Analog Voltage Outputs

0-10V Outputs Control Module

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[2.0]_a	**Changes in the application program**: • New functionality: o Characteristic curve o Advanced Relative Control o Custom On/Off o Day/Night mode o Simple timer o Flashing o Scenes o Auto Off o Lock o Alarm o Standby o Initialization	 8 11 12 13 14 16 17 18 18 20 22 22

1 INTRODUCTION

A variety of **Zennio** devices incorporate a functional module for the control of **fans, adjustable valves or other elements** connected to their outputs and commanded by an **analog continuous voltage signal** in the range 0 to 10 VDC.

Important: *In order to confirm whether a particular device or application program incorporates the analog voltage output function, please refer to the **device user manual**, as there may be significant differences between the functionality of each Zennio device. Moreover, to access the proper analog voltage output user manual, it is always recommended to make use of the specific download links provided at the Zennio website (www.zennio.com) within the section of the specific device being parameterised.*

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2 CONFIGURATION

Please note that the screenshots and object names shown next may be slightly different depending on the device and on the application program.

2.1 ANALOG VOLTAGE OUTPUT X

The analog voltage output, once enabled, can be oriented to regulate a **fan**, the **valves** of a fan coil or a **generic** 0-10V **load**.

For each type of output, the available functionalities will be different. The generic output will have all the options available while the fan and valve type output will have a more limited functionality, according to the element to be controlled:

Functionality	Generic Output	Valve	Fan
On/Off Control	✓	✘	✘
Relative Control	✓	✘	✘
Absolute Control	✓	✓	✓
Limits	✓	✓	✓
Characteristic Curve	✓	✓	✓
Custom On/Off	✓	✘	✘
Day/Night Mode	✓	✘	✘
Simple Timer	✓	✘	✘
Flashing	✓	✘	✘
Scenes	✓	✘	✘
Auto Off	✓	✘	✘
Lock	✓	✘	✘
Alarm	✓	✘	✘
Standby	✓	✘	✘
Initialization	✓	✘	✘

Table 1. Functionalities Generic Output, Valve and Fan.

Devices featuring the analog voltage outputs functional module shall incorporate a LED indicator associated to each output. The LED will remain off while the status of the output is 0% and permanently on while it is 100%. At intermediate values, it will flash at different frequencies (depending on the percentage value). Each LED will have its button, which will be used to control the output manually.

ETS PARAMETERISATION

After enabling the **Analog Voltage Output** module**,** in the device general configuration tab, the tab "Analog Voltage Output X" is added to the left tree.
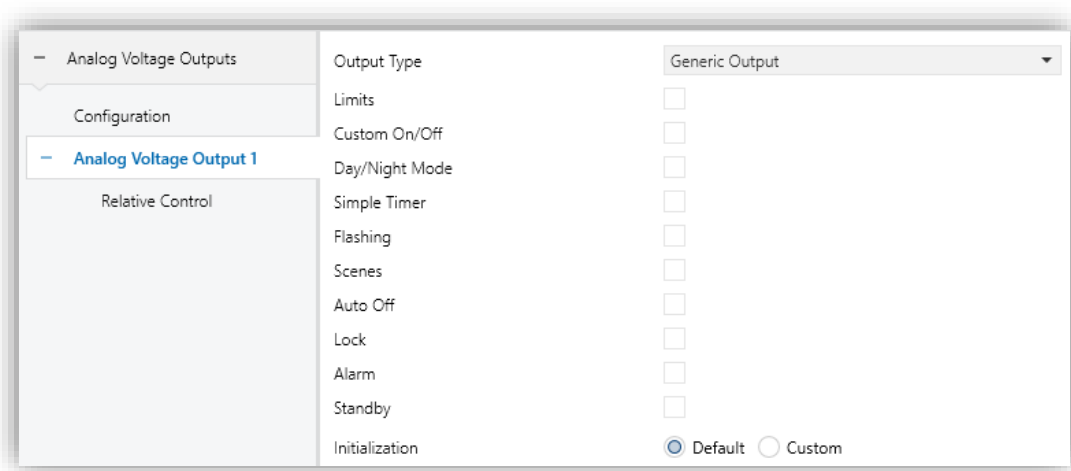

Figure 1. Analog Voltage Output X

- **Output Type** [*Generic Output / Valve / Fan*][1]. The following communication objects are included for any type of output:

  - ➢ **"[AOx] Absolute Control"**: receives a percentage value that is taken as reference to generate a proportional voltage output (0-10V).

  - ➢ **"[AOx] Output (Status)"**: indicates, in percentage terms, the value of the output. This object is sent every time a new voltage is applied to the output.

