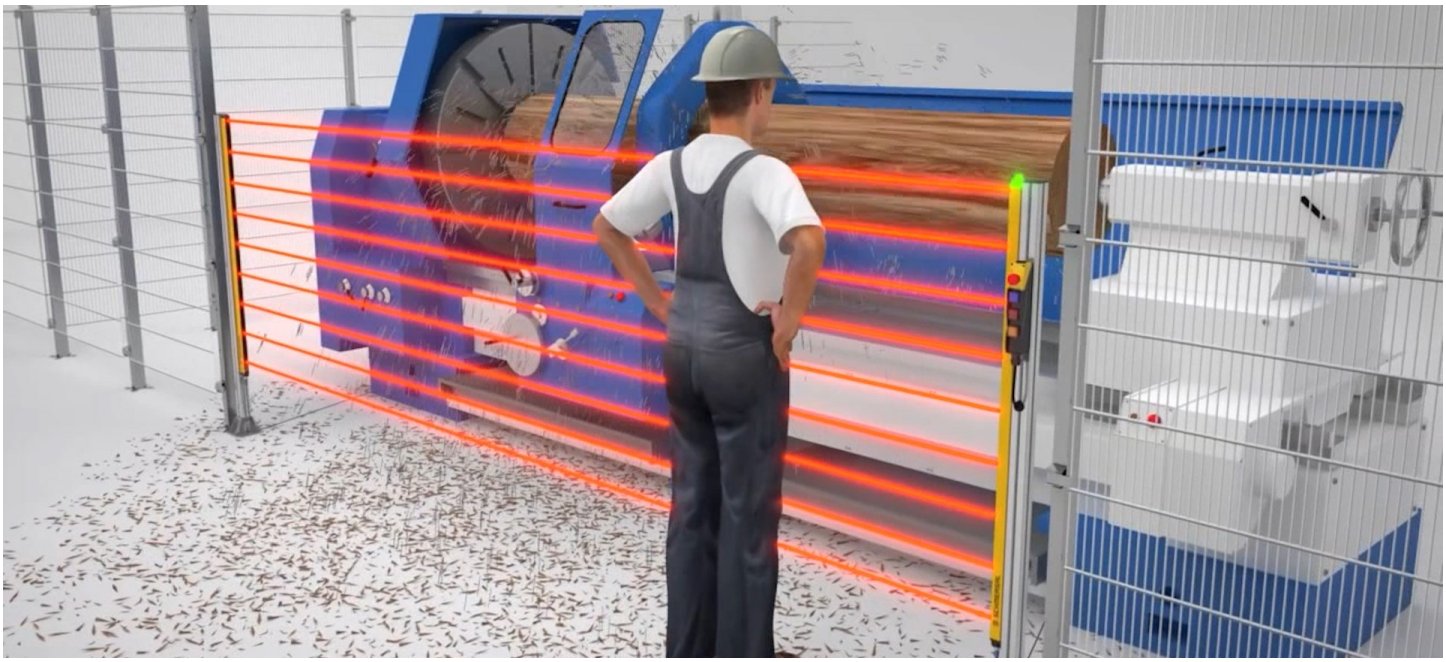
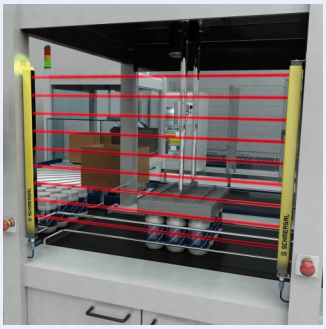
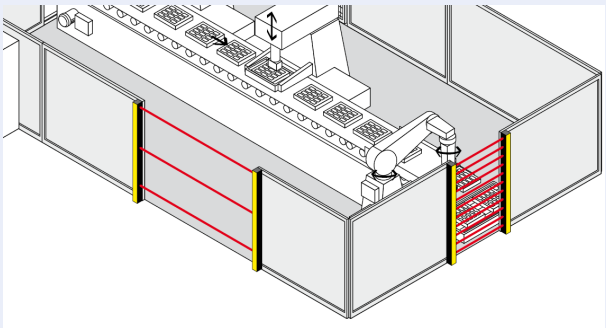
SELECTION GUIDELINES FOR SAFETY LIGHT CURTAINS



