MAKEL®

USER'S

MANUAL

KNX *Switch Actuator* **MSAxxyy-CM**
MSAxxyy-CF
Shutter & Blinds Actuator **MSHxxyy-C**

Device Manipulation & ETS™ Application Description

May, 2015

Revision Sheet

Release No.	Date	Revision Description
Rev. 0	22/05/2015	User's Manual Created
Rev. 1	02/06/2015	Added more detailed descriptions to the functionalities
Rev. 2	11/03/2016	Boot sequence explained in more detail
Rev. 3	30/10/2017	Added reference to flush mount actuator

USER'S MANUAL

TABLE OF CONTENTS

1 GENERAL INFORMATION

1   GENERAL INFORMATION

1.1   System Overview

This manual refers to the following devices for KNX bus:

- **MSAxxyy-C[M/F]**: **xx** Channels, with **yy** amperes of maximum current rating per channel Switch Actuator / Shutter & Blinds actuator; **F** means the device is flush mounted.

- **MSHxxyy-CM**: **xx** Channels, with **yy** amperes of maximum current rating per channel Shutter & Blinds actuator.

All of the variants of MSAxxyy family includes:

- 1 programming touch button with 1 LED that shows whenever programming mode is active;
- 1 Manual Mode enable/disable touch button with 1 LED that shows whenever Manual Mode is active or not;
- **xx** touch buttons that controls each of the **xx** channels (if Manual Mode active) with **xx** LEDs that shows the contact position of each of the channels.

1.2   Acronyms and Abbreviations

CO   Communication Object
EIB   European Installation Bus (former name to KNX; no longer in use)
GA   Group Address
LED   Light Emitting Diode

2 SYSTEM SUMMARY

2   SYSTEM SUMMARY

Table 1: Applications specifications

Specs Variant	Number of Communication Objects	Maximum number of Group Addresses	Maximum number of Associations
MSA04yy-CMA	62	250	250
MSA08yy-CMA	122	250	250
MSA12yy-CMA	182	250	250
MSA16yy-CMA	242	250	250

2.1   Application Functions Overview

The **MSAxxyy-CMA** ETS™' application provides the interface to individually configure each of the pair of channels on the products MSAxxyy-CM with one of the following functions:

- Lighting;
- Shutters and Blinds.

Depending on the function set to each channel, the respective possible configurations and possible available Communication Objects (COs) vary.

When configured to **Lighting** each of the switches (relays) is one channel, what means that one switch can preforme the "On" and "Off" operation over a light (or group of lights under the same control). However, when configured to **Shutter and Blinds**, in order to control "Up" and "Down" movements it takes two switches (relays), one the activates the "Up" movement and other that activates the "Down" movement.

2.2   Application Communication Objects

Table 2: Communication Objects existing in each Function[1]

	Communication Object Name	Lighting	Shutter and Blinds
Per Channel	On / Off	X	
	Start / Stop Timer	X	
	Priority On / Off	X	
	Scene Control	X	
	Time Limited Toggle Switch	X	
	Reset Working Time counter	X	
	Timer delay (seconds)	X	
	Working t. limit reached Ind.	X	
	Working Timer counter Ind.	X	
	Pre-warning Indication	X	
	Status Indication	X	
	Logic – [[Inv.] Authorize / AND / OR / XOR / NAND / NOR / XNOR]	X	
	Jamming	X	X
	Move Up / Down		X
	[Slat Angle |]Stop Up / Down		X
	Priority Move Up / Down		X
	Scene Control		X
	Shutter Position (%)		X
	Blinds Angle (°)		X
	Shutter Position Indication		X
	Blinds Angle Indication		X
	Up Status Indication		X
	Down Status Indication		X
	Rain Alarm		X
	Wind Alarm		X
	Restore Scenes	X	X
	Maintenance Mode	X	X

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1   For further detailed information about the Communication Objects see Appendix C - Detailed description of Communication objects.

3   GETTING STARTED

3   GETTING STARTED

3.1   Connecting for the first time

After connecting the MSAxxyy/CM device for the first time to the KNX/EIB bus, the user will see the LEDs opening and closing preforming a circular sequence. This behavior means that the device hasn't been loaded with a valid ETS™' application yet. The same behavior may be observed when an invalid application is loaded into the device.

While signalising no application loaded, the device can be manually operated by pressing the Manual Mode button and by pressing any of the channels' buttons. However, in this mode a couple of channels (1 and 2, 3 and 4, 5 and 6, ...) cannot not be both "On" at the same time. This is a characteristic of the device for avoiding unintended short-circuit of shutters and blinds devices; if one of the relays from the pair is closed and the other is asked to close, the device will first open the first and then proceed to close the one that as been requested[2].

3.2   Downloading application with ETS™

If it's the first time that the device will be programmed, you must define the Individual Address via ETS™ interface. You must also press the programming button on the device for allowing ETS™ to identify the target device. You will know that the device is in programming mode when the programming LED turns on. During programming process the programming LED and the programming mode will automatically turn off.

The Individual Address is normally written once, however if it's necessary to re-write the Individual Address, the programming button must be pressed.

Once the device has its Individual Address, the device can be configured according to the project needs using ETS™ application, selecting "Download Application".

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2   The minimum gap (both remain "Off" before turning "On" the requested channel) is of 40ms.
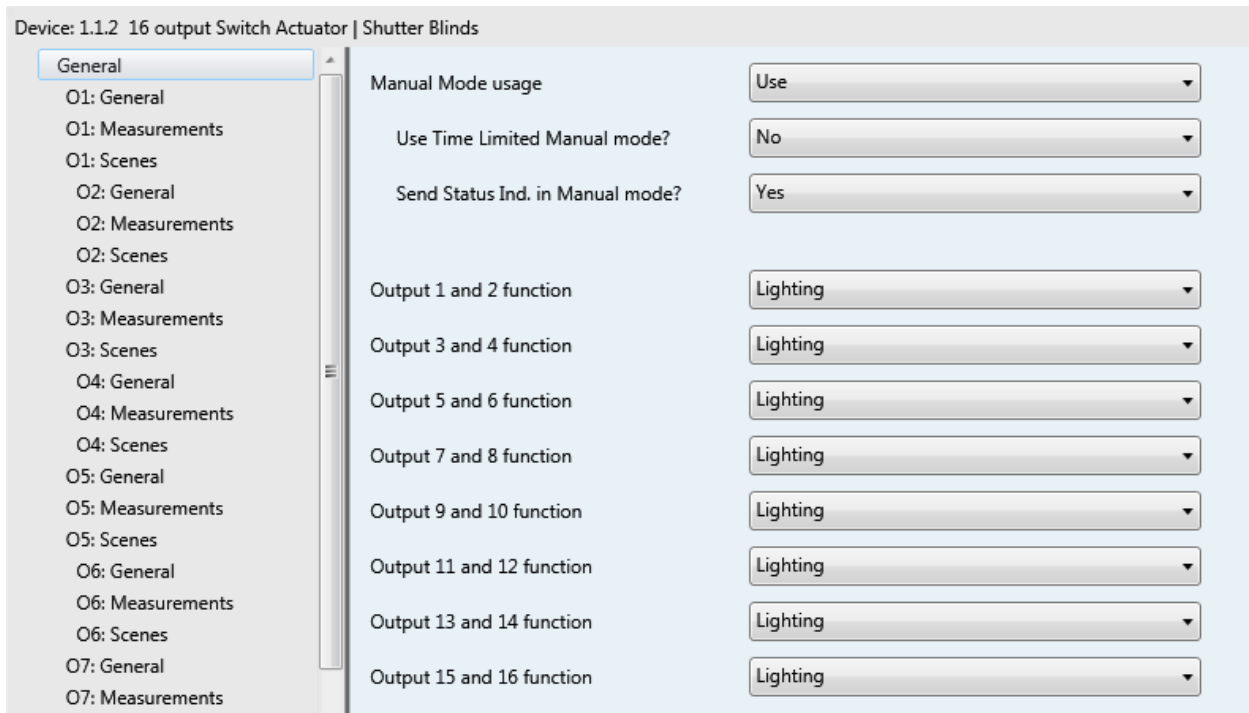
4   DETAILED FUNCTIONS DESCRIPTION

4   DETAILED FUNCTIONS DESCRIPTION

In this section all the functions will be introduced and explained in detail, as well as explained the ETS™ Product Database usage. This information should be enough for the installer to understand the device operation in any of the functions and to configure it with the ETS™ database.

4.1   General Configuration

In ETS™, when the general page is selected an environment similar with the one in Figure 1 shall be displayed. Here it's possible to configure some parameters that will affect all the system. All the parameters are explained in the Table 3.

Figure 1: General Configurations page

Table 3: General configurations' parameters description

Parameter	Description	Values
Manual Mode usage	Selects if the device can be set to Manual Mode operation via Manual Mode button and via `Maintenance Mode` CO	Possible values: *Use Not used
[3] **Use Time Limited Manual mode?**	Should the Manual Mode operation terminate automatically after a certain amount of time?	Possible values: *No Yes
[4] **Duration**	Amount of time after which the Manual Mode operation should be automatically terminated.	Possible values: *5min 10min … 1h15min
[5] **Send Status Ind. In Manual mode?**	If this parameter is set to "Yes", then, even in Manual Mode the device will send the channels' status to the bus.	Possible values: No *Yes
Output `[x]` and `[x+1]` function	Selects the function of a pair of channels.	Possible values: *Lighting Shutters and Blinds

It's convenient to explain in more detail some of the parameters present in the General configurations' page. The **"Use Time Limited Manual mode?"** if set to "No", once the device enters in Manual Mode by pressing Manual Mode button or by sending message via "`Maintenance Mode`" CO it will leave that mode just by pressing again the Manual Mode button or be sending message to the CO. However, if the parameter is set to "Yes" the parameter **"Duration"** is shown; When the device is set to Manual Mode via Manual Mode button or via CO it will leave this mode if the amount of time set in "Duration" parameter expires or if Manual Mode button is again pressed or message is sent to the "`Maintenance Mode`" CO.

The parameter **"Send Status Ind. In Manual mode?"** when set to "Yes" will allow the device to, when in Manual Mode, send the channels status to the bus (all the incoming messages to device will still be ignored). When set to "No" the device wont send the channels' status to the bus.

The **"Manual Mode usage"**, when configured to "Use" will make available one Communication Object:

> ⬌ [input] "`General – Maintenance Mode`": Sending "True" sets the device to maintenance mode.

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3   Visible if **"Manual Mode usage"** is set to "Use"
4   Visible if **"Use Time Limited Manual mode"** is set to "Yes"
5   Visible if **"Manual Mode usage"** is set to "Use"

With this communication object it's possible to set/unset the device to Manual Mode.

Depending on **"Output [x] and [x+1] function"** different configurations become available, depending on if the pair of switches are configured to be 2 Lighting channels or 1 Shutter and Blinds channel.

4.2 Lighting Configurations

Here are explained the configurations for each channel in case it is chosen to Lighting function. All the channels working as Lighting have similar configurations. Whenever from the General configurations' page a pair of channels is set to "Lighting" function, in the tabs list (left side) three new tabs per channel will expand:

- O`[x]`: General
- O`[x]`: Measurements
- O`[x]`: Scenes

4.2.1 O`[x]`: General

In this configuration page it's possible to make general configurations of the channel. The configuration page is like the one presented in Figure 2. The respective detailed descriptions are presented in Table 4.