  For the **output type** "Generic Output", the following objects will be also available:

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[1] The default values of each parameter will be highlighted in blue in this document, as follows: [*default / rest of options*].

➢ **"[AOx] On/Off"**: switches the output value between 0% for off commands, and the parameterized maximum voltage for on commands.

➢ **"[AOx] On/Off (Status)"**: indicates the status of the output. It will be off if the output value is 0% and on for any value from 1 to 100%.

➢ **"[AOx] Relative Control"**: controls the output by increasing or decreasing its value by a specified percentage.

- **Limits** [*disabled/enabled*]: enables "Limits" tab in the left tree, where the analog output limits and its characteristic curve are defined. Please see section 2.1.1 for details.

For the **output type** "Generic Output", several additional functionalities will be available. There will be a tab that will always be available:

- **Relative Control**: where the relative control behaviour can be configured. See section 2.1.2 for more details.

All the other tabs can be enabled by parameter:

- **Custom On/Off** [*disabled/enabled*]: enables the "Custom On/Off" tab, which allows defining the on and off values of the output. See section 2.1.3.

- **Day/Night Mode** [*disabled/enabled*]: activates the day/night mode functionality and enables a tab of the same name for its configuration. See section 2.1.4 for more details.

- **Simple Timer** [*disabled/enabled*]: enables the "Simple Timer" tab, which allows configuring a timed on/off sequence of the output. See section 2.1.5.

- **Flashing** [*disabled/enabled*]: enables the "Flashing" tab to configure a sequence of on and off commands for the output. See section 2.1.6 for more details.

- **Scenes** [*disabled/enabled*]: activates the scenes functionality and enables a tab of the same name for its configuration. See section 2.1.7 for more details.

- **Auto Off** [*disabled/enabled*]: activates the auto off functionality and enables a tab of the same name for its configuration. See section 2.1.8 for more details.

- **Lock** [*disabled*/*enabled*]: enables the "Lock" tab, which allows defining the behaviour of the output when it is locked or unlocked. See section 2.1.9.

- **Alarm** [*disabled*/*enabled*]: activates the alarm functionality and enables a tab of the same name for its configuration. See section 2.1.10 for more details.

- **Standby** [*disabled*/*enabled*]: enables notification when the output is off for a certain period. The "Standby" tab is enabled for the configuration of the related parameters. See section 2.1.11 for more details.

- **Initialization** [*Default / Custom*]: enables configuration of the output initialization type. When selecting "Custom", the new tab "Initialization" is enabled. Please see section 2.1.12 for details.

2.1.1 LIMITS

In this tab is set the voltage operation range of the element to be connected, and a minimum control value for loads that require a minimum voltage level to start operating.

- **Voltage minimum and maximum value**: defines the upper and lower limit of the supplied voltage in order to adjust the behaviour of the output to the working range of the connected load. Therefore, a 1% control command may not correspond to 0.1V at the output nor a 100% command to 10V, if so configured.

Example 1: *Valve 2-8V connected to the output.*

Configuration:

- *Minimum voltage (Vmin) = 2V*

- *Maximum voltage (Vmax) = 8V*

o *Control command of 100%, output voltage of 8V*

o *Control command of 50%, output voltage of 5V*

o *Control command of 0%, output voltage of 0V*
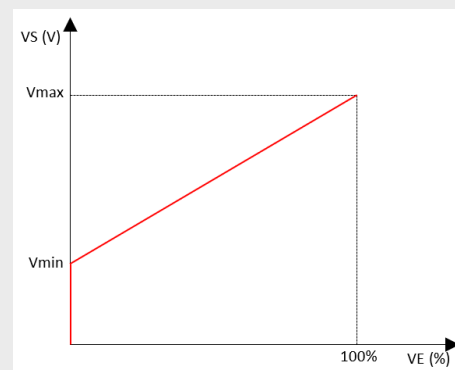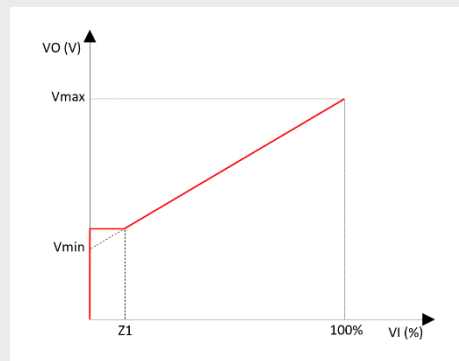

- **Control minimum value:** any control command lower than this value will establish a voltage in the output equivalent to the one it would have if the command were this minimum control value. In this way a minimum voltage in the load can be ensured.

