Advantech WebAccess
- DNP3 Master Ethernet Driver Guide
Version: 1.01

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1. Introduction

1.1 Introduction for DNP3 Master Ethernet Driver

The DNP3(Distributed Network Protocol) is a communication protocol developed specifically for SCADA applications, such as electrical utility, water and wastewater treatment, oil & gas process, etc. The DNP3 Master Ethernet Driver of WebAccess, hereinafter referred to as DNP3 master driver, provides the master functionalities defined in the DNP3 protocol, which allow you to connect the DNP3 outstation devices, such as RTUs and IEDs, through IP network. The communication modes by which WebAccess could gather data from outstations include static data polling, event data polling , unsolicited message response and quiescent communication. A user could freely select any mode to meet the communicating requirement of SCADA system.

1.2 Features of DNP3 Master Driver

1.2.1 Functionalities

The DNP3 master driver could connect the outstations conforming to the DNP3 level 2 and provides the following functionalities:

- Supports the integrity polling, the event class polling and the static data polling
- Supports unsolicited messaging with event class
- Supports the direct operate or select before operate output command sequence for the output point type
- Supports the function code of “Immediate Freeze”, “Immediate Freeze-No Response”, ” Freeze and Clear”, “Freeze and Clear-No Response” for the Frozen counter
- Supports the Time Synchronization of Ethernet

1.2.2 Point types

The DNP3 organized a uniquely identifiable physical or logical entity as point type, like analog input point type, binary output point type, etc, which are represented as “Object Groups” in the protocol. The DNP3 master driver provides the following point types defined in the protocol:

- Analog input
- Analog output
- Counter
- Frozen counter
- Binary input

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- Double-bit binary input
- Binary output
- Control relay output block - binary output

User could map the data points of RTUs or IEDs into the TAG of WebAccess using these point types. For detail, please refer to the "Tag Configuration".

2. Configuration of DNP3 Master Driver

2.1 DNP3 Configuration

First you create a SCADA node as the normal process with WebAccess. Then, in the WebAccess Project Manager create a DNP3 Communication Port on the SCADA node as shown in the figure 2.1.1.

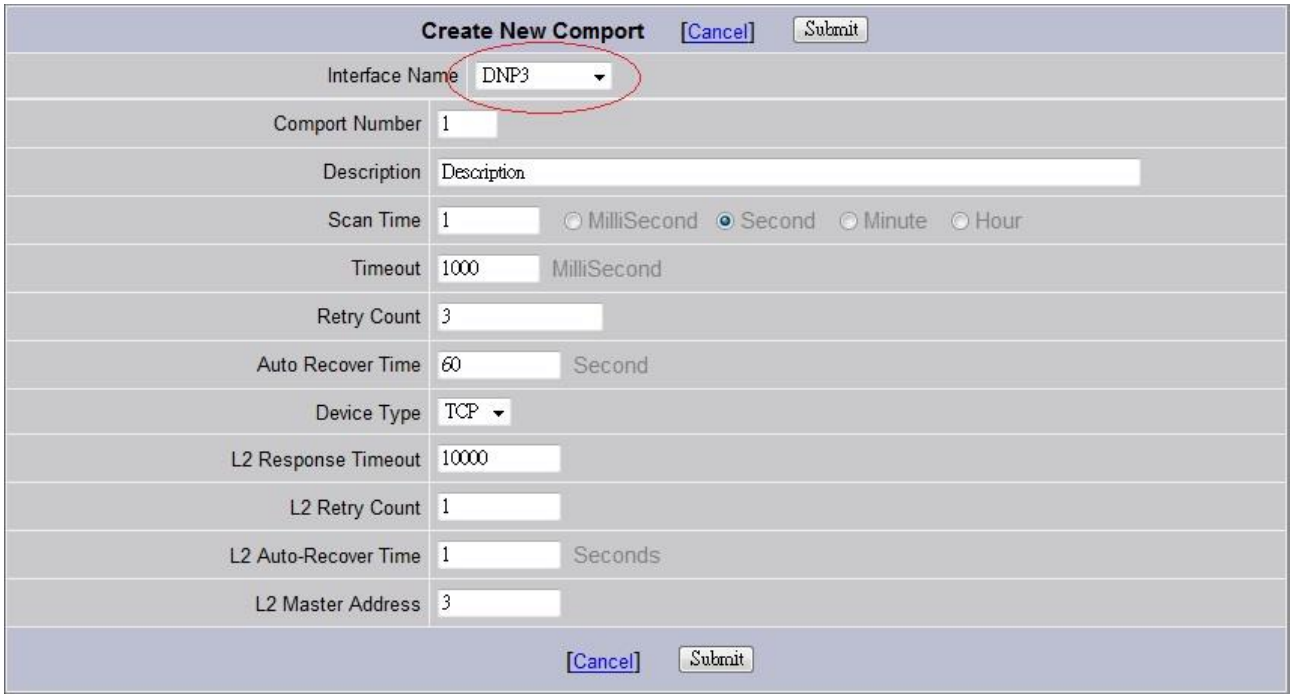

Figure 2.1.1

2.2 Port Configuration

The "Create New Comport" web page is used to specify the DNP3 protocol setting for the master configuration of WebAccess. The setting of "Comport Number", "Description" , "Scan Time", "Timeout", "Retry Count" and "Auto Recover Time" are the common settings of WebAccess, please refer to the user manual of WebAccess to configure. Other settings are for the DNP3 protocol and detailed as follows:

Device Type : The parameter specifies how to connect with the outstations using the DNP3 protocol.

