Configuration Dialog Box (I/O Tags)

I/O tags - configuration dialog box

Editing of all objects in the process D2000 CNF is being performed in the configuration dialog box, a specific part of which is common for all editable objects and another part depends on the type of edited object.

The configuration dialog box of I/O tags consists of several parts (tabs) that contain similar parameters. The display of particular tabs depends on the category of the particular I/O tag.

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General properties

Description

A text string describing the I/O tag. Maximum: 128 characters.
It is possible to use the Dictionary (press **CTRL+L** to open).

Status text

Defines a status text for the I/O tag. The status text allows redefining labels of individual I/O tag values.

Transformation palette

Selection of an index to transformation palette. See the topic Transformation palette.

Value type

I/O tag value type. Admissible types of values are listed in the following table.

Label	I/O tag value type
Ai	Analog Input
Ao	Analog Output
Ci	Cardinal Input - integer input
Co	Cardinal Output - integer output
Di	Digital Input
Do	Digital Output
TiA	Time Input Absolute
ToA	Time Output Absolute
TiR	Time Input Relative
ToR	Time Output Relative
TxtI	Text Input
TxtO	Text Output
QI	Quaternary Input - quaternary input

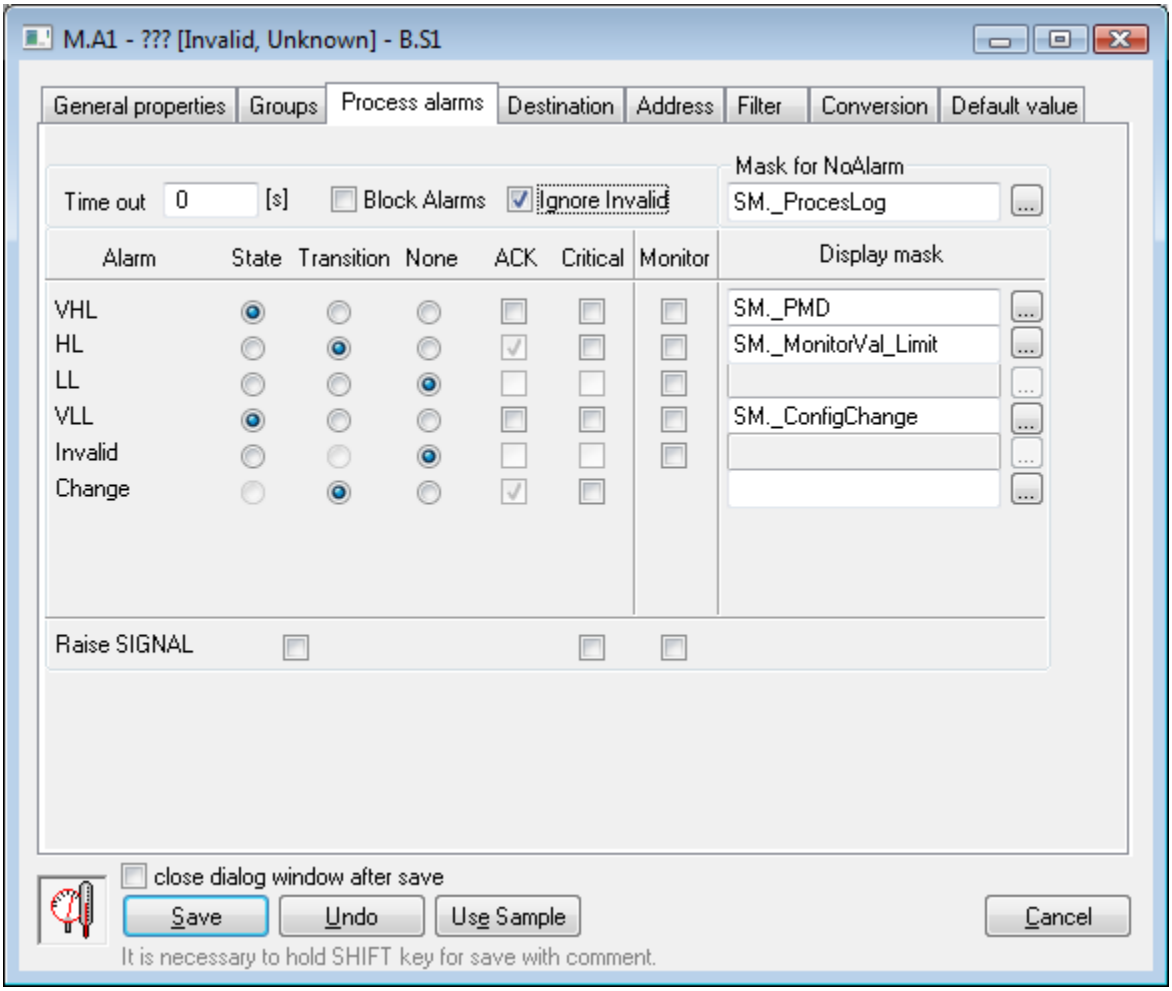
Technical units

Technical units of the I/O tag. Maximum: 12 characters. Possibility to use the Dictionary (press **CTRL+L** to open).

Limits

Technological limits may be defined for I/O tags of Ai, Ao, Ci, Co, TiR, and ToR types.

Process alarms



Timeout

Time delay (in seconds) for the evaluation of process alarm. Process alarm is raised, if the cause of raising the alarm is valid at least during this period.
Note: the time delay is applied only to status alarms - transition alarms occur immediately when the value is changed.

Block Alarms

The **Block Alarms** checkbox disables the evaluation of process alarms.

Ignore Invalid

If checked, it allows removing invalid values when evaluating process alarms.

Example: Value change from S1 to S2 is executed as follows: S1 --> invalid --> S2.
If the parameter is checked, the alarm evaluation will be: S1 --> S2.
If the parameter is not checked, the alarm evaluation will be: S1 --> invalid --> S2.

Mask for NoAlarm

Selection of a Display mask, that will be used in process D2000 HI (the Alarm list window - the **Event description** column) after changing the status of one of the defined process alarms into the **Normal** state.

