SCHUCH - Technical Supplement

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The technical appendix provides information and notes that are important for the planning, installation and operation of lighting systems with SCHUCH Light Fittings.

1. Explosion-Protected lighting

1.1 Introduction

Luminaires may only be brought into areas with explosive atmospheres if they do not constitute a source of ignition for these explosive atmospheres. An explosion is defined as an oxidation or decomposition reaction that takes place at a high reaction rate and produces an increase in temperature or pressure or both at the same time. It involves reactions of flammable gases, mists and vapours or dusts and combustible flyings with the oxygen in the air.

Possible hazardous areas are, for example, in chemical factories, refineries, paint factories, paint shops, cleaning plants, mills and storage facilities for ground products, tank and loading facilities for flammable gases, liquids and solids.

1.2 Legal basis

Electrical installations and equipment in potentially explosive atmospheres are subject to special directives and regulations.

1.2.1 Directive 94/9/EC - 2014/34/EU

For the CENELEC (European Committee for Electrotechnical Standardization) area, Directive 94/9/EC (commonly referred to as ATEX 95, formerly ATEX 100a) of the European Parliament and Council of 23 March 1994 is of fundamental importance. ATEX means: Atmosphères Explosibles, i.e. explosive atmospheres.

The directive is primarily addressed to the manufacturers of explosion-protected equipment.

The harmonised standards of the EN 60079 ff series describe the different types of protection. Conformity with the requirements of the Directive is demonstrated for electrical equipment in categories 1 and 2 by the EU type examination certificate. For category 3 equipment, the manufacturer declares conformity with the requirements of the Directive on his own responsibility and issues an EU declaration of conformity or, for components, an attestation of conformity. The EU type examination certificate can be issued by a German authority, e.g. the Physikalisch Technische Bundesanstalt in Braunschweig (PTB, Notified Body No. 0102) as well as by another Notified Body.

On 29 March 2014, the new version of the ATEX Directive 2014/34/EU was published in the Official Journal of the European Union. The new directive has been in force since 20 April 2016. There are no fundamental improvements for manufacturers and designers. Mainly adaptations to the New Legislative Framework (NLF) are made. Old certificates according to Directive 94/9/EC remain valid.

1.2.2 EC Directive 1999/92/EC

EC Directive 1999/92/EC is generally known as ATEX 137 (formerly ATEX 118a) and is aimed primarily at the operators of installations with potentially explosive atmospheres. In Germany it was transposed into national law on 27 September 2002 as the „Ordinance on the Simplification of Legislation in the Field of Safety and Health Protection in the Provision of Work Equipment and its Use at Work, Safety in the Operation of Installations Requiring Monitoring and the Organisation of Occupational Health and Safety" (Betriebssicherheitsverordnung - Betr.SichV, 27 Sept. 2002 BGBl, I p.2777).

1.3 Technical principles

An explosive atmosphere is a mixture of air and flammable gases, vapours, mists or dusts and combustible flyings under atmospheric conditions in which, after ignition has occurred, the combustion process is transferred to the entire unburned mixture. In a potentially explosive atmosphere, the atmosphere may become explosive due to local and operational conditions.

In EU Directive 2014/34/EU, electrical equipment for potentially explosive atmospheres is divided into groups, categories and temperature classes. This is necessary because the same requirements do not have to be placed on the equipment for every application and for every hazard level, which would also not make economic sense.

Electrical equipment for installations in potentially explosive atmospheres is generally designed for an ambient temperature range of -20 °C to +40 °C, unless an additional temperature specification extends or restricts this.

1.3.1 Equipment groups

A distinction is made between two equipment groups:

Equipment group I applies to equipment for use in underground operations of mines and their surface installations which may be endangered by firedamp and/or combustible dust.

Equipment group II applies to equipment for use in other areas which may be endangered by an explosive atmosphere.

1.3.2 Zone classification (according to Directive 1999/92/EC)

Potentially explosive atmospheres are classified into the following zones according to the likelihood of explosive atmospheres occurring:

Gases, vapours or mists

Zone 0 An area in which an explosive atmosphere is present either **continuously** or over **long periods** of time or **frequently** as a mixture of air and combustible gases, vapours or mists.

Zone 1 An area where under normal operating conditions an explosive atmosphere may **occasionally** be present as a mixture of air and combustible gases, vapours or mists.

Zone 2 An area where an explosive atmosphere is not likely to be present under normal operation but if it should occur for some reason it would normally only exist for a **short period** as a mixture of air and combustible gases, vapours or mists.

Dusts

Zone 20 An area in which an explosive atmosphere is present either **continuously** or over **long periods or frequently** as a cloud of combustible **dust** in the air.

Zone 21 An area where under normal operating conditions an explosive atmosphere may **occasionally** be present as a cloud of combustible dust in the air.

Zone 22 An area where an explosive atmosphere is not likely to be present under normal operation but if it should occur for some reason it would normally only exist for a **short period** as a cloud of combustible dust in the air.

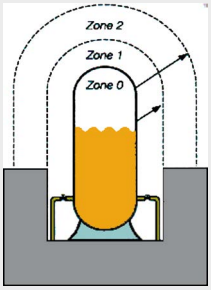


Illustration 1 and **Illustration 2** show typical examples for the Zoning for flammable liquids

Illustration 1: Storage of flammable liquids

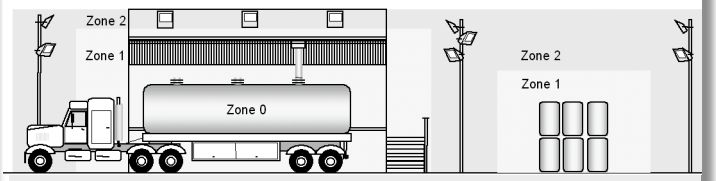


Illustration 2: Filling and storage of flammable liquids

1.3.3 Equipment categories

Acc. to the ATEX standards (2014/34/EU) the appliances for application in their relative zones are classified into categories. Similar to the different zones there are three different categories for group II equipment. Consequently, the explosion protected products can be allocated to the ex-zones existing in the production area.

Category 1 comprises appliances which have been designed in such a way that they may be operated in compliance with the characteristic parameters given by the manufacturer and which ensure a **very high level** of safety. **Appliances of this category** may be used in ZONES 0 and 20 as per their certification.

Category 2 comprises appliances which have been designed in such a way that they may be operated in compliance with the characteristic parameters given by the manufacturer and which ensure a **high level** of safety. **Appliances of this category** may be used in ZONES 1 and 21 as per their certification.

Category 3 comprises appliances which have been designed in such a way that they can be operated in compliance with the characteristic parameters given by the manufacturer and which ensure a **normal level** of safety. **Appliances of this category** may be used in ZONES 2 and 22.

Table 1 shows the relationship between zoning and equipment category.

Zone	Explosive Atmosphere	Category according to 2014/34/EU
Zone 0 Zone 20	continuously, long periods or frequently	Category 1
Zone 1 Zone 21	occasionally	Category 2
Zone 2 Zone 22	infrequently and short periods	Category 3

Table 1: Zoning - Equipment category

1.3.4 Temperature classes acc. to IEC 60079-0

An important parameter for the classification of gases is the ignition temperature. The ignition temperature is the lowest temperature value of a hot surface at which an explosive atmosphere ignites on it. This maximum surface temperature must always be lower than the ignition temperature of the gas, mist or vapour/air mixture in which it is used. **Table 2** shows the temperature classes according to IEC 60079-0.

Temperature classification	Maximum permissible surface temperatures of equipment [°C]	Ignition temperatures of inflammable substances [°C]
T1	450	> 450
T2	300	> 300 ≤ 450
T3	200	> 200 ≤ 300
T4	135	> 135 ≤ 200
T5	100	> 100 ≤ 135
T6	85	> 85 ≤ 100

Table 2: Temperature classes

1.3.5 Group II

EN ISO/IEC 80079-20-1 „Material characteristics for gas and vapour classification" describes a method for determining the maximum experimental safe gap MESG. The maximum gap width is of considerable importance for the type of protection flameproof enclosure „d". Table 3 shows the maximum gap widths of group II for a volume of 20 ml according to EN ISO/IEC 80079-20-1, gap length 25 mm.

Group	Gap width M E S G
IIA	> 0,9 mm
IIB	≥ 0,5 bis ≤ 0,9 mm
IIC	< 0,5 mm

Table 3: Group/maximum gap width (according to EN ISO/IEC 80079-20-1 with 25 mm gap length volume 20 ml)

1.3.6 Group III

Combustible solid particles in form of dust or flyings can explode in combination with air and an ignition source. The type of substance is decisive for the selection of equipment. Combustible solid particles are divided into subgroups according to their properties, see **Table 4**.

Group	
IIIA	combustible flyings
IIIB	non-conductive dusts: Specific electrical resistance > 1 kΩ m
IIIC	conductive dusts: Specific electrical resistance ≤ 1 kΩ m

Table 4: Classification of flammable solid particles into sub-groups (according to the test method in EN ISO/IEC 80079-20-2)

1.3.7 Classification of flammable gases, mists, vapours

Table 5 shows the classification of gases, mists and vapours into groups and temperature classes.

