

7SR210 Non-Directional Relay

Data Communications Definitions

(Software Version 2435H85008R7a-7a)

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1.IEC 60870-5-103 Definitions

1.1. Introduction

This section describes the IEC 60870-5-103 protocol implementation in the relays. This protocol is used for the communication with REYDISP software and can also be used for communication with a suitable control system. The control system or local PC acts as the master in the system with the relay operating as a slave responding to the master's commands. The implementation provides event information, time synchronising, commands and measurands and also supports the transfer of disturbance records.

This protocol can be set to use any or all of the relays hardware interfaces (USB, Fibre Optic and RS485) and is the standard protocol used by the USB port. The relay can communicate simultaneously on all ports regardless of protocol used.

Each relay must be given an address to enable communication and can be set by the *Communication Interface:Relay Address*. A relay with the default address of **0** will not be able to communicate.

Cause of Transmission

The cause of transmission (COT) column of the 'Information Number and Function' table lists possible causes of transmission for these frames. The following abbreviations are used:

Abbreviation	Description
SE	spontaneous event
T	test mode
GI	general interrogation
Loc	local operation
Rem	remote operation
Ack	command acknowledge
Nak	Negative command acknowledge

Note: Events listing a GI cause of transmission can be raised and cleared; other events are raised only.

Function Type

Abbreviation	Description
1	Time tagged message (monitor direction)
2	Time tagged message (relative time) (monitor direction)
3.1	Measurands I
4	Time-tagged measurands with relative time
5	Identification message
6	Time synchronisation
7	General Interrogation Initialization
9	Measurands II
20	General command

1.2. IEC 60870-5-103 Event Numbers

Information Number and Function

The following table lists information number and function definitions together with a description of the message and function type and cause of transmission that can result in that message. Not all definitions are available on all relay types – this is dependent on functionality.

FUN	INF	Description	GI	TYP	COT
60	4	Remote Mode	x	1	1,9
60	5	Service Mode	x	1	1,9
60	6	Local Mode	x	1	1,9
60	7	Local & Remote	x	1	1,9
60	12	Control Received	-	1	1
60	13	Command Received	-	1	1
60	128	Cold Start	-	1	1
60	129	Warm Start	-	1	1
60	130	Re-Start	-	1	1
60	135	Trigger Storage	-	1	1
60	136	Clear Waveform Records	-	1	1
60	137	Clear Fault Records	-	1	1
60	138	Clear Event Records	-	1	1
60	140	Demand metering reset	-	1	1
60	170	General Alarm 1	x	1	1,9
60	171	General Alarm 2	x	1	1,9
60	172	General Alarm 3	x	1	1,9
60	173	General Alarm 4	x	1	1,9
60	174	General Alarm 5	x	1	1,9
60	175	General Alarm 6	x	1	1,9
60	176	General Alarm 7	x	1	1,9
60	177	General Alarm 8	x	1	1,9
60	178	General Alarm 9	x	1	1,9
60	179	General Alarm 10	x	1	1,9
60	180	General Alarm 11	x	1	1,9
60	181	General Alarm 12	x	1	1,9
60	182	Quick Logic E1	x	1	1,9
60	183	Quick Logic E2	x	1	1,9
60	184	Quick Logic E3	x	1	1,9
60	185	Quick Logic E4	x	1	1,9
60	186	Quick Logic E5	x	1	1,9
60	187	Quick Logic E6	x	1	1,9
60	188	Quick Logic E7	x	1	1,9
60	189	Quick Logic E8	x	1	1,9
60	190	Quick Logic E9	x	1	1,9
60	191	Quick Logic E10	x	1	1,9
60	192	Quick Logic E11	x	1	1,9
60	193	Quick Logic E12	x	1	1,9
60	194	Quick Logic E13	x	1	1,9
60	195	Quick Logic E14	x	1	1,9
60	196	Quick Logic E15	x	1	1,9

FUN	INF	Description	GI	TYP	COT
60	197	Quick Logic E16	x	1	1,9
60	214	Function Key 1	x	1	1,9
60	215	Function Key 2	x	1	1,9
60	216	Function Key 3	x	1	1,9
60	217	Function Key 4	x	1	1,9
60	218	Function Key 5	x	1	1,9
60	219	Function Key 6	x	1	1,9

