



Reliance SCADA/HMI

IEC 60870-5-104 Communication Driver Interoperability Guide

This companion standard presents sets of parameters and alternatives from which subsets have to be selected to implement particular telecontrol systems. Certain parameter values, such as the number of octets in the COMMON 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 strikethrough (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:

- | | |
|-------------------------------------|--|
| <input type="checkbox"/> | Function or ASDU is not used. |
| <input checked="" type="checkbox"/> | Function or ASDU is used as standardized (default). |
| <input checked="" type="checkbox"/> | Function or ASDU is used in reverse mode. |
| <input checked="" type="checkbox"/> | 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 stations function by marking one of the following with an "X".

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

Network configuration

Network-specific parameter, all configurations are that used to be marked with an "X".

- Point to point
- Multipoint
- Multiple point to point
- Multipoint star

2. Physical layer

Network-specific parameter, all interfaces and data rates that are used are to be marked "X".

2.1 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

<input checked="" type="checkbox"/> 100 bit/s	<input checked="" type="checkbox"/> 2400 bit/s	<input checked="" type="checkbox"/> 2400 bit/s	<input checked="" type="checkbox"/> 56000 bit/s
<input checked="" type="checkbox"/> 200 bit/s	<input checked="" type="checkbox"/> 4800 bit/s	<input checked="" type="checkbox"/> 4800 bit/s	<input checked="" type="checkbox"/> 64000 bit/s
<input checked="" type="checkbox"/> 300 bit/s	<input checked="" type="checkbox"/> 9600 bit/s	<input checked="" type="checkbox"/> 9600 bit/s	<input type="checkbox"/>
<input checked="" type="checkbox"/> 1200 bit/s	<input type="checkbox"/>	<input checked="" type="checkbox"/> 19200 bit/s	<input type="checkbox"/>
<input checked="" type="checkbox"/> 1200 bit/s	<input type="checkbox"/>	<input checked="" type="checkbox"/> 38400 bit/s	<input type="checkbox"/>

2.2 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	2400 bit/s	2400 bit/s	56000 bit/s
200 bit/s	4800 bit/s	4800 bit/s	64000 bit/s
300 bit/s	9600 bit/s	9600 bit/s	
1200 bit/s		19200 bit/s	
1200 bit/s		38400 bit/s	

3. 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.

Link transmission

Balanced transmission
Unbalanced transmission
Maximum length L (number of octets)

Address field of the link

Not present (balanced transmission only)
One octet
Two octets
Structured
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

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).

4. 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

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 APDU for both directions is 253. It is a fixed system parameter.

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.

X	<1> := Single point information	M_SP_NA_1
X	<2> := Single point information with time tag	M_SP_TA_1
X	<3> := Double point information	M_DP_NA_1
X	<4> := Double point information with time tag	M_DP_TA_1
X	<5> := Step position information	M_ST_NA_1
X	<6> := Step position information with time tag	M_ST_TA_1
X	<7> := Bitstring of 32 bit	M_BO_NA_1
X	<8> := Bitstring of 32 bit with time tag	M_BO_TA_1
X	<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
X	<15> := Integrated totals	M_IT_NA_1
X	<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
X	<20> := Packed single-point information with status change detection	M_PS_NA_1
X	<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
X	<37> := Integrated totals with time tag CP56Time2a	M_IT_TB_1
X	<38> := Event of protection equipment with time tag CP56Time2a	M_EP_TD_1
X	<39> := Packed start events of protection equipment with time tag CP56Time2a	M_EP_TE_1
X	<40> := Packed output circuit information of protection equipment with time tag CP56Time2a	M_EP_TF_1

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 type="checkbox"/>	<46> := Double command	C_DC_NA_1
<input type="checkbox"/>	<47> := Regulating step command	C_RC_NA_1
<input checked="" 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 CP56Time2a	C_SC_TA_1
<input type="checkbox"/>	<59> := Double command with time tag CP56Time2a	C_DC_TA_1
<input type="checkbox"/>	<60> := Regulating step command with time tag CP56Time2a	C_RC_TA_1
<input type="checkbox"/>	<61> := Set point command, normalized value with time tag CP56Time2a	C_SE_TA_1
<input type="checkbox"/>	<62> := Set point command, scaled value with time tag CP56Time2a	C_SE_TB_1
<input type="checkbox"/>	<63> := Set point command, short floating point value with time tag CP56Time2a	C_SE_TC_1
<input type="checkbox"/>	<64> := Bitstring of 32 bit with time tag CP56Time2a	C_BO_TA_1

System information in monitor direction

Station-specific parameter, mark with an "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"/>	<70> := End of initialization	M_EI_NA_1
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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 type="checkbox"/>	<101>:= Counter interrogation command	C_CI_NA_1
<input type="checkbox"/>	<102>:= Read command	C_RD_NA_1
<input checked="" type="checkbox"/>	<103>:= Clock synchronization command	C_CS_NA_1
<input type="checkbox"/>	<104>:= Test command	C_TS_NA_1
<input checked="" type="checkbox"/>	<105>:= Reset process command	C_RP_NA_1
<input type="checkbox"/>	<106>:= Delay acquisition command	C_CD_NA_1
<input type="checkbox"/>	<107>:= Test command with time tag CP56Time2a	C_TS_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.

