DNP 3.0 - Master Communication Protocol

Version 2016.2.1

Reference Manual

00051.01
September 2018

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This symbol indicates that the user should proceed exactly as described in this manual, at the risk of shock or electrical discharge.

DNP 3.0

Master Communication Protocol

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1. GENERAL INFO

1.1 Summary

Communication Driver Name: DNP30.

Current Version: 2016.2.

Implementation DLL: T.ProtocolDriver.DNP30.dll.

Protocol: DNP3.0 Master standard protocol.

Interface: TCP/IP or Serial.

Description: This driver is used for communication with remote IEDs (Intelligent Eletronic Devices) using the protocol DNP 3.0 Level 2. Communication can be established through a multi-point serial channel or a LAN using Ethernet and TCP-IP. In the latter case, each IED has an IP address.

IEDs types supported: Any DNP 3-compatilble IED.

Communication block size: Maximum 250 bytes, FT 1.2 format.

Protocol Options: "LinkConfirm" mode and master station address.

Multi-threading: User defined, five threads per comunication node by default.

Max number of nodes: User defined.

PC Hardware requirements: Standard PC Ethernet interface board, RS485 or RS232 port.

1.2 Data Objects Supported

The table below shows the DNP objects and variants supported by this implementation. Objects labeled L4 are implemented, but are defined at the **L4 level.**

Object			Request (Master)		Response (Slave)	
Obj.	Var.	Description	Function Codes (decimal)	Qualifier. Codes (Hex)	Function Codes (decimal)	Qualifier Codes (Hex)
1	0	Binary Input (any variation)	1	00,01,06		
			22	00,01,06		
1	1	Single Bit Binary Input (packed)	1	00,01,06	129	00, 01
1	2	Binary Input with status	1	00,01,06	129	00, 01
2	0	Binary Input event (any variation)	1	06,07,08		
2	1	Binary Input change without time	1	06,07,08	129,130	17,18
2	2	Binary Input change with absolute time	1	06,07,08	129,130	17,18
2	3	Binary Input change with relative time	1	06,07,08	129,130	17,18
3	0	Double bit Binary input – Any variation –L4	22	00,01,06		
3	1	Double-bit Binary Input – Packed –L4	1	00,01,06	129	00, 01
3	2	Double-bit Binary Input – With flags–L4	1	00,01,06	129	00, 01

4	0	Double-bit Binary Input Event – Any Variation–L4	1	06,07,08		
4	1	Double-bit Binary Input Event – whitout time–L4	1	06,07,08	129,130	17,18
4	2	Double-bit Binary Input Event- with Absolute time–L4	1	06,07,08	129,130	17,18
4	3	Double-bit Binary Input Event - with relative time–L4	1	06,07,08	129,130	17,18
10	1	Binary Output – Any Variation	1	00,01,06		
10	2	Binary Output – status with flags	1	00,01,06	129	00,01
12	1	Control relay output block	3,4,5,6	17,28	129	Echo of request
20	0	Binary Counter – all variations	1,7,8,9,10			
20	1	Counter – 32-bit with flag	1	00,01,06	129	00, 01
20	2	Counter – 16-bit with flag	1	00,01,06	129	00, 01
20	5	Counter – 32-bit without flag	1	00,01,06	129	00, 01
20	6	Counter – 16-bit without flag	1	00,01,06	129	00, 01
21	0	Frozen counter – All variations	1,22			
21	1	Frozen Counter – 32-bit with flag	1	00,01,06	129	00, 01
21	2	Frozen Counter – 16-bit with flag	1	00,01,06	129	00, 01
21	9	Frozen Counter – 32-bit without flag	1	00,01,06	129	00, 01
21	10	Frozen Counter – 16-bit without flag	1	00,01,06	129	00, 01
22	0	Counter Event – Any Variation	1	06		
22	1	Counter Event – 32-bit with flag	1	06,07,08	129,130	17,18
22	2	Counter Event – 16-bit with flag	1	06,07,08	129,130	17,18
23	0	Frozen Counter Event – Any Variation	1	06,07,08		
23	1	Frozen Counter Event – 32-bit with flag	1	06,07,08	129,130	17,18
23	2	Frozen Counter Event – 16-bit with flag	1	06,07,08	129,130	17,18
30	0	Analog Input – all variations	1, 22	00,01,06		
30	1	32 Bits Analog Input	1	00,01,06	129	00, 01
30	2	16 Bit Analog input with flag	1	00,01,06	129	00, 01
30	3	32 Bits Analog Input without flag	1	00,01,06	129	00, 01
30	4	16 Bit Analog input without flag	1	00,01,06	129	00, 01
30	5	Short Floating Point (32bits) – L4	1	00,01,06	129	00, 01
32	0	Analog Input event – All variations	1	06,07,08		

32	1	Analog Input event - 32 Bits without time	1	06,07,08	129,130	17,18
32	2	Analog event without flag – 16 Bits – Without time	1	06,07,08	129,130	17,18
32	3	32 Bit Analog event with flag – L4	1	06,07,08	129,130	17,18
32	4	16 Bit Analog event with flag– L4	1	06,07,08	129,130	17,18
32	5	Analog input event single float –without time– L4	1	06,07,08	129,130	17,18
32	7	Analog input event single float –with time– L4	1	06,07,08	129,130	17,18
40	0	Analog Output Status–Any variation	1			
40	1	Analog Output Status – 32bits with flag	1	00,01,06	129	00, 01
40	2	Analog Output Status - 16bits with flag	1	00,01,06	129	00, 01
40	3	Analog output status – Single float with flag –L4	1	00,01,06	129	00, 01
41	1	Analog output block - 32Bit	3,4,5,6	17,28	129	Echo of request
41	2	Analog output block - 16 Bit	3,4,5,6	17,28	129	Echo of request
41	3	Analog output block – Single float - L4	3,4,5,6	17,28	129	Echo of request
50	1	Time and Data – Absolute time	1,2	0x07	129	07
51	1	Time and Date CTO – Absolute ti me, synchronized			129,130	07
51	2	Time and Date CTO – Absolute ti me, unsynchronized			129,130	07
52	1	Time Delay – Coarse			129	07
52	2	Time Delay – Fine			129	07
60	1	Class 0 data	1	0x06		
60	2	Class 1 data	1,20,21	06,07,08		
60	3	Class 2 data	1,20,21	06,07,08		
60	4	Class 3 data	1,20,21	06,07,08		
80	1	Internal indications	1,2	00,01	129	01