Explosion group	Classification of gases and vapours into temperature classes					
	T1	T2	T3	T4	T5	T6
IIA	**Acetone** **Ethane** **Ethyl acetate** **Ammonia** **Ethyl chloride** **Benzol** **Acetic acid** **Carbon monoxide** **Methanol** **Methyl chloride** **Naphtalene** **Phenol** **Propane** **Toluol**	**i-amyl acetate** **n-butane** **n-butyl alcohol** **Cyclohexane** **1,2-dichlorethane** **Acetic anhydride**	**Gasoline** **Diesel fuel** **Aviation fuel** **Heating oils** **n-hexane**	**Acetaldehyde**	-	
IIB	**Town gas**	**Ethylene** **Ethyl alcohol**	**Hydrogen sulphide**	**Ethyl ether**	-	
IIC	**Hydrogen**	**Acetylene**			-	**Carbon disphide**
I	**Methane**					

Table 5: Classification of flammable gases, mists and vapours

1.3.8 Combustible dusts

Similar to gases, mists and vapours, all combustible dusts and flyings (fibres that have become detached from fabrics or similar materials and are caught, for example, in the lint filter of a clothes dryer) can also react explosively under certain conditions. Possible ignition sources are electric sparks, hot surfaces, electrostatic charges etc. To exclude these ignition sources for the dust atmosphere, special types of ignition protection are used, such as „encapsulation", „pressurised enclosure" or „protection by enclosure".

With the „protection by enclosure" type of protection, dust and flyings are prevented from entering the luminaire by a dust-protected or dust-tight housing.

Dust or flyings can ignite on the outer surfaces of a luminaire. In this case, the surface temperature is the ignition source.

The highest occurring temperature of the luminaire surface with which combustible dust or flyings can come into contact must be noted as the maximum surface temperature on the type plate.

The properties of dust or flyings for explosion protection in luminaires are mainly described by two parameters, the **minimum ignition temperature of a dust cloud (MIT_C)** and the **minimum ignition temperature of a dust layer (MIT_L)**. The **layer**

ignition temperature is the temperature of a hot surface on which a layer of dust 5 mm thick begins to glow.

The **minimum ignition temperature** is the lowest temperature at which a dust cloud can ignite on brief contact with a heated wall.

If the minimum ignition temperature of the combustible dust that occurs is known, the maximum surface temperature of the luminaire can be used to decide on the particular application.

It is important to keep a safety margin between these two values. The lower of the two values is decisive.

The surface temperature of the equipment must be at least 75 K below the layer ignition temperature and must not be greater than 2/3 of the ignition temperature of the dust cloud. An example for hard coal:

MIT_C = 590 °C (minus 1/3 MIT_C = 394 °C).

MIT_L = 245 °C (minus 75 K = 170 °C)

-> max. permissible surface temperature with a dust layer of max. 5 mm: 170 °C

Depending on the height of the dust accumulating on the luminaire, the maximum permissible surface temperature is reduced. A diagram for this can be found in the EN 60079-14 standard, where further information can also be found. For the example given above, this means that with coal dust and a layer thickness of 50 mm, the maximum surface temperature of the equipment must not exceed 80 °C, i.e. the layer ignition temperature is 80 °C with the appropriate safety margin.

A typical luminaire for areas susceptible to dust is shown in **Fig. 3**.

Fig. 3: Explosion-protected luminaire e865 for dust-hazardous areas of zone 21 in type of protection: protection by enclosure „t”.



1.3.9 Types of Protection

In areas where it is not possible to prevent the presence of a hazardous explosive atmosphere (primary explosion protection), only explosion-protected equipment may be used. The design measures required for this are described in the types of protection.

Luminaires are generally built with type of protection flameproof enclosure „d” or increased safety „e”.

EN 60079-7	- stands for: **„Increased safety”**	- code: „**e**”
EN 60079-1	- stands for: **„Flameproof enclosure”**	- code: „**d**”
EN 60079-5	- stands for: **„Powder filling”**	- code: „**q**”
EN 60079-2	- stands for: **„Pressurised apparatus”**	- code: „**p**”
EN 60079-11	- stands for: **„Intrinsic safety”**	- code: „**i**”
EN 60079-18	- stands for: **„Encapsulation”**	- code: „**m**”
EN 60079-31	- stands for: **„Protection by enclosure”**	- code: „**t**“
EN 60079-15	- stands for: **„Zone 2”**	- code: „**n**”
EN 60079-28	- stands for: **„Limitation of optical radiation”**	- code: „**op is**”

Analogous to the degree of protection of the equipment category (according to Directive 2014/34/EU) or the equipment protection levels EPL (according to IEC 60079-0), some types of protection are subdivided into levels of protection, e.g. the type of protection encapsulation in ma (use in Zone 0, 1, 2 or 20, 21, 22); mb (use in Zone 1, 2 or 21, 22) and mc (use in Zone 2 or 22), and the type of protection increased safety in eb (use in Zone 1, 2) and ec (use in Zone 2).

1.3.9.1 Flameproof enclosure „d”

The type of protection flameproof enclosure „d” is used for luminaires for use in Zone 1 mainly where ignition sources such as electric sparks and hot surfaces do not permit the use of the light source in luminaires of the type of protection increased safety. This is the case, for example, with LEDs.

The parts of an item of electrical equipment that can ignite a potentially explosive atmosphere are enclosed in a housing with this type of protection. The explosive mixture can penetrate the enclosure. In the event of an explosion of this mixture inside, the enclosure must withstand this pressure and prevent the transmission of the explosion to the explosive atmosphere surrounding the enclosure.

The fundamental difference to the type of protection increased safety „e” is that in the case of the type of protection „increased safety”, the occurrence of ignition sources that can trigger an explosion is prevented. With flameproof enclosure „d”, an explosion may occur inside the enclosure, but its transmission to the outside is prevented.

1.3.9.2 Increased safety „e”

The principle of this type of protection is to prevent sources of ignition from the equipment, i.e. measures are taken to prevent, with an increased level of safety, the possibility of e.g. impermissibly high temperatures and the occurrence of sparks or arcs inside or on external parts of electrical equipment. The type of protection is applicable to electrical equipment and parts thereof which do not produce sparks or assume dangerous temperatures under normal operating conditions. The type of protection increased safety „e” has become established worldwide for luminaires for fluorescent lamps, especially for economic reasons for use in Zone 1. LEDs must have an additional type of protection in order to be installed in luminaires for use in Zone 1, e.g. encapsulation.

Figs. 4 and 5 show special luminaires with type of protection increased safety „e”.



Fig. 4: Explosion-protected high-bay luminaire e8825 with type of protection: increased safety „e”



Figure 5: Explosion-protected floodlight e8820 in the type of protection: increased safety „e”

Fig. 6 and **Fig. 7** show two typical luminaires with type of protection increased safety „e”. The advantage over luminaires in flameproof enclosure „d” is the considerably lower weight and the simplified replacement of electronic components and easier maintenance. In terms of price, this luminaire also has advantages over the luminaire in flameproof enclosure „d”.



Fig. 6: Explosion-protected polyester diffuser luminaire e865 in type of protection increased safety „e”



Fig. 7: Explosion-protected steep roof luminaire e821 in the type of protection increased safety „e”

Figure 6 shows an Ex-protected LED diffuser luminaire for use in Zone 1 and Zone 21. The LED modules are manufactured with a special encapsulation. The following characteristic data apply:

Type of protection: eb
Explosion protection:
II 2 G Ex eb mb q IIC T4 Gb (Zone 1)
II 2 D Ex tb IIIC T80°C Db (Zone 21)

1.3.10 Marking

Fig. 8 shows the type plate of an explosion-protected LED luminaire in the type of protection increased safety „e" in which other types of protection also apply, in this case encapsulation „m" for the LED module and powder filling „q" in which the electronic ballast is designed and encapsulated.

