

INSTRUCTION MANUAL
FOR
CURRENT DIFFERENTIAL SYSTEM
BE1-CDS240
DISTRIBUTED NETWORK PROTOCOL
(DNP3)



Publication: 9365200991
Revision: F 07/17

INTRODUCTION

This instruction manual provides detailed information about the BE1-CDS240 Current Differential System with the Distributed Network Protocol (DNP3).

First Printing: March 2003

Printed in USA

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July 2017

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REVISION HISTORY

The following information provides a historical summary of the changes made to this instruction manual (9365200991). Revisions are listed in reverse chronological order.

Manual Revision and Date	Change
F, 07/17	<ul style="list-style-type: none">• Added caution statement about nonvolatile memory in Section 1.
E, 03/08	<ul style="list-style-type: none">• Added manual part number and revision to footers.• In Section 5, Table 8, changed from “Default Variation Reported When Variation 0 Requested: 2 (<u>16</u>-Bit Analog Output Status)” to “Default Variation Reported When Variation 0 Requested: 1 (<u>32</u>-Bit Analog Output Status)”.
D, 10/06	<ul style="list-style-type: none">• Added 59X support.• New front cover drawing.
C, 02/04	<ul style="list-style-type: none">• Updated Table 3 in Section 5.
B, 10/03	<ul style="list-style-type: none">• In Section 5, <i>DNP V3.00 Point List</i>, modified notes 10 and 11 pertaining to Table 8, <i>Analog Output Status Points and Control Blocks</i>.
A, 05/03	<ul style="list-style-type: none">• Changed Notes to Index 70 & 71 on page 5-34.• Changed the SDNP-USRAI command on page 6-4.
—, 03/03	<ul style="list-style-type: none">• Initial release.

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SECTION 1 • GENERAL INFORMATION

INTRODUCTION

This document describes the Basler Electric Distributed Network Protocol (DNP) implementation in the BE1-CDS240 Current Differential System. The BE1-CDS240 is classified as an intelligent electronic device (IED) that is capable of reacting or responding to specific requests conforming to a level two slave device, as defined in the DNP3 Subset Definitions Document. This manual contains a list of DNP data objects accessible by a master station.

NOTE

This implementation of DNP3 is fully compliant with DNP3 Subset Definition Level 2, contains many Subset Level 3 features and contains some functionality even beyond Subset Level 3.

CAUTION

This product contains one or more *nonvolatile memory* devices. Nonvolatile memory is used to store information (such as settings) that needs to be preserved when the product is power-cycled or otherwise restarted. Established nonvolatile memory technologies have a physical limit on the number of times they can be erased and written. In this product, the limit is 100,000 erase/write cycles. During product application, consideration should be given to communications, logic, and other factors that may cause frequent/repeated writes of settings or other information that is retained by the product. Applications that result in such frequent/repeated writes may reduce the useable product life and result in loss of information and/or product inoperability.

REFERENCES

- Basler publication 9365200990, Instruction Manual for BE1-CDS240 Current Differential System
- DNP3 Basic 4 Document Set
- DNP Subset Definitions Document
- The DNP Web site (www.dnp.org)

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SECTION 2 • DEVICE PROFILE DOCUMENT

Table 2-1 provides a Device Profile Document in the standard format defined in the DNP3 subset definition document. This table, in combination with the implementation table provided in Section 3, the point list tables provided in Section 5, and description of ASCII commands related to DNP configuration in Section 6, provide a complete application configuration guide for including the BE1-CDS240 DNP protocol in any DNP environment.

Table 2-1. DNP Device Profile Document

DEVICE PROFILE DOCUMENT	
Vendor Name: Basler Electric	
Device Name: BE1-CDS240 Current Differential System	
Highest DNP Level Supported: DNP-L2.	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 are listed below. (The complete list is described in the DNP3 Implementation Table.)</p> <ul style="list-style-type: none"> • For static (non-change event) object requests, request qualifier codes 00 and 01 (start/stop), 07 and 08 (limited quantity), and 17 and 28 (index) are supported in addition to request qualifier code 06 (no range – or all points). • Static object requests sent with qualifiers 00, 01, 06, 07 and 08 will be responded to with qualifiers 00 or 01. • Static object requests sent with qualifiers 17 and 28 will be responded to with qualifiers 17 or 28. • The read function code for string object 110 is supported. • Dead band for each reporting AI point is configurable via object 34 and class assignment for each reporting binary and analog input point via DNP assign class function. • Dead bands and assigned classes changed via DNP can be saved on user request via Analog Output Block object 41 in nonvolatile memory. • There are more programmable DNP features configurable by ASCII commands such as: Slave synchronization time period, pre-transfer delay, assigned class for default analog input and binary input points, dead band for default analog input points, and user selection of analog and binary input points to be reported. Selection of analog and binary input points supports the BE1-CDS240 configurable Class 0 feature. • All DNP parameters changed via ASCII are saved into nonvolatile memory. 	
Maximum Data Link Frame Size (octets): Transmitted <u>292</u> Received <u>292</u>	Maximum Application Fragment Size (octets): Transmitted <u>2048</u> Received <u>1024</u>
Maximum Data Link Re-tries: <input checked="" type="checkbox"/> None <input type="checkbox"/> Fixed at _____ <input type="checkbox"/> Configurable	Maximum Application Layer Re-tries: <input checked="" type="checkbox"/> None <input type="checkbox"/> Fixed at _____ <input type="checkbox"/> Configurable, range _____ to _____
Requires Data Link Layer Confirmation: <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes If 'Sometimes,' when? _____ <input type="checkbox"/> Configurable If 'Configurable,' how? _____	
Requires Application Layer Confirmation: <input type="checkbox"/> Never <input type="checkbox"/> Always (not recommended) <input checked="" type="checkbox"/> When reporting Event Data (slave devices only) <input checked="" type="checkbox"/> When sending multi-fragment responses (slave devices only) <input checked="" type="checkbox"/> When returning IIN1-0 bit set as response to broadcast address hex FFFE or FFFF.	

DEVICE PROFILE DOCUMENT

Timeouts while waiting for:

Data Link Confirm	<input type="checkbox"/> None	<input checked="" type="checkbox"/> Fixed at 3000 ms	<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 5000 ms	<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

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 checked="" type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
Pulse Off	<input checked="" type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
Latch On	<input type="checkbox"/> Never	<input checked="" type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
Latch Off	<input type="checkbox"/> Never	<input checked="" type="checkbox"/> Always	<input 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

Reports Binary Input Change Events when no specific variation requested (slave only):

Never
 Only time-tagged
 Only non-time-tagged
 Configurable to send both, one or the other (attach explanation)

Reports time-tagged Binary Input Change Events when no specific variation requested:

Never
 Binary Input Change With Time
 Binary Input Change With Relative Time
 Configurable (attach explanation)

Master Expects Binary Input Change Events:

Never
 Either time-tagged or non-time-tagged for a single event
 Both time-tagged and non-time-tagged for a single event
 Configurable (attach explanation)

Sends Unsolicited Responses (slave only):

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

Sends Static Data in Unsolicited Responses (slave only):

Never
 When Device Restarts
 When Status Flags Change

No other options are permitted

Default Counter Object/Variation:

No Counters Reported
 Configurable (attach explanation)
 Default Object
 Default Variation
 Point-by-point list attached

Counters Roll Over at:

No Counters Reported
 Configurable (attach explanation)
 16 Bits
 32 Bits
 Other Value:
 Point- by-point list attached

Sends Multi-Fragment Responses (slave only): Yes No

SECTION 3 • IMPLEMENTATION TABLE

DNP IMPLEMENTATION TABLE

Table 3-1 identifies which object variations, function codes, and qualifiers the BE1-CDS240 DNP supports in both request messages and response messages.

For static (non-change-event) objects, requests sent with qualifiers 00, 01, 06, 07, or 08 will be responded to with qualifiers 00 or 01. Static object requests sent with qualifiers 17 or 28 will be responded to with qualifiers 17 or 28.

For change-event objects, qualifiers 17 and 28 are always responded.

Table 3-1. DNP Implementation Table

OBJECT			REQUEST (BE1-CDS-240 will parse)		RESPONSE (BE1-CDS-240 will respond with)	
Object No.	Variation No.	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (hex)	Qualifier Codes (hex)
1	0	Binary Inputs – (Variation 0 is used to request default variation)	1 (read) 22 (assign class)	00,01 (start- stop) 06 (no range) 07,08 (limited qty) 17,28 (index)		
1	1 (default – see Note 1)	Single-Bit Binary Input	1 (read) 22 (assign class)	00,01 (start- stop) 06 (no range) 07,08 (limited qty) 17,28 (index)	81 (response)	00,01 (start-stop) 17,28 (index)
2	0	Binary Input Change (Variation 0 is used to request default variation)	1 (read)	06 (no range) 07,08 (limited qty)		
2	1	Binary Input Change without time	1 (read)	06 (no range) 07,08 (limited qty)	81 (response)	17,28 (index)
2	2 (default – see Note 1)	Binary Input Change with time	1 (read)	06 (no range) 07,08 (limited qty)	81 (response)	17,28 (index)
10	0	Binary Output – (Variation 0 is used to request default variation)	1 (read)	00,01 (start- stop) 06 (no range) 07,08 (limited qty) 17,28 (index)		
10	2 (default – see Note 1)	Binary Output Status	1 (read)	00,01 (start- stop) 06 (no range) 07,08 (limited qty) 17,28 (index)	81	00,01 (start-stop) 17,28 (index)
12	1	Control Relay Output Block	3 (select) 4 (operate) 5 (direct op) 6 (dir op Noack)	00,01 (start-stop) 07,08 (limited qty) 17,28 (index)	81	echo of request
30	0	Analog Input (Variation 0 is used to request default variation)	1 (read) 22 (assign class)	00,01 (start- stop) 06 (no range) 07,08 (limited qty) 17,28 (index)	81(response)	00,01 (start-stop) 17,28 (index)
30	1	32-Bit Analog Input with Flag	1 (read) 22 (assign class)	00,01 (start- stop) 06 (no range) 07,08 (limited qty) 17,28 (index)	81	00,01 (start-stop) 17,28 (index)
30	2	16-Bit Analog Input with Flag	1 (read) 22 (assign class)	00,01 (start- stop) 06 (no range) 07,08 (limited qty) 17,28 (index)	81	00,01 (start-stop) 17,28 (index)

OBJECT			REQUEST (BE1-CDS-240 will parse)		RESPONSE (BE1-CDS-240 will respond with)	
Object No.	Variation No.	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (hex)	Qualifier Codes (hex)
30	3 (default – see Note 1)	32-Bit Analog Input without Flag	1 (read) 22 (assign class)	00,01 (start - stop) 06 (no range) 07,08 (limited qty) 17,28 (index)	81	00,01 (start-stop) 17,28 (index)
30	4	16-Bit Analog Input without Flag	1 (read) 22 (assign class)	00,01 (start - stop) 06 (no range) 07,08 (limited qty) 17,28 (index)	81	00,01 (start-stop) 17,28 (index)
32	0	Analog Change Event (Variation 0 is used to request default variation)	1 (read)	06 (no range) 07,08 (limited qty)		
32	1 (default – see Note 1)	32-Bit Analog Input without time	1 (read)	06 (no range) 07,08 (limited qty)	81	17,28 (index)
32	2	16-Bit Analog Input without time	1 (read)	06 (no range) 07,08 (limited qty)	81	17,28 (index)
32	3	32-Bit Analog Input with time	1 (read)	06 (no range) 07,08 (limited qty)	81	17,28 (index)
32	4	16-Bit Analog Input with time	1 (read)	06 (no range) 07,08 (limited qty)	81	17,28 (index)
34	0	16- Bit Analog Input dead-band (Variation 0 is used to request default variation)	1 (read), 2 (write)	00,01, (start - stop) 06 (no range for reading only) 07,08 (limited qty) 17,28 (index)		
34	1 (default – see Note 1)	16- Bit Analog Input dead-band	1 (read) 2 (write)	00,01, (start - stop) 06 (no range - for reading only) 07,08 (limited qty) 17,28 (index)	81	00,01 (start-stop) 17,28 (index)
34	2	32- Bit Analog Input dead-band	1 (read) 2 (write)	00,01, (start - stop) 06 (no range - for reading only) 07,08 (limited qty) 17,28 (index)	81	00,01 (start-stop) 17,28 (index)
40	0	Analog Output Status – (Variation 0 is used to request default variation)	1	00,01 (start-stop) 06 (no range) 07,08 (limited qty) 17,28 (index)		
40	1 (default - see Note 1)	32-bit Analog Output Status	1 (read)	00,01 (start - stop) 06 (no range) 07,08 (limited qty) 17,28 (index)	81	00,01 (start-stop) 17,28 (index)
40	2	16-bit Analog Output Status	1 (read)	00,01 (start - stop) 06 (no range) 07,08 (limited qty) 17,28 (index)	81	00,01 (start-stop) 17,28 (index)
41	1	32-bit Analog Output Block	3 (select) 4 (operate) 5 (direct op) 6 (dir op noack)	00,01 (start - stop) 07,08 (limited qty) 17,28 (index)	81	echo of request
41	2	16-bit Analog Output Block	3 (select) 4 (operate) 5 (direct op) 6 (dir op noack)	00,01 (start - stop) 07,08 (limited qty) 17,28 (index)	81	echo of request
50	1	Time and date	1 (read) 2 (write)	00,01 (start - stop) 06 (no range or all) 07 (limited qty=1) 08 (limited qty) 17,28 (index)	81	00,01 (start-stop) 17,28 (index)

OBJECT			REQUEST (BE1-CDS-240 will parse)		RESPONSE (BE1-CDS-240 will respond with)	
Object No.	Variation No.	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (hex)	Qualifier Codes (hex)
60	1	Class 0 Data (Note 1) (Note 4)	1 (read)	06	81	
60	2	Class 1 Data	1 22	06, 07, 08 6	81	
60	3	Class 2 Data	1 22	06, 07, 08 6	81	
60	4	Class 3 Data	1 22	06, 07, 08 6	81	
80	1	Internal Indications	2 (write)	00 (start - stop) (index must=7)		
110		Octet (Character) String object	1 (read)	00,01 (start - stop) 06 (no range) 07, 08 17, 28	81	00, 01 (start - stop) 17, 28 (index)
		No Object (function code only) (See Note 3)	13 (cold restart)			
		No Object (function code only) (See Note 3)	14 (warm restart)			
		No Object (function code only)	23 (delay measurement)			

Notes for Table 3-1:

1. A Default variation refers to the variation responded to when variation 0 is requested and/or in class 0, 1, 2, or 3 scans.
2. Object 110 is not included in Class 0 poll response.
3. A cold restart is implemented as a warm restart – the DNP process is restarted.
4. In Class 0 are by default, mapping included only all Binary Inputs (object 1) and all Analog Inputs (object 30). User can configure analog and binary points to be reported in Class 0 by ASCII commands (see details in Section 6, *DNP Configuration via ASCII Protocol*).
5. Size of event buffer for binary events is 512.
6. Size of event buffer for analog events is equal to total number of default analog points.
7. Maximum time between characters (inter-character timeout) is 50 ms.

