FANOX

power T&D

KEMA Laboratories

DNV·GL

SIA-B

Self and Dual Powered Overcurrent & Earth Fault Protection Relay **with Standard Current Transformers.**

DNP3.0 SERIAL PROTOCOL MANUAL

1. DNP3.0 PROTOCOL.....3

1. DNP3.0 PROTOCOL

Communication parameters are:

DNP 3.0 Serial:

- Address and Baudrate
- 8 data bit
- No parity
- 1 stop bit.

1.1. Device Profile Document

DNP V3.00 **DEVICE PROFILE DOCUMENT** This document must be accompanied by : **Implementation Table** and **Point List**.	
Vendor Name: **FANOX Electronic, S.L.**	
Device Name: **SIA-B**	
Highest DNP Level Supported: For Requests **2** For Responses **2**	Device Function: ☐ Master ☒ **Slave**
Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP Levels Supported (the complete list is described in the attached table): **Static object requests sent with qualifiers 06, will be responded with qualifiers 01.32-bit and Analog Change Events with Time may be requested.**	
Maximum Data Link Frame Size (octets): Transmitted **255** Received **255**	Maximum Application Fragment Size (octets): Transmitted **217** Received **217**

Maximum Data Link Re-tries:	Maximum Application Layer Re-tries:
☒ None ☐ Fixed at _____ ☐ Configurable.	☒ **None** ☐ Configurable

Requires Data Link Layer Confirmation:

- ☒ Never
- ☐ Always
- ☐ Sometimes. If 'Sometimes', when? _____
- ☐ Configurable as Never, Only for multi-frame messages, or Always. Default Never

Requires Application Layer Confirmation:

- ☒ Never
- ☐ Always (not recommended)
- ☐ When reporting Event Data (Slave devices only)
- ☐ When sending multi-fragment responses (Slave devices only)
- ☐ Sometimes. If 'Sometimes', when?
- ☐ Configurable as: "Only when reporting event data", or "When reporting event data or multi-fragment messages."

Timeouts while waiting for:

Data Link Confirm	☒ None	☐ Default at 5000ms	☐ Variable	☐ Configurable
Complete Appl. Fragment	☒ **None**	☐ Fixed at ____	☐ Variable	☐ Configurable
Application Confirm	☐ None	☐ Default at 5000ms	☒ **Variable**	☐ Configurable
Complete Appl. Response	☒ **None**	☐ Fixed at ____	☐ Variable	☐ Configurable

Others

Sends/Executes Control Operations:

SELECT (3) / OPERATE (4)	☐ Never	☒ **Always**	☐ Sometimes	☐ Configurable
DIRECT OPERATE (5)	☐ Never	☒ **Always**	☐ Sometimes	☐ Configurable
DIRECT OPERATE - NO ACK (6)	☒ **Never**	☐ Always	☐ Sometimes	☐ Configurable
Count > 1	☒ **Never**	☐ Always	☐ Sometimes	☐ Configurable
Pulse On	☒ **Never**	☐ Always	☐ Sometimes	☐ Configurable
Pulse Off	☒ **Never**	☐ Always	☐ Sometimes	☐ Configurable
Latch On	☐ Never	☒**Always**	☐ Sometimes	☐ Configurable
Latch Off	☐ Never	☒**Always**	☐ Sometimes	☐ Configurable
Queue	☒ **Never**	☐ Always	☐ Sometimes	☐ Configurable
Clear Queue	☒ **Never**	☐ Always	☐ Sometimes	☐ Configurable

_____

Attach explanation:

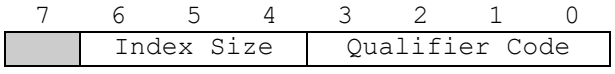
All points support the same Function Codes: Select Before Operate (SBO) and Direct Operate (DO).
All points support the same Control Codes: Latch ON, Latch OFF.