The Channel's general COs are:

- **[input]** "On / Off": Controls the output's status[6];
- **[input]** "Priority On / Off": Makes higher priority control of the output's status;
- **[input]** "Jamming": Sending "True" makes the channel to enter in blocking mode;
- **[output]** "Status Indication": Informs the output's status.

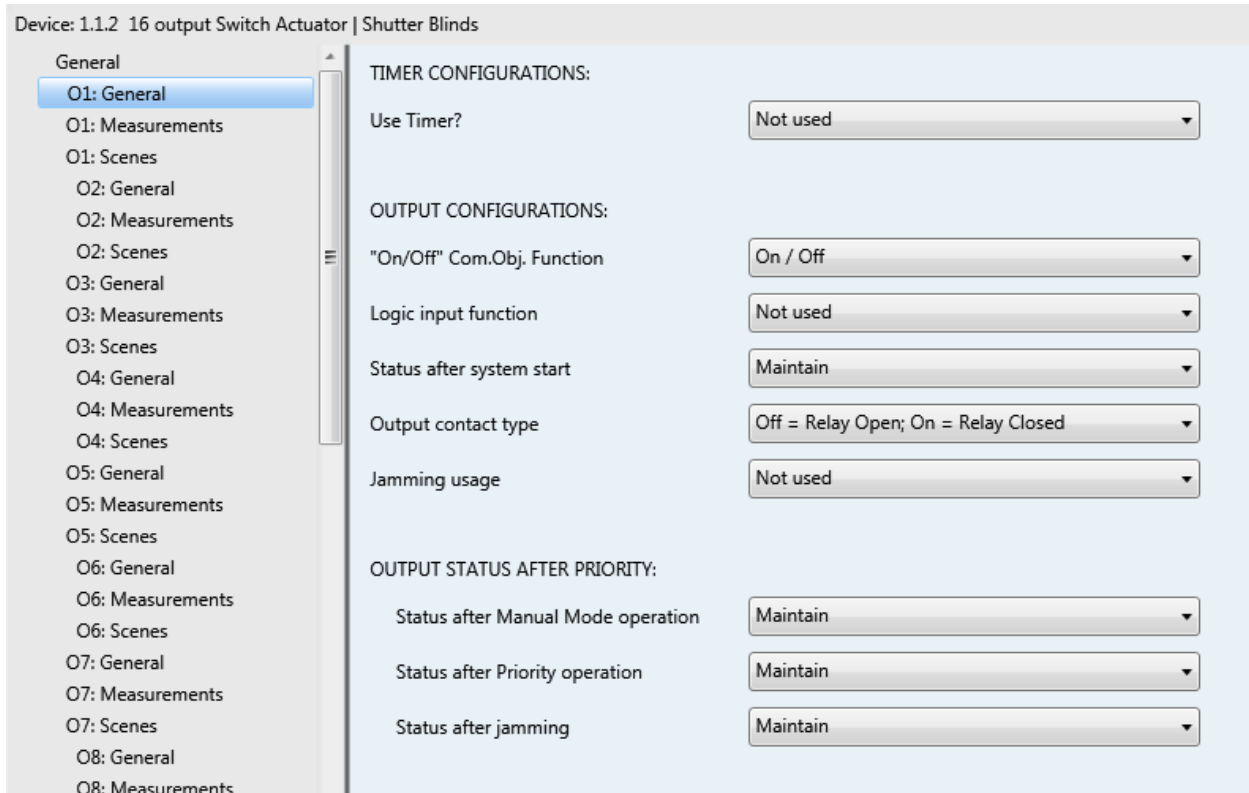
6   Further explanations in 4.2.1b

Figure 2: Channel's General configurations' page.

Table 4: Parameters in Channel's General configurations page.

Parameter	Description	Values
Use Timer?	Selects if the timer functionalities are to be activated and how.	Possible values: *Not used Use (normal Start=1; Stop=0) Use (inverted Start=0; Stop=1)
[7] **Timer (default value)**	The length of the delay time.	Possible values: 1s, … *10s, ... 1min, 1min 15s, …. 2min, 3min, … 15min, 20min, … 1h, 2h, … 1day
[7] **Timer operation mode**	Defines if the timer start triggers an On or Off status.	Possible values: *On Off
[7] **Allow timer interruption with Stop?**	Defines if the timer can be stopped after starting by sending Stop message.	Possible values: *No Yes
[7] **Consecutive presses multiply time (within 10s)?**	Defines if the delay time can be multiplied per n by send multiple Start messages within 10 seconds.	Possible values: *No Yes

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7   Visible if **"Use Timer?"** is set to value different than "Not used".

7	**Allow timer reset?**	Defines if the delay time is reset when a Start message arrives.	Possible values: *No Yes
7	**Timer expiration Pre-Warning usage**	Defines how the timer expiration warning shall be issued.	Possible values: Not used Send Message via Pre-Warning CO *Invert output (during 1s) Send Message + Invert output
8	**Timer expiration pre-warning**	The amount of time before timer expiration that the warning must be issued.	Possible values: *15s, 30s, … 2min, 5min, 10min, … 20min
9	**Pre-warning message type**	Defines the type of message to send via "Pre-Warning" CO.	Possible values: *On Off

7	**Timer Delay change via Com. Obj.**	Defines if the timer's delay time can be changed via communication object, and which is the Datapoint Type of the CO.	Possible values:
			*Not used
			DPT7.005 TimePeriodSec
			    (PDTUNSIGNED_INT)
			DPT9.010 TimeValue
			    (PDT_KNX_FLOAT)

7 **10**	**Time Limited Toggle Switch**	Defines the delay time for the switch-Off when using the "Time Limited Toggle Switch" CO.	Possible values: 1s, 2s, [+1s]… *10s, ... 1min, 1min 15s, [+15s] …. 2min, 3min, [+1min]… 15min, 20min, [+15min]… 1h, 2h, [+1h]… 1day
	"On/Off" Com.Obj. Function	Defines the behaviour of the device upon messages on the "On / Off" CO.	Possible values: *On / Off Delayed On (immediate Off) Delayed Off (immediate On) Delayed On / Off Timer On Timer Off
11	**On Delay amount**	Defines the amount of delay to apply between "On" message arrival and switching the channel.	Possible values: 1s, 2s, [+1s]… *10s, ... 1min, 1min 15s, [+15s] …. 2min, 3min, [+1min]… 15min, 20min, [+15min]… 1h, 2h, [+1h]… 1day
12	**Off Delay amount**	Defines the amount of delay to apply between "Off" message arrival and switching the channel.	Possible values: 1s, 2s, [+1s]… *10s, ... 1min, 1min 15s, [+15s] …. 2min, 3min, [+1min]… 15min, 20min, [+15min]… 1h, 2h, [+1h]… 1day

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8   Visible if **"Timer Pre-Warning expiration usage"** is set to value different than "Not used".
9   Visible if **"Timer Pre-Warning expiration usage"** is set to "Send Message via Pre-Warning CO" or "Send Message + Invert output"
10   The operation of *Time Limited Toggle Switch* is not affected by the previous parameters.
11   Visible if **"'On/Off' Com.Obj. Function"** set to "Delayed On (immediate Off)" or "Delayed On/Off".
12   Visible if **"'On/Off' Com.Obj. Function"** set to "Delayed Off (immediate On)" or "Delayed On/Off".

[13] **Delay**	The length of the delay time.	Possible values: 1s, 2s, [+1s]… *10s, ... 1min, 1min 15s, [+15s] …. 2min, 3min, [+1min]… 15min, 20min, [+15min]… 1h, 2h, [+1h]… 1day
Logic input function	Defines the function the channel's extra input CO.	Possible values: *Not used Authorize "On/Off" Com.Obj. AND OR XOR Inverted Authorize "On/Off" Com.Obj. NAND NOR XNOR
Status after system start	Defines the behaviour of the device after a power restore.	Possible values: *Maintain Off On Scene [1...32]
Output contact type	Defines the relay position for the "On" and "Off" states.	Possible values: *Off = Relay Open; On = Relay Closed Off = Relay Closed; On = Relay Open
Jamming usage	How should the jamming/blocking functionalities of the channel affect the channel.	Possible values: *Not used If '1' If '0'
[14] **Use Time Limited Jamming?**	Should the jamming operation terminate automatically after a certain amount of time?	Possible values: *No Yes
[15] **Duration**	Amount of time after which the Manual Mode operation should be automatically terminated.	Possible values: *5min 10min … 1h15min
Status after Manual Mode operation	Define the behaviour when the Manual Mode operation is terminated.	Possible values: *Maintain Previous status Invert Theoretical status without [manual/priority/jamming] On Off
Status after Priority operation	Define the behaviour when the Priority operation is terminated.	
Status after jamming	Define the behaviour when the jamming is terminated.	

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13   Visible if **"'On/Off' Com.Obj. Function"** set to "Timer On" or "Timer Off".
14   Visible if **"Jamming usage"** set to "Yes".
15   Visible if **"Use Time Limited Jamming?"** set to "Yes".

Some of the parameters presented in Table 4 should get some more attention in order to fully understand they functionalities and impacts on the system operation.

a) Timer

The related COs are:

- ⬛ **[input]** "Start / Stop Timer": control of the timer;
- ⬛ **[input]** "Time Limited Toggle Switch": control of the toggle switch timer;
- ⬛ **[input]** "Timer delay (seconds)": for modifying the timer delay;

The **"Use Timer?"** parameter allows to activate the set of *Timer* and *Time Limited Toggle Switch* functionalities.

The **"Timer (default value)"** parameter is where the delay time can be defined. This value can be changed at run-time via CO if **"Timer Delay change via Com. Obj."** is set to a value different than "Not used".

"Timer operation mode" if set to "On", when a "Start" message is received the output switches On and switches Off once delay time is elapsed (or timer is terminated); if set to "Off", when a "Start" message is received the output switches Off and switches On once the delay time is elapsed (or timer is terminated).

The parameter **"Allow timer interruption with Stop?"** if set to "No", when timer is running it wont be stopped if a "Stop" message is received.

By setting **"Consecutive presses multiply time (within 10s)?"** to "Yes", sending repeatedly *n* "Start" messages (within 10 seconds after the first "Start" message) will cause the delay time to be multiplied per *n*.

When **"Allow timer reset?"** is set to "Yes" receiving a "Start" message when timer is already running will make it to be reset.

> ℹ️ The parameter **"Consecutive presses multiply time (within 10s)?"** if set to "Yes", in the first 10 seconds "Start" messages will multiply the timer and not reset it, even if **"Allow timer reset?"** is set to "Yes".

