

DNP Points List and Implementation

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DNP Points List for 5801 Controls

This instruction sheet provides Distributed Network Protocol (DNP) points and DNP implementation information for S&C 5800 Series Automatic Switch Controls applied in an S&C IntelliTeam® Automatic Restoration System. Points are listed separately for 5801 controls and for 5802/3 controls.

This Points List section is used with **SNCD2A1X Rev. 2.30**. Other related software component version information is found on the *Setup>General>Revisions* screen.

The DNP master station should define the 5801 Control with the following Status, Analog Input, Analog Output, Counter, and Control points:

Point	Count
Status	47
Analog Input	17
Analog Output	5
Counter	2
Control	8

For a specific SCADA system, typically all 5801 switch controls operate with the same DNP point index configuration.

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



5801 Status Points

Table 1. 5801 Status Points

Code #	Name—Definition
0	Switch Open Contact Status —On when the switch (circuit) is open. Otherwise, off.
1	Switch Closed Contact Status —On when the switch (circuit) is closed. Otherwise, off.
2	Switch Disabled —On when switch operation is in the Disabled state. This is a summary point that reports for conditions that disable switch operation. Otherwise, off.
3	Automatic Operation Enabled —On when the Automatic Operation mode is enabled using either the faceplate switch or a SCADA command. Otherwise, off.
4	REMOTE/LOCAL Faceplate Switch Position —On when the faceplate switch is set to Remote mode, and local operation of the switch from the faceplate is blocked. In Local mode, operation of the switch from the SCADA master station is blocked. Otherwise, off.
5	Overcurrent Fault Detected —On when the fault-detection circuitry detects a line-fault condition that has not been reset by the SCADA operator. For a normally closed switch, line-fault condition clears automatically when three-phase line voltage has been sensed, the switch is closed, and 45 minutes have elapsed. Also clears when the faceplate REMOTE/LOCAL switch is toggled. For a normally open switch, toggle the REMOTE/LOCAL switch to clear the condition, and the line switch can be either open or closed. Otherwise, off. Note: If the conditions above are met and the switch control is reinitialized by software or a SCADA operator command, the fault condition is also cleared.
6	Sectionalizer Tripped —On when the switch opened automatically; cleared when the switch is closed for any reason, the switch control is reinitialized by software, or the REMOTE/LOCAL switch is toggled. Otherwise, off.
7	Battery Maintenance Required —On when maintenance is required, typically battery replacement, unless the control is operating or has recently been operating on battery power. Otherwise, off.
8	Maintenance Required —On when some form of maintenance (other than battery replacement) is required, the battery charger has failed due to over voltage, the switch Open/Close contacts are not mutually exclusive, or the controls cannot operate as a team. This is a summary point. The exact cause of the problem can be determined from inspection of the other status points. Otherwise, off.
9	Open/Close Switch Position Indication Is Inconsistent —On when either both indicator contacts are closed, or both are open. Otherwise, off.
10	Control Power Failure —On when ac control power is not available to the battery charger; it indicates the switch control is operating on battery backup. Otherwise, off.
11	Operator Failure Override Set —On after the operator sends the Failure Override Latch On command to let the switch be operated when battery power is low. This point goes off when the override is disabled using the Failure Override Latch Off command. Also, this point goes off and Failure Override mode is disabled after a 15-minute timeout if it was not already turned off by the Latch Off command. Otherwise, off.
12	Battery System Low —On when battery voltage is low but the switch will operate. Otherwise, off.
13	Battery System Bad —On when battery voltage is too low to operate the switch. This condition blocks operation of the switch unless Failure Override mode is set. The Bad Battery status point is only set when the battery voltage is too low to operate the switch. Otherwise, off.
14	Battery Charger Problem —On when the charging voltage applied to the battery system was too high and the charger has been turned off. Otherwise, off.
15	Battery Test in Progress —On when the switch control periodically tests the batteries. Battery voltage fluctuates during the test. Otherwise, off.
16	Cabinet Door Open —On when the enclosure door is open. When the door is closed this point is off and all power to the faceplate LEDs is turned off. Otherwise, off.
17	Temperature Sensor Bad —On when the temperature sensor is reading out of range. Temperature-related correction factors will not be accurate when the sensor is incorrect. Otherwise, off.

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Table 1. 5801 Status Points—Continued

