SUBNET SOLUTIONS INC. DNP3 MESSAGE STRUCTURE TEMPLATE

DATALINK HEADER

2 octets	1 octet	1 octet	2 octets	2 octets	2 octets
05 64	LEN	DLC	DESTINATION (LSB MSB)	SOURCE (LSB MSB)	CRC

START OCTETS
Always 0x05 0x64

Message Length MIN = 5, MAX = 255 (0xFF):
Does not count START, LEN or any CRC octets.

Note: A Data Link Acknowledgement is simply a Data Link header

7	6	5	4	3	2	1	0
DIR	1 PRM 0	FCB	FCV	PRIMARY FUNC. CODE / SECONDARY FUNC. CODE			
1= Master 0= Remote	1= Primary Msg 0= Secondary Msg	Frame Count Bit, alternates 0 or 1	Frame Count Bit Valid; 1= Valid, 0= Invalid			Data Flow Control; 1= No Buffer Left	

Primary Message
Secondary Message

DATA BLOCK 1

1 octet	2 or 4 octets					
TH	APPL HDR	OBJECT HEADER #1	DATA #1	OBJECT HEADER #2	DATA #2	CRC

1 octet	1 octet	2 octets
APPL CTL	APPL FUNC CODE	INTERNAL INDICATIONS FIRST / SECOND

Outstation Responses Only

7	6	5	4	3	2	1	0
FIRST	FINAL	APPL CONFIRM	UNSOLICITED	FRAGMENT SEQUENCE 0 – 15 (0xF)			

Note: The unsolicited sequence numbers are independent of the solicited sequence numbers

7	6	5	4	3	2	1	0
FINAL	FIRST	SEGMENT SEQUENCE 0 – 63 (0x3F)					

Note: Any sequence number is valid when the First Bit is set.

APPLICATION FUNCTION CODES

Master Request Function Codes

0 (0x00): Confirm (ACK)
1 (0x01): Read
2 (0x02): Write
3 (0x03): Select
4 (0x04): Operate
5 (0x05): Direct Operate
6 (0x06): Direct Operate, No ACK
7 (0x07): Immediate Freeze
8 (0x08): Immediate Freeze, No ACK
9 (0x09): Freeze and Clear
10 (0x0A): Freeze and Clear, No ACK
11 (0x0B): Freeze with Time
12 (0x0C): Freeze with Time, No ACK
13 (0x0D): Cold Restart
14 (0x0E): Warm Restart
15 (0x0F): Initialize Data to Defaults
16 (0x10): Initialize Application
17 (0x11): Start Application
18 (0x12): Stop Application
19 (0x13): Save Configuration
20 (0x14): Enable Unsolicited Messages
21 (0x15): Disable Unsolicited Messages
22 (0x16): Assign to Class
23 (0x17): Delay Measurement
24 (0x18): Record Current Time
25 (0x19): Open File
26 (0x1A): Close File
27 (0x1B): Delete File
28 (0x1C): Get File Information
29 (0x1D): Authenticate File
30 (0x1E): Abort File
31 (0x1F): Activate Configuration
32 (0x20): Authentication Request
33 (0x21): Authentication Error

Outstation Response Function Codes

129 (0x81): Solicited Response
130 (0x82): Unsolicited Response
131 (0x83): Authentication Response

IIN1-

7	6	5	4	3	2	1	0
RESTART	DEVICE TROUBLE	LOCAL	NEED TIME	CLASS 3	CLASS 2	CLASS 1	ALL STATIONS

IIN2-

7	6	5	4	3	2	1	0
RESERVED	RESERVED	BAD CONFIG	ALREADY EXEC	BUFFER OVFLW	OUT OF RANGE	OBJECT UNKNWN	BAD FUNCTION

1 octet	1 octet	1 octet	0 to 8 octets
OBJECT GROUP	OBJECT VARIATION	QUALIFIER	RANGE

Refer to Object Definition Summary Table

7	6	5	4	3	2	1	0
				PREFIX	RANGE CODE		

PREFIX
0: No Index; Packed
1: 1-octet Index
2: 2-octet Index
3: 4-octet Index
4: 1-octet Object Size
5: 2-octet Object Size
6: 4-octet Object Size

