baud rate which was entered during parameterization in DIGSI for GlobalSection.Baud_Rate.
StopB.	Display of the Stop bits which was entered during parameterization in DIGSI for GlobalSection.Stop_Bit.
Parity	Display of the Parity which was entered during parameterization in DIGSI for GlobalSection.Parity.
Unsol.	Display whether unsolicited responses configured or not which was entered during parameterization in DIGSI for GlobalSection.EnableUnsol.

1.2.2 Block 2: Status and diagnosis

Block 2 contains various diagnosis counters and status information.

•	Note:
1	All diagnosis counters, which are shown followingly, are 16 bit values (data range: 065535) and start again with 0 after an overflow. Overflows of these counters are not signalized.
RxTxBy	Two diagnostic counters of message processing:
	 Counter 1: Quantity of bytes, which the slave has received since last restart of the SIPROTEC[®] device.
	 Counter 2: Quantity of bytes, which the slave has send since last restart of the SIPROTEC[®] device.



•	Note:
•	If the counter of the quantity of processed bytes is not incremented, then the commu- nication settings (baud rate etc.) are not consistent in the master and the slave device (the counters of framing and/or parity errors then also is incremented, see below).
FmPyEr	Two diagnostic counters for framing and parity errors of the serial data transmission.
	A framing error is reported by the serial communication module if a stop bit is requested after the reception of a byte but the level at the data line remains low. If this counter is incremented continuously, then this indicates a wrong baud rate setting. Disconnecting and re-connecting of the bus line during active communication can be the reason of eigele framing error.
	the reason of single framing errors.
	If the serial communication is configured with evaluation of parity bits (EVEN or ODD, ref. to chap. 3.1) then a parity error indicates a wrong value of a parity bit in the serial byte frame.
	Short-time data transmission errors (e.g. because of disturbing influences) are indi- cated by single incrementing of this counter.
	If the counter of parity errors is incremented continuously then the settings for parity bit evaluation are not consistent in the master and the slave device.
CrToEr	Two diagnostic counters for CRC errors and response-time errors.
	A CRC error is recognized if the result of the CRC calculation of the received DNP 3.0 message is not equal to the CRC value in the DNP 3.0 message from master. Mostly, the reason of CRC errors are data transmission errors (e.g. because of disturbing influences).
	Timeout errors occur if the time for waiting for remote device to confirm is longer than the configured "Link Confirme Timeout" or "Application Timeout" (ref. to chap. 3.1).

1.2.3 Block 3: Firmware versions and mapping file

Block 3 of the module-specific information shows the DNP 3.0 firmware version as well as the number and version of the selected mapping file.

i	Note:
	If no DNP 3.0 mapping file was selected during parameterization in DIGSI then all entries of Block 2 are marked with the text 'not loaded':
	MapNo.: not loaded
	MapRev: not loaded
DNP_SW	DNP 3.0 firmware version loaded on the communication module.
MapNo.	Number of the selected standard mapping.
	The mapping file determines the data size which is available via DNP 3.0 for the SIPROTEC [®] device.

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Depending on the device type, several standard mappings are offered for parameterization in DIGSI.

MapRev. Version of the selected standard mapping with the number MapNo. (see above).

1.2.4 Block 4: Module hardware information and boot firmware version

Block 4 of the module-specific information contains hardware information for the builtin communication module.

Module Hardware type of the communication module built-in in the SIPROTEC[®] device:

Module	Explanation	Note
PSE_GEN	PROFIBUS module RS-485	not for DNP 3.0, please replace
PSO2_GEN	PROFIBUS module fibre-optical, double loop (with two fibre-optical channels)	not for DNP 3.0, please replace
PSO1_GEN	PROFIBUS module fibre-optical, single loop (with one fibre-optical channel)	not for DNP 3.0, please replace
AME_GEN	Asynchronous modul RS-485	ОК
AMO-GEN	Asynchronous modul fibre-optical	ОК

Table 1-2 Communication module hardware types

HWCode A hardware designation, coded on the module, in hexadecimal representation.

HWRev. Hardware revision of the communication module.

BF-No. Serial number (production number) of the communication module.

Ld_Jmp Version of the separate boot firmware part for start-up and with loader functions.





Introduction

The DNP 3.0 slave is introduced in this chapter. An overview of the devices is presented in their features and scope of functions.

2.1	DNP object types	24
2.2	Response time	26



23

2.1 DNP object types

	The communication database profile of the SIPROTEC [®] devices with DNP3.0 proto- col is grouped into the following object types:
Binary Input with	Object 01, Variation 02
Status	These points represent the state of a digital input channel or an internal software in- formation point.
	It is used for a general interrogation request by a RTU (after a reset or cyclic during runtime) and to synchronize the RTU information database.
	They are considered class 1 data (an event with high priority).
Binary Input	Object 02, Variation 02
Change with Time	These points represent the changed state of a digital input channel or an internal soft- ware information point and the time at which the state changed.
	It is used for spontaneous process events.
	They are considered class 1 data (an event with high priority)
Binary Output	Object 10, Variation 02
Status	These points represent the current status of a binary output channel.
	These binary output channels can be controlled by the Control Relay Output Block (ref. to Object 12).
Control Relay	Object 12, Variation 01
Output Block (Direct Operate)	These points are used for commands to the process or setting of internal functions.
32-Bit Binary Coun-	Object 20, Variation 01
ter (with Flag)	These points are used to represent a counter for active and reactive power.
32-Bit Binary Coun-	Object 20, Variation 06
ter (without Flag)	These points are used to represent a counter for active and reactive power.
32-Bit Counter	Object 22, Variation 01
Change Event without Time	These points are used to represent a counter for active and reactive power reported as an event.
32-Bit Analog Input	Object 30, Variation 01
(Measured Values)	This 32-bit signed value could represent a digitized analog signal or a calculated val- ue.



16-Bit Analog Input	Object 30, Variation 02
(Measured Values)	This 16-bit signed value could represent a digitized analog signal or a calculated value.
	It is used for a General Interrogation Functionality within the startup procedure or for a measured value snapshot.
16-Bit Analog Input	Object 30, Variation 04
(Measured Values) without Flag	This 16-bit signed value could represent a digitized analog signal or a calculated value.
I32-Bit Analog	Object 32, Variation 01
Change Event without Time	These points are used to represent a changed analog point.
16-Bit Analog	Object 32, Variation 02
Change Event without Time	These points are used to represent a changed analog point.
Time and Date	Object 50, Variation 01
	Fuction: write
	The time and date object is used for time synchronization.
	Fuction: read
	Read the system time from device.
	Date and time are recorded as milliseconds since midnight, January 1 st , 1970, at zero hours, zero minutes, zero seconds and milliseconds.
Class Data	Object 60, Variation 01, 02, 03, 04
	These objects specify different classes of information elements.
	Class 0 specifies any information objects not assigned to class 1 until class 3.
	Classes 1 to 3 specifies groups of event driven information objects.
	Class 1 data has higher priority than class 2 , class 3 and static data.
Internal Indication	Object 80, Variation 01
	Writing value 00 at index 7 results in resetting of the bit <restart> in the FLAG byte of all data objects.</restart>



25

2.2 Response time

Some approximate response times on a request with a different numbers of selected points at 9600 baud are:

- 1 point \rightarrow 70 milliseconds
- 30 points \rightarrow 115 milliseconds

376 points \rightarrow 670 milliseconds



Parametrization in DIGSI[®] 4

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3.1	Protocol specific parameters	28
3.2	Protocol assignment and mapping files	31
3.3	Customization of the allocation	38
3.4	Scaling of measured values	41
3.5	Time synchronisation	45



27

3.1 Protocol specific parameters

	The following settings for the serial communication between the DNP 3.0 master and the DNP 3.0 slave have to be defined during parameterization of the SIPROTEC [®] device.
	Names written in MonoScriptText are the associated designations of the bus specific parameters in the DIGSI [®] 4 parameterization software (ref. to chap. 3.2).
Slave address	GlobalSection.Slave_Address
	Permissible DNP 3.0 slave addresses for the SIPROTEC [®] devices are in the range between 1 and 65532.
Master address	GlobalSection.Master_Address
	Permissible master addresses are in the range between 1 and 65532
Baud rate	GlobalSection.Baud_Rate
	The baud rates 9600 Baud, 19200 Baud, 38400 Baud and 57600 Baud are supported by the DNP 3.0 communication modules
Data Bit	GlobalSection.Data_Bit
	8 data bits are required for a DNP communication. Changes here have no effect!
Stop Bit	GlobalSection.Stop_Bit
	The DNP 3.0 communication module support one and two stop bits
	(devault value = 1)
Parity	GlobalSection.Parity
	0 = no parity (default)
	1 = even parity
	2 = odd parity
Idle Level	GlobalSection.IdleLevel
	Status for "no signal". The DNP 3.0 communication module only support "Light off". Changes have no effect!
Link Retries	GlobalSection.LinkRe_tries
	Number of attempts to retransmit a data link frame that was not confirmed by the re- mote device (only if frame sent with confirm requested)
	default value = 2



Link Confirme	GlobalSection.LinkConRequires
Requires	Request the remote device to send a data link layer confirm of the last frame sent. Note that this setting is independent of whether the remote device will require this device to send a data link confirm to frames it receives.
	0 = not for any frame (default)
	1 = for multiframe fragments
	2 = for all frames
Link Confirme	GlobalSection.LinkConfTimeout
Timeout	Amount of time, in ms, to wait for remote device data link layer confirm of the last frame sent before doing retries (only if frame sent with confirm requested). Measured after last byte of data frame sent.
	default value = 3000
Application Con-	GlobalSection.ApplConRequires
firm Requires	0 = application confirmations requested only for message fragments containing event data
	1 = application confirmations requested for message fragments containing event da- ta, and for non final fragments in a multifragment response (default)
Application Time-	GlobalSection.ApplTimeout
out	Timeout, in ms, waiting for remote device to confirm previous response, if requested. If application layer confirmations are used with data link confirmations, ensure the application layer confirm timeout is set long enough for all data link retries to complete. (devault value = 5000) The following formula describes this requirement:
	ApplTimeout > LinkConfTimeout * (LinkRe_tries + 1)
Need Time Syn-	GlobalSection.NeedTimeSvnc
chronisation	Time interval, in ms, to set the "need time" internal indication (contained in every application response message) which will cause master to write time back to this device.
	0 = The internal Indication will never set
Arm Select Timer	GlobalSection.ArmSelectTimer
	Amount of time, in ms, after a select command in which an operate command must be received.
	devault value = 10000



29

Enable Unsolicited	GlobalSection.EnableUnsol
	0 = unsolicited responses are not configured, and can never be enabled by the master (default)
	1 = unsolicited responses are configured, and must be specifically enabled by the master after an initial unsolicited response.
Unsolicited Events	GlobalSection.UnsolEvents_1
	For each class of change events (class 1, class 2, and class 3), this controls one con- dition under which an unsolicited response will be sent: If the number of events in each class meets or exceeds this value, an unsolicited response will be sent.
	devault value = 10
Unsolicited Time-	GlobalSection.UnsolTimeout_1
out	For each class of change events (class 1, class 2, and class 3), this controls one con- dition under which an unsolicited response will be sent: If the time (in ms) after an event occurs meets or exceeds this value, even if just 1 event occurs, an unsolicited response will be sent.
	devault value = 15000
Unsolicited Retry	GlobalSection.UnsolRetry
	If an unsolicited response is not confirmed within UnsolConTimeout, this parameter controls how soon another unsolicited response will be sent.
	devault value = 5
Unsolicited Con-	GlobalSection.UnsolConTimeout
firm limeout	Timeout, in ms, waiting for remote device to confirm previous unsolicited response. If this parameter is zero or less than ApplTimeout, the "retry" unsolicited response will be sent as soon as ApplTimeout expires (unless a read request was received in the meantime, in which case the read request will be responded first).
	devault value = 6000



3.2 Protocol assignment and mapping files

Precondition

- The parameterization of DNP 3.0 for a SIPROTEC[®] device requires:
 - selection of DNP 3.0 as system interface,
 - selection of a mapping file which fixes the allocation of the data objects of the SIPROTEC[®] device in the DNP 3.0 messages.

Bus specific parameters have to be defined simultaneously when selecting a mapping file (ref. to chap. 3.1).

3.2.1 Standard mappings 3-1 to 3-n

A number of standard mappings (standard mapping 3-1 to standard mapping 3-n, n = device type dependent number of standard mappings) are available for every $SIPROTEC^{®}$ device type.

Adaption of the
allocationIn adaptation to the concrete installation environment the standard allocation can be
changed (ref. to chap. 3.3):

- removing of data objects from the DNP 3.0 points,
- routing of data objects to free DNP 3.0 point locations,
- scaling of measured values according to the operating values of the primary equipment.



Note:

The size of the DNP 3.0 numbers (number of commands, annunciations, measured values, metered measurands) in output or input direction is exclusively fixed by the selection of a standard mapping.

The data in the DNP 3.0 messages are defined in the bus mapping documentations of the individual SIPROTEC[®] devices.

3.2.2 Compatibility with standard mappings of previous versions

Standard mappingsThe standard mappings 1 to standard mapping n (n = device type dependent number
of standard mappings) enclosed to DIGSI® 4.1 for SIPROTEC® devices
7SJ61...7SJ64 and 6MD63 should not be used for new device parameterizations.
A customization of allocations and scalings is not possible with these mappings and
the same functional limitations as shown below for standard mappings 2-1 to 2-n are
valid.Standard mappings
2-1 to 2-nCompatible with standard mappings 3-1 to 3-n but should not be used for new device
parameterizations.



3.2.3 Interface selection and mapping selection in DIGSI 4.21

Attention! The parameterization of DNP 3.0 with the functionalities described in this manual using standard mapping 3-1 to 3-n (n = device type dependent number of standard mappings) and DIGSI 4.21 requires the following preconditions:

• Update of the Parameter generating DLL for communication modules ("PG.DLL") in the DIGSI directory on the PC to version V02.04.01 or higher.

The update is required because of the extended functionalities of the standard mappings 3-1 to 3-n.

If no update of the Parameter generating DLL is carried out then an error occurs during the translation process of the mapping file when closing the dialog window **Properties - SIPROTEC 4 device** (ref. to Figure 3-1).

You can download the Paramter generating DLL V02.04.01 as

DIGSI 4.21 ServicePack 3 from Internet http://www.digsi.de

or please contact your Siemens representative.

