

## DNP Points List and Implementation

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### DNP Points List for IntelliCap Plus Controls

This instruction sheet provides Distributed Network Protocol (DNP) points and DNP implementation information for the IntelliCap Plus Automatic Capacitor Control and were prepared for use with software versions **PCSD125S or PCVD125S** or subsequent releases.

The DNP master station should define IntelliCap Plus Control with the following Status, Analog Input, Analog Output, Binary Counter, Frozen Counter, and Control points:

Point	Count
Status	28
Analog Input	34
Analog Output	8
Binary Counter	3
Frozen Counter	3
Control	8

The available DNP points are listed in Tables 1 through 8 on pages 2 through 11.

Unless otherwise noted, each point is On if the condition is logically true or active.



## Status Points

Table 1 Status Points	
Point #	Definition
0	<b>Capacitor Bank Closed</b> —On when the capacitor bank is switched in.
1	<b>Capacitor Bank Open</b> —On when the capacitor bank is switched out.
2	<b>Auto/Manual Operation</b> —On when the control is in the <b>Automatic</b> mode.
3	<b>Remote/Local Control Mode</b> —On when the control is in the <b>Remote</b> state. In the <b>Local</b> state operation of the bank from the SCADA master station is blocked.
4	<b>Alarm Summary</b> —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 status points 10, 11, 12, 14, 15, 18, 19, 20, and 23.
5	<b>SCADA Override Enabled</b> —On when the <b>SCADA Override</b> feature is in the <b>Enabled</b> state in the setup software. This override strategy may or may not be controlling the bank state when in the <b>Enabled</b> state, depending on the state of other overrides and SCADA commands that have been issued.
6	<b>Over Voltage</b> —On when an over-voltage condition is present.
7	<b>Under Voltage</b> —On when an under-voltage condition is present.
8	<b>Emergency Voltage Override</b> —On when the voltage has exceeded the Emergency-Voltage Override boundaries.
9	<b>Reclose Block</b> —On for a period of five minutes after a <b>Trip</b> operation to allow the capacitors to discharge fully. During this five-minute period, the bank is prevented from reclosing.
10	<b>Maximum Daily Cycles</b> —On if the number of open operations of the capacitor bank reaches the configured <b>Daily Maximum</b> setpoint. Further automatic operations are prevented until the alarm is cleared. If the daily maximum number of cycles has been reached, this alarm will clear automatically at midnight, or it can be manually cleared at any time.
11	<b>Load Fuse Blown</b> —On if ac voltage is not detected by the control. If the control is communicating, it indicates the load fuse is probably blown.  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.
12	<b>Temperature Sensor Error</b> —On if an error has been detected in the temperature sensor.
13	<b>Temperature System</b> —On if temperature is reported in °F; Off if temperature is reported in °C.
14	<b>Incorrect Voltage Range</b> —On if an error has been detected in the voltage sensor.
15	<b>Low Switching-Voltage Delta</b> —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	<b>Neutral Sensor Option</b> —On if the neutral sensor option is present and cleared if no neutral sensor option is installed.
17	<b>Neutral Sensor Configuration</b> —On if the neutral sensor measures voltage and cleared if the neutral sensor measures current.  <b>Note:</b> Versions without the <b>Neutral</b> option return a 0 value.
18	<b>Neutral Sensor Lockout</b> —On when the neutral current remains above the neutral current alarm level for a period of time specified by the <b>Current Change Time Threshold</b> setting. If the <b>Corrective Action</b> and <b>Neutral Current Retry</b> 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.  <b>Note:</b> Versions without the <b>Neutral</b> option return a 0 value.