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L2 Response Timeout : The parameter specifies how long the WebAccess should wait for the response of link layer before timing out.

L2 Retry Count : This parameter specifies how many times the WebAccess should retry the request before the outstation is considered to be in error.

L2 Auto-Recover Time : The parameter specifies how much time the WebAccess should wait for, then reconnect the outstation.

L2 Master Address : This parameter specifies the address of link layer of DNP3 which the WebAccess is bound to for the Comport.

2.3 Device Configuration

First you follow the steps of “Add Device” within the WebAccess, then the following web page will appear on the screen as shown in the figure 2.3.1.

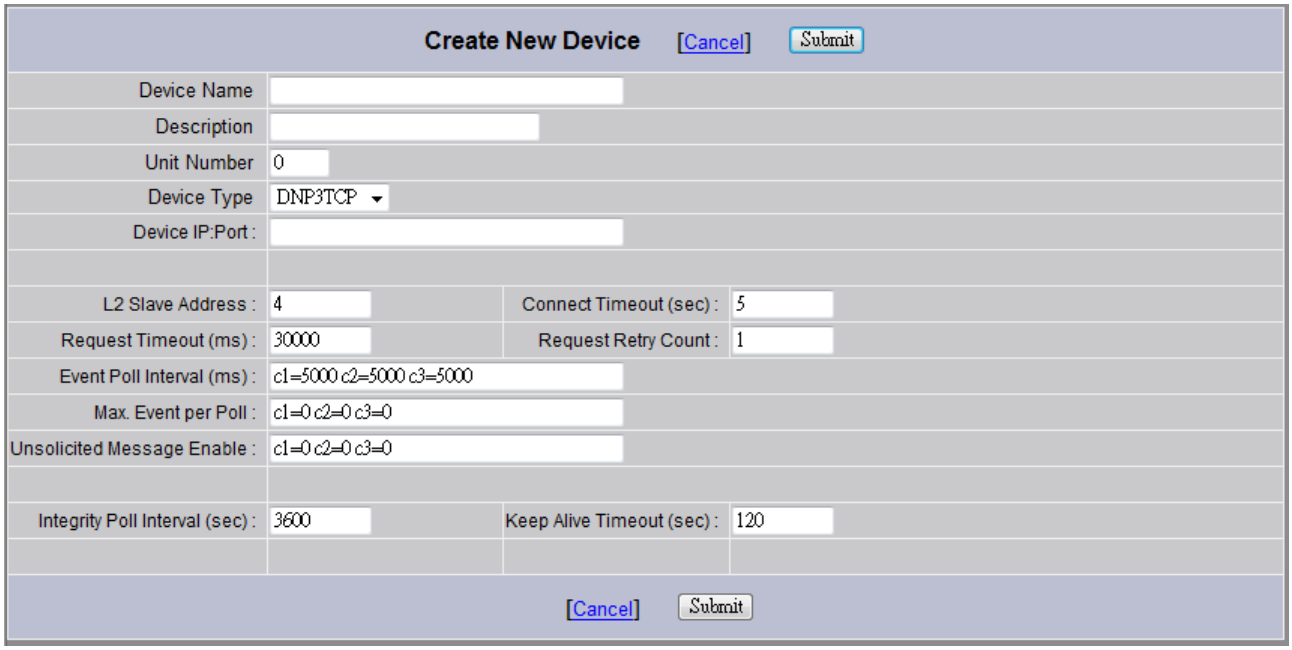

Figure 2.3.1

The settings of “Device Name”, “Description” and “Unit Number” are the common settings of WebAccess, please refer to the user manual of WebAccess to configure. Other settings are for the DNP3 protocol of outstation and detailed as follows:

Device Type : The parameter provides the information how to connect with the outstations using the DNP3 protocol.

Device IP:Port : The parameter specifies the IP address and TCP port to which the WebAccess should connect. If a user doesn’t specify the TCP port, then the default TCP port 20000 is used.

L2 Slave Address : This parameter specifies the link layer address of DNP3 which the outstation is bound to.

Connect Timeout : The parameter specifies how much time the WebAccess should wait

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for the TCP connect request before the outstation is considered as to be in error.

Request Timeout : This parameter specifies how much time the WebAccess should wait for the application layer request before timing out.

Request Retry Count : This parameter specifies how many times the WebAccess should try to resent the application layer request before the request is considered as to be in error.

