KNX

Dimming Actuator

Reference Manual

KNX DIMMING ACTUATOR 2 GANG 300W DM102	WRKT5512E-XXX
KNX DIMMING ACTUATOR 4 GANG 250W DM104	WRKT5414J-XXX

Panasonic

Contents

1 Functional Characteristics

1.1 General

Panasonic Thea IQ series dimming actuators has two different DIN size. 2 channel dimming actuator in DIN4 package and a 4 channel dimming actuator in DIN8 package.

1.2 Operation

Dimming actuator has an LED which indicates its status and manual control buttons for every channel. Manual buttons can activate on, off and dim functions.Mains supplies and channel supplies complately seperated from each other. If the channel is not useable LED indicators flashes every 500ms. The bus voltage does not need to be present.

1.3 Features

- 2 channel and 4 channel versions.
- Dimming range 0-100%.
- For dimming incandescent lamps, low voltage and high voltage halogen lamps, Dimmable CFL and Dimmable LED lamps.
- Removable KNX bus module enables devices to be changed without reprogramming.
- LED channel status indicator for each channel.
- Manual operation on device (even without bus connection).
- Dimming output: 300W per channel for 2 channels version, 250W per channel for 4 channels version.
- Automatic load type detection (can be deactivated).

2 Technical Data

KNX Medium	TP1	
Mode of commissioning	S-Mode	
KNX supply	21-32 V DC	
Mains supply	230 V AC	
Mains frequency	50 Hz	
Installation type	DIN rail	
Mounting width	4 Channels – 144mm (8 modules) 2 Channels – 72mm (4 modules)	
Ambient temperature	-5°C…+45°C	
Storage temperature	-25°C…+55°C	
Trasportation temperature	-25°C…+70°C	
Connection		
KNX	KNX bus terminal	
Mains and outputs	Screw terminals	
Max. cable cross section	**Single wire:** 1.5mm² to 4mm² or 2 x 1.5mm² to 2 x 2.5mm² **Stranded wire without ferrule:** 0.75…4mm² **Stranded wire with ferrule:** 0.5… 2.5mm²	
Max Loads	**DM102 (2 Channels)**	**DM104 (4 Channels)**
Incandesant & Halogen HV	300W (200W in inductive mode)	250W (200W in inductive mode)
Halogen LV (Ferromagnetic Trasformer)	300VA (Capacitive mode not allowed)	250VA (Capacitive mode not allowed)
Halogen LV (Electronic Trasformer)	300VA (Inductive mode not recommended)	250VA (Inductive mode not recommended)
Dimmable LED (Retrofit) & CFL	300VA (30VA in inductive mode, auto calibration mode not recommended)	250VA (30VA in inductive mode, auto calibration mode not recommended)

2.1 Dimmable Loads

The device works according to the phase cut-on or phase cut-off dimming principle and permits switching and dimming of HV incandescent lamps, HV halogen lamps and LV halogen lamps by means of conventional transformers, Dimmable CFL and Dimmable LED Driver loads. The recommended load type according to the "Type of connected load" parameter is shown by table.

	Load			
ETS Parameter	HV halogen, Incandescent lamps	LV halogen, 12V-LED via ferromagnetic trasformer (inductive)	LV halogen, 12V-LED via electronic transformer (capacitive)	LED (Retrofit), CFL
Universal	✓	✓	✓	⊘
Capacitive (phase cut off)	✓	⊗	✓	✓
Inductive (phase cut on)	✓	✓	⊘	✓

✓	Usage possible
⊘	Usage not recommended
⊗	Usage is not possible (Device damage)

Warning! : If the LED load is driven by **"Phase cut off"** technique then select the parameter **"Capacitive",** or If the LED load is driven by **"Phase cut on"** technique then select the parameter **"Inductive".**

2.2 Automatic Load Type Detection

Automatic load detection is an auxiliary feature of dimming actuators for unknown types of load. If the automatic mode selected in ETS parameters, channel calibrates load on every "Switch on" operation.

Resistive / Capacitive Loads	Incandescent lamps, HV halogen lamps, Electronic transformers

Inductive Loads	Conventional transformers (Ferromagnetic Trasformer)

2.3 LED Indications

- If the channel leds flashing about 500ms intervals it says channel not useable. Please check channel connections. Channel supply may not be connected or there is a problem on the channel.
- If the Manual button led flashing about 250ms intervals when button is pressed, it means the manual control parameter disabled on ETS. That parameter can change on ETS.
- If the Set Phys Addr button led is flashing about 3s intervals it means BUS connection failure. In this case, using the buttons on the module switch on, switch off and dimming operations can be done.

