

**IEC60870-5-104 Master Protocol Details
for
KALKI Protocol Gateway/GatewayLite**

Product User Guide

Version – 1.0

KALKI Communication Technologies Pvt.. Ltd.,
#147, 2nd Floor, 5th Main, 7th Sector,
H.S.R. Layout, Bangalore,
INDIA – 560034.
Phone: 91-80-5721263
<http://www.kalkitech.com>

CONTENTS

1.	Introduction	5
2.	Interoperability	5
2.1	System or device	5
2.2	Network configuration	5
2.3	Physical layer	6
2.4	Link layer	6
2.5	Application layer	7
2.5.1	Transmission mode for application data	7
2.5.2	Common address of ASDU	7
2.5.3	Information object address	7
2.5.4	Cause of transmission	7
2.5.5	Length of APDU	8
2.5.6	Selection of standard ASDUs	8
2.5.6.1	Process information in monitor direction	8
2.5.6.2	Process information in control direction	9
2.5.6.3	System information in monitor direction	9
2.5.6.4	System information in control direction	9
2.5.6.5	Parameter in control direction	9
2.5.6.6	File Transfer	10
2.5.7	Type identifier and cause of transmission assignments	11
2.6	Basic application functions	14
2.6.1	Station initialization	14
2.6.2	Cyclic data transmission	14
2.6.3	Read procedure	14
2.6.4	Spontaneous transmission	14
2.6.5	Double transmission of information objects with cause of transmission spontaneous	14
2.6.6	Station interrogation	15
2.6.7	Clock synchronization	15
2.6.8	Command transmission	15
2.6.9	Transmission of integrated totals	15
2.6.10	Parameter loading	16
2.6.11	Parameter activation	16
2.6.12	Test procedure	16
2.6.13	File transfer	16
2.6.14	Background scan	17
2.6.15	Acquisition of transmission delay	17
2.6.16	Definition of time outs	17
2.6.17	Maximum number of outstanding I format APDUs k and latest acknowledge APDUs (w)	17
2.6.18	Portnumber	18
2.6.19	RFC 2200 suite	18
3.	Configuration Details	19
3.1	Channel Configurations	19
3.1.1	ChannelNumber	19
3.1.2	Channel Type	19
3.1.3	IP Address	19
3.1.4	Port Number	19

3.1.5. Connect Timeout	20
3.1.6. First Char Wait	20
3.1.7. Time Out	20
3.1.8. T1Time	20
3.1.9. T2 Time	21
3.1.10. T3 Time	21
3.1.11. Attribute w	21
3.1.12. Attribute k	21
3.2. Node Configurations	22
3.2.1. Node Number	22
3.2.2. Node State	22
3.2.3. Station Address	22
3.2.4. COT Size	22
3.2.5. Originator Address	22
3.2.6. Clock Synchronization	23
3.2.7. Clock Synch Type	23
3.2.8. Clock Synch Interval	23
3.2.9. General Interrogation	23
3.2.10. General Interrogation Mode	23
3.2.11. General Interrogation Interval	24
3.2.12. Group Interrogation	24
3.2.13. Group Interrogation Mode	24
3.2.14. Group Interrogation Interval-1	24
3.2.15. Scan Groups for Interval-1	24
3.2.16. Group Interrogation Interval-2	25
3.2.17. Scan Groups for Interval-2	25
3.2.18. Group Interrogation Interval-3	25
3.2.19. Scan Groups for Interval-3	25
3.2.20. Counter Interrogation	25
3.2.21. Counter Interrogation Mode	26
3.2.22. Counter Interrogation Interval	26
3.2.23. Counter Group Interrogation	26
3.2.24. Counter Group Interrogation Mode	26
3.2.25. Counter Group Interrogation Interval	26
3.2.26. Scan Groups for Counter Interrogation	27
3.2.27. CSE Activation Termination	27
3.2.28. CMD Activation Termination	27
3.3. Profile Attributes	27
3.3.1. ASDU Types	27
3.3.1.1. Single Indications	27
3.3.1.2. Double Indications	27
3.3.1.3. Step position information	28
3.3.1.4. Measured Value (N)	28
3.3.1.4. Measured Value (S)	28
3.3.1.5. Measured Value (F)	28
3.3.1.6. Integrated Totals	29
3.3.1.7. Bitstring of 32 bit	29
3.3.1.8. Single Commands	29
3.3.1.9. Double Commands	29
3.3.1.10. Regulating step Commands	29
3.3.1.11. Setpoint Command (N)	29
3.3.1.12. Setpoint Command (S)	29
3.3.1.13. Setpoint Command (F)	29