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SECTION 4 • RELAY STYLE NUMBER AND ADDRESS

RELAY BASIC PARAMETERS FOR DNP

These paragraphs describe basic configuration settings that must be set to enable the BE1-CDS240 to support DNP. Other DNP configurable parameters via ASCII commands are described in Section 6.

Relay Style Number

BE1-CDS240 relays that support the DNP protocol must have a Style Number with the seventh character as a number 3. This can be verified by reading the relay Style Number via the front communication port using the RG-VER ASCII command. (Reference: The BE1-CDS240 Instructional Manual).

Example:

```
>RG-VER
Model Number : BE1-CDS240
Style Number : 4E3N1H3N3E1
App Program : VER 1.03.00 09/01/2006
DSP Program : VER 1.03.00 08/22/2006
Boot Program : VER 2.14.00 05/13/2003
Serial Number : H00316624
```

BE1-CDS240 Slave Address

BE1-CDS240 relays support DNP through the rear RS-485 communication port, which is communication port 2 (COM2). This port supports baud rates of 300, 600, 1200, 2400, 4800, 9600 and 19200. The default baud rate is 9600.

DNP Slave IED Address Range is from 0 to 65532. Default BE1-CDS240 DNP address is 0.

Three broadcast addresses are assigned for signaling the slave to request or suppress confirmation of receipt of the broadcast message. The following addresses are reserved for broadcast: 0xFFFF, 0xFFFE, and 0xFFFD. (Note: All addresses are in hexadecimal.)

When BE1-CDS240 receives address 65535 (hex FFFF) or 65534(hex FFFE) it must return IIN1-0 bit set with the application layer request for confirmation bit (Application Control, bit 5) set.

When BE1-CDS240 receives address 65533 (hex FFFD) it must return IIN1-0 bit set with the application layer request for confirmation bit (Application Control, bit 5) suppressed.

The communication address can be set by the SG-COM2 ASCII command.

Example: Set the BE1-CDS240 address at 125 and the baud rate at 9600.

(In the following example, the operator's commands are in **bold**.)

```
>a=<global_password> <enter> //enter global password
>ACCESS GRANTED: GLOBAL
>SG-COM2=9600,A125 <enter>
>EXIT<enter>
>SAVE CHANGES (Y/N/C)?
>Y<enter>
>CHANGE COM PARAMETERS
```

To verify the port address, enter the following command:

```
>SG-COM2 <enter>
>SG-COM2=9600, A125, P0,R1,X0
```

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SECTION 5 • POINT LIST

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SECTION 5 • POINT LIST

BINARY INPUT POINTS

Binary Input changes are scanned every quarter of power system cycle. Events are pending in the Slave application buffer until slave (BE1-CDS240) receives from its Master device confirmation that response with pending events was received. Table 5-1 contains default list of all binary input points.

User can select points to be reported via DNP by dedicated ASCII commands as described in Section 6, *DNP Configuration via ASCII Protocol, Mapping of Binary and Analog Input Points*.

Table 5-1. Default List of Binary Input Points

Binary Input Points	
Static Object Number: 1	
Change Event Object Number: 2	
Request Function Codes Supported: 1 (read) and 22 (assign class) for object 2.	
Static Variation Reported When Variation 0 Requested: 1 (Binary Input without status)	
Change Event Variation Reported When Variation 0 Requested: 2 (Binary Input Change with time)	
Change Event scan rate: Four times per power system cycle	
Change Event Buffer Capacity: 512 events	
Change Event Default Class for all points is 1.	

Default Point Index	Description	Default Point Index	Description
0	50T Phase picked up		Latched Targets
1	150T Phase picked up	259	750T Phase A
2	250T Phase picked up	260	750T Phase B
3	350T Phase picked up	261	750T Phase C
4	450T Phase picked up	262	81
5	550T Phase picked up	263	181
6	650T Phase picked up	264	281
7	750T Phase picked up	265	381
8	50T Phase tripped	266	481
9	150T Phase tripped	267	581
10	250T Phase tripped	268	50T Neutral
11	350T Phase tripped	269	150T Neutral
12	450T Phase tripped	270	250T Neutral
13	550T Phase tripped	271	350T Neutral
14	650T Phase tripped	272	450T Neutral
15	750T Phase tripped	273	50T Negative-Sequence
16	50T Neutral picked up	274	150T Negative-Sequence

Default Point Index	Description	Default Point Index	Description
17	150T Neutral picked up	275	250T Negative-Sequence
18	250T Neutral picked up	276	350T Negative-Sequence
19	350T Neutral picked up	277	51 Phase A
20	450T Neutral picked up	278	51 Phase B
21	50T Neutral tripped	279	51 Phase C
22	150T Neutral tripped	280	151 Phase A
23	250T Neutral tripped		Latched Targets
24	350T Neutral tripped	281	151 Phase B
25	450T Neutral tripped	282	151 Phase C
26	87 Restrained pickup	283	251 Phase A
27	87ND pickup	284	251 Phase B
28	187ND pickup	285	251 Phase C
29	87 Restrained trip	286	351 Phase A
30	87ND trip	287	351 Phase B
31	187ND trip	288	351 Phase C
32	Input Contact 1 state	289	51 Neutral
33	Input Contact 2 state	290	151 Neutral
34	Input Contact 3 state	291	251 Neutral
35	Input Contact 4 state	292	351 Neutral
36	Input Contact 5 state	293	451 Neutral
37	Input Contact 6 state	294	51 Negative-Sequence
38	Input Contact 7 state	295	151 Negative-Sequence
39	Input Contact 8 state	296	251 Negative-Sequence
40	Input Contact 9 state	297	351 Negative-Sequence
41	Input Contact 10 state		Relay Trouble Alarms
42	Input Contact 11 state	298	RAM Failure
43	Input Contact 12 state	299	Flash Failure
44	Trip Coil Monitor 1	300	uP Failure
45	Trip Coil Monitor 2	301	EEPROM Fatal Error
46	Trip Coil Monitor 3	302	Analog Failure
47	Trip Coil Monitor 4	303	Calibration Error
48	87 Unrestrained trip	304	Power Supply Error
49	87 2 nd harmonic Phase A	305	Default Settings Loaded
50	87 2 nd harmonic Phase B	306	Calibration Defaults Loaded
51	87 2 nd harmonic Phase C	307	DSP Failure
52	87 5 th harmonic Phase A		
53	87 5 th harmonic Phase B		Programmable Alarms

Default Point Index	Description	Default Point Index	Description
54	87 5 th harmonic Phase C	308	Circuit 1 Monitor Alarm
55	BF1 pick up	309	Circuit 2 Monitor Alarm
56	BF2 pick up	310	Circuit 3 Monitor Alarm
57	BF3 pick up	311	Circuit 4 Monitor Alarm
58	BF4 pick up	312	Breaker 1 Fail Alarm (breaker fail output picked up)
59	BF1 tripped	313	Breaker 2 Fail Alarm (breaker fail output picked up)
60	BF2 tripped	314	Breaker 3 Fail Alarm (breaker fail output picked up)
61	BF3 tripped	315	Breaker 4 Fail Alarm (breaker fail output picked up)
62	BF4 tripped	316	Differential Alarm
63	Logic 0	317	Changes Lost Alarm
64	Virtual OutputA	318	Breaker Alarm 1
65	Virtual Output1	319	Breaker Alarm 2
66	Virtual Output2	320	Breaker Alarm 3
67	Virtual Output3	321	Breaker Alarm 4
68	Virtual Output4	322	Breaker Alarm 5
69	Virtual Output5	323	Breaker Alarm 6
70	Virtual Output6	324	Breaker Alarm 7
71	Virtual Output7	325	Breaker Alarm 8
72	Virtual Output8	326	Breaker Alarm 9
73	Virtual Output9	327	Breaker Alarm 10
74	Virtual Output10	328	Breaker Alarm 11
75	Virtual Output11	329	Breaker Alarm 12
76	Virtual Output12	330	Setting Group Override
77	Virtual Output13	331	SYS I/O Delay Alarm
78	Virtual Output14	332	Communication failure on Serial port(s)
79	Virtual Output15	333	Clock problem (real time clock has not been set)
80	Virtual Input 1	334	Microprocessor reset alarm
81	Virtual Input 2	335	Settings changed
82	Virtual Input 3	336	EEPROM Non-fatal error
83	Virtual Input 4	337	An override is active in one or more outputs
84	Virtual Input 5	338	Loss of IRIG sync or decode problem
85	Virtual Input 6	339	Setting Group Change Active alarm

Default Point Index	Description	Default Point Index	Description
86	Virtual Input 7	340	Virtual Output 13 logic alarm
87	Virtual Input 8	341	Virtual Output 14 logic alarm
88	Virtual Input 9	342	Virtual Output 15 logic alarm
89	Virtual Input 10	343	Fault Record Time Out
90	Virtual Input 11	344	Transformer Alarm 1
91	Virtual Input 12	345	Transformer Alarm 2
92	Virtual Input 13	346	Transformer Alarm 3
93	Virtual Input 14	347	Transformer Alarm 4
94	Virtual Input 15	348	Transformer Alarm 5
95	Virtual Input 16	349	Transformer Alarm 6
96	81 Over/Underfrequency pick up	350	Transformer Alarm 7
97	181 Over/Underfrequency pick up	351	Transformer Alarm 8
98	281 Over/Underfrequency pick up	352	Active logic is NONE alarm
99	381 Over/Underfrequency pick up	353	Phase Demand 1 maximum exceeded alarm
100	481 Over/Underfrequency pick up	354	Phase Demand 2 maximum exceeded alarm
101	581 Over/Underfrequency pick up	355	Phase Demand 3 maximum exceeded alarm
102	81 Over/Underfrequency trip		Programmable Alarms
103	181 Over/Underfrequency trip	356	Phase Demand 4 maximum exceeded alarm
104	281 Over/Underfrequency trip	357	Neutral Demand 1 maximum exceeded alarm
105	381 Over/Underfrequency trip	358	Neutral Demand 2 maximum exceeded alarm
106	481 Over/Underfrequency trip	359	Neutral Demand 3 maximum exceeded alarm
107	581 Over/Underfrequency trip	360	Neutral Demand 4 maximum exceeded alarm
108	50TQ pick up	361	Negative-Sequence Demand 1 maximum exceeded alarm
109	150TQ pick up	362	Negative-Sequence Demand 2 maximum exceeded alarm
110	250TQ pick up	363	Negative-Sequence Demand 3 maximum exceeded alarm
111	350TQ pick up	364	Negative-Sequence Demand 4 maximum exceeded alarm
112	50TQ tripped	365	Ground Current Demand maximum exceeded alarm
113	150TQ tripped	366	VAR Positive Demand maximum exceeded alarm
114	250TQ tripped	367	VAR Negative Demand maximum exceeded alarm
115	350TQ tripped	368	WATT forward Demand maximum exceeded alarm

Default Point Index	Description	Default Point Index	Description
116	101 TRIP - 1	369	WATT reverse Demand maximum exceeded alarm
117	101 TRIP - 2	370	Phase Voltage max demand exceeded
118	101 TRIP - 3	371	Phase Voltage min demand exceeded
119	101 TRIP - 4	372	Neutral Voltage max demand exceeded
120	101 CLOSE - 1	373	Neutral Voltage min demand exceeded
121	101 CLOSE – 2	374	Volts per Hertz alarm exceeded
122	101 CLOSE – 3	375	Undervoltage alarm
123	101 CLOSE – 4	376	Overvoltage alarm
124	101 SLIP CONTACT – 1 (0: breaker tripped, 1: breaker closed)	377	60FL – LOP alarm
125	101 SLIP CONTACT - 2	378	Frequency out of range
126	101 SLIP CONTACT - 3		Indications of Reset/ Set/ Override Actions
127	101 SLIP CONTACT - 4	379	Phase A Demand 1 current reset
128	51 Phase tripped	380	Phase B Demand 1 current reset
129	151 Phase tripped	381	Phase C Demand 1 current reset
130	251 Phase tripped	382	Neutral Demand 1 current reset
131	351 Phase tripped	383	Negative-Sequence Demand 1 reset
132	51 Neutral tripped	384	Phase A Demand 2 current reset
133	151 Neutral tripped	385	Phase B Demand 2 current reset
134	251 Neutral tripped	386	Phase C Demand 2 current reset
135	351 Neutral tripped	387	Neutral Demand 2 current reset
136	451 Neutral tripped	388	Negative-Sequence Demand 2 current reset
137	Spare1	389	Phase A Demand 3 current reset
138	51 Negative-Sequence tripped	390	Phase B Demand 3 current reset
139	151 Negative-Sequence tripped	391	Phase C Demand 3 current reset
140	251 Negative-Sequence tripped	392	Neutral Demand 3 current reset
141	351 Negative-Sequence tripped	393	Negative-Sequence Demand 3 reset
142	27 Phase Undervoltage tripped	394	Phase A Demand 4 current reset
143	127 Phase Undervoltage tripped	395	Phase B Demand 4 current reset
144	51 Phase picked up	396	Phase C Demand 4 current reset
145	151 Phase picked up	397	Neutral Demand 4 current reset
146	251 Phase picked up	398	Neg-Sequence Demand 4 current reset
147	351 Phase picked up	399	IG Demand reset
148	51 Neutral picked up	400	Output A logic override
149	151 Neutral picked up	401	Output 1 logic override