The **"Timer expiration Pre-Warning usage"** parameter enables the possibility of being notified that the timer will expire within a selectable amount of time (defined with **"Timer expiration pre-warning"**). This notification can be done by toggling the output status during 1 seconds, or by sending a binary

(defined with **"Pre-warning message type"**) message via "`Pre-Warning`" CO or both. The Figure 3 suggests a possible time diagram for timer operation when **"Timer (default value)"** is set to T_d, **"Timer operation mode"** is set to "On", **"Timer expiration Pre-Warning usage"** is set to "Send message + Invert output", **"Timer expiration pre-warning"** is set to T_warn and **"Pre-warning message type"** is "On"; here the timer is started due to a received "Start" message and runs until expiration.
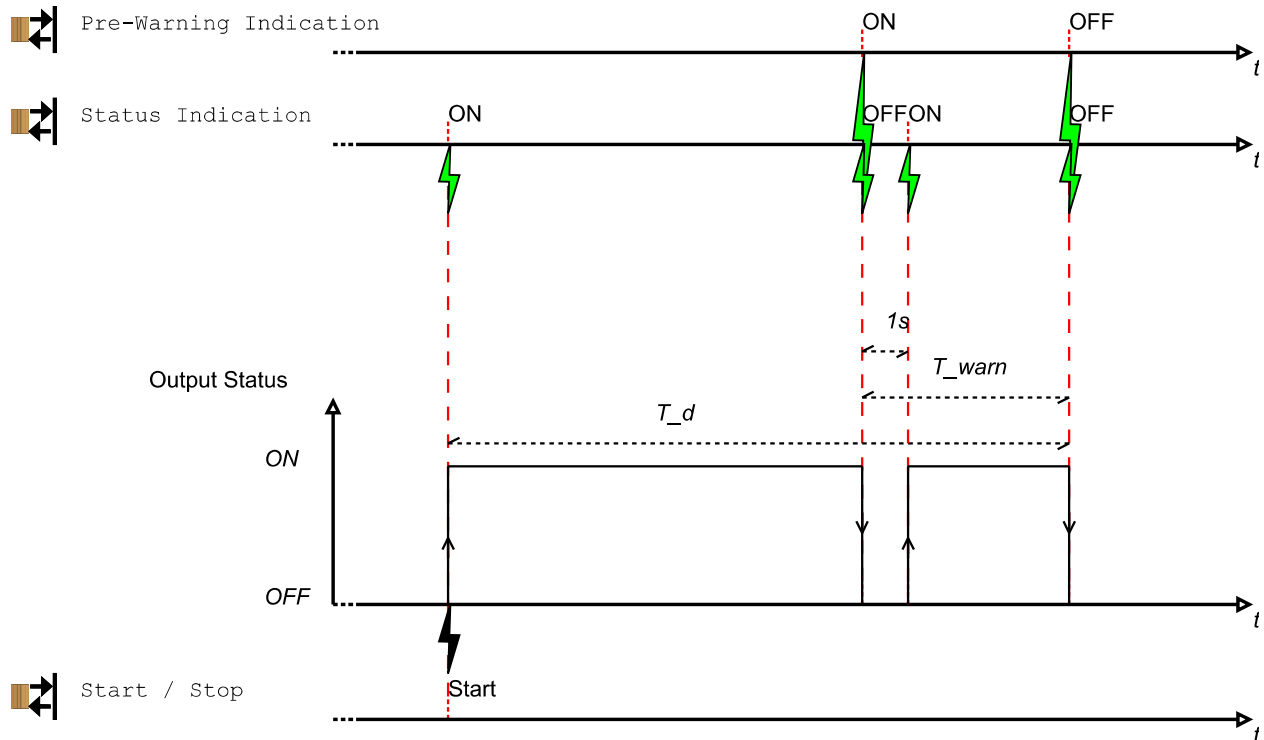

Figure 3: Timer operation example when Pre-Warning uses output status inversion and message.

Setting **"Timer Delay change via Com. Obj."** defined if the timer delay can be changed at run-time via CO, and which is the DPT of the CO with the time delay. The operation has immediate effect, meaning that if the timer is running and a new time delay, smaller than the already elapsed time, is sent via "`Timer delay (seconds)`" CO it will cause the timer to terminate; if the a larger value is sent then the timer will expire just when the new value is reached. Also to be considered that the pre-warning will occur (if active) even in the case the new value is closer to expiration than the defined value for pre-warning; in Figure 4 it's shown a possible scenario that tries to illustrate the previous situation (the device would be making use of **"Timer Delay change via Com. Obj."** and **"Timer expiration Pre-Warning usage"** set to "Send Message via Pre-Warning CO").
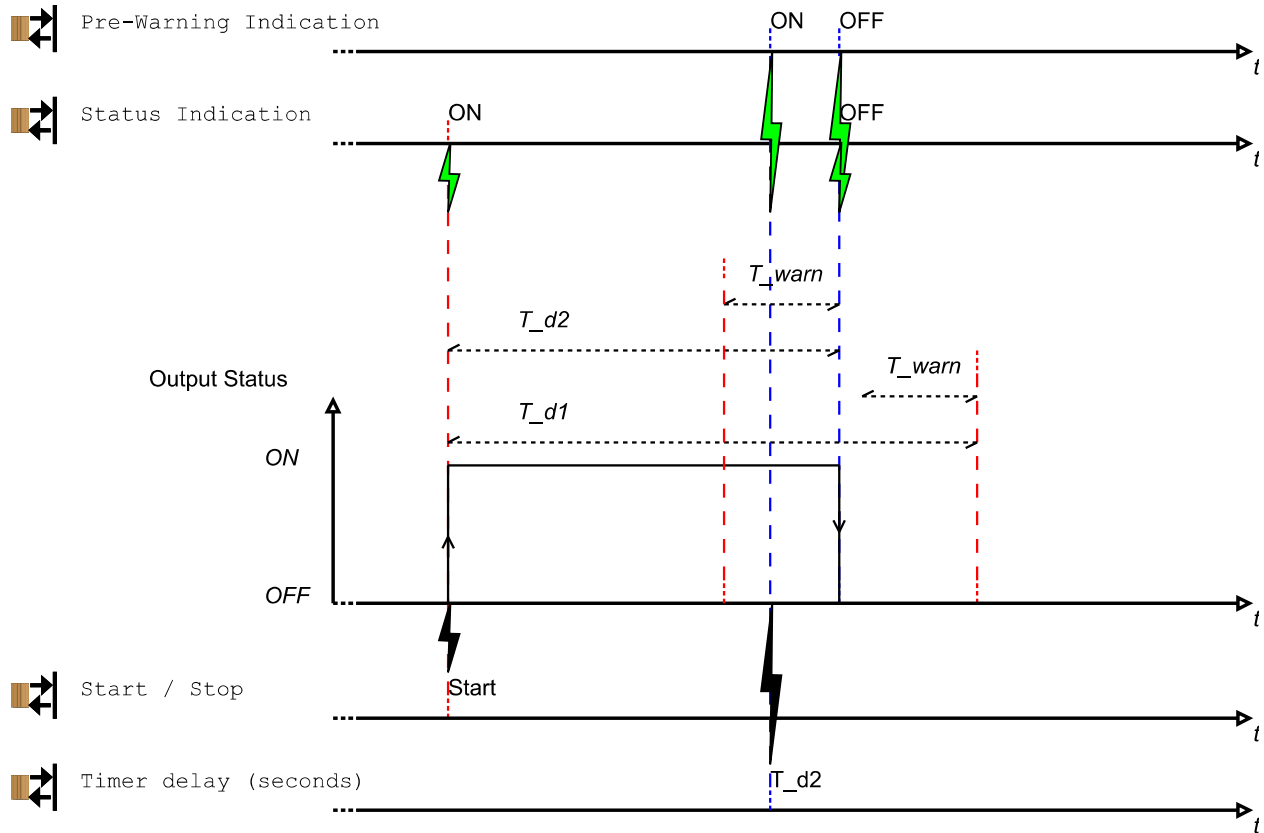
Figure 4: "Timer delay (seconds)" usage example - warning time impact.

No matter the selection of the timer related parameters, the operation of *Time Limited Toggle Switch* wont be affected.

The parameter **"Time Limited Toggle Switch"** appears under the same group ("Use Timer?"), however it implements a separated functionality, not affected by the previous parameters. This function allows to turn On a channel for a certain amount of time, after which the channel will turn Off; sending Off message immediately turns Off the channel.

If the *Timer* is running and *Time Limited Toggle Switch* is set "On" the *Timer* is immediately terminated; if the *Time Limited Toggle Switch* is in process and *Timer* is started the *Time Limited Toggle Switch* is terminated. Sending "Off" via `Time Limited Toggle Switch"` CO while if it wasn't preceded by an "On" message there will be no effect; the same applies to the *Timer* if a "Stop" message is sent to "Start / Stop Timer" CO without a "Start" preceeding it.

b) "On/Off" Communication Object Functions

The COs that are related with this functionality are:

■⇄ **[input]** "On / Off": controls the output's status according to the selection in **"'On/Off' Com.Obj. Function"**;

The function executed when a message arrives to the "On / Off" CO can be defined with the parameter **"'On/Off' Com.Obj. Function"**. When set to its default value "On/Off", when an "On" message is received the output switches to the On position; if an "Off" message is received the output switches to its Off position. Three delayed modes are available: "Delayed On", "Delayed Off" and "Delayed On/Off"; and two timer modes: "Timer On" and "Timer Off". If the parameter is set to "Delayed On (immediate Off)" upon arrival of "On" message in the "On / Off" CO the output status will switch to its On position just after the time defined in **"On Delay amount"**, however an "Off" message will switch the output to its Off position immediately; for "Delayed Off (immediate On)" the behavior is analogous; when the parameter is set to "Delayed On/Off" both On and Off output switch are delayed. The delay is interrupted by the opposite message and restarted if the same message is sent (last message overrides previous).

If the parameter is set to one of the "Timer" functionalities, its operation will be similar to the description in 4.2.1a when the parameters **"Allow timer interruption with Stop?"** is set to "Yes", **"Consecutive presses multiply time (within 10s)?"** is set to "No", **"Allow timer reset?"** set to "Yes" and without pre-warning.

c) Logic functions

The COs related with logic functions are:

■⇄ **[input]** "Logic - [FUNCTION]": the input CO of the logic function;

It's possible to use one more input CO in combination with the "On / Off" CO to control the output status. That is done by selecting the desired operation from the **"Logic input function"** parameter. Chosing "Autorize 'On/Off' Com.Obj." will allow the operation of "On /Off" CO just if "Logic – Authorize" CO is "True", otherwise sending messages to "On /Off" CO has no effect; if the parameter is set to "Inverted Autorize 'On/Off' Com.Obj." the operation of "On /Off" CO is enabled if "Logic – Inv. Authorize" CO is "False".

