

SIEMENS

SIPROTEC Communication Module IEC 60870-5-104

Bus Mapping/Point Lists

Preface

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NOTE

For your own safety, please observe the warnings and safety instructions contained in this document.

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Preface

Purpose of this manual

This manual describes the bus mapping of SIPROTEC 4 Communication Module with IEC60870-5-104.

Target group

Protection engineers, commissioning engineers, persons who are involved in setting, testing and service of protection, automation, and control devices, as well as operation personnel in electrical plants and power stations.

Scope of validity of this manual

This manual is valid for SIPROTEC 4 Communication Module with IEC60870-5-104.

Further support

Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purpose, the matter should be referred to the local Siemens representative.

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Notes On Safety

This manual does not constitute a complete catalog of all safety measures required for operating the equipment (module, device) in question, because special operating conditions may require additional measures. However, it does contain notes that must be adhered to for your own personal safety and to avoid damage to property. These notes are highlighted with a warning triangle and different keywords indicating different degrees of danger.



DANGER

Danger means that death or severe injury **will** occur if the appropriate safety measures are not taken.

- ✧ Follow all advice instructions to prevent death or severe injury.
-



WARNING

Warning means that death or severe injury **can** occur if the appropriate safety measures are not taken.

- ✧ Follow all advice instructions to prevent death or severe injury.
-



CAUTION

Caution means that minor or moderate injury can occur if the appropriate safety measures are not taken.

- ✧ Follow all advice instructions to prevent minor injury.
-

NOTICE

Notice means that damage to property can occur if the appropriate safety measures are not taken.

- ✧ Follow all advice instructions to prevent damage to property.
-



NOTE

is important information about the product, the handling of the product, or the part of the documentation in question to which special attention must be paid.

Qualified Personnel

Commissioning and operation of the equipment (module, device) described in this manual must be performed by qualified personnel only. As used in the safety notes contained in this manual, qualified personnel are those persons who are authorized to commission, release, ground and tag devices, systems, and electrical circuits in accordance with safety standards.

Use as Prescribed

The equipment (device, module) must not be used for any other purposes than those described in the Catalog and the Technical Description. If it is used together with third-party devices and components, these must be recommended or approved by Siemens.

Correct and safe operation of the product requires adequate transportation, storage, installation, and mounting as well as appropriate use and maintenance.

During the operation of electrical equipment, it is unavoidable that certain parts of this equipment will carry dangerous voltages. Severe injury or damage to property can occur if the appropriate measures are not taken:

- Before making any connections at all, ground the equipment at the PE terminal.
- Hazardous voltages can be present on all switching components connected to the power supply.
- Even after the supply voltage has been disconnected, hazardous voltages can still be present in the equipment (capacitor storage).
- Equipment with current transformer circuits must not be operated while open.
- The limit values indicated in the manual or the operating instructions must not be exceeded; this also refers to testing and commissioning

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1 Basics of the Function (Check List)

1.1 Interoperability

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1.1 Interoperability

This companion standard presents sets of parameters and alternatives from which subsets must be selected to implement particular telecontrol systems. Certain parameter values, such as the choice of "structured" or "unstructured" fields of the INFORMATION OBJECT ADDRESS of ASDUs represent mutually exclusive alternatives. This means that only one value of the defined parameters is admitted per system. Other parameters, such as the listed set of different process information in command and in monitor direction allow the specification of the complete set or subsets, as appropriate for given applications. This clause summarizes the parameters of the previous clauses to facilitate a suitable selection for a specific application. If a system is composed of equipment stemming from different manufacturers, it is necessary that all partners agree on the selected parameters.

The interoperability list is defined as in IEC 60870-5-101 and extended with parameters used in this standard. The text descriptions of parameters which are not applicable to this companion standard are strike-through (corresponding check box is marked black).

Note:

In addition, the full specification of a system may 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.

The selected parameters should be marked in the white boxes as follows:

- Function or ASDU is not used
- Function or ASDU is used as standardized (default)
- Function or ASDU is used in reverse mode
- Function or ASDU is used in standard and reverse mode

The possible selection (blank, X, R, or B) is specified for each specific clause or parameter.

A black check box indicates that the option cannot be selected in this companion standard.

1.1.1 System or Device

(specific-parameter, indicate the station's function by marking one of the following with 'X')

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

1.1.2 Network Configuration

(network-specific parameter, all configurations that are used are to be marked 'X')

- | | |
|-------------------------------------------------------------|-------------------------------------------------------------|
| <input checked="" type="checkbox"/> Point-to-point | <input checked="" type="checkbox"/> Point-to-point |
| <input checked="" type="checkbox"/> Multiple point-to-point | <input checked="" type="checkbox"/> Multiple point-to-point |

1.1.3 Physical Layer

(Network-specific parameter, all interfaces and data rates that are used are to be marked 'X')

<u>Transmission Speed (control direction)</u>			
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	
<input type="checkbox"/> 400 bit/s	<input type="checkbox"/> 2 400 bit/s	<input type="checkbox"/> 2 400 bit/s	<input type="checkbox"/> 56 000 bit/s
<input type="checkbox"/> 200 bit/s	<input type="checkbox"/> 4 800 bit/s	<input type="checkbox"/> 4 800 bit/s	<input type="checkbox"/> 64 000 bit/s
<input type="checkbox"/> 300 bit/s	<input type="checkbox"/> 9 600 bit/s	<input type="checkbox"/> 9 600 bit/s	
<input type="checkbox"/> 600 bit/s		<input type="checkbox"/> 19 200 bit/s	
<input type="checkbox"/> 1 200 bit/s		<input type="checkbox"/> 38 400 bit/s	

