



<b>Driver Version:</b>	<b>1.03</b>
<b>Document Revision:</b>	<b>3</b>

## FieldServer Driver - Serial FS-8700-47 DNP 3.0

### Description

The DNP 3.0 Driver allows the FieldServer to transfer data to and from devices over RS-232 or RS-485 using DNP 3.0 Driver protocol. The FieldServer can emulate either a Server or Client.

The following description of DNP is from the DNP User Group internet site,

*"The development of DNP was a comprehensive effort to achieve open, standards-based interoperability between substation computers, RTUs, IEDs (Intelligent Electronic Devices) and master stations (except inter-master station communications) for the electric utility industry. Also important was the time frame and the need for a solution to meet today's requirements. As ambitious an undertaking as this was, we are reaching this objective.*

*DNP is based on the standards of the International Electrotechnical Commission (IEC) Technical Committee 57, Working Group 03 who have been working on an OSI 3 layer "Enhanced Performance Architecture" (EPA) protocol standard for telecontrol applications. DNP has been designed to be as close to compliant as possible to the standards as they existed at time of development with the addition of functionality not identified in Europe but needed for current and future North American applications (e.g. limited transport layer functions to support 2K descriptor transfers for IEDs, RF and fiber support). Recently DNP 3.0 was selected as a Recommended Practice by the IEEE C.2 Task Force; RTU to IED Communications Protocol.*

#### *Feature Rich*

*DNP offers flexibility and functionality that go far beyond conventional communications protocols. Among its robust and flexible features DNP 3.0 includes:*

- *Output options*
- *Secure configuration/file transfers*
- *Addressing for over 65,000 devices on a single link*
- *Time synchronization and time-stamped events*
- *Broadcast messages*
- *Data link and application layer confirmation*

*DNP 3.0 was originally designed based on three layers of the OSI seven-layer model: application layer, data link layer and physical layer. The application layer is object-based with objects provided for most generic data formats. The data link layer provides for several methods of retrieving data such as polling for classes and object variations. The physical layer defines most commonly a simple RS-232 or RS-485 interface.*

*DNP 3.0 is very efficient for a layered protocol while ensuring high data integrity.*

*Suits Any SCADA/EMS Environment*



*Because DNP 3.0 is based on the IEC 870-5 requirements, DNP is suitable for application in the entire SCADA/EMS environment. This includes RTU to IED communications, master to remote communications, and even peer-to-peer instances and network applications.*

*Being an object-based application layer protocol, DNP 3.0 has the flexibility to support multiple operating modes such as poll-response, polled report-by-exception, unsolicited responses and peer-to-peer. It permits multiple masters and encourages distributed intelligence.*

*Users can expect many benefits from using DNP. In the short term:*

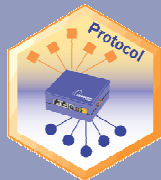
- *Interoperability between multi-vendor devices*
- *Fewer protocols to support in the field*
- *reduced software costs*
- *No protocol translators needed*
- *Shorter delivery schedules*
- *Less testing, maintenance and training*
- *Improved documentation*
- *Independent conformance testing*
- *Support by independent users group and third-party sources (e.g. test sets, source code).*

## Connection Information

<b>Connection type:</b>	RS-485 (RS-232 with converter) (Half-Duplex)
<b>Baud Rates:</b>	All Standard Baud Rates
<b>Data Bits:</b>	7, 8
<b>Stop Bits:</b>	0,1
<b>Parity:</b>	None, Even, Odd
<b>Multidrop Capability</b>	None, RTS/CTS

## Devices tested

Device	Tested (FACTORY, SITE)
Schweitzer Engineering Laboratories SEL351A.	FACTORY
Multilin Generator Management Relay	FACTORY
Energyline 5800 IntelliTeam	FACTORY
ASE2000 Test Software	FACTORY
Televent Oasys Scada	SITE



