

Focus Light Curtains and Light Grids

Point of operation guarding!
Passable protection in risk areas!
Built-in muting capabilities!

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Why should I use Safety Light Curtains and Grids?

...to provide operator protection during production!

A safety light curtain can be used on a machine or in a production plant in the same way as a hatch or door. There are great differences though when it comes to the component installation and functionality. When a light curtain is mounted on a hazardous machine, we are not only concerned with the response times of the safety systems, but also the Depth Penetration Factors. It is possible for the operator's fingers or hands to pass through the light curtain a certain distance before being detected. This becomes the Depth Penetration Factor. This distance must also be entered into the Minimal Safety Distance Calculation for the machine (see page 5:4).

It is also very important that the level of safety of the light curtain with dual supervised outputs be continued throughout the rest of the stopping control circuit. Even valves and contactors, which ultimately control dangerous movements, normally have to be redundant and monitored.

Automatic Machines

For light curtains on automatic machines there shall be a reset function which is active when the machine is set for automatic production, whether or not it is a passable protection. After an engagement one must first use a reset function, then the restart of the cycle should be made with a separate starting device. The same reset applies for machines with semi-automatic drives.

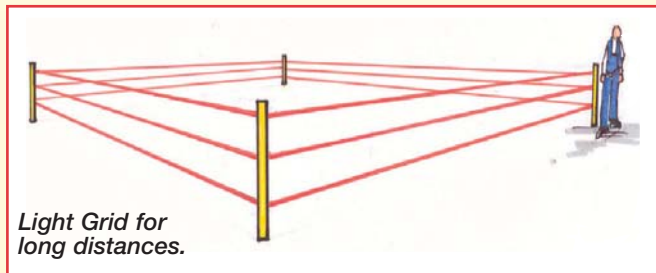
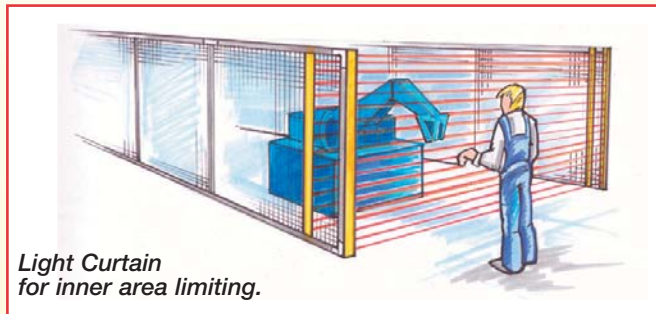
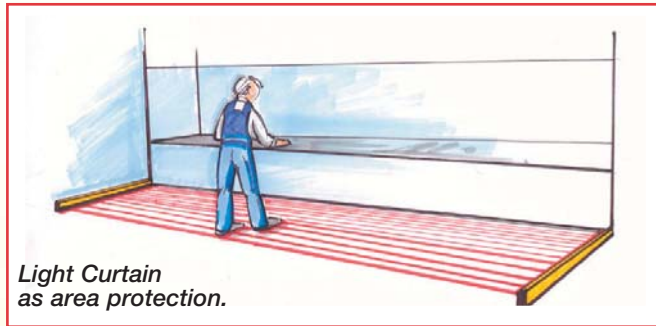
Mechanical and Hydraulic Presses

Light curtain applications are often categorized by the type of guarding required. Protecting an operator from the hazards associated with material positioning or where a process is performed is called Point of Operation Guarding. The point of operation is often called the Zone of Hazardous Operation or the Pinch Point.

This type of guarding is associated with mechanical and hydraulic power presses, molding presses, stamping, forming, riveting, eyelet and automated assembly machinery. Light curtains used in these applications are typically selected for finger and hand protection.

During Manual Servicing of Machines

With manually operated machines where one or more operators move parts in and out between every cycle. This type of application is the most risky because the number of engagements into the machine's dangerous area is often several times per minute.



...to provide passable protection into risk areas!

Both light curtains and light grids can often be used as passable protection into a risk area. This is called passable protection because it is possible to get in behind the safety device. Common applications are robot installations, openings for in and out passage of material, etc. The choice between light curtain or light grid is often a question of available safety distance, reach and price. Light curtains are often chosen for short safety distances light grids are chosen for long reach — up to 50 m — and for a low price.

How do Light Curtains and Light Grids work?

Both Light Curtains and Light Grids utilize optical transmitter and receiver units. Beams of infrared light are sent to the receiver from the transmitters. When a light beam is interrupted, a dual stop signal is given to the dangerous machines inside the light curtain/grid protected area.

What is the difference between a Light curtain and a Light Grid?

A Light Curtain has several beams that are placed closely together, while a Light Grid consists of only one, two, three or four light beams.

The beams are closest on a Light Curtain that is used for finger detection, with a resolution of 14mm. Light Curtain beams are at their widest spacing when



Resolution for hands.



Resolution for fingers.

used for thigh detection, with a resolution of 90mm. For Light Grids the beams are normally placed at a relative distance of 300 to 500mm.

What are the safety requirements for an Optical Protective Device?

High safety demands are stated in the standards EN 61 496-1 and prEN 61 496-2 which deal with optical protective devices. The main demands are on a safe stopping function and that light from light sources other than the transmitter or other disturbances do not affect the safety function.

Depending on how the safety function is built up there are safety components of type 2 and 4 according to EN 954-1 and EN 61496, Part 1 and Part 2.

Type 4, which has the highest safety level, states that a fault is not allowed to affect the safety function and that the fault shall be detected by the outputs opening immediately or that they do not reconnect after being disconnected. Maximum allowed aperture angle for the light is $\pm 2^\circ$.

Type 2 states that a simple but monitored safety function is required, which means that the safety function shall be monitored through periodic tests which open the output when a fault occurs. Between the testing times there can be faults which result in the safety component malfunctioning. The test function can either be built into the safety device or an external unit (e.g. the machine's control system) can initiate a test. Maximum allowed aperture angle for the light is $\pm 4^\circ$.

Light curtains and light grids are included among the products in the machine directive's appendix 4, which means that an external certifying procedure with an officially recognized institution is called for.

