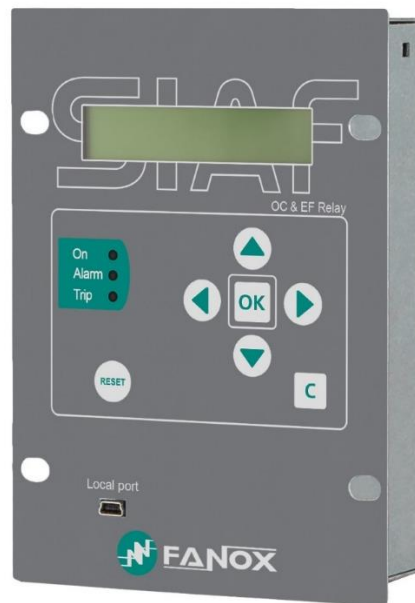




power T&D



## SIA F

Overcurrent & Earth Fault Protection Relay

**DNP3.0 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

<h1>DNP V3.00</h1> <h2>DEVICE PROFILE DOCUMENT</h2> <p>This document must be accompanied by : <b>Implementation Table</b> and <b>Point List</b>.</p>	
<p>Vendor Name:  <b>FANOX Electronic, S.L.</b></p>	
<p>Device Name: <b>SIA-F</b></p>	
<p>Highest DNP Level Supported:</p> <p>For Requests     <b>2</b> For Responses    <b>2</b></p>	<p>Device Function:</p> <p><input type="checkbox"/> Master <input checked="" type="checkbox"/> <b>Slave</b></p>
<p>Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP Levels Supported (the complete list is described in the attached table):</p> <p><b>Static object requests sent with qualifiers 06, will be responded with qualifiers 01.</b> <b>32-bit and Analog Change Events with Time may be requested.</b></p>	
<p>Maximum Data Link Frame Size (octets):</p> <p>Transmitted     <u>  <b>255</b>  </u> Received         <u>  <b>255</b>  </u></p>	<p>Maximum Application Fragment Size (octets):</p> <p>Transmitted     <u>  <b>217</b>  </u> Received         <u>  <b>217</b>  </u></p>

