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# **SOFTWARE DOCUMENTATION**

## **DNP3 Configuration / Interoperability Guide For the DATRAN XL4 RTU**

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# 1 DNP V3.0 Device Profile

The following table provides a “Device Profile Document” in the standard format defined in the DNP 3.0 Subset Definitions Document. While it is referred to in the DNP 3.0 Subset Definitions as a document, it is in fact a table, and only a component of a total interoperability guide.

<h2>DNP V3.0</h2> <h3>DEVICE PROFILE DOCUMENT</h3> <p>(Also see the DNP 3.0 Implementation Table in Section 2)</p>	
Vendor Name: <b>QTech Data Systems Ltd.</b>	
Device Name: <b>DATRAN XL4 RTU, using the Triangle MicroWorks, Inc. DNP3 Slave Source Code Library, Version 3.</b>	
Highest DNP Level Supported:  For Requests: <b>Level 3</b>  For Responses: <b>Level 3</b>	Device Function:  <input type="checkbox"/> Master  <input checked="" type="checkbox"/> <b>Slave</b>
Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP Levels Supported (the complete list is described in the attached table):  <b>For static (non-change-event) object requests, request qualifier codes 07 and 08 (limited quantity), and 17 and 28 (index) are supported. Static object requests sent with qualifiers 07, or 08, will be responded with qualifiers 00 or 01.</b>  <b>Analog Input Deadbands, Object 34, variations 1 through 3, are supported.</b>	
Maximum Data Link Frame Size (octets):  Transmitted: <b>292</b> Received <b>292</b>	Maximum Application Fragment Size (octets):  Transmitted: <b>2048</b> Received <b>2048</b>
Maximum Data Link Re-tries:  <input type="checkbox"/> None <input type="checkbox"/> Fixed <input checked="" type="checkbox"/> <b>Configurable from 0 to 65535</b>	Maximum Application Layer Re-tries:  <input checked="" type="checkbox"/> <b>None</b> <input type="checkbox"/> Configurable
Requires Data Link Layer Confirmation:  <input type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input checked="" type="checkbox"/> <b>Configurable as: Never, Only for multi-frame messages, or Always</b>	
Requires Application Layer Confirmation:  <input type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> When reporting Event Data (Slave devices only) <input type="checkbox"/> When sending multi-fragment responses (Slave devices only) <input type="checkbox"/> Sometimes <input checked="" type="checkbox"/> <b>Configurable as: “Only when reporting event data”, or “When reporting event data or multi-fragment messages.”</b>	

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## DEVICE PROFILE DOCUMENT

(Also see the DNP 3.0 Implementation Table in Section 2)

Timeouts while waiting for:

- Data Link Confirm:  None  Fixed at \_\_\_\_\_  Variable  **Configurable.**
- Complete Appl. Fragment:  **None**  Fixed at \_\_\_\_\_  Variable  Configurable
- Application Confirm:  None  Fixed at \_\_\_\_\_  Variable  **Configurable.**
- Complete Appl. Response:  **None**  Fixed at \_\_\_\_\_  Variable  Configurable

- Others: **Transmission Delay, 0**  
**Need Time Interval, 30 mins**  
**Unsolicited Notification Delay, 5s (configurable)**  
**Unsolicited Response Retry Delay, 5s (configurable)**  
**Unsolicited Offline Interval, 30s**  
**Binary Change Event Scan Period, 50ms**  
**Analogue Change Event Scan Period, 50ms**

Sends/Executes Control Operations:

- WRITE Binary Outputs  **Never**  Always  Sometimes  Configurable
- SELECT/OPERATE  Never  **Always**  Sometimes  Configurable
- DIRECT OPERATE  Never  **Always**  Sometimes  Configurable
- DIRECT OPERATE – NO ACK  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

Reports Binary Input Change Events when no specific variation requested:

- Never
- Only time-tagged
- Only non-time-tagged
- Configurable to send one or the other**

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**

Sends Unsolicited Responses:

- Never
- Configurable**
- Only certain objects
- Sometimes (attach explanation)
- ENABLE/DISABLE UNSOLICITED Function codes supported**

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**
- Default Object
- Default Variation:
- 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

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## DEVICE PROFILE DOCUMENT

(Also see the DNP 3.0 Implementation Table in Section 2)

Sends Multi-Fragment Responses:

- Yes
- No
- Configurable**

Sequential File Transfer Support:

- |                               |                              |   |
|-------------------------------|------------------------------|---|
| Append File Mode              | <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> <b>No</b> |
| Custom Status Code Strings    | <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> <b>No</b> |
| Permissions Field             | <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> <b>No</b> |
| File Events Assigned to Class | <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> <b>No</b> |
| File Events Send Immediately  | <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> <b>No</b> |
| Multiple Blocks in a Fragment | <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> <b>No</b> |
| Max Number of Files Open      | <b>0</b>                     |   |

## 2 DNP V3.0 Implementation Table

The following table identifies which object variations, function codes, and qualifiers the DATRAN XL4 DNP3 RTU supports in both request messages and in response messages. For static (non-change-event) objects, requests sent with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01. Requests sent with qualifiers 17 or 28 will be responded with qualifiers 17 or 28. For change-event objects, qualifiers 17 or 28 are always responded.

