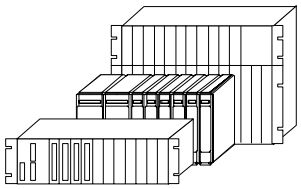
Ax 1703



Firmware Description

DNPSA0

Distributed Network Protocol 3.0 (DNP 3.0) Slave
Unblanced Multiple Point Slave

HW-Type: 2551 / FW-Type: 1531

This document is applicable to the following product(s):

DNPSA0	Rev. 01 and higher

Version	Revision	Date	Change
A, 1	00	22.02.06	First edition

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1. System overview

1.1. Brief description

The system element DNPM00 is designed for the communication of Ax/ACP 1703 system components with remote master terminal units in accordance with Distributed Network Protocol 3.00. The protocol operates on the principle of Unbalanced Multiple Point Slave (multi-point traffic slave station). The firmware is able to connect to only one master station. For the parameterisation of the data points, presently only a maximum of 1500 data records are available in the receive direction and only a maximum of 2500 data records in the transmit direction.

1.2. Technical data

Modulation:	PCM – byte asynchronous	
Transmission rate:	50 – 64000 Bit/s	
USART Byte frame:	8 Data bits none Parity bit (none parity) 1 Stop bit	
Bit transmission sequence:	LSB (least significant bit is transmitted first)	
Message protection:	HA = 6	
Message formats:	Command direction ->	commands set points General interrogation Counter interrogation Time synchronisation
	Transmit direction ->	binary information time tagged measured values time tagged integrated totals time tagged

This protocol element implements, as an adaptation to non-SAT systems, only a part of the functionality and the data formats of the non-SAT interface. For a concrete case of application, it is therefore to be checked, to what extent the real requirements correspond with the functionality implemented here and to what extent additional expansions or adaptations are required.

1.2.1. Limitations

The Firmware described in this specification only supports the data communication mode Unbalanced Multiple Point Slave (multi-point traffic slave function). However, the remote terminal unit can also transmit data without a call from the master (unsolicited response).

- No disturbance record data
- only selected function codes (see chapter 2.2.4.4.)

The Firmware supports all user data objects of the DNP V3.00 "Subset Definitions Level 3", except "pattern control block" and "pattern mask" object types. The detailed description of supported data types and function codes can be found in the device profile document.

1.3. Used interface lines

The following V.24 interface lines are used:

TxD	<103>	Transmission data
RxD	<104>	Reception data
GND	<102>	Signal ground

In addition the following V.24 lines are used, however not in accordance with the V.24 recommendation.

RTS	<105>	serves to switch on the transmit signal level of the transmission facility
DCD	<109>	serves to detect the reception signal level of the transmission facility

1.4. Data communication control

The data communication control functions in accordance with the MASTER/SLAVE principle.

On demand for data by the master, the called remote terminal unit replies with the desired data.

The remote terminal unit is however also able to transmit spontaneous data without interrogation by the master (unsolicited response).

2. DNPSA0 protocol description

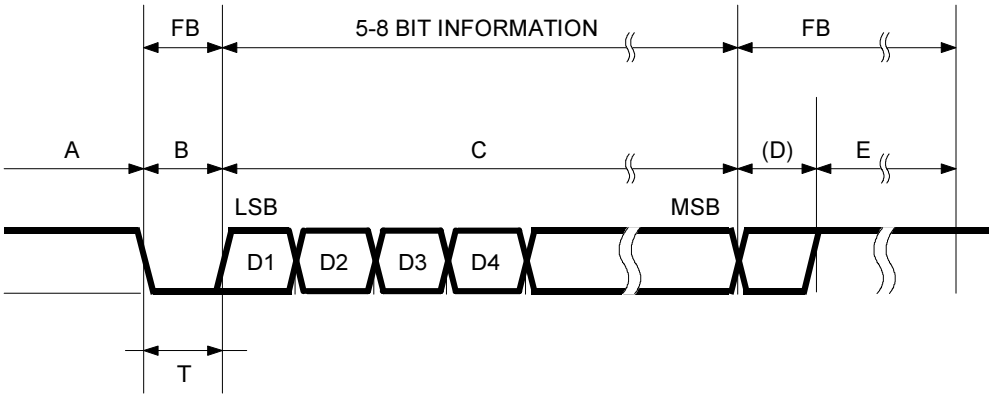
2.1. PCMBA-Modulation method

The data are modulated in groups, each of 8 bit pulse-code and transmitted asynchronously. A USART-module in asynchronous mode thereby provides every byte with a byte frame (BF).

For the DNP protocol, this byte frame contains:

1	Start bit
8	Data bits
1	Parity bit (normally used as no parity)
1	Stop bit

Due to the start- and stop bits of the byte frame, the synchronisation of the receiver takes place anew with every byte.



A: Off-circuit state of the line (binary information "1"), between two messages at least 33 bit (in case of error)
B: Start bit ("0")
C: 5-8 bit data (any frame data or message data), LSB (Least Significant Bit) is transmitted first
D: Parity bit (NO/ODD/EVEN PARITY) (= configurable)
E: 1/1, 5/2 Stop bit(s) ("1") (= configurable)
T: Time for the transmission of a bit (1/transmission rate)
FB: Framing bits of the USART module

2.2. Message description

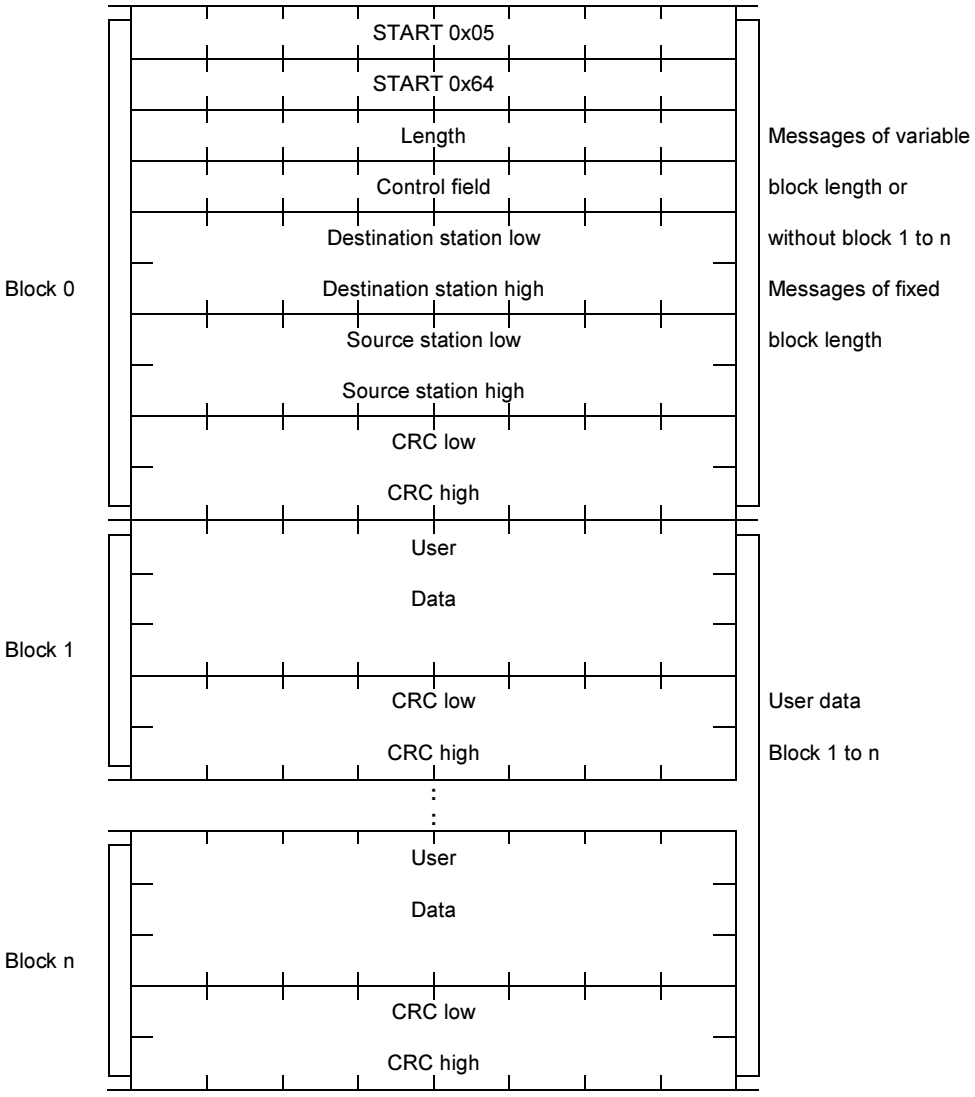
The message structure corresponds to the norms

IEC 870-5-1 "Transmission frame formats"
IEC 870-5-2 "Link transmission procedures"
IEC 870-5-5 "Basic Application Function"

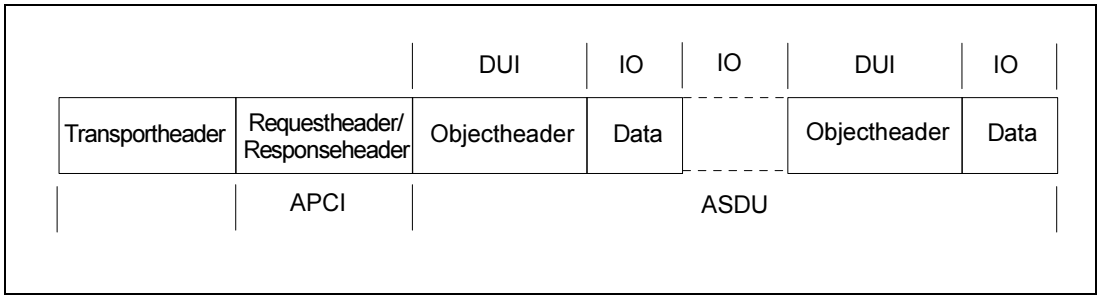
Only message format FT3 is supported.

For a precise message description, please refer to the general protocol documentation DNP.

2.2.1. Message format according to FT3

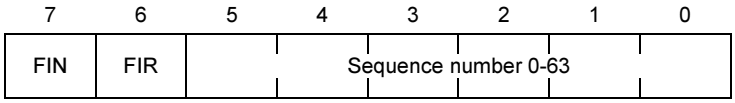


2.2.2. Message structure User Data



2.2.3. Transport header

The transport header is included in every message of a sequence.



