



Interoperability List IEC 60870-5-104

REG-PE(D)



History of document

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Document changes/updates

(The overview contains only the changes concerning the released/distributed document)

Changed chapters /pages	Responsibility	Version	Reason of change / change request
All chapters	Borchers	1.0	Review
All chapters	Borchers	1.1	Baud rate corrected, increased set-point types, measurand type 11 and 12, new com- pany profile
All chapters	Borchers	1.2	Requests (type 102) corrected
Link Layer	Borchers	1.3	COTs corrected
All chapters	Borchers	1.4	Review, extension to topical functionality

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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:

	Χ	
Γ	R	

В

Х

Х

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. System or device

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

System definition

Controlling station definition (Master)

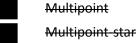
Controlled station definition (Slave)

2. Network configuration

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

Point-to-point

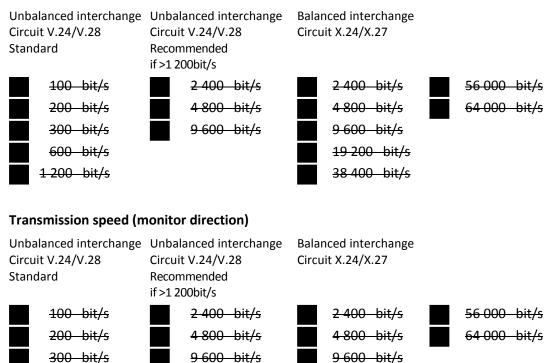
Multiple point to point



3. Physical layer

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

Transmission speed (control direction)



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.)

Frame format FT 1.2, single character 1 and the fixed time out interval are used exclusively in this companion standard.



600 bit/s 1 200 bit/s



Balanced transmission

Unbalanced transmission

Address field of the link

19 200 bit/s

38 400 bit/s



not present (balanced transmission only) One octet



	Two octets
Frame length	Structured
Maximum length L	Unstructured
(number of octets)	

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
1-6, 9-13, 30-36	<3, 11, 20>

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

Type identification	Cause of transmission

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).

5. Application layer

Transmission mode for application data

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

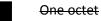
Information object address

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

	One octet		Structured
	Two octets	X	Unstructured
x	Three octets		

Cause of transmission

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



Two octets (with originator address) Originator address is set to zero.

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.

X

Configurable Maximum length of APDU per system

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, ' \mathbf{R} ' if only used in the reverse direction, and ' \mathbf{B} ' if used in both directions)

X	<1> :=	Single-point information	M_SP_NA_1
Χ	<2> :=	Single-point information with time tag	M_SP_TA_1
Χ	<3> :=	Double-point information	M_DP_NA_1
Χ	<4> :=	Double-point information with time tag	M_DP_TA_1
Χ	<5> :=	Step position information	M_ST_NA_1
X	<6> :=	Step position information with time tag	M_ST_TA_1
Χ	<7> :=	Bitstring of 32 bit	M_BO_NA_1
	<8> :=	Bitstring of 32 bit with time tag	M_BO_TA_1
Χ	<9> :=	Measured value, normalized value	M_ME_NA_1
X	<10>:=	Measured value, normalized value with time tag	M_ME_TA_1
X	<11>:=	Measured value, scaled value	M_ME_NB_1
X	<12>:=	Measured value, scaled value with time tag	M_ME_TB_1
X	<13>:=	Measured value, short floating point value	M_ME_NC_1
X	<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_SP_NA_1
	<21>:=	Measured value, normalized value without quality descriptor	M_ME_ND_1
X	<30>:=	Single-point information with time tag CP56Time2a	M_SP_TB_1
X	<31>:=	Double-point information with time tag CP56Time2a	M_DP_TB_1
X	<32>:=	Step position information with time tag CP56Time2a	M_ST_TB_1
X	<33>:=	Bitstring of 32 bit with time tag CP56Time2a	M_BO_TB_1
X	<34>:=	Measured value, normalized value with time tag CP56Time2a	M_ME_TD_1
X	<35>:=	Measured value, scaled value with time tag CP56Time2a	M_ME_TE_1
X	<36>:=	Measured value, short floating point value with time tag CP56Time2a	M_ME_TF_1
	<37>:=	Integrated totals with time tag CP56Time2a	M_IT_TB_1
\square	<38>:=	Event of protection equipment with time tag CP56Time2a	M_EP_TD_1
\square	<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> or of the set <30> - <36> are used.