FUN	INF	Description	GI	TYP	COT
70	5	Binary Input 5	x	1	1,9
70	6	Binary Input 6	x	1	1,9
70	7	Binary Input 7	x	1	1,9
70	8	Binary Input 8	x	1	1,9
70	9	Binary Input 9	x	1	1,9
70	10	Binary Input 10	x	1	1,9
70	11	Binary Input 11	x	1	1,9
70	12	Binary Input 12	x	1	1,9
70	13	Binary Input 13	x	1	1,9
70	14	Binary Input 14	x	1	1,9
70	15	Binary Input 15	x	1	1,9
70	16	Binary Input 16	x	1	1,9
70	17	Binary Input 17	x	1	1,9
70	18	Binary Input 18	x	1	1,9
70	19	Binary Input 19	x	1	1,9

FUN	INF	Description	GI	TYP	COT
80	1	Binary Output 1	x	1	1,9
80	2	Binary Output 2	x	1	1,9
80	3	Binary Output 3	x	1	1,9
80	4	Binary Output 4	x	1	1,9
80	5	Binary Output 5	x	1	1,9
80	6	Binary Output 6	x	1	1,9
80	7	Binary Output 7	x	1	1,9
80	8	Binary Output 8	x	1	1,9
80	9	Binary Output 9	x	1	1,9
80	10	Binary Output 10	x	1	1,9
80	11	Binary Output 11	x	1	1,9
80	12	Binary Output 12	x	1	1,9
80	13	Binary Output 13	x	1	1,9
80	14	Binary Output 14	x	1	1,9
80	15	Binary Output 15	x	1	1,9
80	16	Binary Output 16	x	1	1,9

FUN	INF	Description	GI	TYP	COT
160	0	GI	-	8	10
160	0	Time Synchronisation	-	6	8
160	0	Data Lost	-	1	1

FUN	INF	Description	GI	TYP	COT
160	2	Reset FCB	-	5	3
160	3	Reset CU	-	5	4
160	4	Start/Restart	-	5	5
160	5	Power On	-	1	1
160	16	Auto-reclose active	x	1	1,9
160	19	LED Reset	x	1	1
160	22	Settings changed	-	1	1
160	23	Setting G1 selected	x	1	1,9
160	24	Setting G2 selected	x	1	1,9
160	25	Setting G3 selected	x	1	1,9
160	26	Setting G4 selected	x	1	1,9
160	27	Binary Input 1	x	1	1,9
160	28	Binary Input 2	x	1	1,9
160	29	Binary Input 3	x	1	1,9
160	30	Binary Input 4	x	1	1,9
160	36	Trip Circuit Fail	x	1	1,9
160	64	Start/Pick-up L1	x	2	1,9
160	65	Start/Pick-up L2	x	2	1,9
160	66	Start/Pick-up L3	x	2	1,9
160	67	Start/Pick-up N	x	2	1,9
160	68	General Trip	-	2	1
160	69	Trip L1	-	2	1
160	70	Trip L2	-	2	1
160	71	Trip L3	-	2	1
160	84	General Start/Pick-up	x	2	1,9
160	85	Breaker Failure	-	2	1
160	90	Trip I>	-	2	1
160	91	Trip I>>	-	2	1
160	92	Trip In>	-	2	1
160	93	Trip In>>	-	2	1
160	128	CB on by auto reclose	-	1	1

FUN	INF	Description	GI	TYP	COT
183	10	51-1	x	2	1,9
183	11	50-1	x	2	1,9
183	12	51N-1	x	2	1,9
183	13	50N-1	x	2	1,9
183	14	51G-1	x	2	1,9
183	15	50G-1	x	2	1,9
183	16	51-2	x	2	1,9
183	17	50-2	x	2	1,9
183	18	51N-2	x	2	1,9
183	19	50N-2	x	2	1,9
183	20	51G-2	x	2	1,9
183	21	50G-2	x	2	1,9
183	34	50BF stage 2	x	2	1,9
183	35	49-Alarm	x	2	1,9
183	36	49-Trip	x	2	1,9