Event Poll Interval : The parameter specifies how much time the WebAccess should wait for each event class to issue the event poll request. A user could assign zero to the interval of event class to disable the corresponding event poll request.

Max. Event per Poll : This parameter specifies the maximum number events could be retrieved per the event poll request. A user could assign zero to this field to delimit the count of event.

Unsolicited Message Enable : This parameter specifies whether the WebAccess should enable the unsolicited message response for the event class.

Integrity Poll Interval : The parameter specifies how much time the WebAccess should wait for to issue the class 0, 1, 2 and 3 request data.

Keep Alive Timeout : This parameter specifies the time elapses without any communication from the outstation to transmit a keep-alive status request to the outstation. A user could disable this feature by assigning zero to this field.

2.4 Tag Configuration

The DNP3 master driver uses the form “GRP.VAR.IDX /OPTIONS” as the WebAccess “Address” that maps from the address of point type of DNP3 outstation to the TAG name of WebAccess, where:

GRP: the object group of point type

VAR: the variation specifies the data type of object group requested

IDX: The specified identification of point type in a given group

/OPTIONS: The options give the operating request supported by a given group

The following sections detail the tag configuration of point type supported by the WebAccess.

2.4.1 Binary Input – Object Group 1

The web page of setting for “Binary Input” is shown in the figure 2.4.1.1.

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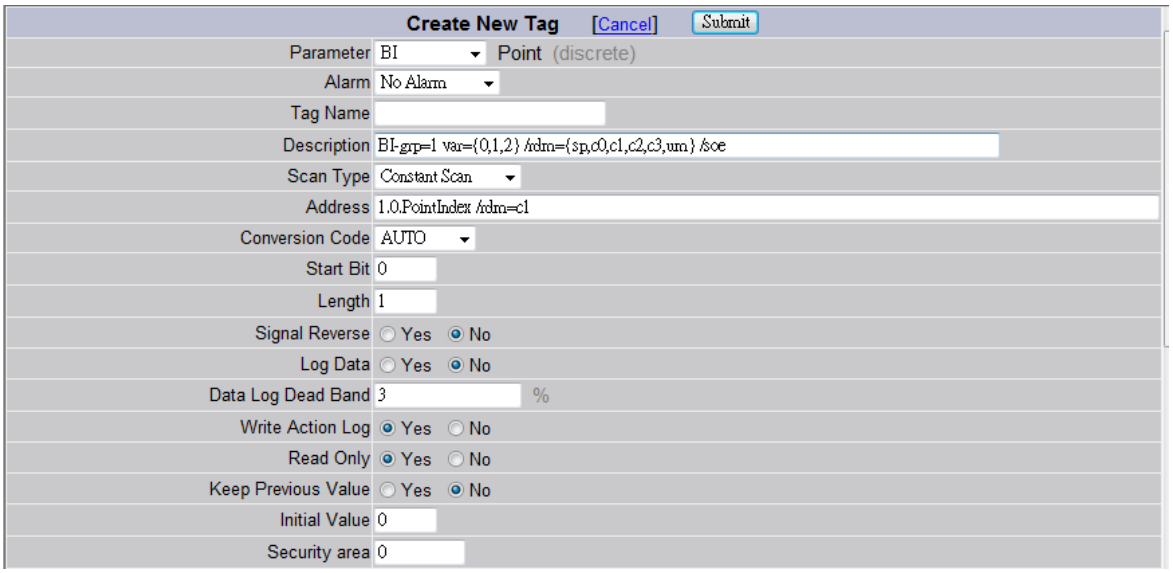

Figure 2.4.1.1

The option "/rdm" specifies how to retrieve the data from outstation by the WabAccess:

- sp : static data polling
- c0: event class 0 polling
- c1: event class 1 polling
- c2: event class 2 polling
- c3: event class 3 polling
- un: unsolicited message response

A user must specify one of modes to retrieve the data from outstation. The VAR is recommended to 0 that means the outstation will return the data type by its default setting.

2.4.2 Double-bit binary input – Object group 3

The web page of setting for "Double-bit Binary Input" is shown in the figure 2.4.2.1.