Code #	Name—Definition
18	<p>Phase A Overcurrent Fault—On when the peak current measured on Phase A exceeded the programmed fault-threshold level continuously for at least the programmed period of time. For a normally closed switch, this point is cleared automatically when ac power has been restored to all phases, the switch is closed, and 45 minutes have elapsed. For a normally open switch, toggle the REMOTE/LOCAL switch to clear the condition, and the line switch can be open or closed. Otherwise, off.</p> <p>Note: If the conditions above are met and the switch control is reinitialized by software or a SCADA operator command, the fault condition also clears.</p>
19	Phase B Overcurrent Fault —As noted in Status Point 18, for Phase B. Otherwise, off.
20	Phase C Overcurrent Fault —As noted in Status Point 18, for Phase C. Otherwise, off.
21	Overcurrent Ground Fault —As noted in Status Point 18, for ground. Otherwise, off.
22	Loss of Voltage on Any Configured Voltage Channel —On when a voltage sensor shows Loss of Voltage status. Otherwise, off.
23	<p>Phase A Reverse Current—On when the current on Phase A is flowing in the direction opposite to the Normal Direction setting configured in the switch control. The switch control identifies a Reverse Current condition when the voltage-current phase angle deviates more than 90 degrees from the Unity Power Factor value set during installation. Otherwise, off.</p>
24	Phase B Reverse Current —As noted in Status Point 23, for Phase B. Otherwise, off.
25	Phase C Reverse Current —As noted in Status Point 23, for Phase C. Otherwise, off.
26	<p>Application Layer Confirmation Requests—On when requests for application layer confirmations by the switch control are enabled. When enabled, the switch control requests a confirmation of receipt from the master station for every application data response generated. When the switch control does not receive a confirmation within the Time Delay Between Attempts setpoint, it issues another data response with a request for confirmation. The Number of Confirmation Attempts setpoint determines the maximum number of times the switch control will reissue a request when it does not receive a confirmation. Otherwise, off.</p>
27	Automatic Transfer Event Status —On when a Transfer operation is in progress. Otherwise, off.
28	Return to Normal Event Status —On when a Return-to-Normal operation is in progress. Otherwise, off.
29	Team Mode Enabled —On when the Features Enabled field for this team includes Automatic Team Operation mode. Otherwise, off.
30	Removed From Team —On when the local switch control is not an active member of the team. Otherwise, off.
31	Clearing Stop Transfer Inhibited —On when the switch control cannot clear a Stop Transfer state. Otherwise, off.
32	Stop Transfer Process —On when the Transfer process is stopped. Otherwise, off.
33	Return to Normal Mode Mismatch —On when not all team members are configured with the same Return to Normal mode. Otherwise, off.
34	Timestamp Mismatch —On when the timestamp is mismatched among team members. Otherwise, off.
35	Database Sequence Number Mismatch —On when the database sequence number is mismatched among team members. Otherwise, off.
36	Stop Transfer and Communications —On when the Transfer process and communications are stopped. Otherwise, off.
37	Configuration Process —On when the Configuration process is active. Otherwise, off.
38	<p>Bad Address Table—On when the address table has incorrect information. Otherwise, off.</p> <p>Note (Points 31 through 38): If there is no record for the local switch control in the team database, these status points are not valid.</p>
39	Transfer Process State —On when the team is ready to perform an Automatic Transfer operation. Otherwise, off.

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5801 Status Points

Table 1. 5801 Status Points—Continued

Code #	Name—Definition
40	Synchronized —On when the team Database Sequence Number and Time values are synchronized. Otherwise, off.
41	Stop Transfer State —On when any switch control in the team is in a Stop Transfer state. Otherwise, off.
42	Stop Transfer and Communications State —On when any switch control in the team is in a Stop Transfer state and has a communication problem. Otherwise, off.
43	Address Table Problem —On when any switch control in the team has a bad address table. Otherwise, off.
44	Configuration Process —On when any switch control in the team is actively in a configuration process. Otherwise, off.
45	Local Record Status —On when no record is found corresponding to the local switch control. Otherwise, off.
46	Return to Normal Mode Summary —On when not all switch controls in the team are in the same Return-to-Normal mode. Otherwise, off.

Table 2. 5801 Analog Input Points

Code #	Name—Definition
0	90% Voltage Reference Standard —A constant, required by protocol implementation to conform to the remote terminal unit (RTU) standard.
1	0% Voltage Reference Standard —A constant, with a value of zero, required by protocol implementation to conform to the RTU standard.
2	Neutral Current —The vector sum of the phase currents on Phases A, B, and C. Current is measured using true RMS techniques. Each count equals one ampere.
3	Current, Phase A —Single-phase true RMS current measured on Phase A. Each count equals one ampere.
4	Current, Phase B —Single-phase true RMS current measured on Phase B. Each count equals one ampere.
5	Current, Phase C —Single-phase true RMS current measured on Phase C. Each count equals one ampere.
6	Voltage, Phase A —Voltage is measured using true RMS techniques and scaled to yield a nominal value of 120 Vac. Configuration of the switch control at installation provides the scaling factors, such as voltage transformer turn ratio, etc. In cases where loads are connected in a Delta (phase-to-phase) configuration, the switch control sensor conditioning module is jumpered to yield phase-to-phase voltage readings. Each count equals 0.1 Vac RMS.
7	Voltage, Phase B —Phase-to-ground or phase-to-phase voltage (depending on setup) measured on Pole B. Each count equals 0.1 Vac RMS.
8	Voltage, Phase C —Phase-to-ground or phase-to-phase voltage (depending on setup) measured on Pole C. Each count equals 0.1 Vac RMS.
9	Phase Angle, on Phase A —Each count equals 0.125 degrees.
10	Phase Angle, on Phase B —Each count equals 0.125 degrees.
11	Phase Angle, on Phase C —Each count equals 0.125 degrees.
12	Single-Phase kvars, Phase A —Kvars (volt-amperes, reactive) are calculated from single-phase true RMS voltage and current sensor values and the respective voltage-current phase angle. Each count equals one kvar.
13	Single-Phase kvars, Phase B —As noted in Analog Input Point 12, for Phase B.
14	Single-Phase kvars, Phase C —As noted in Analog Input Point 12, for Phase C.
15	Cabinet Temperature —Reported in units of degrees Fahrenheit. Each count equals one degree.
16	Battery Voltage —Nominally 24 Vdc. When ac power is on, this value is updated only during battery testing. When ac power is off, this value is continuously updated. One count equals 0.035 Vdc.