FUN	INF	Description	GI	TYP	COT
183	40	60 CTS	x	2	1,9
183	41	51SEF-1	x	2	1,9
183	42	50SEF-1	x	2	1,9
183	43	51SEF-2	x	2	1,9
183	44	50SEF-2	x	2	1,9
183	49	SEF Out	x	2	1,9
183	50	46IT	x	2	1,9
183	51	46DT	x	2	1,9
183	52	64H	x	2	1,9
183	53	E/F Out	x	2	1,9
183	56	50BF stage 1	x	2	1,9
183	62	37-1	x	2	1,9
183	63	37-2	x	2	1,9
183	64	37G-1	x	2	1,9
183	65	37G-2	x	2	1,9
183	70	46BC	x	2	1,9
183	96	81HBL2	x	2	1,9
183	101	Trip Circuit Fail 1	x	2	1,9
183	102	Trip Circuit Fail 2	x	2	1,9
183	103	Trip Circuit Fail 3	x	2	1,9
183	110	Setting G5 selected	x	1	1,9
183	111	Setting G6 selected	x	1	1,9
183	112	Setting G7 selected	x	1	1,9
183	113	Setting G8 selected	x	1	1,9
183	114	Close CB Failed	-	1	1
183	115	Open CB Failed	-	1	1
183	116	Reclaim	x	1	1,9
183	117	Lockout	x	1	1,9
183	119	Successful DAR Close	-	1	1
183	120	Successful Man Close	-	1	1
183	121	HotLine Working	x	1	1,9
183	122	Inst Protection Out	x	1	1,9
183	123	CB Total Trip Count	x	1	1,9
183	124	CB Delta Trip Count	x	1	1,9
183	125	CB Count To AR Block	x	1	1,9
183	126	Reset CB Total Trip Count	-	1	1
183	127	Reset CB Delta Trip Count	-	1	1
183	128	Reset CB Count To AR Block	-	1	1
183	129	I ² t CB Wear	x	1	1,9
183	130	Reset I ² t CB Wear	-	1	1
183	131	79 AR In progress	x	1	1,9
183	132	CB Frequent Ops Count	x	1	1,9
183	133	Reset CB Frequent Ops Count	-	1	1
183	140	Cold Load Active	x	1	1,9
183	141	P/F Inst Protection Inhibited	x	1	1,9
183	142	E/F Inst Protection Inhibited	x	1	1,9
183	143	SEF Inst Protection Inhibited	x	1	1,9
183	144	Ext Inst Protection Inhibited	x	1	1,9

FUN	INF	Description	GI	TYP	COT
183	163	Trip Time Alarm	-	1	1
183	171	60 CTS-I	x	1	1,9
183	181	CB Total Trip Count	-	1	1
183	182	CB Delta Trip Count	-	1	1
183	183	CB Count To AR Block	-	1	1
183	184	CB Freq Ops Count	-	1	1
183	222	37-PhA	x	1	1,9
183	223	37-PhB	x	1	1,9
183	224	37-PhC	x	1	1,9
183	231	50BF-PhA	x	1	1,9
183	232	50BF-PhB	x	1	1,9
183	233	50BF-PhC	x	1	1,9
183	234	50BF-EF	x	1	1,9

FUN	INF	Description	GI	TYP	COT
200	1	CB 1	x	1	1,9
200	200	CB 1 Trip & Reclose	-	1	1
200	201	CB 1 Trip & Lockout	-	1	1
200	255	Blocked By Interlocking	x	1	1

FUN	INF	Description	GI	TYP	COT
255	0	GI End	-	8	10
255	0	Time Synchronisation	-	6	8

Measurand

Function	Information Number	Description	Function Type	Cause of Transmission
183	148	Measurand $I_{L1,2,3}$, P, Q, F, I_{L1} (2.4 x) I_{L2} (2.4 x) I_{L3} (2.4 x) P (2.4 x) Q (2.4 x) F (1.2 x)	9	Cyclic

Disturbance Recorder Actual Channel (ACC) Numbers

Function	ACC Number	Description
182	0	Global
182	1	Va
182	2	Vb
182	3	Vc
182	4	Not Used
182	5	Ia
182	6	Ib
182	7	Ic
182	8	Ig1

1.3. IEC 60870-5-103 Command Numbers

FUN	INF	Description	COM	TYP	COT
60	140	Reset Demand metering	ON	20	20
60	4	Remote Mode	ON	20	20
60	5	Service Mode	ON	20	20
60	6	Local Mode	ON	20	20
60	7	Local & Remote	ON	20	20

FUN	INF	Description	COM	TYP	COT
80	1	Binary Output 1	ON	20	20
80	2	Binary Output 2	ON	20	20
80	3	Binary Output 3	ON	20	20
80	4	Binary Output 4	ON	20	20
80	5	Binary Output 5	ON	20	20
80	6	Binary Output 6	ON	20	20
80	7	Binary Output 7	ON	20	20
80	8	Binary Output 8	ON	20	20
80	9	Binary Output 9	ON	20	20
80	10	Binary Output 10	ON	20	20
80	11	Binary Output 11	ON	20	20
80	12	Binary Output 12	ON	20	20
80	13	Binary Output 13	ON	20	20
80	14	Binary Output 14	ON	20	20
80	15	Binary Output 15	ON	20	20
80	16	Binary Output 16	ON	20	20

FUN	INF	Description	COM	TYP	COT
160	16	Auto-reclose on/off	ON/OFF	20	20
160	19	LED reset	ON	20	20
160	23	Settings Group 1 Select	ON	20	20
160	24	Settings Group 2 Select	ON	20	20
160	25	Settings Group 3 Select	ON	20	20
160	26	Settings Group 4 Select	ON	20	20