In case the parameter **"Logic input function"** is set to any other logic operation (AND, OR, XOR, NAND, NOR, XNOR) to the `"On / Off"` CO is applied the selected logic operation with the logic input CO and the "On / Off" function is processed according to the resulted value. In Figure 5 is presented a possible scenario when "On / Off" uses "Delayed On" combined with logic input function AND.
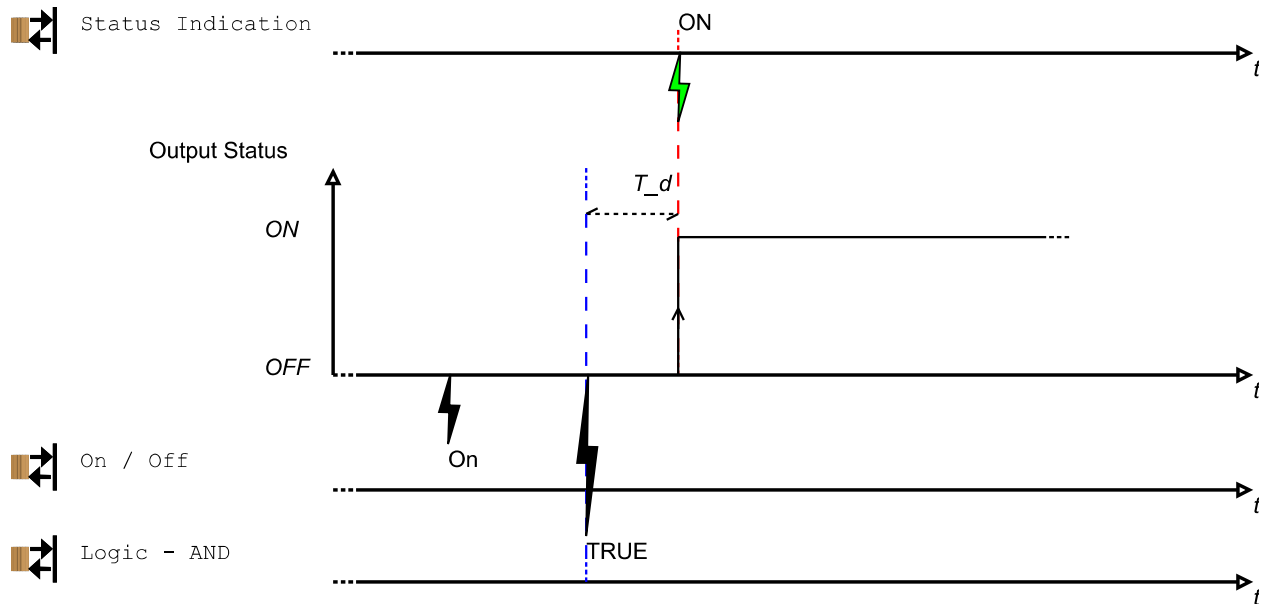
Figure 5: "On / Off" configured to "Delayed On" and using logic "AND".

d) Channel status after system start / power recover

The behavior of each output of the device when it's started, for example after a power failure, can be defined by setting the parameter **"Status after system start"** to the desired value. If the parameter is set to "Maintain", at power failure the device tries to save its current output status and restores it at power restore; it can be defined the channel to turn "On" or "Off" or to set to a defined scene.

e) Channel output contact type

The definition of the "On" and "Off" position of the channel's switch is done in the parameter **"Output contact type"**.

f) Jamming

The directly related COs are:

> **[input]** `"Jamming"`: control of the jamming;

The channel may additionally be blocked via "Jamming" CO it **"Jamming usage"** is set to be used. It can be blocked if "Jamming" CO receives "TRUE" (parameter set to "If '1'") or blocked if "Jamming" CO receives "FALSE" (parameter set to "If '0'").

It's also possible to limit the time extension for which the channel remains blocked. This is is done the setting **"Use Time Limited Jamming?"** to "Yes" and by selecting the duration in the parameter **"Duration"**.

g) Channel status after overriding operations

Manual operation, priority and jamming are considered overriding operations since they impose a certain output status. The status the output takes when any of those overriding operations is ended can be defined in the parameters **"Status after [Manual Mode operation/Priority operation/jamming]"**. Setting this parameter to "Maintain" causes the channel to keep that status that was imposed by the overriding operation; if the parameter is set to "Previous status", when the overriding operation terminates the channel's output is set to its status just before the time the overriding operation starts; if parameter is set to "Invert", when the overriding operation ends the output status inverts the output imposed by the overriding operation; setting the parameter to "On" causes the channel to go to "On" status when the overriding operation terminates; setting the parameter to "Off" causes the channel to go to "Off" status when the overriding operation terminates; by chosing "Theoretical status without [manual/priority/jamming]" causes the channel's output to go to the status it would be in case the overriding operation didn't occur.

In Figure 6 is shown the time diagram of a possible scenario in which the device is configured with **"Jamming usage"** to "If '1'", **"Use Time Limited Jamming?"** set to "Yes", **"Duration"** set to $T\_jamming$; **"'On/Off' Com.Obj. Function"** set to "Delayed On" with **"On Delay amount"** of T_d. In this scenario, the "Jamming" CO takes a message that triggers the beginning of the channel's jamming for a duration of $T\_jamming$; meanwhile "On / Off" CO takes "On" message, once the jamming period expired the "On" message is taken in consideration and the "On Delay" is initiated.

If one operation is already in course that operation will not be blocked, this means, for instance, if a "Delayed On" operation is in course when a jamming/priority/Manual mode message is received, that "Delayed On" operation will continue and the channel will switch.
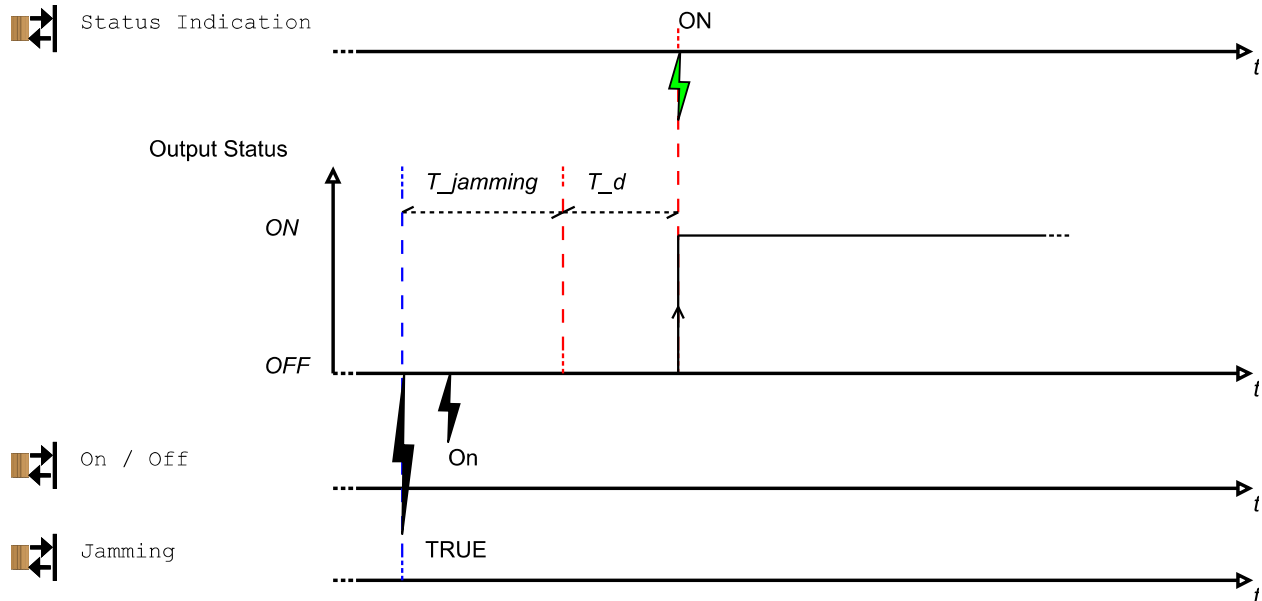
Figure 6: Time Limited Jamming example with "Theoretical Status without jamming" and "Delayed On" function.

4.2.2 O[x]: Measurements

The usage of this functionality makes available the following COs:

- **[input]** "Reset Working Time counter": Sending "True" resets the counter;
- **[output]** "Working t. limit reached Ind.": Sends "True" when the counter reaches the defined limit;
- **[output]** "Working Time counter Ind.": Gives the counter every hour or by reading (the counter is in seconds);

When the channel is set to "Lighting" function it is possible to measure the amount of working time of each of the channels. Additionally it's possible to make the device issue a message whenever a certain channel reaches a certain amount of working time. This can be useful, for example, for getting warning that a lamp/group of lamps is reaching its end of life. The configuration page is like the one presented in Figure 7. The respective detailed descriptions are presented in Table 5.

Figure 7: Channel's Measurements configuration page.

Table 5: Parameters in Channel's General configurations page.

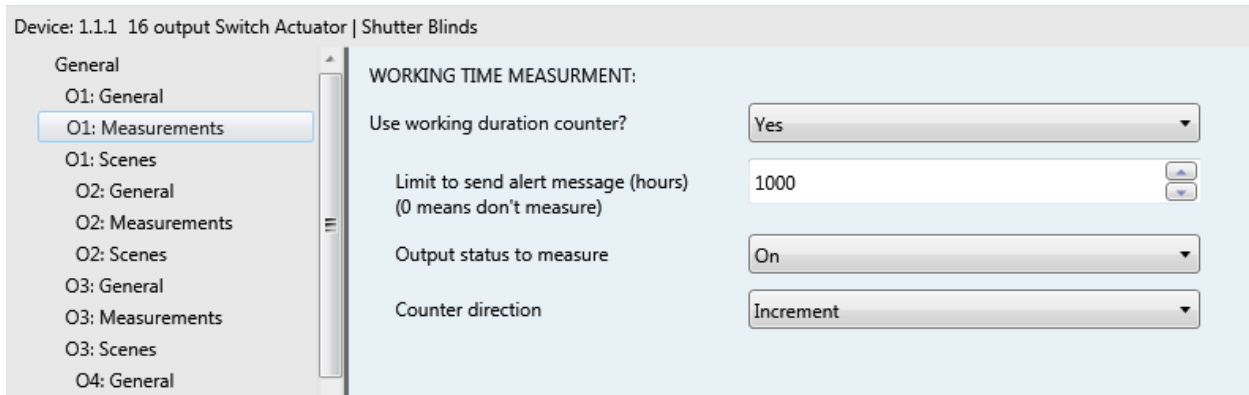| Parameter	Description	Values
Use working duration counter?	Selects if working time counter is to be used for the channel.	Possible values: *No Yes
[16] **Limit to send alert message (hours)**	The amount of time after which a message must be sent via "`Working t. limit reached Ind.`" CO.	Min: 0h Max: 500000h Default: 1000h
[16] **Output status to measure**	Defines which is the channel status to be measured.	Possible values: *On Off
[16] **Counter direction**	Defines if the counter must count from 0 to *Limit* or from *Limit* to 0.	Possible values: *Increment Decrement

The parameter **"Limit to send alert message (hours)"** defines the limit after which a message must be issued informing that the limit has been reached. The parameter **"Output status to measure"** selects which is the output status that must be measured as working.

4.2.3 O[x]: Scenes

The related COs are:

▪↕ **[input]** "`Scene Control`": sets a scene or requests learn;

All the Channels have available from "Scene 1" to "Scene 32" for configuration. Each of the scenes can be configured to a specific action that may, or may not, depending on the installation settings, change at run time. In case changes can be made after configuration with ETS, those changes are persistent, which

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16   Visible if **"Use working duration counter?"** set to "Yes."

means, even after a power dow followed by a power restore the changes will be kept. However, restoring the scenes to the configuration time settings is possible via "Restore Scenes" CO; this process will restore all the scenes form all the channels to its setting of ETS configurations deployment.

