DNP Points List and Implementation With Voltage and Current Sensing Option

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DNP Points List

This instruction sheet provides DNP points and DNP implementation information for S&C M Series Switch Operator with the Voltage and Current Sensing option.

This Points List section is used with **MORD2S0X-5.04**.

The DNP master station should define M Series Switch Operator with the following status, analog input, analog output, and control points:

Point	Count
Status	54
Analog Input	32
Analog Output	3
Binary Counter	1
Frozen Counter	1
Control	11

The points are defined in the following tables. Unless otherwise noted, each bit is set if the condition is logically true or active. Points defined as Reserved are unused in this implementation but reserved for compatibility with past or future products.

Status Points

Code #	Name—Definition
0	**Open Status—**Switch Operator *Open* actuator status. This bit is set if the actuator is positioned within the Open actuator limit range, and the most recent switch operation completed without the Switch Operator detecting that the actuator was disengaged from the motor operator rod.
1	**Closed Status—**Switch Operator *Closed* actuator status. (As above)
2	**Motor Disabled—**Motor operator disabled (not ready). This bit is set when normal, high speed operation of the switch is blocked. If *Not Override Ready* is also active (see Status Point 50), even emergency close/open operations are blocked.
3	**Automatic Operation Enabled—**This bit is set when the faceplate Automatic Operation ENABLE/DISABLE switch is in the ENABLE position.
4	**SCADA Control Enabled—**REMOTE/LOCAL faceplate switch position. This bit is set when the switch is in the REMOTE position. In the REMOTE position, local operation of the switch from the faceplate is blocked. In the LOCAL position, operation of the switch from the SCADA master station is blocked.
5	**Overcurrent Fault Detected—**This bit is set if the fault indicators have detected an overcurrent condition. The bit is cleared when the fault detector hardware resets. (Refer to the fault indicator instruction manual for a complete description of its operation.) See Status Points 18 through 21 for an indication of which phase(s) have active fault indications.
6	**Sectionalizer Tripped—**This bit is set when Automatic Sectionalizing is enabled and has initiated an Open operation of the switch due to a detected recloser operation in response to a load-side fault. The bit is cleared when the switch is closed for any reason.
7	**Combination Battery—**This bit is set if the battery is low or bad. This bit indicates that maintenance is required (probably battery replacement).
8	**Maintenance Required—**This bit is set when some form of maintenance (other than battery replacement) is required. This is a summary bit. The exact cause of the failure can be determined from the inspection of other status points.
9	**Open/Close Indication is Inconsistent—**Open/Close switch position uncertain or not within the normal Open or Closed range. This bit is set when the switch is not in the open or closed position.
10	**AC Control Power Not Present—**This bit is set when ac power is not present at the Battery Charger/Control I/O module.
11	Reserved.
12	**Battery Low—**This bit is set when the battery is approaching a state in which it will be unable to operate the switch properly.
13	**Battery Bad—**This bit is set when the battery has discharged to a state in which it is unable to operate the switch properly.
14	**Battery Charger Bad—**This bit is set when the battery is being charged at an abnormally high voltage. Once this condition is detected, the charger is shut down; this means the condition may be indicated even if the battery voltage appears normal. It is cleared on a successful battery test.
15	**Battery Test in Progress—**The Switch Operator automatically performs a test procedure on the batteries at periodic intervals. During the test, the battery voltage fluctuates.
16	**Cabinet Door Open—**This bit is set when the Switch Operator enclosure door is open. When the door is closed, this bit is cleared and all power to the faceplate LEDs is turned off.
17	**Internal Temperature Sensor Bad—**This bit is set when the Switch Operator's internal temperature sensor reads outside its valid range. When the sensor is reading incorrectly, various temperature-related correction factors will not be accurate.