Default Point Index	Description	Default Point Index	Description
150	251 Neutral picked up	402	Output 2 logic override
151	351 Neutral picked up	403	Output 3 logic override
152	451 Neutral picked up	404	Output 4 logic override
153	Spare 2	405	Output 5 logic override
154	51 Negative-Sequence picked up	406	Output 6 logic override
155	151 Negative-Sequence picked up	407	Output 7 logic override
156	251 Negative-Sequence picked up	408	Output 8 logic override
157	351 Negative-Sequence picked up	409	Output 9 logic override
158	27 Phase Undervoltage picked up	410	Output 10 logic override
159	127 Phase Undervoltage picked up	411	Output 11 logic override
160	47 Neg-Sequence voltage picked up	412	Output 12 logic override
161	47 Neg-Sequence voltage tripped	413	Output 13 logic override
162	59 Phase Overvoltage picked up	414	Output 14 logic override
163	159 Phase Overvoltage picked up	415	Output 15 logic override
164	59 Phase Overvoltage trip	416	Reverse True power (kW) demand reset
165	159 Phase Overvoltage trip	417	Reverse Reactive power (kVA) demand reset
166	24 Volts per Hertz picked up	418	Negative Energy reset
167	24 Volts per Hertz tripped	419	Negative Reactive Energy reset
168	62 Logic Timer tripped	420	Relay Trouble Alarm reset
169	162 Logic Timer tripped	421	Major Alarm reset
170	262 Logic Timer tripped	422	Minor Alarm reset
171	362 Logic Timer tripped	423	Logic Alarm reset
172	Setting Group 0 Active	424	Targets reset
173	Setting Group 1 Active	425	New Fault Counter reset
174	Setting Group 2 Active	426	New SER Counter reset
175	Setting Group 3 Active	427	Time set
176	Serial Controlled Switch 1 (43)	428	Date set
177	Serial Controlled Switch 2 (143)	429	Pick Up trigger expressions state (1 = TRUE, 0 = FALSE)
178	Serial Controlled Switch 3 (243)	430	Trip trigger logic expressions state (1 = TRUE, 0 = FALSE)
179	Serial Controlled Switch 4 (343)	431	Logic trigger expressions state (1 = TRUE, 0 = FALSE)
180	Serial Controlled Switch 5 (443)	432	Transformer Phase A duty register reset
181	Serial Controlled Switch 6 (543)	433	Transformer Phase B duty register reset
182	Serial Controlled Switch 7 (643)	434	Transformer Phase C duty register reset
183	Serial Controlled Switch 8 (743)	435	Transformer True Fault Counter reset
184	Alarm Major	436	Breaker 1, Phase A Duty reset
185	Alarm Minor	437	Breaker 1, Phase B Duty reset

Default Point Index	Description	Default Point Index	Description
186	Alarm Logic	438	Breaker 1, Phase C Duty reset
187	Target Reset Key	439	Breaker 1, Operation Counter reset
188	Alarm Reset Key	440	Breaker 2, Phase A Duty reset
189	59 Neutral Overvoltage picked up	441	Breaker 2, Phase B Duty reset
190	59 Neutral Overvoltage tripped	442	Breaker 2, Phase C Duty reset
191	60 Loss of Potential Alarm	443	Breaker 2, Operation Counter reset
	Hardware Outputs	444	Breaker 3, Phase A Duty reset
192	Output A	445	Breaker 3, Phase B Duty reset
193	Output 1	446	Breaker 3, Phase C Duty reset
194	Output 2	447	Breaker 3, Operation Counter reset
195	Output 3	448	Breaker 4, Phase A Duty reset
196	Output 4	449	Breaker 4, Phase B Duty reset
197	Output 5	450	Breaker 4, Phase C Duty reset
198	Output 6	451	Breaker 4, Operation Counter reset
199	Output 7	452	Max. Voltage Demand reset, Phase A
200	Output 8	453	Max. Voltage Demand reset, Phase B
201	Output 9	454	Max. Voltage Demand reset, Phase C
202	Output 10	455	Max. Voltage Demand reset, Neutral
203	Output 11	456	Min. Voltage Demand reset, Phase A
204	Output 12	457	Min. Voltage Demand reset, Phase B
205	Output 13	458	Min. Voltage Demand reset, Phase C
206	Output 14	459	Min. Voltage Demand reset, Neutral
	Latched Targets	460	True Power Demand reset
207	87 Unrestrained Phase A	461	Reactive Power Demand reset
208	87 Unrestrained Phase B	462	True Energy reset
209	87 Unrestrained Phase C	463	Reactive Energy Demand reset
210	87 restrained Phase A	464	Fault Record Indication * 1 - Saving of the new fault record is triggered. Fault data will be saved as the Most Recent Fault Summary Report. 0 - The Most Recent Fault Summary Report record is closed (available).
211	87 restrained Phase B	465	Breaker 1 Operation (enabled (1) / disabled (OFF))
212	87 restrained Phase C	466	Breaker 2 Operation (enabled (1) / disabled (OFF))
213	87 Restrained Neutral	467	Breaker 3 Operation (enabled (1) / disabled (OFF))
214	187 Restrained Neutral	468	Breaker 4 Operation (enabled (1) / disabled (OFF))
215	24	469	Breaker 1 State (open (1) / closed (0))
216	27 Phase A	470	Breaker 2 State (open (1) / closed (0))
217	27 Phase B	471	Breaker 3 State (open (1) / closed (0))

Default Point Index	Description	Default Point Index	Description
218	27 Phase C	472	Breaker 4 State (open (1)/closed (0))
219	127 Phase A		Additional Latched Targets
220	127 Phase B	473	59 Neutral
221	127 Phase C		
222	47		
223	BF1 Breaker failure tripped		
224	BF2 Breaker failure tripped		
225	BF3 Breaker failure tripped		
226	BF4 Breaker failure tripped		
227	60FL		
228	59 Phase A		
229	59 Phase B		
230	59 Phase C		
231	159 Phase A		
232	159 Phase B		
233	159 Phase C		
234	62		
235	162		
236	262		
237	362		
238	50T Phase A		
239	50T Phase B		
240	50T Phase C		
241	150T Phase A		
242	150T Phase B		
243	150T Phase C		
244	250T Phase A		
245	250T Phase B		
246	250T Phase C		
247	350T Phase A		
248	350T Phase B		
249	350T Phase C		
250	450T Phase A		
251	450T Phase B		
252	450T Phase C		
253	550T Phase A		
254	550T Phase B		
255	550T Phase C		
256	650T Phase A		
257	650T Phase B		

Default Point Index	Description	Default Point Index	Description
258	650T Phase C		

Notes for Table 5-1:

* The time stamp of transition 0 to 1 of point 455 (Fault Record Indication) is the fault trigger time (equal to the time of the Most Recent Fault Summary Report). The time stamp of transition 1 to 0 is the time since the Fault Summary Report for the most recent fault becomes available.

BINARY OUTPUT STATUS POINTS AND CONTROL RELAY OUTPUT BLOCKS

Table 5-2 lists both the Binary Output Status Points (Object 10) and the Control Relay Output Blocks (Object 12). It is important to note that Binary Output Status Points are not included in Class 0.

Table 5-2. Binary Output Status Points and Control Relay Output Blocks

Point Index	Description	Permitted codes
0	Hardware Output A - Latch control	To set output to state 1 0x03 (Latch On / NUL) or 0x41 (Pulse On / Close) To set output to state 0: 0x04 (Latch Off / NUL) or 0x81 (Pulse On / Trip)
1	Hardware Output 1 - Latch control	
2	Hardware Output 2 - Latch control	
3	Hardware Output 3 - Latch control	
4	Hardware Output 4 - Latch control	
5	Hardware Output 5 - Latch control	
6	Hardware Output 6 - Latch control	
7	Hardware Output 7 - Latch control	
8	Hardware Output 8 - Latch control	
9	Hardware Output 9 - Latch control	
10	Hardware Output 10 - Latch control	
11	Hardware Output 11 - Latch control	
12	Hardware Output 12 - Latch control	
13	Hardware Output 13 - Latch control	
14	Hardware Output 14 - Latch control	
15	All Hardware Outputs- Latch control	
16	Hardware Output A - Pulse Control	Pulse output to opposite of current state then restore to previous state (pulsed output is active 200 to 250 ms) Allowed codes are: 0x81(Pulse On / Trip) or 0x01(Pulse On / NUL)
17	Hardware Output 1 - Pulse Control	
18	Hardware Output 2 - Pulse Control	
19	Hardware Output 3 - Pulse Control	
20	Hardware Output 4 - Pulse Control	
21	Hardware Output 5 - Pulse Control	
22	Hardware Output 6 - Pulse Control	
23	Hardware Output 7 - Pulse Control	
24	Hardware Output 8 - Pulse Control	
25	Hardware Output 9 - Pulse Control	
26	Hardware Output 10 - Pulse Control	
27	Hardware Output 11 - Pulse Control	
28	Hardware Output 12 - Pulse Control	
29	Hardware Output 13 - Pulse Control	
30	Hardware Output 14 - Pulse Control	
31	All Hardware Outputs - Pulse Control	
32	Hardware Output A Local Control	To set output to relay logic: 0x03 (Latch On / NUL) or 0x41 (Pulse On / Close)
33	Hardware Output 1 Local Control	
34	Hardware Output 2 Local Control	
35	Hardware Output 3 Local Control	
36	Hardware Output 4 Local Control	
37	Hardware Output 5 Local Control	

38	Hardware Output 6 Local Control	
39	Hardware Output 7 Local Control	
40	Hardware Output 8 Local Control	
41	Hardware Output 9 Local Control	
42	Hardware Output 10 Local Control	
43	Hardware Output 11 Local Control	
44	Hardware Output 12 Local Control	
45	Hardware Output 13 Local Control	
46	Hardware Output 14 Local Control	
47	All Hardware Outputs Local Control	
48	43 Selector Switch Status - Latch control	To set Selector Switch to 1: 0x03 (Latch On / NUL) or 0x41 (Pulse On / Close) To set Selector Switch to 0: 0x04 (Latch Off / NUL) or 0x81 (Pulse On / Trip)
49	143 Selector Switch Status - Latch control	
50	243 Selector Switch Status - Latch control	
51	343 Selector Switch Status - Latch control	
52	443 Selector Switch Status - Latch control	
53	543 Selector Switch Status - Latch control	
54	643 Selector Switch Status - Latch control	
55	743 Selector Switch Status - Latch control	
56	43 Selector Switch - Pulse Control	Pulse Selector switch to opposite of current state then restore to previous state (pulsed output is active 200 to 250 ms) Allowed codes are: codes 0x81(Pulse On / Trip) or 0x01 (Pulse On / NUL)
57	143 Selector Switch - Pulse Control	
58	243 Selector Switch - Pulse Control	
59	343 Selector Switch - Pulse Control	
60	443 Selector Switch - Pulse Control	
61	543 Selector Switch - Pulse Control	
62	643 Selector Switch - Pulse Control	
63	743 Selector Switch - Pulse Control	
64	Setting Group 0	To select group to be active: 0x03 (Latch On / NUL) or 0x41 (Pulse On / Close)
65	Setting Group 1	
66	Setting Group 2	
67	Setting Group 3	
68	Local Setting Group Control Switch	To return Setting Group Control to relay local logic: 0x03 (Latch On / NUL) or 0x41 (Pulse On / Close)
69	101 Virtual Breaker Control Switch	0x41 (Pulse On / Close) Close breaker 0x81 (Pulse On / Trip) Trip breaker
70	1101 Virtual Breaker Control Switch	
71	2101 Virtual Breaker Control Switch	
72	3101 Virtual Breaker Control Switch	

Notes for Table 5-2:

1. Reads of points:
 - Reads of points from 0 to 14, from 16 to 30 and from 32 to 46 return the current state of corresponding hardware output point.
 - Reads for points 15, 31, 47 and from 69 to 72 always return 0.
 - Reads of points from 32 to 46 returns 1 if corresponding hardware output is under relay local control, or 0 if output is override.
 - Reads of points from 48 to 63 returns the current state of the corresponding x43 selector switches.
 - Reads of point 64 to 67 returns 1 if Setting Group is active. Notice that only one of these points can be active at any time.
 - Read of point 68 returns value 1 if the Setting Group Control is under relay local logic.
- 2- When used to control the points listed in Table 5-2, the Control Code field of Object 12 is parsed as described in the following paragraphs:

- If the Control Code is NULL, then the command will be accepted without any action being taken.
 - If the Queue and Clear sub-fields are not zero, the returned Control Status is 4 (“Control operation not supported”).
 - A Code sub-field of “Pulse On” (1) in combination with a value in the Trip/Close sub-field, form a Trip or Close value. A “Trip” value consists of a “PULSE ON” (1) in the Code sub-field and a 2 in the Trip/Close sub-field. This results in a value of 81(hex) in the Control Code field. A “Close” value consists of a “PULSE ON” (1) in the Code sub-field and a 1 in the Trip / Close sub-field. This results in a value of 41 (hex) in the Control Code field.
3. Valid Control Code values are:
- 0x00 = No action will be taken.
 - 0x01 = Pulse output to opposite of current state, then restore to previous state. Pulsed output is active 200 to 250 ms.
 - 0x03 = Latch On
 - 0x04 = Latch Off
 - 0x41 = Close (Breaker Close)
 - 0x81 = Trip (Breaker Open)

All operations not defined above are invalid and will be rejected. If the Control Code is legal but not supported for the requested point, the Status Return value is “Control operation not supported for this point” (value 4).