The configuration page for Scenes is as presented in Figure 8. The parameters are described in Table 6.
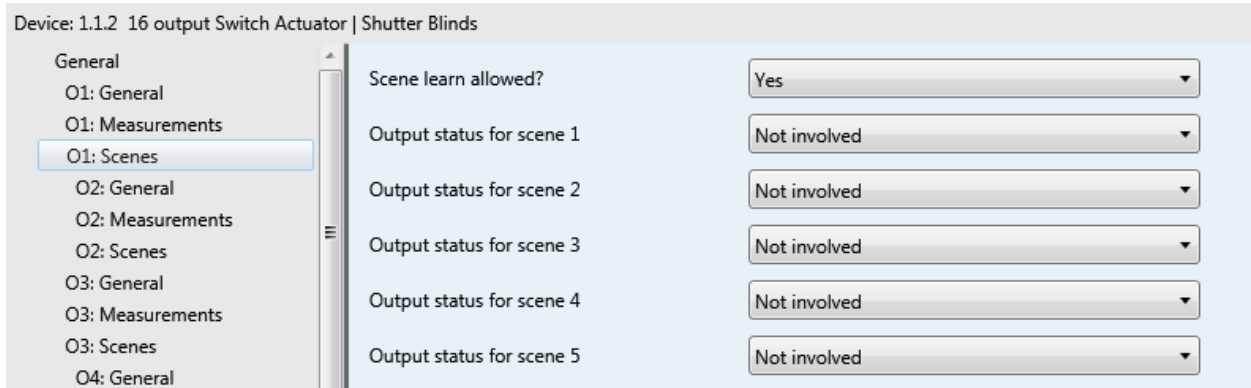
Figure 8: Channel's Scenes configuration page.

Table 6: Parameters in Button's configuration page for "Toggle Switch" function.

Parameter	Description	Values
Scene learn allowed?	Defines if the device will recognise the scene "learn" command and memorise its current status to the respective scene.	Possible values: No *Yes
Output status for scene [1...32]	Defines the channel's behaviour for a certain scene number.	Possible values: *Not involved On Off

i   The Communication Object "Restore Scenes" affects all the channels.

4.3   Shutter and Blinds

Here are explained the configurations for each channel in case it is chosen to Shutter and Blinds function. All the channels working as Shutter and Blinds have similar configurations. Whenever from the General configurations' page a pair of channels is set to "Shutter and Blinds" function, in the tabs list (left side) three new tabs per pair of channel will expand:

- O[x]-[x+1]: General
- O[x]-[x+1]: Scenes
- O[x]-[x+1]: Alarms configurations
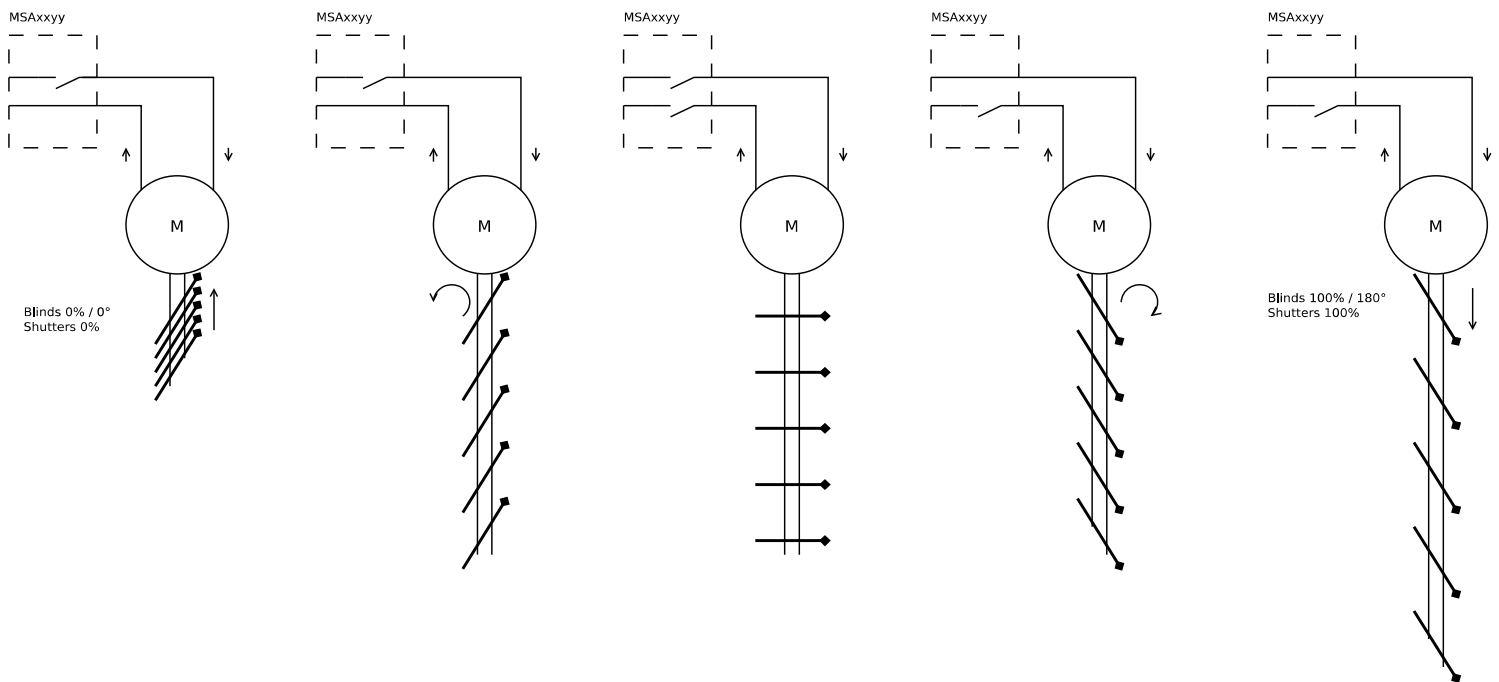
Figure 9: Shutter and Blinds control explanation.

In Figure 9 it's exposed the control of Shutter and Blinds. For initiating the down movement first the blinds will go to 180°, just after that the down movement occurs; for the up movement first the blinds go to 0°, just after the up movement is initiated. It's supposed the shutter and blinds actuator to be controlled via two lines. All the position related measures are time based, which may not give good precision in some cases, however most electric shutter and blinds don't provide means of feedback.

In next each of the configuration pages is going to be explained in more detail, as well some working examples will be presented.

4.3.1 O`[x]`-`[x+1]`: General

The COs involved with general function of shutter and blinds control are:

- ⇄ **[input]** "`Move Up / Down`": Controls the movement direction;
- ⇄ **[input]** "`[Slat Angle |] Stop Up / Down`": [Steps the blinds in certain direction] stops the movement;
- ⇄ **[input]** "`Shutter Position (%)`": Sets the shutter to a specific position[17];
- ⇄ **[input]** "`Blinds [Position (%)/Angle (°)]`": Sets the blinds to a specific [position/angle];
- ⇄ **[input]** "`Jamming`": Blocks the channel's communication with remaining COs;
- ⇄ **[output]** "`Shutter Position Indication`": Informs about the Shutter's current position;
- ⇄ **[output]** "`Blinds [Position/Angle] Indication`": Informs about the Blinds' current [position/angle];
- ⇄ **[output]** "`Up Status Indication`": Informs about the Up movement status ("True" if moving up, "False" otherwise);
- ⇄ **[output]** "`Down Status Indication`": Informs about the Down movement status ("True" if moving down, "False" otherwise);

In Figure 10 it's shown the General configurations page's defaults for Shutter and Blinds pair of channels, and further detailed description is given in the Table 7.

---

17 For this to work correctly the parameters **"Time for complete [up/down] movement (s)"** have to be correctly set.
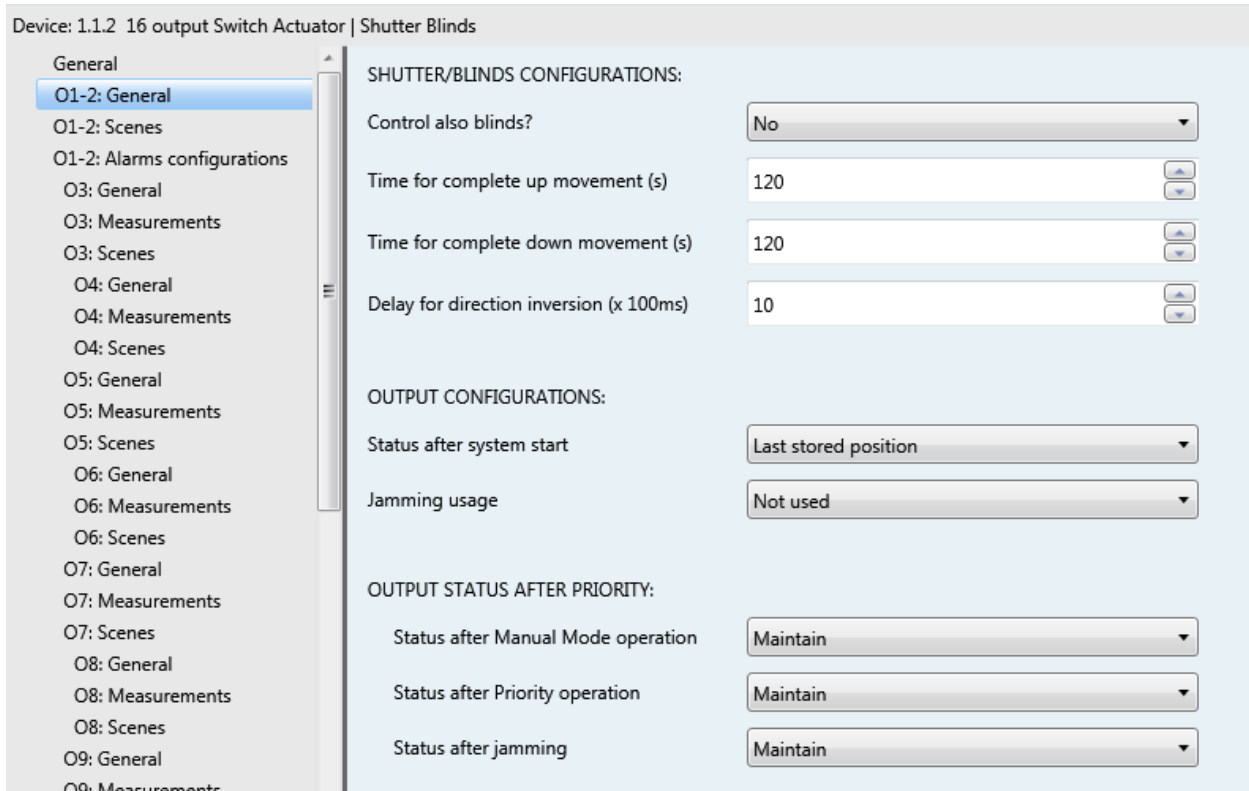
Figure 10: Channel's General configuration page (shutter and blinds).

Table 7: Parameters in General configuration page for Shutter and Blinds.