In the table below, text shaded as 00, 01 (start stop) indicates Subset Level 3 functionality (beyond Subset Level 2).

In the table below, text shaded as 07, 08 (limited qty) indicates functionality beyond Subset Level 3.

OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)
1	0	Binary Input – Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
1	1 (default – see note 1)	Binary Input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
1	2	Binary Input with Status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
2	0	Binary Input Change – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
2	1	Binary Input Change without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
2	2	Binary Input Change with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
2	3 (default – see note 1)	Binary Input Change with Relative Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
10	0	Binary Output Status – Any Variation	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
10	1	Binary Output	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 1)
10	2 (default – see note 1)	Binary Output Status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
12	1	Control Relay Output Block	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	17, 28 (index)	129 (response)	echo of request
20	0	Binary Counter – Any Variation	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
20	1	32-bit Binary Counter (with Flag)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)

OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)
20	5 (default – see note 1)	32-bit Binary Counter (without Flag)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
30	0	Analogue Input - Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
30	1	32-Bit Analogue Input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
30	2	16-Bit Analog Input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
30	3 (default – see note 1)	32-Bit Analogue Input without Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
30	4	16-Bit Analog Input without Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
32	0	Analogue Change Event – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
32	1 (default – see note 1)	32-Bit Analogue Change Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	2	16-Bit Analog Change Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	3	32-Bit Analogue Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
			2 (write)	00, 01 (start-stop) 07, 08 (limited qty) 17, 28 (index)		
32	4	16-Bit Analog Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
34	0	Analog Input Deadband (Variation 0 is used to request default variation)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
34	1	16 bit Analog Input Deadband	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
			2 (write)	00, 01 (start-stop) 07, 08 (limited qty) 17, 28 (index)		
34	2 (default – see note 1)	32 bit Analog Input Deadband	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
			2 (write)	00, 01 (start-stop) 07, 08 (limited qty) 17, 28 (index)		
40	0	Analogue Output Status (Variation 0 is used to request default variation)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
40	1 (default – see note 1)	32-Bit Analogue Output Status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
40	2	16-Bit Analog Output Status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)

OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)
41	1	32-Bit Analogue Output Block	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	17, 28 (index)	129 (response)	echo of request
41	2	16-Bit Analog Output Block	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	17, 28 (index)	129 (response)	echo of request
50	0	Time and Date				
50	1 (default – see note 1)	Time and Date	1 (read)	07, (limited qty = 1)	129 (response)	07 (limited qty = 1)
			2 (write)	07 (limited qty = 1)		
50	3	Time and Date Last Recorded Time	2 (write)	07 (limited qty)		
60	0	Not Defined				
60	1	Class 0 Data	1 (read)	06 (no range, or all)		
60	2	Class 1 Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
			20 (enbl. unsol.)	06 (no range, or all)		
			21 (dab. unsol.)			
			22 (assign class)			
60	3	Class 2 Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
			20 (enbl. unsol.)	06 (no range, or all)		
			21 (dab. unsol.)			
			22 (assign class)			
60	4	Class 3 Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
			20 (enbl. unsol.)	06 (no range, or all)		
			21 (dab. Unsold.)			
			22 (assign class)			
80	1	Internal Indications	1 (read)	00, 01 (start-stop)	129 (response)	00, 01(start-stop)
			2 (write) (see note 3)	00 (start-stop) index=7		
		No Object (function code only)	13 (cold restart)			
		No Object (function code only)	14 (warm restart)			
		No Object (function code only)	23 (delay meas.)			
		No Object (function code only)	24 (record current time)			

Note 1: A Default variation refers to the variation responded when variation 0 is requested and/or in class 0, 1, 2, or 3 scans. Default variations are configurable; however, default settings for the configuration parameters are indicated in the table above.

Note 2: For static (non-change-event) objects, qualifiers 17 or 28 are only responded when a request is sent with qualifiers 17 or 28, respectively. Otherwise, static object requests sent with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01. (For change-event objects, qualifiers 17 or 28 are always responded.)

Note 3: Writes of Internal Indications are only supported for index 7 (Restart IIN1-7)



### 3 DNP V3.0 Point List

The tables below identify all the default data points provided by the DATRAN XL4 DNP3 RTU.

#### 3.1 Binary Input Points

The default binary input event buffer size is set to allow 65536 events.