Individual items allowing to set parameters of process alarms are ordered in a table. The table contains the following columns:

- **Alarm** - the column contains all possible causes of raising process alarm for the object.
- **State** - the radio buttons allow selecting just one of the **State**, **Transition,** or **None** options. Enabled **State** option means, that the process alarm starts when the value of the I/O tag is at least for the period defined by the **Timeout** parameter, in the particular state (the name of a particular state is placed in the respective row, in the **Alarm** column - pa_*ValueStateName*).
- **Transition** - checked **Transition** option means that the process alarm starts when the I/O tag value passes to a particular state (the name of a particular state is placed in the respective row, in the **Alarm** column - *pa_ValueStateName)*.
- **None** - process alarm is not evaluated when this option is enabled
- **ACK** - checked **ACK** option means that the process alarm must be acknowledged by an operator in process D2000 HI. "Transition" process alarm must be always acknowledged.
- **Critical** - this process alarm will have the critical flag.
- **Monitor** - the option will cause a particular change of the I/O tag value to be written into the log database as a spontaneous value change.
- **Display mask** - a selection of a display mask, that will be used in process D2000 HI (the Alarm list window - the **Event description** column) after changing the status of one of the defined process alarms to a particular state.

Raise SIGNAL

Raise SIGNAL parameter contains three checkboxes with the following function:

- **the first checkbox** - is placed below the **State** and **Transition** columns. When the option is enabled (checked), the system generates a signal, if any of the configured process alarms occur.
- **the second checkbox** - is placed below the **Critical** column. When the option is enabled (checked), the system generates the signal, if any of the configured critical process alarms occur.
- **the third checkbox** - is placed below the **Monitor** column. When the option is enabled (checked), the system will generate the signal, if any of the changes of defined process alarms are written into the log database.

Generating the signal means that the system tag **Signal_Trigger** is set to the TRUE value.