FUN	INF	Description	COM	TYP	COT
183	49	SEF Out/In	ON/OFF	20	20
183	53	E/F Out/In	ON/OFF	20	20
183	110	Settings Group 5 Select	ON	20	20
183	111	Settings Group 6 Select	ON	20	20
183	112	Settings Group 7 Select	ON	20	20
183	113	Settings Group 8 Select	ON	20	20
183	121	Hot Line Working on/off	ON/OFF	20	20
183	122	Inst Protection Out/In	ON/OFF	20	20
183	126	Reset CB Total Trip Count	ON	20	20
183	127	Reset CB Delta Trip Count	ON	20	20
183	128	Reset CB Count To AR Block	ON	20	20
183	130	Reset I ² t CB Wear	ON	20	20
183	176	Reset Energy Meters	ON	20	20

FUN	INF	Description	COM	TYP	COT
200	1	CB 1	ON/OFF	20	20
200	200	CB1 Trip & Reclose	ON	20	20
200	201	CB1 Trip & Lockout	ON	20	20

FUN	INF	Description	COM	TYP	COT
255	0	GI Initiation		7	9
255	0	Time Synchronisation		6	8

2.MODBUS Definitions

2.1. Introduction

This section describes the MODBUS-RTU protocol implementation in the relays. This protocol is used for the communication with a suitable control system.

This protocol can be set to use the Fibre Optic and RS485 ports. The relay can communicate simultaneously on all ports regardless of protocol used.

Each relay must be given an address to enable communication and can be set by the *Communication Interface:Relay Address*. A relay with the default address of **0** will not be able to communicate.

Not all definitions are available on all relay types – this is dependent on functionality. The shaded area indicates only available on 7SR22 models.

Coils (Read Write Binary values)

Address	Description
00001	Binary Output 1
00002	Binary Output 2
00003	Binary Output 3
00004	Binary Output 4
00005	Binary Output 5
00006	Binary Output 6
00007	Binary Output 7
00008	Binary Output 8
00009	Binary Output 9
00010	Binary Output 10
00011	Binary Output 11
00012	Binary Output 12
00013	Binary Output 13
00014	Binary Output 14
00015	Binary Output 15
00016	Binary Output 16
00100	LED Reset (Write only location)
00101	Settings Group 1
00102	Settings Group 2
00103	Settings Group 3
00104	Settings Group 4
00105	Settings Group 5
00106	Settings Group 6
00107	Settings Group 7
00108	Settings Group 8
00109	CB 1
00110	CB 1 Trip & Reclose (Write only location)
00111	CB 1 Trip & Lockout (Write only location)
00112	Auto-reclose on/off
00113	Hot Line Working on/off
00114	E/F off/on
00115	SEF off/on
00116	Inst Protection off/on
00118	Reset CB Total Trip Count
00119	Reset CB Delta Trip Count
00120	Reset CB Count To AR Block
00121	Reset CB Frequent Ops Count
00126	Demand metering

Inputs (Read Only Binary values)

10001	Binary Input 1
10002	Binary Input 2
10003	Binary Input 3
10004	Binary Input 4
10005	Binary Input 5
10006	Binary Input 6
10007	Binary Input 7
10008	Binary Input 8
10009	Binary Input 9
10010	Binary Input 10
10011	Binary Input 11
10012	Binary Input 12
10013	Binary Input 13
10014	Binary Input 14
10015	Binary Input 15
10016	Binary Input 16
10017	Binary Input 17
10018	Binary Input 18
10019	Binary Input 19
10102	Remote mode
10103	Service mode
10104	Local mode
10105	Local & Remote mode
10111	Trip Circuit Fail
10112	A-Starter
10113	B-Starter
10114	C-Starter
10115	General Starter
10119	Start/Pick Up N
10122	51-1
10123	50-1
10124	51N-1
10125	50N-1
10126	51G-1
10127	50G-1
10128	51-2
10129	50-2
10130	51N-2
10131	50N-2
10132	51G-2
10133	50G-2
10146	50BF Stage 2
10147	49 Alarm
10148	49 Trip
10150	46IT
10151	46DT
10154	46BC
10167	64H
10168	37-1
10169	37-2
10171	AR Active
10172	CB on by AR
10173	Reclaim
10174	Lockout
10175	Hot Line Working
10176	Inst Protection Out
10177	CB Trip Count Maintenance

