DIGSI 5 QUICK NOTES
DIGSI-5-QN0021: DNP 3.0 and Time stamps

In DIGSI 5, communication mapping provides the options to map the DNP3 signals to transmit (to SCADA) or to receive (from SCADA).

When a signal needs to be transmitted to SCADA, it should be configured under Transmit column in the communication mapping screen. Once the signal is routed to the 'Transmit' column, DIGSI will indicate the Object group type as Object group 01 or Object group 30 depending on the signal type:

- Object group 01 is used for indication for e.g. SPS type (Single Point Status).
- Object 30 will be used for Analogue values for e.g. MV type (Measured Value).

The user needs to assign the DNP3 index and class for that particular signal. While there is a dropdown menu for selecting Object group, it only gives one option (Object 1 for binary points and Object 30 for Analogue values). There is no option (or need) to select for example Object group 02 for binary inputs.

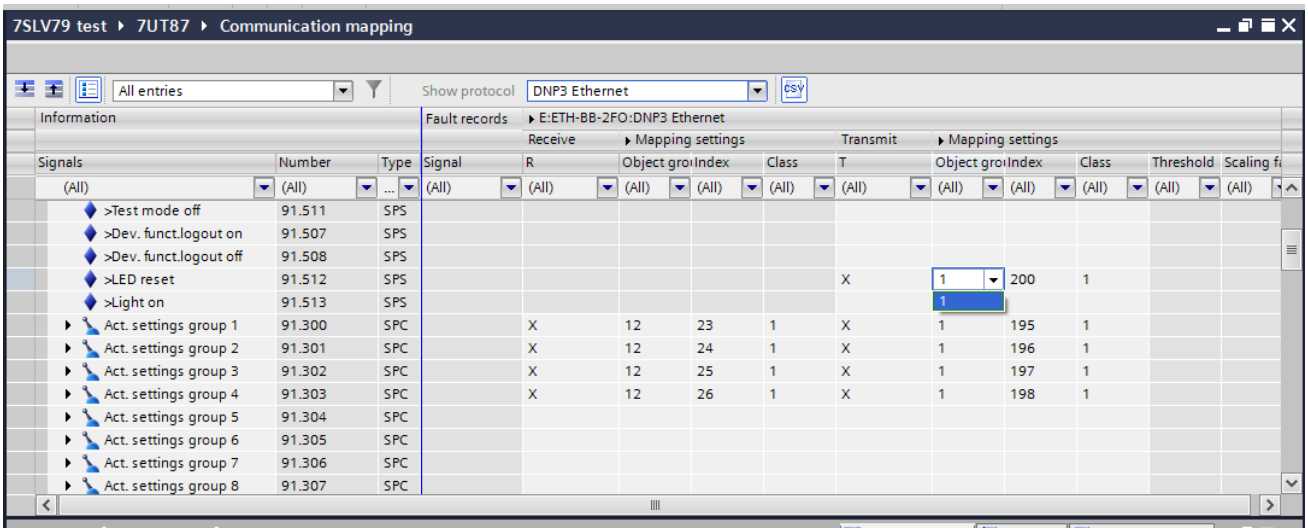

Figure 1. Communication Mapping screen and Object Group for type SPS point

Figure 2, is an extract from the SIPROTEC 5 Communications Protocol Manual of the DNP Functional Scope, that shows Object group 01 and variation 02 and Object group 02 and variation 02 is supported (the static object and the event object).

These do not need to be setup in the communication mapping screen – but are simply provided appropriately depending upon the class of the poll. A Class 0 poll will provide Object 01 variation 02 data, while a Class 1/2/3 poll will provide the Object 02 variation 02 data. This is in compliance with the DNP3 standard, refer to Figure 3.