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Table 1 Status Points—Continued	
Point #	Definition
19	<p><b>Continuous Neutral Sensor</b>—On when the neutral current remains above the <b>Neutral Current Alarm Level</b> setpoint for a period of time specified by the <b>Neutral Current Change Time Threshold</b> setpoint. It is reset if the neutral current falls below the <b>Neutral Current Alarm Level</b> setpoint after the retry (if a retry attempt has been enabled).</p> <p><b>Note:</b> Versions without the <b>Neutral</b> option return a 0 value.</p>
20	<p><b>Zero Neutral Sensor</b>—This is a user-selectable option. If enabled in the setup software, this bit is set if the neutral sensor detects 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><b>Note:</b> Versions without the <b>Neutral</b> option return a 0 value.</p>
21	<p><b>Var Option</b>—On if the var option is present and cleared if no var option has been installed.</p>
22	<p><b>Current Direction</b>—On if the control detects the current-flow direction is reversed from the normal direction. This should only occur during emergency switching operations.</p> <p><b>Note:</b> Non-var versions return a 0 value.</p>
23	<p><b>Low Switching Var Delta</b>—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><b>Note:</b> Non-var versions return a 0 value.</p>
24	<p><b>Neutral Sensor Alarming</b>—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><b>Note:</b> Versions without the <b>Neutral</b> option return a 0 value.</p>
25	<p><b>Neutral Sensor Data Logging</b>—This bit is zero when neutral sensor data logging 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 value logged.</p> <p><b>Note:</b> Versions without the <b>Neutral</b> option will return a 0 value.</p>
26	<p><b>Current Sensor Location</b>—On when the current sensor is located on the load side.</p> <p><b>Note:</b> Non-var versions return a 0 value.</p>
27	<p><b>Automatic Calculation Enabled</b>—On when the <b>Automatic Calculation</b> feature is enabled for the <b>Bank Voltage Change + Margin</b> mode and cleared if the feature is disabled.</p>

## Analog Input Points

Table 2. Analog Input Points	
Point #	Definition
0	<b>90% Voltage Reference Standard</b> —This is provided for the benefit of protocol implementation to conform to the RTU standard. It is loaded as a constant.
1	<b>0% Voltage Reference Standard</b> —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><b>Control Strategy</b>—This is the presently configured control strategy in use. The possible values are:</p> <ul style="list-style-type: none"> <li>0 Temperature</li> <li>1 Timeclock</li> <li>2 Voltage Only</li> <li>3 Time-Biased Voltage</li> <li>4 Time-Biased Temperature</li> <li>5 Auto Off-Line Mode</li> <li>6 Auto On-Line Mode</li> <li>7 Current</li> <li>8 Var</li> <li>9 Reverse-Current Voltage Only</li> <li>10 Temperature-Sensor Error, Voltage Only</li> <li>11 SCADA Override</li> <li>12 Timeclock with Temperature Override</li> <li>13 Current with Temperature Override</li> <li>14 Var with Temperature Override</li> </ul> <p><b>Note:</b> Values 7, 8, 13 and 14 do not apply to non-var versions.</p>
3	<b>The Most Recent Temperature Reading</b> —This value is in units of °F or °C, as selected in the IntelliLink Setup Software.
4	<b>Most Recent (Secondary) Voltage Measurement</b> —Each count equals 0.1 Vac RMS.
5	<p><b>Primary Line Voltage</b>—Each count equals 10 Vac RMS.</p> <p><b>Note:</b> Non-var versions return a 0 value.</p>
6	<b>Time Remaining in SCADA Override Mode</b> —If in <b>Timed</b> mode, returns the number of minutes remaining; if in <b>Latched</b> mode, always returns 65535(FFFF).
7	<p><b>Neutral Current or Neutral Voltage</b>—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><b>Note:</b> Versions without the <b>Neutral</b> option return a 0 value.</p>
8	<p><b>Single-Phase Line Current</b>—Each count equals 1 ampere.</p> <p><b>Note:</b> Non-var versions return a 0 value.</p>
9	<p><b>Phase Angle</b>—Each count equals one eighth of a degree.</p> <p><b>Note:</b> Non-var versions will return a -720 value.</p>
10	<p><b>Three-Phase kvars</b>—Kvars (volt-amperes, reactive) are calculated from the measured single-phase voltage, current, and phase angles times three. Each count equals 1 kvar.</p> <p><b>Note:</b> Non-var versions will return a -30000 value.</p>