Safety Certifications



Minimal Safe Distance Calculation

The Minimal Safe Distance Calculation shall guarantee that a person is not able to reach a dangerous machine part before the machine movement has stopped. This is calculated with the formula as called

for from the *ANSI B11.19-2003 Performance Criteria for the Design, Construction, Care and Operation of Safeguarding Standard*.

$$Ds = [K \times (Ts + Tc + Tr + Tspm)] + Dpf$$

Where:

Ds = minimum safe distance between the safeguarding device and the hazard.

K = hand speed constant: 1.6 m/sec (63 inches/sec) minimum based on the movement being the hand/arm only and the body being stationary.

Ts = worst stopping time of the machine/equipment.

Tc = worst stopping time of the control system.

Tr = response time of the safeguarding device including its interface.

Tspm = the additional stopping time, in seconds, allowed by the stopping performance monitor before it detects stop time deterioration.

Dpf = maximum travel towards the hazard within the presence sensing safeguarding devices (PSSD) field that may occur before a stop is signaled. Depth penetration factors will change depending on the type of device and application.

Note: Ts + Tc are usually measured together with the Jokab Safety Stop Time Analyzer.

K = The maximum speed at which an individual can approach the hazard, expressed in inches per second.

To quote ANSI B11.19-2003: "The factor K is the speed constant and includes hand and body movements of an individual approaching a hazard area. The following factors should be considered when determining K: a) Hand and arm movement; b) Twisting of the body or shoulder, or bending at the waist; c) Walking or running.

One of the accepted values for K is the hand speed constant (it is usually considered as the horizontal motion of the hand and arm while seated). Its common value is 63 in./s although other values (typically higher) are also used. The hand speed constant does not include other body movements, which can affect the actual approach speed. Consideration of the above factors should be included when determining the speed constant for a given application."

For finger and hand detection Safety Light Curtains:

$$Dpf \text{ in mm} = 3.4 \times (Os - 6.875\text{mm})$$

$$Dpf \text{ in inches} = 3.4 \times (Os - 0.275")$$

Where:

Os = minimum object sensitivity or resolution.

For horizontal mounted Safety Light Curtains:

$$Dpf \text{ in mm} = 1200\text{mm}$$

$$Dpf \text{ in inches} = 48"$$

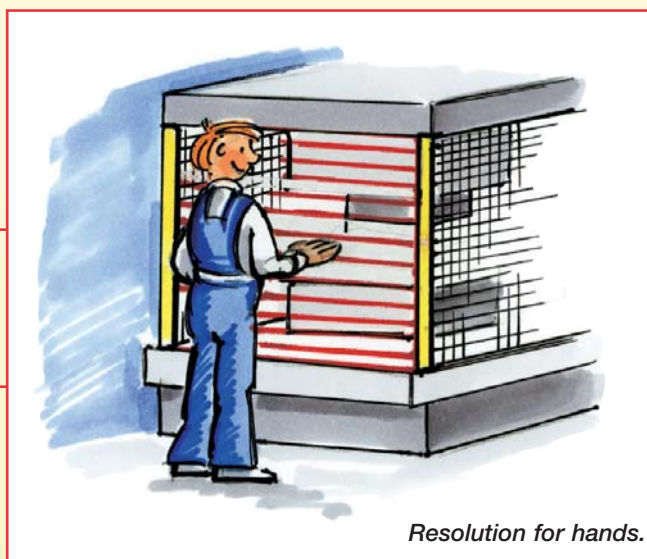
For multi beam Safety Light Grids:

Dpf in mm = 1200mm for a 2 beam system with beams spaced 600mm apart.

Dpf in inches = 48" for a 2 beam system with beams spaced 600mm apart.

Dpf in mm = 900mm for a 3 beam system with beams spaced 450mm apart.

Dpf in inches = 36" for a 3 beam system with beams spaced 450mm apart.



Minimal Safe Distance Calculation (continued)

Example 1: With the aid of the Jokab Smart Stop Time Analyzer, a mechanical power press has a measured stopping time ($T_s + T_c$) of 325 ms. This includes both the stopping time of the machine as well as the stopping time of the control circuit. The response time of the Focus Safety Light Curtain F4-35-900 with 35mm (1.38") resolution and 900mm (35.43") protective height is 20ms (T_r). The stop time break monitor is set for 400 ms.

In this example the safety light curtain must be mounted no closer than 767.63mm (30.22") from the hazardous pinch point.



Light Curtain as hand protection.

$$T_{spm} = 400\text{ms} - (T_s + T_c)$$

$$T_{spm} = 400\text{ms} - 325\text{ms}$$

$$T_{spm} = 75\text{ms}$$

$$D_{pf} = 3.4 \times (35\text{mm} - 6.875\text{mm})$$

$$D_{pf} = 3.4 \times 28.125\text{mm}$$

$$D_{pf} = 95.63\text{mm}$$

$$D_{pf} = 3.4 \times (1.38" - 0.275")$$

$$D_{pf} = 3.4 \times 1.105"$$

$$D_{pf} = 3.76"$$

$$D_s = [K \times (T_s + T_c + T_r + T_{spm})] + D_{pf}$$

$$D_s = [1.6\text{m/s} \times (325\text{ms} + 20\text{ms} + 75\text{ms})] + 95.63\text{mm}$$

$$D_s = [63\text{inch/s} \times (325\text{ms} + 20\text{ms} + 75\text{ms})] + 3.76"$$

$$D_s = [1600\text{mm/s} \times 420\text{ms}] + 95.63\text{mm}$$

$$D_s = [63\text{inch/s} \times 420\text{ms}] + 3.76"$$

$$D_s = [1600\text{mm/s} \times .420\text{s}] + 95.63$$

$$D_s = [63\text{inch/s} \times .420\text{s}] + 3.76"$$

$$D_s = 672\text{mm} + 95.63\text{mm}$$

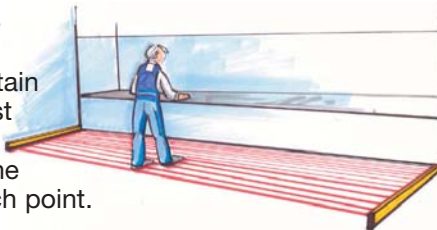
$$D_s = 26.46" + 3.76"$$

$$D_s = 767.63\text{mm}$$

$$D_s = 30.22"$$

Example 2: With the aid of the Jokab Smart Stop Time Analyzer, a robotic loader has a measured stopping time ($T_s + T_c$) of 175 ms. This includes both the stopping time of the machine as well as the stopping time of the control circuit. The response time of the

In this example the horizontal safety light curtain must be at least 1518.4mm (60.54") from the hazardous pinch point.