<u>Transmission Speed (monitor direction)</u>			
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	
<input type="checkbox"/> 400 bit/s	<input type="checkbox"/> 2 400 bit/s	<input type="checkbox"/> 2 400 bit/s	<input type="checkbox"/> 56 000 bit/s
<input type="checkbox"/> 200 bit/s	<input type="checkbox"/> 4 800 bit/s	<input type="checkbox"/> 4 800 bit/s	<input type="checkbox"/> 64 000 bit/s
<input type="checkbox"/> 300 bit/s	<input type="checkbox"/> 9 600 bit/s	<input type="checkbox"/> 9 600 bit/s	
<input type="checkbox"/> 600 bit/s		<input type="checkbox"/> 19 200 bit/s	
<input type="checkbox"/> 1 200 bit/s		<input type="checkbox"/> 38 400 bit/s	

1.1.4 Link Layer

(network-specific parameter, all options that are used are to be marked 'X'. Specify the maximum frame length. If a non-standard assignment of class 2 messages is implemented for unbalanced transmission, indicate the Type ID and COT of all messages assigned to class 2.)

<u>Frame format FT 1.2, single character 1 and the fixed time out interval are used exclusively in this companion standard.</u>	
<u>Link transmission procedure</u>	<u>Address field of the link</u>
<input type="checkbox"/> Balanced transmission	<input type="checkbox"/> not present (balanced transmission only)
<input type="checkbox"/> Unbalanced transmission	<input type="checkbox"/> One octet
<u>Frame length</u>	<input type="checkbox"/> Two octets
<input type="checkbox"/> Maximum length L (number of octets)	<input type="checkbox"/> Structured
	<input type="checkbox"/> Unstructured

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

- The standard assignment of ASDUs to class 2 messages is used as follows:

Type identification	Cause of transmission
9,11,13,21	<1>

- A special assignment of ASDUs to class 2 messages is used as follows:

Type identification	Cause of transmission

1.1 Interoperability

Note: (In response to a class 2 poll, a controlled station may respond with class 1 data when there is no class 2 data available).

1.1.5 Application Layer

Transmission Mode for Application

Mode 1 (Least significant octet first), as defined in clause 4.10 of IEC 60870-5-4, is used exclusively in this companion standard.

Common address of ASDU

(system-specific parameter, all configurations that are used are to be marked 'X')

- One octet
- Two octets

Information object address

(system-specific parameter, all configurations that are used are to be marked 'X')

- One octet
- Structured
- Two octets
- Unstructured
- Three octets

Cause of Transmission

(system-specific parameter, all configurations that are used are to be marked 'X')

- One octet
- Two octets (with originator address) Originator address is set to zero if not used

Length of APDU

(system-specific parameter, specify the maximum length of the APDU per system)

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

- Maximum length of APDU per system in control direction
- Maximum length of APDU per system in monitor direction

Selection of standard ASDUs

Process Information in Monitor Direction

(station-specific parameter, mark each Type ID 'X' if it is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions)

<input checked="" type="checkbox"/>	<1>:=	Single-point information	M_SP_NA_1
<input checked="" type="checkbox"/>	<2>:=	Single-point information with time tag	M_SP_TA_1
<input checked="" type="checkbox"/>	<3>:=	Double-point information	M_DP_NA_1
<input checked="" type="checkbox"/>	<4>:=	Double-point information with time tag	M_DP_TA_1
<input checked="" type="checkbox"/>	<5>:=	Step position information	M_ST_NA_1
<input checked="" type="checkbox"/>	<6>:=	Step position information with time tag	M_ST_TA_1
<input checked="" type="checkbox"/>	<7>:=	Bitstring of 32 bit	M_BO_NA_1
<input checked="" type="checkbox"/>	<8>:=	Bitstring of 32-bit with time tag	M_BO_TA_1
<input type="checkbox"/>	<9>:=	Measured value, normalized value	M_ME_NA_1
<input checked="" type="checkbox"/>	<10>:=	Measured value, normalized value with time tag	M_ME_TA_1
<input type="checkbox"/>	<11>:=	Measured value, scaled value	M_ME_NB_1
<input checked="" type="checkbox"/>	<12>:=	Measured value, scaled value with time tag	M_ME_TB_1
<input checked="" type="checkbox"/>	<13>:=	Measured value, short floating point value	M_ME_NC_1
<input checked="" type="checkbox"/>	<14>:=	Measured value, short floating point value with time tag	M_ME_TC_1
<input checked="" type="checkbox"/>	<15>:=	Integrated totals	M_IT_NA_1
<input checked="" type="checkbox"/>	<16>:=	Integrated totals with time tag	M_IT_TA_1
<input checked="" type="checkbox"/>	<17>:=	Event of protection equipment with time tag	M_EP_TA_1
<input checked="" type="checkbox"/>	<18>:=	Packed start events of protection equipment with time tag	M_EP_TB_1
<input checked="" type="checkbox"/>	<19>:=	Packed output circuit information of protection equipment with time tag	M_EP_TC_1
<input type="checkbox"/>	<20>:=	Packed single-point information with status change detection	M_SP_NA_1
<input type="checkbox"/>	<21>:=	Measured value, normalized value without quality descriptor	M_ME_ND_1
<input checked="" type="checkbox"/>	<30>:=	Single-point information with time tag CP56Time2a	M_SP_TB_1
<input checked="" type="checkbox"/>	<31>:=	Double-point information with time tag CP56Time2a	M_DP_TB_1
<input checked="" type="checkbox"/>	<32>:=	Step position information with time tag CP56Time2a	M_ST_TB_1
<input type="checkbox"/>	<33>:=	Bitstring of 32 bit with time tag CP56Time2a	M_BO_TB_1
<input type="checkbox"/>	<34>:=	Measured value, normalized value with time tag CP56Time2a	M_ME_TD_1
<input type="checkbox"/>	<35>:=	Measured value, scaled value with time tag CP56Time2a	M_ME_TE_1
<input checked="" type="checkbox"/>	<36>:=	Measured value, short floating point value with time tag CP56Time2a	M_ME_TF_1
<input checked="" type="checkbox"/>	<37>:=	Integrated totals with time tag CP56Time2a	M_IT_TB_1
<input checked="" type="checkbox"/>	<38>:=	Event of protection equipment with time tag CP56Time2a	M_EP_TD_1
<input type="checkbox"/>	<39>:=	Packed start events of protection equipment with time tag CP56Time2a	M_EP_TE_1
<input type="checkbox"/>	<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.

