

SAFETY LIGHT CURTAINS

Useful things to know, selection guide & installation tips

Did you know that you need safety technology? Anyone who works with and on machines, automated systems or robots, is often not aware of the dangers involved. The potential impact on the health of all users can be devastating, however. As is so often the case, prevention is the best protection! The right safety technology is needed here. Why safety light curtains in particular are the best solution and what important selection criteria as well as installation information which needs to be taken into consideration can be found in this guide.

Why is safeguarding hazardous points with safety light curtains relevant for you?

Hazards from machines lurk around almost every corner in manufacturing processes. A particularly high risk is posed by **manual work and testing stations** such as presses, cutting, bending and punching machines. Without appropriate protective measures it can happen all too quickly that users come into contact with moving machine parts. The consequences: cuts, bruises, fractures, sprains or even worse.

To prevent this from happening in the first place, **reliable detection of fingers, hands and other limbs** entering hazardous areas is essential. In this way, the shutdown of dangerous machine movements can be initiated automatically. **Safety light curtains** are an ideal solution for this!



Fig. 1: The risk of injury in manufacturing processes is very high.

What are safety light curtains and how do they work?



Fig 2: Safety light curtains consist of a transmitter and a receiver unit. Example: Datalogic 957901130 - SG4-30-030-00-00-E

Safety light curtains are one of a range of optoelectronic safety sensors. They consist of a transmitter and a receiver unit and are similar in their operating principle to through beam light barriers from the field of photoelectric sensors, which are used in particular for position detection.

A safety light curtain transmitter transmits a **multitude of light beams at defined distances** to the receiver module. This creates a virtual and **very close-meshed barrier** to demarcate or secure hazardous areas. As soon as fingers, hands or other limbs penetrate this barrier and interrupt the light beams, the **hazardous movements can be automatically switched off**.

Another important difference to standard light barriers is that safety light curtains, as safety sensors, have corresponding safety technology and/or features to **prevent unexpected failures**. For example, they have **redundant OSSD outputs** that pass on switching states to corresponding safety controllers or safety relay modules. OSSD is the abbreviation for the full name „Output Signal Switching Device“. These outputs send out **periodic test pulses** to detect possible short circuits. In addition, safety light curtains have **self-test** functions that also counteract system failure.

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What are the selection criteria for a suitable safety light curtain for your application?

The selection of a suitable safety light curtain is very simple. You only need to consider these **three to four selection criteria**:

Criteria	Descr
❶ Resolution	Describes the distance between the light beams . This defines which part of the body can be reliably detected. Finger protection: 14 mm Hand protection: 30 mm
❷ Protection field height	Stands for the height of the area to be protected by the safety light curtain . This depends on the size of the accessible danger area.
❸ Protection type	Provides information about the internal structure of the light curtain to safeguard against unexpected failures. A distinction is made in particular between type 2 and type 4 safety light curtains (rarely type 3). The higher the type, the higher the Performance Level (PL) that can be met according to the DIN EN ISO 12849 standard. Type 4 light curtains meet the requirements up to PLe. Nowadays, type 4 light curtains have established themselves as the standard and light curtains with lower types are increasingly being displaced from the market.
❹ Range (optional)	Describes the maximum distance between transmitter and receiver . However, the maximum range of most safety light curtains is usually so large that it only plays a role in very few applications. Therefore, it is considered an optional criterion .