Light Curtain as area protection.

horizontally mounted Focus Safety Light Curtain with 35mm (1.38") resolution is 24ms. The depth of penetration factor is fixed at 1200mm (48").

$$D_s = [K \times (T_s + T_c + T_r)] + D_{pf}$$

$$D_s = [1.6\text{m/s} \times (175\text{ms} + 24\text{ms})] + 1200\text{mm}$$

$$D_s = [63\text{inch/s} \times (175\text{ms} + 24\text{ms})] + 48"$$

$$D_s = [1600\text{mm/s} \times 199\text{ms}] + 1200\text{mm}$$

$$D_s = [63\text{inch/s} \times 199\text{ms}] + 48"$$

$$D_s = [1600\text{mm/s} \times .199\text{s}] + 1200\text{mm}$$

$$D_s = [63\text{inch/s} \times .199\text{s}] + 48"$$

$$D_s = 318.4\text{mm} + 1200\text{mm}$$

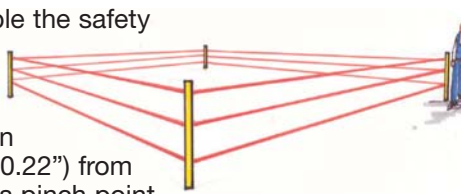
$$D_s = 12.54" + 48"$$

$$D_s = 1518.4\text{mm}$$

$$D_s = 60.54"$$

Example 3: With the aid of the Jokab Smart Stop Time Analyzer, a transfer gantry system has a measured stopping time ($T_s + T_c$) of 212 ms. This includes both the stopping time of the machine as well as the stopping time of the control circuit. The response time of the Focus Safety Light Grid F4-K3-900 with

In this example the safety light curtain must be mounted no closer than 767.63mm (30.22") from the hazardous pinch point.



Light Curtain for long distances.

300mm (11.81") beam spacing and 900mm (35.43") protective height is 14ms (T_r). For a 3 beam Safety Light Grid the depth of penetration factor is fixed at 900mm (35.43").

$$D_s = [K \times (T_s + T_c + T_r)] + D_{pf}$$

$$D_s = [1.6\text{m/s} \times (212\text{ms} + 14\text{ms})] + 900\text{mm}$$

$$D_s = [63\text{inch/s} \times (212\text{ms} + 14\text{ms})] + 35.43"$$

$$D_s = [1600\text{mm/s} \times 226\text{ms}] + 900\text{mm}$$

$$D_s = [63\text{inch/s} \times 226\text{ms}] + 35.43"$$

$$D_s = [1600\text{mm/s} \times .226\text{s}] + 900\text{mm}$$

$$D_s = [63\text{inch/s} \times .226\text{s}] + 35.43"$$

$$D_s = 361.6\text{mm} + 900\text{mm}$$

$$D_s = 14.24" + 35.43"$$

$$D_s = 1261.6\text{mm}$$

$$D_s = 49.67"$$

Focus Safety Light Curtains and Light Grids

If your company is concentrating on machine safety to protect your employees and manufacturing operations, then you need the new Focus Safety Light Curtains and Light Grids. The latest in a long list of machine safety innovations from Jokab Safety North America, the Focus product line is designed to be the most control reliable and dependable presence sensing devices on the market today.

The Focus Curtains and Grids offer unsurpassed ease of installation and alignment, plus built-in muting capabilities. They are rated Category 4 Safety Level and have received all necessary national and international approvals.

Focus Curtains and Grids provide muting flexibility with inputs provided for partial or complete muting. Features include bypass lamp supervision, automatic or manual supervised reset, 2 supervised PNP safety outputs with cross-circuit monitoring, and M12 connections. LEDs provide easy alignment and indication of pollution, power supply and output status. Outputs are overload protected for a maximum load of 500mA. Floating blanking is offered as an optional feature in the FB units.

Focus comes standard with a prereset function for increased operator safety for applications where the operator can physically pass through the light curtain field. This function prevents inadvertent reset of a cell or machine, thus requiring a prereset button to be activated before the final reset function can occur. *(Not available with FB units.)*

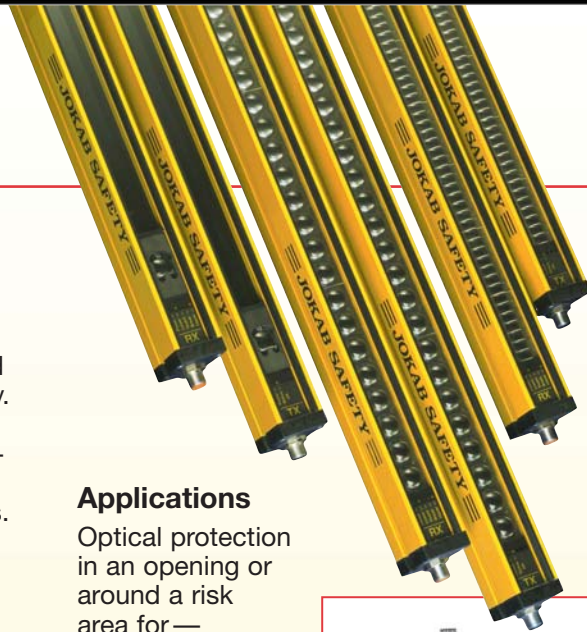
Muting and Override

The "muting" and "override" functions are available on all Focus Curtains and Grids and is enabled directly when an indication lamp is connected. Muting implies that one or more segments or the whole light curtain can be bypassed during in and out passage of material.

In the Focus with muting there is also an override function which makes it possible to bypass the light curtain/grid (i.e. activate the outputs if a machine start is necessary) even if one or more light beams are interrupted. This is the case when the muting function is chosen and the A and B inputs are activated. If during the muting operation a loading pallet has stopped inside the safety field after a voltage loss, the override function is used to enable the pallet to be driven clear.