__Example 2__: Valve 2-8V connected to the output.

__Configuration:__

- *Minimum voltage (Vmin) = 2V*

- *Maximum voltage (Vmax) = 8V*

- *__Minimum Control (Z1) = 25%__*

o *Control command of 100%, <u>output voltage of 8V</u>*

o *Control command of 25%, <u>output voltage of 3,5V</u>*

o *Control command of 10%, <u>output voltage of 3,5V</u>*

o *Control command of 0%, <u>output voltage of 0V</u>*

Additionally, a parameter can be enabled so that a **control command of 0%** maintains the parameterized value at **Voltage Minimum Value (Vmin)** instead of 0V. In the case of enabling this parameter, the output voltage will never be lower than Vmin during normal operation of the device.

__Example 3__: Valve 2-8V connected to the output.

__Configuration:__

- *Minimum voltage (Vmin) = 2V*

  → *__Even with control = 0%__*

- *Maximum voltage (Vmax) = 8V*

- *Minimum Control (Z1) = 25%*

o *Control command of 100%, output voltage of 8V*

o *Control command of 10%, output voltage of 3,5V*

o *Control command of 0%, <u>output voltage of 2V</u>*
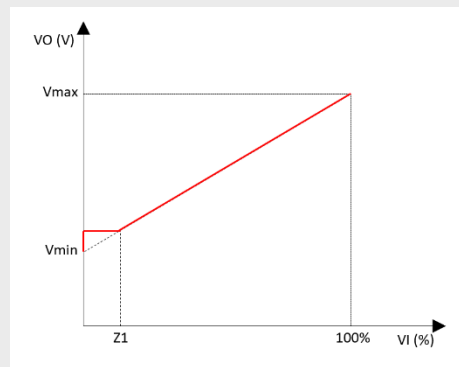
In addition, a **characteristic curve** for the output can be **customised** so that the control signal is not applied directly to the output but is scaled beforehand. For this purpose, up to 2 additional pairs of values can be entered in addition to those provided by the limits.

The output status object, will provide a percentage according to the established limits: 100% when the voltage reaches the maximum value and 0% with a voltage of 0V or the minimum value, as indicated above.

Note: *if incorrect values are set, either in the limits or in the characteristic curve values, the default values will be downloaded to the device.*

ETS PARAMETERISATION

When **Limits** is enabled in the "Analog Voltage Output X" tab (see section 2.1), a new tab of the same name is added to the left tree.
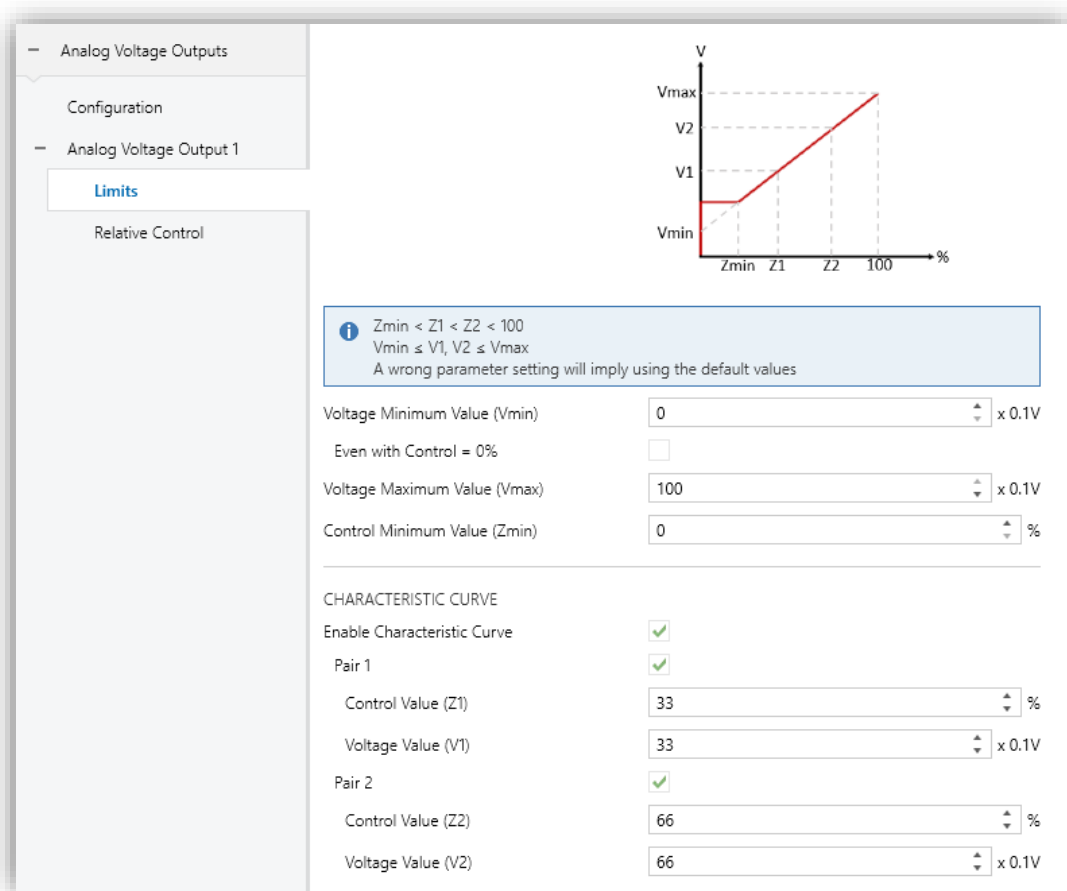

