

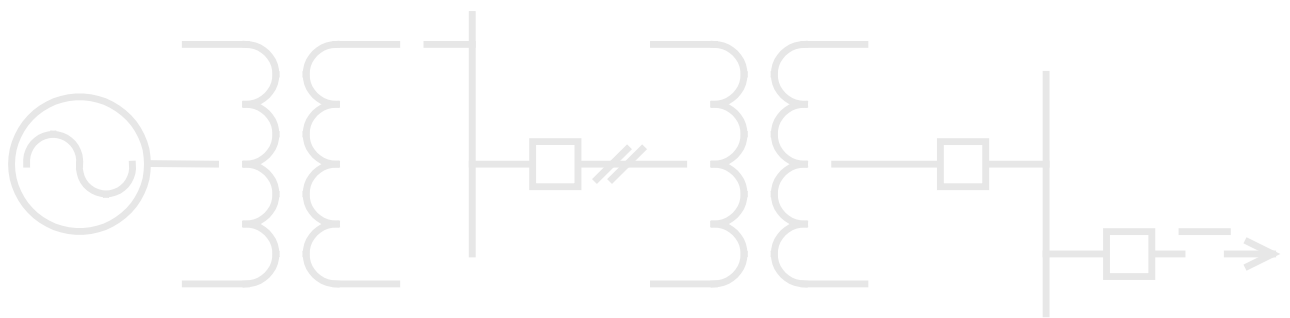
IEC 60870-5-101-104 Server (DPA) for the Multifunction Controller Platform

Conformance Statement

NTEK-A024M-OCS

Version 1.00 Revision 0

Associated Software Release: Version 1.00



COPYRIGHT NOTICE

© 2019, General Electric Company. All rights reserved.

The Software Product described in this documentation may only be used in accordance with the applicable License Agreement. The Software Product and Associated Material are deemed to be “commercial computer software” and “commercial computer software documentation,” respectively, pursuant to DFAR Section 227.7202 and FAR Section 12.212, as applicable, and are delivered with Restricted Rights. Such restricted rights are those identified in the License Agreement, and as set forth in the “Restricted Rights Notice” contained in paragraph (g) (3) (Alternate III) of FAR 52.227-14, Rights in Data-General, including Alternate III (June 1987).

If applicable, any use, modification, reproduction release, performance, display or disclosure of the Software Product and Associated Material by the U.S. Government shall be governed solely by the terms of the License Agreement and shall be prohibited except to the extent expressly permitted by the terms of the License Agreement.

The information contained in this online publication is the exclusive property of General Electric Company, except as otherwise indicated. You may view, copy and print documents and graphics incorporated in this online publication (the “Documents”) subject to the following: (1) the Documents may be used solely for personal, informational, non-commercial purposes; (2) the Documents may not be modified or altered in any way; and (3) General Electric Company withholds permission for making the Documents or any portion thereof accessible via the internet. Except as expressly provided herein, you may not use, copy, print, display, reproduce, publish, license, post, transmit or distribute the Documents in whole or in part without the prior written permission of General Electric Company. If applicable, any use, modification, reproduction, release, performance, display, or disclosure of the Software Product and Associated Material by the U.S. Government shall be governed solely by the terms of the License Agreement and shall be prohibited except to the extent expressly permitted by the terms of the License Agreement.

The information contained in this online publication is subject to change without notice. The software described in this online publication is supplied under license and may be used or copied only in accordance with the terms of such license.

TRADEMARK NOTICES

GE and  are trademarks and service marks of General Electric Company.

* Trademarks of General Electric Company.

IEC is a registered trademark of Commission Electrotechnique Internationale.

Other company or product names mentioned in this document may be trademarks or registered trademarks of their respective companies.

Contents

- 1. IEC 60870-5-101 DPA Interoperability Profile 4**
 - 1.1 System or Device (8.1)..... 5
 - 1.2 Network Configuration (8.2) 5
 - 1.3 Physical Layer (8.3) 5
 - 1.4 Link Layer (8.4)..... 6
 - 1.5 Application Layer (8.5)..... 7
 - 1.6 Basic Application Functions (8.6) 12

- 2. IEC 60870-5-104 DPA Interoperability Profile 16**
 - 2.1 System or Device (9.1)..... 16
 - 2.2 Network Configuration (9.2) 16
 - 2.3 Physical layer (9.3) 16
 - 2.4 Link Layer (9.4)..... 17
 - 2.5 Application Layer (9.5)..... 17
 - 2.6 Basic Application Functions (9.6) 23

1. IEC 60870-5-101 DPA Interoperability Profile

This interoperability profile presents the sets of parameters and alternatives, and identifies by selection, those items required for implementation in the GE Grid Solutions MCP. The following legend reflects the options used in this selection of requirements:

- ☒ Function or ASDU is used as standardized (default)
- ☐ A black check box indicate that the option cannot be selected (and is thus not required)
- ☐R Function or ASDU is used in reverse mode
- ☐B Function or ASDU is used in standard and reverse mode
- ☐ Function or ASDU is not used

In cases where several options are available, for example, multiple lengths of address fields, the GE Grid Solutions MCP shall be configurable to use the required value.

In this document, the bracketed number trailing each subheading title refers to the corresponding section number within the IEC® 60870-5-101 standard.