- The Count, On Time, and Off Time fields are ignored.
- **Arm timer value for all Select / Operate operations is 30 seconds.**

It is important to notice that any control function may be rejected because of the relay internal state. When this happens, the Status Return value is “Request not accepted because of hardware problems” (value 6). One of the reasons for the rejection may be that that point Logic Function Block has the Logic (Control) Mode disabled.

For example: Control functions for the hardware output points (points 0 to 47) will be rejected if the Output Control for all hardware outputs is disabled.

ANALOG INPUTS

The following table presents the default list of Analog Inputs (Objects 30 and 32). 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. Even for analog input points that are not valid as negative values, the maximum positive representation for a 16-bit variation is $\langle 2^{15} - 1 \rangle = 32,767$. For a 32-bit variation the maximum positive representation is $\langle 2^{31} - 1 \rangle = 2,147,483,647$.

BE1-CDS240 uses fixed dead band to generate an event. If the absolute value of the difference between the last reported value of an analog input object and the current value of the object exceeds the dead band value, then an event is generated for that object with the current value sent as the value for the event. Change events for analog inputs are reported in CURRENT mode (when a change is detected, the report of the change contains the current value of the time of the report - not the time the change was detected).

User can select analog points to be reported (can configure Class 0) via ASCII commands SDNP-USERAI and SDNP-AIMAP as described in Section 6.

For analog input data included in Class 0, dead-band can be changed via Object 34 and assigned class can be changed via Assign Class function (function code 22). The indices assigned to Object 34 parallel those assigned to Object 30. If changed via DNP, any selected data must be referenced with its reporting index not its default index presented in Table 5-3.

Applied dead-band and assigned class values for each analog input from the default list (Table 5-3) can be obtained or changed via ASCII command SDNP-DFLTAI as described in Section 6.

Table 5-3. Default List of Analog Inputs

Analog Inputs

Static Object Number: 30

Change Event Object Number: 32

Request Function Codes Supported: 1 (read) and 22 (assign class) for Object 30.

Static Variation Reported When Variation 0 Requested: 3 (32-bit Analog Input without Flag)

Change Event Variation Reported When Variation 0 Requested: 1 (32-bit Analog Change Event without time).

Default Index	Description	Change Event Default Assigned Class (1, 2, 3 or none)	Notes
Current Magnitudes (See Note 1)			
0	Winding #1 Phase A Current Magnitude	2	1
1	Winding #1 Phase B Current Magnitude	2	1
2	Winding #1 Phase C Current Magnitude	2	1
3	Winding #1 Neutral Current Magnitude	2	1
4	Winding #1 Negative-Sequence Current Magnitude	2	1
5	Winding #2 Phase A Current Magnitude	2	1
6	Winding #2 Phase B Current Magnitude	2	1
7	Winding #2 Phase C Current Magnitude	2	1
8	Winding #2 Neutral Current Magnitude	2	1
9	Winding #2 Negative-Sequence Current Magnitude	2	1
10	Winding #3 Phase A Current Magnitude	2	1
11	Winding #3 Phase B Current Magnitude	2	1
12	Winding #3 Phase C Current Magnitude	2	1
13	Winding #3 Neutral Current Magnitude	2	1
14	Winding #3 Negative-Sequence Current Magnitude	2	1
15	Winding #4 Phase A Current Magnitude	2	1
16	Winding #4 Phase B Current Magnitude	2	1
17	Winding #4 Phase C Current Magnitude	2	1
18	Winding #4 Neutral Current Magnitude	2	1
19	Winding #4 Negative-Sequence Current Magnitude	2	1
20	Winding #5 Phase A Current Magnitude	2	1
21	Winding #5 Phase B Current Magnitude	2	1
22	Winding #5 Phase C Current Magnitude	2	1
23	Winding #5 Neutral Current Magnitude	2	1
24	Winding #5 Negative-Sequence Current Magnitude	2	1
25	Winding #6 Phase A Current Magnitude	2	1
26	Winding #6 Phase B Current Magnitude	2	1
27	Winding #6 Phase C Current Magnitude	2	1
28	Winding #6 Neutral Current Magnitude	2	1
29	Winding #6 Negative-Sequence Current Magnitude	2	1
30	Ground Current Magnitude	2	1
Default Index	Description	Change Event Default	Notes

		Assigned Class (1, 2, 3 or None)	
Current angles			
31	Winding #1 Phase A angle	2	2
32	Winding #1 Phase B angle	2	2
33	Winding #1 Phase C angle	2	2
34	Winding #1 Neutral angle	2	2
35	Winding #1 Negative-Sequence angle	2	2
36	Winding #2 Phase A angle	2	2
37	Winding #2 Phase B angle	2	2
38	Winding #2 Phase C angle	2	2
39	Winding #2 Neutral angle	2	2
40	Winding #2 Negative-Sequence angle	2	2
41	Winding #3 Phase A angle	2	2
42	Winding #3 Phase B angle	2	2
43	Winding #3 Phase C angle	2	2
44	Winding #3 Neutral angle	2	2
45	Winding #3 Negative-Sequence angle	2	2
46	Winding #4 Phase A angle	2	2
47	Winding #4 Phase B angle	2	2
48	Winding #4 Phase C angle	2	2
49	Winding #4 Neutral angle	2	2
50	Winding #4 Negative-Sequence angle	2	2
51	Winding #5 Phase A angle	2	2
52	Winding #5 Phase B angle	2	2
53	Winding #5 Phase C angle	2	2
54	Winding #5 Neutral angle	2	2
55	Winding #5 Negative-Sequence angle	2	2
56	Winding #6 Phase A angle	2	2
57	Winding #6 Phase B angle	2	2
58	Winding #6 Phase C angle	2	2
59	Winding #6 Neutral angle	2	2
60	Winding #6 Negative-Sequence angle	2	2
61	Ground angle	2	2
Differential Compensated Per Centi-Unit Currents			
62	Winding #1 Phase A Compensated Current	2	3
63	Winding #1 Phase B Compensated Current	2	3
64	Winding #1 Phase C Compensated Current	2	3
65	Winding #2 Phase A Compensated Current	2	3
66	Winding #2 Phase B Compensated Current	2	3
67	Winding #2 Phase C Compensated Current	2	3
68	Winding #3 Phase A Compensated Current	2	3

69	Winding #3 Phase B Compensated Current	2	3
70	Winding #3 Phase C Compensated Current	2	3
71	Winding #4 Phase A Compensated Current	2	3
72	Winding #4 Phase B Compensated Current	2	3
73	Winding #4 Phase C Compensated Current	2	3
74	Neutral 1 Compensated Current	2	3
75	Neutral 2 Compensated Current	2	3
76	Ground 1 Compensated Current	2	3
77	Ground 2 Compensated Current	2	3
Differential Compensated angles			
78	Winding #1 Phase A Compensated angle	2	2
79	Winding #1 Phase B Compensated angle	2	2
80	Winding #1 Phase C Compensated angle	2	2
81	Winding #2 Phase A Compensated angle	2	2
82	Winding #2 Phase B Compensated angle	2	2
83	Winding #2 Phase C Compensated angle	2	2
84	Winding #3 Phase A Compensated angle	2	2
85	Winding #3 Phase B Compensated angle	2	2
86	Winding #3 Phase C Compensated angle	2	2
87	Winding #4 Phase A Compensated angle	2	2
88	Winding #4 Phase B Compensated angle	2	2
89	Winding #4 Phase C Compensated angle	2	2
90	Neutral 1 Compensated angle	2	2
91	Neutral 2 Compensated angle	2	2
92	Ground 1 Compensated angle	2	2
93	Ground 2 Compensated angle	2	2
Differential Operating Per Centi-Unit Currents			
94	Differential Operating Phase A Current (IAOP)	2	4
95	Differential Operating Phase B Current	2	4
96	Differential Operating Phase C Current	2	4
97	Differential Operating Neutral Current 1 (INOP1)	2	4
98	Differential Operating Neutral Current 2 (INOP2)	2	4
Differential Second Harmonic Centi-Percentage			
99	Phase A 2 nd Harmonic Percentage (IA2TH)	2	5
100	Phase B 2 nd Harmonic Percentage	2	5
101	Phase C 2 nd Harmonic Percentage	2	5
Differential Fifth Harmonic Centi-Percentage			
102	Phase A 5 th Harmonic Percentage (IA5TH)	2	5
103	Phase B 5 th Harmonic Percentage	2	5
104	Phase C 5 th Harmonic Percentage	2	5
Primary Voltages			
105	Voltage Phase A	2	1

106	Voltage Phase B	2	1
107	Voltage Phase C	2	1
108	Calculated Neutral Voltage (3V0)	2	1
109	Positive-Sequence voltage (V1)	2	1
110	Negative-Sequence voltage (V2)	2	1
111	Line Voltage, Phase A-B	2	1
112	Line Voltage, Phase B-C	2	1
113	Line Voltage, Phase C-A	2	1
Voltage angles			
114	Voltage Phase A angle	2	2
115	Voltage Phase B angle	2	2
116	Voltage Phase C angle	2	2
117	Calculated Neutral Voltage angle (3V0)	2	2
118	Positive-Sequence Voltage (V1) angle	2	2
119	Negative-Sequence Voltage (V2) angle	2	2
120	Line Voltage, Phase A-B angle	2	2
121	Line Voltage, Phase B-C angle	2	2
122	Line Voltage, Phase C-A angle	2	2
Primary Power Data			
123	True Power, Phase A	2	6
124	True Power, Phase B	2	6
125	True Power, Phase C	2	6
126	Total True Power	2	6
127	Reactive Power, Phase A	2	6
128	Reactive Power, Phase B	2	6
129	Reactive Power, Phase C	2	6
130	Total Reactive Power	2	6
131	Apparent Power (S)	2	6
132	Power Factor	2	7
133	Power Factor Lead/Lag	2	8
134	Measured Frequency	2	1
Breaker Data			
135	Breaker 1 Duty – Phase A	2	9
136	Breaker 1 Duty – Phase B	2	9
137	Breaker 1 Duty – Phase C	2	9
138	Breaker 2 Duty – Phase A	2	9
139	Breaker 2 Duty – Phase B	2	9
140	Breaker 2 Duty – Phase C	2	9
141	Breaker 3 Duty – Phase A	2	9
142	Breaker 3 Duty – Phase B	2	9
143	Breaker 3 Duty – Phase C	2	9
144	Breaker 4 Duty – Phase A	2	9

145	Breaker 4 Duty – Phase B	2	9
146	Breaker 4 Duty – Phase C	2	9
147	Breaker 1 Operation Counter	2	10
148	Breaker 2 Operation Counter	2	10
149	Breaker 3 Operation Counter	2	10
150	Breaker 4 Operation Counter	2	10
Transformer Data			
151	Transformer 1 Phase A Duty	2	11
152	Transformer 1 Phase B Duty	2	11
153	Transformer 1 Phase C Duty	2	11
154	Transformer 2 Phase A Duty	2	11
155	Transformer 2 Phase B Duty	2	11
156	Transformer 2 Phase C Duty	2	11
157	Transformer 3 Phase A Duty	2	11
158	Transformer 3 Phase B Duty	2	11
159	Transformer 3 Phase C Duty	2	11
160	Transformer 4 Phase A Duty	2	11
161	Transformer 4 Phase B Duty	2	11
162	Transformer 4 Phase C Duty	2	11
163	Transformer Through Fault Operations Counter	2	12
	Most Recent Fault Summary Report (164 – 266)		13
164	Fault Number	1	14
165	Fault Trigger Time Stamp – Part 1; days	1	15
166	Fault Trigger Time Stamp – Part 2; ms	1	15
167	Active Setting Group	1	16
168	Trigger	1	17
169	System Status – Part 1	1	18
170	System Status – Part 2	1	18
171	System Status – Part 3	1	18
172	System Status – Part 4	1	18
173	System Status – Part 5	1	18
174	System Status – Part 6	1	18
175	System Status – Part 7	1	18
176	System Status – Part 8	1	18
177	System Status – Part 9	1	18
178	System Status – Part 10	1	18
179	System Status – Part 11	1	18
180	System Status – Part 12	1	18
181	Targets - Part 1	1	19
182	Targets - Part 2	1	19
183	Targets - Part 3	1	19
184	Targets - Part 4	1	19
185	Targets - Part 5	1	19

186	Targets - Part 6	1	19
187	Fault Clearing Time	1	20
188	Breaker 1 Operate Time	1	21
189	Breaker 2 Operate Time	1	21
190	Breaker 3 Operate Time	1	21
191	Breaker 4 Operate Time	1	21
192	Number of Oscillographic Records	1	22
193	Winding 1 Phase A Fault Current	1	1
194	Winding 1 Phase B Fault Current	1	1
195	Winding 1 Phase C Fault Current	1	1
196	Winding 1 Neutral Fault Current	1	1
197	Winding 1 Negative-Sequence Fault Current	1	1
198	Winding 1 Phase A angle	1	2
199	Winding 1 Phase B angle	1	2
200	Winding 1 Phase C angle	1	2
201	Winding 1 Neutral angle	1	2
202	Winding 1 Negative-Sequence angle	1	2
203	Winding 2 Phase A Fault Current	1	1
204	Winding 2 Phase B Fault Current	1	1
205	Winding 2 Phase C Fault Current	1	1
206	Winding 2 Neutral Fault Current	1	1
207	Winding 2 Negative-Sequence Fault Current	1	1
208	Winding 2 Phase A angle	1	2
209	Winding 2 Phase B angle	1	2
210	Winding 2 Phase C angle	1	2
211	Winding 2 Neutral angle	1	2
212	Winding 2 Negative-Sequence angle	1	2
213	Winding 3 Phase A Fault Current	1	1
214	Winding 3 Phase B Fault Current	1	1
215	Winding 3 Phase C Fault Current	1	1
216	Winding 3 Neutral Fault Current	1	1
217	Winding 3 Negative-Sequence Fault Current	1	1
218	Winding 3 Phase A angle	1	2
219	Winding 3 Phase B angle	1	2
220	Winding 3 Phase C angle	1	2
221	Winding 3 Neutral angle	1	2
222	Winding 3 Negative-Sequence Current angle	1	2
223	Winding 4 Phase A Fault Current	1	1
224	Winding 4 Phase B Fault Current	1	1
225	Winding 4 Phase C Fault Current	1	1
226	Winding 4 Neutral Fault Current	1	1
227	Winding 4 Negative-Sequence Fault Current	1	1