Destination

Destination column

It can contain the reference to a column of an object of the Structured variable type in the form *ObjectName[0]^ColumnName.* In such a case, the KOM process tries to copy the values of arrays with the start address which is configured in tab Address to the relevant column of the structured variable. There is no need to create individual I/O tags for each item of an array or for some other repeated address structure. Only selected communication protocols support this functionality. More additional information is mentioned in the description of a particular communication protocol.
Note: it is also possible to use a non-zero index, e.g. SV.MyVal[7]^MyCol - in this case, values are written into the structured variable starting with the specified row (in example 7).

The copying of values into the column of a structured variable is implemented only for input, the change of a particular value of a structured variable (e.g. in HI or via event) will not be transferred as output through the communication into the device.

The processing of values that are inserted into a structured variable is limited. The following processing is applied:

- Conversion
- Polarity
- Filter (except for the Oscillation, Value delay, and Alignment of value time)
- Limits

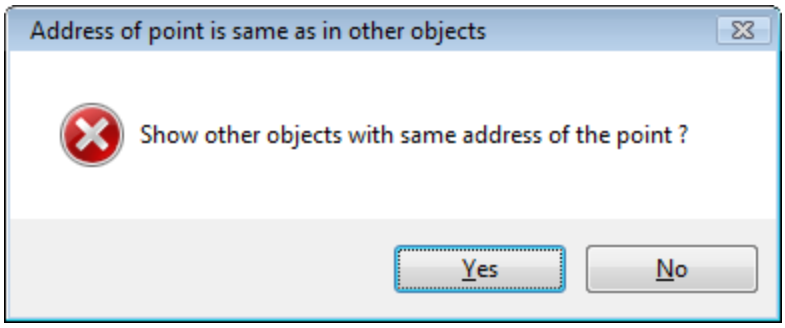
All parameters which are to be processed (e.g. limit setting) are applied according to the setting of the I/O tag where the destination column is configured (i. e. "master" I/O tag). The timestamps of the values inserted into the column of a structured variable are identical to the timestamp of a "master" I/O tag. The value of the "master" I/O tag and its behavior is normal, and it is not influenced by the configuration of the destination column.