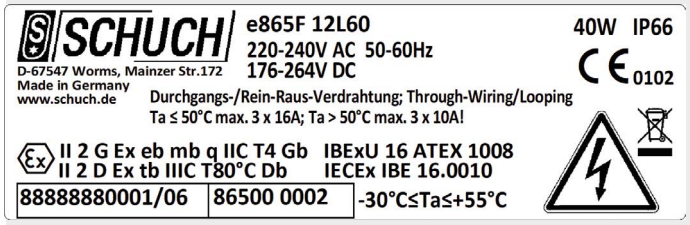
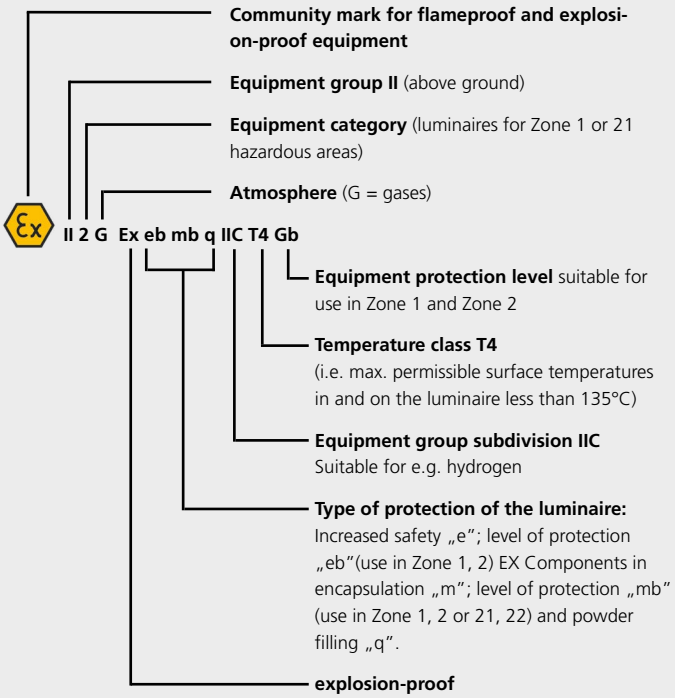
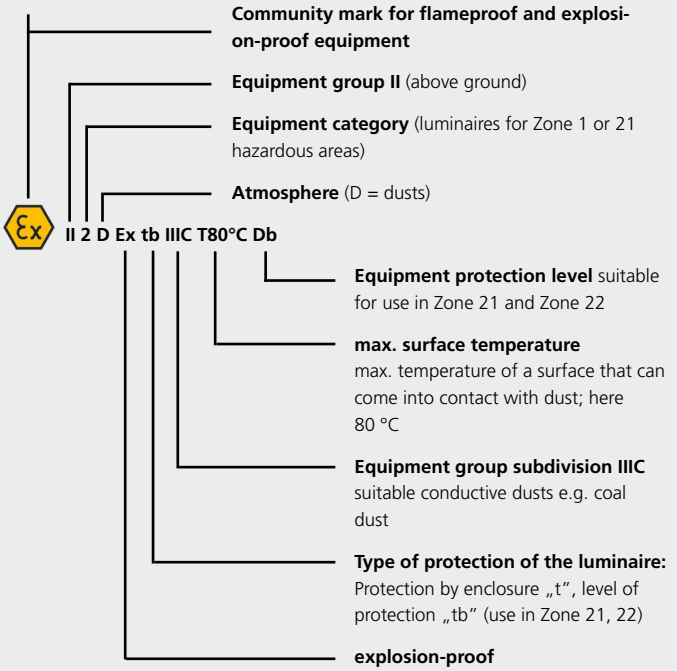


Figure 8: Example of marking of an explosion-protected luminaire





In addition, the following information is required:

-30 °C ≤ Ta ≤ +55 °C	permissible operating temperature range if different from -20 °C bis +40 °C
IBExU	Notified body (Institute for Safety Engineering)
CE 0102	CE -marking with the number of the Notified Body that monitors the QM system (0102 = Physikalisch Technische Bundesanstalt, PTB).

1.4 Special operating conditions

If the luminaire is subject to special oerating conditions, such as chemical, mechanical, thermal, electrical, vibration, humidity, etc., this must be discussed in advance between the operator and the manufacturer so that additional measures can be taken if necessary. This is pointed out both by Directive 1999/92/EC and by the standard DIN EN 60079-14 or VDE 0165, which is authoritative for the operator of electrical equipment in potentially explosive atmospheres.

Ex luminaires usually have a high IP degree of protection, expressed e.g. by the marking „IP66". However, this does not mean that the luminaire is hermetically sealed.

Luminaires are classified and tested in different degrees of protection according to the European standard EN 60529. This standard contains the German translation of the international standard IEC 60529 and is also a VDE regulation, as it has been approved by the VDE and classified under VDE 0470, Part 1.

In the current edition of this standard, a brief description and definition for the degrees of protection represented by the second code number is given in section 6.

For example, the short description for the second code number 6 is: „Protected against strong jets of water." The definition given is: „Water splashing against the enclosure from any direction as a strong jet shall have no harmful effects."

In this standard, the humidity of the air is not taken into account as a relevant criterion when classifying the degrees of protection.

Damp and cold ambient conditions combined with low duty cycles can restrict the use of luminaires with electronic ballasts.

Before installing luminaires, e.g. in rainwater retention basins, in water treatment plants or above clarification basins, etc., the manufacturer should be consulted in order to use special designs if necessary.

2. Marking

All SCHUCH luminaires bear the CE -marking. The CE -marking documents that the product complies with the relevant EU directives and may be freely marketed on the EU domestic market.

Whether a luminaire has test marks or other optional markings can also be found in the product data sheet.

3. General information

3.1 Permissible ambient temperatures

If no additional information is given, **LED luminaires** are designed for a maximum permissible ambient temperature of **-20 °C to +25 °C**.

Emergency luminaires are excluded from this.

Explosion-protected equipment is generally designed for an ambient temperature of up to **+40 °C**.

Special versions for lower **(T..)** or higher **(H..)** temperatures are available on request.

3.2 Rated voltage

Unless otherwise indicated, all luminaires listed in the catalogue are suitable for a rated voltage of 230 V ± 10 % / 50 Hz. Luminaires for other voltages and frequencies are usually available on request.

3.3 EMC

The EMC Directive and the Electromagnetic Compatibility Act (EMVG) regulate the requirements for EMC and ensure that only luminaires with a sufficient level of electromagnetic compatibility are placed on the European market; EMC is therefore a product characteristic and thus a quality feature. The corresponding technical requirements as a basis for EMC are defined in the European standards. In Germany, the Bundesnetzagentur is responsible for and monitors EMC.

EMC conformity means that every luminaire complies with the protection requirements; these are:

- limited interference emission (EN IEC 55015)
- adequate immunity to interference (EN IEC 61547)
- limitation of mains harmonics (EN IEC 61000-3-2)
- limitation of voltage changes/fluctuations and flicker (EN IEC 61000-3-3)

Compliance with the standards ensures a defined compatibility of different loads. Nevertheless, even if the standards are complied with, unfavourable distances between useful and interference levels may impair e.g. radio reception when using a radio with a rod antenna. In this case, the distance between the radio and the luminaire must be increased, for example.

4. Properties of LED luminaires

4.1 Rated values in the data sheets of LED luminaires

All tolerances of the rated values for system wattage, luminaire luminous flux and luminous efficacy stated in the catalogue comply with the specifications according to IEC 62722-2-1. The luminaire luminous flux is not more than 10 % below the stated rated luminous flux. The connected load of the luminaire is not more than 10 % above the rated power specified in the data sheet. All rated values refer to an ambient temperature of Ta = 25 °C unless otherwise stated. If LED luminaires are operated at higher temperatures, the luminaire luminous flux is typically reduced by 1.5 % per 10 K.

4.2 Service life specifications of LED luminaires:

The data sheet specifies the average rated service life Lx. Lx describes the time after the original luminaire luminous flux has decreased to a percentage value x. At the rated service life L_x, the luminaire luminous flux is x% of the initial value. Typical values of „x" are 70 (L_{70}), or 80 (L_{80}). The specification of the rated service life is linked to the proportion of luminaires with increased luminous flux reduction B_y and is represented as L_xB_y. The value B_{50} thus means that 50 percent of the luminaires fall short of the declared luminous flux component „x" at the end of the average rated service life L_x and 50 percent exceed it. **The service life specifications are based on defined test procedures. The specifications in the data sheet are expected values. The specified service life is therefore not a guaranteed property of the luminaire.** The specification $L_{80}B_{10} \geq 50{,}000$h means that statistically 90 % (100-10) of all luminaires still have at least 80 % of their original luminous flux after 50,000 h. $B_y = B_{50}$ applies to the average rated service life Lx (without addition). According to a recommendation of the ZVEI, this value should be stated in the data sheets.

Failures of control gear as well as the degree of soiling of the luminaire are not taken into account here.

The failure rate of operating devices depends not only on the specification of the components and their quality, but also to a large extent on the operating temperature. The following applies: for tc max. (maximum permissible device temperature) the failure rate is 2 ‰ per 1,000 h, i.e. for a service life of 50,000 h the percentage of failed units is up to 10 %.

Example: With 100 ECGs in continuous operation (at the max. permissible t_c temperature), statistically up to 10 units will have failed after 5.7 years.

Operation at lower ambient temperatures reduces failure rate.

4.4 Use of LED luminaires in corrosive atmospheres

Harmful gases and other corrosive substances (e.g. ammonia, sulphur or chlorine compounds) can damage LEDs. Depending on the substance, concentration, temperature and duration of exposure, damage or even total failure is possible.

Even luminaires with a high ingress protection are affected by this. Corrosive atmospheres can penetrate the luminaires. A high IP code does not automatically mean that a luminaire is gas-tight The suitability of the luminaires for the respective application can be determined e.g. by a practical test on site.

We recommend the use of luminaires from our luminaire range that are specially designed for use in areas exposed to hazardous gases.

