Emergency lighting units
EM powerLED

Product description
• Emergency lighting LED Driver with self-test function
• For self-contained emergency lighting
• SELV for output voltage < 60 V DC
• Low profile casing (21 x 30 mm cross-section)
• 5 years guarantee (conditions at www.tridonic.com)

Properties
• Mains and emergency operation
• Self-test as per IEC 62034
• Constant current mode
• With either screw or clip fastening (clip-fix)
• 1, 2 or 3 h rated duration
• Selectable operating time (jumper)
• Output power limitation
• Two-colour status display LED
• „Rest mode“ function
• Simple set-up
• Automatic restart after LED replacement
• Electronic multi-level charge system
• Pulse current charging to optimize battery life
• SELV (outputs powerLED, battery, status LED, test switch)
• Polarity reversal protection for battery
• Deep discharge protection
• Very low energy consumption from the battery after activation of the deep discharge protection
• Short-circuit-proof battery connection
• Emergency lighting LEDs available

Self-test:
• Status of the battery
• Status of the LED
• Charge condition
• Function test
• Lifetime test

Batteries
• High-temperature cells: 2 Ah
• NiMH batteries
• Cs cells
• 4-year design life
• 1-year guarantee
• For battery compatibility refer to table „Battery selection“

For wiring diagrams and installation examples, page 5
Emergency lighting units
EM powerLED

Technical data
Rated supply voltage 220 – 240 V
Mains frequency 50 / 60 Hz
Forward voltage range LED module (1 x LED)\[^{\text{a}}\] 2.8 – 3.4 V
Forward voltage range LED module (2 x LED)\[^{\text{a}}\] 5.6 – 6.8 V
Max. open circuit voltage 10 V
Time to light 0.31 s from detection of emergency event
Overvoltage protection 320 V (for 1 h)
Battery discharge current See page 4
Max. casing temperature tc 70 °C
Mains voltage changeover threshold according to EN 60598-2-22
Type of protection IP20
Lifetime up to 50,000 h
Guarantee (conditions at www.tridonic.com) 5 years

Specific technical data

<table>
<thead>
<tr>
<th>Type[^{\text{a}}]</th>
<th>Rated duration</th>
<th>Typ λ (at 230 V, 50 Hz)[^{\text{a}}]</th>
<th>Typ output power</th>
<th>Non-maintained operation: Mains current</th>
<th>Non-maintained operation: Mains power</th>
<th>Maintained operation: Mains current</th>
<th>Maintained operation: Mains power</th>
</tr>
</thead>
<tbody>
<tr>
<td>EM powerLED 1 W ST</td>
<td>1 h</td>
<td>0.52c</td>
<td>1 W</td>
<td>16 mA</td>
<td>16 mA</td>
<td>13 mA</td>
<td>11 W</td>
</tr>
<tr>
<td>EM powerLED 1 W ST</td>
<td>2 h</td>
<td>0.52c</td>
<td>1 W</td>
<td>16 mA</td>
<td>16 mA</td>
<td>13 mA</td>
<td>11 W</td>
</tr>
<tr>
<td>EM powerLED 1 W ST</td>
<td>3 h</td>
<td>0.52c</td>
<td>1 W</td>
<td>16 mA</td>
<td>16 mA</td>
<td>13 mA</td>
<td>11 W</td>
</tr>
<tr>
<td>EM powerLED 2 W ST</td>
<td>1 h</td>
<td>0.55c</td>
<td>2 W</td>
<td>16 mA</td>
<td>16 mA</td>
<td>13 mA</td>
<td>12 W</td>
</tr>
<tr>
<td>EM powerLED 2 W ST</td>
<td>2 h</td>
<td>0.55c</td>
<td>2 W</td>
<td>16 mA</td>
<td>16 mA</td>
<td>13 mA</td>
<td>12 W</td>
</tr>
<tr>
<td>EM powerLED 2 W ST</td>
<td>3 h</td>
<td>0.55c</td>
<td>2 W</td>
<td>16 mA</td>
<td>16 mA</td>
<td>13 mA</td>
<td>12 W</td>
</tr>
</tbody>
</table>

\[^{\text{a}}\] Maintained operation
\[^{\text{a}}\] EM = Emergency
\[^{\text{a}}\] Tolerance range for electrical data ±10 %
**Test switch EM2**

