Product Manual

ABB i-bus® KNX

Dim Actuator Modules for the Room Controller
SD/M 2.6.2
LR/M 1.6.2
UD/M 1.300.1

Intelligent Installation Systems

Contents

1 General

This manual describes the function of the Switch/Dim Actuator Module SD/M 2.6.2, the Light Controller Module LR/M 1.6.2 and the Universal Dim Actuator Module UD/M 1.300.1 for operation in the Room Controller Basis Device with the application program "Room Controller modular xf/1.0" (RC/A x.2) and "Room Controller modular 8f/2.0" (RC/A 8.1).
Subject to changes and errors excepted.

Exclusion of liability:
Despite checking that the contents of this document match the hardware and software, deviations cannot be completely excluded. We therefore cannot accept any liability for this. Any necessary corrections will be inserted in new versions of the manual.
Please inform us of any suggested improvements.

1 General

The Switch/Dim Actuator Module SD/M 2.6.2, the Light Controller Module LR/M 1.6.2 and the Universal Dim Actuator Module UD/M 2.230.1 are snapped into a module slot of the Room Controller Basis Device. They are used to control dimmable lighting.

The Room Controller Basis Device establishes the connection to the ABB i-bus® KNX installation bus.

The SD/M 2.6.2 dims electronic ballasts with a 1…10 V interface. It has two independent outputs for dimming and switching two groups of luminaries.

The LR/M 1.6.2 dims one group of luminaries with electronic ballasts using a 1…10 V interface. There is an additional input for connecting a light sensor LF/U 2.1 in order to implement constant lighting control.

The UD/M 1.300.1 dims a group of luminaries with max. 300 W (VA) output capacity. It is designed for operation with different types of luminaries (load types):

- Incandescent lamps (resistive load).
- 230 V halogen lamps (resistive load).
- Low voltage halogen lamps on wound (inductive load) or electronic (capacitive load) transformers.

The devices are automatically connected to the incoming supply when they are snapped into the Room Controller Basis Device. On the output side, the devices have screw terminals with plug-in connection.

The comprehensive functionality is defined by programming the Room Controller Basis Device with the ETS. It is very similar for all three devices.

2 Device technology

2.1 SD/M 2.6.2 Switch/Dim Actuator Module, 2-fold, 6 AX

The Switch/Dim Actuator Module can be operated in any module slot of the Room Controller Basis Device. It dims electronic ballasts with a 1…10 V interface. The device has two independent outputs for dimming two groups of luminaries. One relay contact per channel is used to switch the lighting circuit on/off.

The device operates passively, i.e. its 1…10 V output behaves like a controlled resistor. The connected electronic ballast supplies the control voltage.

Both the incoming supply and the internal voltage are supplied via the Room Controller Basis Device. Contact is automatically established when the modules are snapped in place.

2.1.1 Technical data

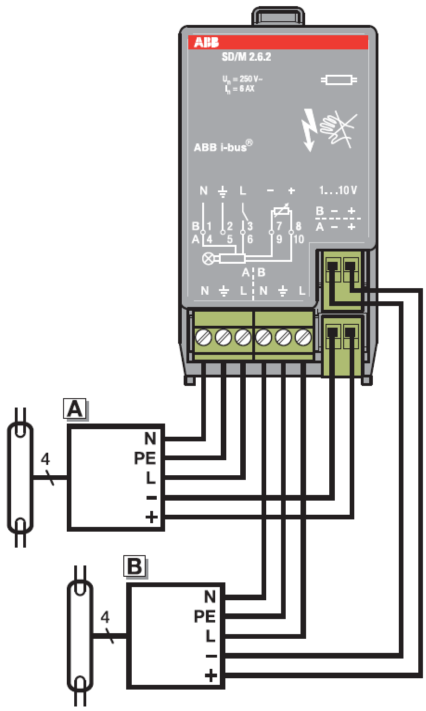
Supply / Incoming supply	– Operating voltage	Made available by the Room Controller Basis Device, contact made via contact system on base of module
	– Incoming supply	0 … 264 V, contact established via contact surfaces at the front
Outputs	– 2 load circuits	Relay outputs
	– U_n rated voltage	250/440 V AC
	– I_n rated current	6 AX
	– 2 control outputs	1…10 V DC (passive)
	– Max. control current	30 mA
	– Max. cable length	100 m
Load circuit (relay) switching currents	– AC3 operation (cos φ = 0.45) EN 60 947-4-1	6 A / 230 V
	– AC1 operation (cos φ = 0.8) EN 60 947-4-1	6 A / 230 V
	– Fluorescent lighting load AX to EN 60 669-1	6 A / 250 V (70 µF) [1)]
	– Minimum switching performance	100 mA/12 V 100 mA/24 V
	– DC current switching capacity (resistive load)	6 A / 24 V=
Load circuit (relay) service life	– Mechanical endurance	3 x 10^6
	– Electrical endurance to EN 60 947-4-1	
	– AC1(240 V/cosφ = 0.8)	> 10^5
	– AC3 (240 V/cosφ = 0.45)	> 3 x 10^4
	– AC5a (240 V/cosφ = 0.45)	> 3 x 10^4
Connections	– Load circuits	Two 3-pole screw terminals with plug-in connection
	– Control outputs	Two 2-pole screw terminals with plug-in connection
	– Connection cross-sections	0.2…2.5 mm² stranded 0.2…4.0 mm² solid
Ambient temperature range	– Storage	-25 °C … 55 °C
	– Transport	-25 °C … 70 °C
Design	– Type of installation	For snapping into the Room Controller Basis Device
	– Housing, colour	Plastic housing, anthracite, halogen-free
	– Housing dimensions (W x H x D)	49 x 42 x 93 mm
	– Weight	0.1 kg
CE mark	– In accordance with the EMC guideline and low voltage guideline	

2.1.2 Lamp loads at 230 V AC

Lamps	– Incandescent lamp load	1380 W
Fluorescent lamp T5 / T8	– Uncorrected	1380 W
	– Parallel compensated	1380 W
	– DUO circuit	1380 W
Low-volt halogen lamps	– Inductive transformer	1200 W
	– Electronic transformer	1380 W
	– Halogen lamp 230 V	1380 W
Dulux lamp	– Uncorrected	1100 W
	– Parallel compensated	1100 W
Mercury-vapour lamp	– Uncorrected	1380 W
	– Parallel compensated	1380 W
Switching capacity	– Max. peak inrush-current I_P (150 µs)	400 A
	– Max. peak inrush-current I_P (250 µs)	320 A
	– Max. peak inrush-current I_P (600 µs)	200 A
Number of electronic ballast's (T5/T8, single element)[1)]	– 18 W (e.g. ABB EVG 1x18 CF)	23
	– 24 W (ABB EVG-T5 1x24 CY)	23
	– 36 W (ABB EVG 1x36 CF)	14
	– 58 W (ABB EVG 1x58 CF)	11
	– 80 W (Helvar EL 1x80 SC)	10

[1)] For multiple element lamps or other types the number of electronic ballast's must be determined using the peak inrush current of the electronic ballast's.

2.1.3 Circuit diagram



2.1.4 Description of the outputs

The device features the outputs A and B. Each output has a switch output (3-pole plug-in terminal) and a control output (2-pole plug-in terminal) that are both connected to the electronic ballast.

The PE conductor is brought out from the device to connect the protective conductor.

2.1.5 Assembly and installation

The device is solely intended for operation in the Room Controller Basis Device. It can be snapped into any module slot. The mounting position can be selected as required.

2.2 LR/M 1.6.2 Light Controller Module, 2-fold, 6 AX

The light controller module can be operated in any module slot of the Room Controller Basis Device. It dims electronic ballasts with a 1…10 V interface and enables constant lighting control.

The device has an output for dimming a group of luminaries. A relay contact is used for switching the lighting circuit on/off. For constant lighting control, the device measures the current brightness (luminance) via a light sensor input.

The device operates passively, i.e. its 1…10 V output behaves like a controlled resistor. The connected electronic ballast supplies the control voltage.

Both the incoming supply and the internal voltage are supplied via the Room Controller Basis Device. Contact is automatically established when the modules are snapped in place.

2.2.1 Technical data

Supply / Incoming supply	– Operating voltage	Made available by the Room Controller Basis Device, contact made via contact system on base of module
	– Incoming supply	0 … 264 V AC, contact established via contact surfaces at the front
Outputs	– 1 load circuit	Relay output
	– U_n rated voltage	250/440 V AC
	– I_n rated current	6 AX
	– 1 control output	1…10 V DC (passive)
	– Max. control current	30 mA
	– Max. cable length	100 m
Load circuit (relay) switching currents	– AC3 operation (cos φ = 0.45) EN 60 947-4-1	6 A / 230 V
	– AC1 operation (cos φ = 0.8) EN 60 947-4-1	6 A / 230 V
	– Fluorescent lighting load AX to EN 60 669-1	6 A / 250 V (70 µF) 1)
	– Minimum switching performance	100 mA/12 V 100 mA/24 V
	– DC current switching capacity (resistive load)	6 A / 24 V=
Load circuit service life	– Mechanical endurance	3×10^6
	– Electrical endurance to EN 60 947-4-1	
	– AC1(240 V/cosφ = 0.8)	$> 10^5$
	– AC3 (240 V/cosφ = 0.45)	$> 3 \times 10^4$
	– AC5a (240 V/cosφ = 0.45)	$> 3 \times 10^4$
Light sensor input	– 1 light sensor input	For connection of a light sensor type LF/U 2.1
	– max. cable length per sensor	per sensor 100 m, Ø 0.8 mm, P-YCYM or J-Y(ST)Y cable (SELV), e.g. shielded KNX bus cable
Brightness detection	– Lighting control operating range	Optimised for 500 Lux. 200…1200 Lux for rooms with average furnishing reflection of 0.5 max. 860 Lux in very darkly furnished rooms (reflection 0.7) max. 3000 Lux in very darkly furnished rooms (reflection 0.2)
	– Optimum installation height	2-3 m
Connections	– Load circuit	3-pole screw terminal with plug-in connection
	– Control output	2-pole screw terminal with plug-in connection
	– Light sensor input	2-pole screw terminal with plug-in connection
	– Connection cross-sections	0.2…2.5 mm^2 stranded 0.2…4.0 mm^2 solid
Ambient temperature range	– Operation	- 5 °C … 45 °C

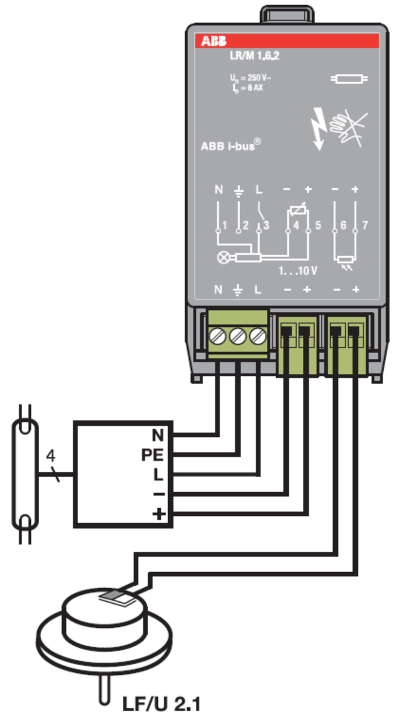
	– Storage	-25 °C … 55 °C
	– Transport	-25 °C … 70 °C
Design	– Type of installation	For snapping into the Room Controller Basis Device
	– Housing, colour	Plastic housing, anthracite, halogen-free
	– Housing dimensions (W x H x D)	49 x 42 x 93 mm
	– Weight	0.095 kg
CE mark	– In accordance with the EMC guideline and low voltage guideline	

2.2.2 Lamp loads at 230 V AC

Lamps	– Incandescent lamp load	1380 W
Fluorescent lamp T5 / T8	– Uncorrected	1380 W
	– Parallel compensated	1380 W
	– DUO circuit	1380 W
Low-volt halogen lamps	– Inductive transformer	1200 W
	– Electronic transformer	1380 W
	– Halogen lamp 230 V	1380 W
Dulux lamp	– Uncorrected	1100 W
	– Parallel compensated	1100 W
Mercury-vapour lamp	– Uncorrected	1380 W
	– Parallel compensated	1380 W
Switching capacity	– Max. peak inrush-current I_P (150 µs)	400 A
	– Max. peak inrush-current I_P (250 µs)	320 A
	– Max. peak inrush-current I_P (600 µs)	200 A
Number of electronic ballast's (T5/T8, single element)[1)]	– 18 W (e.g. ABB EVG 1x18 CF)	23
	– 24 W (ABB EVG-T5 1x24 CY)	23
	– 36 W (ABB EVG 1x36 CF)	14
	– 58 W (ABB EVG 1x58 CF)	11
	– 80 W (Helvar EL 1x80 SC)	10

[1)] For multiple element lamps or other types the number of electronic ballasts must be determined using the peak inrush current of the electronic ballasts.

2.2.3 Circuit diagram



2.2.4 Description of the inputs and outputs

Outputs A has a switch output (3-pole plug-in terminal) and a control output (2-pole plug-in terminal) which are both connected to the electronic ballast. The light sensor LF/U 2.1 is connected to a further 2-pole plug-in terminal.

The PE conductor is brought out from the device to connect the protective conductor.

2.2.5 Assembly and installation

The device is solely intended for operation in the Room Controller Basis Device. It can be snapped into any module slot. The mounting position can be selected as required.

2.3 UD/M 1.300.1 Universal Dim Actuator Module, 1-fold, 300 VA

The Universal Dim Actuator Module is operated in a module slot of the Room Controller Basis Device. It is used to dim a group of luminaries.

Various types of loads such as incandescent lamps, high voltage halogen lamps or low voltage halogen lamps on electronic or conventional transformers can be operated on the dimmable output. Transformers from ABB are recommended for connection of low-voltage halogen lamps.

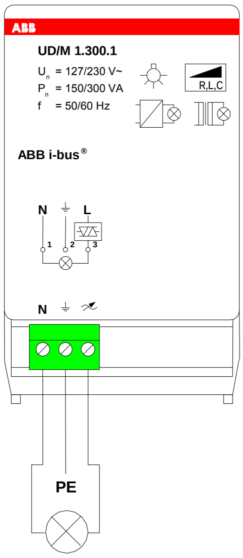
When the incoming supply is restarted (after disconnection from supply for more than approx. 10 seconds), the device conducts a load test and adapts the operating mode accordingly. When the load type is changed, the device must be de-energised.

Both the incoming supply and the internal voltage are supplied via the Room Controller Basis Device. Contact is automatically established when the modules are snapped in place.

2.3.1 Technical data

Supply / Incoming supply	– Operating voltage	Made available by the Room Controller Basis Device, contact made via contact system on base of module
	– Incoming supply	90 … 253 V AC, contact established via contact surfaces at the front
Outputs:	– 1 dimming output	Semiconductor output, dimmed via phase angle control or inverse phase control
	– Maximum output capacity	300 VA at 230 V AC 150 VA at 127 V AC
	– Minimum output capacity	2 VA
Connections	– Dimming output	3-pole screw terminal with plug-in connection
	– Connection cross-sections	0.2…2.5 mm² stranded 0.2…4.0 mm² solid
Ambient temperature range	– Storage	-25 °C … 55 °C
	– Transport	-25 °C … 70 °C
Design:	– Type of installation	For snapping into the Room Controller Basis Device
	– Housing, colour	Plastic housing, anthracite, halogen-free
	– Housing dimensions (W x H x D)	49 x 42 x 93 mm
	– Weight	0.12 kg
CE mark:	– in accordance with the EMC guideline and low voltage guideline	

2.3.2 Circuit diagram



2.3.3 Description of the outputs

The device has a dimmed output for the connection of a dimmable load. The PE conductor is brought out from the device to connect the protective conductor.

2.3.4 Assembly and installation

The device is solely intended for operation in the Room Controller Basis Device. It can be snapped into any module slot. The mounting position can be selected as required.

3 Commissioning

3.1 Overview

The Room Controller has a single application program that is used to set the device function. Programming requires ETS2 **V1.3a** or higher.

Note: Please note that the programming of the device is only possible when the supply voltage is available.

User programs	Max. number of communication objects	Max. number of group addresses	Max. number of associations
RC/A 4.2: Room Controller modular 4f2/1.0	125	254	255
RC/A 8.1: Room Controller modular 8f/1.7	246	254	255
RC/A 8.2: Room Controller modular 8f2/1.0	245	254	255

Note

The programming requires EIB Software Tool ETS2 V1.3 or higher.

