IEC60870-5-104 Slave Protocol Details

for

KALKI Protocol Gateway/GatewayLite

Product User Guide

Version – 1.0

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1. Introduction

The purpose of this document is to describe the functionalities of IEC104 Slave protocol implemented in the Kalki Protocol Gateway / Kalki Substation GatewayLite. This will contain details of interoperability, configuration details & mapping of the data from some of the other master protocols available in Kalki Protocol Gateway.

2. 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).

The selected parameters are marked in the white boxes as follows:

☐ Function or ASDU is not used

☒ Function or ASDU is used as standardized (default)

☒ **R** Function or ASDU is used in reverse mode

☒ **B** Function or ASDU is used in standard and reverse mode

2.1 System or device

☐ System definition

☐ Controlling station definition (Master)

☒ Controlled station definition (Slave)

2.2 Network configuration

■ ~~Point-to-point~~ ■ ~~Multipoint~~

■ ~~Multiple point-to-point~~ ■ ~~Multipoint-star~~

2.3 Physical layer

Transmission speed (control direction)

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

Transmission speed (monitor direction)

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

2.4 Link layer

Link transmission procedure

- ~~Balanced transmission~~
- ~~Unbalanced transmission~~

Address field of the link

- ~~not present (balanced transmission only)~~
- ~~One octet~~
- ~~Two octets~~
- ~~Structured~~
- ~~Unstructured~~

Frame length

- ~~Maximum length L (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
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).~~

2.5 Application layer

2.5.1 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.

2.5.2 Common address of ASDU

■ ~~One octet~~ [X] Two octets

2.5.3 Information object address

■ ~~One octet~~
■ ~~Two octets~~
[X] Three octets

[X] Structured
[X] Unstructured

2.5.4 Cause of transmission

■ ~~One octet~~ [X] Two octets (with originator address)
Originator address is set to zero if not used

2.5.5 Length of APDU

The maximum length of the APDU is 253 (default).

2.5.6 Selection of standard ASDUs

2.5.6.1 Process information in monitor direction

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~~
X	<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
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
	<38>	:=	Event of protection equipment with time tag CP56Time2a	M_EP_TD_1
	<39>	:=	Packed start events of protection equipment with time tag CP56Time2a	M_EP_TE_1
	<40>	:=	Packed output circuit information of protection equipment with time tag CP56Time2a	M_EP_TF_1

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

2.5.6.2 Process information in control direction

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
X	<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
X	<62> :=	Set point command, scaled value with time tag CP56Time 2a	C_SE_TB_1
X	<63> :=	Set point command, short floating point value with time tag CP56Time 2a	C_SE_TC_1
X	<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.

2.5.6.3 System information in monitor direction

	<70> :=	End of initialization	M_EI_NA_1

2.5.6.4 System information in control direction

X	<100>:=	Interrogation command	C_IC_NA_1
X	<101>:=	Counter interrogation command	C_CI_NA_1
X	<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~~
X	<107>:=	Test command with time tag CP56time2a	C_TS_TA_1

2.5.6.5. Parameter in control direction

	<110>:=	Parameter of measured value, normalized value	P_ME_NA_1
	<111>:=	Parameter of measured value, scaled value	P_ME_NB_1

☐	<112>:=	Parameter of measured value, short floating point value	P_ME_NC_1
☐	<113>:=	Parameter activation	P_AC_NA_1

2.5.6.6 File Transfer

☐	<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***

2.5.7. Type identifier and cause of transmission assignments

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		**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									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					X									X					
~~<8>~~	~~M_BO_TA_1~~			■		■														
<9>	M_ME_NA_1	X				X									X					
~~<10>~~	~~M_ME_TA_1~~			■		■														
<11>	M_ME_NB_1	X				X									X					
~~<12>~~	~~M_ME_TB_1~~			■		■														
<13>	M_ME_NC_1	X				X									X					
~~<14>~~	~~M_ME_TC_1~~			■		■														
<15>	M_IT_NA_1															X				
~~<16>~~	~~M_IT_TA_1~~			■												■				
~~<17>~~	~~M_EP_TA_1~~			■																