3.3.1.14. Setpoint Command (B) _____	30
3.3.2. Information Object Address _____	30
3.3.3. No of Points _____	30

4. Mapping Details to other protocols: - _____ 30

1. Introduction

The purpose of this document is to describe the functionalities of IEC104 Master 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)
- Function or ASDU is used in reverse mode
- 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

- | | |
|---|---|
| <input checked="" type="checkbox"/> Point-to-point | <input checked="" type="checkbox"/> Multipoint |
| <input checked="" type="checkbox"/> Multiple point-to-point | <input checked="" type="checkbox"/> 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	
<input type="checkbox"/> 100 bit/s	<input type="checkbox"/> 2 400 bit/s	<input type="checkbox"/> 2 400 bit/s	<input type="checkbox"/> 56 000 bit/s
<input type="checkbox"/> 200 bit/s	<input type="checkbox"/> 4 800 bit/s	<input type="checkbox"/> 4 800 bit/s	<input type="checkbox"/> 64 000 bit/s
<input type="checkbox"/> 300 bit/s	<input type="checkbox"/> 9 600 bit/s	<input type="checkbox"/> 9 600 bit/s	
<input type="checkbox"/> 600 bit/s		<input type="checkbox"/> 19 200 bit/s	
<input type="checkbox"/> 1 200 bit/s		<input type="checkbox"/> 38 400 bit/s	

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	
<input type="checkbox"/> 100 bit/s	<input type="checkbox"/> 2 400 bit/s	<input type="checkbox"/> 2 400 bit/s	<input type="checkbox"/> 56 000 bit/s
<input type="checkbox"/> 200 bit/s	<input type="checkbox"/> 4 800 bit/s	<input type="checkbox"/> 4 800 bit/s	<input type="checkbox"/> 64 000 bit/s
<input type="checkbox"/> 300 bit/s	<input type="checkbox"/> 9 600 bit/s	<input type="checkbox"/> 9 600 bit/s	
<input type="checkbox"/> 600 bit/s		<input type="checkbox"/> 19 200 bit/s	
<input type="checkbox"/> 1 200 bit/s		<input type="checkbox"/> 38 400 bit/s	

2.4 Link layer

Link transmission procedure

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

Frame length

- ~~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:~~

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

<input checked="" type="checkbox"/>	<1> := Single-point information	M_SP_NA_1
<input type="checkbox"/>	<2> := Single-point information with time tag	M_SP_TA_1
<input checked="" type="checkbox"/>	<3> := Double-point information	M_DP_NA_1
<input type="checkbox"/>	<4> := Double-point information with time tag	M_DP_TA_1
<input checked="" type="checkbox"/>	<5> := Step position information	M_ST_NA_1
<input type="checkbox"/>	<6> := Step position information with time tag	M_ST_TA_1
<input checked="" type="checkbox"/>	<7> := Bitstring of 32 bit	M_BO_NA_1
<input type="checkbox"/>	<8> := Bitstring of 32 bit with time tag	M_BO_TA_1
<input checked="" type="checkbox"/>	<9> := Measured value, normalized value	M_ME_NA_1
<input type="checkbox"/>	<10> := Measured value, normalized value with time tag	M_ME_TA_1
<input checked="" type="checkbox"/>	<11> := Measured value, scaled value	M_ME_NB_1
<input type="checkbox"/>	<12> := Measured value, scaled value with time tag	M_ME_TB_1
<input checked="" type="checkbox"/>	<13> := Measured value, short floating point value	M_ME_NC_1
<input type="checkbox"/>	<14> := Measured value, short floating point value with time tag	M_ME_TC_1
<input checked="" type="checkbox"/>	<15> := Integrated totals	M_IT_NA_1
<input type="checkbox"/>	<16> := Integrated totals with time tag	M_IT_TA_1
<input type="checkbox"/>	<17> := Event of protection equipment with time tag	M_EP_TA_1
<input type="checkbox"/>	<18> := Packed start events of protection equipment with time tag	M_EP_TB_1
<input type="checkbox"/>	<19> := Packed output circuit information of protection equipment with time tag	M_EP_TC_1
<input type="checkbox"/>	<20> := Packed single-point information with status change detection	M_SP_NA_1
<input type="checkbox"/>	<21> := Measured value, normalized value without quality descriptor	M_ME_ND_1
<input checked="" type="checkbox"/>	<30> := Single-point information with time tag CP56Time2a	M_SP_TB_1
<input checked="" type="checkbox"/>	<31> := Double-point information with time tag CP56Time2a	M_DP_TB_1
<input checked="" type="checkbox"/>	<32> := Step position information with time tag CP56Time2a	M_ST_TB_1
<input checked="" type="checkbox"/>	<33> := Bitstring of 32 bit with time tag CP56Time2a	M_BO_TB_1
<input checked="" type="checkbox"/>	<34> := Measured value, normalized value with time tag CP56Time2a	M_ME_TD_1
<input checked="" type="checkbox"/>	<35> := Measured value, scaled value with time tag CP56Time2a	M_ME_TE_1
<input checked="" type="checkbox"/>	<36> := Measured value, short floating point value with time tag CP56Time2a	M_ME_TF_1
<input checked="" type="checkbox"/>	<37> := Integrated totals with time tag CP56Time2a	M_IT_TB_1
<input type="checkbox"/>	<38> := Event of protection equipment with time tag CP56Time2a	M_EP_TD_1
<input type="checkbox"/>	<39> := Packed start events of protection equipment with time tag CP56Time2a	M_EP_TE_1
<input type="checkbox"/>	<40> := Packed output circuit information of protection equipment with time tag CP56Time2a	M_EP_TF_1