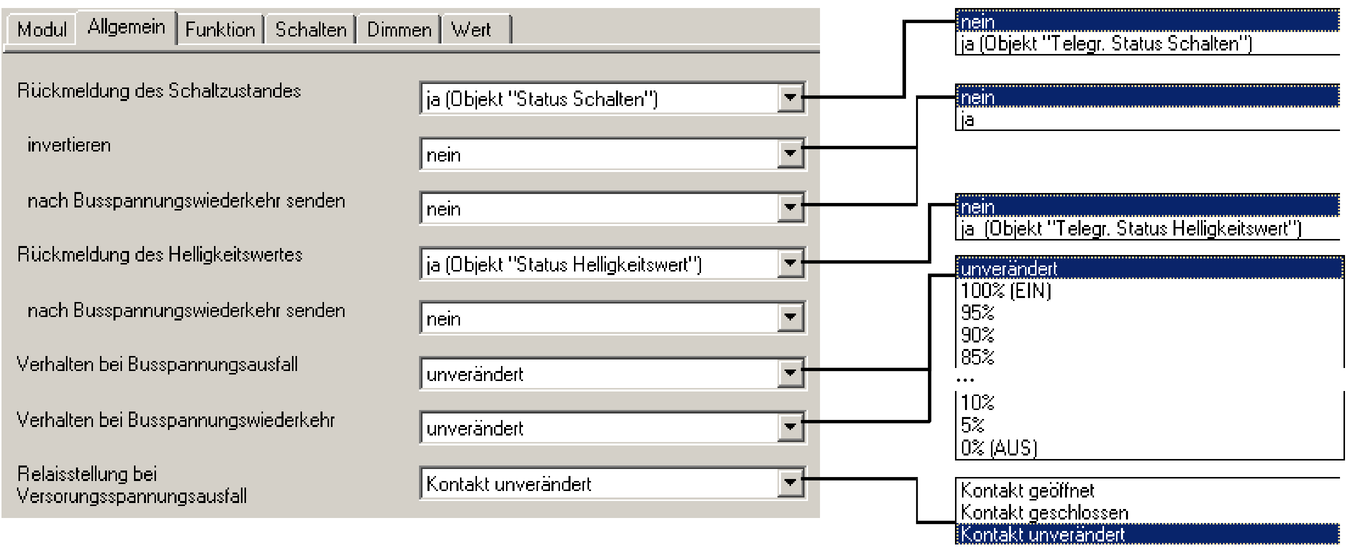
If ETS3 is used, a *.VD3 or higher type file must be imported.

The application program for the ETS product tree can be found at *ABB/Room automation/Room Controller*.

The devices do not support the closing function of a project or the KNX devices in the ETS. If you inhibit access to all devices of the project with a *BA password* (ETS2) or a *BCU code* (ETS3), it has no effect on this device.
Data can still be read and programmed.

3.2 Parameters

3.2.1 *General* parameter window



Status response of switching state

Here you set whether a status response (1 bit) is sent when the output is switched on or off.

The status feedback is carried out via the object *Status switch*. It is sent in the event of a change.

inverted

With this parameter the response of the switching state can be inverted.

The parameter is visible if the value “yes” has been selected in the parameter *“Status response of switching state”*. With an inverted response (parameter value “yes”), the object *Status switch* features the following values:

“0” Lighting is switched on
“1” Lighting is switched off

sending after bus voltage recovery

With this parameter you can set whether the object *Status switch* is sent after bus voltage recovery.

This parameter is visible if a *“Status response of switching state”* is undertaken. It defines whether the status feedback *Status switch* is updated on the bus after bus voltage recovery. The object is then only sent if the status of the relay is unambiguous. This cannot be ensured with certainty, e.g. after a failure of the supply voltage. The update is carried out in connection with the transmission delay of the Room Controller.

Status response of brightness value

This parameter enables the object *Status brightness value*, which represents the current brightness value on the bus. The object value updates only at the completion of a switching or dimming process.

sending after bus voltage recovery

This parameter determines whether the object *Status brightness value* is sent after bus voltage recovery.

Reaction on bus voltage failure

With this parameter, the output can be set to a defined state at bus voltage failure. A fixed brightness value (0…100%) can be specified.

With the setting *unchanged*, the brightness value remains unchanged. In this case, the output can continue to be operated, provided that the operation is not carried out via the bus (e.g. via binary input modules).

Note: In the parameters of the additional functions (e.g. function *Staircase lighting*) the settings for reaction with bus voltage failure can be undertaken. These settings have a higher priority when the additional function is active.

Reaction on bus voltage recovery

With this parameter, the output can be set to a defined state after recovery of the bus voltage or communication.

On bus voltage recovery, the brightness value is set once the initialisation period has elapsed. In the setting *unchanged*, the current brightness value is retained.

In the additional functions (e.g. staircase lighting function, lighting control, …), further parameters can be found which influence the behaviour of the device at bus voltage recovery.

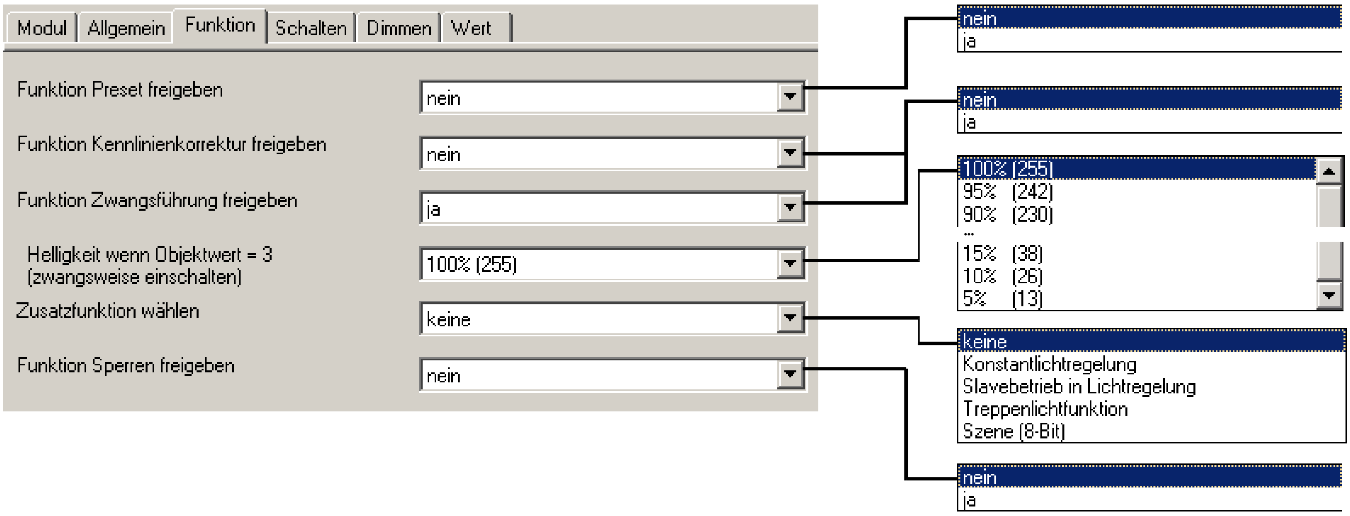
State of relay output on supply voltage failure

The relay position which is triggered by the module when the supply voltage has failed can be set here.

The supply voltage has failed if there is a failure of both the 115/230 V AC supply and the 12 V DC auxiliary supply. The Room Controller has no function in this case.

3.2.2 Parameter window *Function*

In this parameter window, additional functions of the output can be enabled.



Enable function Preset

The “Preset” function can be enabled with this parameter. The function is used to recall or save brightness values via a 1 bit object.

Further information can be found under the parameter window *Preset*.

Enable characteristic adjustment

If “yes” is entered in this parameter, the parameter window *Adjustment of lighting characteristic* is enabled. Using this parameter the dim characteristic (lighting dependent on the brightness value) can be changed. Further information about this function can be obtained in section 0.

Enable function forced operation

The object *Forced operation* is enabled via this parameter.

Brightness while object value = 3 (forced operation = active, ON)

Here the brightness value is set, should the object *Forced operation* be set with the value “3” (“forced operation”).

After forced operation is revoked the normal state of the output is restored. During forced operation the brightness value is calculated further; only telegrams *Relative dimming* are ignored.

Select extra function

One of several additional functions can be enabled with this parameter.

The possible additional functions are dependent on the type of module:

	SD/M 2.6.2	LR/M 1.6.2	UD/M 1.300.1
Constant lighting control		X	
Slave mode in lighting control	X	X	X
Staircase lighting	X	X	X
Scene (8 bit)	X	X	X

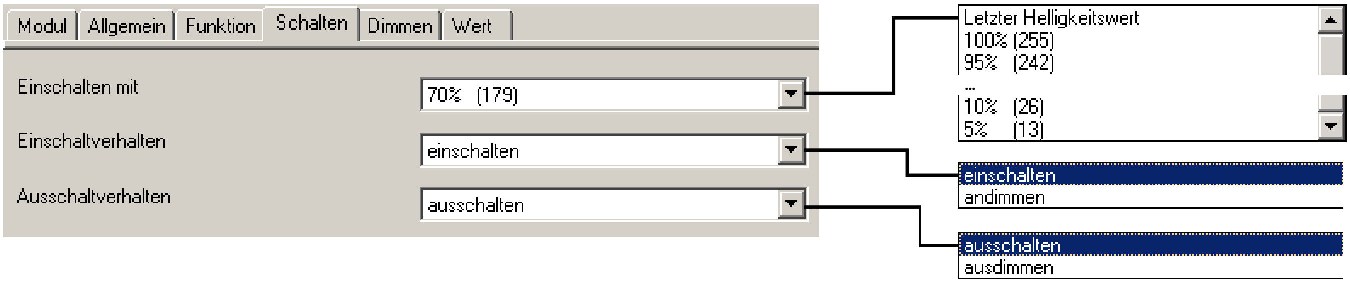
Enable function “Blocking”

This parameter is only visible if an additional function has not been selected. The object *Blocking* is enabled here. The function of the object can be blocked here, so that it cannot be changed via the EIB.

3.2.3 Parameter window *Switch*

This parameter window determines the function of the object *Switch*.

As long as the staircase lighting function is active during operation of the devices, the response is defined as stated on parameter page Staircase lighting. In this case, the parameters on this page have no meaning.



Switch ON via

Here you set the brightness of the lighting which is applied when a *Switch* object receives the telegram value “1”.

In the setting *Last brightness value*, the brightness level that was selected before the device was last switched off is restored. At the very least however, the brightness value of the lower dimming limit is set.

Behaviour when switching ON

The lighting type to be switched on can be set. The following table provides an overview:

Switching on	Switching on as quickly as possible
Dimming on	Switching on with the corresponding dimming ramp (see parameter window *Dimming*).

Switch OFF behaviour

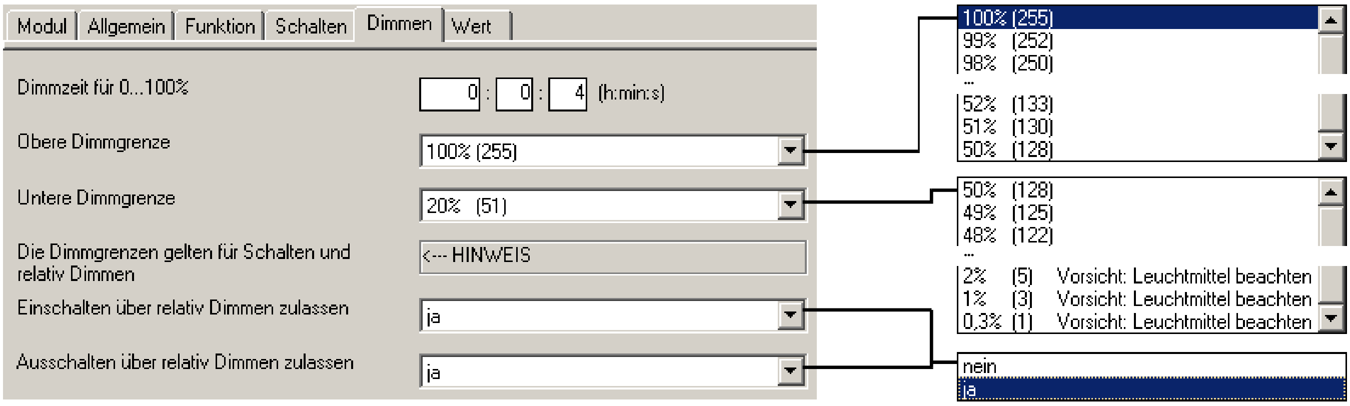
The lighting type to be switched off can be set. The following table provides an overview:

Switching off	Switching off as quickly as possible
Dimming off	Switching off with the corresponding dimming ramp (see parameter window *Dimming*).

3.2.4 Parameter window *Dimming*

This parameter window determines the function of the object *Relative dimming*. A detailed description of the objects can be found in section 0.

As long as the staircase lighting function is active during operation of the device, the communication object *Relative dimming* does not function. In this case, the parameters on this page have no meaning.



Time for passing from 0% to 100%

The dimming ramp which the dimmer uses to dim to a new brightness value can be defined here. The time for dimming from 0% to 100% brightness is set..

Maximum dimming value

Here the largest brightness value is set which can be controlled with the dimmer via relative dimming or switching commands. In this way the service life of fluorescent lighting can be extended.

If the brightness value is above the upper dimming value (e.g. by recall of a preset or a scene), it is only possible to reduce the brightness.

Minimum dimming value

Here the smallest brightness value is set which can be controlled with the dimmer via relative dimming or switching commands. In this way for example, it is possible to prevent control of brightness ranges in which the fluorescent lighting is already switched off.

The smallest minimum dimming value has a value of “1”.

Allow switching on via relative dimming

Here you can set if switched off fluorescent lighting can be switched on “BRIGHTER” by a dimming telegram.

Allow switching off via rel. dimming

Here you can set if switched on fluorescent lighting can be switched off “DARKER” by a dimming telegram. With the parameter value *no* the brightness value remains under the minimum dimming value.

3.2.5 Parameter window *Value*

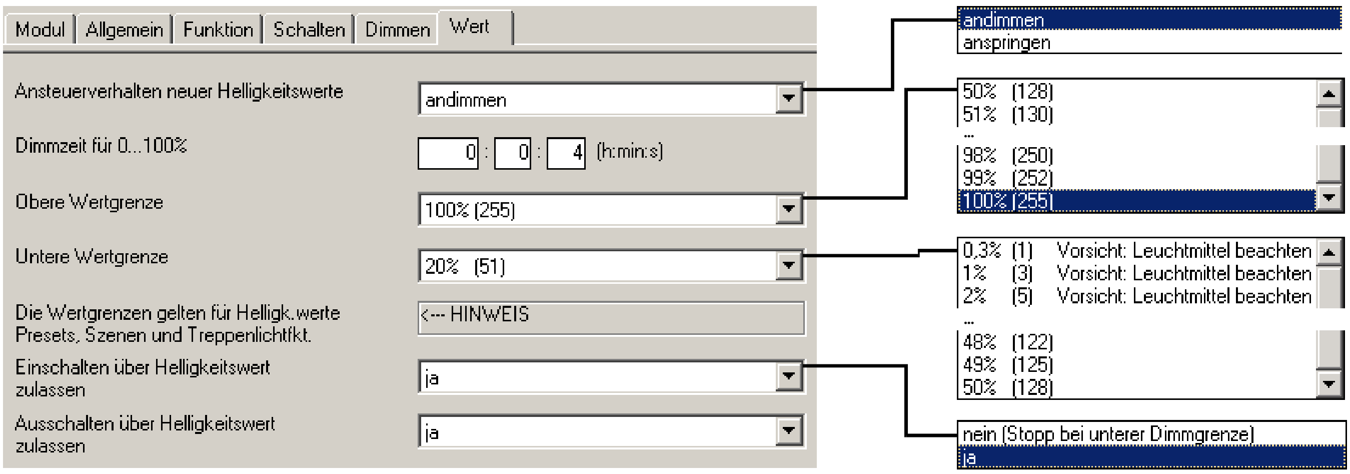
This parameter window determines the function of the 1 byte object *Brightness value*. A detailed description of the objects can be found in section 0.

As long as the staircase lighting function is active during operation of the device, the communication object *Brightness value* does not function. In this case, the parameters (with the exception of the dimming limits) on this page have no meaning.

Function

The upper and lower dimming limit set here also apply when retrieving presets and 8 bit scenes as well as in the staircase lighting function and in slave mode. If a brightness value is retrieved which exceeds the upper dimming limit, the upper dimming limit is set.

If a brightness value is received during a dimming process, the dimming process is stopped and then a new brightness value is controlled.



Brightness values are called

This parameter sets whether the dimmer jumps to the new dimming value as quickly as possible on receipt of a brightness value (1 byte) or whether the dimmer dims slowly to the brightness value.

Time for passing from 0% to 100%

This parameter is visible if the dimmer dims to the new brightness value. The speed which the dimmer uses to dim to a new brightness value can be defined here. The time which is required to dim from 0…100% brightness is set.

Maximum brightness value

Here the upper brightness value that can be controlled with the dimmer via a brightness value telegram is set.

If a brightness value that is greater than the maximum brightness value is received, the output sets the maximum brightness value. This value is reported back on the bus.

Minimum brightness value

Here the lower brightness value that can be controlled with the dimmer via a brightness value telegram is set. If the dimmer receives a brightness value less than the minimum brightness value (not zero), the minimum brightness value is set.

Allow switching ON via brightness values

Here you can set if switched off fluorescent lighting can be switched on "BRIGHTER" by a brightness telegram exceeding "0".

Allow switching OFF via brightness value

If a brightness value equal to zero is received, you can set here if the lighting switches off ("yes") or if it remains at the minimum dimming value.