- **ER version:** Increased protection against corrosive atmospheres. Luminaires in ER version are approved e.g. for use in production facilities and warehouses for vehicle tyres.
- **Version HR:** High protection against corrosive atmospheres. Luminaires in version AUS HR are approved e.g. for use in outdoor areas of sewage treatment plants.
- **Version XR:** Absolutely gas-tight luminaire. The PRIMO XR luminaire is approved for hazardous gas areas (exception: explosive atmospheres, swimming pools, exposure to chemicals that attack PMMA or stainless steel).

4.5 Use of LED luminaires in a humid atmosphere

If luminaires are operated in damp or damp and cold environmental conditions in conjunction with a short duty cycle, there is a risk of premature failure. This also affects luminaires with a higher degree of protection. In particular, components and circuit boards within the control gear absorb moisture over time. This leads to corrosion, leakage currents and component failures. It is not necessarily the case that condensation has formed inside the luminaire for a failure to occur.
Typical applications where this problem occurs include rainwater retention basins, corridors in watergates or dam walls, installations in the drinking water or wastewater sectors, and applications in the agricultural sector (potato stores, wine cellars).
This problem can be remedied by switching the luminaire on regularly for extended periods (e.g. every two days for approx. 2 hours). If condensation appears, a braething gland should also be used. Furthermore, particularly when luminaires are mounted on cold surfaces, they must be fixed at a distance from the mounting surface.
Luminaires in the HL (High Humidity) version are available specifically for situations where regular switching on is not possible or not desired (e. g. series 161PX, 167 G2, nD866, e865). These luminaires incorporate components that are specially protected against moisture, which significantly enhances operational reliability under critical environmental conditions. Usually, it is not necessary to operate the luminaires regularly to dry the internal components (exception: occurrence of condensation → see above). In the event of persistently high concentrations of harmful gases (e.g. hydrogen sulphide), the luminous flux may be degraded. (See also Section 4.4).

4.6 Mounting of LED outdoor luminaires of protection class II on mounting devices that are electrically insulated from the earth potential.

When mounting LED luminaires of protection class II on fixing devices that are electrically insulated from the earth potential, electrostatic charges may occur due to weather conditions, among other things. This can cause damage to the control gear and/or the LED modules.

Mounting devices insulated from the earth potential are, for example, wooden, concrete or plastic poles, insulated steel poles, wall mountings and cable suspensions.

The installation of a luminaire in protection class I is a remedy. In this case, charges are discharged via the PE.

If protection class II luminaires are to be installed, a special version with ESD discharge is available.

4.7 Overvoltage protection for LED outdoor luminaires

LED outdoor luminaires are significantly more sensitive to overvoltage events than luminaires with conventional ballasts.Switching operations/load changes can cause overvoltages of up to approx. 6 kV in the mains.

Lightning strikes in the vicinity of outdoor lighting installations can cause voltages up to a multiple of 10 kV, depending on the distance of the strikes to the luminaire and the conductivity in the ground.

In the case of direct lightning strikes in a streetlight, the pulse heights that occur are so great that there is no economically justifiable protective measure.

The ECGs used by SCHUCH already have an increased surge voltage resistance.

The surge voltage resistance of the luminaire can be further increased by an additional surge protection module in the luminaire or in the cable junction box.

Surge protection modules, which disconnect the luminaire from the mains in the event of their own defect, offer even greater operational safety.

Increased overvoltage protection in protection class II luminaires is only possible to a limited extent for normative reasons, among others!

No protective earth conductor may be connected in protection class II luminaires. However, comprehensive overvoltage protection is only possible if the protective earth conductor is available and the luminaire housing and mast are connected to the protective earth conductor.

As a further measure, we recommend installing surge arresters in the distribution boards. This will intercept direct and indirect lightning strikes into the supply network.

The probability of a lightning strike varies greatly from region to region and in Central Europe varies from less than one strike per year and km² to over 20 strikes per year and km².

Should outdoor LED luminaires or outdoor luminaires with electronic ballasts be installed e.g. in areas with an increased probability of lightning strikes, we recommend the use of luminaires of protection class I and an additional surge protection module in the cable junction box, or in the luminaire (on request) as well as measures in the distribution board.

4.8 Restrictions in the operation of LED outdoor luminaires with power reduction

In extremely rare cases, leakage currents may occur between the phases or phase and neutral. This can lead to incorrect switching behaviour in luminaires with power reduction. The luminaires then do not switch to power reduction.

Leakage currents can be caused by old, damaged cables with insufficient insulation or high capacitive coupling.

When replacing individual luminaires in existing installations with older LED luminaires or when extending lighting installations, problems can also occur when switching to power reduction. In such cases, additional relays must be retrofitted at the control phase input in the luminaires already installed. In such cases, it is more cost-effective to add luminaires with autonomous power reduction (LA => without control phase).

4.9 Inrush currents with LED luminaires - limited automatic load capacity

In contrast to luminaires with conventional control gear, in lighting systems with LED luminaires all luminaires start at the same time (also applies to ECG luminaires with conventional lamps).

In the storage capacitor of these ECGs, a very high charging current flows for a short time at the moment of switch-on. The maximum permissible number of luminaires per miniature circuit-breaker is not limited by the operating current but by the inrush current. It can be found online on the respective product data sheet of the luminaire.

4.10 Photobiological safety

The photobiological safety of luminaires is dealt with in the DIN EN 62471:2009 standard. It describes limit values or risk groups for irradiation as well as corresponding measurement methods in the UV, visible and infrared spectral range. The protection goal is to exclude thermal as well as photochemical hazards to the human eye and skin.

Almost all SCHUCH luminaires fall into the lower risk groups 0 and 1. They cannot cause any photobiological damage to the eye or human skin and are therefore harmless. Luminaires that fall into risk group 2 are marked with a picture symbol („do not look into the light source"). In addition, the installation instructions indicate the distance at which looking into the luminaire is safe. Due to the installation location, a hazard can be ruled out for most technical luminaires of risk group 2, as it is not possible to look into the luminaire from a short distance. Doubling the distance reduces the radiation reaching the eye to a quarter (square law of distance). Therefore, in most cases, caution is only required during maintenance work.

Luminaires in risk group 3 cannot be approved because they would pose a not inconsiderable risk.

4.11 Replacement of control gear and LED modules when repairing luminaires.

SCHUCH LED luminaires contain „light sources that cannot be replaced by the user*", so-called LED modules. These LED modules may only be replaced by SCHUCH, a service technician appointed by SCHUCH or a similarly qualified person. (* not an electrotechnical specialist).

The replacement of electrical components or the repair of LED luminaires may only be carried out with components supplied or authorised by SCHUCH.

Many control gear units have programming, i.e. replacing a control gear unit with an identical unit does not automatically guarantee the desired function!

When repairing LED luminaires, there is a risk that LEDs may be damaged or even directly destroyed by electrostatic discharges. ESD protective measures must therefore be taken when repairing the luminaires (dissipative work surface, ESD shoes/ESD wristband, ESD clothing).

In protection class II luminaires with metal housings, cables with double insulation are installed for safety reasons and cables are fixed to each other with cable ties at terminal points. When repair work is carried out, the original condition of the luminaire must be restored, e.g. double-insulated cables must not be replaced by single-insulated cables. Cable ties that have been removed must be replaced.

4.12 Light emissions (ULOR+ULR)

ULOR (Upward Light Output Ratio): Indicates the proportion of the luminous flux emitted by a horizontally aligned luminaire (inclination 0°) into the upper half-space. The value is usually given as an integer percentage.

ULR (Upward Light Ratio): In contrast to ULOR, which refers exclusively to the luminaire, ULR indicates the proportion of luminous flux emitted into the upper half-space by a luminaire mounted in an installation. This is therefore largely dependent on the inclination of the luminaire. The value is usually given as an integer percentage.

5 Control of lighting systems, dimming and power reduction

5.1 DIMA (Analogue Dimming)

By means of an external potentiometer or a control voltage of 1-10V, dimming in the range of typically 10-100 % is possible (LED). Several luminaires can be operated in parallel on one 1-10 V line, the max. number depends on the load capacity of the potentiometer/control unit and the line length . The number of ECGs to be connected can be increased with a signal amplifier. Due to voltage drop on the line and coupling of interference, luminaires on a line may nevertheless have slightly different dimming levels.

All luminaires with DIMA feature are supplied with 2 additional terminals, marked „1-10 V+"and „1-10 V-". The cables to the control inputs must be of mains voltage-proof design and can be included in the connection cable.

5.2 DIMD (Digital Dimming and Control with DALI)

DALI (Digital Addressable Lighting Interface) and the further developed standard DALI-2 are a protocol for controlling luminaires. With a small number of lines, many luminaires can be controlled individually even over long distances. In addition, DALI can be easily integrated into higher-level building automation systems such as KNX, EIB or LON.

DALI-2 is the latest version of DALI, which ensures improved interoperability between components from different suppliers through mandatory certification and extended functions, e.g. energy data.