FIN: If this bit is set, then this message is the last of a sequence or a fragment.

FIN = 0 More messages are to follow
FIN = 1 Last message of a fragment

FIR: This bit is set for the first message of a sequence or a fragment.

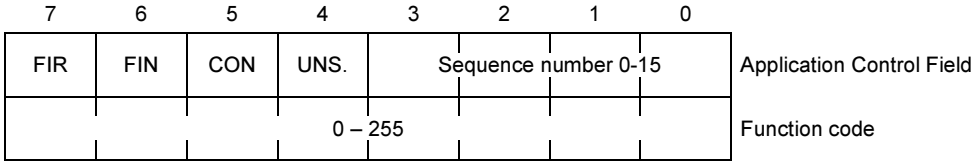
FIR =1 First message of a sequence
FIR =0 Part-message of a sequence

Sequence No.: The sequence number serves to identify the correct message sequence of fragments. It is used in a range of 0 to 63. With each message of a fragment, with the exception of the first message of a fragment, the sequence number is raised by 1. Once the sequence number has reached the value 63, then the next message of a sequence is transmitted with the sequence number 0. With each FIR bit that is set, a new sequence number is adopted.

2.2.4. Application header

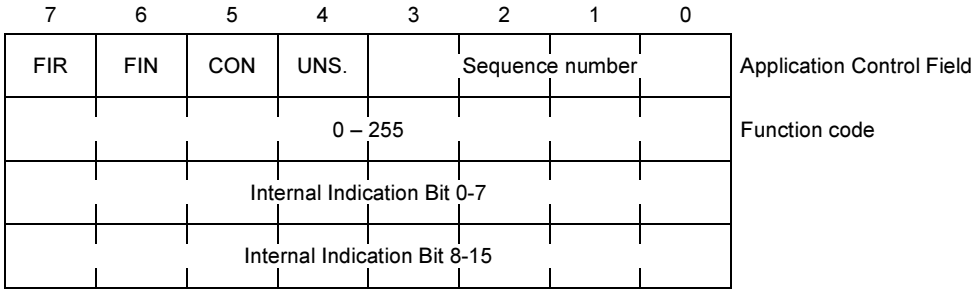
2.2.4.1. Request header

The request header is only included in the first message of a sequence. It comprises the application header and the function code. Only the master transmits a request header.



2.2.4.2. Response header

The response header is only included in the first message of a sequence. It comprises the application header, the function code and the internal indications. Only the slave transmits a response header.



2.2.4.3. Structure Application Control Field

The Application Control Field is used for the identification and utilisation of multifragment-messages.

FIR: If this bit is set, then this sequence is the first of a multifragment.

FIR = 0 More sequences are to follow
FIR = 1 First sequence of a multifragment

FIN: If this bit is set, then this sequence is the last of a multifragment.

FIN = 0 More messages are to follow
FIN = 1 Last sequence of a multifragment

CON: This bit is used for the application acknowledgement of a fragment.

CON = 0 No acknowledgement is expected
CON = 1 an acknowledgement is expected for this fragment

Uns.: This bit is set, when it has to do with an unsolicited response (spontaneous message of the remote terminal unit) or the application acknowledgement for an unsolicited response.

Uns. = 0 No unsolicited response
Uns. = 1 Unsolicited response

Sequence No.: The sequence number is used for identifying the sequence of individual fragments and the sequence of fragments within a multifragment. The sequence number is raised in a range of 0 to 15 with every application header received.
If an application acknowledgement is expected, then this acknowledgement has the same sequence number as the application header of the remote station that demanded this acknowledgement.

2.2.4.4. Application Function Code

2.2.4.4.1. Application Function Code of the Master

CODE	Function	Description	Supported by DNPSA0
General function codes			
0	confirm	Acknowledgement for a fragment at application level	✓
1	read	Interrogation for data	✓
2	write	Write/Save data	✓
Function codes for commands			
3	select	Selection or activation of commands or set point values without command output	✓
4	operate	Output of the selected or activated command or set point values	✓
5	direct operate	direct output of commands or set point values without prior selection	✓
6	direct operate – No Acknowledgement	direct output of commands or set point values without prior selection Do not generate acknowledgement about the status of the output	✓
Function codes for counters			
7	Immediate freeze	Freeze the data	✓
8	immediate freeze –No Acknowledgement	Freeze the data Do not generate acknowledgement about the status of the operation	✓
9	freeze and clear	Freeze and reset the data	✓
10	freeze and clear –No Acknowledgement	Freeze and reset the data Do not generate acknowledgement about the status of the operation	✓
11	freeze with time	Freeze the data at the moment stated	**x[1]**
12	freeze with time –No Acknowledgement	Freeze the data at the moment stated Do not generate acknowledgement about the status of the operation	**x[1]**

x[1] the integrated totals will be frozen at the reception time of the telegram

CODE	FUNCTION	DESCRIPTION	SUPPORTED BY DNPSA0
Application Control Function Codes			
13	cold restart	Carries out a cold restart in the remote terminal unit	✓
14	warm restart	Carries out a warm restart in the remote terminal unit	X
15	initialise data to defaults	Initialises the data with the default values	X
16	initialise application	Initialises an application program	X
17	start application	Starts an application program	X
18	stop application	Stops an application program	X
Configuration Function Codes			
19	save configuration	Saves the configuration	X
20	enable unsolicited messages	Enables the transmission of spontaneous messages	✓
21	disable unsolicited messages	Disables the transmission of spontaneous messages	✓
22	assign class	The transmitted data are assigned a class (class 0,1,2 or 3)	✓
Time-synchronisation Function Codes			
23	delay measurement	Calculation of the message transfer time and time delay of the remote terminal unit for the time-synchronisation	✓
Reserved			
24 – 120		Reserved	X
121 – 128		Reserved	X

2.2.4.4.2. Application function codes of the Slave

CODE	Function	Description	Supported by DNPM00
General function codes			
0	confirm	Acknowledgement for a fragment at application level	✓
129	response	Response to an interrogation for data	✓
130	unsolicited message	Spontaneous message of the remote terminal unit without interrogation from the master	✓

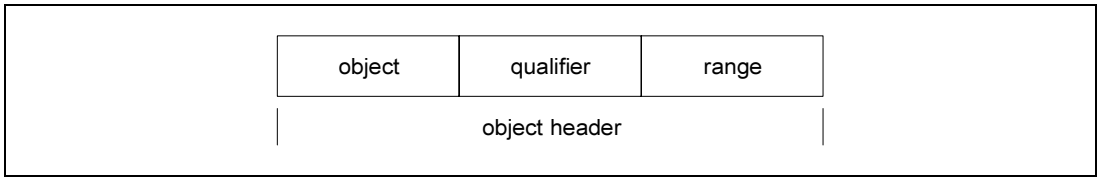
2.2.4.5. Internal Indication

Each message with user data of the remote terminal unit includes the internal indication in the response header. The internal indication comprises 16 bits and contains information and errors of the remote terminal unit.

Bit 0: A message addressed to all remote terminal units has been received.
Bit 1: Data class 1 available
Bit 2: Data class 2 available
Bit 3: Data class 3 available
Bit 4: The remote terminal unit expects a time-synchronisation.
Bit 5: Some or all data points are controlled locally (local/remote switch)
Bit 6: Error in the remote terminal unit
Bit 7: Cold restart of the remote terminal unit
Bit 8: The function code is not supported
Bit 9: The requested data do not exist in the remote terminal unit.
Bit 10: Error in qualifier/index field or in the range field of the object header
Bit 11: Event memory overflow
Bit 12: The received interrogation is being carried out.
Bit 13: Fault or error in the parameters of the remote terminal unit
Bit 14: Reserved
Bit 15: Reserved

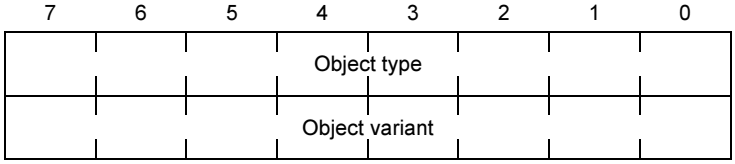
2.2.5. Structure of object header

The object header defines and describes the following data objects for this object header.



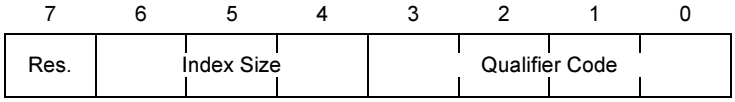
2.2.5.1. Object field of the object header

The object field consists of the object type and the object variant.



2.2.5.2. Qualifier-field of the object header

The qualifier-field determines the number and the structure of the individual data objects for this object header. For precise usage of the qualifier field, please refer to the general description of the DNP protocol.



The qualifier code determines how the data objects are addressed and structured and the index size defines how the index of the data objects is formed.

2.2.5.3. Range-field of the object header

The range-field can be a single index of a data object or a table from a start index and an end index. The size of the index can be maximum 32 bit or 42949671295.

2.2.6. Data objects

For the description of the individual data objects, please refer to the document DNP V3.00 Data Object Library of the DNP Organisation.

3. Message conversion

3.1. General

The conversion of the message formats Ax 1703 ↔ IEC 60870-5-103 and the conversion of the address information is described as message conversion.
The conversion of the address information is carried out with the aid of the OPM (Object-orientated Process-data Manager) protocol - detailed routing.