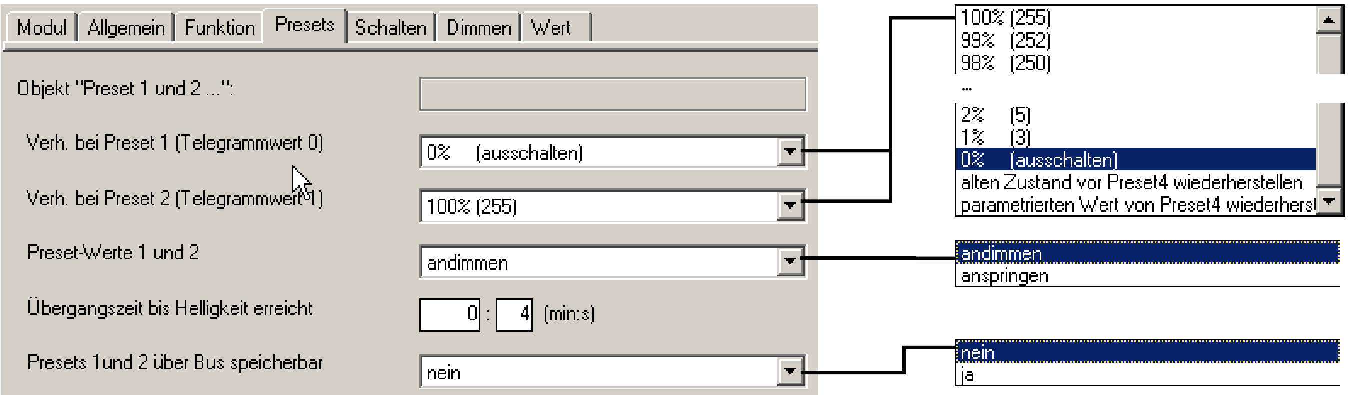
3.2.6 Parameter window *Presets*

The presets are used to recall predefined brightness values via 1 bit telegrams.

For further information see: [Presets]

As long as the staircase lighting function or the constant lighting control are active during operation of the device, the communication object *Preset…* does not function. In this case, the parameters (with the exception of the dimming limits) on this page have no meaning.

After a failure in the supply voltage and after programming the device, the parameterised preset values are restored.



Reaction on preset1 (telegr. value 0)

This parameter defines how the output behaves when retrieving preset 1, i.e. when object *Call preset 1 and 2* receives the telegram value 0. A fixed brightness value can be retrieved. The following functions can be selected as further selection options:

Restore old value recreates the state before the last retrieval of preset2. If the lighting control function or slave mode were active, they are also reactivated.

Restore parameterised value resets Preset 2 to the parameterised value. This can be advisable if the preset can be stored via the bus (see below).

Reaction on preset 2 (telegr. value 1)

Here you set the brightness that is activated with a recall of preset 2 (= object *Call preset 1 and 2* receives telegram value "1").

Preset values 1 and 2

This parameter sets whether the dimmer jumps to the preset value as quickly as possible or whether the dimmer dims to the preset value using the transition time.

Time to set new brightness value

The speed with which a new preset value is set can be defined here.

This parameter is visible if the value *dimming on* has been set in the parameter *Preset values 1 and 2*.

Preset 1 and 2 can be set via the bus

With this parameter, the object *Set preset 1 and 2* is enabled. It is used to store the currently set brightness value at the new preset value. Telegram value "0" stores preset1 while telegram value "1" stores preset2.

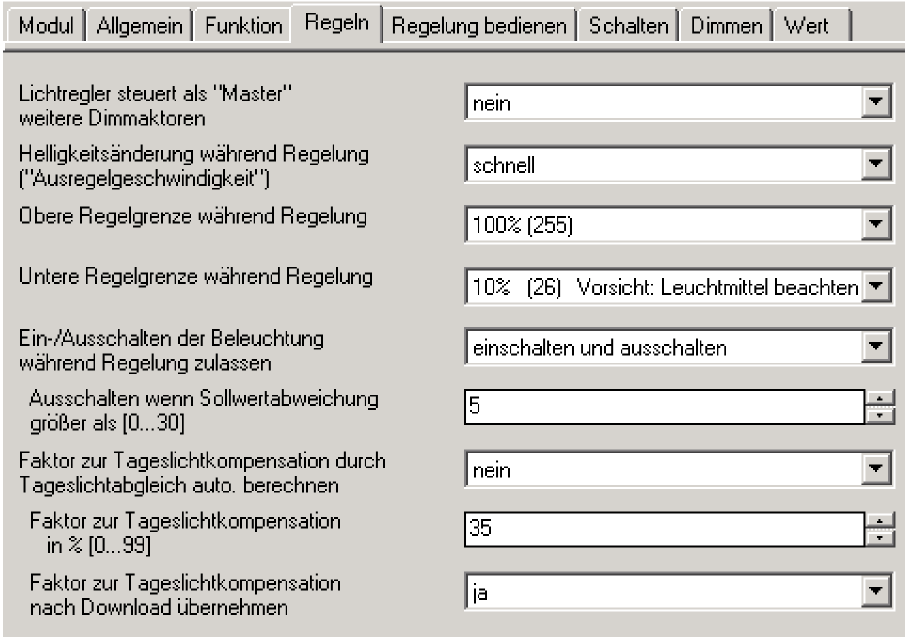
The parameters for presets 3 and 4 are identical to presets 1 and 2.

3.2.7 Parameter window *Control*

In this parameter window, the settings for the constant lighting control are undertaken. It is only available for the Light Controller Module LR/M 1.6.2. It is visible if in the parameter window *Function* the additional function *constant lighting control* has been selected.

If constant lighting control has been selected, it will remain activated after a download and supply voltage recovery.

For further information see constant lighting control.



Light controller controls as "master" other dimmer actuators

Options: <u>no</u>
yes

With the setting *yes* the object *Brightness value of slave* is enabled. Here you set whether the light controller controls further dimming actuators (“slaves”) via a 1 byte brightness value.

Note: The slaves are only controlled during active constant lighting control. Should constant lighting control be inactive and only the brightness of the master is changed, the brightness of the slave will remain unchanged.

Changing brightness during lighting control

Options: <u>fast</u>
medium
slow
individual setting

This parameter determines how fast the lighting changes when the lighting control is active.

Normally, it is possible to choose between *fast*, *medium* and *slow*. With master mode, only *medium* and *slow* are possible to reduce the bus load.

With the *individual setting* selection, the parameter window Control dynamics appears and detailed setting of the control speed can be undertaken (only for experienced commissioning personnel!).

Upper control limit during active lighting control

Options: 100 % (255)/99 % (252)…51 % (130)/50 % (128)

This parameter defines the maximum brightness value, which the output of the light controller can use during light control.

If a brightness value is recalled that is larger than the upper limit, the light controller sets the upper limit for the output. This value is reported back on the bus.

The control limits are independent of the dim and value limits that are parameterised in the parameter windows *Dimming* and *Value*.

Lower control limit during lighting control

The smallest brightness value that the dimmer can trigger during lighting control is set here.

The functionality complies with the *Upper control limit*.

Note
All luminaries have a minimum dimming value to which you can dim down based on its physical properties. The luminaries react in different ways should this value be exceeded. For this reason, using a brightness value less than or equal to 10 %, the message *Attention: illuminant charact.* is displayed.

If a lower control limit ≤ 10 is set, the following parameter appears:

Allow switching on/off during lighting control

Options: no, illumination is always on
switch off only
switching on and off

These parameters define if switch off or switch off and switch on of the lighting during light control is allowed by the light controller.

- *no, illumination is always on:* The lighting is not switched on or off independently by the light control. When dimming down the lighting remains at the minimum control limit.
In this way, a problematic or extended period of lighting up the luminaries can be avoided. This is the case particularly when ignition takes a few seconds. This causes interference and damages the service life of the luminaries.
- *switch off only:* The light controller switches off the light, however the lighting must be implemented manually via an ON command.
- *switching on and off* In this way it is possible to parameterise switch off dependent on the setpoint deviation. In this way, continuous switch on and switch off is avoided. This causes interference and damages the luminaries. The following parameter appears:

Switch off if control deviation is greater than [0…30]

Options: 0/1/2…5…29/30

This parameter is visible if in the above parameter *switch on and off* or *switch off only* has been set.

When the lower control limit is reached the light controller normally switches off the lighting immediately. This avoids abrupt changes in the brightness or in certain circumstances that the lighting is switched back on immediately. In order to avoid continuous switch on and off of the lighting, a minimum divergence can be parameterised for this parameter.

The light controller maintains the minimum control limit until the calculated setpoint deviation has exceeded the parameterised value. Only then is the lighting switched off.

Compensation factor for daylight calibration automatically

Options: no / yes

Here you set whether a daylight calibration (via communication object *Calibration daylight)* is undertaken. If *no* is set, the daylight compensation should be set manually with the following parameters.

Factor for daylight compensation in % [0…99]

Options: 0…35…99

A larger value compensates more for natural light.
This means that artificial light has a higher weighting, which also means that more artificial light is added, and that the light is switched off later as a result. The room will remain brighter than the setpoint brightness.

A smaller value compensates less for natural light.
This means that artificial light has a lower weighting and that less artificial light is added. The setpoint value tends to be slightly undershot and the artificial light is switched off earlier.

In practical usage it has been shown that – depending on the ambient conditions – a factor of between 30 and 50 generally provides the best results in most cases.

Restore factor for daylight compensation after download

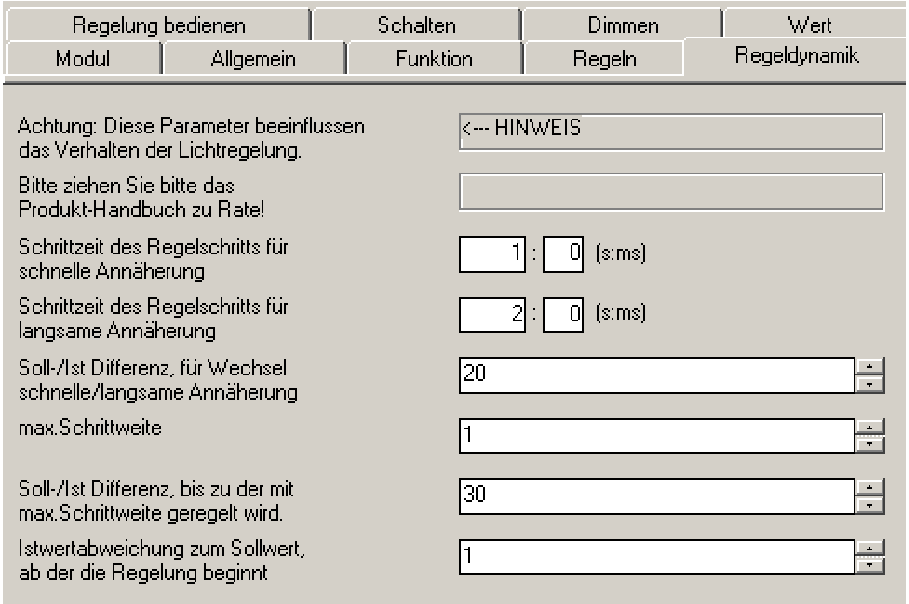
Options: no
yes

This parameter defines if the factor for daylight compensation is overwritten with the value from the ETS.

- *yes:* With a download, the value stored in the light controller for daylight compensation is overwritten with the value set in the ETS.
- *no:* The factor is not overwritten during download. This is useful, for example, if you want to avoid that the values which have been determined over the course of many attempts in then light controller are not overwritten by mistake, and that a renewed calibration is required.

3.2.8 Parameter window *Control dynamics*

This parameter window is visible if in parameter *Changing brightness during lighting control* (parameter window *Control*) the value *individual setting* has been set. It is only available for the Light Controller Module LR/M 1.6.2.



Max. time between two control steps

Options: Time value in range [0 s…10 s]

This parameter defines the step time of a control step in the start up phase. The smaller the step time, the faster that the control steps are applied with their increment size (brightness). The light control quickly approaches the setpoint.

This step time is used if the actual value still varies greatly from the setpoint. Otherwise the step time for slow approach is used.

For further information see: Constant lighting control

Note
The step time may not be selected to be less than the delay of the control circuit. This is comprised of the detection speed of the light sensor and the dynamic response of the luminaries. If the step time is less than the delay of the control circuit, the light controller will set the brightness beyond the target value and oscillation will occur in the lighting control. In this case, the change in brightness due to a control step will only be achieved after sending the next control step.

Step time for slow approach

Options: Time value in range [0 s…10 s]

This parameter defines the step time of a control step when approaching the actual value. The larger the step time, the longer until the brightness of the control step is set. The Light Control slowly approaches the setpoint. This step time is used when the actual value is relatively near to the setpoint. Otherwise the step time for fast approach is used.

For further information see: Constant lighting control

Control deviation for medium dimming speed

Options: 10…<u>20</u>…50

This value represents the control divergence (difference between the setpoint and actual value) at which there is a change between fast and slow approach to the setpoint. Above this control divergence there is a fast approach (small increments of the control step), below it there is slow approach with a large step time.

At the same time, the response of the lighting control is slower with larger values, whereby they do not respond too sensitively to brightness changes caused by clouds or temporary changes, e.g. persons in the detection area of the light sensor in the room.

For further information see: Constant lighting control

Maximum brightness change

Options: <u>1</u>…<u>5</u>*…10

* Default value if control parameterised as a master

This value defines the maximum increment size of a control step. This is the maximum brightness difference that the light controller can perform per control step. In this way, the light controller can approach the setpoint value in large steps. There is a danger however than the setpoint is exceeded and the light control circuit will be unstable.

For further information see: Constant lighting control

Control deviation for high increments (max. control step)

Options: 10…<u>30</u>…255

This value represents the control divergence (difference between the setpoint and actual value) up to which the maximum increment can be controlled.
In this way, the Light Controller can approach the setpoint value in fast steps. The increment should always be considered in conjunction with both approach parameters. Both parameters change the control dynamics and the approach speed to the setpoint value.

For further information see: Constant lighting control

Control deviation for high increments

Options: 0…<u>1</u>…30

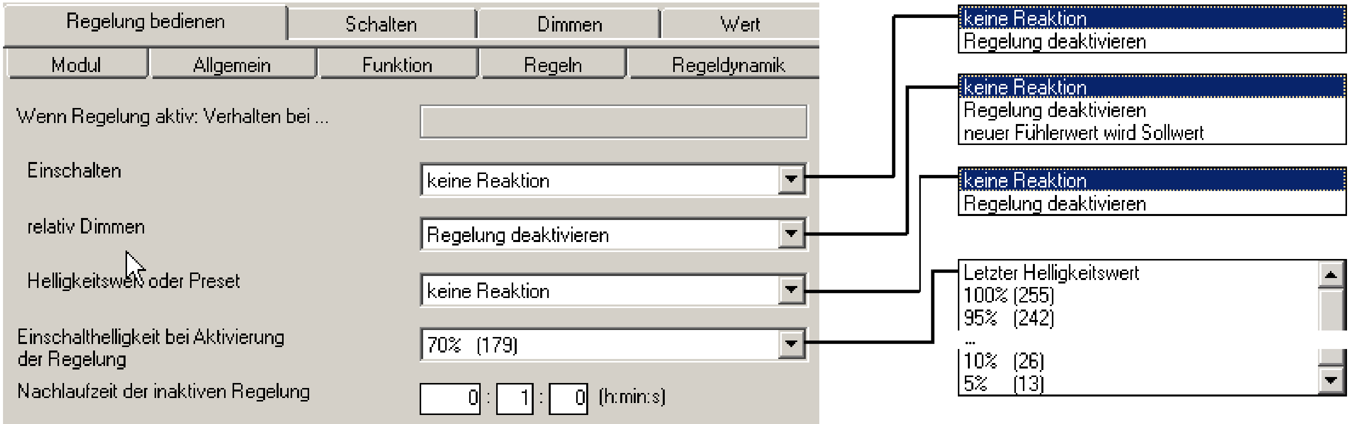
This value defines a range around the setpoint at which no light control occurs. Only after the actual value (brightness value) is again outside this range does light control recommence. In this way, continuous control with the respective changes in brightness are avoided. This generates a smoother and less abrupt response and considerably reduces the bus load with a master/slave control.

For further information see: Constant lighting control

3.2.9 Parameter window *Control: operating*

This parameter window is visible if in the parameter window *Function* the additional function *constant lighting control* has been selected. It is only available for the Light Controller Module LR/M 1.6.2.

Here you define how the user may operate the lighting during constant lighting control. A detailed description of the objects can be found in section 0.



If lighting control is active: reaction on …

With these three parameters you can set how an output reacts with active lighting control if the following telegrams have been received:

Switch on	Telegram value “1” received on the object *Switch*
Relative dimming	Receipt of a telegram on the object *Relative dimming*
Brightness value or preset	Receipt of a telegram on the object *Brightness value* or *Recall preset*

You can set which effect the receipt of the telegram has on the active control function:

In the setting *no reaction*, the receipt is ignored.

In the setting *Deactivate lighting control*, the lighting control is deactivated. The control can be reactivated by an ON telegram.

In the setting *Setpoint = new sensor value* (only possible with *Relative dimming*), the new sensor value is adopted as a temporary setpoint value. The lighting control remains active. The old setpoint value is restored the next time the control function is activated.

Brightness value when lighting control is activated

The brightness value which is set immediately on activation of the lighting control can be defined via this parameter. The lighting is gradually readjusted starting with this value.

