

DNP Points List and Implementation

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Introduction

These instructions provide DNP point and implementation information for the IntelliCap 2000 Automatic Capacitor Control, and were prepared for use with software: **IC2000Installer-1.1.x** or subsequent releases.

For accessing the IntelliCap 2000, the DNP master station should define the Capacitor Control with the following I/O:

	Point Count
Status Points	36
Analog Inputs	51
Analog Outputs	7
Binary Counter	4
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Control Outputs	17

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



STATUS POINTS	
Point #	Definition
0	Capacitor Bank CLOSED —On if the capacitor bank is switched in.
1	Capacitor Bank OPEN —On if the capacitor bank is switched out.
2	AUTO/MANUAL Operation —On when the control is in the automatic mode.
3	REMOTE/LOCAL Control Mode —On when the control is in the REMOTE state. In the LOCAL state, operation of the bank from the SCADA master station is blocked.
4	Alarm Summary —On when an alarm or trouble condition occurs. This is a summary bit. The exact cause of the alarm can be determined from inspection of the <i>Diagnostics>Alarms</i> screen.
5	SCADA Override Enabled —On when the SCADA Override feature is enabled in the setup software. This override strategy may or may not be controlling the bank state when enabled, depending on the state of other overrides and SCADA commands that have been issued.
6	Over Voltage —On when an over voltage condition is present.
7	Under Voltage —On when an under voltage condition is present.
8	Emergency Voltage Override —On when the voltage has exceeded the Emergency Voltage Override boundaries.
9	Reclose Block —On for a period of five minutes after a Trip operation to allow the capacitors to discharge fully. During this five minute period, the bank is prevented from reclosing.
10	Maximum Daily Cycles —On if the number of open operations of the capacitor bank reaches the Daily Maximum configured in the setup software. Further automatic operations are prevented until the alarm is cleared. If the Maximum Daily Cycles has been reached, this alarm will clear automatically at midnight, or it can be manually cleared at any time.
11	<p>Load Fuse Blown—On if ac voltage is not detected by the control. If the control is communicating, it indicates that the load fuse is probably blown.</p> <p>A blown load fuse will be alarmed by all wiring options except “-J67.” For “-J67” any type of station power, even dc, could be used as wetting voltage, so the sensing input is wired to control power, and will not go off if the load fuse is blown. For all other wiring options the sensing input is wired to the load side of the load fuse, and the alarm will be set for a blown load fuse.</p>
12	Temperature Sensor Error —On if an error has been detected in the temperature sensor.
13	Temperature System —On if temperature is reported in °F, Off if temperature is reported in °C.
14	Incorrect Voltage Range —On if an error has been detected in the voltage sensor.
15	Low Switching Voltage Delta —On if the delta voltage measured during the present switching operation is lower than the average of the last four switching operations by the percentage configured in the setup software.
16	Neutral Sensor Option —On if the neutral sensor option is present, and cleared if no neutral sensor option is installed.
17	<p>Neutral Sensor Configuration—On if the neutral sensor measures voltage, and cleared if the neutral sensor measures current.</p> <p>NOTE: Versions without the Neutral option will return a 0 value.</p>
18	<p>Neutral Sensor Lockout—On when the neutral current remains above the Neutral Current Alarm Level for a period of time specified by the Current Change Time Threshold. If the Corrective Action and Neutral Current Retry features were enabled in setup software, and this bit is set, the retry operation was unsuccessful. This alarm prevents further operation of the capacitor bank by any other automatic means. To reset, issue control point 3, Reset Neutral Lockout.</p> <p>NOTE: Versions without the Neutral option will return a 0 value.</p>