10178	CB Trip Count Delta
10179	CB Trip Count Lockout
10180	I ^Δ 2t CB Wear
10181	79 AR In Progress
10182	Cold Load Active
10183	E/F Protection Out
10184	P/F Inst Protection Inhibited
10185	E/F Inst Protection Inhibited
10186	SEF Inst Protection Inhibited
10187	Ext Inst Protection Inhibited
10202	51SEF-1
10203	50SEF-1
10204	51SEF-2
10205	50SEF-2
10210	SEF Out
10211	Trip Circuit Fail 1
10212	Trip Circuit Fail 2
10213	Trip Circuit Fail 3
10214	CB Total Trip Count
10215	CB Delta Trip Count
10216	CB Count To AR Block
10217	CB Frequent Ops Count
10218	I ^Δ 2t CB Wear
10219	CB Open
10220	CB Closed
10290	General Alarm 1
10291	General Alarm 2
10292	General Alarm 3
10293	General Alarm 4
10294	General Alarm 5
10295	General Alarm 6
10296	General Alarm 7
10297	General Alarm 8
10298	General Alarm 9
10299	General Alarm 10
10300	General Alarm 11
10301	General Alarm 12
10302	Quick Logic E1
10303	Quick Logic E2
10304	Quick Logic E3
10305	Quick Logic E4
10306	Quick Logic E5
10307	Quick Logic E6
10308	Quick Logic E7
10309	Quick Logic E8
10310	Quick Logic E9
10311	Quick Logic E10
10312	Quick Logic E11
10313	Quick Logic E12
10314	Quick Logic E13
10315	Quick Logic E14
10316	Quick Logic E15
10317	Quick Logic E16
10334	CTS-I
10335	81HBL2
10336	37G-1
10337	37G-2
10367	50BF-1

10369	37-PhA
10370	37-PhB
10371	37-PhC
10378	50BF-PhA
10379	50BF-PhB
10380	50BF-PhC
10381	50BF-EF

Registers

Address	Name	Format	Description
30001	No.of Events In Store	1 Register	
30002	Event Record	8 Registers ³	
30064	Phase A Primary Curr	FP_32BITS_3DP ¹	Ia A
30066	Phase B Primary Curr	FP_32BITS_3DP ¹	Ib A
30068	Phase C Primary Curr	FP_32BITS_3DP ¹	Ic A
30070	Phase a Secondary Curr	FP_32BITS_3DP ¹	Ia A
30072	Phase b Secondary Curr	FP_32BITS_3DP ¹	Ib A
30074	Phase c Secondary Curr	FP_32BITS_3DP ¹	Ic A
30076	Phase A Nominal Curr	FP_32BITS_3DP ¹	Ia x Inom
30078	Phase B Nominal Curr	FP_32BITS_3DP ¹	Ib x Inom
30080	Phase C Nominal Curr	FP_32BITS_3DP ¹	Ic x Inom
30082	Phase A Nominal Curr	FP_32BITS_3DP ¹	Ia Degrees
30084	Phase B Nominal Curr	FP_32BITS_3DP ¹	Ib Degrees
30086	Phase C Nominal Curr	FP_32BITS_3DP ¹	Ic Degrees
30088	In Primary	FP_32BITS_3DP ¹	In A
30090	In Secondary	FP_32BITS_3DP ¹	In A
30092	In Nominal	FP_32BITS_3DP ¹	In xInom
30094	Ig Primary	FP_32BITS_3DP ¹	Ig A
30096	Ig Secondary	FP_32BITS_3DP ¹	Ig A
30098	Ig Nominal	FP_32BITS_3DP ¹	Ig xInom
30100	Izps Nominal	FP_32BITS_3DP ¹	Izps xIn
30102	Ipps Nominal	FP_32BITS_3DP ¹	Ipps xIn
30104	Inps Nominal	FP_32BITS_3DP ¹	Inps xIn
30106	Izps Nominal	FP_32BITS_3DP ¹	Izps Degrees
30108	Ipps Nominal	FP_32BITS_3DP ¹	Ipps Degrees
30110	Inps Nominal	FP_32BITS_3DP ¹	Inps Degrees
30152	Thermal Status Ph A	UINT16 ²	%
30153	Thermal Status Ph B	UINT16 ²	%
30154	Thermal Status Ph C	UINT16 ²	%
30167	Waveform Records	UINT16 ²	
30168	Event Records	UINT16 ²	
30169	Waveform Records	UINT16 ²	
30193	Ia Max Demand	FP_32BITS_3DP ¹	Ia A
30195	Ib Max Demand	FP_32BITS_3DP ¹	Ib A
30197	Ic Max Demand	FP_32BITS_3DP ¹	Ic A

1) FP_32BITS_3DP: 2 registers - 32 bit fixed point, a 32 bit integer containing a value to 3 decimal places e.g. 50000 sent = 50.000

2) UINT16: 1 register - standard 16 bit unsigned integer

3) Sequence of 8 registers containing an event record. Read address 30002 for 8 registers (16 bytes), each read returns the earliest event record and removes it from the internal store. Repeat this process for the number of events in the register 30001, or until no more events are returned. (the error condition exception code 2)

Holding Registers (Read Write values)

Address	Description
40001	Time Meter

Event Format

The format of the event record is defined by the zero byte. It signifies the type of record which is used to decode the event information. The zero byte can be one of the following.