When entering the device MLFB (order number) to create a new SIPROTEC[®] device in the **DIGSI 4 Manager** for parameterization, you are asked automatically for the selection of DNP 3.0 as system interface if the SIPROTEC[®] device has a DNP 3.0 communication module at delivery.

Changing the system interface to DNP 3.0 for already existing devices in DIGSI is also possible.

Protocol	Select the SIPROTEC [®] device in your project in the DIGSI 4 Manager and use
assignment for	the menu item Edit - Object properties to open the Properties -
system interface	SIPROTEC 4 device dialog window (ref. to Figure 3-1).

In the property sheet **Communications Modules** the entry "additional protocols, see MLFB Ext. L" has to be selected for "11. SYSTEM-Port".

By pressing the button "L: ..." the dialog window **Additional information** is opend which is used to enter the type of the communication module.

Please select in the dialog window Additional information:

- "Protocol" or "none" (depending on the SIPROTEC[®] device type) for "1. SYSTEM-Port" and
- "DNP3.0, RS485" or "DNP3.0, 820nm fiber ST-Connector" (depending on the hardware composition of the SIPROTEC[®] device) for "2. SYSTEM-Port".



Properties - SIPROTEC 4	device				>
Global MLFB Communi	cations Modules Syst	tem Management	FMS / IEC setting		
1 <u>1</u> . Port B 1 <u>2</u> . Port C		additional Protoc	cols, see MLFB Ext. I		• <u>L</u> :
Configuration:		Other protocols		- <u></u>	jet
1. SYSTEM-Port		Protocol			T
2. SYSTEM-Port		DNP3.0, RS	185		
OK				Help	
ОК			Ca	ancel	Help

Figure 3-1 DIGSI[®] 4.21: DNP 3.0 protocol assignment

Mapping fileThe mapping file selection is available in the dialog window **Other protocols** which
is opend by pressing the button "Set ..." in the property sheet **Communications**
Modules (ref. to Figure 3-1).

Other protocols	×
Mapping file : DNP V3.0 Standardmapping 3-2 (C53000-L1840-A006-03)	•
Changeable area : Load standard contents	
1// 7SJ617SJ65, 6MD63 DNP 3.0 standard mapping 3-2 V01.00.03 //	
// DNP Slave Address (165532): GlobalSection.Slave_Address = 1;	
// Data link address of the master device GlobalSection.MasterAddress = 100;	
// Baud Rate (9600, 19200)	
OK	Help

// Parity (0=ND, 1=EVEN, 2=0DD) GlobalSection.Parity = 2;	
// Idle Level for fiber optical modul (ref. Manual) GlobalSection.IdleLevel = 0;	
// Number of attempts to re-transmit a data link frame GlobalSection.LinkRe_tries = 2;	
// Request the remote device to send a data link layer confirm // (0=never/1=sometimes/2=always) GlobalSection.LinkConRequires = 0;	
// Time, in ms, to wait for remote device data link layer confirm GlobalSection.LinkConfTimeout = 3000;	

// Hequested or not for non-tinal tragments of multitragment messages // (Il-only fragments/1=lifew control) GlobalSection.ApplConRequires = 1;
// Timeout, in ms, waiting for remote device to confirm previous response GlobalSection.AppITimeout = 5000;
// Time Interval of Timesynchronisation (in ms) GlobalSection.NeedTimeSync = 3600000;
// Amount of time, in ms, after a select command must be received GlobalSection.ArmSelectTimer = 10000;
// Permit or not-permit unsolicited responses (0=disable/1=enable) GlobalSection.EnableUnsol = 1;
// Number of class 1 events to sent unsolicited response GlobalSection.UnsolEvents_1 = 10;

// Number of class 2 events to sent unsolicited response GlobalSection.UnsolEvents_2 = 10; // Time after an class 2 event occurs to sent an unsolicited response (in ms) GlobalSection.UnsolTimeout_2 = 15000; // Number of class 3 events to sent unsolicited response GlobalSection.UnsolEvents_3 = 10; // Time after an class 3 event occurs to sent an unsolicited response (in ms) GlobalSection.UnsolTimeout_3 = 15000; // This parameter controls how soon another unsolicited response will be sent GlobalSection.UnsolTetry = 5; // Timeout, in ms, waiting to confirm previous unsolicited response GlobalSection.UnsolTimeout = 5000;

Figure 3-2 DIGSI 4.21: Mapping file selection and bus specific parameters

The list box "Mapping file:" includes all available DNP 3.0 mapping files for the respective SIPROTEC[®] device type with their name and a reference to the associated bus mapping documentation.

In the edit area "Changeable area:" bus specific parameters can be changed. Please refer to chap. 3.1 for a description of these parameters.

The button "Load standard contents" restores the default values of the bus specific parameters.

Note:

Please, edit only the numbers in the rows which do not start with "//" and note the semicolons at the end of the line.

Editing anything else in the "Changeable area:" may cause an error when closing the **Properties - SIPROTEC 4** device dialog window.

Attention!

If after change of a measured value's scaling (ref. to chap. 3.4) a bus specific parameter is changed then all scalings are reset to their defaults according to the bus mapping documents again.



3.2.4 Interface selection and mapping selection in DIGSI 4.3 or higher

When entering the device MLFB (order number) to create a new SIPROTEC[®] device in the **DIGSI 4 Manager** for parameterization, you are asked automatically for the selection of DNP 3.0 as system interface if the SIPROTEC[®] device has a DNP 3.0 communication module at delivery.

Changing the system interface to DNP 3.0 for already existing devices in DIGSI[®] 4 is also possible.

ProtocolSelect the SIPROTEC® device in your project in the DIGSI 4 Manager and useassignment forthe menu item Edit - Object properties... to open the Properties -system interfaceSIPROTEC 4 device dialog window (ref. to Figure 3-3).

In the property sheet **Communications Modules** the entry "additional protocols, see MLFB Ext. L" has to be selected for "11. SYSTEM-Port".

By pressing the button "L: ..." the dialog window **Additional information** is opend which is used to enter the type of the communication module.

Please select in the dialog window **Additional information**:

- "Protocol" or "none" (depending on the SIPROTEC[®] device type) for "1. SYSTEM-Port" and
- "DNP3.0, RS485" or "DNP3.0 820nm fiber ST-Connector" (depending on the hardware composition of the SIPROTEC[®] device) for "2. SYSTEM-Port".

Properties - SIPROTEC device	x
Global MLFB Communications Modules S	ystem Management FMS / IEC setting
1 <u>1</u> . Port B 1 <u>2</u> . Port C, Port D	weitere Protokolle, s. Zusatz L
Configuration: To set a protocol with mapping (not IEC or f "Settings".	PROFIBUS FMS), open this device an then "Serial Ports" under
Additional information	on 🔀
<u>1</u> . Port B	Protokolle
<u>2</u> . Port B	DNP3.0, RS485
OK.	Help
0K	Cancel Help

Figure 3-3 DIGSI 4.3: DNP 3.0 protocol assignment



Mapping file

To select a mapping file, please open the SIPROTEC[®] device in DIGSI[®] 4.