Process Information in Control Direction

(station-specific parameter, mark each Type ID 'X' if it is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions)

<input checked="" type="checkbox"/>	<45>:= Single command	C_SC_NA_1
<input checked="" type="checkbox"/>	<46>:= Double command	C_DC_NA_1
<input checked="" type="checkbox"/>	<47>:= Regulating step command	C_RC_NA_1
<input type="checkbox"/>	<48>:= Set point command, normalized value	C_SE_NA_1
<input type="checkbox"/>	<49>:= Set point command, scaled value	C_SE_NB_1
<input type="checkbox"/>	<50>:= Set point command, short floating point value	C_SE_NC_1
<input type="checkbox"/>	<51>:= Bitstring of 32 bit	C_BO_NA_1
<input type="checkbox"/>	<58>:= Single command with time tag CP56Time 2a	C_SC_TA_1
<input type="checkbox"/>	<59>:= Double command with time tag CP56Time 2a	C_DC_TA_1
<input type="checkbox"/>	<60>:= Regulating step command with time tag CP56Time 2a	C_RC_TA_1
<input type="checkbox"/>	<61>:= Set point command, normalized value with time tag CP56Time 2a	C_SE_TA_1
<input type="checkbox"/>	<62>:= Set point command, scaled value with time tag CP56Time 2a	C_SE_TB_1
<input type="checkbox"/>	<63>:= Set point command, short floating point value with time tag CP56Time 2a	C_SE_TC_1
<input type="checkbox"/>	<64>:= Bitstring of 32 bit with time tag CP56Time 2a	C_BO_TA_1

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

System Information in Monitor Direction

(station-specific parameter, mark 'X' if used)

<input checked="" type="checkbox"/>	<70>:= End of initialization	M_EI_NA_1
-------------------------------------	------------------------------	-----------

System Information in Control Direction

(station-specific parameter, mark each Type ID 'X' if it is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions)

<input checked="" type="checkbox"/>	<100>:= Interrogation command	C_IC_NA_1
<input checked="" type="checkbox"/>	<101>:= Counter interrogation command	C_CI_NA_1
<input checked="" type="checkbox"/>	<102>:= Read command	C_RD_NA_1
<input checked="" type="checkbox"/>	<103>:= Clock synchronization command (option see 7.6)	C_CS_NA_1
<input checked="" type="checkbox"/>	<104>:= Test command	C_TS_NA_1
<input checked="" type="checkbox"/>	<105>:= Reset process command	C_SE_NC_1
<input checked="" type="checkbox"/>	<106>:= Delay acquisition command	C_BO_NA_1
<input type="checkbox"/>	<107>:= Test command with time tag CP56time2a	C_SC_TA_1

Parameter in Control Direction

(station-specific parameter, mark each Type ID 'X' if it is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions)

<input type="checkbox"/>	<110>:= Parameter of measured value, normalized value	P_ME_NA_1
<input type="checkbox"/>	<111>:= Parameter of measured value, scaled value	P_ME_NB_1
<input type="checkbox"/>	<112>:= Parameter of measured value, short floating point value	P_ME_NC_1
<input type="checkbox"/>	<113>:= Parameter activation	P_AC_NA_1

File Transfer

(station-specific parameter, mark each Type ID 'X' if it is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions)

- <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 X, only available in monitor (standard) direction} F_DR_TA_1

Type Identifier and Cause of Transmission Assignments

(station-specific parameters)

Shaded boxes are not required.

Blank: functions or ASDU not used.

