Hadron Xtorm Series
IEC 60870-5-104
Client
Device Profile

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altus

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DEVICE PROFILE REVISION HISTORY

Date	Revision	Reason for change	Edited by
05/02/2022	A	First edition.	Osmar Brune

Interoperability IEC 60870-5-104

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)

Network configuration

(Not Applicable)

Physical layer

(Not Applicable)

Link layer

(Not Applicable)

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

☐ <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

In this companion standard only the use of the set <30> – <40> for ASDUs with time tag is permitted.

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)

X <45> := Single command C_SC_NA_1

X <46> := Double command C_DC_NA_1

X <47> := Regulating step command C_RC_NA_1

X <48> := Set point command, normalized value C_SE_NA_1

X <49> := Set point command, scaled value C_SE_NB_1

X <50> := Set point command, short floating point value C_SE_NC_1

☐ <51> := Bitstring of 32 bit C_BO_NA_1

☐ <58> := Single command with time tag CP56Time 2a C_SC_TA_1

<59> := Double command with time tag CP56Time 2a C_DC_TA_1

<60> := Regulating step command with time tag CP56Time 2a C_RC_TA_1

<61> := Set point command, normalized value with time tag CP56Time 2a C_SE_TA_1

<62> := Set point command, scaled value with time tag CP56Time 2a C_SE_TB_1

<63> := Set point command, short floating point value with time tag CP56Time 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> – <51> or of the set <58> – <64> are used.

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).

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)

X <100>:= Interrogation command C_IC_NA_1

[X]	<101>:= Counter interrogation command	C_CI_NA_1
[ ]	<102>:= Read command	C_RD_NA_1
[X]	<103>:= Clock synchronization command (option see 7.6)	C_CS_NA_1
[■]	<104>:= ~~Test command~~	~~C_TS_NA_1~~
[X]	<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

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)

[ ]	<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
[ ]	<127>:= Query Log – Request archive file	F_SC_NB_1

Type identifier and cause of transmission assignments
(station-specific parameters)

'**X**' if only used in the standard direction
'**R**' if only used in the reverse direction
'**B**' if used in both directions

Type identification		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			X					
<2>	~~M_SP_TA_1~~			■		■						■	■							
<3>	M_DP_NA_1											X			X					
<4>	~~M_DP_TA_1~~			■		■						■	■							
<5>	M_ST_NA_1											X			X					
<6>	~~M_ST_TA_1~~			■		■						■	■							
<7>	M_BO_NA_1																			
<8>	~~M_BO_TA_1~~			■		■														
<9>	M_ME_NA_1														X					
<10>	~~M_ME_TA_1~~			■		■														
<11>	M_ME_NB_1														X					
<12>	~~M_ME_TB_1~~			■		■														
<13>	M_ME_NC_1														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																
<31>	M_DP_TB_1			X																

Type identification		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
\<32\>	M_ST_TB_1			X																
\<33\>	M_BO_TB_1																			
\<34\>	M_ME_TD_1			X																
\<35\>	M_ME_TE_1			X																
\<36\>	M_ME_TF_1			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
\<50\>	C_SE_NC_1						X	X	X	X	X						X	X	X	X
\<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	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
<101>	C_CI_NA_1						X	X			X						X	X	X	X
<102>	C_RD_NA_1																			
<103>	C_CS_NA_1						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																			
<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*																			

* Blank or X only

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)

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

Transmission Mode of Analog Events
(station-specific parameter, mark '**X**' if function is used)

☐ SOE

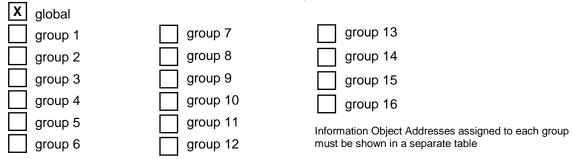☐ Most Recent Event

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)

X 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 Addresses assigned to each group must be shown in a separate table
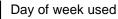
Clock synchronization
(station-specific parameter, mark '**X**' if function is only used in the standard direction, '**R**' if only used in the reverse direction, and '**B**' if used in both directions)

X Clock synchronization

☐ Day of week used

☐ RES1, GEN (time tag substituted/ not substituted) used

☐ SU-bit (summertime) used

optional, see 7.6

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)

X Direct command transmission

X Direct set point command transmission

X Select and execute command

X Select and execute set point command

X 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

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)

☐ 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)

☐ Background scan

Acquisition of transmission delay

(Not Applicable)

Definition of time outs

Parameter	Default value	Remarks	Selected value
t_0	30s	Time-out of connection establishment	**Not 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 180 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 to send state variable	**Configurable**
w	8 APDUs	Latest acknowledge after receiving w I-format APDUs	**Configurable**

Maximum range of values k: 1 to 12 APDUs, accuracy 1 APDU
Maximum range of values w: 1 to 8 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.

$\boxed{\text{X}}$ Ethernet 802.3

$\square$ Serial X.21 interface

$\square$ Other selection from RFC 2200