In master mode protocol implementation, the master only performs the requests highlighted in blue. The server equipment responds using the answers highlighted in yellow. Note that it is up to the server equipment to decide how to respond and the master must support all the features of level 2 to be used as a possible answer.

The objects, object variations, function codes and qualifiers have their standard meanings in DNP. Tables with the function code and qualifiers are shown below:

Function Code	Description	Origin
1	Read	Master
2	Write	Master
3	Select	Master
4	Operate	Master
5	Direct Operate (without selection)	Master
6	Direct Operate (without ack)	Master
7	Freeze Immediately	Master
8	Freeze Immediately (without ack)	Master
9	Freeze and Clear	Master
10	Freeze and Read	Master
13	Restart (Cold)	Master
14	Restart (Warm)	Master
20	Enable non-requested messages	Master
21	Disable non-requested messages	Master
22	Assigns class for an object	Master
23	Measurement with delay	Master
129	Response	Slave
130	Non-Requested Response (doesn´t exist on level 2)	Slave

Qualifier Code	Use on Request	Use on Response
00,01	Static Points range (class 0) or a single point with a number	Static Object
06	All points	Invalid
07,08	A limited number of events A single point without number (this is a timestamp)	A single point without number (this is a timestamp)
17, 28	Controls (one or more unrelated points)	Event Objects (one or more unrelated points)

DNP has the concept of data classes, with four classes defined:

Class 0: Corresponds to the static points, analog or digital. Its content is the value of an

analog or digital variable, input or output, at a given time.

Class 1, 2 and 3: Events corresponding to class 0 variable transitions, state transitions or internal relay situations that causes an event.

A common practice in DNP IEDs is to associate the state variation of digital variables or the dead band pass of analog variables with class 1, 2 or 3 events. Thus, modifying the state/value of these variables will cause events to be transmitted at the request of the respective classes of events (60/2, 60/3 and 60/4). Periodically, a class 0 reading (60 / 1) may be requested for checking integrity.

Notes:

Static variables not assigned to a class do not cause events.

Class and variable association should be performed on the IED, using an appropriate program. The SCADA runs data acquisition through the classes, however, without defining which variable belongs to which class.

1.3 General Operation

The normal master sequence operation is shown below:

- Once started, as the first step, it sends a read request for events of class 1, 2 and 3 (60/2, 60/3 and 60/4) for all IEDs;
- Next, it sends a class 0 read request (read integrity - 60/1) for all IEDs;
- Periodically, at the time intervals defined in the initialization file, it makes classes 0, 1, 2 and 3 (60/1 to 60/4) readings;
- When it has received a message with IIN (Internal Indication) stating that the IED requires synchronization, it sends timing message (50.1). This message is only sent at the request of a remote IED;
- When it's received a message with IIN stating that a restart has occurred, a "clear device flag" write (80/1) is done, and it goes back to the first step;
- When the user commands a digital output or an analog output, the respective request to the IED (12/1 or 41/2) is sent;

2. Channel Settings

2.1 Protocol Options

LinkConfirmMode – Protocol mode in which, in the link layer, all requests should be confirmed by the remote IED. The default content is "Enabled."

Accept Unsolicited DNP – Enabling this option causes an Enable Unsolicited Messages message (Function Code = 20) to be sent out from the master to the slave at the start of a channel execution, right after the Class 0 request and every time the master receives a "RESTART" indication in the Internal Indications field.

MasterStationID - A univocal number between 1 and 65534 corresponding to the master station address. This way, the master informs its own address to the slave when sending it a message. Some slaves reply to the master disregarding this number, while others demand that the address declared on the slave match the one from the master. The default for this field is "65534."

Quality changes timestamp – Enabling this option will lead to alteration in the tag present timestamp when a new reading of a flagged object is received, even if there is no alteration to the tag status (value), but there is quality alteration.

Logging Level – You can choose from this list the logging mode created by the communication module.

Logging level	Debug	All messages are registered in the LOG.
	Info	Only Info, Warning and Error messages are registered in the LOG.
	Warning	Only Warning and Error messages are registered in the LOG.
	Error	Only Error messages are registered in the LOG.

IED time bias from GMT – On SCADA, internally, all timestamps are stored with GMT (UTC) dates. IEDs usually send these dates also in GMT, and no correction is made. The default for this option is Zero. If in the current implementation the IEDs send the timestamps in their local time, the difference between this time and GMT time must be specified here. For example in Brasilia the local time is 3 hours less than GMT. In this case, -3 should be specified in this table.

Password for commands: To increase the security of sending commands, normally initiated only by a change in the state of a tag, it is possible here to specify a password of up to nine digits. The communication module will, at the moment the command is received, verify this password against the current value of the ***EstimatedValue*** attribute tag involved in the command. Therefore, in the operation of sending a command through a window, script, etc. this number must be loaded in this attribute. The communication module, after executing the command, changes the value of ***EstimatedValue*** to ZERO. This verification does not occur if this option is left as zero.