<b>Binary Input Points</b> Static (Steady-State) Object Number: <b>1</b> Change Event Object Number: <b>2</b> Static Variation reported when variation 0 requested: <b>1 (Binary Input 2 without status)</b> Change Event Variation reported when variation 0 requested: <b>3 (Binary Input Change with Relative Time)</b>		
Point Index	Name/Description	Default Change Event Assigned Class (1, 2, 3 or none)
0-65535	Maps to XL4 RTU TDI1 to TDI65536 as seen in QTech Workbench configuration software.	1

### 3.2 Binary Output Status Points and Control Relay Output Blocks

The following table lists both the Binary Output Status Points (Object 10) and the Control Relay Output Blocks (Object 12).

While Binary Output Status Points are included here for completeness, they are not often polled by DNP 3.0 Masters. It is recommended that Binary Output Status points represent the most recent DNP “commanded” value for the corresponding Control Relay Output Block point. Because many, if not most, Control Relay Output Block points are controlled through pulse mechanisms, the value of the output status may in fact be meaningless. Binary Output Status points are not recommended to be included in class 0 polls.

As an alternative, it is recommended that “actual” status values of Control Relay Output Block points be looped around and mapped as Binary Inputs. (The “actual” status value, as opposed to the “commanded” status value, is the value of the actuated control. For example, a DNP control command may be blocked through hardware or software mechanisms; in this case, the actual status value would indicate the control failed because of the blocking. Looping Control Relay Output Block actual status values as Binary Inputs has several advantages:

- it allows actual statuses to be included in class 0 polls,
- it allows change event reporting of the actual statuses, which is a more efficient and time-accurate method of communicating control values,
- it allows reporting of time-based information associated with controls, including any delays before controls are actuated, and any durations if the controls are pulsed.

The default select/control buffer size is large enough to hold 10 of the largest select requests possible.

<b>Binary Output Status Points</b> Object Number: <b>10</b> Default Variation reported when variation 0 requested: <b>2 (Binary Output Status)</b>		
<b>Control Relay Output Blocks</b> Object Number: <b>12</b>		
Point Index	Name/Description	Supported Control Relay Output Block Fields
0-65535	Maps to XL4 RTU TDO1 to TDO65536 as seen in QTech Workbench configuration software.	All

### 3.3 Analogue Inputs

The following table lists Analogue Inputs (Object 30). It is important to note that Analogue Inputs, Analogue Output Control Blocks, and Analogue Output Statuses are transmitted through DNP as signed numbers.

The “Default Deadband,” and the “Default Change Event Assigned Class” columns are used to represent the absolute amount by which the point must change before an analogue change event will be generated, and once generated in which class poll (1, 2, 3, or none) will the change event be reported.

The default analogue input event buffer size is set to 65536.

<b>Analogue Inputs</b>			
Static (Steady-State) Object Number: <b>30</b>			
Change Event Object Number: <b>32</b>			
Static Variation reported when variation 0 requested: <b>3 (32-Bit Analogue Input w/o Flag)</b>			
Change Event Variation reported when variation 0 requested: <b>1 (32-Bit Analogue Change Event w/o Time)</b>			
<b>Point Index</b>	<b>Name/Description</b>	<b>Default Deadband</b>	<b>Default Change Event Assigned Class (1, 2, 3 or none)</b>
0-65535	Maps to XL4 RTU TAI1 to TAI65536 as seen in QTech Workbench configuration software.	0	2

### 3.4 Analogue Output Status Points and Analogue Output Control Blocks

The following table lists both the Analogue Output Status Points (Object 40) and the Analogue Output Control Blocks (Object 41).

While Analogue Output Status Points are included here for completeness, they are not often polled by DNP 3.0 Masters. It is recommended that Analogue Output Status points represent the most recent DNP “commanded” value for the corresponding Analogue Output Control Block point. Analogue Output Status points are not recommended to be included in class 0 polls.

As an alternative, it is recommended that “actual” status values of Analogue Output Control Block points be looped around and mapped as Analogue Inputs. (The “actual” status value, as opposed to the “commanded” status value, is the value of the actuated control.) For example, a DNP control command may be blocked through hardware or software mechanisms; in this case, the actual status value would indicate the control failed because of the blocking. Looping Analogue Relay Output Block actual status values as Analogue Inputs has several advantages:

- it allows actual statuses to be included in class 0 polls,
- it allows change event reporting of the actual statuses, which is a more efficient method of communicating control values,
- and if analogue change events with time variations are supported by the DNP master, it allows reporting of time-based information associated with controls, including delays before the controls are actuated.

The default select/control buffer size is large enough to hold 10 of the largest select requests possible.

<b>Analogue Output Status Points</b> Object Number: <b>40</b> Default Variation reported when variation 0 requested: <b>2 (16-Bit Analogue Output Status)</b>	
<b>Analogue Output Blocks</b> Object Number: <b>41</b>	
Point Index	Name/Description
0-65535	Maps to XL4 RTU TAO1 to TAO65536 as seen in QTech Workbench configuration software.