Parameter	Description	Values
Control also Blinds	Defines if the system to be controlled also includes blinds.	Possible values: *No Yes
[18] **Blinds step time (x10ms)**	Defines the length of one blinds' step. The value is multiplied per 10ms.	Min: 5 (50 ms) Max: 255 (2550 ms) Default: 20 (200ms)
[18] **Number of blinds steps**	Defines the number of steps (with the defined length) are needed for a full movement of the blinds.	Min: 1 Max: 255 Default: 10
[18] **Blinds position control CO type**	Defines which datapoint type is to be used for control the blinds position.	Possible values: *Angle [DPT_ID Angle 5.003] Percentage [DPT_ID Scaling 5.001]
Time for complete up movement (s)	Defines the amount of time it takes for the shutter to go from totally closed to totally opened.	Min: 1 Max: 65535 Default: 120
Time for complete down movement (s)	Defines the amount of time it takes for the shutter to go from totally opened to totally closed.	Min: 1 Max: 65535 Default: 120

_____

18 Visible is **"Control also Blinds?"** set to "Yes".

Delay for direction inversion (x100 ms)		Defines the time gap between movements when the shutter is moving one direction and is told to move the opposite direction.	Min: 5 (500 ms) Max: 255 (25500 ms) Default: 10 (1000 ms)
Status after System start		Sets the behaviour of the Shutter/Blinds channel when the device is powered.	Possible values: *Last stored position Close Open Scene [1-32]
Jamming usage		Defines the usage of blocking function.	Possible values: *Not used If '1' If '0'
[19]	**Use Time Limited Jamming?**	Enables/Disables time limited jamming.	Possible values: *No Yes
Status after Manual Mode operation		Define the behaviour when the Manual Mode operation is terminated.	Possible values: *Maintain Previous status
Status after Priority operation		Define the behaviour when the Priority operation is terminated.	Theoretical status without [manual/priority/jamming]
Status after jamming		Define the behaviour when the jamming is terminated.	Close Open

a) Blinds Control

Blinds control is not enabled by default and can be enabled by setting to "Yes" the **"Control also Blinds"**. Enabling blinds control requires to define three more parameters that basically define how the blinds are controlled. The value of **"Blinds step time (x10ms)"** multiplied by **"Number of blinds steps"** must correspond to the total time the blinds take to make a full movement (180° to 0°).

When configured to control also blinds, when "Up" message is sent to `Slat Angle | Stop Up / Down` CO and no movement is occurring, the device will drive the Up switch for de time defined in **"Blinds step time (x10ms)"**; analogous for "Down" message. If a movement is in progress the movement is stoped, no matter if the received message is "Up" or "Down" (see Figure 11).

In Figure 12 it's presented a possible situation of shutter and blinds control. It must be assumed that initially the shutters are totally opened (meaning 0%) and the blinds with and angle of 0°. When the down movement is started the blinds will start towards 180° which takes T_b_180 (**"Blinds step time (x10ms)"** multiplied by **"Number of blinds steps"**), after the device starts counting **"Time for complete down movement (s)"** divided per 2 (which corresponds to half of the way, 50%[20]); once this value is reached

---

19 Visible if "Jamming usage" set to other than "Not used".
20 The movement speed is considered to be constant, so the movement time vs position is a linear function.

the shutter is considered in half of the way (50%) and the down movement stops; since before the movement the blinds angle was of 0°, the MSAxxyy will restore that position by driving the up direction from of 180° towards of 0°, which takes *T_b_180*; once this time is elapsed the movement is stopped. In the occurrence of a message to the blinds angle, 120° as in the example, the necessary time to rotate the blinds from 0° to 120° is calculated (*T_b_120*) and the down direction is driven for that amount of time
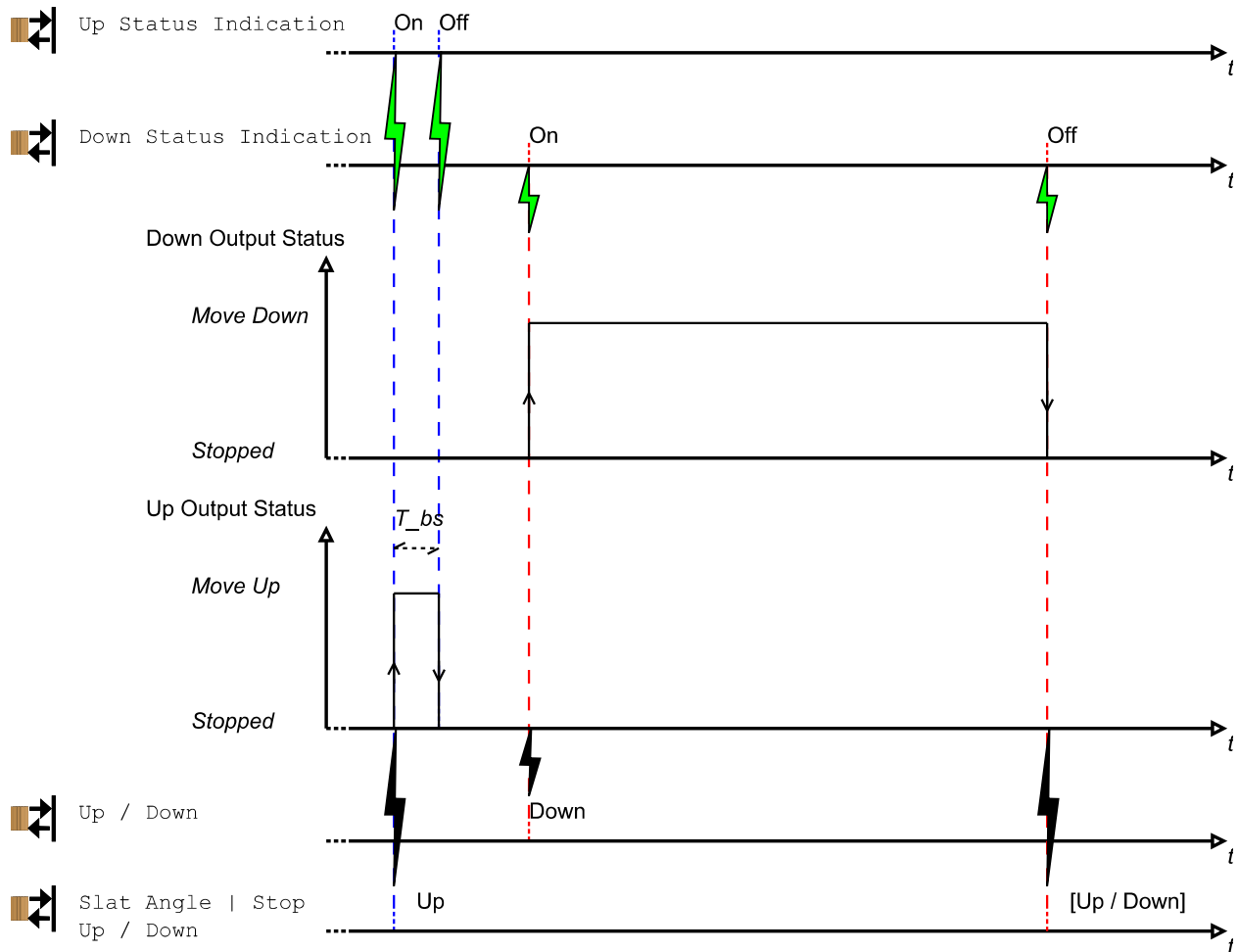
Figure 11: Usage of "Slat Angle | Stop Up / Down" CO.
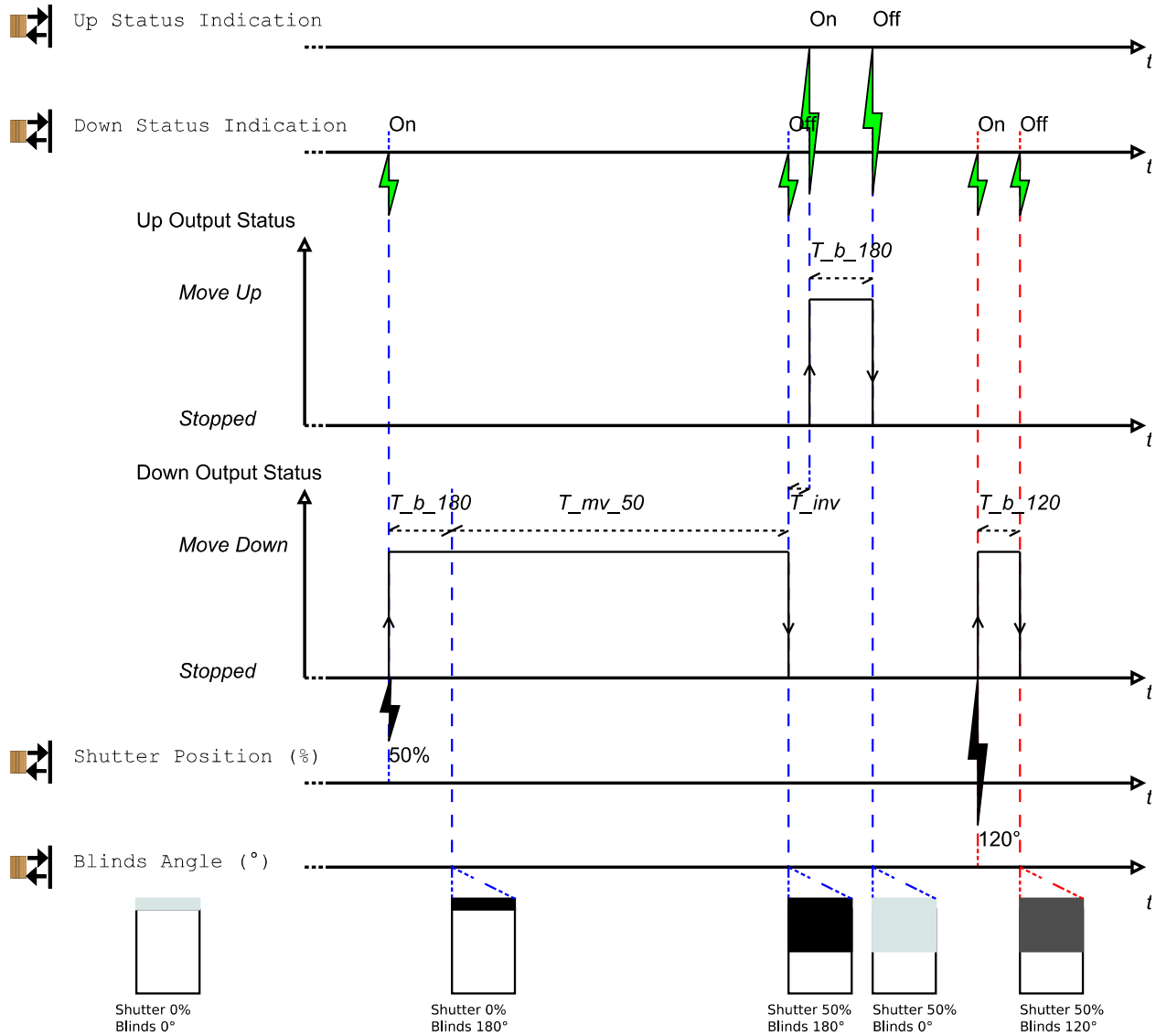
Figure 12: Example of shutter and blinds operation.

b) Channel status after system start / power recover

The position of each channel when the system is (re)started, for example after a power failure, can be defined by setting the parameter **"Status after system start"** to the desired value. If this parameter is set to "Last stored position", at power failure the device attempts to save the channel's current positions for shutter and blinds and, in case of success, when power is restored the device will set the saved values; it's possible to set the channel to close (shutter at 100% and blinds 180°) when the system (re)starts or to

open (shutter at 0% and blinds 0°) by setting the parameter to "Close" or "Open" respectively; if specific positions for shutter and blinds are desired then the scenes must be used (see 4.3.2).