Floating Blanking or Fixed Blanking

It is also possible to obtain the Focus Curtains and Grids with either "floating blanking" or "fixed blanking". Floating blanking makes it possible to 'disconnect' a defined number of beams from the safety field. The object is then free to move in the safety field without the safety function being triggered. During fixed blanking, the object is not able to move in the safety field. The other beams are active with normal resolution. During blanking applications, the object must remain in the sensing field.



Applications

Optical protection in an opening or around a risk area for —

- Mechanical and Hydraulic Power Presses
- Molding Presses
- Stamping, Riveting and Eyelet Operations
- Automated Machinery
- Robotic Cells
- Conveyors
- Material Handling Equipment
- Printing Presses
- Welding Equipment
- Machining Centers
- Packaging Machinery



Features

- Type 4 according to EN 61496
- Flexible assembly
- LED indication
- High protection class (IP65)
- Range 0.2 up to 50 m
- Time reset
- Muting, fixed/floating blanking
- Bypassing possibilities
- Light grid, E-stop and Eden in the same safety circuit with Vital or Pluto enables safety category 4 according to EN 954-1

Approvals



Focus Technical Data

Focus consists of two units, a transmitter unit and a receiver unit. All the optical units are scanned regularly so that all objects that are placed between the transmitter and the receiver will be detected.

If any light beam is interrupted, the dangerous machine movement will be stopped by the outputs from the light curtain. The reaction time for the Focus varies from 14ms to 45ms, depending on the number of beams in the light curtain. The five LEDs in the receiver and the two in the transmitter show the status of the light curtain/grid.

Safety Outputs OSSD1 and OSSD2

Focus has two PNP outputs — OSSD1 and OSSD2. If the load to be switched is alternating current or requires a higher current than 500 mA, then one should use a safety relay, e.g. RT9, Pluto PLC or the FRM-1 unit (converts the outputs to relay contacts) from Jokab Safety. The FMC-Tina and Tina 10A/10B converts the outputs to a dynamic signal for connection to Pluto or Vital. Pluto can also work directly with the OSSD outputs.

Focus Reset

On every Focus there are inputs for reset and other functions — Reset, Alignment and Override (bypassing is only possible when muting is used).

Reset possibilities:

- Automatic reset — when the light field is free the outputs are closed directly.
- Manual reset — Focus gives a ready signal when the light field is free and the reset button has been actuated.
- Time reset — during manual reset. To reset the Focus a pre-reset button must first be actuated and afterwards, within 8 seconds, a reset button outside the risk area must be actuated.

Choice of reset:

Reset alternatives are chosen with double change-over switches in the Focus receiver.

Note: For further technical information, please reference the Focus Operating Manual.

Manufacturer.....JOKAB SAFETY

Ordering Data/Article Numbers..... see page 5:16

Supply voltage.....24VDC +/-10%, +/-10% ripple

Power Consumption.....10 W max
(transmitter and receiver connected)

Wavelength on Transmitter LED.....950 nm

Profile Dimensions.....35 x 45 mm

Protection Class.....IP65

Temperature Range

Operating-10°C to +55°C

Storage.....-25°C to +70°C

Outputs.....2 supervised PNP outputs
with cross circuit monitoring

Maximum Load.....500 mA
(overload c.c. protection)

Response Time14 - 45 ms

Connections

Transmitter.....M12 4-pin

Receiver.....M12 8-pin

Indication.....LEDs on transmitter and receiver
showing alignment, status and power supply
(LEDs are also used for troubleshooting)

LED on Transmitter

Green (Power).....lit when the transmitter
has supply voltage

Yellow (Status)lit when the transmitter
is functioning correctly

Yellow (Status).....flashing or is turned off during
an error in the transmitter

LED on Receiver

Yellow (Upper).....alignment

Red (Break).....lit if the light curtains
beam is interrupted

Green (Guard).....lit when the entire
light field is free

Yellow (Lower).....lit during normal operation
when there is dirt on the light
curtain's front glass

Yellow (Lower).....flashing during normal operation
when the OSSD outputs
are short-circuited

Green (Power).....lit when the receiver
has supply voltage

Reset Alternatives

Reset

On the servicing side (i.e. the side/sides where there is an operator who moves parts in and out) there shall be a separate reset function for the light curtain. If there are several light curtains (e.g. on the front and back) there shall be one for each. If the light curtain is actuated during a dangerous movement, the press should not be able to restart without being reset. During engagement after the end of the cycle no reset is needed.

For a light curtain which is placed as protection on both sides which are not servicing sides, there shall be a reset button which always needs to be activated after an engagement.

Supervised Manual Reset

When a light curtain/light grid is interrupted it will give a stop signal to dangerous machines within the risk area it protects. For a new start of the machine the light curtain/light grid has to be reset. This is done with the reset button (Figure 1) which is placed where it cannot be reached from within the area which is protected. There are high requirements on the reset function — neither a short circuit nor a component fault shall give automatic reset. When the reset button has been affected the outputs are activated and the machine can initiate.

Automatic Reset

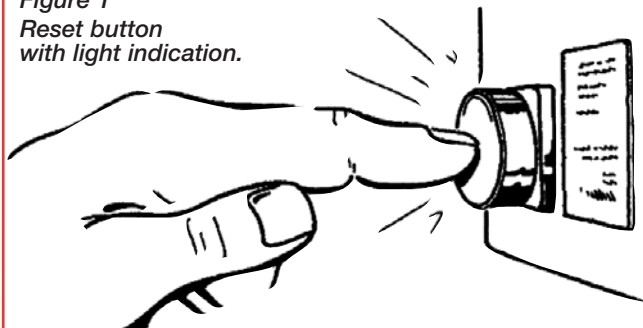
Automatic reset can only be used when it is impossible to get between the safety light curtain and the hazardous pinch point. When the operator removes his hands from the protective field the dual safety outputs will energize starting the next machine cycle immediately.

Pre-Reset Solution

If the machine start button is not located such that you have a clear view of the entire work area, additional safe guards must be used. Typical devices include Safety Laser Scanners, Safety Mats and Horizontal Safety Light Curtains.