STATUS POINTS	
Point #	Definition
19	<p>Continuous Neutral Sensor—On when the neutral current remains above the Neutral Current Alarm Level for a period of time specified by the Neutral Current Change Time Threshold. It is reset if the neutral current falls below the Neutral Current Alarm Level, after the retry (if a retry attempt has been enabled).</p> <p>NOTE: Versions without the Neutral option will return a 0 value.</p>
20	<p>Zero Neutral Sensor—This is a user selectable option, if enabled in the setup software, this bit is set if the neutral sensor is detecting zero neutral current or voltage indicating a possible problem with the neutral sensor or its cabling. This only applies when the bank is switched in.</p> <p>NOTE: Versions without the Neutral option will return a 0 value.</p>
21	<p>VAR Option—On if the VAR option is present, and cleared if no VAR option has been installed.</p>
22	<p>Current Direction—On if the Control has detected that the direction of current flow is reversed from the normal direction. This should only occur during emergency switching operations.</p> <p>NOTE: Non-VAR versions will return a 0 value.</p>
23	<p>Low Switching VAR Delta—On if the delta VAR measured during the present switching operation is lower than the average of the last four switching operations by the percentage configured in the setup software.</p> <p>NOTE: Non-VAR versions will return a 0 value.</p>
24	<p>Neutral Sensor Alarming on Total RMS—This bit is zero when Neutral Sensor Alarming is based on fundamental RMS measurements, using only the 60 Hz component of the neutral voltage or neutral current. This bit is set when the total RMS measurement is the basis for this alarm.</p> <p>NOTE: Versions without the Neutral option will return a 0 value.</p>
25	Reserved
26	Current Sensor Load Side
27	Automatic Calculations Enabled
28	<p>Cabinet Door Installed and Open—On when the optional door position indication has been enabled and the enclosure door is open.</p>
29	<p>User Defined Input—On when the optional user defined input has been enabled and is active.</p>
30	<p>Operation Inhibit—On when:</p> <ol style="list-style-type: none"> 1. The voltage is between BVC+M and Low Voltage Override. 2. The voltage is between BVC+M and High Voltage Override. 3. Automatic operations are inhibited due to User Input. 4. Automatic operations are inhibited due to Digital Switch Position issue. 5. SCADA Inhibit Automatic Operation. <p>NOTE: BVC+M = Bank Voltage Change + Margin.</p>
31	<p>WiFi Connected—On when the WiFi is connected.</p>
32	<p>WiFi Intrusion Alarm—On when a WiFi intrusion attempt has been detected.</p>
33	<p>WiFi Disabled from SCADA—On when WiFi has been disabled for SCADA Control Points 9 or 10.</p>
34	<p>Warning Summary—On when a Warning condition occurs. This is a summary bit. The exact cause of the warning can be determined from inspection of the <i>Diagnostics>Warnings</i> screen.</p>
35	<p>Error Summary—On when an Error condition occurs. This is a summary bit. The exact cause of the error can be determined from inspection of the <i>Diagnostics>Errors</i> screen.</p>

ANALOG INPUT POINTS	
Point #	Definition
0	90% Voltage Reference Standard —This is provided for the benefit of protocol implementation to conform to the RTU standard. It is loaded as a constant. The value returned is 24300.
1	0% Voltage Reference Standard —This is provided for the benefit of protocol implementation to conform to the RTU standard. It is loaded as a constant with the value zero.
2	<p>Control Strategy—This is the presently configured control strategy in use. The possible values are:</p> <ul style="list-style-type: none"> 0 Temperature 1 Timeclock 2 Voltage Only 3 Time-Biased Voltage 4 Time-Biased Temperature 5 Auto Off-Line Mode 6 Auto On-Line Mode 7 Current 8 VAR 9 Reverse Current Voltage Only 10 Temperature Sensor Error, Voltage Only 11 SCADA Override 12 Timeclock with Temperature Override 13 Current with Temperature Override 14 VAR with Temperature Override 15 Manual Operation 16 Reserved 17 Voltage Override 18 Reverse Current Trip Inhibit <p>NOTE: Values 7, 8, 13, 14, and 18 do not apply to non-VAR versions.</p>
3	The Most Recent Temperature Reading —This value is in units of °F.
4	Most Recent (Secondary) Voltage Measurement —Each count equals 0.1 Vac RMS.
5	<p>Primary Line Voltage—Each count equals 10 Vac RMS.</p> <p>NOTE: Non-VAR versions will return a 0 value.</p>
6	Time Remaining in SCADA Override Mode —If in timed mode, returns the number of minutes remaining, if in latched mode, always returns 255.
7	<p>Neutral Current or Neutral Voltage Fundamental Harmonic RMS—The data reported is the fundamental harmonic RMS value. Each count equals 1 ampere for a control with neutral current sensing installed or each count equals 1 Volt for a control with neutral voltage sensing installed.</p> <p>NOTE: Versions without the Neutral option will return a 0 value.</p>
8	<p>Single-Phase Line Current—Each count equals 1 ampere.</p> <p>NOTE: Non-VAR versions will return a 0 value.</p>
9	<p>Corrected Phase Angle—Each count equals one eighth of a degree.</p> <p>NOTE: Non-VAR versions will return a -720 value.</p>