Typical Safety Light curtain applications



Point of operation



Perimeter guarding

Safety light curtains are a viable safeguarding option for point of operation or perimeter guarding. They provide a non-separating barrier which will detect operators attempting to access hazardous machines and areas. When the infrared light beams (non-visible) are Interrupted, the redundant safety circuit is disabled causing the hazardous process to come to a halt within milliseconds. The process can only be restarted after the safety light curtain is cleared of a blockage and is reset.

Choosing a safety light curtain is not terribly complicated, once a thorough risk assessment is performed. Besides identifying the hazardous process, the risk assessment will help answer vital questions:

What level of reliability is needed?

What size object needs to be detected?

What size opening needs to be monitored?

Are any special operating modes necessary for the application?

These questions relate to 4 main categories:

- **Type**
- **Resolution**
- **Protection Field**
- **Special operation modes**

Type

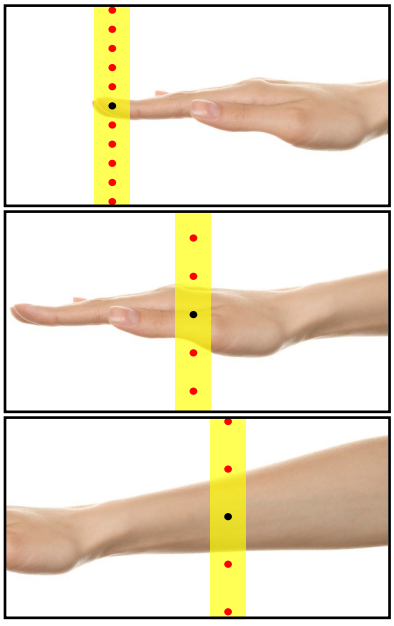
There are two Types of safety light curtains, as defined in IEC61496, determined by how they perform. A risk assessment based on ISO 12100 or similar should be performed to determine which Type is needed. Additionally, safety standards such as IEC 61508 and ISO 13849 which evaluates the safety functions of machines, can be used to define a SIL level or Performance Level (PL) which will also determine the required Type of the light curtain.

Type 2 safety light curtains feature a periodic self-test, which may experience a failure in between test cycles. They can be used for lower risk situations, up to a SIL2 or PLc and typically feature a large sensing distance and are considered a lower cost solution.

Type 4 safety light curtains feature an active self-test that happens throughout the operation and have high tolerance to faults. They are used in high-risk applications and meet the requirements for the highest safety levels of SIL3 or PLe.

Resolution

The resolution is the distance between consecutive beams, or the size of the object that will be detected passing through the protection field. This size, typically noted in millimeters, determines if the device can be used for point of operation applications or for perimeter guarding.



14 mm:
For point of operation, detects fingers and other small objects.

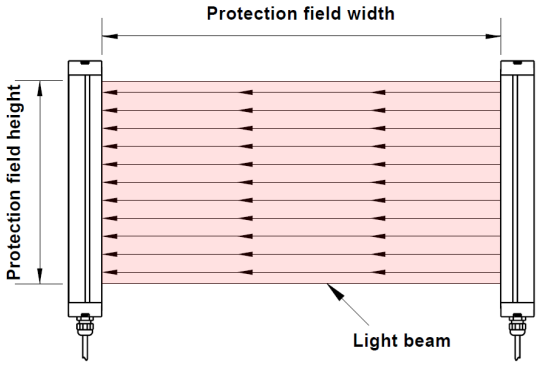
30 mm:
For point of operation, detects hands and similar sized objects.

35 - 40mm:
For point of operation, detects arms or other larger objects.

50 mm or greater:
Detects legs, bodies or other large objects, limited to perimeter guarding.

