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Technical application guide

LINEARlight Flex Diffuse (LFD)

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Please note:

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1 Product overview

1.1 General features

- Highly uniform flexible light
- Continuous light without shadows
- Excellent mechanical stability
- Extremely good optical stability over time, no yellowing effect
- Fine white binning (3 SDCM)
- Dimmable (PWM)
- Lifetime of up to 50000 h
- Flammability: glow wire test at 650 °C – EN 60598-1
- Mixed gas corrosion test – IEC 60068-2-60
- IP67 or IP66 protection with high-performance silicone¹⁾
 - Encapsulated electronics
 - UV-resistant
 - Salt-mist-proof
- Easy installation
 - Adhesive tape for easy mounting
 - Connectors and channel system available
- Scalable system
 - Cuttable to required length
 - 24 V system with matching OPTOTRONIC LED driver and light management system
- Top-emitting and side-emitting versions: TOP (T) and SIDE (S)

1.2 Application areas

LINEARlight Flex Diffuse (LFD) are suitable for various applications that require a nice-looking, uniform light line with no dots, e.g. indoor and outdoor decoration. Together with polished architectural materials, LFD can also be effectively used for cove or high-class furniture lighting, where the indirect light is reflected by the surfaces.

Applications at a glance:

- General and cove lighting
- Marine lighting, wall integration
- Path illumination, illuminated signs
- Spa lighting¹⁾
- Outdoor facade decoration

1.3 LINEARlight Flex Diffuse White

Light output: up to 490lm/m
 Luminous efficacy: up to 68lm/W
 LEDs/m: 140 invisible dots
 Available white tones: 2700K, 3000K, 4000K, 6500K



LINEARlight Flex Diffuse White
 Left: TOP (T) = top-emitting (LFDxxxT)
 Right: SIDE (S) = side-emitting (LFDxxxS)

1.4 LINEARlight Flex Diffuse Monochrome

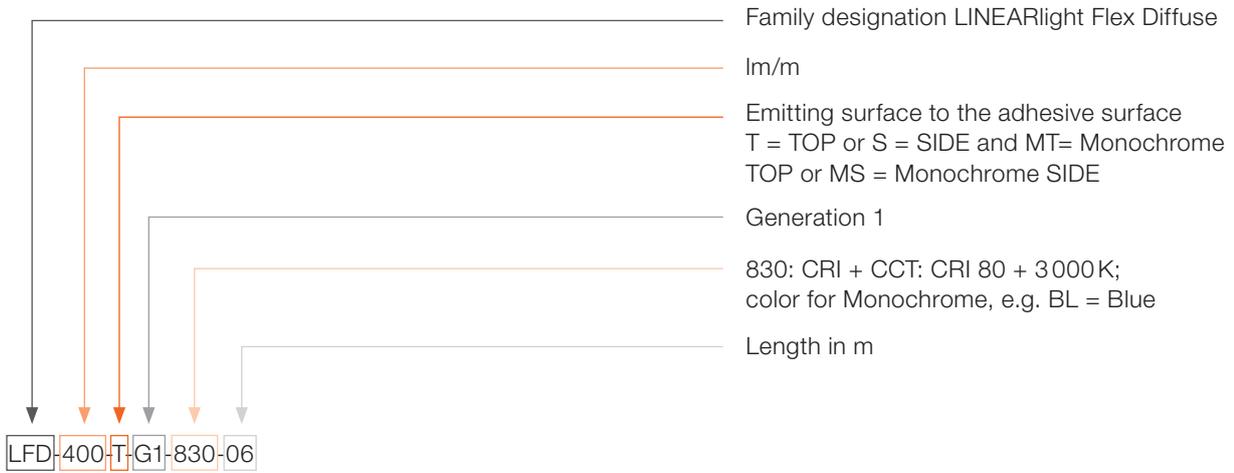
Light output: up to 320lm/m
 Luminous efficacy: up to 48lm/W
 LEDs/m: 150 invisible dots
 Available colors: blue, green, red, orange, yellow



LINEARlight Flex Diffuse Monochrome (LFDxxxMT, LFDxxxMS)

¹⁾ Please refer to the technical application guide “IP codes in accordance with IEC 60529”, which can be downloaded at www.osram.com/oem-downloads (see “General”).

1.5 Nomenclature



1.6 OPTOTRONIC LED drivers



OPTOTRONIC LED drivers

1.7 Flexessories



CONNECTsystem Diffuse

Diffuse Mounting System (mounting brackets)

2 Installation

2.1 Precautionary measures

Before installing LINEARlight Flex Diffuse, attention should always be paid to the following important issues:

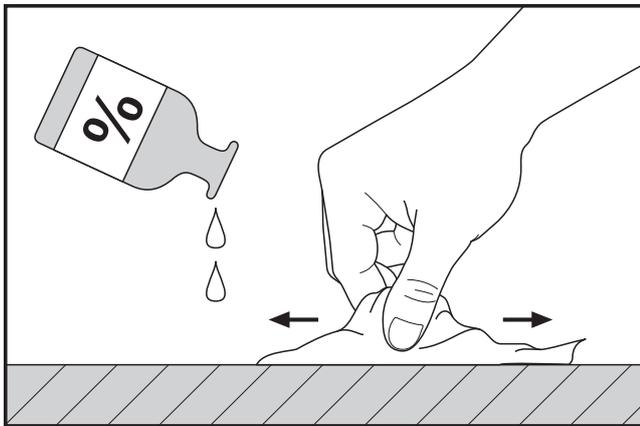
ESD

Be aware that the products can be damaged by electrostatic discharge (ESD). Earthing is a very effective measure to avoid damaging effects due to electrostatic discharge. Therefore, use a personal earthing system (ESD field kit) during mounting to prevent the build-up of static charge.