FILL OUT THE FOLLOWING ITEMS FOR SLAVE DEVICES ONLY:	
Reports Binary Input Change Events when no specific variation requested: ☐ Never ☐ Only time-tagged ☒ **Only non-time-tagged** ☐ Configurable to send both, one or the other (attach explanation)	Reports time-tagged Binary Input Change Events when no specific variation requested: ☐ Never ☒ **Binary Input Change with Time** ☐ Binary Input Change with Relative Time ☐ Configurable (attach explanation)
Sends Unsolicited Responses: ☐ Never ☐ Configurable ☐ Only certain objects (Class 1) ☐ Sometimes (attach explanation) ☒ **ENABLE/DISABLE UNSOLICITED**	Sends Static Data in Unsolicited Responses: ☒ **Never** ☐ When Device Restarts ☐ When Status Flags Change No other options are permitted.
Default Counter Object/Variation: ☐ No Counters Reported ☐ Configurable (attach explanation) ☒ **Default Object 20** **Default Variation 01** ☐ Point-by-point list attached	Counters Roll Over at: ☐ No Counters Reported ☐ Configurable (attach explanation) ☐ 16 Bits ☒ **32 Bits** ☐ Other Value _____ ☐ Point-by-point list attached
Sends Multi-Fragment Responses: ☐ Yes ☒ No	

QUICK REFERENCE FOR DNP3.0 LEVEL 2 FUNCTION CODES & QUALIFIERS

Function Codes

1	Read
2	Write
3	Select
4	Operate
5	Direct Operate
6	Direct Operate-No ACK
13	Cold Start
14	Warm Start
20	Enable Unsol. Messages
21	Disable Unsol. Messages
23	Delay Measurement
129	Response
130	Unsolicited Message



Index Size

0- No Index, Packed
1- 1 Byte Index
2- 2 Byte Index
3- 4 Byte Index
4- 1 Byte Object Size
5- 2 Byte Object Size
6- 4 Byte Object Size

Qualifier Code

0- 8-Bit Start and Stop Indices
1- 16-Bit Start and Stop Indices
2- 32-Bit Start and Stop Indices
3- 8-Bit Absolute Address Ident.
4- 16-Bit Absolute Address Ident.
5- 32-Bit Absolute Address Ident.
6- No Range Field (All)
7- 8-Bit Quantity
8- 16-Bit Quantity
9- 32-Bit Quantity
11-(0xB) Variable array

1.2. Implementation Table

The following implementation table indentifies which object groups and variations, function codes and qualifiers the device supports in both requests and responses. The *Requests* columns identify all requests that may be sent by a master, or all requests that must be parsed by an outstation. The *Response* columns identify all responses that must be parsed by a Master, or all responses that may be sent by an outstation.

In the table below, text shaded as 01(start-stop) indicates subset Level 3 functionality (beyond Subset Level 2).

In the table below, text shaded as 08(limited qty) indicates functionality beyond Subset Level 3.

OBJECT			REQUEST (BCD will parse)		RESPONSE (BCD will respond)		
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes (dec)**	**Qual Codes (hex)**	**Notes**
1	0	Binary Input - Any variation	1 (read)	6 (no range, or all)			
1	1	Binary Input - Packed Format	1 (read)	06 (no range, or all)	129 (response)	01 (start - stop)	
1	2	Binary Input - With Flags **(Default)**	1 (read)	06 (no range, or all)	129 (response)	01 (start - stop)	Assigned to Class 0
2	0	Binary Input Event - Any variation	1 (read)	06 (no range, or all)			
2	2	Binary Input Event – with absolute Time **(Default)**	1 (read)	06 (no range, or all)	129 (response), 130 (unsolicited)	28 (index)	Assigned to Class 1.
10	0	Binary Output – Any variation	1 (read)	06 (no range, or all)			
10	2	Binary Output – Output status with flags **(Default)**	1 (read)	06 (no range, or all)	129 (response)	01 (start - stop)	Assigned to Class 0.
11	0	Binary Output Event – Any Variation	1 (read)	06 (no range, or all)			
11	2	Binary Output Event – Status with Time **(Default)**	1 (read)	06 (no range, or all)	129 (response) 130 (unsolicited)	28 (index)	Assigned to Class 1
12	1	Binary Command – Control Relay Output Block (CROB)	3 (Select) 4 (Operate) 5 (Direct Operate)	28 (index)			
20	0	Counter – Any Variation	1 (read)	06 (no range, or all)			
20	1	Counter – 32 Bit with flag **(Default)**	1 (read)	06 (no range, or all)	129 (response)	01 (start - stop)	Assigned to Class 0