Figure 2. Limits

- **Voltage Minimum Value (Vmin)** [*0…100*] [*x 0.1V*]: defines the minimum operating voltage of the load*.*

    ➢ **Even with Control = 0%** [*disabled/enabled*]: if enabled, the voltage will go to the parameterised minimum value with an input signal of 0%.

- **Voltage Maximum Value (Vmax)** [*10…100*] [*x 0.1V*]: defines the maximum operating voltage of the load.

- **Control Minimum Value (Zmin)** [*0…100*] [*%*]: sets the minimum percentage value for the control signal.

In addition, the parameters for customising the output **characteristic curve** will be displayed:

- **Enable Characteristic Curve** [*disabled/enabled*]: enables up to two additional pairs of values to those provided by the limits, for the curve configuration.

    ➢ **Pair N** [*disabled/enabled*]:

      • **Control Value (Zn)** [*0…100*] [*%*]: defines an additional percentage value within the curve. It must comply with the following condition:

$$Zmin < Zn < 100$$

      • **Voltage Value (Vn)** [*0…100*] [*x 0.1V*]: sets the load operating voltage for the control signal Zn. It must comply with:

$$Vmin \leq Vn \leq Vmax$$

2.1.2 OUTPUT CONTROL

The output can be controlled in three different ways depending on the type of object used:

- **On/Off**: switching the output on (maximum voltage) or off.

- **Relative control:** implies an increase or decrease of the voltage by a specific percentage.

    In addition, it will be possible to choose whether to allow the output to be switched on and/or off by means of a relative control command or not. If switching off is not permitted, the output remains at the parameterised minimum after a relative control command below the **control minimum value** (see section 2.1.1).

- **Absolute control:** the command received is of percentage type. The output voltage will be proportional to this value.

Note: *relative and on/off control will only be available for the generic analog voltage output. See section 2.1 for more information.*
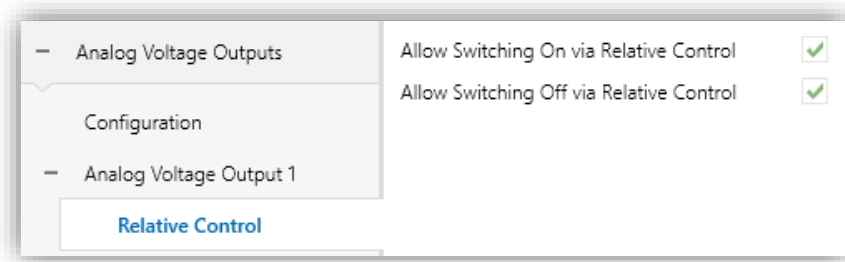
Control Relative tab will always be available.

Figure 3. Relative Control

- **Allow Switching On via Relative Control** [*disabled/enabled*]: determines whether a previously switched off output may be switched on by means of a relative control command.

- **Allow Switching Off via Relative Control** [*disabled/enabled*]: determines whether the output may be switched off if a relative control command is received with a value lower than the parameterized minimum.

2.1.3 CUSTOM ON/OFF

This function offers one additional on/off control for each output, and therefore another new communication object to be switched on and off.

This additional control can be customized with specific control levels for the "On" and "Off" states.