> *i* When configured for "Shutter/Blinds" function, at boot time the channel will always open the relay making sure no channel remains in closed position due to power failure while moving a channel.

c) Jamming

The directly related COs are:

■↕ **[input]** "Jamming": control of the jamming;

The channel may additionally be blocked via "Jamming" CO it **"Jamming usage"** is set to be used. It can be blocked if "Jamming" CO receives "TRUE" (parameter set to "If '1'") or blocked if "Jamming" CO receives "FALSE" (parameter set to "If '0'").

It's also possible to limit the time extension for which the channel remains blocked. This is is done the setting **"Use Time Limited Jamming?"** to "Yes" and by selecting the duration in the parameter **"Duration"**.

d) Channel status after overriding operations

Manual operation, priority and jamming are considered overriding operations since they impose a certain output status. The status the output takes when any of those overriding operations is ended can be defined in the parameters **"Status after [Manual Mode operation/Priority operation/jamming]"**. Setting this parameter to "Maintain" causes the channel to keep that status that was imposed by the overriding operation; if the parameter is set to "Previous status", when the overriding operation terminates the channel's will set the sutter (and blinds) to the status just before the time the overriding operation starts; setting the parameter to "Close" causes the shutter (and blinds) to go to closed status (shutter 100% and blinds 180°) when the overriding operation terminates; setting the parameter to "Open" causes the the shutter (and blinds) to go to opened status (shutter 0% and blinds 0°) when the overriding operation terminates; by chosing "Theoretical status without [manual/priority/jamming]" causes the channel's output to go to the status it would be in case the overriding operation didn't occur.

4.3.2 O[x]-[x+1]: Scenes

The COs related with scenes functionality are:

▪↺ **[input]** "Scene Control": Controls the scenes;

Every Shutter and Blinds channel can have a specific position (for the shutters and for the blinds) for a certain scene number. All the Channels have available from "Scene 1" to "Scene 32" for configuration. Each of the scenes can be configured to a specific action that may, or may not, depending on the installation settings, change at run time. In case changes can be made after configuration with ETS, those changes are persistent, which means, even after a power dow followed by a power restore the changes will be kept. However, restoring the scenes to the configuration time settings is possible via "Restore Scenes" CO; this process will restore all the scenes form all the channels to its setting of ETS configurations deployment.

Scenes configuration page in its defaults can be seen in Figure 13 and detailed information in Table 8.
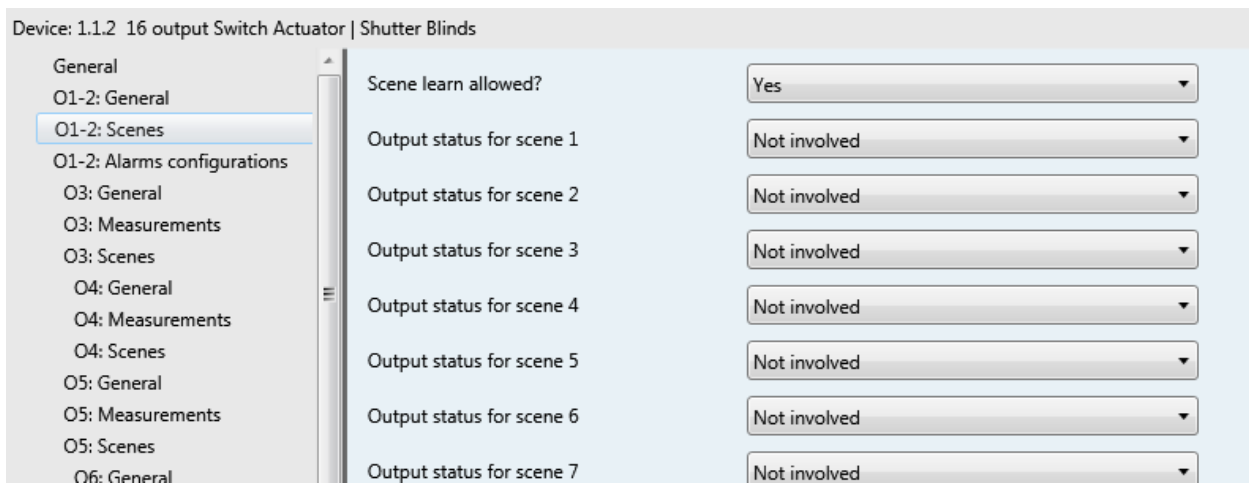
Figure 13: Shutter and Blinds' Channel Scenes configuration page.

Table 8: Parameters for Shutter and Blinds' Channel Scenes configuration.

Parameter	Description	Values
Scene learn allowed?	Defines if the device will recognise the scene "learn" command and memorise its current status to the respective scene.	Possible values: No *Yes
Output status for scene [1...32]	Defines the channel's behaviour for a certain scene number.	Possible values: *Not involved Close Open Position

21	**Shutter position**	Defines the shutter's position for the corresponding scene.	<u>Min:</u> 0% <u>Max:</u> 100% <u>Default:</u> 0%
22	**Blinds position**	Defines the Blinds' position for the corresponding scene.	<u>Min:</u> 0° <u>Max:</u> 180° <u>Default:</u> 0°

4.3.3 O`[x]`-`[x+1]`: Alarms configurations

The COs related with alarms functions are:

- ⇄ **[input]** "Rain Alarm": receiving "True" makes device to set to rain alarm position;
- ⇄ **[input]** "Wind Alarm": receiving "True" makes device to set to wind alarm position;

Every Shutter and Blinds' channel may have associated a specific position with each of the available alarm inputs. The device can handle two alarms, by default the wind alarm and rain alarm. The configuration page of the alarms when both are activated is presented in Figure 14 and further details are given in Table 9.
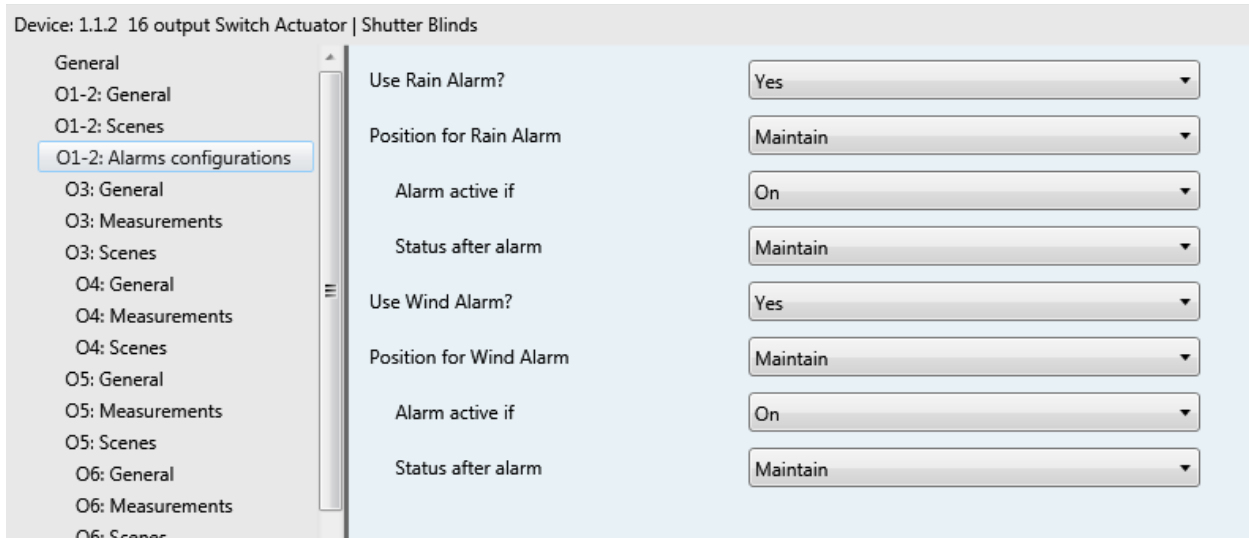
Figure 14: Shutter and Blinds' Alarms configuration page (when alarms in usage)

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21   Visible if **"Output status for scene[1...32]"** is "Position".
22   Visible if **"Output status for scene[1...32]"** is "Position" and **"O`[x]`-`[x+1]`: General"** → **"Control also Blinds?"** is "Yes".

Table 9: Shutter and Blinds' Alarms configurations page description.

Parameter	Description	Values
Use rain alarm?	Defines if the rain alarm is to be used.	Possible values: *No Yes
[23] **Position for rain alarm**	Defines the behavior of the device when rain alarm is triggered.	Possible values: *Maintain Close Open Scene [1...32]
[23] **Alarm active if**	Defines the polarity of the alarm signal (active if '1' or active if '0').	Possible values: *On Off
[23] **Status after alarm**	Defines the behavior of the device in pos-alarm.	Possible values: *Maintain Previous status Theoretical status without alarm Close Open
Use wind alarm?	Defines if the wind alarm is to be used.	Possible values: *No Yes
[24] **Position for rain alarm**	Defines the behavior of the device when wind alarm is triggered.	Possible values: *Maintain Close Open Scene [1...32]
[24] **Alarm active if**	Defines the polarity of the alarm signal (active if '1' or active if '0').	Possible values: *On Off
[24] **Status after alarm**	Defines the behavior of the device in pos-alarm.	Possible values: *Maintain Previous status Theoretical status without alarm Close Open

a) Positions at Alarm

The position the shutter and blinds should assume when a specific alarm occurs can be set in **"Position for [rain/wind] alarm"**. It's possible to set it not to react when the alarm occurrence is givin by setting the parameter to "Maintain"; set it to "closed" (shutter at 100% and blinds at 180°); set it to "opened" (shutter at 0% and blinds at 0°); or to the position defined in a certain scene.

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23   Visible if **"Use rain alarm?"** is "Yes".
24   Visible if **"Use wind alarm?"** is "Yes".

b) Positions after Alarm

The position the shutter and blinds assume when an alarm is terminated is also possible to determine by setting the desired value in the parameter **"Status after alarm"**. The shutter and blinds will remain in alarm position when the alarm is terminated if the parameter is set to "Maintain"; setting the parameter to "Previous status" will set the shutter and blinds to the position it was just before the beginning of the alarm; if the parameter is set to "Theoretical status without alarm", once the alarm is terminated the shutter and blinds will go to the position they would be in case the alarm hadn't occurred (the last request related with shutter and blinds positioning is kept); it's possible to "close" (shutter 100% and blinds 180°) after alarm or to "open" (shutter 0% and blinds 0°).

c) Alarm input mode

The alarm can be indicate active with '1' and inactive with '0' if the parameter **"Alarm active if"** is set to "On"; alarm active with '0' and inactive with '1' if the parameter is set to "Off".

4.3.4 Operation considerations

a) Power failure considerations

The device implements a backup mechanism at power failure, attempting to save shutter's position and blinds' position; this isn't however a fail-safe mechanism since many variables may cause the system to be unable to create the backup.

Moreover, if the power failure occurs while the Shutter/Blind channel is preforming a movement the device wont attempt to create a backup; its position will instead be marked as undefined and afterwards, while operation the device will need a full movement Up or Down in order to calibrate.

b) Position and Movement considerations

The device implements a mechanism for shutter and blinds positioning that is time based, this means that works in open-loop (without getting feedback from the shutter/blinds controller); this has several implications. Most of times the controller is not linear, changing it's operation speed with time; this affects directly the accuracy of the position value calculated by the actuator. It's possible and likely that with usage the real shutter position and the position indicated by the actuator starts to become different; imagine the shutter is at 55% but he actuator indicates 45%, when the actuator is requested to move to 0% the shutter is going to go to around 10%; in this case the "Up/Down" Comm. Obj. can be used with the

"Up" command that allows the shutter to move up to 10% of the Up/Down time, or until "Stop" is received.

