

# SIEMENS

## SICAM A8000 Series CP-8000, CP-8021, CP-8022

## DNP3

### Conformance Test Report of the DNP3 Protocol Implementation

### Test Report

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**Note**

Please take notice of the notes and warnings for your safety in the preface.

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**Disclaimer of Liability**

Although we have carefully checked the contents of this publication for conformity with the hardware and software described, we cannot guarantee complete conformity since errors cannot be excluded.

The information provided in this manual is checked at regular intervals and any corrections that might become necessary are included in the next releases. Any suggestions for improvement are welcome.

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# Preface

**This document is applicable to the following product(s):**

- SICAM A8000 Series (CP-8000, CP-8021, CP-8022)

## **Purpose of this manual**

This manual describes the conformance test based on interoperability of SICAM A8000 Series (CP-8000, CP-8021, CP-8022) using protocol element according to DNP3 (Serial,TCP/IP) and essentially contains

- Summary of test results
- Interoperability DNP3

## **Target Group**

The document you are reading right now is addressed to users, who are in charge of the following tasks:

- Sales engineering and technical clarification
- Conceptual activities, as for example design and configuration



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# 1. Introduction, Summary of Test Results

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## 1.1. Area of Application

In this documentation, all definitions are described that are necessary for communication of SICAM A8000 Series (CP-8000, CP-8021, CP-8022) and 3<sup>rd</sup> party systems using DNP3 communication protocol.

This document is used also as test report for DNP3 protocol implementation in SICAM A8000 Series CP-8000, CP-8021, CP-8022) .

The functions tested are based on DNP3 Interoperability document.



## 1.2. Summary of Test Results

Tests based on DNP3 Interoperability document DC0-046-2.07 released on 2017-07-05.

### Notes:

- DNP3 Interoperability according document DC0-046-2.07 (released on 2017-07-05) is included without modifications in this document in chapter 2 "Interoperability of SICAM RTUs for DNP3 Master (Serial+Ethernet) using DNPM" and chapter 3 "Interoperability of SICAM RTUs for DNP3 Slave (Serial+Ethernet) using DNPS" for information.

(only SICAM RTUs replaced with SICAM A8000 Series)

Tests performed	Test	Tester	Signature
<b>SICAM A8000 CP-8000 "DNP3 Slave (serial)"</b> Firmware DNPST0 Rev. 06 Functionality tested according Interoperability of SICAM A8000 for DNP3 Slave (Serial+Ethernet) using DNPS	PASSED	T. Schwarz	<i>F. M. A</i> <i>Schwarz</i>
<b>SICAM A8000 CP-8000 "DNP3 Master (serial)"</b> Firmware DNPMT0 Rev. 02 Functionality tested according Interoperability of SICAM A8000 for DNP3 Master (Serial+Ethernet) using DNPM	PASSED	T. Schwarz	<i>F. M. A</i> <i>Schwarz</i>
<b>SICAM A8000 CP-8000 "DNP3 TCP/IP Slave"</b> Firmware DNPIT1 Rev. 02.10 Functionality tested according Interoperability of SICAM A8000 for DNP3 Slave (Serial+Ethernet) using DNPS	PASSED	T. Schwarz	<i>F. M. A</i> <i>Schwarz</i>
<b>SICAM A8000 CP-8000 "DNP3 TCP/IP Master"</b> Firmware DNPIT2 Rev. 02.10 Functionality tested according Interoperability of SICAM A8000 for DNP3 Master (Serial+Ethernet) using DNPM	PASSED	T. Schwarz	<i>F. M. A</i> <i>Schwarz</i>

Note: All Firmwares for SICAM A8000 Series (CP-8000, CP-8021, CP-8022) are identical.  
DNP3 conformance testing was done using CP-8000 hardware.

## 1.3. General Information

Syntax:

Function is not supported

Function is supported as standard (default)

? Function is planned, please contact the product management

Function or ASDU is used in a specific project

~~strike-through~~ the text descriptions of parameters which are not applicable to this companion standard

### Definition:

DNPM	<b>Protocol element for DNP3 Master (serial)</b>	
	Standard protocol element for communication for DNP3 Master (serial) with multipoint configuration for the link between SICAM A8000 Series (CP-8000, CP-8021, CP-8022) as controlling station and other systems	
	CP-8000/DNPMT0	SICAM A8000 Series SICAM CP-8000
	CP-8021/DNPMT0	SICAM CP-8021
	CP-8022/DNPMT0	SICAM CP-8022
	<b>Protocol element for DNP3 Master (TCP/IP)</b>	
CP-8000/DNPIt2	SICAM A8000 Series SICAM CP-8000	
CP-8021/DNPIt2	SICAM CP-8021	
CP-8022/DNPIt2	SICAM CP-8022	
DNPS	<b>Protocol element for DNP3 Slave (serial)</b>	
	Standard protocol element for communication according DNP3 serial with multipoint configuration for the link between SICAM A8000 Series (CP-8000, CP-8021, CP-8022) as controlled station and other systems.	
	CP-8000/DNPST0	SICAM A8000 Series SICAM CP-8000
	CP-8021/DNPST0	SICAM CP-8021
	CP-8022/DNPST0	SICAM CP-8022
	<b>Protocol element for DNP3 Slave (TCP/IP)</b>	
CP-8000/DNPIt1	SICAM A8000 Series SICAM CP-8000	
CP-8021/DNPIt1	SICAM CP-8021	
CP-8022/DNPIt1	SICAM CP-8022	

## 2. Interoperability of SICAM A8000 for DNP3 Master (Serial+Ethernet) using DNPM

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## 2.1. DNP3 Device Profile

The following table provides a "Device Profile Document" in the standard format defined in the DNP3 Subset Definitions Document. While it is referred to in the DNP3 Subset Definitions as a "Document", it is only a component of a total interoperability guide. The table, in combination with the "Implementation Table" and the "Point List Tables", should provide a complete configuration/interoperability guide for communicating with a device implementing the Triangle MicroWorks, Inc. DNP3 Master Source Code Library.

In the tables below, text marked as "strike through" indicates functionality not supported by SICAM A8000 Series (CP-8000, CP-8021, CP-8022) DNP3 Implementation based on Triangle MicroWorks Inc. DNP3 Source Code Library.

<b>DNP3</b> <b>DEVICE PROFILE DOCUMENT</b> (Also see the DNP3 Implementation Table)	
Vendor Name: <b>SIEMENS</b>	
Device Name: - <b>SICAM A8000 CP-8000</b> - <b>SICAM A8000 CP-8021</b> - <b>SICAM A8000 CP-8022</b> DNP3 Device Profile Document based on DNP3 Configuration Interoperability Guide for TMWTEXT.EXE V2 Document Version 1.10, December 5, 2007 using the Triangle MicroWorks Inc. DNP3 Master Source Code Library, Version 3.21.00.	
Highest DNP Level Supported: For Requests: <b>Level 3</b> For Responses: <b>Level 3</b>	Device Function: <input checked="" type="checkbox"/> <b>Master</b> <input type="checkbox"/> 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):  <b>For static (non-change-event) object requests, request qualifier codes 07 and 08 (limited quantity), and 17 and 28 (index) are supported.</b>  <b>16-bit and 32-bit and Floating Point Analog Change Events with Time may be requested.</b> <del>Analog Input Deadbands, Object 34, variations 1 through 3, are supported.</del> <del>Long Floating Point Analog Output Status and Output Block Objects 40 and 41 are supported.</del> <del>Sequential file transfer, Object 70, variations 2 through 7, are supported.</del> <del>Octet String and String Event Objects 110 and 111 are supported.</del> <del>Virtual Terminal Output and Event Objects 112 and 113 are supported.</del> <del>Device Attribute Object 0 is supported.</del> <del>Data Set Objects 85 — 88 are supported.</del> <del>Output Event Objects 11, 13, 42 and 43 are supported.</del> <del>Activated Configuration Secure Authentication</del> <del>Secure Authentication</del>	
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 Retries: <input type="checkbox"/> None <input type="checkbox"/> Fixed at <input checked="" type="checkbox"/> <b>Configurable from 0 to 255</b>	Maximum Application Layer Retries: <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>	

<b>DNP3 DEVICE PROFILE DOCUMENT</b> (Also see the DNP3 Implementation Table)					
Requires Application Layer Confirmation:					
<input type="checkbox"/>	<b>Never</b>				
<input type="checkbox"/>	Always				
<input type="checkbox"/>	When reporting Event Data				
<input type="checkbox"/>	When sending multi-fragment responses				
<input type="checkbox"/>	Sometimes				
<input type="checkbox"/>	Configurable				
Timeouts while waiting for:					
Data Link Confirm	<input type="checkbox"/> None	<input type="checkbox"/> Fixed at _____	<input type="checkbox"/> Variable	<input type="checkbox"/>	<b>Configurable</b>
Complete Appl. Fragment	<input type="checkbox"/> <b>None</b>	<input type="checkbox"/> Fixed at _____	<input type="checkbox"/> Variable	<input type="checkbox"/>	Configurable
Application Confirm	<input type="checkbox"/> <b>None</b>	<input type="checkbox"/> Fixed at _____	<input type="checkbox"/> Variable	<input type="checkbox"/>	Configurable
Complete Appl. Response	<input type="checkbox"/> <b>None</b>	<input type="checkbox"/> Fixed at _____	<input type="checkbox"/> Variable	<input type="checkbox"/>	Configurable
Sends/Executes Control Operations:					
WRITE Binary Outputs	<input type="checkbox"/> <b>Never</b>	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/>	Configurable
SELECT/OPERATE	<input type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/>	<b>Configurable</b>
DIRECT OPERATE	<input type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/>	<b>Configurable</b>
DIRECT OPERATE-NO ACK	<input type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/>	<b>Configurable</b>
Count > 1	<input type="checkbox"/> <b>Never</b>	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/>	Configurable
Pulse On	<input type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/>	<b>Configurable</b>
Pulse Off	<input type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/>	<b>Configurable</b>
Latch On	<input type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/>	<b>Configurable</b>
Latch Off	<input type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/>	<b>Configurable</b>
Queue	<input type="checkbox"/> <b>Never</b>	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/>	Configurable
Clear Queue	<input type="checkbox"/> <b>Never</b>	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/>	Configurable
Attach explanation if "Sometimes" or "Configurable" was checked for any operation.					
Expects Binary Input Change Events:					
<input type="checkbox"/>	Either time-tagged or non-time-tagged for a single event				
<input type="checkbox"/>	Both time-tagged and non-time-tagged for a single event				
<input type="checkbox"/>	<b>Configurable, target database may be designed to handle either or both</b>				
Sequential File Transfer Support:					
Append File Mode	<input type="checkbox"/> Yes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<b>No</b>
Custom Status Code Strings	<input type="checkbox"/> Yes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<b>No</b>
Permissions Field	<input type="checkbox"/> Yes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<b>No</b>
File Events Assigned to Class	<input type="checkbox"/> Yes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<b>No</b>
File Events Poll Specifically	<input type="checkbox"/> Yes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<b>No</b>
Multiple Blocks in a Fragment	<input type="checkbox"/> Yes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<b>No</b>
Max Number of Files Open	<b>0</b>				

## 2.2. DNP3 Implementation Table

The following table identifies the objects variations, function codes, and qualifiers supported by the DNP3 Master implementation for SICAM A8000 Series (CP-8000, CP-8021, CP-8022) (using Triangle MicroWorks, Inc. DNP3 Slave Source Code Library) in both request messages and in response messages.

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 may send)		RESPONSE (Library will parse)		
Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)	
£	0	1-253	Device Attribute – Specific	1 (read) 2 (write)	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)
£	0	254	Device Attribute – Non-Specific All Attributes Request	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)
£	0	255	Device Attribute – List of Attribute Variations	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)
T	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)		
T	1	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 1)
T	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 1)
T	2	0	Binary Input Change – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
T	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)
T	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)
T	2	3	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)
T	3	0	Double Bit Input – Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
T	3	1 (default – see note 1)	Double Bit 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 1)
T	3	2	Double Bit 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 1)
T	4	0	Double Bit Input Change – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
T	4	1	Double Bit Input Change without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	4	2	Double Bit Input Change with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)

OBJECT			REQUEST (Library may send)		RESPONSE (Library will parse)		
Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)	
T	4	3 (default – see note 1)	Double Bit Input Change with Relative Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	10	0	Binary Output – Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
T	10	1	Binary Output	1 (read)  1 (write)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index) 00, 01 (start-stop)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 1)
T	10	2	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 1)
£	11	0	Binary Output Change – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
£	11	1	Binary Output Change without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	11	2	Binary Output Change with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	12	0	Control Relay Output Block	22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
T	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
£	12	2	Pattern Control Block	3 (select) 4 (operate) 5 (direct op) 6 (dir.op.noack)	7 (limited quantity)	129 (response)	echo of request
£	12	3	Pattern Mask	3 (select) 4 (operate) 5 (direct op) 6 (dir.op.noack)	00, 01 (start-stop)	129 (response)	echo of request
£	13	0	Binary Output Command Event – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
£	13	1	Binary Output Command Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	13	2	Binary Output Command Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	20	0	Binary Counter – Any Variation	1 (read) 22 (assign class)  7 (freeze) 8 (freeze noack) 9 (freeze clear) 10 (frz. cl. noack)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index) 00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty)		
T	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 1)
T	20	2	16-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 1)
T	20	5	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 1)
T	20	6	16-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 1)

		OBJECT	REQUEST (Library may send)		RESPONSE (Library will parse)		
Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)	
T	21	0	Frozen Counter – Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
T	21	1	32-Bit Frozen 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 1)
T	21	2	16-Bit Frozen 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 1)
T	21	5	32-Bit Frozen Counter with Time Of Freeze	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)
T	21	6	16-Bit Frozen Counter with Time Of Freeze	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)
T	21	9	32-Bit Frozen 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 1)
T	21	10	16-Bit Frozen 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 1)
T	22	0	Counter Change Event – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
T	22	1	32-Bit Counter Change Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	22	2	16-Bit Counter Change Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	22	5	32-Bit Counter Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	22	6	16-Bit Counter Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	23	0	Frozen Counter Event (Variation 0 is used to request default variation)	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
T	23	1	32-Bit Frozen Counter Event	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	23	2	16-Bit Frozen Counter Event	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	23	5	32-Bit Frozen Counter Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	23	6	16-Bit Frozen Counter Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	30	0	Analog Input - Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
T	30	1	32-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 1)
T	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 1)
T	30	3	32-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 1)
T	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 1)



OBJECT			REQUEST (Library may send)		RESPONSE (Library will parse)			
Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)		
T	30	5		short floating point	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)
£	30	6		long floating point	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)
T	32	0		Analog Change Event – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
T	32	1		32-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)
T	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)
T	32	3		32-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)
T	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)
T	32	5		short floating point 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	6		long floating point Analog Change Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	32	7		short floating point Analog Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	32	8		long floating point Analog Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	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)		
T	34	1		16 bit Analog Input Deadband	1 (read) 2 (write)	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)
T	34	2		32 bit Analog Input Deadband	1 (read) 2 (write)	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)
T	34	3		Short Floating Point Analog Input Deadband	1 (read) 2 (write)	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)
T	40	0		Analog Output Status (Variation 0 is used to request default variation)	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
T	40	1		32-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 1)
T	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 1)
T	40	3		short floating point 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 1)

	OBJECT		REQUEST (Library may send)		RESPONSE (Library will parse)		
	Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)
£	40	4	long floating point 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 1)
£	41	0	Analog Output Block	22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
T	41	1	32-Bit Analog Output Block	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	17, 28 (index)	129 (response)	echo of request
T	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
T	41	3	short floating point Analog Output Block	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	17, 28 (index)	129 (response)	echo of request
£	41	4	long floating point Analog Output Block	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	17, 28 (index)	129 (response)	echo of request
£	42	1	32-Bit Analog Output Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	42	2	16-Bit Analog Output Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	42	3	32-Bit Analog Output Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	42	4	16-Bit Analog Output Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	42	5	short floating point Analog Output Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	42	6	long floating point Analog Output Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	42	7	short floating point Analog Output Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	42	8	long floating point Analog Output Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	43	0	Analog Output Command Event – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
£	43	1	32-Bit Analog Output Command Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	43	2	16-Bit Analog Output Command Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	43	3	32-Bit Analog Output Command Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	43	4	16-Bit Analog Output Command Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	43	5	short floating point Analog Output Command Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	43	6	long floating point Analog Output Command Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	43	7	short floating point Analog Output Command Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	50	0	Time and Date				
T	50	1	Time and Date	1 (read) 2 (write)	07 (limited qty = 1) 07 (limited qty = 1)	129 (response)	07 (limited qty = 1)
£	50	3	Time and Date Last Recorded Time	2 (write)	07 (limited qty)		

OBJECT			REQUEST (Library may send)		RESPONSE (Library will parse)		
Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)	
T	51	1	Time and Date CTO			129 (response) 130 (unsol. resp)	07 (limited qty) (qty = 1)
T	51	2	Unsynchronized Time and Date CTO			129 (response) 130 (unsol. resp)	07 (limited qty) (qty = 1)
T	52	1	Time Delay Coarse			129 (response)	07 (limited qty) (qty = 1)
T	52	2	Time Delay Fine			129 (response)	07 (limited qty) (qty = 1)
£	60	0	Not Defined				
T	60	1	Class 0 Data	1 (read)	06 (no range, or all)		
T	60	2	Class 1 Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
				20 (enbl. unsol.) 21 (dsbl. unsol.) 22 (assign class)	06 (no range, or all)		
T	60	3	Class 2 Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
				20 (enbl. unsol.) 21 (dsbl. unsol.) 22 (assign class)	06 (no range, or all)		
T	60	4	Class 3 Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
				20 (enbl. unsol.) 21 (dsbl. unsol.) 22 (assign class)	06 (no range, or all)		
£	70	0	File Event – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
				22 (assign class)	06 (no range, or all)		
£	70	2	File Authentication	29 (authenticate)	5b (free-format)	129 (response)	5B (free-format)
£	70	3	File Command	25 (open) 27 (delete)	5b (free-format)		
£	70	4	File Command Status	26 (close) 30 (abort)	5b (free-format)	129 (response) 130 (unsol. resp)	5B (free-format)
£	70	5	File Transfer	1 (read) 2 (write)	5b (free-format)	129 (response) 130 (unsol. resp)	5B (free-format)
£	70	6	File Transfer Status			129 (response) 130 (unsol. resp)	5B (free-format)
£	70	7	File Descriptor	28 (get file info)	5b (free-format)	129 (response) 130 (unsol. resp)	5B (free-format)
£	70	8	File Specification String	31 (acti config)	5b (free-format)		
T	80	1	Internal Indications	1 (read)	00, 01 (start-stop)	129 (response)	00, 01 (start-stop)
				2 (write (see note 2))	00 (start-stop) index = 4 or 7		
£	85	0	Data Set Prototype	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
£	85	1	Data Set Prototype	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	5B (free-format)
				2 (write)	5b (free-format)		
£	86	0	Data Set Descriptor	22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
£	86	1	Data Set Descriptor - Contents	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	5B (free-format)
				2 (write)	5b (free-format)		

		OBJECT	REQUEST (Library may send)		RESPONSE (Library will parse)		
Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)	
£	86	2	Data Set Descriptor – Characteristics	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)
£	86	3	Data Set Descriptor – Point Index Attributes	1 (read) 2 (write)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index) 5b (free-format)	129 (response)	5B (free-format)
£	87	0	Data Set – Present Value	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
£	87	1	Data Set – Present Value	1 (read) 2 (write)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index) 5b (free-format)	129 (response)	5B (free-format)
£	88	0	Data Set Event	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
£	88	1	Data Set Event - Snapshot	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	5B (free-format)
£	91	1	Activate Status			129 (response)	07 (limited qty)
£	110	string length	Octet String Object	1 (read) 22 (assign class) 2 (write)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index) 00, 01 (start-stop) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop)
£	111	string length	Octet String Event Object	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	112	string length	Virtual Terminal Output Block	2 (write)	00, 01 (start-stop) 07, 08 (limited qty) 17, 28 (index)		
£	113	string length	Virtual Terminal Event Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	120	1	Authentication Challenge	32 (auth challenge)	5b (free-format)	131 (challenge) 132 (unsol. challenge)	5b (free-format)
£	120	2	Authentication Reply	33 (auth reply)	5b (free-format)	129 (response)	5b (free-format)
£	120	3	Authentication Aggressive Mode Request		5b (free-format)	131 (challenge) 132 (unsol. challenge)	5b (free-format)
£	120	4	Authentication Session Key Status Request	1 (read)	5b (free-format)		
£	120	5	Authentication Session Key Status			129 (response)	5b (free-format)
£	120	6	Authentication Session Key Change			129 (response)	5b (free-format)
£	120	7	Authentication Error	34 (auth challenge)	5b (free-format)	129 (response)	5b (free-format)
T			No Object (function code only)	13 (cold restart)			
T			No Object (function code only)	14 (warm restart)			
T			No Object (function code only)	23 (delay meas.)			
T			No Object (function code only)	24 (record current time)			

Note 1: 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 2: Writes of Internal Indications are only supported for indexes 4 and 7 (Restart and need Time IIN).

**2.2.1. Table 2: Supported DNP3 Function Codes**

<b>Application Layer Function Codes</b>			
	<b>Function</b>	<b>Mnemonic</b>	<b>Description</b>
T	0	Confirm	Message Fragment Confirmation
T	1	Read	Request/Response of data objects
T	2	Write	Store data objects, reply with status (only for write data and time, write analog deadband and clear internal indication bit restart)
T	3	Select	SBO Control Select – reply with status
T	4	Operate	SBO Operate – reply with status
T	5	Direct Operate	Select and Operate relays – reply with status (IIN)
T	6	Direct Operate - no Acknowledgement	Select and Operate relays – no status reply
T	7	Immediate Freeze	Copy specified objects to freeze buffer, reply with status (IIN)
T	8	Immediate Freeze - no Acknowledgement	Copy objects to freeze buffer, no status reply
T	9	Freeze and Clear	Copy objects to freeze buffer then reset objects and reply (IIN)
T	10	Freeze & Clear – no Acknowledgement	Copy to freeze buffer and reset objects, no status reply
£	11	Freeze with Time	Freeze operation at specified time in the future (IIN)
£	12	Freeze & Clear – no Acknowledgement	Freeze at specified time with no status reply
£	13	Cold Start	Initiate desired reset, reply with time till available
£	14	Warm Start	Initiate partial reset, reply with time till available
£	15	Initialize Data to Defaults	Initialize data object to power-up defaults, reply w/status
£	16	Initialize Application	Ready the specified application, respond with status
£	17	Start Application	Start executing the application, reply with status
£	18	Stop Application	Stop the application, reply with status
£	19	Save Configuration	Save specified configuration to non-volatile memory, reply with time till outstation availability
T	20	Enable Unsolicited Messages	Enable spontaneous reporting of the specified objects
T	21	Disable Unsolicited Messages	Disable spontaneous reporting of the specified objects
T	22	Assign Class	Assign objects to a particular class
T	23	Delay Measurement	Calculate communication line round-trip message delay
£	29		
£	24 - 120	Reserved for further use	Future Use
£	121 - 128	Reserved for Testing only	
T	129	Response	A reply to a specific request message
T	130	Unsolicited Message	Unsolicited response message

<b>Application Layer Function Codes for File Transfers</b>			
	<b>Function</b>	<b>Mnemonic</b>	<b>Description</b>
£	25	Open a File	Open a File for read/write
£	26	Close a File	Close a opened File
£	28	Get File Info	Get a File's description
£	30	Abort	Abort of a File's operation

**2.2.2. Table 3: Supported DNP3 Qualifier Codes  
(Specifies the meaning of the range field)**

Application Layer Qualifier Codes			
	Qual-Code	Qualifier	Note
T	0x00	8 Bit Start and Stop indices in the Range Field	Start Range and Stop Range are interpreted as indices of data
T	0x01	16 Bit Start and Stop indices in the Range Field	Start Range and Stop Range are interpreted as indices of data
£	0x02	32 Bit Start and Stop indices in the Range Field	Start Range and Stop Range are interpreted as indices of data
£	0x03	8 Bit absolute address identifiers in the Range	Start Range and Stop Range are interpreted as virtual memory addresses
£	0x04	16 Bit absolute address identifiers in the Rang	Start Range and Stop Range are interpreted as virtual memory addresses
£	0x05	32 Bit absolute address identifiers in the Range	Start Range and Stop Range are interpreted as virtual memory addresses
T	0x06	no range field	implies all the specified objects
T	0x07	8 Bit single field quantity	Range Field consists of a single count indicating the number of data objects in question beginning from 0
T	0x08	16 Bit single field quantity	Range Field consists of a single count indicating the number of data objects in question beginning from 0
£	0x09	32 Bit single field quantity	Range Field consists of a single count indicating the number of data objects in question beginning from 0
£	0x10	reserved	
£	0x11	Free Format	Range Field (index) cannot uniquely specify the data objects in question
£	0x12	reserved	
£	0x13	reserved	
£	0x14	reserved	
£	0x15	reserved	
T	0x17	8 Bit single field quantity	Number of data objects with 1 byte index for each data object
T	0x27		
T	0x28	16 Bit single field quantity	Number of data objects with 2 bytes index for each data object
£	0x5B		

### 2.2.3. Restrictions

- The implementation of DNP3 for for SICAM A8000 Series (CP-8000, CP-8021, CP-8022) does not provide support for dial-up configuration. While the protocol implementation does not support dial-up, it does not preclude the use of external communications devices which may hide dial-up functionality from the DNP3 driver software.
- Note that support of DNP-L3 does not require issuing requests for each data object, only supporting all responses defined by DNP-L3.



### **3. Interoperability of SICAM A80000 for DNP3 Slave (Serial+Ethernet) using DNPS**

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### 3.1. DNP3 Device Profile

The following table provides a "Device Profile Document" in the standard format defined in the DNP3 Subset Definitions Document. While it is referred to in the DNP3 Subset Definitions as a "Document", it is in fact a table, and only a component of a total interoperability guide. The table, in combination with the "Implementation Table" and the "Point List Tables", should provide a complete configuration/interoperability guide for communicating with a device implementing the Triangle MicroWorks, Inc. DNP3 Slave Source Code Library.

In the tables below, text marked as "strike through" indicates functionality not supported by for SICAM A8000 Series (CP-8000, CP-8021, CP-8022) DNP3 Implementation based on Triangle MicroWorks Inc. DNP3 Source Code Library.

<b>DNP3 DEVICE PROFILE DOCUMENT</b> (Also see the DNP3 Implementation Table in Section 3, beginning on page 5.)	
Vendor Name: <b>SIEMENS</b>	
Device Name: - <b>SICAM A8000 CP-8000</b> - <b>SICAM A8000 CP-8021</b> - <b>SICAM A8000 CP-8022</b> DNP3 Device Profile Document based on DNP3 Configuration Interoperability Guide for TMWTEXT.EXE V2 Document Version 1.10, December 5, 2007 using the Triangle MicroWorks Inc. DNP3 Master Source Code Library, Version 3.21.00.	
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>16-bit, 32-bit and Floating Point Analog Change Events with Time may be requested.</b> <b>Analog Input Deadbands, Object 34, variations 1 through 3, are supported.</b> <del>Long Floating Point Analog Output Status and Output Block Objects 40 and 41 are supported.</del> <del>Sequential file transfer, Object 70, variations 2 through 8, are supported.</del> <del>Virtual Terminal Output and Event Objects 112 and 113 are supported</del> <del>Device Attribute Object 0 is supported</del> <del>Data Set Objects 85-88 are supported</del> <del>Output Event Objects 11, 13, 42 and 43 are supported</del> <del>Activate Configuration</del> <del>Secure Authentication</del>	
Maximum Data Link Frame Size (octets): Transmitted: <b>Configurable up to 292</b> Received: <b>Configurable up to 292</b>	Maximum Application Fragment Size (octets): Transmitted: <b>Configurable up to 2048</b> Received: <b>2048</b>
Maximum Data Link Retries: <input type="checkbox"/> None <input type="checkbox"/> Fixed <input checked="" type="checkbox"/> <b>Configurable from 0 to 255</b>	Maximum Application Layer Retries: <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>	

<b>DNP3 DEVICE PROFILE DOCUMENT</b> (Also see the DNP3 Implementation Table.)					
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"/>	<b>Sometimes when: no Link Layer Confirmation and only for Multiframe Messages</b>				
<input type="checkbox"/>	<b>Configurable</b>				
Timeouts while waiting for:					
Data Link Confirm	<input type="checkbox"/> None	<input type="checkbox"/> Fixed at _____	<input type="checkbox"/> Variable	<input type="checkbox"/> Configurable	<input type="checkbox"/> <b>Configurable</b>
Complete Appl. Fragment	<input type="checkbox"/> <b>None</b>	<input type="checkbox"/> Fixed at _____	<input type="checkbox"/> Variable	<input type="checkbox"/> Configurable	<input type="checkbox"/> <b>Configurable</b>
Application Confirm	<input type="checkbox"/> None	<input type="checkbox"/> Fixed at _____	<input type="checkbox"/> Variable	<input type="checkbox"/> Configurable	<input type="checkbox"/> <b>Configurable</b>
Complete Appl. Response	<input type="checkbox"/> <b>None</b>	<input type="checkbox"/> Fixed at _____	<input type="checkbox"/> Variable	<input type="checkbox"/> Configurable	<input type="checkbox"/> <b>Configurable</b>
Others:					
	<b>Transmission Delay, configurable</b>				
	<b>Select/Operate Arm Timeout, configurable</b>				
	<b>Need Time Interval, configurable</b>				
	<del><b>Application File Timeout, configurable</b></del>				
	<b>Unsolicited Notification Delay, configurable</b>				
	<b>Unsolicited Response Retry Delay, configurable</b>				
	<b>Unsolicited Offline Interval, configurable</b>				
	<del><b>Binary Change Event Scan Period, configurable</b></del>				
	<del><b>Double Bit Change Event Scan Period, configurable</b></del>				
	<del><b>Analog Change Event Scan Period, configurable</b></del>				
	<del><b>Counter Change Event Scan Period, configurable</b></del>				
	<del><b>Frozen Counter Change Event Scan Period, configurable</b></del>				
	<del><b>String Change Event Scan Period, configurable</b></del>				
	<del><b>Virtual Terminal Event Scan Period, configurable</b></del>				
Sends/Executes Control Operations:					
WRITE Binary Outputs	<input type="checkbox"/> <b>Never</b>	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable	<input type="checkbox"/> <b>Configurable</b>
SELECT/OPERATE	<input type="checkbox"/> Never	<input type="checkbox"/> <b>Always</b>	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable	<input type="checkbox"/> <b>Configurable</b>
DIRECT OPERATE	<input type="checkbox"/> Never	<input type="checkbox"/> <b>Always</b>	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable	<input type="checkbox"/> <b>Configurable</b>
DIRECT OPERATE-NO ACK	<input type="checkbox"/> Never	<input type="checkbox"/> <b>Always</b>	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable	<input type="checkbox"/> <b>Configurable</b>
Count > 1	<input type="checkbox"/> <b>Never</b>	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable	<input type="checkbox"/> <b>Configurable</b>
Pulse On	<input type="checkbox"/> Never	<input type="checkbox"/> <b>Always</b>	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable	<input type="checkbox"/> <b>Configurable</b>
Pulse Off	<input type="checkbox"/> Never	<input type="checkbox"/> <b>Always</b>	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable	<input type="checkbox"/> <b>Configurable</b>
Latch On	<input type="checkbox"/> Never	<input type="checkbox"/> <b>Always</b>	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable	<input type="checkbox"/> <b>Configurable</b>
Latch Off	<input type="checkbox"/> Never	<input type="checkbox"/> <b>Always</b>	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable	<input type="checkbox"/> <b>Configurable</b>
Queue	<input type="checkbox"/> <b>Never</b>	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable	<input type="checkbox"/> <b>Configurable</b>
Clear Queue	<input type="checkbox"/> <b>Never</b>	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable	<input type="checkbox"/> <b>Configurable</b>
Attach explanation if "Sometimes" or "Configurable" was checked for any operation.					

<b>DNP3 DEVICE PROFILE DOCUMENT</b> (Also see the DNP3 Implementation Table.)	
Reports Binary Input Change Events when no specific variation requested: <input type="checkbox"/> Never <input type="checkbox"/> Only time-tagged <input type="checkbox"/> Only non-time-tagged <input checked="" type="checkbox"/> <b>Configurable to send one or the other</b>	Reports time-tagged Binary Input Change Events when no specific variation requested: <input type="checkbox"/> Never <input type="checkbox"/> Binary Input Change with Time <input type="checkbox"/> Binary Input Change with Relative Time <input checked="" type="checkbox"/> <b>Configurable</b>
Send Unsolicited Responses: <input type="checkbox"/> Never <input checked="" type="checkbox"/> <b>Configurable</b> <input type="checkbox"/> Only certain objects <input type="checkbox"/> Sometimes (attach explanation) <input checked="" type="checkbox"/> <b>ENABLE/DISABLE UNSOLICITED Function codes supported.</b>	Send 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 checked="" type="checkbox"/> <b>Configurable</b> <input type="checkbox"/> Default Object Default Variation: <input checked="" type="checkbox"/> <b>Point-by-point list attached</b>	Counters Roll Over at: <input type="checkbox"/> No Counters Reported <input checked="" type="checkbox"/> <b>Configurable</b> (16 or 32 bits, but depends on default variation) <input type="checkbox"/> 16 Bits <input type="checkbox"/> 32 Bits <input type="checkbox"/> Other Value: _____ <input type="checkbox"/> Point-by-point list attached
Sends Multi-Fragment Responses: <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <b>Configurable</b>	
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>	

### 3.2. DNP3 Implementation Table

The following table identifies which object variations, function codes, and qualifiers the Triangle MicroWorks, Inc. DNP3 Slave Source Code Library 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)
£	0	1-253	Device Attribute Specific	1 (read) 2 (write)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response) 00, 01 (start-stop) 17, 28 (index – see note 1)
£	0	254	Device Attribute - Non-Specific All Attributes Request	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response) 00, 01 (start-stop) 17, 28 (index – see note 1)
£	0	255	Device Attribute – List of Attribute Variations	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response) 00, 01 (start-stop) 17, 28 (index – see note 1)
T	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, 27, 28 (index)	
T	1	1 (default – see note 1)	Binary Input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response) 00, 01 (start-stop) 17, 28 (index – see note 2)
T	1	2	Binary Input with Status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response) 00, 01 (start-stop) 17, 28 (index – see note 2)
T	2	0	Binary Input Change – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)	
T	2	1	Binary Input Change without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)
T	2	2	Binary Input Change with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)
T	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)
T	3	0	Double Bit Input – Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	
T	3	1 (default – see note 1)	Double Bit Input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response) 00, 01 (start-stop) 17, 28 (index – see note 1)
T	3	2	Double Bit Input with Status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response) 00, 01 (start-stop) 17, 28 (index – see note 1)

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)	
T	4	0	Double Bit Input Change – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
T	4	1	Double Bit Input Change without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	4	2	Double Bit Input Change with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	4	3 (default – see note 1)	Double Bit Input Change with Relative Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	10	0	Binary Output – Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
T	10	1	Binary Output	1 (read) 2 (write)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index) 00, 01 (start-stop)	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, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
£	11	0	Binary Output Change – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
£	11	1 (default – see note 1)	Binary Output Change without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	11	2	Binary Output Change with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	12	0	Control Relay Output Block	22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
T	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
£	12	2	Pattern Control Block	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	7 (limited quantity)	129 (response)	echo of request
£	12	3	Pattern Mask	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	00, 01 (start-stop)	129 (response)	echo of request
£	13	0	Binary Output Command Event – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
£	13	1	Binary Output Command Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	13	2	Binary Output Command Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	20	0	Binary Counter – Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
				7 (freeze) 8 (freeze noack) 9 (freeze clear) 10 (frz. cl. noack)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty)		
T	20	1	32-Bit Binary Counter (with Flag)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
T	20	2	16-Bit Binary Counter (with Flag)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 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)
T	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, 27, 28 (index)	129 (response) 00, 01 (start-stop) 17, 28 (index – see note 2)
T	20	6	16-Bit Binary Counter without Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response) 00, 01 (start-stop) 17, 28 (index – see note 2)
T	21	0	Frozen Counter – Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	
T	21	1	32-Bit Frozen Counter (with Flag)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response) 00, 01 (start-stop) 17, 28 (index – see note 2)
T	21	2	16-Bit Frozen Counter (with Flag)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response) 00, 01 (start-stop) 17, 28 (index – see note 2)
T	21	5	32-Bit Frozen Counter with Time Of Freeze	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response) 00, 01 (start-stop) 17, 28 (index – see note 1)
T	21	6	16-Bit Frozen Counter with Time Of Freeze	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response) 00, 01 (start-stop) 17, 28 (index – see note 1)
T	21	9 (default – see note 1)	32-Bit Frozen Counter without Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response) 00, 01 (start-stop) 17, 28 (index – see note 2)
T	21	10	16-Bit Frozen Counter without Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response) 00, 01 (start-stop) 17, 28 (index – see note 2)
T	22	0	Counter Change Event – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)	
T	22	1 (default – see note 1)	32-Bit Counter Change Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp) 17, 28 (index)
T	22	2	16-Bit Counter Change Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp) 17, 28 (index)
T	22	5	32-Bit Counter Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp) 17, 28 (index)
T	22	6	16-Bit Counter Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp) 17, 28 (index)
T	23	0	Frozen Counter Event (Variation 0 is used to request default variation)	1 (read)	06 (no range, or all) 07, 08 (limited qty)	
T	23	1 (default – see note 1)	32-Bit Frozen Counter Event	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp) 17, 28 (index)
T	23	2	16-Bit Frozen Counter Event	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp) 17, 28 (index)
T	23	5	32-Bit Frozen Counter Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp) 17, 28 (index)
T	23	6	16-Bit Frozen Counter Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp) 17, 28 (index)
T	30	0	Analog Input - Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	
T	30	1	32-Bit Analog Input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 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)
T	30	2	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
T	30	3 (default – see note 1)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
T	30	4	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
T	30	5	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
£	30	6	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 1)
T	32	0	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
T	32	1 (default – see note 1)	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	32	2	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	32	3	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	32	4	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	32	5	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	32	6	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	32	7	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	32	8	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
T	34	0	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
T	34	1	1 (read) 2 (write)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
T	34	2 (default – see note 1)	1 (read) 2 (write)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
T	34	3	1 (read) 2 (write)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 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)
T	40	0	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
T	40	1	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
T	40	2 (default – see note 1)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
T	40	3	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
F	40	4	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
F	41	0	22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
T	41	1	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	17, 28 (index) 27 (index)	129 (response)	echo of request
T	41	2	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	17, 28 (index) 27 (index)	129 (response)	echo of request
T	41	3	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	17, 27, 28 (index)	129 (response)	echo of request
F	41	4	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	17, 27, 28 (index)	129 (response)	echo of request
F	42	0	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
F	42	1	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
F	42	2 (default – see note 1)	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
F	42	3	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
F	42	4	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
F	42	5	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
F	42	6	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
F	42	7	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
F	42	8	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
F	43	0	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
F	43	1	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
F	43	2 (default – see note 1)	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
F	43	3	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
F	43	4	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)

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)	
£	43	5	short floating point Analog Output Command Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	43	6	long floating point Analog Output Command Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	43	7	short floating point Analog Output Command Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	43	8	long floating point Analog Output Command Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
£	50	0	Time and Date				
T	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)		
T	51	1	Time and Date CTO			129 (response) 130 (unsol. resp)	07 (limited qty) (qty = 1)
T	51	2	Unsynchronized Time and Date CTO			129 (response) 130 (unsol. resp)	07 (limited qty) (qty = 1)
T	52	1	Time Delay Coarse			129 (response)	07 (limited qty) (qty = 1)
T	52	2	Time Delay Fine			129 (response)	07 (limited qty) (qty = 1)
£	60	0	Not Defined				
T	60	1	Class 0 Data	1 (read)	06 (no range, or all)		
T	60	2	Class 1 Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
				20 (enbl. unsol.) 21 (dab. unsol.) 22 (assign class)	06 (no range, or all)		
T	60	3	Class 2 Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
				20 (enbl. unsol.) 21 (dab. unsol.) 22 (assign class)	06 (no range, or all)		
T	60	4	Class 3 Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
				20 (enbl. unsol.) 21 (dab. unsol.) 22 (assign class)	06 (no range, or all)		
£	70	0	File Event – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
				22 (assign class)	06 (no range, or all)		
£	70	2	File Authentication	29 (authenticate)	5b (free-format)	129 (response)	5B (free-format)
£	70	3	File Command	25 (open) 27 (delete)	5b (free-format)		
£	70	4	File Command Status	26 (close) 30 (abort)	5b (free-format)	129 (response) 130 (unsol. resp)	5B (free-format)
£	70	5	File Transfer	1 (read) 2 (write)	5b (free-format)	129 (response) 130 (unsol. resp)	5B (free-format)
£	70	6	File Transfer Status			129 (response) 130 (unsol. resp)	5B (free-format)
£	70	7	File Descriptor	28 (t file info)	5b (free-format)	129 (response) 130 (unsol. resp)	5B (free-format)

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)	
£	70	8	File Specification String	31 (activate config)	5b (free-format)		
T	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=4 or 7		
£	85	0	Data Set Prototype	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
£	85	1	Data Set Prototype	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	5B (free-format)
				2 (write)	5b (free-format)		
£	86	0	Data Set Descriptor	22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
£	86	1	Data Set Descriptor - Contents	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	5B (free-format)
				2 (write)	5b (free-format)		
£	86	2	Data Set Descriptor – Characteristics	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
£	86	3	Data Set Descriptor – Point Index Attributes	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	5B (free-format)
				2 (write)	5b (free-format)		
£	87	0	Data Set – Present Value	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
£	87	1	Data Set – Present Value	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	5B (free-format)
				2 (write)	5b (free-format)		
£	88	0	Data Set Event	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
£	88	1	Data Set Event - Snapshot	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response)	5B (free-format)
						130 (unsol. resp)	
£	91	1	Activate Status			129 (response)	07 (limited qty)
£	110	string length	Octet String Object	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop)
				22 (assign class)			
				2 (write)	00, 01 (start-stop) 07, 08 (limited qty) 17, 27, 28 (index)		
£	111	string length	Octet String Event Object	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response)	17, 28 (index)
						130 (unsol. resp)	
£	112	string length	Virtual Terminal Output Block	2 (write)	00, 01 (start-stop) 07, 08 (limited qty) 17, 27, 28 (index)		
£	113	string length	Virtual Terminal Event Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response)	17, 28 (index)
						130 (unsol. resp)	

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)	
£	120	1	Authentication Challenge	32 (auth challenge)	5b (free-format)	131 (challenge) 132(unsol. challenge)	5b (free-format)
£	120	2	Authentication Reply	33 (auth reply)	5b (free-format)	129 (response)	5b (free-format)
£	120	3	Authentication Aggressive Mode Request		5b (free-format)	131 (challenge) 132(unsol. challenge)	5b (free-format)
£	120	4	Authentication Session Key Status Request	1 (read)	5b (free-format)		
£	120	5	Authentication Session Key Status			129 (response)	5b (free-format)
£	120	6	Authentication Session Key Change			129 (response)	5b (free-format)
£	120	7	Authentication Error	34 (auth challenge)	5b (free-format)	129 (response)	5b (free-format)
T			No Object (function code only)	13 (cold restart)			
£			No Object (function code only)	14 (warm restart)			
T			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 4 or 7 (need Time IIN 1-4 or Restart IIN1-7).

### 3.2.1. DNP3 Point List

The tables below identify all the default data points provided by the implementation of the Triangle MicroWorks, Inc. DNP3 Slave Source Code Library.

In the tables below, text marked as "strike through" indicates functionality not supported by SAT's. DNP3 Implementation based on Triangle MicroWorks Inc. DNP3 Source Code Library.

#### 3.2.1.1. Binary Input Points

The default binary input event buffer size is set to allow 200 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	- determined by implementation - maximum value of 1000 single or double binary information	1

#### 3.2.1.2. Double Bit Input Points

The default double bit input event buffer size is set to allow 200 events.

<b>Double Bit Input Points</b> Static (Steady-State) Object Number: <b>3</b> Change Event Object Number: <b>4</b> Static Variation reported when variation 0 requested: <b>1 (Double Bit Input 2 without status)</b> Change Event Variation reported when variation 0 requested: <b>4 (Double Bit Input Change with Relative Time)</b>		
Point Index	Name/Description	Default Change Event Assigned Class (1, 2, 3 or none)
0-65535	- determined by implementation - maximum value of 1000 single or double binary information	1

### 3.2.1.3. 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 DNP3 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,
- and 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	- determined by implementation - maximum value of 1000 binary output points	All <sup>1</sup>

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<sup>1</sup> For some implementations, pulse on-times are fixed. In these cases, a note should be added here that states that variable pulse on-time widths specified in the control relay output block will be ignored, not rejected.

### 3.2.1.4. Counters

The following table lists both Binary Counters (Object 20) and Frozen Counters (Object 21). When a freeze function is performed on a Binary Counter point, the frozen value is available in the corresponding Frozen Counter point. The default Binary Counter and Frozen Counter event buffer sizes are set to 30.

<b>Binary Counters</b>			
Static (Steady-State) Object Number: <b>20</b>			
Change Event Object Number: <b>22</b>			
Static Variation reported when variation 0 requested: <b>5 (32-Bit Binary Counter without Flag)</b>			
Change Event Variation reported when variation 0 requested: <b>1 (32-Bit Counter Event w/o Time)</b>			
<b>Frozen Counters</b>			
Static (Steady-State) Object Number: <b>21</b>			
Change Event Object Number: <b>23</b>			
Static Variation reported when variation 0 requested: <b>9 (32-Bit Frozen Binary without Flag)</b>			
Change Event Variation reported when variation 0 requested: <b>1 (32-Bit Frozen Counter Event w/o Time)</b>			
Point Index	Name/Description	Default Frozen Counter Change Event Assigned Class (1, 2, 3 or none)	Default Counter Change Event Assigned Class (1, 2, 3 or none)
0-65535	- determined by implementation - maximum value of 100 binary counter objects	3	3

### 3.2.1.5. Analog Inputs

The following table lists Analog Inputs (Object 30). It is important to note that 16-bit and 32-bit variations of Analog Inputs, Analog Output Control Blocks, and Analog 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 analog 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 analog input event buffer size is set 30.