Note: *functionality only available for generic analog voltage output. See section 2.1 for more information.*

ETS PARAMETERISATION

When **Custom On/Off** is enabled in the "Analog Voltage Output X" tab (see section 2.1), the 1-bit communication object **"[AOx] Custom On/Off"** is also enabled and a new tab of the same name is added to the left tree.
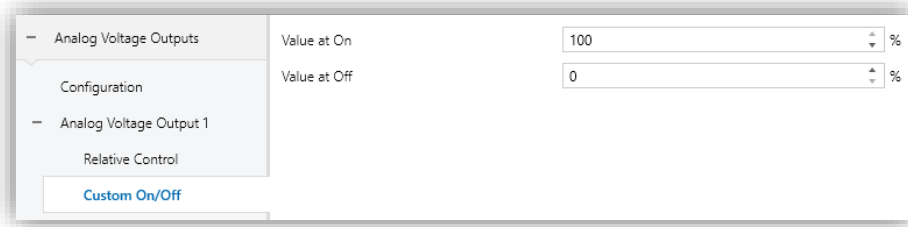

Figure 4. Custom On/Off

- **Value at On** [*0…100*] [*%*]: sets the percentage to apply to the output when a '1' is received.

- **Value at Off** [*0…100*] [*%*]: sets the percentage to apply to the output when a '0' is received.

2.1.4 DAY/NIGHT MODE

In addition to custom On/Off, analog voltage output module offers the control known as Day/Night Mode.

This control enables the output to be switched On and Off using a 1-bit object and to change between two control modes.

Note: *functionality only available for generic analog voltage output. See section 2.1 for more information.*

ETS PARAMETERISATION

When **Day/Night Mode** is enabled in the "Analog Voltage Output X" tab (see section 2.1), a new tab of the same name is added to the left tree.
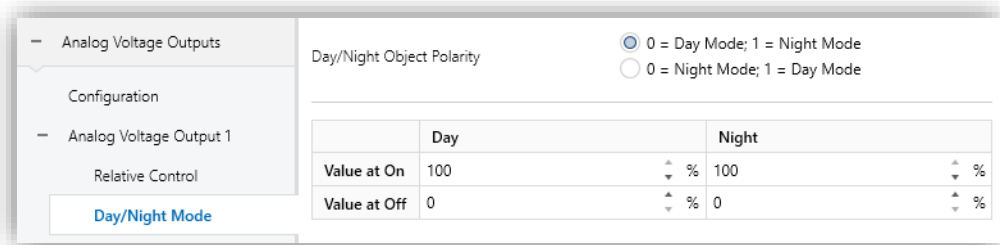

Figure 5. Day/Night Mode

- **Day/Night Object Polarity** [*0 = Day Mode; 1 = Night Mode / 0 = Night Mode; 1 = Day Mode*]: configures which value of the object **"[AOx] Day/Night Mode"** should activate which mode.

- **Value at On** [*0…100*] [*%*]: sets the percentage applied to the output for each of the modes when the value '1' is received via the object **"[AOx] Day/Night Mode On/Off"**.

- **Value at Off** [*0…100*] [*%*]: sets the percentage applied to the output for each of the modes when the value '0' is received via the object **"[AOx] Day/Night Mode On/Off"**.

2.1.5 SIMPLE TIMER

This function consists in a switch on of the output (with an optional delay) after receiving the corresponding trigger object, and a later automatic switch off after a set time or after the corresponding object has been received from the bus (also optionally delayed).

Additionally, once this functionality is being executed, it is possible to parameterise the action to be performed when the trigger object is received again, allowing to restart the time count of the active stage (on duration or delays) or multiply the on duration according to de number of retriggering actions received (up to a maximum of 5).

Note: *functionality only available for generic analog voltage output. See section 2.1 for more information.*

ETS PARAMETERISATION

Once **Simple Timer** function is enabled, in the "Analog Voltage Output X" tab (see section 2.1), the one-bit communication object **"[AOx] Simple Timer"** will be shown, allowing the output to be activated when receiving a value of '1' and deactivated when receiving a '0'.
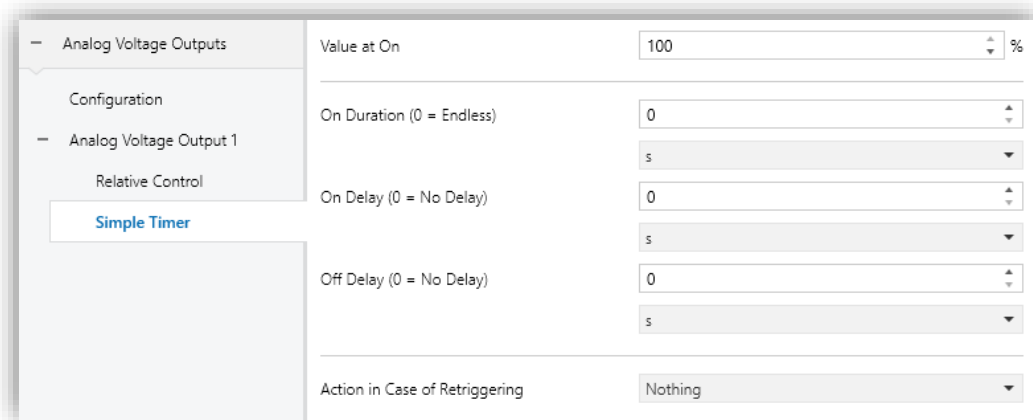