Follow-up time of the inactive control

If constant lighting control is deactivated or interrupted by the user, e.g. by manual dimming, the current brightness value is stored for the duration of the follow up time. The follow up time commences with the deactivation of the light control. If the lighting is switched back on within the follow-up time, the light control is not reassumed and the lights are controlled with the stored brightness value. If the lighting is switched back on after the follow-up time, light control is reactivated and the light controller assumes control.

This function should re-establish the same level of lighting for persons who leave the room and return after a brief period. It is particularly useful if the lighting is automatically switched by a presence or motion detector.

3.2.10 Parameter window *Slave*

In slave mode, the dimming actuator applies the brightness value that has been specified by the light controller. In this way, it can be integrated in a constant lighting control. A detailed description of the objects can be found in section 0.

Function

If the slave function is activated, the dim actuator strictly adheres to the brightness value, which is predefined by the object *Brightness value of slave*.

The dimming limits from the parameter window *Value* are adopted. The respective parameterized values of these limits are set with overshoot or undershoot brightness values. If the master sends the brightness value “0”, the lighting is switched off.

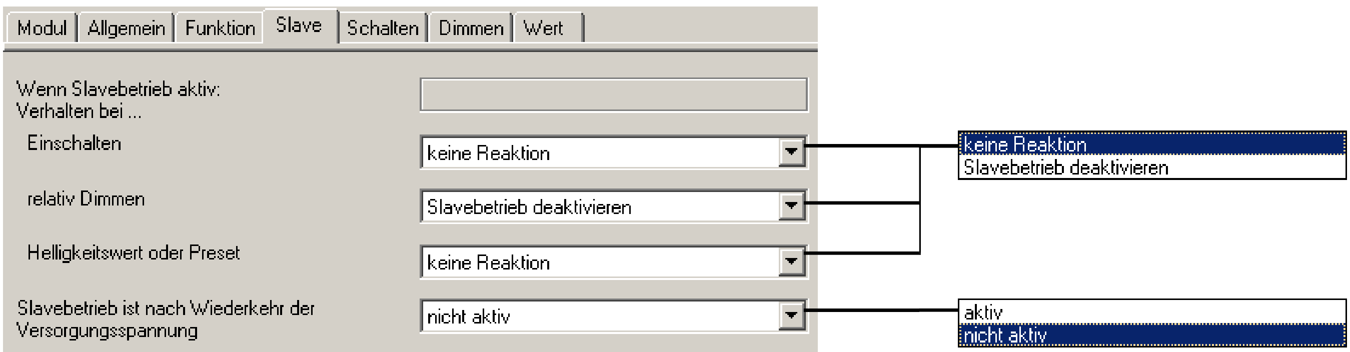
When the slave function is activated, the functions “Relative dimming”, “Brightness value” and “Preset” are deactivated, unless otherwise set in the parameters. When the slave function is deactivated the functions are again available.

Response of the function “Slave mode” during and after voltage failures:

Bus voltage failure	Behaviour of the output as defined in the *General* parameter window. The slave mode is deactivated.
Bus voltage recovery	Status of slave mode just as before bus voltage failure; brightness remains unchanged until the receipt of the first brightness value.
Supply voltage failure	No function
Supply voltage recovery	State of slave mode can be parameterised

Parameters

The parameter window is enabled in the parameter *Select extra function* (parameter window *Function*).



If slave mode is active: reaction on …

With these three parameters you can set how an output reacts with active lighting control if the following telegrams have been received:

Switch on	Telegram value “1” received on the object *Switch*
Relative dimming	Receipt of a telegram on the object *Rel. dimming*
Brightness value or preset	Receipt of a telegram on the object *Brightness value* or *Recall preset*

You can set which effect the receipt of the telegram has on the active slave mode:

In the setting *no reaction*, the receipt is ignored.

In the setting *Deactivate slave mode*, the slave mode is deactivated. It can be reactivated by a switch on telegram.

Slave mode after supply voltage recovery

In this parameter, you can set whether the slave mode is *active* or *inactive* after bus voltage recovery. If the slave function is *active*, the slave brightness value is recalled after bus voltage recovery.

3.2.11 Parameter window *Staircase lighting*

Function

On receipt of the telegram value “1” on the object *Switch*, the lighting is switched on. Once the staircase lighting time t_{ON} has elapsed, the lighting is dimmed down to the lower dimming limit during an adjustable dimming down period t_D and then switches off. The minimum dimming limit from the parameter window *Value* is adopted.

Response of the “Staircase lighting function” during and after voltage failures:

Bus voltage failure	Behaviour of the output as defined in the *General* parameter window. The staircase lighting function is deactivated.
Bus voltage recovery	State of the staircase lighting function is restored. If the staircase lighting was switched on or is in the dimming down period, the staircase lighting time is restarted (normal staircase lighting time). ‘Pumping’ is not taken into account.
Supply voltage failure	No function
Supply voltage recovery	Same as for bus voltage recovery

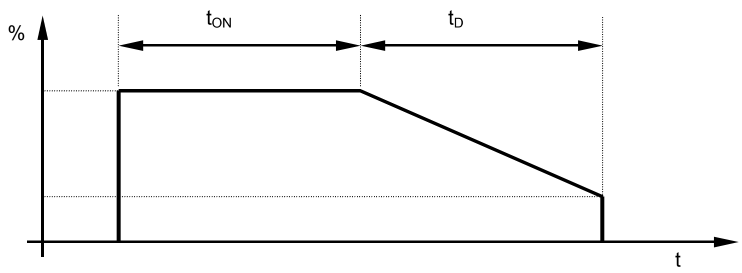


Fig. 1: Progression of the brightness level during staircase lighting function

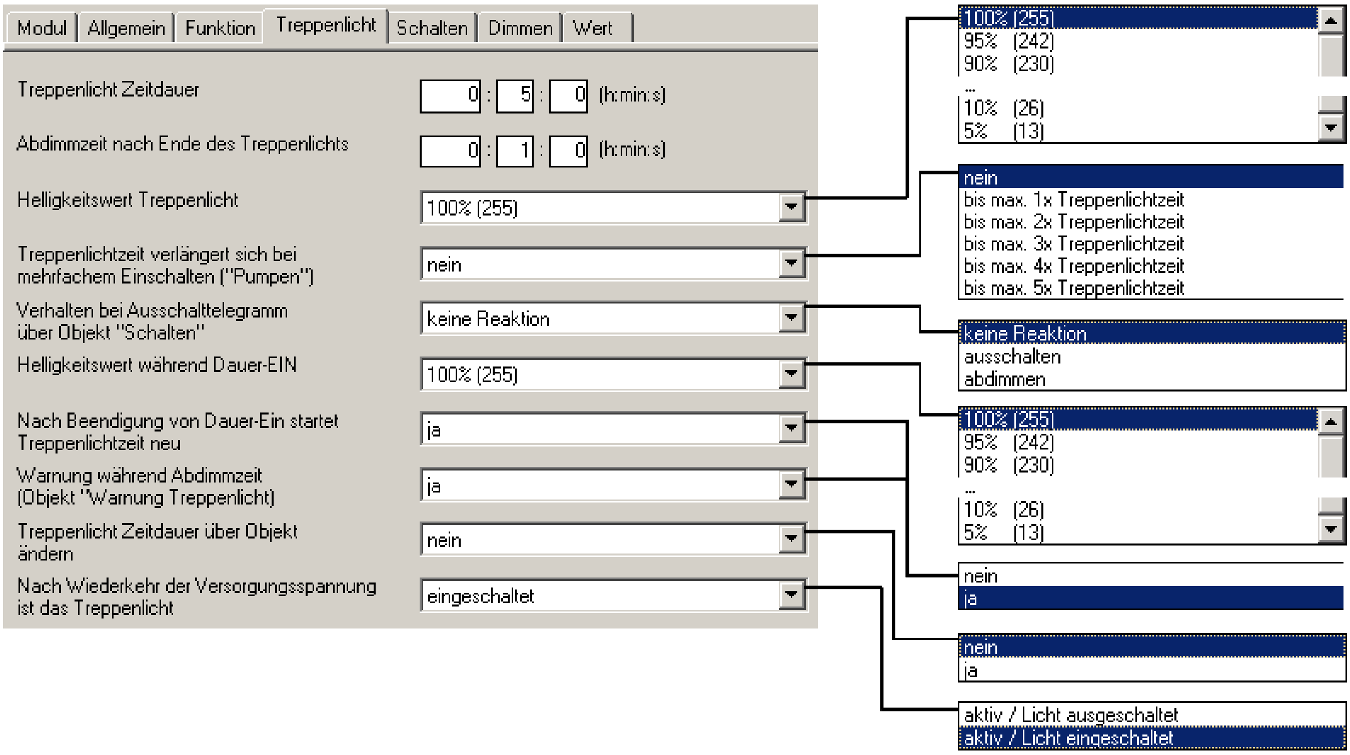
With the active staircase lighting function, the functions “Relative dimming”, “Brightness value” and “Preset” are deactivated.

By sending “0” to the object *Duration of staircase lighting*, the staircase lighting function is deactivated. Thereafter, the functions “Relative dimming”, “Brightness value” and “Preset” can be fully operated. For reactivation of the staircase function, a telegram with a value greater than “0” must be sent to the object.

With switched on staircase lighting, the maximum and minimum dimming values, as defined in parameter window *Value* apply. The respective parameterized values are set with overshoot or undershoot.

Parameters

The parameter window is enabled in the parameter *Select extra function* (parameter window *Function*). A detailed description of the objects can be found in section 0.



Duration of staircase lighting

Here the period is defined in which the staircase lighting is switched on (staircase lighting time t_{ON}).

Time for dimming down after enlightmt.

Here the speed that is used with the end of the staircase lighting time to dim down ("Dimming down time t_D") is set.

Brightness value of staircase lighting

Here the brightness of the lighting during the staircase lighting time can be set (0…100%). If the brightness value is less than the minimum dimming value, the minimum dimming value is set.

Extending staircase lighting by multiple operation ("pumping up")

If a further ON telegram is received during the staircase lighting time, the remaining staircase lighting time can be extended by a further period. The maximum time can be set using this parameter.

In the setting *no*, the staircase lighting restarts on receipt of an ON telegram ("retrigger function").

Reaction on switching off via object "switch"

In the setting *no reaction*, ON telegrams are ignored.

In the setting *switch off, the lighting is switched off (not for permanent ON)*.

In the setting *dimming down*, the dimming down time is started when the lighting is switched on (not for permanent ON).

Brightness value during permanent ON

Here you can set the brightness of the lighting (0…100%), which is used when object *Permanent ON* has the value 1.

Restart of staircase time after end of permanent ON

With setting *no,* the lighting switches off when the permanent lighting has ended. With the *yes* setting, the lighting remains on the staircase lighting time restarts.

Warning during dimming down\r\n(object "Warning stairc. lighting")

The user can be additionally warned during the dimming time by setting the object *Warning staircase lighting* to “1”.

Duration of staircase lighting can be changed by object

The object *Duration of staircase lighting* is enabled via this parameter. It enables the staircase lighting time to be modified via the bus.

After supply voltage recovery the staircase light is

Here you can set whether the staircase lighting is switched on or off after recovery of the supply voltage (mains voltage).

switched on: The lighting is on and the staircase lighting time starts.

switched off: The lighting is switched off.

The output also follows this parameter on recovery of the bus voltage.

3.2.12 Parameter window *Scene (1)* and *Scene (2)*

Function

This function enables the assignment of the output in up to 6 scene lightscenes. If a scene number is received via the object *8 bit scene*, the stored scene value (brightness value) is recalled or the current brightness value is stored.

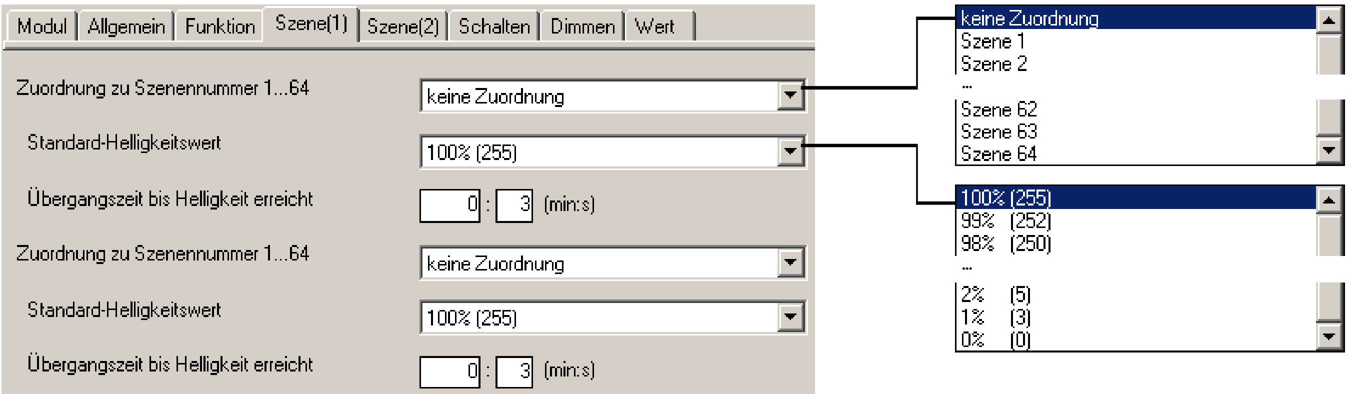
With the recall of lightscenes, the maximum and minimum dimming values as set in the parameter window *Value* apply. The respective parameterized values are set with overshoot or undershoot.

A detailed description of the objects can be found in section 0.

The scene values saved during operation are lost when the supply voltage fails or the programming is lost; they are overwritten by the values set in the parameters. On a bus voltage failure the scene values are retained.

Parameters

The parameter windows are enabled in the parameter (parameter window *Function*).



Assignment to scene number 1…64

Max. 64 different scenes (1…64) can be addressed via a group address. The output can be assigned to a maximum of six scenes.

Standard brightness value

The brightness value that is assigned to the lightscene after programming is set here.

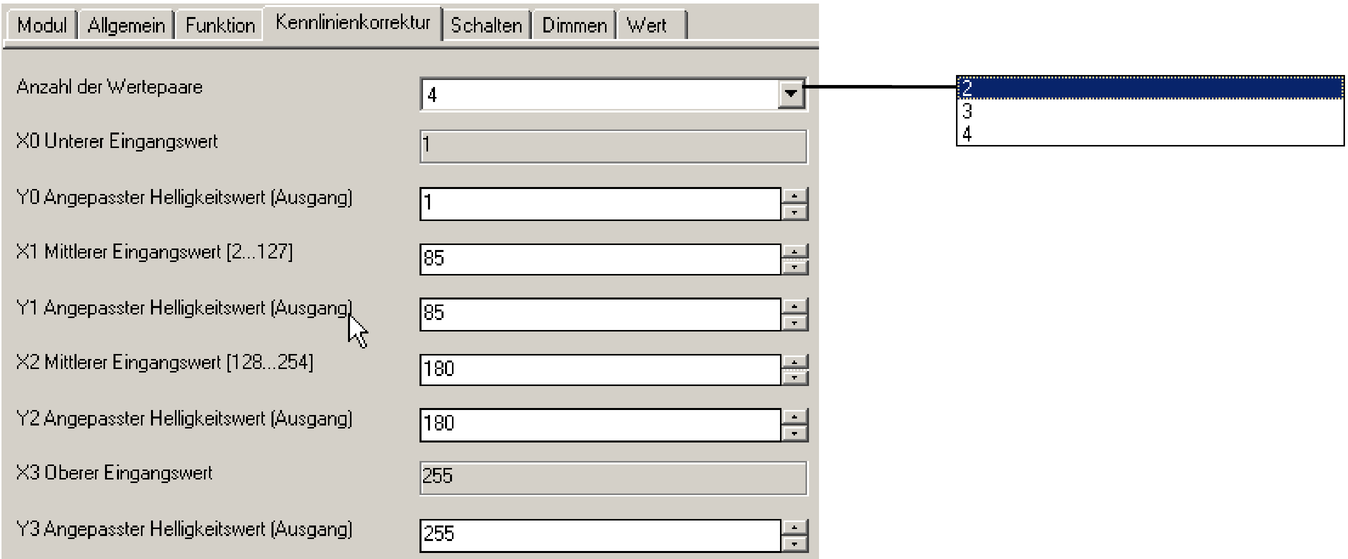
Time to set new brightness value ("Transition time") in s

The transition time which is used to set the new lightscene is defined here.

3.2.13 Parameter window *Adjustment of lighting characteristic*

The characteristic adjustment enables the adaption of the dimming characteristic of the lamps to the sensitivity of the eyes. Further information about the function can be found under section 0.

A detailed description of the objects can be found in section 0.



Number of value pairs

Here the number of value pairs that are used in the characteristic curve are set.

Other parameters:

In accordance with the number of value pairs, the X-value and the Y-value can be determined here. The X-value (input value) indicates the value defined by the object *Brightness*. The Y-value denotes the brightness value that is issued at this object value.

The first X-value is always defined with 1 and the last X-value with “255”.