Synchronization LAN – Indicates the synchronization method to be used by the driver, according to the device to which it communicates. Choose **ENABLE** to use the LAN Synchronization method.

Timeout (ms) –Waiting time in milliseconds for receiving a response after sending any request. It is a functional check, which does not take into account the type of request or response, and it only verifies if there are responses being received in the channel.

Dnp30 Level - By default, the Level 3 profile is used. If you want the operation as level 2, you can enter here the number 2. The client will not use objects and functions available in level 3, such as enabling and disabling Dynamic Unsolicited and requests of several classes in the same message.

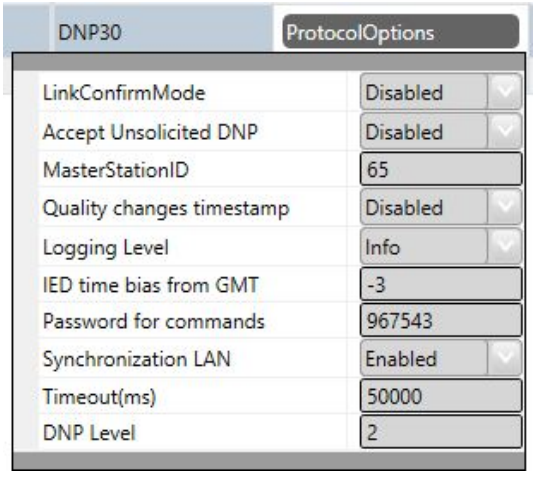

Figure 1 – Protocol Options

2.2 Settings

Serial and Multiserial Channel:

Com: Communication Port used on the computer;
BaudRate
DataBits: 8
StopBits: 1 or 2
Parity: None, Even, Odd;
DTR: on, off
RTS: on, off
CTS: on, off
Port configuration must match remote IEDs configurations.

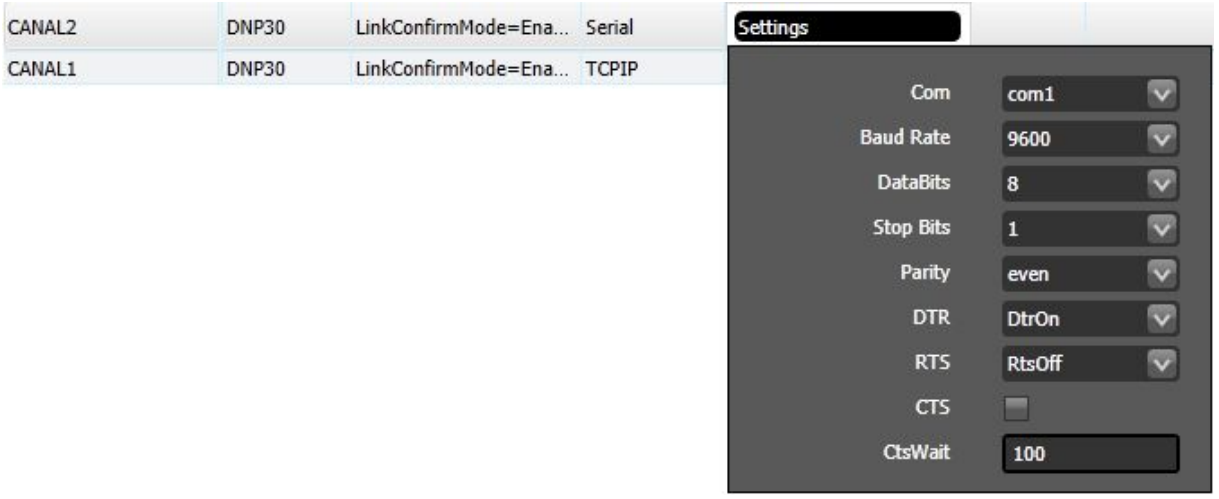

Figure 2 – Serial Channel Settings

TCP/IP channels:

- ShareNodeSameIP: Accepts IEDs with the same IP.
- Preferably, leave default settings on.

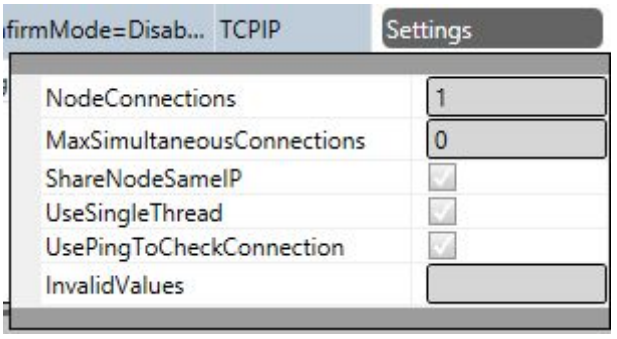

Figure 3 – TCP/IP Settings

2.3 Timeout

Defines limit times for transmission and reception of message characters and the number of retries.

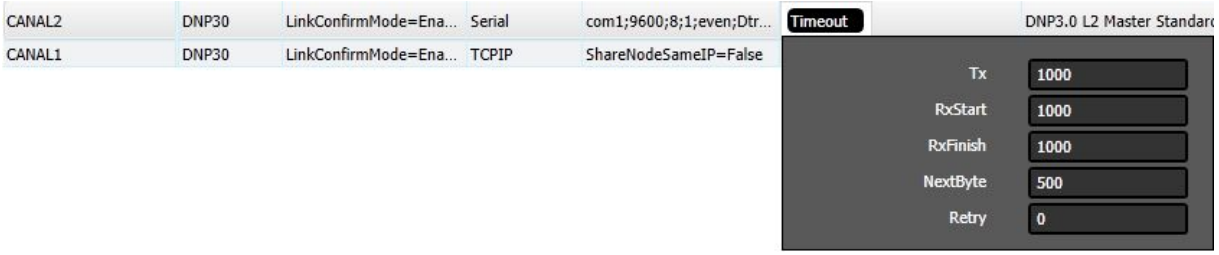

Figure 4 –Timeout Attributes

2.4 Initial State

Defines how the channel will initiate: enabled or disabled. If the channel is disabled, no message will be sent or received through it. In other words, the channel will be deactivated.

