

DNP Points List and Implementation

This appendix describes the DNP points and DNP implementation for the BankGuard PLUS™ Control, using software UPPD106S.

DNP Points List

For accessing the BankGuard PLUS the DNP master station should define the Control with the following I/O:

	<u>Point Count</u>
Status Points	6
Analog Inputs	4
Analog Outputs	3
Binary Counter	0
Frozen Counter	0
Control Outputs	3

The points are defined in the tables below. Unless otherwise noted, each bit is set if the condition is logically true or active.

Status Points

<i>Status Point #</i>	<i>Definition</i>
----------------------------------	--------------------------

- | | |
|---|--|
| 0 | Control device lockout. This bit is set if the control device has isolated and locked out the bank or reactor after capacitor unit or reactor turn failures. |
| 1 | Control device alarm. This bit is set when any alarm condition in the control is active, meaning either for relay failure/trouble or over-voltage condition. |
| 2 | Unbalance compensation in use. This bit is set if the unbalance compensation feature is enabled. |
| 3 | Alarm state at power up. This bit is set if the control device is set to alarm when power returns after an outage. |

Status

Point # Definition

- 4 Auxiliary contact state. This bit is set if the capacitor bank/reactor switching device is in the closed state. This point is updated only when auxiliary contacts have been enabled.
- 5 Over-voltage alarm. This bit is set when neutral voltage increases above a user defined setpoint. This is a warning alarm that indicates loss of capacitor units or reactor turns, allowing maintenance before escalating losses require bank lockout.

Analog Input Points

Analog

Input

Point # Definition

- 0 90% voltage reference standard. This is provided for the benefit of the protocol implementation to conform to the RTU standard. It is loaded as a constant.
- 1 0% voltage reference standard. This is provided for the benefit of the protocol implementation to conform to the RTU standard. It is loaded as a constant with the value zero.
- 2 Installation Type. This is the type of equipment the control device is protecting. The possible values are:
 - 0 Ungrounded, wye connected capacitor bank
 - 1 Ungrounded, wye connected reactor
 - 2 Grounded, wye connected capacitor bank
- 3 Most recent N-G/Unbalance Voltage reading. This value displays the neutral-to-ground voltage. For an ungrounded, wye connected capacitor bank or reactor, the units are Volts. For a grounded, wye connected capacitor bank, the units are percent (0.00 – 99.99%).

Analog Output Points

Analog Output Point #	Definition
0	<p>Application layer confirmation retry time. This is the length of time the Control waits for an application layer confirmation on an event response message before resending the response. It uses “timer byte format,” with a range of 0.1 second to 10 minutes. The retry time is only in effect when the confirmation process is enabled.</p> <p>◆NOTE: In “timer byte format,” the top two bits are the time units (0 = tenths of seconds, 1 (\$40) = seconds, 2 (\$80) = minutes, 3 (\$C0) = hours). The bottom 6 bits are the count. A value of 1 second (\$41) can be more accurately specified as 10 tenths (\$0A). A value of 1 minute (\$81) can be specified as 60 seconds (\$7C). A value of 1 hour (\$C1) can be specified as 60 minutes (\$BC). The value \$FF generates an “infinite” time value. A non-zero value causes the output to be on (active) continuously. The value zero causes the output to remain off. Do not set the count field to zero unless the timer byte units field is also zero.</p>
1	<p>Application layer confirmation retry count. This is the number of times the Control sends an event response message without receiving a confirmation. This number (from 1 to 25) includes the initial response. The retry count is only in effect when the confirmation process is enabled.</p>
2	<p>Control point select time. During a Select-Before-Operate procedure, this is the length of time that may elapse between receiving the Select function for a point and receiving the Operate function for that same point. If an Operate is not received within this time period, the point is deselected and another Select is required before the point will operate. It uses “timer byte format”, with a range of 1 second to 10minutes.</p>

Control Points

Control Point #	Definition
0	<p>Reset Lockout Indicator. This command must be issued using the Pulse On/Off request in the control relay output block. It clears the control device LOCKOUT INDICATOR LED and the lockout condition.</p>
1	<p>Reset Alarm Indicator. This command must be issued using the Pulse On/Off request in the control relay output block. It clears the control device ALARM INDICATOR LED and the alarm condition.</p>
2	<p>Enable/disable application retries. Issued with the Latch On/Off request.</p>

DNP Implementation

This implementation of DNP and this section of documentation conform to the document *DNP V3.00 Subset Definitions*, Version 0.01, available from the DNP Users Group.

Device Profile Description

This section describes the compatibility of the S&C implementation of DNP with other devices.