**Product description**
- For connection to the emergency lighting unit
- For checking the device function

### Ordering data

<table>
<thead>
<tr>
<th>Type</th>
<th>Article number</th>
<th>Packaging bag</th>
<th>Packaging carton</th>
<th>Weight per pc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test switch EM 2</td>
<td>89805277</td>
<td>25 pc(s)</td>
<td>600 pc(s)</td>
<td>0.011 kg</td>
</tr>
</tbody>
</table>

**Status indication bi-colour LED**

**Product description**
- Two-colour status display LED
- Green: system OK, red: fault

### Ordering data

<table>
<thead>
<tr>
<th>Type</th>
<th>Article number</th>
<th>Packaging bag</th>
<th>Packaging carton</th>
<th>Weight per pc</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED EM bi-colour</td>
<td>89899720</td>
<td>25 pc(s)</td>
<td>200 pc(s)</td>
<td>0.017 kg</td>
</tr>
<tr>
<td>LED EM bi-colour, high brightness</td>
<td>89899753</td>
<td>25 pc(s)</td>
<td>800 pc(s)</td>
<td>0.013 kg</td>
</tr>
</tbody>
</table>
1. Standards

- EN 61347-2-7
- EN 61347-2-13
- EN 62384
- EN 55015
- EN 61000-3-2
- EN 61547
- EN 60068-2-64
- EN 60068-2-29
- EN 60068-2-30
- according to EN 50172
- according to EN 60598-2-22
- according to EN 62034

1.1 Glow-wire test

according to EN 61347-1 with increased temperature of 850 °C passed.

1.2 Insulation and electric strength testing of luminaires

Electronic devices can be damaged by high voltage. This has to be considered during the routine testing of the luminaires in production.

According to IEC 60598-1 Annex Q (informative only!) or ENEC 303-Annex A, each luminaire should be submitted to an insulation test with 500 Vdc for 1 second. This test voltage should be connected between the interconnected phase and neutral terminals and the earth terminal. The insulation resistance must be at least 2 MΩ.

As an alternative, IEC 60598-1 Annex Q describes a test of the electrical strength with 1,500 Vac (or 1414 x 1500 Vdc). To avoid damage to the electronic devices this test must not be conducted.

2. Thermal details and lifetime

2.1 Lifetime

Average lifetime 50,000 hours under rated conditions with a failure rate of less than 10%. Average failure rate of 0.2% per 1000 operating hours.

3. Installation / Wiring

3.1 Wiring diagrams

3.1.1 Serial wiring with one or two LED modules

Data sheet 05/22-EM018-31
Subject to change without notice. Information provided without guarantee.
3.1.2 Parallel wiring with multiple LED modules (3 – 12)

Take care that the LED is connected with the right polarity. LED that are connected to the EM powerLED devices should have a reverse polarity protection device such as a schottky diodes fitted, otherwise irreversible damage could occur if the LED is connected in reverse polarity. Any protection device must be capable of handling in excess of 700 mA.

Note: Please ensure that at the terminal of the EM powerLED module the battery negative is not connected to the negative of the LED load.

3.1.3 Manually tested emergency lighting with combined LED modules for general and emergency lighting

Due to the fact that independent circuits are used for general and emergency lighting it is important that the normal supply of the mains LED Driver is switched off together with the permanent emergency supply prior to checking the operation of the emergency LEDs. If this is not done then it may not be possible to see that the emergency LEDs are operating.

Use a circuit similar to that shown next.

* Use 230 V Test switch
3.1.4 Simple CORRIDOR FUNCTION with EM powerLED 1–2 W

With the mains operation function of the EM powerLED 1–2 W a simple corridor function can be realised.

An external presence detector switches the mains LED Driver.
The EM powerLED 1–2 W has the switched line SL connected to permanent mains supply.

On presence both mains LED Driver and EM powerLED 1–2 W are active and driving all LEDs. With no presence the mains LED Driver is switched off by the presence detector and the EM powerLED 1–2 W stays on operating the emergency LEDs at low power.

Use a circuit similar to that shown next.

![Circuit Diagram](image)

3.2 Wiring type and cross section

**Wiring**
- mains (SL, N, L)
- LED (LED +, LED –)
- batteries (Bat +, Bat –)
- test switch (switch)
- status indication LED (status K, A)

Use one wire for each terminal connector only.

3.3 Release of the wiring

Press down the ‘push button’ and remove the cable from front.

