LU 131 – EIB Combination Sensor for Brightness and Temperature

LU 131 – EIB
Order no. 131 9 200

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1 Function Properties

The LU 131 – EIB combination sensor is sensitive to brightness and temperature. These values can be sent to the bus.
In addition, the device is equipped with the following threshold switches for controlling switching actuators, dimming actuators and window shade system actuators depending on the ambient brightness and/or temperature.

- Threshold switch for brightness
- Threshold switch for temperature
- Threshold switch for shading (combination of brightness and temperature)

Via an inhibition object (1 bit), it is also possible to deactivate one or more threshold switches temporarily.

Areas of Application

The LU 131– EIB is suited for the following applications:

- Multistage lighting control
- Temperature control, e.g. for controlling electric band heaters for defrosting applications
- Awning control
- Winter garden control
- Greenhouse control
- Facilities in which brightness and outside temperature are to be visualized.

2 Technical Data

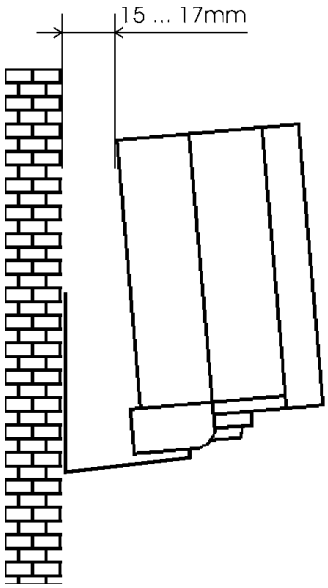
Voltage supply:	Via the bus voltage
Connections:	1 bus connection (via bus connecting terminal)
Measuring range:	
Brightness:	1 to 100,000 lx
Temperature:	– 25 to 55 °C
Angular coverage:	horizontal +/– 60° vertical – 35° to + 66.5°
Protection rating:	IP 54 in compliance with DIN EN 60 529
Permissible ambient temperature:	– 25 °C to + 55 °C
Housing dimensions:	110 x 72 x 54 mm (H/W/D)
Weight:	approx. 140 g

2.1 Installation

2.1.1 Connecting the EIB Installation Bus

2.1.2 Angular Coverage and the Position of the Sun

When installing the device at a location south of 47 degrees of latitude (e.g. Berne, Graz), you may obtain better results by slightly tilting the device upward because of the high position of the sun. For this purpose, when mounting the device, the retaining bracket must be bent until the space between the upper edge of the back panel and the mounting surface (house wall etc.) is in the range between 15 and 17 mm.



3 The "Sensor for Brightness and Temperature" Application Program

3.1 Function Properties

The application program provides the functions listed below.

Function	Description
Value of brightness	When selecting this function, the value of brightness can be sent cyclically and/or upon a change.
Value of temperature	When selecting this function, the value of temperature can be sent cyclically or upon a change.
Temperature thresholds	Using this function, the LU 131 – EIB can be used as a three-channel threshold switch with a setting range of from 1 to 100 000 lx (limited accuracy in the range of from 1 to 10 lx). Each threshold value can be set separately. The reaction of each channel if the value exceeds/falls below a threshold value can be set via parameters.
Automatic brightness control	With this function and the aid of a dimming actuator the LU 131 – EIB can permanently control the lighting on a predefined brightness level.
Temperature thresholds	Using this function, the LU 131 – EIB can be used as a two-channel threshold switch with a setting range of from – 15 to 50 °C. Each threshold value can be set separately. The reaction of each channel if the value exceeds/falls below a threshold value can be set via parameters.
Shading object	The LU 131 – EIB offers the possibility of controlling as many as two shading systems in dependence of light and temperature.

<u>Important:</u> After downloading the application or after the bus voltage has been restored, it takes approximately 1 minute until the device is ready for operation and starts sending telegrams on the bus again.