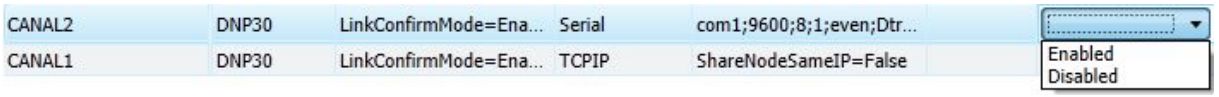

Figure 5 – Channel Initial State

3. Nodes Settings

Each node represents a remote station (IED). The user can configure multiple workstations into a single channel for serial communication. In the case of TCP-IP communication, only one node is supported for each channel. In this case, the user must set as many channels as there are nodes.

3.1 Channel Data (Primary and Backup)

Attribute set associated with the node (channel), which refers to its address and other attributes presented below:

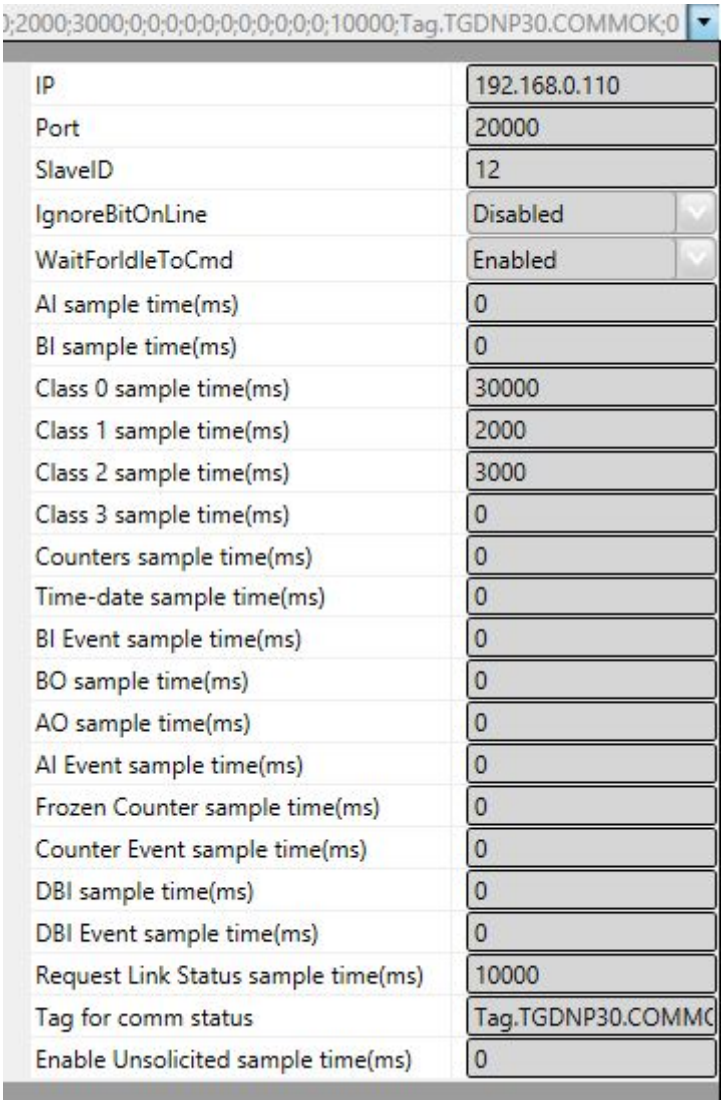

Figure 6 – Channel Data

For TCP-IP Communication:

IP Address – Type in the IP Address of the IED server.

Port – Input the port number on which the IED will receive communication.

.

Note: In the case of serial communication, these two first fields do not exist.

For any case:

SlaveID - Address of the server IED (slave mode) at the application layer.

IgnoreBitOnLine - If "enabled," it indicates that the driver should ignore the "BitOnLine" indication that is inserted by the IED when a failure or normality occurs at a point, according to the IED criteria.

WaitForIdleToCmd – if "enabled," it indicates that a command will only be sent when the sampling communication is stopped, i.e. not occurring.

AI sample time (ms) – Time in milliseconds between two consecutive analog point value requests (type 30 Objects request, all variations).

BI sample time (ms) - Time in milliseconds between two consecutive digital point value requests (type 1 Objects request, all variations).

Class 0 sample time (ms) – Time in milliseconds between two consecutive all points requests.

Class 1 sample time (ms) – Time in milliseconds between two consecutive class 1 points requests.

Class 2 sample time (ms) – Time in milliseconds between two consecutive class 2 points requests.

Class 3 sample time (ms) – Time in milliseconds between two consecutive class 3 points requests.

Counters sample time (ms) - Time in milliseconds between two consecutive counter value requests (type 21 Objects request, all variations).

Time-Date sample time (ms) – Time in milliseconds between two consecutive synchronization submissions, i.e. sending the current date and time to IED (object 50). Time is sent only in GMT.

BI Event sample time (ms) – Time in milliseconds between two consecutive requests asking that the current EVENTS of the digital points be sent (request for Type 2 objects, all variations).

BO sample time (ms) - Time in milliseconds between two consecutive requests asking that the current states of the Binary Output points be sent (request of type 10 Objects, all variations).

AO sample time (ms) - Time in milliseconds between two consecutive requests asking that the current values of the Analog Output points be sent (request of type 40 Objects, all variations).