The following detailed routing types are available in the receive direction:

-Commands for single- or double commands
-Set point values normalised, scaled for set point commands and short floating point

The following detailed routing types are available in the transmit direction:

-Information as process information for single- or double-point information
-Measured values normalised, scaled or floating point
-Integrated totals as counting value signed 31 bit with sequence number

The Ax-address consists of 5 + 1 bytes:

1. Octet of the CAASDU/ region number
2. Octet of the CAASDU/ component number
1. Octet of the IOA/ module number
2. Octet of the IOA/ value number
3. Octet of the IOA/ sub address
Data type (process control addressing)

The non-SAT address consists of:

DNP data index (Address of the data point)
Additional information for each object type

3.2. Message Conversion General Rules

3.2.1. Data Objects with Status Information

3.2.1.1. Status Information for Binary Information:

7							0
0/1	Res.	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit 0: Online (Status of the data point)
This status is shown on the BL-Status bit of the Ax/ACP-message.
0 = offline, the data point is blocked within the Ax/ACP system
1 = online, the transmission of the data point is allowed

Bit 1: Restart (restart of the module that acquires this data point)
This status is set by the firmware directly after restart
0 = normal, normal status
1 = restart, restart of the module

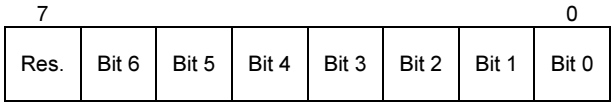
Bit 2: Communication lost (failure of the module that acquires this data point)
This status is shown on the NT-Status bit of the Ax/ACP message.
0 = normal, normal status
1 = lost, communication failed

Bit 3: Remote Forced Data (The change to the data point was caused by a remote command)
This status is used as transmission cause feedback by remote command (COT=11) in the Ax/ACP-message.
0 = normal, change without command
1 = remote forced, change due to a remote command

Bit 4: Local Forced Data (The change to the data point was caused by a local command)
This status is used as transmission cause feedback by local command (COT=12) or spontaneous change (COT=3) in the Ax-message.
0 = normal, change without command
1 = local forced, change due to a local command or spontaneous change

Bit 5: Chatter Filter (The transmission of the data point was prevented as a result of too many changes; bounce suppression)
This status is shown on the IV-Status bit of the Ax/ACP message.
0 = normal, normal status
1 = filter on, bounce suppression

3.2.1.2. Status Information for Measured Values:



Bit 0: Online (Status of the data point)
This status is shown on the BL-Status bit of the Ax/ACP-message.
0 = offline, the data point is blocked within the Ax/ACP system
1 = online, the transmission of the data point is allowed

Bit 1: Restart (restart of the module that acquires this data point)
This status is set by the firmware directly after restart
0 = normal, normal status
1 = restart, restart of the module

Bit 2: Communication lost (failure of the module that acquires this data point)
This status is shown on the NT-Status bit of the Ax/ACP message.
0 = normal, normal status
1 = lost, communication failed

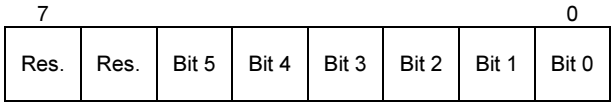
Bit 3: Remote Forced Data (The change to the data point was caused by a remote command)
This status is used as transmission cause feedback by remote command (COT=11) in the Ax/ACP-message.
0 = normal, change without command
1 = remote forced, change due to a remote command

Bit 4: Local Forced Data (The change to the data point was caused by a local command)
This status is used as transmission cause feedback by local command (COT=12) or spontaneous change (COT=3) in the Ax-message.
0 = normal, change without command
1 = local forced, change due to a local command or spontaneous change

Bit 5: Over-range (The acquisition/calculation of the measured value resulted in the measured value range being exceeded)
This status is shown on the OV-Status bit of the Ax-message.
0 = normal, normal status
1 = over-range, measured value range exceeded

Bit 6: Reference Check (Error in the reference voltage for the acquisition of the measured value)
This status is shown on the IV-Status bit of the Ax-message.
0 = normal, normal status
1 = error, error reference voltage

3.2.1.3. Status Information for Counter Values:



Bit 0: Online (Status of the data point)
This status is shown on the BL-Status bit of the Ax/ACP-message.
0 = offline, the data point is blocked within the Ax/ACP system
1 = online, the transmission of the data point is allowed

Bit 1: Restart (restart of the module that acquires this data point)
This status is set by the firmware directly after restart
0 = normal, normal status
1 = restart, restart of the module

Bit 2: Communication lost (failure of the module that acquires this data point)
This status is shown on the NT-Status bit of the Ax/ACP message.
0 = normal, normal status
1 = lost, communication failed

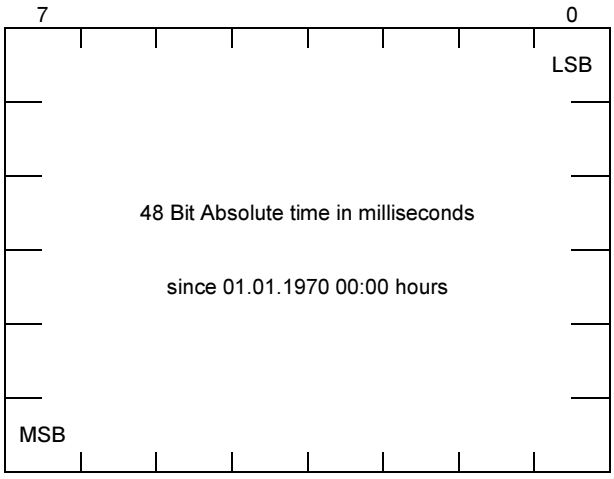
Bit 3: Remote Forced Data (The change to the data point was caused by a remote command)
This status is used as transmission cause feedback by remote command (COT=11) in the Ax/ACP-message.
0 = normal, change without command
1 = remote forced, change due to a remote command

Bit 4: Local Forced Data (The change to the data point was caused by a local command)
This status is used as transmission cause feedback by local command (COT=12) or spontaneous change (COT=3) in the Ax-message.
0 = normal, change without command
1 = local forced, change due to a local command or spontaneous change

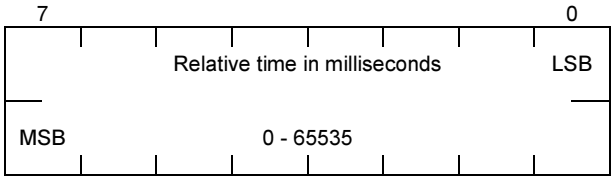
Bit 5: Roll-over (Overflow of the accumulated counter, by exceeding the maximum value)
0 = normal, normal state
1 = roll-over, counter overflow

3.2.2. Data Objects with Time Information

Time of Occurrence (Absolute Time):



Relative Time (Relative time):



If time tagged events occur and the time is within 59,999 seconds, it is also possible to transmit these data not with absolute time but instead with relative time. This relative time is based to one time object (common time of occurrence → CTO data object 51 variation 01 or 02) sent in prior to the data.

3.2.3. Message Conversion Time-Synchronisation

If time synchronisation is desired, it is possible to send the request for time synchronisation by the firmware DNPSA0. The cycle for the request for time synchronisation can be set by system technical parameter. If cycle time is set to 0, the firmware will send out no request for time synchronisation.

The time synchronisation runs in 2 steps. The first step is to determine the delay time for transmission and internal processing. The calculated delay time then will be added to the actual time in the time synchronisation object.

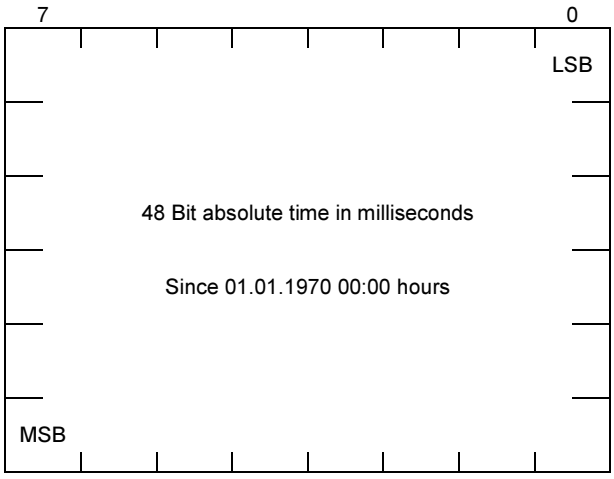
3.2.3.1. Measuring the time delay

An inquiry is transmitted to the remote terminal unit with the function code 23 (Delay Measurement) without data objects. The remote terminal unit replies with the data object Time Delay Fine (Data Object 52 – Variation 2). The content of this data object is the time delay of the remote terminal unit in milliseconds. The time delay is half of the message transfer time and the time delay of the remote terminal unit.

3.2.3.2. Time-setting message

Object format DNP V3.00 Time and Date:

Data Object 50 - Variation 01 Type: Static



The received DNP time format will be converted to internal real time and date format and then used to set the internal time of Ax/ACP system.

3.3. Message conversion in transmitting direction

SAT Ax/ACP 1703		DNP V3.00			
TI	**Description**	**Description**	**Object type**	**Object variation**	
30 31	Single binary input time tagged double binary input time tagged	Binary Input Binary Input Change	1 2	0, 1, 2 0, 1, 2, 3	
31	double binary input time tagged	Double Binary Input Double Binary Input Change	3 4	0, 1, 2 0, 1, 2, 3	
34 35 36	Measured value signed 15 Bit normalized Measured value signed 15 Bit scaled Measured value short floating point	Analog Input Analog Change Event	30 32	0, 1, 2, 3, 4 0, 1, 2	
37	Counter value signed 31 Bit with sequence number	Binary Counter Frozen Counter Frozen Counter Event	20 21 23	0, 1, 5 0, 1, 5, 9 0, 1, 5	
	Time synchronisation	Time Delay Fine	52	2	1)

1) Internal generated message

3.3.1. Message conversion binary information

3.3.1.1. Conversion to Single Binary Input

Object format DNP V3.00 Binary Input:

Object type 1 - variation 01 Type: Static

7							0
7	6	5	4	3	2	1	0
15	14	13	12	11	10	9	8
	↓						
0	0	0	n	n-1	n-2	n-3	n-4

Object format DNP V3.00 Binary Input with Status:

Object type 1 - variation 02 Type: Static

7							0
0/1	Res.	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

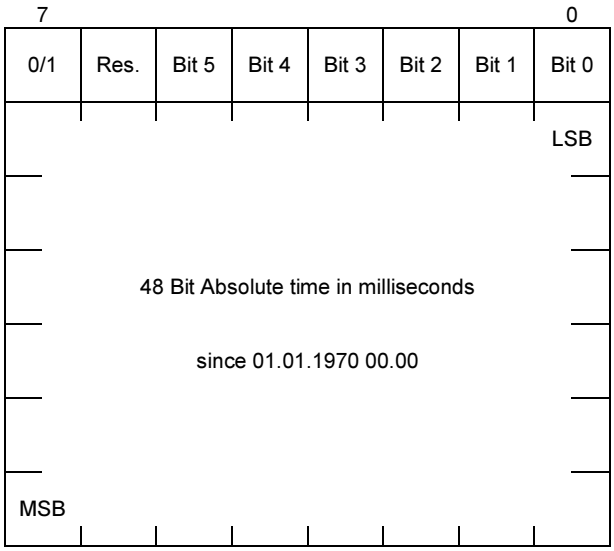
Object format DNP V3.00 Binary Input Change without Time:

Object type 2 - variation 01 Type: Event

7							0
0/1	Res.	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

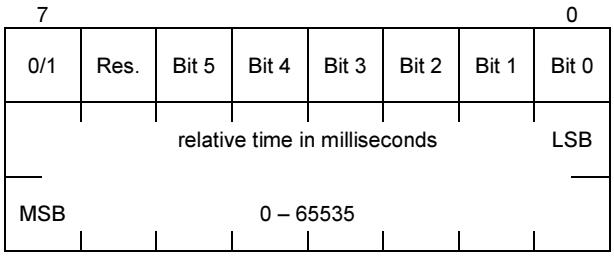
Object format DNP V3.00 Binary Input Change with Time:

Object type 2 - variation 02 Type: Event



Object format DNP V3.00 Binary Input Change without Time:

Object type 2 - variation 03 Type: Event



Address conversion SAT 1703 → DNP V3.00:

The address conversion is parameterised with the help of the OPM (Object-orientated Process-data Manager). For this, in the protocol detailed routing, the detailed routing type "Transmit_Information" is made available with the following entries.