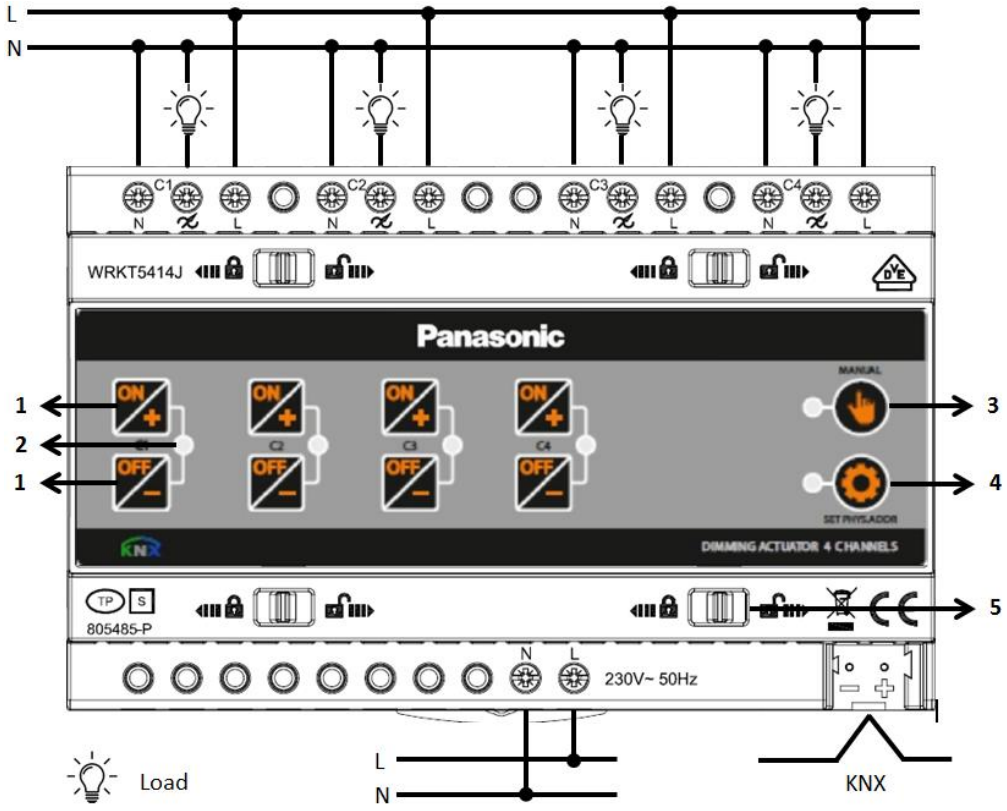
2.4 Important Informations

- Don't connect dimmer channels series or parallel.
- If you know load type select true type of load. Auto load detection does not recommened for known LED load types.

3 Before Operation

3.1 Connection

Every output (C1, C2, C3, C4 can be used separately for dimming control. Belove figure shows possible connections.



1. **Control buttons for dimming channels:** Allows control the channels manually.
2. **Status leds for dimming channels:** When led is on the channel is on. When led is off the channel is off.
3. **Manual button and led:** When led is on only manual control is allowed. Device does not response to bus commands.
4. **Set physical address button and led:** KNX programming button and led.
5. **Lock for upper and lower modules:** The device consists of two parts. Lower part which has dimming unit and upper part which runs application. KNX application is loaded to upper part of the device. Upper part can be removed with unlock all switches.

3.2 Device behaviour after ETS download

After ETS download related channel will be off. Status led will also be off. If manual control is activated from ETS channels can be controlled via control buttons on device.

3.3 Device behaviour after bus failure

This can be configured from ETS for every channel.

3.4 Device behaviour after mains failure

After main voltage failure all output channels will be off.

3.5 Device behaviour after main or bus recovery

This can be configured from ETS for every channel.

4 Application Program

4.1 Communication objects

No	Object Name	Function	Object Size	Datapoint Type	Flags			
					C	R	W	T
0	Channel 1 Switching	Switch ON/OFF	1 Bit	1.001 DPT_Switch	✓		✓	
1	Channel 1 Dimming	Relative Dimming	4 Bit	3.007 DPT_Dimming Control	✓	✓	✓	
2	Channel 1 Dimming	Absolute Dimming	1 Byte	5.001 DPT_Percentage	✓		✓	
3	Channel 1 Switching	Soft Switching	1 Bit	1.001 DPT_Switch	✓		✓	
4	Channel 1 Feedback	Switch On Off Feedback	1 Bit	1.001 DPT_Switch	✓	✓		✓
5	Channel 1 Feedback	Brightness Feedback	1 Byte	5.001 DPT_Percentage	✓	✓		✓
6	Channel 1 Switching	Disable	1 Bit	1.001 DPT_Switch	✓	✓	✓	
7	Channel 1 Switching	Forced Position	2 Bit	2.001 DPT_Switch_Control	✓	✓	✓	
8	Channel 1 Logic	AND	1 Bit	1.001 DPT_Switch	✓	✓	✓	
	Channel 1 Logic	OR	1 Bit	1.001 DPT_Switch	✓	✓	✓	
9	Channel 1 Error	Short Circuit/ High Load	1 Bit	1.003 DPT_Alarm	✓	✓		✓
10	Channel 1 Error	Over Temperature	1 Bit	1.003 DPT_Alarm	✓	✓		✓
11	Channel 1 Error	Over Load	1 Bit	1.003 DPT_Alarm	✓	✓		✓
12	Channel 1 Counter	Operating Hours Counter (h)	2 Byte	7.001 DPT_Pulses	✓	✓		✓
13	Channel 1 Counter	Restart Hours Counter	1 Bit	1.001 DPT_Switch	✓		✓	
14	Channel 1 Status	Channel Status	1 Bit	1.005 DPT_Enable	✓	✓		✓
15	Channel 1 Counter	Operating Hours Counter (s)	4 Byte	13.100 DPT_LongDeltaTimeSec	✓	✓		✓
68	Central Switching	Switch ON/OFF	1 Bit	1.001 DPT_Switch	✓		✓	
69	Access / Save Scene	Dimming	1 Byte	1.001 DPT_Switch	✓	✓	✓	
					C	R	W	T

	4 Channel			
	2 Channel			
	Channel 1	Channel 2	Channel 3	Channel 4
Channel 1 Switching	0	17	34	51
Channel 1 Dimming	1	18	35	52
Channel 1 Dimming	2	19	36	53
Channel 1 Switching	3	20	37	54
Channel 1 Feedback	4	21	38	55
Channel 1 Feedback	5	22	39	56
Channel 1 Switching	6	23	40	57
Channel 1 Switching	7	24	41	58
Channel 1 Logic	8	25	42	59
Channel 1 Error	9	26	43	60
Channel 1 Error	10	27	44	61
Channel 1 Error	11	28	45	62
Channel 1 Counter	12	29	46	63
Channel 1 Counter	13	30	47	64
Channel 1 Status	14	31	48	65
Channel 1 Counter	15	32	49	66

4.1.1 Object Descriptions

- **Objects 0, 17, 34, 51 "Switching On Off" (Channel Object)**

It's a 1 bit 1.001 DPT_Switch type object.
If the "1" value sended on this object its dims up to 1-100%, and "0" dims to 0%.