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Table 2. Analog Input Points—Continued	
Point #	Definition
11	<b>Three-Phase kVA</b> —The single-phase kVA is multiplied by three. <b>Note:</b> Non-var versions return a 0 value.
12	<b>Three-Phase kW</b> —The single-phase kW is multiplied by three. <b>Note:</b> Non-var versions return a 0 value.
13	<b>Voltage, % Total Harmonic Distortion (THD)</b> —In units of 0.1%.
14	<b>Voltage, % Third Harmonic Distortion</b> —In units of 0.1%.
15	<b>Voltage, % Fifth Harmonic Distortion</b> —In units of 0.1%.
16	<b>Voltage, % Seventh Harmonic Distortion</b> —In units of 0.1%.
17	<b>Current, % Total Harmonic Distortion (THD)</b> —In units of 0.1%. <b>Note:</b> Non-var versions return a 0 value.
18	<b>Current, % Third Harmonic Distortion</b> —In units of 0.1%. <b>Note:</b> Non-var versions return a 0 value.
19	<b>Current, % Fifth Harmonic Distortion</b> —In units of 0.1%. <b>Note:</b> Non-var versions return a 0 value.
20	<b>Current, % Seventh Harmonic Distortion</b> —In units of 0.1%. <b>Note:</b> Non-var versions return a 0 value.
21	<b>Neutral, % Total Harmonic Distortion (THD)</b> —In units of 0.1%. <b>Note:</b> Versions without the <b>Neutral</b> option return a 0 value.
22	<b>Neutral, % Third Harmonic Distortion</b> —In units of 0.1%. <b>Note:</b> Versions without the <b>Neutral</b> option return a 0 value.
23	<b>Neutral, % Fifth Harmonic Distortion</b> —In units of 0.1%. <b>Note:</b> Versions without the <b>Neutral</b> option return a 0 value.
24	<b>Neutral, % Seventh Harmonic Distortion</b> —In units of 0.1%. <b>Note:</b> Versions without the <b>Neutral</b> option return a 0 value.
25	<b>The Last Switch-In or Out Voltage Delta</b> —Each count is 0.1 Volt. This will be a signed value if the voltage after switching is less than the voltage before switching.
26	<b>Neutral Current or Neutral Voltage</b> —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. <b>Note:</b> Versions without the <b>Neutral</b> option return a 0 value.
27	<b>Last kvar Delta Value</b> —Each count equals 1 kvar. <b>Note:</b> Non-var versions will return a 0 value.