The dialog window Interface Settings (in $DIGSI^{(R)}$ 4 via Settings - Serial **Ports**) offers in the property sheet Supplementary protocols at device the following dialog elements:

- display of the chosen communication module (ref. to page 3-35, "Protocol assignment for system interface"),
- the list box "Mapping file:" which includes all available DNP 3.0 mapping files for the respective SIPROTEC[®] device with their name and a reference to the associated bus mapping documentation,
- the edit area "Module-specific settings:" to change the bus specific parameters (ref. to chap. 3.1 for a description of these parameters).

Select function Control	DNP V2 / Testversionen / 7SJ	633 V4.4 1775J633 V04.4	0.01		
Betting Device Configuration Matixi Annunciation Masking I/O [Configuration Matixi) Default Display Control Display C	🖃 🏮 Online	Select function			
Advance in the intervent interv		Device Configuration			
Image: Second	Control Control Control Control	Masking I/O (Configural	ion Matrix)		
Docidiographic Records Control Userglays C C C Power System Data 1 Setting Group A Dictiographic Fash Reference Settings C General Device Setting Setial port on PC: Processing Communications Processing Setial port on PC: Processing Communications Processing Processing Mapping file: DNP V3.0 standard mapping 32 (C53000-L1840-A006-03) Module-specific setting: //7.56.55.6MD633 DNP 3.0 standard mapping 32 V01.00.03 /// 7.56.55.6MD633 DNP 3.0 standard mapping 32 V01.00.03 ///7.56.55.6MD633 DNP 3.0 standard mapping 32 V01.00.03 // 7.56.55.6MD633 DNP 3.0 standard mapping 32 V01.00.03 ///7.56.55.6MD633 DNP 3.0 standard mapping 32 V01.00.03 // 7.56.55.6MD633 DNP 3.0 standard mapping 32 V01.00.03 ///7.56.55.6MD633 DNP 3.0 standard mapping 32 V01.00.03 // 7.56.55.6MD633 DNP 3.0 standard mapping 32 V01.00.03 ///7.56.55.6MD633 DNP 3.0 standard mapping 32 V01.00.03 // 7.56.55.6MD633 DNP 3.0 standard mapping 32 V01.00.03 ///7.56.55.6MD633 DNP 3.0 standard mapping 32 V01.00.03 // 8 Data Bits GlobalSection Stand_Bit es = 5000; <td>N9 Measurement</td> <td>Default Display</td> <td></td> <td></td> <td></td>	N9 Measurement	Default Display			
Chi Power System Data 1 Setting Group A Declographic Fault Ref General Device Setting Time Synchronization Setial Ports Setial port on PC Presswords PROFIBUS FMS on the PC VD P3:0, FS405 Mapping file: DNP3:0, FS405 Module:specific setting: (** Language Module:specific setting: (** Language Module:specific setting: (** Tistific Setting) Module:specific setting: (** Language Module:specific setting: (** Stating Setting) Module:specific setting: (** Stating Setting Setting) Module:specific setting:	Oscillographic Becords	Control Display			
C Prover system Das 1 Oscillographic Fault Reing Group A Therface Settings Serial Ports	Test				
All Decilographic Fash Ref Interface Settings Setial Ports Setial port on PC: PROFIBUS FMS on the PC VD Addresses Deperator Interface Service interface Supplementary protocols at device Communications DNP3.0, R5495 Mapping file: DNP V3.0 standard mapping 3-2 (C53000-L1840-A006-03) Module specific settings: /// TSJ61.75J85, EMD63 DNP 3.0 standard mapping 3-2 V01.00.03 /// TSJ61.75J85, EMD63 DNP 3.0 standard mapping 3-2 V01.00.03 // DNP Slave Address = 1.; GlobalSection Match device GlobalSection Rate device GlobalSection Rate = 9600; // B Data Bits GlobalSection Slave_Address = 10; // Sop Bit [1, 2] GlobalSection Slave_B, Address = 10; // Sop Bit [1, 2] GlobalSection Slave_B, Bit = 1; // Sop Bit [1, 2] GlobalSection Slave_B, Bit = 1; // Sop Bit [1, 2] GlobalSection Slave_B, Bit = 1;		Setting Group A			
Interface Settings Interface Settings Setial port on PC: PROFIBUS FMS on the PC VD Addresses Setial Ports Setial port on PC: PROFIBUS FMS on the PC VD Addresses Setial Ports Setial port on PC: PROFIBUS FMS on the PC VD Addresses Operator Interface Setvice interface Supplementary protocols at device Communications DNP3.0.R5485 Mapping file: DNP3.0.85485 Mapping file: DNP3.0.85485 Mapping file: DNP3.0.85485 Module specific settings: ////////////////////////////////////		All Decillographic Fault Poli			
Serial port on PC: PROFIBUS FMS on the PC VD Addresses Serial port on PC: PROFIBUS FMS on the PC VD Addresses Serial port on PC: PROFIBUS FMS on the PC VD Addresses Serial port on PC: PROFIBUS FMS on the PC VD Addresses Serial port on PC: PROFIBUS FMS on the PC VD Addresses Serial port on PC: PROFIBUS FMS on the PC VD Addresses Serial port on PC: PROFIBUS FMS on the PC VD Addresses Serial port on PC: PROFIBUS FMS on the PC VD Addresses Serial port on PC: PROFIBUS FMS on the PC VD Addresses Or partial interface Service interface Supplementary protocols at device Communications DNP V3.0 standard mapping 3.2 (V01.00.03 Image: Provide Address of the master device GlobalSection Stave_Address = 1; // DNP Slave Address = 10; // Data link address of the master device GlobalSection Baud_Rate = 9600; // Baud Rate (9600.19200) GlobalSection Baud_Rate = 9600; // Stop Bit (1, 2) GlobalSection Stop_Bit = 1; Image: Period Image: Period Image: Period		General Device Setting	Interface Settings		×
Serial Ports Operator Interface Supplementary protocols at device Gwr Passwords atte: Language ONP30, RS485 Mapping file: ONP30, RS485 Module-specific settings: ///TSU51.75365, 6MD63 DNP 3.0 standard mapping 3.2 V01.00.03 // DNP Slave Address 11.655321; GlobalSection, MasterAddress = 1; // DNP Slave Address of the master device GlobalSection, MasterAddress = 10; // Data link address of the master device GlobalSection, Baud, Rate 9600; // B aub Rate (9600, 19200) GlobalSection, Data Bit = 8; // Stop Bit (1, 2) GlobalSection, Stop_Bit = 1; Image: Image: Image: Image: Image: Image:		Time Synchronization	Serial port on PC:	PB0EIBLIS EMS on	the PC VD Addresses
