



The **brightness sensor 3gang** controls switch and/or dimming actuators depending on the brightness of the surroundings. The surrounding brightness is registered using a connected light probe that is part of the delivery scope (max. cable length 100 m). Depending on the application, the device has several transmission channels whose switching limited values can be parameterised by the ETS. Furthermore, a blocking object (1 byte) can be used to temporarily deactivate any combination of transmission channels. The brightness sensor 3gang is suitable for all applications where comfortable lighting controls are required. Currently 2 different applications are available (application programs):

**Switching, 3 limited values:** With this application, the device assumes the function of a 3-channel limited value switch with a setting range from 1 to 10.000 Lux. Every limited value value can be set separately. Each channel's send response can be parameterised for when it exceeds/undershoots a limited value.

**Switching, Value transmitter, 4 brightness areas:** In this application, the brightness sensor 3gang assumes the function of a brightness-controlled light scene component with a setting range of 1 to 100 Lux or 100 to 20.000 Lux.

The scene consists of 3 switching and 1 value object. Various brightness ranges are assigned to one light scene. If the measured brightness value is in such a range, then corresponding switch and value telegrams are sent to the bus.

**Voltage supply:**

Via bus voltage

**Connections:**

- 1 bus connection (via bus connector terminal)
- 1 light probe (via 2 screw-type termin., cable length max. 100 m)

**Setting range:**

1 ... 20 000 Lux

**Protection class:**

Brightness sensor:

IP 21 according to DIN EN 60 529

Light probe:

IP 54 according to DIN EN 60 529

**Permitted ambient temperature:**

Brightness sensor:

- 5° C ... + 45° C

Light probe:

- 40° C ... +70° C

**Housing dimensions:**

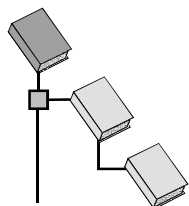
Brightness sensor:

86 x 35.8 x 60 mm (H/W/D), RMD width 2 units

Light probe with mounting  
bracket:

86 x 27 x 38 mm  
Max. 118 x 27 x 62 mm

**Database structure:**



Gebr. Berker

Physical sensors

Brightness  
sensor

Brightness  
sensor 3gang  
RMD

**Application Summary:**



**Switching, 3 limited values**

**Switching, Value transmitter, 4 brightness areas**

**Description of application**

**Applikation: Switching, 3 limited values**

In this application, the brightness sensor 3gang has three switching channels that can be parameterised individually. The following can be set individually for each channel:

- Switch limited value (setting range between 1 and 10.000 Lux)
- Switch response when “brighter than limited value”
- Switch response when “darker than limited value”

The following can be parameterised together for all three channels:

- Time for cyclic transmission responses
- Delay time
- Hysteresis

Any combination of channels can be temporarily deactivated or activated by a 1 Byte object (Object 3).

**Communications objects**

No	Object name	Function	Type	Response
0	Limiting value 1	Switching	1 Bit	Send
1	Limiting value 2	Switching	1 Bit	Send
2	Limiting value 3	Switching	1 Bit	Send
3	Brightness sensor	Locking	1 Byte	Receive

Max. number of group addresses: 5

Max. number of assignments: 5

• **Objects 0, 1, 2: Limiting value 1, 2, 3**

The parameterised value is sent (see parameters) when it is darker or brighter than the set limited value.

• **Object 3: Locking**

The send response of every individual channel can be blocked or enabled via this 1 Byte object.

Value of blocking object (Type 1 Byte)		Send response for channels		
		A = active B = blocked (Send to the corresponding channel object is suppressed)		
Decimal	Binary	Channel 1 (Object 0)	Channel 2 (Object 1)	Channel 3 (Object 2)
0	0000 0000	A	A	A
1	0000 0001	B	A	A
2	0000 0010	A	B	A
3	0000 0011	B	B	A
4	0000 0100	A	A	B
5	0000 0101	B	A	B
6	0000 0110	A	B	B
7	0000 0111	B	B	B

**Caution!**

When resetting a blocking bit, the corresponding channel object immediately sends its current value. In the case of a bus voltage failure, the entire blocking object is reset to 0.

**Note: Changing a bit blocking telegram into a byte blocking telegram:** If the blocking command was generated with the help of a 1 bit sensor, then the application for converting 1 to 8 bit telegrams belonging to the logic operation controller can be used (BCU-RMD with controller application).