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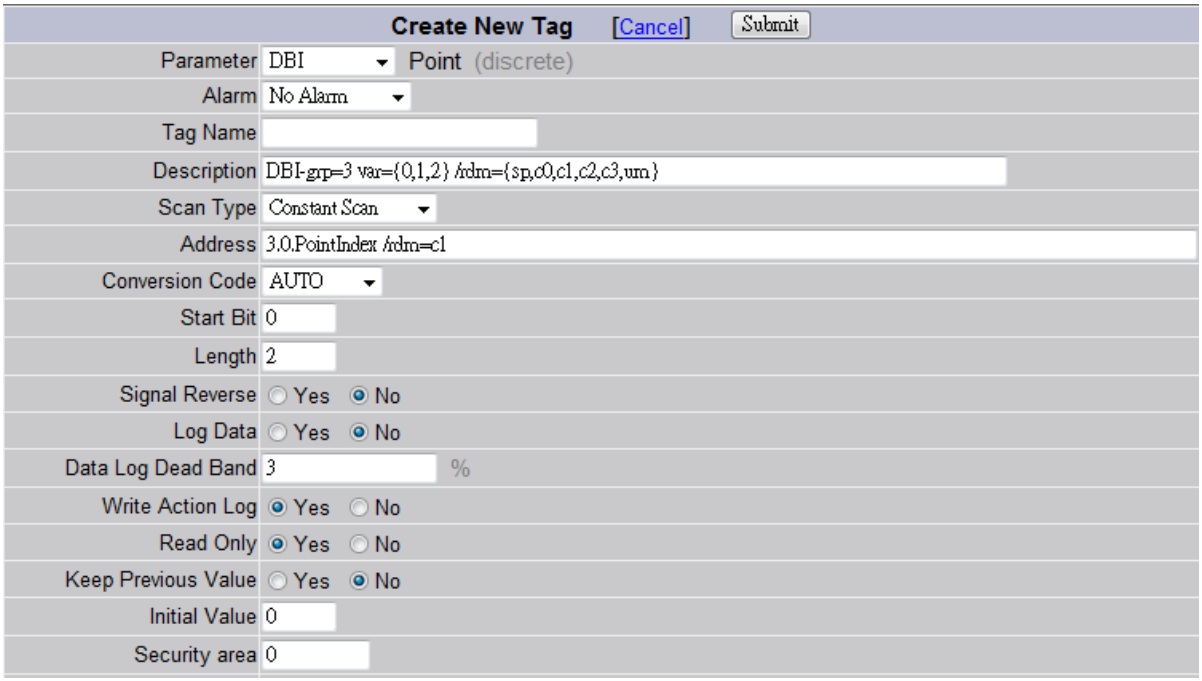

Figure 2.4.2.1

The option "/rdm" specifies how to retrieve the data from outstation by the WabAccess:

- sp : static data polling
- c0: event class 0 polling
- c1: event class 1 polling
- c2: event class 2 polling
- c3: event class 3 polling
- un: unsolicited message response

A user must specify one of modes to retrieve the data from outstation. The VAR is recommended to 0 that means the outstation will return the data type by its default setting.

2.4.3 Binary output – Object group 10

The web page of setting for "Binary output" is shown in the figure 2.4.3.1.

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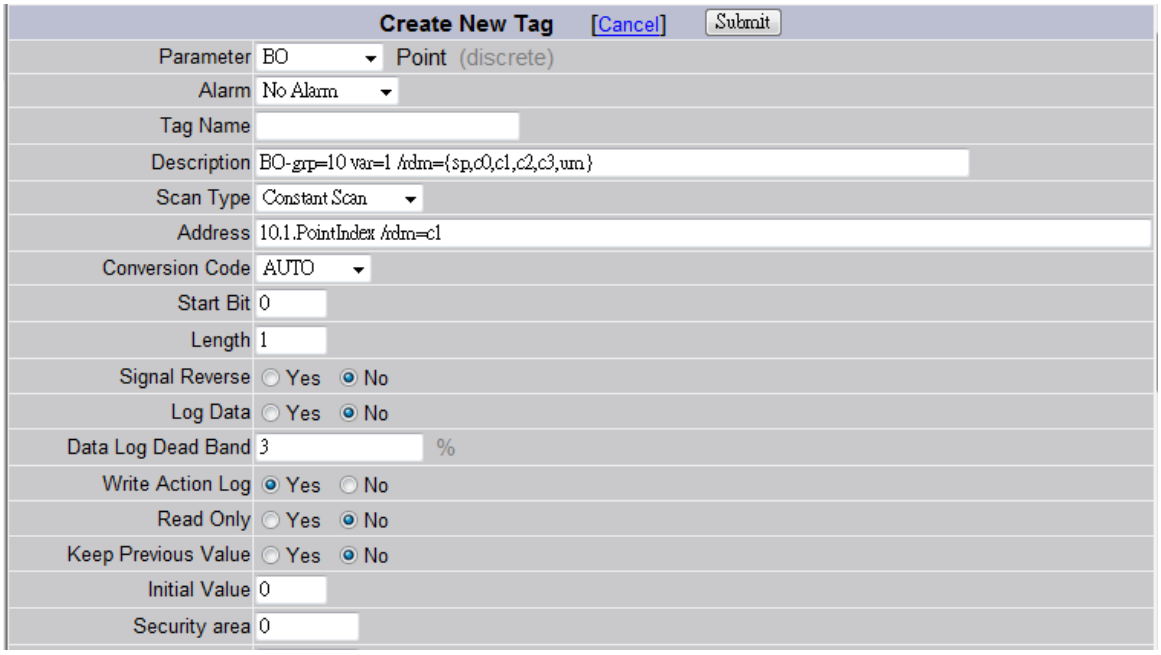

Figure 2.4.3.1

The option "/rdm" specifies how to retrieve the data from outstation by the WabAccess:

- sp : static data polling
- c0: event class 0 polling
- c1: event class 1 polling
- c2: event class 2 polling
- c3: event class 3 polling
- un: unsolicited message response

A user must specify one of modes to retrieve the data from outstation. Writing binary value into the TAG will trigger the DNP3 function code "WRITE" to be sent to the outstation. However, the "WRITE" function code is not supported by the object group 10 for each outstation. Please refer to the user manual of outstation about the "WRITE" function code being suitable for your device.