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
~~<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							
<33>	M_BO_TB_1			X																
<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									
<46>	C_DC_NA_1						X	X	X	X	X									
<47>	C_RC_NA_1						X	X	X	X	X									
<48>	C_SE_NA_1						X	X	X	X	X									
<49>	C_SE_NB_1						X	X	X	X	X									
<50>	C_SE_NC_1						X	X	X	X	X									
<51>	C_BO_NA_1						X	X			X									
<58>	C_SC_TA_1						X	X	X	X	X									
<59>	C_DC_TA_1						X	X	X	X	X									
<60>	C_RC_TA_1						X	X	X	X	X									
<61>	C_SE_TA_1						X	X	X	X	X									
<62>	C_SE_TB_1						X	X	X	X	X									
<63>	C_SE_TC_1						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
<64>	C_BO_TA_1						X	X			X									
<70>	M_EI_NA_1*)																			
<100>	C_IC_NA_1						X	X	X	X	X									
<101>	C_CI_NA_1						X	X			X									
<102>	C_RD_NA_1					X														
<103>	C_CS_NA_1			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						X	X												
<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*)																			

*** Blank or X only**

2.6. Basic application functions

2.6.1. Station initialization

[X] Remote initialization

2.6.2. Cyclic data transmission

[X] Cyclic data transmission

2.6.3. Read procedure

[X] Read procedure

2.6.4. Spontaneous transmission

[X] Spontaneous transmission

2.6.5. Double transmission of information objects with cause of transmission spontaneous

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

2.6.6. Station interrogation

[X] global

[X] group 1	[X] group 7	[X] group 13
[X] group 2	[X] group 8	[X] group 14
[X] group 3	[X] group 9	[X] group 15
[X] group 4	[X] group 10	[X] group 16
[X] group 5	[X] group 11	
[X] group 6	[X] group 12	

2.6.7. Clock synchronization

[X] Clock synchronization

2.6.8. Command transmission

[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

[X] No additional definition
[X] Short pulse duration (duration determined by a system parameter in the outstation)
[X] Long pulse duration (duration determined by a system parameter in the outstation)
[X] Persistent output

[X] Supervision of maximum delay in command direction of commands and set point commands

5 Seconds* Maximum allowable delay of commands and set point commands

* Will be made configurable in the next release

2.6.9. Transmission of integrated totals

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

- [X] Counter read
- [X] Counter freeze without reset
- [X] Counter freeze with reset
- [X] Counter reset

- [X] General request counter
- [X] Request counter group 1
- [X] Request counter group 2
- [X] Request counter group 3
- [X] Request counter group 4

2.6.10. Parameter loading

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

2.6.11. Parameter activation

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

2.6.12.Test procedure

- [ ] Test procedure

2.6.13. File transfer

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

2.6.14. Background scan

☐ Background scan

2.6.15. Acquisition of transmission delay

■ ~~Acquisition of transmission delay~~

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

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

Parameter	Default value	Remarks	Selected value
k	12 APDUs	Maximum difference 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 32767 (2^{15}-1) APDUs, accuracy 1 APDU
Maximum range of values w: 1 to 32767 APDUs, accuracy 1 APDU (Recommendation: w should not exceed two-thirds of k).

2.6.18. Portnumber

Parameter	Default Value	Remarks	Selected value
Portnumber	2404		**Configurable**

2.6.19. 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:**

3. Configuration Details

Configuration of KSGL is done through the configuration utility named "EasyConnect". The IEC104 slave configuration is divided into 3 parts – channel configuration, node configuration & configuration of mapping for IEC104 slave.

3.1. Channel Configurations

Channel configuration involves configuration of the following parameters.

3.1.1. ChannelNumber

Description: Indicates the Unique Identification Number For Channel

Default: Depends up on the order of creation

Range: 1-4,8,16 (Depends upon converter model)

3.1.2. Channel Type

Description: Indicates the type of Channel

Default: TCP/IP

Range: TCP/IP

3.1.3. IP Address

Description: Indicates the TCP/IP Address or Host Name of the slave device.

Default: None

Range: None

3.1.4. Port Number

Description: Indicates the TCP/IP Connection Port Number. The port number has to be same in master and slave sides.

Default: 2404

Range: 1025-65535

3.1.5. First Char Wait

Description: Delay between receiving a character and transmitting next character

Default: 1milliseconds

Range: 0-100 milliseconds

3.1.6. Time Out

Description: Indicates the Application layer incremental timeout in milliseconds.

Default: 30000 milliseconds

Range: 0-100000 milliseconds

3.1.7. T1Time

Description: Confirm timeout of send or test APDUs. After sending test APDUs (TESTFR = act), the slave will wait for 't1' time for the conformation (TESTFR = con) from master. If it does not get the confirmation within this period the slave will go for an active close of the connection.