**Description of parameters**

<b>Limited value 1, 2, 3</b>		
Limited value	2.0 kOhm (10 000 Lux) to 2.40 MOhm (1 Lux)	Setting for switching limited value at which a telegram is sent via the corresponding channel (Obj. 0, 1 or 2). Because of the tolerance of the light probe a resistance value must be entered here. The corresponding value can be taken from the Auxiliary Table (see 0).
Transmission if limited value is fallen under	No function OFF <b>ON</b> OFF ON, cyclic transmission OFF, cyclic transmission	Setting concerning which telegram will be sent via the channel object if it is darker than the set limited value.
Transmission if limited value is exceeded	No function OFF ON <b>OFF</b> ON, cyclic transmission OFF, cyclic transmission	Setting concerning which telegram will be sent via the channel object if it is brighter than the set limited value.

**Auxiliary Table for the Parameterisation of the Brightness Values**

Because of the tolerance of the light probe, the switching limited value of the brightness value is given as the resistance value.

<b>Brightness</b>	<b>Resistance of ... to</b>	<b>Average value</b>	<b>Resolution</b>
1 Lux	2.000 MOhm ... 3.000 MOhm	2.400 MOhm	Resolution 20 KOhm
1.5 Lux	1.400 MOhm ... 2.500 MOhm	2.000 MOhm	
2 Lux	1.000 MOhm ... 2.000 MOhm	1.500 MOhm	
3 Lux	700 KOhm ... 1.500 MOhm	1.000 MOhm	
5 Lux	450 KOhm ... 1.000 MOhm	700 MOhm	
10 Lux	250 KOhm ... 550 KOhm	350 KOhm	
20 Lux	120 KOhm ... 300 KOhm	200 KOhm	
30 Lux	95 KOhm ... 200 KOhm	130 KOhm	
50 Lux	60 KOhm ... 120 KOhm	90 KOhm	
100 Lux	35 KOhm ... 75 KOhm	50 KOhm	
200 Lux	20 KOhm ... 40 KOhm	28 KOhm	
300 Lux	12 KOhm ... 30 KOhm	20 KOhm	
500 Lux	9 KOhm ... 20 KOhm	13 KOhm	
1000 Lux	5.5 KOhm ... 11 KOhm	8.5 KOhm	
2000 Lux	3.5 KOhm ... 7.5 KOhm	5 KOhm	
5000 Lux	2 KOhm ... 4 KOhm	2.8 KOhm	
10000 Lux	1.2 KOhm ... 3 KOhm	2 KOhm	
20000 Lux	0.8 KOhm ... 2.4 KOhm	1.2 KOhm	

<b>Transmission delay and hysteresis</b>		
Send delay	Approx. 10 sec. Approx. 20 sec. <b>Approx. 30 sec.</b> Approx. 45 sec. Approx. 60 sec. Approx. 90 sec. Approx. 2 min. Approx. 3 min.	To avoid switching errors because of light reflexes or brief de-activation, an ON and OFF delay should be set in the parameters. This parameter setting applies for all 3 switching limited values. A telegram will only be sent if the measured brightness value for the parameterised time is higher or lower than the preset limited value value (incl. hysteresis).