DNP V3.00 DEVICE PROFILE DOCUMENT	
Vendor Name : FieldServer Technologies	
Device Name : FS-X40 and FS-X20 Series	
Highest DNP Level Supported: For Requests: 1 For Responses: 1	Device Function: <input checked="" type="checkbox"/> Master <input checked="" type="checkbox"/> Slave
<p>Notable objects, functions and or qualifiers supported in addition to the highest DNP Levels Supported.</p> <p>Although the highest level implemented is level 1 there are very few functions and objects that have not been implemented that would allow classification as level 2 compliance. These exceptions include some functions on the analog output objects, no processing of the time delay objects, setting internal indications and no handling of object type 101.</p> <p>In addition to being compliant with most level 2 requirements the FieldServer can parse a greater number of qualifiers than are required for level 2 compliance.</p> <p>The attached table indicates the objects, object variations, functions and qualifiers that can be processed.</p>	
Maximum Data Link Frame Size (Octets) Transmitted: 242 Received: 292	Maximum Application Fragment Size Transmitted: 242 Received: 2048
Maximum Data Link Re-Tries <input type="checkbox"/> None <input checked="" type="checkbox"/> Fixed at 3 <input type="checkbox"/> Configurable	Maximum Application Layer Retries <input checked="" type="checkbox"/> None <input type="checkbox"/> Fixed <input type="checkbox"/> Configurable
Requires Application Layer Confirmation <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> When reporting event data <input type="checkbox"/> When sending multi-fragment responses (Slaves Only) <input type="checkbox"/> Sometime _____ <input type="checkbox"/> Configurable _____	
Timeouts while waiting for: <b>Data Link Confirm :</b> <input type="checkbox"/> None <input type="checkbox"/> Fixed at _____ <input type="checkbox"/> Variable <input checked="" type="checkbox"/> Configurable (Use timeout param in CSV file.) <b>Complete App Fragment:</b> <input type="checkbox"/> None <input type="checkbox"/> Fixed at _____ <input type="checkbox"/> Variable <input checked="" type="checkbox"/> Configurable (Use timeout param in CSV file.) <b>App Confirm:</b> <input type="checkbox"/> None <input type="checkbox"/> Fixed at _____ <input type="checkbox"/> Variable <input checked="" type="checkbox"/> Configurable (Use timeout param in CSV file.) <b>Complete App Response:</b> <input type="checkbox"/> None <input type="checkbox"/> Fixed at _____ <input type="checkbox"/> Variable <input checked="" type="checkbox"/> Configurable (Use timeout param in CSV file.)	
Sends / Executes Control Operations <b>Write Binary Outputs:</b> <input type="checkbox"/> Never <input checked="" type="checkbox"/> Always <input type="checkbox"/> Sometimes <input checked="" type="checkbox"/> Configurable (May Over-ride default) <b>Select/Operate :</b> <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable (May Over-ride default) <b>Direct Operate:</b> <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable (May Over-ride default)	