Default: 15000 milliseconds

Range: 0-255000 milliseconds

3.1.8. T2 Time

Description: Indicates the Timeout for acknowledges in case of no data messages (The maximum amount of time after receiving the last I-FORMAT APDU before transmitting an S-FORMAT APDU.). The timeout for sending an acknowledgement if the amount of I- FORMAT APDUs defined by the "w" attribute is not received. The timer is restarted when an I- FORMAT APDU is received and cancelled when an acknowledge (S-FORMAT APDU) is sent.

Default: 10000 milliseconds

Range: 0-255000 milliseconds

3.1.9. T3 Time

Description: Indicates the Timeout for sending test frames in case of a long idle state. Unused, but open, connections may be periodically tested in both directions by sending test APDUs (TESTFR = act) which are confirmed by the receiving station sending TESTFR = con. Both stations may initiate the test procedure after a specified period of time in which no data transfers occur. This time is specified by "t3" attribute. The reception of every frame – I frame, S frame or U frame – retriggers timer t3.

Default: 20000 milliseconds

Range: 0-255000 milliseconds

3.1.10. Attribute w

Description: This implies the maximum number of I-FORMAT APDUs for which no acknowledgement (S-FORMAT APDU) is send. The S-FORMAT APDU has to be send when number of I-FORMAT APDU received = w or an expiry of "t2" timer has happened.

Default: 8

Range: 1-100

3.1.11. Attribute k

Description: Indicates the maximum number of outstanding I-FORMAT APDU. The transmitter stops sending the transmission at k unacknowledged I-FORMAT APDUs.

Default: 12

Range: 0-100

3.2. Node Configurations

3.2.1. Node Number

Description: Indicates the Unique Identification Number For Node

Default: Depends up on the order of creation.

Range: 1-64,128,256(Depends upon converter model).

3.2.2. Node State

Description: Indicates whether Node is active or not.

Default: 0

Range: 0 or 1.

3.2.3. Station Address

Description: Indicates the Address (ASDU address) of Remote Device.

Default: 1

Range: 0-255 or 0-65535

3.2.4. COT Size

Description: Indicates the Number of Octets for Cause of Transmission Octets.

Default: 2 bytes

Range: 1 byte or 2 bytes.

3.2.5. Propagation Delay

Description: Indicates the Network Propagation Delay. This network propagation delay will be considered while time synchronization.

Default: 0 milliseconds

Range: 0-10000 milliseconds.

3.2.6. Cyclic Interval

Description: Indicates the Period for cyclic data transmission.

- When it is '0' the cyclic transmission will be disabled.
- In cyclic transmission the data that is configured as class-2 will only get updated.

Default: 10 seconds

Range: 0-3600 seconds

3.2.7. Clock Valid

Description: Time to allow between clock syncs before setting clock invalid bit.

Default: 10 minutes

Range: 0-1440 minutes

3.2.8. Select Timeout

Description: Indicates maximum allowed delay between a select and the corresponding execute

Default: 2 seconds

Range: 1-180 seconds

3.2.9. Number of Single Point Events

Description: Indicates the Max count of Events stored for single point events.

Default: 100

Range: 0-2000

3.2.10. Event storage Mode

Description: There are two event storage modes – Sequence Of Events and Most Recent.

- All Events are stored in SOE Mode.
- In Most Recent Mode any latest event over writes an already stored event of a particular point.

Default: Sequence of Events.

Range: Sequence of Events /Most Recent

3.2.11. Number of Double Point Events

Description: Indicates the Max count of Events stored for double point events.

Default: 100

Range:0-2000.

3.2.12. Number of Step Position Events

Description: Indicates the Max count of Events to be stored for step position events.

Default: 10

Range: 0-200.

3.2.13. Number of Analog Value Events

Description: Indicates the Max count of Events to be stored for analog value events.

Default: 100.

Range: 0-2000

3.2.14. Event Time Stamp

Description: There are two types of time stamp formats - 24 Bit Time Stamp and 56 Bit Time Stamp.

- 24 bit time stamp is in hh:mm:ss and Milliseconds format.
- 56 Bit Time Stamp is in yy:mm::dd, hh:mm:ss and Milliseconds format.

Default: 56 Bit Time Stamp

Range: 24 Bit Time Stamp / 56 Bit Time Stamp

3.2.15. CSE Activation Termination

Description: Indicates whether activation termination is required on CSE commands.

Default: Enable

Range: Enable / Disable

3.2.16. CMD Activation Termination

Description: Indicates whether activation termination is required for all other Commands.

Default: Enable.

Range: Enable / Disable.