1.1 System or Device (8.1)

- ☐ System definition
- ☐ Controlling station definition (Master)
- ☒ Controlled station definition (Slave)

1.2 Network Configuration (8.2)

(network-specific parameter)

- ☒ Point-to-point
- ☒ Multipoint-party line
- ☒ Multiple point-to-point
- ☒ Multipoint-star

1.3 Physical Layer (8.3)

(network-specific parameter)

1.3.1 Transmission Speed (Control Direction)

Unbalanced interchange circuit V.24/V.28 Standard	Unbalanced interchange circuit V.24/V.28 Recommended if > 1,200 bit/s	Balanced Interchange Circuit X.24/X.27	
☐ 100 bit/s	☒ 2,400 bit/s	☐ 2,400 bit/s	☐ 56,000 bit/s
☐ 200 bit/s	☒ 4,800 bit/s	☐ 4,800 bit/s	☐ 64,000 bit/s
☒ 300 bit/s	☒ 9,600 bit/s	☐ 9,600 bit/s	
☒ 600 bit/s	☒ 19,200 bit/s	☐ 19,200 bit/s	
☒ 1,200 bit/s		☐ 38,400 bit/s	

1.3.2 Transmission Speed (Monitor Direction)

Unbalanced Interchange Circuit V.24/V.28 Standard	Unbalanced Interchange Circuit V.24/V.28 Recommended if > 1,200 bit/s	Balanced Interchange Circuit X.24/X.27	
☐ 100 bit/s	☒ 2,400 bit/s	☐ 2,400 bit/s	☐ 56,000 bit/s
☐ 200 bit/s	☒ 4,800 bit/s	☐ 4,800 bit/s	☐ 64,000 bit/s
☒ 300 bit/s	☒ 9,600 bit/s	☐ 9,600 bit/s	
☒ 600 bit/s	☒ 19,200 bit/s	☐ 19,200 bit/s	
☒ 1,200 bit/s		☐ 38,400 bit/s	

NOTE: The DPA shall only support the Unbalanced Interchange (Circuit V.24/V.28). The combination of V.24 and V.28 is ITU-T's equivalent to the EIA's RS-232.

1.4 Link Layer (8.4)

(network-specific parameter)

Frame format FT 1.2 (IEC 60870-5-1 Section 6.2.4.2) fixed and variable length is used (length is configurable).

Single character 1 (IEC 60870-5-1 Section 6.2.4.3) is used as an acknowledge.

Fixed time out interval is used (value is configurable).

Link Transmission Procedure

- ☒ Balanced transmission
- ☒ Unbalanced transmission

Frame Length

Maximum length L (number of bytes)

Number of repetitions.

Address Field of the Link

- ☐ Not present (balanced transmission only)
- ☒ One byte
- ☒ Two bytes
- ☒ Structured
- ☒ Unstructured

NOTE: For unbalanced mode, Maximum Frame Length (L) = Maximum ASDU frame length. For balanced mode, Max Frame Length (L) = Maximum ASDU frame length + 1 + Link Address Length.

When using an unbalanced link layer, the following ASDU types are returned in Class 2 messages (low priority) with the indicated clauses of transmission:

- ☒ The standard assignment of ASDUs to Class 2 messages is used as follows

Type identification

9,11,13,21

Cause of transmission

<1>

- ☒ A special assignment of ASDUs to Class 2 messages is used as follows

Type identification

1,2,3,4,5,6,7,8,9,10,11,12,13,14,20,21,30,31,32,33,34,35

1,2,3,4,5,6,7,8,9,10,11,12,13,14,20,21,30,31,32,33,34,35

1,2,3,4,5,6,7,8,9,10,11,12,13,14,20,21,30,31,32,33,34,35

Cause of transmission

<2>

<5>

<20-36>

NOTE: In response to a Class 2 poll, a controlled station can respond with Class 1 data when there is no Class 2 data available.

1.5 Application Layer (8.5)

1.5.1 Transmission Mode for Application Data

Mode 1 (Least significant byte first), as defined in clause 4.10 of IEC 60870-5-4, is used exclusively for all application data.

1.5.2 Common Address of ASDU

(system-specific parameter)

- ☒ One byte ☒ Two bytes

1.5.3 Information Object Address

(system-specific parameter)

- ☒ One byte ☒ Structured
☒ Two bytes ☒ Unstructured
☒ Three bytes

1.5.4 Cause of Transmission

(system-specific parameter)

- ☒ One byte ☒ Two bytes (with originator address).
Set to zero in case of no originator address

1.5.5 Selection of Standard ASDUs

1.5.5.1 Process Information in Monitor Direction

(station-specific parameter)

- | | | | | |
|-------------------------------------|------|----|--|-----------|
| ☒ | <1> | := | Single-point information | M_SP_NA_1 |
| ☒ | <2> | := | Single-point information with time tag | M_SP_TA_1 |
| ☒ | <3> | := | Double-point information | M_DP_NA_1 |
| ☒ | <4> | := | Double-point information with time tag | M_DP_TA_1 |
| ☒ | <5> | := | Step position information | M_ST_NA_1 |
| ☒ | <6> | := | Step position information with time tag | M_ST_TA_1 |
| ☒ | <7> | := | Bitstring of 32 bits | M_BO_NA_1 |
| ☒ | <8> | := | Bitstring of 32 bits with time tag | M_BO_TA_1 |
| ☒ | <9> | := | Measured value, normalized value | M_ME_NA_1 |
| ☒ | <10> | := | Measured value, normalized value with time tag | M_ME_TA_1 |
| ☒ | <11> | := | Measured value, scaled value | M_ME_NB_1 |
| ☒ | <12> | := | Measured value, scaled value with time tag | M_ME_TB_1 |