AI Event sample time (ms) - Time in milliseconds between two consecutive requests asking that the current values of the Analog Event points be sent (request of type 32 Objects, all variations).

Frozen Counter sample time (ms) - Time in milliseconds between two consecutive requests asking that the current values of frozen counters be sent (request for type 23 Objects, all variations).

Counter Event sample time (ms) - Time in milliseconds between two consecutive requests asking that the current counter events be sent (request of type 22 Objects, all variations).

DBI sample time (ms) - Time in milliseconds between two consecutive requests asking that the current states of the double digital points be sent (request of Type 03 Objects, all variations).

DBI Event sample time (ms) - Time in milliseconds between two consecutive requests asking that the current EVENTS of the double digital points be sent (request of type 04 Objects, all variations).

Request Link Status sample time (ms) – Time in milliseconds between two consecutive requests asking for the current status of the link (link status).

Tag for Comm status - In this field the name of an existing tag in the project can be indicated to show success/failure in communication from a functional point of view. When requests are made, the module waits for a maximum of timeout milliseconds (defined in the Protocol Options, above) to receive a response. In case of failure, the value of this tag will be set to ZERO. In case of success, the value will be set to ONE.

Enable Unsolicited sample time (ms) - Time in milliseconds between two consecutive submissions requesting to enable an Unsolicited Submission (function 22) for classes 1, 2 and 3.

Backup Station – The same settings adjusted for the master station can be adjusted for an alternative backup IED station with identical point configuration, if it exists in the installation.

4. Points Settings

4.1 General

Points can be input or output points.

Entry points, i.e. points that are acquired through the protocol, have basically two main parameters: point type and address.

Output points, used for remote controls, have a “Control Code” parameter in addition to the type and address to specify the output operation. In the address map of an IED the addresses restart for each type of point.

The states or values of the points are reported by the IED by Information Objects defined in the protocol. These objects have variations such as with or without timestamp. Whenever the IED reports with a “timestamp” it will be used in the corresponding attribute of a point on SCADA. When it does not come with a “timestamp” the driver will put the current time of the computer where the driver is running as “timestamp.”

SCADA communication module on master mode implements:

- Digital points read;
- Analog points read;
- Counters read;
- Analog and Digital points commands;
- Select Before Operate commands.

4.2 Point Types

The implemented SCADA point types, listed below, are defined based on the data objects set out in the standard. For each type of point, whichever the object variation received on the IED might be, with or without a “flag” or a timestamp, the values acquired will be placed in points with the types listed below. In the **Points** table, the “**Address**” field is used to choose the type of point and to specify its address.

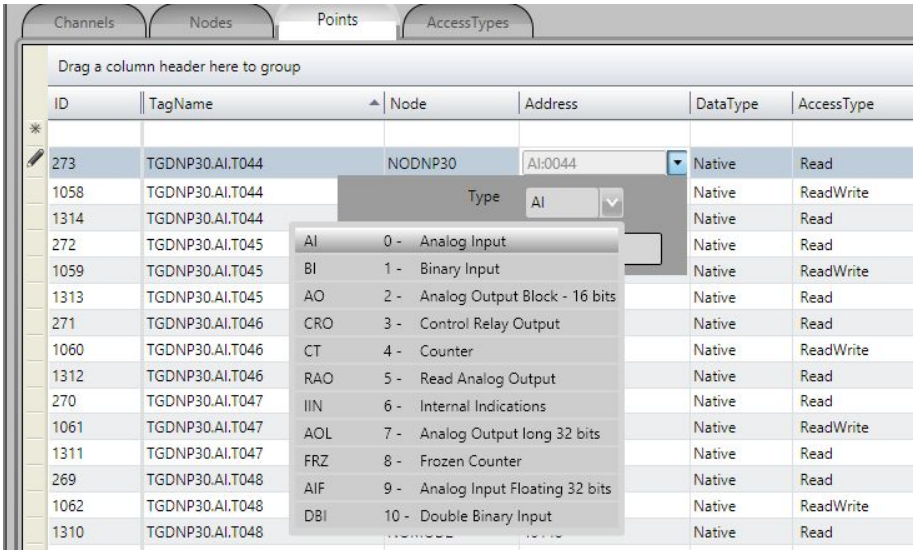

Figure 7 – Options for Point Types

AI- Analog Input

Scalar analog measurement used for transmission of analog quantities. Used to receive data sent through objects 30 and 32 and all their variations. They are 16 or 32-bit integers.

BI - Binary Input

Simple binary entry point, value 0 or 1. Used to receive data sent through objects 1 and 2 and all their variations.

DBI - Double Binary Input

Dual binary input point, value between 0 and 3. Used to receive data sent through objects 3 and 4 and all their variations.

RAO – Read Analog Output

Point for reading the contents of analog output of 16 bits or 32 bits. Used for the reception of objects of types 40 and 41.

CRO - Control Relay Output

Digital output point used to control the switches and circuit breakers. The DNP object 12, including a Control Code (8 bits), is used to indicate the type of command and execution details. When chosen, a field will show requesting this code information. After clicking on the right arrow (), a window with the selected attributes for the present value will appear. If the user changes the selected attributes and presses the return arrow (), a new value associated with the selected attributes will be generated.