- **Objects 1, 18, 35, 52 "Relative dimming" (Channel Object)**

This object is actuated with 4-bit telegrams. This function can be used to incrase or decrase the light dim value.

- **Objects 2, 19, 36, 53 "Absolute dimming" (Channel Object)**

This object can be used to select the desired dim level directly. This object can take any value from 0% to 100%.
Format: 1 byte percentage value (5.001 DPT_Percentage).

- **Objects 3, 20, 37, 54 "Soft switch" (Channel Object)**

It's a 1 bit 1.001 DPT_Switch type object. A "1" on this object starts a soft switching cycle, i.e:
The brightness is gradually approximates to selected value, starting from the current brightness. The dimming value remains constant for the programmed time and is then gradually reduced after this time has elapsed. Once the programmed minimum brightness has been reached the dimming value is reset to 0%. The cycle can be extended or prematurely terminated via telegrams. This sequence can also be

controlled using a time switch if the "Time between soft ON and soft OFF" parameter is set to "Until soft OFF telegram". The dimming cycle is then started with a “1” and finished with a “0”.

- **Objects 4, 21, 38, 55 “Switching feedback” (Channel Object)**

This object sends the channel dimming status, i.e the information of the on off status of the channel:

1 = Channel dimming value is between 1% and 100%
0 = Channel dimming value is 0% (Channel off)

- **Objects 5, 22, 39, 56 “Brightness feedback” (Channel Object)**

This object sends the channel dimming value after a change as soon as a dimming procedure is completed, i.e. once the new set point value has been reached.

Format: 1 byte percentage value (5.001 DPT_Percentage).

- **Objects 6, 23, 40, 57 “Disable” (Channel Object)**

This object is a 1-bit object for disabling a dimming channel. It is used for activating and deactivating the disabling function.

0 = Deactivates disabling function

1= Activates disabling function

- **Objects 7, 24, 41, 58 “Forced position” (Channel Object)**

This object is a 2-bit object for activating and deactivating the forced position function. The behaviour of a dimming channel at the end of the forced-position function can be configured:

Bit1	Bit0	Result
0	x	Normal control, not active
0	x	Normal control, not active
1	0	Switch off, active
1	1	Switch on, active

- **Objects 8, 25, 42, 59 “Logic” (Channel Object)**

This is a 1-bit object for the input of the logical link of a dimming channel. This object can act like AND or OR logic gates and it can be directly effects output. And the switching objects effected by this object too.

AND	Switch Object	Out
0	0	0
0	1	0
1	0	0
1	1	1

OR	Switch Object	Out
0	0	0
0	1	1
1	0	1
1	1	1

This object is resets on main power failure. Is set value is necessary for use, it must be set from bus after mains power returns.

- **Objects 9, 26, 43, 60 “Short circuit / High load” (Channel Object)**

This object is a 1-bit object that is used for screening any short circuit or very high load on channel.

0 = There is no short circuit or very high load on channel
1 = There is short circuit or very high load on channel

- **Objects 10, 27, 44, 61 “Over temperature” (Channel Object)**

This object is a 1-bit object that is used for screening any excess temperature status.

0 = There is no excess temperature on the channel
1 = There is excess temperature on the channel

- **Objects 11, 28, 45, 62 “Over load” (Channel Object)**

This object is a 1-bit object that is used for screening any overload status.

0 = There is no overload on the channel
1 = There is overload on the channel

- **Objects 12, 29, 46, 63 “Hours counter value” (Channel Object)**

This is a 2-byte object for transmission or readout of the current count of the operating hours counter in hours.

- **Objects 13, 30, 47, 64 “Restart hours counter” (Channel Object)**

This is a 1-bit object for reset the operating hours counter of a channel.

0 = No effect
1 = Reset to zero

- **Objects 14, 31, 48, 65 “Channel status” (Channel Object)**

This object is a 1-bit object that is used for screening channel status.

0 = Channel is not usable
1 = Channel is usable

- **Objects 15, 32, 49, 66 “Channel status” (Channel Object)**

This is a 4-byte object for transmission or readout of the current count of the operating hours counter in seconds.

- **Object 68 “Central Switching” (Common Object)**

This object is a central object. It can be configured to be effective on all channels. If a "1" or "0" is sent to this object then this is the same as if a "1" or "0" is sent to the switching objects of the channels (Object 0, Object 17, Object 34...). The same functionality could also be achieved by connecting all

switching objects to the same group as that of this object. Accordingly, using this object saves time during the assignment of the group addresses and also saves on the number of assignments.

- **Object 69 "Access/Save scene" (Common Object)**

This object can be used to save and subsequently call up scenes. Saving stores the dimming value of the channel. It does not matter how this dimming value is produced (whether via switching commands, central objects or the buttons on the device). The saved dimming value is re-established when it is called up.