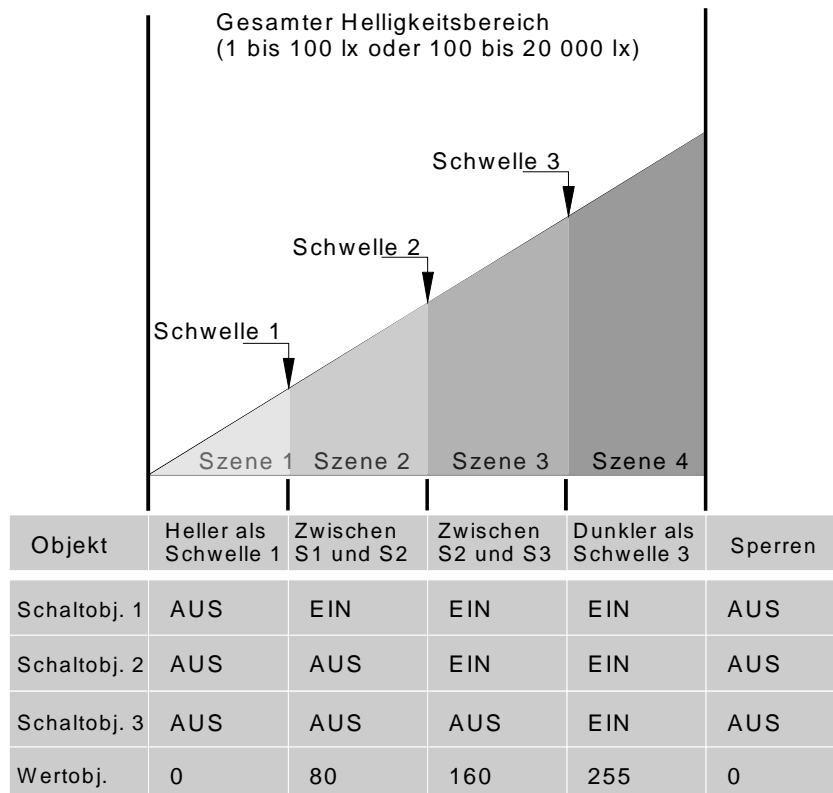
Positive Hysteresis	Approx. 6 % Approx. 12.5 % Approx. 25 %	Setting a hysteresis value eliminates repeated switching if the measured brightness value is in the range of the set limited value. One should note that this only involves positive hysteresis values.
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<b>Cycle time</b>		
Cycle time	Approx. 3 min. <b>Approx. 5 min.</b> Approx. 10 min. Approx. 15 min. Approx. 20 min. Approx. 30 min. Approx. 45 min.	Setting for the cycle time with which a telegram is repeatedly sent to the bus. This parameter applies for all send objects where the send response is set to "Cyclical send".

**Application: Brightness sensor with 4 light scenes**

In this application, the brightness sensor assumes the function of a brightness-controlled lighting arrangement component with a setting range between 1 and 100 Lux and 100 and 20,000 Lux.

Four brightness ranges can be defined through 3 different switch limited values. Every brightness range therefore has a lighting arrangement consisting of three switching and one value object assigned to it. If the measured brightness value is in one of these ranges for a certain delay time then the parameterised switching and value telegrams are sent to the bus. In addition, each light scene object can be positively driven via a so-called blocking object.



**Communications objects**

Nr.	Object name	Function	Type	Response
0	Brightness sensor	Value transmitter	1 Byte	Send
1	Output 1	Switching	1 Bit	Send
2	Output 2	Switching	1 Bit	Send
3	Output 3	Switching	1 Bit	Send
4	Brightness sensor	Locking	1 Byte	Receive

Max. number of group addresses: 5  
Max. number of assignments: 5

• **Object: Brightness sensor**

A value telegram (8 Bit) is sent depending on which brightness range the current measured brightness value is in. In accordance with the preset transmission response, the telegram is sent cyclically or only when changing to another brightness range.

• **Objects: Outputs 1, 2, 3**

Switch telegrams (1 Bit) are send, depending on which brightness range the current measured brightness value is in. In accordance with the preset transmission response, the telegram is sent cyclically or only when changing to another brightness range.

• **Object : Brightness sensor, locking**

If a suitable value (see table) is transferred to this 8 bit receive object then the corresponding switch or value object assumes the parameterised state (Response if blocked).

After receiving a blocking bit, the following transmission response can be parameterised for the corresponding switch or value object:

Send no telegram	No further telegram will be sent out to the corresponding switch or value object after receiving the corresponding blocking bit.
Send OFF telegram	An OFF telegram will be sent out <u>once</u> to the corresponding switch or value object after the blocking bit is received.
Send ON telegram	An ON telegram will be sent out <u>once</u> to the corresponding switch or value object after the blocking bit is received

**Please note:**

**If a blocking bit is set, then all light scene objects (Objects 0 – 3) send their current value, i.e. the light scene objects that do not have a blocked state send the value based on the current lighting range and the assigned light scene. The light scene objects that have a blocked state respond as though “Respond if blocked” had been set.**

**Changing a bit blocking telegram into a byte blocking telegram:** If the blocking command was generated with the help of a 1 bit sensor, then application for converting 1 to 8 bit telegrams belonging to the logic operation controller can be used (BCU RMD with controller application).