Mark Type Identification/Cause of transmission combinations:

'X' if only used in the standard direction

'R' if only used in the reverse direction

'B' if used in both directions

Type identification		Cause of transmission																		
		periodic, cyclic	background scan	spontaneous	initialized	request or requested	activation	activation confirmation	deactivation	deactivation confirmation	activation termination	return info caused by a remote cmd	return info caused by a local cmd	file transfer	interrogated by group <number>	request by group <n> counter request	unknown type identification	unknown cause of transmission	unknown common address of ASDU	unknown information object address
		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					
<2>	M_SP_TA_1																			
<3>	M_DP_NA_1														X					
<4>	M_DP_TA_1																			
<5>	M_ST_NA_1														X					

1.1 Interoperability

Type identification		Cause of transmission																		
		periodic, cyclic	background scan	spontaneous	initialized	request or requested	activation	activation confirmation	deactivation	deactivation confirmation	activation termination	return info caused by a remote cmd	return info caused by a local cmd	file transfer	interrogated by group <number>	request by group <n> counter request	unknown type identification	unknown cause of transmission	unknown common address of ASDU	unknown information object address
		1	2	3	4	5	6	7	8	9	10	11	12	13	20 to 36	37 to 41	44	45	46	47
<6>	M_ST_TA_1																			
<7>	M_BO_NA_1														X					
<8>	M_BO_TA_1																			
<9>	M_ME_NA_1																			
<10>	M_ME_TA_1																			
<11>	M_ME_NB_1																			
<12>	M_ME_TB_1																			
<13>	M_ME_NC_1	X		X		X									X					
<14>	M_ME_TC_1																			
<15>	M_IT_NA_1															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																			
<21>	M_ME_ND_1																			
<30>	M_SP_TB_1					X						X	X							
<31>	M_DP_TB_1					X						X	X							
<32>	M_ST_TB_1					X						X	X							

Type identification		Cause of transmission																			
		periodic, cyclic	background scan	spontaneous	initialized	request or requested	activation	activation confirmation	deactivation	deactivation confirmation	activation termination	return info caused by a remote cmd	return info caused by a local cmd	file transfer	interrogated by group <number>	request by group <n> counter request	unknown type identification	unknown cause of transmission	unknown common address of ASDU	unknown information object address	
		1	2	3	4	5	6	7	8	9	10	11	12	13	20 to 36	37 to 41	44	45	46	47	
<33>	M_BO_TB_1																				
<34>	M_ME_TD_1																				
<35>	M_ME_TE_1																				
<36>	M_ME_TF_1			X																	
<37>	M_IT_TB_1			X																	
<38>	M_EP_TD_1			X																	
<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																				
<49>	C_SE_NB_1																				
<50>	C_SE_NC_1																				
<51>	C_BO_NA_1																				
<58>	C_SC_TA_1																				
<59>	C_DC_TA_1																				
<60>	C_RC_TA_1																				
<61>	C_SE_TA_1																				

1.1 Interoperability

Type identification		Cause of transmission																			
		periodic, cyclic	background scan	spontaneous	initialized	request or requested	activation	activation confirmation	deactivation	deactivation confirmation	activation termination	return info caused by a remote cmd	return info caused by a local cmd	file transfer	interrogated by group <number>	request by group <n> counter request	unknown type identification	unknown cause of transmission	unknown common address of ASDU	unknown information object address	
		1	2	3	4	5	6	7	8	9	10	11	12	13	20 to 36	37 to 41	44	45	46	47	
<62>	C_SE_TB_1																				
<63>	C_SE_TC_1																				
<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																				
<110>	P_ME_NA_1																				
<111>	P_ME_NB_1																				
<112>	P_ME_NC_1																				
<113>	P_AC_NA_1																				
<120>	F_FR_NA_1																				
<121>	F_SR_NA_1																				
<122>	F_SC_NA_1					X									X			X	X	X	X

Type identification		Cause of transmission																		
		periodic, cyclic	background scan	spontaneous	initialized	request or requested	activation	activation confirmation	deactivation	deactivation confirmation	activation termination	return info caused by a remote cmd	return info caused by a local cmd	file transfer	interrogated by group <number>	request by group <n> counter request	unknown type identification	unknown cause of transmission	unknown common address of ASDU	unknown information object address
		1	2	3	4	5	6	7	8	9	10	11	12	13	20 to 36	37 to 41	44	45	46	47
<123>	F_LS_NA_1													X						
<124>	F_AF_NA_1													X			X	X	X	X
<125>	F_SG_NA_1													X			X	X	X	X
<126>	F_DR_TA_1*					X														
* Blank or X only																				

1.1.6 Basic Application Functions

Station Initialization

(station-specific parameter, mark 'X' if function is used)

Remote Initialization

Cyclic Data Transmission

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions)

Cyclic data transmission

Read Procedure

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions)

Read procedure

Spontaneous Transmission

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions)

- Spontaneous transmission

Double Transmission of Information Objects with Cause of Transmission Spontaneous

(station-specific parameter, mark each information type 'X' where both a Type ID without time and corresponding Type ID with time are issued in response to a single spontaneous change of a monitored object)

The following type identifications may be transmitted in succession caused by a single status change of an information object. The particular 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 bit M_BO_NA_1, M_BO_TA_1 and M_BO_TB_1 (if defined for a specific project)
- 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

Station Interrogation

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions)

- | | | |
|--------------------------------------------|-----------------------------------|-----------------------------------|
| <input checked="" type="checkbox"/> global | <input type="checkbox"/> group 7 | <input type="checkbox"/> group 13 |
| <input type="checkbox"/> group 1 | <input type="checkbox"/> group 8 | <input type="checkbox"/> group 14 |
| <input type="checkbox"/> group 2 | <input type="checkbox"/> group 9 | <input type="checkbox"/> group 15 |
| <input type="checkbox"/> group 3 | <input type="checkbox"/> group 10 | <input type="checkbox"/> group 16 |
| <input type="checkbox"/> group 4 | <input type="checkbox"/> group 11 | |
| <input type="checkbox"/> group 5 | <input type="checkbox"/> group 12 | |
| <input type="checkbox"/> group 6 | | |
- Information Object Addresses assigned to each group must be shown in a separate table

Clock Synchronization

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions)

- Clock synchronization
- Day of week used
- Day of week used
- SU-bit (summertime) used

Command Transmission

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions)

- Direct command transmission
- Direct command transmission
- Select 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 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 of commands and set point commands

Transmission of Integrated Totals

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions)

- Mode A: Local freeze with spontaneous transmission
- Mode B: Local freeze with counter interrogation
- Mode C: Freeze and transmit by counter-interrogation commands
- 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

Parameter Loading

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions)

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

Parameter Activation

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions)

1.1 Interoperability

Act/deact of persistent cyclic or periodic transmission of the addressed object

Test Procedure

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions)

Test procedure

File Transfer

(station-specific parameter, mark 'X' if function is used)

File transfer in monitor direction

- Transparent file
- Transmission of disturbance data of protection equipment
- Transmission of sequences of events
- Transmission of sequences of recorded analog

File transfer in control direction

Transparent file

Background Scan

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions)

Test procedure

Acquisition of Transmission Delay

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions)

Acquisition of transmission delay

Definition of Time Outs

Parameter	Default value	Remarks	Selected Value
t0	30s	Time-out of connection establishment	Fixed
t1	15s	Time-out of send or test APDUs	Configurable
t2	10s	Time-out for acknowledges in case of no data messages $t2 < t1$	Configurable
t3	20s	Time-out for 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

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

Parameter	Default value	Remarks	Selected Value
k	12 APDUs	Maximum difference receive sequence number	Fixed
w	8 APDUs	Latest acknowledge after receiving w I-format	Fixed

Maximum range of values k: 1 to 32767 (215-1) 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).

Portnumber

Parameter	Value	Remarks
Portnumber	2404	Configurable

Maximum range of values k: 1 to 32767 (215-1) 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).

Redundant Connections

1	Number N of redundancy group connections used
---	-----------------------------------------------

1.1 Interoperability

RFC 2200 Suite

RFC 2200 is an official Internet Standard which describes the state of standardization of protocols used in the Internet as determined by the 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 has to 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.
 7. etc.

2 Point Lists

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2.1 Indications

Information Object Address (IOA)	Name	Description
Double-point Indication		
Control Switches Return Position Indication		
1001	52 Breaker	input state of Breaker
1002	Disc.Swit.	input state of Disconnect Switch
1003	GndSwit.	input state of Ground Switch
1004	user MDP1	input state of user defined double command 1
1005	user MDP2	input state of user defined double command 1
Single-point Indication		
Single Control Feedback		
1006	P-GrpA act	Setting Group A; 0 = Group A is deactivated, 1 = Group A is activated and Groups B, C, D are deactivated.
1007	P-GrpB act	Setting Group B; 0 = Group B is deactivated, 1 = Group B is activated and Groups A, C, D are deactivated.
1008	P-GrpC act	Setting Group C; 0 = Group C is deactivated, 1 = Group C is activated and Groups A, B, D are deactivated.
1009	P-GrpD act	Setting Group D; 0 = Group D is deactivated, 1 = Group D is activated and Groups A, B, C are deactivated.
1010	ModeREMOTE	Control mode REMOTE; UNLOCKED = 1, LOCKED = 0
1011	user MSP1	Feedback of user defined single command 1
1012	user MSP2	Feedback of user defined single command 2
1013	user MSP3	Feedback of user defined single command 3
1014	user MSP4	Feedback of user defined single command 4
Overcurrent Time Protection		
1020	50/51 PH ACT	50/51 O/C is ACTIVE; ON = 1, OFF = 0
1021	50N/51N ACT	50N/51N is ACTIVE; ON = 1, OFF = 0
1022	50(N)/51(N) PU	50(N)/51(N) O/C PICKUP; ON = 1, OFF = 0
1023	50/51 Ph A PU	50/51 Phase A picked up; ON = 1, OFF = 0
1024	50/51 Ph B PU	50/51 Phase B picked up; ON = 1, OFF = 0
1025	50/51 Ph C PU	50/51 Phase C picked up; ON = 1, OFF = 0
1026	50N/51NPickedup	50N/51N picked up; ON = 1, OFF = 0