3.4 Wiring instructions

- The EM powerLED terminals, battery, indicator LED and test switch terminals are classified as SELV. Keep the wiring of the DALI and the input terminals separated from the wiring of the SELV terminals or consider special wiring (double insulation, 6 mm creepage and clearance) when these connections should be kept SELV.
- The output to the LED is DC but has high frequency content at 125 kHz, which should be considered for good EMC compliance.
- EM powerLED leads should be separated from the mains and DALI connections and wiring for good EMC performance.
- Maximum lead length on the EM powerLED terminals is 3 m. For a good EMC performance keep the LED wiring as short as possible.
- The secondary wires (LED module) should be routed in parallel to ensure good EMC performance.
- Maximum lead length for the test switch and Indicator LED connection is 1 m. The test switch and Indicator LED wiring should be separated from the EM powerLED leads to prevent noise coupling.
- Battery leads are specified with 0.5 mm² cross section and a length of < 1.3 m.
- DALI terminals are mains proof.
- Switched live and unswitched live supplies must be off the same phase.
- To avoid the damage of the control gear, the wiring must be protected against short circuits to earth (sharp edged metal parts, metal cable clips, louver, etc.).

3.5 Max. lead insulation diameter

- Battery 2.1 mm
- Test switch 2.1 mm
- Indicator LED 2.1 mm
3.6 Maximum lead length

- LED: 3 m
- Status indication LED: 1 m
- Batteries: 1 m

4. Mechanical details

Case manufactured from polycarbonate.

LED bi-colour status indicator
- Green / red
- Mounting hole 6.5 mm diameter, 1 – 1.6 mm thickness
- Lead length 1000 mm
- Insulation rating: 90 °C

Test switch
- Mounting hole 7.0 mm diameter
- Lead length 550 mm

Battery leads
- Quantity: 1 red and 1 black
- Length: 1 m
- Wire type: 0.5 mm² solid conductor
- Insulation rating: 90 °C

Battery end termination
Push on 4.8 mm receptacle to suit battery spade fitted with insulating cover

Module end termination
8.0 mm stripped insulation

Two-piece batteries are supplied with a 200 mm lead with 4.8 mm receptacles at each end and insulating covers to connect the separate sticks together.

4.1 Recommended fixing details for clip fixing

Max. torque at the clamping screw: 0.5 Nm / M4

5. Electrical values

5.1 Maximum loading of automatic circuit breakers

<table>
<thead>
<tr>
<th>Automatic circuit breaker type</th>
<th>B10</th>
<th>C10</th>
<th>B13</th>
<th>C13</th>
<th>B16</th>
<th>C16</th>
<th>B20</th>
<th>C20</th>
<th>l_in</th>
<th>time</th>
</tr>
</thead>
<tbody>
<tr>
<td>EM powerLED 1 W ST</td>
<td>90</td>
<td>180</td>
<td>130</td>
<td>260</td>
<td>130</td>
<td>260</td>
<td>130</td>
<td>260</td>
<td>10 A</td>
<td>120 μs</td>
</tr>
<tr>
<td>EM powerLED 2 W ST</td>
<td>90</td>
<td>180</td>
<td>130</td>
<td>260</td>
<td>130</td>
<td>260</td>
<td>130</td>
<td>260</td>
<td>10 A</td>
<td>120 μs</td>
</tr>
</tbody>
</table>
5.2 Insulation matrix

<table>
<thead>
<tr>
<th>Mains</th>
<th>Switched Live</th>
<th>Battery, LED, Test switch, Indicator LED</th>
<th>REST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switched Live</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Battery, LED, Test switch, Indicator LED</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REST</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Represents basic insulation
** Represents double or reinforced insulation

5.3 Typ. LED current

<table>
<thead>
<tr>
<th>EM powerLED 1-2 W ST, 1 / 2 / 3 h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
</tr>
<tr>
<td>Article no.</td>
</tr>
<tr>
<td>LED current in emergency operation</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>LED current in mains operation</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

6. Emergency output factor EOFi

<table>
<thead>
<tr>
<th>EM powerLED 1-2 W ST, 1 / 2 / 3 h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
</tr>
<tr>
<td>Article no.</td>
</tr>
<tr>
<td>Cells</td>
</tr>
<tr>
<td>LED current</td>
</tr>
<tr>
<td>LED load</td>
</tr>
<tr>
<td>350 mA</td>
</tr>
<tr>
<td>350 mA</td>
</tr>
<tr>
<td>600 mA</td>
</tr>
<tr>
<td>600 mA</td>
</tr>
<tr>
<td>600 mA</td>
</tr>
</tbody>
</table>

7. Functions

7.1 Duration link selection

<table>
<thead>
<tr>
<th>Duration</th>
<th>Link Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 hr</td>
<td>1 hr without jumper</td>
</tr>
<tr>
<td>2 hr</td>
<td>2 hr position A</td>
</tr>
<tr>
<td>3 hr</td>
<td>3 hr position B</td>
</tr>
</tbody>
</table>

7.2 Jumper selection

Module supplied with jumper in 3 hours position (position B).