Wr Passwords #te: Language Communications Mapping file: DNP V3.0 standard mapping 3:2 (C53000L1840:A006:03) Module-specific settings: // 7SUST.7SUS5. SMDS3 DNP 3.0 standard mapping 3:2 V01.00.03 // DNP Slave Address 11. 65532): GlobalS ection, Slave_Address 11: // Data link address of the master device GlobalS ection. Baue_Rate = \$600; // Baud Rate (\$600, 19200) GlobalS ection. Stop_Bit = 1; IslobalS ection. Stop_Bit = 1; IslobalS ection. Stop_Bit = 1;		Serial Ports	Operator Interface	Service interface	Supplementary protocols at device
etc. Language Communications DNP3.0, R5485 Mapping file: DNP3.0, standard mapping 3.2 (C53000-L1840-A006-03) Module-specific settings: ///		Passwords	operator interface	Scivice intellidee	
Mapping file: DNP V3.0 standard mapping 3.2 (C53000L1840-A006-03) Module-specific settings: ///TSJ61.75J65.6MD63 DNP 3.0 standard mapping 3.2 V01.00.03 ///DNP Slave Address [1.65532]: GlobalSection.Slave_Address = 1; //Data link address of the master device GlobalSection.Baud_Rate = 9600; //B aud Rate (9600, 19200) GlobalSection.Baud_Rate = 9600; //S Data Bits GlobalSection.Stap_Bit = 8; //Stop Bit (1.2) GlobalSection.Stop_Bit = 1; Image: Comparison Stop_Bit = 1; Image: Comparison Stop_Bit = 1;		abc Language	Communications	DNP3.0, RS485	
Mapping file: DNP V3.0 standard mapping 3.2 (C53000-L1840-A006-03) Module-specific settings: // TSU51.75J65, 6MD63 DNP 3.0 standard mapping 3.2 V01.00.03 // DNP Slave Address [1.65532]; GlobalSection, Slave_Address = 1; // Data link address of the master device GlobalSection, MasterAddress = 10; // Baud Rate (9600, 19200) GlobalSection, Data_Bit = 8; // Stop Bit (1, 2) GlobalSection, Stop_Bit = 1; Image:					
Module-specific settings: // 75J61.75J65, 6MD63 DNP 3.0 standard mapping 3.2 V01.00.03 // UNP Slave Address [1, 65532]; GlobalSection, Blave, Address = 1; // Data link, address, address = 100; // Data link, address, address = 100; // Bauk Rate (9600, 19200) GlobalSection, Bauk_Rate = 9600; // Stop Bat (Bits Data Bits = 8; // Stop Bit (1, 2) GlobalSection, Stop_Bit = 1; Image: Stop Bit (1, 2) GlobalSection, Stop_Bit = 1; Image: Stop Bit (1, 2) GlobalSection, Stop_Bit = 1;			Mapping file:	DNP V3.0 standard mapping 3-2	(C53000+L1840+A006+03)
Module-specings: ///TSJG1.7SJ65, 6MDG3 DNP 3.0 standard mapping 3:2 V01.00.03 ///DNP Slave Address [1.65532]: BlobalSection, Slave_Address = 1; // Data link address of the master device BlobalSection, Blave_Address = 100; // Baud Rate (9600, 19200) BlobalSection, Blave_Address = 100; // Baud Rate (9600, 19200) BlobalSection, Blave_Address = 100; // B Data Bits BlobalSection, Blave_Bit = 8; // Stop Bit (1, 2) BlobalSection, Stop_Bit = 1; Image: Device OK DEGI > Device			NA 1.1 12 12		
// 73.16173.1656M.DB3 DNP 3.0 standard mapping 3.2 V01.00.03 //			Module-specific settings:		
// DNP Slave Address (1.65532): GlobalS ection. Slave_Address = 1; // Data link. address of the master device GlobalS ection. MasterAddress = 100; // B aud Rate (9600, 19200) GlobalS ection. Baud_Rate = 9600; // B D ab Bits GlobalS ection. Data_Bit = 48; // Stop Bit (1, 2) GlobalS ection. Stop_Bit = 1; Image: Stop Bit (1, 2) GlobalS ection. Stop_Bit = 1; Image: Stop Bit (1, 2) GlobalS ection. Stop_Bit = 1;			// 7SJ617SJ65, 6MD6	3 DNP 3.0 standard mapping 3-2 V01	.00.03
// DNP Slave Address 11: 5532; GlobalS ection, Slave_Address = 1; // Data link address of the master device GlobalS ection.MasterAddress = 100; // Baud Rate (9600, 19200) GlobalS ection.Baud_Rate = 9500; // 8 Dala Bits GlobalS ection.Baud_Rate = 9500; // 8 Dala Bits GlobalS ection.Stop_Bit = 1; Image: Stop Bit (1, 2) GlobalS ection.Stop_Bit = 1; Image: Stop Bit (1, 2) GlobalS ection.Stop_Bit = 1; Image: Stop Bit (1, 2) GlobalS ection.Stop_Bit = 1;			//		
Lidobals ection. Slave_Address = 1; // Data link address of the master device Giobals ection. Masker Address = 100; // Baud Rate (9600, 19200) Giobals ection. Baud_Rate = 9600; // B Data Bits Giobals ection. Data_Bit = 8; // Stop Bit (1, 2) Giobals ection. Stop_Bit = 1; Image: Comparison of the provide stop			// DNP Slave Address	(165532):	
// Data link address of the master device GlobalS ection.Master/Address = 100; // B aud Rate (9600, 19200) GlobalS ection.Baud_Rate = 9600; // 8 Data Bits GlobalS ection.Data_Bit = 8; // Stop Bit (1, 2) GlobalS ection.Stop_Bit = 1; Image: Construction of the stop of			GIODAISECTION.Slave_A	(ddress = 1;	
LilobalSection.Maste/Address = 100; // Baud Rate (Bodo). 19200) GlobalSection.Baud_Rate = 9600; // 8 Data Bits GlobalSection.Data_Bit = 8; // Stop Bit (1, 2) GlobalSection.Stop_Bit = 1; Image: State			// Data link address of	the master device	
// Baud Rate (9600, 19200) GlobalSection.Baud, Rate = 9600; // B Data Bits GlobalSection.Baud, Rate = 9500; // S Data Bits GlobalSection.Stop_Bit = 8; // S top Bit (1, 2) GlobalSection.Stop_Bit = 1; Image: Comparison of the sector stop			GlobalSection.MasterA	ddress = 100;	
GlobalSection.Baud_Rate = 9600; // 8 Data Bits GlobalSection.Data_Bit = 8; // Stop Bit (1, 2) GlobalSection.Stop_Bit = 1; ▼ OK DIGSI > Device Abbrechen Hille			// Baud Rate (9600, 1)	9200)	
// 8 Data Bits GlobalSection.Data_Bit = 8; // Stop Bit (1, 2) GlobalSection.Stop_Bit = 1; Image: Comparison of the store of			GlobalSection.Baud_R	ate = 9600;	
GiobalSection.Data_Bit = 8; // Stop Bit (1, 2) GiobalSection.Stop_Bit = 1; OK DGGI > Device Abbrechen Hilfe			// 8 Data Bits		
V Stop Bit (1, 2) GlobalSection Stop_Bit = 1; Image: Constraint of the section of t			GlobalSection.Data_Bi	t = 8;	
OK DGSI⇒ Device			// Stop Rit (1, 2)		
			GlobalSection.Stop_Bit	t=1;	
					-
OK Digisi > Device Abbrechen Hilfe			4		Þ
OK Digisi > Device Abbrechen Hille		1 1			
		,	OK DIGSI >	Device	Abbrechen Hilfe

Figure 3-4 DIGSI[®] 4.3: Mapping file selection and bus specific parameters





List box "Mapping file"

If no mapping file is currently assigned to the SIPROTEC[®] device then the following entries are available in the list box "Mapping file":

Selection	Meaning			
<none></none>	No mapping file is assigned to the device.			
DNP 3.0 standard mapping 3-1	Selection of a mapping file 3-1 to 3-n (n = device			
 DNP 3.0 standard mapping 3-n	type dependent number of standard mappings).			