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

2.5.6.2 Process information in control direction

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

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

2.5.6.3 System information in monitor direction

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

2.5.6.4 System information in control direction

<input checked="" type="checkbox"/>	<100>:= Interrogation command	C_IC_NA_1
<input checked="" type="checkbox"/>	<101>:= Counter interrogation command	C_CI_NA_1
<input checked="" type="checkbox"/>	<102>:= Read command	C_RD_NA_1
<input checked="" type="checkbox"/>	<103>:= Clock synchronization command (option see 7.6)	C_CS_NA_1
<input 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 checked="" type="checkbox"/>	<107>:= Test command with time tag CP56time2a	C_TS_TA_1

2.5.6.5. Parameter in control direction

<input type="checkbox"/>	<110>:= Parameter of measured value, normalized value	P_ME_NA_1
<input type="checkbox"/>	<111>:= Parameter of measured value, scaled value	P_ME_NB_1

<input type="checkbox"/> <112>:=	Parameter of measured value, short floating point value	P_ME_NC_1
<input type="checkbox"/> <113>:=	Parameter activation	P_AC_NA_1

2.5.6.6 File Transfer

<input type="checkbox"/> <120>:=	File ready	F_FR_NA_1
<input type="checkbox"/> <121>:=	Section ready	F_SR_NA_1
<input type="checkbox"/> <122>:=	Call directory, select file, call file, call section	F_SC_NA_1
<input type="checkbox"/> <123>:=	Last section, last segment	F_LS_NA_1
<input type="checkbox"/> <124>:=	Ack file, ack section	F_AF_NA_1
<input type="checkbox"/> <125>:=	Segment	F_SG_NA_1
<input type="checkbox"/> <126>:=	<i>Directory {blank or X, only available in monitor (standard) direction}</i>	F_DR_TA_I

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 <id> 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																			
<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																			

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																			
<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

Remote initialization

2.6.2. Cyclic data transmission

Cyclic data transmission

2.6.3. Read procedure

Read procedure

2.6.4. Spontaneous transmission

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

- | | | |
|---|--|--|
| <input checked="" type="checkbox"/> global | | |
| <input checked="" type="checkbox"/> group 1 | <input checked="" type="checkbox"/> group 7 | <input checked="" type="checkbox"/> group 13 |
| <input checked="" type="checkbox"/> group 2 | <input checked="" type="checkbox"/> group 8 | <input checked="" type="checkbox"/> group 14 |
| <input checked="" type="checkbox"/> group 3 | <input checked="" type="checkbox"/> group 9 | <input checked="" type="checkbox"/> group 15 |
| <input checked="" type="checkbox"/> group 4 | <input checked="" type="checkbox"/> group 10 | <input checked="" type="checkbox"/> group 16 |
| <input checked="" type="checkbox"/> group 5 | <input checked="" type="checkbox"/> group 11 | |
| <input checked="" type="checkbox"/> group 6 | <input checked="" type="checkbox"/> group 12 | |

2.6.7. Clock synchronization

- Clock synchronization

2.6.8. Command transmission

- 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
- 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

2.6.9. Transmission of integrated totals

- 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

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 master configuration is divided into 3 parts – channel configuration, node configuration & configuration of profile.