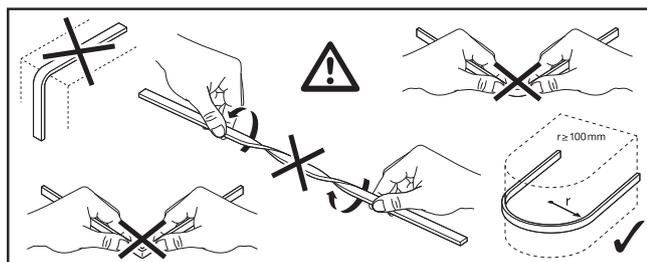
Cleaning

Depending on the surface, use a multi-purpose cleaner, such as isopropyl alcohol, to provide a clean and dry mounting surface, which is free of oils, silicone coatings and dirt particles.



Mechanical forces

Avoid mechanical forces on the connector and the LEDs; try to connect the connector as the last step of the installation. A relief on the cable is recommended. In addition, mechanical stress must not be applied to the LED strip itself (e.g. no twisting or bending in excess of the allowed radius).



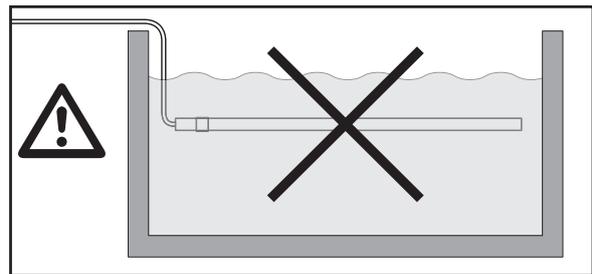
IP rating

The IP rating specifies the degree of protection against the intrusion of solid objects (including body parts such as hands and fingers), dust and water into electrical enclosures. While the first digit of the IP rating indicates the protection against foreign bodies, the second digit indicates the protection against water. The following IP ratings apply to LINEARlight Flex Diffuse LED strips:

IP67:

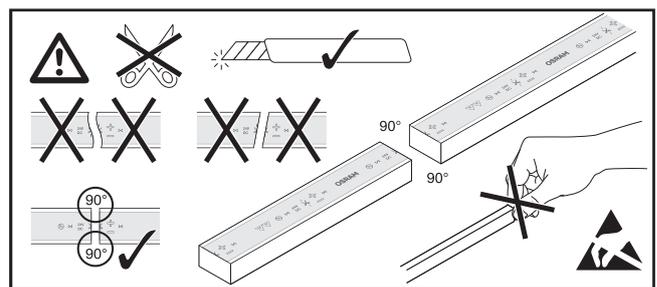
- [6] Full protection against contact and penetration of dust
- [7] Protection against ingress of water in case of temporary flooding

Note: Permanent submersion is not allowed.



Cutting

Ensure that the LED strips are cut properly at an angle of 90° before attaching the connector!



2.2 Connection with CONNECTsystem Diffuse

2.2.1 Connection of LINEARlight Flex Diffuse TOP

TOP

| | | |
|--|--|---|
| <p>LINEARlight Flex Diffuse TOP White</p> <p>[mm]</p> | <p>LINEARlight Flex Diffuse TOP Monochrome</p> <p>[mm]</p> | |
| <p>FX-DCS-G1-CM2PF-IP67-0500-X5 EAN 4052899451971</p> <p>5x</p> <p>[mm]</p> | <p>[mm]</p> | |
| <p>FX-DCS-G1-CM2PJ-IP67-0190-X5 EAN 4052899452039</p> <p>5x</p> <p>[mm]</p> | <p>[mm]</p> | |
| <p>FX-DCS-G1-ECT-KIT20 EAN 4052899452107</p> <p>20x</p> <p>1x</p> <p>5g</p> <p>[mm]</p> | <p>FX-DCS-G1-EHT-KIT20 EAN 4052899452176</p> <p>20x</p> <p>2x</p> <p>5g</p> <p>[mm]</p> | |
| <p>FX-DCS-G1-CM2PF-IP67-TOPKIT5 EAN 4052899451995</p> <p>10x</p> <p>5x</p> <p>1x</p> <p>5g</p> | <p>FX-DCS-G1-CM2PJ-IP67-TOPKIT5 EAN 4052899452053</p> <p>10x</p> <p>5x</p> <p>1x</p> <p>5g</p> | <p>FX-DCS-G1-GL-25 EAN 4052899452244</p> <p>1x</p> <p>25g</p> |