Process information in control direction

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

Χ	<9> :=	Measured value, normalized value	M_ME_NA_1
X	<13>:=	Measured value, short floating point value	M_ME_NC_1
Χ	<30>:=	Single-point information with time tag CP56Time2a	M_SP_TB_1
Χ	<31>:=	Double-point information with time tag CP56Time2a	M_DP_TB_1
Χ	<34>:=	Measured value, normalized value with time tag CP56Time2a	M_ME_TD_1
Χ	<36>:=	Measured value, short floating point value with time tag CP56Time2a	M_ME_TF_1
Χ	<45>:=	Single command	C_SC_NA_1
Χ	<46>:=	Double command	C_DC_NA_1
Χ	<47>:=	Regulating step command	C_RC_NA_1
Χ	<48>:=	Set point command, normalized value	C_SE_NA_1
Χ	<49>:=	Set point command, scaled value	C_SE_NB_1
Χ	<50>:=	Set point command, short floating point value	C_SE_NC_1
	<51>:=	Bitstring of 32 bit	C_BO_NA_1

X	<58>:=	Single command with time tag CP56Time 2a	C_SC_TA_1
X	<59>:=	Double command with time tag CP56Time 2a	C_DC_TA_1
X	<60>:=	Regulating step command with time tag CP56Time 2a	C_RC_TA_1
X	<61>:=	Set point command, normalized value with time tag CP56Time 2a	C_SE_TA_1
Χ	<62>:=	Set point command, scaled value with time tag CP56Time 2a	C_SE_TB_1
Χ	<63>:=	Set point command, short floating point value with time tag CP56Time $\ensuremath{2a}$	C_SE_TC_1
	<64>:=	Bitstring of 32 bit with time tag CP56Time 2a	C_BO_TA_1

Either the ASDUs of the set <45> – <50> are used.

System information in monitor direction

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

<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 (option see 7.6)	C_CS_NA_1
<104>:= Test command	C_TS_NA_1
<105>:= Reset process command	C_RP_NA_1
<106>:= Delay acquisition command	C_CD_NA_1
<107>:= Test command with time tag CP56time2a	C_TS_TA_1
	<101>:= Counter interrogation command <102>:= Read command <103>:= Clock synchronization command (option see 7.6) < 104>:= Test command <105>:= Reset process command < 106>:= Delay acquisition command

Parameter in control direction

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

<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



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.
- Black boxes are not permitted in this companion standard
- 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								Cá	ause	e of	trai	nsm	issi	on						
		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	<pre>B interrogated by group <number></number></pre>	었 request by group <n> counter request</n>	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	to 36	to 41	44	45	46	47
<1>	M_SP_NA_1			х								Х	х		х					
<2>	M_SP_TA_1			х											х					
<3>	M_DP_NA_1			х								х	х		х					
<4>	M_DP_TA_1			х											х					
<5>	M_ST_NA_1			х								х	х		х					
<6>	M_ST_TA_1			х											х					
<7>	M_BO_NA_1			X											х					
**	M_BO_TA_1																			
<9>	M_ME_NA_1	х		х											х					
<10>	M_ME_TA_1	х		Х											х					
<11>	M_ME_NB_1	х		х											х					
<12>	M_ME_TB_1	х		х											х					
<13>	M_ME_NC_1	Х		X											х					



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></number>	request by group <n> counter request</n>	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
<14>	M_ME_TC_1	х		х											х					
<30>	M_SP_TB_1			Х								Х	Х		Х					
<31>	M_DP_TB_1			Х								Х	Х		Х					
<32>	M_ST_TB_1			Х								Х	Х		Х					
<33>	M_BO_TB_1			Х								Х	Х		Х					
<34>	M_ME_TD_1	х		Х								Х	х		Х					
<35>	M_ME_TE_1	х		Х								Х	Х		Х					
<36>	M_ME_TF_1	х		Х								Х	Х		Х					
<70>	M_EI_NA_1*)				х															
<100>	C_IC_NA_1						Х	х	Х	Х	Х									
<101>	C_CI_NA_1						X	Х			X									
<102>	C_RD_NA_1																			
<103>	C_CS_NA_1			Х			Х	Х												
<104>	C_TS_NA_1																			
<105>	C_RP_NA_1						Х	х												
<106>	C_CD_NA_1																			
<107>	C_TS_TA_1						х	х												
* Blar	* Blank or X only																			

6. Basic application functions

Station initialization

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

X 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)

Х	Read	procedure
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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)

X 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

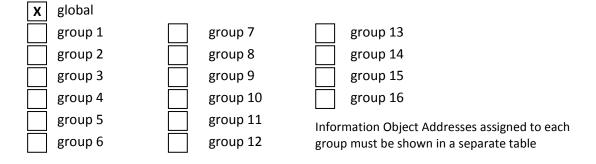
Measured value, scaled value M_ME_NB_1, M_ME_TB_1 and M_ME_TE_1

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)



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)

X Clock synchronization

optional, see clause 'System or device'

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)

Χ	
Χ	
X	

Х

Х

Х

Direct command transmission

Direct set point command transmission

Select and execute command

- Select and execute set point command
- C_SE ACTTERM used

No additional definition

Measured value, short floating point number M_ME_NC_1, M_ME_TC_1 and M_ME_TF_1

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 commandsConfigurableMaximum 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

Cou
Cou
Cou
C

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)

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

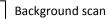
- Transmission of sequences of events
- Transmission of sequences of recorded analog values

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)



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
t _o	30s	Time-out of connection establishment	Configurable
t ₁	15s	Time-out of send or test APDUs	Configurable
t ₂	10s	Time-out for acknowledges in case of no data messages $t_2 < t_1$	Configurable
t ₃	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

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

Maximum number of outstanding I format APDUs k and latest acknowledge APDUs (w)

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	In all cases

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.

Χ

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.



Notes



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