3.3. Mapping Attributes

3.3.1. ASDU Types

You can configure the different ASDU types of IEC104 here. The following are major ASDU types available for configuration.

3.3.1.1. Single Indications

When you configure this point you will get the following ASDU types of IEC104.

M_SP_NA_1 (ASDU type 1) → the data will be updated in this format when you give general interrogation.
~~M_SP_TA_1 (ASDU type 2) → the data will be updated in this format when the data is reported spontaneously & Event time stamp attribute is configured as 24 bits.~~
M_SP_TB_1 (ASDU type 30) → the data will be updated in this format when the data is reported spontaneously ~~& Event time stamp attribute is configured as 56 bits.~~

3.3.1.2. Double Indications

When you configure this point you will get the following ASDU types of IEC104.

M_DP_NA_1 (ASDU type 3) → the data will be updated in this format when you give general interrogation.
~~M_DP_TA_1 (ASDU type 4) → the data will be updated in this format when the data is reported spontaneously & Event time stamp attribute is configured as 24 bits.~~
M_DP_TB_1 (ASDU type 31) → the data will be updated in this format when the data is reported spontaneously ~~& Event time stamp attribute is configured as 56 bits.~~

3.3.1.3. Step position information

When you configure this point you will get the following ASDU types of IEC104.

M_ST_NA_1 (ASDU type 5) → the data will be updated in this format when you give general interrogation.
~~M_ST_TA_1 (ASDU type 6) → the data will be updated in this format when the data is reported spontaneously & Event time stamp attribute is configured as 24 bits.~~
M_ST_TB_1 (ASDU type 32) → the data will be updated in this format when the data is reported spontaneously ~~& Event time stamp attribute is configured as 56 bits.~~

3.3.1.4. Measured Value (N)

When you configure this point you will get the following ASDU types of IEC104.

M_ME_NA_1 (ASDU type 9) → the data will be updated in this format when you give general interrogation.

~~M_ME_TA_1 (ASDU type 10) → the data will be updated in this format when the data is reported spontaneously & Event time stamp attribute is configured as 24 bits.~~

M_ME_TD_1 (ASDU type 34) → the data will be updated in this format when the data is reported spontaneously ~~& Event time stamp attribute is configured as 56 bits.~~

3.3.1.4. Measured Value (S)

When you configure this point you will get the following ASDU types of IEC104.

M_ME_NB_1 (ASDU type 11) → the data will be updated in this format when you give general interrogation.

~~M_ME_TB_1 (ASDU type 12) → the data will be updated in this format when the data is reported spontaneously & Event time stamp attribute is configured as 24 bits.~~

M_ME_TE_1 (ASDU type 35) → the data will be updated in this format when the data is reported spontaneously ~~& Event time stamp attribute is configured as 56 bits.~~

3.3.1.5. Measured Value (F)

When you configure this point you will get the following ASDU types of IEC104.

M_ME_NC_1 (ASDU type 13) → the data will be updated in this format when you give general interrogation.

~~M_ME_TC_1 (ASDU type 14) → the data will be updated in this format when the data is reported spontaneously & Event time stamp attribute is configured as 24 bits.~~

M_ME_TF_1 (ASDU type 36) → the data will be updated in this format when the data is reported spontaneously ~~& Event time stamp attribute is configured as 56 bits.~~

3.3.1.6. Integrated Totals

When you configure this point you will get the following ASDU types of IEC104.

M_IT_NA_1 (ASDU type 15) → the data will be updated in this format when you give general interrogation.

~~M_IT_TA_1 (ASDU type 16) → the data will be updated in this format when the data is reported spontaneously & Event time stamp attribute is configured as 24 bits.~~

M_IT_TB_1 (ASDU type 37) → the data will be updated in this format when the data is reported spontaneously ~~& Event time stamp attribute is configured as 56 bits.~~

3.3.1.7. Bitstring of 32 bit

When you configure this point you will get the following ASDU types of IEC104.

M_BO_NA_1 (ASDU type 7) → the data will be updated in this format when you give general interrogation.

~~M_BO_TA_1 (ASDU type 8) → the data will be updated in this format when the data is reported spontaneously & Event time stamp attribute is configured as 24 bits.~~

M_BO_TB_1 (ASDU type 33) → the data will be updated in this format when the data is reported spontaneously ~~& Event time stamp attribute is configured as 56 bits.~~

3.3.1.8. Single Commands

It will accept two types of single commands from IEC104 master - C_SC_NA_1 (ASDU type 45) & C_SC_TA_1 (ASDU type 58). Both will support SBO & direct operate command variations.