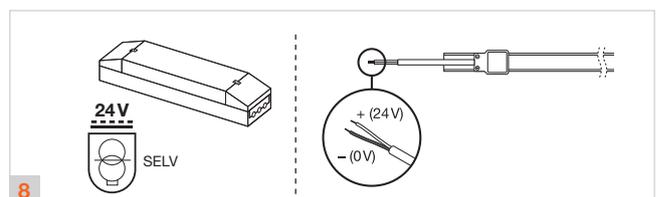
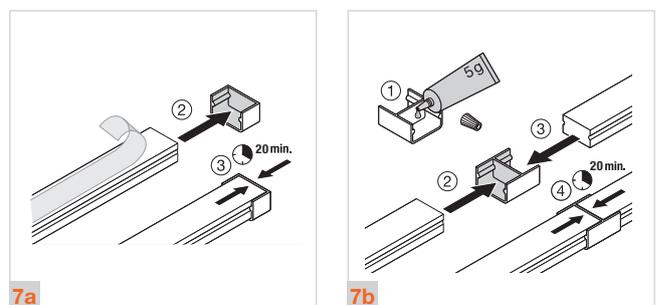
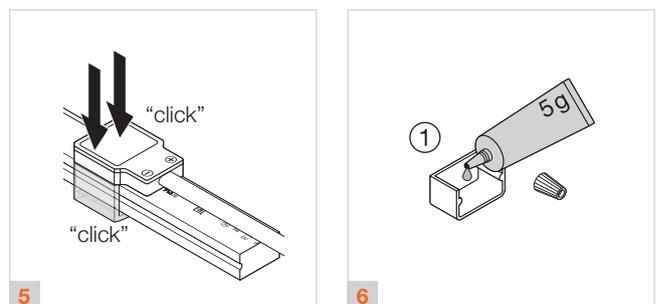
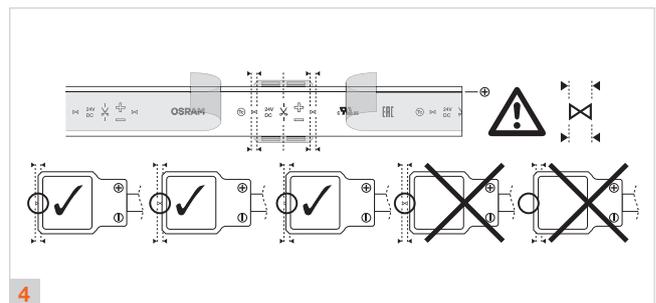
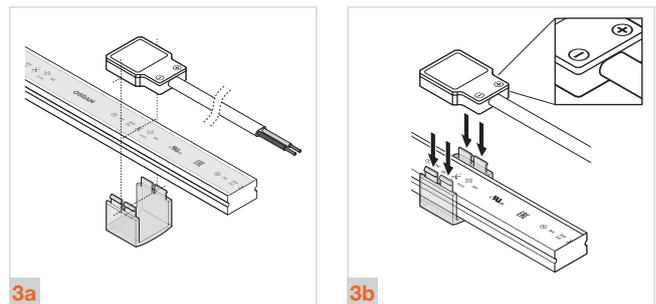
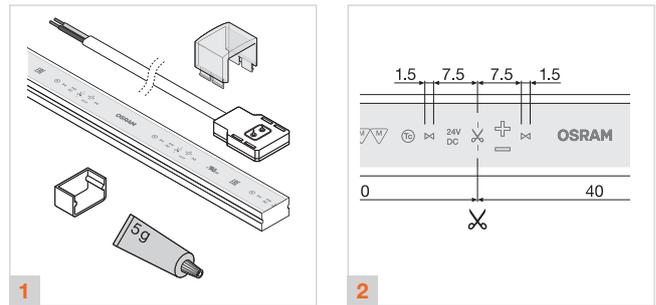
2.2.2 Connection of LINEARlight Flex Diffuse SIDE

| SIDE | | |
|---|---|---|
| <p>LINEARlight Flex Diffuse SIDE White</p> <p>[mm]</p> | <p>LINEARlight Flex Diffuse SIDE Monochrome</p> <p>[mm]</p> | |
| <p>FX-DCS-G1-CM2PF-IP67-0500-X5 EAN 4052899451971</p> <p>5x</p> <p>[mm]</p> | <p>[mm]</p> | |
| <p>FX-DCS-G1-CM2PJ-IP67-0190-X5 EAN 4052899452039</p> <p>5x</p> <p>[mm]</p> | <p>[mm]</p> | |
| <p>FX-DCS-G1-ECS-KIT20 EAN 4052899452121</p> <p>20x</p> <p>1x</p> <p>5g</p> <p>[mm]</p> | <p>FX-DCS-G1-EHS-KIT20 EAN 4052899452206</p> <p>20x</p> <p>2x</p> <p>5g</p> <p>[mm]</p> | |
| <p>FX-DCS-G1-CM2PF-IP67-SIDEKIT5 EAN 4052899452015</p> <p>10x</p> <p>5x</p> <p>1x</p> <p>5g</p> | <p>FX-DCS-G1-CM2PJ-IP67-SIDEKIT5 EAN 4052899452077</p> <p>10x</p> <p>5x</p> <p>1x</p> <p>5g</p> | <p>FX-DCS-G1-GL-25 EAN 4052899452244</p> <p>1x</p> <p>25g</p> |