Information Object Address (IOA)	Name	Description
1027	50 (N)/51(N)TRIP	50(N)/51(N) TRIP; ON = 1, OFF = 0
Directional Overcurrent Time Protection		
1028	67 ACTIVE	67/67-TOC is ACTIVE; ON = 1, OFF = 0
1029	67N ACTIVE	67N/67N-TOC is ACTIVE; ON = 1, OFF = 0
1030	67/67N pickedup	67/67N picked up; ON = 1, OFF = 0
1031	67 A picked up	67/67-TOC Phase A picked up; ON = 1, OFF = 0
1032	67 B picked up	67/67-TOC Phase B picked up; ON = 1, OFF = 0
1033	67 C picked up	67/67-TOC Phase C picked up; ON = 1, OFF = 0
1034	67N picked up	67N/67N-TOC picked up; ON = 1, OFF = 0
1035	67/67N TRIP	67/67N TRIP; ON = 1, OFF = 0
Frequency Protection		
1037	81 ACTIVE	81 ACTIVE; ON = 1, OFF = 0
1038	81-1 picked up	81-1 picked up; ON = 1, OFF = 0
1039	81-2 picked up	81-2 picked up; ON = 1, OFF = 0
1040	81-3 picked up	81-3 picked up; ON = 1, OFF = 0
1041	81-4 picked up	81-4 picked up; ON = 1, OFF = 0
1042	81-1 TRIP	81-1 TRIP; ON = 1, OFF = 0
1043	81-2 TRIP	81-2 TRIP; ON = 1, OFF = 0
1044	81-3 TRIP	81-3 TRIP; ON = 1, OFF = 0
1045	81-4 TRIP	81-4 TRIP; ON = 1, OFF = 0
Voltage Protection		
1046	27 ACTIVE	27 under voltage protection is ACTIVE; ON = 1, OFF = 0
1047	27-1 picked up	27-1 under voltage picked up; ON = 1, OFF = 0
1048	27-1 TRIP	27-1 under voltage TRIP; ON = 1, OFF = 0
1049	27-2 picked up	27-2 under voltage picked up; ON = 1, OFF = 0
1050	27-2 TRIP	27-2 under voltage TRIP; ON = 1, OFF = 0
1051	27 Vx ACTIVE	27 under voltage Vx is ACTIVE; ON = 1, OFF = 0
1052	27-1 Vx PU	27-1 under voltage Vx PICKUP; ON = 1, OFF = 0
1053	27-1 Vx TRIP	27-1 under voltage Vx TRIP; ON = 1, OFF = 0
1054	27-2 Vx PU	27-2 under voltage Vx PICKUP; ON = 1, OFF = 0
1055	27-2 Vx TRIP	27-2 under voltage Vx TRIP; ON = 1, OFF = 0

Information Object Address (IOA)	Name	Description
1056	59 ACTIVE	59 over voltage protection is ACTIVE; ON = 1, OFF = 0
1057	59-1 picked up	59-1 overvoltage V> picked up; ON = 1, OFF = 0
1058	59-1 TRIP	59-1 overvoltage V> TRIP; ON = 1, OFF = 0
1059	59-2 picked up	59-2 overvoltage V>> picked up; ON = 1, OFF = 0
1060	59-2 TRIP	59-2 overvoltage V>> TRIP; ON = 1, OFF = 0
1061	59 Vx ACTIVE	59 over voltage Vx is ACTIVE; ON = 1, OFF = 0
1062	59-1 Vx PU	59-1 over voltage Vx PICKUP; ON = 1, OFF = 0
1063	59-1 Vx TRIP	59-1 over voltage Vx TRIP; ON = 1, OFF = 0
1064	59-2 Vx PU	59-2 over voltage Vx PICKUP; ON = 1, OFF = 0
1065	59-2 Vx TRIP	59-2 over voltage Vx TRIP; ON = 1, OFF = 0
1066	59-1 PhA pickup	59-1 Phase A picked up; ON = 1, OFF = 0
1067	59-1 PhB pickup	59-1 Phase B picked up; ON = 1, OFF = 0
1068	59-1 PhC pickup	59-1 Phase C picked up; ON = 1, OFF = 0
1069	59-1 PhA TRIP	59-1 Phase A TRIP; ON = 1, OFF = 0
1070	59-1 PhB TRIP	59-1 Phase B TRIP; ON = 1, OFF = 0
1071	59-1 PhC TRIP	59-1 Phase C TRIP; ON = 1, OFF = 0
1072	59-2 PhA pickup	59-2 Phase A picked up; ON = 1, OFF = 0
1073	59-2 PhB pickup	59-2 Phase B picked up; ON = 1, OFF = 0
1074	59-2 PhC pickup	59-2 Phase C picked up; ON = 1, OFF = 0
1075	59-2 PhA TRIP	59-2 Phase A TRIP; ON = 1, OFF = 0
1076	59-2 PhB TRIP	59-2 Phase B TRIP; ON = 1, OFF = 0
1077	59-2 PhC TRIP	59-2 Phase C TRIP; ON = 1, OFF = 0
Breaker failure protection		
1078	50BF ACTIVE	50BF is ACTIVE; ON = 1, OFF = 0
1079	50BF int Pickup	50BF (internal) PICKUP; ON = 1, OFF = 0
1080	50BF ext Pickup	50BF (external) PICKUP; ON = 1, OFF = 0
1081	50BF TRIP	50BF TRIP; ON = 1, OFF = 0
1082	50BF int TRIP	50BF (internal) TRIP; ON = 1, OFF = 0
1083	50BF ext TRIP	50BF (external) TRIP; ON = 1, OFF = 0
Negative sequence protection		
1084	46 ACTIVE	46 is ACTIVE; ON = 1, OFF = 0