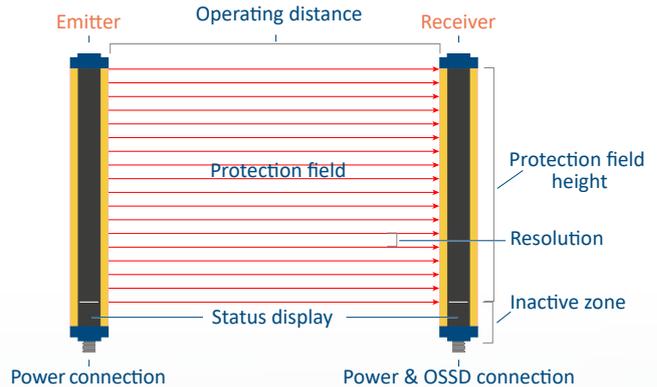


Fig. 3: Safety light curtain - structure & selection criteria

There are other design features in which safety light curtains can differ. These include, for example, an extremely narrow type or the elimination of a dead zone. However, these features are **relevant** for very few industrial applications. In most cases, the use of **light curtains with standard functions** is perfectly adequate.

Safety light curtains vs. safety light grids

Did you know that? It is not uncommon for safety light curtains and safety light grids to be **misleadingly used as synonymous terms**. This is a fallacy, however. Although outwardly they look very similar to each other, there are **essential differences** with regard to their characteristics and suitable areas of application.

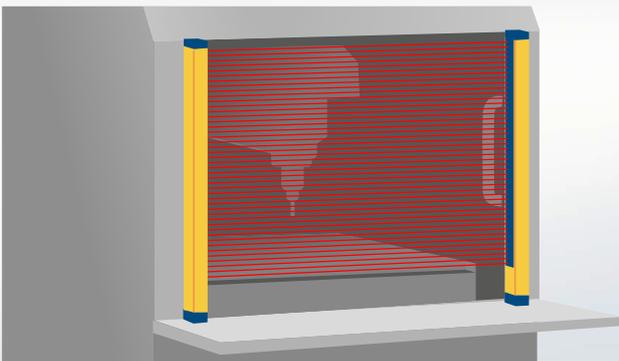


Fig. 4 Safeguarding hazardous points with a safety light curtain

One of the most significant differences is the resolution. While light curtains create a multitude of light beams at a **small distance**, light grids usually create only two to four light beams **spaced at significantly larger distances**.

This is due to the **different purposes** for which they are designed. While **safety light curtains are used for finger and hand protection detection** at hazardous locations, **light grids are used for more extensive area protection**, whereby body detection by means of fewer light beams is sufficient.

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Safety light curtains vs. safety light grids

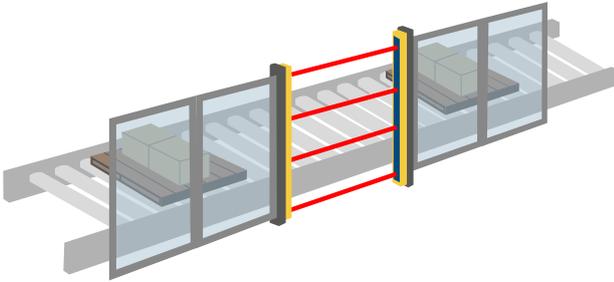


Fig. 5 Area protection with safety light grid

Area safeguard are often relevant in **logistics applications**. In this context, **muting** is also an important requested feature, which makes it possible to bridge light grids **for a short time** in order, for example, to move pallets out of the hazardous area **without bringing system processes to a standstill**. Immediately after the pallet transport, the light grid is reactivated to detect persons entering the danger zone again.

Hazardous location safeguarding with light curtains does not require a muting function in most cases, as **transporting materials out of the danger zone is rarely necessary** here.

How do you install and test safety light curtains correctly?

Before safety light curtains can be used, it is important that they are first installed correctly and that their functionality is tested.

Selecting the correct minimum distance

A very important point is to maintain the **correct minimum distance** between the light curtain and the hazardous location. The regulations for this are clearly defined in the **standard DIN EN ISO 13855**.

Light curtain safety distance - calculation formula:

$$S = K * (t_1 + t_2) + C$$

S = min. safety distance

K = approach speed

t_1 = response time of the light curtain

t_2 = response time of the machine until standstill

C = maximum distance of undetected movement behind light curtain

K and C set the standard here.