Address

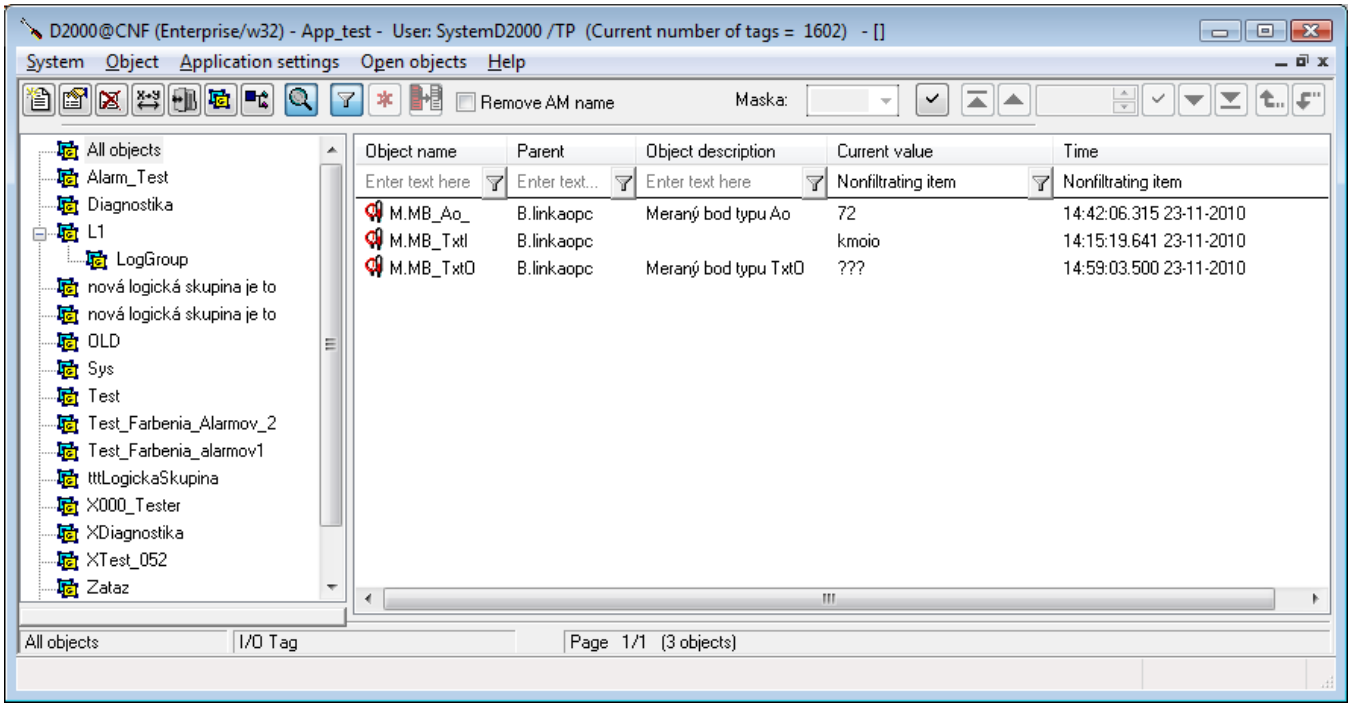
Address

I/O tag address. The address type depends on the communication protocol of the station, which is the parent of a particular I/O tag. The address is stored in the configuration database in text form. A specific communication protocol converts this address into a binary form. For internal communication protocols of the D2000 system, a protocol-dependent dialog box with the validity check of a specified address is used during the I/O tag address configuration. For external communication protocols (*OEM Protocol 1* up to *OEM Protocol 16*) of the D2000 system, the address is entered directly in text form.

During the saving of the I/O tag configuration, the uniqueness of its address is tested. If the address of the I/O tag is not unique (within a parent station), the system will inform you about the error.



By choosing the option **Yes**, a new CNF dialog window opens. Only I/O tags with conflicting addresses sharing a common parent are displayed in this window. The user can (but does not have to) change the address of these I/O tags.



Minute correction

A parameter is an integer number within the range of 0 to 59. If the timestamps of receiving values should be rounded to minutes, this value is important for rounding either up or down.
If the value is 0, it means the time correction is ignored. The timestamps of values that are limited by interval (0 - parameter) will be rounded down, i.e. to the minute in which they were received. Higher timestamps will be rounded up to the next minute.

Filter

Using the following group of parameters allows for defining a filtering method of analog inputs and outputs - Ai, Ao, Ci, Co, TiR, ToR.

New time => new value

Values of I/O tags acquired from the communication, which have a new time and their values are not changed, will be represented as new values.

Limits by device

This option is available if the device and communication protocols allow detecting device limits. If the parameter is checked, then the limits obtained from communication with this device will be used.

None

The filtering of the I/O tag values is not enabled.

Value = New * K + Old * (1-K)

Weighed first-order filter.

- *Value*- value after filtering
- *New* - filtered value
- *Old* - previous value
- *K* - the weight of the new value - a real number from the interval (0.0 .. 1.0).

The **Repeat** Parameter: This parameter provides compatible weighted filter behavior for change-based and server protocols (IEC-60870-5-101, IEC-60870-5-104, Modbus Server, TG809, BACnet, OPC, OPC UA ...). If a positive value of the **Repeat** parameter is specified, it determines the period of repeated generation of the value received by the I/O tag - similar to when the same value is repeatedly retrieved for periodically polling protocols (e.g. Modbus Client). So, if a one-time change of the I/O tag value occurs, the weighted filter will gradually progress toward the target value by repeating this value.

Values out of limits are undefined

If a new value is less than **Min** or greater than **Max**, the system sets it as an undefined value.

Keep value always in limits

If a new value is less than the **Min** value, the system will assign the **Min** value to this new value. If a new value is greater than the **Max** value, the system will assign the **Max** value to this new value. This filter may be used to eliminate values, which technically may not break given limits (e.g. throttle stops), but the particular sensor (converter) may also generate values out of limits

Set value if out of limits

If a new value is less than the **Min** value, the system will assign the **SetMin** value to this new value. If a new value is greater than the **Max** value, the system will assign the **SetMax** value to this new value.

Ignore value if out of limits

If a new value is less than the **Min** value or greater than the **Max** value, it will be discarded.