Supported SAT 1703-message formats:

- 1 Single-point information (TI = 30)
- 1 Double-point information (TI = 31)

SAT 1703-Address:

CASDU1 CASDU2 IOA1 IOA2 IOA3		5-level freely parameterised SAT 1703 destination address possible: 0 – 255

TI: Type identification
possible: 30 = Single-point information
31 = Double-point information

DNP 3.0 Address:

DNP Data index: Unambiguous address of this data point
possible: 0-65535

Object variation: Assignment of the data to the DNP object types
possible: Binary Input
Double Binary Input

Additional information:

Event class: Assignment of the data to one of the following event classes
possible: event class 1
event class 2
event class 3
not used/no event class

Conversion information:

Conversion of IEC binary information:

Conversion of the IEC binary information to the related DNP data index possible:
- single binary information
- single binary information inverted
- double binary information OFF before ON (TI 31)
- double binary information ON before OFF (TI 31)
- double binary information condition OFF (TI 30)
- double binary information condition ON (TI 30)

3.3.1.2. Conversion to Double Binary Input

Object format DNP V3.00 Binary Input:

Object type 1 - variation 01 Type: Static

7							0
7	6	5	4	3	2	1	0
15	14	13	12	11	10	9	8
	↓						
0	0	0	n	n-1	n-2	n-3	n-4

Object format DNP V3.00 Binary Input with Status:

Object type 1 - variation 02 Type: Static

7							0
ON	OFF	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

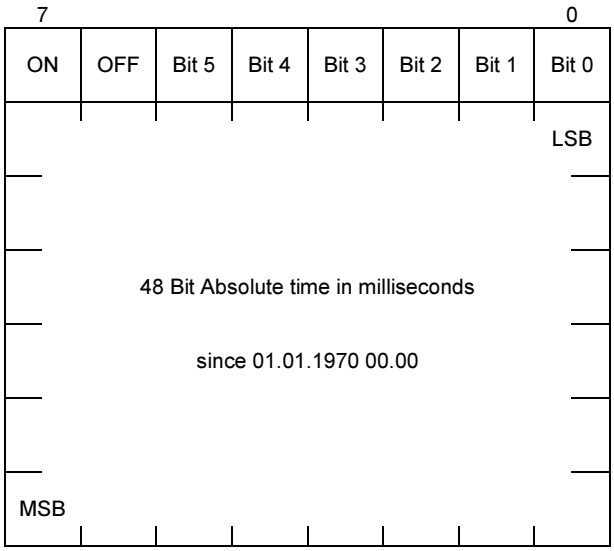
Object format DNP V3.00 Binary Input Change without Time:

Object type 2 - variation 01 Type: Event

7							0
ON	OFF	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

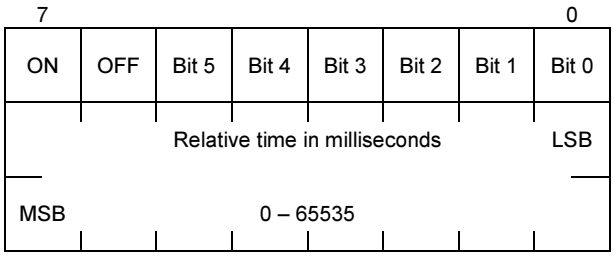
Object format DNP V3.00 Binary Input Change with Time:

Object type 2 - variation 02 Type: Event



Object format DNP V3.00 Binary Input Change without Time:

Object type 2 - variation 03 Type: Event



Address conversion SAT 1703 → DNP V3.00:

The address conversion is parameterised with the help of the OPM (Object-orientated Process-data Manager). For this, in the protocol detailed routing, the detailed routing type "Transmit_Information" is made available with the following entries.

Supported SAT 1703-message formats:

- 1 Double-point information (TI = 31)

SAT 1703-Address:

CASDU1 CASDU2 IOA1 IOA2 IOA3		5-level freely parameterised SAT 1703 destination address possible: 0 – 255

TI: Type identification
possible: 31 = Double-point information

DNP 3.0 Address:

DNP Data index: Unambiguous address of this data point
possible: 0-65535

Object variation: Assignment of the data to the DNP object types
possible: Double Binary Input

Additional information:

Event class: Assignment of the data to one of the following event classes
possible: event class 1
event class 2
event class 3
not used/no event class

Conversion information:

Conversion of IEC binary information:

Conversion of the IEC binary information to the related DNP data index possible:
- single binary information
- single binary information inverted
- double binary information OFF before ON (TI 31)
- double binary information ON before OFF (TI 31)
- double binary information condition OFF (TI 30)
- double binary information condition ON (TI 30)

3.3.2. Message Conversion Measured Values

Object format DNP V3.00 32 Bit Analog Input:

Object type 30 - variation 01 Type: Static

Object format DNP V3.00 32 Bit Frozen Analog Input:

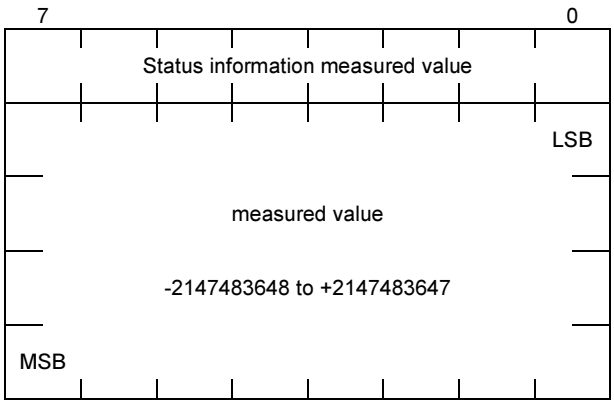
Object type 31 - variation 01 Type: Static

Object format DNP V3.00 32 Bit Analog Change Event without Time:

Object type 32 - variation 01 Type: Event

Object format DNP V3.00 32 Bit Frozen Analog Event without Time:

Object type 33 - variation 01 Type: Event

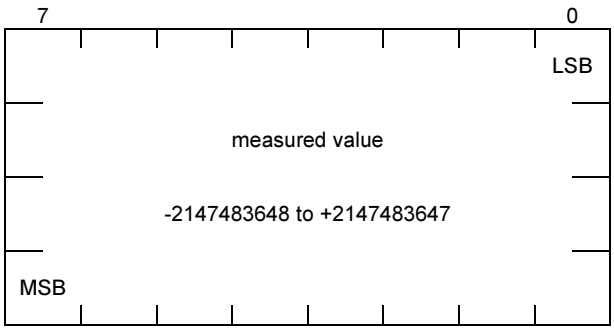


Object format DNP V3.00 32 Bit Analog Input without Flag:

Object type 30 - variation 03 Type: Static

Object format DNP V3.00 32 Bit Frozen Analog Input without Flag:

Object type 31 - variation 05 Type: Static



Object format DNP V3.00 32 Bit Frozen Analog Input with Time of Freeze:

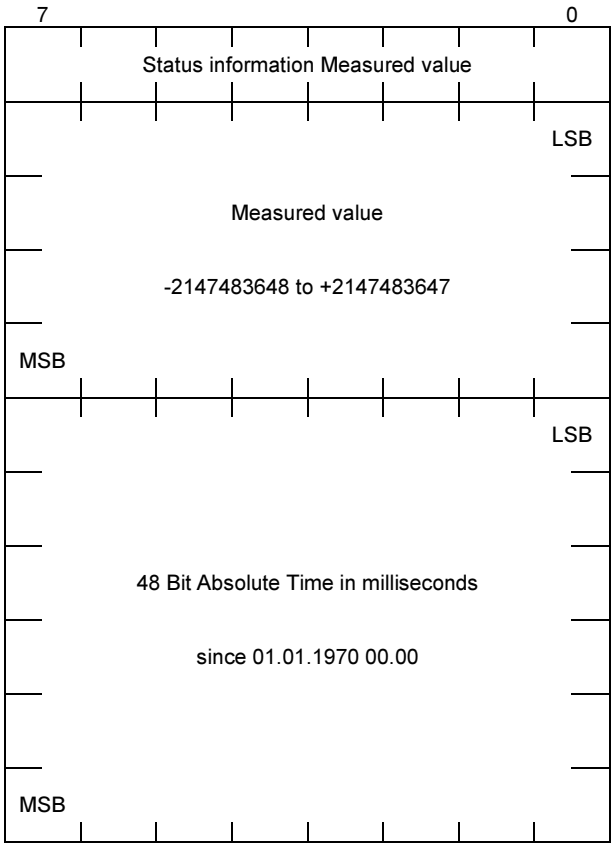
Object type 31 - variation 03 Type: Static

Object format DNP V3.00 32 Bit Analog Change Event with Time:

Object type 32 - variation 03 Type: Event

Object format DNP V3.00 32 Bit Frozen Analog Event with Time:

Object type 33 - variation 03 Type: Event



Object format DNP V3.00 16 Bit Analog Input:

Object type 30 - variation 02 Type: Static

Object format DNP V3.00 16 Bit Frozen Analog Input:

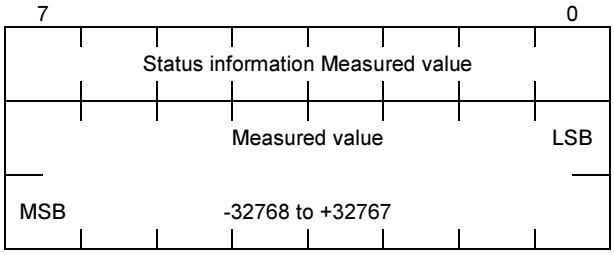
Object type 31 - variation 02 Type: Static

Object format DNP V3.00 16 Bit Analog Change Event without Time:

Object type 32 - variation 02 Type: Event

Object format DNP V3.00 16 Bit Frozen Analog Event without Time:

Object type 33 - variation 02 Type: Event

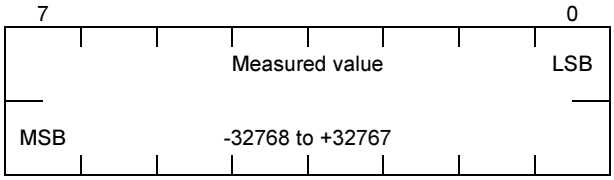


Object format DNP V3.00 16 Bit Analog Input without Flag:

Object type 30 - variation 04 Type: Static

Object format DNP V3.00 15 Bit Frozen Analog Input without Flag:

Object type 31 - variation 06 Type: Static



Object format DNP V3.00 16 Bit Frozen Analog Input with Time of Freeze:

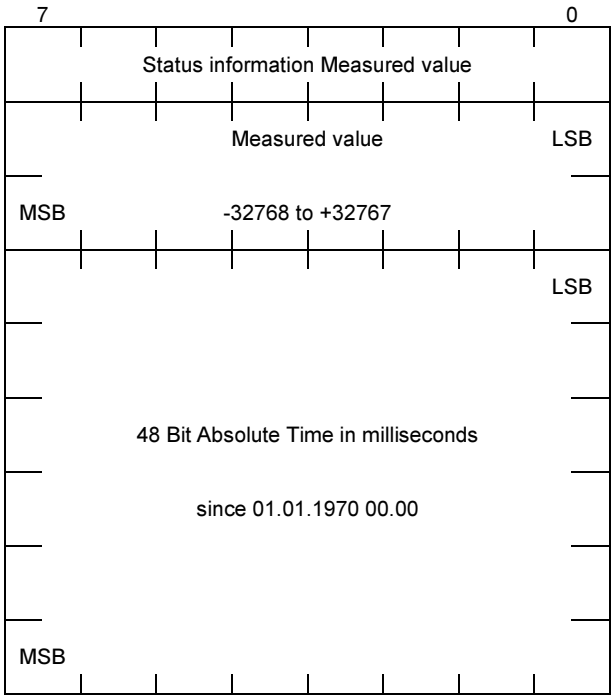
Object type 31 - variation 04 Type: Static

Object format DNP V3.00 16 Bit Analog Change Event with Time:

Object type 32 - variation 04 Type: Event

Object format DNP V3.00 16 Bit Frozen Analog Event with Time:

Object type 33 - variation 04 Type: Event



Object format DNP V3.00 short floating point Analog Input:

Object type 30 - variation 05 Type: Static

Object format DNP V3.00 short floating point Frozen Analog Input:

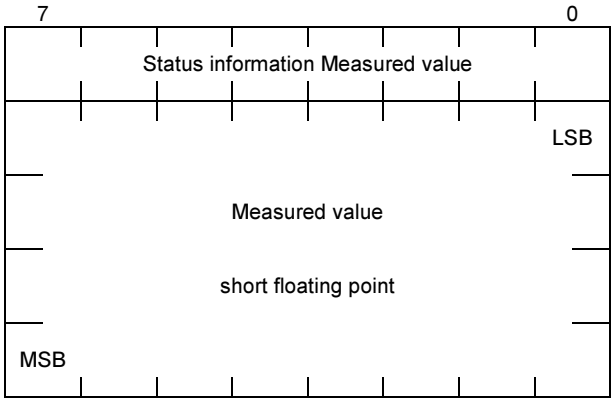
Object type 31 - variation 07 Type: Static

Object format DNP V3.00 short floating point Analog Change Event without Time:

Object type 32 - variation 05 Type: Event

Object format DNP V3.00 short floating point Frozen Analog Event without Time:

Object type 33 - variation 05 Type: Event

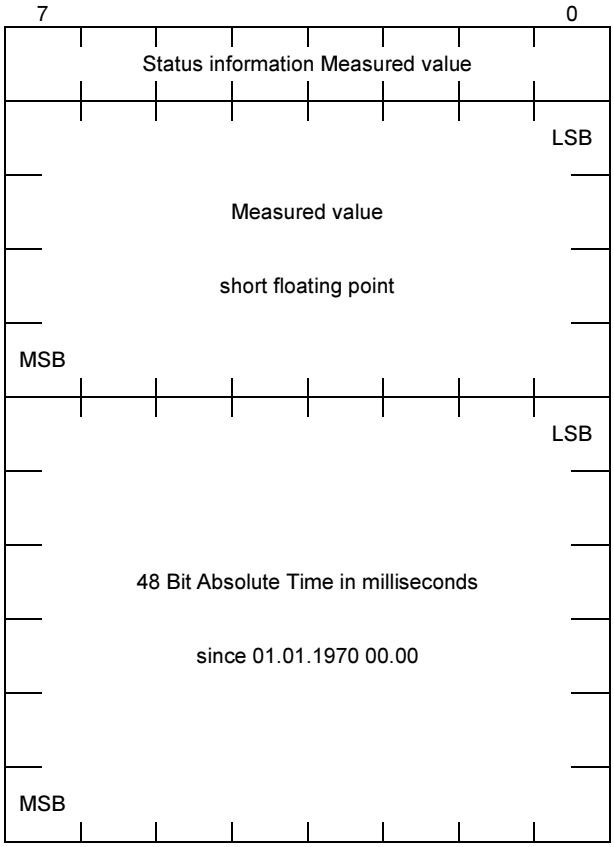


Object format DNP V3.00 short floating point Analog Change Event with Time:

Object type 32 - variation 07 Type: Event

Object format DNP V3.00 short floating point Frozen Analog Event with Time:

Object type 33 - variation 04 Type: Event



Address conversion SAT 1703 → DNP V3.00:

The address conversion is parameterised with the help of the OPM (Object-orientated Process-data Manager). For this, in the protocol detailed routing, the detailed routing type "Transmit_Measured_value" is made available with the following entries.

Supported SAT 1703-message formats:

- measured value signed 15 bit normalised (TI = 34)
- measured value signed 15 bit scaled (TI = 35)
- measured value short floating point (TI = 36)

SAT 1703-Address:

CASDU1 CASDU2 IOA1 IOA2 IOA3		5-level freely parameterised SAT 1703 destination address possible: 0 – 255

TI: Type identification
possible: 34 = measured value signed 15 bit normalised
35 = measured value signed 15 bit scaled
36 = measured value short floating point

DNP 3.0 Address:

DNP Data index: Unambiguous address of this data point
possible: 0-65535

Object variation: Assignment of the data to the DNP object types
possible: analog input 16 bit
analog input 32 bit
analog input short floating point

Additional information:

Event class: Assignment of the data to one of the following event classes
possible: event class 1
event class 2
event class 3
not used/no event class

Conversion information:

Additional information for set point values/measured values:

Adaption X0:	This is the minimum value of the SAT internal analog value (source)
Adaption X100:	This is the maximum value of the SAT internal analog value (source)
Adaption Y0:	This is the minimum value of the DNP external analog value (destination)
Adaption Y100:	This is the maximum value of the DNP external analog value (destination)
Measured value threshold:	Change monitoring of analog values If the delta between old and new value is greater than the threshold, a change event of the parameterised event class will be generated.

3.3.3. Message Conversion Integrated Totals

Object format DNP V3.00 32 Bit Binary Counter:

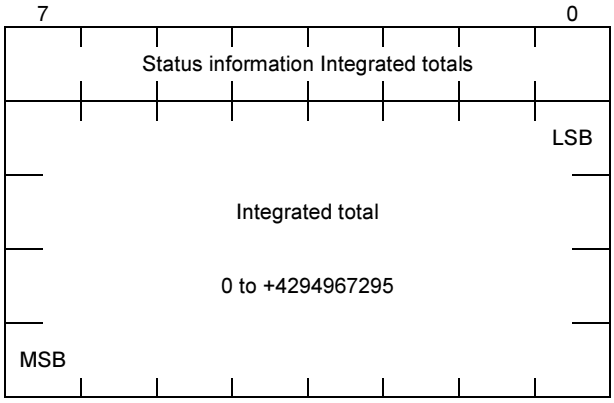
Object type 20 - variation 01 Type: Static

Object format DNP V3.00 32 Bit Frozen Binary Counter:

Object type 21 - variation 01 Type: Static

Object format DNP V3.00 32 Bit Binary Frozen Counter Change Event without Time:

Object type 23 - variation 01 Type: Event

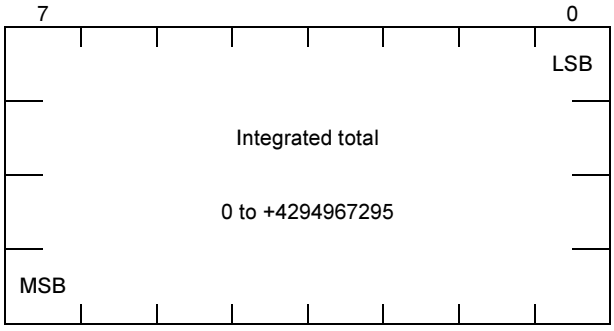


Object format DNP V3.00 32 Bit Binary Counter without Flag:

Object type 20 - variation 05 Type: Static

Object format DNP V3.00 32 Bit Binary Frozen Counter without Flag:

Object type 21 - variation 09 Type: Static



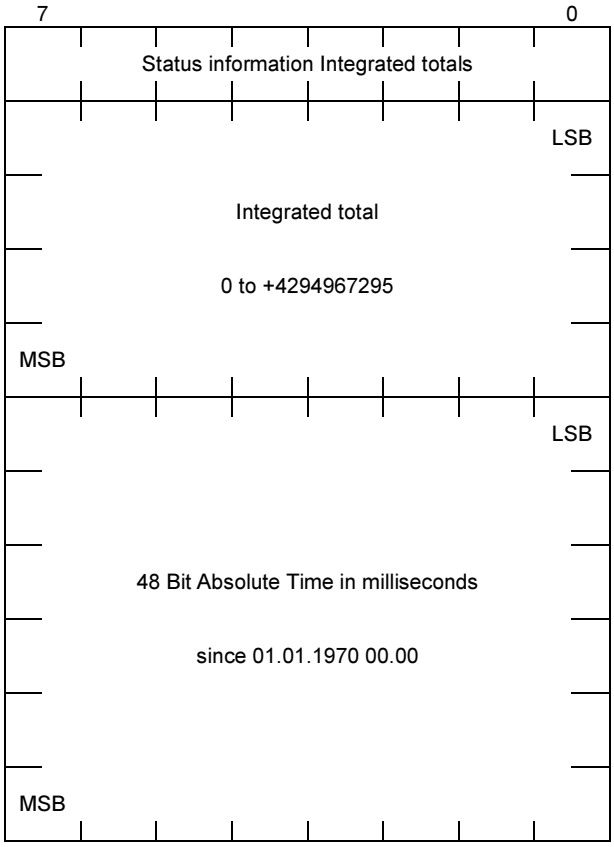
Object format DNP V3.00 32 Bit Binary Frozen Counter with Time of Freeze:

Object type 21 - variation 05 Type: Static

Object format DNP V3.00 32 Bit Binary Frozen Delta Counter with Time of Freeze:

Object format DNP V3.00 32 Bit Binary Frozen Counter Change Event with Time:

Object type 23 - variation 05 Type: Event



Address conversion SAT 1703 → DNP V3.00:

The address conversion is parameterised with the help of the OPM (Object-orientated Process-data Manager). For this, in the protocol detailed routing, the detailed routing type "Transmit_Integrated_totals" is made available with the following entries.

Supported SAT 1703-message formats:

- binary counter signed 31 bit with sequence number (TI = 37)

SAT 1703-Address:

CASDU1 CASDU2 IOA1 IOA2 IOA3		5-level freely parameterised SAT 1703 destination address possible: 0 – 255

TI: Type identification
possible: 37 = binary counter signed 31 Bit with sequence number

DNP 3.0 Address:

DNP Data index: Unambiguous address of this data point
possible: 0-65535

Object variation: Assignment of the data to the DNP object types
possible: 32 bit binary counter
16 bit binary counter
32 bit binary delta counter
16 bit binary delta counter

Additional information:

Event class: Assignment of the data to one of the following event classes
possible: event class 1
event class 2
event class 3
not used/no event class

Conversion information:

IEC-Integrates total type:

Usage of integrated total as absolute or relative value
possible: absolute value
relative value

Overflow: how the overflow of the integrated total has to be calculated
possible: 31 bit integer
24 bit integer
2 decades of BCD (99)
3 decades of BCD (999)
4 decades of BCD (9999)
5 decades of BCD (99999)
6 decades of BCD (999999)
7 decades of BCD (9999999)
8 decades of BCD (99999999)
9 decades of BCD (999999999)
16 bit integer

Transmission: This parameter defines how the binary counter internal gets frozen and transmitted. The binary counter can be requested by the master (counter interrogation) or it can be frozen by the selected interval of time. If an event class is defined, the frozen binary counter will be transmitted as an event.
possible: counter interrogation
1 minute
2 minutes
3 minutes
5 minutes
10 minutes
15 minutes
30 minutes
60 minutes

3.4. Message conversion in receiving direction

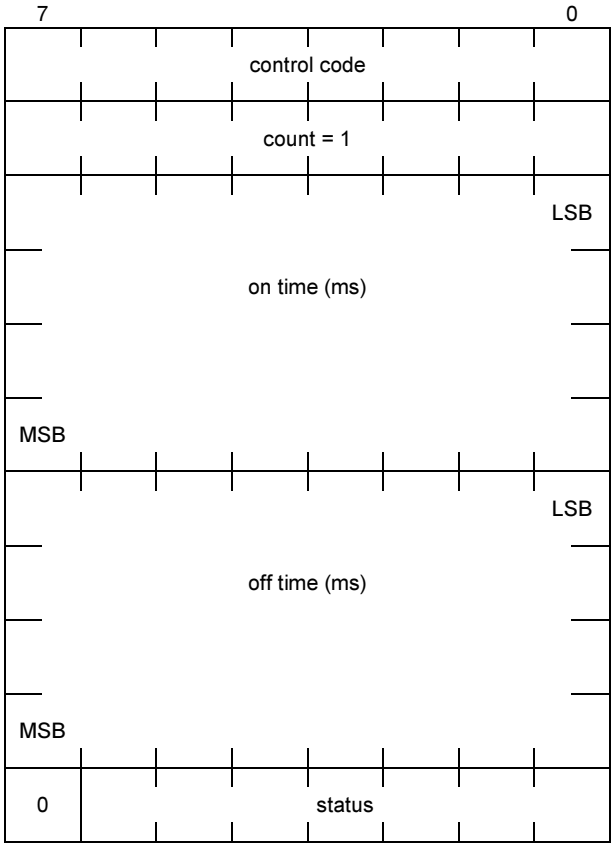
DNP V3.00			SAT 1703		
Object type	**Object variation**	**Description**	**Description**	**TI**	
12	1	Control Relay Output Block	Single command Double command	45 46	
41	1 2 3	32 Bit Analog Output Block 16 Bit Analog Output Block short floating point Analog Output Bl.	Set point value signed 15 Bit normalized Set point value signed 15 Bit scaled Set point value short floating point	48 49 50	
60	1, 2, 3, 4	Request for data class 0, 1, 2 or 3			1)
60	2, 3, 4	Enable/Disable unsolicited messages for data class 1, 2 or 3			1)
		Assign given data to class 1, 2 or 3			1)
		Delay Measurement			1)
50	1	Time and Date Time synchronisation			1)

1) Internal evaluation by firmware only

3.4.1. Message conversion for commands

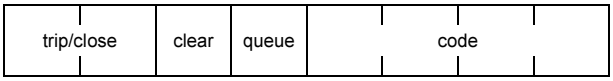
Object format DNP V3.00 Control Relay Output Block:

Object type 12 - variation 01 Type: Static



Count: counter for the number of command outputs
only count = 1 is supported by the firmware

Control code:



Code: 0 = NUL operation, no operation specified (not evaluated by the firmware)
1 = Pulse ON, the point is turned on (specified on time) then turned off (specified off time) and left in the off state
the firmware does interpret this as a latch on command
2 = Pulse OFF, the point is turned off (specified off time) then turned on (specified on time) and left in the on state
the firmware does interpret this as a latch off command
3 = Latch ON, this latches the point on
4 = Latch OFF, this latches the point off
5 – 15 Reserve

Queue: place operation at the back of the control queue when complete
(not supported by the firmware)

Clear: cancel currently running operation remove queued operations on affected points immediately before activating this new operation (if not NUL)
(not supported by the firmware)

Trip/Close: This field determines which control relay to activate in a system where a trip and close relay pair is used to energize and de-energize the field points. This can be converted to IEC double point commands.
(only applicable to double point commands)

Status:
0 = SUCCESS, request accepted, initiated or queued
1 = TIMEOUT, request not accepted because no previous matching select request exists. (An operate message was sent to activate an output that was not previously armed with a matching select message)
2 = NO SELECT, request not accepted because no previous matching select request exists. (An operate message was sent to activate an output that was not previously armed with a matching select message)
3 = FORMAT ERROR, request not accepted because there where formatting errors in the control request.
4 = NOT SUPPORTED, request not accepted because a control operation is not supported fort his point.
5 = ALREADY ACTIVE, request not accepted because the control queue is full ort he point is already active
6 = HARDWARE ERROR, request not accepted because of control hardware problems.
7 = LOCAL, request not accepted because local/remote switch is in local position.
8 = TOO MANY OPS, request not accepted because too many operations requested.
9 = NOT AUTHORIZED, request not accepts because of insufficient authorization.
10 – 127 Reserved for future use

Address conversion DNP V3.00 → SAT 1703:

The address conversion is parameterised with the help of the OPM (Object-orientated Process-data Manager). For this, in the protocol detailed routing, the detailed routing type "Receive_commands" is made available with the following entries.

Supported SAT 1703-message formats:

- single point command (TI = 45)
- double point command (TI = 46)
- regulating step command (TI = 47)

DNP 3.0 Address:

DNP Data index: Unambiguous address of this data point
possible: 0-65535

Object variation: Assignment of the data to the DNP object types
possible: not used

Additional information:

IEC command conversion:
This parameter defines how the DNP command procedure will be converted to the IEC commands. The IEC command can be generated as a command with SELECT/EXECUTE or as a command only with EXECUT. Furthermore it is possible to emulate the SELECT command, if the master station can't send SELECT/OPERATE procedure.
possible: send SELECT/EXECUTE
emulate SELECT
ignore SELECT

QOC: The qualifier of command defines the duration of command output time.
possible: no output time defined
short output time defined
long output time defined

SAT 1703-Address:

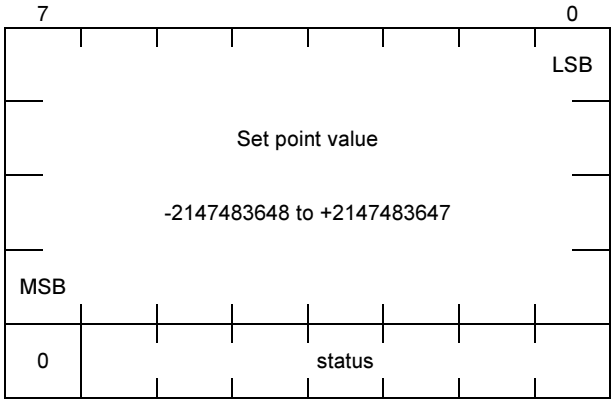
CASDU1 CASDU2 IOA1 IOA2 IOA3	5-level freely parameterised SAT 1703 destination address possible: 0 – 255