K as reaching speed = 2,000 mm/s,

if result of this formula > 500 mm,

K = 1,600 mm/s (walking speed) may be used

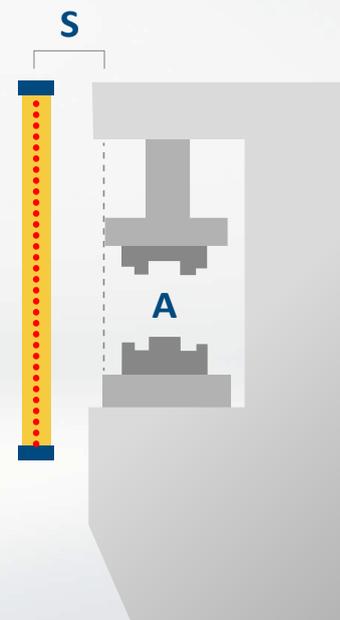
C equals 8 * (resolution (d) - 14 mm)

i.e. when using a 14 mm light curtain, C = 0 mm,
and with a 30 mm light curtain C = 128 mm

The following formulas are derived from this:

For light curtains with 14 mm resolution: $S = 2,000 \text{ mm/s} * (t_1 + t_2)$

For light curtains with 30 mm resolution: $S = 2,000 \text{ mm/s} * (t_1 + t_2) + 128 \text{ mm}$



S = Minimum safety distance

A = Hazardous zone

Fig. 6 - Light curtain safety distance: according to DIN EN ISO 13855, a minimum distance must be maintained

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How do you install and test safety light curtains correctly?

Anti-circumvention protection

When correctly installing a safety light curtain, it is imperative that limbs entering hazardous areas **are detected without exception**. The prerequisite for this is the correct selection of the **appropriate protection field height** so that it is not even possible to **reach past the light curtain** into the danger zone.

Furthermore, it must be ensured that no one can **be present behind the light curtain** unnoticed. If the safety distance in an application needs to be very large, the additional installation of a **horizontal light curtain** is essential.

Correct vs. impermissible mounting:



Fig. 7: Installation at a low safety distance

Fig. 7.1: It must not be possible to reach past a safety light curtain.



Fig. 8: At a very high safety distance, the horizontal installation of a safety light curtain is required.

Fig. 8.1: An undetected stay behind the light curtain must not be possible.

Alignment aid

Since the light beams transmitted by the light curtain are **not visible**, aligning the transmitter and receiver over longer distances can prove very difficult. **Laser pointers** mounted on the transmitter can **help here**.

Vibration protection

Safety light curtains are designed to cause machines to be switched off as soon as the light beam transmitted by the transmitter cannot reach the receiver. However, this is a hindrance with strongly vibrating machines, as the vibration may cause the transmitter and receiver to be **briefly offset** from each other. Vibration-heavy applications therefore require the use of **special vibration dampers** to prevent false tripping.

Daily function tests with test rods

To trust is good, to check is better. This also applies to safety light curtains! To verify correct functionality and reduce the **risk of liability** in the event of a malfunction, a **daily function test** of each safety light curtain is recommended.

For this purpose, a test rod is passed through the protection field to check the correct interruption of the light curtain beams. The test rod must have the **diameter of the resolution** of the relevant light curtain.

Protect yourself and your employees with light curtains

You now know how important it is to have **adequate point of operation guarding** and why safety light curtains in particular are a great solution here. In many online shops you will find designs for every need and budget. Most applications can be covered with basic light curtains. For example **Automation24** offers an **appealing range** from Datalogic for standard requirements. Particularly **good prices** and **fast delivery capabilities** go hand in hand with this offer.

Safety technology must not be a luxury. Do not take your **health or the health of your employees** lightly and insist on **reliable safety light curtains** for your protection! With this compact guidebook, you are now **ideally prepared, to choose the right safety light curtain** for your application and **install it in accordance with the standards**.