<b>Direct Operate No Ack</b>		<input type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input checked="" type="checkbox"/> Configurable
<b>Count &gt; 1</b>		<input type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input checked="" type="checkbox"/> Configurable
<b>Pulse On</b>		<input type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input checked="" type="checkbox"/> Configurable
<b>Pulse Off</b>		<input type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input checked="" type="checkbox"/> Configurable
<b>Latch On</b>		<input type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input checked="" type="checkbox"/> Configurable
<b>Latch Off</b>		<input type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input checked="" type="checkbox"/> Configurable
<b>Queue</b>		<input checked="" type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
<b>Clear Queue</b>		<input checked="" type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
Configurable using CSV file parameters and data array values.					
Fill Out the following for Master Devices Only					
Expects Binary Change Events					
<input type="checkbox"/> Either time tagged or non-time tagged for a single event. <input type="checkbox"/> Both time tagged or non-time tagged for a single event. <input type="checkbox"/> Configurable					
Fill Out the following for Slave Devices Only					
Reports Binary Change Events when no specific variation requested.			Reports Binary Input Events when no specific variation requested.		
<input type="checkbox"/> Never <input type="checkbox"/> Only Time Tagged <input type="checkbox"/> Only Non Time Tagged <input type="checkbox"/> Configurable			<input type="checkbox"/> Never <input type="checkbox"/> Only Time Tagged <input type="checkbox"/> Only Non Time Tagged <input type="checkbox"/> Configurable		
Send Unsolicited Messages			Sends Static Data in Unsolicited Responses		
<input type="checkbox"/> Never <input checked="" type="checkbox"/> Configurable (Active Server with wrbc/wrbc functions) <input type="checkbox"/> Only certain Objects <input type="checkbox"/> Sometimes <input type="checkbox"/> Enable / Disable			<input checked="" type="checkbox"/> Never <input type="checkbox"/> When device restarts <input type="checkbox"/> When status flags change		
Default Counter Object Variation			Counters Roll Over at		
<input checked="" type="checkbox"/> No Counters Reported <input type="checkbox"/> Configurable <input type="checkbox"/> Default Object _____ <input type="checkbox"/> Default variation _____ <input type="checkbox"/> Point by Point List Attached			<input checked="" type="checkbox"/> No Counters Reported <input type="checkbox"/> Configurable <input type="checkbox"/> 16 bits <input type="checkbox"/> 32 Bits <input type="checkbox"/> Other Value _____ <input type="checkbox"/> List attached		
Sends Multi-fragment Responses : <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes					



**Table 2.3-1**  
Level 2 Implementation (DNP-L2)

Note:  
Underline indicates exception to level 2 compliance.  
Bold indicates additional functions qualifiers supported.

OBJECT			REQUEST			RESPONSE				
Obj	Var	Description	(slave must parse)			(master must parse)				
			Func Codes (dec)	Qual Codes (hex)		Func Codes	Qual Codes (hex)			
1	0	Binary Input - All Variations	1	6		<b>00,01,07,08,17,28</b>				
1	1	Binary Input			1	<b>01,06,07,08,17,28</b>	129, 130	00, 01		<b>07,08,17,28</b>
1	2	Binary Input with Status			1	<b>01,06,07,08,17,28</b>	129, 130	00, 01		<b>07,08,17,28</b>
2	0	Binary Input Change - All Variations	1	06,07,08		<b>00,01,07,08,17,28</b>				
2	1	Binary Input Change without Time	1	06,07,08	2	<b>00,01,17,28</b>	129, 130	17, 28		<b>00,07,08</b>
2	2	Binary Input Change with Time	1	06,07,08	2	<b>00,01,17,28</b>	129, 130	17, 28		<b>00,07,08</b>
2	3	Binary Input Change with Relative Time	1	06,07,08	2	<b>00,01,17,28</b>	129, 130	17, 28		<b>00,07,08</b>
10	0	Binary Output - All Variations	1	6		<b>00,01,07,08,17,28</b>			129, 130	<b>00,01,07,08,17,28</b>
10	1	Binary Output			1,2	<b>01,06,07,08,17,28</b>			129, 130	<b>00,01,07,08,17,28</b>
10	2	Binary Output Status			1,2	<b>01,06,07,08,17,28</b>	129, 130	00, 01		<b>07,08,17,28</b>
12	0	Control Block - All Variations			1	<b>00,01,07,08,17,28</b>			129, 130	<b>00,01,07,08,17,28</b>
12	1	Control Relay Output Block	3,4,5,6	17, 28	1,2	<b>01,06,07,08</b>	129	echo of request		
12	2	Pattern Control Block								
12	3	Pattern Mask								
20	0	Binary Counter - All Variations	1,7,8,9,10	6		<b>00,01,07,08,17,28</b>				
20	1	32-Bit Binary Counter			1,2	<b>00,01,06,07,08,17,28</b>	129, 130	00, 01		<b>07,08,17,28</b>
20	2	16-Bit Binary Counter			1,2	<b>00,01,06,07,08,17,28</b>	129, 130	00, 01		<b>07,08,17,28</b>
20	3	32-Bit Delta Counter			1,2	<b>00,01,06,07,08,17,28</b>	129, 130	00, 01		<b>07,08,17,28</b>
20	4	16-Bit Binary Counter			1,2	<b>00,01,06,07,08,17,28</b>	129, 130	00, 01		<b>07,08,17,28</b>
20	5	32-Bit Binary Counter without Flag			1,2	<b>00,01,06,07,08,17,28</b>	129, 130	00, 01		<b>07,08,17,28</b>
20	6	16-Bit Binary Counter without Flag			1,2	<b>00,01,06,07,08,17,28</b>	129, 130	00, 01		<b>07,08,17,28</b>
20	7	32-Bit Delta Counter without Flag			1,2	<b>00,01,06,07,08,17,28</b>	129, 130	00, 01		<b>07,08,17,28</b>
20	8	16-Bit Delta Counter without Flag			1,2	<b>00,01,06,07,08,17,28</b>	129, 130	00, 01		<b>07,08,17,28</b>
21	0	Frozen Counter - All Variations	1	6		<b>00,01,07,08,17,28</b>				
21	1				1,2	<b>00,01,06,07,08,17,28</b>	129, 130	00, 01		<b>07,08,17,28</b>