The following entries can be selected at an already existing mapping file assignment:

Selection	Meaning
<none></none>	No mapping file is assigned to the device.
<see module-specific="" settings=""></see>	This selection indicates the currently to the device assigned mapping file with the changes of bus specific parameters already carried out in the edit area "Module-specific settings". Number and version of the mapping file have to be taken from the first line in the edit area "Module- specific settings".
DNP 3.0 standard mapping 3-1 DNP 3.0 standard mapping 3-n	(New) Selection of a mapping file 3-1 to 3-n (n = device type dependent number of standard mappings). All bus specific parameters are reset to default values.

If the mapping file assignment was changed for a SIPROTEC[®] device, then this is in general connected with a change of the routing of the SIPROTEC[®] objects to the system interface.

Please, check after choice of a new mapping file the allocations to "Destination system interface" or "Source system interface" in the **DIGSI configuration matrix**.

Edit area Please, edit only the numbers in the rows which do not start with "//" and note the semicolons at the end of the line.

Editing anything else in the "Module-specific settings" may cause an error when closing the **Interface Settings** device dialog window.



3.3 Customization of the allocation

The identification whether an SIPROTEC[®] information is routed on system interface (DNP) is shown in the columns "Source system interface" and "Destination system interface" in the DIGSI[®] 4 Configuration matrix.

A cross ('X') in this column indicates the associated information as "routed on system interface".

🏥 Settings - Maski	ing I/	'O (Configuration Matr	Inf x) - EV S E IS / DNP 7SA / 7	ormation type	S syster A522	iour n in	ce tei	fac	ce	sy	De /ste	esti em	nat inte	ior erfa	ו ace
			Information			S	Sou	çe			0)esi	hati	on	
	No.	Display text:	Long text:		Туре	ы	F	ŝ	С	во	LE	Buf	ŝ	С	CM
 P Svetem Data 1	-														
1.5ystembata 1		>Set Group Bit0	>Setting Group Select Bit 0		SP										
		>Set Group Bit1	>Setting Group Select Bit 1		SP									ion erface on C CM	
Chapter Oroup		Group A	Group A		IntSP			Х					х		
Change Group		Group B	Group B		IntSP			х					х		
		Group C	Group C		IntSP			х					х		
		Group D	Group D		IntSP			Х					Х		

	Figure 3-5	DIGSI [®] 4 Configuration matrix with columns for system interface routing
Source system	The SIPRC	DTEC [®] object can be controlled via DNP.
interface	This is pos	sible for the following information types:
	IntSP	Internal single-point indication (tagging)
	IntDP	Internal double-point indication (tagging)
	SC/DC	Singel control/Double control without feedback from process
	SF/DF	Singel control/Double control with feedback from process
Destination system	The value of	of the SIPROTEC [®] object is transmitted to the DNP master.
interface	This is pos	sible for the following information types:
	SP	Single-point indication
	DP	Double-point indication
	Out	Output indication
	IntSP	Internal single-point indication (tagging)
	IntDP	Internal double-point indication (tagging)
	MV	Measured values
	MVMV	Power meter (metered value, source is a measured value)
	PMV	Pulse (metered value, source is a pulsed binary input)
	To add or r interface" s	emove an information to "Source system interface" or "Destination system set/reset the cross ('X') in the associated column of the DIGSI [®] 4 configura-
	tion matrix	(pop-up menu when pressing the right mouse button).



1						*		
Ī	e i	X	(cor	l hfigu	red)	**	X	XIX
1		_ (inot	conf	igure	ed)		k

Figure 3-6 Pop-up menu in DIGSI[®] 4 Configuration matrix

9	Note:
	The max. number of routable objects of an information type varies according to the chosen mapping file.
	If e.g. a measured value, not routed in the mapping file per default, shall be transferred via DNP then first a measured value already routed has to be removed from system interface so that the DNP information point gets available.
	An error message is shown if all routing possibilities of an information type are occupied and if it is nevertheless tried to route an information of this type.
Adding an allocation	Adding an allocation requires (in addition to the identification in the system interface column of the DIGSI [®] 4 Configuration matrix) the selection of the position of the information in the DNP point list as well as the definition of DNP specific parameter (e.g. Class number) and scaling values for measured values (scaling of measured values ref. to chap. 3.4.3).
	Therefore, after adding the allocation the "Object properties" dialog window which is

Therefore, after adding the allocation the "Object properties" dialog window which is used to define the message position of the information is opend automatically.

ect pr	roperties - Error Sum Alarm - OUT	
otocol	info-Destination	
ransn	nission via supplementary protocol:	
No.	Settings	Value
1	Point index	47
1	DNP class	Class 2
OK	Ü <u>b</u> ernehmen	Abbrechen Hilfe



Changing of an existing allocation

If an information, already routed on system interface, shall get another (empty) position in the DNP point list, then the "Object properties" dialog window (ref. to Figure 3-7) has to be used to this ("Properties ..." in the pop-up menu when pressing the right mouse button in the row associated to the information in one of the columns "Display text", "Long text" or "Type").

U2 =	U2	2 (negative sequend
P = Q = S =	Insert Information Delete Information	tive power) tive power) arent power)
Freq= 3U0 =	Properties 3L	ncy I0 (zero sequence)



Dependent on the information type the following parameters are to select in the property sheet "Protocol info source" or "Protocol info destination" of the "Object properties" dialog window:

Protocol info source

Parameter	Comments	Info types
Point index	The index indicates the position in the DNP point list of Binary Outputs.	IntSP, IntDP, SC/
Flags	Command properties (Latch ON/OFF, depending on the object info type)	DC, SF/DF

Protocol info destination

Parameter	Comments	Info types
Point index	The index indicates the position in the DNP point list of Binary Inputs, Analog Inputs or Counters (depending on the object info type).	SP, DP, Out, IntSP, IntDP, MV, MVMV, PMV
DNP Class	Class of the DNP information object.	

Example

The information "Error sum alarm" (ref. to Figure 3-7) is transferred after routing to "Destination system interface" at DNP Binary Input point list index no. 47 as a Class 2 data object.

9	Note:
	Only the positions in the DNP point list (Point index) are offered to the selection on which the information type still can be routed according to the mapping file and the current occupancy.
Binary incoming annunciations	Binary incoming annunciations (marked with the sign '>' in the name, e.g. ">BLOCK 21 Dist.") cannot be routed directly as "Source system interface". A control of these objects via DNP as a substitute for using binary inputs is however often meaningful.
	To do this, Taggings (information type: IntSP) routed to "Source system interface" as well as "Destination CFC" are used. The binary incoming annunciation which is routed as "Source CFC" is connected via a CONNECT module in CFC to the tagging.
Example	 Control of object ">BLOCK 21 Dist." using a user-defined Tagging via DNP: In the DIGSI[®] 4 configuration matrix set the source for ">BLOCK 21 Dist." to CFC output. Create a user-defined Tagging from the Information catalog and connect this information to CFC input and to "Source system interface" (e.g. in the "User-allocated")
	single commands" block of the Binary Output point list, ref. to Point lists manuals of the SIPROTEC [®] devices).