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## Analog Input Points

Table 2. Analog Input Points—Continued	
Point #	Definition
28	<p><b>Last Switch Operation Reason</b>—The possible values are:</p> <ul style="list-style-type: none"> <li>1 Manual Operation</li> <li>2 SCADA Operation</li> <li>3 Voltage Override</li> <li>4 Temperature</li> <li>5 Timeclock</li> <li>6 Voltage</li> <li>7 Time-Biased Voltage</li> <li>8 Time-Biased Temperature</li> <li>9 Auto Off Line</li> <li>10 Auto On Line</li> <li>11 Current</li> <li>12 Var Mode</li> <li>13 Reverse-Current Voltage</li> <li>14 Temperature-Sensor Error, Default-Voltage Strategy</li> <li>15 SCADA Override</li> <li>16 Temperature Override of Timeclock Strategy</li> <li>17 Temperature Override of Current Strategy</li> <li>18 Temperature Override of Var Strategy</li> <li>19 Reverse-Current Trip Inhibit</li> <li>20 Neutral Lockout</li> <li>21 Neutral-Voltage or Current Corrective Action</li> <li>22 Trip on Loss of Voltage</li> </ul>
29	<p><b>Voltage, % Ninth Harmonic Distortion</b>—In units of 0.1%.</p>
30	<p><b>Current, % Ninth Harmonic Distortion</b>—In units of 0.1%.  <b>Note:</b> Non-var versions return a 0 value.</p>
31	<p><b>Neutral, % Ninth Harmonic Distortion</b>—In units of 0.1%.  <b>Note:</b> Versions without the <b>Neutral</b> option return a 0 value.</p>
32	<p><b>Three-Phase Bank Size</b>—In units of 50 kvars per count.  <b>Note:</b> Non-var versions return a 0 value.</p>
33	<p><b>Extended Voltage Sampling Average Value</b>—Voltage is sampled approximately every 0.3 seconds. Four of these raw samples are averaged and scaled every 1.2 seconds to produce the RMS voltage reading. These averaged and scaled RMS voltages are further accumulated and averaged over the new extended sampling period. The number of samples collected is based on the configured number of seconds plus one, multiplied by 5/6, rounded down. A default setting will thus result in 17 samples being collected and averaged over a time period of approximately 20.4 seconds. Each count equals 0.1 Vac.</p>

<b>Table 3. Deadband Configurable Analog Input Points</b>		
Unsolicited-Response Mode V2 or V3 must be enabled for these reports to occur. Deadband configuration is located on Page 3 of the <i>Communications Setup</i> screen.		
<b>Point #</b>	<b>Definition</b>	<b>Reports on Switch Event</b>
3	Temperature	No
4	Secondary Voltage	Yes
5	Primary Voltage (var only)	Yes
7	Neutral-Fundamental Current or Voltage (neutral only)	Yes
8	Single-phase Current (var only)	Yes
9	Phase Angle (var only)	Yes
10	Three-phase kvars (var only)	Yes
11	Three-phase kVA (var only)	Yes
12	Three-phase kW (var only)	Yes
13	Voltage Total Harmonic Distortion	No
17	Current Total Harmonic Distortion (var only)	No
21	Neutral Total Harmonic Distortion (neutral only)	No