OBJECT			REQUEST (slave must parse)		RESPONSE (master must parse)				
Obj	Var	Description	Func Codes (dec)	Qual Codes (hex)		Func Codes	Qual Codes (hex)		
21	2	16-Bit Frozen Counter			1,2	00,01,06,07,08,17,28	129, 130	00, 01	07,08,17,28
21	3	32-Bit Frozen Delta Counter			1,2	00,01,06,07,08,17,28			129, 130 00,01,07,08,17,28
21	4	16-Bit Frozen Delta Counter			1,2	00,01,06,07,08,17,28			129, 130 00,01,07,08,17,28
21	5	32-Bit Frozen Counter with Time of Freeze			1,2	00,01,06,07,08,17,28			129, 130 00,01,07,08,17,28
21	6	16-Bit Frozen Counter with Time of Freeze			1,2	00,01,06,07,08,17,28			129, 130 00,01,07,08,17,28
21	7	32-Bit Frozen Delta Counter with Time of Freeze			1,2	00,01,06,07,08,17,28			129, 130 00,01,07,08,17,28
21	8	16-Bit Frozen Delta Counter with Time of Freeze			1,2	00,01,06,07,08,17,28			129, 130 00,01,07,08,17,28
21	9	32-Bit Frozen Counter without Flag			1,2	00,01,06,07,08,17,28	129, 130	00, 01	07,08,17,28
21	10	16-Bit Frozen Counter without Flag			1,2	00,01,06,07,08,17,28	129, 130	00, 01	07,08,17,28
21	11	32-Bit Frozen Delta Counter without Flag			1,2	00,01,06,07,08,17,28			129, 130 00,01,07,08,17,28
21	12	16-Bit Frozen Delta Counter without Flag			1,2	00,01,06,07,08,17,28			129, 130 00,01,07,08,17,28
22	0	Counter Change Event - All Variations	1	06,07,08		00,01,17,28			
22	1	32-Bit Counter Change Event without Time			1,2	00,01,06,07,08,17,28	129, 130	17, 28	00,01,07,08
22	2	16-Bit Counter Change Event without Time			1,2	00,01,06,07,08,17,28	129, 130	17, 28	00,01,07,08
22	3	32-Bit Delta Counter Change Event without Time			1,2	00,01,06,07,08,17,28			129, 130 00,01,07,08,17,28
22	4	16-Bit Delta Counter Change Event without Time			1,2	00,01,06,07,08,17,28			129, 130 00,01,07,08,17,28
22	5	32-Bit Counter Change Event with Time			1,2	00,01,06,07,08,17,28			129, 130 00,01,07,08,17,28
22	6	16-Bit Counter Change Event with Time			1,2	00,01,06,07,08,17,28			129, 130 00,01,07,08,17,28
22	7	32-Bit Delta Counter Change Event with Time			1,2	00,01,06,07,08,17,28			129, 130 00,01,07,08,17,28
22	8	16-Bit Delta Counter Change Event with Time			1,2	00,01,06,07,08,17,28			129, 130 00,01,07,08,17,28
23	0	Frozen Counter Event - All Variations			1,	00,01,06,07,08,17,28			129, 130 00,01,07,08,17,28
23	1	32-Bit Frozen Counter Event without Time			1,2	00,01,06,07,08,17,28			129, 130 00,01,07,08,17,28