TI: Type identification
possible: 45 = single binary command
46 = double binary command
47 = regulating step command

3.4.2. Message conversion set point values

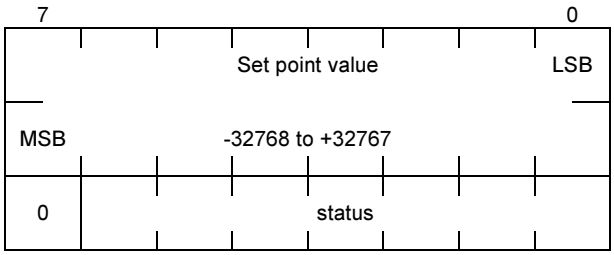
Object format DNP V3.00 32 Bit Analog Output Block:

Object type 41 - variation 01 Type: Static



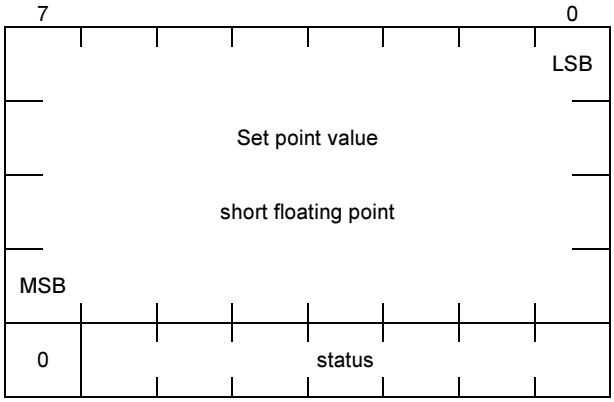
Object format DNP V3.00 16 Bit Analog Output Block:

Object type 41 - variation 02 Type: Static



Object format DNP V3.00 Short Floating Point Analog Output Block:

Object type 41 - variation 03 Type: Static



Status:
- 0 = SUCCESS, request accepted, initiated or queued
- 1 = TIMEOUT, request not accepted because no previous matching select request exists. (An operate message was sent to activate an output that was not previously armed with a matching select message)
- 2 = NO SELECT, request not accepted because no previous matching select request exists. (An operate message was sent to activate an output that was not previously armed with a matching select message)
- 3 = FORMAT ERROR, request not accepted because there where formatting errors in the control request.
- 4 = NOT SUPPORTED, request not accepted because a control operation is not supported fort his point.
- 5 = ALREADY ACTIVE, request not accepted because the control queue is full ort he point is already active
- 6 = HARDWARE ERROR, request not accepted because of control hardware problems.
- 7 = LOCAL, request not accepted because local/remote switch is in local position.
- 8 = TOO MANY OPS, request not accepted because too many operations requested.
- 9 = NOT AUTHORIZED, request not accepted because of insufficient authorization.
- 10 – 127 Reserved for future use

Address conversion DNP V3.00 → SAT 1703:

The address conversion is parameterised with the help of the OPM (Object-orientated Process-data Manager). For this, in the protocol detailed routing, the detailed routing type "Receive_setpoint_values" is made available with the following entries.

Supported SAT 1703-message formats:

- set point value signed 15 bit normalized (TI = 48)
- set point value signed 15 bit scaled (TI = 49)
- set point value short floating point (TI = 50)

DNP 3.0 Address:

DNP Data index: Unambiguous address of this data point
possible: 0-65535

Object variation: Assignment of the data to the DNP object types
possible: set point value 16 bit
set point value 32 bit
set point value short floating point

Additional information:

IEC command conversion:
This parameter defines how the DNP command procedure will be converted to the IEC commands. The IEC command can be generated as a command with SELECT/EXECUTE or as a command only with EXECUT. Furthermore it is possible to emulate the SELECT command, if the master station can't send SELECT/OPERATE procedure.
possible: send SELECT/EXECUTE
emulate SELECT
ignore SELECT

Data conversion information:

Additional information for set point values/measured values:

Adaption X0: This is the minimum value of the DNP external analog value (source)

Adaption X100: This is the maximum value of the DNP external analog value (source)

Adaption Y0: This is the minimum value of the SAT internal analog value (destination)

Adaption Y100: This is the maximum value of the SAT internal analog value (destination)

4. General Protocol Functions

4.1. Failure concept

The protocol element DNPM00 is not able to detect a failure of the master station by the absence of acknowledgement messages, because the used source code library from the company Triangle Microworks can't provide this information.

4.2. Acknowledgement behaviour

Protocol DNP knows 2 different acknowledgement variants. These are the normal acknowledgement at message level and the application acknowledgement at application level. For all messages that the master transmits, the acknowledgement that the master expects from the remote terminal unit can be set.

The acknowledgement at message level consists of a message of fixed block length with the contents ACK or NACK.

The acknowledgement at application level consists of a message of variable block length with the data bytes for transport header, application header and the function code 0.

4.3. Retry behaviour

If the acknowledgement for a message or fragment with a non-faulty line is absent, then this message or fragment is repeated n-times (n = configurable number).

The retry detection takes place exclusively via the sequence numbers of the transport header and the application header.

4.4. General interrogation

The DNP Protocol does not support any general interrogation message. The remote terminal unit can only transmit that data that is inquired for by the master.

4.5. Redundancy

With the help of Ax-Redundancy, it is possible to put the Firmware in Standby-mode. In Standby-mode, all services running on SIP are aborted and all messages that are on SIP or arrive new are acknowledged positively for BSE. All messages received are transferred to the SAT 1703 System.

4.6. Fragments and Multifragments

If all the data of an object is interrogated, then the reply to this interrogation can contain more data than can be transmitted with one message (max. 249 user data bytes). For this reason, a reply to this interrogation consists of several single messages (frames). Several of these single messages form a fragment. The size of a fragment is dependent on the maximum application buffer size (maximum application fragment size). Several of these fragments form a Multifragment.

4.7. Unsolicited Response

The remote terminal unit is able to transmit spontaneous changes to the data immediately. These messages are called unsolicited response and can be transmitted without interrogation by the master.

After every firmware restart or after every concluded initialisation of the link layer, depending on the parameterisation, the messages for Disable and Enable Unsolicited Messages are transmitted.

A. Appendix: Diagnosis

A.1. Class Internal

A.1.1. Class Internal - Record 0 : Internal Errors in Operating System

Bit	Description
00	RAM error
01	STACK error The defined stack range was exceeded; Exchange system element or inform SAT.
02	Firmware shut down Diagnosis: - read out system diagnostics ring (command ID R) in ST emulation (possibly store in file)
03	Not enough freespace For dynamic memory management, not enough free RAM is available; Diagnosis: - Change parameter setting of size definitions (e.g. real-time rings, pool size) - Inform SAT.
08	CPU 80186 error Occurs in the event of an internal software error.

A.1.2. Class Internal - Record 2 : Parameter Errors ZSE

Bit	Description
00	Parameter error detected by the SIP
01	Parameter error - migration (parameter block L06) Possible causes: - TI 38-40 and 136-143 must not be parameterized without time - TI 160 must not be parameterized with time - Transmission of objects in case of GI with/w/o time;value>3 - number of octets - cause of transmission (COT) <> 2 - number of octets - common address of ASDU (CAASDU) <> 2 - number of octets - information object address (IOA) <> 3 - number of octets - time mark <> 7
02	Parameter error - ZSE general
03	Configured LINK address is wrong. Reason: The same LINK address was assigned several times to various stations.
04	Configured station number is wrong. Reason: station number is already being used.
05	Parameter error in IEC870 connection layer
06	Parameter error in IEC870 application layer
07	Parameter error - redundancy
08	Parameter error - detailed transmission routing

Bit	Description
09	Parameter error - detailed reception routing
10	Parameter error - general
12	Parameter error Adaption for measured values
15	Parameter error - time zones

A.1.3. Class Internal - Record 3 : ZSE Format Conversion Errors

Bit	Description
00	Format conversion error in transmit direction Read out erroneous message in the ST emul with "id r"
02	Format conversion error in receive direction Read out erroneous message in the ST emul with "id r"
15	Error detected in the conversion of an PST control message Diagnosis: - Read out system diagnostics ring (command ID R) in ST emulation (possibly save in file)

A.1.4. Class Internal - Record 4 : Internal Protocol-Specific Error

Bit	Description
01	Software Bug
0A	Error in DNP source code library

A.2. Class Communication

A.2.1. Class Communication - Record 2 : Communication errors to station nos. 0 - 15

Bit	Description
00	Communication error to station no. 0

A.3. Class Test

A.3.1. Class Test - Record 0 : Test Mode of Operating and Base Systems

Bit	Description
00	Memory test disabled

A.4. Class Warning

A.4.1. Class Warning - Record 4 : WARNING! Internal Protocol-Specific Error

Bit	Description
01	Software Bug
0A	Error in DNP source code library

B. Appendix: Parameter Documentation

B.1. Common settings

Parameter	Description	Values/Ranges
Address of the link	Address of the link	Integer [#####]
Parity		[0] no parity [1] even parity [2] odd parity
baud rate	baud rate transmit- and receiving direction	[50] 50 [Bd] [75] 75 [Bd] [100] 100 [Bd] [110] 110 [Bd] [134] 134,5 [Bd] [150] 150 [Bd] [200] 200 [Bd] [300] 300 [Bd] [600] 600 [Bd] [1050] 1050 [Bd] [1200] 1200 [Bd] [1800] 1800 [Bd] [2000] 2000 [Bd] [2400] 2400 [Bd] [4800] 4800 [Bd] [9600] 9600 [Bd] [19200] 19200 [Bd] [38400] 38400 [Bd] [56000] 56000 [Bd] [57600] 57600 [Bd] [64000] 64000 [Bd] [65000] 115200 [Bd]
data bits	Number of data bits	[0] 5 bit [1] 6 bit [2] 7 bit [3] 8 bit
interface modem	Selection of the interface modem. Most of the parameters for the predefined interface modems are standardized and not changeable.	[0] free defineable [5] OPTICAL [8] NULL-Modem interface (RS-485)
stop bits		[0] 1 bit [1] 1,5 bit [2] 2 bit