Type	Description
1	Event
2	Event with Relative Time
4	Measurand Event with Relative Time

3.DNP 3.0 Definitions

3.1. Device Profile

The following table provides a “Device Profile Document” in the standard format defined in the DNP 3.0 Subset Definitions Document. While it is referred to in the DNP 3.0 Subset Definitions as a “Document,” it is in fact a table, and only a component of a total interoperability guide. The table, in combination with the Implementation Table provided and the Point List Tables provided should provide a complete configuration/interoperability guide for communicating with a device implementing the Triangle MicroWorks, Inc. DNP 3.0 Slave Source Code Library.

DNP V3.0 DEVICE PROFILE DOCUMENT (Also see the DNP 3.0 Implementation Table in Section 3.2, beginning on page 22.)	
Vendor Name: Siemens Protection Devices Ltd.	
Device Name: 7SR2* using the Triangle MicroWorks, Inc. DNP3 Slave Source Code Library, Version 3.	
Highest DNP Level Supported: For Requests: Level 2 For Responses: Level 2	Device Function: <input type="checkbox"/> Master <input checked="" type="checkbox"/> Slave
<p>Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP Levels Supported (the complete list is described in the attached table):</p> <p>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.</p> <p>Output Event Objects 11 is supported.</p>	
Maximum Data Link Frame Size (octets): Transmitted: 256 Received 256	Maximum Application Fragment Size (octets): Transmitted: 2048 Received 2048
Maximum Data Link Re-tries: <input type="checkbox"/> None <input type="checkbox"/> Fixed <input checked="" type="checkbox"/> 3	Maximum Application Layer Re-tries: <input checked="" type="checkbox"/> None <input type="checkbox"/> Configurable
Requires Data Link Layer Confirmation: <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable as: Never, Only for multi-frame messages, or Always	
Requires Application Layer Confirmation: <input type="checkbox"/> Never <input type="checkbox"/> Always <input checked="" type="checkbox"/> When reporting Event Data (Slave devices only) <input checked="" type="checkbox"/> When sending multi-fragment responses (Slave devices only) <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable as: “Only when reporting event data”, or “When reporting event data or multi-fragment messages.”	

DNP V3.0 DEVICE PROFILE DOCUMENT (Also see the DNP 3.0 Implementation Table in Section 3.2, beginning on page 22.)	
Timeouts while waiting for: Data Link Confirm: <input type="checkbox"/> None <input checked="" type="checkbox"/> Fixed at 2sec <input type="checkbox"/> Variable <input type="checkbox"/> Configurable Complete Appl. Fragment: <input checked="" type="checkbox"/> None <input type="checkbox"/> Fixed at _____ <input type="checkbox"/> Variable <input type="checkbox"/> Configurable Application Confirm: <input type="checkbox"/> None <input checked="" type="checkbox"/> Fixed at 10sec <input type="checkbox"/> Variable <input type="checkbox"/> Configurable Complete Appl. Response: <input checked="" type="checkbox"/> None <input type="checkbox"/> Fixed at _____ <input type="checkbox"/> Variable <input type="checkbox"/> Configurable Others: Transmission Delay, (0 sec) Select/Operate Arm Timeout, (5 sec) Need Time Interval, (30 minutes) Application File Timeout, (60 seconds) Unsolicited Notification Delay, (5 seconds) Unsolicited Response Retry Delay, (between 3 – 9 seconds) Unsolicited Offline Interval, (30 seconds) Binary Change Event Scan Period, (Polled; Not Applicable) Double Bit Change Event Scan Period, (Unsupported; Not Applicable) Analog Change Event Scan Period, (Unsupported; Not Applicable) Counter Change Event Scan Period, (Unsupported; Not Applicable) Frozen Counter Change Event Scan Period, (Unsupported; Not Applicable) String Change Event Scan Period, (Unsupported; Not Applicable) Virtual Terminal Event Scan Period, (Unsupported; Not Applicable)	
Sends/Executes Control Operations: WRITE Binary Outputs <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable SELECT/OPERATE <input type="checkbox"/> Never <input checked="" type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable DIRECT OPERATE <input type="checkbox"/> Never <input checked="" type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable DIRECT OPERATE – NO ACK <input type="checkbox"/> Never <input checked="" type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable Count > 1 <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable Pulse On <input type="checkbox"/> Never <input type="checkbox"/> Always <input checked="" type="checkbox"/> Sometimes <input type="checkbox"/> Configurable Pulse Off <input type="checkbox"/> Never <input type="checkbox"/> Always <input checked="" type="checkbox"/> Sometimes <input type="checkbox"/> Configurable Latch On <input type="checkbox"/> Never <input type="checkbox"/> Always <input checked="" type="checkbox"/> Sometimes <input type="checkbox"/> Configurable Latch Off <input type="checkbox"/> Never <input type="checkbox"/> Always <input checked="" type="checkbox"/> Sometimes <input type="checkbox"/> Configurable Queue <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable Clear Queue <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable	
Attach explanation if 'Sometimes' or 'Configurable' was checked for any operation.	
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"/> Configurable to send one or the other	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"/> Configurable
Sends Unsolicited Responses: <input type="checkbox"/> Never <input checked="" type="checkbox"/> Configurable <input type="checkbox"/> Only certain objects <input type="checkbox"/> Sometimes (attach explanation) <input checked="" type="checkbox"/> ENABLE/DISABLE UNSOLICITED Function codes supported	Sends Static Data in Unsolicited Responses: <input checked="" type="checkbox"/> Never <input type="checkbox"/> When Device Restarts <input type="checkbox"/> When Status Flags Change No other options are permitted.