OBJECT			REQUEST (BCD will parse)		RESPONSE (BCD will respond)		
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes (dec)**	**Qual Codes (hex)**	**Notes**
21	0	Frozen Counter – Any Variation	1 (read)	06 (no range, or all)			
21	1	Frozen Counter – 32 Bit with flag **(Default)**	1 (read)	06 (no range, or all)	129 (response)	01 (start - stop)	
22	0	Counter Event – Any Variation	1 (read)	06 (no range, or all)			Assigned to Class 1
22	1	Counter Event – 32 Bit with flag **(Default)**	1 (read)	06 (no range, or all)	129 (response) 130 (unsolicited)	28 (index)	
30	0	Analog Input – Any Variation	1 (read)	06 (no range, or all)			
30	1	Analog Input – 32-Bit with flag **(Default)**	1 (read)	06 (no range, or all)	129 (response)	00 (start - stop)	Assigned to Class 0
32	0	Analog Input Event – Any variation	1 (read)	06 (no range, or all)			
32	1	Analog Input Event – 32-Bit without Time **(Default)**	1 (read)	06 (no range, or all)	129 (response) 130 (unsolicited)	28 (index)	Assigned to Class 2
50	1	Time and Data – Absolute time	2 (write) 3 (read)	07 (limited qty = 1)			
60	1	Class Objects – Class 0 Data	1 (read)	06 (no range, or all)			
60	2	Class Objects – Class 1 Data	1 (read)	06 (no range, or all)			
60	3	Class Objects – Class 2 Data	1 (read)	06 (no range, or all)			

1.3. Point List

BINARY INPUT (OBJECT 1) -> Assigned to Class 0. BINARY INPUT CHANGE (OBJECT 2) -> Assigned to Class 1.		
Index	**Criteria**	**Point**
00	**General**	Trip
01		External Trip
02		No Trip Power
03		50 Hz
04		Trip Block Enable
05		Measure Error
06		Ready
07		Settings Changed
08		Set Date /Time
09		Local Activity
10		Factory Settings
11		EEPROM Error
12		EEPROM Changed
13		Events Erased
14		New DFR
15		Reset
16		Pickup
17		Phase A Pickup
18		Phase B Pickup
19		Phase C Pickup
20		Neutral Pickup
21		Phase A Trip
22		Phase B Trip
23		Phase C Trip
24		50 Trip
25		50G Trip
26		Auxiliary Power
27		Self-powering
28		Battery
29	**50_1**	50_1 Pickup
30		50_1 Trip
31	**50_2**	50_2 Pickup
32		50_2 Trip

BINARY INPUT (OBJECT 1) -> Assigned to Class 0. BINARY INPUT CHANGE (OBJECT 2) -> Assigned to Class 1.		
Index	**Criteria**	**Point**
33	**51**	51 Pickup
34		51 Trip
35	**50G_1**	50G_1 Pickup
36		50G_1 Trip
37	**50G_2**	50G_2 Pickup
38		50G_2 Trip
39	**51G**	51G Pickup
40		51G Trip
41	**46**	46 Pickup
42		46 Trip
43	**49**	49 Alarm
44		49 Trip
45	**SHB**	SHB Phase Block
46	**52**	52 Error
47		52 Open
48		52 Opening time
49		52 Opening Error
50		52 Closed
51		52 Closing time
52		52 Closing Error
53		52 Max. Number of openings
54		52 Max. Accumulated amperes (I2t).
55		52 Max. openings/Time
56	**CLP**	Cold Load Pickup
57	**50BF**	50BF Pickup
58		50BF Trip
59	**Trip Block**	Phase Block
60	**Input**	Input 1
61		Input 2
62		Input 3

Hola que tal solo tenemos

BINARY INPUT (OBJECT 1) -> Assigned to Class 0. BINARY INPUT CHANGE (OBJECT 2) -> Assigned to Class 1.		
Index	**Criteria**	**Point**
63	Local Communication	Open Breaker
64		Close Breaker
65		Reset Thermal Image
66	Remote Communication	Open Breaker
67		Close Breaker
68		Reset Thermal Image

BINARY OUTPUT (OBJECT 10) -> Assigned to Class 0. BINARY OUTPUT CHANGE (OBJECT 11) -> Assigned to Class 1.		
Index	**Description**	
0	Output 1	
1	Output 2	
2	Output 3	
3	Trip Output	

ANALOG INTPUT (OBJECT 30) -> Assigned to Class 0. ANALOG INTPUT CHANGE (OBJECT 32) -> Assigned to Class 2.		
Index	**Description**	
0	Phase A current IA	
1	Phase B current IB	
2	Phase C current IC	
3	Neutral current IN	
4	Negative sequence current I-2	
5	Phase A second harmonic current IA-2H	
6	Phase B second harmonic current IB-2H	
7	Phase C second harmonic current IC-2H	
8	Maximum phase current IMAX	
9	Thermal Image TI	

Measurements are in primary values with a scalefactor of 100.

i.e. A current measurement of 2A in secondary with a RT=20 will be shown as 2*20*100=4000

The DeadBand of the current measurements is adjustable by General settings and it is X% of the Nominal Current (X%*In).

i.e. If the In = 1A and the deadband is adjusted to 10%, then

10%*1A = 0.1 (100mA), the measurement will be reported by event when it changes more than 100 mA and if the In = 5A, the deadband will be 10%*5A = 0.1 (500mA), the measurement will be reported by event when it changes more than 500 mA.