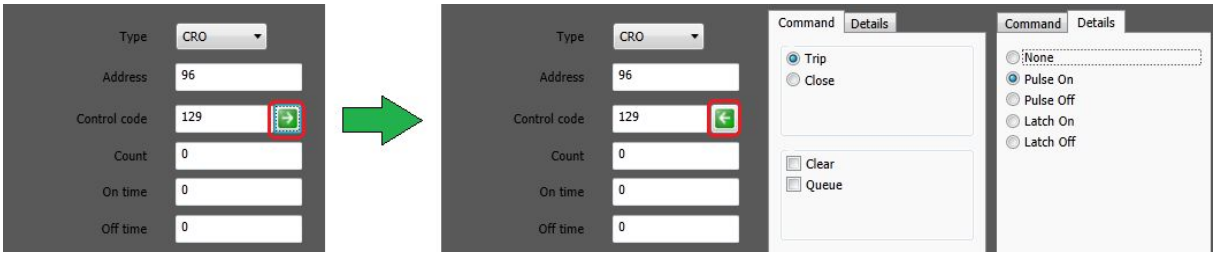

Figure 8 – Command Attribute

The possible values are presented in the table below with the respective associated actions:

Control Code	Action
1	Output Pulse ON
2	Output Pulse OFF
3	Output Latch ON
4	Output Latch OFF
65	Output Pulse ON + Close
66	Output Pulse OFF + Close
67	Output Latch ON + Close
68	Output Latch OFF + Close
129	Output Pulse ON + Trip
130	Output Pulse OFF + Trip
131	Output Latch ON + Trip
132	Output Latch OFF + Trip
+ 16	Queue + Trip

+ 32	Clear + Trip

funcCode – In the commands it's possible also to define the operation to be executed in the command according to the following table:

funcCode	Action
3	Select
4	Operate
5	Direct Operation (no selection)
6	Direct Operation (without ack)
34	Select and Operate

Note: Code 5 will be used if no code is chosen.

CT – Counter

Binary counter of 16 or 32 bits, received from the IEDs through type 20 objects and all their variations. This number has the last state of counter, at the instant it is read.

FRZ - Frozen Counter

Binary counter of 16 or 32 bits, received from the IED through object 21 and its variations, which contains information on the last time a counter was "frozen." The frozen value shows the value of the counter (the same index) when the last freeze operation was performed on the counter of the slave IED.

AO - Analog Output Status or Block (16bits)

Analog output for a 16-bit DA converter, using type 40 objects (actual value to be applied to the drive) or type 41 objects (amount required to be achieved in the analogue output), both on variation 2 (16 bits).

AOL - Analog Output long (32 bits)

Analog output for a 32-bit DA converter, using type 40 objects (actual value to be applied to the drive) or type 41 objects (amount required to be achieved in the analogue output), both on variation 1 (32 bits).

AIF - Analog Input Floating (32 bits)

Measurement used for analog transmission of analog quantities. Used to receive data sent over type 100 objects and all their variations. Floating point numbers are 32 or 64-bit IEEE-754 format.

CRS – Control Relay Signaling

A type defined for SCADA for setting the match between the output tag and the input tag that performs the signaling, as a result of the command. When the CRS type is chosen, in the definition of the Address column, a different menu appears with the fields to define the necessary parameters.

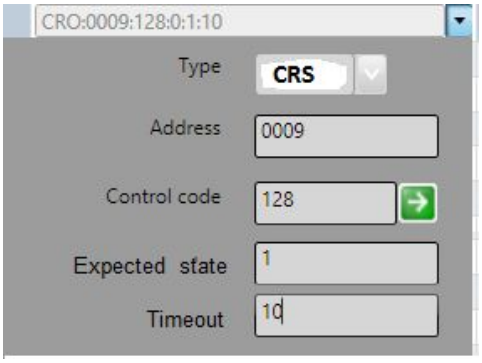

Figure 9 – CRS Type

The following figure shows the setting in the POINTS table. The signaling comes in tag A2.DJ.DJ, which is of type DBI. The two lines highlighted in yellow show the definition of the signaling of commands with the same address (0009) and control code (128 - Open and 64 - Close).

These two lines are used to load the protocol module to create a static list with all matches on the node. Their information does not create new points in real time.

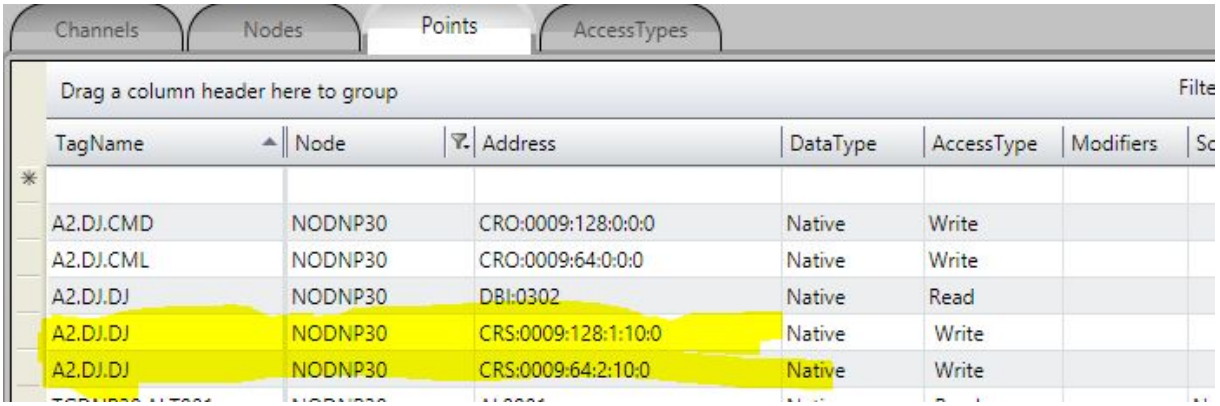

Figure 10 – CRS Type

Nothing else is required for setup. With this list, the module will automatically call the transaction creation and verification methods.

The command signaling is only used for digital CRO commands and BI and DBI digital signals.

IIN - Internal Indications

On this implementation, it is possible to get access to the internal indication statuses or to the response status of commands by defining tags with the IIN type, for these to receive this information from the communication module.