3.2 Selecting in the Product Database

Manufacturer:	THEBEN-WERK ZEITAUTOMATIK
Product family	Physical sensors
Product type:	Brightness and temperature
Product name:	Luna 131 EIB

Download the application from: http://www.theben.de

3.3 Communication Objects

3.3.1 Properties

No.	Object name	Function	Type	Reaction
0	Value of brightness	Send the current brightness value	2 bytes	Send
1	Value of temperature	Send the temperature value	2 bytes	Send
3	Brightness threshold 1	Send the switching/value/control telegram	1 bit/1 byte	Send
4	Brightness threshold 2	Send the switching/value telegram	1 bit/1 byte	Send
5	Brightness threshold 3	Send the switching/value telegram	1 bit/1 byte	Send
6	Temperature threshold 1	Send the switching/value telegram	1 bit/1 byte	Send
7	Temperature threshold 2	Send the switching/value telegram	1 bit/1 byte	Send
8	Shading 1	Send the switching/value telegram	1 bit/1 byte	Send
9	Shading 2	Send the switching/value telegram	1 bit/1 byte	Send
10	Inhibit	Receive the inhibition telegram	1 bit	Receive

Number of communication objects	10
Number of group addresses:	15
Number of associations:	15

3.3.2 Description

- **Object 0 "Value of brightness"**

  Depending on the parameters set, it sends the current value of brightness cyclically and/or upon a change of brightness.

- **Object 1 "Value of temperature"**

  Depending on the parameters set, it sends the current value of temperature cyclically and/or upon a change of temperature.

- **Objects "3, 4, 5 – Brightness thresholds 1, 2, 3"**
  Brightness thresholds 1, 2, 3:
  The parameterised telegram is sent if the value exceeds or falls below the set threshold value.

Important:
Threshold 1 (object 3) can also be parameterised as an **automatic brightness control**:
Dimming telegrams are sent until the brightness measured has reached the set nominal value.
Permanent light regulation is performed within the parameterised hysteresis.

- **Objects "6, 7 – Temperature thresholds 1, 2"**
  The parameterised telegram is sent if the value exceeds or falls below the set threshold value.

- **Objects "8, 9 – Shading 1, 2"**
  The parameterised telegram is sent if the shading condition is true or false.

- **Object "10 – Inhibit"**
  Via this 1-bit object the sending of each object can be disabled (inhibit bit = 1) or enabled (inhibit bit = 0). The parameters are set on the side of the object to be inhibited.

Caution!
When the inhibit bit is reset, each object that was previously inhibited immediately sends its current value.
In the case of a bus voltage failure, the inhibit object is set to the value of 0.

3.4 The Parameters

3.4.1 General

On the "general" tab you can define the basic properties of the application.
The parameters that can be set are listed in the table below.

Table 1-1: Parameters on the "General" tab

Designation	Values	Description
Number of brightness thresholds	1, 2, 3 brightness thresholds	Setting that defines how many of the three brightness thresholds are to be used.
Function of brightness threshold 1	brightness threshold, automatic brightness control	Setting that defines whether brightness threshold 1 is to be used as a threshold switch or as an automatic brightness control. IMPORTANT: If threshold 1 is used as an automatic brightness control, it can no longer be included in a shading condition!
Number of temperature thresholds	none, 1, 2 temperature thresholds	Setting that defines whether and how many temperature thresholds are to be used.
Number of shading objects	no shading 1, 2 shading objects	Setting that defines whether and how many shading objects are to be used.

3.4.2 Value of Brightness

The Lu 131 – EIB can send the measured topical value of brightness via the bus.

Table 1-2: Parameters on the "Value of brightness" tab

Designation	Values	Description
Send brightness value again at change of	5 %, 10 %, 20 %, 30 % min. 1 lx send only cyclically	Setting that defines by what percentage the measured new brightness value must deviate from the brightness value sent last to be sent again.
Send brightness value cyclically	every minute, every 3, 5, 10, 20, 30, 45, 60 minutes don't send cyclically	Setting of the cycle interval at which the brightness value is repeatedly sent via the bus. If "don't send cyclically" is selected, the brightness value is sent only in the case of a change, provided this option was selected. Otherwise a send operation is not performed.

3.4.3 Value of Temperature

The measured topical temperature value can also be sent via the bus.