Up to 64 operating devices can be controlled via one DALI line. It should be noted that several control gear units can be installed in one luminaire. The maximum cable length is 300 m with a minimum cable cross-section of 1.5 mm². The range may be limited due to unfavourable conditions. A larger range can only be achieved with repeaters, a higher number of luminaires per DALI line only with broadcast commands. (Attention, this severely limits the functionality of a DALI-2 system in particular). Better is the parallel operation of several DALI lines with one controller. With LIMAS Line PRO SCE controllers, 3 DALI lines can be operated. By networking (LAN) several controllers, up to 15 DALI lines are possible (960 control gear units).

Dimming levels of 1-100 % are possible depending on the control gear. For the operation of a DALI system, further devices are required (controller, power supply unit, etc.), which are not included in the scope of delivery of the luminaire.

All luminaires with DIMD feature are delivered with 2 additional terminal points, marked „DA". The polarity is irrelevant. The cables to the control inputs must be of mains voltage-proof design and can be included in the connection cable.

DALI inputs have only a low overvoltage resistance. Networking with DALI is therefore not recommended for outdoor luminaires. The lines should be routed from the luminaire to the cable transition box at the most, e.g. for connecting Powerline or a programming interface. Additional overvoltage protection is recommended.

DALI luminaires and DALI cables must not be installed or laid in the vicinity of high-voltage equipment. Electrical and magnetic fields can interfere with DALI communication or even destroy DALI components.

If the DALI function is not used but the lines have been laid, they should be short-circuited at a central point to avoid interference (disconnect bus power supply!).

There should be no mixed installations of DALI and DALI-2 peripherals.

Further information is available at: https://www.dali-alliance.org/

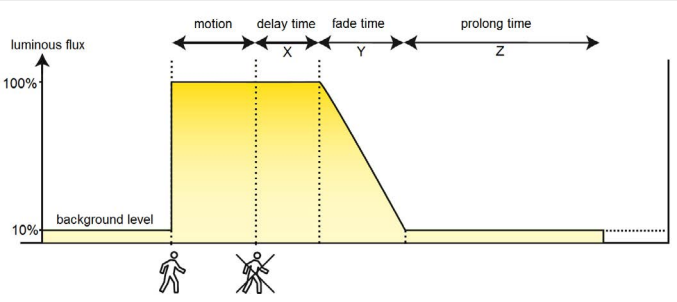
5.3 DIMC (corridor function with control phase)

The corridor function enables simple power reduction of luminaires to a fixed value by means of an ordinary 230 V control voltage.

In combination with motion sensors or door contacts, high energy savings are possible in rarely used areas.

In the standard setting, the luminaire only provides 100 % luminous flux as long as the control phase is active. After deactivation of the control phase, the luminaire dims down to the background level of 10% within approx. 30 seconds (due to technical limitations, a higher dimming level results for individual versions). The luminaire never switches itself off, but may be switched off by the user at any time.

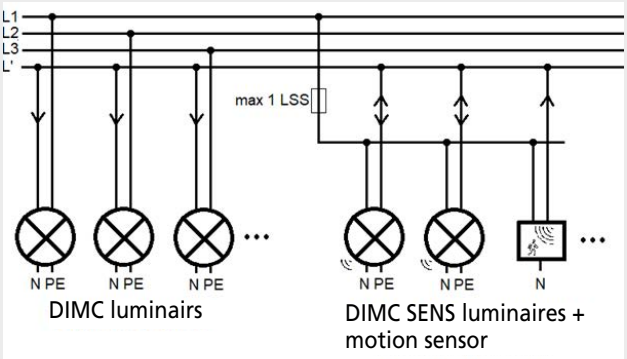
The graphic shows the luminous flux output of a luminaire with DIMC that is controlled via a motion sensor.



The following default settings are made for luminaires with DIMC. The parameters can be customised on request:

- Delay time: luminaire maintains 100 % luminous flux for time duration X after switching off the control phase (default setting 0 seconds, but customer can set his own „hold time" by setting the switch-off time delay of the motion sensor).
- Fade time: faster or slower dimming down of the luminaire in time period Y (default setting: approx. 30 seconds)
- Automatic switch-off: Luminaire switches off completely after time period Z without activity. (Standard setting: never switch off; versions Z30: luminaire switches off after 30 minutes)
- Background level: Dimming level when there is no activity. (Standard setting: 10 %; due to technical limitations, a higher dimming level may result for individual versions).

All luminaires with DIMC feature are supplied with a 4-pole terminal.



For the different versions, the following instructions must be observed during installation:

- **DIMC SENS** luminaires have an integrated motion sensor, as well as a connection for the control phase L'. (The connection here is both input and output). For this reason, the supply of all **DIMC SENS** luminaires, as well as all external motion sensors, must be on the same phase and a common circuit breaker. (-> Note the limited number of luminaires per common circuit breaker).
- **DIMC** luminaires do not contain an integrated motion sensor. They only have one input for the control phase L' (-> at least one additional external detector or one additional DIMC SENS luminaire is required). The supply of all DIMC luminaires operated on one control phase can be divided among all 3 phases and any number of common circuit breaker. (-> number practically unlimited)

Radar sensors are built into DIMC and SENS luminaires to detect movement. Objects (e.g. metal partition walls, concrete beams, etc.) that reflect or absorb the radar waves have an influence on the detection range of the sensor. Radar waves can also penetrate lightweight walls, for example, and detect unwanted movements behind these walls. In the vicinity of transmission masts (e.g. on the roofs of parking garages), there may also be functional impairments.

When using external motion sensors/sensors, only units with relay output may be used.

5.4 LR (power reduction with control phase) for outdoor luminaires

In the standard setting, the luminaire delivers 100% luminous flux when the control phase is applied. Without control phase, the luminaire is dimmed to 50 %.

The time until the lower dimming level (usually 50 %) is reached can be up to 180 seconds (comfort function). The 100 % level is reached without any time delay.

Optionally, other dimming levels (10 %-90 %) and an inverse function of the control phase (reduced operation 50 % when control phase is present) are possible.

All luminaires with LR feature have an additional terminal point, labelled LST. The control phase does not have to be in phase with the supply (L).

Chapter 4 describes possible restrictions in the operation of LED outdoor luminaires with power reduction via control phase.

5.5 LA (autonomous power reduction without control phase) for outdoor luminaires

If luminaires with power reduction are to be operated in existing installations where there is no control line, a self-sufficient power reduction can be used.

The time until the dimming level (usually 50 %) is reached can be up to 180 seconds. The same applies to switching back to 100 %. The gradual lowering or raising of the luminous flux of luminaires with power reduction means that switching is not visually perceptible. It thus serves the comfort of the user, as disturbing influences on road users or residents are avoided. Since a visual check of the power reduction is not possible, the change of the luminaire input current or the illuminance should be used for a possibly necessary verification of the proper function.

After the initial start-up, a luminaire needs up to 3 days until the line reduction works reliably.

The luminaire dims completely automatically to different levels (between 10 % and 90 %) at preset times. Several dimming levels per night are possible. Standard: One dimming level, 50% luminous flux from 22:00-04:00 CET and 23:00-05:00 CEST.

The luminaire does not use a real-time clock as a timer; instead, the dimming times are recalculated every night from the previous switch-on and switch-off times. This excludes the possibility of deviations in the dimming rate, even after decades of operation.

For this reason, however, it is also not possible to change over to daylight saving time, as the switch-on and switch-off times are determined by twilight. Controlling the luminaires via a timer is not recommended; the dimming times are then dependent on the respective setting.

In Germany, shifts of up to +18 or -18 minutes may occur due to the width of the time zone.

Special programming may be necessary for installation locations outside Germany.

5.6 CL (constant luminous flux function)

Luminaires with feature CL are initially set to approx. 90 % of the output compared to basic types without CL. The luminous flux remains constant throughout the entire service life. The output increases from 90 % to a maximum of 100 % at the end of the service life (100,000 h). After this time, the luminous flux degradation is no longer compensated by an increase in output.

5.7 MA-Z (central monitoring of self-contained luminaires via DALI line)

Up to **64 luminaires** with MA-Z version can be centrally **monitored** via a DALI line. All known restrictions of a DALI system apply (see 5.2).

In addition, a LIMAS Line PRO SCE controller is required (not included in delivery). The emergency luminaires can be switched on and off via a 230 V control phase (L') using a switch.

All control gear is certified according to IEC 62386-202 (DALI-Self-contained emergency control gear).

5.8 DIMD MA-Z (central control and monitoring of self-contained luminaires with DALI-2 ECG)

Up to **32 luminaires** with DIMD MA-Z version can be centrally **monitored and controlled** via a DALI line. All known restrictions of a DALI system apply (see 5.2).

In addition, a LIMAS Line PRO SCE controller is required (not included in delivery).

The emergency luminaires can only be dimmed and switched via DALI-2 compatible control elements/sensors. No 230V control phase may be connected.

All control gear is DALI-2 and certified according to IEC 62386-202 (DALI-Self-contained emergency control gear).