4.2 Parameters

4.2.1 Parameter Pages

Function	Description
General	Dimming actuators general parameters.
Ghannel 1...4 General	Channels general parameters.
Dimming Characteristic	Behavior of the dimming command.
Soft On/Off	Behavior of the soft switching command.
Feedbacks	Behavior of the feedback objects.
Scenes	Scene selection.
Supplementary Functions	Disabling, forced position and logic functions.

4.2.2 General Parameters

Name	Value	Description
Cycle time for sending of feedback objects	2min, 3min, **5min,** 10min, 15min,20min, 30min, 45min, 60min	This parameter specifies the cycle time of switching feedback object and brightness feedback of each channel. The channel sends its own state cyclically to the bus according to selected value.
Delay for feedbacks after bus voltage return	2min, 3min, **5min,** 10min, 15min,20min, 30min, 45min, 60min	This parameter specifies the delay time before the feedback objects are sent to the bus. After this value the feedback objects will be sent to bus.
Report operating hours at change	[**0**…65535] hours ****(If this parameter selected as "0" operating hours is not send at change)***	This parameter sets the cycle time for sending the counted hours value.
Feedback cycle time for operating hours counter	2min, 3min, **5min,** 10min, 15min,20min, 30min, 45min, 60min	This parameter specifies the cycle time of hours counter feedback for each channel.

Cycle time for sending of error and status objects	2min, 3min, **5min,** 10min, 15min,20min, 30min, 45min, 60min	This parameter specifies the cycle time of error objects and channel status object of each channel. The channel sends its own state cyclically to the bus according to selected value.
Manual control	**No** Yes	This parameter specifies whether the manual buttons will be used or not for all dimming channels.
Blinking rate	**1sec**, 2sec, 3sec, 10sec	At the start and end of the "disable" supplementary function, a dimming channel can flash. The flash cycle time is generally set here for all dimming channels concerned.

4.2.3 Channel General Parameters

Name	Value	Description
Type of connected load	**Universal** Capacitive (phase cut off) Inductive (phase cut on)	This parameter specifies the load type of the dimming channel. The dimming principle of the dimming channel is specified here.
Minimum brightness	**1%**...45%	The minimum brightness of the channel is specified by this parameter.
Maximum brightness	50%...**100%**	The maximum brightness of the channel is specified by this parameter. The minimum brightness must be smaller than the maximum brightness.
Response when receiving a dimming value	Dimming **Immediate ON**	This parameter is used here to define whether a brightness value received via the bus is instantly jumped to (absolute dimming), or whether the brightness is dimmed to via the set dimming characteristic.
Switch-ON brightness	Brightness value before last switch-OFF **Minimum brightness** 5% - 100%	This parameter specifies the brightness value, which should be set whenever switching on via the “switching” or “central switching” object or by manual operation on the dimming channel. *****

Automatic switch off at minimum brightness	**No** Yes	This parameter determines whether the channel will be switched off at minimum brightness level or not.
Central function	**No** Yes	This parameter determines the assignment of the dimming channel to the central function.
Behaviour after bus failure	**No change** Minimum brightness Off 10% - 100%	The actuator permits setting the brightness value separately for each dimming channel in case of bus voltage failure. *****
Behaviour after restoration of the bus/mains power	**Same as before bus failure** Minimum brightness Off 10% -100%	This parameter defines the behaviour of the dimming channel after bus or mains voltage recovers. *****
Time for Soft ON	0-…**10**...-60 sec.	This parameter defines the soft on time when soft on command comes to the dimming channel.
Dimming value after Soft ON	10% - **100%**	This parameter defines the dimming value when soft on command comes to the dimming channel. *****
Time between Soft ON and Soft OFF	**Until "Soft Off" telegram** 2-60 sec.	This parameter defines the delay time between soft on and soft off procedure. After soft on is processed, then the dimming channel waits for this delay time before soft off starts.
Time for Soft OFF	0-…**10**…-60 sec.	This parameter defines the soft off time after the soft on and/or delay time elapsed before soft off.

**If this parameters smaller than minimum brightness parameter or greater than maximum brightness parameter, after first ETS download this parameters are adjusted to minimum or maximum brightness parameter.*

4.2.4 **Channel Dimming Characteristic Parameters**

Name	Value	Description
Characteristic curve	**Linear** User defined	The dimming characteristic curve of the dimming channel can be set here. The lamp used can thus be adapted to the brightness sensitivity of the human eye.
Dimming time between min. to 100% **(Linear Selection)**	1sec…**10sec**…60sec	The brightness curve of basic brightness (decimal brightness value "1") up to 100 % (decimal brightness value "255") is linear.
1st area dimming time **(User defined selection)**	1sec…**10sec**…60sec	In the case of a linear characteristic curve, the dimming increment speed is set here.
Brightness value for 1st area **(User defined selection)**	1%…**20%**…100 %	The first brightness limiting value is parametrised here. This limiting value defines the boundary between the first and second section. *****
2nd area dimming time **(User defined selection)**	1sec…**10sec**…60sec	In the case of a user-defined characteristic curve, the dimming increment speed of the second section is set here.
Brightness value for 2nd area **(User defined selection)**	1%…**60%**…100%	The second brightness limiting value is parameterised here. This limiting value defines the boundary between the second and third section. *****
3rd area dimming time **(User defined selection)**	1sec…**10sec**…60sec	In the case of a user-defined characteristic curve, the dimming increment speed of the third section is set here.