Table 1-3: Parameters on the "Value of temperature" tab

Designation	Values	Description
Send temperature value again	at change of 1K, 2K, 3K send only cyclically	Setting that defines by what value the measured new temperature value must deviate from the temperature value sent last to be sent again.
Send value of temperature cyclically	every minute, every 3, 5, 10, 20, 30, 45, 60 minutes don't send cyclically	Setting of the cycle interval at which the temperature value is repeatedly sent via the bus. If "don't send cyclically" is selected, the temperature value is sent only in the case of changes, provided this option was selected. Otherwise a send operation is not performed.
Value for temperature adjustment in 0.1K (-128 … 127)	Inputs from – 128 to 127 Default = 0	Enables a correction of the temperature measured it this temperature deviates from the true temperature due to the position of the device. The correction is performed in steps of $1/10^{th}$ of a degree, i.e. from –12.8 to + 12.7 K Example: The value of 5 corresponds to a correction of $5/10^{th}$ of a degree. The value of 10 corresponds to 1 degree (i.e. $10/10^{th}$). In the latter case, the device will send the following value when it measures a temperature of 20 °C: 20 + 1 = 21 °C

3.4.4 Temperature Thresholds

The LU 131 – EIB has three brightness thresholds that can be parameterised individually.

Table 1-4: Parameters on the "Brightness threshold 1, Brightness threshold 2 and Brightness threshold 3" tabs

Designation	Values	Description
Threshold value	2, 3...10...100...100000 lx (in 84 increments)	Setting that defines the brightness value at which the switching threshold has been reached.
Hysteresis	10 %, 20 %, 30 %, 50 % min. 1 lx	The hysteresis prevents multiple switching if the brightness measured is within the set threshold. Example: see below
Delay at threshold overflow	undelayed, 2 sec, 5 sec, 10 sec, 15 sec, 20 sec, 30 sec, 45 sec, 60 sec, 90 sec 2 min, 3 min, 5 min, 10 min, 15 min, 30 min	Delay from the detection of a threshold overflow to the reaction to it. It serves for preventing incorrect switching caused by luminous reflectance or by transient shading. Recommendation: Lighting control from 2 to 60 s Shading device 5 to 30 min
Delay at threshold underflow	undelayed, 2 sec, 5 sec, 10 sec, 15 sec, 20 sec, 30 sec, 45 sec, 60 sec, 90 sec, 2 min, 3 min, 5 min, 10 min, 15 min, 30 min	Delay from the detection of a threshold underflow to the reaction to it. It serves for preventing incorrect switching caused by luminous reflectance or by transient shading. Recommendation: Lighting control from 2 to 60 s Shading device 5 to 30 min

Example of a hysteresis: Switch off the light in the case of a threshold overflow, switch on the light in the case of a threshold underflow.
If the threshold is set to 1,000 lx with a hysteresis of 10 %, the light is switched off at approx. 1,000 lx and switched on again at approx. 900 lx (= 1,000 lx – 10 %).

Important:
At low brightness values, the time needed for light measurement will increase.
At values below 20 Lux, this delay may rise up to approx. 1 minute.

3.4.5 Brightness Objects

Each brightness threshold is assigned a brightness object to be able to parameterise the switching behaviour.
The values that can be set for each brightness object are listed in the table below.

Table 1-5: Parameters on the "Brightness object 1, Brightness object 2 and Brightness object 3" tabs

Designation	Values	Description
Function of the threshold switch	switching send value	The type of telegram that is to be sent. Switch on/switch off telegram or value (0 to 255)
At threshold overflow reaction	send no telegram, send following telegram only once, send following telegram cyclically send no value, send following value only once, send following value cyclically*	Setting that defines whether and how often a telegram is to be sent in the case of a threshold overflow
Telegram	switch off, switch on	Setting that defines what is to be sent in the case of a threshold overflow
Value*	0 to 255	Input: The value that is to be sent in the case of a threshold overflow
At threshold underflow reaction	send no telegram, send following telegram only once, send following telegram cyclically send no value, send following value only once, send following value cyclically*	Setting that defines whether and how often a telegram is to be sent in the case of a threshold underflow
Telegram	switch off, switch on	Setting that defines what is to be sent in the case of a threshold underflow
Value*	0 to 255	Input: The value that is to be sent in the case of a threshold underflow
Send cyclically	every minute, every 3, 5, 10, 20, 30, 45, 60 minutes	Setting of the cycle interval at which the telegram is repeatedly sent via the bus.
Reaction at inhibition	inhibited, ignore	Defines whether the inhibit bit is to be taken into consideration, i.e. whether all send operations are to be inhibited when this bit is set or whether the inhibit bit is to have no effect.