☒	<13>	:= Measured value, short floating-point value	M_ME_NC_1
☒	<14>	:= Measured value, short floating-point value with time tag	M_ME_TC_1
☒	<15>	:= Integrated totals	M_IT_NA_1
☒	<16>	:= Integrated totals with time tag	M_IT_TA_1
☐	<17>	:= Event of protection equipment with time tag	M_EP_TA_1
☐	<18>	:= Packed start events of protection equipment with time tag	M_EP_TB_1
☐	<19>	:= Packed output circuit information of protection equipment with time tag	M_EP_TC_1
☒	<20>	:= Packed single-point information with status change detection	M_PS_NA_1
☒	<21>	:= Measured value, normalized value without quality descriptor	M_ME_ND_1
☒	<30>	:= Single-point information with time tag CP56Time2a	M_SP_TB_1
☒	<31>	:= Double-point information with time tag CP56Time2a	M_DP_TB_1
☒	<32>	:= Step position information with time tag CP56Time2a	M_ST_TB_1
☒	<33>	:= Bit string of 32 bits with time tag CP56Time2a	M_BO_TB_1
☒	<34>	:= Measured value, normalized value with time tag CP56Time2a	M_ME_TD_1
☒	<35>	:= Measured value, scaled value with time tag CP56Time2a	M_ME_TE_1
☒	<36>	:= Measured value, short floating point with time tag CP56Time2a	M_ME_TF_1
☒	<37>	:= Integrated totals with time tag CP56Time2a	M_IT_TB_1
☐	<38>	:= Event of protection equipment with time tag CP56Time2a	M_EP_TD_1
☐	<39>	:= Packed start events of protection equipment with time tag CP56Time2a	M_EP_TE_1
☐	<40>	:= Packed output circuit information of protection equipment with time tag CP56Time2a	M_EP_TF_1

1.5.5.2 Process Information in Control Direction

(station-specific parameter)

☒	<45>	:= Single command	C_SC_NA_1
☒	<46>	:= Double command	C_DC_NA_1
☒	<47>	:= Regulating step command	C_RC_NA_1
☒	<48>	:= Set point command, normalized values	C_SE_NA_1
☒	<49>	:= Set point command, scaled value	C_SE_NB_1
☒	<50>	:= Set point command, short floating-point value	C_SE_NC_1
☐	<51>	:= Bitstring of 32 bits	C_BO_NA_1

1.5.5.3 System Information in Monitor Direction

(station-specific parameter)

✘ <70> := End of initialization

M_EI_NA_1

1.5.5.4 System Information in Control Direction

(station specific parameter)

✘ <100> :=	Interrogation command	C_IC_NA_1
✘ <101> :=	Counter interrogation command	C_CI_NA_1
✘ <102> :=	Read command	C_RD_NA_1
✘ <103> :=	Clock synchronization command	C_CS_NA_1
✘ <104> :=	Test command	C_TS_NA_1
✘ <105> :=	Reset process command	C_RP_NC_1
✘ <106> :=	Delay acquisition command	C_CD_NA_1

1.5.5.5 Parameter in Control Direction

(station-specific parameter)

✘ <110> :=	Parameter of measured value, normalized value	P_ME_NA_1
✘ <111> :=	Parameter of measured value, scaled value	P_ME_NB_1
✘ <112> :=	Parameter of measured value, short floating-point value	P_ME_NC_1
✘ <113> :=	Parameter activation	P_AC_NA_1

1.5.5.6 File Transfer

(station-specific parameter)

File Download and Upload

✘ <120> :=	File ready	F_FR_NA_1
✘ <121> :=	Section ready	F_SR_NA_1
✘ <122> :=	Call directory, select file, call file, call section	F_SC_NA_1
✘ <123> :=	Last section, last segment	F_LS_NA_1
✘ <124> :=	Ack file, ack section	F_AF_NA_1
✘ <125> :=	Segment	F_SG_NA_1
✘ <126> :=	Directory {blank or ✘, only available in monitor (standard) direction}	F_DR_TA_1

1.5.5.7 Type identifier and Cause of Transmission Assignments

(station-specific parameter)

Shaded box[es] are not required.