26	Neutral RMS Current or Voltage (neutral only)	Yes
33	Extended Voltage-Sampling Average	No

<b>Table 4. Analog Input Points - Not Deadband Configurable</b>		
Unsolicited-Response Mode V2 or V3 must be enabled for these reports to occur.		
<b>Point #</b>	<b>Definition</b>	<b>Reports on Switch Event</b>
25	Last Voltage Delta	Yes
27	Last kvar Delta (var only)	Yes
28	Last Switch-Operation Reason	Yes

## 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 Status Code 6 (Hardware Error).

Table 5. Analog Output Points	
Point #	Definition
0	<p><b>Application-Layer Confirmation Retry Time</b>—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 a 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><b>Note:</b> In a 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 six 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><b>Application Layer Confirmation Retry Count</b>—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><b>Control Point Select Time</b>—During a <b>Select-Before-Operate</b> procedure, this is the length of time that may elapse between receiving the <b>Select</b> function for a point and receiving the <b>Operate</b> function for that same point. If an <b>Operate</b> function is not received within this time period, the point is deselected and another <b>Select</b> function is required before the point will operate. It uses a timer-byte format with a range of 1 second to 10 minutes.</p>
3	<p><b>SCADA Override Timer (In Timer-Byte Format)</b>—Time values supported are: 5, 15, or 30 minutes and 1–24 hours, in one-hour increments. 255 (decimal) is the <b>Latched</b> mode. (Decimal values are: 133, 143, 158, and 193–216.) If <b>Latched</b> mode is selected for the timer and <b>SCADA Override</b> mode becomes active with a <b>Close</b> or <b>Open</b> command, DNP will report -1 for the minutes remaining in <b>SCADA Override</b> mode (Analog Input #6). See Control Point #2 for <b>SCADA Override</b> mode operation details.</p> <p>If <b>SCADA Override</b> mode is currently active and you reset the <b>SCADA Override Timer</b> setpoint to a different value, timer operation will continue for the duration of the new value.</p>
4	<p><b>High-Voltage Override for the SCADA Override Mode</b>—The values are entered at 0.1 Volt increments, e.g. 130.0 Volts = 1300.</p>
5	<p><b>Low-Voltage Override for the SCADA Override Mode</b>—The values are entered at 0.1 Volt increments, e.g. 130.0 Volts = 1300.</p>
6	<p><b>Maximum Automatic Control Cycles Per Day</b>—If the bank switches out this number of times during any calendar day while in <b>Automatic</b> mode, further switching in <b>Automatic</b> mode is inhibited until the next calendar day. (Default: 4)</p>
7	<p><b>Extended Voltage Sampling Averaging Period</b>—Configurable from one to 300 seconds. (Default: 20)</p>