Figure 6. Simple Timer

- **Value at On** [*0…100*] [*%*]: sets the percentage to be applied to the output during timed switch-on.

- **On Duration** [[*0…3600*][*s*] / [*0…1440*][*min*] / [*0…24*][*h*]]: time the output will remain on before being automatically switched off.

- **On Delay** [[*0…3600*][*s*] / [*0…1440*][*min*] / [*0…24*][*h*]]: time to elapse between the reception of a simple timer command with value '1' and the activation of the output.

- **Off Delay** [[*0…3600*][*s*] / [*0…1440*][*min*] / [*0…24*][*h*]]: time to elapse between the reception of a simple timer command with value '0' and the deactivation of the output.

- **Action in Case of Retriggering** [*Nothing / Restart / Multiply*]: sets the action to be performed in case the value '1' is received several times.

2.1.6 FLASHING

The flashing function allows a sequence of on/off commands to be executed on the output for an indefinite duration or for a specific number of repetitions.

Note: *functionality only available for generic analog voltage output. See section 2.1 for more information.*

ETS PARAMETERISATION

Once **Flashing** function is enabled, in the "Analog Voltage Output X" tab (see section 2.1), the one-bit communication object **"[AOx] Flashing"** will be shown, which allows the initiation of an *On-Off-On…* sequence when receiving the value '1', as well as its interruption when receiving a '0'.

Figure 7. Flashing

- **Value at On** [*0…100*] [*%*]: sets the percentage to be applied to the output during the on state of the flashing.

- **On Duration** [[*1…3600*][*s*] / [*1…1440*][*min*] / [*1…24*][*h*]]: time the output will remain in the 'On' state.

- **Off Duration** [[*1…3600*][*s*] / [*1…1440*][*min*] / [*1…24*][*h*]]: time the output will remain in the 'Off' state.

- **Number of Repetitions** [*0…255*]: times the *On-Off* sequence will be repeated

- **Final Value** [*0…255*]: sets the percentage to be applied to the output at the end of the last flashing or after receiving a flashing command with value '0'.

2.1.7 SCENES

The Scenes function enables the definition of specific scenarios that can be triggered by sending their corresponding trigger values via a 1-byte object.

Note: *functionality only available for generic analog voltage output. See section 2.1 for more information.*

ETS PARAMETERISATION

Once the **Scenes** function is enabled, in the "Analog output X" tab (see section 2.1), the 1-byte communication object **"[AOx] Scene Control"** will appear, allowing the scene whose number is received through the object to be executed or saved.

Figure 8. Scenes.

- **Scene N** [*disabled/enabled*]: enables scene number N out of the 10 available scenes.

  - ➢ **Scene Number** [*1…64*]: defines the scene identifier number on receipt of which the scene will execute or save (if the value is received incremented by 128) the scene.

  - ➢ **Value** [*0…100*] [*%*]: percentage of the output to be reached when the scene is executed.

2.1.8 AUTO OFF

This functionality will automatically switch off the output when, for a certain time, it remains steady (without receiving additional control orders) under a certain control level or threshold.

This functionality will not be applied if the output is locked or in alarm status, as they are higher priority functionalities.

Note: *functionality only available for generic analog voltage output. See section 2.1 for more information.*

ETS PARAMETERISATION

When **Auto Off** is enabled in the "Analog Voltage Output X" tab (see section 2.1), a new tab of the same name is added to the left tree.
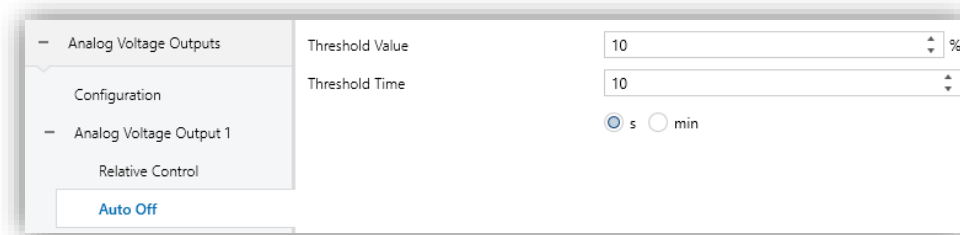

Figure 9. Auto Off

- **Threshold Value** [*1…10…100*] [*%*]: control value beneath which the Auto Off will be triggered in case the output remains steady at that value for more than the threshold time.