Blank = Function or ASDU is not used

Type identification		Cause of transmission																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	20 to 36	37 to 41	44	45	46	47	
<1>	M_SP_NA_1		x	x		x									x						
<2>	M_SP_TA_1			x		x															
<3>	M_DP_NA_1		x	x		x									x						
<4>	M_DP_TA_1			x		x															
<5>	M_ST_NA_1		x	x		x									x						
<6>	M_ST_TA_1			x		x															
<7>	M_BO_NA_1		x	x		x									x						
<8>	M_BO_TA_1			x		x															
<9>	M_ME_NA_1	x	x	x		x									x						
<10>	M_ME_TA_1			x		x															
<11>	M_ME_NB_1	x	x	x		x									x						
<12>	M_ME_TB_1			x		x															
<13>	M_ME_NC_1	x	x	x		x									x						
<14>	M_ME_TC_1			x		x															
<15>	M_IT_NA_1			x												x					
<16>	M_IT_TA_1			x												x					
<17>	M_EP_TA_1																				
<18>	M_EP_TB_1																				
<19>	M_EP_TC_1																				
<20>	M_PS_NA_1		x	x		x									x						
<21>	M_ME_ND_1		x	x		x									x						
<30>	M_SP_TB_1			x		x															
<31>	M_DP_TB_1			x		x															
<32>	M_ST_TB_1			x		x															
<33>	M_BO_TB_1			x		x															
<34>	M_ME_TD_1			x		x															
<35>	M_ME_TE_1			x		x															
<36>	M_ME_TF_1			x		x															
<37>	M_IT_TB_1			x												x					
<38>	M_EP_TD_1																				
<39>	M_EP_TE_1																				
<40>	M_EP_TF_1																				
<45>	C_SC_NA_1						x	x	x	x	x						x	x	x	x	
<46>	C_DC_NA_1						x	x	x	x	x						x	x	x	x	
<47>	C_RC_NA_1						x	x	x	x	x						x	x	x	x	
<48>	C_SE_NA_1						x	x	x	x	x						x	x	x	x	
<49>	C_SE_NB_1						x	x	x	x	x						x	x	x	x	

11

1.6 Basic Application Functions (8.6)

1.6.1 Station Initialization

(station-specific parameter)

- ☒ Remote initialization

1.6.2 Cyclic Data Transmission

(station-specific parameter)

- ☒ Cyclic data transmission

1.6.3 Read Procedure

(station-specific parameter)

- ☒ Read Procedure

1.6.4 Spontaneous Transmission

(station-specific parameter)

- ☒ Spontaneous transmission

1.6.5 Double Transmission of Information Objects with Cause of Transmission Spontaneous

(Station-specific parameter)

The following type identification can be transmitted in succession caused by a single status change of an information object. The information object addresses for which double transmission is enabled are defined in a project-specific list.

- ☐ Single-point information M_SP_NA_1, M_SP_TA_1, M_SP_TB_1 and M_PS_NA_1
- ☐ Double-point information M_DP_NA_1, M_DP_TA_1 and M_DP_TB_1
- ☐ Step position information M_ST_NA_1, M_ST_TA_1 and M_ST_TB_1
- ☐ Bitstring of 32 bits M_BO_NA_1, M_BO_TA_1 and M_BO_TB_1
- ☐ Measured value, normalized value M_ME_NA_1, M_ME_TA_1, M_ME_ND_1 and M_ME_TD_1
- ☐ Measured value, scaled value M_ME_NB_1, M_ME_TB_1 and M_ME_TE_1
- ☐ Measured value, short floating-point number M_ME_NC_1, M_ME_TC_1 and M_ME_TF_1

1.6.6 Station Interrogation

(station-specific parameter)

- ☒ global
- ☒ group 1 ☒ group 7 ☒ group 13

☒ group 2	☒ group 8	☒ group 14
☒ group 3	☒ group 9	☒ group 15
☒ group 4	☒ group 10	☒ group 16
☒ group 5	☒ group 11	Information Object Address assigned to each group shall be shown in a separate table
☒ group 6	☒ group 12	

1.6.7 Clock Synchronization

(station-specific parameter)

- ☒ Clock synchronization
- ☐ Day of week used
- ☐ RES1, GEN (time tag substituted/not substituted used)
- ☐ SU-bit (summertime) used

1.6.8 Command Transmission

(object-specific parameter)

- ☒ Direct command transmission
- ☒ Direct set point command transmission
- ☒ Selected and Execute Command
- ☒ Select and execute set point command
- ☒ C-SE ACTTERM Used

- ☒ No additional definition
- ☒ Short pulse duration (duration determined by a system parameter in the controlled station)
- ☒ Long pulse duration (duration determined by a system parameter in the controlled station)
- ☒ Persistent output

1.6.9 Transmission of Integrated Totals

(station or object-specific parameter)

- ☒ Mode A: Local freeze with spontaneous transmission
- ☐ Mode B: Local freeze with counter interrogation
- ☒ Mode C: Freeze and transmit by counter-interrogation command
- ☐ Mode D: Freeze by counter-interrogation command, frozen values reported spontaneously

- ☒ Counter read
- ☒ Counter freeze without reset
- ☒ Counter freeze with reset
- ☒ Counter reset

- ☒ General request counter
- ☒ Request counter group 1
- ☒ Request counter group 2
- ☒ Request counter group 3
- ☒ Request counter group 4

Addresses per group must be defined

1.6.10 Parameter Loading

(object-specific parameter)

- ☒ Threshold value
- ☐ Smoothing factor
- ☒ Low limit for transmission of measured value
- ☒ High limit for transmission of measured value

1.6.11 Parameter Activation

(object-specific parameter)

- ☒ Activ/deactiv. of persistent cyclic or periodic transmission of the addressed object

1.6.12 Test Procedure

(station-specific parameter)

- ☒ Test procedure

1.6.13 File Transfer

(station-specific parameter)