CONTINUED ▶

Status Points—Continued

Code #	Name—Definition
18	**Phase A Overcurrent Fault—**This bit is set if the (optional) fault indicator for Phase A has recently detected overcurrent.
19	**Phase B Overcurrent Fault—**As above, for Phase B.
20	**Phase C Overcurrent Fault—**As above, for Phase C.
21	**Overcurrent Ground Fault—**As above, for Ground.
22	**Ac Power Failure—**At least one of the three phases has lost voltage.
23	**Phase A Current Direction—**This bit is set if the current on Phase A is flowing in the direction opposite to the normal direction configured in the Switch Operator. The Switch Operator identifies reverse current when value set during installation for unity power factor.
24	**Phase B Current Direction—**As above, for Phase B.
25	**Phase C Current Direction—**As above, for Phase C.
26	**Application Layer Confirmation Requests—**This bit is set when requests for application layer confirmations by the Switch Operator are enabled. If enabled, the Switch Operator requests a confirmation of receipt from the master station for every application data response generated. If the Switch Operator does not receive a confirmation within the *Time Delay Between Attempts*, it issues another data response with request for confirmation. The *Number of Confirmation Attempts* setpoint determines the maximum number of times the Switch Operator will reissue a request if it does not receive a confirmation.
27	**External Temperature Sensor Bad—**This bit is set when the Switch Operator's external temperature sensor reads outside of its valid range.
28	**Decoupled—**This bit is set when the Switch Operator detects that the switch is decoupled from the operator. It is cleared by entering *Align* mode and jogging the operator into the operating range.
29	**Motor Overload on Last Operation Detected—**This bit is set when the Switch Operator detected a motor overload on the last operation. It is automatically cleared on the next operation. The Switch Operator detects a motor overload by monitoring the voltage and current draw to the motor. The overload causes the motor to shut down after a brief delay, regardless of the output actuator position.
30	**Operation Undershoot on Last Operation—**This bit is set when the switch did not reach a fully open or fully closed position on the last operation. This is usually caused by blockage in the switch contacts or external linkages.
31	**Closed Operation Overshoot—**This bit is set when the Switch Operator traveled too far on the last close operation. It is cleared on the next switch operation.
32	**Inspection Required—**This bit is set when inspection of the switch installation is required (after a motor overload or an undershoot on an open or close operation). This condition prevents normal operation of the switch, but allows override operation. It is cleared by toggling the faceplate ENABLE/DISABLE switch.
33	**Calibration Required—**This bit is set when the output actuator travel limits need to be reset. This condition is set, for example, when an encoder error or an undershoot on an open operation occurs. This condition prevents normal, high speed operation of the switch, but allows emergency override operation. It is cleared by setting the limits of travel.
34	**Unrecoverable Error Detected—**This bit is set when an internal error has been detected. It is cleared by selecting the *Clear these errors* field on the *TROUBLESHOOTING: Event Status* screen via directly-connected PC.
35	**Motor Overload During Low Torque Operation—**This bit is set when a motor overload is detected on the last jog operation. It is cleared by selecting the *Clear these errors* field on the *TROUBLESHOOTING: Event Status* screen via directly-connected PC.

CONTINUED ▶

Status Points—Continued

Code #	Name—Definition
36	**Motor Overload Error Detected on High Speed Operation—**This bit is set when a motor overload error is detected on a high speed operation. It is cleared by selecting the *Clear these errors* field on the *TROUBLESHOOTING: Event Status* screen via directly-connected PC.
37	**Internal Bad Command Detected—**This bit is set when the software is requested to perform an undefined type of operation. This is an impossible operating condition and should be regarded as a microprocessor failure.
38	**Internal Bad State Detected—**This bit is set when the software moves into an invalid operating state. This is an impossible operating condition and should be regarded as a microprocessor failure.
39	**Bad Encoder Checksum Detected—**This bit is set when the Switch Operator detects corruption of the information related to the absolute position of output actuator. The drive train position is considered invalid and thus requires resetting of the travel limits.
40	**Bad Encoder Checksum at Operation Start.—**This bit is set when the condition described above is detected on a power-up of the Switch Operator. The drive train position is considered invalid and thus requires resetting of the travel limits.
41	**Bad Encoder Range Detected—**This bit is set when the Switch Operator detects an impossible position of the output actuator (beyond the absolute operating range of the drive train). The drive train position is considered invalid and thus requires resetting of the travel limits.
42	**Bad Encoder Range at Operation Start Detected.—**This bit is set when the condition described above is detected on a power-up of the control. The drive train position is considered invalid and thus requires resetting of the travel limits.
43	**Bad Encoder in Use at Operation Start Detected—**This bit is set after the Switch Operator fails catastrophically during a switching operation. The drive train position is considered invalid and thus requires resetting of the travel limits.
44	**Bad Encoder Runaway Detected—**This bit is set when substantial motion of the drive train is detected without an operation being underway. Because the drive train gearbox is mechanically self-locking, this generally indicates some form of catastrophic failure of the gearbox or shaft position encoder.
45	**Bad Encoder Drift Detected—**This bit is set when slight motion of the drive train is detected without an operation being underway. Because the drive train gearbox is mechanically self-locking, this generally indicates some form of catastrophic failure of the gearbox or shaft position encoder.
46	**Overshoot on Open Operation Detected on Last Operation—**This bit is set when the Switch Operator traveled too far on the last open operation. It is cleared by selecting the *Clear these errors* field on the *TROUBLESHOOTING: Event Status* screen via directly-connected PC.
47	**Handle Not Stowed—**This bit is set when the manual operating handle is not stowed on the faceplate.
48	**Limits of Travel Spacing Bad—**This bit is set when the closed and open travel limits are more than 180° apart. This condition prevents both normal and override operation of the switch.
49	**Manufacturing Variance Not Set—**This bit is set when the manufacturing variance setpoints have not been set. It is cleared by running the hardware diagnostics and saving the results. (See the *HARDWARE DIAGNOSTICS* screen.)
50	**Not Override Ready—**This bit is set when *Not Ready* conditions which block normal, high speed operation of the switch cannot be overridden using the emergency close/open operations.
51	**In Align Mode—**This bit is set when the Switch Operator is in *Low Speed* or *Align* mode. Active, normal, high speed switching operations are blocked, and faceplate CLOSE/OPEN operations cause slow or *jogging* movement of the output actuator. In addition, the faceplate NOT READY LED blinks.