<p>Maximum Data Link Re-tries:</p> <p><input checked="" type="checkbox"/> None</p> <p><input type="checkbox"/> Fixed at _____</p> <p><input type="checkbox"/> Configurable.</p>	<p>Maximum Application Layer Re-tries:</p> <p><input checked="" type="checkbox"/> <b>None</b></p> <p><input type="checkbox"/> Configurable</p>																																																		
<p>Requires Data Link Layer Confirmation:</p> <p><input checked="" type="checkbox"/> Never</p> <p><input type="checkbox"/> Always</p> <p><input type="checkbox"/> Sometimes. If 'Sometimes', when? _____</p> <p><input type="checkbox"/> Configurable as Never, Only for multi-frame messages, or Always. Default Never</p>																																																			
<p>Requires Application Layer Confirmation:</p> <p><input checked="" type="checkbox"/> Never</p> <p><input type="checkbox"/> Always (not recommended)</p> <p><input type="checkbox"/> When reporting Event Data (Slave devices only)</p> <p><input type="checkbox"/> When sending multi-fragment responses (Slave devices only)</p> <p><input type="checkbox"/> Sometimes. If 'Sometimes', when?</p> <p><input type="checkbox"/> Configurable as: "Only when reporting event data", or "<u>When reporting event data or multi-fragment messages.</u>"</p>																																																			
<p>Timeouts while waiting for:</p> <table style="width: 100%; border: none;"> <tr> <td>Data Link Confirm</td> <td><input checked="" type="checkbox"/> None</td> <td><input type="checkbox"/> Default at 5000ms</td> <td><input type="checkbox"/> Variable</td> <td><input type="checkbox"/> Configurable</td> </tr> <tr> <td>Complete Appl. Fragment</td> <td><input checked="" type="checkbox"/> <b>None</b></td> <td><input type="checkbox"/> Fixed at _____</td> <td><input type="checkbox"/> Variable</td> <td><input type="checkbox"/> Configurable</td> </tr> <tr> <td>Application Confirm</td> <td><input type="checkbox"/> None</td> <td><input type="checkbox"/> Default at 5000ms</td> <td><input checked="" type="checkbox"/> <b>Variable</b></td> <td><input type="checkbox"/> Configurable</td> </tr> <tr> <td>Complete Appl. Response</td> <td><input checked="" type="checkbox"/> <b>None</b></td> <td><input type="checkbox"/> Fixed at _____</td> <td><input type="checkbox"/> Variable</td> <td><input type="checkbox"/> Configurable</td> </tr> </table> <p>Others</p>		Data Link Confirm	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Default at 5000ms	<input type="checkbox"/> Variable	<input type="checkbox"/> Configurable	Complete Appl. Fragment	<input checked="" type="checkbox"/> <b>None</b>	<input type="checkbox"/> Fixed at _____	<input type="checkbox"/> Variable	<input type="checkbox"/> Configurable	Application Confirm	<input type="checkbox"/> None	<input type="checkbox"/> Default at 5000ms	<input checked="" type="checkbox"/> <b>Variable</b>	<input type="checkbox"/> Configurable	Complete Appl. Response	<input checked="" type="checkbox"/> <b>None</b>	<input type="checkbox"/> Fixed at _____	<input type="checkbox"/> Variable	<input type="checkbox"/> Configurable																														
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Complete Appl. Response	<input checked="" type="checkbox"/> <b>None</b>	<input type="checkbox"/> Fixed at _____	<input type="checkbox"/> Variable	<input type="checkbox"/> Configurable																																															
<p>Sends/Executes Control Operations:</p> <table style="width: 100%; border: none;"> <tr> <td>SELECT (3) / OPERATE (4)</td> <td><input type="checkbox"/> Never</td> <td><input checked="" type="checkbox"/> <b>Always</b></td> <td><input type="checkbox"/> Sometimes</td> <td><input type="checkbox"/> Configurable</td> </tr> <tr> <td>DIRECT OPERATE (5)</td> <td><input checked="" type="checkbox"/> Never</td> <td><input type="checkbox"/> <b>Always</b></td> <td><input type="checkbox"/> Sometimes</td> <td><input type="checkbox"/> Configurable</td> </tr> <tr> <td>DIRECT OPERATE - NO ACK (6)</td> <td><input checked="" type="checkbox"/> <b>Never</b></td> <td><input type="checkbox"/> Always</td> <td><input type="checkbox"/> Sometimes</td> <td><input type="checkbox"/> Configurable</td> </tr> <tr> <td>Count &gt; 1</td> <td><input checked="" type="checkbox"/> <b>Never</b></td> <td><input type="checkbox"/> Always</td> <td><input type="checkbox"/> Sometimes</td> <td><input type="checkbox"/> Configurable</td> </tr> <tr> <td>Pulse On</td> <td><input checked="" type="checkbox"/> <b>Never</b></td> <td><input type="checkbox"/> Always</td> <td><input type="checkbox"/> Sometimes</td> <td><input type="checkbox"/> Configurable</td> </tr> <tr> <td>Pulse Off</td> <td><input checked="" type="checkbox"/> <b>Never</b></td> <td><input type="checkbox"/> Always</td> <td><input type="checkbox"/> Sometimes</td> <td><input type="checkbox"/> Configurable</td> </tr> <tr> <td>Latch On</td> <td><input type="checkbox"/> Never</td> <td><input checked="" type="checkbox"/> <b>Always</b></td> <td><input type="checkbox"/> Sometimes</td> <td><input type="checkbox"/> Configurable</td> </tr> <tr> <td>Latch Off</td> <td><input type="checkbox"/> Never</td> <td><input checked="" type="checkbox"/> <b>Always</b></td> <td><input type="checkbox"/> Sometimes</td> <td><input type="checkbox"/> Configurable</td> </tr> <tr> <td>Queue</td> <td><input checked="" type="checkbox"/> <b>Never</b></td> <td><input type="checkbox"/> Always</td> <td><input type="checkbox"/> Sometimes</td> <td><input type="checkbox"/> Configurable</td> </tr> <tr> <td>Clear Queue</td> <td><input checked="" type="checkbox"/> <b>Never</b></td> <td><input type="checkbox"/> Always</td> <td><input type="checkbox"/> Sometimes</td> <td><input type="checkbox"/> Configurable</td> </tr> </table> <hr style="border: 0; border-top: 1px solid black; margin: 5px 0;"/> <p>Attach explanation:</p> <p><b>All points support the same Function Codes: Select Before Operate (SBO).</b></p> <p><b>All points support the same Control Codes: Latch ON, Latch OFF.</b></p>		SELECT (3) / OPERATE (4)	<input type="checkbox"/> Never	<input checked="" type="checkbox"/> <b>Always</b>	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable	DIRECT OPERATE (5)	<input checked="" type="checkbox"/> Never	<input type="checkbox"/> <b>Always</b>	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable	DIRECT OPERATE - NO ACK (6)	<input checked="" type="checkbox"/> <b>Never</b>	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable	Count > 1	<input checked="" type="checkbox"/> <b>Never</b>	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable	Pulse On	<input checked="" type="checkbox"/> <b>Never</b>	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable	Pulse Off	<input checked="" type="checkbox"/> <b>Never</b>	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable	Latch On	<input type="checkbox"/> Never	<input checked="" type="checkbox"/> <b>Always</b>	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable	Latch Off	<input type="checkbox"/> Never	<input checked="" type="checkbox"/> <b>Always</b>	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable	Queue	<input checked="" type="checkbox"/> <b>Never</b>	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable	Clear Queue	<input checked="" type="checkbox"/> <b>Never</b>	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
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**FILL OUT THE FOLLOWING ITEMS FOR SLAVE DEVICES ONLY:**