228	Winding 4 Phase A angle	1	2
229	Winding 4 Phase B angle	1	2
230	Winding 4 Phase C angle	1	2
231	Winding 4 Neutral angle	1	2
232	Winding 4 Negative-Sequence Current angle	1	2
233	Winding 5 Phase A Fault Current	1	1
234	Winding 5 Phase B Fault Current	1	1
235	Winding 5 Phase C Fault Current	1	1
236	Winding 5 Neutral Fault Current	1	1
237	Winding 5 Negative-Sequence Fault Current	1	1
238	Winding 5 Phase A angle	1	2
239	Winding 5 Phase B angle	1	2
240	Winding 5 Phase C angle	1	2
241	Winding 5 Neutral angle	1	2
242	Winding 5 Negative-Sequence Current angle	1	2
243	Winding 6 Phase A Fault Current	1	1
244	Winding 6 Phase B Fault Current	1	1
245	Winding 6 Phase C Fault Current	1	1
246	Winding 6 Neutral Fault Current	1	1
247	Winding 6 Negative-Sequence Fault Current	1	1
248	Winding 6 Phase A angle	1	2
249	Winding 6 Phase B angle	1	2
250	Winding 6 Phase C angle	1	2
251	Winding 6 Neutral angle	1	2
252	Winding 6 Negative-Sequence Current angle	1	2
253	Ground Current	1	1
254	Ground angle	1	7
255	Fault Voltage Phase A	1	1
256	Fault Voltage Phase B	1	1
257	Fault Voltage Phase C	1	1
258	Fault Calculated Neutral Voltage (3V0)	1	1
259	Fault Positive-Sequence Voltage (V1)	1	1
260	Fault Negative-Sequence Voltage (V2)	1	1
261	Fault Voltage Phase A angle	1	2
262	Fault Voltage Phase B angle	1	2
263	Fault Voltage Phase C angle	1	2
264	Fault Calculated Neutral Voltage angle (3V0)	1	2
265	Fault Positive-Sequence Voltage angle	1	2
266	Fault Negative-Sequence Voltage angle	1	2
	Selected Fault Summary Report (267 - 369)		23
267	Fault Number	3	14
268	Fault Trigger Time Stamp – Part 1; days	3	15
269	Fault Trigger Time Stamp – Part 2; ms	3	15

270	Active Setting Group	3	16
271	Trigger	3	17
272	System Status – Part 1	3	18
273	System Status – Part 2	3	18
274	System Status – Part 3	3	18
275	System Status – Part 4	3	18
276	System Status – Part 5	3	18
277	System Status – Part 6	3	18
278	System Status – Part 7	3	18
279	System Status – Part 8	3	18
280	System Status – Part 9	3	18
281	System Status – Part 10	3	18
282	System Status – Part 11	3	18
283	System Status – Part 12	3	18
284	Targets - Part 1	3	19
285	Targets - Part 2	3	19
286	Targets - Part 3	3	19
287	Targets - Part 4	3	19
288	Targets - Part 5	3	19
289	Targets - Part 6	3	19
290	Fault Clearing Time	3	20
291	Breaker 1 Operate Time	3	21
292	Breaker 2 Operate Time	3	21
293	Breaker 3 Operate Time	3	21
294	Breaker 4 Operate Time	3	21
295	Number of Oscillographic Records	3	22
296	Winding 1 Phase A Fault Current	3	1
297	Winding 1 Phase B Fault Current	3	1
298	Winding 1 Phase C Fault Current	3	1
299	Winding 1 Neutral Fault Current	3	1
300	Winding 1 Negative-Sequence Fault Current	3	1
301	Winding 1 Phase A angle	3	2
302	Winding 1 Phase B angle	3	2
303	Winding 1 Phase C angle	3	2
304	Winding 1 Neutral angle	3	2
305	Winding 1 Negative-Sequence Current angle	3	2
306	Winding 2 Phase A Fault Current	3	1
307	Winding 2 Phase B Fault Current	3	1
308	Winding 2 Phase C Fault Current	3	1
309	Winding 2 Neutral Fault Current	3	1
310	Winding 2 Negative-Sequence Fault Current	3	1
311	Winding 2 Phase A angle	3	2

312	Winding 2 Phase B angle	3	2
313	Winding 2 Phase C angle	3	2
314	Winding 2 Neutral angle	3	2
315	Winding 2 Negative-Sequence Current angle	3	2
316	Winding 3 Phase A Fault Current	3	1
317	Winding 3 Phase B Fault Current	3	1
318	Winding 3 Phase C Fault Current	3	1
319	Winding 3 Neutral Fault Current	3	1
320	Winding 3 Negative-Sequence Fault Current	3	1
321	Winding 3 Phase A angle	3	2
322	Winding 3 Phase B angle	3	2
323	Winding 3 Phase C angle	3	2
324	Winding 3 Neutral angle	3	2
325	Winding 3 Negative-Sequence Current angle	3	2
326	Winding 4 Phase A Fault Current	3	1
327	Winding 4 Phase B Fault Current	3	1
328	Winding 4 Phase C Fault Current	3	1
329	Winding 4 Neutral Fault Current	3	1
330	Winding 4 Negative-Sequence Fault Current	3	1
331	Winding 4 Phase A angle	3	2
332	Winding 4 Phase B angle	3	2
333	Winding 4 Phase C angle	3	2
334	Winding 4 Neutral angle	3	2
335	Winding 4 Negative-Sequence Current angle		2
336	Winding 5 Phase A Fault Current	3	1
337	Winding 5 Phase B Fault Current	3	1
338	Winding 5 Phase C Fault Current	3	1
339	Winding 5 Neutral Fault Current	3	1
340	Winding 5 Negative-Sequence Fault Current	3	1
341	Winding 5 Phase A angle	3	2
342	Winding 5 Phase B angle	3	2
343	Winding 5 Phase C angle	3	2
344	Winding 5 Neutral angle	3	2
345	Winding 5 Negative-Sequence Current angle		2
346	Winding 6 Phase A Fault Current	3	1
347	Winding 6 Phase B Fault Current	3	1
348	Winding 6 Phase C Fault Current	3	1
349	Winding 6 Neutral Fault Current	3	1
350	Winding 6 Negative-Sequence Fault Current	3	1
351	Winding 6 Phase A angle	3	2
352	Winding 6 Phase B angle	3	2
353	Winding 6 Phase C angle	3	2
354	Winding 6 Neutral angle	3	2

355	Winding 6 Negative-Sequence Current angle		2
356	Ground Current	3	1
357	Ground angle	3	2
358	Fault Voltage Phase A	3	1
359	Fault Voltage Phase B	3	1
360	Fault Voltage Phase C	3	1
361	Fault Calculated Neutral Voltage (3V0)	3	1
362	Fault Positive-Sequence Voltage (V1)	3	1
363	Fault Negative-Sequence Voltage (V2)	3	1
364	Fault Voltage Phase A angle	3	2
365	Fault Voltage Phase B angle	3	2
366	Fault Voltage Phase C angle	3	2
367	Fault Calculated Neutral Voltage angle (3V0)	3	2
368	Fault Positive-Sequence Voltage angle	3	2
369	Fault Negative-Sequence Voltage angle	3	2
	Peak Demands Since Reset		25
370	Phase A Current, 1	3	1
371	Phase A Time Stamp – Part 1; days	3	15
372	Phase A Time Stamp – Part 2; ms	3	15
373	Phase B Current, 1	3	1
374	Phase B Time Stamp – Part 1; days	3	15
375	Phase B Time Stamp – Part 2; ms	3	15
376	Phase C Current, 1	3	1
377	Phase C Time Stamp – Part 1; days	3	15
378	Phase C Time Stamp – Part 2; ms	3	15
379	Neutral Current, 1	3	1
380	Neutral Time Stamp – Part 1; days	3	15
381	Neutral Time Stamp – Part 2; ms	3	15
382	Negative Sequence, 1	3	1
383	Negative-Sequence Time Stamp – Part 1; days	3	15
384	Negative-Sequence Time Stamp – Part 2; ms	3	15
385	Phase A Current, 2	3	1
386	Phase A Time Stamp – Part 1; days	3	15
387	Phase A Time Stamp – Part 2; ms	3	15
388	Phase B Current, 2	3	1
389	Phase B Time Stamp – Part 1; days	3	15
390	Phase B Time Stamp – Part 2; ms	3	15
391	Phase C Current, 2	3	1
392	Phase C Time Stamp – Part 1; days	3	15
393	Phase C Time Stamp – Part 2; ms	3	15
394	Neutral Current, 2	3	1
395	Neutral Time Stamp – Part 1; days	3	15

396	Neutral Time Stamp – Part 2; ms	3	15
397	Negative-Sequence, 2	3	1
398	Negative-Sequence Time Stamp – Part 1; days	3	15
399	Negative-Sequence Time Stamp – Part 2; ms	3	15
400	Phase A Current, 3	3	1
401	Phase A Time Stamp – Part 1; days	3	15
402	Phase A Time Stamp – Part 2; ms	3	15
403	Phase B Current, 3	3	1
404	Phase B Time Stamp – Part 1; days	3	15
405	Phase B Time Stamp – Part 2; ms	3	15
406	Phase C Current, 3	3	1
407	Phase C Time Stamp – Part 1; days	3	15
408	Phase C Time Stamp – Part 2; ms	3	15
409	Neutral Current, 3	3	1
410	Neutral Time Stamp – Part 1; days	3	15
411	Neutral Time Stamp – Part 2; ms	3	15
412	Negative-Sequence Current, 3	3	1
413	Negative-Sequence Time Stamp – Part 1; days	3	15
414	Negative-Sequence Time Stamp – Part 2; ms	3	15
415	Phase A Current, 4	3	1
416	Phase A Time Stamp – Part 1; days	3	15
417	Phase A Time Stamp – Part 2; ms	3	15
418	Phase B Current, 4	3	1
419	Phase B Time Stamp – Part 1; days	3	15
420	Phase B Time Stamp – Part 2; ms	3	15
421	Phase C Current, 4	3	1
422	Phase C Time Stamp – Part 1; days	3	15
423	Phase C Time Stamp – Part 2; ms	3	15
424	Neutral Current, 4	3	1
425	Neutral Time Stamp – Part 1; days	3	15
426	Neutral Time Stamp – Part 2; ms	3	15
427	Negative-Sequence Current, 4	3	1
428	Negative-Sequence Time Stamp – Part 1; days	3	15
429	Negative-Sequence Time Stamp – Part 2; ms	3	15
430	IG	3	1
431	IG Time Stamp – Part 1; days	3	15
432	IG Time Stamp – Part 2; ms	3	15
433	Maximum Voltage Demand, Phase A	3	1
434	Phase A Time Stamp – Part 1; days	3	15
435	Phase A Time Stamp – Part 2; ms	3	15

436	Maximum Voltage Demand, Phase B	3	1
437	Phase A Time Stamp – Part 1; days	3	15
438	Phase A Time Stamp – Part 2; ms	3	15
439	Maximum Voltage Demand, Phase C	3	1
440	Phase A Time Stamp – Part 1; days	3	15
441	Phase A Time Stamp – Part 2; ms	3	15
442	Maximum Neutral Voltage Demand	3	1
443	Phase A Time Stamp – Part 1; days	3	15
444	Phase A Time Stamp – Part 2; ms	3	15
445	Minimum Voltage Demand, Phase A	3	1
446	Phase A Time Stamp – Part 1; days	3	15
447	Phase A Time Stamp – Part 2; ms	3	15
448	Minimum Voltage Demand, Phase B	3	1
449	Phase A Time Stamp – Part 1; days	3	15
450	Phase A Time Stamp – Part 2; ms	3	15
451	Minimum Voltage Demand, Phase C	3	1
452	Phase A Time Stamp – Part 1; days	3	15
453	Phase A Time Stamp – Part 2; ms	3	15
454	Minimum Neutral Voltage Demand	3	1
455	Phase A Time Stamp – Part 1; days	3	15
456	Phase A Time Stamp – Part 2; ms	3	15
457	True Power Demand	3	6
458	Phase A Time Stamp – Part 1; days	3	15
459	Phase A Time Stamp – Part 2; ms	3	15
460	Reverse True Power Demand	3	6
461	Phase A Time Stamp – Part 1; days	3	15
462	Phase A Time Stamp – Part 2; ms	3	15
463	Reactive Power Demand	3	6
464	Phase A Time Stamp – Part 1; days	3	15
465	Phase A Time Stamp – Part 2; ms	3	15
466	Reverse Reactive Power Demand	3	6
467	Phase A Time Stamp – Part 1; days	3	15
468	Phase A Time Stamp – Part 2; ms	3	15
	Today's Peak Demands		25
469	Phase A Current, 1	3	1
470	Phase A Time Stamp – Part 1; days	3	15
471	Phase A Time Stamp – Part 2; ms	3	15
472	Phase B Current, 1	3	1
473	Phase B Time Stamp – Part 1; days	3	15

474	Phase B Time Stamp – Part 2; ms	3	15
475	Phase C Current, 1	3	1
476	Phase C Time Stamp – Part 1; days	3	15
477	Phase C Time Stamp – Part 2; ms	3	15
478	Neutral Current, 1	3	1
479	Neutral Time Stamp – Part 1; days	3	15
480	Neutral Time Stamp – Part 2; ms	3	15
481	Negative-Sequence, 1	3	1
482	Negative-Sequence Time Stamp – Part 1; days	3	15
483	Negative-Sequence Time Stamp – Part 2; ms	3	15
484	Phase A Current, 2	3	1
485	Phase A Time Stamp – Part 1; days	3	15
486	Phase A Time Stamp – Part 2; ms	3	15
487	Phase B Current, 2	3	1
488	Phase B Time Stamp – Part 1; days	3	15
489	Phase B Time Stamp – Part 2; ms	3	15
490	Phase C Current, 2	3	1
491	Phase C Time Stamp – Part 1; days	3	15
492	Phase C Time Stamp – Part 2; ms	3	15
493	Neutral Current, 2	3	1
494	Neutral Time Stamp – Part 1; days	3	15
495	Neutral Time Stamp – Part 2; ms	3	15
496	Negative-Sequence, 2	3	1
497	Negative-Sequence Time Stamp – Part 1; days	3	15
498	Negative-Sequence Time Stamp – Part 2; ms	3	15
499	Phase A Current, 3	3	1
500	Phase A Time Stamp – Part 1; days	3	15
501	Phase A Time Stamp – Part 2; ms	3	15
502	Phase B Current, 3	3	1
503	Phase B Time Stamp – Part 1; days	3	15
504	Phase B Time Stamp – Part 2; ms	3	15
505	Phase C Current, 3	3	1
506	Phase C Time Stamp – Part 1; days	3	15
507	Phase C Time Stamp – Part 2; ms	3	15
508	Neutral Current, 3	3	1
509	Neutral Time Stamp – Part 1; days	3	15
510	Neutral Time Stamp – Part 2; ms	3	15
511	Negative-Sequence, 3	3	1
512	Negative-Sequence Time Stamp – Part 1; days	3	15
513	Negative-Sequence Time Stamp – Part 2; ms	3	15

514	Phase A Current, 4	3	1
515	Phase A Time Stamp – Part 1; days	3	15
516	Phase A Time Stamp – Part 2; ms	3	15
517	Phase B Current, 4	3	1
518	Phase B Time Stamp – Part 1; days	3	15
519	Phase B Time Stamp – Part 2; ms	3	15
520	Phase C Current, 4	3	1
521	Phase C Time Stamp – Part 1; days	3	15
522	Phase C Time Stamp – Part 2; ms	3	15
523	Neutral Current, 4	3	1
524	Neutral Time Stamp – Part 1; days	3	15
525	Neutral Time Stamp – Part 2; ms	3	15
526	Negative-Sequence Current, 4	3	1
527	Negative-Sequence Time Stamp – Part 1; days	3	15
528	Negative-Sequence Time Stamp – Part 2; ms	3	15
529	IG	3	1
530	IG Time Stamp – Part 1; days	3	15
531	IG Time Stamp – Part 2; ms	3	15
532	Maximum Voltage Demand, Phase A	3	1
533	Phase A Time Stamp – Part 1; days	3	15
534	Phase A Time Stamp – Part 2; ms	3	15
535	Maximum Voltage Demand, Phase B	3	1
536	Phase A Time Stamp – Part 1; days	3	15
537	Phase A Time Stamp – Part 2; ms	3	15
538	Maximum Voltage Demand, Phase C	3	1
539	Phase A Time Stamp – Part 1; days	3	15
540	Phase A Time Stamp – Part 2; ms	3	15
541	Maximum Neutral Voltage Demand	3	1
542	Phase A Time Stamp – Part 1; days	3	15
543	Phase A Time Stamp – Part 2; ms	3	15
544	Minimum Voltage Demand, Phase A	3	1
545	Phase A Time Stamp – Part 1; days	3	15
546	Phase A Time Stamp – Part 2; ms	3	15
547	Minimum Voltage Demand, Phase B	3	1
548	Phase A Time Stamp – Part 1; days	3	15
549	Phase A Time Stamp – Part 2; ms	3	15
550	Minimum Voltage Demand, Phase C	3	1
551	Phase A Time Stamp – Part 1; days	3	15
552	Phase A Time Stamp – Part 2; ms	3	15

553	Minimum Neutral Voltage Demand	3	1
554	Phase A Time Stamp – Part 1; days	3	15
555	Phase A Time Stamp – Part 2; ms	3	15
556	True Power Demand	3	6
557	Phase A Time Stamp – Part 1; days	3	15
558	Phase A Time Stamp – Part 2; ms	3	15
559	Reverse True Power Demand	3	6
560	Phase A Time Stamp – Part 1; days	3	15
561	Phase A Time Stamp – Part 2; ms	3	15
562	Reactive Power Demand	3	6
563	Phase A Time Stamp – Part 1; days	3	15
564	Phase A Time Stamp – Part 2; ms	3	15
565	Reverse Reactive Power Demand	3	6
566	Phase A Time Stamp – Part 1; days	3	15
567	Phase A Time Stamp – Part 2; ms	3	15
	Yesterday's Peak Demands		25
568	Phase A Current, 1	3	1
569	Phase A Time Stamp – Part 1; days	3	15
570	Phase A Time Stamp – Part 2; ms	3	15
571	Phase B Current, 1	3	1
572	Phase B Time Stamp – Part 1; days	3	15
573	Phase B Time Stamp – Part 2; ms	3	15
574	Phase C Current, 1	3	1
575	Phase C Time Stamp – Part 1; days	3	15
576	Phase C Time Stamp – Part 2; ms	3	15
577	Neutral Current, 1	3	1
578	Neutral Time Stamp – Part 1; days	3	15
579	Neutral Time Stamp – Part 2; ms	3	15
580	Negative-Sequence Current, 1	3	1
581	Negative sequence Time Stamp – Part 1; days	3	15
582	Negative sequence Time Stamp – Part 2; ms	3	15
583	Phase A Current, 2	3	1
584	Phase A Time Stamp – Part 1; days	3	15
585	Phase A Time Stamp – Part 2; ms	3	15
586	Phase B Current, 2	3	1
587	Phase B Time Stamp – Part 1; days	3	15
588	Phase B Time Stamp – Part 2; ms	3	15
589	Phase C Current, 2	3	1
590	Phase C Time Stamp – Part 1; days	3	15
591	Phase C Time Stamp – Part 2; ms	3	15

592	Neutral Current, 2	3	1
593	Neutral Time Stamp – Part 1; days	3	15
594	Neutral Time Stamp – Part 2; ms	3	15
595	Negative-Sequence Current, 2	3	1
596	Negative-Sequence Time Stamp – Part 1; days	3	15
597	Negative-Sequence Time Stamp – Part 2; ms	3	15
598	Phase A Current, 3	3	1
599	Phase A Time Stamp – Part 1; days	3	15
600	Phase A Time Stamp – Part 2; ms	3	15
601	Phase B Current, 3	3	1
602	Phase B Time Stamp – Part 1; days	3	15
603	Phase B Time Stamp – Part 2; ms	3	15
604	Phase C Current, 3	3	1
605	Phase C Time Stamp – Part 1; days	3	15
606	Phase C Time Stamp – Part 2; ms	3	15
607	Neutral Current, 3	3	1
608	Neutral Time Stamp – Part 1; days	3	15
609	Neutral Time Stamp – Part 2; ms	3	15
610	Negative-Sequence Current, 3	3	1
611	Negative-Sequence Time Stamp – Part 1; days	3	15
612	Negative-Sequence Time Stamp – Part 2; ms	3	15
613	Phase A Current, 4	3	1
614	Phase A Time Stamp – Part 1; days	3	15
615	Phase A Time Stamp – Part 2; ms	3	15
616	Phase B Current, 4	3	1
617	Phase B Time Stamp – Part 1; days	3	15
618	Phase B Time Stamp – Part 2; ms	3	15
619	Phase C Current, 4	3	1
620	Phase C Time Stamp – Part 1; days	3	15
621	Phase C Time Stamp – Part 2; ms	3	15
622	Neutral Current, 4	3	1
623	Neutral Time Stamp – Part 1; days	3	15
624	Neutral Time Stamp – Part 2; ms	3	15
625	Negative -Sequence Current, 4	3	1
626	Negative-Sequence Time Stamp – Part 1; days	3	15
627	Negative-Sequence Time Stamp – Part 2; ms	3	15
628	IG	3	1
629	IG Time Stamp – Part 1; days	3	15
630	IG Time Stamp – Part 2; ms	3	15

631	Maximum Voltage Demand, Phase A	3	1
632	Phase A Time Stamp – Part 1; days	3	15
633	Phase A Time Stamp – Part 2; ms	3	15
634	Maximum Voltage Demand, Phase B	3	1
635	Phase A Time Stamp – Part 1; days	3	15
636	Phase A Time Stamp – Part 2; ms	3	15
637	Maximum Voltage Demand, Phase C	3	1
638	Phase A Time Stamp – Part 1; days	3	15
639	Phase A Time Stamp – Part 2; ms	3	15
640	Maximum Neutral Voltage Demand	3	1
641	Phase A Time Stamp – Part 1; days	3	15
642	Phase A Time Stamp – Part 2; ms	3	15
643	Minimum Voltage Demand, Phase A	3	1
644	Phase A Time Stamp – Part 1; days	3	15
645	Phase A Time Stamp – Part 2; ms	3	15
646	Minimum Voltage Demand, Phase B	3	1
647	Phase A Time Stamp – Part 1; days	3	15
648	Phase A Time Stamp – Part 2; ms	3	15
649	Minimum Voltage Demand, Phase C	3	1
650	Phase A Time Stamp – Part 1; days	3	15
651	Phase A Time Stamp – Part 2; ms	3	15
652	Minimum Neutral Voltage Demand	3	1
653	Phase A Time Stamp – Part 1; days	3	15
654	Phase A Time Stamp – Part 2; ms	3	15
655	True Power Demand	3	6
656	Phase A Time Stamp – Part 1; days	3	15
657	Phase A Time Stamp – Part 2; ms	3	15
658	Reverse True Power Demand	3	6
659	Phase A Time Stamp – Part 1; days	3	15
660	Phase A Time Stamp – Part 2; ms	3	15
661	Reactive Power Demand	3	6
662	Phase A Time Stamp – Part 1; days	3	15
663	Phase A Time Stamp – Part 2; ms	3	15
664	Reverse Reactive Power Demand	3	6
665	Phase A Time Stamp – Part 1; days	3	15
666	Phase A Time Stamp – Part 2; ms	3	15
	Energy Data		
667	Total Primary True Energy	3	24
668	Total Primary Reverse True Energy	3	24
669	Total Primary Reactive Energy	3	24

670	Total Primary Reverse Reactive True Energy	3	24
-----	--	---	----

Notes for Table 5-3:

1. This point represents value in centi units. To get value in units, use 0.01 as a multiplier.
 - Current point represents primary current in centiamps. For example, value 125 represents 125 centiamps or 1.25 amperes. The default dead-band is 10 centiamps.
 - Voltage point represents primary voltage in centivolts. Default dead-band is 10 centivolts.
 - Frequency value is in centiHz. For example, 5506 value is 55.06 hertz. The default frequency dead-band is 1 (0.01 Hz) which means that a ± 0.01 Hz value change causes an event.
2. The unit for angle is degrees (from 0 to 359).
3. Differential Compensated Current is expressed as differential compensated per unit current multiplied by TAP. Read of this point returns differential compensated per centiunit current (value from 0 to 10,000). For example, if the return read value is 27 it means that the differential compensated current is equal to 27 times 0.01 times TAP which is equal to 0.27 times TAP. The default dead band is 10 centiunits.
4. The differential operating current is expressed as differential operating per unit current multiplied by TAP. Read of this point returns differential operating per centiunit current (value from 0 to 10,000). For example, if the return read value is 40 it means that the differential operating current is equal to 40 times 0.01 times TAP which is equal to 0.40 times TAP. The default dead band is 10 centiunits.
5. Differential 5th and 2nd harmonic currents are expressed as a percentage of the operating current. Read of this point returns centipercents value (value from 0 to 10,000) of the operating current. For example, if the return read value is 1400, it means that the harmonic current is equal to 14 percent of IOP. The default dead band is 10 centiunits.
6. Point value represents apparent or true or reactive primary power in kilo units.
 - True power point value is expressed in kW.
 - Reactive power is expressed in kvars and apparent power is expressed in kVA. The default dead band is 1 kilo unit.
7. Power factor point has range from -1000 to +1000. Power factor point value must be multiplied by 0.001 to represent real power factor range from -1 to +1.
8. The power factor is leading if value is 1, lagging if value is 0.
9. Point represents assigned phase accumulated breaker pole duty as a centipercents of the maximum duty (D_{MAX}) that the breaker contacts can withstand before they need service. (Refer to ASCII command SB-DUTY to see the explanation of breaker duty settings.) Value range is from 0 to 20,000 where 20,000 represents 200% of D_{MAX} . The default dead band is 20 centipercent. Breaker accumulated duty can be changed via Object 41, appropriate point from 7 to 18 in Table 5-6.
10. This is the number of recorded breaker operations (0 – 99,999). If the operations counter exceeds 99,999, the counter will wrap back to zero. Value can be changed via Object 41 (see points 19 to 22 in Table 5-6 for Analog Output Status Points and Control Blocks) to any value from 0 to 99,999. The default dead band is 1 count.
11. Point represents assigned phase accumulated transformer pole duty as a centipercents of the maximum duty (D_{MAX}) that the transformer contacts can withstand before they need service. (Refer to ASCII command ST-DUTY to see the explanation of transformer duty settings.) The point value range is from 0 to 20,000 where 20,000 represents 200% of D_{MAX} . The default dead band is 20 centipercents. Accumulated transformer pole duty value can be changed via Object 41, appropriate point from 23 to 34 in Table 5-6.
12. This is a number of recorded transformer through-fault operations (0 to 99,999). If the operations counter exceeds 99,999, the counter will wrap back to 0 (zero). Transformer through-fault operations value can be changed via Object 41, point 35 in Table 5-6 to any value from 0 to 99,999. The default dead band is 1.
13. The Most Recent Fault Summary Report is constituted of data mapped from point 164 to 266 (total number of 103 points). The default dead band for all points which belong to the Most Recent Fault Summary Report is 1.
14. The Fault Number range is from 1 to 255. For example, after 255, fault number is going to be 1.
15. Time is presented in the relay's internal format. Part 1 contains days (1 to 65535) and Part 2 contains milliseconds (1 to 86,400,000) since January 1, 1984. The fault time of the "Most Recent Fault Summary Report" is equal to the time of binary input event of binary input point "New Fault" triggered (transition from 0 to 1). Notice that the Binary Input Event time stamp is presented in DNP time stamp format, since January 1, 1970.
16. The active setting group at time of fault (0 or 1 or 2 or 3).

17. The event type (value is 1, 2, 4, 8 or 16) reports the classification assigned to the fault event. Fault events are classified into five categories:
 - Breaker Failure (Event Type value is 1): A fault was initiated by the pickup expression and the breaker failure trip became TRUE before fault was cleared.
 - Trip (Event Type value is 2): A fault was initiated by overcurrent pickup and the relay tripped to clear the fault.
 - Logic (Event Type value is 4): A fault was detected as defined by the relay logic trigger expression but no fault was detected as defined by the pickup expression.
 - Pickup (Event Type value is 8): A fault was initiated by the pickup expression but the relay never tripped indicating that the fault was cleared by some other device.
 - RF=TRIG (Event Type value is 16): A Fault was triggered by the ASCII command. RF=TRIGGER received via the front or rear RS-232 communication port.
18. The BE1-CDS240 relay system status is represented as 12, 16-bit mapped variables (see Table 5-5).
19. Targets are bit-mapped variables. (1 = TRUE, 0 = FALSE). In Fault Report, targets are logged to the fault report between the time that the trip expression became TRUE until the end of the fault. The Latched Targets Status format is described in Table 5-4.
20. Fault Clearing Time is time in milliseconds from 0 to 60,000.
21. Breaker Operate Time is time in milliseconds from 0 to 60,000.
22. The number of recorded oscillographic records per fault can be 1 or 2.
23. The Selected Fault Summary Report is constituted of data mapped from point 267 to 369 (total number of 103 points) and represents Fault Summary Report of fault which number was selected through the value of the Analog Output Status (Object 40) point 1 (see paragraph *Analog Output Status Points And Control Blocks*). The default dead band for all points which belong to Selected Fault Summary Report is 1.
24. The point read value represents primary true/reactive energy in kWh/kvarh. The default dead-band is 1 KWH/KVARH.
25. The default dead-band for all demands (points from 370 to 666) is 1.

Table 5-4. Target Status Format

Bit Mask (hex)	Part 1	Part 2	Part 3	Part 4	Part 5	Part 6
0001	87UA	BF 1	50TA	550TB	50TN	251A
0002	87UB	BF 2	50TB	550TC	150TN	251B
0004	87UC	BF 3	50TC	650TA	250TN	251C
0008	87RA	BF 4	150TA	650TB	350TN	351A
0010	87RB	60FL	150TB	650TC	450TN	351B
0020	87RC	59A	150TC	750TA	50TQ	351C
0040	87ND	59B	250TA	750TB	150TQ	51N
0080	187ND	59C	250TB	750TC	250TQ	151N
0100	24	159A	250TC	81	350TQ	251N
0200	27A	159B	350TA	181	Spare 3	351N
0400	27B	159C	350TB	281	51A	451N
0800	27C	62	350TC	381	51B	51Q
1000	127A	162	450TA	481	51C	151Q
2000	127B	262	450TB	581	151A	251Q
4000	127C	362	450TC	Spare 1	151B	351Q
8000	47	59X	550TA	Spare 2	151C	Spare 4

Table 5-5. BE1-CDS240 Relay Status

BIT Mask (hex)	Part 1	Part 2	Part 3	Part 4	Part 5	Part 6
0001	P50P	N50P	IN 1	T87U	VO A	VIN1
0002	P150P	N150P	IN 2	HAR2ND A	VO 1	VIN2
0004	P250P	N250P	IN 3	HAR2ND B	VO 2	VIN3
0008	P350P	N350P	IN 4	HAR2ND C	VO 3	VIN4
0010	P450P	N450P	IN 5	HAR5TH A	VO 4	VIN5
0020	P550P	T50P	IN 6	HAR5TH B	VO 5	VIN6
0040	P650P	T150P	IN 7	HAR5TH C	VO 6	VIN7
0080	P750P	T250P	IN 8	PBF1	VO 7	VIN8
0100	T50P	T350P	IN9	PBF2	VO 8	VIN9
0200	T150P	T450P	IN10	PBF3	VO 9	VIN10
0400	T250P	P87R	IN11	PBF4	VO 10	VIN11
0800	T350P	P87ND	IN12	TBF1	VO 11	VIN12
1000	T450P	P187ND	CKTMON 1	TBF2	VO 12	VIN13
2000	T550P	T87R	CKTMON 2	TBF3	VO 13	VIN14
4000	T650P	T87ND	CKTMON 3	TBF4	VO 14	VIN15
8000	T750P	T187ND	CKTMON 4	Logic 0 (always FALSE)	VO 15	VIN16
BIT MASK (HEX)	Part 7	Part 8	Part 9	Part 10	Part 11	Part 12
0001	P81P	T50Q	T51P	P51P	P47P	S43
0002	P181P	T150Q	T151P	P151P	T47P	S143
0004	P281P	T250Q	T251P	P251P	P59P	S243
0008	P381P	T350Q	T351P	P351P	P159P	S343
0010	P481P	T101	T51N	P51N	T59P	S443
0020	P581P	T1101	T151N	P151N	T159P	S543
0040	T81P	T2101	T251N	P251N	P24	S643
0080	T181P	T3101	T351N	P351N	T24	S743
0100	T281P	C101	T451N	P451N	T62	ALMMAJ
0200	T381P	C1101	SPARE 1	SPARE 2	T162	ALMMIN
0400	T481P	C2101	T51Q	P51Q	T262	ALMLGC
0800	T581P	C3101	T151Q	P151Q	T362	TRKYE
1000	P50Q	SC101	T251Q	P251Q	SG0	ARKEY
2000	P150Q	SC1101	T351Q	P351Q	SG1	P59X
4000	P250Q	SC2101	T27P	P27P	SG2	T59X
8000	P350Q	SC3101	T127P	P127P	SG3	LOP

ANALOG OUTPUT STATUS POINTS AND CONTROL BLOCKS

Table 5-6 is both the Analog Status Points (Object 40) and the Analog Output Control Blocks (Object 41). It is important to note that Analog Output Status Points are not included into Class 0.

The Return Status Value for Object 41 for all control operations may be 3 (format problem) due to out of range value. One of the reasons for rejection may be if another communication port or front panel human-machine interface (HMI) is in Edit mode (Error Code 9).

Table 5-6. Analog Output Status Points and Control Blocks

<p>Analog Output Status Points Object Number: 40 Variations Supported: 1, 2 Request Function Codes supported: 1 (read) Default Variation Reported When Variation 0 Requested: 1 (32-Bit Analog Output Status)</p> <p>Analog Output Blocks Object Number: 41 Variations Supported: 1, 2 Request Function Codes supported: 3 (select), 4 (operate), 5 (direct operate), 6 (direct operate, noack)</p>
--

Index	Description	Notes
0	Save AI and BI parameters to non-volatile memory	1
1	Fault Number for Selected Fault Summary Report	2
2	Target Status reset	3
3	Major Alarms reset	4
4	Minor Alarm reset	4
5	Logic Alarms reset	4
6	Relay Trouble Alarms reset	4
	Points for Writing / Resetting Breaker Duty	
7	Breaker Accumulated Duty for Phase A CKT 1	5
8	Breaker Accumulated Duty for Phase B CKT 1	5
9	Breaker Accumulated Duty for Phase C CKT 1	5
10	Breaker Accumulated Duty for Phase A CKT 2	5
11	Breaker Accumulated Duty for Phase B CKT 2	5
12	Breaker Accumulated Duty for Phase C CKT 2	5
13	Breaker Accumulated Duty for Phase A CKT 3	5
14	Breaker Accumulated Duty for Phase B CKT 3	5
15	Breaker Accumulated Duty for Phase C CKT 3	5
16	Breaker Accumulated Duty for Phase A CKT 4	5
17	Breaker Accumulated Duty for Phase B CKT 4	5
18	Breaker Accumulated Duty for Phase C CKT 4	5
	Writing / Resetting Breaker Operation Counters	
19	Breaker Operation Counter CKT 1	6
20	Breaker Operation Counter CKT 2	6
21	Breaker Operation Counter CKT 3	6

Index	Description	Notes
22	Breaker Operation Counter CKT 4	6
	Points for Writing / Resetting Transformer Duty	
23	Transformer 1 Accumulated Duty for Phase A	7
24	Transformer 1 Accumulated Duty for Phase B	7
25	Transformer 1 Accumulated Duty for Phase C	7
26	Transformer 2 Accumulated Duty for Phase A	7
27	Transformer 2 Accumulated Duty for Phase B	7
28	Transformer 2 Accumulated Duty for Phase C	7
29	Transformer 3 Accumulated Duty for Phase A	7
30	Transformer 3 Accumulated Duty for Phase B	7
31	Transformer 3 Accumulated Duty for Phase C	7
32	Transformer 4 Accumulated Duty for Phase A	7
33	Transformer 4 Accumulated Duty for Phase B	7
34	Transformer 4 Accumulated Duty for Phase C	7
	Writing/Resetting Transformer Through Fault Operation Counter	
35	Transformer Through Fault Operation Counter	8
	Resetting Demands	
36	Demand Current - Phase A, 1	9
37	Demand Current - Phase B , 1	9
38	Demand Current - Phase C , 1	9
39	Demand Current – Neutral, 1	9
40	Demand Current – Negative-Sequence, 1	9
41	Demand Current - Phase A, 2	9
42	Demand Current - Phase B, 2	9
43	Demand Current - Phase C, 2	9
44	Demand Current – Neutral, 2	9
45	Demand Current – Negative-Sequence, 2	9
46	Demand Current - Phase A, 3	9
47	Demand Current - Phase B, 3	9
48	Demand Current - Phase C, 3	9
49	Demand Current – Neutral, 3	9
50	Demand Current – Negative-Sequence, 3	9
51	Demand Current - Phase A, 4	9
52	Demand Current - Phase B, 4	9
53	Demand Current - Phase C, 4	9
54	Demand Current – Neutral, 4	9
55	Demand Current – Negative-Sequence, 4	9
56	Demand IG	9
57	Max. Demand Voltage, Phase A	9
58	Min. Demand Voltage, Phase A	9
59	Max. Demand Voltage, Phase B	9

Index	Description	Notes
60	Min. Demand Voltage, Phase B	9
61	Max. Demand Voltage, Phase C	9
62	Min. Demand Voltage, Phase C	9
63	Max. Demand Voltage, Neutral	9
64	Min. Demand Voltage, Neutral	9
65	True Power Demand	9
66	Reverse True Power Demand	9
67	Reactive Power Demand	9
68	Reverse Reactive Power Demand	9
69	Total Primary True Energy	10
70	Total Primary Reverse True Energy	11
71	Total Primary Reactive Energy	10
72	Total Primary Reverse Reactive Energy	11

Notes for Table 5-6:

1. Saving of DNP parameters to a nonvolatile memory will be executed if this point is set to any positive value (>0). Parameters saved via this point are classes assigned to any mapped binary or analog point and dead band for any mapped analog point changed previously through DNP. If relay is already in Edit mode at some other serial port, this command will be rejected with error code 9. If setting value is ≤ 0 , error code will be 3. Read value of this point is always 0.
2. Fault Number for Selected Fault Summary Report. This point value range is from 1 to 255. The Fault Summary Report for this selected fault number will be available as analog objects from point 267 to 369. If the Fault Summary Report for the Selected Fault does not exist in the relay at that time, the Return Status Value for Object 41 will be 3 (format problem).
3. Target Status Reset Control can only be reset with write value equal zero. A read of this point returns 1 if there are active targets or 0 if targets are not active.
4. Writing value 0 will reset the alarms. Read value is 1 if alarms are present, otherwise 0.
5. This point represents assigned phase accumulated breaker pole duty as a centipercents of the maximum duty (D_{MAX}) that the breaker contacts can withstand before they need service. Breaker Accumulated Duty for Phase A, B, and C is calculated as ΣI or ΣI^2 . This is defined by Breaker Contact Duty Operation Mode in ASCII protocol command SB-DUTY. D_{MAX} is defined through the same SB-DUTY command (refer to the Instruction Manual for BE1-CDS240). Allowed value range is from 0 to 20000 where 20000 represents 200% of D_{MAX} . Example: To change accumulated breaker duty for Phase A, CKT1 to 134 % of D_{MAX} , set its point, using the appropriate control function(s) code, to value 13,400. A read of the same point will return a value of 13,400 (134% of D_{MAX}).
6. Read value of this point is a number of recorded breaker operations (0 – 99,999). If the operations counter exceeds 99,999, the counter will wrap back to 0 (zero). It acts as a counter but is implemented as analog object so that the initial value can be set or current value changed to any value from 0 to 99,999.
7. This point represents assigned phase accumulated transformer pole duty as a centipercents of the maximum duty (D_{MAX}) the transformer contacts can withstand before they need service. Transformer Duty for Phase A, B, and C is calculated as ΣI or ΣI^2 . This is defined by Transformer Duty Operation Mode entered via ASCII protocol command ST-DUTY. D_{MAX} is defined through the same ST-DUTY command (refer to the Instruction Manual for BE1-CDS240). Example: To change accumulated transformer duty for Phase B to 134 % of D_{MAX} , set its point via Object 41, variation 1 or 2 using appropriate control function(s), to value 13,400. Read the value of Accumulated Transformer Duty for Phase B as Object 40, variation 1 or 2. The returned value of 13,400 means 134% of D_{MAX} .
8. The read value of this point is a number of recorded transformer through fault operations (0 – 99,999). If the operations counter exceeds 99,999, the counter will wrap back to 0 (zero). It acts as a counter, but is implemented as analog object so that the initial value can be set or the current value changed to any value from 0 to 99,999.