5.9 DI (central monitoring of self-contained Ex luminaires via DALI line)

Up to **64 luminaires** with DI version can be centrally monitored via a DALI line. All known restrictions of a DALI system apply (see 5.2).
In addition, a LIMAS Line PRO SCE controller is required (not included in delivery).
The emergency luminaires can be switched on and off via a 230V control phase (L') using a switch.
All control gear is certified according to IEC 62386-202 (DALI-Self-contained emergency control gear).

5.10 DIMDI (central control and monitoring of self-contained Ex luminaires with DALI-2 ECG)

Up to **64 luminaires** with DIMDI version can be centrally **monitored and controlled** via a DALI line. All known restrictions of a DALI system apply (see 5.2). A LIMAS Line PRO SCE controller is required to monitor and control the luminaires (not included in delivery).

The emergency luminaires can only be dimmed and switched via DALI-2 compatible control elements/sensors. No 230 V control phase may be connected.

DIMDI control gear is IEC 62386-202 (DALI-Self-contained emergency control gear) and DALI-2 compatible.

5.11 RFL (luminaire with Zhaga Book 18 socket(s), prepared for light control)

Luminaires with RFL socket (Ready for Lightmanagement System) enable easy retrofitting of light controls and/or sensors. The luminaire does not have to be opened or rewired. All Zhaga Book 18 compatible and D4i certified sensors, IoT nodes etc. are supported.(Due to the variety of systems on the market, we can only provide support for setting up the systems we sell).

Versions:

- RFLO: The luminaire has a socket on the top of the luminaire e.g. for stand-alone photocell or controller with GPS and radio reception.
- RFLU: The luminaire has a socket on the underside, e.g. for stand-alone motion sensors or controllerwith radio reception.
- RFLOU: The luminaire has 2 interconnected sockets at the top and bottom, e.g. for controller and motion sensor (use only compatible products).
- RFLS: The luminaire has a base without the 24V power supply on pin 1 (only use compatible products).

Due to the design of some luminaires, the socket can only be installed at the top or at the bottom. For Pole-Top luminaires, the socket is located in the luminaire (luminaire must be opened for replacement).

Zhaga and D4i define, among other things, the mechanical and electrical connection of luminaire and Light Management products. The choice of Light Management system can thus be made independently of the luminaire manufacturer. However, different Light Management systems are not compatible with each other!

All luminaires are delivered with sealing caps mounted on the sockets. If no components are installed, the sealing caps must not be removed! Without a cap, the luminaire does not meet the specified IP protection class and warranty claims cannot be made.

When installing the Light Management components, ensure that they engage properly in the socket and that they are firmly seated (bayonet lock).

The connection of non-Zhaga/ D4i compliant adapters, extension cables or devices is not permitted. Electrical and magnetic fields can interfere with radio communication.

In many applications, RFL luminaires are initially operated without Light Management components, but are initially intended to contain special functions that later conflict with the selected Light Management system:

The constant luminous flux function (CL) and the set maximum luminous flux are not affected (for luminaires in VARIO version, the maximum luminous flux can possibly be increased via DIP switch).

All other functions (autonomous dimming LA, control phase LR) are automatically deactivated as soon as the base is used. DIMD (DALI) versions are not possible.

Important note:
If radio equipment, such as mobile phone masts, is located near the luminaires, this may cause malfunctions in lighting management components and motion detectors (failure to operate, reduced range, error codes).
Such faults are system-related. They are difficult to predict and do not constitute grounds for a complaint.
They usually affect only a few luminaires in a lighting system.

5.12 Important information on the use of RFL luminaires with LIMAS Air SNC

For networking RFL luminaires in outdoor applications with LIMAS AIR SYNC, each luminaire requires a suitable LASC controller.

Two commissioning and configuration methods are generally available for a LIMAS AIR SYNC network:

- Offline commissioning using the **LASC DONGLE USB + SOFT + LIZ**
- Online commissioning using at least one **RFL LASC DS GPS SIM**

The **RFL LASC DS GPS SIM** simultaneously provides gateway, cloud, and GPS functionality. It can connect up to 100 LIMAS AIR SYNC network participants to the cloud.

For time-based functions, AstroDim applications, and scheduled switching profiles, at least one GPS-enabled component must be present within the network. The time information is distributed to all other participants via the mesh network. This can, for example, be provided by an **RFL LASC DS GPS** or an **RFL LASC DS GPS SIM**.

When cloud connectivity is used, ongoing communication costs apply for each participant within the network. If commissioning is performed exclusively locally using the **LASC DONGLE USB + SOFT + LIZ**, no recurring communication costs are incurred.

5.13 Other dimming functions

Other dimming functions are available on request, e.g.:

- amplitude dimming (dimming by varying the mains voltage)
- different dimming levels in emergency lighting mode for luminaires on central battery systems (see also chapter Emergency lighting).

5.14 Limitations when using radar sensors:

Radar sensors work ideally when steady movements in the environment (background noise) are as low as possible.
(background noise) are as low as possible. In heavy fog, rain and branches and leaves moved by wind, the detection of moving objects such as pedestrians, cyclists and cars is made more difficult. Conversely, heavy rain and/or branches and leaves moved by wind, for example, may trigger motion detection. Shrubs and trees in the vicinity of the radar sensor should therefore be continuously cut back. In the vicinity of high-voltage power lines and transmission masts, the function of radar sensors may also be impaired.

5.15 Restrictions on the use of infrared sensors:

IR sensors operate with a pixel-based detection field that detects temperature differences between moving objects (road users) and their surroundings.
The detection range of the sensor depends on the corresponding light spot height and luminaire inclination.

In practical operation, objects cannot be detected under the following conditions:

- Sensor is covered by object (e.g. branch)
- Persons or objects do not have the required size in the detection range of the sensor
- Persons or vehicles are moving at a speed < 1 m/s
- Persons (e.g. with special heat-insulating clothing) or vehicles (e.g. still cold vehicles in winter) do not have a sufficient temperature difference (at least 4 K to the environment).

- People move precisely between the rasterised pixel-based detection points. detection points.
- Persons or objects are too far away from the detection range of the sensor. of the sensor.

In addition, there are operating conditions under which the sensor has no function or a malfunction:

- Condensation on the sensor (e.g. in fog) or icing.
- Static charge caused by wind (should, however, be discharged through the earthed luminaire housing).
- Operation outside of the specified operating temperature (see product data sheets)
- Incorrect switching due to air turbulence, e.g. on branches

6. Safety classification for luminaires

The selection of luminaires for certain applications requires the consideration of corresponding protection types and protection classes.

6.1 Ingress Protection Code according to DIN VDE 0711/EN IEC 60598-1

	1st CHARACTERISTIC NUMERAL	2nd CHARACTERSTIC NUMERAL	
RATING	**SOLID PARTICLE PROTECTION**	**LIQIUD INGRESS PROTECTION**	**Symbol**
IP 20	solid objects > 12 mm	non-protected	
IP 23	solid objects > 12 mm	protected against spraying water	
IP 40	solid objects > 1 mm	non-protected	
IP 43	solid objects > 1 mm	protected against spraying water	
IP 44	solid objects > 1 mm	protected against splashing water	
IP 54	dust protected	protected against spraying water	
IP 55	dust protected	protected against water jets	
IP 65	dust tight	protected against water jets	
IP 66	dust tight	protected against heavy seas	
IP 67	dust tight	protected against effects of immersion in water between 15 cm and 1m for 30 minutes	
IP 68	dust tight	protected against effects of immersion in water under pressure for long periods	
IPx9k	dust tight	protected against effects of high pressure water jets	

6.2 Protection classes

		Meaning	Notes
I		Light fittings with connection point for protective conductor, to which all touchable metal parts must be connected, which can immediately be on mains voltage level in the event of a fault.	Connection to the mains protective conductor is mandatory. The symbol is attached to the connection point.
II		In the case of such light fittings, no metal parts may be touched that could immediately be on mains voltage level in the event of a fault (protective insulation or double insulation).	The light fitting must not have a protective earth connection and must not be connected to a protective earth conductor (except for functional earth*).
III		Light fittings for operation with safety extra-low voltage, i.e. with voltages below 42 V, which are generated with a safety transformer according to VDE 0551 or taken from batteries or accumulators.	

* Functional earth: Earthing of a point in a system, which is necessary e.g. to start a lamp or to fulfil EMC requirements.
This is not part of the electrical protection system. Symbol: 

7. Areas of application and properties of SCHUCH luminaires

DIN VDE 0100 must be observed when selecting luminaires.
(see section 4).

7.1 Use of moisture-proof luminaires taking into account their degree of protection

Damp-proof luminaires with a high ingress protection (IP 65) are indoor luminaires for ceiling, pendant and trunking mounting (horizontal mounting). If these luminaires are not used as intended, e.g. if they are mounted outdoors, in a different mounting position and/or in extremely high humidity, condensation may occur. In the very dense luminaires, a underpressure is created during the cooling phase after switching off or in the case of strong temperature fluctuations (e.g. mounting in outdoor installations). This can cause moist air to be drawn into the interior of the luminaire and to condense. Water accumulation in a moisture-proof luminaire is thus by no means due to a leaky luminaire, but rather to a luminaire that is too tight. (The tighter the luminaire, the greater the risk of condensation).