Reports Binary Input Change Events when no specific variation requested: <input type="checkbox"/> Never <input type="checkbox"/> Only time-tagged <input checked="" type="checkbox"/> <b>Only non-time-tagged</b> <input type="checkbox"/> Configurable to send both, one or the other (attach explanation)	Reports time-tagged Binary Input Change Events when no specific variation requested: <input type="checkbox"/> Never <input checked="" type="checkbox"/> <b>Binary Input Change with Time</b> <input type="checkbox"/> Binary Input Change with Relative Time <input type="checkbox"/> Configurable (attach explanation)
Sends Unsolicited Responses: <input checked="" type="checkbox"/> <b>Never</b> <input type="checkbox"/> Configurable <input type="checkbox"/> Only certain objects (Class 1) <input type="checkbox"/> Sometimes (attach explanation)  <input type="checkbox"/> ENABLE/DISABLE UNSOLICITED	Sends Static Data in Unsolicited Responses: <input checked="" type="checkbox"/> <b>Never</b> <input type="checkbox"/> When Device Restarts <input type="checkbox"/> When Status Flags Change  No other options are permitted.
Default Counter Object/Variation: <input type="checkbox"/> No Counters Reported <input type="checkbox"/> Configurable (attach explanation) <input checked="" type="checkbox"/> <b>Default Object 20</b> <b>Default Variation 01</b> <input type="checkbox"/> Point-by-point list attached	Counters Roll Over at: <input type="checkbox"/> No Counters Reported <input type="checkbox"/> Configurable (attach explanation) <input type="checkbox"/> 16 Bits <input checked="" type="checkbox"/> <b>32 Bits</b> <input type="checkbox"/> Other Value _____ <input type="checkbox"/> Point-by-point list attached
Sends Multi-Fragment Responses: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	