Range Code determines Range Size

RANGE CODE	RANGE SIZE
Used to describe sequential points	
0: 1-octet Start and Stop Indices	2
1: 2-octet Start and Stop Indices	4
2: 4-octet Start and Stop Indices	8
3: 1-octet Absolute Address Identifiers	2
4: 2-octet Absolute Address Identifiers	4
5: 4-octet Absolute Address Identifiers	8
6: All points/objects	0
A count of unrelated points/objects	
7: 1-octet Quantity	1
8: 2-octet Quantity	2
9: 4-octet Quantity	4
11 (0xB): Variable Array	1

DATA BLOCK 2

.... DATA #2 (cont'd)	OBJECT HEADER #3	DATA #3	CRC

DATA 1	DATA 2	DATA 3	DATA 4	DATA 5 .....

PACKED DATA

Data Block Size =
# of Objects * (Object Size + Index Size)

INDEX 1	DATA 1	INDEX 2	DATA 2 .....

INDEXED DATA

DATA BLOCK 16

..... OBJECT HEADER #N	DATA #N	CRC

DATA LINK FUNCTION CODES

Primary Frames (PRM=1)			
Fn Code	Function	Frame Type	FCV
0x0 (0000)	RESET Link	SEND/CONFIRM	0
0x1 (0001)	Reset User Process	SEND/CONFIRM	0
0x2 (0010)	TEST link	SEND/CONFIRM	1
0x3 (0011)	User Data	SEND/CONFIRM	1
0x4 (0100)	User Data	SEND/NO REPLY	0
0x9 (1001)	Request Link Status	REQUEST/RESPOND	0

Secondary Frames (PRM=0)		
Fn Code	Function	Frame Type
0x0 (0000)	ACK	CONFIRM
0x1 (0001)	NACK	CONFIRM
0xB (1011)	Link Status	RESPOND
0xF (1111)	Not Supported	RESPOND

DATA LINK CONTROL OCTET CHART

		From Remote	From Master	FUNCTION	OTHER / NOTES
SECONDARY	DFC = 0	00	80	ACK	
		01	81	NACK	Failed Transaction
		0B	8B	Link Status Reply	No Flow Control
		0F	8F	Not Supported	Link Service Not Supported
	DFC = 1	10	90	ACK	No Buffers, Frame Accepted
		11	91	NACK	No Buffers, Frame Not Accepted
		1B	9B	Link Status Reply	No Buffers
		1F	9F	Not Supported	No Buffers, LS Not Supported
PRIMARY	FCV = 0	40	C0	RESET LINK	FCB=0 ignored
		41	C1	Reset User Process	OBSOLETE
		44	C4	Unconfirmed User Data	FCB=0 ignored
		49	C9	Link Status Request	FCB=0 ignored
		60	E0	RESET LINK	FCB=1 ignored
		61	E1	Reset User Process	OBSOLETE
		64	E4	Unconfirmed User Data	FCB=1 ignored
		69	E9	Link Status Request	FCB=1 ignored
	FCV = 1	52	D2	Test Link	FCB=0
		53	D3	Confirmed User Data	FCB=0
		72	F2	Test Link	FCB=1
		73	F3	Confirmed User Data	FCB=1

Qualifier (0x)	Range Size	Use in a Request	Use in a Response
00: No Index (Packed), 1-octet Start & Stop	2 octets	A range of static points, or A single point	Static objects
01: No Index (Packed), 2-octet Start & Stop	4 octets		
06: All, No Index	0 octets	All points/objects	Not Valid
07: No Index (Packed), 1-octet Quantity	1 octet	A limited quantity of events, or A single object with no index (e.g. Time and Date)	A single object with no index (e.g. Time and Date)
08: No Index (Packed), 2-octet Quantity	2 octets		
17: 1-octet Index, 1-octet Quantity	1 octet	Controls (usually one or more unrelated points)	Event objects (usually one or more unrelated points)
28: 2-octet Index, 2-octet Quantity	2 octets		

Binary Representation Table

0	0000		8	8	1000
1	0001		9	9	1001
2	0010		10	A	1010
3	0011		11	B	1011
4	0100		12	C	1100
5	0101		13	D	1101
6	0110		14	E	1110
7	0111		15	F	1111

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