Information Object Address (IOA)	Name	Description
1085	46-1 picked up	46-1 picked up; ON = 1, OFF = 0
1086	46-2 picked up	46-2 picked up; ON = 1, OFF = 0
1087	46 TRIP	46-2 TRIP; ON = 1, OFF = 0
Internal Mode Status		
1088	Cntrl Auth	Control Authority; LOCAL = 1, REMOTE = 0
1089	ModeLOCAL	Control mode LOCAL; UNLOCKED = 1, LOCKED = 0
1090	Device OK	Device is Operational and Protecting; ON = 1, OFF = 0
1091	Settings Calc.	Setting calculation is running; ON = 1, OFF = 0
1092	ProtActive	At least one protection function is active; ON = 1, OFF = 0
1093	Error Sum Alarm	Error with a summary alarm; ON = 1, OFF = 0
1094	Alarm Sum Event	Alarm Summary Event; ON = 1, OFF = 0
1095	Relay Pickup	Relay Pickup; ON = 1, OFF = 0
1096	Relay TRIP	General TRIP of the relay; ON = 1, OFF = 0
1097	Test mode	Test mode; ON = 1, OFF = 0
1098	Fail Battery	Failure: (internal) Battery empty; ON = 1, OFF = 0
1099	GPS ModuleError	GPS Module Error; ON = 1, OFF = 0
1100	BATTERY BAD	(external) Battery bad or defect; ON = 1, OFF = 0
1101	EXT.V.INVALID	Invalid external voltage; ON = 1, OFF = 0
1102	EXT.VOLT.VALID	Valid external voltage; ON = 1, OFF = 0
HMI		
1103	Local ON	Local Mode is active
1104	Auto ON	Auto Mode is active
1105	Restore ON	Restoration Mode is active
1106	Simulation ON	Simulation Mode is active
1107	HotLineTag ON	Hot Line Tag is active
1108	MotorInhibit ON	Motor Inhibit is active
1109	Lockout ON	Lockout is active
User Defined		
1110	user MSP1	User defined single indication 1
1111	user MSP2	User defined single indication 2
1112	user MSP3	User defined single indication 3

Information Object Address (IOA)	Name	Description
1113	user MSP4	User defined single indication 4
1114	user MSP5	User defined single indication 5
1115	user MSP6	User defined single indication 6
1116	user MSP7	User defined single indication 7
1117	user MSP8	User defined single indication 8
1118	user MSP9	User defined single indication 9
1119	user MSP10	User defined single indication 10
Step Position Indication		
Step Position Feedback		
1015	user MST1	Feedback of user defined step position 1
1016	user MST2	Feedback of user defined step position 2
1017	user MST3	Feedback of user defined step position 3
1018	user MST4	Feedback of user defined step position 4
1019	user MST4	Feedback of user defined step position 5

2.2 Control

Information Object Address(IOA)	Name	Description	Supported Control (QOC)
Double Point Commands			
2001	52Breaker	Trip / Close command for Circuit Breaker	Short Pulse, Long Pulse
2002	Disc.Swit.	Trip / Close command for Disconnect Switch	Short Pulse, Long Pulse
2003	GndSwit.	Trip / Close command for Ground Switch	Short Pulse, Long Pulse
2004	user CDC1	Trip / Close command for user defined double command 1	Short Pulse, Long Pulse
2005	user CDC2	Trip / Close command for user defined double command 2	Short Pulse, Long Pulse
Single Point Commands			
2006	P-GrpA act	Select Setting Group A and deactivate Groups B, C, D	Persistent Output
2007	P-GrpB act	Select Setting Group B and deactivate Groups A, C, D	Persistent Output
2008	P-GrpC act	Select Setting Group C and deactivate Groups A, B, D	Persistent Output
2009	P-GrpD act	Select Setting Group D and deactivate Groups A, B, C	Persistent Output
2010	ModeREMOTE	Mode REMOTE control; Latch On = UNLOCKED Latch Off = LOCKED	Persistent Output
2011	user CSC1	User defined single command 1	Short Pulse, Long Pulse, Persistent Output
2012	user CSC2	User defined single command 2	Short Pulse, Long Pulse, Persistent Output
2013	user CSC3	User defined single command 3	Short Pulse, Long Pulse, Persistent Output

Information Object Address(IOA)	Name	Description	Supported Control (QOC)
2014	user CSC4	User defined single command 4	Short Pulse, Long Pulse, Persistent Output
2036	Count Res	Counter Reset Command	Short Pulse, Long Pulse, Persistent Output
Step Position Commands			
2015	user CRC1	User defined step position command 1	Short Pulse, Long Pulse, Persistent Output
2016	user CRC2	User defined step position command 2	Short Pulse, Long Pulse, Persistent Output
2017	user CRC3	User defined step position command 3	Short Pulse, Long Pulse, Persistent Output
2018	user CRC4	User defined step position command 4	Short Pulse, Long Pulse, Persistent Output
2019	user CRC5	User defined step position command 5	Short Pulse, Long Pulse, Persistent Output