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

<p align="center"><b>Function Codes</b></p> <p>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</p>	<table style="margin: auto; border-collapse: collapse;"> <tr> <td style="border: none; padding: 0 5px;">7</td> <td style="border: none; padding: 0 5px;">6</td> <td style="border: none; padding: 0 5px;">5</td> <td style="border: none; padding: 0 5px;">4</td> <td style="border: none; padding: 0 5px;">3</td> <td style="border: none; padding: 0 5px;">2</td> <td style="border: none; padding: 0 5px;">1</td> <td style="border: none; padding: 0 5px;">0</td> </tr> <tr> <td colspan="4" style="border: 1px solid black; text-align: center;">Index Size</td> <td colspan="4" style="border: 1px solid black; text-align: center;">Qualifier Code</td> </tr> </table> <table style="width:100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width:50%; padding: 5px; vertical-align: top;"> <p align="center"><b>Index Size</b></p> <p>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</p> </td> <td style="width:50%; padding: 5px; vertical-align: top;"> <p align="center"><b>Qualifier Code</b></p> <p>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</p> </td> </tr> </table>	7	6	5	4	3	2	1	0	Index Size				Qualifier Code				<p align="center"><b>Index Size</b></p> <p>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</p>	<p align="center"><b>Qualifier Code</b></p> <p>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</p>
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## 1.2. Implementation Table

The following implementation table identifies 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)	06 (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 <b>(Default)</b>	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 <b>(Default)</b>	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 <b>(Default)</b>	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 <b>(Default)</b>	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)	4 (Select) 5 (Operate)	28 (index)			
20	0	Counter – Any Variation	1 (read)	06 (no range, or all)			
20	1	Counter – 32 Bit with flag <b>(Default)</b>	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 <b>(Default)</b>	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 <b>(Default)</b>	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 <b>(Default)</b>	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 <b>(Default)</b>	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

<b>BINARY INPUT (OBJECT 1) -&gt; Assigned to Class 0.</b> <b>BINARY INPUT CHANGE (OBJECT 2) -&gt; Assigned to Class 1.</b>		
Index	Criteria	Point
0	<b>52</b>	52 Closed
1		52 Excessive Openings
2		52 Accumulated Amperes
3		52 Excessive Openings per minute
4	<b>General</b>	Local Control
5		Ready
6		50Hz
7		Measurement Error
8		Default EEPROM
9		Error EEPROM
10	<b>Input</b>	Input 1
11		Input 2
12	<b>50BF</b>	50BF Pickup
13		50BF Trip
14	<b>50G</b>	50G Pickup
15		50G Trip
16	<b>50P</b>	50P Pickup
17		50P Trip
18	<b>51G</b>	51G Pickup
19		51G Trip
20	<b>51P</b>	51P Pickup
21		51P Trip
22	<b>49</b>	49 Alarm
23		49 Trip
24	<b>Trip Block</b>	Activation
25	<b>CLP</b>	Activation
26	<b>MODBUS Commands</b>	52 Open
27		52 Close
28		Reset TI
29	<b>DNP3 Commands</b>	52 Open
30		52 Close
31		Reset TI



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

ANALOG INPUT (OBJECT 30) -> Assigned to Class 0. ANALOG INPUT CHANGE (OBJECT 32) -> Assigned to Class 2.		
Index	Description	
0	Measurement I-A	
1	Measurement I-B	
2	Measurement I-C	
3	Measurement I-N	

Measurements are in primary values with a scale factor of 100.

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

The DeadBand of the current measurements is fix and it is 10% of the Nominal Current ( $10\% \cdot I_n$ ).

**i.e.** If the  $I_n = 1A$ , the deadband will be  $10\% \cdot 1A = 0.1$  (100mA), the measurement will be reported by event when it changes more than 100 mA and if the  $I_n = 5A$ , the deadband will be  $10\% \cdot 5A = 0.5$  (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 (OBJECT 21)		
Index	Description	
0	Openings Number	
1	Accumulated Amperes	

CONTROL RELAY OUTPUT BLOCK (OBJECT 12)		
Index	Description	
0	52 Open Command	Point Number = 0 (ON)
1	52 Close Command	Point Number = 0 (OFF)
2	Reset Command	Point Number = 1 (ON)
5	Thermal Image Reset Command	Point Number = 2 (ON)



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