**If this parameters smaller than minimum brightness parameter or greater than maximum brightness parameter, after first ETS download this parameters are adjusted to minimum or maximum brightness parameter.*

4.2.5 **Channel Feedback Parameters**

Name	Value	Description
Sending switch on off feedback	**No** Yes, only on change Yes, cyclical and on change	This parameter sets whether the dimming channel status will be sent to the bus or not. The cycle time can be set from the General page.
Sending brightness feedback	**No** Yes, only on change Yes, cyclical and on change	This parameter sets whether the brightness value of dimming channel will be sent to the bus or not. The cycle time can be set from the General page.
Operating hours counter	**Disable** Enable	This parameter specifies whether the operating hours counter function will be used or not. If Enable is selected, each channel waits for starting command for counting. If “start hours counter” object is updated to “1”, then the channel starts to count “ON” status time only(i.e it doesn’t count the “OFF” status). The cycle time can be set from General page.
Transmit operating hours cyclically	**No** Yes	This parameter specifies whether the channel hours counter value will be send cyclically or not.
Send channel status	**No** Yes, only on change Yes, cyclical and on change	This parameter defines whether the availability status of dimming channel will be sent or not. The cycle time can be set from the General page.
Send over temperature error	**No** Yes, only on change Yes, cyclical and on change	This parameter defines whether the excess temperature status of dimming channel will be sent or not. The cycle time can be set from the General page.
Send short circuit error	**No** Yes, only on change Yes, cyclical and on change	This parameter defines whether the short circuit status of dimming channel will be sent or not. The cycle time can be set from the General page.
Send overload error	**No** Yes, only on change Yes, cyclical and on change	This parameter defines whether the overload status of dimming channel will be sent or not. The cycle time can be set from the General page.

4.2.6 **Channel Scene Parameters**

Name	Value	Description
Behaviour when recalling a scene	**Immediate On** Dimming	This parameter determines the dimming behavior when scene recall function has been run.
Scene 1...8 activatable by scene number **(from Scene1 to Scene8)**	**No scene number** Scene number 1…64	This parameter sets the included scenes for each of 8 scenes according to activation number. For each scene (from scene1 to scene8), there are 64 selection number from scene number 1 to scene number 64.
Brightness value for scene 1...8 **(from Scene1 to Scene8)**	%0…%100	This parameter defines the brightness value of dimming channel when the related scene is called. *****
Storage function for scene 1...8 **(from Scene1 to Scene8)**	**No** Yes	Setting "yes" enables the storage function of the scene. If the function is enabled, the current brightness value can be stored internally via the extension object on receipt of a storage telegram. If "no" is selected, the storage telegrams are rejected.

**If this parameters smaller than minimum brightness parameter or greater than maximum brightness parameter, after first ETS download this parameters adjusted to minimum or maximum brightness parameter.*

4.2.7 **Channel Supplemetary Parameters**

Name	Value	Description
Selection of supplementary function	**No supplementary function** Forced position Disabling function	The supplementary function can be defined and enabled here. The disabling function is only configurable as an alternative to the forced position function.
Behaviour at the beginning of the disabling function **(If Disabling Function Selected)**	Switch off **Minimum brightness** 5 %...100 % No reaction Flashing	The behaviour of the dimming channel at the beginning of the disabling function can be configured. For the selection of “Flashing” the “Blinking rate” can be parametrized from “General” page. *****
Behaviour at the end of the disabling function **(If Disabling Function Selected)**	Switch off **Minimum brightness** 5 %...100 % No reaction Flashing	The behaviour of the dimming channel at the end of the disabling function can be configured. For the selection of “Flashing” the “Blinking rate” can be parametrized from “General” page. *****
Brightness for forced position “active, switch on” **(If Forced Position Function Selected)**	**Minimum brightness** 5 %...100 % No reaction	If the forced position is activated and forced-position state is "ON", you can define here how the dimming channel should behave. *****
Brightness for forced position"active, switch off" **(If Forced Position Function Selected)**	**Switch off only**	This parameter is only information for “active switch off” process of the forced position function and it can not be used.
Brightness for forced position "end inactive" **(If Forced Position Function Selected)**	**No reaction** Tracked brightness value	The behaviour of the dimming channel at the end of the forced-position can be configured here. Tracked brightness defines the brightness value before forced position function has been started.
Logic operation function?	**No** AND OR	This parameter defines which type of logic function will be used for the dimming channel.

**If this parameters smaller than minimum brightness parameter or greater than maximum brightness parameter, after first ETS download this parameters are adjusted to minimum or maximum brightness parameter.*

5 Dimmer Function Details

5.1 General

5.1.1 Delay for Feedbacks after Bus Voltage Return

To reduce telegram traffic on the bus line after bus voltage activation (bus reset), after connection of the device to the bus line or after programming with the ETS, it is possible to delay all actively transmitted feedback telegrams of the actuator. For this purpose, a channel-independent delay can be specified (parameter “Delay for feedbacks after bus voltage return" on parameter page "General".

5.1.2 Manual Control Functions (Buttons on the Device)

The Universal Dimmer has manual control buttons for adjusting the channel dim levels manually. The switch on off command can be realized by manual buttons at the same time with bus telegram. If a channel button is pushed or pulled directly, the button switches on or off the dimming channel. But if a channel button is pushed and waited for 500ms then the channel realize the dimming function. For each channel there is one level up or level down button which has the on off command at the same time. Also there is a manual control buton that is called “Manual” on the device. If this buton is pushed then the device can be controlled only from manual control buttons on device and dimmer can not respond any bus commands such as swithcing, dimming, scene or central control.