The following relationship exists between the value of the blocking object and light scene objects 0 to 3:

Value of the blocking object (Object 4 / Type 1 Byte)		Transmission responses of the channels A = active B = blocked (i.e. the send object assumes the status that has been set on the parameter side for "Response when blocked" after receiving the corresponding blocking bit.)			
Decimal	Binary	Object 3	Object 2	Object 1	Object 0
0	0000 0000	A	A	A	A
1	0000 0001	A	A	A	B
2	0000 0010	A	A	B	A
3	0000 0011	A	A	B	B
4	0000 0100	A	B	A	A
5	0000 0101	A	B	A	B
6	0000 0110	A	B	B	A
7	0000 0111	A	B	B	B
8	0000 1000	B	A	A	A
9	0000 1001	B	A	A	B
10	0000 1010	B	A	B	A
11	0000 1011	B	A	B	B
12	0000 1100	B	B	A	A
13	0000 1101	B	B	A	B
14	0000 1110	B	B	B	A
15	0000 1111	B	B	B	B
16 to 255	Bits 4 to 7 have no function	A	A	A	A

**Function of blocking object:**

**Response in case of bus voltage failure**

As it is not possible to predict how long such a failure will last, light scene objects 0 to 3 lose their current value. As a result, only the value of the blocking object is retained.

**Response after restoration of bus voltage**

All light scene objects that are not in a blocked state are re-initialised and thus send out telegrams concerning the measured brightness values after the bus voltage is restored. The telegrams are however only sent to the bus after the preset delay time (see parameter "Transmission delay").  
Such light scene objects that are in a blocked state assume the state that is set on the parameter side under "Lock function" after 17 seconds. If telegrams are sent during the blocked state then the setting on the "Behaviour of transmission" side apply.

**Description of parameters:**

<b>Limited values</b>		
Limited value, base	<b>10 kOhm (1 – 100 Lux area)</b> 200 Ohm (100 – 20000 Lux area)	The brightness value for the individual switch limited values is entered as the resistance value because of the tolerance of the light probe. The common basic value with the corresponding measuring range is set for all limited values with this parameter. The resistance value for a limited value is calculated as follows:  <b>Resistance value = Base x Factor</b>  The corresponding resistance value for the appropriate Lux value can be found in the Auxiliary Table (see 0).
Help to calculate factor (only for information !)	15 Lux: Factor approx. 200: 100 Lux: Factor approx. 5	This parameter serves only as a setting aid for rough orientation with the parameterisation of the factors for limited values 1 to 3, i.e. the parameter has no affect on the application program.
Limited value 1, factor (upper brightness value)	5 : 250	Enter the factor for the resistance value for limited value 1: The factor for limited value 1 must be smaller than the factor for limited value 2.
Limited value 2, factor (middle brightness value)	5 : 250 Not used	Enter the factor for the resistance value for limited value 2: The factor for limited value 2 must be smaller than the factor for limited value 3.
Limited value 3, factor (lower brightness value)	5 : 250 Not used	Enter the factor for the resistance value for limited value 3.
Positive hysteresis	Approx. 6 % <b>Approx. 12.5 %</b> Approx. 25 %	By setting the hysteresis, it is possible to prevent repeating switching if the measured brightness value is in the range of the set limited value. Please note that this only involves positive hysteresis values.
Transmission delay	Approx. 20 sec. <b>Approx. 30 sec.</b> Approx. 45 sec. Approx. 60 sec. Approx. 90 sec. Approx. 2 min. Approx. 3 min. Approx. 4 min.	To avoid switching errors because of light reflexes or brief de-activation, an ON and OFF delay should be set in the parameters. This parameter setting applies for all 3 switching limited values. A telegram will only be sent if the measured brightness value for the parameterised time is higher or lower than the preset limited value (incl. hysteresis).

Important information with regard to defining parameters for switch limited values:

- ◆ **Entering the factors for limited values 1 to 3 must occur in ascending order, i.e. + Factor for limited value 1 < Factor for limited value 2 < Factor for limited value 3.**
- ◆ For the factors for limited values 2 and 3, the setting “not used” can be selected. The following must be observed if this is the case:
  - Example “Do not use one limited value“
    - Set factor for limited value 3 to “not used”.
    - Result: Light scene 4 is not executed.
  - Example “Do not use two limited values“
    - Set factor for limited values 2 and 3 to “not used”.
    - Result: Light scenes 3 and 4 are not executed.