Focus Safety Light Curtains address this requirement without costly additional safety devices. By selecting the Pre-Reset mode through the Focus Receiver's internal dials, the primary requirement for accidental resets is satisfied. The Pre-Reset must first be cycled, which gives a clear view of the work area, then no longer than 7 seconds later the Final Reset must be cycled.

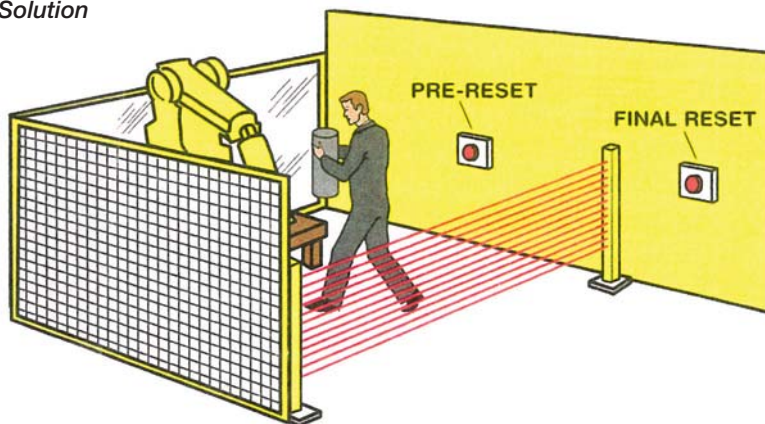
*Figure 1
Reset button
with light indication.*



*Automatic
Reset*



*Pre-Reset
Solution*



Mounting Focus Light Curtains and Light Grids

Vertical Safety Light Curtains

A vertically mounted safety light curtain that is used as the primary safety device must be mounted so that the bottom beam is no higher than 300mm (12") from the ground. Mounting heights above 300mm (12") may require supplemental safeguarding to prevent crawling or ducking under the horizontal light curtain. The top beam must be no lower than 900mm for reach over applications and 1200mm (48") for reach through applications. Mounting heights lower than this will require additional safeguarding.



Vertical Safety Light Curtain

Horizontal Safety Light Curtains

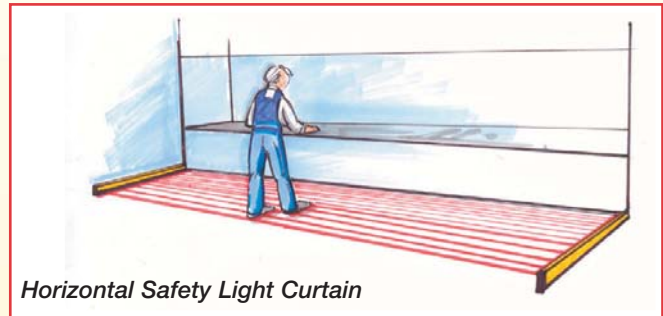
A horizontal safety light curtain that is used as the primary safety device must be mounted no higher than 300mm (12") from the ground. Mounting heights above 300mm (12") may require supplemental safeguarding to prevent crawling or ducking under the horizontal light curtain. The minimal length the safety light curtain can be 1200mm (48") long.

The formula below is for mounting different resolutions from a horizontal surface.

$$\text{Height} = 15 \times (\text{Os} - 50\text{mm})$$

$$\text{Height} = 15 \times (\text{Os} - 2")$$

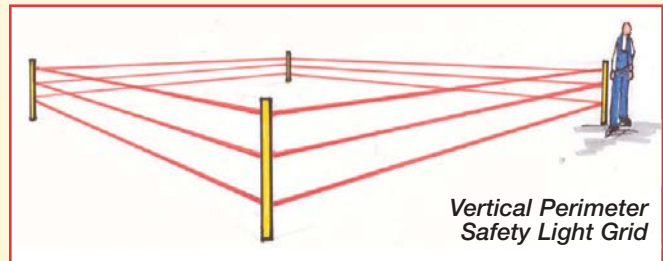
Note: Os represents the beam spacing.



Horizontal Safety Light Curtain

Vertical Perimeter Safety Light Grids

A vertically mounted safety light grid must be mounted such that the bottom beam is no higher than 300mm (12") from the ground. If the light grid is of only 2 beams then the second beam must be located 900mm (36") from the ground. For a 3 or 4 beam system the top beam must be 1200mm (48") above the ground.



Vertical Perimeter Safety Light Grid



Correctly Installed

The operator cannot reach into the machine without actuating Light Curtain.



Incorrect Installation

Gap below Light Curtain. The operator can reach into the machine without actuating the Light Curtain.



Correctly Installed

Light Curtain complemented with a horizontal Light Curtain to detect the operator.



Incorrect Installation

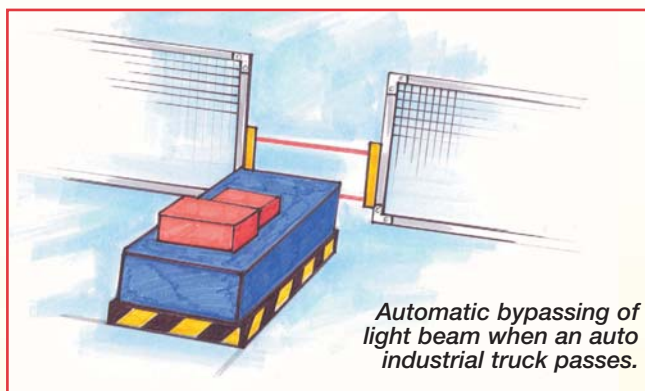
Gap above Light Curtain. The operator can reach into the machine without actuating Light Curtain.

Muting (Bypassing)

Bypassing may be needed for different reasons. One of the most common reasons for bypassing is during in and out feeding of material on a conveyor, auto industrial trucks, etc. Another common application is bypassing while passing with a three-position device to the risk area.

Important aspects for bypassing are that it should be safe, not be activated by mistake and be difficult to defeat. In other words, it should give a reliable bypassing when a loading carrier comes but not allow a human to pass. To achieve the highest safety level a dual and supervised bypassing system is needed — usually with at least two independent signals. If this is done with sensors, it is recommended they be of different kinds, because the probability of them both malfunctioning for the same reason (e.g. common mode failure) is eliminated. An example of a solution is to use a mechanical limit switch and a photocell sensor.