5801 Analog Output Points

Table 3. 5801 Analog Output Points

Code #	Name—Definition
0	<p>Application Layer Confirmation Retry Time—This is the length of time the switch control waits for an application layer confirmation on a response message before re-sending the response. It uses timer byte format. 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.</p>
1	<p>Application Layer Confirmation Retry Count—The number of times (0 to 10) the switch control sends an event response message without receiving a confirmation. This number 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, the time (10 to 1000 tenths of a second) allowed to elapse between receiving the Select function for a point and receiving the Operate function for it. If an Operate function is not received within this period, the point is de-selected and another Select function is required before the point will operate. This uses timer byte format.</p>
3	<p>Real-Time Loading on Right Feeder—Total averaged three-phase feeder loading (10 amperes to maximum source capacity minus 10 amperes), measured at the source breaker. This value is used to determine whether the load can be transferred to another source. Each count equals one ampere.</p>
4	<p>Real-time Loading on Left Feeder—Total averaged three-phase feeder loading (10 amperes to maximum source capacity minus 10 amperes), measured at the source breaker. This value is used to determine whether the load can be transferred to another source. Each count equals one ampere.</p>
	<p>Note: A DNP device with real-time feeder-loading data can use these analog output points to inform the switch controls in a team of the real-time loading at both sources for the team. The team can use the real-time loading data to determine more accurately whether transferring load can be accomplished safely. See the associated setpoints on Page 2 of the <i>Setup>Automatic Operation</i> screen.</p>

5801 Counter Points

Table 4. 5801 Binary Counter Points

Code #	Name—Definition
0	<p>Operation Count—This is the number of switch operations. The counter is incremented on each Close operation. This is a 16-bit counter and will overflow back to zero at 65,535.</p>

Table 5. 5801 Frozen Counter Points

Code #	Name—Definition
0	<p>Frozen Operation Count—This is the number of switch operations before the operation counter received a Freeze command.</p>

Table 6. 5801 Control Points

Code #	Name—Definition
0	Issue the Close/Open Command to the Switch —The Close/Open command may be issued using either the Select/Operate sequence, the Direct Operate function, or the Direct Operate Without Ack function. Both the Trip and Close commands are valid for this point.
1	Issue the Shots-to-Lockout Command to the Switch —This command may be issued using either the Select/Operate sequence, the Direct Operate function, or the Direct Operate Without Ack function. Only a Close command is valid for this point. This command is ignored and returns an error if the switch is not open or Automatic Operation mode is not enabled.
	Note (Points 0 and 1): These commands are ignored and return an error if a Bad Battery condition is active and the Failure Override command has not been issued or if the visual disconnect is open. These commands are ignored when the REMOTE/LOCAL switch is not in the Remote state.
2	Reset (clear) Any Outstanding Overcurrent Fault Conditions Present —This command must be issued using a Pulse On request. The fault condition otherwise remains active for 45 minutes after the switch is closed and ac power is fully restored, or until the REMOTE/LOCAL switch is toggled.
3	Begin a Battery Test Cycle —This command must be issued using a Pulse On request. When ac power is on, the charger is disconnected for several minutes while the test is in progress. When ac power is off, a brief battery impedance test evaluates the battery condition.
4	Enable or Disable the Failure Override State —This command must be issued using the Latch On/Off request in the control relay output block. This allows Open and Close commands to be processed even when the Switch Not Ready condition is active.
5	Enable or Disable Automatic Operation Mode —This command must be issued using the Latch On/Off request in the control relay output block. In Automatic Operation mode, the switch control automatically opens the switch if a pre-configured Reclose Sequence mode is recognized after a detected fault. Note: Automatic Operation mode is not disabled by the faceplate REMOTE/LOCAL switch in the Local state.
6	Enable or Disable Application Layer Confirmations —This command must be issued using the Latch On/Off request in the control relay output block. When enabled, the switch control requests a confirmation from the master station for every response message generated.
7	Enable or Disable Data-Link Layer Confirmations —This command must be issued using the Latch On/Off request in the control relay output block. When enabled, the switch control uses confirmed user data packets for all messages originated by the switch control.

DNP Points List for 5802 and 5803 Controls

This instruction sheet section provides Distributed Network Protocol (DNP) points and DNP implementation information for use with software **PADD2A1X Rev 2.32**. Other related software component version information is found on the *Setup>General>Revisions* screen.

The DNP master station should define 5802/3 Controls with the following Status, D, Analog Input, Analog Output, Counter, and Control points:

Point	Count
Status	63
Analog Input	34
Analog Output	5
Counter	6
Control	11

For a specific SCADA system, typically all 5802/3 switch controls operate with the same DNP point index configuration.