1.6.13.1 File Transfer in Monitor Direction

- ☐ Transparent file
- ☐ Transmission of disturbance data of protection equipment
- ☐ Transmission of sequences of events
- ☐ Transmission of sequences of recorded analogue values

1.6.13.2 File Transfer in Control Direction

- ☒ Transparent file

1.6.14 Background Scan

(station-specific parameter)

- ☒ Background scan

1.6.15 Acquisition of Transmission Delay

(station-specific parameter)

- ☒ Acquisition of transmission delay

2. IEC 60870-5-104 DPA Interoperability Profile

This interoperability profile presents the sets of parameters and alternatives, and identifies by selection, those items required for implementation in the GE Grid Solutions MCP. The following legend reflects the options used in this selection of requirements:

- ☒ Function or ASDU is used as standardized (default)
- ☐ A black check box indicate that the option cannot be selected (and is thus not required)
- ☒ R Function or ASDU is used in reverse mode
- ☒ B Function or ASDU is used in standard and reverse mode
- ☐ Function or ASDU is not used

The text descriptions of parameters, which are not applicable to this standard, are strike-through (corresponding check box is marked black).

In this document, the bracketed number trailing each subheading title refers to the corresponding section number within the IEC 60870-5-104 standard.

NOTE: In addition, the full specification of a system shall possibly require individual selection of certain parameters for certain parts of the system, such as the individual selection of scaling factors for individually addressable measured values.

2.1 System or Device (9.1)

- ☐ System definition
- ☐ Controlling station definition (Master)
- ☒ Controlled station definition (Slave)

2.2 Network Configuration (9.2)

(network-specific parameter)

- | | |
|---|---|
| ☐ Point to point | ☐ Multipoint party line |
| ☐ Multiple point to point | ☐ Multipoint star |

2.3 Physical layer (9.3)

(network-specific parameter)

2.3.1 Transmission Speed (Control Direction)

Unbalanced interchange circuit V.24/V.28 Standard	Unbalanced interchange circuit V.24/V.28 Recommended if > 1200 bit/s	Balanced Interchange Circuit X.24/X.27
☐ 100 bit/s	☐ 2,400 bit/s	☐ 2,400 bit/s
☐ 200 bit/s	☐ 4,800 bit/s	☐ 4,800 bit/s
☐ 300 bit/s	☐ 9,600 bit/s	☐ 9,600 bit/s
☐ 600 bit/s	☐ 19,200 bit/s	☐ 19,200 bit/s
☐ 1,200 bit/s		☐ 38,400 bit/s
		☐ 56,000 bit/s
		☐ 64,000 bit/s

2.3.2 Transmission Speed (Monitor Direction)

Unbalanced Interchange Circuit V.24/V.28 Standard	Unbalanced Interchange Circuit V.24/V.28 Recommended if > 1200 bit/s	Balanced Interchange Circuit X.24/X.27
☐ 100 bit/s	☐ 2,400 bit/s	☐ 2,400 bit/s
☐ 200 bit/s	☐ 4,800 bit/s	☐ 4,800 bit/s
☐ 300 bit/s	☐ 9,600 bit/s	☐ 9,600 bit/s
☐ 600 bit/s	☐ 19,200 bit/s	☐ 19,200 bit/s
☐ 1,200 bit/s		☐ 38,400 bit/s
		☐ 56,000 bit/s
		☐ 64,000 bit/s

2.4 Link Layer (9.4)

(network-specific parameter)

Frame format FT1.2, single character 1 and the fixed time out interval is used exclusively in this companion standard.

Link Transmission Procedure

- ☐ Balanced transmission
- ☐ Unbalanced transmission

Frame Length

- ☐ Maximum length L (number of bytes)

Address Field of the Link

- ☐ Not present (balanced transmission only)
- ☐ One byte
- ☐ Two bytes
- ☐ Structured
- ☐ Unstructured

2.5 Application Layer (9.5)

2.5.1 Transmission Mode for Application Data

Mode 1 (Least significant byte first), as defined in clause 4.10 of IEC 870-5-4, is used exclusively in this companion standard.

2.5.2 Common address of ASDU

(system-specific parameter)

- ☐ One byte ☒ Two bytes

2.5.3 Information Object Address

(system-specific parameter)

- ☐ One byte ☒ Structured
☐ Two bytes ☒ Unstructured
☒ Three bytes

2.5.4 Cause of Transmission

(system-specific parameter)

- ☐ One byte ☒ Two bytes (with originator address). Originator address is set to zero if not used

2.5.5 Length of APDU

(system specific parameter)

The maximum length of APDU is 253 (default). The maximum length can be reduced by the system.