2.2.3 Assembly

1. Components for assembly:
 - LINEARlight Flex Diffuse (LFD)
 - Connector (FX-DCS-G1-CM2PF-IP67-0500-X5)
 - End cap (FX-DCS-G1-ECT for TOP version, FX-DCS-G1-ECS for SIDE version)
2. Cut at the "scissors" mark.
- 3a. Apply the connector.
- 3b. Observe the correct polarity.
4. Ensure that the "hourglass" mark is still visible but not completely visible.
5. Gently press both sides down until you feel both sides close with a click.
6. After the LED strip has been cut, an end cap has to be applied with a dedicated silicone glue to ensure IP protection. For assembly, apply the glue on the exposed copper part of the end cap. The silicone glue has a maximum working time of 10 minutes.
- 7a. Remove the protection tape from the end of the LED strip. Fully insert the silicone part of the LED strip into the end cap. Wait 20 minutes after insertion.
- 7b. In case of a double-sided end cap, the process is the same for both parts of the LED strip.
8. Connect the LFD to the LED driver. Observe the correct polarity (red+/black-). Perform final operating test.

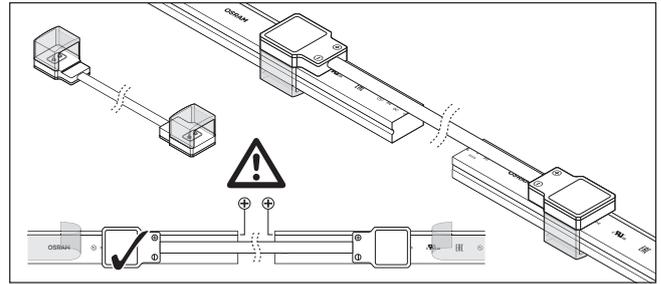
Note: When connecting two LINEARlight Flex Diffuse LED strips with the connector, ensure that the same polarities are always properly connected to each other.



2.2.4 Electrical connection with jumper

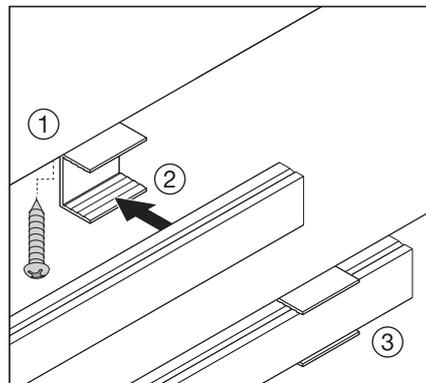
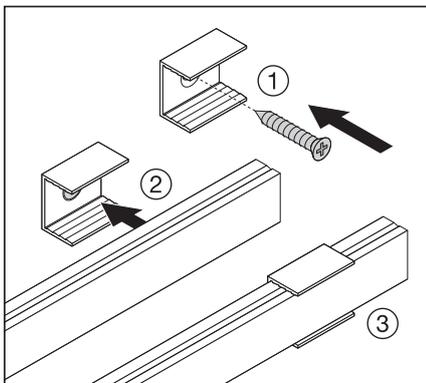
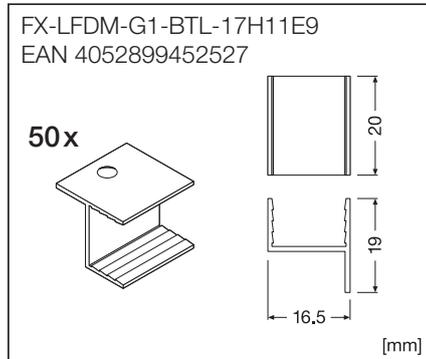
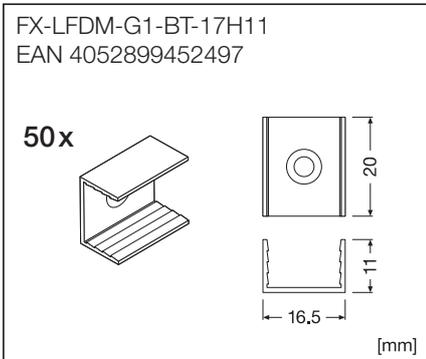
The jumper is an accessory necessary to create a bridge between two parts of the LED strip. Align the polarity on the cable of the jumper with the polarity of the LED strips. To connect the jumper, follow the instructions in chapter 2.2.3. After installation, ensure that the “hourglass” mark is still visible but not completely visible.

Note: When connecting multiple LFD strips in series, always consider the allowed power per single LED driver (see page 14).