X	<110>:= Parameter of measured value, normalized value	P_ME_NA_1
	<111>:= Parameter of measured value, scaled value	P_ME_NB_1
X	<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
	<127>:= Query Log – Request archive file	F_SC_NB_1

Type identifier and cause of transmission assignments

Station-specific parameters

- Shaded boxes: option not required
 Black boxes: option 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		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	return info caused by a local cmd	file transfer	interrogated by group <number>	request by group <n> counter	unknown type identification	unknown cause of transmission	unknown common address of	unknown information object
		1	2	3	4	5	6	7	8	9	10	11	12	13	20 23 26	37 40 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							
<10>	M_ME_TA_1											X	X							
<11>	M_ME_NB_1			X		X						X	X							
<12>	M_ME_TB_1											X	X							
<13>	M_ME_NC_1			X		X						X	X							
<14>	M_ME_TC_1											X	X							
<15>	M_IT_NA_1			X		X						X	X							
<16>	M_IT_TA_1					X						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						X	X							
<31>	M_DP_TB_1			X		X						X	X							
<32>	M_ST_TB_1			X		X						X	X							

<33>	M_BO_TB_1			X	X							X	X						
<34>	M_ME_TD_1			X	X							X	X						
<35>	M_ME_TE_1			X	X							X	X						
<36>	M_ME_TF_1			X	X							X	X						
<37>	M_IT_TB_1			X	X							X	X						
<38>	M_EP_TD_1																		
<39>	M_EP_TE_1			X	X							X	X						
<40>	M_EP_TF_1			X	X							X	X						
<45>	C_SC_NA_1							X	X			X							
<46>	C_DC_NA_1																		
<47>	C_RC_NA_1							X	X			X							
<48>	C_SE_NA_1							X	X			X							
<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																		
<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							
<101>	C_CI_NA_1																		
<102>	C_RD_NA_1																		
<103>	C_CS_NA_1			X				X	X			X							
<104>	C_TS_NA_1																		
<105>	C_RP_NA_1							X	X										
<106>	C_CD_NA_1																		
<107>	C_TS_TA_1																		
<110>	P_ME_NA_1							X	X										
<111>	P_ME_NB_1																		
<112>	P_ME_NC_1							X	X										
<113>	P_AC_NA_1																		
<120>	F_FR_NA_1																		
<121>	F_SR_NA_1																		
<122>	F_SC_NA_1																		
<123>	F_LS_NA_1																		
<124>	F_AF_NA_1																		
<125>	F_SG_NA_1																		
<126>	F_DR_TA_1																		
<127>	F_SC_NB_1																		

Basic Application Functions

Station initialization (station-specific parameter, mark with an "X" if function is used).

Remote initialization

Cyclic data transmission

Station-specific parameter, mark with an "X" if function is used only in the standard direction, "R" if used only in the reverse direction, and "B" if used in both directions).

Cyclic data transmission

Read procedure

Station-specific parameter, mark with an "X" if function is used only in the standard direction, "R" if used only in the reverse direction, and "B" if used in both directions.

Read procedure

Spontaneous transmission

Station-specific parameter, mark with an "X" if function is used only in the standard direction, "R" if used only 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 with an "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.

<input type="checkbox"/>	Single point information	M_SP_NA_1, M_SP_TA_1, M_SP_TB_1, M_PS_NA_1
<input type="checkbox"/>	Double-point information	M_DP_NA_1, M_DP_TA_1, M_DP_TB_1
<input type="checkbox"/>	Step position information	M_ST_NA_1, M_ST_TA_1, M_ST_TB_1
<input type="checkbox"/>	Bitstring of 32 bit	M_BO_NA_1, M_BO_TA_1, M_BO_TB_1*
<input type="checkbox"/>	Measured value, normalized value	M_ME_NA_1, M_ME_TA_1, M_ME_ND_1, M_ME_TD_1
<input type="checkbox"/>	Measured value, scaled value	M_ME_NB_1, M_ME_TB_1, M_ME_TE_1
<input type="checkbox"/>	Measured value, short floating point number	M_ME_NC_1, M_ME_TC_1, M_ME_TF_1