3.3 Communication objects

General objects

<table>
<tr><td>No.</td><td>Function</td><td>Object name</td><td>Data type</td><td>Flags</td></tr>
<tr><td>0/15</td><td>Switch</td><td>Output A</td><td>1 bit (EIS 1)
DPT 1.001</td><td>C, W</td></tr>
<tr><td colspan="5">Switches the output on or off
Telegram value “0” switches off the lighting; the lighting is switched on with “1”. The brightness when switching ON can be parameterised.
With constant lighting control (Light Controller LR/M 1.6.2), the receipt of the value “1” activates the lighting as well as the control. The slave function is activated with the slaves in a constant lighting control.</td></tr>
<tr><td>1/16</td><td>Status switch</td><td>Output A</td><td>1 bit (EIS 1)
DPT 1.001</td><td>C, R, T</td></tr>
<tr><td colspan="5">Used for feedback of the current switching state. It can be inverted if required.
This object is used for feedback of the current switching state. It can be inverted if required. It normally has the following object values:
0: Lighting is switched off
1: Lighting is switched on
The object has the following values with inverted feedback:
0: Lighting is switched on
1: Lighting is switched off
The object is visible provided the parameter Status response of switching state has the value yes.</td></tr>
<tr><td>2/17</td><td>Relative dimming</td><td>Output A</td><td>4 bit (EIS 2)
DPT 3.007</td><td>C, W</td></tr>
<tr><td colspan="5">The dim commands (BRIGHTER, DARKER, STOP) are received via this object.</td></tr>
<tr><td>3/18</td><td>Brightness value</td><td>Output A</td><td>1 byte (EIS 6)
DPT 5.001</td><td>C, W</td></tr>
<tr><td colspan="5">This object is used to assign a specific brightness value.
You can parameterise whether the dimmer immediately jumps to the received brightness value (0…255 corresponds to 0…100%) or slowly dims to it.</td></tr>
<tr><td>4/19</td><td>Status brightness value</td><td>Output A</td><td>1 byte (EIS 6)
DPT 5.001</td><td>C, R, T</td></tr>
<tr><td colspan="5">This object is used to feedback the brightness value which is currently output. The object value updates only at the completion of a switching or dimming process.
This object is visible provided the parameter Status response of brightness value has the value yes.</td></tr>
<tr><td>5/20</td><td>Forced operation</td><td>Output A</td><td>2 bit (EIS 8)
DPT 2.001</td><td>C, W</td></tr>
<tr><td colspan="5">This object is used for the forced assignment of a parameterisable brightness value e.g. by a higher level control. The output state is unchanged during the forced operation. There are three different states:
0 or 1: The output is not operated with forced operation
2: The output is switched off with forced operation
3: The output is switched on with forced operation (brightness value can be parameterised).
At the end of forced operation, the state which would be present without forced operation is restored. Put another way: the device continues to operate normally in the background during the forced operation but any change in the brightness value cannot be detected.
This object is visible if the parameter Enable function ‘forced operation’ is = yes.</td></tr>
</table>

No.	Function	Object name	Data type	Flags
6	**Error report**	**Output A**	**1 bit (EIS1) DPT 1.005**	**C, R, T**
(only Universal Dim Actuator Module UD/M 1.300.1) This object reports a general error. In the event of an error, the dimming actuator offers the possibility of providing detailed information on the bus about the cause of the error. Object values: 0: Device operates without errors 1: Malfunction				
7	**Error code**	**Output A**	**1 byte non DPT**	**C, R, T**
(only Universal Dim Actuator Module UD/M 1.300.1) This object provides more detailed information about the cause of an error. The object value is sent in the event of a change: Bit0: Error during load detection Bit1: (not used) Bit2: (not used) Bit3: No-load operation or low load Bit4: Short circuit or overload Bit5: Overvoltage in load circuit (overvoltage pulse) Bit6: Excess temperature in device Bit7: Critical temperature rise in device				

Objects of the function *Preset*

No.	Function	Object name	Data type	Flags
8/23 10/25	**Call preset 1 and 2 *and* Call preset 3 and 4**	**Output A**	**1 bit (EIS1) DPT 1.017**	**C, W**
Calls a parameterised brightness value. 0: retrieves preset 1 or preset 3 1: retrieves preset 2 or preset 4. For preset 1 (or preset 3), it is also possible to specify that the state is restored before retrieving preset 2 (or preset 4). As another option, the stored brightness value can be reset to the parameterised brightness value by preset 1 or preset 3 (advisable, if preset 2 or preset 4 can be stored).				
9/24 11/26	**Set preset 1 and 2 *and* Set preset 3 and 4**	**Output A**	**1 bit (EIS1) DPT 1.017**	**C, W**
Saves the currently set brightness value as the new preset value. 0: stores preset 1 or preset 3 1: stores preset 2 or preset 4				

Object for function “Constant lighting control” (only for LR/M 1.6.2)

The following objects can be enabled in the parameter window *Function* in the parameter *Select additional function* when the option *constant light control* is set.

<table>
<tr><th>No.</th><th>Function</th><th>Object name</th><th>Data type</th><th>Flags</th></tr>
<tr><td>12</td><td>Activate control</td><td>Light control</td><td>1 bit (EIS1)
DPT 1.003</td><td>C, R, W</td></tr>
<tr><td colspan="5">The lighting control can be activated and deactivated via this object. Activation of lighting control simultaneously switches on the lighting. Lighting control then immediately starts to be effective.

With deactivation of the light control, the brightness value initially remains unchanged and the output behaves just like a “normal” switch/dim actuator.

The status of the light control can not be sent via this object.

0: Deactivate lighting control
1: Activate lighting control

Explanation for the purpose of clarification:
When the lighting has been switched off by a switch off command (communication object Switch), the lighting control is not deactivated but rather in “standby”. The control will recommence with the next switch on command.</td></tr>
<tr><td>13</td><td>Enable calibration</td><td>Light control</td><td>1 bit (EIS1)
DPT 1.003</td><td>C,R,W,T</td></tr>
<tr><td colspan="5">With this communication object the communication objects Calibration lighting and Calibration daylight are enabled. i.e., the light controller undertakes a calibration of the daylight or artificial lighting if the value 1 has been received beforehand on this communication object. This ensures that calibration is not performed unintentionally.

The enable is automatically withdrawn after a calibration of the daylight or artificial lighting. The enable is also automatically withdrawn if calibration has not been undertaken within an hour of enable.

When the enable is withdrawn, the communication object sends a telegram with value 0 on the bus.

Telegram value:

1: The communication objects Calibration lighting and Calibration daylight are enabled for an hour.
0: The communication objects Calibration lighting and Calibration daylight are inhibited.</td></tr>
<tr><td>14</td><td>Calibration lighting</td><td>Light control</td><td>1 bit (EIS1)
DPT 1.003</td><td>C, R, W</td></tr>
<tr><td colspan="5">Using this object the artificial lighting calibration in the light controller is triggered. The calibration lighting must be enabled beforehand (communication object Enable calibration = 1).

Telegram value:

1: Trigger calibration lighting
0: No effect

The calibration of the artificial lighting takes about 1 minute. When the calibration of the lighting is completed the object value is reset to 0. The value is sent on the bus by setting the T flag. After calibration the light control for the output is activated and controlled.

The light controller is thought to recognise the artificial lighting levels with lighting calibration. At the same time, a characteristic for the lighting is recorded and stored in the light controller. The artificial light calibration should be undertaken without the influence of daylight. The lighting should be set so that the brightness value (setpoint) which is required during constant lighting control in the room is set.

After a reset or discharge of the light controller via the ETS the stored values are not lost. The values are only overwritten after a renewed calibration.

The artificial lighting calibration should always be undertaken so that the characteristic curve of the luminaries is known to the light controller. In principle a setpoint can be read for the Setpoint object for the light controller.

The current brightness of the setpoint can be read via the Actual value object. If required, it can be read in the light controller as a new setpoint via the Setpoint object. In this way, the current actual value is overwritten.

The sequence of daylight and artificial lighting calibration is <u>not</u> random. Calibration with artificial light must be performed before calibration with daylight.

For further information see: Detailed description of the Calibration lighting</td></tr>
</table>

No.	Function	Object name	Data type	Flags
15	**Calibration daylight**	**Light control**	**1 bit (EIS1) DPT 1.003**	**C, R, W**
This object is enabled if in parameter window *X: Control* automatic daylight calibration is parameterised. Using this object, the calibration daylight in the light controller is triggered. The lighting calibration must be enabled beforehand (communication object *Enable calibration* = 1). The daylight calibration is undertaken with natural light. The artificial lighting source is switched off by the lighting. In order to avoid an undershoot of the set brightness setpoint in the controlled state, the brightness for the daylight calibration in the reference range should be about 10 % above the brightness for the daylight calibration. Telegram value: 1: Trigger calibration daylight 0: no reaction The daylight calibration takes about 10 minutes. When the daylight calibration is completed the object value is reset to 0. The value is sent on the bus by setting the T flag. After calibration, the light control for the output is activated and controlled. The daylight calibration is thought to recognise the natural lighting levels with lighting calibration. In this way, the light controller determines the relationship between artificial lighting and daylight which improves the constant lighting control. The daylight calibration should be performed without the influence of artificial lighting. The setpoint brightness is again to be set on the reference point in the room by the change of shading of the setpoint brightness value. If this is not possible the daylight calibration factor can be assigned via the die ETS. This factor can be optimised by experiment by observing the light controller so that the light control is set to the setpoint brightness. ***For further information see: Detailed description of the daylight calibration*** The sequence of daylight and artificial lighting calibration is **not** random. Calibration with artificial light must be performed before calibration with daylight.				
16	**Brightness value of slave**	**Light control master**	**1 bit (EIS1) DPT 1.003**	**C, R, W**
Via this object the current brightness value of the control is sent on the bus so that further devices (slaves) can be set to the same value. These devices can be any dimming actuators or DALI gateways. Telegram value: 0: OFF, channel is switched off, slave mode remains active … 255 100 % With inactive light control (communication object activate control = 0), the brightness value is still sent by the object Master*:* via the object *Brightness value of slave*. In this way, the lighting combination (master/slave) is always controlled as a unit even with deactivated light control. The master/slave unit is separated, for example, by deactivation of the slave mode (telegram with the value 0 to object *Activate slave mode*). If the slave mode is deactivated, the brightness values received from the slave via the object *Master: Brightness value of slave* are not switched to its output.				
17	**Setpoint**	**Light control**	**1 byte (EIS6) DPT 5.010**	**C, R, T**
After successful calibration lighting, the result is stored in this communication object. In order to transfer this value to other rooms, this value of this communication object can be read and written to the object value of the actuators for the other rooms. The transfer of the calibration lighting to other rooms is only useful when they have a similar layout and lighting conditions.				
18	**Sensor value**	**Input light sensor**	**1 byte (EIS6) DPT 5.010**	**C, R, T**
This object contains the values which are currently measured by the light sensor. They can be sent on the bus via a read request.				

Objects of function *Slave mode in lighting control*

No.	Function	Object name	Data type	Flags

No.	Function	Object name	Data type	Flags
12/27	**Activate slave operation**	**Output A**	**1 bit (EIS1)** **DPT 1.003**	**C, W, T**
The slave mode can be activated (“1”) and deactivated (“0”) via this object. On activation/deactivation of the slave mode by other action (e.g. by ON / OFF command to the communication object *Switch*), the device sends the new state on the bus. 0: Slave inactive 1: Slave active				
13/28	**Brightness value of slave**	**Output A**	**1 byte (EIS6)** **DPT 5.001**	**C,W,T,A**
Via this object, the Dim actuator receives the brightness value from a higher level light control (master).				

Objects of the function *Staircase lighting*

No.	Function	Object name	Data type	Flags
12/27	**Permanent ON**	**Output A**	**1 bit (EIS1)** **DPT 1.001**	**C, W**
Serves as an active staircase light control for permanent switch on of the lighting (also called “Service light”). If this object receives the value “1”, the lighting is permanently switched on at the parameterised brightness value. On receipt of the telegram value “0”, the staircase lighting remains switching on and the dimming down time is started. Note.: A permanent ON function can also be carried out via the 2 bit object *Forced operation*. The difference is that the lighting is switched off under certain conditions when the forced operation is deactivated.				
13/28	**Duration of staircase lighting**	**Output A**	**2 byte** **DPT 7.005**	**C, R, W**
The staircase lighting time t_{ON} can be set via this object. The time is defined in seconds. The object value is overwritten by the parameterised value after bus voltage recovery. The staircase lighting function is deactivated with the value “0”. The object is visible if the parameter *Duration of staircase lighting can be changed by bus* is equal to *yes*.				
14/29	**Warning staircase lighting**	**Output A**	**1 bit (EIS1)** **DPT 1.005**	**C, T**
Used to provide a warning before the staircase lighting time times out. The object sends the value “1” during the warning period before the end of the staircase lighting time. Thus, for example, the user can be warned by actuation of the push button LED.				

Objects of the function *8 bit scene*

No.	Function	Object name	Data type	Flags
12/27	**8 bit scene**	**Output A**	**1 byte** **DTP 18.001**	**C, W**

A scene number (1…64) is received on the device via this object, as well as the information whether a scene is recalled or whether the current brightness should be stored in the scene.

Bit by bit telegram code: MxSSSSSS
M: 0 – scene is called
1 – scene is stored
x not used
S: Number of the scene (1…64)

The following object values result:

0: Call scene 1 1: Call scene 2 … 63: Call scene 64	128: Store scene 1 129: Store scene 2 … 191: Store scene 64

Other values are ignored.

Stored scene brightness values are lost at supply voltage failure. They are overwritten by the parameterised brightness values.

Objects of the function *Block*

No.	Function	Object name	Data type	Flags
12/27	**Block**	**Output A**	**1 bit (EIS1)** **DPT 1.003**	**C, W**

This object is used for blocking an output to prevent unwanted operation.

It is visible if in parameter window *Function* no additional functions have been selected and the parameter *Enable function "Blocking"* = *yes*.

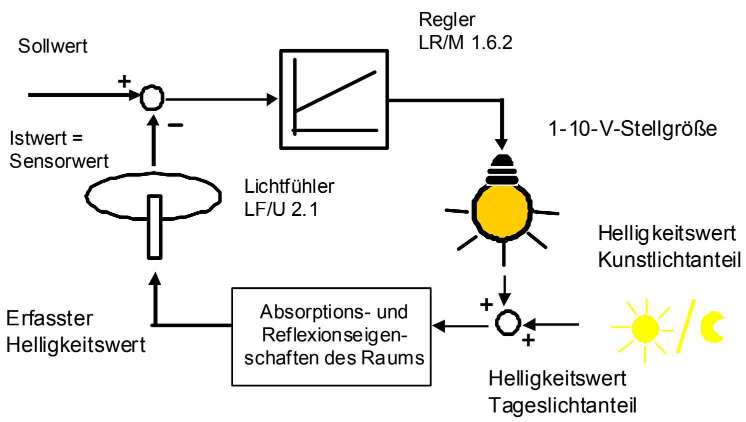
If this object receives the value "1", telegrams to the objects *Switch* and *Relative dimming* are ignored. If the object value is "0", these objects behave normally. On receipt of an object value, the output remains unchanged.

4 Planning and application

In this section, you will find tips and examples for the practical application of the devices SD/M 2.6.2, LR/M 1.6.2 and UD/M 1.300.1.

4.1 Constant lighting control

Constant lighting control is possible with the Light Controller LR/M 1.6.1 in conjunction with the Light Sensor LFU 2.1. The following illustration indicates the principle function of constant light control.



Principle representation of constant lighting control

With constant light control, this is a so-called fixed (or constant) value control or interference variable control. The interference variable in our case is the incidence of daylight. The setpoint is the brightness value which should be set automatically in the room. The setpoint is stored during the artificial lighting calibration during commissioning of the light controller. The technical lighting properties of the room and the characteristic of the luminaries are automatically determined during the artificial lighting calibration by the Light Controller LR/M 1.6.1. This parameter uses the light controller for determination of the controlled system. The light controller sets the brightness (luminaries) so that the control divergence between the setpoint and the actual value is equal to 0.

The light controller sets constant room brightness levels by the addition or removal of artificial lighting. This constant room brightness is often selected so that sufficient lighting is available for an optimum working environment.

The following EN 12464-1 compliant brightness levels must be observed for special working conditions:

- Self-service restaurants 200 lx
- Open-plan offices 500 lx
- Assembly of fine devices, e.g. radio and television sets 750 lx

In ideal cases, the daylight is sufficient to ensure optimum brightness levels at the place of work. In this case the artificial light is completely switched off by the light controller. If the level of daylight is not sufficient for the setpoint, artificial lighting is added until the setpoint brightness is achieved.

The energy consumption can be reduced further if additional presence detectors, e.g. ABB i-bus® Presence Detectors BW/S or Presence Detector PM/A are integrated into the system.