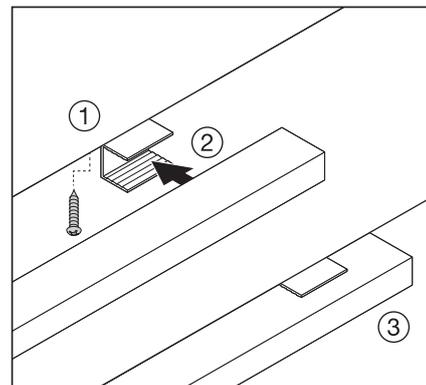
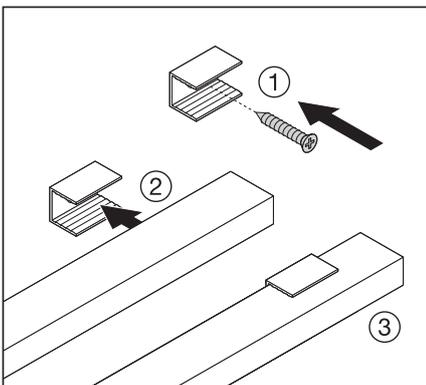
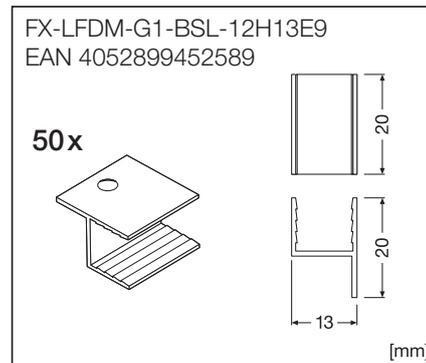
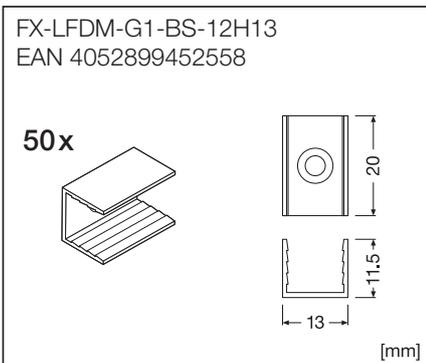


2.2.5 Installation with Diffuse Mounting System (mounting brackets)

LINEARlight Flex Diffuse TOP



LINEARlight Flex Diffuse SIDE



3 OPTOTRONIC LED drivers

3.1 General

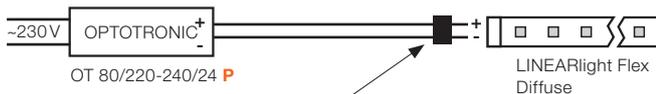
Several OPTOTRONIC LED drivers are not designed for un-protected use in outdoor applications and are rated as IP20 products (not protected against moisture). Exceptions are products marked with the additional letter E (“Exterior”) or P (“Protected”), which are designed for outdoor applications and are available with a higher IP rating. The IP rating of each product is also specified in the respective data-sheets.

OPTOTRONIC LED drivers with an IP rating of IP64 and IP65 are VDE-approved and protected against dust and splashing water (IP64) or water jets (IP65). For indoor applications with LINEARlight Flex Diffuse LED strips, every OPTOTRONIC with an output voltage of 24 V can be used. Attention should be paid to the length of the LED strip: Adjust the length to the output power of the applied OPTOTRONIC.



3.2 Standard connection

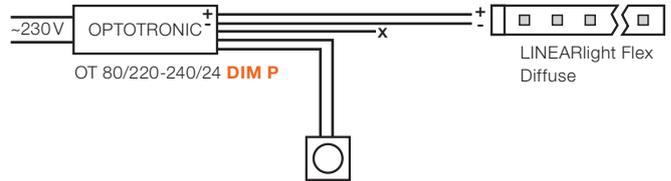
Use a multi-purpose cleaner, such as isopropyl alcohol, to provide a clean and dry mounting surface, which is free of oils, silicone coatings and dirt particles.



Apply a clamp with appropriate IP rating!

The electrical connection between the secondary side of the OPTOTRONIC LED driver and the LINEARlight Flex Diffuse LED strip must be IP-protected. Therefore, a clamp with appropriate IP rating has to be applied when indicated.

3.3 Dimming connection



1...10V interface (for connection to standard dimmers such as potentiometers) or digital signals, e.g. DALI, for dimming control

Notes:

- Ensure that unconnected wires are insulated properly
- Required type of potentiometer: 47 kΩ
- For further information, see the datasheets of the OPTOTRONIC LED drivers

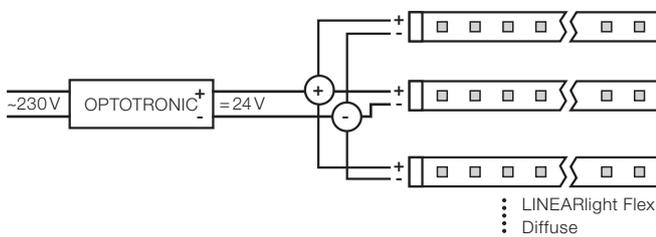
4 Important notes

4.1 Basic steps of system planning

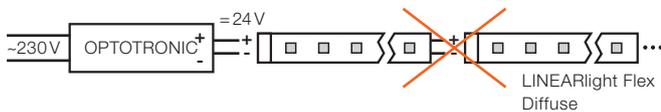
1. Select the suitable LINEARlight Flex Diffuse with regard to your application and its requirements (bending direction, light color, level of light output etc.).
2. Determine the required level of control for the application (dimming, control interface etc.).
3. Determine the length of the LINEARlight Flex Diffuse and the total wattage to be installed.
4. Consider all possible limitations of the setup: cable lengths, thermal load, mechanical forces, ambient conditions and all other factors that may occur in a certain application.

4.2 Parallel connection

If multiple LINEARlight Flex Diffuse are connected to one LED driver, they have to be connected in parallel. It is not allowed to connect complete units (total length) in series.