2.3 Analog Inputs

2.3.1 Measurements

Information Object Address (IOA)	Name	Description	Scaling (32767 corresponds to ...)
Recorded Measured Values			
1	Ia =	Current phase a	3276.7 A
2	Ib =	Current phase b	3276.7 A
3	Ic =	Current phase c	3276.7 A
4	In =	Current In	3276.7 A
5	Va =	Voltage phase a	32.767 kV
6	Vb =	Voltage phase b	32.767 kV
7	Vc =	Voltage phase c	32.767 kV
8	Va-b =	Voltage phase a to phase b	32.767 kV
9	Vb-c =	Voltage phase b to phase c	32.767 kV
10	Vc-a =	Voltage phase c to phase a	32.767 kV
11	VN =	Voltage ground	32.767 kV
12	P =	Active power	32767 kW
13	Q =	Reactive power	32767 kVar
14	S =	Apparent power	32767 kVar
15	Freq =	Frequency	327.67 Hz
16	PF =	Power factor	3.2767
17	Vx =	4th voltage input Vx	32.767 kV
18	Vbat =	Battery voltage	3276.7 V
19	SysTemp =	System temperature	3276.7 °,C / F
Min/Max Values			
20	Ia Min=	Current phase a minimum	3276.7 A
21	Ia Max=	Current phase a maximum	3276.7 A
22	Ib Min=	Current phase b minimum	3276.7 A
23	Ib Max=	Current phase b maximum	3276.7 A
24	Ic Min=	Current phase c minimum	3276.7 A
25	Ic Max=	Current phase c maximum	3276.7 A

Information Object Address (IOA)	Name	Description	Scaling (32767 corresponds to ...)
26	Va-nMin=	Voltage phase a minimum	32.767 kV
27	Va-nMax=	Voltage phase a maximum	32.767 kV
28	Vb-nMin=	Voltage phase b minimum	32.767 kV
29	Vb-nMax=	Voltage phase b maximum	32.767 kV
30	Vc-nMin=	Voltage phase c minimum	32.767 kV
31	Vc-nMax=	Voltage phase c maximum	32.767 kV
32	Vn Min=	Voltage neutral minimum	32.767 kV
33	Vn Max=	Voltage neutral maximum	32.767 kV
34	Pmin=	Active power minimum	32767 kW
35	Pmax=	Active power maximum	32767 kW
36	Qmin=	Reactive power minimum	32767 kVar
37	Qmax=	Reactive power maximum	32767 kVar
38	Smin=	Apparent power minimum	32767 kVar
39	Smax=	Apparent power maximum	32767 kVar
40	fmin=	frequency Minimum	327.67 Hz
41	fmax=	frequency Maximum	327.67 Hz
42	PF min=	Power factor minimum	3.2767
43	PF max=	Power factor maximum	3.2767
Statistic Values			
44	Ia =	Primary fault current Ia	32767 A
45	Ib =	Primary fault current Ib	32767 A
46	Ic =	Primary fault current Ic	32767 A
47	Sum Ia =	Accumulation of interrupted current Ph A	327.67 kA
48	Sum Ib =	Accumulation of interrupted current Ph B	327.67 kA
49	Sum Ic =	Accumulation of interrupted current Ph C	327.67 kA
50	Op. Hours=	Counter of operating hours	32767 h
51	Q0 OpCnt=	Circuit Breaker operation counter	32767
52	Q1 OpCnt=	Disconnect Switch operation counter	32767
53	Q8 OpCnt=	Ground Switch operation counter	32767
54	dist =	Fault locator: distance to fault	3276.7 km/
User defined			

Information Object Address (IOA)	Name	Description	Scaling (32767 corresponds to ...)
55	user MME1	user defined measurement 1	32767
56	user MME2	user defined measurement 2	32767
57	user MME3	user defined measurement 3	32767
58	user MME4	user defined measurement 4	32767
59	user MME5	user defined measurement 5	32767

2.3.2 Counters

Information Object Address (IOA)	Name	Description	Scaling (232-1 of the unsigned long-value corresponds to...)
200	Wp+=	Wp Forward (metered measurand derived from measured value)	232-1 impulses
201	Wq+=	Wq Forward (metered measurand derived from measured value)	232-1 impulses
202	Wp-=	Wp Reverse (metered measurand derived from measured value)	232-1 impulses
203	Wq-=	Wq Reverse (metered measurand derived from measured value)	232-1 impulses
204	Wp(puls) =	Pulsed Energy Wp (active) (metering im-pulses at binary input)	232-1 impulses
205	Wq(puls) =	Pulsed Energy Wq (reactive) (metering im-pulses at binary input)	232-1 impulses
206	#of TRIPs	Number of TRIPs	232-1 TRIPs
207	user MIT1	User defined Counter 1	232-1 impulses
208	user MIT2	User defined Counter 2	232-1 impulses
209	user MIT3	User defined Counter 3	232-1 impulses
210	user MIT4	User defined Counter 4	232-1 impulses
211	user MIT5	User defined Counter 5	232-1 impulses

2.3.3 Bitstring

Information Object Address (IOA)	Bitstring	Description
3001	Serial number 1: Serial number	Serial number
3002	Serial number 2: Production date	Year and month Example: 0912 decimal = December 2009

Information Object Address (IOA)	Bitstring	Description
*The serial number corresponds to the Series-/ BF number printed on the type label of the device.		
Example	on device:	BF0912088097
	via IEC 60870-5-104:	Serial number1 = 88097dec = 15821hex Serial number2 = 0912dec = 390hex The "BF" at the beginning is dropped at assignment via IEC60870-5-104.

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