- Open a CFC working page and insert a CONNECT module.
- Connect the input ("BO X") of the CONNECT module with user-defined Tagging object.
- Connect the output ("Y BO") of the CONNECT module with the operand ">BLOCK 21 Dist." (group: "21 Dis general").
- Save and translate the CFC working page.

The object ">BLOCK 21 Dist." (and with that the associated protective function) can be influenced by changing the value of the user-defined Tagging object via DNP now.

3.4 Scaling of measured values

Measured values will be transferred via DNP between the SIPROTEC[®] device and the DNP master as integer values but they are in general available in the SIPROTEC[®] device in floating-point format as a percentage referred to the parameterized nominal values of the primary equipment.

3.4.1 Measurement conversion

Before transmission of a measured value via DNP a measurement conversion (scaling) must be executed in the SIPROTEC[®] device.

Scaling Scaling of a measured value to the format for the transmission via DNP means the definition of:

- Type,
- Scaling factor,
- Zero offset.

Type Decision, whether the measured value is transmitted as percentage value or whether a conversion shall take place into primary or secondary value before (depending on the measured value not all of these three possibilities are available, e.g. no secondary values for power values).

Threshold value Changes of measured values are transmitted using DNP object 32 (Analog Change Event) only if the accumulated change differences of the 16-Bit Analog Input exceed the threshold value.

Scaling factor The measured value in the SIPROTEC[®] device (floating-point format) is multiplied by the *Scaling factor* before transformation to an integer value. With that it is possible to transfer fractional digits by multiplication by a multiple of 10 in the integer value.

Zero offset The *Zero offset* is added to the result of the multiplication of the measured value in the SIPROTEC[®] device (floating-point format) by the scaling factor.

41



The measured value in the integer format for transmission via DNP is calculated summarizing according to the following formula:

Measured value_{Integer} = Measured value_{Float} * Scaling factor + Zero offset

in which "Measured value_{Float}" is a percentage value or, if necessary, changed into primary value or secondary value before (according to the definition of *Type*).

3.4.2 Number representation in dependence of the parametrization

For specification of the scaling of a measured value it must be known in which number format (number of the relevant fractional digits) the measured value is available in the SIPROTEC[®] device and to which unit it refers.

 Percentage value
 A scaling factor of 100 is recommended for percentage values.

 With that the "Measured value_{Integer}" in the DNP message has to be interpreted as:

+/- 32767 corresponds to +/- 327.67 %

Secondary value The transmission of a measured value as secondary value is meaningful only in few cases (e.g. transducer measured values in mA).

The number of significant fractional digits depends on the installations and transducers data.

Primary value The fractional digits and the respective unit at primary values depends tightly on the parameterized nominal values of the primary equipment (DIGSI[®] 4: "Power system data 1" and "Power system data 2").

Voltages: V_a , V_b , V_c , V_{a-b} , V_{b-c} , V_{a-c} , $3V_0$, V1, V2 Parameter: 1103 Full Scale Voltage

Parameter area	Number representation / unit
1.0 10.0 kV	0.00 99.99 kV
>10.0 100.0 kV	0.0 999.9 kV
>100.0 1000.0 kV	0 9999 kV
>1 MV	0 99.99 MV

Displacement voltages: V_N

Parameter: 0203 Voltage Transformer - Rated Primary Voltage 0211 Ratio factor V_{ph}/V_{delta}

Product of parameters 0203 and 0211	Number representation / unit
100.0 1000.0 V	0 9999 V
>1.0 10.0 kV	0.00 99.99 kV
>10.0 100.0 kV	0.0 999.9 kV
>100.0 1000.0 kV	0 9999 kV
>1 MV	0.00 99.99 MV





Currents: I_a , I_b , I_c , $3I_0$, I_1 , I_2

Parameter: 1104 Full Scale Current

Parameter area	Number representation / unit
10 100 A	0.0 999.9 A
>100 1000 A	0 9999 A
>1 10 kA	0.00 99.99 kA

Ground currents: \mathbf{I}_{Ns} , \mathbf{I}_{N}

Parameter: 0205 Current Transformer – Rated Primary Current 0221 Ratio factor I₄ / I_{ph} for CT's

Product of parameters 0205 and 0221	Number representation / unit
0.0 1.0 A	0 9999 mA
>1.0 10.0 A	0.00 99.99 A
>10.0 100.0 A	0.0 999.9 A
>100.0 1000.0 A	0 9999 A
>1.0 kA 10.0 kA	0.00 99.99 kA
>10 kA	0.0 999.9 kA

Power: P, Q, S

Parameter: 1103 Full Scale Voltage 1104 Full Scale Current

Product of parameters 1103 and 1104 multiplied by $\sqrt{3}$	Number representation / unit
10.0 100.0 kW (kVAR)	0.0 999.9 kW (kVAR)
>100.0 1000.0 kW (kVAR)	0 9999 kW (kVAR)
>1.0 10.0 MW (MVAR)	0.00 99.99 MW (MVAR)
>10.0 100.0 MW (MVAR)	0.0 999.9 MW (MVAR)
>100.0 1000.0 MW (MVAR)	0 9999 MW (MVAR)
>1.0 10.0 GW (GVAR)	0.00 99.99 GW (GVAR)
>10 GW (GVAR)	0.0 999.9 GW (GVAR)

Example

Definition of the scaling for a power measurement value

In the parameter set is configured:

Full Scale Voltage (1103):V_{prim} = 400 kV

Full Scale Current (1104):Iprim = 1000 A

It follows:

 $V_{prim} * I_{prim} * \sqrt{3} = 692.82 \text{ MW} (MVAR)$

In the SIPROTEC[®] device the power measurement values are available with the following number representation and unit (see table above):

0 ... 9999 MW (MVAR)

According to this a scaling factor of 1 is meaningful.

With that the "Measured value_{Integer}" in the DNP message has to be interpreted as:

+/- 32768 corresponds to +/- 32768 MW (MVAR)



3.4.3 Parametrization of scaling values in DIGSI[®] 4

The "Object properties" dialog window contains for measured values -besides the property sheet "Protocol info source" or "Protocol info destination" – an additional property sheet titled "Measured value destination".

1 S	a stimulation in status	
	caling index	
1 Z	lero offset	0.0
1 S	caling factor	10.0
1 T	hreshold value	10.0
1 T	ype	Primary value

Figure 3-9 Scaling settings of a measured value

The change of the scaling and with that customization to the installation-specific operating values is made by selection of one scaling index in the "Object properties" dialog window of the measured value.

Scaling index

A predefined scaling possibility (settings of *Type, Threshold value, Scaling factor* and *Zero offset*) is summarized using a scaling index.

Scaling Index	Туре	Threshold value	Scaling factor	Zero offset
0	Primary value	1.0	1.0	0.0
1	Primary value	10.0	10.0	0.0
2	Primary value	100.0	100.0	0.0
3	Primary value	1000.0	1000.0	0.0
4	Primary value	10000.0	10000.0	0.0
5	Secondary value	1000.0	1000.0	0.0
6	Percentage value	100.0	100.0	0.0
7	Secondary value	10.0	1.0	0.0
8	Secondary value	100.0	10.0	0.0
9	Secondary value	1000.0	100.0	0.0



Note:

If after change of the scaling a bus specific parameter is changed (e.g. DNP Slave address, ref. to chap. 3.2), then all scalings are reset to their defaults according to the point lists (ref. to Point lists manuals of the SIPROTEC[®] devices) again.