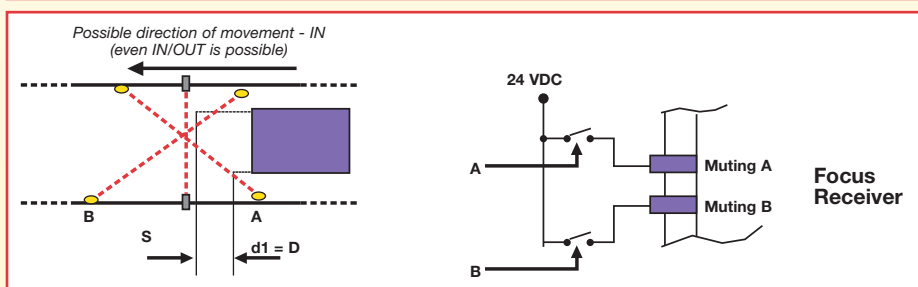
To avoid deliberate defeating/manipulation of the bypassing sensors/signals a safety relay or a safety



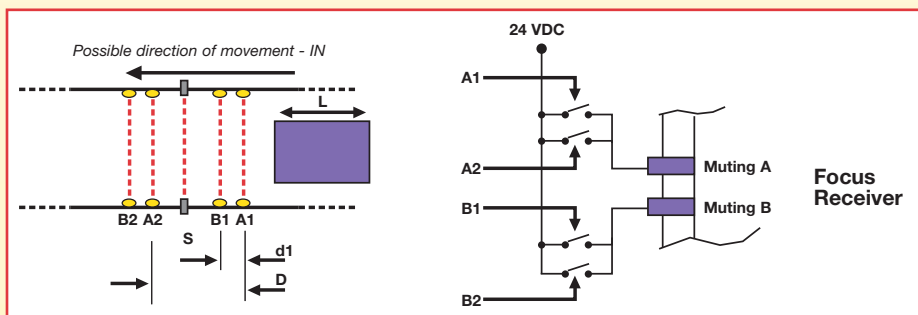
PLC is connected, thereby monitoring that both sensors are activated and deactivated in every bypassing cycle.

The amount of variants of bypassing systems are almost infinite, depending on the specific requirements of each plant/machine. For Focus there are a number of bypassing possibilities prepared.

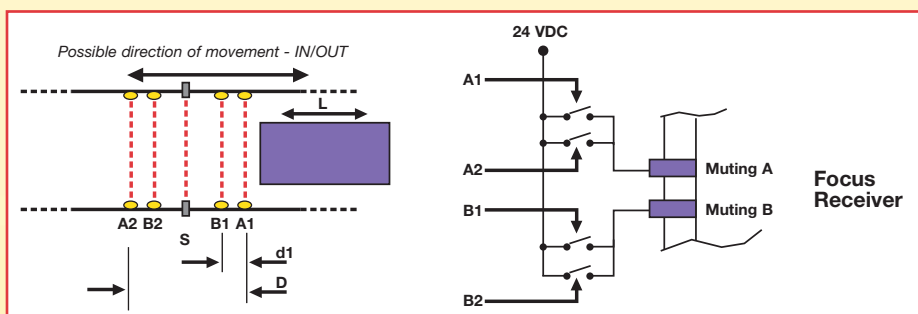
Examples on how the Muting Sensors can be placed



A solution with two sensors (photocells shown) and ONE (or TWO) movement directions for material transport.



A solution with four sensors and ONE movement direction for material transport.



A solution with four sensors and TWO movement directions for material transport.

Muting with FMC and FMI Units

The FMC Focus Muting Connector is a small, optimal unit which is used when the Focus Light Curtain or Light Grid is required to be bypassed for in and out passage to and from a dangerous area. The FMC unit is easily connected to Focus with an M12 connector.

The FMI Focus Muting Indicator is a small unit with built-in muting lamp, reset button, "power off" (for alignment and override). The FMI unit is connected to the FMC unit with M12 connectors to facilitate the muting function connection.



Various FMC, FMI, FRM Versions and Tina Units

FMC-1 22-042-00 M12-8 -8 M12-8	FMC-2 22-042-10 -8	FMI-1A 22-043-00 Muting Lamp LMS Reset Power Off -5	FMI-1B 22-043-01 LMS Reset Power Off -5	FMI-1C 22-043-02 Reset Power Off -5	FMI-1D 22-043-03 Reset Power Off -5	FMI-1E 22-043-04 Reset -5	FMI-1G 22-043-05 Reset -5	FMC-1(2): With connectors for muting sensors (A+B), reset, power off and muting lamp (r) and (M). FMI-1A: Only muting lamps. FMI-1B: With reset, power off and muting lamp. FMI-1C: With reset and power off. FMI-1D: With reset, power off and resistor instead of muting lamp. FMI-1E: As pre-reset fitted in connector A (A2) on FMC-1(2) (Tina) or as reset for Tina Duo 2 in (R) connector. FMI-1G: With reset and resistor instead of muting lamp. FMC-1(2) Tina: The same as FMC-1(2) but made for connection of Vital or Pluto. Tina 10A: Adapter unit for connection of Vital or Pluto. Tina 10B: Simplified FMC-1(2) Tina but with only (R) connector. Tina 10C: Simplified FMC-1(2) Tina but with only power feed at connector 3. M12-3M: Bypass unit for easy connection outside the enclosure. FRM-1A: Converts the two OSSD outputs to relay outputs (and power feed). JS SP-1: Blanking plug for unused inputs. JS AP-1: Adapter for FMC units for use without FMI-1B or FMI-1D at (R) connector with muting resistor.
FMC-1 Tina 22-045-00 M12-8 M12-5	FMC-2 Tina 22-046-00 -8	Tina 10A 20-054-12 -8 1 2 3 -5	Tina 10B 20-054-13 -8 1 2 3 -5	Tina 10C 20-054-15 -8 1 2 3 -5	M12-3M 20-055-04 -5 1 2 3 -5	FRM-1A 22-048-00 -8	JS SP-1 22-070-00 -5 JS AP-1 22-070-10 -5	