> ⚠️ It's recommended the usage of Shutter/Blind controllers with protection switch for avoiding overdrive.

APPENDIXES

APPENDIX A - LOGIC OPERATIONS

Each of the Lighting Channels can have one logic input (see 4.2.1), that can be used to control the output status of the channel. In here, useful theoretical information about the four logic operations will be presented.

These functions belongs to the algebra's subarea Boolean algebra, in which the values of the variables are the truth values *TRUE* and *FALSE*, that commonly are denoted by '1' and '0', respectively.

I - AND (Logical Conjunction)

This operator can be represented by the symbol "". A *n*-place logical operator AND results *TRUE* if *n* of its operands are *TRUE*, otherwise the value is *FALSE*.

Main properties:

- Commutativity: $A \wedge B \Leftrightarrow B \wedge A$;
- Associativity: $A \wedge (B \wedge C) \Leftrightarrow (A \wedge B) \wedge C$;
- Distributivity: $A \wedge (B \vee C) \Leftrightarrow (A \wedge B) \vee (A \wedge C)$;

Table 10: Truth tables for Conjunction Operation

Input		Output
A	B	AB
0	0	0
0	1	0
1	0	0
1	1	1

			Output
A	B	C	ABC
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

Input				Output
A	B	C	D	ABCD
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

II - OR (Logical Disjunction)

This operator can be represented by the symbol "". A *n*-place logical operator AND results *TRUE* if at least 1 of *n* operands is *TRUE*, if *n* operands are *FALSE,* then the result is *FALSE*.

Main properties:

- Commutativity: $A \vee B \Leftrightarrow B \vee A$;
- Associativity: $A \vee (B \vee C) \Leftrightarrow (A \vee B) \vee C$;
- Distributivity: $A \vee (B \wedge C) \Leftrightarrow (A \vee B) \wedge (A \vee C)$;

Table 11: Truth tables for Disjunction Operation

Input		Output
A	B	AB
0	0	0
0	1	1
1	0	1
1	1	1

			Output
A	B	C	ABC
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

Input				Output
A	B	C	D	ABCD
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

III -   XOR (Exclusive disjunction)

This operator can be represented by the symbol "". A *n*-place logical operator XOR results *TRUE* if one odd number of operands is *TRUE*, otherwise the result is *FALSE*.

Main properties:

- Commutativity: $A \oplus B \Leftrightarrow B \oplus A$;
- Associativity: $A \oplus (B \oplus C) \Leftrightarrow (A \oplus B) \oplus C$;

Table 12: Truth tables for Exclusive Disjunction Operation

Input		Output
A	B	AB
0	0	0
0	1	1
1	0	1
1	1	0

			Output
A	B	C	ABC
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

Input				Output
A	B	C	D	ABCD
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

IV -   NOT (Negation)

This operator can be represented by the symbol "¬". Negation is unary (single-argument) logical operator. Negation function takes *Falsity* to *Truth* and vice versa.

Main properties:

• Double negation: $\neg\neg A \Leftrightarrow A$ and $\neg\neg\neg A \Leftrightarrow \neg A$;
• Distributivity (Morgan's law): $\neg(A \vee B) \Leftrightarrow (\neg A \wedge \neg B)$ and $\neg(A \wedge B) \Leftrightarrow (\neg A \vee \neg B)$;

Table 13: Truth table for NOT Operation

A	¬A
0	1
1	0

APPENDIX B - KNX DATA TYPES

Table 14: Some of the KNX Data Points Types

DPT_ID	DPT_Name	Size (bits)
1.001	DPT_Switch	1
1.002	DPT_Bool	1
1.003	DPT_Enable	1
1.004	DPT_Ramp	1
1.005	DPT_Alarm	1
1.006	DPT_BinaryValue	1
1.007	DPT_Step	1
1.008	DPT_UpDown	1
1.009	DPT_OpenClose	1
1.010	DPT_Start	1
1.011	DPT_State	1
1.012	DPT_Invert	1
1.013	DPT_DimSendStyle	1
1.014	DPT_InputSource	1
1.015	DPT_Reset	1
1.016	DPT_Ack	1
1.017	DPT_Trigger	1
1.018	DPT_Occupancy	1
1.019	DPT_Window_Door	1
1.021	DPT_LogicalFunction	1
1.022	DPT_Scene_AB	1
1.023	DPT_ShutterBlinds_Mode	1
1.100	DPT_eat/Cool	1
2.001	DPT_Switch_Control	2
2.002	DPT_Bool_Control	2
2.003	DPT_Enable_Control	2
2.004	DPT_Ramp_Control	2
2.005	DPT_Alarm_Control	2
2.006	DPT_BinaryValue_Control	2
2.007	DPT_Step_Control	2
2.008	DPT_Direction1_Control	2
2.009	DPT_Direction2_Control	2
2.010	DPT_Start_Control	2
2.011	DPT_State_Control	2
2.012	DPT_Invert_Control	2
3.007	DPT_Control_Dimming	4

3.008	DPT_Control_Blinds	4
4.001	DPT_Char_ASCII	8
4.002	DPT_Char_8859_1	8
5.001	DPT_Scaling	8
5.003	DPT_Angle	8
5.004	DPT_Percent_U8	8
5.005	DPT_DecimalFactor	8
5.010	DPT_Value_1_Ucount	8
6.001	DPT_Percent_V8	8
6.010	DPT_Value_1_Count	8
6.020	DPT_Status_Mode3	8
7.001	DPT_Value_2_Ucount	16
7.002	DPT_TimePeriodMsec	16
7.003	DPT_TimePeriod10MSec	16
7.004	DPT_TimePeriod100MSec	16
7.005	DPT_TimePeriodSec	16
7.006	DPT_TimePeriodMin	16
7.007	DPT_TimePeriodrs	16
7.010	DPT_PropDataType	16
7.011	DPT_Length_mm	16
7.012	DPT_UEICurrentmA	16
7.013	DPT_Brightness	16
8.001	DPT_Value_2_Count	16
8.002	DPT_DeltaTimeMsec	16
8.003	DPT_DeltaTime10MSec	16
8.004	DPT_DeltaTime100MSec	16
8.005	DPT_DeltaTimeSec	16
8.006	DPT_DeltaTimeMin	16
8.007	DPT_DeltaTimers	16
8.010	DPT_Percent_V16	16
8.011	DPT_Rotation_Angle	16
9.001	DPT_Value_Temp	16
9.002	DPT_Value_Tempd	16
9.003	DPT_Value_Tempa	16
9.004	DPT_Value_Lux	16
9.005	DPT_Value_Wsp	16
9.006	DPT_Value_Pres	16
9.007	DPT_Value_umidity	16
9.008	DPT_Value_AirQuality	16
9.010	DPT_Value_Time1	16
9.011	DPT_Value_Time2	16

9.020	DPT_Value_Volt	16
9.021	DPT_Value_Curr	16
9.022	DPT_PowerDensity	16
9.023	DPT_KelvinPerPercent	16
9.024	DPT_Power	16
9.025	DPT_Value_Volume_Flow	16
...	...	...

APPENDIX C - DETAILED DESCRIPTION OF COMMUNICATION OBJECTS

Depending on the device, the number of COs differs, and so it does some of their numbers. However, the numbers, from device to device change according to an offset (Δ):

- **MSA04yy-CM**: $\Delta = 60$
- **MSA08yy-CM**: $\Delta = 120$
- **MSA12yy-CM**: $\Delta = 180$
- **MSA16yy-CM:** $\Delta = 240$

Table 15: General COs specification

Function	#GO[25]	GO Name	IN/OUT	DPT
Restore Scenes	Δ	Restore Scenes	IN	1.001
Maintenance	$\Delta+1$	Maintenance Mode	IN	1.001

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25   First CO is the number 0, according to ETS™.

I - Lighting

Since all the channels are identical, also their COs have identical characteristics, differing only in their number. The GO number increment per channel is $\partial = 15$.

Table 16: Lighting Channel x's specific COs' description (x=1...n, where n is the number of channels available)

Function		#GO	GO Name	IN/OUT	DPT
ON / OFF		0+x*∂	On / Off	IN	1.001
Start / Stop Timer		1+x*∂	Start / Stop Timer	IN	1.010
Priority On / Off		2+x*∂	Priority On / Off	IN	1.001
Scene Control		3+x*∂	Scene Control	IN	18.001
Time Limited Toggle Switch		4+x*∂	Time Limited Toggle Switch	IN	1.001
Logic	**Authorize**	5+x*∂	Logic - Authorize	IN	1.002
	AND	5+x*∂	Logic - AND	IN	1.002
	OR	5+x*∂	Logic - OR	IN	1.002
	XOR	5+x*∂	Logic - XOR	IN	1.002
	Inverted Authorize	5+x*∂	Logic - Inv. Authorize	IN	1.002
	NAND	5+x*∂	Logic - NAND	IN	1.002
	NOR	5+x*∂	Logic - NOR	IN	1.002
	XNOR	5+x*∂	Logic - XNOR	IN	1.002
Jamming		7+x*∂	Jamming	IN	1.002
Reset Working Time Counter		8+x*∂	Reset Working Time Counter	IN	1.002
Timer delay (seconds)		9+x*∂	Timer delay (seconds)	IN	7.005
		9+x*∂	Timer delay (seconds)	IN	9.010
Working Time Limit Reached indication		11+x*∂	Working t. limit reached Ind.	OUT	1.002
Working Time Counter indication		12+x*∂	Working Time counter Ind.	OUT	13.100
Timer expiration pre-warning		13+x*∂	Pre-warning Indication	OUT	1.002
Output Status Indication		14+x*∂	Status Indication	OUT	1.001

II - Shutter and Blinds

Since all the channels are identical, also their COs have identical characteristics, differing only in their number. The GO number increment is $\theta = 30$.

Table 17: Shutter and Blinds Channel [x]-[x+1]'s specific COs' description (x=1...n-1, where n is the number of channels available)

Function	#GO	GO Name	IN/OUT	DPT
Up / Down Control	$0+x*\theta$	Move Up / Down	IN	1.008
Wind Alarm	$1+x*\theta$	Wind Alarm	IN	1.002
Scene Control	$3+x*\theta$	Scene Control	IN	18.001
Slat angle Up/Down and Stop Up/Down	$4+x*\theta$	Slat Angle | Stop Up / Down	IN	1.008
Shutter Position	$5+x*\theta$	Shutter Position (%)	IN	5.001
Blinds Position	$6+x*\theta$	Blinds Angle (°)	IN	5.003
	$6+x*\theta$	Blinds Position (%)	IN	5.001
Jamming	$7+x*\theta$	Jamming	IN	1.002
Rain Alarm	$8+x*\theta$	Rain Alarm	IN	1.002
Shutter Position Indication	$10+x*\theta$	Shutter Position Indication	OUT	5.001
Blinds Position Indication	$11+x*\theta$	Blinds Angle Indication	OUT	5.003
	$11+x*\theta$	Blinds Position Indication	OUT	5.001
Up Movement Status Indication	$14+x*\theta$	Up Status Indication	OUT	1.001
Down Movement Status Indication	$29+x*\theta$	Down Status Indication	OUT	1.001