Explanations of terms

Actual value	The actual value is the brightness value measured by the light sensor.
Setpoint	The setpoint is the decisive control value in practical application for constant lighting control. The light controller calculates the setpoint for the lighting so that the actual value to be set is as near as possible to the predefined setpoint with all room lighting conditions. Due to the differing ambient conditions in rooms (incidence of light, reflections and absorption conditions) this setpoint can not be easily achieved via the figure value defined in the ETS, but must rather be set using a daylight and artificial light calibration. With this calibration the lighting characteristic and the technical lighting properties of the room are automatically detected by the light controller in order to match the control parameter to the room. Irrespective of this calibration, overshoot or undershoot of the setpoint lighting value can occur during phases in ongoing operation of constant lighting control. These are even greater with greater differences of the reflection and absorption conditions from the original ambient conditions during the calibration procedure. A further possibility for deviations is a direct or indirect incidence of light on the light sensor, which does not or only barely affects the area detected by the sensor.
Calibration lighting	With artificial light, the light controller determines the internal actual value which results with the required setpoint value if artificial lighting is switched on exclusively. The artificial light calibration should be undertaken without the influence of daylight. The lighting should be set so that the required setpoint in the room is set exclusively using artificial lighting which is available during light control in the room. During the artificial lighting calibration, the light controller automatically determines the characteristic curve of the lighting and detects the technical lighting properties of the room. The required room brightness (setpoint) is set exclusively using artificial light. The artificial lighting calibration is triggered by a telegram with the value 1 to the object *Calibration lighting*. During the calibration, the light controller automatically progresses through the brightness characteristic from maximum to minimum brightness. In this way, the brightness characteristic of the room, the operating point and the associated parameters for light control are determined. If the brightness curve has been run through and the control parameters have been automatically set, the light controller switches the lighting to maximum brightness. Artificial lighting calibration must always be undertaken.

Calibration daylight	With daylight calibration, the light controller determines the actual value which produces the required setpoint without artificial lighting. In this way the light controller determines the different influences of artificial lighting and natural incidence of light on the Light sensor. The daylight calibration should be performed without the influence of artificial lighting. This should be set by the change of shading of the setpoint brightness value on the reference point in the room. If this is not possible, the daylight calibration can be assigned with a predefined factor via the ETS. By observing the control behaviour this factor, it should be optimised empirically so that the light control is set as exactly as possible to the target brightness level. ***For further information see: Constant lighting control*** The sequence of daylight and artificial lighting calibration is **not** random. Calibration with artificial light must be performed before calibration with daylight.
Control active/inactive	At any time, the user can operate the light control with appropriate parameterisation using normal dimming commands, e.g. interrupt dimming, switching or scene recall. The light controller is in standby mode and recommences with light control via an ON command. The “actual” deactivation of the light control is implemented via the object *activate control*. With inactive light control, the light controller acts like a normal Switch/Dim actuator. Switch commands are implemented without light control being active. Light control is only restarted if on object *activate control* a telegram with the value 1 is received. If the light control is activated it can be recognised using the first bit of the status byte. The general object *Status function* indicates if the light control actually controls, i.e. the light controller continuously performs a setpoint/actual comparison. The control value for the illumination is provided dependent on the control difference.
Master/slave operation	This function is used to integrate further dimming actions into the lighting control. . In this case, the light controller (master) controls the other dimming actuators (slaves) directly via the object *Slave brightness value*.

4.1.1 Constant lighting control basic functionality

The active control dims the illumination so that the difference between the light sensor actual value and the setpoint value is as small as possible.

Response during voltage failure:

Bus voltage failure	Behaviour of the output as defined in the *General* parameter window. The control is inactive.
bus voltage recovery	State of the lighting control just as before bus voltage failure. The setpoint is restored.
Supply voltage failure	No function
Supply voltage recovery	Constant lighting control is always active after application of the supply voltage and programming of the device. State of the lighting control just as before supply voltage failure. The setpoint is restored.

4.1.2 Placement of the light sensor

The light sensor measures the brightness (light density) of an area in a room which is suitable for a reference measurement. The following criteria should be taken into account during placement:

1. The light sensor should be situated directly above the reference surface, e.g. the desk. Observe the detection range of the light sensor.

2. The ceiling must be monitored when the room is not darkened and the lighting is switched off. Those ceiling areas which are not directly subject to daylight or reflections are suitable.
3. The rod should be pushed about 15 mm deep into the device right up to the limit. The light sensor must be aligned with the longitudinal axis of the rod pointing vertically downwards.
4. It must be assured that the brightness sensor only measures indirect reflected light. Sunrays or light rays which shine directly into the rod lead to measurement faults, just as the incidence of light mirrored directly from surfaces.
5. The optimum installation height is between 2 and 3 m.
6. If possible measure different actual values of the light sensor with different lighting relationships with daylight (cloud, sun) at the same Lux count on the reference surfaces. The difference in the actual value should be minimal.

Note
Rooms are lit up differently by the incidental daylight and the artificial lighting of the lamps. Not all surfaces in the rooms, e.g. walls, floor, and furniture reflect the light in the same way. Accordingly, even though there is an exactly calibrated constant lighting control in daily operation, deviations to the set target value may occur. These deviations may be up to +/- 100 lx should the current ambient conditions in the room, and accordingly the reflection properties of the surfaces (paper, persons, reorganized or new furniture), differ significantly from the original ambient conditions at the time of calibration. Deviations may also occur if the light sensor is influenced by direct or reflected light falling on it, which is not influenced or only slightly influenced, by the surfaces in the detection range of the light sensor.

4.1.3 Calibration lighting and calibration daylight

Commissioning of the constant lighting control should be undertaken when the intended furnishings are in place. The technical lighting attributes of the room are influenced by the furniture and the floor coverings, e.g. reflection and absorption. This on the other hand has a direct effect on the brightness value which is detected by the light sensor.

If constant lighting control is set in a room, which does not yet have its final configuration and changes are then made to the layout in the room, this will have a direct effect on the lighting control. In the simplest case this can lead to larger setpoint overshoots or undershoots. In extreme cases it can lead to unstable oscillating control.

With a calibration of the constant lighting control all lamps which are controlled directly (master) or indirectly (slave) by the light controller can be included.

Implementation of artificial lighting calibration

The room should be darkened for this purpose. The lighting intensity in the detection range of the light sensor should be less than 20 lx. Interference of the artificial lighting calibration caused by daylight has the effect that the light controller assumes that the illumination can produce a larger brightness level than is actually the case. The light controller will set a lower level of brightness in control operation.

The light sensor is ideally vertically positioned above the monitored working surfaces. If it is not possible to darken the room, the artificial lighting calibration should be performed early in the morning or in the evening. The artificial lighting should be set using a Luxmeter so that 500 lx is measured on the reference surface. Proceed as follows for the best results:

- Switch the artificial lighting fully on.
- Wait until the Luxmeter on the reference surface indicates a stable value.
- Set the setpoint brightness.

If this brightness value has been set to a constant, the calibration lighting must first of all be enabled via the object *Enable calibration* (telegram value 1). This is a security measure to ensure that the calibration is not inadvertently triggered during normal operation. The enable must be re-enabled every time after calibration lighting is performed.

The artificial lighting calibration is triggered by a telegram value 1 to the object *Calibration lighting*. The light controller saves the current brightness value as a setpoint for light control. At the same time, the lighting is switched on with 100 % brightness by the light controller and the lighting characteristic progresses to the value 0. In this way, the brightness characteristic of the lighting is stored in the Lighting Controller. The progression takes about one minute. The lighting is switched off automatically by the light controller. This completes the calibration lighting and the light controller switches on the lighting as a result and activates light control.

Instructions for calibration lighting:

	Implementation	By	Effect
1.	Checking the light sensor	Set T flag object *Sensor value* (No. 32). Partial download is sufficient. Observe the sensor value.	The sensor value must change with a change in the brightness value.
1a.	Check the light sensor position.	See Placement of the light sensor	Sensor value is not subject to interference.
1b.	After checking the light sensor.	Reset the T flag object *Sensor value* (No. 32). Partial download is sufficient.	Reduction of the bus load in normal operation.
2.	Deactivate lighting control	Send 0 to object *activate control* (No. 24).	Control is deactivated.
3.	Slaves must be actively integrated into the lighting.	Write the corresponding *Activate slave mode* objects with 1.	The entire lighting which is effective in the control must be active during calibration.
4.	Darken the room.	Blind or time of day.	Brightness in the detection range of the light sensor less than 20 lx [2)]
5.	Set the artificial lighting so that the setpoint brightness is set to the reference point. The light sensor should be positioned above the reference surface.	Dimming via object *Relative dimming* (No. 12).	Setpoint is set, e.g. 500 lx. Luxmeter is positioned vertically below the light sensor.
6.	Enable calibration lighting.	Send telegram value 1 to the object *Enable calibration*.	Object *Calibration lighting* is enabled for 1 hour.
7.	Initiate artificial lighting calibration.	Send telegram value 1 to the object *Calibration lighting*.	Control commences calibration of artificial lighting. Jump to 100 % brightness. Dimming to 0. The calibration is completed after about 1 minute.
8.	End of daylight calibration.	Automatic via LR/M.	Control active and controlling. At the end of calibration, the object *Calibration lighting* (26) is reset to 0.

[1)] Before the artificial lighting calibration, ensure that the luminaries feature a constantly reproducible dimming performance during dimming. For this purpose, the burn-in time (Effect of ageing on lamps) of the luminaries must be considered and already completed. Consider also that some fluorescent lamps only develop their full lighting intensity after a few seconds.

[2)] Interference of the artificial lighting calibration caused by daylight has the effect that the light controller assumes that the illumination can produce a larger brightness level than is actually the case. The light controller will set a lower level of brightness in control operation.

Implementation of automatic daylight calibration

The sequence of daylight and artificial lighting calibration is not random. Calibration with artificial light must be performed before calibration with daylight.

The daylight calibration can be undertaken automatically by the light controller or experimentally by the user. The required setting can be found in the parameter window X: Control with the parameter *Compensation factor for daylight calibration automatically*. Automatic calibration is preferred.

The artificial lighting should be turned off for daylight calibration. The same brightness level (setpoint) as artificial lighting can generally be created using shading units. In order to prevent with a high level of certainty that the setpoint is not undershot in the controlled state, a brightness can be set for the daylight brightness which is about 10 % above the brightness value of artificial brightness calibration.

First of all Calibration daylight should be enabled via the object *Enable calibration*. The calibration can be undertaken by a telegram with value 1 sent to the object *Calibration daylight*. The light controller undertakes the calibration and determines the levels (weighting) of artificial lighting and daylight. After this calibration, the light controller switches the setpoint and commences with lighting control. When the daylight calibration has ended, the value of the object *Calibration daylight* is set again to 0. The T flag should be set beforehand. The value can be read as an alternative. At the start of daylight calibration, the value of the object *Enable calibration* (25) can be detected. At the start of daylight calibration this object value is set to 0 by the light controller.

If a shading device is not available for use or the daylight is not sufficient, a manual daylight calibration can be undertaken.

As an example, short operating instructions for output A are listed for automatic daylight calibration:

	Implementation	By	Effect
	Daylight calibration		
0.	Calibration lighting	See [Atificial lighting calibration table]	Lighting characteristic stored in the light controller.
1.	Deactivate lighting control	Send 0 to object *activate control* (No. 24).	Control is deactivated.
2.	Switch off artificial lighting.	Send 0 to object *Switch control* (No. 10).	Artificial lighting switched off.
3.	Set the setpoint brightness, e.g. 500 lx with daylight.	The same setpoint can be set using blinds or time of day as with artificial lighting calibration. **Note:** In order to prevent with a high level of certainty that the setpoint is not undershot in the controlled state, a brightness about 10 % above the brightness value of artificial brightness calibration is set.	Setpoint is set, e.g. 500 lx. Optional manual calibration possible.
4.	Switch calibration object to ready to receive.	Send a telegram with the value 1 to object *Enable calibration* (No. 25).	Object *Calibration lighting* and *Calibration daylight* are ready to receive for 1 hour.
5.	Initiate daylight calibration.	Send a telegram with the value 1 to object *Calibration daylight* (No. 27).	Control commences calibration of daylight. Calibration has ended after about 10 seconds. At the start of the daylight calibration the object *Enable calibration* (No. 25) is again set to 0.
6.	End of daylight calibration.	Automatic via LR/S.	Control active and controlling. Value of the object *Calibration daylight* (No. 27) is reset to 0.

[1)] Before the daylight calibration ensure that the luminaries feature a constantly reproducible dimming performance during dimming. For this purpose, the burn-in time (see section 4.7.4) of the luminaries must be considered and already completed. Consider also that some fluorescent lamps only develop their full lighting intensity a few seconds after being switched on.

Manual implementation of daylight calibration

If a daylight calibration is not possible, for example, because the setpoint is not reached with the available daylight or a shading option is not available to darken the detection range of the light sensor so that the setpoint can be set, manual daylight calibration can be undertaken.

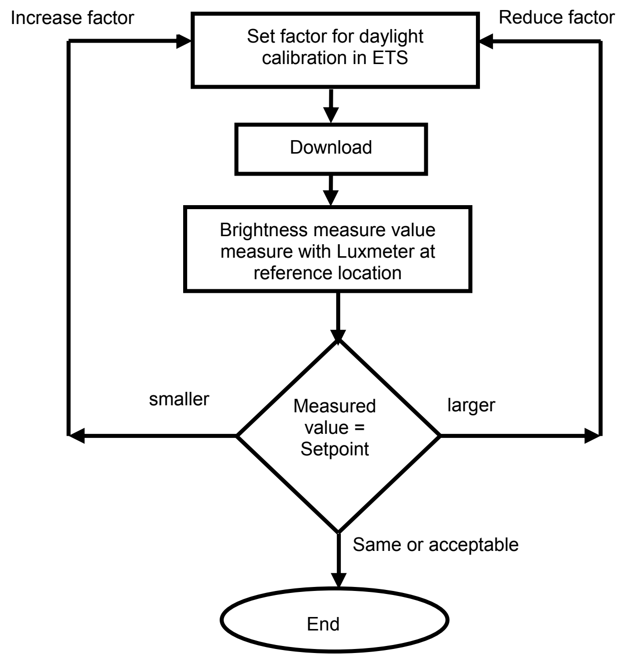
First of all set in the parameter window *X: Control* the parameter *Compensation factor for daylight calibration automatically* to *no*.

Subsequently a factor between 0 and 99 can be entered.
This factor defines the relationship between daylight and artificial lighting.
A larger value compensates more for daylight. A smaller value on the other hand gives a higher weighting to artificial lighting. After the factor has been transferred for download in the light controller using the brightness measured in the detection range of the light controller by the Luxmeter. More artificial lighting is required if the desired setpoint is undershot. This is achieved by increasing the factor. Too much artificial lighting is available if the desired setpoint is exceeded. The artificial lighting share must be reduced. This is implemented by reducing the factor. This is repeated until the light control controls the required brightness.

As an example in the following, short operating instructions for output A are listed for manual daylight calibration:

The calibration should be performed preferably at two measurement points, e.g. at a setpoint of 500 lx, the light control should be performed in daylight from about 200 lx and 400 lx.

	Implementation	By	Effect
Manual daylight calibration			
1.	Enable manual daylight calibration.	In Parameter window *X: Control* the parameter *Compensation factor for daylight calibration automatically* is to be set to *no*.	Parameter for the assignment of a factor for daylight calibration is enabled.
2.	Load the factor for daylight calibration in the light controller.	Download	The factor is stored in the LR/S after download. Light control is started.
3.	Checking of controlled brightness value.	The brightness is to be measured in the detection range of the light sensor with the Luxmeter.	The factor must be reduced if the constant brightness to be set is greater than the required setpoint. The factor must be increased if the brightness is too small. Step 2 should be repeated until the required brightness is set.



Note
After a reset or discharge of the light controller via the ETS, the stored values, e.g. lighting characteristic curves, are still available to the light controller. The calibration must be performed again. The values are overwritten only after a new calibration. The artificial lighting and the daylight calibrations should be considered separately in this case. This is independent of whether the calibration has been performed manually or automatically. The artificial lighting and daylight calibration must be performed again with a change of the light sensor arrangement.

4.1.4 Effect of ageing on lamps

Every fluorescent lamp ages in service. The lighting power of the fluorescent lamps degrades, i.e. a lower brightness is produced at the same control value. This can even mean that the setpoint originally required can no longer be achieved with maximum control. For this reason, the lighting is to be dimensioned so that the required setpoint brightness can be achieved until the luminaries are routinely exchanged.

In principle the ageing luminaries have no effect on the control circuit. If a lower brightness level is achieved due to ageing of the luminaries with the same control, the light controller will continue to increase the level of artificial lighting until the setpoint brightness is achieved.

However, it must be considered that the characteristic of the luminaries change with ageing. The characteristic has been determined during the calibration procedure and is the basis for the control algorithm. In this way it is possible that light control discrepancies result.

The following approach results:

The recorded characteristic of the artificial lighting is calculated with the control value. Assuming that the lamp generated 30 % less light, the value of the characteristic would be 1.33 times larger than the real value.

The light controller "thinks" that the daylight share is less than it is in reality. For the light controller there is less daylight as compensation is required.

With a compensation factor of 30 (for the control algorithm 0.3) an approximate reduction of the setpoint value by 10 % would be achieved. The light controller would control to a level which is too dark by 10 %.

In concrete terms that would mean that a light control originally set by the light controller to 500 lx will now only provide a brightness value of 450 lx. Furthermore, the tolerances apply as described in the light controller.