Station interrogation

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"/>	Global	<input type="checkbox"/>	Group 7	<input type="checkbox"/>	Group 14
<input type="checkbox"/>	Group 1	<input type="checkbox"/>	Group 8	<input type="checkbox"/>	Group 15
<input type="checkbox"/>	Group 2	<input type="checkbox"/>	Group 9	<input type="checkbox"/>	Group 16
<input type="checkbox"/>	Group 3	<input type="checkbox"/>	Group 10	<input type="checkbox"/>	
<input type="checkbox"/>	Group 4	<input type="checkbox"/>	Group 11	<input type="checkbox"/>	
<input type="checkbox"/>	Group 5	<input type="checkbox"/>	Group 12	<input type="checkbox"/>	
<input type="checkbox"/>	Group 6	<input type="checkbox"/>	Group 3	<input type="checkbox"/>	

Note: Information Object Addresses assigned to each group must be shown in a separate table.

Clock synchronization

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"/>	Clock synchronization
<input type="checkbox"/>	Day of week used
<input type="checkbox"/>	RES1, GEN (time tag substituted/not substituted) used
<input type="checkbox"/>	SU-bit (summertime) used

Note: optional, see clause 7.6.

Command transmission

Object-specific parameter, mark with an "X" if function is used only in the standard direction, "R" if used only in the reverse direction, and "B" if used in both directions.

<input checked="" type="checkbox"/>	Direct command transmission
<input checked="" type="checkbox"/>	Direct set point command transmission
<input checked="" type="checkbox"/>	Select and execute command
<input checked="" type="checkbox"/>	Select and execute set point command
<input type="checkbox"/>	C_SE_ACTTERM used
<input checked="" type="checkbox"/>	No additional definition
<input type="checkbox"/>	Short pulse duration (duration determined by a system parameter in the outstation)
<input type="checkbox"/>	Long pulse duration (duration determined by a system parameter in the outstation)
<input type="checkbox"/>	Persistent output
<input type="checkbox"/>	Supervision of maximum delay in command direction of commands and set point commands

Transmission of integrated tools

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 type="checkbox"/>	Mode A: Local freeze with spontaneous
<input type="checkbox"/>	Mode B: Local freeze with counter
<input type="checkbox"/>	Mode C Freeze and transmit by counter interrogation
<input type="checkbox"/>	Mode C Freeze by counter-interrogation command, frozen values reported
<input checked="" type="checkbox"/>	Counter read
<input type="checkbox"/>	Counter freeze without reset
<input type="checkbox"/>	Counter freeze with reset
<input checked="" type="checkbox"/>	Counter reset
<input checked="" type="checkbox"/>	General request counter
<input type="checkbox"/>	Request counter group 1
<input type="checkbox"/>	Request counter group 2
<input type="checkbox"/>	Request counter group 3
<input type="checkbox"/>	Request counter group 4

Parameter loading

Object-specific parameter, mark with an "X" if function is used only in the standard direction, "R" if used only in the reverse direction, and "B" if used in both directions.

<input type="checkbox"/>	Threshold value
<input type="checkbox"/>	Smoothing factor
<input type="checkbox"/>	Low limit for transmission of measured value
<input type="checkbox"/>	High limit for transmission of measured value

Parameter activation

Object-specific parameter, mark with an "X" if function is used only in the standard direction, "R" if used only in the reverse direction, and "B" if used in both directions.

<input type="checkbox"/>	Activation/deactivation of persistent cyclic or periodic transmission of the addressed object
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Test procedure

Station-specific parameter, mark with an "X" if function is used only in the standard direction, "R" if used only in the reverse direction, and "B" if used in both directions.

<input type="checkbox"/>	Test procedure
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File transfer

Station-specific parameter, mark with an "X" if function is used.
File transfer in monitor direction.

- Transparent file
- Transmission of disturbance data of protection
- 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 with an "X" if function is used only in the standard direction, "R" if used only in the reverse direction, and "B" if used in both directions.

- Background scan

Acquisition of transmission delay

Station-specific parameter, mark with an "X" if function is used only in the standard direction, "R" if used only 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 ₀	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 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 to send state variable	configurable
w	8 APDUs	Latest acknowledge after receiving w I-format APDUs	configurable

Port number

Parameter	Default value	Remarks	Selected value
Port number	2404		configurable

Redundant connections

Configurable	Number N of redundancy group connections used
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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.

<input checked="" type="checkbox"/>	Ethernet 802.3
<input type="checkbox"/>	Serial X.21 interface
<input type="checkbox"/>	Other selection from RFC 2200: