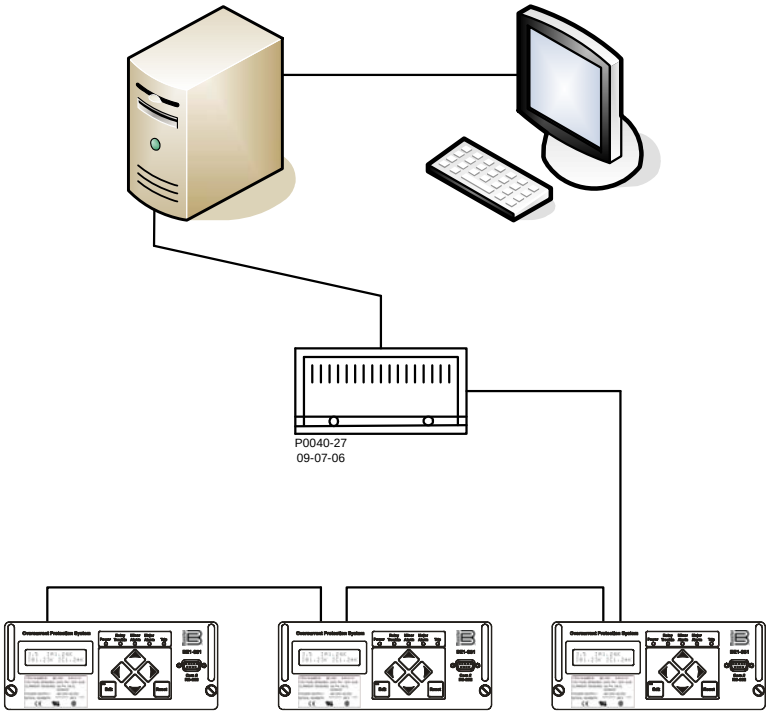
INSTRUCTION MANUAL

FOR

OVERCURRENT PROTECTION SYSTEM
BE1-1051

DISTRIBUTED NETWORK PROTOCOL
(DNP V3.00)



Basler Electric

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INTRODUCTION

This instruction manual provides detailed information about the BE1-1051 Overcurrent Protection System with the Distributed Network Protocol (DNP V3.00).

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It is not the intention of this manual to cover all details and variations in equipment, nor does this manual provide data for every possible contingency regarding installation or operation. The availability and design of all features and options are subject to modification without notice. Should further information be required, contact Basler Electric.

BASLER ELECTRIC
ROUTE 143, BOX 269
HIGHLAND IL 62249 USA
http://www.basler.com, info@basler.com
PHONE +1 618.654.2341 **FAX +1 618.654.2351**

REVISION HISTORY

The following information provides a historical summary of the changes made to this instruction manual (9334800992). Revisions are listed in reverse chronological order.

Manual Revision and Date	Change
C, 09/09	• Added Analog Input Points 480 through 483.
B, 03/08	• Added manual part number and revision to footers.
A, 08/06	• Added Option 2 (# of Inputs/Outputs) to style number.
—, 08/02	• Initial release.

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SECTION 1 • GENERAL INFORMATION

INTRODUCTION

This document describes how the Basler Electric Distributed Network Protocol (DNP) is implemented in the BE1-1051. The BE1-1051 is classified as an Intelligent Electronic Device (IED) that is capable of reacting or responding to specific requests to a level two slave device, as defined in the DNP V3.00 *Subset Definitions Document*. This manual contains a list of DNP data objects accessible by a master station.

NOTE

This implementation of DNP V3.00 is fully compliant with DNP V3.00 Subset Definition Level 2, contains many Subset Level 3 features, and contains some functionality even beyond Subset Level 3.

REFERENCES

- Instruction Manual for BE1-1051
- DNP V3.00 Basic 4 Document Set
- DNP Subset Definitions Document
- The DNP website (www.DNP.org)

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SECTION 2 • DEVICE PROFILE DOCUMENT

Table 2-1 illustrates a *Device Profile Document* in the standard format defined by the DNP V3.00 subset definition document. The table, in combination with the implementation table provided in Section 3, *Implementation Table,* and the point list tables provided in Section 5, *DNP V3.00 Point List,* provide a complete application configuration guide for including the BE1-1051 DNP protocol in any DNP environment.

Table 2-1. Device Profile Document

DEVICE PROFILE DOCUMENT

Vendor Name: Basler Electric Company

Device Name: BE1-1051 Overcurrent Protection System

Highest DNP Level Supported:	Device Function:
DNP-L2.	☐ Master ☒ Slave

Notable objects, functions, and/or qualifiers supported in addition to the highest DNP levels supported (the complete list is described in DNP V3.00 Implementation Table):

- 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 object 102 (8-bit unsigned integer), variation 1, is supported.
- Time period when device requires time-synchronization from the master is configurable via object 41, point 38.
- Current Change Event Dead band is configurable via object 41, point 40.
- Voltage Change Event Dead band is configurable via object 41, point 41.
- Power Change Event Dead band is configurable via object 41, point 42.

Maximum Data Link Frame Size (octets):	Maximum Application Fragment Size (octets):
Transmitted 292 Received 292	Transmitted 2048 Received 1024

Maximum Data Link Re-tries:	Maximum Application Layer Re-tries:
☒ None ☐ Fixed at ☐ Configurable	☒ None ☐ Fixed at ☐ Configurable, range _____ to _____

Requires Data Link Layer Confirmation:

☒ Never
☐ Always
☐ Sometimes If 'Sometimes', when?_____
☐ Configurable If 'Configurable', how?_____

Requires Application Layer Confirmation:

☐ Never
☐ Always (not recommended)
☒ When reporting Event Data (Slave devices only)
☒ When sending multi-fragment responses (Slave devices only)

DEVICE PROFILE DOCUMENT

Timeouts while waiting for:

Data Link Confirm	☐ None	☒ Fixed at 3000 ms	☐ Variable	☐ Configurable
Complete Appl. Fragment	☒ None	☐ Fixed at ____	☐ Variable	☐ Configurable
Application Confirm	☐ None	☒ Fixed at 5000 ms	☐ Variable	☐ Configurable
Complete Appl. Response	☒ None	☐ Fixed at ____	☐ Variable	☐ Configurable

Sends/Executes Control Operations:

WRITE Binary Outputs	☒ Never	☐ Always	☐ Sometimes	☐ Configurable
SELECT/OPERATE	☐ Never	☒ Always	☐ Sometimes	☐ Configurable
DIRECT OPERATE	☐ Never	☒ Always	☐ Sometimes	☐ Configurable
DIRECT OPERATE - NO ACK	☐ Never	☒ Always	☐ Sometimes	☐ Configurable
Count > 1	☒ Never	☐ Always	☐ Sometimes	☐ Configurable
Pulse On	☐ Never	☒ Always	☐ Sometimes	☐ Configurable
Pulse Off	☒ Never	☐ Always	☐ Sometimes	☐ Configurable
Latch On	☐ Never	☒ Always	☐ Sometimes	☐ Configurable
Latch Off	☐ Never	☒ Always	☐ Sometimes	☐ Configurable
Queue	☒ Never	☐ Always	☐ Sometimes	☐ Configurable
Clear Queue	☒ Never	☐ Always	☐ Sometimes	☐ 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 BE1-1051 DNP supports in both request messages and in response messages.

For static (non-change-event) objects, requests sent with qualifiers 00, 01, 06, 07, or 08 will be responded 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 (BE1-1051 will parse)		RESPONSE (BE1-1051 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)	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)	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)	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)	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)	00,01 (start- stop) 06 (no range) 07,08 (limited qty) 17,28 (index)	81	00,01 (start-stop) 17,28 (index)
30	3 (default – see note 1)	32-Bit Analog Input Without Flag	1 (read)	00,01 (start- stop) 06 (no range) 07,08 (limited qty) 17,28 (index)	81	00,01 (start-stop) 17,28 (index)

OBJECT			REQUEST (BE1-1051 will parse)		RESPONSE (BE1-1051 will respond with)	
Object No.	**Variation No.**	**Description**	**Function Codes (dec)**	**Qualifier Codes (hex)**	**Function Codes (hex)**	**Qualifier Codes (hex)**
30	4	16-Bit Analog Input Without Flag	1 (read)	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)
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	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 (default - see note 1)	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)
60	1	Class 0 Data (Note 1) (Note 4)	1 (read)	06 (no range or all)	81	
60	2	Class 1 Data	1 (read)	06 (no range or all) 07,08 (limited qty)	81	
60	3	Class 2 Data	1 (read)	06 (no range or all) 07,08 (limited qty)	81	
60	4	Class 3 Data	1 (read)	06 (no range or all) 07,08 (limited qty)	81	
80	1	Internal Indications	2 (write)	00 (start-stop) (index must=7)		
102	1	8-Bit Unsigned Integer (Note 2)	1 (read)	00,01 (start- stop) 06 (no range) 07,08 (limited qty) 17,28 (index)	81(response)	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 meas)			

Notes for Table 3-1:

1. If variation 0 is requested and/or it is in class 0, 1, 2, or 3 scans, a default variation has occurred.
2. Object 102 is not included in the class 0 poll response.
3. If a cold restart is implemented as a warm restart – the DNP process is restarted.
4. All binary Inputs (object 1), and a selected set of Analog Inputs (object 30) are included in Class 0. Binary output status points and Analog Output Status points are not included in Class 0.

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SECTION 4 • CONFIGURATION PARAMETERS

DNP CONFIGURATION PARAMETERS

These paragraphs describe configuration settings that may be verified/changed from the BE1-1051 front panel or using ASCII protocol commands.

Relay Style Number

BE1-1051 relays that support the DNP protocol must have a Style Number in which the sixth character (RS-485 port protocol) is 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 BE1-1051 Instructional Manual).

Example:
>rg-ver
Model Number: BE1-1051
Style Number: E3N2H3U2
Serial Number:H12345678
App Program: VER 2.00.00 03/04/2002
Boot Program: VER 2.01.02 10/21/2001

BE1-1051 Slave Address

BE1-1051 relays support DNP through the rear RS-485 (COM2) communication port. Baud Rates of 1200, 2400, 4800, 9600, and 19200 are supported by COM2. The default Baud Rate is 9600.

DNP Slave IED Address Range is from 0 to 65534. Address 65535 (hex FFFF) is used to broadcast messages to all devices. The communication address can be set by the SG-COM ASCII command. For more information about changing the relay parameters, refer to the BE1-1051 Instructional Manual.

Example: Set the BE1-1051 address to be 125, and baud rate to be 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 COMM PARAMETERS
>
To verify port address, enter command
>**sg-com2**(**enter**)
>SG-COM2=9600, A125, P0,R1,X0

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SECTION 5 ● POINT LIST

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Tables

SECTION 5 • POINT LIST

BINARY INPUT POINTS

Binary input changes are scanned every ½ cycle (8.3 milliseconds for 60 Hz relay). Events are pending in the Slave application buffer until the master device sends confirmation that the response with pending events was received. Table 5-1 describes the binary input points.

Table 5-1. Binary Input Points

Binary Input Points
Static Object Number: 1 Change Event Object Number: 2 Request Function Codes Supported: 1 (read) 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)

Point Index	Description	Change Event Assigned Class (1,2,3 or none)	Notes
0	50T Phase Tripped	1	
1	150T Phase Tripped	1	
2	50T Neutral Tripped	1	
3	150T Neutral Tripped	1	
4	50T Negative Sequence Tripped	1	
5	150T Negative Sequence Tripped	1	
6	50BF Tripped	1	
7	51 Phase Tripped	1	
8	51 Neutral Tripped	1	
9	151 Neutral Tripped	1	
10	51 Negative Sequence Tripped	1	
11	50T Phase Picked-Up	1	
12	150T Phase Picked-Up	1	
13	50 Neutral Picked Up	1	
14	150 Neutral Picked Up	1	
15	50T Negative Sequence Picked Up	1	
16	150T Negative Sequence Picked Up	1	
17	50BF Picked Up	1	
18	51 Phase Picked-Up	1	
19	51 Neutral Picked Up	1	
20	151 Neutral Picked Up	1	
21	51 Negative Sequence Picked Up	1	
22	86 Lockout	1	
23	186 Lockout	1	
24	52B Trip	1	
25	79P Pilot Reclose Output	1	
26	79C Close	1	

Point Index	Description	Change Event Assigned Class (1,2,3 or none)	Notes
27	79RNG Enabled/Active/Block Tap Changer	1	
28	79LO Lockout	1	
29	79R Recloser Reset	1	
30	79SCB Block Output	1	
31	VIRTUAL OUTPUTA	1	
32	VIRTUAL OUTPUT1	1	
33	VIRTUAL OUTPUT2	1	
34	VIRTUAL OUTPUT3	1	
35	VIRTUAL OUTPUT4	1	
36	VIRTUAL OUTPUT5	1	
37	VIRTUAL OUTPUT6	1	
38	VIRTUAL OUTPUT7	1	
39	VIRTUAL OUTPUT8	1	
40	VIRTUAL OUTPUT9	1	
41	VIRTUAL OUTPUT10	1	
42	VIRTUAL OUTPUT11	1	
43	VIRTUAL OUTPUT12	1	
44	VIRTUAL OUTPUT13	1	
45	VIRTUAL OUTPUT14	1	
46	VIRTUAL OUTPUT15	1	
47	VIRTUAL OUTPUT16	1	
48	VIRTUAL OUTPUT17	1	
49	IN1	1	
50	IN2	1	
51	IN3	1	
52	IN4	1	
53	IN5	1	
54	IN6	1	
55	IN7	1	
56	IN8 (only when style # Option 2 = A or B)	1	
57	101 Trip	1	
58	101 Close	1	
59	101 Slip Contact	1	
60	Alarm Relay Trouble	1	
61	Alarm Major	1	
62	Alarm Minor	1	
63	32 Forward/Reverse Power Tripped	1	
64	132 Forward/Reverse Power Tripped T	1	
65	32 Forward/Reverse Power Pickup	1	

Point Index	Description	Change Event Assigned Class (1,2,3 or none)	Notes
66	132 Forward/Reverse Power Pickup	1	
67	Load Encroachment	1	
68	27 Phase Undervoltage Tripped	1	
69	27 Neutral / X Undervoltage Tripped (27XT)	1	4
70	27 Phase Undervoltage Pickup	1	
71	27 Neutral / X Undervoltage Pickup (27XPU)	1	4
72	Voltage Phase Sequence Trip (T47P)	1	
73	Voltage Phase Sequence Pickup (P47P)	1	
74	24 Volts Per Hertz Tripped	1	
75	24 Volts Per Hertz Pickup	1	
76	59 Phase Overvoltage Tripped	1	
77	59 Neutral / X Overvoltage Trip	1	4
78	159 Neutral /X Overvoltage Trip	1	4
79	59 Phase Overvoltage Pickup	1	
80	59 Neutral /X Overvoltage Pickup	1	4
81	159 Neutral / X Overvoltage Pickup	1	4
82	81 Over/Under/Frequency Trip	1	
83	181 Over/Under/Frequency Trip	1	
84	281 Over/Under/Frequency Trip	1	
85	381 Over/Under/Frequency Trip	1	
86	481 Over/Under/Frequency Trip	1	
87	581 Over/Under/Frequency Trip	1	
88	Output Trip Coil Monitor	1	
89	62 Tripped	1	
90	162 Tripped	1	
91	25 Voltage Monitor 1 Pickup	1	
92	25 Voltage Monitor 2 Pickup	1	
93	25 Synch-Check Tripped	1	
94	60 Loss of Potential Alarm	1	
95	VIRTUAL INPUT1	1	
96	VIRTUAL INPUT2	1	
97	VIRTUAL INPUT3	1	
98	VIRTUAL INPUT4	1	
99	VIRTUAL INPUT5	1	
100	VIRTUAL INPUT6	1	
101	VIRTUAL INPUT7	1	
102	VIRTUAL INPUT8	1	
103	VIRTUAL INPUT9	1	
104	VIRTUAL INPUT10	1	

Point Index	Description	Change Event Assigned Class (1,2,3 or none)	Notes
105	VIRTUAL INPUT11	1	
106	VIRTUAL INPUT12	1	
107	VIRTUAL INPUT13	1	
108	VIRTUAL INPUT14	1	
109	VIRTUAL INPUT15	1	
110	VIRTUAL INPUT16	1	
111	Alarm Reset Key	1	
112	Target Reset Key	1	
113	Virtual Selector Switch 43	1	
114	Virtual Selector Switch 143	1	
115	Virtual Selector Switch 243	1	
116	Virtual Selector Switch 343	1	
117	Virtual Selector Switch 443	1	
118	P85 Echo Shifted To Trip	1	
119	P85 Echo To Transmitter	1	
120	P85 Signal Transmitter	1	
121	P85 Local Trip	1	
122	Switch On To Fault	1	
123	Setting Group 0 Active	1	
124	Setting Group 1 Active	1	
125	Setting Group 2 Active	1	
126	Setting Group 3 Active	1	
	Output status (points from 127 to 133)		
127	OUTPUT A	1	
128	OUTPUT 1	1	
129	OUTPUT 2	1	
130	OUTPUT 3	1	
131	OUTPUT 4	1	
132	OUTPUT 5	1	
133	OUTPUT 6	1	
	Latched Targets (points from 134 to 192)		
134	24 Volts per Hertz Tripped	1	
135	27 Phase A Tripped	1	
136	27 Phase B Tripped	1	
137	27 Phase C Tripped	1	
138	27 Neutral / X Tripped	1	4
139	32 Phase Tripped	1	
140	132 Phase Tripped	1	
141	Switch On To Fault Tripped	1	

Point Index	Description	Change Event Assigned Class (1,2,3 or none)	Notes
142	TAR_47	1	
143	TAR_T52B	1	
144	TAR_BF	1	
145	TAR_50A	1	
146	TAR_50B	1	
147	TAR_50C	1	
148	TAR_150A	1	
149	TAR_150B	1	
150	TAR_150C	1	
151	TAR_50N	1	
152	TAR_150N	1	
153	TAR_50TQ	1	
154	TAR_150TQ	1	
155	TAR_51A	1	
156	TAR_51B	1	
157	TAR_51C	1	
158	TAR_51N	1	
159	TAR_151N	1	
160	TAR_51Q	1	
161	TAR_59A	1	
162	TAR_59B	1	
163	TAR_59C	1	
164	TAR_59X	1	4
165	TAR_159X	1	4
166	TAR_60FL	1	
167	TAR_62	1	
168	TAR_162	1	
169	TAR_P85	1	
170	TAR_P85E	1	
171	TAR_67A	1	
172	TAR_67B	1	
173	TAR_67C	1	
174	TAR_167A	1	
175	TAR_167B	1	
176	TAR_167C	1	
177	TAR_67N	1	
178	TAR_167N	1	
179	TAR_67Q	1	
180	TAR_167Q	1	

Point Index	Description	Change Event Assigned Class (1,2,3 or none)	Notes
181	TAR_67TA	1	
182	TAR_67TB	1	
183	TAR_67TC	1	
184	TAR_67TN	1	
185	TAR_167TN	1	
186	TAR_67TQ	1	
187	TAR_81	1	
188	TAR_181	1	
189	TAR_281	1	
190	TAR_381	1	
191	TAR_481	1	
192	TAR_581	1	
	Breaker Status (points 193 to 194)		
193	Breaker Control 1/0=enabled/disabled	1	
194	Breaker state 1/0=open/closed	1	
	Relay Trouble Alarms (points 195 to 206)		
195	MPU self test error	1	
196	EEPROM Read/Write Fatal error	1	
197	Analog problem detected	1	
198	Calibration error	1	
199	Power Supply Error	1	
200	Setting defaults loaded	1	
201	Calibration defaults loaded	1	
202	All Sequence of Events Records (archived in non-volatile memory) lost	1	
203	Oscillographic fault data (archived in non-volatile memory) lost	1	
204	Lost of SER fault data archived in non-volatile memory	1	
205	Flash Block Erase Error	1	
206	Sequence of Events Record (archived in non-volatile memory) lost	1	
	Programmable Alarms (points 207 to 250)		3
207	Trip Circuit Monitor Alarm	1	
208	Breaker Fail Alarm	1	
209	Recloser Fail	1	
210	Recloser Lockout	1	
211	Breaker Alarm 1	1	
212	Breaker Alarm 2	1	
213	Breaker Alarm 3	1	
214	Group Override (0=Local Control, 1=Overide)	1	
215	CPU Overload Alarm	1	

Point Index	Description	Change Event Assigned Class (1,2,3 or none)	Notes
216	Communication Error Alarm	1	
217	Clock Error Alarm	1	
218	MPU Reset Alarm	1	
219	Settings Changed	1	5
220	EEPROM Non fatal error	1	
221	An override is active in one or more outputs	1	
222	Loss of IRIG	1	
223	SGC Active	1	
224	Virtual Output 13 Logic Alarm	1	
225	Virtual Output 14 Logic Alarm	1	
226	Virtual Output 15 Logic Alarm	1	
227	FLT RPT Time Out	1	
228	Logic=None Alarm	1	
229	Freq Range Alarm	1	
230	Changes Lost Alarm	1	
231	60 Fuse Alarm	1	
232	Volts/HZ Alarm	1	
233	27 Under Voltage Alarm	1	
234	59 Over Voltage Alarm	1	
235	Virtual Test Switch active Alarm	1	
236	P current Demand Alarm	1	
237	N current Demand Alarm	1	
238	Q current Demand Alarm	1	
239	IG demand maximum exceeded		
240	IAVG demand maximum exceeded		
241	VAR positive demand maximum exceeded	1	
242	WATT forward demand maximum exceeded	1	
243	VAR negative demand maximum exceeded	1	
244	WATT reverse demand maximum exceeded	1	
245	Phase Voltage max. demand exceeded	1	
246	Phase Voltage min. demand exceeded	1	
247	Average Voltage max. demand exceeded	1	
248	Average Voltage min. demand exceeded	1	
249	Neutral Voltage max. demand exceeded	1	
250	Neutral Voltage min. demand exceeded	1	
	Indications of reset/set /override actions (251 - 294)		
251	Phase A Demand current reset	1	
252	Phase B Demand current reset	1	
253	Phase C Demand current reset	1	

Point Index	Description	Change Event Assigned Class (1,2,3 or none)	Notes
254	IN Neutral current reset	1	
255	IQ Negative sequence current reset	1	
256	IG Ground current reset	1	
257	Average current Demand Reset	1	
258	True Power demand reset	1	
259	Reverse True Power Demand Reset	1	
260	Reactive Power Demand Reset	1	
261	Reverse Reactive Power Demand Reset	1	
262	True energy Reset	1	
263	Negative True Energy Reset	1	
264	Reactive Energy Reset	1	
265	Negative Reactive Energy Reset	1	
266	Relay Trouble alarms reset	1	
267	Major alarms reset	1	
268	Minor alarms reset	1	
269	Logic alarm reset	1	
270	Targets reset	1	
271	New Fault counter reset	1	
272	Phase A Breaker Duty Reset	1	
273	Phase B Breaker Duty Reset	1	
274	Phase C Breaker Duty Reset	1	
275	Breaker operate counter reset	1	
276	Time set	1	
277	Date set	1	
278	OUTA Logic Override	1	
279	OU1T Logic Override	1	
280	OUT2 Logic Override	1	
281	OUT3 Logic Override	1	
282	OUT4 Logic Override	1	
283	OUT5 Logic Override	1	
284	OUT6 Logic Override	1	
285	Phase Voltage A High demand reset	1	
286	Phase Voltage A Low demand reset	1	
287	Phase Voltage B High demand reset	1	
288	Phase Voltage B Low demand reset	1	
289	Phase Voltage C High demand reset	1	
290	Phase Voltage C Low demand reset	1	
291	Average V3 High demand reset	1	
292	Average V3 Low demand reset	1	

Point Index	Description	Change Event Assigned Class (1,2,3 or none)	Notes
293	Phase Voltage N High demand reset	1	
294	Phase Voltage N Low demand reset	1	
	Fault related Indications		
295	Pickup Trigger expression state(1=TRUE,0=FALSE)	1	1
296	Trip Trigger expression state(1=TRUE,0=FALSE)	1	1
297	Logic Trigger expression state(1=TRUE,0=FALSE)	1	1
298	Close Trigger expression state(1=TRUE,0=FALSE)	1	1
299	1: New Fault triggered. Fault data will be saved as the “Most Recent Fault Summary Report“ and available when this point becomes 0. 0: The “Most Recent Fault Summary Report “available.	1	2
	Indications of TAG/UNTAG actions (300 to 311)		
300	TAG 43	1	
301	TAG 143	1	
302	TAG 243	1	
303	TAG 343	1	
304	TAG 443	1	
305	TAG 101	1	
306	UNTAG 43	1	
307	UNTAG 143	1	
308	UNTAG 243	1	
309	UNTAG 343	1	
310	UNTAG 443	1	
311	UNTAG 101	1	
312	OUTPUT 7 (only when style # Option 2 = C or D)	1	
313	OUT7 Logic Override (only when style # Option 2 = C or D)	1	

Notes for Table 5-1:

1. Refer to ASCII serial command SG-TRIGGER in the BE1-1051 Instruction Manual.
2. The time stamp from transition 0 to 1 is a fault trigger time (equal to the time in the most recent fault summary report).

   The time stamp from transition 1 to 0 is the time since the most recent fault summary report is available (see related analog input object points).

   Total count of transitions from 0 to 1 (new faults triggered) in response to CLASS 1 request represents the number of faults that have occurred between two consecutive CLASS 1 scans.

   A class 1 scan reports only the most recent fault summary report as analog events of object 32, points 57 to 172. If more than one New Fault event is triggered in Class 1 response, the previous fault summary reports can be retrieved through the select fault summary report (see object 30, points 362 to 477).
3. Any alarm from the programmable alarms group may be declared as a major, minor, or logic alarm. Refer to ASCII serial command SG-LGC, SA-MAJ, and SA-MIN in the BE1-1051 Instruction Manual.
4. The meaning of this point index depends on the function logic mode and VTX connection as presented in the following table. The mode and VTX Connection can be obtained via analog output object points (refer to Table 5-8). For mode 0 and mode 2, the point always represents N (Neutral).

For example if the VTX connection is set to ground and the mode is set to 3, then point 138 represents 27-3N.

When Mode is 1 and VTX connection is not Ground, point 138 represents 27BUS.

5. Point 219 toggles states every time changes are saved.

Table 5-2. Point Index Description

Mode	VTX Connection Is Ground	Other VTX Connections
0	N	N
1	N	BUS
2	N	N
3	3N	3BUS

BINARY OUTPUT STATUS POINTS AND CONTROL RELAY OUTPUT BLOCKS

Table 5-3 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 5-3. Binary Output Status Points and Control Relay Output Blocks

Binary Output Status Points:
Object Number: 10
Variations supported: 2
Request Function Codes supported: 1 (read)
Default Variation reported when variation 0 requested: 2 (Binary Output Status)

Control Relay Output Blocks
Object Number: 12
Variations supported: 1
Request Function Codes supported: 3(select), 4(operate), 5(direct operate), 6 (direct operate, noack)

Point Index	Description	Control Codes And Their Description
0	Hardware Output A State	Latch On: Set Output x to state 1 Latch Off: Set Output x to state 0 Pulse On: Pulse output x to opposite of current state then restore to previous state (pulsed output is active 200 to 250 ms)
1	Hardware Output 1 State	
2	Hardware Output 2 State	
3	Hardware Output 3 State	
4	Hardware Output 4 State	
5	Hardware Output 5 State	
6	Hardware Output 6 State	
7	All Hardware Outputs State	
8	Hardware Output A Local Control	Latch On: Set Hardware Output x to relay logic or local control
9	Hardware Output 1 Local Control	
10	Hardware Output 2 Local Control	
11	Hardware Output 3 Local Control	
12	Hardware Output 4 Local Control	
13	Hardware Output 5 Local Control	
14	Hardware Output 6 Local Control	
15	All Hardware Outputs Local Control	
16	43 Selector Switch Status	Latch On: Set x Selector Switch to 1 Latch Off: Set x Selector Switch to 0 Pulse On: Pulse x Selector Switch state to opposite of the current state then restore to previous state (pulsed input is active 200 to 250 ms).
17	143 Selector Switch Status	
18	243 Selector Switch Status	
19	343 Selector Switch Status	
20	443 Selector Switch Status	
21	Setting Group 0	Latch On: Select Group x to be Active
22	Setting Group 1	
23	Setting Group 2	
24	Setting Group 3	
25	Local Setting Group Control Switch	Latch On: Return Setting Group Control to relay local logic

Point Index	Description	Control Codes And Their Description
26	101 Virtual Breaker Control Switch	Close: Close Breaker (changes 101C Binary Input from 0 to 1 for 200 ms) Trip: Trip Breaker (changes 101T from 0 to 1 for 200 ms)
27	43 switch TAG Status	Latch On: TAG Latch Off: UNTAG
28	143 switch TAG Status	
29	243 switch TAG Status	
30	343 switch TAG Status	
31	443 switch TAG Status	
32	101 TAG Status	Latch On: TAG Latch Off: UNTAG
33	Hardware Output 7 State	Latch On: Set Output x to state 1 Latch Off: Set Output x to state 0 Pulse On: Pulse output x to opposite of current state then restore to previous state (pulsed output is active 200 to 250 ms)
34	Hardware Output 7 Local Control	Latch On: Set Hardware Output x to relay logic or local control

Notes for Table 5-3:

1. Reads of Points
   - Reads of points from 0 to 6 and 33, and 16 to 20 returns the current state of the corresponding point.
   - Reads of points from 8 to 14 and 34 always returns 1 if corresponding hardware output is under relay local control, or 0 if output is override.
   - Reads of points from 21 to 24 returns 1 if the setting group is active. Notice that only one of these points can be active (1) at a time.
   - A read of point 25 returns 1 if setting group control is under the relay's local control.
   - A read of point 7, 15, and 26 always returns 0.
   - A Read of point 27 to 32 returns 0 if point is untagged and 1 if point is tagged.
2. When used to control the points listed in Table 5-3, 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, and 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, OnTime and OffTime 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’s 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 15) will be rejected if the output control for all hardware outputs is disabled.

The logic (control) mode of any object 12 point can be changed (enabled/disabled) via the specific point of object 41 (Analog Output Control Blocks). Refer to analog output status points and analog output control block points from 25 to 36.

ANALOG INPUTS

Table 5-4lists Analog Inputs (Object 30). It is important to note that 16-bit and 32-bit variations of Analog Inputs 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 $<2^{15}-1>$ = 32,767. For a 32-bit variation the maximum positive representation is $<2^{31}-1>$ = 2,147,483,647.

An analog change event will be generated if the point changes its value by the absolute amount equal or bigger than the dead band. Analog change events, once generated, will be reported in one of the class polls (1, 2, 3 or none) as defined in the column “*Change Event Assigned Class”*.

Points not assigned to any class can be read as object 30 points, in any supported variation or qualifier implemented for object 30.

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.

Table 5-4. Analog Inputs

Analog Inputs

Static Object Number : 30
Change Event Object Number : 32
Request Function Codes Supported: 1 (read)
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)

Index	Description	Change Event Assigned Class (1, 2, 3, or none)	Notes
	Primary Currents		
0	Phase A Current Magnitude	2	1,21,21*
1	Phase B Current Magnitude	2	1,21,21*
2	Phase C Current Magnitude	2	1,21,21*
3	Phase Average current	2	1,21,21*
4	Neutral current	2	1,21,21*
5	Ground Current	2	1,21, 21**
6	Positive Sequence Current Magnitude	2	1,21,21*
7	Negative Sequence Current Magnitude	2	1,21,21*
	Currents’ Angles		
8	Angle of primary Phase A Current	2	1

Index	Description	Change Event Assigned Class (1, 2, 3, or none)	Notes
9	Angle of primary Phase B Current	2	1
10	Angle of primary Phase C Current	2	1
11	Angle of Neutral current	2	1
12	Angle of Ground Current	2	1
13	Angle of Positive Sequence Current	2	1
14	Angle of Negative Sequence Current	2	1
	Primary Voltages		
15	Voltage, A-phase	2	1,22,22*
16	Voltage, B-phase	2	1,22,22*
17	Voltage, C-phase	2	1,22,22*
18	Average Phase Voltage		1,22,22*
19	Voltage, Positive Sequence	2	1,22,22*
20	Voltage, Negative Sequence	2	1,22,22*
21	Voltage, Zero Sequence	2	1,22,22*
22	Auxiliary voltage	2	1,22,22**
23	Auxiliary voltage 3rd harmonic	2	1,22,22**
24	Voltage, A-phase - B-phase	2	1,22,22***
25	Voltage, B-phase - C-phase	2	1,22,22***
26	Voltage, C-phase - A-phase	2	1,22,22***
	Voltages' Angles		
27	A-phase Voltage Angle	2	1
28	B-phase Voltage Angle	2	1
29	C-phase Voltage Angle	2	1
30	Positive Sequence Voltage Angle	2	1
31	Negative Sequence Voltage Angle	2	1
32	Zero Sequence Voltage Angle	2	1
33	Auxiliary voltage Angle	2	1
34	Auxiliary voltage 3rd harmonic Angle	2	1
35	A-phase - B-phase Voltage Angle	2	1
36	B-phase - C-phase Voltage Angle	2	1
37	C-phase - A-phase Voltage Angle	2	1
	Primary Power Data		
38	Power Factor (PF)	2	3
39	Power Factor Lead/Lag	2	4
40	Power, True Phase A	2	5,23,23*
41	Power, True Phase B	2	5,23,23*
42	Power, True Phase C	2	5,23,23*
43	Power, True Total (for phases A, B, and C)	2	5,23,23**
44	Power, Reactive Phase A	2	5,23,23*
45	Power, Reactive Phase B	2	5,23,23*

Index	Description	Change Event Assigned Class (1, 2, 3, or none)	Notes
46	Power, Reactive Phase C	2	5,23,23*
47	Power, Reactive Total (for phases A, B, and C)	2	5,23,23**
48	Power Apparent	2	5,23,23**
	Frequency and Sync Data (points 49 to 52)		
49	Generator Frequency	2	1
50	Bus Frequency	2	1
51	Slip Frequency	2	1
52	Slip Angle	2	1
	Breaker Data (Points 53 to 56)		
53	Breaker Duty Phase A	2	12
54	Breaker Duty Phase B	2	12
55	Breaker Duty Phase C	2	12
56	Breaker Operation Counter	2	13
	The Most Recent Fault Summary Report (Points 57 to 173)		
57	Fault Number	1	6,19
58	Fault Trigger Time Stamp-Part 1: days	1	7,19
59	Fault Trigger Time Stamp-Part 2: ms	1	7,19
60	Trigger	1	9,19
61	Active Setting Group	1	2,19
62	Relay Status Part 1	1	15,19
63	Relay Status Part 2	1	15,19
64	Relay Status Part 3	1	15,19
65	Relay Status Part 4	1	15,19
66	Relay Status Part 5	1	15,19
67	Relay Status Part 6	1	15,19
68	Relay Status Part 7	1	15,19
69	Relay Status Part 8	1	15,19
70	Targets - Part 1	1	10,19
71	Targets - Part 2	1	10,19
72	Targets - Part 3	1	10,19
73	Targets - Part 4	1	10,19
74	Recloser Status	1	24,19
75	Fault clearing Time ms	1	16,19
76	Breaker Operate Time - ms	1	17,19
77	Breaker Close Time ms	1	17,19
78	Number of Oscillographic Reports	1	18,19
79	Fault loop identification	1	8,19
80	Distance to fault	1	20,19
81	Fault Current Phase A	1	1,19
82	Fault Current Phase B	1	1,19

Index	Description	Change Event Assigned Class (1, 2, 3, or none)	Notes
83	Fault Current Phase C	1	1,19
84	Fault Neutral current	1	1,19
85	Fault Ground current	1	1,19
86	Fault Current I1	1	1,19
87	Fault Current IQ	1	1,19
88	Fault Voltage Phase A	1	1,19
89	Fault Voltage Phase B	1	1,19
90	Fault Voltage Phase C	1	1,19
91	Fault Voltage VX	1	1,19
92	Fault Voltage V1	1	1,19
93	Fault Voltage V2	1	1,19
94	Fault Voltage 3V0	1	1,19
95	Angle of fault current Phase A	1	1,19
96	Angle of fault current Phase B	1	1,19
97	Angle of fault current Phase C	1	1,19
98	Angle of Zero Seq. fault current	1	1,19
99	Angle of Ground fault current	1	1,19
100	Angle of fault current I1	1	1,19
101	Angle of fault current IQ	1	1,19
102	Angle of Fault Voltage Phase A	1	1,19
103	Angle of Fault Voltage Phase B	1	1,19
104	Angle of Fault Voltage Phase C	1	1,19
105	Angle of Fault Voltage VX	1	1,19
106	Angle of Fault Voltage V1	1	1,19
107	Angle of Fault Voltage V2	1	1,19
108	Angle of Fault Voltage 3V0	1	1,19
109	Frequency P	1	1,19
110	Frequency X	1	1,19
111	Frequency S	1	1,19
	At Close/Trip Summary voltages , currents and frequencies of the Most Recent Fault		
112	Fault Current Phase A	1	1,19
113	Fault Current Phase B	1	1,19
114	Fault Current Phase C	1	1,19
115	Fault Zero Sequence current	1	1,19
116	Fault Ground current	1	1,19
117	Fault Current I1	1	1,19
118	Fault Current IQ	1	1,19
119	Fault Voltage Phase A	1	1,19
120	Fault Voltage Phase B	1	1,19

Index	Description	Change Event Assigned Class (1, 2, 3, or none)	Notes
121	Fault Voltage Phase C	1	1,19
122	Fault Voltage VX	1	1,19
123	Fault Voltage V1	1	1,19
124	Fault Voltage V2	1	1,19
125	Fault Voltage 3V0	1	1,19
126	Angle of fault current Phase A	1	1,19
127	Angle of fault current Phase B	1	1,19
128	Angle of fault current Phase C	1	1,19
129	Angle of Zero Seq. fault current	1	1,19
130	Angle of Ground fault current	1	1,19
131	Angle of fault current I1	1	1,19
132	Angle of fault current IQ	1	1,19
133	Angle of Fault Voltage Phase A	1	1,19
134	Angle of Fault Voltage Phase B	1	1,19
135	Angle of Fault Voltage Phase C	1	1,19
136	Angle of Fault Voltage VX	1	1,19
137	Angle of Fault Voltage V1	1	1,19
138	Angle of Fault Voltage V2	1	1,19
139	Angle of Fault Voltage 3V0	1	1,19
140	Frequency P	1	1,19
141	Frequency X	1	1,19
142	Frequency S	1	1,19
	After Close Summary voltages , currents and frequencies of the Most Recent Fault		
143	Fault Current Phase A	1	1,19
144	Fault Current Phase B	1	1,19
145	Fault Current Phase C	1	1,19
146	Zero Seq. fault current	1	1,19
147	Ground fault current	1	1,19
148	Fault Current I1	1	1,19
149	Fault Current IQ	1	1,19
150	Fault Voltage Phase A	1	1,19
151	Fault Voltage Phase B	1	1,19
152	Fault Voltage Phase C	1	1,19
153	Fault Voltage VX	1	1,19
154	Fault Voltage V1	1	1,19
155	Fault Voltage V2	1	1,19
156	Fault Voltage 3V0	1	1,19
157	Angle of fault current Phase A	1	1,19
158	Angle of fault current Phase B	1	1,19

Index	Description	Change Event Assigned Class (1, 2, 3, or none)	Notes
159	Angle of fault current Phase C	1	1,19
160	Angle of Zero Seq. fault current	1	1,19
161	Angle of Ground fault current	1	1,19
162	Angle of fault current I1	1	1,19
163	Angle of fault current IQ	1	1,19
164	Angle of Fault Voltage Phase A	1	1,19
165	Angle of Fault Voltage Phase B	1	1,19
166	Angle of Fault Voltage Phase C	1	1,19
167	Angle of Fault Voltage VX	1	1,19
168	Angle of Fault Voltage V1	1	1,19
169	Angle of Fault Voltage V2	1	1,19
170	Angle of Fault Voltage 3V0	1	1,19
171	Frequency P	1	1,19
172	Frequency X	1	1,19
173	Frequency S	1	1,19
	Today's Peak Demands (points 174 to 236)		
174	**Phase A Current**	3	1,21,21*
175	Phase A Time Stamp – part 1; days	3	11
176	Phase A Time Stamp – part 2; ms	3	11
177	**Phase B Current**	3	1,21,21*
178	Phase B Time Stamp – part 1; days	3	11
179	Phase B Time Stamp – part 2; ms	3	11
180	**Phase C Current**	3	1,21,21*
181	Phase C Time Stamp – part 1; days	3	11
182	Phase C Time Stamp – part 2; ms	3	11
183	**Average Phase Current**	3	1,21,21*
184	Neutral Time Stamp – part 1; days	3	11
185	Neutral Time Stamp – part 2; ms	3	11
186	**Ground Current**	3	1,21,21**
187	Neutral Time Stamp – part 1; days	3	11
188	Neutral Time Stamp – part 2; ms	3	11
189	**Negative Sequence Current**	3	1,21,21*
190	Time Stamp – part 1; days	3	11
191	Time Stamp – part 2; ms	3	11
192	**Neutral Current**	3	1,21,21*
193	Time Stamp – part 1; days	3	11
194	Time Stamp – part 2; ms	3	11
195	**Maximum Voltage Demand -Phase A**	3	1,22,22*
196	Time Stamp – part 1; days	3	11
197	Time Stamp – part 2; ms	3	11

Index	Description	Change Event Assigned Class (1, 2, 3, or none)	Notes
198	**Maximum Voltage Demand -Phase B**	3	1,22,22*
199	Time Stamp – part 1; days	3	11
200	Time Stamp – part 2; ms	3	11
201	**Maximum Voltage Demand -Phase C**	3	1,22,22*
202	Time Stamp – part 1; days	3	11
203	Time Stamp – part 2; ms	3	11
204	**Maximum Voltage Demand - Phase Average**	3	1,22,22*
205	Time Stamp – part 1; days	3	11
206	Time Stamp – part 2; ms	3	11
207	**Maximum Voltage Demand - Neutral**	3	1,22,22*
208	Time Stamp – part 1; days	3	11
209	Time Stamp – part 2; ms	3	11
210	**Minimum Voltage Demand -Phase A**	3	1,22,22*
211	Time Stamp – part 1; days	3	11
212	Time Stamp – part 2; ms	3	11
213	**Minimum Voltage Demand -Phase B**	3	1,22,22*
214	Time Stamp – part 1; days	3	11
215	Time Stamp – part 2; ms	3	11
216	**Minimum Voltage Demand -Phase C**	3	1,22,22*
217	Time Stamp – part 1; days	3	11
218	Time Stamp – part 2; ms	3	11
219	**Minimum Voltage Demand - Phase Average**	3	1,22,22*
220	Time Stamp – part 1; days	3	11
221	Time Stamp – part 2; ms	3	11
222	**Minimum Voltage Demand - Neutral**	3	1,22,22*
223	Time Stamp – part 1; days	3	11
224	Time Stamp – part 2; ms	3	11
225	**Total True Power Demand**	3	5,23,23**
226	Time Stamp – part 1; days	3	11
227	Time Stamp – part 2; ms	3	11
228	**Total Reverse True Power Demand**	3	5,23,23**
229	Time Stamp – part 1; days	3	11
230	Time Stamp – part 2; ms	3	11
231	**Total Reactive Power Demand**	3	5,23,23**
232	Time Stamp – part 1; days	3	11
233	Time Stamp – part 2; ms	3	11
234	**Total Reverse Reactive Power Demand**	3	5,23,23**
235	Time Stamp – part 1; days	3	11
236	Time Stamp – part 2; ms	3	11
237	**Phase A Current**	3	1,21,21*

Index	Description	Change Event Assigned Class (1, 2, 3, or none)	Notes
238	Phase A Time Stamp – part 1; days	3	11
239	Phase A Time Stamp – part 2; ms	3	11
240	**Phase B Current**	3	1,21,21*
241	Phase B Time Stamp – part 1; days	3	11
242	Phase B Time Stamp – part 2; ms	3	11
243	**Phase C Current**	3	1,21,21*
244	Phase C Time Stamp – part 1; days	3	11
245	Phase C Time Stamp – part 2; ms	3	11
246	**Average Phase Current**	3	1,21,21*
247	Neutral Time Stamp – part 1; days	3	11
248	Neutral Time Stamp – part 2; ms	3	11
249	**Ground Current**	3	1,21,21**
250	Neutral Time Stamp – part 1; days	3	11
251	Neutral Time Stamp – part 2; ms	3	11
252	**Negative Sequence Current**	3	1,21,21*
253	Time Stamp – part 1; days	3	11
254	Time Stamp – part 2; ms	3	11
255	**Neutral Current**	3	1,21,21*
256	Time Stamp – part 1; days	3	11
257	Time Stamp – part 2; ms	3	11
258	**Maximum Voltage Demand -Phase A**	3	1,22,22*
259	Time Stamp – part 1; days	3	11
260	Time Stamp – part 2; ms	3	11
261	**Maximum Voltage Demand -Phase B**	3	1,22,22*
262	Time Stamp – part 1; days	3	11
263	Time Stamp – part 2; ms	3	11
264	**Maximum Voltage Demand -Phase C**	3	1,22,22*
265	Time Stamp – part 1; days	3	11
266	Time Stamp – part 2; ms	3	11
267	**Maximum Voltage Demand - Phase Average**	3	1,22,22*
268	Time Stamp – part 1; days	3	11
269	Time Stamp – part 2; ms	3	11
270	**Maximum Voltage Demand - Neutral**	3	1,22,22*
271	Time Stamp – part 1; days	3	11
272	Time Stamp – part 2; ms	3	11
273	**Minimum Voltage Demand -Phase A**	3	1,22,22*
274	Time Stamp – part 1; days	3	11
275	Time Stamp – part 2; ms	3	11
276	**Minimum Voltage Demand -Phase B**	3	1,22,22*
277	Time Stamp – part 1; days	3	11

Index	Description	Change Event Assigned Class (1, 2, 3, or none)	Notes
278	Time Stamp – part 2; ms	3	11
279	**Minimum Voltage Demand -Phase C**	3	1,22,22*
280	Time Stamp – part 1; days	3	11
281	Time Stamp – part 2; ms	3	11
282	**Minimum Voltage Demand - Phase Average**	3	1,22,22*
283	Time Stamp – part 1; days	3	11
284	Time Stamp – part 2; ms	3	11
285	**Minimum Voltage Demand - Neutral**	3	1,22,22*
286	Time Stamp – part 1; days	3	11
287	Time Stamp – part 2; ms	3	11
288	**Total True Power Demand**	3	5,23,23**
289	Time Stamp – part 1; days	3	11
290	Time Stamp – part 2; ms	3	11
291	**Total Reverse True Power Demand**	3	5,23,23**
292	Time Stamp – part 1; days	3	11
293	Time Stamp – part 2; ms	3	11
294	**Total Reactive Power Demand**	3	5,23,23**
295	Time Stamp – part 1; days	3	11
296	Time Stamp – part 2; ms	3	11
297	**Total Reverse Reactive Power Demand**	3	5,23,23**
298	Time Stamp – part 1; days	3	11
299	Time Stamp – part 2; ms	3	11
300	**Phase A Current**	3	1
301	Phase A Time Stamp – part 1; days	3	11
302	Phase A Time Stamp – part 2; ms	3	11
303	**Phase B Current**	3	1
304	Phase B Time Stamp – part 1; days	3	11
305	Phase B Time Stamp – part 2; ms	3	11
306	**Phase C Current**	3	1
307	Phase C Time Stamp – part 1; days	3	11
308	Phase C Time Stamp – part 2; ms	3	11
309	**Average Phase Current**	3	1
310	Neutral Time Stamp – part 1; days	3	11
311	Neutral Time Stamp – part 2; ms	3	11
312	**Ground Current**	3	1
313	Neutral Time Stamp – part 1; days	3	11
314	Neutral Time Stamp – part 2; ms	3	11
315	**Negative Sequence Current**	3	1
316	Time Stamp – part 1; days	3	11
317	Time Stamp – part 2; ms	3	11

Index	Description	Change Event Assigned Class (1, 2, 3, or none)	Notes
318	**Neutral Current**	3	1
319	Time Stamp – part 1; days	3	11
320	Time Stamp – part 2; ms	3	11
321	**Maximum Voltage Demand -Phase A**	3	1
322	Time Stamp – part 1; days	3	11
323	Time Stamp – part 2; ms	3	11
324	**Maximum Voltage Demand -Phase B**	3	1
325	Time Stamp – part 1; days	3	11
326	Time Stamp – part 2; ms	3	11
327	**Maximum Voltage Demand -Phase C**	3	1
328	Time Stamp – part 1; days	3	11
329	Time Stamp – part 2; ms	3	11
330	**Maximum Voltage Demand - Phase Average**	3	1
331	Time Stamp – part 1; days	3	11
332	Time Stamp – part 2; ms	3	11
333	**Maximum Voltage Demand - Neutral**	3	1
334	Time Stamp – part 1; days	3	11
335	Time Stamp – part 2; ms	3	11
336	**Minimum Voltage Demand -Phase A**	3	1
337	Time Stamp – part 1; days	3	11
338	Time Stamp – part 2; ms	3	11
339	**Minimum Voltage Demand -Phase B**	3	1
340	Time Stamp – part 1; days	3	11
341	Time Stamp – part 2; ms	3	11
342	**Minimum Voltage Demand -Phase C**	3	1
343	Time Stamp – part 1; days	3	11
344	Time Stamp – part 2; ms	3	11
345	**Minimum Voltage Demand - Phase Average**	3	1
346	Time Stamp – part 1; days	3	11
347	Time Stamp – part 2; ms	3	11
348	**Minimum Voltage Demand - Neutral**	3	1
349	Time Stamp – part 1; days	3	11
350	Time Stamp – part 2; ms	3	11
351	**Total True Power Demand**	3	5
352	Time Stamp – part 1; days	3	11
353	Time Stamp – part 2; ms	3	11
354	**Total Reverse True Power Demand**	3	5
355	Time Stamp – part 1; days	3	11
356	Time Stamp – part 2; ms	3	11
357	**Total Reactive Power Demand**	3	5

Index	Description	Change Event Assigned Class (1, 2, 3, or none)	Notes
358	Time Stamp – part 1; days	3	11
359	Time Stamp – part 2; ms	3	11
360	**Total Reverse Reactive Power Demand**	3	5
361	Time Stamp – part 1; days	3	11
362	Time Stamp – part 2; ms	3	11
363	Fault Number	none	6
364	Fault Trigger Time Stamp-Part 1: days	none	7
365	Fault Trigger Time Stamp-Part 2: ms	none	7
366	Trigger (Event Type)	none	9
367	Active Setting Group	none	2
368	Relay Status Part 1	none	15
369	Relay Status Part 2	none	15
370	Relay Status Part 3	none	15
371	Relay Status Part 4	none	15
372	Relay Status Part 5	none	15
373	Relay Status Part 6	none	15
374	Relay Status Part 7	none	15
375	Relay Status Part 8	none	15
376	Target Flags Bits Part 1	none	10
377	Target Flags Bits Part 2	none	10
378	Target Flags Bits Part 3	none	10
379	Target Flags Bits Part 4	none	10
380	Recloser Status	none	24
381	Clearing Time ms	none	16
382	Breaker Operate Time - ms	none	17
383	Breaker Close Time - ms	none	17
384	Number of Oscillographic Reports	none	18
385	Fault loop identification	none	8
386	Distance to fault	none	20
	Selected Fault Summary currents, voltages and frequencies		25
387	Fault Current Phase A	none	1
388	Fault Current Phase B	none	1
389	Fault Current Phase C	none	1
390	Fault Zero Sequence current	none	1
391	Fault Ground current	none	1
392	Fault Current I1	none	1
393	Fault Current IQ	none	1
394	Fault Voltage Phase A	none	1
395	Fault Voltage Phase B	none	1

Index	Description	Change Event Assigned Class (1, 2, 3, or none)	Notes
396	Fault Voltage Phase C	none	1
397	Fault Voltage VX	none	1
398	Fault Voltage V1	none	1
399	Fault Voltage V2	none	1
400	Fault Voltage 3V0	none	1
401	Angle of fault current Phase A	none	1
402	Angle of fault current Phase B	none	1
403	Angle of fault current Phase C	none	1
404	Angle of Zero Seq. fault current	none	1
405	Angle of Ground fault current	none	1
406	Angle of fault current I1	none	1
407	Angle of fault current IQ	none	1
408	Angle of Fault Voltage Phase A	none	1
409	Angle of Fault Voltage Phase B	none	1
410	Angle of Fault Voltage Phase C	none	1
411	Angle of Fault Voltage VX	none	1
412	Angle of Fault Voltage V1	none	1
413	Angle of Fault Voltage V2	none	1
414	Angle of Fault Voltage 3V0	none	1
415	Frequency P	none	1
416	Frequency X	none	1
417	Frequency S	none	1
	At Close/Trip Selected Fault Summary currents, voltages and frequencies		25
418	Fault Current Phase A	none	1
419	Fault Current Phase B	none	1
420	Fault Current Phase C	none	1
421	Fault Zero Sequence current	none	1
422	Fault Ground current	none	1
423	Fault Current I1	none	1
424	Fault Current IQ	none	1
425	Fault Voltage Phase A	none	1
426	Fault Voltage Phase B	none	1
427	Fault Voltage Phase C	none	1
428	Fault Voltage VX	none	1
429	Fault Voltage V1	none	1
430	Fault Voltage V2	none	1
431	Fault Voltage 3V0	none	1
432	Angle of fault current Phase A	none	1
433	Angle of fault current Phase B	none	1

Index	Description	Change Event Assigned Class (1, 2, 3, or none)	Notes
434	Angle of fault current Phase C	none	1
435	Angle of Zero Seq. fault current	none	1
436	Angle of Ground fault current	none	1
437	Angle of fault current I1	none	1
438	Angle of fault current IQ	none	1
439	Angle of Fault Voltage Phase A	none	1
440	Angle of Fault Voltage Phase B	none	1
441	Angle of Fault Voltage Phase C	none	1
442	Angle of Fault Voltage VX	none	1
443	Angle of Fault Voltage V1	none	1
444	Angle of Fault Voltage V2	none	1
445	Angle of Fault Voltage 3V0	none	1
446	Frequency P	none	1
447	Frequency X	none	1
448	Frequency S	none	1
	After Close Selected Fault Summary currents, voltages and frequencies		25
449	Fault Current Phase A	none	1
450	Fault Current Phase B	none	1
451	Fault Current Phase C	none	1
452	Fault Zero Sequence current	none	1
453	Fault Ground current	none	1
454	Fault Current I1	none	1
455	Fault Current IQ	none	1
456	Fault Voltage Phase A	none	1
457	Fault Voltage Phase B	none	1
458	Fault Voltage Phase C	none	1
459	Fault Voltage VX	none	1
460	Fault Voltage V1	none	1
461	Fault Voltage V2	none	1
462	Fault Voltage 3V0	none	1
463	Angle of fault current Phase A	none	1
464	Angle of fault current Phase B	none	1
465	Angle of fault current Phase C	none	1
466	Angle of Zero Seq. fault current	none	1
467	Angle of Ground fault current	none	1
468	Angle of fault current I1	none	1
469	Angle of fault current IQ	none	1
470	Angle of Fault Voltage Phase A	none	1
471	Angle of Fault Voltage Phase B	none	1

Index	Description	Change Event Assigned Class (1, 2, 3, or none)	Notes
472	Angle of Fault Voltage Phase C	none	1
473	Angle of Fault Voltage VX	none	1
474	Angle of Fault Voltage V1	none	1
475	Angle of Fault Voltage V2	none	1
476	Angle of Fault Voltage 3V0	none	1
477	Frequency P	none	1
478	Frequency X	none	1
479	Frequency S	none	1
480	Frequency Generator (Most Recent Fault)	1	1
481	Frequency Bus (Most Recent Fault)	1	1
482	Frequency Generator (Selected Fault)	3	1
483	Frequency Bus (Selected Fault)	3	1

Notes for Table 5-4:

1. This point represents analog value in centiunits. To get the value in units, use 0.01 as a multiplier.
   - The current point represents primary current in centiamps. For example value 125 represents 125 centiamps or 1.25 amperes.
   - The voltage point represents primary voltage in centivolts.
   - Frequency value is in centiHz. For example 5506 value is 55.06 hertz. Frequency change of 0.1 hertz or +-10 value change causes an event.
   - Angle value is in centidegrees, from -18000 to +18000 what represents the range from 180 to +180 degrees. Delta of 1 degree deviation will cause an event.
2. Active setting group at the time when the fault occurred (0 or 1 or 2 or 3).
3. The power factor point has a range from –1000 to +1000. The power factor point value must be multiplied by 0.001 to represent real power factor range from –1 to +1.
4. The power factor is leading if the value is 1 or lagging if the value is 0.
5. The point value represents apparent or true or reactive primary power in Kilo units.
   – True power point value is expressed in kilowatts.
   – Reactive power in Kvar, and
   – Apparent power in KVA.
6. The fault number range is from 1 to 255. For example, after 255 the next fault number is going to be 1.
7. This time is a fault trigger time 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. This time is equal to the time of the binary input event "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.
8. Fault loop identification values are:

Value	0	1	2	3	4	5	6	7	8	9	10
Fault Type	ABC	AB	BC	CA	ABG	BCG	CAG	AG	BG	CG	N/A

9. The trigger reports the classification assigned to the fault event. Fault events are classified into eight categories.

- Breaker Failure (Event Type value is 1): A fault was initiated by the pickup expression and the breaker failure trip became true before the fault was cleared.
- Pickup (Event Type value is 2): A fault was initiated by the pickup expression but the relay never tripped indicating that the fault was cleared by some other device.
- Trip (Event Type value is 4): A fault was initiated by overcurrent pickup and the relay tripped to clear the fault.
- Logic (Event Type value is 8): A fault was detected as defined by the relay logic trigger expression, but no fault was detected as defined by the pickup expression.
- 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.
- CLOSE (event type value is 32)
- CLOSE/PICKUP (event type value is 64)
- CLOSE/TRIP (event type value is 128)

10. Fault targets contain bit mapped variables. (1= TRUE, 0=FALSE). These targets are logged to the fault report between the times that the trip expression became true until the end of the fault. Bits 27X, 59X and 159X report as explained in Note 4 for Binary Inputs.

Table 5-5. Target Format

BIT	Part 1	Part 2	Part 3	Part 4
0	59A	67N	24	50TA
1	59B	167N	27A	50TB
2	59C	67Q	27B	50TC
3	59X	167Q	27C	150TA
4	159X	67TA	spare	150TB
5	60FL	67TB	spare	150TC
6	62	67TC	spare	50TN
7	162	67TN	27X	150TN
8	P85	167TN	spare	50TQ
9	P85E	67TQ	32P	150TQ
10	67A	81	132P	51A
11	67B	181	spare	51B
12	67C	281	SOTF	51C
13	167A	381	47	51N
14	167B	481	T52B	151N
15	167C	581	BF	51Q

11. Time presented in the relay's internal format: part 1 contains days (1 to 65,535) and part 2 milliseconds (1 to 86,400,000) since January 1, 1984.
12. Point represents assigned phase accumulated breaker pole duty as a centipercent of the maximum duty (DMAX) 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 the breaker contact duty operation mode 0/1/2 entered via the ASCII protocol command SB-DUTY. DMAX is defined through the same SB-DUTY command (for more information, see the BE1-1051 Instruction Manual). Value range is from 0 to 20,000 where 20,000 represents 200% of DMAX. Delta of 20 centipercent will cause an event.
13. 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. This value can be changed via object 41, point 3 to any value from 0 to 99,999. A change of 1 will cause an event.
14. The selected fault summary report contains fault data for the fault number defined by the value of the Analog Output Status (object 40) point 33, Fault Number for Selected Fault Summary Report.
15. The BE1-1051 relay system status is represented as eight, from Part1 to Part 8; 16-bit mapped variables (see Table 5-6). Bits 27X, 59X and 159X report as explained in Note 4 for binary inputs.

Table 5-6. Relay Status

BIT	Part 1	Part 2	Part 3	Part 4	Part 5	Part 6	Part7	Part8
0	50TPT	150TQPU	VOA	VO16	32T	59PPU	VIN1	ARSTKEY
1	150TPT	50BFPU	VO1	VO17	132T	59XPU	VIN2	TRSTKEY
2	50TNT	51PPU	VO2	IN1	32PU	159XPU	VIN3	43
3	150TNT	51NPU	VO3	IN2	132PU	81T	VIN4	143
4	50TQT	151NPU	VO4	IN3	LE	181T	VIN5	243
5	150TQT	51QPU	VO5	IN4	27PT	281T	VIN6	343
6	50BFT	86	VO6	IN5	27XT	381T	VIN7	443
7	51TP	186	VO7	IN6	27PPU	481T	VIN8	P85ET
8	51NT	52BT	VO8	IN7	27XPU	581T	VIN9	P85ETX
9	151NT	79P	VO9	IN8	47T	CKTMON	VIN10	P85TX
10	51QT	79C	VO10	101T	47PU	62	VIN11	P85T
11	50TPPU	79RNG	VO11	101C	24T	162	VIN12	SOFT
12	150TPPU	79LO	VO12	101SC	24PU	25 VMP 1	VIN13	SG0
13	50TNPU	79RST	VO13	ALMLGS	59PT	25 VMP 2	VIN14	SG1
14	150TNPU	79SCB	VO14	ALMMAJ	59XT	25	VIN15	SG2
15	50TQPU	0	VO15	ALMIN	159XT	60 LOP	VIN16	SG3

16. Fault clearing time is the time in milliseconds from 0 to 60,000.
17. This point is a time in milliseconds from 0 to 60,000.
18. The number of recorded oscillographic records per fault (read value of this point) can be 1 or 2.
19. A change of 1 bit (any change) will cause an event.
20. Distance to fault in centiunits: The range is from - (line length * 3) to + (line length *3), where line length is a user defined parameter with a range of 1 to 650 units (refer to ASCII command SG-LINE in 1051 Instruction Manual).
21. The current analog input point generates an analog event if the current value is greater than the previous current value plus the dead band, or less than the previous current value minus the dead band. The dead band for an analog event is configurable via the analog output, point 34, current dead band. The default value for current dead band is set to be ±2.5% of the primary nominal current. For more information about dead band configuration see the notes under *Analog Output Status and Control Points*, point 34.

    21* - Absolute value of current change, that causes analog Change Event is the same for all phase currents, neutral current, neg. seq. and positive seq. current.

    21** - Ground current has its unique current absolute value of event dead band.
22. Voltage point has configurable Change Event dead band via Analog Output Control object, point 35. The default value for current dead band is set to be ±1.0% of the primary nominal voltage. For details refer to the following paragraph about Analog Status Points and Analog Output Control Blocks, and see notes related to point 35.

    22* - Absolute value of voltage change, that causes an analog Change Event is the same for all phase voltages, neutral, neg. seq. and positive seq. voltages.

    22** - Line voltages have their unique voltage absolute value of event dead band.

    22*** - Auxiliary voltage has its unique absolute value of event dead band.
23. The power point has a configurable Change Event Dead Band via Analog Output Control object, point 36. The default value for power dead band is set to be ±2.5% of the primary nominal power. For details refer to the following paragraph about Analog Status Points and Analog Output Control Blocks, and see notes related to point 36.

    23* - Absolute value of single power change, that causes analog change event is the same for all single true and reactive powers.

    23** - Absolute value of total power change, that causes analog Change Event is the same for total apparent, true and reactive powers.

    Reclose Status contains bit mapped variables that report the state of the recloser shot counter prior to the fault that triggered the fault (see format in the Table 5-7).

Table 5-7. Reclose Status Format

Value/Bit Mask	Description
0001h	Recloser active
0002h	Recloser Reset
0004h	Reclose Max Timing
0008h	Reclose Failure
0010h	Reclose Lockout
0020h	Reclose Wait
0040h	Reclose Enable
0080h	Reclose Max Enable
0100h	Reclose Fail Enable
0200h	Reclose Wait Enable
0400h	Reclose Timing 1
1000h	Reclose Timing 2
2000h	Reclose Timing 3
4000h	Reclose Timing 4
8000h	Reclose Timing Fail

Fault report (The most recent or selected fault summary report) will contain fault summary data (voltages, currents, and frequencies) for the following fault event type (fault trigger): breaker Failure, Pickup, Trip, Logic, and RF=TRIGG, and CLOSE/TRIP. For fault event type (fault trigger): CLOSE, CLOSE/PICKUP and CLOSE/TRIP currents, voltages, and frequencies AT CLOSE and AFTER CLOSE will be available.

ANALOG OUTPUT STATUS POINTS AND CONTROL BLOCKS

Table 5-8 lists 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. It is important to note that Analog Output Control Blocks and Analog Output Status are transmitted through DNP as signed names.

The return status value for object 41 for all control operations may be 6 (hardware problem) due to a value out of range, or a relay internal state. One of the reasons for rejection may be if another communication port or front panel HMI is actively programming. For more information, see the BE1-1051 Instructional Manual, Section 7, *Communications, Command Descriptions, Changing Settings through the Serial Port*.

Table 5-8. Analog Output Status Points and Control Blocks

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)

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)

Index	Description	Notes
	Points for Resetting Breaker Data (points 0 – 3)	
0	Breaker Accumulated Duty for Phase A	1, 15

Index	Description	Notes
1	Breaker Accumulated Duty for Phase B	1, 15
2	Breaker Accumulated Duty for Phase C	1, 15
3	Breaker Operations Counter	3, 15
	Points for Resetting Demand Currents Since Reset (points 4 to 10)	
4	Peak Demand Current Since Reset - Phase A	6
5	Peak Demand Current Since Reset - Phase B	6
6	Peak Demand Current Since Reset - Phase C	6
7	Peak Demand Average Current Since Reset	6
8	Peak Demand Current Since Reset - Ground	6
9	Peak Demand Current Since Reset - Negative Sequence	6
10	Peak Demand Current Since Reset - Neutral	6
	Points for Resetting Peak Demand Voltages Since Reset (points 11 to 20)	
11	Maximum Demand Voltage Since Reset - Phase A	6
12	Minimum Demand Voltage Since Reset - Phase A	6
13	Maximum Demand Voltage Since Reset - Phase B	6
14	Minimum Demand Voltage Since Reset - Phase B	6
15	Maximum Demand Voltage Since Reset - Phase C	6
16	Minimum Demand Voltage Since Reset - Phase C	6
17	Maximum Demand Voltage Since Reset - Neutral	6
18	Minimum Demand Voltage Since Reset - Neutral	6
19	Maximum Demand Average Voltage Since Reset	6
20	Minimum Demand Average Voltage Since Reset	6
	Points for Resetting Peak Demand Power Since Reset (points 21 to 24)	
21	Total True Power Demand Since Reset	7
22	Total Reverse True Power Demand Since Reset	7
23	Total Reactive Power Demand Since Reset	7
24	Total Reverse Reactive Power Demand Since Reset	7
	Miscellaneous Controls (points 25 to 39)	
25	Hardware Output Logic Control Mode	11, 17
26	43 AUX Virtual Switch Logic Mode	8, 17
27	143 AUX Virtual Switch Logic Mode	8, 17
28	243 AUX Virtual Switch Logic Mode	8, 17
29	343 AUX Virtual Switch Logic Mode	8, 17
30	443 AUX Virtual Switch Logic Mode	8,17
31	43 AUX Virtual Switch TAG Logic Mode	18,17
32	143 AUX Virtual Switch TAG Logic Mode	18,17
33	243 AUX Virtual Switch TAG Logic Mode	18,17
34	343 AUX Virtual Switch TAG Logic Mode	18,17
35	443 AUX Virtual Switch TAG Logic Mode	18,17
36	101 Virtual Breaker Control Switch	9,17
37	Active Setting Group Control Mode	10, 17
38	Sync Time Period	13, 15

Index	Description	Notes
39	Fault Number for Selected Fault Summary Report	5
	Configurable Dead Band of Analog Input change event objects (40 - 42)	
40	Current Change Event Dead band	14,15
41	Voltage Change Event Dead band	14,15
42	Power Change Event Dead band	14,15
	Points for Resetting Energy (43 and 46)	
43	Total Primary True Energy in KWH	2
44	Total Primary Reverse True Energy in KWH	2
45	Total Primary Reactive Energy in KVARH	2
46	Total Primary Reverse Reactive Energy in KVARH	2
	Alarm and targets Reset Control (points 47 to 51)	
47	Reset Major Alarms	4
48	Reset Minor Alarms	4
49	Reset Logic Alarms	4
50	Reset Relay Trouble Alarm	12
51	Reset Targets	16
	Miscellaneous Controls (points 52 to 62)	
52	86 Logic Mode	19
53	186 Logic Mode	19
54	VTS mode (Virtual Test Control)	20
55	Control operation via communication ports Mode	21
56	Comm. port 0 (Front RS-232 port) Control Operation Status	22
57	Comm. port 1 (Rear RS-232 port) Control Operation Status	22
58	DNP port (Rear RS-485 port) Control Operation Status	22
59	27 Logic Mode	23
60	59 Logic Mode	24
61	159 Logic Mode	24
62	Auxiliary Voltage sensing type	25

Notes for Table 5-8:

1. This point represents assigned phase accumulated breaker pole duty as a centipercent of the maximum duty (DMAX) 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 0/1/2 entered via ASCII protocol command SB-DUTY. DMAX is defined through the same SB-DUTY command (refer to INSTRUCTION MANUAL for BE1-1051).

   Allowed value range is from 0 to 20000, where 20000 represents 200% of DMAX. Example: To change accumulated breaker duty for Phase B to 134 % of DMAX, set this point using appropriate request function code, with value 13400. A read of this point, will return a value of 13400 (134% of DMAX).

2. A point read value represents primary true/reactive energy in KWH/KVARH. Positive energy can be changed to any positive value from 0 (Reset) to 1000 000 000 KWH / KVARH. Reverse, true, or reactive energy can be changed to 0 (Reset) or to any negative number up to min. -1000000000 KWH / KVARH.

3. A read value of this point is a number of recorded breaker operations (0 – 99999). If the operations counter exceeds 99999, 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 99999.
4. Major, Minor, and Logic Alarms can only be reset with write value equal to zero. Note that only latched alarms will be cleared. A read returns 1 if a major, minor or logic alarm is set, or 0 if no respective alarm is set. Individual alarms can be read as binary input objects from points 207 to 250.
5. 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 363 to 479. 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 6 (hardware problem).
6. The read value is in primary centiunits (value 1 represents 0.01 A or 0.01 V). For example: 670 represents 6.7 Amps.or if voltage 6.7V. These points can only be set to value 0 (Reset).
7. Peak power demand point can only be reset. Its read value is primary value in Kilounits (KW / Kvar).
8. Logic Mode of AUX x43 switch can be 0(disable), 1(enable), 2(on.off), and 3 (off/momentary on). (See ASCII command SL-x43 in Instruction Manual for the BE1-1051.) Depending on the logic mode value, and a state of Tagged status, AUX x43 Switch can or can not be successfully controlled via the Control Relay Output Block x43.
9. The logic mode of the 101 Breaker Control Switch can be 0(disable) or 1(enable). Depending on this point value, the 101 Virtual Breaker Control Switch can or can not be successfully controlled via Control Relay Output Block point for 101 Virtual Breaker Control Switch. (See ASCII command SL-101 in Instruction Manual for the BE1-1051.)
10. The setting group mode can be 0(disable), 1 (discrete select) or 2 (binary select). If the setting group is to be switched via object 12 (Control Relay Output Block), it must be first Enabled via this point. (See ASCII command SL-GROUP in Instruction Manual for the BE1-1051.)
11. Hardware output logic control mode can be 0 (Disable) or 1(Enable). If hardware outputs are to be controlled via object 12 (Control Relay Output Blocks), their control must be Enabled through this point. (See ASCII command CS/CO-OUT=ENA/DIS in the BE1-1051Instruction Manual.)
12. Relay Trouble Alarms can be reset by writing value 0 to this point. This is a 32-bit mapped variable as described in Table 5-9.

Table 5-9. Relay Trouble Status Format

Bit Mask (hex)	Name	Bit Mask (hex)	Name
00000001	spare	00000200	CALIBRATION DFLT LOADED
00000002	spare	00000400	spare
00000004	MPU self test error	00000800	spare
00000008	EEPROM FATAL ERROR	00001000	spare
00000010	ANALOG FAILURE	00002000	All SER fault data lost
00000020	CALIBRATION ERR	00004000	Oscillographic fault data lost
00000040	Power supply out of tolerance	00008000	Fault Record Data Lost
00000080	spare	00010000	Erase Flash Block Error
00000100	SET DFLT LOADED	00020000	Bad SER Data

13. Time period, in milliseconds, when the relay (slave) sets “NEED TIME” bit in first octet of the application response header Internal Indication. When time is set by the Master via object 50 (functions Select/Operate/Direct Operate), the relay resets this 0 bit. The relay sets this bit again, periodically, if the time period is not zero. The Default value on cold and warm restarts is 0. This means that on cold and warm restarts, this bit will never be set. Allowed value is from 0 to 2^{31}-1 = 2,147,483,647 milliseconds.
14. The Analog Change Event Dead Band is programmable via this point. The point value must be entered as a percentage of primary nominal current (for point 40) or as a percentage of primary nominal voltage (for point 41, or as a percentage of primary nominal power (for point 42). Allowed range is from 10 to 100 in steps of 1. This represents 1 to 10% in steps of 0.1%.

Default Change Event Dead Bands are:

- Current Default Change Event Dead Band is 2.5%
- Voltage Default Change Event Dead Band is 1%
- Power Default Change Event Dead Band is 2.5%

Relay converts % into absolute amount of amps, volts, watts, or vars by applying the following formulas:

- Current Change Event Dead Band for Phase, Neutral, Positive and Negative Seq. Currents = Inom * CTP * % * 0.01
- Ground Current Change Event Dead Band = IGnom * CTG * %*0.01
- Voltage Change Event Dead Band for phase, residual, pos. and neg. seq. voltages = Vnom * VTP * %*0.01.
- Aux Voltage Change Event Dead Band = Vnom * VTX * %*0.01
- Line Voltage Change Event Dead Band = Vnom * VTP * % *0.01* √ 3
- Power Change Event Dead Band = Vnom * VTP * Inom * CTP * % * 0.01
- Total Power Change Event Dead Band = Vnom * VTP * Inom * CTP * % * 0.01* 3 Where: CTP is Current CT Ratio, CTG is Ground Current CT Ratio, VTP is Voltage VT Ratio, and VTX is AUX voltage input VT Ratio.

Examples:

1. To configure the Current Change Event Dead Band to be 4% of primary nominal current enter, for point 40, value 40.

   The relay converts this % into an ampere value. For a 5 A relay, and CTP ratio =120 turns, dead band value for Phase current 5*120*4 * 0.01 = 24 primary A (2400 centiamps).

   If CTG=100 turns, Ground Current Change Event Dead Band = 5*100*4 * 0.01 = 20 A.

2. To configure the Voltage Change Event Dead Band to be 2% of the primary nominal voltage enter, for point 41, a value of 20.

   The relay converts this % into a voltage value. For a VTP ratio =1000 turns, dead band value in volts for the Phase to Neutral Voltage Dead Band = 120 *1000 * 2 * 0.01 = 2400 V.

   If VTX=2000 then the Aux Voltage Change Event Dead Band=120 * 2000 * 2*0.01=4800 V.

   Line Voltage Change Event Dead Band=120 *1000 * 2 * 0.01 *√ 3= 4152 V.

3. To configure Power Change Event Dead Band to be 4 % of primary nominal power enter for point 42, a value of 40. Relay converts this % into primary power absolute amount in W / VAR / VA. = 120 * 1000 * 120 * 5 * 4% * 0.01 = 2880 KW/KVAR/KVA. Total primary Power Change Event Dead Band absolute amount = 120 * 1000 * 120 * 5 * 4% * 0.01 * 3 = 8640 KW/KVAR/KVA.

15. This is a setting, and as such is active after being saved to a non-volatile memory. Saving to a non-volatile memory is performed immediately after a response to Master is sent, to prevent response time-out due to the saving operation.
16. Latched targets can be reset via this point. A read of this point returns 1 if there are active targets or 0 is targets are not active. Latched targets can be read as binary inputs.
17. Note that this data is a setting, and as such, it takes effect after being saved to a non-volatile memory. The procedure for saving data to a non-volatile memory is performed only once per request for all points requested to be changed through function Operate (4), Direct Operate (5), or Direct Operate No Ack (6).

    Saving to a non-volatile memory is not implemented on a per point basis because it would significantly prolong requested message processing time and cause response time-out. It is important to note that object 12 (Binary Output Status) points from 0 to 26 can be successfully controlled only if the function blocks mode are enabled at the time of parsing. This is the reason that in the same request, with FC= 5 or 6, specific Binary Output Status points can not be first Enabled via the Mode point of object 41, and controlled immediately after that (object 12).

    For example: To control any 43 Aux Control Relay Output Block, Master should do the following steps:

    - Enable control of x43 Aux Switch(s) via request(s) with FC= (3, 4) or 5 or 6 for specific point(s) of object 41.
    - Control Binary Output Status point(s) (object 12) with via next request(s).

18. Logic Mode of TAG AUX x43 switch can be set to 0/1/2. (Refer to SL-x43TAG ASCII command in Instruction Manual for the BE1-1051.)
19. Reads 86/186 Logic Mode (refer to ASCII command SL-x86 in BE1-1051 manual); 0/1 for Disabled/Enabled. To Enable/Disable mode set point value to 1 or 0 via functions select and operate or direct operate.
20. This point reads mode of Virtual Test Control (refer to ASCII command SL-VTS in BE1-1051 manual); 0/1 for Disabled/Enabled. To Enable/Disable mode set point value to 1 or 0 via functions Select/Operate/Direct Operate.
21. This point reads mode of Control operation via communication ports; 1 / 0 if Blocking control via all communications port is enabled /disabled (refer to ASCII command SL-CTRL in BE1-1051 manual). To Enable/Disable Blocking mode set point value to 1 or 0 via functions select and operate or direct operate.
22. This point only reads (Functions Select/Operate/Direct Operate are not allowed) control status of assigned port; 1 means that control via this comm. port is blocked, 0 means that control operations via this port are allowed. (Refer to ASCII command SL-CTRL in BE1-1051 manual.)
23. This point reads function 27 logic mode (refer to sl-27 ASCII command in 1051 manual); 0/1/2/3 for Disabled/Enabled/Fundamental Vx/3vo. Functions Select/Operate/Direct Operate are not supported.
24. This point reads function x59 logic mode (refer to sl-x59 ASCII command in 1051 manual0/1/2/3 for Disabled/Enabled/Fundamental Vx/3vo. Functions Select/Operate/Direct Operate are not supported.
25. This points reads Auxiliary Voltage sensing type; 0/1/2/3/4/5/6 for AB, BC, CA, AN, BN, CN, GR. Functions Select/Operate/Direct Operate are not supported.

8-BIT UNSIGNED INTEGER, OBJECT 102

Table 5-10 is the point list for Object 102, and lists the 8-Bit Unsigned Integer Points. Note that this object has only variation 1 and can not be requested with default variation 0.

Table 5-10. Object 102, 8-Bit Unsigned Integer Points

8-Bit Unsigned Integer
Object Number: 102
Variations Supported: 1
Request Function Codes supported: 1 (read)

Index	Description
0 - 9	Model Number
10 - 28	Application Software Version Number and Date
29 - 47	Boot Software Version Number and Date
48 - 61	Serial Number
62 - 83	Style Number
84 - 99	Part Number
100 - 131	Relay ID
132 - 163	Station ID
164 – 171	Active Logic Name

Explanation:

Each point represents one character of a particular string.
Example: To read the Model Number, which is “BE1-1051”, the returned read value for points 0 to 9 are:

Point	0	1	2	3	4	5	6	7	8	9
Read Value in ASCII format	B	E	1	-	9	5	1	NULL	NULL	NULL

Object 102 is not included in Class 0 poll response.

Basler Electric
ROUTE 143, BOX 269
HIGHLAND, IL 62249 USA
http://www.basler.com, info@basler.com
PHONE +1 618-654-2341 FAX +1 618-654-2351