Note
The burn-in time where the light may not be dimmed must be complied with to ensure that the most stable possible luminary performance is assured. During the burn-in time which usually lasts between 50 and 100 hours, the luminaries must be operated at 100 % brightness. The burn-in time of a luminary can be obtained from the manufacturer.

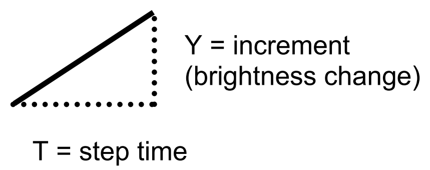
4.1.5 How does brightness detection function

The Light Sensor LF/U 2.1 of the LR/M 1.6.2 detects the light intensity of the surfaces in its detection range and converts it to a current. Before the light reaches the photodiode, it passes through a light filter whose maximum pass band attributes are in the visible wavelength range of the human eye. The light intensity is on the one hand dependent on the lighting intensity, i.e. the intensity of the daylight or artificial lighting, and on the other hand on the characteristics of the surfaces which are illuminated. If the surfaces in the detection range of the light sensor are completely covered with white paper, the light sensor measures a different light intensity with the lighting intensity as when the surface is covered with grey environmentally-friendly paper. When setting the setpoint the light density is measured by the light sensor and stored as a setpoint value. Subsequently, the light control will control the artificial lighting level in the room so that it more and more accurately achieves this setpoint value, i.e. the lighting control attempts to keep the lighting density and not the lighting intensity at a constant level.

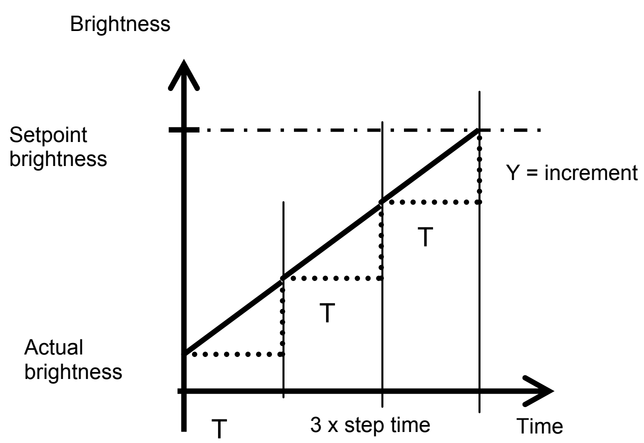
4.1.6 Constant lighting control function

The task of a constant lighting control is to control the setpoint brightness which results at a reference point in the room as accurately as possible. Starting from the actual brightness, the setpoint brightness is approached in steps (brightness change over time).

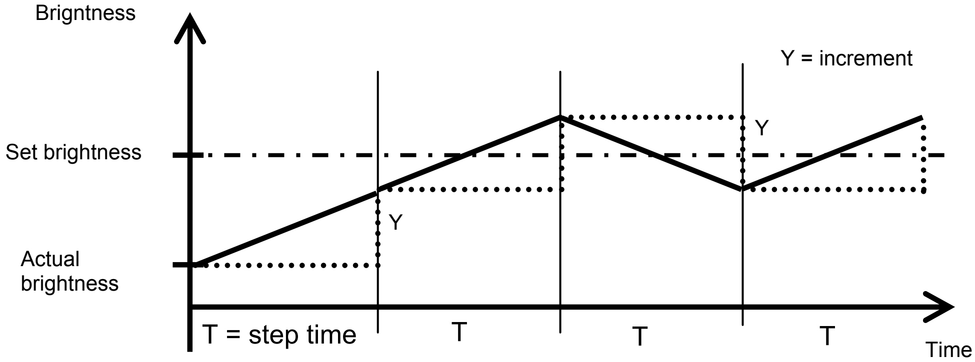
A control step is defined by the increment (brightness change) and the step time (time duration) in which the brightness change is performed.



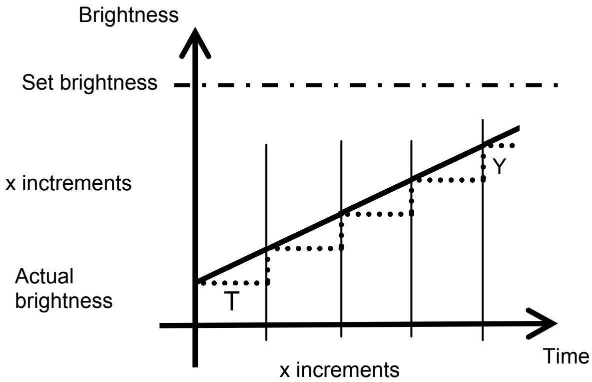
In principle, simplified light control can appear as follows. In the following example, the setpoint brightness is achieved starting from an actual brightness level to a setpoint brightness level in three steps:



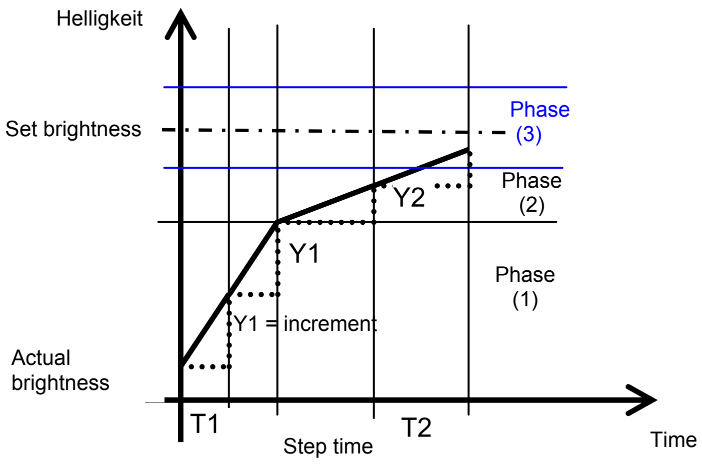
If the increment is too large, the light control reaches the setpoint faster. The setpoint brightness is exceeded. The light controller starts to oscillate around the setpoint brightness.



If the increment is too small, it will take too long until the setpoint brightness is reached. This is critical particularly where blinds which are closing to darken the room quickly.



The increment time should be selected so that the brightness change of a control step is available via the light controller/luminary/light sensor before the next control step is triggered. Otherwise the brightness setpoint will be exceeded and has to be regulated back a step. Normally the light controller determines these control variables.
If required these variables can be set individually in the parameter window *X: Control Dynamics*. The parameter window *X: Control Dynamics* is visible if in the parameter window *X: Control* the parameter *Changing brightness during lighting control* is set to *individual setting*. The parameterised variables are written in the following illustration.



In the start-up phase (1) the increment time (T1) of the control step can be parameterised. The smaller this time, the faster that the control steps are sent with the calculated step increment (Y1). The setpoint brightness is approached in a relatively short time.

If the difference between the setpoint brightness and the actual brightness has undershot a parameterised value, the fine tuning phase (2) in which the *Step time for fine tuning* (T2) slowly approaches the setpoint value.

The increment (Y2) can also be parameterised. To reach the setpoint faster or slower. This increment only is valid until a determined interval to the setpoint value. This interval can be set via the parameter *Control deviation for high increments (max. control step)*.

Phase (3) is adjustable with an additional parameter in which light control is suspended. A range around the setpoint value where there is no light control must be parameterised. Only when the actual brightness is again larger than this difference will the light control recommence. In this way, continuous control with the respective changes in brightness is avoided. This generates smoother and less abrupt response and considerably reduces the bus load with a master/slave control.

In order to get a point of reference for the individual control parameterisation, in the following table, you will find the fixed parameterised settings in the light controller and/or the adjustable values via the parameter window *X: Control Dynamics* listed for the Changing brightness during lighting control (fast, medium, slow and the individual setting):

Changing brightness during lighting control	fast	medi um	slow	Individual setting
Max. time between two control steps [0.1 s…2.0 s]	as fast as possible	0.5	1	1
Step time for slow approach [1 s…10 s]	2	3	4	4
Control deviation for medium dimming speed [0…50]	20	20	20	20
Maximum increment size of a control step [1…10]	1	1	1	1
Control deviation for high increments (max. control step) [10…255]	30	30	30	30
Control deviation for high increments [0…30]	1	1	1	1

4.1.7 Constant lighting control characteristics

4.1.7.1 Deactivation of control

Constant lighting control can be deactivated by users at any time if this option has been enabled. Corresponding parameterisation options can be found in the parameter window X: Control Operating.
The deactivation of the light control can for example be implemented by a local operation, dimming or switching of the lighting. Thus the user always has the option of setting their optimum brightness .

4.1.7.2 Activating constant lighting control

Before light control runs (controls), the constant lighting control must be selected on the parameter page X: General via the parameter *Enable function*. The light control is activated and controlled after the first download. With a further download the light control state before the download is restored. Light control can be activated (telegram with value 1) or deactivated (telegram with value 0) via the object *activate control*. In the activated state the light control is triggered as follows:

Constant lighting control is then activated and set to the control state when the switched off lighting is switched on (via object *Switch* a telegram with the value 1 is received).

The switch command can also be provided by a presence detector. In this case it is possible to fully relinquish manual operation of the lighting in extreme cases. This can prove to be useful if an optimum energy consumption is to be achieved, or if you must ensure that when a certain task is performed a particular level of brightness is assured.

In the following cases, the light control which is in standby mode is not triggered by an ON command:

- The output is inhibited or is under forced operation.
- The *Follow-up time of the inactive control* is active.

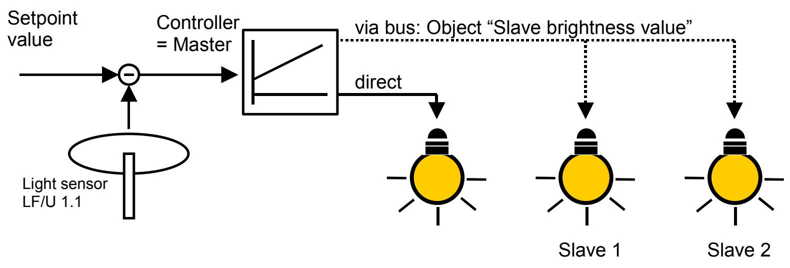
4.1.7.3 Follow-up time of the inactive control

This function is particularly useful when there is a presence detector in the room.

Example
The user has deactivated the light control and set the maximum level of brightness. The user leaves the room and the presence detector switches off the light. If the user returns after a short time (within the adjustable follow-up time) the lighting is automatically set again to the maximum brightness value and the light control remains active. The temporary setpoint set by the user, e.g. by dimming, remains active.

4.1.7.4 Slave mode

Slave mode in a constant lighting control:



Further luminaries can be integrated into the constant lighting control which are not directly connected to the light controller. These for example, can be DALI lamps via an ABB i-bus® KNX DALI Gateway or a dimmer. These components are controlled directly as so-called slaves directly by the light controller (= master). The slaves have the same brightness value as the master if no characteristic correction is parameterised or no other brightness characteristic of the luminaries is available.
The brightness value is transferred via the object *Brightness value of slave*.

Tip
It may be desirable that the lights in the vicinity of the window are darker than the lights in the interior of the room. This can be achieved by the parameterised characteristic correction in the slave. The darker lighting strip should be parameterised as the master. Please observe here that the brightness differences should also be present at night or when it is dark!

4.1.7.5 Different luminaries

Luminaries with varying brightness characteristic curves should be avoided in control circuits. In a light controller control circuit a mix of 1-10 V luminaries and DALI luminaries (controlled via DALI gateways) is not possible.

This is because of the different brightness characteristic curves (linear/logarithmic) involved. The same control value, e.g. of 50 % with 1-10 V luminaries causes a brightness of 50 %, with DALI lamps a light current of 3 % will correspond to a brightness of 3 % as the curve is adapted to the logarithmic response of the eye. Because of these brightness differences at the same control value, a common lighting control (in a light controller control circuit) is not recommended.

A control circuit with 1-10 V luminaries and a second control circuit with DALI lamps controlled via a DALI Gateway must however by controlled via two separated outputs of a single light controller.

4.2 Presets

A parameterisable brightness state can be retrieved with the help of presets. Lightscenes can therefore be implemented for example.

Retrieve preset

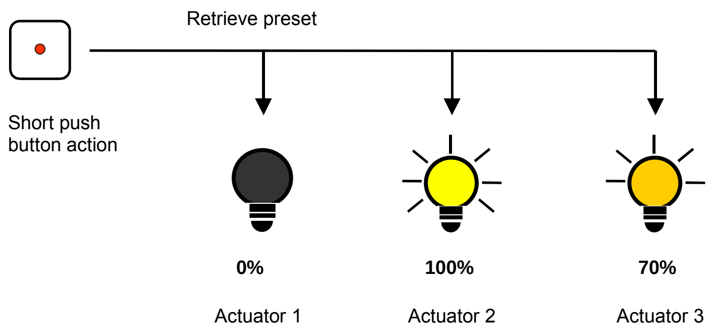


Fig. 2: Controlling lightscenes via presets

Brightness states ("preset values") can be retrieved via the object *Call preset …*. A maximum of 4 preset values are available for each output:

Action	Telegram
Retrieve preset1	Object "*Call preset 1 and 2*" = 0
Retrieve preset2	Object "*Call preset 1 and 2*" = 1
Retrieve preset3	Object "*Call preset 3 and 4*" = 0
Retrieve preset4	Object "*Call preset 3 and 4*" = 0

Recall with delay

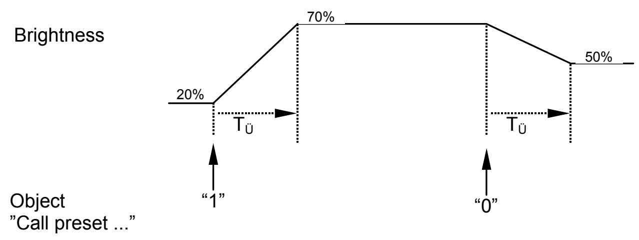


Fig. 3: Recall a preset with a "transition time"

Here you set whether the dimmer jumps to the preset value immediately (*immediate*) or whether it is slowly dimmed down. The above example shows the progression of the brightness after the recall of two presets.. The transition time T_u defines the period in which the lighting changes from the old to the new brightness value.

Store preset

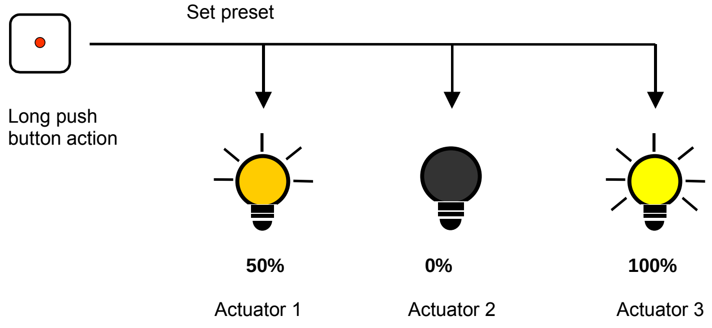


Fig. 4: Storing the current brightness as the new preset value

The current brightness value is stored as a new preset value via the object *Set preset …*. The user can for example adapt a lightscene in this way. The presets are stored via the following values:

Action	**Telegram**
Store preset1	Object *Set Preset 1 and 2* = 0
Store preset2	Object *Set Preset 1 and 2* = 1
Store preset3	Object *Set Preset 3 and 4* = 0
Store preset4	Object *Set Preset 3 and 4* = 1

Special function: Restore state

A useful special function can also be assigned to preset1 and preset3, which is used to recreate the brightness level that was present before retrieving preset2 or preset4. The following diagram clarifies this:

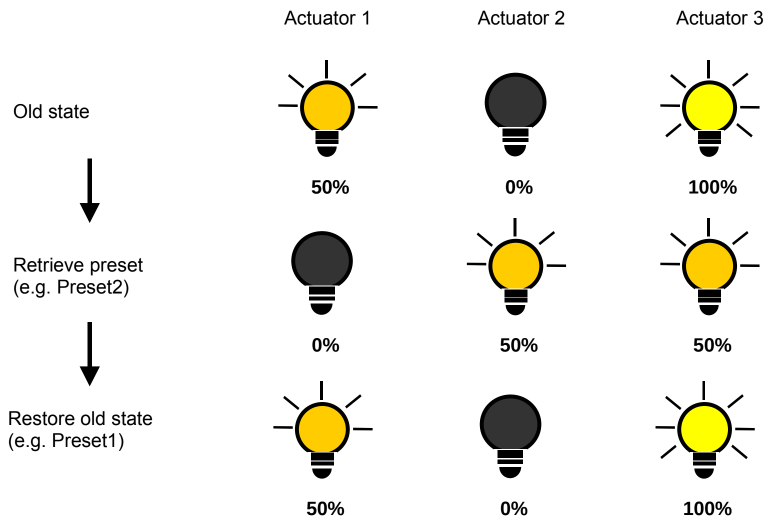


Fig. 5: Restoring the old brightness state (example)

This function can be used for example after a presentation to restore the lighting to the state it was in beforehand.