<b>Limited value 1 is exceeded, Between limited values 1 and 2, Between limited values 2 and 3, Limited value 3 is fallen under</b>		
Use switch object of output 1 ?	YES NO	Setting concerning whether a telegram will be sent to switch object 1 when limited value value is exceeded.
Telegram when exceeding limited value	ON OFF	Setting concerning which telegram is to be sent.
Use switch object of output 2 ?	YES NO	See switch object 1
Telegram when exceeding limited value	ON OFF	See switch object 1
Use switch object of output 3 ?	YES NO	See switch object 1
Telegram when exceeding limited value	ON OFF	See switch object 1
Use value object of brightness sensor ?	YES NO	See switch object 1
Telegram value	0 ... 255	Setting concerning what value (0 ... 255) is to be sent.

<b>Locking function</b>		
Use switch object of output 1 ?	YES NO	Setting concerning whether a telegram will still be sent to switch object 1 directly after setting the corresponding blocking bit.
Telegram at locking	ON OFF	Setting concerning what telegram will be sent one more time.
Use switch object of output 2 ?	YES NO	See switch object 1
Telegram at locking	ON OFF	See switch object 1
Use switch object of output 2 ?	YES NO	See switch object 1
Telegram at locking	ON OFF	See switch object 1
Use value object of brightness sensor ?	YES NO	See switch object 1
Telegram at locking	0 ... 255	Setting concerning what value (0 ... 255) is to be sent.



<b>Behaviour of transmission</b>		
Behaviour of transmission	<b>Cyclic</b> If limited value is exceeded or fallen under	The preset send response applies mutually for all objects (0 to 3).
Cycle time	2,5 min. <b>5 min</b> : 60 min.	Setting concerning cycle time with which the telegram is repeatedly sent to the bus.

### Application examples

#### **Example 1: 3 stage switching of a lighting system dependent on outside light**

A lighting system in a purpose build structure is to be switched in 3 stages depending on outside brightness.

#### **Requirements:**

- ⇒ The entire outside lighting should be switched off if the outside lighting has an intensity of more than 50 Lux. If the outside light value falls under the value of 50 Lux, the outside lighting will be switched on again.
- ⇒ The lighting in halls, staircases and lobby areas is to be switched off if there is an inside lighting intensity of more than 200 Lux. If the inside light falls under this value, the lights will be switched on again automatically.
- ⇒ All the remaining lights in the rooms with daylight are to be switched off when the lighting intensity inside exceeds 500 Lux.

#### **Implementation:**

A brightness sensor with the **application "Switching, 3 limited values"** is used to solve this task. The light trap is mounted in an eastern direction on an outside wall.<sup>1</sup>

The **"Daylight quotients"** are used to calculate what level of outside brightness is required to achieve the required lighting intensity at a reference point in the inside area. The daylight quotient is indicated as a percentage and shows the relationship between the inside lighting intensity  $E_{\text{inside}}$  and the outside lighting intensity  $E_{\text{outside}}$ .

The daylight quotient T is therefore calculated as follows.

$$T = E_{\text{inside}} / E_{\text{outside}}$$

The corresponding limited value value  $E_{\text{limited value}}$  for the parameter setting can be calculated using the required lighting intensity at the reference points in the inside area and a daylight quotient determined by a measurement

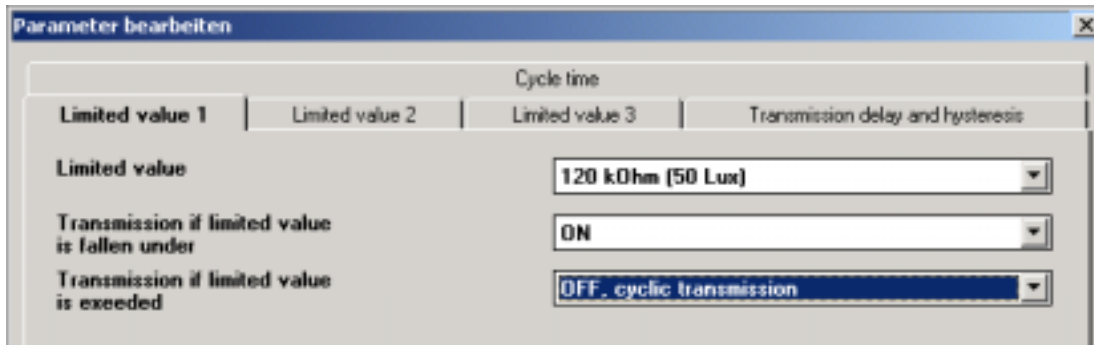
<b>Lighting system</b>	<b>Daylight quotient</b>	<b><math>E_{\text{Req'd}}</math></b>	<b><math>E_{\text{limited value}}</math></b>
Outside lighting	100 %	50 lx	50 lx
Inside lighting 1	10 %	200 lx	2000 lx
Inside lighting 2	10 %	500 lx	5000 lx