COUNTER (OBJECT 20) -> Assigned to Class 0. COUNTER EVENT (OBJECT 22) -> Assigned to Class 1. FROZEN COUNTER (OBJECT21)		
Index	**Description**	
0	Openings Number	
1	Accumulated Amperes	

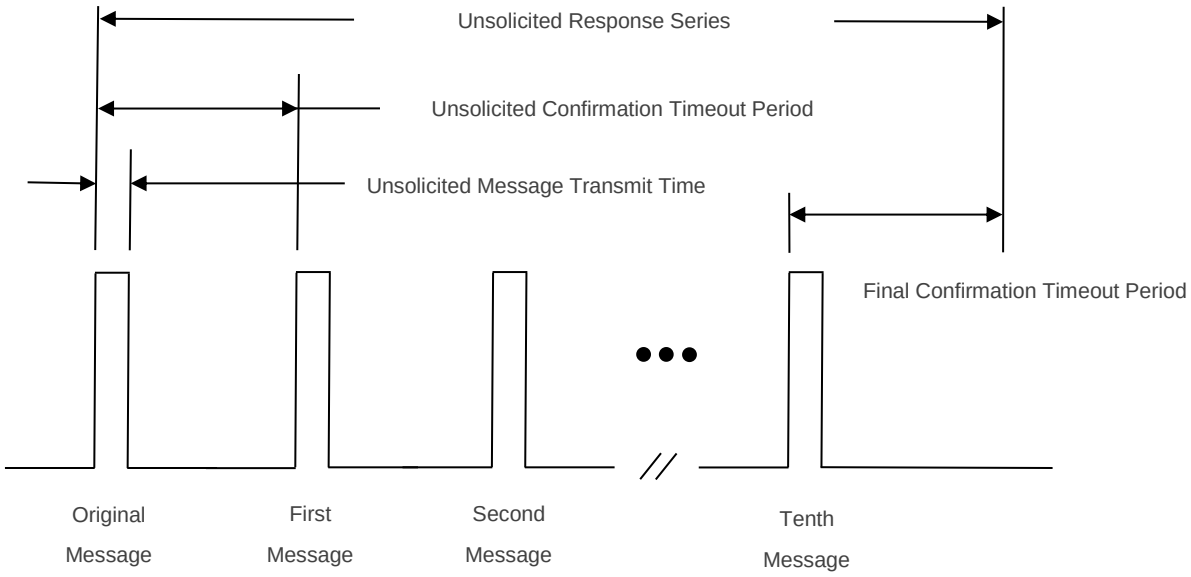
CONTROL RELAY OUTPUT BLOCK (OBJECT 12)		
Index	**Description**	
0	Opening Command	Point Number = 0 (ON)
1	Closing Command	Point Number = 0 (OFF)
5	Thermal Image Command	Point Number = 3 (ON)

1.4. Unsolicited Responses

Unsolicited responses are messages spontaneously sent from SIA-B without a specific request from a master station when “something of significance” occurs.

The SIA-B relay supports the functions code 29 (Enable Unsolicited Responses) and 30 (Disable Unsolicited Responses). The SIA-B default configuration has the unsolicited responses disable, if the user wants to start using these messages must perform the function code 29. After the function code 29 is sent, the user must open the communication port. This communication port is set to 20000 as default.

The unsolicited responses behavior follows the procedure decribed in the standard and it is illustrated in the following diagram:



After the original message in sent, the outstation waits two seconds for the master confirmation, this time is shown as the *Unsolicited Confirmation Timeout Period* in the figure. If the outstation does not receive any confirmation from the master, then the outstation replies the original message in a serie of ten messages.

All the Binary Inputs, Outputs and Counter changes described previously in this document are available to be sent in an Unsolicited Response message.

The measurements sent via Analog Input objects are available to be sent in an Unsolicited response considering the deadband variation previously explained in this document regarding the specific data object (Current).

Note: Only the first eight measurements will be considered as data in unsolicited responses using the Analog Input Change object.

FANOX

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