Dead Band

Definition of the bandwidth (quantization level), within which changes are not sent into the system (they are filtered out).

Oscillation limits

I/O tag values, which are changed by defined **Number** times in defined time (**Time** spin button), will cause the object value change to Oscillate.

Value absorption

The system will assign the value from the **Value** option to a particular I/O tag when its value belongs in <**Value-Range** ....**Value+Range>** interval (this option is used to suppress the "noise" of I/O tag value)

Value delay

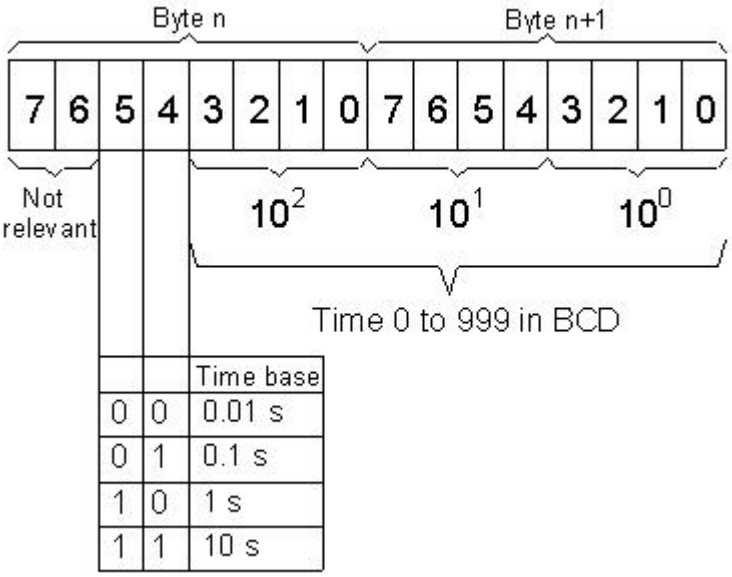
The system will assign a (True or False - it is defined by checking the respective checkbox) to a particular I/O tag only after it was unchanged during a defined time [s]. This filter can be configured for Boolean and Quaternary values only.

Round value time to

Allows rounding the value time to the closest time with a defined period (parameters **Hours**, **Minutes,** and **Seconds**).

Conversion

Conversion to technical units may be defined for analog and cardinal inputs and outputs - Ai, Ao, Ci, Co, TiR, and ToR.

Conversion type	Conversion formula
None	-
Linear	Output = A * Input + B
Polynomial	Output = A * Input^n *B x Input + C
Pt 100	Output = $\frac{-b + \sqrt{b^2 - 4ab\,Input}}{2a}$ a = -5.802E-05 b = 0.390802
Simatic S5Time	Conversion of the Siemens Simatic relative time structure.  Time base 0 0 0.01 s 0 1 0.1 s 1 0 1 s 1 1 10 s
Absolute value	Output = abs(Input)
Bitmask filter AND	Output = ((A + B<<32) & Input) >> C Note: the filter is configurable only for *Integer inputs* (Ci), constant A is a mask for the lower 32 bits, constant B is a mask for the upper 32 bits, and constant C indicates an optional shift of the result to the right by C bits. If C is negative, the result is shifted to the left by -C bits.

A, B, C, n - conversion constants

The above table shows the conversion performed when processing the value received from the device. An inverse conversion is performed when writing to the output I/O tag.

Therefore for I/O tags of output type (Ao, Co, and ToR), it's possible to configure only the linear conversion because only in this case there is an unambiguous inverse function used during value writing into a particular device.

Output control

Enable mode change

The option will enable or disable mode change (from Manual mode into Auto mode and vice-versa) on the operator level in process D2000 HI.

- If the option is enabled, then a value must be entered into the **Start value** input box and a control object must be defined - **Control object** input box. The valid mode is defined by means of **Manual/Auto** radio buttons. A mode may be changed in the D2000 HI process and its changes will be stored in the system database. The operator can change the required value in **Manual mode**. Its change is also stored in the system database.
- If the option is disabled, then only one of the **Auto** or **Manual** modes may be enabled. The operator's right to change the required value is defined by means of their access rights. Changing a required value in the D2000 HI process is allowed to an operator with **Control** access right level (or higher).