Maximum length of APDU

2.5.6 Selection of Standard ASDUs

2.5.6.1 Process Information in Monitor Direction

(station-specific parameter)

☒	<1>	:=	Single-point information	M_SP_NA_1
☐	<2>	:=	Single-point information with time tag	M_SP_TA_1
☒	<3>	:=	Double-point information	M_DP_NA_1
☐	<4>	:=	Double-point information with time tag	M_DP_TA_1
☒	<5>	:=	Step position information	M_ST_NA_1
☐	<6>	:=	Step position information with time tag	M_ST_TA_1
☒	<7>	:=	Bitstring of 32 bits	M_BO_NA_1
☐	<8>	:=	Bitstring of 32 bits with time tag	M_BO_TA_1
☒	<9>	:=	Measured value, normalized value	M_ME_NA_1
☐	<10>	:=	Measured value, normalized value with time tag	M_ME_TA_1
☒	<11>	:=	Measured value, scaled value	M_ME_NB_1
☐	<12>	:=	Measured value, scaled value with time tag	M_ME_TB_1
☒	<13>	:=	Measured value, short floating-point value	M_ME_NC_1
☐	<14>	:=	Measured value, short floating-point value with time tag	M_ME_TC_1
☒	<15>	:=	Integrated totals	M_IT_NA_1

☒	<16>	:= Integrated totals with time tag	M_IT_TA_1
☒	<17>	:= Event of protection equipment with time tag	M_EP_TA_1
☒	<18>	:= Packed start events of protection equipment with time tag	M_EP_TB_1
☒	<19>	:= Packed output circuit information of protection equipment with time tag	M_EP_TC_1
☒	<20>	:= Packed single-point information with status change detection	M_PS_NA_1
☒	<21>	:= Measured value, normalized value without quality descriptor	M_ME_ND_1
☒	<30>	:= Single-point information with time tag CP56Time2a	M_SP_TB_1
☒	<31>	:= Double-point information with time tag CP56Time2a	M_DP_TB_1
☒	<32>	:= Step position information with time tag CP56Time2a	M_ST_TB_1
☒	<33>	:= Bit string of 32 bits with time tag CP56Time2a	M_BO_TB_1
☒	<34>	:= Measured value, normalized value with time tag CP56Time2a	M_ME_TD_1
☒	<35>	:= Measured value, scaled value with time tag CP56Time2a	M_ME_TE_1
☒	<36>	:= Measured value, short floating point with time tag CP56Time2a	M_ME_TF_1
☒	<37>	:= Integrated totals with time tag CP56Time2a	M_IT_TB_1
☐	<38>	:= Event of protection equipment with time tag CP56Time2a	M_EP_TD_1
☐	<39>	:= Packed start events of protection equipment with time tag CP56Time2a	M_EP_TE_1
☐	<40>	:= Packed output circuit information of protection equipment with time tag CP56Time2a	M_EP_TF_1

Either the ASDUs of the set <2>, <4>, <6>, <8>, <10>, <12>, <14>, <16>, <17>, <18>, <19> or of the set <30> – <40> are used.

2.5.6.2 Process Information in Control Direction

(station-specific parameter)

☒	<45>	:= Single command	C_SC_NA_1
☒	<46>	:= Double command	C_DC_NA_1
☒	<47>	:= Regulating step command	C_RC_NA_1
☒	<48>	:= Set point command, normalized values	C_SE_NA_1
☒	<49>	:= Set point command, scaled value	C_SE_NB_1
☒	<50>	:= Set point command, short floating-point value	C_SE_NC_1
☐	<51>	:= Bitstring of 32 bits	C_BO_NA_1
☒	<58>	:= Single command with time tag CP56Time2a	C_SC_TA_1
☒	<59>	:= Double command with time tag CP56Time2a	C_DC_TA_1
☒	<60>	:= Regulating step command with time tag CP56Time2a	C_RC_TA_1
☒	<61>	:= Set point command, normalized values with time tag CP56Time2a	C_SE_TA_1
☒	<62>	:= Set point command, scaled value with time tag CP56Time2a	C_SE_TB_1
☒	<63>	:= Set point command, short floating-point value with time tag CP56Time2a	C_SE_TC_1
☐	<64>	:= Bitstring of 32 bits with time tag CP56Time2a	C_BO_TA_1

Either the ASDUs of the set <45> – <51> or of the set <58> – <64> are used.

2.5.6.3 System Information in Monitor Direction

(station-specific parameter)

☒ <70> :=	End of initialization	M_EI_NA_1
--------------	-----------------------	-----------

2.5.6.4 System Information in Control Direction

(station-specific parameter)

☒ <100> :=	Interrogation command	C_IC_NA_1
☒ <101> :=	Counter interrogation command	C_CI_NA_1
☒ <102> :=	Read command	C_RD_NA_1
☒ <103> :=	Clock synchronization command	C_CS_NA_1
■ <104> :=	Test command	C_TS_NA_1
☒ <105> :=	Reset process command	C_RP_NC_1
■ <106> :=	Delay acquisition command	C_CD_NA_1
☒ <107> :=	Test command with time tag CP56Time2a	C_TS_TA_1

2.5.6.5 Parameter in Control Direction

(station-specific parameter)

☒ <110> :=	Parameter of measured value, normalized value	P_ME_NA_1
☒ <111> :=	Parameter of measured value scaled value	P_ME_NB_1
☒ <112> :=	Parameter of measured value, short floating-point value	P_ME_NC_1
☒ <113> :=	Parameter activation	P_AC_NA_1

2.5.6.6 File Transfer

(station-specific parameter)

File Download and Upload

☒ <120> :=	File ready	F_FR_NA_1
☒ <121> :=	Section ready	F_SR_NA_1
☒ <122> :=	Call directory, select file, call file, call section	F_SC_NA_1
☒ <123> :=	Last section, last segment	F_LS_NA_1
☒ <124> :=	Ack file, ack section	F_AF_NA_1
☒ <125> :=	Segment	F_SG_NA_1
☒ <126> :=	Directory	F_DR_TA_1

2.5.6.7 Type identifier and Cause of Transmission Assignments

(station-specific parameter)

Shaded box[es] are not required.