ANALOG INPUT POINTS	
Point #	Definition
10	Three-Phase kVARs —KVARs (volt-amperes, reactive) are calculated from the measured single phase voltage, current and phase angles times three. Each count equals 1 kVAR. NOTE: Non-VAR versions will return a -30000 value.
11	Three-Phase kVA —The single-phase kVA is multiplied by three. NOTE: Non-VAR versions will return a 0 value.
12	Three-Phase kW —The single-phase kW is multiplied by three. NOTE: Non-VAR versions will return a 0 value.
13	Voltage, % Total Harmonic Distortion (THD) —In units of 0.1%.
14	Voltage, % Third Harmonic Distortion —In units of 0.1%.
15	Voltage, % Fifth Harmonic Distortion —In units of 0.1%.
16	Voltage, % Seventh Harmonic Distortion —In units of 0.1%.
17	Current, % Total Harmonic Distortion (THD) —In units of 0.1%. NOTE: Non-VAR versions will return a 0 value.
18	Current, % Third Harmonic Distortion —In units of 0.1%. NOTE: Non-VAR versions will return a 0 value.
19	Current, % Fifth Harmonic Distortion —In units of 0.1%. NOTE: Non-VAR versions will return a 0 value.
20	Current, % Seventh Harmonic Distortion —In units of 0.1%. NOTE: Non-VAR versions will return a 0 value.
21	Neutral, % Total Harmonic Distortion (THD) —In units of 0.1%. NOTE: Versions without the Neutral option will return a 0 value.
22	Neutral, % Third Harmonic Distortion —In units of 0.1%. NOTE: Versions without the Neutral option will return a 0 value.
23	Neutral, % Fifth Harmonic Distortion —In units of 0.1%. NOTE: Versions without the Neutral option will return a 0 value.
24	Neutral, % Seventh Harmonic Distortion —In units of 0.1%. NOTE: Versions without the Neutral option will return a 0 value.
25	The Last Switch In or Out Voltage Delta —Each count is 0.1 Volt. This will be a signed value if the switch after voltage is less than the before switching voltage.
26	Neutral Current or Neutral Voltage Total True RMS —The data reported is the total true RMS value. Each count equals 1 ampere for a control with neutral current sensing installed, or each count equals 1 Volt for a control with neutral voltage sensing installed. NOTE: Versions without the Neutral option will return a 0 value.
27	Last kVAR Delta Value —Each count equals 1 kVAR. NOTE: Non-VAR versions will return a 0 value.

Analog Input Points

ANALOG INPUT POINTS	
Point #	Definition
28	<p>Last Switch Operation Reason—The possible values are:</p> <ul style="list-style-type: none"> 1 Manual Operation 2 Reserved 3 Voltage Override 4 Reverse Current Inhibit 5 Neutral Voltage or Current Corrective 6 Temperature 7 Timeclock 8 Voltage 9 Reserved 10 Time Biased Temperature 11 Auto Off Line 12 Auto On Line 13 Current 14 VAR Mode 15 Reserved 16 Reserved 17 SCADA Override 18 Temperature Override Time Clock Strategy 19 Temperature Override Current Strategy 20 Temperature Override VAR Strategy 21 Reserved 22 Reserved 23 Trip on Loss of Voltage 24 User Defined Input 25 Inconsistent Bank Position 26 Contradictory Bank Position 27 Holiday <p>NOTE: Values 13, 14, 19, and 20 do not apply to non-VAR versions.</p>
29	Voltage, % Ninth Harmonic Distortion —In units of 0.1%.
30	<p>Current, % Ninth Harmonic Distortion—In units of 0.1%.</p> <p>NOTE: Non-VAR versions will return a 0 value.</p>
31	<p>Neutral, % Ninth Harmonic Distortion—In units of 0.1%.</p> <p>NOTE: Versions without the Neutral option will return a 0 value.</p>
32	<p>Three-Phase Bank Size—In units of 1 kVARs per count.</p> <p>NOTE: Non-VAR versions will return a 0 value.</p>
33	Reserved
34	Number of Seasons Configured