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

Table 7. 5802/3 Status Points

Code #	Name—Definition
0	Switch 1 Open —On when contact is in an Open state. Otherwise, off.
1	Switch 1 Closed —On when contact is in a Closed state. Otherwise, off.
2	Switch 2 Open —On when contact is in an Open state. Otherwise, off.
3	Switch 2 Closed —On when contact is in a Closed state. Otherwise, off.
4	Switch 3 Open —On when contact is in an Open state. Otherwise, off.
5	Switch 3 Closed —On when contact is in a Closed state. Otherwise, off.
6	N.A.
7	Switch 1 Disabled/External Local —On when switch operation is in the Disabled state. This is a summary point that reports for Status Point 22, Battery System Bad. Only this point reports when the LOCAL/REMOTE switch in the motor operator cabinet is set to the Local position. The 5802/5803 switch control has no ability to command switch operation when the motor operator LOCAL/REMOTE switch is set to the Local position. Otherwise, off.
8	Switch 2 Disabled/External Local —On when switch operation is in the Disabled state. This is a summary point that reports for Status Point 17, Battery System Bad. Only this point reports when the LOCAL/REMOTE switch in the motor operator cabinet is set to the Local position. The 5802/5803 switch control has no ability to command switch operation when the motor operator LOCAL/REMOTE switch is set to the Local position. Otherwise, off.
9	Automatic Operation Enabled —On when the Automatic Operation mode is enabled using either the faceplate switch or a SCADA command. Otherwise, off.
10	REMOTE/LOCAL Faceplate Switch Position —On when the faceplate switch is set to Remote mode; local operation of the switch from the faceplate is blocked. In the Local mode, operation of the switch from the SCADA master station is blocked. Otherwise, off.
11	Overcurrent Fault Detected, Switch 1 —On when the fault-detection circuitry detects a line-fault condition that has not been reset by the SCADA operator. For a normally closed switch, line-fault conditions clear automatically when three-phase line voltage has been sensed, the switch is closed, and 45 minutes have elapsed or the faceplate REMOTE/LOCAL switch is toggled. For the normally open switch, the REMOTE/LOCAL switch can be toggled to clear the condition while the line switch is either open or closed. Otherwise, off. Note: When the conditions above are met and the switch control is reinitialized by software or a SCADA operator command, the fault condition also clears.
12	Overcurrent Fault Detected, Switch 2 —As above, for Switch 2. Otherwise, off.
13	Sectionalizer Tripped, Switch 1 —On when the switch opened automatically. Cleared when the switch is closed for any reason. It is also cleared on reinitialization of the switch control by software or by toggling the REMOTE/LOCAL switch. Otherwise, off.
14	Sectionalizer Tripped, Switch 2 —As above, for Switch 2. Otherwise, off.
15	Battery Maintenance Required —On when maintenance is required, typically battery replacement, unless the switch control is operating or has recently been operating on battery power. Otherwise, off.
16	Maintenance Required —On when some form of maintenance (other than battery replacement) is required. It is on when the battery charger has failed because of over voltage, when the switch Open/Close contacts are not mutually exclusive, or when the controls cannot operate as a team. This is a summary point. The exact cause of the problem can be determined from inspection of the other status points. Otherwise, off.
17	Open/Close Indication is Inconsistent, Switch 1 —On when both contacts are closed or open. Otherwise, off.
18	Open/Close Indication is Inconsistent, Switch 2 —On when both contacts are closed or open. Otherwise, off.
19	Control Power Failure —On when ac power is not available to the battery charger. It indicates the switch control is operating on battery backup. Otherwise, off.