The position of the link will only be read on first power up. If it is changed afterwards both the battery and mains supply must be disconnected for 10 seconds to enable the EM powerLED to read the new link position on reconnection of the battery and mains. It will lead to a false battery failure indication if the link is changed after installation without this reset.
7.3 Status indication

System status is indicated by a bi-colour LED.

<table>
<thead>
<tr>
<th>LED Indication</th>
<th>Status</th>
<th>Commentary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent green</td>
<td>System OK</td>
<td>AC mode</td>
</tr>
<tr>
<td>Fast flashing green (0.1s on – 0.1s off)</td>
<td>Function test underway</td>
<td></td>
</tr>
<tr>
<td>Slow flashing green (1s on – 1s off)</td>
<td>Duration test underway</td>
<td></td>
</tr>
<tr>
<td>Red LED on</td>
<td>Load failure</td>
<td>Open circuit / Short circuit / LED failure</td>
</tr>
<tr>
<td>Slow flashing red (1s on – 1s off)</td>
<td>Battery failure</td>
<td>Battery failed the duration test or function / Battery is defect / Incorrect battery voltage</td>
</tr>
<tr>
<td>Fast flashing red (0.1s on – 0.1s off)</td>
<td>Charging failure</td>
<td>Incorrect charging current</td>
</tr>
<tr>
<td>Double pulsing green</td>
<td>Rest mode</td>
<td>Switching into blocking mode via controller</td>
</tr>
<tr>
<td>Green and red off</td>
<td>DC mode</td>
<td>Battery operation (Emergency mode)</td>
</tr>
</tbody>
</table>

1 If the EM powerLED is operated in non-maintained mode and an LED fault is detected, the red indicator LED will be illuminated and the output will be stopped. The unswitched mains supply must be switched off before the LED is changed in order that the new LED can be detected. A function or duration test will not reset the fault indication.

7.4 Testing

Functional test

Functional tests are carried out for 5 seconds on a weekly basis under the control of the Micro controller. Initiation and timing of these tests is set during the commissioning of the luminaire.

Duration test

A full duration test is carried out yearly to check the capacity of the batteries.

For a full description of commissioning and test features please refer to application notes.

Commissioning

After installation of the luminaire and initial connection of the mains supply and battery supply to the EM powerLED ST the unit will commence charging the batteries for 20 hours (initial charge). Afterwards the module will conduct a commissioning test for the full duration. The 20 hours recharge occurs also if a new battery is connected or the module exits the rest mode condition.

The following automatic commissioning duration test is only performed when a battery is replaced and fully charged (after 20 hours). The easy commissioning feature will set the initial test day and time to ensure random testing of units.

Test switch

An optional test switch can be wired to each EM powerLED ST. This can be used to:
• initiate a 5 seconds function test press 200 ms < T < 1 s
• execute function test as long as switch pressed > 1 s press
• adjust local timing > 10 s press

Rest Mode / Inhibit Mode

Emergency operation is automatically started when the mains supply is switched off. If the Rest Mode is activated, the discharging of the battery will be minimized by switching off the LED output. If the Inhibit Mode has been activated before the mains supply is switched off, Rest Mode will be automatically activated if the mains supply is switched off within 15 minutes.

Rest Mode and Inhibit Mode can be initiated by applying a short pulse between 95 and 225 Vdc in amplitude for a period of 150 to 1,000 ms. This pulse shall be applied to terminals marked Rest. After a mains reset the EM powerLED ST exits the Rest Mode. Rest Mode and Inhibit Mode can both be disabled by applying a voltage pulse of 1,000 to 2,000 ms to the terminals marked as Rest to send the RE-LIGHT/RESET INHIBIT command.

7.5 Further technical data

The EM powerLED has a unique power regulation circuit; this is designed to limit the total power drawn from the battery in the event of using LED’s with a forward voltage (Vf) higher than 3.4 V.