OBJECT		REQUEST (slave must parse)		RESPONSE (master must parse)				
Obj	Var	Description	Func Codes (dec)	Qual Codes (hex)	Func Codes	Qual Codes (hex)		
23	2	16-Bit Frozen Counter Event without Time			1,2	00,01,06,07,08,17,28	129,130	00,01,07,08,17,28
23	3	32-Bit Frozen Delta Counter Event without Time			1,2	00,01,06,07,08,17,28	129,130	00,01,07,08,17,28
23	4	16-Bit Frozen Delta Counter Event without Time			1,2	00,01,06,07,08,17,28	129,130	00,01,07,08,17,28
23	5	32-Bit Frozen Counter Event with Time			1,2	00,01,06,07,08,17,28	129,130	00,01,07,08,17,28
23	6	16-Bit Frozen Counter Event with Time			1,2	00,01,06,07,08,17,28	129,130	00,01,07,08,17,28
23	7	32-Bit Frozen Delta Counter Event with Time			1,2	00,01,06,07,08,17,28	129,130	00,01,07,08,17,28
23	8	16-Bit Frozen Delta Counter Event with Time			1,2	00,01,06,07,08,17,28	129,130	00,01,07,08,17,28
30	0	Analog Input - All Variations	1	6		00,01,07,08,17,28		
30	1	32-Bit Analog Input			1,2	00,01,06,07,08,17,28	129,130	00,01
30	2	16-Bit Analog Input			1,2	00,01,06,07,08,17,28	129,130	00,01
30	3	32-Bit Analog Input without Flag			1,2	00,01,06,07,08,17,28	129,130	00,01
30	4	16-Bit Analog Input without Flag			1,2	00,01,06,07,08,17,28	129,130	00,01
31	0	Frozen Analog Input - All Variations			1	00,01,06,07,08,17,28		
31	1	32-Bit Frozen Analog Input			1,2	00,01,06,07,08,17,28	129,130	00,01,07,08,17,28
31	2	16-Bit Frozen Analog Input			1,2	00,01,06,07,08,17,28	129,130	00,01,07,08,17,28
31	3	32-Bit Frozen Analog Input with Time of Freeze			1,2	00,01,06,07,08,17,28	129,130	00,01,07,08,17,28
31	4	16-Bit Frozen Analog Input with Time of Freeze			1,2	00,01,06,07,08,17,28	129,130	00,01,07,08,17,28
31	5	32-Bit Frozen Analog Input without Flag			1,2	00,01,06,07,08,17,28	129,130	00,01,07,08,17,28
31	6	16-Bit Frozen Analog Input without Flag			1,2	00,01,06,07,08,17,28	129,130	00,01,07,08,17,28
32	0	Analog Change Event - All Variations	1	06,07,08		00,01,06,17,28		
32	1	32-Bit Analog Change Event without Time			1,2	00,01,06,07,08,17,28	129,130	17,28
32	2	16-Bit Analog Change Event without Time			1,2	00,01,06,07,08,17,28	129,130	17,28
32	3	32-Bit Analog Change Event with Time			1,2	00,01,06,07,08,17,28	129,130	00,01,07,08,17,28
32	4	16-Bit Analog Change Event with Time			1,2	00,01,06,07,08,17,28	129,130	00,01,07,08,17,28
33	0	Frozen Analog Event - All Variations			1	00,01,06,07,08,17,28		