5.1.3 Bus Failure Function

When the bus voltage fails, there are five possible selections that the dimming channel can perform:

- No change (the dimming channel does not respond the failure)
- Minimum brightness (the dimming channel dim level goes to parametrized min. brightness)
- Off (the dimming channel will be switched off)
- 10% -100% (the dimming channel dim level goes to this parametric brightness value)

5.1.4 Bus or Mains Voltage Recovery Function

When the bus voltage or mains voltage recovers, there are five possible selections that the dimming channel can perform:

- Same as before bus failure(the dimming channel dim level returns back to the level before failure)
- Minimum brightness (the dimming channel dim level goes to parametrized min. brightness)
- Off (the dimming channel will be switched off)
- 10% -100% (the dimming channel dim level goes to this parametric brightness value)

5.2 Feedbacks

5.2.1 Feedbacks for Switching Status and Brightness Value

The dimmer can send the current switching state and brightness value of a dimming channel via separate feedback objects and can also transmit them to the bus, if the bus voltage is on. The following feedback objects can be enabled independently of each other for each channel:
- Sending switch on off feedback (1 bit)
- Sending brightness feedback (1 byte)

The dimmer calculates the object value of the feedback objects during each switching or dimming procedure. The dimmer sends the switching state or brightness value and updates the feedback objects even when a dimming channel is activated by the manual operation or scene function.

5.2.2 Send Excess Temperature Error

If there is an overtemperature in the device, the load is switched off by the temperature control of the device. The actuator, after switching off, transmits a message telegram "Excess temperature=1" to the bus for the dimming channel concerned, if this message is enabled in the ETS by “Send excess temperature error” parameter. In this state, the dimming channel concerned can no longer be switched on by manual or bus control. To reset such a fault, it might be necessary to switch off the mains voltage supply of the load outputs.

5.2.3 Send Short Circuit Error

Short-circuit protection is integrated in the device for each output. If the device detects short-circuit, the load is switched off automatically. After switching off, the actuator transmits a message telegram "Short-circuit = 1" to the bus for the dimming channel concerned, if this message is enabled in the ETS by “Send short circuit error” parameter. This error is not defines real short circuit every time, it will be very high load on the channel too.

5.2.4 Send Over Load Error

Over load protection is integrated in the device for each output as a part of short circuit protection. If the device detects a over load, the channel does not switch on state. If the channel already on a on state the channel is switched off automatically after over load error. After switching off, the actuator transmits a message telegram "Over Load = 1" to the bus for the dimming channel concerned, if this message is enabled in the ETS by “Send over load error” parameter.

5.2.5 Operating Hours Counter Function

The operating hours counter counts the ON-time of a dimming channel. For the operating hours counter an output must be actively switched on, i.e. when current is flowing to the load. The operating hours counter sums up the determined ON-time for a dimming channel. The accumulated operating hours are tracked in a 2-byte counter. The count value can be

transmitted cyclically to the bus via the communication object "Operating hours counter value". The counting interval can be set from the “Report operating hours at change” parameter in General page. The counter can be reset by the “Restart operating hours” counter object. If this object is set to “1” during counting, the counter is reset and it counts from the begining. Resetting the counter does not reset the Operating hours counter value. It only resets the counter timer. The counted value can be sent to bus cyclically by the channel “Transmit operating hours cyclically” parameter of each channel.

5.3 Supplementary Functions

Supplementary functions can be enabled for each dimming channel. As a supplementary function, a disabling or alternatively a forced position function can be configured. In this respect, only one of these functions can be enabled for one channel. Additionally, a logic operation function can be parameterized.

5.3.1 Setting the Disabling Function

At the beginning of the disabling function, the configured behaviour will be executed and the bus control of the dimming channel locked. When a “1” is sent to Disabling object, then the disabling function is started so the channel is disabled, locked. At the begining of the disabling function the channel behaviour is depend on the “Behaviour at the beginning of the disabling function” parameter selection:

- Switch off (channel will be switched off)
- Minimum brightness (dim channel dim level will be minimum brightness value)
- 5 %...100 %(channel dim value will be selected value)
- No reaction(channel does nothing)
- Flashing (channel flashes according to Blinking rate parameter at General page)

When a “0” is sent to Disabling object, then the disabling function is ended so the channel is enabled again. At the end of the disabling function the channel behaviour is depend on the “Behaviour at the end of the disabling function” parameter selection:

- Switch off (channel will be switched off)
- Minimum brightness (dim channel dim level will be minimum brightness value)
- 5 %...100 %(channel dim value will be selected value)
- No reaction(channel does nothing)
- Flashing (channel flashes according to Blinking rate parameter at General page)

5.3.2 Setting the Forced Position Function

The forced position function, according to the function diagram, can also be combined with other functions of a dimming channel. With an active forced position the upstream functions are overridden so that the output concerned is locked. The forced position function possesses a separate 2-bit communication object. The first bit (Bit 0) of the object "Forced position" indicates whether the dimming channel is switched off or switched on by force. If the dimming channel is switched on by force, an ETS parameter defines which brightness value it should be switched on to. The second bit (bit 1) activates or deactivates the forced-position state (see Table2).

Bit1	Bit0	Result
0	*	*Normal control, Forced position not active*
0	*	*Normal control, Forced positionnot active*
1	0	*Switch off, Forced position active*
1	1	*Switch on, Forced position active*

At the begining of the forced position, i.e. when the forced function is activated, there are two possible activation the forced function by 2-bit forced position object:

- Bit0 = 0, Bit1 = 1 (*Switch off, Forced position active)*
  The dimming channel is only switched off independent of the parameters.
- Bit0 = 1, Bit1 = 1(*Switch on, Forced position active)*
  The dimming channel behaviour depends on the “Brightness for forced position"active, switch on” parameter selection:
  - Minimum brightness
  - 5 %...100 %
  - No reaction

At the end of the forced position, i.e. when the forced position is deactivated, the dimming channel behaves according to the “Brightness for forced position "end inactive” parameter selection:

- Bit0 = x, Bit1 = 0 (*Normal control, Forced position not active)*
  - No reaction
  - Tracked brightness value (The dimming channel returns the dimming level before activating the forced position function)

5.3.3 Setting the Logic Function

A logic function can be parameterized separately for each dimming channel. This function allows the logic operation of the "switch on off" object state and an additional logic operation object. There are two possible logic operation dependent of the “Logic operation function” parameter:

- OR (Logic operation object and switch on off object will be performed by OR logic operation)

- AND (Logic operation object and switch on off object will be performed by AND logic operation)

5.4 Dimming Characteristic Functions

For adusting the dimming characteristic of a dimming channel can be parametrized by “Characteristic curve” parameter:

- Linear
- User defined

Linear dimming lets the channel dim for a linear dim speed. The dimming speed can be set by “Dimming time between min. to 100%” parameter. The dimming time can be parametrized from “1sec.” to “60 sec”. The dimming channel dims from minimum dimming level to maximum dimming level according to this parameter selection. Linear dimming characteristic can be seen from Figure 1.

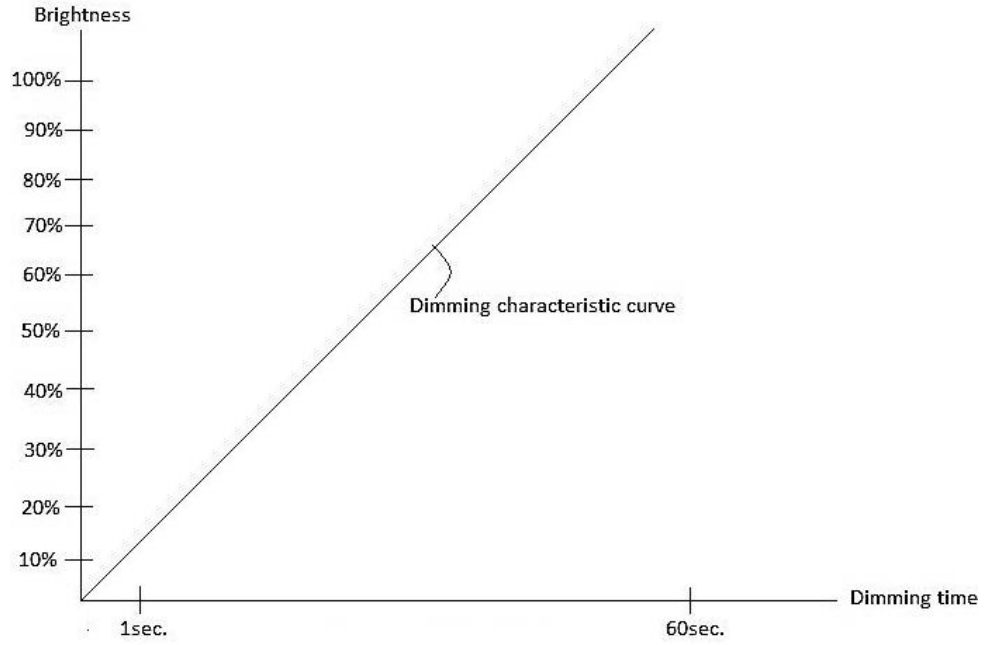


Figure 1: Linear dimming characteristic

The dimming characteristic can be parametrized for 3-sections by the use of “User defined” selection. In some practical applications, a linear dimming characteristic is not optimal. Hence, the actuator in the ETS alternatively permits a user-defined adjustment of the dimming progress. In this way, for example, brightness changes can be adjusted to the brightness sensitivity of the human eye when dimming by subdividing the brightness range in up to three sections with different dimming increment times. User defined dimming characteristic can be seen from Figure 2:

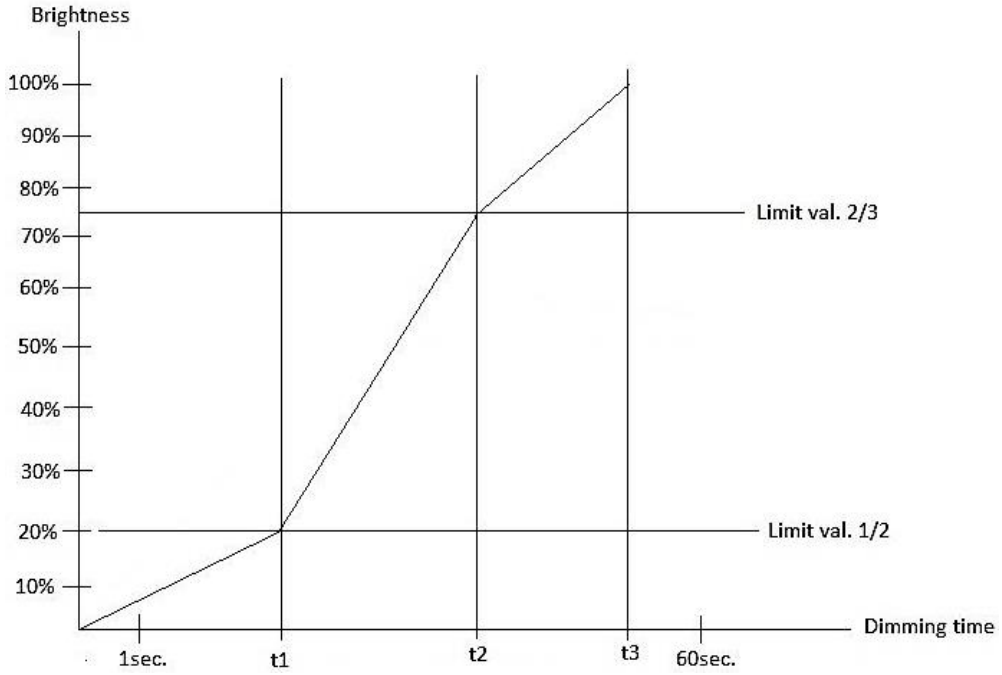


Figure 2: User defined dimming characteristic

Dimming time "t1" for 1st area can be parametrized by "1st area dimming time" parameter. Dimming limit value for 1st and 2nd area can be parametrized by "Brightness value for 1st area" parameter. Dimming time "t2" for 2nd area can be parametrized by "2nd area dimming time" parameter. Dimming limit value for 2nd and 3rd area can be parametrized by "Brightness value for 2nd area" parameter. Dimming time "t3" for 3rd area can be parametrized by "3rd area dimming time" parameter.