M12 Connection Device with Screw Connectors



M12-C01 (Female)



M12-C02 (Male)



M12-C03 (Female)

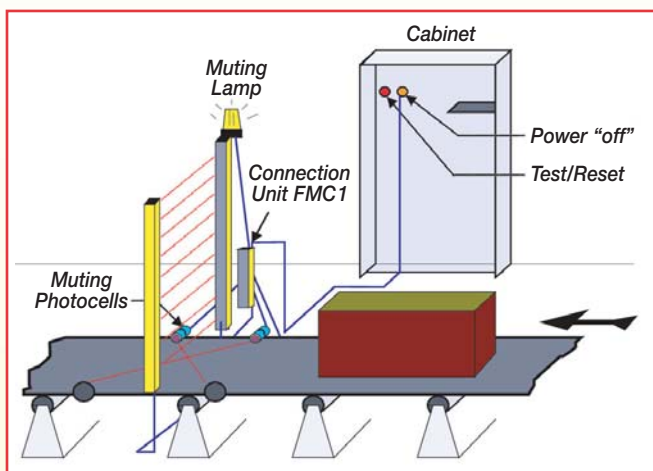


M12-C04 (Male)

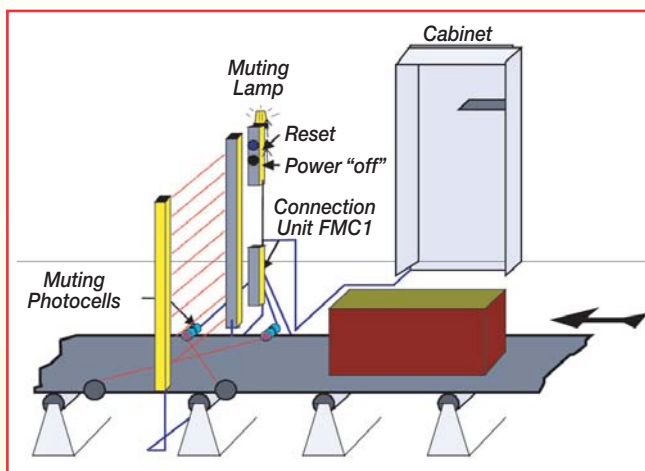
Note: Connector drawings are shown from cable side.

Connection of Focus and Muting Components with FMC1 and FMI1

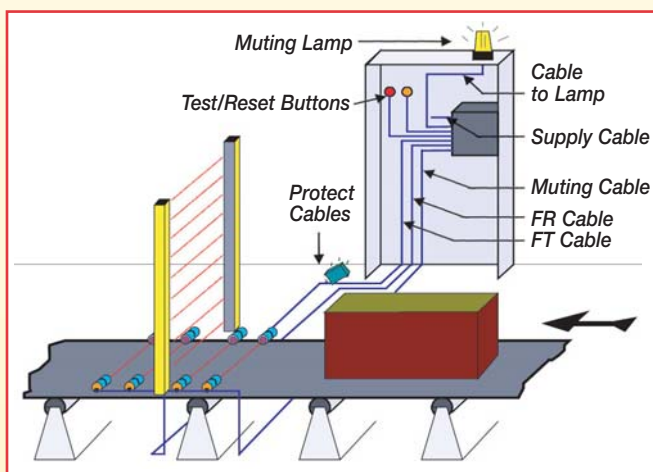
Connection of light curtain with connection block FMC 1, test/reset button 1 and switch for supply voltage placed in or by the control cabinet.



Connection of light curtain with connection block FMC1. The FMI reset unit must be placed out of reach from the risk area.



Connection of Focus and Muting Components directly to Control Cabinet



The test/reset button shall be placed so the operator can see the protected area during reset, testing and bypassing. It should not be possible to reach the button from within the risk area.

The LMS lamp for indication of muting and bypassing shall be placed so that it can be seen from all directions from where it is possible to access the dangerous area.

If photocells are used as muting sensors, the sensor receivers should be assembled on the light curtain's transmitter side to minimize the interference risk.

The system is protected against dangerous functions caused by damage on the transmitter cable and/or the receiver cable. However, we recommend that the cables be protected so that physical damage to them can be minimized.

Focus Modular Muting Capabilities

The Focus Safety Light Curtain offers the selection of complete muting of the protective field during the in and out passage of material. Through dipswitch settings in the Focus standard version, it is also capable of muting only specific modules within the protective field.

The Focus is capable of muting independent beam module packets or a combination of them (up to 4).

For example, a box travels down a conveyor and instead of muting the entire light curtain you can mute only modules 1 and 2 — which equates to the height of the box — allowing continual protection on the remaining Safety Light Curtain modules.

The module size is directly dependent on the Focus Light Curtain resolution and length.

Muting with MF-T and MF-L Units

MF-T and MF-L are muting units with integrated photocells in the same profile type as the Focus Light Curtain/Grid. No additional sensors are required because the muting units contain the required components. MF-T/MF-L is connected directly to Focus with M12 connectors.

MF-T (Option 1)

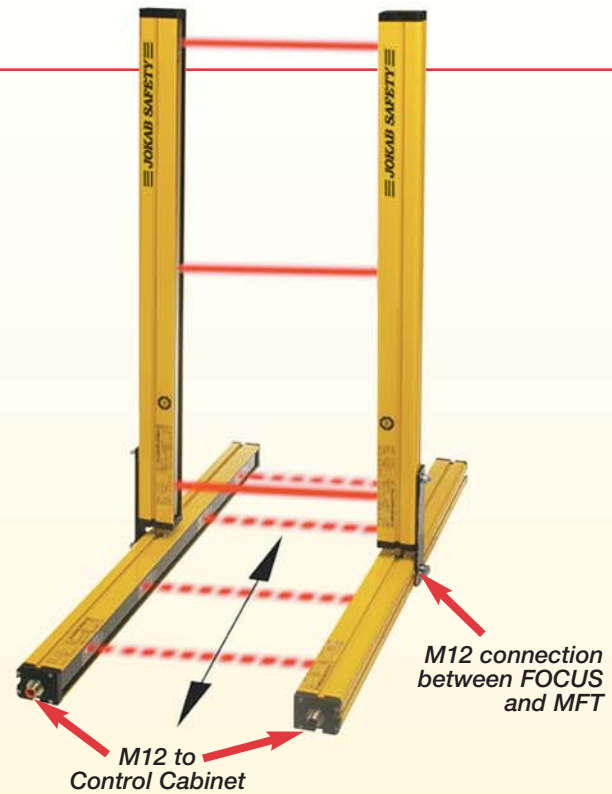
MF-T contains four photocells — A1, B1, B2 and A2 — arranged as shown. they are configured for installations where material is transported “in” or “out”—or in both directions “in and out”.