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5802/3 Status Points

Table 7. 5802/3 Status Points—Continued

Code #	Name—Definition
20	Operator Failure Override Set —On after the operator sends the Failure Override Latch On command to let the switch be operated when battery power is low. This point goes off when the override is disabled using the Failure Override Latch Off command. Also, this point goes off and Failure Override mode is disabled after a 15-minute timeout, if it was not already turned off by the Latch Off command. Otherwise, off.
21	Battery System Low —On when battery voltage is low, but the switch will operate. Otherwise, off.
22	Battery System Bad —On when battery voltage is too low to operate the switch. This condition blocks operation of the switch unless the Failure Override mode is active. The Bad Battery state is only set when the battery voltage is too low to operate the switch. Otherwise, off.
23	Battery Charger Problem —On when the charging voltage applied to the battery system was too high and the charger was turned off. Otherwise, off.
24	Battery Test In Progress —On when the switch control periodically tests the batteries. The battery voltage fluctuates during a test. Otherwise, off.
25	Cabinet Door Open —On when the enclosure door is open. When the door is closed; this point is cleared and all power to the faceplate LEDs is turned off. Otherwise, off.
26	Temperature Sensor Bad —On when the temperature sensor is reading out of range. Temperature-related correction factors will not be accurate when the sensor is incorrect. Otherwise, off.
27	Phase A Overcurrent Fault, Switch 1 —On when the peak current measured on Phase A exceeds the programmed threshold level continuously for at least the programmed period of time. For a normally closed switch, this point is cleared automatically when ac power is restored to all phases, the switch is closed, and 45 minutes have elapsed or the faceplate REMOTE/LOCAL switch is toggled. For a normally open switch, the REMOTE/ LOCAL switch can be toggled to clear the condition, regardless of whether the line switch is open or closed. Otherwise, off. Note: The fault condition also clears when the conditions above are met and the switch control is reinitialized by a software command or a SCADA operator command.
28	Phase B Overcurrent Fault, Switch 1 —As noted in Status Point 27, for Phase B, Switch 1. Otherwise, off.
29	Phase C Overcurrent Fault, Switch 1 —As noted in Status Point 27, for Phase C, Switch 1. Otherwise, off.
30	Overcurrent Ground Fault, Switch 1 —As noted in Status Point 27, for ground, Switch 1. Otherwise, off.
31	Phase A Overcurrent Fault, Switch 2 —As noted in Status Point 27, for Phase A, Switch 2. Otherwise, off.
32	Phase B Overcurrent Fault, Switch 2 —As noted in Status Point 27, for Phase B, Switch 2. Otherwise, off.
33	Phase C Overcurrent Fault, Switch 2 —As noted in Status Point 27, for Phase C, Switch 2. Otherwise, off.
34	Overcurrent Ground Fault, Switch 2 —As noted in Status Point 27, for ground, Switch 2. Otherwise, off.
35	Loss of Voltage on Any Configured Voltage Channel —On when the voltage sensor on a configured voltage channel shows loss of voltage. Pad-mounted gear may be configured with three voltage sensors or six voltage sensors. Otherwise, off.
36	Phase A Reverse Current, Switch 1 —On when the current on Phase A is flowing in the direction opposite to the Normal Direction setting configured in the switch control. The switch control identifies a Reverse Current condition when the voltage-current phase angle deviates more than 90 degrees from the Unity Power Factor value set during installation. Otherwise, off.
37	Phase B Reverse Current, Switch 1 —As noted in Status Point 36, for Phase B, Switch 1. Otherwise, off.
38	Phase C Reverse Current, Switch 1 —As noted in Status Point 36, for Phase C, Switch 1. Otherwise, off.
39	Phase A Reverse Current, Switch 2 —As noted in Status Point 36, for Phase A, Switch 2. Otherwise, off.
40	Phase B Reverse Current, Switch 2 —As noted in Status Point 36, for Phase B, Switch 2. Otherwise, off.
41	Phase C Reverse Current, Switch 2 —As noted in Status Point 36, for Phase C, Switch 2. Otherwise, off.

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Table 7. 5802/3 Status Points—Continued

Code #	Name—Definition
42	Application Layer Confirmation Requests —On when requests for application layer confirmations by the switch control are enabled. When enabled, the switch control requests a confirmation of receipt from the master station for every application data response generated. When the switch control does not receive a confirmation within the Time Delay Between Attempts setpoint, it issues another data response with request for confirmation. The Number of Confirmation Attempts setpoint determines the maximum number of times the switch control will reissue a request when it does not receive a confirmation. Otherwise, off.
43	Automatic Transfer Event —On when a Transfer operation is in progress. Otherwise, off.
44	Return to Normal Event —On when a Return-to-Normal operation is in progress. Otherwise, off.
45	Team Mode Enabled —On when the Features Enabled field for this team of switch controls includes Automatic Team Operation mode. Otherwise, off.
46	Removed From Team —On when the local switch control is not an active member of the team. Otherwise, off.
47	Clearing Stop Transfer Inhibited —On when the switch control cannot clear a Stop Transfer state. Otherwise, off.
48	Stopped Transfer Process —On when the Transfer process is stopped. Otherwise, off.
49	Return to Normal Mode Mismatch —On when not all team members are configured with the same Return-to-Normal mode. Otherwise, off.
50	Timestamp Mismatch —On when the timestamp is mismatched among team members. Otherwise, off.
51	Database Sequence Number Mismatch —On when the database sequence number is mismatched among team members. Otherwise, off.
52	Transfer and Communications Stopped —On when the Transfer process and communications are stopped. Otherwise, off.
53	Configuration Process Active —On when the Configuration process is active. Otherwise, off.
54	Bad Address Table —On when the address table has incorrect information. Otherwise, off.
	Note (Points 47 through 54): These status points are not valid when there is no record for the local switch control in the team database.
55	Transfer Process Ready —On when the team is ready to perform an Automatic Transfer operation. Otherwise, off.
56	Synchronized —On when the Database Sequence Number and Time values are synchronized for the team. Otherwise, off.
57	Stop Transfer State —On when any switch control in the team is in a Stop Transfer state. Otherwise, off.
58	Stop Transfer and Communications —On when any switch control in the team is in a Stop Transfer state and has a communication problem. Otherwise, off.
59	Address Table Problem —On when any switch control in the team has a bad address table. Otherwise, off.
60	Configuration Process —On when any switch control in the team is actively in a Configuration process. Otherwise, off.
61	Local Record Status —On when no record is found corresponding to the local switch control. Otherwise, off.
62	Return to Normal Mode Problem —On when not all switch controls in the team are in the same Return-to-Normal mode. Otherwise, off.