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Status Points—Continued

Code #	Name—Definition
52	**Limits of Travel Not Set—**This bit is set when the closed and/or open travel limit needs to be set.
53	**Battery Test Hardware Bad—**This bit is set when a battery test hardware failure is detected during a battery test. The cause may be a malfunctioning battery test relay, battery load test resistor problem, or wiring problem. It is cleared on a successful battery test.

Analog Input Points

Analog Input Points

Code #	Name—Definition
0	**90% Voltage Reference Standard—**This is provided for the benefit of the protocol implementation to conform to the RTU standard. It is loaded as a constant.
1	**0% Voltage Reference Standard—**This is provided for the benefit of the protocol implementation to conform to the RTU standard. It is loaded as a constant with the value zero.
2	**Neutral Current, 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 1 count equals 1 ampere.
3	**Single-Phase Current Measured on Phase A—**Current is measured using true RMS techniques and reported in units of 1 count equals 1 ampere.
4	**Single-Phase Current Measured on Phase B—**Current is measured using true RMS techniques and reported in units of 1 count equals 1 ampere.
5	**Single-Phase Current Measured on Phase C—**Current is measured using true RMS techniques and reported in units of 1 count equals 1 ampere.
6	**Single-Phase Voltage Measured on Jaw-Side Phase A—**Voltage is measured using true RMS techniques with a nominal value of 120 Vac. Configuration of the switch control at installation time 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 1 sensor count equals 0.1 Vac RMS.
7	**Single-Phase Voltage Measured on Jaw-Side Phase B—**As above, for Phase B.
8	**Single-Phase Voltage Measured on Jaw-Side Phase C—**As above, for Phase C.
9	**Phase Angle on Phase A—**Each count equals one eighth of a degree.
10	**Phase Angle on Phase B—**As above, for Phase B.
11	**Phase Angle on Phase C—**As above, for Phase C.
12	**Single-Phase kVARs Measured on 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 Measured on Phase B—**As above, for Phase B.
14	**Single-Phase kVARs Measured on Phase C—**As above, for Phase C.
15	**The Most Recent Cabinet Temperature Reading—**This value is in units of °F.
16	**Battery Voltage, Nominally 24 Vdc.—**If ac power is on, this value is updated only during battery testing. If ac power is off, this value is continuously updated. One count equals 0.035 VDC.

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Analog Input Points—Continued