Parallel connection of LINEARlight Flex Diffuse LED strips

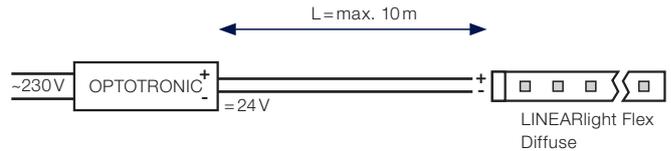


Not permitted:

Series connection of complete LINEARlight Flex Diffuse units.
 Length of single strip (or series operation) must not exceed maximum operable length (6 m; except for LFD400MT-G1-GR-03 and LFD-400MS-G1-GR-03: 4 m).

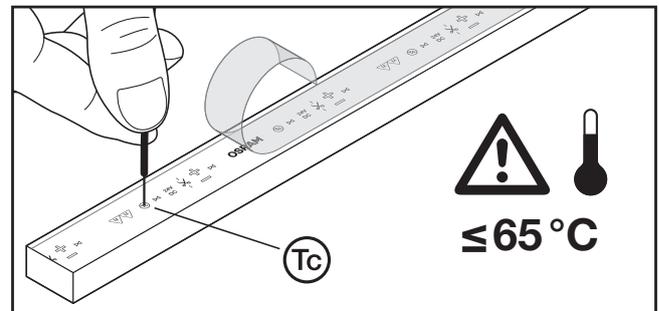
4.3 Cable length

The cable length L between the output side of the LED driver (secondary side) and the LINEARlight Flex Diffuse is limited by EMI and the voltage drop that occurs along the cables.



4.4 Temperature

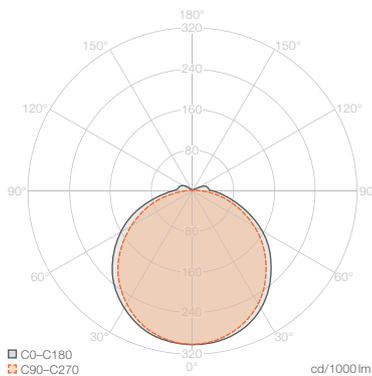
The maximum allowed temperature at the T_c point is 65 °C. In applications where the temperature rises above $T_c = 40$ °C, the adhesive tape loses its adhesive properties. Therefore, additional mounting aids may be required and are generally recommended.



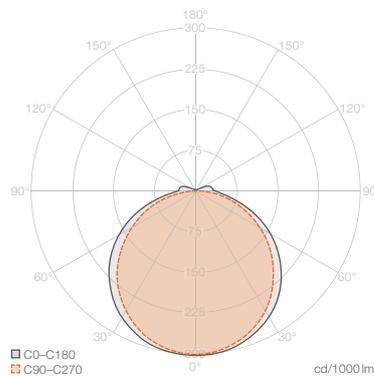
5 Technical data

LINEARlight Flex Diffuse – the new, integration-ready diffused light

| Product reference | Product number (EAN) | COLOR | K | λ | V | W METER | lm METER | lm/W | METER | L [mm] | I min. [mm] | w [mm] | h [mm] | Icons * |
|---|----------------------|--------|---------|-----------|------|------------|-------------|------|-------|-----------|----------------|-----------|-----------|---------|
| LINEARlight Flex Diffuse TOP (LFD400T, LFD400MT) | | | | | | | | | | | | | | |
| LFD400T-G1-827-06 | 4052899953512 | White | 2700 K | 24 | 7.2 | 490 | 68 | 60 | 6000 | 50 | 14.1 | 10 | A+ | |
| LFD400T-G1-830-06 | 4052899953529 | White | 3000 K | 24 | 7.2 | 490 | 68 | 60 | 6000 | 50 | 14.1 | 10 | A+ | |
| LFD400T-G1-840-06 | 4052899953536 | White | 4000 K | 24 | 7.2 | 480 | 67 | 60 | 6000 | 50 | 14.1 | 10 | A+ | |
| LFD400T-G1-865-06 | 4052899953543 | White | 6500 K | 24 | 7.2 | 460 | 64 | 60 | 6000 | 50 | 14.1 | 10 | A+ | |
| LFD400MT-G1-BL-06 | 4052899953550 | Blue | 457-467 | 24 | 12.0 | 60 | 5 | 60 | 6000 | 40 | 14.1 | 10 | - | |
| LFD400MT-G1-GR-06 | 4052899953567 | Green | 525-539 | 24 | 12.0 | 285 | 24 | 60 | 6000 | 40 | 14.1 | 10 | - | |
| LFD400MT-G1-GR-03 | 4052899450851 | Green | 525-539 | 24 | 12.0 | 285 | 24 | 30 | 3000 | 40 | 14.1 | 10 | - | |
| LFD400MT-G1-RE-06 | 4052899953574 | Red | 612-626 | 24 | 12.0 | 320 | 27 | 60 | 6000 | 40 | 14.1 | 10 | - | |
| LFD400MT-G1-YE-06 | 4052899953581 | Yellow | 586-594 | 24 | 12.0 | 162 | 14 | 60 | 6000 | 40 | 14.1 | 10 | - | |
| LFD400MT-G1-OR-06 | 4052899953598 | Orange | 603-611 | 24 | 12.0 | 175 | 15 | 60 | 6000 | 40 | 14.1 | 10 | - | |