DNP V3.00 DEVICE PROFILE DOCUMENT	
Vendor Name: S&C Electric Company	
Device Name: BankGuard PLUS Control	
Highest DNP Level Supported: For Requests - Level 2 For Responses - Level 2	Device Function: ___ Master <input checked="" type="checkbox"/> Slave
Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP Levels Supported (the complete list is described in the attached table): 8-Bit Unsigned Integers _____ _____ _____ _____	
Maximum Data Link Frame Size (bytes) Transmitted - 292 Received - 292	Max Application Fragment Size (bytes) Transmitted - 249 Received - 249
Maximum Data link Re-tries: <input checked="" type="checkbox"/> None ___ Fixed at _____ ___ Configurable, range 1 to 25	Maximum Application Layer Re-tries ___ None ___ Fixed at _____ <input checked="" type="checkbox"/> Configurable, range 1 to 25

Requires Data Link Layer Confirmation: <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes If 'Sometimes', when? - When requested by the Master <input type="checkbox"/> Configurable If 'Configurable', how? - Data link confirmations are configured through SCADA communications or through locally connected setup software.																																																																																			
Requires Application Layer Confirmation: <input type="checkbox"/> Never <input type="checkbox"/> Always (not recommended) <input type="checkbox"/> When reporting Event Data (Slave devices only) <input type="checkbox"/> When sending multi-fragment responses (Slave devices only) <input type="checkbox"/> Sometimes If 'Sometimes', when? - When requested by the Master during a request. <input checked="" type="checkbox"/> Configurable If 'Configurable', how? - Response confirmations are configured through SCADA communications or through locally connected setup software.																																																																																			
Timeouts while waiting for: <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 40%;">Data Link Confirm</td> <td style="width: 10%;"><input checked="" type="checkbox"/> None</td> <td style="width: 10%;"><input type="checkbox"/> Fixed</td> <td style="width: 10%;"><input type="checkbox"/> Variable</td> <td style="width: 10%;"><input type="checkbox"/> Config</td> <td style="width: 10%;"></td> </tr> <tr> <td>Complete Appl. Fragment</td> <td><input checked="" type="checkbox"/> None</td> <td><input type="checkbox"/> Fixed</td> <td><input type="checkbox"/> Variable</td> <td><input type="checkbox"/> Config</td> <td></td> </tr> <tr> <td>Application Confirm</td> <td><input type="checkbox"/> None</td> <td><input type="checkbox"/> Fixed</td> <td><input type="checkbox"/> Variable</td> <td><input checked="" type="checkbox"/> Config</td> <td></td> </tr> <tr> <td>Complete Appl. Response</td> <td><input checked="" type="checkbox"/> None</td> <td><input type="checkbox"/> Fixed</td> <td><input type="checkbox"/> Variable</td> <td><input type="checkbox"/> Config</td> <td></td> </tr> </table> Others _____ Attach explanation if 'Variable' or 'Configurable' was checked (see Note 1 below for explanation)						Data Link Confirm	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Fixed	<input type="checkbox"/> Variable	<input type="checkbox"/> Config		Complete Appl. Fragment	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Fixed	<input type="checkbox"/> Variable	<input type="checkbox"/> Config		Application Confirm	<input type="checkbox"/> None	<input type="checkbox"/> Fixed	<input type="checkbox"/> Variable	<input checked="" type="checkbox"/> Config		Complete Appl. Response	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Fixed	<input type="checkbox"/> Variable	<input type="checkbox"/> Config																																																							
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FILL OUT THE FOLLOWING ITEM FOR MASTER DEVICES ONLY:	
Master Expects Binary Input Change Events: <input type="checkbox"/> Either time-tagged or non-time-tagged for a single event <input type="checkbox"/> Both time-tagged and non-time-tagged for a single event <input type="checkbox"/> Configurable (attach explanation)	
FILL OUT THE FOLLOWING ITEMS FOR SLAVE DEVICES ONLY:	
Reports Binary Input Change Events when no specific variation requested: <input type="checkbox"/> Never <input type="checkbox"/> Only time-tagged <input checked="" type="checkbox"/> Only non-time-tagged <input type="checkbox"/> Configurable to send both	Reports time-tagged Binary Input Change Events when no specific variation requested: <input type="checkbox"/> Never <input checked="" type="checkbox"/> Binary Input Change with Time <input type="checkbox"/> Bin In Change Relative Time <input type="checkbox"/> Configurable (explain)
Sends Unsolicited Responses: <input type="checkbox"/> Never <input checked="" type="checkbox"/> Configurable (explain) <input type="checkbox"/> Only certain objects <input type="checkbox"/> Sometimes (explain) <input type="checkbox"/> ENABLE/DISABLE UNSOLICITED Function codes supported (see Note 3 below)	Sends Static Data in Unsolicited Responses: <input type="checkbox"/> Never <input type="checkbox"/> When Device Restarts <input checked="" type="checkbox"/> When Status Flags Change No other options are permitted. (see Note 3 below)
Default Counter Object/Variation: <input checked="" type="checkbox"/> No Counters Reported <input type="checkbox"/> Configurable (explain) <input type="checkbox"/> Default Object - 20 <input type="checkbox"/> Default Variation - 6 <input type="checkbox"/> Point-by-point list attached	Counters Roll Over at: <input checked="" type="checkbox"/> No Counters Reported <input type="checkbox"/> Configurable (explain) <input type="checkbox"/> 16 Bits <input type="checkbox"/> 32 Bits <input type="checkbox"/> Other Value _____ <input type="checkbox"/> Point-by-point list attached
Sends Multi-Fragment Responses (Slave Only): <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