Note: If the "Brightness value for 1st area" parameter selected as equal to minimum brightness parameter, the "1st area dimming time" becomes equal to zero. Likewise if the "Brightness value for 2nd area" parameter selected as equal to "Brightness value for 1st area" parameter, the "2nd area dimming time" becomes equal to zero.

5.4.1 Soft ON/OFF Function

The soft-functions permit a dimming channel to be switched on or off at reduced speed when a switching command is received via the "Soft switch" communication objects. If the soft ON function is activated, a dimming procedure is executed until the switch-on brightnes. This also occurs if the dimming channel is already switched on to a brightness value smaller than switch-on brightness. Likewise, with the soft OFF function, a dimming procedure is executed to 0 % brightness after receipt of an OFF telegram (Figure 17). The dimming time can be configured separately in the ETS for the soft ON and soft OFF function. The soft ON or soft OFF functions are not retriggerable by the receipt of further switching telegrams while maintaining the switching status. The soft functions can be activated and configured separately in the ETS. The delay time between Soft ON and Soft OFF function can be adjusted by "Time between Soft ON and Soft OFF" parameter. By the use of Soft switching

function a dimming channel can be characterized as a “Staircase” or “Entrance lighting” function. These usages can be seen from Figure 3.

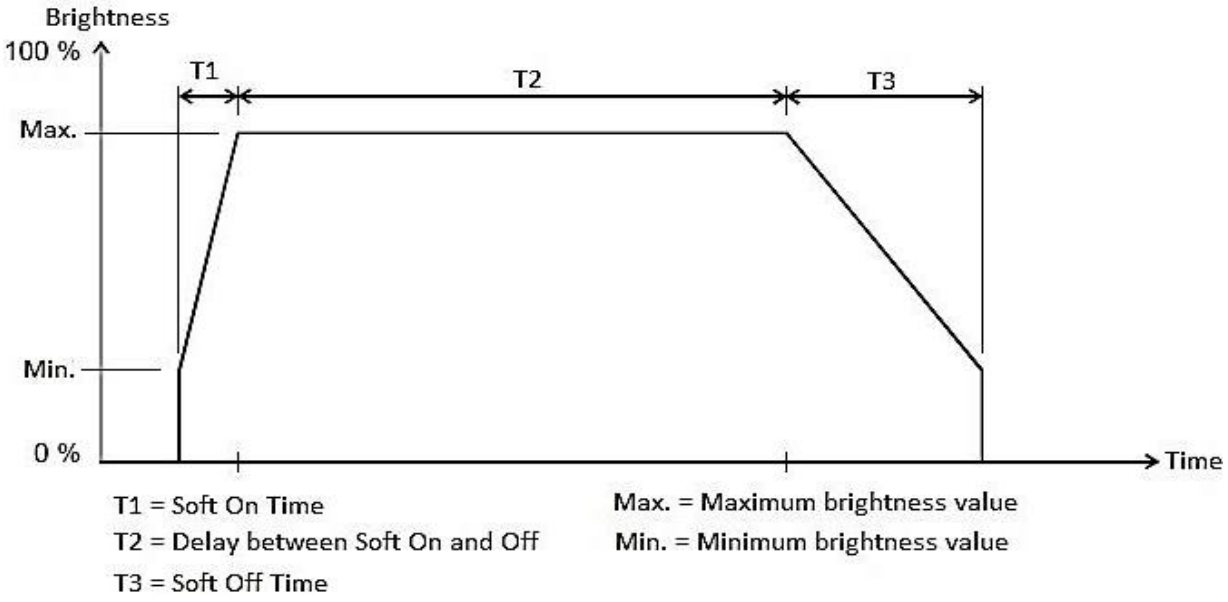


Figure3: The usage of Soft On and Soft Off function

Note: If the “Dimming value after soft on” parameter selected as equal to minimum brightness parameter, the T1 and T3 times becomes equal to zero. Likewise if the soft on function is activated when the current dim level equal to “Dimming value after soft on” parameter, the T1 time becomes equal to zero.

5.4.2 Central Switching

With the central switching, the behaviour of the channels is identical with 'normal' activation via the "Switch On Off" object. If the central switch object is set to “1”, the channels which are participated to central switching are switched on and if it is set to “0” the participated channels are switched off. For seperating a channel to central switch function, this must be specified by the “Central Function” parameter.

5.4.3 Scene Functions

There are 8 scene parameters for one channel. Each of 8 scenes is called by the selected scene number from 1 to 64. The” Brightness value for scene 1…8” parameter specifies the behaviour of the channel when the related scene is called. (After installed from ETS, the behaviour for scene number can be changed if the Permit teaches in parameter is “YES”). The “Storage function for scene 1...8” parameter specifies whether the related scene can be saved or not when the save scene command is called. The saving and recalling scenes can be realized by Access/Save scene communication object.