ANALOG INPUT POINTS	
Point #	Definition
35	Power Factor — Single-phase power factor measured on Pole 1, reported as the cosine of the phase angle. Leading power factor is represented by a negative number. Each count equals 0.001 with a 1000 offset (0 = -1.0 PF, 1000 = 0.0 PF, 2000 = 1.0 PF).
36	Voltage, % Eleventh Harmonic Distortion —In units of 0.1%.
37	Voltage, % Thirteenth Harmonic Distortion —In units of 0.1%.
38	Voltage, % Fifteenth Harmonic Distortion —In units of 0.1%.
39	Voltage, % Seventeenth Harmonic Distortion —In units of 0.1%.
40	Voltage, % Nineteenth Harmonic Distortion —In units of 0.1%.
41	Voltage, % Twenty-first Harmonic Distortion —In units of 0.1%.
42	Voltage, % Twenty-third Harmonic Distortion —In units of 0.1%.
43	Current, % Eleventh Harmonic Distortion —In units of 0.1%.
44	Current, % Thirteenth Harmonic Distortion —In units of 0.1%.
45	Current, % Fifteenth Harmonic Distortion —In units of 0.1%.
46	Current, % Seventeenth Harmonic Distortion —In units of 0.1%.
47	Current, % Nineteenth Harmonic Distortion —In units of 0.1%.
48	The Most Recent Temperature Reading —This value is in units of °C.
49	Total Cycles Since Installation
50	Total Cycles this Year

Analog Output Points

NOTE: An Analog Output Point message sent with an invalid value, either due to being out of range, or in conflict with other settings, will result in a return message with a Status Code other than 0 (Success).

ANALOG OUTPUT POINTS	
Point #	Definition
0	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 re-sending the response. The retry time is only in effect when the confirmation process is enabled. The range is 0.1 to 32.767 milliseconds.
1	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 0 to 10 seconds, each unit = 0.1 second) includes the initial response. The retry count is only in effect when the confirmation process is enabled.
2	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. The range is 1 to 100 tenths of seconds.
3	SCADA Override Timer —If latched mode is selected for the timer and SCADA override becomes active with a close or open command, DNP will report -1 for the minutes remaining in SCADA override (Analog Input #6). See Control Point 2 for SCADA Override operation details. If SCADA Override is currently active and you reset the SCADA override timer to a different value, timer operation will continue for the duration of the new value. Range is 1 to 1440 minutes (24 hours) in one minute increments. To latch SCADA Override, write 65,535 or 0xFFFF.
4	High-Voltage Override for the SCADA Override Mode —The values are entered at 0.1 Volt increments, e.g. 130.0 Volts = 1300.
5	Low-Voltage Override for the SCADA Override Mode —The values are entered at 0.1 Volt increments, e.g. 130.0 Volts = 1300.
6	Maximum Automatic Control Cycles Per Day —If the bank switches out this number of times during any calendar day while in <i>Automatic</i> mode, further switching in <i>Automatic</i> mode is inhibited until the next calendar day. Default is 4.

BINARY COUNTER POINTS

Point #	Definition
0	Reserved
1	Reserved
2	Daily Automatic Operations —This is the number of switch operations during the day, and is incremented when the bank is switched out. This is a 16-bit counter and will overflow back to zero at 65,535.
3	WiFi Intrusion Attempt Counter —This is the number of WiFi Intrusion attempts detected. This is a 16-bit counter and will overflow back to zero at 65,535.