In such cases the unit will reduce the LED current in order to maintain an acceptable drain current from the battery and hence meet the required duration time. This feature enables the EM powerLED to have minimum battery count for a given range of LED’s.

At a low charge state of the battery (<1.5 V at the 1W driver and <3 V at the 2W driver) the LED will not be driven in maintained mode via the switched line until the rated battery voltage levels are exceeded.
8. Battery data

8.1 Battery selection

<table>
<thead>
<tr>
<th>Technology and capacity</th>
<th>Design</th>
<th>Number of cells</th>
<th>Type</th>
<th>Article no.</th>
<th>Assignable batteries</th>
</tr>
</thead>
<tbody>
<tr>
<td>NiMH 2.2 Ah Cs cells</td>
<td>stick</td>
<td>1 x 2</td>
<td>Accu-NiMH 2A</td>
<td>28002087</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>stick</td>
<td>1 x 3</td>
<td>Accu-NiMH 3A</td>
<td>28002088</td>
<td></td>
</tr>
<tr>
<td></td>
<td>stick</td>
<td>1 x 4</td>
<td>Accu-NiMH 4A</td>
<td>28002089</td>
<td></td>
</tr>
<tr>
<td></td>
<td>stick</td>
<td>1 x 5</td>
<td>Accu-NiMH 5A</td>
<td>28002090</td>
<td></td>
</tr>
<tr>
<td></td>
<td>side by side</td>
<td>5 x 1</td>
<td>Accu-NiMH 5B</td>
<td>28002093</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>remote box</td>
<td>1 x 3</td>
<td>Pack-NiMH 2.2Ah 3 CON</td>
<td>28001898</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>remote box</td>
<td>1 x 4</td>
<td>Pack-NiMH 2.2Ah 4 CON</td>
<td>28001899</td>
<td>+</td>
</tr>
</tbody>
</table>

8.2 Battery charge / discharge data

<table>
<thead>
<tr>
<th>Type</th>
<th>EM powerLED 1 W ST</th>
<th>EM powerLED 2 W ST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article no.</td>
<td>89899860, 89899867</td>
<td>89899861, 89899868</td>
</tr>
<tr>
<td>Duration</td>
<td>1 h</td>
<td>1 h</td>
</tr>
<tr>
<td>Cells</td>
<td>2 cells</td>
<td>2 cells</td>
</tr>
</tbody>
</table>

Battery charge time
- Initial charge: 20 h
- Fast recharge: 12 h
- Trickle charge: continuously (pulse charge)

Charge current
- Fast recharge: 210 mA
- Trickle charge: 130 mA / 0 mA (4 min. / 16 min.)

Discharge current
- 1 x LED: 770 mA, 460 mA, 460 mA, 900 mA, 640 mA, 500 mA
- 2 x LED: –, –, –, 870 mA, 630 mA, 500 mA

Charge voltage range: 1.07 – 1.6 V per cell
Discharge voltage range: 16 – 107 V per cell

8.3 Accu-NiMH 2.2 Ah
- Battery voltage/cell: 1.2 V
- Cell type: Cs
- Case temperature range: +5 °C to +55 °C
- Max. short term battery case temperature (shorter than 1 month over the battery lifetime): 70 °C
- Max. number discharge cycles: 4 cycles per year plus 30 cycles during commissioning
- Max. storage time: 12 months

8.4 Accupack-NiMH 2.2 Ah
- Battery voltage/cell: 1.2 V
- Cell type: Cs
- Ambient temperature range: +5 °C to +35 °C
- Max. short term battery case temperature (shorter than 1 month over the battery lifetime): 70 °C
- Max. number discharge cycles: 4 cycles during commissioning
- Max. storage time: 12 months
8.5 Batteries

Connection method: 4.8 x 0.5 mm spade tag welded to end of cell

For stick packs this connection is accessible after the battery caps have been fitted.

To inhibit inverter operation disconnect the batteries by removing the connector from the battery spade tag.

For further information refer to corresponding battery datasheet.

8.6 Storage, installation and commissioning

Relevant information about storage conditions, installation and commissioning are provided in the battery datasheets.

9. Miscellaneous

9.1 Additional information

Additional technical information at www.tridonic.com → Technical Data

Lifetime declarations are informative and represent no warranty claim.
No warranty if device was opened.

9.2 Mains-connected transformers

The EM powerLED does not contain mains-connected windings of transformers.