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 to which the master has to be connected.

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. Connect Timeout (t0)

Description: Indicates the IP Connect Timeout. This indicates time-out of connection establishment (t0 attribute specified in IEC60870-5-104).

Default: 2 milliseconds

Range: 1-100 milliseconds

3.1.6. First Char Wait

Description: Delay between receiving a character and transmitting next character

Default: 1 milliseconds

Range: 0-100 milliseconds

3.1.7. Time Out

Description: Indicates the Application layer incremental timeout in milliseconds.

Default: 30000 milliseconds

Range: 0-100000 milliseconds

3.1.8. T1Time

Description: Confirm timeout of send or test APDUs. After sending test APDUs (TESTFR = act), the master will wait for 't1' time for the conformation (TESTFR = con) from slave. 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

3.1.9. 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

3.1.10. 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

3.1.11. 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

3.1.12. 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 (slave 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. Originator Address

Description: Originator address of this device, if not used set to zero.

Default: 4

Range: 0-255

3.2.6. Clock Synchronization

Description: To enable/disable clock synchronization.

Default: Enable

Range: Enable / Disable

3.2.7. Clock Synch Type

Description: When to send clock synchronization.

Default: End Of Init

Range: End Of Init, Interval

3.2.8. Clock Synch Interval

Description: Enabled only when Clock Synch Type is Interval. Denotes interval in which clock is synchronized.

Default: 10

Range: 1-120 minutes

3.2.9. General Interrogation

Description: To enable/disable General Interrogation.

Default: Enable

Range: Enable / Disable

3.2.10. General Interrogation Mode

Description: When to request for General Interrogation.

Default: End Of Init

Range: End Of Init, Interval

3.2.11. General Interrogation Interval

Description: Interval in which a General Interrogation command is send.

Default: 5

Range: 1-120 minutes

3.2.12. Group Interrogation

Description: To enable/disable Group Interrogation.

Default: Enable

Range: Enable/Disable

3.2.13. Group Interrogation Mode

Description: When to request for Group Interrogation.

Default: End Of Init

Range: End Of Init, Interval

3.2.14. Group Interrogation Interval-1

Description: Enabled only when Group Interrogation Mode is Interval. Denotes interval for scan group -1.

Default: 5

Range: 1-120 minutes

3.2.15. Scan Groups for Interval-1

Description: Groups defined under Interval-1

Default:

Range: Group 1 to 16

3.2.16. Group Interrogation Interval-2

Description: Enabled only when Group Interrogation Mode is Interval. Denotes interval for scan group-2.

Default: 10

Range: 1-120 minutes

3.2.17. Scan Groups for Interval-2

Description: Groups defined under Interval-2

Default:

Range: Group 1 to 16

3.2.18. Group Interrogation Interval-3

Description: Enabled only when Group Interrogation Mode is Interval. Defines interval for scan group-3.

Default: 15

Range: 1-120 minutes

3.2.19. Scan Groups for Interval-3

Description: Groups defined under Interval-3

Default:

Range: Group 1 to 16

3.2.20. Counter Interrogation

Description: To enable/disable Counter Interrogation.

Default: Enable

Range: Enable/Disable

3.2.21. Counter Interrogation Mode

Description: When to request for Counter Interrogation.

Default: End Of Init

Range: End Of Init, Interval

3.2.22. Counter Interrogation Interval

Description: Enabled only when counter Interrogation Mode is Interval. Denotes interval in which a Counter Interrogation Command is Send.

Default: 10

Range: 1-120 minutes

3.2.23. Counter Group Interrogation

Description: To enable/disable Counter Group Interrogation.

Default: Enable

Range: Enable / Disable

3.2.24. Counter Group Interrogation Mode

Description: When to request for Counter Group Interrogation.

Default: End Of Init

Range: End Of Init, Interval

3.2.25. Counter Group Interrogation Interval

Description: Interval in which a Counter Group Interrogation Command is Send.

Default: 15

Range: 1-120 minutes

3.2.26. Scan Groups for Counter Interrogation

Description: Groups defined for Counter Group Interrogation

Default:

Range: Group 1 to 4

3.2.27. CSE Activation Termination

Description: Expect activation termination on CSE commands

Default: Enable

Range: Enable / Disable

3.2.28. CMD Activation Termination

Description: Expect activation termination on all other commands Expect activation termination on all other commands

Default: Enable

Range: Enable / Disable

3.3. Profile 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.~~