* Only in the case of "Function of the threshold switch" = send value

3.4.6 Automatic Brightness Control

If brightness threshold 1 on the „General“ tab is parameterised to take on the function of an automatic brightness control, then the "Automatic brightness control" tab is displayed instead of "Brightness threshold 1" and "Brightness object 1".

Table 1-6: Parameters on the "Automatic brightness control" tab

Designation	Values	Description
Set point for brightness control in 10 lx	Input: 20 to 250	Input of the nominal value: Setting that defines the brightness value the device is to control. 20 corresponds to 200 lx and 250 corresponds to 2,500 lx
Hysteresis	10 %, 20 %, 30 %, 50 % min. 1 lx	Setting a hysteresis can prevent a repetition of the send operation if the brightness measured is within the range of the set nominal value Example: see below
Telegram restriction for automatic control	max. 2 telegrams/second max. 1 telegrams/second max. 1 telegram within 2 seconds	Setting that defines the permissible number of control telegrams per second during the control operation
Approaching the set point at big difference	slow medium fast	Setting of the spacing between two dimming telegrams in the case of a substantial deviation between the desired and the measured brightness value See below
Send cyclically	every minute, every 3, 5, 10, 20, 30, 45, 60 minutes	Setting of the cycle interval at which the telegram is repeatedly sent via the bus.
Reaction at inhibition	inhibited, ignore	Defines whether the inhibit bit is to be taken into consideration, i.e. whether all send operations are to be inhibited when this bit is set or whether the inhibit bit is to have no effect.

Example of a hysteresis: The brightness is to be controlled to a value of 1,000 lx.
If the threshold is set to 1,000 lx with a hysteresis of 10 %, the light is permanently kept at a value between approx. 1,000 lx and 1,100 lx (= 1000 lx + 10 %).

Approaching the set point:
The LU 131 – EIB sends absolute dimming telegrams for adjusting the brightness.
If only a minor deviation between the desired and the measured brightness value is detected, the dimming telegram is modified by 1 only. If a substantial deviation is detected, the dimming telegram is modified in larger steps. In this case, apart from the control deviation, the spacing also depends on the parameter "approaching the set point at big difference" (behaviour of the P-controller). Too fast an approach can cause a ballistic effect. A slow approach increases the control response time.

3.4.7 Temperature Thresholds

The LU 131 – EIB has two temperature thresholds that can be parameterised individually.

Table 1-7: Parameters on the "Temperature threshold 1, Temperature threshold 2" tabs

Designation	Values	Description
Threshold value in °C	Input of the switching threshold (setting range: – 15 to 50 °C)	Setting that defines the temperature at which the threshold responds
Hysteresis	1 K, 2 K, 3 K, 4 K	Setting a hysteresis can prevent a repetition of the switch operation if the temperature measured is within the range of the set threshold Example: see the next page
Function of the threshold switch	switching	The type of telegram that is to be sent. Switch on/switch off telegram or value (0 to 255)
	send value	
At threshold overflow reaction	send no telegram, send following telegram only once, send following telegram cyclically	Setting that defines whether and how often a telegram is to be sent in the case of a threshold overflow
	send no value, send following value only once, send following value cyclically*	
Telegram	switch off, switch on	Setting that defines what is to be sent in the case of a threshold overflow
Value*	0 to 255	Input: The value that is to be sent in the case of a threshold overflow
At threshold underflow reaction	send no telegram, send following telegram only once, send following telegram cyclically	Setting that defines whether and how often a telegram is to be sent in the case of a threshold underflow
	send no value, send following value only once, send following value cyclically*	
Telegram	switch off, switch on	Setting that defines what is to be sent in the case of a threshold underflow
Value*	0 to 255	Input: The value that is to be sent in the case of a threshold underflow