For such cases, e.g. for outdoor use, SCHUCH has special luminaires such as the 161/162... AUS series. These luminaires are suitable for unprotected use outdoors. However, it is crucial that the luminaires are switched on regularly for several hours at a time. LUXANO 2 luminaires in HL (high humidity) versions are available for indoor use. These luminaires are equipped with components that are specially protected against moisture. Regular operation is not necessary.

When installing moisture-proof luminaires on cold surfaces, condensation can also occur. In such cases, it is necessary to mount the luminaires at a distance from the mounting surface. Luminaires with protection class IP65 are „jet water protected". Direct spraying (e.g. during cleaning work) with high-pressure cleaners/steam jets is not permitted. The forces that occur are many times higher than during a water jet test and can lead to water ingress.

7.2 „F" symbol

Luminaires suitable for mounting on normally flammable surfaces (ignition temperature >200 °C) must be constructed in such a way that in the event of a fault, a maximum of 180°C will occur on the mounting surface.

Such luminaires used to be marked with the Ⓕ-symbol. Luminaires that do not meet the requirements must now be negatively marked with the symbol .

7.3 Luminaires with limited surface temperature „D" symbol

In areas subject to fire hazards (risk of combustible dust deposits), only luminaires that comply with the requirements of DIN EN 60598-2-24 and bear the Ⓓmark may be used. The marking Ⓓ replaces the ⒻⒻ-marking previously used in Germany. Examples include lighting installations in paper and wood processing and agricultural premises.

Requirements and information are given in the installation regulations
(e.g. VDE 0100 Part 482) and also in the requirements of property insurers
(e.g. VDS 2033).
Similar to gases, mists and vapours, all combustible dusts and fluff can also react explosively under certain conditions, i.e. in these cases Ex luminaires must be used. In case of doubt, consult the supervisory authorities, e.g. the trade inspectorate or the TÜV.

7.4 Frameless glass made of toughened safety glass

Frameless glass must not be damaged by installation or maintenance work, neither on the surface nor in the edge area!

If, for example, a tool hits the edge of the glass and material flakes off, glass breakage cannot be ruled out. Such a breakage can also occur with a considerable time delay after the damage.

7.5 Use of luminaires in animal husbandry

When used in stables, luminaires are particularly exposed to ammonia from animal excrement.

The LED modules mounted in linear luminaires of classic design (e.g. series 161 or 163) and their control gear are damaged by ammonia exposure.

We recommend the use of the Tube light fitting „PRIMO XR LW". This luminaire is hermetically sealed to prevent aggressive substances from entering the interior of the luminaire.

The linear luminaire „LUXANO 2 LW", or other luminaires in the „LW" or „ER" versions are also suitable for most agricultural applications. Please consult us.

In poultry farming, the „PRIMO XR LW DIMD" luminaire should be used. This meets the special requirements regarding flicker as required by the Federal Ordinance on Livestock Husbandry.

7.6 PC cover glasses

Polycarbonate has the property that it tends to turn yellow under the influence of UV light. PC luminaire cover glasses are exposed to natural UV light when installed outdoors. However, the UV content of the light sources used must also be taken into account.

IThe polycarbonates we use to manufacture our PC cover glasses are provided with so-called UV additives that improve UV stability.

However, „yellowing" due to UV radiation cannot be prevented. The additives merely delay this process!

The parameters here are the operating time of the luminaire and the level of UV exposure.

Discolouration of PC glasses does not represent a product defect.

8. Emergency lighting

8.1 Classification and terms

Emergency lighting is divided into safety lighting, spatially limited lighting and replacement lighting, whereby safety lighting is further subdivided in accordance with DIN EN 1838:2025-03 into:

- safety lighting for escape routes
- anti-panic lighting
- safety lighting for workplaces with particular hazards

8.2 Occupational safety

In Germany, occupational safety is divided into two parts. State regulations (e.g. Workplace Ordinance) and the regulations of the German Social Accident Insurance (DGUV) (e.g. DGUV Regulation 3, previously BGV A3) apply.

According to the Workplace Ordinance, which has been in force since August 2004, safety lighting must be provided in workplaces if it is not possible to leave the workplace safely or if there is a risk of accidents in the event of a failure of the general lighting.

The individual regulations are specified in more detail by the „Technical Rules for Workplaces", which are relevant for safety lighting:

- ASR A1.3 Safety and health protection signage
- ASR A2.3 Escape routes and emergency exits
- ASR A3.4 Lighting and visual

8.3 Electrical engineering requirements

DIN VDE 0108-1, with its comprehensive statements on the design of emergency lighting systems, was withdrawn in March 2007. It was replaced by the European standard DIN EN 50172 (VDE 0108-100), which is now available in its second edition from 2024.
The withdrawal of DIN 0108-1 became necessary because national standards must be withdrawn as soon as a European standard on the same subject is published.

It should be noted that the MVV TB 2023/01 of May 2023, which is binding under building law, refers to an interim status of the revision of DIN EN 50172, which has been published as a pre-standard – DIN VDE V 0108-100-1:2018-12.

8.4 Lighting requirements

The lighting requirements for emergency lighting are regulated in DIN EN1838, although it should be noted that the current edition of this standard from March 2025 is not referenced in the binding Technical Building Regulations (MVV TB 2023/1). The MVV TB still refers to the November 2019 edition of DIN EN 1838.

Emergency lighting
Lighting that comes into effect when the power supply to the general electrical lighting fails.

8.4.1 Safety lighting for escape routes

Definition according to DIN EN 1838: Part of safety lighting that enables users to clearly recognise and safely use the escape route.

The following lighting values must be observed for safety lighting for escape routes:

(Horizontal) **illuminance**: Emin ≥ 1 lx measured on the floor*) of the escape route

*) According to ASR A2.3, this must be measured as follows: The illuminance must be measured on the centre line of the escape route at a maximum height of 20 cm above the floor or the steps.

Measuring area:

a) for escape route widths ≤ 2 m, ¼ of the width can be disregarded

b) for escape route widths > 2 m, areas of 0.5 m

at the edges can be disregarded.

Uniformity $U_d = E_{min}/E_{max}$ must not be less than 1:40

Glare limitation:

The (physiological) glare effect of safety luminaires must be limited. This means that, within a specified beam angle of the luminaires, the luminous intensity of the luminaires must not exceed the following values depending on the mounting height:

h[m]	< 2,5	2,5 ≤ h < 3	3 ≤ h < 3,5	3,5 ≤ h < 4	4 ≤ h < 4,5	≥ 4,5
I_{max}[cd]	500	900	1.600	2.500	3.500	5.000

h = mounting height in metres
I_{max} = maximum permissible luminous intensity in cd at specific exit angles

Colour rendering index: To ensure the visibility of safety colours, the minimum colour rendering index of light sources used in emergency lighting for escape routes must be Ra >40.

8.4.2 Safety lighting for workplaces with particular hazards:

Definition according to DIN EN 1838: Part of the emergency lighting that serves the safety of persons who are in potentially hazardous work processes or situations and enables necessary shutdown measures to be taken for the safety of operating personnel and other building users.

The following lighting values must be observed for workplaces with particular hazards:

Illuminance: E as close as possible to 10% of the maintenance value of the illuminance of the work area/visual task in question, at least 15 lx

Measurement level: on the work surface

Uniformity $U_d = E_{min}/E^{max}$ must not fall below 1:10

Glare limitation:

h[m]	< 2,5	2,5 ≤ h < 3	3 ≤ h < 3,5	3,5 ≤ h < 4	4 ≤ h < 4,5	≥ 4,5
I_{max}[cd]	500	900	1.600	2.500	3.500	5.000

h = mounting height in metres
I_{max} = maximum permissible luminous intensity in cd at specific exit angles

Colour rendering index: To ensure the visibility of safety colours, the minimum colour rendering index of light sources used in emergency lighting for escape routes must be Ra >40.

8.4.3 Safety signs and markings for escape routes:

A safety sign marking escape routes must be visible from all points along the escape route.
Photometry and colour must comply with ISO 3864, and the symbol used must comply with ISO 7010 – the safety signs to be used in Germany for marking escape routes in workplaces are specified in ASR A1.3.
The luminance of the safety colour green must be at least 2 cd/m² at every point after a power failure.
When connected to the mains, the luminance of the contrasting colour white must be 500 cd/m².