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3.1.3 Functional Scope

The DNP3 interface of the SIPROTEC 5 device supports the following functions:

Function	Description
Binary inputs with status	Remote Terminal Unit (RTU) Object 01 and variation 02 describe the state of a digital input channel or internal software information. They are also used during the general interrogation by an RTU to synchronize the database. The general interrogations are conducted after the run or cyclically during the runtime.
Binary inputs with changed time	Object 02 and variation 02 describe the changes of a digital input channel or of internal software information with the associated change time. The binary inputs are used for spontaneous process events.
Binary outputs with status	Object 10 and variation 02 describe the current status of a binary output channel. The control relay output block controls the binary output channels. See also object 12.
Control relay output block	Object 12 and variation 01 are used for commands for the process or for the setting-up of internal functions.
32-bit binary meter with marking	Object 20 and variation 01 are used for the display of metered values for active and reactive power.
32-bit binary change meter without time	Object 22 and variation 01 are used for the display of changed meter data for active and reactive power.
32 bit analog inputs (measured values)	Object 30 and variation 01 describe signed 32-bit values for the digitalized analog signals or their calculated values.
16 bit analog inputs (measured values)	Object 30 and variation 02 describe signed 16-bit values for the digitalized analog signals or their calculated values. They are used for the general interrogation during start-up. A measured value snapshot is also possible.
32-bit analog change values without time	Object 32 and variation 01 are used for the display of a changed analog value.
16-bit analog change values without time	Object 32 and variation 02 are used for the display of a changed analog value.
Time and date Write function	Object 50, variation 01 The time and date object are used for time synchronization.
Time and date Read function	Read the system time of the device. Date and time are displayed in milliseconds. Here midnight on January 1, 1970 is 00:00 hours, 00:00 minutes, 00:00 seconds and 00:00 milliseconds.

120 SIPROTEC 5, Communication Protocols, Manual
C53000-L1840-C055-2, Edition 06.2016

Figure 2. DNP3 Functional Scope.

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3.2 POINT NUMBERING

The following rules apply to the interpretation of the object point number (DNP Application Layer *range* field) in conjunction with objects and variations.

Rule 1:
Point **i** of object **x**, variation **y** represents the same physical point as point **i**, object **x**, variation **z**, where **y** and **z** are variations of object **x**.

For example: A device has 16 running counters (object 20) numbered 0 to 15. Point 5 can be asked for in four different ways:

- Obj 20, var 1, range 5 returns the running value of counter 5 in 32-bit format.
- Obj 20, var 2, range 5 reports the same information, only in 16-bit format.
- Obj 20, var 3, range 5 returns the number of counts accumulated in counter 5 since the last time it was reported, again in 32-bit format.
- Obj 20, var 4, range 5 reports the same information, only in 16-bit format.

RULE 2:
Point **i** of object **x** can be reported in one of many variations (i.e. it can be a 16-bit or 32-bit counter). When reported as an event, point **i** can be returned in either one of the variations for that object. The exact variation to return is an application specific decision, however an application should report only ONE event object in any one variation for each event. When responding to a request for Class data or variation 0 of object **x**, there should be only one variation of the object returned.

RULE 3:
Point **i** within different objects of the same grouping are not necessarily unique, however, within each of the binary input, binary output, analog input, analog output and counter groupings the following rules apply.

(a) Point **i** in the static object is the same physical point as point **i** in the event object.

(b) Point **i** in the frozen object is the same physical point as point **i** in the frozen event object.

For example: For binary inputs, point **i** in obj 1 var 1 and 2 is the same point as point **i** in obj 2 var 1, 2 and 3 (static and event correlation). For counters, point **i** in obj 20 var 1, 2, 3, and 4 is the same point as point **i** in obj 22 var 1, 2, 3, 4, 5, 6, 7, and 8 (static and event correlation). In addition, point **i** in obj 21 var 1, 2, 3, 4, 5, 6, 7, and 8 is the same point as point **i** in obj 23 var 1, 2, 3, 4, 5, 6, 7, and 8 (frozen and frozen static correlation).

Figure 3. DNP3 Standard for Object 1 and Object 2.

Point **i** in the static object is the same physical point as point **i** in the event object. For example: if a SPS type signal is configured in DIGSI 5 in the Transmit column with index (point) 50, object 01 (fixed), this SPS type signal reports the static status to DNP3 Master with Object group 01, variation 02 and reports the event to DNP3 master with Object group 02, variation 02. This is the correct behaviour according to RULE 3 of the DNP3 standard.