FROZEN COUNTER POINTS

Point #	Definition
0	Reserved
1	Reserved
2	Total Frozen Cycles This Day —This is the number of switch operations before the operation counter received a Freeze command, counted during this calendar day.
3	WiFi Intrusion Attempt Counter —This is the number of WiFi Intrusion attempts detected.

Control Points

The Object Type must be configured on the *Communication—Point Mapping—Controls—DNP Control Point Mapping* screen for each control point when it is mapped. Only the configured Object Type will be accepted and acted on for that control point. The available Object Types are Breaker, Latched, or Pulse for each control point. Supported command types are shown in Table 1.

Table 1. Supported Commands

CONTROL POINT COMMANDS						
OBJECT TYPE	Breaker Trip	Breaker Close	Latch On	Latch Off	Pulse On	Pulse Off
Breaker	Supported ^①	Supported	Supported	Supported ^①	Not Supported	Not Supported
Latch	Supported ^①	Supported	Supported	Supported ^①	Not Supported	Not Supported
Pulse	Not Supported	Not Supported	Not Supported	Not Supported	Supported	Supported ^①

^① Not applicable for points: 4, 5, 8, 10, and 11.

CONTROL POINTS	
Point #	Definition
0	Issue the CLOSE/OPEN Command to the Switch— NOTE: If you try to close the capacitor bank while the Reclose Delay Block is active the control reports a hardware error. The control will also return a hardware error if you attempt to operate the bank while the control is in Automatic mode, unless the SCADA Override set point is also enabled. SCADA Override can be enabled with Control Point 2.
1	Enable or Disable Automatic Operation— This command disables all Automatic Operation (the control is set to Manual mode) until a subsequent command to Enable Automatic Operation is issued. As distinguished from Control Point 6—Inhibit Automatic Operation, this command changes the operating mode to Manual and does not time-out. Disabling Automatic Operation with Control Point 1 will cancel an active SCADA Override status without changing the bank state. In Manual mode SCADA bank state commands will still be accepted by the control as long as the faceplate SCADA Control mode is set to REMOTE . NOTE: Automatic Operation is not disabled when the faceplate REMOTE/LOCAL switch is set to the LOCAL position.
2	Enable or Disable SCADA Override Mode— Enabling SCADA Override allows subsequent SCADA commands to override automatic operation when the control is in Automatic mode. If the control is in Automatic mode and a SCADA command is issued when SCADA Override is disabled, the control will return a hardware error message. When SCADA Override is enabled, issuing a Close or Open command to Control Point 0, or a Control Point 6 command to Inhibit Automatic Operation will start the SCADA Override Timer. When the SCADA Override Timer expires the control reverts to Automatic Operation, SCADA Override becomes inactive (not disabled), and another SCADA command will override Automatic Operation, and start the SCADA Override Timer. SCADA Override mode maintains Automatic Operation, but allows a SCADA command to change the bank state and override Automatic Operation for the duration of the SCADA Override Timer. When the control is in Automatic Mode, unless inhibited by the Inhibit Automatic Operation command, Neutral Sensor Corrective Action and Voltage Overrides are still active when SCADA commands an overriding bank action. Once enabled, SCADA Override remains enabled, even if inactive, until the control is put into Manual Operation mode, or a Disable SCADA Override message is received. In Manual mode, any SCADA command is accepted, even if SCADA Override is Disabled, because Automatic Operation is disabled in Manual mode, and there is no automatic activity to override. If SCADA Override is active due to an Inhibit Automatic Operation command or an Open or Close command, and Automatic Operation is subsequently disabled (Manual mode is entered) and then re-enabled, SCADA Override must be re-enabled before either an Inhibit Automatic Operation command or a bank operation command will be accepted.