Save mode changes

A mode change (from Manual mode to Auto mode and vice-versa) is stored in the configuration database.

Save start value changes

Each start value change performed through the control window in process D2000 HI is written into the configuration database.

Start value

The start value is saved in text form. Then it is converted to a corresponding value type and it is set as the value of the I/O tag. If it is not entered or the conversion has not been successful, the initialization of output I/O tags' values is not performed.

Start value checkout

The button **Start value checkout** ( ) checks the defined start value and reports failure if the conversion is not successful.

Control object

The value of this object is to be used as the value of the output I/O tag in the **Auto** mode.

Auto

Enabling the option causes the value of the output I/O tag to copy the value of the control object.

Manual

Enabling the option causes the value of the I/O tag to use the value specified in the parameter **Start value** or the operator sets it manually in process D2000 HI.

Output mode

I/O tag output mode.

- **Value** - I/O tag with its own value acquired from the communication. Writing a new value of the I/O tag into a particular device is accompanied by a transient state. The new value is confirmed after the communication verifies the writing.
- **Command** - Output I/O tag, that may not have its own value (cannot acquire it by means of communication with a particular device). A new value written into the device does not go through the transient state. Control windows in the D2000 HI process also allow writing the same value several times (e.g. enabled ON and OFF buttons at the same time - unlike the *value output* tags where only the button of the opposite value than the current one is enabled).

Execution timeout

The parameter defines the command execution timeout - writing a value of the I/O tag. If the value of the parameter is different from zero and writing an I/O tag value is not confirmed during the timeout, the writing is not considered successful and a process alarm *ErrorWriteCmd* occurs if it is defined (the item **ErrorWriteCmd** in the tab Process alarms).

Output time

The parameter **Use D2000 Server time** allows using the time of the computer where the process D2000 Server is running as the time for output I/O tag's value. Otherwise, the time acquired by the communication with the device is used.

Maximum step size for a change

The parameter "**Maximum step size for a change**" allows limiting the maximum change of value for manual control. This limitation has the character of a recommendation and a user is able to override it.

Default value

The default value allows replacing an I/O tag value acquired by the D2000 KOM process, with another one in some cases, (e.g. the sensor device breakaway, a failure of the communication with the device). An I/O tag value may be replaced by a value of another object (so-called control object) or adjusted manually by the operator of the D2000 HI process via the control window.

Use default value

Enables the use of default value. The default value for a particular I/O tag is used automatically from the beginning - since the D2000 KOM process is started.

Save changes of the default value mode

If the option **Use default value** is checked, then a change of the use of default value or disabling the default value from the control window in the D2000 HI process is to be stored in the configuration database (it enables or disables the option **Use default value**).

Force default value on HardError

If the communication process evaluates an I/O tag value as unknown (acquired from the communication or failure of the communication with the station), then the default value will be used. After the communication is recovered, the default value will be ignored and the I/O tag gets a value acquired from the communication. This change into the default value or ignoring of the default value will not be written into the configuration database (even if the option **Save default value changes** is enabled).

Allow switchover to default value in HI

The operator may switch an I/O value into the default value and vice-versa in the D2000 HI process.

Enabled mode change

The option allows us to enable or disable mode change (from Manual mode to Auto mode and vice-versa) on the operator level in the D2000 HI process. If the option is enabled, a control object must be entered - **Control object** item.

Save default value changes

A change of the default value, adjusted manually in a particular control window, is to be stored in the configuration database.

Default value

The default value is stored in text form. It is converted to a required value type and then is used as the value of the I/O tag.
If it is not defined or conversion has failed, the initialization of the values of the output I/O tag will not be executed (more info...).

Default value verification

The **Default value verification** ( ) button will verify entered default value and if is not valid, the system will display the report on it.

Control object

The value of this object will replace the value of the I/O tag in Auto mode.

Auto

Enabling the option will cause the default value of the I/O tag to follow the value of the control object.

Manual

Enabling the option will cause the default value of the I/O tag to use a value in the **Default value** input box or it can be manually entered by the operator in the D2000 HI process.