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To confirm this, DNP3 points were tested in a SIPROTEC 5 relay using a DNP3 Master software simulator software. The signals were configured for Object group 01 in DIGSI 5. The point was reported to SCADA as Object 02 variation 02 (i.e. with time stamp) when there was a change in state, via a Class 1/2/3 poll**,** as demonstrated by Figure 4.

```
    IIN= Restart Local
    Objects:(2,2) Binary Change with Time, Qual=(8-bit:Quant & 8-bit index ), Quantit
Point: 143, OFF [Offline Comms Lost ] Time: 2019/07/16 11:03:11.083
    (2,2) Binary Change with Time, Qual=(8-bit:Quant & 8-bit index ), Quantity=1.
Point: 125, ON  Time: 2019/07/16 11:03:11.183
    (2,2) Binary Change with Time, Qual=(8-bit:Quant & 8-bit index ), Quantity=1.
Point: 126, OFF Time: 2019/07/16 11:03:11.183
    (2,2) Binary Change with Time, Qual=(8-bit:Quant & 8-bit index ), Quantity=1.
Point: 127, OFF Time: 2019/07/16 11:03:11.183
    (2,2) Binary Change with Time, Qual=(8-bit:Quant & 8-bit index ), Quantity=1.
Point: 128, OFF Time: 2019/07/16 11:03:11.183
    (2,2) Binary Change with Time, Qual=(8-bit:Quant & 8-bit index ), Quantity=1.
Point: 140, OFF Time: 2019/07/16 11:03:11.563
    (2,2) Binary Change with Time, Qual=(8-bit:Quant & 8-bit index ), Quantity=1.
Point: 145, OFF Time: 2019/07/16 11:03:11.563
    (2,2) Binary Change with Time, Qual=(8-bit:Quant & 8-bit index ), Quantity=1.
Point: 26, OFF Time: 2019/07/16 11:03:15.749
    (2,2) Binary Change with Time, Qual=(8-bit:Quant & 8-bit index ), Quantity=1.
Point: 32, OFF Time: 2019/07/16 11:03:15.749
    (2,2) Binary Change with Time, Qual=(8-bit:Quant & 8-bit index ), Quantity=1.
Point: 102, OFF Time: 2019/07/16 11:03:15.751
    (2,2) Binary Change with Time, Qual=(8-bit:Quant & 8-bit index ), Quantity=1.
Point: 113, OFF Time: 2019/07/16 11:03:15.752
    (2,2) Binary Change with Time, Qual=(8-bit:Quant & 8-bit index ), Quantity=1.
Point: 138, OFF Time: 2019/07/16 11:03:15.758
    (2,2) Binary Change with Time, Qual=(8-bit:Quant & 8-bit index ), Quantity=1.
Point: 139, OFF Time: 2019/07/16 11:03:15.758
    (2,2) Binary Change with Time, Qual=(8-bit:Quant & 8-bit index ), Quantity=1.
Point: 142, ON  Time: 2019/07/16 11:03:15.758
    (2,2) Binary Change with Time, Qual=(8-bit:Quant & 8-bit index ), Quantity=1.
Point: 129, OFF Time: 2019/07/16 11:03:15.763
    (2,2) Binary Change with Time, Qual=(8-bit:Quant & 8-bit index ), Quantity=1.
Point: 130, OFF Time: 2019/07/16 11:03:15.763
    (2,2) Binary Change with Time, Qual=(8-bit:Quant & 8-bit index ), Quantity=1.
Point: 131, OFF Time: 2019/07/16 11:03:15.763
    (2,2) Binary Change with Time, Qual=(8-bit:Quant & 8-bit index ), Quantity=1.
Point: 132, ON  Time: 2019/07/16 11:03:15.763
    (2,2) Binary Change with Time, Qual=(8-bit:Quant & 8-bit index ), Quantity=1.
Point: 68, OFF Time: 2019/07/16 11:03:15.771
    (2,2) Binary Change with Time, Qual=(8-bit:Quant & 8-bit index ), Quantity=1.
Point: 69, ON  Time: 2019/07/16 11:03:15.771
    (2,2) Binary Change with Time, Qual=(8-bit:Quant & 8-bit index ), Quantity=1.
Point: 70, OFF Time: 2019/07/16 11:03:15.771
    (2,2) Binary Change with Time, Qual=(8-bit:Quant & 8-bit index ), Quantity=1.
```