These IED internal indication statuses are reported through flags placed on the objects transmitted in the communication.

In order to receive the IIN, an analog int tag must be defined as IIN type and 65000 address. This tag will receive the register with the bits whose meaning are presented in the table below.

In order to receive the statuses from the most recently sent commands, an analog int tag must be defined as IIN type and 65001 address.

IIN: 16 16 bits sent in every slave answer with control data - Address: 65000

BIT	Origin	Description	Content
0	IIN	Broadcast	Returns 1 if slave receives a broadcast message (address = FFFF)
1	IIN	Class 1	Returns 1 if slave has class 1 events
2	IIN	Class 2	Returns 1 if slave has class 2 events
3	IIN	Class 3	Returns 1 if slave has class 3 events
4	IIN	Clock Synchronization	Returns 1 if slave asks for clock synchronization
5	IIN	Outputs set to local	Returns 1 if slave has any output set to local
6	IIN	Problem	Returns 1 if slave has a problem
7	IIN	Restart	Returns 1 if slave has restarted
8	IIN	Function not Implemented	Returns 1 if a function asked by the master was not implemented in the slave
9	IIN	Unknown Object	Returns 1 if slave does not have a certain object at all or in a specific class
10	IIN	Invalid Data	Returns 1 if slave has an invalid parameter in the qualifier or the address range is invalid
11	IIN	Overflow	Returns 1 if slave buffer has an overflow
12	IIN	Busy	Returns 1 if the request was received but is already running
13	IIN	Corrupted Data	Returns 1 if the parametric data was corrupted
14	IIN	Reserved	Always 0
15	IIN	Reserved	Always 0

Status field: 8 bits sent as an answer to a command. Address: 65001

Byte Value	Origin	Description	Content
0	Status	Command Accepted	after a correct command
1	Status	Command Not Accepted	a timeout has occurred between select and operate
2	Status	Select Fault	operate has occurred without a prior select
3	Status	Format Error	command has a format error
4	Status	Control not supported	operation is not supported
5	Status	Full Queue	the request queue on the slave is full or the point is already active
6	Status	Hardware Error	a hardware error occurred while the command was being processed
7 to 127		Not used	

These IIN can be defined in dictionaries and shown on event lists and/or alarms. This way, for example purposes, a dictionary associated with a variable which contains the resulting status of a command is shown below. Next are the definition of this variable and a template of its declaration on the Device table points.

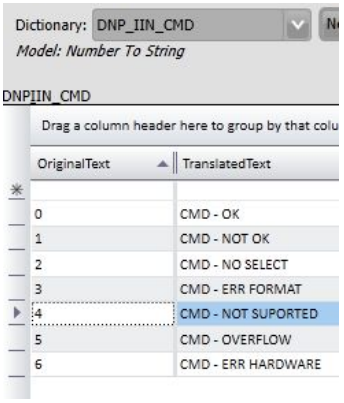

Figure 11 – Dictionary associated with Command Attribute

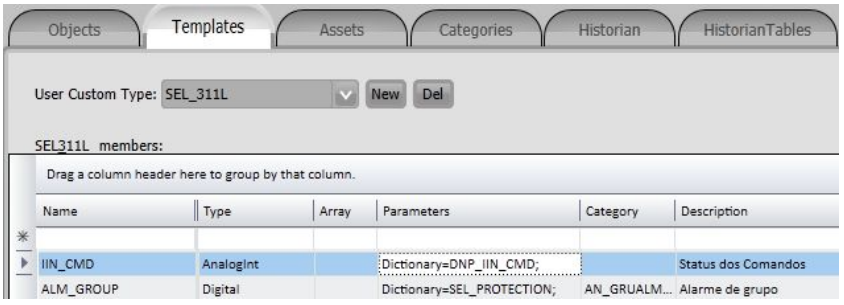

Figure 12 – Variable Tag which receives a Command Result

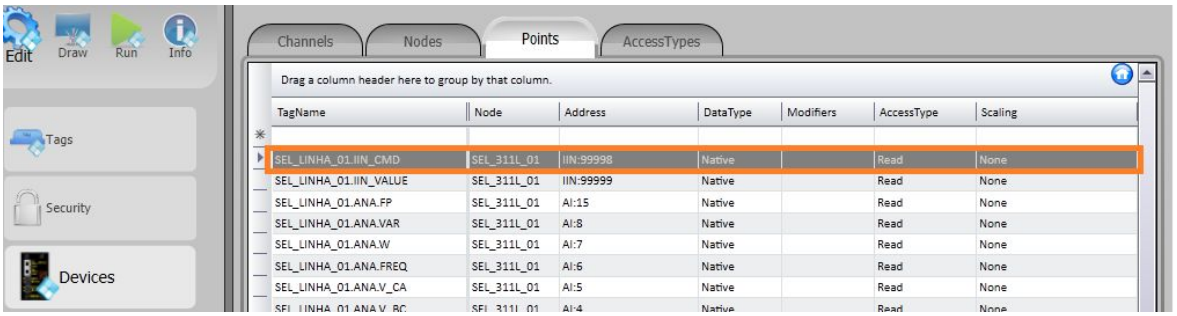

Figure 13 – Declaration of a point which receives the result of a DNP3 command

Note: For an event to always occur in this tag, the communication module always sets the value as 99 in the tag before starting to send a command. Afterwards, it puts in the tag the result obtained from the response to the command.

4.3 Point Address

The **Address** field to be filled when registering a point is what the standard calls "Index." It consists of a 16-bit number that is the indicative index [0 to n-1] of each of the points of the same type mapped within the IED.

For example purposes, a points table filled with several types of points is presented below. The digital output type points (CRO), as mentioned above, have their control code, besides the address.