CONTROL POINTS	
Point #	Definition
3	<p>Reset Neutral Lockout—</p> <p>Starting with Software Revision 1.19 (and later revisions), Neutral Lockout is reset when the Operating Mode is changed, either from Automatic to Manual or Manual to Automatic, which also resets any active alarms and lockout conditions. This Control Point resets Neutral Lockout without changing the Operating Mode.</p>
4	Reserved
5	<p>Reset All Alarms—</p> <p>All Trouble Conditions and Error Conditions viewed from the Alarm Status button on the Operations screen can be reset with this control point. Starting with Software Revision 1.19 (and later revisions), all alarms are reset when the Operating Mode is changed, either from Automatic to Manual or Manual to Automatic, which also resets any lockout conditions. This Control Point resets all alarms without changing the Operating Mode.</p>
6	<p>Inhibit Automatic Operation for Duration of the SCADA Override Timer—</p> <p>When the master sends a valid command to this control point, Automatic Operation is inhibited for the duration of the SCADA Override Timer. If SCADA Override is presently active, the SCADA Override Timer is reset to its full duration. Any subsequent Automatic Override condition will not be processed and the bank will remain in its present state until the timer expires.</p> <p>To use this command, SCADA Override must be presently enabled. If SCADA Override is presently disabled, Control Point 2 can be used to enable it. An attempt to issue this command while SCADA Override is disabled will cause the control to return a hardware error response, indicating that the control is not in the proper state to accept this command.</p> <p>Issuing this command does not allow a SCADA Override bank operation command to supersede a preexisting Voltage Override condition, because it would place the bank in a state contraindicated by the Voltage Override. Such a bank operation command will be accepted though, and subsequently acted upon, if the Voltage Override condition clears before the SCADA Override Timer expires.</p> <p>When the SCADA Override Timer expires the previous automatic strategy is resumed. If the timer has not expired, sending an additional <i>Latch On</i> command to this point will restart the SCADA Override count-down timer and maintain the inhibition of Automatic Operation for the duration of the timer. If a <i>Latch Off</i> command is sent, both Inhibit Automatic Operation and SCADA Override are cancelled.</p> <p>Any bank operation command will turn Off the Inhibit Automatic Operation mode and restart the SCADA Override Timer for the Open or Close operation, as long as there are no other conditions that have higher precedence. Inhibit Automatic Operation will be cancelled if an emergency voltage override condition occurs. A presently active Override condition will supersede a SCADA command to put the bank into a state contrary to that dictated by the Automatic Override condition.</p>
7	<p>Enable/Disable Automatic Bank Voltage Change Calculation—Where applicable, Breaker Close, Latch On, and Pulse On enable automatic calculation; where applicable, Breaker Trip, Latch Off, and Pulse Off disable the calculation.</p>
8	<p>Reset Voltage Overrides to Factory Defaults—Where applicable, Breaker Close, Latch On, and Pulse On reset all voltage override level thresholds and time thresholds for all configured or un-configured seasons to the proper factory defaults for the nominal system operating voltage.</p>
9	<p>WiFi Enable/Disable—Where applicable, Breaker Close, Latch On, and Pulse On enable WiFi; Latch Breaker Open, Latch Off, and Pulse Off disable WiFi.</p>
10	<p>Disable WiFi—Where applicable, Breaker Close, Latch On, and Pulse On disable WiFi.</p>
11	<p>Enable WiFi—Where applicable, Breaker Close, Latch On, and Pulse On enable WiFi.</p>

Control Points

CONTROL POINTS	
Point #	Definition
12	WiFi Test —Where applicable, Breaker Close, Latch On, and Pulse On cause the WiFi to transmit its SSID.
13	Clear WiFi Intrusion Alarm —Where applicable, Breaker Close, Latch On, and Pulse On, clear the WiFi Intrusion Alarm.
14	Clear Alarms —Where applicable, Breaker Close, Latch On, and Pulse On, Clear Alarms.
15	Clear Warnings —Where applicable, Breaker Close, Latch On, and Pulse On, Clear Warnings.
16	Clear Errors —Where applicable, Breaker Close, Latch On, and Pulse On, Clear Errors.

Group 0 Objects

GROUP 0 OBJECTS		
Variation	Variation Name	Definition
242	Device manufacturer's software version	The S&C implementation will return a string containing the MCU Application and MCU EOS. The following is an example of the string that will be returned: "003.003.004.003 060.001.021.043," representing MCU Application 3.3.4.3, MCU EOS 60.1.21.43.
248	Device serial number	The S&C implementation will return a string containing the IC2000 serial number.