DNP V3.0	
DEVICE PROFILE DOCUMENT	
(Also see the DNP 3.0 Implementation Table in Section 3.2, beginning on page 22.)	
Default Counter Object/Variation:	Counters Roll Over at:
<input checked="" type="checkbox"/> No Counters Reported <input type="checkbox"/> Configurable <input type="checkbox"/> Default Object Default Variation: <input type="checkbox"/> Point-by-point list attached	<input checked="" type="checkbox"/> No Counters Reported <input type="checkbox"/> Configurable (attach explanation) <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 checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Configurable	
Sequential File Transfer Support:	
Append File Mode	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Custom Status Code Strings	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Permissions Field	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
File Events Assigned to Class	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
File Events Send Immediately	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Multiple Blocks in a Fragment	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Max Number of Files Open	0

3.2. Implementation Table

The following table identifies which object variations, function codes, and qualifiers the Triangle MicroWorks, Inc. DNP 3.0 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)
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)		
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)
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)
2	0	Binary Input Change – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
2	1	Binary Input Change without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
2	2	Binary Input Change with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
2	3 (default – see note 1)	Binary Input Change with Relative Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
10	0	Binary Output – Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
10	1	Binary Output	1 (read) 1 (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)

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)
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)		
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
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)		
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)
30	2	16-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)
30	3 (default – see note 1)	32-Bit Analog Input 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)
30	4	16-Bit Analog Input 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)
30	5	short floating point	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)
30	6	long floating point	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)
32	0	Analog Change Event – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
32	1 (default – see note 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)
32	2	16-Bit Analog Change Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	3	32-Bit 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	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)
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)
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)
50	0	Time and Date				
50	1 (default – see note 1)	Time and Date	1 (read)	07, (limited qty = 1)	129 (response)	07 (limited qty = 1)
			2 (write)	07 (limited qty = 1)		
50	3	Time and Date Last Recorded Time	2 (write)	07 (limited qty)		
51	1	Time and Date CTO			129 (response) 130 (unsol. resp)	07 (limited qty) (qty = 1)
51	2	Unsynchronized Time and Date CTO			129 (response) 130 (unsol. resp)	07 (limited qty) (qty = 1)
52	1	Time Delay Coarse			129 (response)	07 (limited qty) (qty = 1)
52	2	Time Delay Fine			129 (response)	07 (limited qty) (qty = 1)
60	0	Not Defined				
60	1	Class 0 Data	1 (read)	06 (no range, or all)		
60	2	Class 1 Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)		

OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)
			20 (enbl. unsol.) 21 (dab. unsol.) 22 (assign class)	06 (no range, or all)		
60	3	Class 2 Data	1 (read) 20 (enbl. unsol.) 21 (dab. unsol.) 22 (assign class)	06 (no range, or all) 07, 08 (limited qty) 06 (no range, or all)		
60	4	Class 3 Data	1 (read) 20 (enbl. unsol.) 21 (dab. unsol.) 22 (assign class)	06 (no range, or all) 07, 08 (limited qty) 06 (no range, or all)		
80	1	Internal Indications	1 (read) 2 (write (see note 3))	00, 01 (start-stop) 00 (start-stop) index=7	129 (response)	00, 01 (start-stop)
		No Object (function code only)	13 (cold restart)			
		No Object (function code only)	14 (warm restart)			
		No Object (function code only)	23 (delay meas.)			
		No Object (function code only)	24 (record current time)			