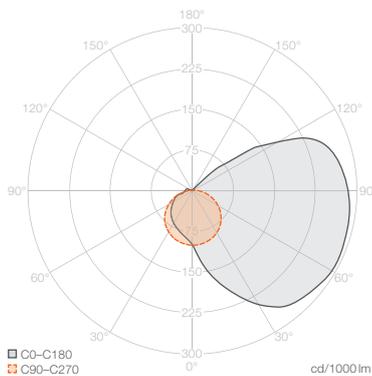


Light distribution curve White TOP

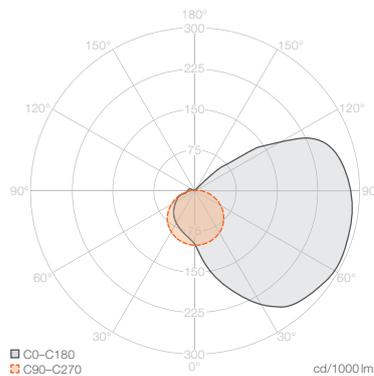


Light distribution curve Monochrome TOP

| | | | | | | | | | | | | | | |
|--|---------------|--------|---------|----|------|-----|----|----|------|----|----|------|----|--|
| LINEARlight Flex Diffuse SIDE (LFD400S, LFD400MS) | | | | | | | | | | | | | | |
| LFD400S-G1-827-06 | 4052899953611 | White | 2700 K | 24 | 7.2 | 410 | 57 | 60 | 6000 | 50 | 10 | 14.1 | A+ | |
| LFD400S-G1-830-06 | 4052899953628 | White | 3000 K | 24 | 7.2 | 410 | 57 | 60 | 6000 | 50 | 10 | 14.1 | A+ | |
| LFD400S-G1-840-06 | 4052899953635 | White | 4000 K | 24 | 7.2 | 410 | 57 | 60 | 6000 | 50 | 10 | 14.1 | A+ | |
| LFD400S-G1-865-06 | 4052899953642 | White | 6500 K | 24 | 7.2 | 350 | 52 | 60 | 6000 | 50 | 10 | 14.1 | A | |
| LFD400MS-G1-BL-06 | 4052899953659 | Blue | 457-467 | 24 | 12.0 | 55 | 5 | 60 | 6000 | 40 | 10 | 14.1 | - | |
| LFD400MS-G1-GR-06 | 4052899953666 | Green | 525-539 | 24 | 12.0 | 260 | 22 | 60 | 6000 | 40 | 10 | 14.1 | - | |
| LFD400MS-G1-GR-03 | 4052899450882 | Green | 525-539 | 24 | 12.0 | 260 | 22 | 30 | 3000 | 40 | 10 | 14.1 | - | |
| LFD400MS-G1-RE-06 | 4052899953673 | Red | 612-626 | 24 | 12.0 | 240 | 20 | 60 | 6000 | 40 | 10 | 14.1 | - | |
| LFD400MS-G1-YE-06 | 4052899953680 | Yellow | 586-594 | 24 | 12.0 | 150 | 13 | 60 | 6000 | 40 | 10 | 14.1 | - | |
| LFD400MS-G1-OR-06 | 4052899953697 | Orange | 603-611 | 24 | 12.0 | 160 | 13 | 60 | 6000 | 40 | 10 | 14.1 | - | |



Light distribution curve White SIDE



Light distribution curve Monochrome SIDE

*Based on measurements of a 500 mm long LED strip.