9. Peak Demand can only be set to value 0 (reset). Current's or voltage's point read value is in primary centiamps/centivoltage. For Example: 670 represents 6.7 amperes if current or 6.7 volts if voltage. Power read value is in kunits(kW/kvars).
10. Read value of energy is in kWh/kvarh units. The total primary true energy or reactive energy can be set from zero (0) to a maximum of 1,000,000,000 kWh/kvarh. Any number outside this range will be rejected with Error Code 3.
11. Read value of energy is in kWh/kvarh units. The total primary true reverse energy or reactive reverse energy can be set from zero (0) to -1,000,000,000 kWh/kvarh. Any number outside this range will be rejected with Error Code 3. Note that the value entered must be negative.

OCTET (CHARACTER) STRING OBJECTS

Table 5-7. List of Octet String Objects

Object Number: 110 Variations Supported: 0: Any Variation (The variation within the object represent the length of the octet string). The maximum length that is supported by BE1-CDS240 is 40. Request Function Codes supported: 1 (read)

Index	Max String Length	Description
0	10	Model number
1	18	Application software version number and date
2	18	DSP software version number and date
3	18	Boot software version number and date
4	13	Serial number
5	21	Style number
6	12	Part number
7	32	Relay ID
8	32	Station ID
9	32	User ID #1
10	32	User ID #2
11	16	Active Logic name

Object 110 is not included in Class 0 poll response.

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SECTION 6 • CONFIGURATION VIA ASCII PROTOCOL

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SECTION 6 • CONFIGURATION VIA ASCII PROTOCOL

BE1-CDS240 ASCII commands for DNP are:

Name	Purpose
SDNP -----	Read all DNP configurable settings
SDNP-DFLT -----	Read parameters of all analog and binary default input points
SDNP-TXDL -----	Read/Set DNP pre transfer delay
SDNP-SYNCH -----	Read/Set synchronization period with master
SDNP-USERA I -----	Read/Select analog input points to user analog input map
SDNP-USERBI -----	Read/Select binary input points to user binary input map
SDNP-AIMAP -----	Read/Select active analog input map
SDNP-BIMAP -----	Read/Select active binary input map
SDNP-DFLTA I -----	Read/Set assigned class and dead-band for default analog input point
SDNP-DFLTBI -----	Read/Set assigned class for default binary input point

If the BE1-CDS240 does not have the required style number to support DNP, the relay will respond with *DNP NOT IN STYLE NUMBER* to any of the SDNP related commands.

SDNP-DFLT Command

This command reads parameters of all analog and binary default input points, and the relay responds as if the sequence of SDNP-DFLTA I; SDNP-DFLTBI commands were received.

SDNP Command

This command reads all DNP parameters and the relay responds as if the sequence of all other DNP related commands were received.

SDNP-TXDL; SDNP-SYNCH; SDNP-USERA I;SDNP-AIMAP;SDNP-USERBI;SDNP-BIMAP
SDNP-DFLTA I ; SDNP-DFLTBI

SDNP-TXDL Command

This command is used to read/change pre transfer delay. Pre transfer delay is minimum time between receiving last byte of request message from Master device and transmitting the first byte of response. Its value is in ms and default value is 0.

Command syntax is:

SDNP-TXDL[=delay] where delay can be from 0 to 50,000 ms.

Examples:

- Read pre transfer delay.

```
>SDNP-TXDL
```

```
>10
```

- Set pre transfer delay to 200 ms.

```
>SDNP-TXDL=200
```

SDNP-SYNCH Command

This command is used to read/set synchronization period with master. If synchronization period is defined as a non-zero value, BE1-CDS240 will set in its response to Master IIN1-4 bit (need time) each time after synchronization period expires. This bit will not be cleared in the slave until the time is received from master (via function request "write" time and date, Object 50). The default value is 0.

Command syntax:

SDNP-SYNCH[=valueX] where X is D/ H/ M/ S for days/ hours/ min/ sec and value is from:0 to maximum 31 if D, 0 to maximum 24 if H and from 0 to maximum 60 if M or S.

Example: Read DNP synchronization period with master.

```
>SDNP- SYNCH
```

```
>0
```

Example: Set device to “need time” from master every 24 hours.

>SDNP-SYNCH=24H or SDNP-SYNCH=1D

SDNP-DFLTAI Command

This command reads/sets assigned class and/or dead-band to one or all default analog input point(s).

The term “default” analog input point means that analog input data is identified by its default point index as specified in Table 5 (*Default List of Analog Inputs*).

Command syntax is:

SDNP-DFLTAIx[= class, dead band]

where x is omitted, or from 0 to maximum default analog input point. When x is omitted, all points are read or parameters applied to all default analog input points.

Class can be 0/ 1/ 2/ 3 and dead band can be only an integer from 0 to 4,294,967,295.

Dead band 0 will permit any change to generate an event.

Notes:

- Class 0 means that analog input data, identified with default index if selected in active analog input map (refer to *Mapping of Analog Input Points*) will be reported only via Class 0 request but will not generate any analog change event.
- If assigned class for default analog point is 1 or 2 or 3, then analog input data identified by its default index if selected in active analog input map (refer to *Mapping of Analog Input Points*) will be reported via Class 0 request and its analog change event will be reported as Class 1 or Class 2 or Class 3 event.
- Analog Change event occurs if current analog point value, for point that is mapped in active analog point map, is greater than or equal to its previous analog change event value plus the dead-band value or if current analog point value is less than or equal to previous analog change event value minus dead band value.
- The dead-band value is expressed in the same physical unit as the point’s “read” value is. For example, for any current magnitude point which read value is in centiamps, dead band represents value in centiamps, too.

Example 1: Read parameters for primary voltage of Phase A.

As defined in Table 5, default index for Voltage Phase A is 105.

>SDNP-DFLTAI105

>2,10

This means that delta of ± 0.01 V (10 centivolts) will cause an event which will be reported via Class 2 if point is selected in active analog input map (refer to SDNP-AIMAP and SDNP-USERA I commands).

Example 2: Change voltage of Phase A to generate events if dead-band is 1 V and set to be reported as Class 3 event. (**Note:** Reporting will actually take place only if particular point is included in “active” analog input map (refer to SDNP-AIMAP and SDNP-USERA I commands).

>SDNP-DFLTAI105=3,100

Example 3: Set all analog inputs event to be reported via Class 3 but leave their dead bands as they are.

>SDNP-DFLTAI=3

SDNP-DFLTBI Command

This command reads/sets assigned class to one or all default binary input point(s).

The term “default” binary input point means that binary input data is identify by its default point index as specified in Table 3, *Default List of Binary Input Points*.

Command syntax:

SDNP-DFLTBIx[= class]

where x is omitted or from 0 to max default binary input point. When x is omitted all points are read or parameters applied to all default binary input points.

Class can be 0/ 1/ 2/ 3.

Notes:

- Class 0 means that binary input data, identified with its default index if selected in active binary input map (refer to *Mapping of Binary Input Points*, below), will be reported only via Class 0 request but will not generate events.
- If assigned class for default binary point is 1 or 2 or 3, then binary input data, identified by its default index, if selected in active binary input map (refer to *Mapping of Binary Input Points*, below) will be reported via Class 0 request and its events will be reported as class 1 or 2 or 3 events.

Mapping of Binary and Analog Input Points

Any binary or analog Input point can be reported via DNP only if included into active analog/binary input map. User can choose active analog/binary map between **Default** binary/analog map as presented in Table 3/Table 5 and **User** binary/analog configured map via the ASCII command:

“SDNP-BIMAP” / “SDNP-AIMAP”

By default, all BI/AI points are included in Default BI/AI map. User BI/AI map can be configured by ASCII command “SDNP-USERBI” / “SDNP-USERAI” and will be saved in nonvolatile memory.

In configuration of binary/analog inputs, each point is identified by its identification number (IN) which is the default point index as specified in Table 3/5.

Map is composed of list of indices. Each index from that list represents unique binary/analog input identification number. The order in which they occur in the list determines the index that the corresponding value is reported as to the DNP master. If the BI/AI IN is not in the list, it is not available to the DNP master (will not be reported via class 0 or any event class).

User configured BI/AI map can have from none to maximum total number of default BI/AI points.

NOTE

After BE1-CDS240 points have been remapped, the device responds with IIN1-7 set indicating the device has been restarted.

Class can be assigned via DNP Assign function only for currently mapped, active, binary/analog inputs. Also, dead bands can be assigned via DNP Object 34 only for currently mapped, active, analog inputs. Assigned classes and dead bands for all active, currently mapped points can be saved on user request via DNP object Analog Output Control Block, point 0.

SDNP-USERBI and SDNP-USERAI Commands

Two commands support BI/AI points configurable mapping: SDNP-USERBI /SDNP-USERAI and SDNP-BIMAP/ SDNP-AIMAP.

Syntax of SDNP-USERAI / SDNP-USERBI ASCII commands are:

SDNP-USERAI [= T, startndx, endndx, p1, p2, p3,...px] and for mapping of binary inputs

SDNP-USERBI [= T, startndx, endndx, p1, p2, p3,...px]

where:

T is the total number of points in the user map. It can be from 0 to max. number of BI/AI default points.

startndx is reporting index of the first point in the command

endndx is reporting index of the last point in the command

p1 is point IN and will be reported as index startndx

p2 is point IN and will be reported as index startndx+1

p3 is point IN and will be reported as index startndx+2

px is the last point IN in command line which will be reported as index endndx

One SDNP-USERAI / SDNP-USERBI command can define a maximum of 50 points for reporting. In other words, (Startndx – endndx +1) can be a maximum of 50. It means that remapping of more than 50 points to the USER map requires sequence of more SDNP-USERAI/ SDNP-USERBI commands until all points are being specified. The rule is that first SDNP-USERAI / SDNP-USERBI command must have startndx

equal 0 and endndx <= 49. The preceding SDNP-USERAI / SDNP-USERBI commands must have the same T number but startndx for 1 higher than the previous endndx. And so on, until all points are mapped.

Example:

1) Map only points 32, 33,34,35,36 and 37 to user binary map.

```
SDNP-USERBI=6,0,5,32,33,34,35,36,37
```

2) Map the following 57 points to the User AI map.

```
0, 2, 4, 5, 6, 7, 8, 9, 10, 20, 21, 22, 23, 45, 46, 47, 100, 101, 105, 200, 201, 202, 203, 204, 205, 206, 207, 208, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 300, 301, 302, 303, 304, 305, 400, and 405.
```

Two commands must be sent:

```
>SDNP-USERAI=
```

```
57,0,49,0,2,4,5,6,7,8,9,10,20,21,22,23,45,46,47,100,101,105,200,201,202,203,204,205,206,207,208,50,51,52,53,54,55,56,57,58,59,60,90,91,92,93,94,95,96,97,98,99,300
```

```
>SDNP-USERBI =57,50,56, 301,302,303,304,305,400,405
```

The same mapping can be accomplished via more commands, as presented below. The basic rule to apply is that the total number of points to be mapped in one command line must not exceed 50.

```
>SDNP-USERAI = 57,0,9, 0,2,4,5,6,7,8,9,10,20
```

```
>SDNP-USERAI = 57,10,19, 21,22,23,45,46,47,100,101,105,200
```

```
>SDNP-USERAI = 57,20, 29, 201,202,203,204,205,206,207,208,50,51
```

```
>SDNP-USERAI = 57,30,39, 52,53,54,55,56,57,58,59,60,90
```

```
>SDNP-USERAI = 57,40,49, 91,92,93,94,95,96,97, 98,99,300
```

```
>SDNP-USERAI = 57,50,56, 301,302,303,304,305,400,405
```

For example, to eliminate all BI points from reporting, apply the command SDNP-USERBI=0.

Mapping becomes remembered after being saved to a nonvolatile memory (refer to ASCII commands for changing and saving relay's settings).

SDNP-BIMAP and SDNP-AIMAP Commands

Binary/Analog User map becomes active if selected by ASCII command SDNP-BIMAP/ SDNP-AIMAP.

Syntax of SDNP-BIMAP/ SDNP-AIMAP command is:

```
SDNP-AIMAP= type or for binary inputs, SDNP-BIMAP= type.
```

Type can be **USER** or **U** to select User map configured by ASCII command SDNP-USERAI or SDNP-USERBI or **DEFAULT** or **DFT** or **D** for default mapping as presented with default BI/AI Table 3/5.

Selection between maps can be successfully accomplished if User BI/AI map was already saved in a nonvolatile memory.

Differences between Changing DNP Parameters by DNP versus using ASCII Protocol

DNP Assign Class function, for (Particular) active BI/AI points will change class of active point and class of belonging default BI/AI point.

This can be explained through the following example where the analog user map is active and defined as:

```
SDNP-USERAI=4,0,3,165,166,167,168
```

In this case, analog input data which identification number (IN) is 165 is reported as point 0, data with IN = 166 as point 1, data with IN = 167 as point 2 and data with IN = 168 as a point 3. Assume that all points have Class 2.

If assigned class is changed to 3 via DNP for (active) index 1 and if DNP parameters are saved after that by command via Object 41 (see description in Section 5, *DNP3 Point List, Analog Output Status Points and Control Blocks*) assigned class for data with IN=166 will be changed to that value as well. The same rule apply when dead band for active analog index "j" is changed via Object 34 and then DNP parameters saved via Object 41. The dead band of analog data with identification number (IN) which is reported in active map as index "j" is changed and saved in nonvolatile memory.



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