

SPA Master Protocol Details
for
KALKI Protocol Gateway/GatewayLite

Product User Guide

Version – 1.0

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1. Introduction

SPA master is implemented as a part of Kalki Substation GatewayLite / Protocol gateway. This document contains the details of SPA master protocol which includes interoperability, configuration details and mapping details to other protocols.

2. Protocol Interoperability List

The types, which are not supported in KALKI GatewayLite, are stroked off.

2.1. Channel / Node Parameters

Channel Attributes	Default Value	Supported Values	Details
Channel Type	RS232	RS232,RS485	Indicates the physical type of Channel
Baud Rate	9600	9600 , 19200	Indicates the baud rate.
Data Bits	7	7,8	Indicates the number of data bits.
Stop Bits	1	1,2	Indicates the Number of Stop Bits.
Parity	Even	Even ,Odd, None	Indicates the Parity Type
Port	Com1	Com1 → 4	Indicates the Name of the Port
Flow Control	None	H/W, S/W ,None	Indicates the type of flow control.
Poll Delay in mSec	100	0 → 100	Indicates the minimum Delay between reception of data and next poll.
CTS Delay in mSec	30	0 → 100	Indicates the Delay between rising of CTS signal by the modem and starting of a new transmission
Header Timeout	1000	0 → 100000	Indicates the maximum waiting time in milliseconds within which the first byte of a response from the Station should have been received after the transmission of a request message.
Retries	3	0 → 5	Indicates the Maximum number of retries.
Events Per poll Cycle	4	1→10	Indicates number of event polls on a complete poll cycle. By changing the ratio between EventsPerPollCycle and DatapollsPerPollCycle , more priority can be assigned to the event poll
Data Polls Per Poll Cycle	1	1→10	Indicates number of data polls on a complete poll cycle.
Time Synchronization	Enable	Enable , Disable	Enables or disables time synchronization. (Both 'D' & 'T' SPA types will get enabled. 'T' type synchronization will be send for every second & 'D' type for

			every minute.)
Node Address	1	1 → 255	Indicates the Address of Remote Device
Integrity Poll for Events	20 min	1 → 100 min	Indicates the Event updated points are polled periodically with this interval to ensure that the value in the database is fine.
Poll Cycle	1 sec	0 → 255 sec	Indicates the Minimum time interval between two consecutive polls on any cyclically updated point.

2.2. Protocol Specific Features

Feature	Object Types	Supported SPA Data Types	Supported Formats	Interval
Read Data	SI, DI, AI	I, O, V, S, M, C	Bool, Hex, Real, LongInt	Configurable
Write Data (commands)	SC,DC, AO	I, O, V, S, M, C	Bool, Hex, Real, LongInt	Configurable
Read Events	SI,DI	L, B	E, Q	Configurable
Time Synchronization	--	T		1 sec
Date & Time Synchronization	--	D		1 minute
Event Integrity Poll	SI,DI	I, O, V, S, M, C	Bool, Hex, Real, LongInt	Configurable
Polling Suspended stations	--	F		Configurable
Parameterization (through Transparent Channel)				
File Transfer		M		
Alarm Data		A		
Disturbance Recording		M, V		

3. Protocol Profile Details

3.1. Object Type: -

Each profile entry is classified according to it's type. Various available types and it's details are given below.

Object Types	Details
SI (Single Indications)	These are the single indications, which can hold a single binary value.
DI (Double Indications)	These objects can have values 0 → 3. '1' is considered as off state and '2' is considered as on state.
AI (Analog Input)	It can hold various analog values depending upon the data format specified.
PC (Pulse Counter)	It can hold various analog values depending upon the data format specified. It gets mapped to corresponding pulse counters present in the slave.

OC (Object Command / Single Command)	It is a single command using which we can set either 0 or 1 to a corresponding address.
AO (Analog Output)	Using this we can set an analog set point to an address.
DC (Double Command)	It is a double command. '1' indicates off state and '2' indicates the on state.

3.2. Update Method: -

Kalki GatewayLite supports the following methods of updating.