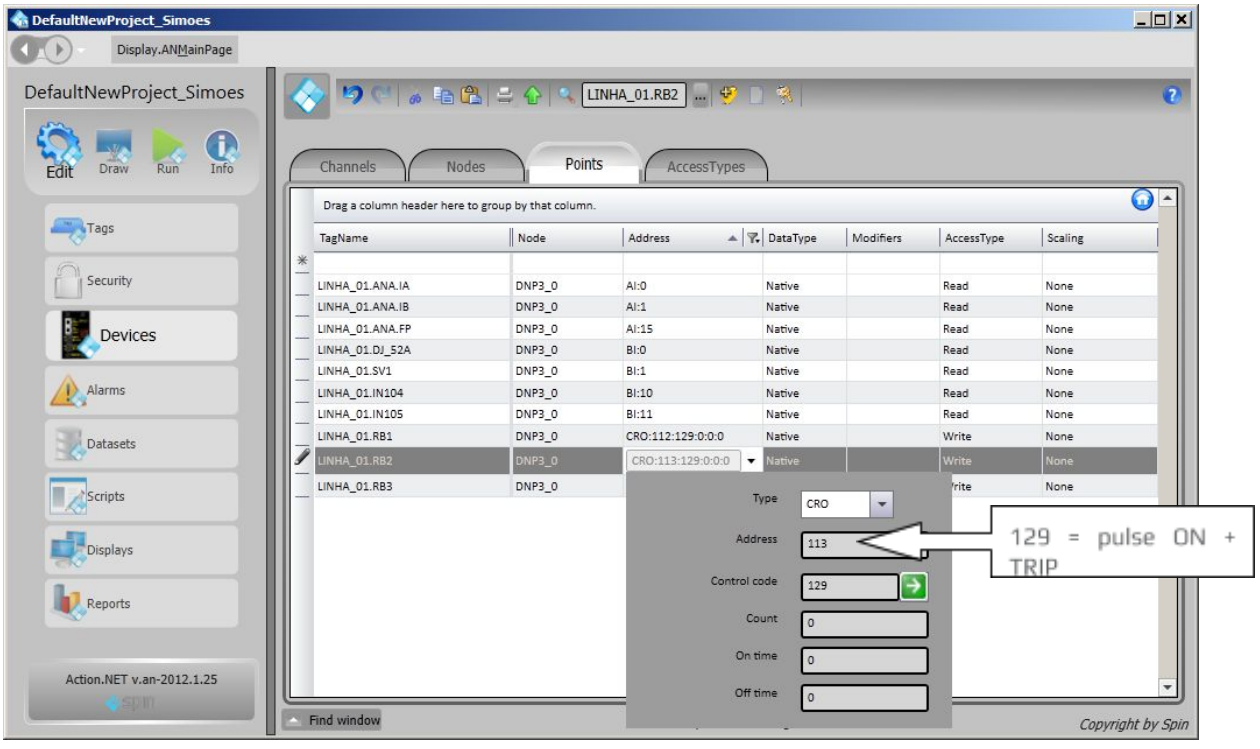

Figure 14 – Sample points table with different types of points

To implement discrete digital input points, it is enough to use the "Bit" attribute of a tag for each of the points that define the discrete digital input value. Therefore, for example, a switch with two contacts that define its state:

Tag	Address	Complement
SEL_LINHA_01.SC89_1	8	Switch Open
SEL_LINHA_01.SC89_1	9	Switch Closed

This is defined as an AnalogInt Tag and the Bit attribute of this 16-bit variable (AnalogInt) is used on the node table to address two points, as in the figure below:

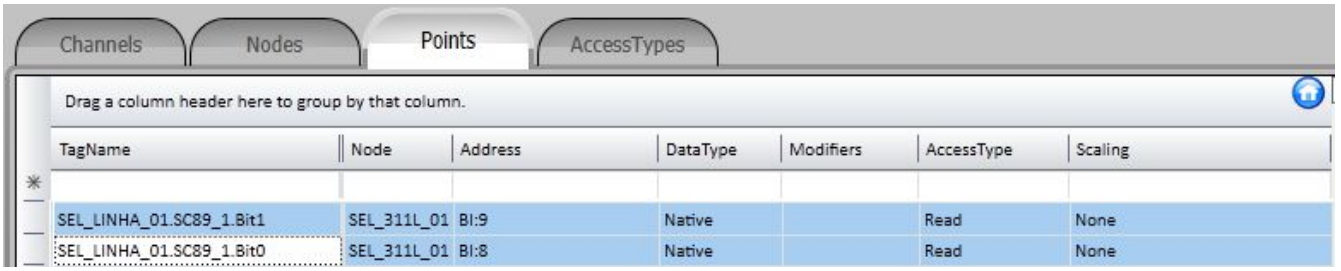

Figure 15 – Bit Attribute

The values assumed by the SEL_LINHA_01.SC89_1 variable will be:

TAG	Bit 0	Bit 1	VALUE	MEANING
SEL_LINHA_01.SC89_1	0	0	0	UNDEFINED
SEL_LINHA_01.SC89_1	1	0	1	OPEN
SEL_LINHA_01.SC89_1	0	1	2	CLOSED
SEL_LINHA_01.SC89_1	1	1	3	ERROR

4.4 Access Type

Since this is a communication module in client mode, it requires a few characteristics of its own for parametrization of the Access Type field in the **Points table:**

For reading-type points, the Access Type must be defined as:
ReadOnStartup= On;
ReadPooling= Always;
ReadPoolongRate: 500 milliseconds
WriteEvent= Changed;
AccepUnsolictited = On;

For command-type points (CRO, AO and AOL), the Access Type must be defined as:
ReadPooling = Never;
WriteEnable = On
WriteEvent= Changed;