Table 1-7: continued

Designation	Values	Description
Send cyclically	every minute, every 3, 5, 10, 20, 30, 45, 60 minutes	Setting of the cycle interval at which the telegram is repeatedly sent via the bus
Reaction at inhibition	inhibited, ignore	Defines whether the inhibit bit is to be taken into consideration, i.e. whether all send operations are to be inhibited when this bit is set or whether the inhibit bit is to have no effect.

* Only in the case of "Function of the threshold switch" = send value

Example of a hysteresis: Switch off the heating in the case of a threshold overflow, switch the heating back on in the case of a threshold underflow.

If the threshold is set to 20 °C with a hysteresis of 1K (corresponds to 1 °C), the heating is switched off at 20 °C and switched back on at 19 °C (= 20 °C – 1 °C).

3.4.8 Shading

The LU 131 – EIB has two shading thresholds that can be parameterised individually. Each shading control consists of a shading condition and a shading object.

3.4.8.1 Shading Condition

A shading condition is a logical link between a brightness and a temperature threshold. The shading condition is true if the parameterized subconditions have been met.

Table 1-8: Parameters on the "Shading condition 1, Shading condition 2" tabs

Designation	Values	Description
If brightness	don't care higher than brightness threshold 1, 2, 3 lower than brightness threshold 1, 2, 3	The first shading subcondition At what value of brightness does the condition come true? IMPORTANT: If brightness threshold 1 is used as an automatic brightness control, it can no longer be included in a shading condition!
and if temperature	don't care higher than temperature threshold 1, 2, 3 lower than temperature threshold 1, 2, 3	second subcondition: At what temperature together with the defined brightness value does the condition come true?

Example:
An awning is used to shade a winter garden to keep the summer sun from increasing the temperature to an undesired level. In winter, however, heating by the sun is desired. In the case of a brightness above 30,000 lx and an outside temperature of 18 °C shading is to be performed.
The parameters are set as follows:

- Brightness threshold 1 = 30000 lx
- Temperature threshold 1 = 18°C

These values result in the following shading condition:

- If brightness higher than brightness threshold 1
- and if temperature higher than temperature threshold 1

Annotation:
It is also possible to parameterise the shading condition *solely* dependent on the brightness or the temperature. In this case, the irrelevant measurable variable is set to "*don't care*".

3.4.8.2 Shading Objects

The shading object is used to define what is to be sent in which way.

Table 1-9: Parameters on the "Shading object 1, Shading object 2" tabs

Designation	Values	Description
Function of shading object	switching	The type of telegram that is to be sent. Switch on/switch off telegram or value (0 to 255)
	send value	
If shading condition true reaction	send no telegram, send following telegram only once, send following telegram cyclically	Setting that defines whether and how often a telegram is to be sent if a shading condition is true
	send no value, send following value only once, send following value cyclically*	
Telegram	switch off, switch on	Setting that defines what is to be sent if the shading condition is true
Value*	0 to 255	Input: The value that is to be sent if the shading condition is true
If shading condition false reaction	send no telegram, send following telegram only once, send following telegram cyclically	Setting that defines whether and how often a telegram is to be sent if a shading condition is false
	send no value, send following value only once, send following value cyclically*	
Telegram	switch off, switch on	Setting that defines what is to be sent if the shading condition is false
Value*	0 to 255	Input: The value that is to be sent if the shading condition is false
Send cyclically	every minute, every 3, 5, 10, 20, 30, 45, 60 minutes	Setting of the cycle interval at which the telegram is repeatedly sent via the bus
Reaction at inhibition	inhibited, ignore	Defines whether the inhibit bit is to be taken into consideration, i.e. whether all send operations are to be inhibited when this bit is set or whether the inhibit bit is to have no effect.

* Only in the case of "Function of the threshold switch" = send value