2.4.4 Control Relay Binary output – Object group 12

The web page of setting for "Control Relay Binary output" is shown in the figure 2.4.4.1.

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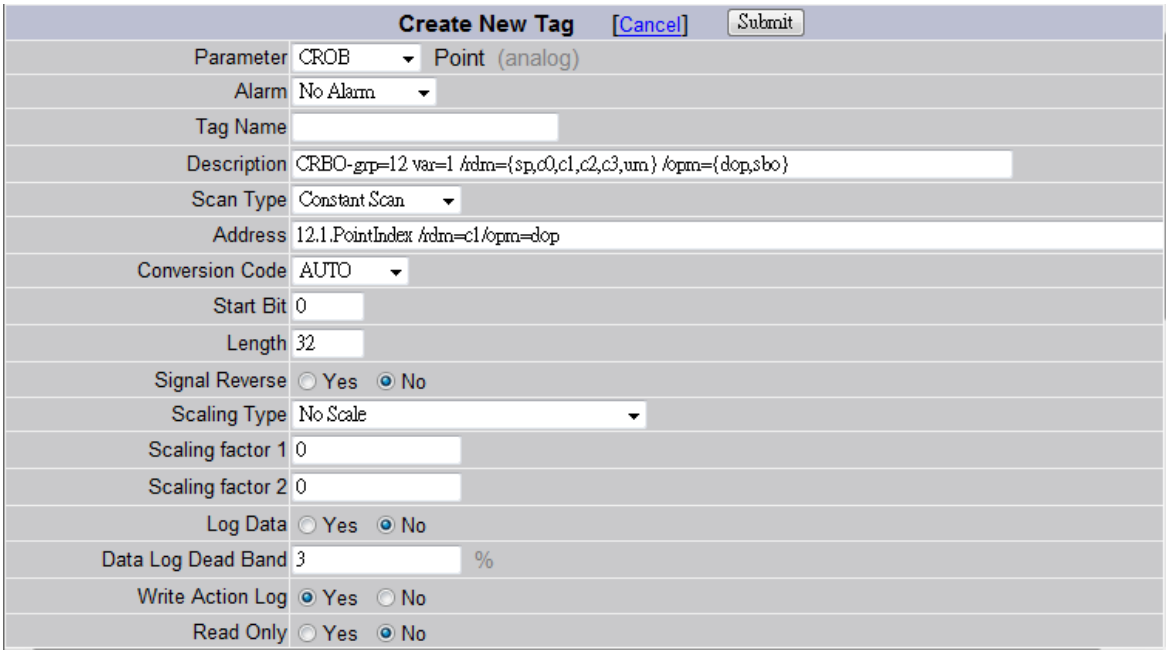

Figure 2.4.4.1

The option "/rdm" specifies how to retrieve the data from outstation by the WabAccess:

- sp : static data polling
- c0: event class 0 polling
- c1: event class 1 polling
- c2: event class 2 polling
- c3: event class 3 polling
- un: unsolicited message response

A user must specify one of modes to retrieve the data from outstation.

The option "/opm" specifies which function code is used to write the value into the outstation:

- dop : "direct_operate" function code is used to operate the "binary output"
- sbo: "select" and "operate" function code sequence is used to operate the "binary output"

How to issue a CROB, please refer the section "Output the value of binary output using CROB" for detail.

2.4.5 Counter – Object group 20

The web page of setting for Counter is shown in the figure 2.4.5.1.