Blank = Function or ASDU is not used

Type identification		Cause of transmission																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	20 to 36	37 to 41	44	45	46	47	
<1>	M_SP_NA_1		x	x		x									x						
<2>	M_SP_TA_1																				
<3>	M_DP_NA_1		x	x		x									x						
<4>	M_DP_TA_1																				
<5>	M_ST_NA_1		x	x		x									x						
<6>	M_ST_TA_1																				
<7>	M_BO_NA_1		x	x		x									x						
<8>	M_BO_TA_1																				
<9>	M_ME_NA_1	x	x	x		x									x						
<10>	M_ME_TA_1																				
<11>	M_ME_NB_1	x	x	x		x									x						
<12>	M_ME_TB_1																				
<13>	M_ME_NC_1	x	x	x		x									x						
<14>	M_ME_TC_1																				
<15>	M_IT_NA_1			x												x					
<16>	M_IT_TA_1																				
<17>	M_EP_TA_1																				
<18>	M_EP_TB_1																				
<19>	M_EP_TC_1																				
<20>	M_PS_NA_1		x	x		x									x						
<21>	M_ME_ND_1	x	x	x		x									x						
<30>	M_SP_TB_1			x		x															
<31>	M_DP_TB_1			x		x															
<32>	M_ST_TB_1			x		x															
<33>	M_BO_TB_1			x		x															
<34>	M_ME_TD_1			x		x															
<35>	M_ME_TE_1			x		x															
<36>	M_ME_TF_1			x		x															
<37>	M_IT_TB_1			x												x					
<38>	M_EP_TD_1																				
<39>	M_EP_TE_1																				
<40>	M_EP_TF_1																				
<45>	C_SC_NA_1					x	x	x	x	x							x	x	x	x	
<46>	C_DC_NA_1					x	x	x	x	x							x	x	x	x	
<47>	C_RC_NA_1					x	x	x	x	x							x	x	x	x	
<48>	C_SE_NA_1					x	x	x	x	x							x	x	x	x	
<49>	C_SE_NB_1					x	x	x	x	x							x	x	x	x	

Type identification		Cause of transmission																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	20 to 36	37 to 41	44	45	46	47	
<50>	C_SE_NC_1						x	x	x	x	x						x	x	x	x	
<51>	C_BO_NA_1																				
<58>	C_SC_TA_1						x	x	x	x	x						x	x	x	x	
<59>	C_DC_TA_1						x	x	x	x	x						x	x	x	x	
<60>	C_RC_TA_1						x	x	x	x	x						x	x	x	x	
<61>	C_SE_TA_1						x	x	x	x	x						x	x	x	x	
<62>	C_SE_TB_1						x	x	x	x	x						x	x	x	x	
<63>	C_SE_TC_1						x	x	x	x	x						x	x	x	x	
<64>	C_BO_TA_1																				
<70>	M_EI_NA_1				x																
<100>	C_IC_NA_1						x	x	x	x	x						x	x	x	x	
<101>	C_CI_NA_1						x	x			x						x	x	x	x	
<102>	C_RD_NA_1					x											x	x	x	x	
<103>	C_CS_NA_1			x			x	x									x	x	x	x	
<104>	C_TS_NA_1																				
<105>	C_RP_NA_1						x	x									x	x	x	x	
<106>	C_CD_NA_1																				
<107>	C_TS_TA_1						x	x									x	x	x	x	
<110>	P_ME_NA_1						x	x													
<111>	P_ME_NB_1						x	x													
<112>	P_ME_NC_1						x	x													
<113>	P_AC_NA_1						x	x	x	x											
<120>	F_FR_NA_1													x							
<121>	F_SR_NA_1													x							
<122>	F_SC_NA_1					x								x							
<123>	F_LS_NA_1													x							
<124>	F_AF_NA_1													x							
<125>	F_SG_NA_1													x							
<126>	F_DR_TA_1					x															

2.6 Basic Application Functions (9.6)

2.6.1 Station Initialization

(station-specific parameter)

- ☒ Remote initialization

2.6.2 Cyclic Data Transmission

(station-specific parameter)

- ☒ Cyclic data transmission

2.6.3 Read Procedure

(station-specific parameter)

- ☒ Read Procedure

2.6.4 Spontaneous Transmission

(station-specific parameter)

- ☒ Spontaneous transmission

2.6.5 Double Transmission of Information Objects with Cause of Transmission Spontaneous

(station-specific parameter)

The following type identification can be transmitted in succession caused by a single status change of an information object. The information object addresses for which double transmission is enabled are defined in a project-specific list.