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 S&C's implementation of DNP with other devices.

DNP V3.00 DEVICE PROFILE DOCUMENT	
Vendor Name: S&C Electric Company	
Device Name: IntelliCap 2000 Capacitor Control	
Highest DNP Level Supported: For Requests - Level 2 For Responses - Level 2	Device Function: ___ Master X 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): Variation 4 Analog Change Event Object 32 _____ _____ _____ _____	
Maximum Data Link Frame Size (bytes) Transmitted - 292 Received - 292	Max Application Fragment Size (bytes) Transmitted - 249 Received - 249
Maximum Data link Re-tries: X None ___ Fixed at _____ ___ Configurable, range 1 to 25	Maximum Application Layer Re-tries: ___ None ___ Fixed at _____ X Configurable, range 1 to 10 and infinite

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)
☐ Sometimes If 'Sometimes', when?
☒ Configurable If 'Configurable', how? - Response confirmations are configured through SCADA communications or through locally connected setup software.

Timeouts while waiting for:

- | | | | | | |
|-------------------------|-------------------------------------|-------------------------------|--------------------------------|-----------------------------------|--|
| Data Link Confirm | <input checked="" type="checkbox"/> | <input type="checkbox"/> None | <input type="checkbox"/> Fixed | <input type="checkbox"/> Variable | <input type="checkbox"/> Config |
| Complete Appl. Fragment | <input checked="" type="checkbox"/> | <input type="checkbox"/> None | <input type="checkbox"/> Fixed | <input type="checkbox"/> Variable | <input type="checkbox"/> Config |
| Application Confirm | <input type="checkbox"/> | <input type="checkbox"/> None | <input type="checkbox"/> Fixed | <input type="checkbox"/> Variable | <input checked="" type="checkbox"/> Config |
| Complete Appl. Response | <input checked="" type="checkbox"/> | <input type="checkbox"/> None | <input type="checkbox"/> Fixed | <input type="checkbox"/> Variable | <input type="checkbox"/> Config |
- Others _____
- Attach explanation if 'Variable' or 'Configurable' was checked
(see Note 1 below for explanation)

Sends/Executes Control Operations:

- | | | | | | |
|-------------------------|-------------------------------------|--------------------------------|---------------------------------|---|---------------------------------|
| WRITE Binary Outputs | <input checked="" type="checkbox"/> | <input type="checkbox"/> Never | <input type="checkbox"/> Always | <input type="checkbox"/> Sometimes | <input type="checkbox"/> Config |
| SELECT/OPERATE | <input type="checkbox"/> | <input type="checkbox"/> Never | <input type="checkbox"/> Always | <input checked="" type="checkbox"/> Sometimes | <input type="checkbox"/> Config |
| DIRECT OPERATE | <input type="checkbox"/> | <input type="checkbox"/> Never | <input type="checkbox"/> Always | <input checked="" type="checkbox"/> Sometimes | <input type="checkbox"/> Config |
| DIRECT OPERATE - NO ACK | <input type="checkbox"/> | <input type="checkbox"/> Never | <input type="checkbox"/> Always | <input checked="" type="checkbox"/> Sometimes | <input type="checkbox"/> Config |
| | | | | | |
| Count > 1 | <input checked="" type="checkbox"/> | <input type="checkbox"/> Never | <input type="checkbox"/> Always | <input type="checkbox"/> Sometimes | <input type="checkbox"/> Config |
| Pulse On | <input type="checkbox"/> | <input type="checkbox"/> Never | <input type="checkbox"/> Always | <input checked="" type="checkbox"/> Sometimes | <input type="checkbox"/> Config |
| Pulse Off | <input type="checkbox"/> | <input type="checkbox"/> Never | <input type="checkbox"/> Always | <input checked="" type="checkbox"/> Sometimes | <input type="checkbox"/> Config |
| Latch On | <input type="checkbox"/> | <input type="checkbox"/> Never | <input type="checkbox"/> Always | <input checked="" type="checkbox"/> Sometimes | <input type="checkbox"/> Config |
| Latch Off | <input type="checkbox"/> | <input type="checkbox"/> Never | <input type="checkbox"/> Always | <input checked="" type="checkbox"/> Sometimes | <input type="checkbox"/> Config |
| | | | | | |
| Queue | <input checked="" type="checkbox"/> | <input type="checkbox"/> Never | <input type="checkbox"/> Always | <input type="checkbox"/> Sometimes | <input type="checkbox"/> Config |
| Clear Queue | <input checked="" type="checkbox"/> | <input type="checkbox"/> Never | <input type="checkbox"/> Always | <input type="checkbox"/> Sometimes | <input type="checkbox"/> Config |
- Attach explanation if 'Sometimes' or 'Configurable' was checked
(see Note 2 below for explanation)