- **Threshold Time** [[*1…10…3600*][*s*] / [*1…1440*][*min*]]: time count before triggering the Auto Off mode.

2.1.9 LOCK

Enabling the lock function will bring a 1-bit object which will allow locking and unlocking the corresponding output. Output locking causes that any bus orders addressing to that group are not executed.

Receiving a lock order while running a flashing sequence or a timed action will stop the execution of that action.

Note: *functionality only available for generic analog voltage output. See section 2.1 for more information.*

ETS PARAMETERISATION

When **Lock** is enabled in the "Analog Voltage Output X" tab (see section 2.1), the 1-bit communication object **"[AOx] Lock"** is also enabled and a new tab of the same name is added to the left tree.
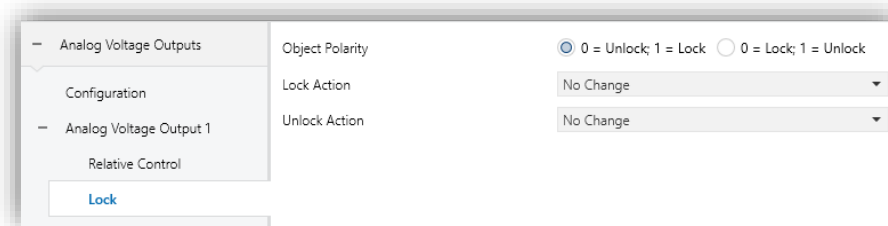

Figure 10. Lock

- **Object Polarity** [*0 = Unlock; 1 = Lock / 0 = Lock; 1 = Unlock*]: sets which value will be interpreted as a lock order and which one as an unlock order.

- **Lock Action** [*No change / Off / On*]: sets the action to be performed when a lock order is received.

- **Unlock Action** [*No change / Off / On*]: sets the action to be performed when an unlock order is received.

  If the 'On' option is selected for both locking and unlocking, the On value can be selected

  Value [*0…100*] [*%*]: percentage of the output to be reached when the 'On' option is selected.

2.1.10 ALARM

This function brings the possibility of configuring an **alarm action** over the output, which will be executed on the arrival of a specific trigger object from the bus.

Any control orders received during the alarm state will be ignored. Moreover, the activation of the alarm will interrupt any timed action that is in progress (simple timers or flashing).

There is the possibility of **cyclical monitoring**, with a period to be chosen by the user. If enabled, the alarm will not only be activated if the trigger with the parameterized value is received, but also in case the no-alarm value is not received at least once within the configured cycle time.

Regarding the **alarm deactivation**, can be either normal or frozen:

- **Normal:** the device leaves the alarm state as soon as the no-alarm value is received.

- **Frozen:** after the arrival of the no-alarm value, an additional acknowledgement object must be received before the device leaves the alarm state.

Note: *functionality only available for generic analog voltage output. See section 2.1 for more information.*

ETS PARAMETERISATION

When **Alarm** is enabled in the "Analog Voltage Output X" tab (see section 2.1), the 1-bit communication object **"[AOx] Alarm"** is also enabled and a new tab of the same name is added to the left tree.
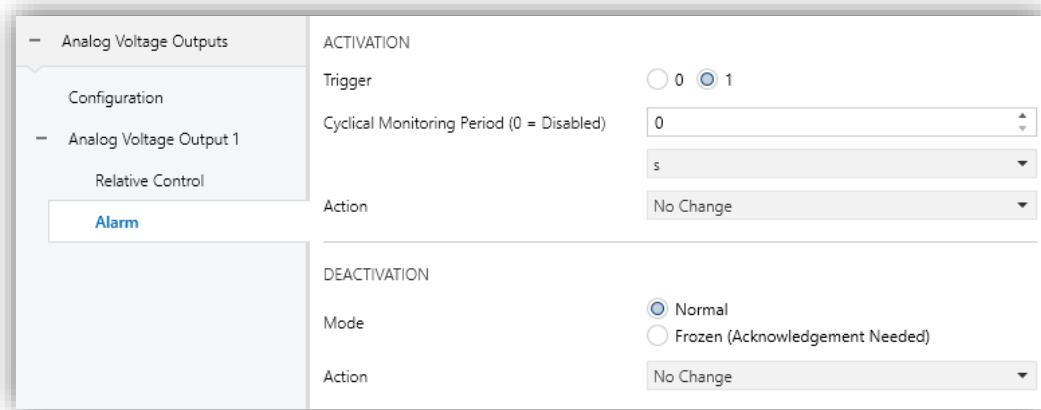
Figure 11. Alarm

The parameters involved in the **alarm activation** are:

- **Trigger** [*0 / 1*]: sets which value will imply the alarm activation. The reception of this value results in the execution of the corresponding **action** on the output.