<sup>1</sup> A brightness sensor 3gang must be used for each direction in the sky if outside light-dependent lighting controls, depending on a certain sky direction, are to be used.

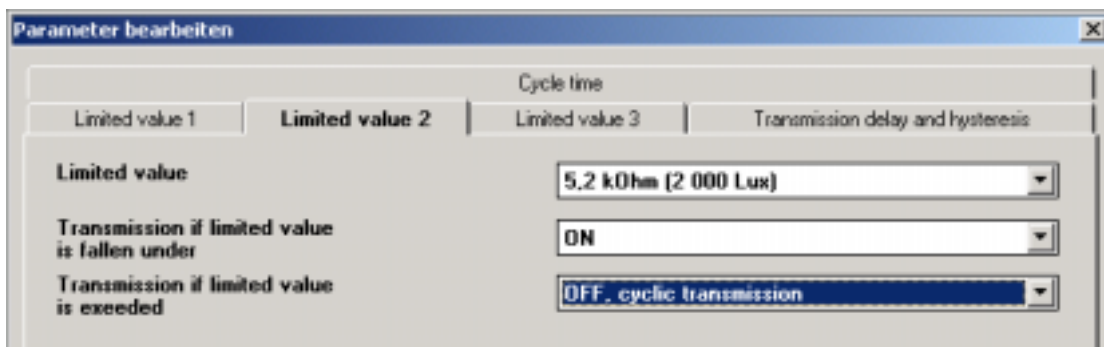
Configuration steps:

⇒ Add a brightness sensor into the works "Brightness sensor with 3 limited values".

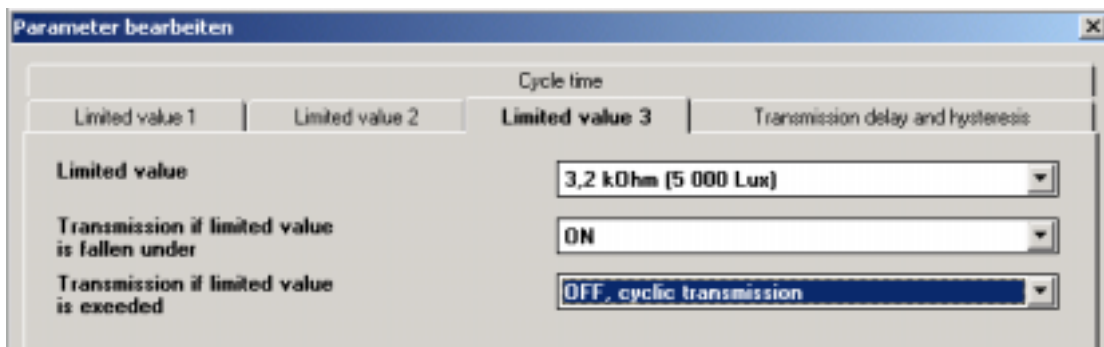
⇒ Set the following parameters for the application "**Switching, 3 limited values**":