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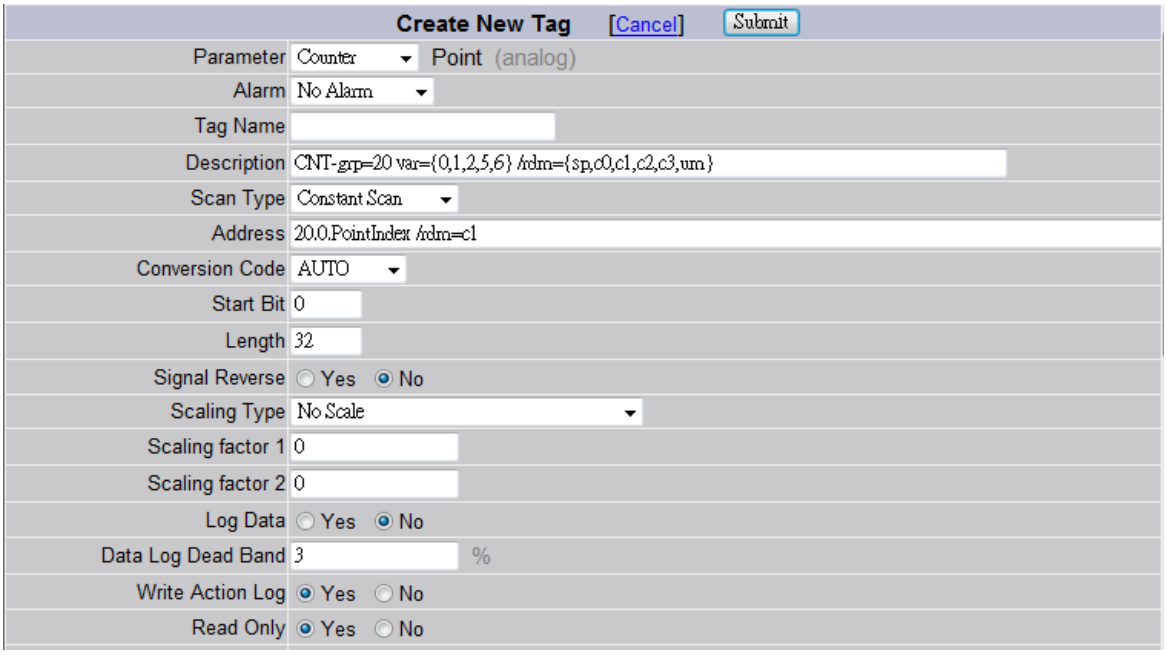

Figure 2.4.5.1

The option "/rdm" specifies how to retrieve the data from outstation by the WabAccess:

- sp : static data polling
- c0: event class 0 polling
- c1: event class 1 polling
- c2: event class 2 polling
- c3: event class 3 polling
- un: unsolicited message response

A user must specify one of modes to retrieve the data from outstation. The VAR is recommended to 0 that means the outstation will return the data type by its default setting.

2.4.6 Frozen Counter – Object group 21

The web page of setting for "Frozen Counter" is shown in the figure 2.4.6.1.

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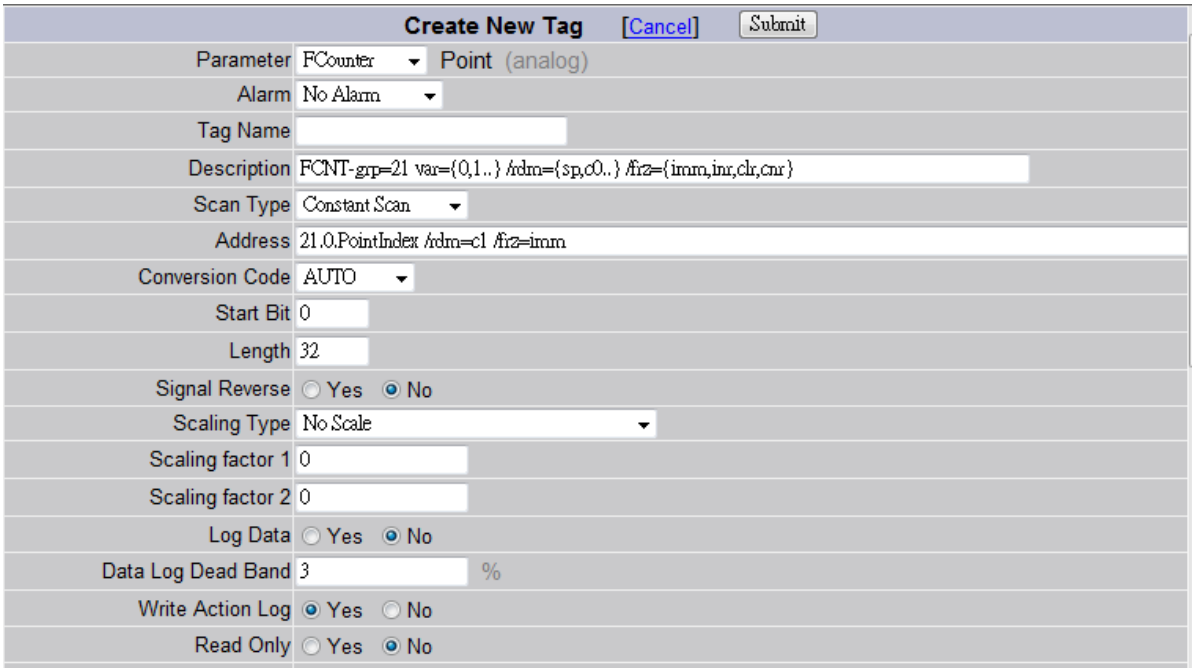

Figure 2.4.6.1

The option "/rdm" specifies how to retrieve the data from outstation by the WabAccess:

- sp : static data polling
- c0: event class 0 polling
- c1: event class 1 polling
- c2: event class 2 polling
- c3: event class 3 polling
- un: unsolicited message response

A user must specify one of modes to retrieve the data from outstation.