Table 6. Binary Counter Points	
Point #	Definition
0	<b>Total Cycles Since Installation</b> —This is the number of switch operations since the installation of the control. The counter is incremented when the bank is switched out. This is a 16-bit counter and overflows back to zero at 65,535.
1	<b>Total Cycles This Year</b> —This is the number of switch operations during this calendar year. The counter is incremented when the bank is switched out. This is a 16-bit counter and overflows back to zero at 65,535.
2	<b>Daily Automatic Operations</b> —This is the number of switch operations during the day and is incremented when the bank is switched out.

Table 7. Frozen Counter Points	
Point #	Definition
0	<b>Total Frozen Cycles Since Installation</b> —This is the number of switch operations before the operation counter received a <b>Freeze</b> command, counted since the installation of the control.
1	<b>Total Frozen Cycles This Year</b> —This is the number of switch operations before the operation counter received a <b>Freeze</b> command, counted during this calendar year.
2	<b>Total Frozen Cycles This Day</b> —This is the number of switch operations before the operation counter received a <b>Freeze</b> command, counted during this calendar day.

## Control Points

Table 8. Control Points	
Point #	Definition
0	<p><b>Issue the Close/Open Command to the Switch—</b></p> <p>The <b>Close/Open</b> command may be issued using either the Select/Operate sequence, the <b>Direct Operate</b> function, or the <b>Direct Operate without Ack</b> function. Both <b>Trip</b> and <b>Close</b> commands are valid for this point.</p> <p><b>Note:</b> If you try to close the capacitor bank while the <b>Reclose Delay Block</b> feature 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 <b>Automatic</b> mode, unless the <b>SCADA Override</b> setpoint is also enabled. The <b>SCADA Override</b> mode can be enabled with Control Point 2.</p>
1	<p><b>Enable or Disable Automatic Operation—</b></p> <p>This command is issued using the <b>Latch On/Off</b> request in the control relay output block. This command disables the <b>Automatic Operation</b> mode (the control is set to <b>Manual</b> mode) until a subsequent command to <b>Enable the Automatic Operation</b> mode is issued.</p> <p>As distinguished from Control Point 6—Inhibit Automatic Operation, this command changes the operating mode to <b>Manual</b> and does not time-out. Disabling <b>Automatic Operation</b> mode with Control Point 1 will cancel an active <b>SCADA Override</b> mode status without changing the bank state. In <b>Manual</b> mode, SCADA bank state commands will still be accepted by the control as long as the faceplate <b>SCADA Control</b> mode is set to the <b>Remote</b> state.</p> <p><b>Note:</b> The <b>Automatic Operation</b> mode is not disabled when the faceplate REMOTE/LOCAL switch is set to the <b>Local</b> state.</p>
2	<p><b>Enable or Disable SCADA Override Mode—</b></p> <p>This command is issued using the <b>Latch On/Off</b> request in the control relay output block. Enabling the <b>SCADA Override</b> mode allows subsequent SCADA commands to override automatic operation when the control is in the <b>Automatic</b> mode. If the control is in <b>Automatic</b> mode and a SCADA command is issued when the <b>SCADA Override</b> mode is disabled, the control will return a hardware error message. When the <b>SCADA Override</b> mode is in the <b>Enabled</b> state, issuing a <b>Close</b> or <b>Open</b> command to Control Point 0 or a Control Point 6 command to <b>Inhibit Automatic Operation</b> will start the SCADA Override Timer. When the SCADA Override Timer expires, the control reverts to <b>Automatic Operation</b> mode, <b>SCADA Override</b> mode becomes inactive (not disabled), and another SCADA command will override the <b>Automatic Operation</b> mode and start the SCADA Override Timer.</p> <p><b>SCADA Override</b> mode maintains automatic operation but allows a SCADA command to change the bank state and override <b>Automatic Operation</b> mode for the duration of the SCADA Override Timer. When the control is in <b>Automatic</b> mode, unless inhibited by the <b>Inhibit Automatic Operation</b> command, <b>Neutral Sensor Corrective Action</b> and <b>Voltage Override</b> modes are still active when SCADA commands an overriding bank action.</p> <p>When enabled, the <b>SCADA Override</b> mode remains enabled, even if inactive, until the control is put into <b>Manual Operation</b> mode or a <b>Disable SCADA Override</b> command message is received. In <b>Manual</b> mode, any SCADA command is accepted, even if <b>SCADA Override</b> mode is disabled, because <b>Automatic Operation</b> mode is disabled in <b>Manual</b> mode and there is no automatic activity to override.</p> <p>If <b>SCADA Override</b> mode is active due to an <b>Inhibit Automatic Operation</b> command or an <b>Open</b> or <b>Close</b> command, and <b>Automatic Operation</b> mode is subsequently disabled (<b>Manual</b> mode is entered) and then re-enabled, <b>SCADA Override</b> mode must be re-enabled before either an <b>Inhibit Automatic Operation</b> command or a bank operation command will be accepted.</p>
3	<p><b>Reset Neutral Lockout—</b></p> <p>This command is issued using a <b>Pulse On</b> request. Starting with software revision 1.19 (and later revisions), the <b>Neutral Lockout</b> state is reset when the <b>Operating Mode</b> state is changed, either from the <b>Automatic</b> to <b>Manual</b> or <b>Manual</b> to <b>Automatic</b> state, which also resets any active alarms and lockout conditions. This control point resets a <b>Neutral Lockout</b> state without changing the <b>Operating</b> mode.</p>