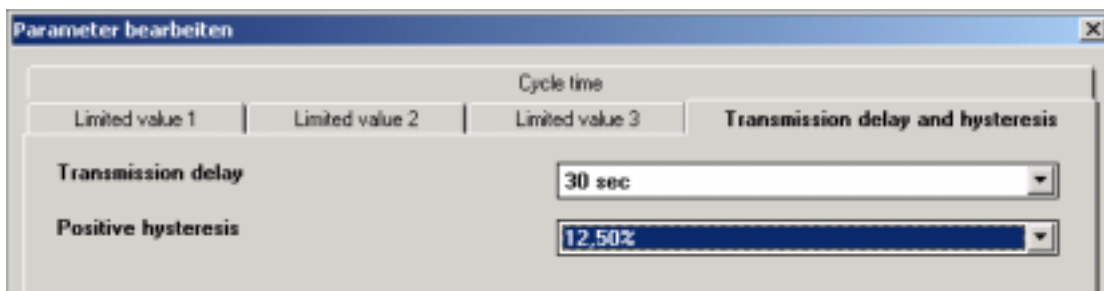
The screenshot shows the 'Parameter bearbeiten' dialog box with the 'Limited value 1' tab selected. The 'Cycle time' parameter is visible at the top. The 'Limited value' is set to '120 kOhm (50 Lux)'. The 'Transmission if limited value is fallen under' is set to 'ON'. The 'Transmission if limited value is exceeded' is set to 'OFF, cyclic transmission'.



The screenshot shows the 'Parameter bearbeiten' dialog box with the 'Limited value 2' tab selected. The 'Cycle time' parameter is visible at the top. The 'Limited value' is set to '5,2 kOhm (2 000 Lux)'. The 'Transmission if limited value is fallen under' is set to 'ON'. The 'Transmission if limited value is exceeded' is set to 'OFF, cyclic transmission'.



The screenshot shows the 'Parameter bearbeiten' dialog box with the 'Limited value 3' tab selected. The 'Cycle time' parameter is visible at the top. The 'Limited value' is set to '3,2 kOhm (5 000 Lux)'. The 'Transmission if limited value is fallen under' is set to 'ON'. The 'Transmission if limited value is exceeded' is set to 'OFF, cyclic transmission'.



The screenshot shows the 'Parameter bearbeiten' dialog box with the 'Transmission delay and hysteresis' tab selected. The 'Transmission delay' is set to '30 sec'. The 'Positive hysteresis' is set to '12,50%'.

Arrange suitable bus communication for the bus subscribers involved (Assign communications objects for the EIB-device group addresses).

***Expanding the tasks by the function “Time-controlled enabling of the brightness controls”***

**Requirement:**

The brightness sensor channels for the outside-dependent switching of the lighting system are to be activated or deactivated at a certain time.

The following timing controls are required:

<b>Time</b>	<b>Functionality of the brightness sensors' switching channels</b>
22:00	All brightness-dependent channels are blocked
05:00	Enable brightness-dependent switching of the outside lighting (Channel 1 activated, Channel 2 & Channel 3 blocked)
06:00	Enable brightness-dependent switching of the lighting in halls, staircases and lobby areas (Channel 1 & Channel 2 activated, Channel 3 blocked)
07:00	Enable brightness-dependent switching of all channels (Channel 1, Channel 2, Channel 3 activated)
17:00	Block brightness-dependent switching in the working areas with daylight (Channel 1 & Channel 2 activated, Channel 3 blocked)
20:00	Block brightness dependent switching of the lighting in the halls, staircases and lobby areas (Channel 1 activated, Channel 2 & Channel 3 blocked)
Vacation	All brightness-dependent channels are blocked

**Implementation:**

To achieve the task, a 3 of 4 channel weekly contact making clock, which writes one byte telegrams with various values to the brightness sensor's blocking object, depending on the switching states of its channels, is used. Every brightness dependent switching channel is enabled or blocked in this way.

The 3 or 4-channel make contact clock must fulfil the following function:

<b>Time</b>	<b>Status of clock channels</b>			<b>Value to be sent</b>	<b>Bit combination at blocking object</b>	<b>Functionality of the brightness sensor's switching channels</b>
	<b>C3</b>	<b>C2</b>	<b>C1</b>			
22:00	0	0	0	7	111	All brightness-dependent channels are blocked
05:00	0	0	1	6	110	Channel 1 activated, Channel 2 & Channel 3 blocked
06:00	0	1	1	4	100	Channel 1 & Channel 2 activated, Channel 3 blocked
07:00	1	1	1	0	000	All brightness-dependent channels are activated
17:00	0	1	1	4	100	Channel 1 & Channel 2 activated, Channel 3 blocked
20:00	0	0	1	6	110	Channel 1 activated, Channel 2 & Channel 3 blocked
Vacation	0	0	0	7	111	All brightness-dependent channels are blocked