<b>Analog 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 Analog Input w/o Flag)</b> Change Event Variation reported when variation 0 requested: <b>1 (32-Bit Analog 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	- determined by implementation - maximum value of 800 analog inputs	0	2



### Analog Output Status Points and Analog Output Control Blocks

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

While Analog Output Status Points are included here for completeness, they are not often polled by DNP3 Masters. It is recommended that Analog Output Status points represent the most recent DNP "commanded" value for the corresponding Analog Output Control Block point. Analog Output Status points are not recommended to be included in class 0 polls.

As an alternative, it is recommended that "actual" status values of Analog Output Control Block points be looped around and mapped as Analog 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 Analog Relay Output Block actual status values as Analog 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 analog 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>Analog Output Status Points</b> Object Number: <b>40</b> Default Variation reported when variation 0 requested: <b>2 (16-Bit Analog Output Status)</b>	
<b>Analog Output Blocks</b> Object Number: <b>41</b>	
Point Index	Name/Description
0-65535	- determined by implementation - maximum value of 500 analog output points

### 3.2.1.6. Octet Strings

The default string event buffer size is set to allow 10 events.

<b>Octet Strings</b> Static (Steady State) Object Number: <del>110</del> Change Event Object Number: <del>111</del> Static Variation reported when variation 0 requested: <del>all (variation specifies length of string)</del> Change Event Variation reported when variation 0 requested: <del>all (variation specifies length of string)</del>		
Point Index	Name/Description	Default Change Event Assigned Class (1, 2, 3 or none)
0-9	(determined by implementation)	3

### 3.2.1.7. Virtual Terminal

The default Virtual Terminal event buffer size is set to allow 5 events.

<b>Octet Strings</b> Static (Steady State) Object Number: <del>112</del> Change Event Object Number: <del>113</del> Static Variation reported when variation 0 requested: <del>all (variation specifies length of string)</del> Change Event Variation reported when variation 0 requested: <del>all (variation specifies length of string)</del>		
Point Index	Name/Description	Default Change Event Assigned Class (1, 2, 3 or none)
0-4	(determined by implementation)	3

**3.2.2. Table 2: Supported DNP3 Function Codes**

<b>Application Layer Function Codes</b>			
	<b>Function</b>	<b>Mnemonic</b>	<b>Description</b>
T	0	Confirm	Message Fragment Confirmation
T	1	Read	Request/Response of data objects
T	2	Write	Store data objects, reply with status (only for write data and time, write analog deadband and clear internal indication bit restart)
T	3	Select	SBO Control Select – reply with status
T	4	Operate	SBO Operate – reply with status
T	5	Direct Operate	Select and Operate relays – reply with status (IIN)
T	6	Direct Operate - no Acknowledgement	Select and Operate relays – no status reply
T	7	Immediate Freeze	Copy specified objects to freeze buffer, reply with status (IIN)
T	8	Immediate Freeze - no Acknowledgement	Copy objects to freeze buffer, no status reply
T	9	Freeze and Clear	Copy objects to freeze buffer then reset objects and reply (IIN)
T	10	Freeze & Clear – no Acknowledgement	Copy to freeze buffer and reset objects, no status reply
£	11	Freeze with Time	Freeze operation at specified time in the future (IIN)
£	12	Freeze & Clear – no Acknowledgement	Freeze at specified time with no status reply
T	13	Cold Start	Initiate desired reset, reply with time till available
£	14	Warm Start	Initiate partial reset, reply with time till available
£	15	Initialize Data to Defaults	Initialize data object to power-up defaults, reply w/status
£	16	Initialize Application	Ready the specified application, respond with status
£	17	Start Application	Start executing the application, reply with status
£	18	Stop Application	Stop the application, reply with status
£	19	Save Configuration	Save specified configuration to non-volatile memory, reply with time till outstation availability
T	20	Enable Unsolicited Messages	Enable spontaneous reporting of the specified objects
T	21	Disable Unsolicited Messages	Disable spontaneous reporting of the specified objects
T	22	Assign Class	Assign objects to a particular class
T	23	Delay Measurement	Calculate communication line round-trip message delay
£	24 - 120	Reserved for further use	Future Use
£	121 - 128	Reserved for Testing only	
T	129	Response	A reply to a specific request message
T	130	Unsolicited Message	Unsolicited response message

<b>Application Layer Function Codes for File Transfers</b>			
	<b>Function</b>	<b>Mnemonic</b>	<b>Description</b>
£	25	Open a File	Open a File for read/write
£	26	Close a File	Close a opened File
£	28	Get File Info	Get a File's description
£	30	Abort	Abort of a File's operation

**3.2.3. Table 3: Supported DNP3 Qualifier Codes  
(Specifies the meaning of the range field)**

Application Layer Qualifier Codes			
	Qual-Code	Qualifier	Note
T	0x00	8 Bit Start and Stop indices in the Range Field	Start Range and Stop Range are interpreted as indices of data
T	0x01	16 Bit Start and Stop indices in the Range Field	Start Range and Stop Range are interpreted as indices of data
£	0x02	32 Bit Start and Stop indices in the Range Field	Start Range and Stop Range are interpreted as indices of data
£	0x03	8 Bit absolute address identifiers in the Range	Start Range and Stop Range are interpreted as virtual memory addresses
£	0x04	16 Bit absolute address identifiers in the Rang	Start Range and Stop Range are interpreted as virtual memory addresses
£	0x05	32 Bit absolute address identifiers in the Range	Start Range and Stop Range are interpreted as virtual memory addresses
T	0x06	no range field	implies all the specified objects
T	0x07	8 Bit single field quantity	Range Field consists of a single count indicating the number of data objects in question beginning from 0
T	0x08	16 Bit single field quantity	Range Field consists of a single count indicating the number of data objects in question beginning from 0
£	0x09	32 Bit single field quantity	Range Field consists of a single count indicating the number of data objects in question beginning from 0
£	0x10	reserved	
£	0x11	Free Format	Range Field (index) cannot uniquely specify the data objects in question
£	0x12	reserved	
£	0x13	reserved	
£	0x14	reserved	
£	0x15	reserved	
T	0x17	8 Bit single field quantity	Number of data objects with 1 byte index for each data object
T	0x28	16 Bit single field quantity	Number of data objects with 2 bytes index for each data object



# Literature

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