3.3.1.9. Double Commands

It will accept two types of single commands from IEC104 master - C_DC_NA_1 (ASDU type 46) & C_DC_TA_1 (ASDU type 59). Both will support SBO & direct operate command variations.

3.3.1.10. Regulating step Commands

It will accept two types of single commands from IEC104 master - C_RC_NA_1 (ASDU type 47) & C_RC_TA_1 (ASDU type 60). Both will support SBO & direct operate command variations.

3.3.1.11. Setpoint Command (N)

It will accept two types of single commands from IEC104 master - C_SE_NA_1 (ASDU type 48) & C_SE_TA_1 (ASDU type 61). Both will support SBO & direct operate command variations.

3.3.1.12. Setpoint Command (S)

It will accept two types of single commands from IEC104 master - C_SE_NB_1 (ASDU type 49) & C_SE_TB_1 (ASDU type 62). Both will support SBO & direct operate command variations.

3.3.1.13. Setpoint Command (F)

It will accept two types of single commands from IEC104 master - C_SE_NC_1 (ASDU type 50) & C_SE_TC_1 (ASDU type 63). Both will support SBO & direct operate command variations.

3.3.1.14. Setpoint Command (B)

It will accept two types of single commands from IEC104 master - C_BO_NA_1 (ASDU type 51) & C_BO_TA_1 (ASDU type 64). Both will support SBO & direct operate command variations.

3.3.2. Information Object Address

This specifies the Information object address of the data point of IEC104 slave to which the master data is mapped.

3.3.3. No of Points

This specifies the total number of points. Maximum number of points can be no. of points of master profile row to which the slave row is mapped.

3.3.4. Group Mask

This specifies the group mask (0 → 16) for the specific data points. '0' indicates that the specific point will be updated in the master by general interrogation only. The other values indicate the specific point can be updated in the master by general interrogation and specific group interrogation.

3.3.5. Class Mask

We can classify the points into different classes (class-1 & class-2) using this functionality. If we define the points as class-1 it will have high priority and will get updated spontaneously. If the specific point is class-2, it can be updated on a cyclic basis.

4. Mapping Details from other protocols: -

This section gives detailed idea of the data types in other master protocols, which can be mapped, to specific IEC104 slave types.

IEC104 slave Types	14-M1	14-M2	14-M3	14-M4 14-M5 14-M6	14-M7	14-M8	14-C1	14-C2	14-C3	14-C4 14-C5 14-C6	14-C7
IEC101/ 104 master types	14-M1	14-M2	14-M3	14-M4 14-M5 14-M6	14-M7	14-M8	14-C1	14-C2	14-C3	14-C4 14-C5 14-C6	14-C7
IEC103 master types	103-T1 103-T2	103-T1 103-T2	103-T3 103-T4 103-T9	103-T3 103-T4 103-T9	103-T3 103-T4 103-T9	103-T3 103-T4 103-T9	103-T20	103-T20	103-T20	--	--
Modbus master types	MB-T1 MB-T2	MB-T3 MB-T4	MB-T5 MB-T6	MB-T5 MB-T6	MB-T5 MB-T6	MB-T5 MB-T6	MB-T7 MB-T8	MB-T9 MB-T10	MB-T7 MB-T8 MB-T9 MB-T10	MB-T11 MB-T12	MB-T11 MB-T12
DNP3.0 master types	DN-T1 DN-T3	DN-T1 DN-T3	DN-T2 DN-T4	DN-T2 DN-T4	DN-T2 DN-T4	DN-T2 DN-T4	DN-T5	DN-T5	DN-T5	DN-T6	DN-T6
SPA master types	SP-T1	SP-T2	SP-T3	SP-T3	SP-T4	SP-T3	SP-T5	SP-T6	SP-T5 SP-T6	SP-T7	SP-T7
Courier master types	CR-T1	CR-T2	CR-T3	CR-T3	CR-T3	CR-T3	CR-T4	CR-T5	CR-T4 CR-T5	CR-T6	CR-T6

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IEC101/104 Type Details	
IEC101/104 types	**Type Details**
14_M1	Single Indication
14_M2	Double Indication
14_M3	Step position information
14_M4	Measured value, normalized value
14_M5	Measured value, Scaled value
14_M6	Measured value, short floating point value
14_M7	Integrated totals
14_M8	Bitstring of 32 bit
14_C1	Single command
14_C2	Double command
14_C3	Regulating step command
14_C4	Set point command, normalised value
14_C5	Set point command, Scaled value
14_C6	Set point command, short floating point value
14_C7	Set point command, Bitstring of 32 bit