The option "/frz" specifies which function code is used to freeze the count value of frozen counter:

- imm : "Immediate Freeze" function code is used to operate the "frozen counter"
- inr: "Immediate Freeze –No Response" function code sequence is used to operate the "frozen counter"
- clr : "Freeze and Clear" function code is used to operate the "frozen counter"
- cnr: "Freeze and Clear-No Response" function code is used to operate the "frozen counter"

How to issue a freezing function code, please refer the section "Freeze the value of frozen counter" for detail.

2.4.7 Analog Input– Object group 30

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The web page of setting for “Analog Input” is shown in the figure 2.4.7.1.

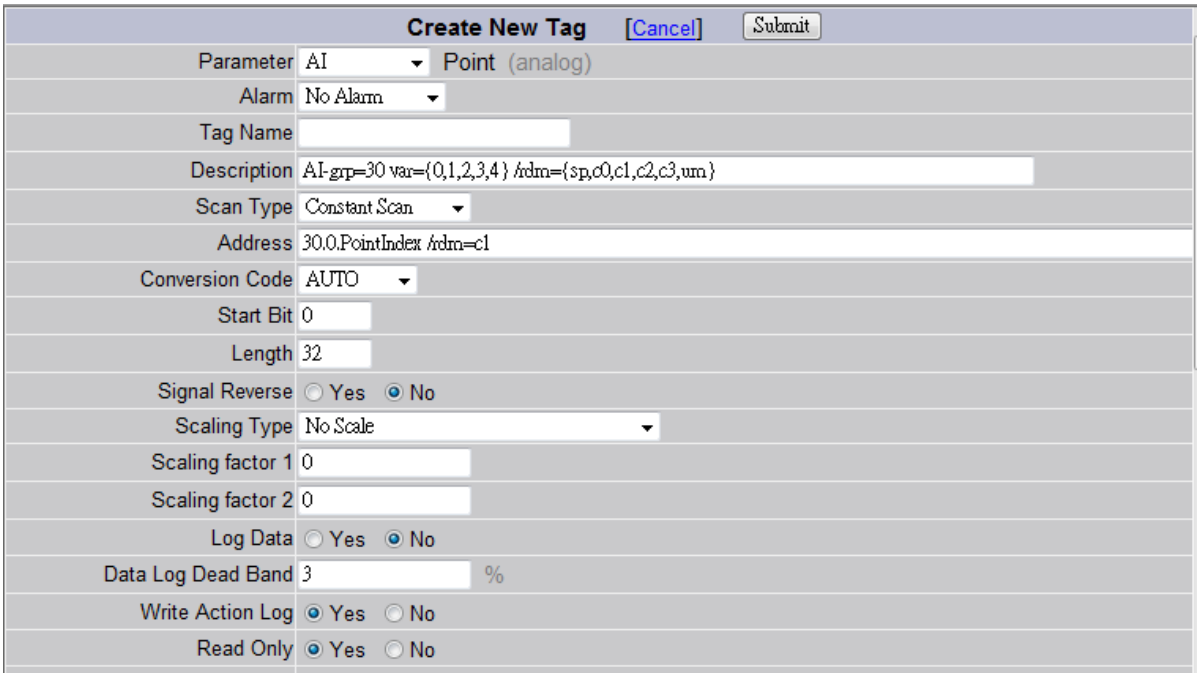

Figure 2.4.7.1

The option “/rdm” specifies how to retrieve the data from outstation by the WabAccess:

- sp : static data polling
- c0: event class 0 polling
- c1: event class 1 polling
- c2: event class 2 polling
- c3: event class 3 polling
- un: unsolicited message response

A user must specify one of modes to retrieve the data from outstation. The VAR is recommended to 0 that means the outstation will return the data type by its default setting.

2.4.8 Analog Output– Object group 40

The web page of setting for “Analog Output” is shown in the figure 2.4.4.1.