5802/3 Analog Input Points

Table 8. 5802/3 Analog Input Points

Code #	Name—Definition
0	90% Voltage Reference Standard —A constant required by protocol implementation to conform to the Remote Terminal Unit (RTU) standard.
1	0% Voltage Reference Standard —A constant, with a value of zero, required by protocol implementation to conform to the RTU standard.
2	Neutral Current of Switch 1 —Taken as the vector sum of the phase currents on Phases A, B, and C. Current is measured using true RMS techniques. Each count equals one ampere.
3	Current, Phase A Switch 1 —Single-phase true RMS current measured on Phase A. Each count equals one ampere.
4	Current, Phase B Switch 1 —Single-phase true RMS current measured on Phase B. Each count equals one ampere.
5	Current, Phase C Switch 1 —Single-phase true RMS current measured on Phase C. Each count equals one ampere.
6	Neutral Current of Switch 2 —Taken as the vector sum of the phase currents on Phases A, B, and C. Current is measured using true RMS techniques. Each count equals one ampere.
7	Current, Phase A Switch 2 —Single-phase true RMS current measured on Phase A. Each count equals one ampere.
8	Current, Phase B Switch 2 —Single-phase true RMS current measured on Phase B. Each count equals one ampere.
9	Current, Phase C Switch 2 —Single-phase true RMS current measured on Phase C. Each count equals one ampere.
10	Neutral Current of Switch 3 —Taken as the vector sum of the phase currents on Phases A, B, and C. Current is measured using true RMS techniques and reported in units of one count equals one ampere.
11	Current, Phase A Switch 3 —Single-phase true RMS current measured on Phase A. Each count equals one ampere.
12	Current, Phase B Switch 3 —Single-phase true RMS current measured on Phase B. Each count equals one ampere.
13	Current, Phase C Switch 3 —Single-phase true RMS current measured on Phase C. Each count equals one ampere.
14	Voltage, Phase A Switch 1 —Single-phase voltage measured on Phase A of Switch 1. Voltage is measured using true RMS techniques and scaled to yield a nominal value of 120 Vac. Configuration of the switch control at installation provides the scaling factors, such as voltage transformer turn ratio, etc. In cases where loads are connected in a Delta (phase-to-phase) configuration, the switch control sensor conditioning module is jumpered to yield phase-to-phase voltage readings. Voltage is reported in units of one sensor count equals 0.1 Vac RMS.
15	Voltage, Phase B Switch 1 —Phase-to-ground or phase-to-phase voltage (depending on setup) measured on Pole B, Switch 1. Each count equals 0.1 Vac RMS.
16	Voltage, Phase C Switch 1 —Phase-to-ground or phase-to-phase voltage (depending on setup) measured on Pole C, Switch 1. Each count equals 0.1 Vac RMS.
17	Voltage, Phase A Switch 2 —Phase-to-ground or phase-to-phase voltage (depending on setup) measured on Pole A, Switch 2. Each count equals 0.1 Vac RMS.
18	Voltage, Phase B Switch 2 —Phase-to-ground or phase-to-phase voltage (depending on setup) measured on Pole B, Switch 2. Each count equals 0.1 Vac RMS.
19	Voltage, Phase C Switch 2 —Phase-to-ground or phase-to-phase voltage (depending on setup) measured on Pole C, Switch 2. Each count equals 0.1 Vac RMS.
20	Phase Angle, on Phase A Switch 1 —Each count equals 0.125 degree.
21	Phase Angle, on Phase B Switch 1 —Each count equals 0.125 degree.

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Table 8. 5802/3 Analog Input Points—Continued

Code #	Name—Definition
22	Phase Angle, on Phase C Switch 1 —Each count equals 0.125 degree.
23	Phase Angle, on Phase A Switch 2 —Each count equals 0.125 degree.
24	Phase Angle, on Phase B Switch 2 —Each count equals 0.125 degree.
25	Phase Angle, on Phase C Switch 2 —Each count equals 0.125 degree.
26	Single-Phase kvars, Phase A Switch 1 —Kvars (volt-amperes, reactive) are calculated from single-phase true RMS voltage and current sensor values and the respective voltage-current phase angle. Each count equals one kvar.
27	Single-Phase kvars, Phase B Switch 1 —As noted in Analog Input Point 26.
28	Single-Phase kvars, Phase C Switch 1 —As noted in Analog Input Point 26.
29	Single-Phase kvars, Phase A Switch 2 —As noted in Analog Input Point 26.
30	Single-Phase kvars, Phase B Switch 2 —As noted in Analog Input Point 26.
31	Single-Phase kvars, Phase C Switch 2 —As noted in Analog Input Point 26.
32	Cabinet Temperature —In units of degrees Fahrenheit.
33	Battery Voltage —Nominally 24 Vdc. When ac power is on, this value is updated only during battery testing. When ac power is off, this value is continuously updated. One count equals 0.035 Vdc.