Polarity

The logical polarity of the I/O tag is adjusted for digital I/O tags - Di, Dout.

- **Normal** - an I/O tag value is not to be changed.
- **Inverse** - an I/O tag value is to be inverted.

Verification

The tab **Verification** allows setting confirmation for writing the output (verified) I/O tag using an input object (verifying). The verifying object can be an object of I/O tag, Switch, or other types (e.g. Eval tag). For the I/O tag with enabled verification to be written successfully, it is not enough to send a value to the communication (and receive the confirmation of successful writing from the partner station, if the communication protocol allows it), but a value of the verifying object must be received, that confirms the writing.
Verification is useful if the D2000 system is part of a distributed control system (e.g. in energetics), where successful writing of an I/O tag (e.g. setting the setpoint for the generator output) doesn't mean that the real value was changed to a required value (the generator can be in the manual mode with the regulator disconnected, so the setpoint change of the regulator does not have any effect on the generator output). Only after a new value of the I/O tag which represents the real value of the generator output, if it is the same (with the Delta tolerance) as the value set, means that writing was successful.

When the verification is enabled, the following rules are valid :

- Writing a verified output I/O tag is successful if a new value of the verifying object that confirms the value written will come within the execution timeout (the Output control tab). Values of the verifying object, which do not meet the condition, will not cause any action (i.e. they do not cause unsuccessful writing).
- If the execution timeout is 0, waiting is not time-limited.
- If the execution timeout expires, writing to the output I/O tag is considered to be unsuccessful and the alarm ErrorWriteCmd occurs, if it is configured.
- Within the execution timeout, several values of the verifying object may come. The values, which are not equal to the value written (with the Delta tolerance) do not cause the writing to be treated as unsuccessful, i.e. writing to the I/O tag is unsuccessful only after the execution timeout exceeds.
- If the value of the verifying object is equal to the written value of the output I/O tag (with the Delta tolerance) when the value was written, the writing is acting as if the verification is not enabled, i.e. it does not wait for a new value of the verifying object, but writing is successful immediately after sending the value to the communication (and after confirmation, if the protocol supports it).

Table: evaluation of equation and validity of the tolerance parameter *Delta* for various type combinations of verifying object and verified output I/O tag.

	D - logical value I - integer value		R - real value Ta - absolute time Tr - relative time			Txt - text Q - quaternary value	
Verifying object Verified I/O tag	**D**	**I**	**R**	**Ta**	**Tr**	**Txt**	**Q**
Dout (logical)	equation	equation *	Delta				On/Off
Co (integer)	equation **	Delta	Delta				Delta ***
Ao (real)	Delta **	Delta	Delta				Delta ***
ToR (relative time)			Delta		Delta		
ToA (absolute time)			Delta	Delta			
TxtO (text)						equation	

Notes:

* - the value of 0 corresponds to the status B_False, the other values correspond to the status B_True

** - the values of 0, 1, 2 correspond to the states B_False, B_True, B_Oscillate of logical value

*** - the values 0, 1, 2, 3, 4 correspond to the states Q_Trans, Q_Off, Q_On, Q_Err, Q_Osc

Verifying object

An I/O tag (or Eval tag, Switch, ...), the value of which is the reaction to writing to the verified output I/O tag.

Delta

A number that determines the permitted deviation of the values of the verified output I/O tag and the verifying object. If the absolute value of the value difference is smaller or equal to Delta, the writing is successfully confirmed (**Abs(Out-In)<Delta**, details for various type combinations are shown in the table above). For I/O tags of TxtO type (text output), the parameter is not used.

Absolute value

Delta is an absolute number.

Percent of range

Delta is a percent of range (the range is the difference between the high and low limits of the verified object, i.e. HL - LL). If the limits are defined dynamically and they are crossed, verification is evaluated according to the last valid Delta.

Follow the verifying object value

If this option is active, the output I/O tag copies the value of the verifying object (but without performing writes in the communication). It is thus possible to ensure e.g. initialization after the start or controlling from the scheme by entering changes relative to the current value (e.g. +/- buttons on the scheme).

Related pages:

I/O tags
I/O tags - processing a value acquired from the communication
IO tags - values