Update Method	Details
Update By Polling	This implies that the corresponding point gets updated only by frequent polling for the data. Supported data types for this update method are I, O, V, S, M & C. For all AI and PC object types, updating is only possible using polling. It is configurable for both SI & DI. "Poll Cycle" coming under the node specifies the time interval for the polling.
Event Consume	This indicates that only specified events update the corresponding point. Supported data types for this update method are L & B. This is only applicable for object types SI & DI.
Event And Polling	This is composite of the two-update methods mentioned above. The corresponding point will get updated both by events and by polling. "Integrity Poll for Events" coming under the node specifies time interval for the integrity poll.

3.3. SPA Data Categories: -

According to SPA protocol, each data is classified into different types. The types supported by the Gateway and it's details are given below.

Object Types		Details & Implementation in Gateway
I	Input data	Includes slave analog input values and digital input states. Selectable for the entire object types available in the profile.
O	Output data	Includes slave analog output values and digital output states. Selectable for the entire object types available in the profile.
S	Setting values	The setting values generally include such data, which sets the parameters of the slave to be compatible with the current operating situation. Selectable for the entire object types available in the profile.
V	Variables (internal)	The internal variables include such data which: <ul style="list-style-type: none"> - gives complementing data on the supervised process or its events - gives complementing data on the slave or its functions - controls the functions of the slave in an operating situation - programs some general functions of the slave. Selectable for the entire object types available in the profile.
M	Memory data	Includes memory stored measurement or status data. This kind of memory-stored data is typically available only from datalogger type

		slaves. It can be used for transferring different kinds of complementary data, such as dimensional units and verbose parts of transferred data or programming data. Selectable for the entire object types available in the profile.
C	Slave status (conditions)	It is used to indicate various slave status like reset of the slave, event buffer overflow etc. Selectable for the entire object types available in the profile.
F	Slave identification	The slave type is identified by an identification code (max. length 10 characters). The ID code can be, for instance, the product code of the slave. In Kalki GatewayLite, all the slave stations will be treated as offline at startup. GatewayLite will request for identification of all the configured stations using slave identification request ('F' type). The stations that are responding correctly to this request will be treated as online. All the data/event requests for the station will be send only after it's state becomes online. When timer for suspended poll (attribute present under channel) expires, all the suspended (offline) stations will be polled using slave identification request. A station will go offline when it does not responds to any request even after the retries.
T	Time	This is used to send time synchronization command to slaves. Using this will synchronize only second and millisecond. Kalki GatewayLite will send this broadcast command every second if time synchronization is enabled for the channel.
D	Date and time	This is used to send date & time synchronization command to slaves. Kalki GatewayLite will send this broadcast command every minute if time synchronization is enabled for the channel.
L	Last events	Data category L includes events entered into the event buffer after the last request.. The station will send event poll depending upon the configured ratio between event poll per cycle and data poll per cycle. When the corresponding event is configured in the profile (update method as event consume or event and polling), the data will be updated in the database depending upon the event to data conversion.
B	Last events from backup buffer	Data category B includes same data as data category L. Generally, the master requests the slave for latest events by addressing data category L. re-request data category L but instead it will request data category B.
A	Alarms valid	This is not included in present version of the protocol converter.

3.4. Data Format: -

There are 4 different types of data format available for SPA. They are

- Bits
- Hexadecimal
- Long Integer
- Real

3.5. Channel Number:

The channel number is given in decimal format as 0...999.

Only one channel number at a time can be issued if information associated with a specified channel is requested. Information associated with a string of several channels can be requested by issuing the numbers of the first and last desired channel in the request message.

3.6. Data Number: -

The data number is given in decimal format as 1...999999.

Data items in each data category of the slave are numbered. A string of several data items can be addressed by issuing the number of first and last item of the string.

3.7. Event to Data Conversion: -

Whenever an event based updating for SI or DI is chosen, event to data conversion has to be given correctly.

The data part in this has to be filled as double indication having '1' as off state and '2' as on state.