- ☐ Single-point information M_SP_NA_1, M_SP_TA_1, M_SP_TB_1 and M_PS_NA_1
- ☐ Double-point information M_DP_NA_1, M_DP_TA_1 and M_DP_TB_1
- ☐ Step position information M_ST_NA_1, M_ST_TA_1 and M_ST_TB_1
- ☐ Bitstring of 32 bits M_BO_NA_1, M_BO_TA_1 and M_BO_TB_1
- ☐ Measured value, normalized value M_ME_NA_1, M_ME_TA_1, M_ME_ND_1 and M_ME_TD_1
- ☐ Measured value, scaled value M_ME_NB_1, M_ME_TB_1 and M_ME_TE_1
- ☐ Measured value, short floating-point number M_ME_NC_1, M_ME_TC_1 and M_ME_TF_1

2.6.6 Station Interrogation

(station-specific parameter)

- ☒ Global
- ☒ Group 1 ☒ Group 7 ☒ Group 13

- | | | |
|---|--|--|
| ☒ Group 2 | ☒ Group 8 | ☒ Group 14 |
| ☒ Group 3 | ☒ Group 9 | ☒ Group 15 |
| ☒ Group 4 | ☒ Group 10 | ☒ Group 16 |
| ☒ Group 5 | ☒ Group 11 | |
| ☒ Group 6 | ☒ Group 12 | |

Information Object Address assigned to each group shall be shown in a separate table

2.6.7 Clock Synchronization

(station-specific parameter)

- ☒ Clock synchronization

2.6.8 Command Transmission

(object-specific parameter)

- | | |
|--|---|
| ☒ Direct Command Transmission (Step Position) | ☒ Selected and Execute Command (Single & Double CMDS) |
| ☒ Direct set point command transmission | ☒ Select and execute set point command |
| | ☒ C-SE ACTTERM Used |
| ☒ No additional definition | |
| ☒ Short pulse duration (duration determined by a system parameter in the outstation) | |
| ☒ Long pulse duration (duration determined by a system parameter in the outstation) | |
| ☒ Persistent output | |
| ☒ Supervision of maximum delay in command direction of Commands and Set Point Commands | |

Configurable

Maximum allowable delay for Commands and Set Point Commands

2.6.9 Transmission of Integrated Totals

(station or object-specific parameter)

- | | |
|--|---|
| ☒ Mode A: Local freeze with spontaneous transmission | |
| ☐ Mode B: Local freeze with counter interrogation | |
| ☒ Mode C: Freeze and transmit by counter-interrogation command | |
| ☐ Mode D: Freeze by counter-interrogation command, frozen values reported spontaneously | |
| | |
| ☒ Counter read | ☒ General request counter |
| ☒ Counter freeze without reset | ☒ Request counter group 1 |
| ☒ Counter freeze with reset | ☒ Request counter group 2 |
| ☒ Counter reset | ☒ Request counter group 3 |
| | ☒ Request counter group 4 |

Addresses per group must be defined

2.6.10 Parameter Loading

(object-specific parameter)

- ☒ Threshold value
- ☐ Smoothing factor
- ☒ Low limit for transmission of measured value
- ☒ High limit for transmission of measured value

2.6.11 Parameter Activation

(object-specific parameter)

- ☒ Act/de-act of persistent cyclic or periodic transmission of the addressed object

2.6.12 Test Procedure

(station-specific parameter)

- ☒ Test procedure

2.6.13 File Transfer

(station-specific parameter)

2.6.13.1 File Transfer in Monitor Direction

- ☐ Transparent file
- ☐ Transmission of disturbance data of protection equipment
- ☐ Transmission of sequences of events
- ☐ Transmission of sequences of recorded analogue values

2.6.13.2 File Transfer in Control Direction

- ☒ Transparent file

2.6.14 Background Scan

(station-specific parameter)

- ☒ Background scan

2.6.15 Acquisition of Transmission Delay

(station-specific parameter)

- ☐ Acquisition of transmission delay

2.6.16 Definition of Time Outs

Parameter	Default value	Remarks	Selected value
t_0	30 s	Time-out of connection establishment	Configurable
t_1	15 s	Time-out of send or test APDUs	Configurable
t_2	10 s	Time-out for acknowledges in case of no data messages $t_2 < t_1$	Configurable
t_3	20 s	Time-out of sending test frames in case of a long idle state	Configurable

Maximum range of values for all time-outs: 1 to 255 s, accuracy 1 s.

2.6.17 Maximum Number of Outstanding I Format APDUs k and Latest Acknowledge APDUs (w)

Parameter	Default value	Remarks	Selected value
K	12 APDUs	Maximum difference receives sequence number to send state variable	Configurable
W	8 APDUs	Latest acknowledge after receiving w I format APDUs	Configurable

Maximum range of values k : 1 to 32767 ($2^{15}-1$) APDUs, accuracy 1 APDU

Maximum range of values w : 1 to 32767 APDUs, accuracy 1 APDU (Recommendation: w should not exceed two-thirds of k).

2.6.18 Port Number

Parameter	Value	Remarks
Port number	2404	In all cases

2.6.19 RFC 2200 suite

RFC 2200 suite is an official Internet Standard that describes the state of standardization of protocols used in the Internet as determined by Internet Architecture Board (IAB). It offers a broad spectrum of actual standards used in the Internet. The suitable selection of documents from RFC 2200 defined in this standard for given projects must be chosen by the user of this standard.

- ☒ Ethernet 802.3
- ☐ Serial X.21 interface
- ☐ Other selection from RFC 2200:

List of valid documents from RFC 2200

1.
2.
3.
4.
5.

6.

MODIFICATION RECORD

VERSION	REV.	DATE	AUTHOR	CHANGE DESCRIPTION
1.00	0	2 nd May, 2019	G. LaMarre	Created.