Code #	Name—Definition
17	**Most Recent External Temperature Reading—**This value is in units of °F.
18	**Switch Operator Actuator Position—**This value is returned as percentage closed, in units of 0.1%.
19	**Battery Hours Remaining Until the Battery Low Warning—**This value is in units of hours.
20	**Single-Phase kW on Phase A—**The kW value is calculated from single phase true RMS voltage and current sensor values. Each count equals one kW.
21	**Single-Phase kW on Phase B—**As above, for Phase B.
22	**Single-Phase kW on Phase C—**As above, for Phase C.
23	**Single-Phase kVA on Phase A—**The kVA value is calculated from single phase true RMS voltage, current sensor values, and the respective voltage current phase angle. Each count equals one kVA.
24	**Single-Phase kVA on Phase B—**As above, for Phase B.
25	**Single-Phase kVA on Phase C—**As above, for Phase C.
26	**Three Phase Sum of kVARs (sum of A, B, and C Phase kVARs)—**Each count equals one kVAR.
27	**Three Phase Sum of kW (sum of A, B, and C Phase kW)—**Each count equals one kW.
28	**Three Phase Sum of kVA (sum of A, B, and C Phase kVA)—**Each count equals one kVA.
29	**Single-Phase Voltage Measured on Hinge-Side Phase A—**Voltage is measured using true RMS techniques with a nominal value of 120 Vac. Configuration of the switch control at installation time provides the scaling factors such as voltage transformer turn ratio. 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 1 sensor count equals 0.1 Vac RMS.
30	**Single-Phase Voltage Measured on Hinge-Side Phase B—**As above, for Phase B.
31	**Single-Phase Voltage Measured on Hinge-Side Phase C—**As above, for Phase C.

Analog Output Points

Code #	Name—Definition
0	**Application Layer Confirmation Retry Time—**This is the length of time the Switch Operator 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. **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.
1	**Application layer confirmation retry count—**This is the number of times the Switch Operator sends a 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.
2	**Control point select time—**During a *Select-Before-Operate* procedure, this is the length of time that may elapse between receiving the *Select* function for a point and receiving the *Operate* function for that same point. If an *Operate* is not received within this time period, the point is deselected and another *Select* is required before the point will operate. It uses *timer byte format*.

Binary Counter Points

Binary Counter Points

Code #	Name—Definition
0	**Operation Counter—**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.

Frozen Counter Points

Frozen Counter Points

Code #	Name—Definition
0	**Frozen Operation Counter—**This is the number of switch operations before the operation counter received a Freeze command.

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 Trip and Close are valid for this point. **NOTE:** These commands are ignored if the *Not Ready* condition (status point 2) is active. These commands are also ignored and return an error if the REMOTE/LOCAL switch is not in the REMOTE position.
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 will fail unless *Sectionalizing* is an enabled feature on the *Automatic Operations* screen, and the control must be in the *Automatic Enabled* mode. **NOTE (Points 0 and 1):** These commands are ignored if the *Battery Bad* condition (status point 3) is active, and the *Failure Override* command has not been issued. Commands are ignored and return an error if the REMOTE/LOCAL switch is not in the REMOTE position.
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 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. If ac power is on, the charger is disconnected while the test is in progress.
4	Reserved.
5	**Enable or Disable Automatic Operation—**This command must be issued using the Latch On/Off request in the control relay output block. In *Automatic* mode, the Switch Operator automatically opens the switch if a pre-configured recloser sequence is recognized after a detected fault. **NOTE:** Automatic sectionalizer operation is not disabled by the faceplate REMOTE/LOCAL switch being in the LOCAL position.
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 Operator 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 Operator uses confirmed user data packets for all messages originated by the Switch Operator.
8	**Override Operation With Automatic Reverse, if the automatic reverse feature is enabled—**The override operation command may be issued using either the Select/Operate sequence, the Direct Operate function, or the Direct Operate without Ack function.
9	**Override Operation Without Automatic Reverse—**The override operation command may be issued using either the Select/Operate sequence, the Direct Operate function, or the Direct Operate without Ack function.
10	**Exit Align Mode—**This command must be issued using a Pulse On request.

This section describes the DNP implementation for the M Series Switch Operator. This implementation of DNP and this section of documentation conform to the document DNP V3.00 Subset Definitions, Version 2.00, available from the DNP Users Group.