5802/3 Analog Output Points

Table 9. 5802/3 Analog Output Points

Code #	Name—Definition
0	<p>Application Layer Confirmation Retry Time—This is the time the switch control waits for an application layer confirmation to an event response message before re-sending the response. It uses timer byte format. 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.</p>
1	<p>Application Layer Confirmation Retry Count—This is the number of times (0 to 10) the control will send an event response message if a confirmation is not received. This number 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 time (10 to 1000 tenths of a second) allowed to elapse between receiving the Select function for a point and receiving the Operate function for it. If an Operate function is not received within this period, the point is de-selected; another Select function is required before the point will operate.</p>
3	<p>Real-Time Loading on Right Feeder—Total averaged three-phase feeder loading (10 amperes to maximum source capacity minus 10 amperes), measured at the source breaker. This value is used to determine whether the load can be transferred to another source. Each count equals one ampere.</p>
4	<p>Real-Time Loading on Left Feeder—Total averaged three-phase feeder loading (10 amperes to maximum source capacity minus 10 amperes), measured at the source breaker. This value is used to determine whether the load can be transferred to another source. Each count equals one ampere.</p>
	<p>Note: A DNP device with real-time feeder-loading data can use these analog output points to inform the switch controls in a team of the real-time loading at both sources for the team. The team can then use this real-time loading data to determine more accurately whether transferring load can be accomplished safely. See the associated setpoints on the second <i>Setup>Automatic Operation</i> screen.</p>

Table 10. 5802/3 Binary Counter Points

Code #	Name—Definition
0	Operation Count, Switch 1 —This is the number of switch operations. The counter is incremented on each Close operation. This is a 16-bit counter and will overflow back to zero at 65,535.
1	Operation Count, Switch 2 —This is the number of switch operations. The counter is incremented on each Close operation. This is a 16-bit counter and will overflow back to zero at 65,535.
2	Operation Count, Switch 3 —This is the number of switch operations. The counter is incremented on each Close operation. This is a 16-bit counter and will overflow back to zero at 65,535.

Table 11. 5802/3 Frozen Counter Points

Code #	Name—Definition
0	Frozen Operation Count, Switch 1 —This is the number of switch operations before the operation counter received a Freeze command.
1	Frozen Operation Count, Switch 2 —This is the number of switch operations before the operation counter received a Freeze command.
2	Frozen Operation Count, Switch 3 —This is the number of switch operations before the operation counter received a Freeze command.

5802/3 Control Points

Table 12. 6801/2/3 Control Points

Code #	Name—Definition
0	Open or Close Switch 1 —This command may be issued using either the Select/Operate sequence, the Direct Operate function, or the Direct Operate Without Ack function. Both Trip and Close commands are valid for this point.
1	Open or Close Switch 2 —This command may be issued using either the Select/Operate sequence, the Direct Operate function, or the Direct Operate Without Ack function. Both Trip and Close commands are valid for this point.
2	Open or Close Switch 3 —This command may be issued using either the Select/Operate sequence, the Direct Operate function, or the Direct Operate Without Ack function. Both Trip and Close commands are valid for this point.
3	Issue Shots-to-Lockout Command to Switch 1 —This command may be issued using either the Select/Operate sequence, the Direct Operate function, or the Direct Operate Without Ack function. Only a Close command is valid for this point. This command is ignored and returns an error if the switch is not open or the Automatic Operation state is not enabled.
4	Issue Shots-to-Lockout Command to Switch 2 —This command may be issued using either the Select/Operate sequence, the Direct Operate function, or the Direct Operate Without Ack function. Only a Close command is valid for this point. This command is ignored and returns an error if the switch is not open or the Automatic Operation state is not enabled.
	Note (Codes 0–4): These commands are ignored and return an error if a Bad Battery condition is active and the Failure Override command has not been issued, or the external LOCAL/REMOTE switch in the motor operator cabinet associated with the intended position is set to the Local position. These commands are ignored if the LOCAL/REMOTE switch is not in the Remote position.
5	Clear Any Outstanding Overcurrent Fault Conditions Present —This command must be issued using a Pulse On request. The fault condition otherwise remains active for 45 minutes, after the switch is closed and ac power is fully restored, or until the REMOTE/LOCAL switch is toggled.
6	Begin Battery Test Cycle —This command must be issued using a Pulse On request. When ac power is on, the charger is disconnected for several minutes while the test is in progress. When ac power is off, a brief battery impedance test evaluates the battery condition.
7	Enable/Disable Failure Override State —This command must be issued using the Latch On/Off request in the control relay output block. This allows Open and Close commands to be processed even if the Switch Not Ready condition is active.
8	Enable/Disable Automatic Operation Mode —This command must be issued using the Latch On/Off request in the control relay output block. In Automatic mode, the switch control automatically opens the switch if a pre-configured Reclose Sequence is recognized after a detected fault. Note: The Automatic Operation state is not disabled when the faceplate REMOTE/LOCAL switch is set to the Local state.
9	Enable/Disable Application Layer Confirmations —This command must be issued using the Latch On/Off request in the control relay output block. When enabled, the switch control requests a confirmation from the master station for every response message generated.
10	Enable/Disable Data-Link Layer Confirmations —This command must be issued using the Latch On/Off request in the control relay output block. When enabled, the switch control uses confirmed user data packets for all messages originated by the switch control.