- **Cyclical Monitoring Period** [[*0…3600*][*s*] / [*0…1440*][*min*] / [*0…24*][*h*]]: sets the maximum time without receiving the no-alarm value before the alarm is automatically activated.

- **Action** [*No Change / On / Off / Flashing*]: sets the desired response to the alarm activation. If the selected option is On, the output value can be configured, and if it is "Flashing", a flashing can be configured in the same way as described in section 2.1.6.

On the other hand, the parameters involved in the **alarm deactivation** are:

- **Mode** [*Normal / Frozen (Acknowledgement Needed)*]: sets the alarm deactivation procedure. When opting for the second option, the object **"[AOx] Unfreeze Alarm"** will be included into the project topology for the reception of the acknowledgement messages (value "1").

- **Action** [*No Change / On / Off / Last (Before Alarm)*]: sets the desired response to the alarm deactivation. If the selected option is On, the output value can be configured.

2.1.11 STANDBY

This functionality is used to notify, by sending a binary status object to the KNX bus, when an output is off for a certain period.

Note: *functionality only available for generic analog voltage output. See section 2.1 for more information.*

ETS PARAMETERISATION

When **Standby** is enabled in the "Analog Voltage Output X" tab (see section 2.1), the 1-bit communication object **"[AOx] Standby (Status)"** is also enabled and a new tab of the same name is added to the left tree.

Figure 12. Standby

- **Time for Activation** [[*0...3600*][*s*] / [*0...1440*][*min*]]: time during which the output must remain off for the standby mode activation to be sent. The deactivation sending will be immediate when an order that implies turning the output on is received.

- **Object Polarity** [*0 = Standby Off; 1 = Standby On* / *0 = Standby On; 1 = Standby Off*]: selects the value of the object whose sending involves the activation and deactivation of the standby mode.

2.1.12 INITIALIZATION

The outputs by default are initialized with their previous value (off after download) as a protection against bus failures or resets.

This tab offers the possibility to switch the outputs to a certain state during the actuator start-up and have this event notified to the bus (with a configurable delay).

Note: *functionality only available for generic analog voltage output. See section 2.1 for more information.*

ETS PARAMETERISATION

After selecting the "Custom" option in the **Initialization** parameter, in the "Analog Voltage Output X" tab (see section 2.1), a new tab of the same name is added to the left tree.
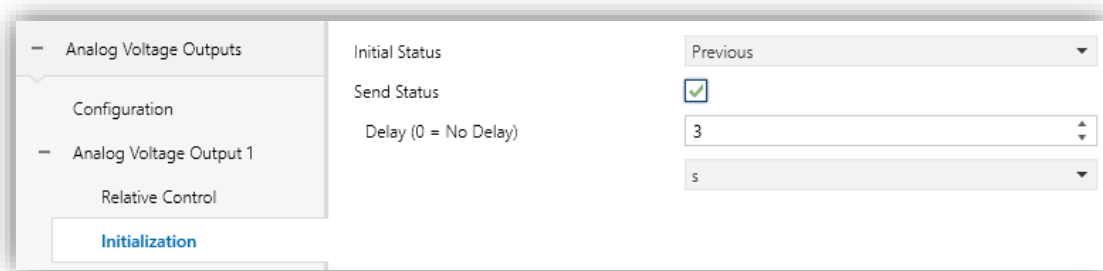

Figure 13 Initialization

- **Initial Status** [*Previous / Off / On*]. If "Previous" is selected, the status before the failure shall be maintained, except after programming, in which case the output will be off. If "On" is selected, the next parameter will be available:

  - **Output Value** [*0 … 100*] [*%*]: status of the output after recovery in percentage terms.

- **Send Status** [*disabled/enabled*]: if enabled, the status objects will be sent to the bus with a parameterisable **delay** ([*0…3 …3600*][*s*] / [*0…1440*][*min*] / [*0…24*][*h*]).

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