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OBJECT		REQUEST (slave must parse)			RESPONSE (master must parse)					
Obj	Var	Description	Func Codes (dec)	Qual Codes (hex)		Func Codes	Qual Codes (hex)			
33	1	32-Bit Frozen Analog Event without Time			1,2	00,01,06,07,08,17,28			129, 130	00,01,07,08,17,28
33	2	16-Bit Frozen Analog Event without Time			1,2	00,01,06,07,08,17,28			129, 130	00,01,07,08,17,28
33	3	32-Bit Frozen Analog Event with Time			1,2	00,01,06,07,08,17,28			129, 130	00,01,07,08,17,28
33	4	16-Bit Frozen Analog Event with Time			1,2	00,01,06,07,08,17,28			129, 130	00,01,07,08,17,28
40	0	Analog Output Status - All Variations	1	6		00,01,07,08,17,28				
40	1	32-Bit Analog Output Status			1,2	00,01,06,07,08,17,28			129, 130	00,01,07,08,17,28
40	2	16-Bit Analog Output Status			1,2	00,01,06,07,08,17,28	129, 130	00, 01		07,08,17,28
41	0	Analog Output Block - All Variations			1,	00,01,06,07,08,17,28				
41	1	32-Bit Analog Output Block			1,2,4,6	00,01,06,07,08,17,28			129, 130	00,01,07,08,17,28
41	2	16-Bit Analog Output Block	3,4,5,6	17, 28	$\frac{*3 *5}{2} 1$	00,01,06,07,08	129	echo of request		
50	0	Time and Date - All Variations			1,2	00,01,06,07,08,17,28				
50	1	Time and Date	2 (see 4.14)	07 where quantity = 1	1,	00,01,06,08,17,28			129,	00,01,07,08,17,28
50	2	Time and Date with Interval			1,2	00,01,06,07,08,17,28			129,	00,01,07,08,17,28
51	0	Time and Date CTO - All Variations			1,	00,01,06,07,08,17,28				
51	1	Time and Date CTO			1,2	00,01,06,07,08,17,28	129, 130	07, quantity=1	129**	
51	2	Unsynchronized Time and Date CTO			1,2	00,01,06,07,08,17,28	129, 130	07, quantity=1	129**	
52	0	Time Delay - All Variations								
52	1	Time Delay Coarse					129	07, quantity=1	129*	
52	2	Time Delay Fine	1,23	N/A			129	07, quantity=1	129*	
60	0									
60	1	Class 0 Data	1	6						
60	2	Class 1 Data	1	06,07,08						
60	3	Class 2 Data	1	06,07,08						
60	4	Class 3 Data	1	06,07,08						
70	1	File Identifier								
80	1	Internal Indications	2	0	$\underline{2}^*$					
				index=7						
81	1	Storage Object								





OBJECT			REQUEST (slave must parse)		RESPONSE (master must parse)				
Obj	Var	Description	Func Codes (dec)	Qual Codes (hex)		Func Codes	Qual Codes (hex)		
82	1	Device Profile							
83	1	Private Registration Object							
83	2	Private Registration Object Descriptor							
90	1	Application Identifier							
100	1	Short Floating Point							
100	2	Long Floating Point							
100	3	Extended Floating Point							
101	1	Small Packed Binary-Coded Decimal							
101	2	Medium Packed Binary-Coded Decimal							
101	3	Large Packed Binary-Coded Decimal							
		No Object	13						
		No Object	23 (see 4.14)						



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