DNP Implementation

Timeouts while waiting for:

Data Link Confirm	X	None	<input type="checkbox"/>	Fixed	<input type="checkbox"/>	Variable	<input type="checkbox"/>	Config
Complete Appl. Fragment	X	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	X	Config
Complete Appl. Response	X	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 on page 20 for explanation)

Sends/Executes Control Operations:

Write Binary Outputs	X	Never	<input type="checkbox"/>	Always	<input type="checkbox"/>	Sometimes	<input type="checkbox"/>	Config
Select/Operate	<input type="checkbox"/>	Never	<input type="checkbox"/>	Always	X	Sometimes	<input type="checkbox"/>	Config
Direct Operate	<input type="checkbox"/>	Never	<input type="checkbox"/>	Always	X	Sometimes	<input type="checkbox"/>	Config
Direct Operate - NO ACK	<input type="checkbox"/>	Never	<input type="checkbox"/>	Always	X	Sometimes	<input type="checkbox"/>	Config

Count > 1	X	Never	<input type="checkbox"/>	Always	<input type="checkbox"/>	Sometimes	<input type="checkbox"/>	Config
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Pulse On	<input type="checkbox"/>	Never	<input type="checkbox"/>	Always	X	Sometimes	<input type="checkbox"/>	Config
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Pulse Off	X	Never	<input type="checkbox"/>	Always	<input type="checkbox"/>	Sometimes	<input type="checkbox"/>	Config
-----------	---	-------	--------------------------	--------	--------------------------	-----------	--------------------------	--------

Latch On	<input type="checkbox"/>	Never	<input type="checkbox"/>	Always	X	Sometimes	<input type="checkbox"/>	Config
----------	--------------------------	-------	--------------------------	--------	---	-----------	--------------------------	--------

Latch Off	<input type="checkbox"/>	Never	<input type="checkbox"/>	Always	X	Sometimes	<input type="checkbox"/>	Config
-----------	--------------------------	-------	--------------------------	--------	---	-----------	--------------------------	--------

Queue	X	Never	<input type="checkbox"/>	Always	<input type="checkbox"/>	Sometimes	<input type="checkbox"/>	Config
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Clear Queue	X	Never	<input type="checkbox"/>	Always	<input type="checkbox"/>	Sometimes	<input type="checkbox"/>	Config
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Attach explanation if "Sometimes" or "Configurable" was checked

(see Note 2 on page 20 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 on page 20)	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 on page 20)
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 - 6 <input type="checkbox"/> Point-by-point list attached	Counters Roll Over at: <input type="checkbox"/> No Counters Reported <input type="checkbox"/> Configurable (explain) <input checked="" 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 a data-link confirmation (during a request to reset the transmit link) or an application layer response confirmation is requested, the switch control waits before sending another response/confirmation attempt (if the retry number has not been reached) or stopping the confirmation process. Both confirmation requests use the same timeout period (the **Time Delay Between Attempts** function).

The **Time Delay Between Attempts** function can be set with the setup software or via SCADA. See S&C Instruction Sheet 1042-530, “S&C 5800 Series Automatic Switch Controls With IntelliTeam Automatic Restoration Software: *Setup*,” for more information.

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.

The **Trip/Close** bits must be used for these functions in the control block. Set the **Count** value to “1” and the **Code** value to “NUL” (0) or “1.” The switch control ignores the **On-Time** and **Off-Time** values and the **Queue** and **Clear** flags in the control code.

For all momentary bit operations, the **Pulse On** function must be used. When using the **Pulse On** function, set the **Count** value to “1” and the **Code** value to “1.” Set the **Trip/Close** state to “NUL” (0). The switch control ignores the **On-Time** and **Off-Time** values and the **Queue** and **Clear** flags in the control code.

For all latching bit operations, 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** mode or “4” for **Latch Off** mode. Set the **Trip/Close** state to “NUL” (0). The switch control ignores the **On-Time** and **Off-Time** values and the **Queue** and **Clear** flags in the control code.

For more information, see the “Control Relay Output Block” section of the document object library in “IEEE std 1815-2012” available from the DNP Users Group.

NOTE 3: Unsolicited Responses

The switch control returns unsolicited responses to the configured master station address when a change occurs in any mapped status point or when the device is restarted. For the 2852-SC, Object 2, Variation 2 (“Binary Input Change with Time”) is returned.

The unsolicited responses can be enabled or disabled from the setup software or via SCADA (Function Code 20 to enable; Function Code 21 to disable).

Table 14. Implementation

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 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 on page 23)	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 5 on page 23)			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	

DNP Implementation

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	
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
102	0	8-Bit Unsigned Integer (see Note 6 on page 23)	1	04	04
102	1	8-Bit Unsigned Integer (see Note 6 on page 23)	1,2	04	04
No Object			13		
No Object			23		

NOTE 4: Change Event Objects

This is the default object returned in the unsolicited report by exception (if enabled) and the default object for a Class 1 data request. **Note:** The maximum number of records returned in one packet for this object is 29. Returning 29 records will cause 232 bytes of data to be returned; with overhead, this makes almost a full packet. If more than 29 status-change records exist, the remaining records can be retrieved with an additional request.

NOTE 5: Binary Output Status

In a response to a **Binary Output Status** request, the switch 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.

The state of all digital bits (controlled and not controlled) can be inspected by using the **Binary Input** object.

NOTE 6: Polling Class

DNP points are assigned to polling classes. S&C Automatic Controls implement Class 0 for static data, and Classes 1, 2, and 3 for event data. The Class 0 poll response contains all DNP points assigned to Classes 0, 1, 2, or 3 and their most recent static value. The Class 1, 2, or 3 polls return event data, and any DNP point whose value has changed since the last event response message was transmitted. Polling frequency is an aspect of the user's SCADA system and is user selectable.