Figure 4. Binary inputs with change time. Class 1/2/3 poll

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The information reported to SCADA in response to a Class 0 poll for the same point was with status but no time tag, as demonstrated by Figure 5.

```
    Objects:(1,2) Binary Input with Status, Qual=(8-Bit:Start/Stop & No index ), Start=0, End=7.
Points 0  -7  : OFF OFF OFF OFF OFF OFF OFF OFF
    (1,2) Binary Input with Status, Qual=(8-Bit:Start/Stop & No index ), Start=24, End=26.
Points 0  -2  : OFF OFF OFF
    (1,2) Binary Input with Status, Qual=(8-Bit:Start/Stop & No index ), Start=30, End=41.
Points 0  -7  : OFF OFF OFF OFF OFF [Comms Lost ] OFF [Comms Lost ] OFF [Comms Lost ] OFF [Comms L
Points 8  -11 : OFF [Comms Lost ] ON  OFF [Comms Lost ] OFF [Comms Lost ]
    (1,2) Binary Input with Status, Qual=(8-Bit:Start/Stop & No index ), Start=43, End=50.
Points 0  -7  : OFF [Comms Lost ] OFF ON  ON  [Comms Lost ] OFF [Comms Lost ] OFF [Comms Lost ] OF
    (1,2) Binary Input with Status, Qual=(8-Bit:Start/Stop & No index ), Start=52, End=59.
Points 0  -7  : OFF [Comms Lost ] OFF ON  ON  [Comms Lost ] OFF [Comms Lost ] OFF [Comms Lost ] OF
    (1,2) Binary Input with Status, Qual=(8-Bit:Start/Stop & No index ), Start=61, End=106.
Points 0  -7  : OFF [Comms Lost ] OFF ON  OFF [Comms Lost ] OFF [Comms Lost ] OFF [Comms Lost ] OF
Points 8  -15 : ON  OFF OFF OFF OFF OFF OFF OFF
Points 16 -23 : OFF ON  OFF [Comms Lost ] OFF [Comms Lost ] OFF [Comms Lost ] OFF [Comms Lost ] OF
Points 24 -31 : OFF [Comms Lost ] OFF [Comms Lost ] OFF [Comms Lost ] OFF [Comms Lost ] OFF [Comms
Points 32 -39 : OFF [Comms Lost ] OFF [Comms Lost ] OFF ON  OFF [Comms Lost ] OFF [Comms Lost ] OF
Points 40 -45 : OFF OFF OFF OFF OFF OFF
    (1,2) Binary Input with Status, Qual=(8-Bit:Start/Stop & No index ), Start=109, End=117.
Points 0  -7  : OFF OFF OFF OFF OFF OFF OFF OFF
Points 8  -8  : OFF
    (1,2) Binary Input with Status, Qual=(8-Bit:Start/Stop & No index ), Start=120, End=133.
```

Figure 5. Binary inputs with status. Class 0 poll.

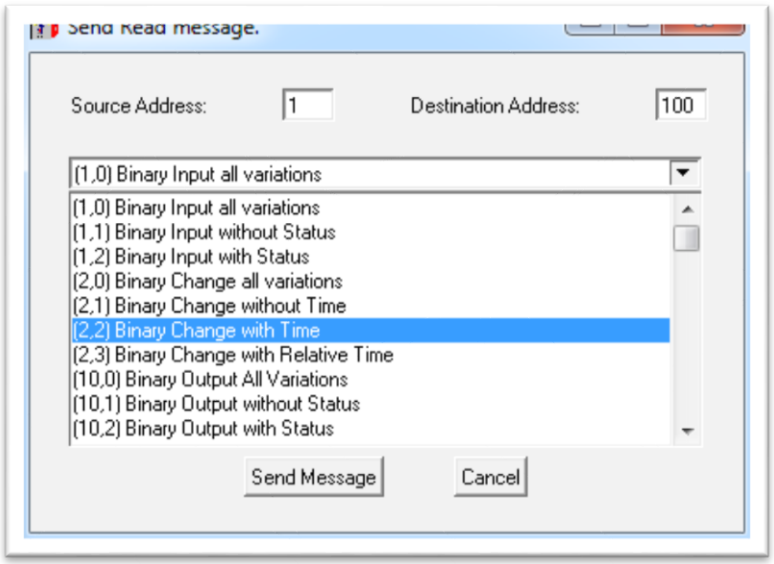

Figure 6. Binary input with change time.

In summary the time tag, or not does not depend upon the setting file, but rather what you request from SCADA. If you poll for Object group 02, variation 02 as per example shown in Figure 6, the binary input signal with time will be provided to the DNP3 Master.

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