Modbus Type Details		
Modbus types	**Type Details**	**Supported Formats**
MB-T1	Single Indication, Read Coil status	NA
MB-T2	Single Indication, Read Discrete inputs	NA
MB-T3	Double Indication, Read Coil status	NA
MB-T4	Double Indication, Read Discrete inputs	NA
MB-T5	Analog I/P, Read Input Registers	NA
MB-T6	Analog I/P, Read Holding Registers	Signed Single Register Unsigned Single Register Signed 32 bit Register (lsw – msw) Signed 32 bit Register (msw – lsw) Unsigned 32 bit Register (lsw – msw) Unsigned 32 bit Register (msw – lsw) Float (lsw – msw) Float (msw – lsw) Double
MB-T7	Single Command, Force single coil	NA
MB-T8	Single Command, Force multiple coils	NA
MB-T9	Double Command, Force single coil	NA
MB-T10	Double Command, Force multiple coils	NA
MB-T11	Analog O/P, Force single register	Signed Single Register Unsigned Single Register
MB-T12	Analog O/P, Force multiple registers	Signed Single Register Unsigned Single Register Signed 32 bit Register (lsw – msw) Signed 32 bit Register (msw – lsw) Unsigned 32 bit Register (lsw – msw) Unsigned 32 bit Register (msw – lsw) Float (lsw – msw) Float (msw – lsw)

IEC103 Type Details	
IEC103 types	**Type Details**
103-T1	Time Tagged Message (103 TYPE = 1)
103-T2	Time Tagged Message With Relative Time(103 TYPE = 2)
103-T3	Measurands I (103 TYPE = 3)
103-T4	Time Tagged Measurands with Relative Time. (103 TYPE = 4)
103-T5	Identification (103 TYPE = 5)
103-T9	Measurands II (103 TYPE = 9)
103-T20	Write general commands (103 TYPE = 20)
103-T21	Directory

DNP3.0 Type Details	
DNP3.0 types	**Type Details**
DN-T1	Binary Input
DN-T2	Analog Input
DN-T3	Binary Output Status
DN-T4	Analog Output Status
DN-T5	Binary Output Command
DN-T6	Analog Output Command

SPA Type Details				
SPA types	**Type Details**	**Supported Data Types**	**Supported Data Formats**	**Update Methods**
SP-T1	Single Indications	I, O, S, V, M, C	Bits, Hex, Real, Long Int	Polling , Events , polling & events
SP-T2	Double Indications	I, O, S, V, M, C	Bits, Hex, Real, Long Int	Polling , Events , polling & events
SP-T3	Analog Inputs	I, O, S, V, M, C	Bits, Hex, Real, Long Int	Polling
SP-T4	Pulse Counters	I, O, S, V, M, C	Bits, Hex, Real, Long Int	Polling
SP-T5	Object Commands	I, O, S, V, M, C	Bits, Hex, Real, Long Int	NA
SP-T6	Double Commands	I, O, S, V, M, C	Bits, Hex, Real, Long Int	NA
SP-T7	Analog Outputs	I, O, S, V, M, C	Bits, Hex, Real, Long Int	NA

Courier Type Details			
Courier types	**Type Details**	**Supported Data Formats**	**Update Methods**
CR-T1	Single Indications	NA	Polling , Events , polling & events
CR-T2	Double Indications	NA	Polling , Events , polling & events
CR-T3	Analog Inputs	UnsignedInteger (1Byte) – 24H UnsignedInteger (2Bytes) – 25H UnsignedInteger (4Bytes) – 26H SignedInteger (1Byte) – 28H SignedInteger (2Bytes) – 29H SignedInteger (4Bytes) – 2AH CourierNumber (4Bytes) – 2CH Extended Courier (6Bytes) --30 H IEEE floating Format (4Bytes)--34 H	Polling
CR-T4	Single Commands	Indexed String Courier Number	NA
CR-T5	Double Commands	Indexed String Courier Number Two bits setting command	NA
CR-T6	Analog Outputs	UnsignedInteger (1Byte) – 24H UnsignedInteger (2Bytes) – 25H UnsignedInteger (4Bytes) – 26H SignedInteger (1Byte) – 28H SignedInteger (2Bytes) – 29H SignedInteger (4Bytes) – 2AH CourierNumber (4Bytes) – 2CH Extended Courier (6Bytes) --30 H IEEE floating Format (4Bytes)--34 H	NA