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

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

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

Binary Input Points		
Static (Steady-State) Object Number: 1		
Change Event Object Number: 2		
Static Variation reported when variation 0 requested: 2 (Binary Input 2 with status)		
Change Event Variation reported when variation 0 requested: 3 (Binary Input Change with Absolute Time)		
Point Index	Name/Description	Default Change Event Assigned Class (1, 2, 3 or none)
133	I ² t CB Wear	1
211	50BF-1	
212	50BF-2	1
213	49-Alarm	1
214	49-Trip	1
215	64H	1
217	37-1	1
218	37-2	1
219	Cold Load Active	1
225	General Alarm 1	1
226	General Alarm 2	1
227	General Alarm 3	1
228	General Alarm 4	1
229	General Alarm 5	1
230	General Alarm 6	1
231	General Alarm 7	1
232	General Alarm 8	1
233	General Alarm 9	1
234	General Alarm 10	1
235	General Alarm 11	1
236	General Alarm 12	1
237	Quick Logic E1	1
238	Quick Logic E2	1
239	Quick Logic E3	1
240	Quick Logic E4	1
241	Quick Logic E5	1
242	Quick Logic E6	1
243	Quick Logic E7	1
244	Quick Logic E8	1
245	Quick Logic E9	1
246	Quick Logic E10	1
247	Quick Logic E11	1
248	Quick Logic E12	1
249	Quick Logic E13	1
250	Quick Logic E14	1
251	Quick Logic E15	1
252	Quick Logic E16	1
269	60 CTS-I	1
270	81HBL2	1

Binary Input Points		
Static (Steady-State) Object Number: 1		
Change Event Object Number: 2		
Static Variation reported when variation 0 requested: 2 (Binary Input 2 with status)		
Change Event Variation reported when variation 0 requested: 3 (Binary Input Change with Absolute Time)		
Point Index	Name/Description	Default Change Event Assigned Class (1, 2, 3 or none)
271	37G-1	1
272	37G-2	1
373	37SEF-1	1
374	37SEF-2	1

Binary Output Status Points Object Number: 10 Default Variation reported when variation 0 requested: 2 (Binary Output Status) Control Relay Output Blocks Object Number: 12		
Point Index	Name/Description	Supported Control Relay Output Block Fields
33	LED reset	Pulse On
34	Settings Group 1	Latch On
35	Settings Group 2	Latch On
36	Settings Group 3	Latch On
37	Settings Group 4	Latch On
38	Settings Group 5	Latch On
39	Settings Group 6	Latch On
40	Settings Group 7	Latch On
41	Settings Group 8	Latch On
42	Auto-reclose on/off	Pulse On / Pulse Off
43	Hot Line Working on/off	Pulse On / Pulse Off
44	E/F off/on	Pulse On / Pulse Off
45	SEF off/on	Pulse On / Pulse Off
46	Inst Protection off/on	Pulse On / Pulse Off
48	Reset CB Total Trip Count	Pulse On
49	Reset CB Delta Trip Count	Pulse On
50	Reset CB Count To AR Block	Pulse On
51	Reset CB Frequent Ops Count	Pulse On
53	Reset I ² t CB Wear	Pulse On
54	CB 1	Pulse On / Pulse Off
55	CB 1 Trip & Reclose	Pulse On
56	CB 1 Trip & Lockout	Pulse On
59	Demand metering reset	Pulse On
87	Reset Energy Meters	Pulse On

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.

Point Index	Name/Description	Data Type	Default Deadband	Default Change Event Assigned Class (1, 2, 3 or none)
81	Thermal Status Ph A (%)	DT2		1
82	Thermal Status Ph B (%)	DT2		1
83	Thermal Status Ph C (%)	DT2		1
108	Ia Max Demand (A)	DT1		1
109	Ib Max Demand (A)	DT1		1
110	Ic Max Demand (A)	DT1		1

Data Type	Static Variant	Description
DT1	3	Data is sent as a 32 bit integer in fixed point to 3 decimal places format. E.g. a value of 1023 = 1.023
DT2	4	Data is sent as a 16 bit integer.

4.IEC 61850

4.1. IEC 61850 Points

IEC 61850 information can be found in the following documents:

1. "7SR210 MICS.doc",
2. "7SR210 & 7SR220 PICS.doc",
3. "7SR210 & 7SR220 PIXIT.doc"