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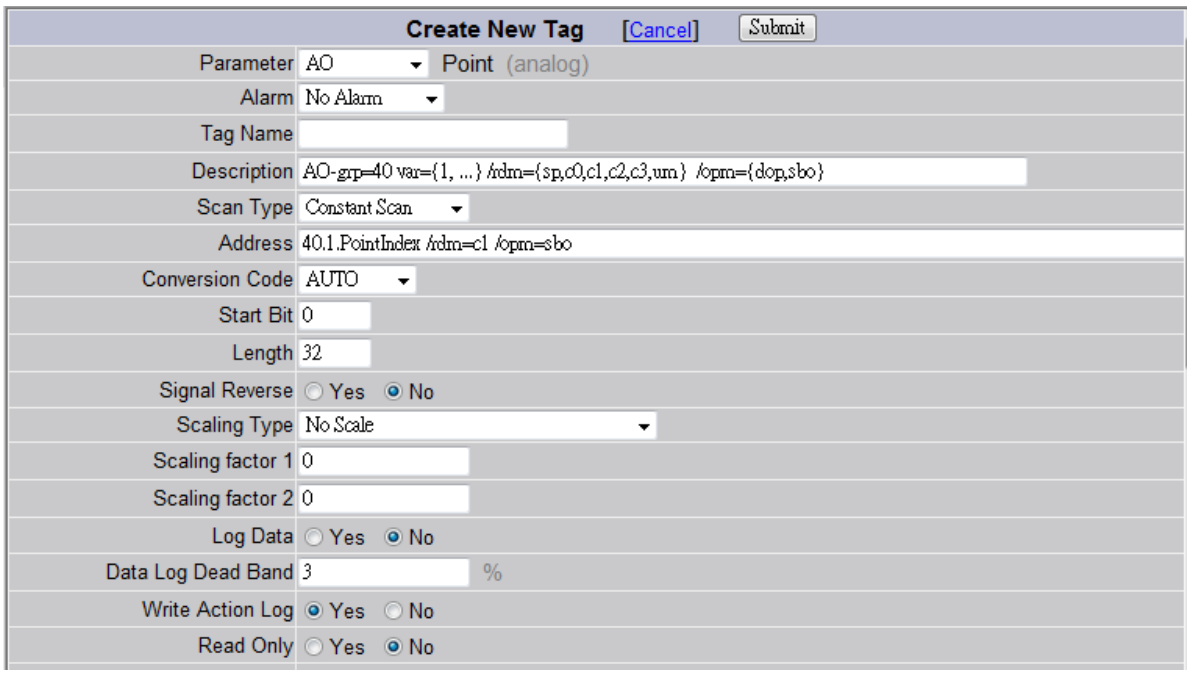

Figure 2.4.8.1

The option "/rdm" specifies how to retrieve the data from outstation by the WabAccess:

- sp : static data polling
- c0: event class 0 polling
- c1: event class 1 polling
- c2: event class 2 polling
- c3: event class 3 polling
- un: unsolicited message response

A user must specify one of modes to retrieve the data from outstation.

The option "/opm" specifies which function code is used to write the value into the outstation:

- dop : "direct_operate" function code is used to operate the "Analog output"
- sbo: "select" and "operate" function code sequence is used to operate the "Analog output"

Writing the analog value into the TAG will trigger the selected DNP3 function code to be sent to the outstation.

2.5 Parameter Template

For the convenient of user, the WebAccess provide the default parameter sets as shown in figure 2.5.1.

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Parameter set : DNP3TCP

Parameter name	Parameter Type	Description	Update	Delete
AI	analog	AI-grp=30 var={0,1,2,3,4} /rdm={sp,c0,c1,c2,c3,um}	Update	Delete
AO	analog	AO-grp=40 var={1, ...} /rdm={sp,c0,c1,c2,c3,um} /opm={dop,sbo}	Update	Delete
Counter	analog	CNT-grp=20 var={0,1,2,5,6} /rdm={sp,c0,c1,c2,c3,um}	Update	Delete
CROB	analog	CRBO-grp=12 var=1 /rdm={sp,c0,c1,c2,c3,um} /opm={dop,sbo}	Update	Delete
FCounter	analog	FCNT-grp=21 var={0,1..} /rdm={sp,c0..} /frz={imm,inr,clr,cnr}	Update	Delete
BI	discrete	BI-grp=1 var={0,1,2} /rdm={sp,c0,c1,c2,c3,um} /soe	Update	Delete
BO	discrete	BO-grp=10 var=1 /rdm={sp,c0,c1,c2,c3,um}	Update	Delete
DBI	discrete	DBI-grp=3 var={0,1,2} /rdm={sp,c0,c1,c2,c3,um}	Update	Delete

Figure 2.5.1

User could add or modify these Parameter Sets as the standard procedure provided by the WebAccess.

3. Special Point type Access method

3.1 Output the value of binary output using CROB

The CROB is representative as a array of analog data type. The format of CROB is as follows:

TAG(0): The current value of “CROB binary output”

TAG(1): Writing any value to this filed will trigger the request function code to be sent to the outstation

TAG(2): The control code of CROB defined in the standard of DNP3TAG(3): The number of times the outstation shall execute the operation

TAG(4): This is the duration, expressed as the number of milliseconds, that the output driver remains active

TAG(5): This is the duration, expressed as the number of milliseconds, that the output driver remains non-active

For detail information how to build a CROB value, please refer to the standard of DNP3.

3.2 Freeze the value of frozen counter

Reading the tag of frozen counter is to get the current value of frozen counter. Writing any value to the tag of frozen counter is to trigger the specified function code, for example

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"Immediate Freeze", to be sent to the outstation.

3.3 Add the SOE feature to a data point

User could add the option "/soe" to the tag address to indicate the changed value will be logged in the SOE log file.

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