For example if 25E10 corresponds to breaker on status and 25E11 corresponds to breaker off status, then the entries for event to data conversion are as follows

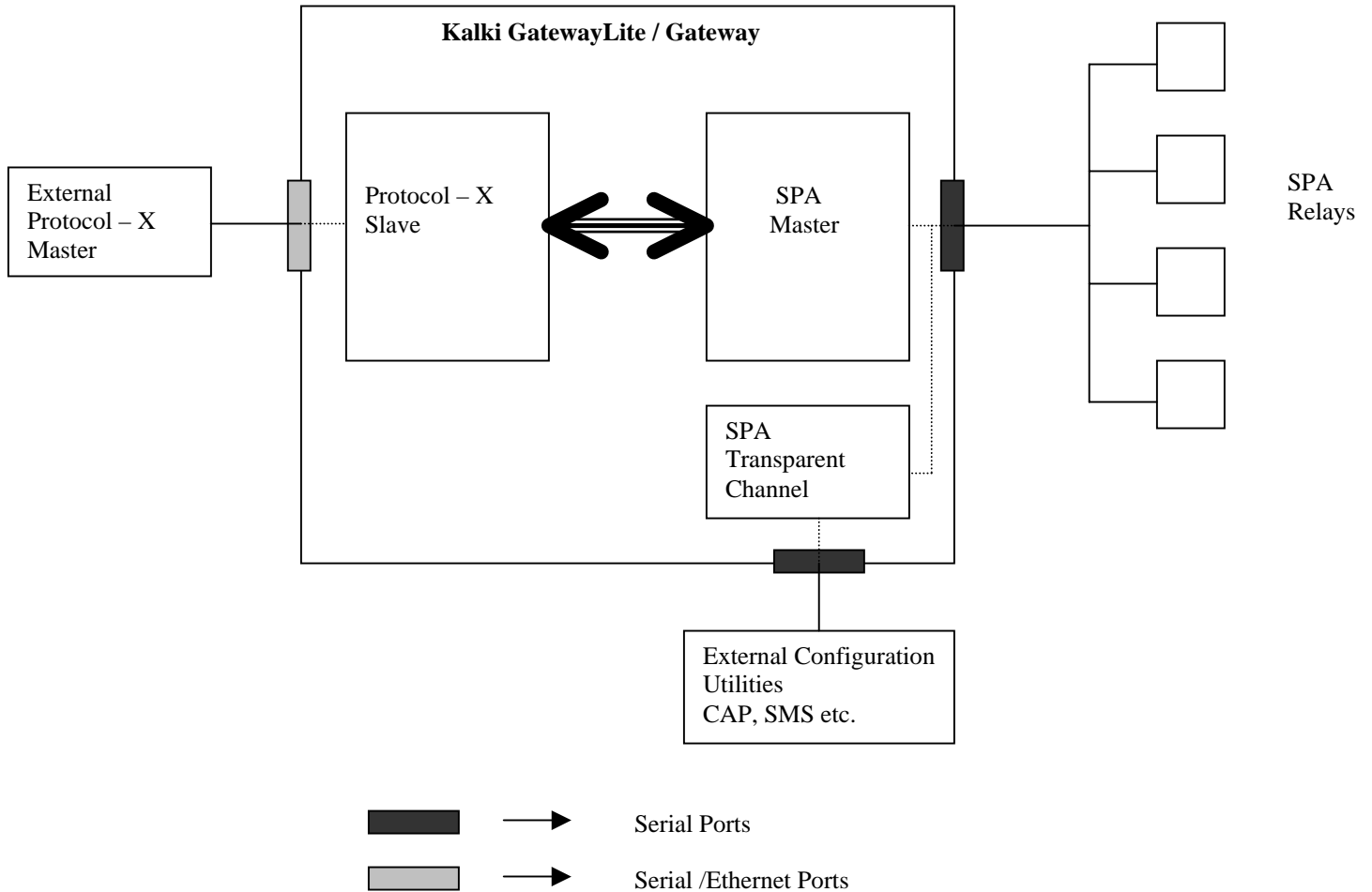
Event Number	Data
10	2
11	1

if 25E10 corresponds to breaker on status , 25E11 → breaker off status, 25E12 → invalid position & 25E13 → error position then the entries for event to data conversion are as follows

Event Number	Data
10	2
11	1
12	0
13	3

4. Parameterization through Transparent Channel: -

Kalki GatewayLite / Gateway provides a special functionality for parameterization of relays using SPA protocol. This can be done through a transparent (pass – through) channel. This enables you to connect an external spa master (CAP, SMS etc.) through another serial port whose requests are passed to the slave devices. The responses for these messages will be directly passed to the external SPA master. The details of this configuration is given below.



The transparent channel can be configured under the SPA master channel using “Easy Connect” configuration utility.

5. Mapping Details to other protocols: -

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

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

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

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

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