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Table 8. Control Points—Continued	
Point #	Definition
4	<p><b>Enable or Disable Application-Layer Confirmations—</b></p> <p>This command is issued using the <b>Latch On/Off</b> request in the control relay output block. When in the <b>Enabled</b> state, the control requests a confirmation from the master station for every event response message generated.</p>
5	<p><b>Reset All Alarms—</b></p> <p>All <b>Trouble</b> conditions and <b>Error</b> conditions viewed from the <b>Alarm Status</b> button on the <i>Operations</i> screen can be reset with this control point. Only the <b>Pulse On/Momentary</b> relay operation is supported. Starting with software revision 1.19 (and later revisions), all alarms are reset when the <b>Operating Mode</b> state is changed, either from the <b>Automatic to Manual</b> or <b>Manual to Automatic</b> state, which also resets any lockout conditions. This control point resets all alarms without changing the <b>Operating Mode</b> state.</p>
6	<p><b>Inhibit Automatic Operation for Duration of the SCADA Override Timer—</b></p> <p>When the master station sends a <b>Latch On</b> command to this control point, automatic operation is inhibited for the duration of the SCADA Override Timer. If the <b>SCADA Override</b> mode is presently active, the SCADA Override Timer is reset to its full duration. Any subsequent <b>Automatic Override</b> condition will not be processed and the bank will remain in its present state until the timer expires.</p> <p>To use this command, the <b>SCADA Override</b> mode must be presently enabled. If the <b>SCADA Override</b> mode is presently disabled, Control Point 2 can be used to enable it. An attempt to issue this command while the <b>SCADA Override</b> mode 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 <b>SCADA Override</b> bank operation command to supersede a preexisting <b>Voltage Override</b> condition because it would place the bank in a state contraindicated by the <b>Voltage Override</b> condition. Such a bank operation command will be accepted though, and subsequently acted upon, if the <b>Voltage Override</b> 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 <b>Latch On</b> command to this point will restart the SCADA Override Timer count-down and maintain the inhibition of <b>Automatic Operation</b> mode for the duration of the timer. If a <b>Latch Off</b> command is sent, both the <b>Inhibit Automatic Operation</b> and <b>SCADA Override</b> modes are cancelled.</p> <p>Any bank operation command will disable the <b>Inhibit Automatic Operation</b> mode and restart the SCADA Override Timer for the <b>Open</b> or <b>Close</b> operation. A presently active <b>Override</b> condition will supersede a SCADA command to put the bank into a state contrary to that dictated by the <b>Automatic Override</b> condition.</p>
7	<p><b>Enable/Disable Automatic Bank Voltage Change Calculation—</b>The <b>Latch On</b> command enables automatic calculation; the <b>Latch Off</b> command disables automatic calculation.</p>

# DNP Implementation

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

## Table 9. 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 Plus 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):  8-Bit Unsigned Integers _____ 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 25 and infinite

CONTINUED ►

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"/>	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
Others _____								

Attach explanation if "Variable" or "Configurable" was checked  
(see Note 1 below for explanation)

CONTINUED ►

# DNP Implementation

Sends/Executes Control Operations:

WRITE Binary Outputs	<input checked="" type="checkbox"/>	Never	<input type="checkbox"/>	Always	<input type="checkbox"/>	Sometimes	<input type="checkbox"/>	Config
SELECT/OPERATE	<input type="checkbox"/>	Never	<input type="checkbox"/>	Always	<input checked="" type="checkbox"/>	Sometimes	<input type="checkbox"/>	Config
DIRECT OPERATE	<input type="checkbox"/>	Never	<input type="checkbox"/>	Always	<input checked="" type="checkbox"/>	Sometimes	<input type="checkbox"/>	Config
DIRECT OPERATE - NO ACK	<input type="checkbox"/>	Never	<input type="checkbox"/>	Always	<input checked="" type="checkbox"/>	Sometimes	<input type="checkbox"/>	Config
Count > 1	<input checked="" type="checkbox"/>	Never	<input type="checkbox"/>	Always	<input type="checkbox"/>	Sometimes	<input type="checkbox"/>	Config
Pulse On	<input type="checkbox"/>	Never	<input type="checkbox"/>	Always	<input checked="" type="checkbox"/>	Sometimes	<input type="checkbox"/>	Config
Pulse Off	<input checked="" type="checkbox"/>	Never	<input type="checkbox"/>	Always	<input type="checkbox"/>	Sometimes	<input type="checkbox"/>	Config
Latch On	<input type="checkbox"/>	Never	<input type="checkbox"/>	Always	<input checked="" type="checkbox"/>	Sometimes	<input type="checkbox"/>	Config
Latch Off	<input type="checkbox"/>	Never	<input type="checkbox"/>	Always	<input checked="" type="checkbox"/>	Sometimes	<input type="checkbox"/>	Config
Queue	<input checked="" type="checkbox"/>	Never	<input type="checkbox"/>	Always	<input type="checkbox"/>	Sometimes	<input type="checkbox"/>	Config
Clear Queue	<input checked="" 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:

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)

FILL OUT THE FOLLOWING ITEMS FOR SLAVE DEVICES ONLY:

Reports Binary Input Change Events when no specific variation requested:

Never  
 Only time-tagged  
 Only non-time-tagged  
 Configurable to send both

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

Never  
 Binary Input Change with Time  
 Bin In Change Relative Time  
 Configurable (explain)

CONTINUED ►

<p>Sends Unsolicited Responses:</p> <p><input type="checkbox"/> Never</p> <p><input checked="" type="checkbox"/> Configurable (explain)</p> <p><input type="checkbox"/> Only certain objects</p> <p><input type="checkbox"/> Sometimes (explain)</p> <p><input type="checkbox"/> ENABLE/DISABLE UNSOLICITED</p> <p>Function codes supported</p> <p>(see Note 3 below)</p>	<p>Sends Static Data in Unsolicited Responses:</p> <p><input type="checkbox"/> Never</p> <p><input type="checkbox"/> When Device Restarts</p> <p><input checked="" type="checkbox"/> When Status Flags Change</p> <p>No other options are permitted.</p> <p>(see Note 3 below)</p>
<p>Default Counter Object/Variation:</p> <p><input type="checkbox"/> No Counters Reported</p> <p><input type="checkbox"/> Configurable (explain)</p> <p><input checked="" type="checkbox"/> Default Object - 20</p> <p><input type="checkbox"/> Default Variation - 5</p> <p><input type="checkbox"/> Point-by-point list attached</p>	<p>Counters Roll Over at:</p> <p><input type="checkbox"/> No Counters Reported</p> <p><input type="checkbox"/> Configurable (explain)</p> <p><input checked="" type="checkbox"/> 16 Bits</p> <p><input type="checkbox"/> 32 Bits</p> <p><input type="checkbox"/> Other Value _____</p> <p><input type="checkbox"/> Point-by-point list attached</p>
<p>Sends Multi-Fragment Responses (Slave Only):    <input checked="" type="checkbox"/> Yes    <input type="checkbox"/> No</p>	

**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 the timeout period **Time Delay Between Attempts** setpoint.

The **Time Delay Between Attempts** setpoint can be set with IntelliLink Setup Software or via SCADA. (See Instruction Sheet 1023-530, “S&C IntelliCap® Plus Automatic Capacitor Control: *Setup*” 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** commands 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** function. When using this function, set the **Count** value in the Control Block to “1” and the **Code** value to “1.” Set the **Trip/Close** command 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** command 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 the DNP V 3.00 Basic 4 Document Set, 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 4”) 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 Table 10 on Page 17. Object 32, variation 4 (“Analog Change Event - Variation 4”) 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 **Online** 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.

### Note 5: 8-Bit Unsigned Integer

This object provides efficient access to all types of memory-mapped data. All virtual memory locations are addressed using 16-bit absolute address identifiers in the **Range** field (qualifier code 4), least significant byte (LSB) first.

To perform a write to general memory, make sure the high bytes of the addresses do not span virtual memory regions or multiple tables and the low bytes of the addresses are in ascending order.



**Implementation Table**

This section describes the 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.

Table 10. DNP Implementation					
OBJECT			REQUEST		RESPONSE
Obj	Var	Description	Func Code (dec)	Qualifier Codes (hex)	Default Var. (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 (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	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	

CONTINUED ►

# DNP Implementation

**Table 10. DNP Implementation—Continued**

OBJECT			REQUEST		RESPONSE
Obj	Var	Description	Func Code (dec)	Qualifier Codes (hex)	Default Var. (hex)
30	0	Analog Input - All Variations	1	06	
30	4	16-Bit Analog Input Without Flag			00
32	0	Analog Change Event - All Variations (object parsed but no data to return)	1	06,07,08	Variation 4
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 (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
102	0	8-Bit Unsigned Integer (see note 5)	1	04	04
102	1	8-Bit Unsigned Integer (see Note 5)	1,2	04	04
		No Object	13		
		No Object	23		