4.3 8 bit scene

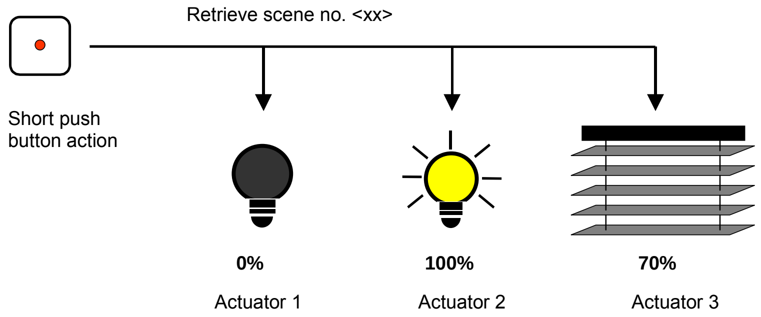


Fig. 6: Retrieve scene, 8-bit scene

With the 8 bit scene, the push button issues the instruction to call a scene. The scene is not stored in the push button but rather in the actuator. All actuators are addressed using the same group address. It is thus sufficient to send a single telegram to recall the scene.

A scene number is sent with the telegram value which must correspond with the scene number in the parameters of the actuator.

Up to 64 different scenes are managed via a single group address. An 8 bit scene telegram contains the following information:
- Number of the scene (1…64)
- Retrieve scene / store scene

After a long push button action, the actuators receive a save command which causes them to store the current value issued by the actuator as a new scene value.

4.4 Staircase lighting control

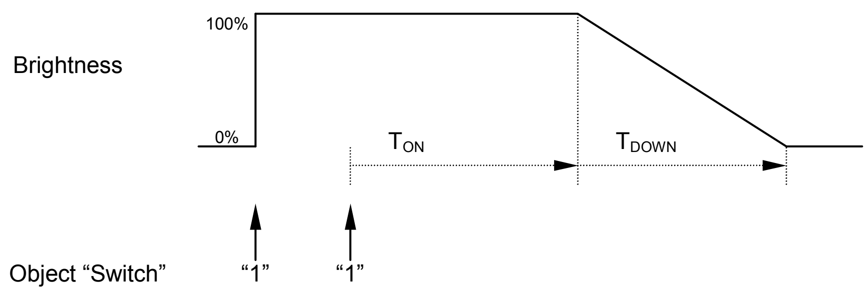


Fig. 7: Brightness progression when using the staircase lighting control

Once the staircase lighting time T_{ON} has elapsed, the output slowly dims down over the period T_{DOWN} and then switches off. The user is thus warned and has sufficient time to restart the staircase lighting time by pressing the push button again.

A **warning function** sets the value of the object *Warning staircase lighting* to "1" during the dimming down period. The user can thus be warned in good time by another signal (e.g. rapid flashing of the push button LEDs).

With **pumping up**, the user can adapt the staircase lighting time to the current requirements by pressing the push button several times in succession. The maximum duration of the staircase lighting time can be set in the parameters.

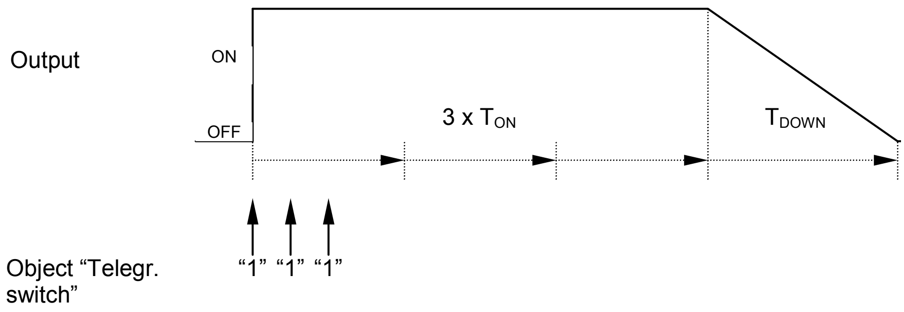


Fig. 8: Extending the staircase lighting time by "pumping up"

If the device receives a further ON command when the staircase lighting is switched on, the staircase lighting time is added to the remaining period.

4.5 Characteristic adjustment

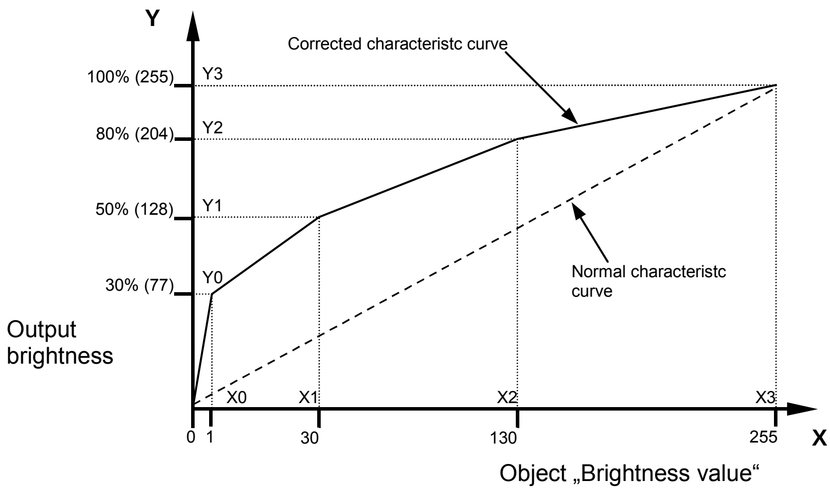


Fig. 9: Example for a characteristic adjustment

Sometimes it is necessary to adjust the dimming characteristic of a light to the sensitivity of the human eye. This can be undertaken with a characteristic adjustment.

Normally the object value 0…255 is assigned with the proportional brightness value 0 %…100 % (see "normal characteristic"). This curve can be converted by 4 value pairs to a curve.

If the lights should be brighter in the lower range, the brightness can be increased with the object value "1". In the upper example (see figure above), for the first value pair the brightness for value "1" has therefore been defined at 30 %.

The other value pairs in the example have been defined so that they result in a curve that has a flatter progression in the upper range. With relative dimming a flatter dimming ramp is thus achieved.

Note: The dimming limits from the parameter windows *Dimming* and *Value* apply. The respective parameterized values of these limits are set with overshoot and undershoot brightness values.

4.6 Priority between functions

The functions of the dimming actuator modules have the following priority (in descending order):

1. Forced operation

2. Reaction on bus voltage failure and recovery

3. Blocked function

Example: Blocked outputs are set to the parameterised state on bus voltage failure.

4.7 Reaction on voltage failure and recovery

Reaction on bus voltage failure

The behaviour of the outputs on bus voltage failure can be parameterised. The function of the Room Controller is retained provided that the supply voltage (115 / 230 V AC or 12 V DC auxiliary voltage) is available.

If it has been set accordingly in the parameters, the Room Controller can continue to function normally after bus voltage failure and the functions in the room are retained.

Example: Conventional push buttons are connected to a Room Controller via binary input modules. The Room Controller also regulates the lighting. At bus voltage failure, the lighting can still be operated since the Room Controller is not supplied by the bus.

On bus voltage failure, the constant lighting control of the *Light Controller Module LR/M 1.6.2* is deactivated. The current setpoint value of the constant lighting control will remain unchanged.

Reaction on bus voltage recovery

Any output brightness can be set in the parameters. The setting *unchanged* is also possible. Further information and parameter settings can be found the parameter window *General*.

Reaction on supply voltage failure

The supply voltage has failed if there is a failure of both the 115/230 V AC supply and the 12 V DC auxiliary supply of the Room Controller. The Room Controller has no function in this case.

The *Light Controller Module LR/M 1.6.2* and the *Switch/Dim Actuator Module SD/M 2.6.2* switch the control output to 100% (high resistance). The state of the relay output remains unchanged.

The setpoint of the constant lighting control is retained with the *Light Controller Module LR/M 1.6.2*.

The *Universal Dim Actuator Module UD/M 1.300.1* switches off the output.

Note: Some stored preset and scene values are lost on failure of the supply voltage. They are overwritten by the parameterised default values.

Reaction on supply voltage recovery

The behaviour of the outputs is identical to the behaviour on bus voltage recovery. It can be parameterised for each output. It is possible to restore the brightness value prior to the supply voltage failure.

The constant lighting control of the *Light Controller Module LR/M 1.6.1* is activated if this function is enabled in the parameters.

4.8 Behaviour after programming

After programming, the device behaves in the same way as after bus voltage recovery (see above).

On the *Light Controller Module LR/M 1.6.2, t*he current setpoint value of the constant lighting control (object *Setpoint*) is retained.

5 Appendix

5.1 Value table for the object *Error code*

Error code value		Critical excess temperature	Excess temperature	Load overvoltage	Short circuit or overload	No-load or low load	not used	not used	Error during load detection
0	00								
1	01								■
2	02							■	
3	03							■	■
4	04						■		
5	05						■		■
6	06						■	■	
7	07						■	■	■
8	08					■			
9	09					■			■
10	0A					■		■	
11	0B					■		■	■
12	0C					■	■		
13	0D					■	■		■
14	0E					■	■	■	
15	0F					■	■	■	■
16	10				■				
17	11				■				■
18	12				■			■	
19	13				■			■	■
20	14				■		■		
21	15				■		■		■
22	16				■		■	■	
23	17				■		■	■	■
24	18				■	■			
25	19				■	■			■
26	1A				■	■		■	
27	1B				■	■		■	■
28	1C				■	■	■		
29	1D				■	■	■		■
30	1E				■	■	■	■	
31	1F				■	■	■	■	■
32	20			■					
33	21			■					■
34	22			■				■	
35	23			■				■	■
36	24			■			■		
37	25			■			■		■
38	26			■			■	■	
39	27			■			■	■	■
40	28			■		■			
41	29			■		■			■
42	2A			■		■		■	
43	2B			■		■		■	■
44	2C			■		■	■		
45	2D			■		■	■		■
46	2E			■		■	■	■	
47	2F			■		■	■	■	■
48	30			■	■				
49	31			■	■				■
50	32			■	■			■	
51	33			■	■			■	■
52	34			■	■		■		
53	35			■	■		■		■
54	36			■	■		■	■	
55	37			■	■		■	■	■
56	38			■	■	■			
57	39			■	■	■			■
58	3A			■	■	■		■	
59	3B			■	■	■		■	■
60	3C			■	■	■	■		
61	3D			■	■	■	■		■
62	3E			■	■	■	■	■	
63	3F			■	■	■	■	■	■
64	40		■						
65	41		■						■
66	42		■					■	
67	43		■					■	■
68	44		■				■		
69	45		■				■		■
70	46		■				■	■	
71	47		■				■	■	■
72	48		■			■			
73	49		■			■			■
74	4A		■			■		■	
75	4B		■			■		■	■
76	4C		■			■	■		
77	4D		■			■	■		■
78	4E		■			■	■	■	
79	4F		■			■	■	■	■
80	50		■		■				
81	51		■		■				■
82	52		■		■			■	
83	53		■		■			■	■
84	54		■		■		■		
85	55		■		■		■		■
86	56		■		■		■	■	
87	57		■		■		■	■	■
88	58		■		■	■			
89	59		■		■	■			■
90	5A		■		■	■		■	
91	5B		■		■	■		■	■
92	5C		■		■	■	■		
93	5D		■		■	■	■		■
94	5E		■		■	■	■	■	
95	5F		■		■	■	■	■	■
96	60		■	■					
97	61		■	■					■
98	62		■	■				■	
99	63		■	■				■	■
100	64		■	■			■		
101	65		■	■			■		■
102	66		■	■			■	■	
103	67		■	■			■	■	■
104	68		■	■		■			
105	69		■	■		■			■
106	6A		■	■		■		■	
107	6B		■	■		■		■	■
108	6C		■	■		■	■		
109	6D		■	■		■	■		■
110	6E		■	■		■	■	■	
111	6F		■	■		■	■	■	■
112	70		■	■	■				
113	71		■	■	■				■
114	72		■	■	■			■	
115	73		■	■	■			■	■
116	74		■	■	■		■		
117	75		■	■	■		■		■
118	76		■	■	■		■	■	
119	77		■	■	■		■	■	■
120	78		■	■	■	■			
121	79		■	■	■	■			■
122	7A		■	■	■	■		■	
123	7B		■	■	■	■		■	■
124	7C		■	■	■	■	■		
125	7D		■	■	■	■	■		■
126	7E		■	■	■	■	■	■	
127	7F		■	■	■	■	■	■	■
128	80	■							
129	81	■							■
130	82	■						■	
131	83	■						■	■
132	84	■					■		
133	85	■					■		■
134	86	■					■	■	
135	87	■					■	■	■
136	88	■				■			
137	89	■				■			■
138	8A	■				■		■	
139	8B	■				■		■	■
140	8C	■				■	■		
141	8D	■				■	■		■
142	8E	■				■	■	■	
143	8F	■				■	■	■	■
144	90	■			■				
145	91	■			■				■
146	92	■			■			■	
147	93	■			■			■	■
148	94	■			■		■		
149	95	■			■		■		■
150	96	■			■		■	■	
151	97	■			■		■	■	■
152	98	■			■	■			
153	99	■			■	■			■
154	9A	■			■	■		■	
155	9B	■			■	■		■	■
156	9C	■			■	■	■		
157	9D	■			■	■	■		■
158	9E	■			■	■	■	■	
159	9F	■			■	■	■	■	■
160	A0	■		■					
161	A1	■		■					■
162	A2	■		■				■	
163	A3	■		■				■	■
164	A4	■		■			■		
165	A5	■		■			■		■
166	A6	■		■			■	■	
167	A7	■		■			■	■	■
168	A8	■		■		■			
169	A9	■		■		■			■
170	AA	■		■		■		■	
171	AB	■		■		■		■	■
172	AC	■		■		■	■		
173	AD	■		■		■	■		■
174	AE	■		■		■	■	■	
175	AF	■		■		■	■	■	■
176	B0	■		■	■				
177	B1	■		■	■				■
178	B2	■		■	■			■	
179	B3	■		■	■			■	■
180	B4	■		■	■		■		
181	B5	■		■	■		■		■
182	B6	■		■	■		■	■	
183	B7	■		■	■		■	■	■
184	B8	■		■	■	■			
185	B9	■		■	■	■			■
186	BA	■		■	■	■		■	
187	BB	■		■	■	■		■	■
188	BC	■		■	■	■	■		
189	BD	■		■	■	■	■		■
190	BE	■		■	■	■	■	■	
191	BF	■		■	■	■	■	■	■
192	C0	■	■						
193	C1	■	■						■
194	C2	■	■					■	
195	C3	■	■					■	■
196	C4	■	■				■		
197	C5	■	■				■		■
198	C6	■	■				■	■	
199	C7	■	■				■	■	■
200	C8	■	■			■			
201	C9	■	■			■			■
202	CA	■	■			■		■	
203	CB	■	■			■		■	■
204	CC	■	■			■	■		
205	CD	■	■			■	■		■
206	CE	■	■			■	■	■	
207	CF	■	■			■	■	■	■
208	D0	■	■		■				
209	D1	■	■		■				■
210	D2	■	■		■			■	
211	D3	■	■		■			■	■
212	D4	■	■		■		■		
213	D5	■	■		■		■		■
214	D6	■	■		■		■	■	
215	D7	■	■		■		■	■	■
216	D8	■	■		■	■			
217	D9	■	■		■	■			■
218	DA	■	■		■	■		■	
219	DB	■	■		■	■		■	■
220	DC	■	■		■	■	■		
221	DD	■	■		■	■	■		■
222	DE	■	■		■	■	■	■	
223	DF	■	■		■	■	■	■	■
224	E0	■	■	■					
225	E1	■	■	■					■
226	E2	■	■	■				■	
227	E3	■	■	■				■	■
228	E4	■	■	■			■		
229	E5	■	■	■			■		■
230	E6	■	■	■			■	■	
231	E7	■	■	■			■	■	■
232	E8	■	■	■		■			
233	E9	■	■	■		■			■
234	EA	■	■	■		■		■	
235	EB	■	■	■		■		■	■
236	EC	■	■	■		■	■		
237	ED	■	■	■		■	■		■
238	EE	■	■	■		■	■	■	
239	EF	■	■	■		■	■	■	■
240	F0	■	■	■	■				
241	F1	■	■	■	■				■
242	F2	■	■	■	■			■	
243	F3	■	■	■	■			■	■
244	F4	■	■	■	■		■		
245	F5	■	■	■	■		■		■
246	F6	■	■	■	■		■	■	
247	F7	■	■	■	■		■	■	■
248	F8	■	■	■	■	■			
249	F9	■	■	■	■	■			■
250	FA	■	■	■	■	■		■	
251	FB	■	■	■	■	■		■	■
252	FC	■	■	■	■	■	■		
253	FD	■	■	■	■	■	■		■
254	FE	■	■	■	■	■	■	■	
255	FF	■	■	■	■	■	■	■	■

5.2 Ordering information

Designation	Type	Order No.	bbn 40 16779 EAN	Price 1 pc. [EURO]	Price group	Weight 1 pc. [kg]	Packaging [pc.]
Switch/Dim Actuator Module, 2-fold, 6 AX	SD/M 2.6.2	2CDG 110 107 R0011	680660		26		1
Light Controller Module, 1-fold, 6 AX	LR/M 1.6.2	2CDG 110 108 R0011	680677		26		1
Universal Dim Actuator Module, 1-fold, 300 VA	UD/M 1.300.1	2CDG 110 012 R0011	583602		26		1

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