B.2. Common settings | free defineable transmission facility

free defineable transmission facility

Parameter	Description	Values/Ranges
5V supply (DSR)	Power supply for interface modem via DSR state line (e.g. CM0821).	[0] disabled [1] enabled
DCD handling	DCD signal handling. DCD can be used for message	[0] disabled

Parameter	Description	Values/Ranges
	synchronization in receive direction.	[1] enabled
Transmission delay if countinous level (tcldly)	If continous level is detected on the line, the next message will be sent after transmission delay.	Float [####.#] 0.1 to 6553.5 [s] 0 [s]
asynchron/isochron	asynchronous (V.24/V.28, 16 x receive-/transmit clock) or isochron (X.24/X.27 1 x receive-/transmit clock)	[0] asynchronous "V.24/V.28" (16 x bit clock) [1] Isochron "X.24/X.27" (1x bit clock)
bounce suppression time (tbounce)	State of DCD signal will be used after bounce suppression time (tbounce).	Integer [#####] 0 to 65535 [ms]
continuous level monitoring time (tcl)	continuous level monitoring time (tcl)	Float [####.#] 0.1 to 6553.5 [s] 0 [s]
disable time "time base" (tdis)	Parametrized times in bits depend on the the baudrate!	[0] Bit [1] ms
disable time (tdis)	disable time of the receiver after a received message. Note: Used for suppressing of bad characters during carrier switching.	Integer [#####] 0 to 32767 [ms / Bit]
pause time "time base" (tp)	Parametrized times in bits depend on the the baudrate!	[0] Bit [1] ms
pause time (tp)	Before a message transmission the set pause time is waited before switching on the transmit carrier (RTS).	Integer [#####] 0 to 32767 [ms / Bit]
run-out time "time base" (tn)	Parametrized times in bits depend on the the baudrate!	[0] Bit [1] ms
run-out time (tn)	After message transmission, the transmit carrier (RTS) is switched off after run-out time.	Integer [#####] 0 to 32767 [ms / Bit]
set up time "time base" (tv)	Parametrized times in bits depend on the the baudrate!	[0] Bit [1] ms
set up time (tv)	After switching the carrier to ON (RTS) the message transmission is started after set up time. Note: If "tv=0" no carrier switching is used (RTS=OFF)!	Integer [#####] 0 to 32767 [ms / Bit]
source for receive-/transmit clock (only for "Isochronous")	Source for receive-/transmit clock (only for "Isochronous"). Either external (from RXC-input) or intern (at TXC-output)	[0] extern (bit clock from RXC input) [1] internal (bit clock at the TXC-output)
stability monitoring time (tstab)	stability monitoring time (tstab). The "new" DCD state is utilized after stability monitoring time (DCD can be used for message synchronization).	Integer [#####] 0 to 65535 [ms]

B.3. Message retries

Parameter	Description	Values/Ranges
Retries for INIT-messages SEND/CONFIRM (station selective)	Number of max. message retrys	Integer [###] 0 to 255
Retries for data message SEND/CONFIRM (station selective)	Number of max. message retrys	Integer [###] 0 to 255
Retries for data message SEND/NO REPLY (broadcast)	Number of max. message retrys	Integer [###] 0 to 255

B.4. Redundancy

Parameter	Description	Values/Ranges
Delay time passive=>active	delay time in case of switch over from PASSIVE=>ACTIVE (0 = without delay)	Integer [####] 0 to 2000 [s]
listening_mode (failure monitoring time)	failure monitoring time in listening mode (0 = no monitoring)	Float [####.] 0 to 60000 [s]
operation if passive	operation if passive	[0] transmitter "tristate", listening mode [1] transmitter "active", listening mode [3] transmitter "active", normal operation

B.5. advanced parameters

Parameter	Description	Values/Ranges
Startup delay	This delay is used to update the process image table after restart and before the communication is getting started.	Integer [###] 15 to 200 [s]

B.6. advanced parameters | DNP timeout settings

DNP timeout settings

Parameter	Description	Values/Ranges
Timeout emulate SELECT		Float [####.#] 0.1 to 6553.5 [s] 0 [s]
timeout SELECT --> OPERATE		Float [####.#] 0.1 to 6553.5 [s] 0 [s]
timeout application confirmation		Float [####.#] 0.1 to 6553.5 [s] 0 [s]
timeout transmit delay		Float [###.##] 0.01 to 655.35 [s] 0 [s]
timeout unsolicited message offline retry		Float [####.#] 0.1 to 6553.5 [s] 0 [s]
timeout unsolicited message retry		Float [####.#] 0.1 to 6553.5 [s] 0 [s]

B.7. advanced parameters | Software test points

Software test points

Parameter	Description	Values/Ranges
Handshake RTS,GPB	The change of this parameter required profoundness	[0] NO

Parameter	Description	Values/Ranges
(ASCII-Mode)	communication knowledge. A specialist should be contacted before.	[1] YES
Handshake RTS,GPB (HEX-Mode)	The change of this parameter required profoundness communication knowledge. A specialist should be contacted before.	[0] NO [1] YES
Init-end processing	The change of this parameter required profoundness communication knowledge. A specialist should be contacted before.	[0] NO [1] YES
ZDT-filter	The change of this parameter required profoundness communication knowledge. A specialist should be contacted before.	[0] NO [1] YES
data and acknowledgement between BSE	The change of this parameter required profoundness communication knowledge. A specialist should be contacted before.	[0] NO [1] YES
level locking station locking	The change of this parameter required profoundness communication knowledge. A specialist should be contacted before.	[0] NO [1] YES
mask for blocking data pick-up	The change of this parameter required profoundness communication knowledge. A specialist should be contacted before.	[0] NO [1] YES
master-standby switchover	The change of this parameter required profoundness communication knowledge. A specialist should be contacted before.	[0] NO [1] YES
stop_serialtest_after_comm_error	The change of this parameter required profoundness communication knowledge. A specialist should be contacted before.	[0] NO [1] YES

B.8. advanced parameters | common DNP settings

common DNP settings

Parameter	Description	Values/Ranges
data link layer confirmation		[0] no acknowledgement [1] only for multi fragments [2] always expect acknowledgement
delete oldest event if event buffer overflow		[0] NO [255] YES
destination station number		Integer [#####] 0 to 65500
own station number	own station number must be parametrized always	Integer [#####] 0 to 65500
retrycount for unsolicited messages		Integer [###] 0 to 255
send data class 1		[0] NO [1] YES
send data class 2		[0] NO [1] YES
send data class 3		[0] NO [1] YES
send multifragments		[0] NO [255] YES

Parameter	Description	Values/Ranges
send static data as unsolicited message		[0] NO [255] YES
send unsolicited messages		[0] NO [255] YES

B.9. advanced parameters | default data object settings

default data object settings

Parameter	Description	Values/Ranges
for analog input (object 30)		[1] 32 bit analog input with status [2] 16 bit analog input with status [3] 32 bit analog input without status [4] 16 bit analog input without status [5] short floating point
for analog input change (object 32)		[1] 32 bit analog change event without time [2] 16 bit analog change event without time [3] 32 bit analog change event with time [4] 16 bit analog change event with time [5] short floating point analog change event without time [7] short floating point analog change event with time
for analog input deadband (object 34)		[1] 16 bit analog input deadband [2] 32 bit analog input deadband [3] short floating point analog input deadband
for analog output status (object 40)		[1] 32 bit analog output status [2] 16 bit analog output status [3] short floating point analog output status
for binary counter change event (object 22)		[1] 32 bit counter with status [2] 16 bit counter with status [5] 32 bit counter [6] 16 bit counter
for binary couter (object 20)		[1] 32 bit counter with status [2] 16 bit counter with status [5] 32 bit counter [6] 16 bit counter
for binary input (object 1)		[1] binary input [2] binary input with status
for binary input change (object 2)		[1] binary input without time [2] binary input with time [3] binary input with relative time

Parameter	Description	Values/Ranges
for binary output (object 10)		[1] binary output [2] binary output with status
for double binary input (object 3)		[1] binary input [2] binary input with status
for double binary input change (object 4)		[1] binary input without time [2] binary input with time [3] binary input with relative time
for frozen binary counter (object 21)		[1] 32 bit counter with status [2] 16 bit counter with status [9] 32 bit counter [10] 16 bit counter
for frozen binary counter event (object 23)		[1] 32 bit counter with status [2] 16 bit counter with status [5] 32 bit counter with time [6] 16 bit counter with time

B.10. advanced parameters | monitoring times

monitoring times

Parameter	Description	Values/Ranges
Character monitoring time	Maximum possible gap between sequential bytes of a message in receive direction. If a gap is detected, the message is ignored and the idle monitoring time will be started.	Integer [#####] 0 to 32767 [ms / Bit]
Character monitoring time "time base"	Parametrized times in bits depend on the the baudrate!	[0] Bit [1] ms
expected_ack_time_corr_factor	The expected acknowledgement time is calculated automatically. Signal transfer times and other delays must be parametrized in the "expected acknowledgement time correction factor."	Float [###.##] 0 to 655.35 [s]
idle monitoring time	After communication errors,the line is monitored for quiescent state. After expiry of this monitoring time, the resynchronisation of the receiver takes place. By using the DCD input, faster resynchronisation can be achieved.	Integer [#####] 0 to 32767 [ms / Bit]
idle monitoring time "time base"	Parametrized times in bits depend on the the baudrate!	[0] Bit [1] ms

B.11. advanced parameters | settings in receive direction

settings in receive direction

Parameter	Description	Values/Ranges
maximum application fragment size		Integer [####] 100 to 2048
maximum link fragem size		Integer [###] 20 to 296

B.12. advanced parameters | settings in transmit direction

settings in transmit direction

Parameter	Description	Values/Ranges
maximum application fragment size		Integer [####] 100 to 2048
maximum link fragem size		Integer [###] 20 to 296

B.13. advanced parameters | time management settings

time management settings

Parameter	Description	Values/Ranges
correction time for clock synchronization command	The time of the clock synchronization command will be adjusted with the transmission delay and the correction time.	Float [###.###] -60.000 to 60.000 [ms]
cycle time for sending clock synchronization command	0=no cyclic time setting	Integer [#####] 0 to 65535 [s]
support daylight saving time		[0] NO [255] YES
time offset daylight saving time		Integer [####] -120 to 120 [min]