Device Profile Description

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

DNP V3.00 DEVICE PROFILE DOCUMENT	
Vendor Name: S&C Electric Company	
Device Name: M Series Switch Operator	
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_____ _____ _____ _____ _____	
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
Requires Data Link Layer Confirmation: X Never __ Always __ Sometimes If 'Sometimes', when? - When requested by the Master. __ Configurable If 'Configurable', how? - Response confirmations are configured through SCADA communications or through locally connected setup software.	

```
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?
    X  Configurable  If 'Configurable', how? - Response confirmations are configured
                     through SCADA communications or through locally connected
                     setup software.
```

```
Timeouts while waiting for:
    Data Link Confirm          X  None  __ Fixed  __ Variable  __ Config
    Complete Appl. Fragment    X  None  __ Fixed  __ Variable  __ Config
    Application Confirm        __ None  __ Fixed  __ Variable  X  Config
    Complete Appl. Response    X  None  __ Fixed  __ Variable  __ Config
    Others _____________________________________________________________
    Attach explanation if 'Variable' or 'Configurable' was checked
    (see Note 1 below for explanation)
```

```
Sends/Executes Control Operations:
    WRITE Binary Outputs      X  Never  __ Always  __ Sometimes  __ Config
    SELECT/OPERATE            __ Never  __ Always  X  Sometimes  __ Config
    DIRECT OPERATE            __ Never  __ Always  X  Sometimes  __ Config
    DIRECT OPERATE - NO ACK   __ Never  __ Always  X  Sometimes  __ Config

    Count > 1                 X  Never  __ Always  __ Sometimes  __ Config
    Pulse On                  __ Never  __ Always  X  Sometimes  __ Config
    Pulse Off                 X  Never  __ Always  __ Sometimes  __ Config
    Latch On                  __ Never  __ Always  X  Sometimes  __ Config
    Latch Off                 __ Never  __ Always  X  Sometimes  __ Config

    Queue                     X  Never  __ Always  __ Sometimes  __ Config
    Clear Queue               X  Never  __ Always  __ Sometimes  __ 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 X Only non-time-tagged __ Configurable to send both	Reports time-tagged Binary Input Change Events when no specific variation requested: __ Never X Binary Input Change with Time __ Bin In Change Relative Time __ Configurable (explain)
Sends Unsolicited Responses: __ Never X Configurable (explain) __ Only certain objects __ Sometimes (explain) __ ENABLE/DISABLE UNSOLICITED Function codes supported (see Note 3 below)	Sends Static Data in Unsolicited Responses: __ Never __ When Device Restarts X When Status Flags Change No other options are permitted. (see Note 3 below)
Default Counter Object/Variation: __ No Counters Reported __ Configurable (explain) X Default Object - 20 __ Default Variation - 6 __ Point-by-point list attached	Counters Roll Over at: __ No Counters Reported __ Configurable (explain) X 16 Bits __ 32 Bits __ Other Value _____ __ Point-by-point list attached
Sends Multi-Fragment Responses (Slave Only): X Yes __ No	

NOTE 1: Timeouts While Waiting for Confirmations

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

You can set the *Time Delay Between Retries* with the Setup software or via SCADA. (See the *Setup* instruction sheet for more details.)

NOTE 2: Control Operations Executed

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

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

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

You must use the *Trip/Close* bits for these functions in the Control Block. Set the *Count* value to "1" and the *Code* value to "NUL" (0) or "1". The Switch Operator 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 *Pulse On*, set the *Count* value to "1" and the *Code* value to "1." Set the *Trip/Close* to "NUL" (00). The Switch Operator ignores the *On-Time* and *Off-Time* values and the *Queue* and *Clear* flags in the Control Code.

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

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

NOTE 3: Unsolicited Responses

The Switch Operator returns unsolicited responses to the configured master station address when a change occurs in any mapped status point or when the device is restarted. Object 2, variation 2 ("Binary Input Change with Time") is returned.

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

Implementation Table

This section describes which objects and requests this implementation accepts and which responses are returned. Object, Variation, and Qualifier Codes in the request must exactly match what is expected; otherwise, the Switch Operator 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)	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 the on-line bit is used)			00
12	1	Control Relay Output Block	3,4, 5,6	17,28	echo of request

OBJECT			REQUEST		RESPONSE
Obj	Var	Description	Func Code (dec)	Qualifier Codes (hex)	Default Var. (hex)
20	0	Binary Counter - All Variations	1,7, 8,9,10	06	
20	6	16-Bit Binary Counter without Flag			00
21	0	Frozen Counter - All Variations	1	06	
21	10	16-Bit Frozen Counter without Flag			00
22	0	Counter Change Event - All Variations (object parsed but no data to return)	1	06,07,08	

OBJECT			REQUEST		RESPONSE
Obj	Var	Description	Func Code (dec)	Qualifier Codes (hex)	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	17,18	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)	1	04	04
102	1	8-Bit Unsigned Integer (see Note 6)	1,2	04	04
No Object			13		
No Object			23		

NOTE 4: Binary Input Change with Time

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 that the maximum number of records returned in one packet for this new 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, you can retrieve the remaining records with an additional request.

NOTE 5: Binary Output Status

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

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

NOTE 6: 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 that the high bytes of the addresses do not span virtual memory regions or multiple tables, and that the low bytes of the addresses are in ascending order.

This is available for SCADA implementation, but is not required.