LED drivers

| Recommended LED driver | Product number (EAN) | Inter-face for dimming | IP | LINEARlight Flex Diffuse | | | |
|--|----------------------|------------------------|------|--|----------------------------|-------------------------------|----------------------------|
| | | | | Maximum lengths for the connection to one LED driver | | | |
| | | | | T _{ambient} = 25 °C | | T _{ambient} = -20 °C | |
| | | | | LFD400T/S 827/830/840/865 | LFD400MT/MS YE/OR/RE/BL/GR | LFD400T/S 827/830/840/865 | LFD400MT/MS YE/OR/RE/BL/GR |
| Maximum length: up to ... meters | | | | | | | |
| OPTOTRONIC OT 6/200-240/24 CE | 4008321113269 | | IP65 | 0.8 | 0.5 | 0.65 | 0.44 |
| OPTOTRONIC OT 8/200-240/24 | 4008321040169 | | IP20 | 1.1 | 0.7 | 0.9 | 0.8 |
| OPTOTRONIC OT 20/220-240/24 | 4050300618111 | | IP20 | 2.8 | 1.7 | 2.25 | 1.56 |
| OPTOTRONIC OT 30/220-240/24 P | 4052899043497 | | IP66 | 4.2 | 2.5 | 3.3 | 2.28 |
| OPTOTRONIC OT 50/220-240/24 | 4052899905566 | | IP20 | 6.9 | 4.2 | 5.65 | 3.92 |
| OPTOTRONIC OT 50/220...240/24 P | 4052899043510 | | IP66 | 6.9 | 4.2 | 5.65 | 3.92 |
| OPTOTRONIC OT 75/220-240/24 | 4050300817477 | | IP20 | 10.4 | 6.3 | 8.45 | 5.88 |
| OPTOTRONIC OT 75/220-240/24 E | 4008321362476 | | IP64 | 10.4 | 6.3 | 8.75 | 6.08 |
| OPTOTRONIC OT 80/220-240/24 P | 4008321981684 | | IP67 | 11.1 | 6.7 | 9.05 | 6.28 |
| OPTOTRONIC OT 120/220-240/24 P | 4008321981707 | | IP67 | 16.7 | 10.0 | 13.55 | 9.44 |
| OPTOTRONIC OT 240/220-240/24 P | 4008321981721 | | IP67 | 33.3 | 20.0 | 27.15 | 18.88 |
| OPTOTRONIC OT EASY 80 | 4008321808363 | EASY | IP20 | 11.1 | 6.7 | 9.05 | 6.28 |
| OPTOTRONIC OTi DALI 75/220-240/24 1-4 CH | 4008321371560 | DALI | IP20 | 10.4 | 6.3 | 8.45 | 5.88 |
| OPTOTRONIC OTi DALI 50/220-240/24 TW | 4052899490772 | DALI | IP20 | 6.9 | 4.2 | 5.6 | 3.92 |
| OPTOTRONIC OTi DALI 80/220-240/24 TW | 4052899490758 | DALI | IP20 | 11.1 | 6.7 | 9.05 | 6.28 |
| OPTOTRONIC OT 80/220-240/24 DIM P | 4008321981677 | 1-10 V | IP67 | 11.1 | 6.7 | 9.05 | 6.28 |
| OPTOTRONIC OT 120/220-240/24 DIM P | 4008321981691 | 1-10 V | IP67 | 16.7 | 10.0 | 13.55 | 9.44 |
| OPTOTRONIC OT 240/220-240/24 DIM P | 4008321981714 | 1-10 V | IP67 | 33.3 | 20.0 | 27.15 | 18.88 |
| OPTOTRONIC OTe 120/220...240/24 E | 4008321645715 | | IP64 | 16.7 | 10.0 | 13.55 | 9.44 |
| ELEMENT 30/220...240/24 | 4052899463776 | | IP20 | 4.2 | 2.5 | 3.35 | 2.36 |
| ELEMENT 60/220...240/24 | 4052899463790 | | IP20 | 8.3 | 5.0 | 6.75 | 4.72 |
| ELEMENT 90/220...240/24 | 4052899463813 | | IP20 | 12.5 | 7.5 | 10.15 | 7.08 |

Maximum length of LED strip must be 6 m (4 m for monochrome GR).

6 Flexessories

To support the installation of Flex LED strips, a whole range of Flexessories – dedicated accessories for Flex LED strips – are available. Our new extended range of Flexessories facilitates a quick and easy installation.

CONNECTsystem Diffuse for LINEARlight Flex Diffuse TOP

| | | |
|------------------------------|---------------------------------|---------------|
| FX-DCS-G1-CM2PF-IP67-0500-X5 | Middle power feeder | 4052899451971 |
| FX-DCS-G1-CM2PJ-IP67-0190-X5 | Strip-to-strip middle jumper | 4052899452039 |
| FX-DCS-G1-CM2PF-IP67-TOPKIT5 | Feeder kit with end caps & glue | 4052899451995 |
| FX-DCS-G1-CM2PJ-IP67-TOPKIT5 | Jumper kit with end caps & glue | 4052899452053 |
| FX-DCS-G1-ECT-KIT20 | End caps & glue | 4052899452107 |
| FX-DCS-G1-EHT-KIT20 | Double-sided end caps & glue | 4052899452176 |
| FX-DCS-G1-GL-25 | Silicone glue 25 g | 4052899452244 |

CONNECTsystem Diffuse for LINEARlight Flex Diffuse SIDE

| | | |
|-------------------------------|---------------------------------|---------------|
| FX-DCS-G1-CM2PF-IP67-0500-X5 | Middle power feeder | 4052899451971 |
| FX-DCS-G1-CM2PJ-IP67-0190-X5 | Strip-to-strip middle jumper | 4052899452039 |
| FX-DCS-G1-CM2PF-IP67-SIDEKIT5 | Feeder kit with end caps & glue | 4052899452015 |
| FX-DCS-G1-CM2PJ-IP67-SIDEKIT5 | Jumper kit with end caps & glue | 4052899452077 |
| FX-DCS-G1-ECS-KIT20 | End caps & glue | 4052899452121 |
| FX-DCS-G1-EHS-KIT20 | Double-sided end caps & glue | 4052899452206 |
| FX-DCS-G1-GL-25 | Silicone glue 25 g | 4052899452244 |

Diffuse Mounting System

| | | |
|------------------------|---------------------------------------|---------------|
| FX-LFDM-G1-BT-17H11 | Mounting bracket | 4052899452480 |
| FX-LFDM-G1-BTL-17H11E9 | Mounting bracket with additional wing | 4052899452510 |
| FX-LFDM-G1-BS-12H13 | Mounting bracket | 4052899452541 |
| FX-LFDM-G1-BSL-12H13E9 | Mounting bracket with additional wing | 4052899452572 |

Disclaimer

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Symbols

| | | | |
|---|--------------------------------|--|------------------------|
|  K | Color temperature in K |  lm/W | Luminous efficacy |
|  V | Voltage in V |  | No. of LEDs per meter |
|  COLOR | Color |  | Length l in mm |
|  λ | Wavelength |  | Minimal length l in mm |
|  W METER | Nominal wattage per meter in W |  | Width w in mm |
|  lm METER | Luminous flux per meter |  | Height h in mm |
|  | Energy efficiency class | | |

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