NOTE 1: Timeouts While Waiting for Confirmations

When an application layer response confirmation is requested, the BankGuard PLUS waits before sending another response/confirmation attempt (if the retry number has not been reached), or stopping the confirmation process. This confirmation request uses timeout period "Time Delay Between Attempts".

"Time Delay Between Attempts" can only be set with the Setup software.

NOTE 2: Control Operations Executed

For all Binary Output Relay operations and Analog Output operations, the allowed BankGuard PLUS functions are:

- Select/Operate
- Direct Operate
- Direct Operate No Ack

The master station can choose which of these two functions to use at any given time.

For all momentary point operations, you must use the `Pulse On` function. When using `Pulse On`, set the `Count` value in the Control Block to “1” and the `Code` value to “1.” Set the `Trip/Close` to “NUL” (00). The BankGuard PLUS ignores the `On-Time` and `Off-Time` values and the `Queue` and `Clear` flags in the Control Code.

For all latching point operations, you can use either the `Latch On` or `Latch Off` function. For either function, set the `Count` value in the Control Block to “1.” Set the `Code` value to “3” for `Latch On` or “4” for `Latch Off`. Set the `Trip/Close` to “NUL” (00). The BankGuard PLUS ignores the `On-Time` and `Off-Time` values and the `Queue` and `Clear` flags in the Control Code.

For more details, see the *Control Relay Output Block* section of the document object library in the *DNP V3.00 Basic 4 Document Set*, available from the DNP Users Group.

NOTE 3: Unsolicited Responses

The BankGuard PLUS returns unsolicited responses to the configured master station address when a change occurs in any status point or when the device is restarted, object 2, variation 2 (“Binary Input Change with Time”) is returned.

You can enable and disable unsolicited responses from the Setup software or via SCADA (function code 20 to enable, function code 21 to disable).

Implementation Table

This section describes which objects and requests this implementation accepts and which responses are returned. Object, Variation, and Qualifier Codes in the request must exactly match what is expected; otherwise, the BankGuard PLUS flags an error. All application layer responses use the standard response function code 129.

OBJECT			REQUEST		RESPONSE
Obj	Var	Description	Func Code (dec)	Qualifier Codes (hex)	Qual Codes (hex)
1	0	Binary Input - All Variations	1	06	
1	1	Binary Input			00
2	0	Binary Input Change - All Variations	1	06,07,08	
2	1	Binary Input Change without Time	1	06,07,08	17
2	2	Binary Input Change with Time	1	06,07,08	17
2	3	Binary Input Change with Relative Time (object parsed but no data to return)	1	06,07,08	17
10	0	Binary Output - All Variations	1	06	
10	1	Binary Output (object parsed but WRITE not used)	2	17, 28	
10	2	Binary Output Status (only use the on-line bit, see Note 4)			00
12	1	Control Relay Output Block	3,4,5,6	17, 28	echo of request
20	0	Binary Counter - All Variations	1,7,8,9,10	06	
20	6	16-Bit Binary Counter without Flag			00
21	0	Frozen Counter - All Variations	1	06	
21	10	16-Bit Frozen Counter without Flag			00
22	0	Counter Change Event - All Variations (object parsed but no data to return)	1	06,07,08	

OBJECT			REQUEST		RESPONSE
Obj	Var	Description	Func Code (dec)	Qualifier Codes (hex)	Qual Codes (hex)
30	0	Analog Input - All Variations	1	06	
30	4	16-Bit Analog Input without Flag			00
40	0	Analog Output Status - All Variations	1	06	
40	2	16-Bit Analog Output Status			00
41	2	16-Bit Analog Output Block	3,4,5,6	17, 28	echo of request
50	1	Time and Date	2	07 where quantity =1	IINs only
60	1	Class 0 Data	1	06	
60	2	Class 1 Data	1	06,07,08	
60	3	Class 2 Data (object parsed but no data to return)	1	06,07,08	
60	4	Class 3 Data (object parsed but no data to return)	1	06,07,08	
80	1	Internal Indications	2	00 index=7	IINs only
No Object			13		
No Object			23		

NOTE 4: Binary Output Status

In a response to a Binary Output Status request, the BankGuard PLUS returns a status byte for each control point available. In this implementation of the Binary Output Status object, only the On-Line bit is used. All other bits, including the State bit, should be ignored.

You can inspect the state of all digital points (controlled and not controlled) by using the Binary Input object.