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 type="checkbox"/> No Counters Reported <input type="checkbox"/> Configurable (explain) <input checked="" type="checkbox"/> Default Object - 20 <input type="checkbox"/> Default Variation - 5 <input type="checkbox"/> Point-by-point list attached	Counters Roll Over at: <input type="checkbox"/> No Counters Reported <input type="checkbox"/> Configurable (explain) <input type="checkbox"/> 16 Bits <input checked="" 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 control waits before sending another response/confirmation attempt (if the retry number has not been reached, or the confirmation process has been stopped). This Confirmation request uses timeout period "Time Delay Between Attempts."

"Time Delay Between Attempts" can be set with the Setup software or via SCADA. (See the *Setup* Instruction Sheet 1024-530 for more details.)

NOTE 2: Control Operations Executed

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

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

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

You must use the Trip/Close bits for these functions in the Control Block. Set the Count value to “1” and the Code value to “NUL” (0) or “1.” The control ignores the On-Time and Off-Time values and the Queue and Clear flags in the Control Code.

For all momentary point operations, you must use the Pulse On or Pulse Off function. When using Pulse for either function, set count value in the Control Block to “1” and the Code value to “1.” Set the Trip/Close to “NUL” (00). The switch control 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 switch control 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 IEEE 1815-2012, available from the DNP Users Group.

NOTE 3: Unsolicited Responses

The control 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.

The control returns unsolicited responses to the configured master station address when a deadband-configurable analog input point change occurs that exceeds the configured deadband delta. Object 32, variation 4 (“Analog Change Event - Variation 2”) is returned.

The control also returns unsolicited responses when certain analog input points have been enabled to report on a bank switching event, and that event occurs. See the tables on Page 4. Object 32, variation 2 (“Analog Change Event - Variation 2”) 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).

NOTE 4: Binary Output Status

In a response to a Binary Output Status request, the control 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.

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 switch control 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)	Default Qual. (hex)
0	242	Device Manufacturer's Device Software	1	00,06	00
0	248	Device Manufacturer's Serial Number	1	00,06	00
0	254	Non-Specific All Attribute Request	1	00,06	
0	255	Device List of Attribute	1	00,06	17
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 (see Note 4)	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	5	32-Bit Binary Counter without Flag			00
21	0	Frozen Counter - All Variations	1	06	
21	9	32-Bit Frozen Counter without Flag			00
22	0	Counter Change Event - All Variations (object parsed but no data to return)	1	06,07,08	

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OBJECT			REQUEST		RESPONSE
Obj	Var	Description	Func Code (dec)	Qualifier Codes (hex)	Default Qual. (hex)
30	0	Analog Input - All Variations	1	06	
30	4	16-Bit Analog Input Without Flag	1	06	00
32	0	Analog Change Event - All Variations	1	06	
32	2	16-Bit Without Time	1	06,07,08	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	1 read, 2 write	07 where range =1	Date, with time reported to the nearest second
60	1	Class 0 Data	1	06	
60	2	Class 1 Data	1	06,07,08	
60	3	Class 2 Data	1	06,07,08	
60	4	Class 3 Data	1	06,07,08	
80	1	Internal Indications	2	00 index=7	IINs only