L_{min} / L_{max} > 10: 1
L_{white} / L_{green} = 5: 1 to 15: 1

The following specification applies to determining the intended recognition distance of a safety sign:

$l = h \times z$

where

h = height of the pictogram
z = 100 for illuminated signs
z = 200 for backlit signs

8.5 Use of luminaires in emergency lighting systems with centralised safety power supply systems (ZB)

Many control gear units are labelled as being suitable for 220V DC operation. This does not mean that they are automatically suitable for centralised emergency power supply systems. These control gear units and the luminaires must meet all the requirements of DIN EN 60598-2-22, which applies to luminaires with a centrali sed emergency power supply (ZB) and also to self-contained luminaires (EB).
They must meet the requirements of this standard, e.g. section 22.7.3 on protecting the luminaire with, for example, a direct current fuse, or section 22.19 on operation at higher temperatures (70 °C).

8.6 Monitoring LED lights in emergency lighting systems with centralised safety power supply systems

The (common) monitoring modules from INOTEC, CEAG, Ecker/Stahl, etc. for 230 V system voltage monitor the current consumption on the primary side of the control gear and generate an error message if the current falls below a certain value.

LED modules are constructed from series and parallel connections of individual LEDs. Low-resistance failures of individual LEDs in an LED module (on the secondary side of the control gear) do not necessarily lead to a change in current consumption on the primary side that is recognised as an error by monitoring modules!

8.7 Individual monitoring of self-powered LED luminaires

According to DIN EN 50172:2024-10, the status of the power source for safety purposes (ready for operation, fault, power source for safety purposes in operation) must be monitored and displayed at a suitable location. Self-contained emergency luminaires equipped with a display in accordance with EN IEC 60598-2-22 are assumed to meet this requirement if the displayed status is easily recognisable during normal use.
Central monitoring systems and automatic testing systems*) are recommended, especially for installations where the emergency luminaires are difficult to access, e.g. if they are installed at great heights.
*) Automatic testing systems must comply with EN 62034.

SCHUCH supplies luminaires with a DALI interface (see options) for central monitoring.

Additional devices (controller, power supply unit) are required to operate a DALI bus system; these are not included in the scope of delivery of the luminaire.

8.8 Maintenance and testing of emergency lighting systems

Regular maintenance and testing must be carried out to ensure that emergency lighting works when needed.
The test intervals are specified in DIN EN 50172 of 2024-10, Section 7.3 – Initial testing and Section 7.4 – Recurring tests.

8.9 Conversion of general lighting luminaires to emergency luminaires

Converting a general lighting luminaire into an emergency luminaire creates a new product. This new luminaire must comply with all technical regulations and legal requirements applicable to the product, such as RED, LVD, EMC, RoHS, VDE regulations, DIN standards, and a new conformity assessment must be carried out and a new declaration of conformity issued. See 'Information on converting general lighting luminaires to emergency luminaires' (ZVEI 05/2019) for more details.

Literature:

B. Weis, H. Finke: „Not - und Sicherheitsbeleuchtung", Hüthig & Pflaum-Verlag Fachbuch: ISBN 978-3-8101-0584-4 E-Book/PDF: ISBN 978-3-8101-0585-1

9. Plastics in SCHUCH luminaires

9.1 Chemical resistance

The **luminaire housings** of many SCHUCH luminaires are made of **glass-fibre reinforced polyester.** This material is heat-resistant, mechanically stable, electrically insulating, weatherproof and chemically resistant.

The luminaire covers are usually made of silicate glass, polycarbonate (PC) or polymethyl methacrylate (PMMA).

For polycarbonate (PC) and polymethyl methacrylate (PMMA), their resistance to various chemical substances - according to the current knowledge of the relevant material manufacturers - is given below. Experience shows that the temperature of chemical (aggressive) substances often plays a significant role.

Parts made of polycarbonate (trade name Makrolon, Lexan etc.) are more impact resistant and heat resistant than parts made of PMMA (trade name Diakon, Plexiglas etc.). Polycarbonate is not resistant to all agents. For cleaning, we recommend warm water with a weakly alkaline detergent, e.g. REI and PRIL. Afterwards, rinse well with clear water. After rinsing, there must be no residual cleaner on the treated luminaire. The ph value of the cleaner must be less than 7.5. For this reason, no soap or similar should be used. In particular, we would like to point out that PC is not resistant to oils and greases! For moisture-proof diffuser luminaires with plastic caps, their chemical resistance must also be taken into account (please consult us). In many cases, KE fasteners (made of stainless steel) are an alternative.

Material	Poly-methylacrylat (PMMA)	Polycarbonat (PC)	Thermoplastic polyester (PBT)
Acetone	–	–	–
Ethylalcohol (to 30 %)	o	o 96 % [1]	+
Battery acid	+	+	n/a
Ammonia	+	–	+ up to 10 % [1]
Boric acid 3 %	+	+	n/a
Sodium Hypochlorite	+	–	n/a
Chlorine (moist)	–	–	n/a
Chromium acid 10 %	o	+	n/a
Acetic acid concentrated	–	–	–
Acetic acid (up to 10%)	+	+ < 10 % [1]	+
Formaldehyde (up to 10%)	o	+	n/a
Glycerin	+	o	+
Uric acid (up to 20 %)	+	n/a	n/a
Potassium (20-25 °C)	+	–	–
Kerosene (aviation gasoline)	o/–	–	+
Sea water	+	+	+
Methyl alcohol (up to 23 °C)	o/–	–	+
Lactic acid < 4 %	+	+	n/a
Sodium chloride	+	+	+ up to 10 % [1]
Sodium hydroxide Solution 20-25 °C	+	–	+
Petroleum	o	o	+
Phosphoric acid Concentrated	–	+ 10 up to 30 % [1]	+ 25 % [1]
Soap liquor (at 23 °c)	+	o	up to 10 % OK
Sulfuric acid H2S04	–	–	–
Sulfuric acid up to 30 %	+	+	+ bis 10 % [1]
Sulphur dioxide dry (at 23 °C)	–	o	n/a
Turpentine (at 23 °C)	+/o	–	+
Toluene	–	–	–
Acidity of wine	+ up to 50 % [1]	+ up to 10 % [1]	n/a
Citric acid up to 20 %	+	+	+ up to 10 % [1]

Legend: + = resistant, O = limited resistent – = volaltile (unstably) [1] = concentration

10. Corrosion resistance of sheet steel luminaires

Our sheet steel luminaires are powder-coated with a high-quality polyester lacquer.

In addition to corrosion protection, the coating offers very good scratch resistance.

Depending on the conditions of use at the installation site, however, corrosion on the housings cannot be completely ruled out.

Examples of this are applications with permanent humidity, mounting locations near lakes under canopies or areas with aggressive media/chemicals.

For such conditions, depending on the requirements, we offer modified versions with KTL coating, aluminium or VA enclosures.

11. Glare evaluation in industrial lighting

A distinction is made between 2 types of glare:

1. Discomfort glare

This causes an unpleasant sensation without necessarily involving a noticeable reduction in visual acuity.

2. Disability glare

This results in a reduction in visual function.

The United Glare Rating (UGR) method was developed to standardise the assessment of discomfort glare caused by indoor/office lighting worldwide.

In industrial lighting, however, it is usually a question of visual performance and thus of disability glare, which is essential for occupational safety and accident prevention.

The UGR method cannot assess disability glare. Accordingly, it is not taken into account in lighting design in industrial plants. The UGR method is therefore not suitable for assessing the glare of lighting installations in industrial applications, especially for hall lighting.

A suitable procedure must be developed for these applications in the future. The relevant expert committees in the ZVEI have already taken up this task.

Detailed information:

- ZVEI position paper „UGR method - application and limits".
  www.schuch.de/de/Positionspapier-UGR_ZVEI
- Statement „Glare assessment in industrial lighting" by Prof. Dr. Bruno Weis, Technical Manager Adolf Schuch GmbH
  www.schuch.de/de/Blendungsbewertung-Industriebeleuchtung_Weis

12. Adaptive lighting

Adaptive lighting refers to intelligently controlled lighting systems that dynamically adapt their characteristics to the environment and the needs of users. This includes:

- Motion- and presence-controlled luminaires
- Daylight-controlled luminaires
- Time-controlled luminaires (LA and LR versions)
- Networked outdoor luminaires and advance lighting (LIMAS Air SYNC)
- Weather-controlled luminaires

Adaptive lighting enables, for example, the variation of light colour in outdoor areas: high-contrast neutral white light for better recognition of objects and hazards during periods of high traffic density. And during the night, warm white light, which has a positive effect on the circadian rhythm and well-being (EcoTune). The light distribution can also be adjusted. For example, façade lighting can be reduced during late night or glare from wet roads can be significantly reduced. Daylight- and presence-dependent control (LIMAS Air CASA and LIMAS Line BASIC + PRO) ensures optimal lighting in the workplace while reducing energy consumption.

Literature:
B. Weis, G. Finke: Emergency and safety lighting, Hüthig & Pflaum-Verlag. ISBN 978-3-8101-0584-4
B. Weis, J-G. Kaiser, N. Wittig: Industrial lighting, Hüthig & Pflaum-Verlag
Volume 1: Fundamentals - Standards - Regulations ISBN 978-3-8101-0370-3
Volume 2: Installation regulations - Applications ISBN 978-3-8101-0391-8

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