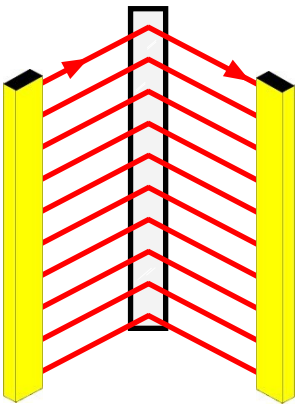
Protection field

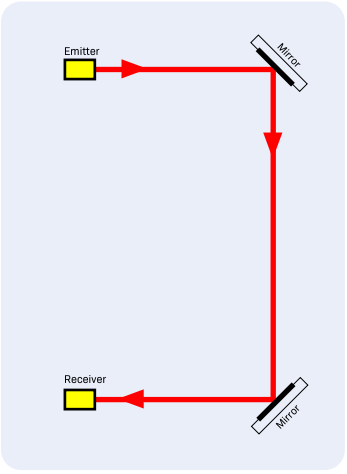
The protection field is the plane in which the inferred beams travel from emitter to receiver which will detect an object passing through. It should be of sufficient height and width (range) that operators cannot reach over, reach under, or go around to reach the hazard.



Height: The distance between the first and last (top and bottom) beams. Most manufacturers indicate this height in their part number. This length can vary from a minimum 6 inches to over 6 feet. Keep in mind, this measurement is only between the beams, so the actual housing will be physically longer.

Range: The operating range or sensing distance between emitter and receiver can also vary greatly. Current units range from a close 12 inches of sensing distance to over 65 feet maximum depending on the resolution and other factors.





Mirrors: Mirrors can be used to form a L- or U-shaped protective field around the perimeter or section of a hazard or machine. Please note that with every mirror used the beam strength and range is reduced by 10% or more, depending on brand and application. It is recommended to use no more than 2 mirrors.

Special Operating Modes

Double acknowledgement Reset:
This feature is necessary when there is a hazardous area that is not fully visible by an operator, where the machine could be reset with someone in the hazardous area.

Once the safety light curtain is interrupted in this example, S2 needs to be reset inside the hazard area to verify the start of the reset sequence, then the beam needs to be interrupted indicating that personnel is exiting the hazardous area, and finally S1 is reset outside the area to activate the safety light curtain circuit providing another level of safety.

Double reset example

Muting:
The muting function temporarily turns off the protected field to allow the regular passage of material into or out of the hazardous area. Additional sensors placed before and after the curtain are monitored to verify that a transport system is passing and not a person approaching the hazardous area. Muting can be adapted to allow solutions for different sizes of objects, partial muting, variable transport speeds, material loading with gaps and unforeseeable belt stoppages.


Muting example

Blanking:
Blanking is when certain beams are disabled, to allow items to pass through. Blanking can be fixed or floating. Fixed blanking is where certain beams are disabled in a fixed location. Floating blanking can move based on the movement of the material, provided that no more than the specific number of beams is interrupted. Blanking, especially floating blanking can effectively change the resolution of the light curtain.

Multi-scan:
The Multi-scan function provides multiple evaluations of the protection field, which would allow small material debris, steam clouds or insects to pass through the field without triggering machine stoppage. This increases machine productivity and availability by limiting the false stops associated with temporary disturbances. However, the safety light curtain will still prevent operators from passing into the hazardous area.

Cyclic Mode:
Cyclic Mode, also known as Presence Sensing Device Initiation (PSDI) allows the safety light curtain to be used as a machine control device. The programming of the machine expects the protection field to be interrupted between machine cycles, to place or remove materials. The machine will initiate the next cycle once the beams are restored. This function should not override the primary function of the curtain - if the protection field is interrupted during the machine cycle, the hazardous motion is stopped, and the machine is put into an interlock state until the safety is reset.

Beam coding:
The infrared beams aren't perfectly parallel like a laser and can have some scattering dispersion based on the condition of the protective lens and the atmosphere. If several safety light curtains are used close together it is possible to get interference between the units because of this scattering. It could be possible to interrupt one field and have it not register because the receiver is still perceiving uninterrupted beams from another emitter. Beam coding introduces a modulation and sequence to the beams so that a receiver will only acknowledge beams from its matching emitter.

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