3.5 Time synchronisation

For time synchronization of the SIPROTEC[®] devices via DNP protocol the "Source of time synchronisation" has to be configured as "Fieldbus" in DIGSI[®] 4.

Fieldbus	Fault indication after:
Internal Clock IRIG B DCF77	2 (>1 min)
Synch.Box	Time format for display
External Impulse via Binary Input	C dd mm yy
rieladus	• mm/dd/yy
	Time correction
Pulse via binary input:	Offset to time signal:
Not configure	00:00 hh:mm

Figure 3-10 Source of time synchronisation

Two additional parameter influence the time synchronisation:

Time Interval of Interval of the DNP slave time synchronisation requests to the DNP master (ref. to Timesynchronichap. 3.2, Figure 3-2). sation For best precision of time synchronisation a value of 1 min (60000 ms) is recommended. The SIPROTEC[®] device supervises the continuous reception of time synchronisation Time synchronisation monitoring messages. After the time duration of "Fault indication after:" (ref. to Figure 3-10) the fault indication "Clock SyncError" in the SIPROTEC[®] device is set to ON and remains ON until the next time synchronisation message is received. The value of "Fault indication after:" must be chosen greater than the "Time Interval of Timesynchronisation"(ref. to chap. 3.1).



Hardware interface

4.1	Technical data of the RS485 modul	48
4.2	Technical data of the fiber-optical modul	49



47

4

	Two communication modules are available for the connection of DNP3.0 to the SIPROTEC $^{\mbox{$^{\circ}$}}$ devices.
AME module	Universal asynchronous communication module with isolated RS485 interface.
AMO module	Universal asynchronous communication module with fibre-optical interface.

4.1 Technical data of the RS485 modul

Connection	9-pin D-SUB port; signals A, B, RTS, VCC1 and GND1 (s. table below)
Protocol	half-duplex
Maximum Distance of Transmission	3300 ft
Test voltage	500 V _{AC}
Bus termination	Integrated, activatable terminating resistors 221 Ω between A and B 392 Ω between B and VCC1 or A and GND1 Input resistance not terminated \geq 10 k Ω , then bus termination via bus plug with integrated ter- minating resistors.
Level	$ \begin{array}{l} \mbox{Transmitter:} \\ \mbox{Low: -5 V \leq U_{A-B} \leq -1.5 V} \\ \mbox{High: +5V \geq U_{A-B} \geq +1.5V} \\ \mbox{Receiver:} \\ \mbox{Low: } U_{A-B} \leq -0.2V \\ \mbox{High: } U_{A-B} \geq +0.2V \\ \mbox{Transmitter and receiver are surge-proof in case of voltage-range } -7V+12V \mbox{ between A and GND1 and/or B and GND 1} \end{array} $
Maximum of DNP-devices connected to the same bus segment without any repeater	32 [*]

Table 4-1 Technical data of the connection via the RS485 module

*For exclusive utilisation of *AME* modules at the bus.

This value could be smaller depending on the used DNP master and further modules at the bus.

If more then 32 devices at the bus are needed, RS485 repeaters which support bit retiming have to be used



Pin	RS485 signal	Meaning
1	Shield	Shield / operational ground
2		
3	A	RS485 connection pin A
4	RTS	Directions control RTS (TTL level)
5	GND1	Ground to VCC1
6	VCC1	Supply voltage +5V DC (max. 100 mA, supply voltage for terminating resistors)
7		
8	В	RS485 connection pin B
9		

Table 4-2 Assignment of the bus connection at the device (D-SUB outlet)

4.2 Technical data of the fiber-optical modul

Connection	fibre-optical interface, Rx and Tx, 820nm, BFOC/2.5
Protocol	half-duplex
Max. line length	- 2000 m / 1.25 miles for glass fiber 62.5/125 μm - approx. 2 m / 6,56 feet for plastic fibre
Optical budget	min. 8 dB for glass fiber 62.5/125 μm
Status for "no signal"	"Light off"

Table 4-3Technical data of the connection via fibre-optical module





Glossary

AR	Automatic Recloser
CFC	Continuous Function Chart
DC	Double Command
DIGSI [®] 4	Parameterization system for SIPROTEC [®] devices
DNP	Distributed Network Protocol
DP	Double-point Indication
Input data/ input direction	Data from the DNP slave to the DNP master.
Mapping	Allocation of the SIPROTEC [®] data objects to the DNP point index.
Output data/ output direction	Data from the DNP master to the DNP slave.
RTU	Remote Terminal Unit
SC	Single Command
SP	Single-point Indication



51



Index

Α

Additional support	4
AME module	14
AMO module	14
Applicability of manual	4
Application Confirm Requires	29
Application Timeout	29
Arm Select Timer	29

В

Baud rate		.28
Bus specific parameters	28,	34

С

Caution (definition)4
communication database24
Communication modules
Communication module types 14
Hardware revisions 14
Compatibility
Copyright2

D

Danger (definition)4
Data Bit
DIGSI 4.21
Display of module-specific information17
Firmware versions and mapping file 20
HW information and boot firmware 21
Status and parameters of the DP slave 19
DNP messages
DNP V3.0 specification

Ε

Edit area	
Enable Unsolicited	

F

fiber-optical modul	
---------------------	--

Index

G

GlobalSection.ApplConRequires2	29
GlobalSection.ApplTimeout2	29
GlobalSection.ArmSelectTimer2	29
GlobalSection.Baud_Rate2	28
GlobalSection.Data Bit2	28
GlobalSection.EnableUnsol	30
GlobalSection.IdleLevel2	28
GlobalSection.LinkConfTimeout2	29
GlobalSection.LinkConRequires	29
GlobalSection.LinkRe_tries	28
GlobalSection.Master_Address	28
GlobalSection.NeedTimeSync2	29
GlobalSection.Parity	28
GlobalSection.Slave Address	28
GlobalSection.Stop Bit2	28
GlobalSection.UnsolConTimeout	30
GlobalSection.UnsolEvents	30
GlobalSection.UnsolRetry	30
GlobalSection.UnsolTimeout	30

Н

Hardware revisions	14
Compatibility with firmware version	15
Compatibility with mapping files 16	

I

Idle Level	

L

Link Confirme Requires	29
Link Confirme Timeou	29
Link Retries	28
List box	37
list box	34

Μ

Master address	·	
----------------	---	--



Ν

Need Time Synchronisation	29
Note (definition)	4

Ρ

Parameter names	5
Parameter options	5
parameterization of DNP 3.0	31
Parity	28
Percentage value	42
Primary value	42

Q

R

response times	26
	20
RS185 modul	18
	7 0

S

Scaling	41
Scaling factor	41
Scaling index	44
Scaling of a measured	41
Secondary value	42
Slave address	28

standard mappings31Stop Bit28Symbol conventions5

Т

Target audience of manual	
Threshold value	41
time synchronization	45
Typographic conventions	5

U

Unsolicited Confirm Timeou	30
Unsolicited Events	30
Unsolicited Retry	30
Unsolicited Timeout	30

V

Validity		4
----------	--	---

W

Morning	(definition)		л
vvanning	(deminion)	······ · · · · · · · · · · · · · · · ·	+

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