Note: All standard Focus Light Curtains/Grids are delivered connected to function together with the MF-T.

MF-L (Option 2)

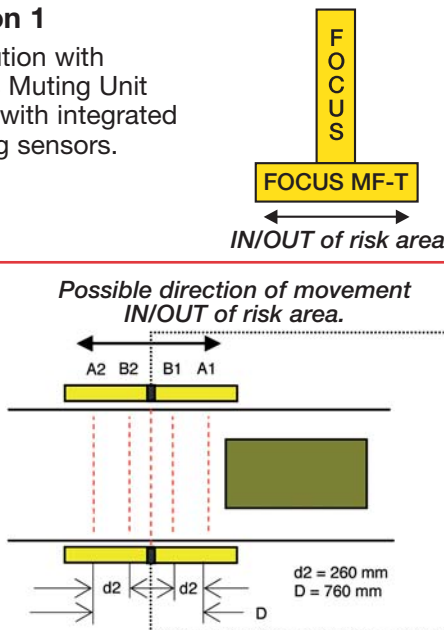
MF-L contains two photocells — A1 and B1— which are actuated before and by material exiting through the light curtain/grid. The light curtain/grid remains bypassed just prior to the exit of the material.

Note: MF-L Reflex unit is primarily intended for material transport “out” of a working area. The standard Focus Light Curtain/Grid delivered does not function together with the MF-L Reflex version. The Focus Light Curtain/Grid L version needs to be ordered separately, as well as the MF-L unit.



Option 1

A solution with Focus Muting Unit MF-T with integrated muting sensors.

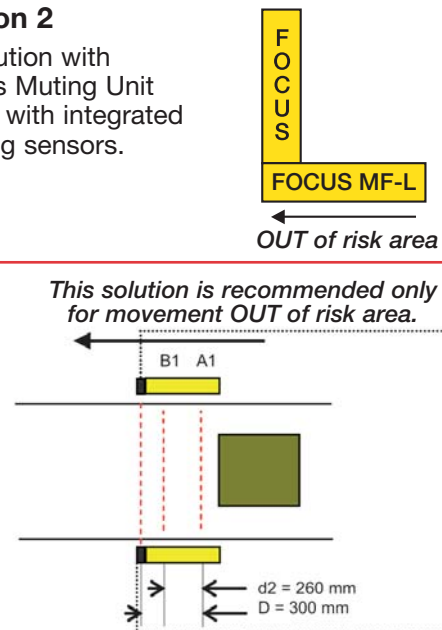


Note: The muting sensors A and B must be placed so that the sensor A is always activated at least 30 ms before sensor B.

D: indicates the minimum length of the material that is to actuate the muting sensors that must be maintained during the passage through the light curtain/grid.

Option 2

A solution with Focus Muting Unit MF-L with integrated muting sensors.



d2: indicates the measurement between the two preassembled muting sensors within the MF-T and MF-L (= 150mm).

Muting with MF-T Reflex and MF-L Reflex Units

MF-T Reflex and MF-L Reflex are muting units with integrated retro-reflective photocells in the same profile type as the Focus Light Curtain/Grid. No additional sensors are required because the muting units contain the required components. The Reflex series simplifies the set up of muting sensors, as only 1 side requires a cable connection. The reflective side is a polarized reflector bar. MF-T Reflex and MF-L Reflex are connected directly to the Focus Receiver with M12 connectors.

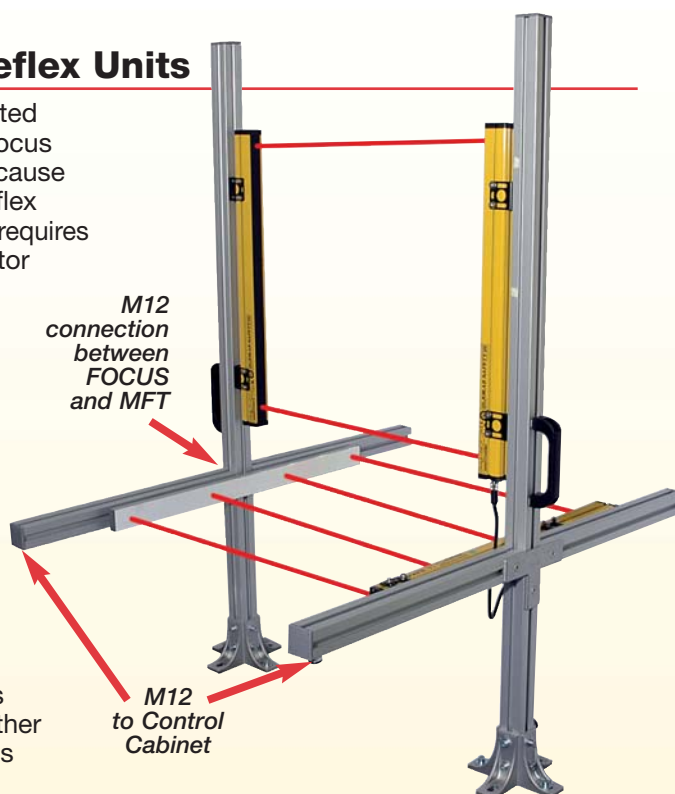
MF-T Reflex (Option 3)

MF-T Reflex contains four transmitters/receivers and a separate reflector unit. Range 6m. Used in the muting mode for transport of material into and/or out of hazardous areas. For other functions refer to Option 1. This unit, together with light beam F4-K1C-500 provides electrical connections on only one side.

MF-L Reflex (Option 4)

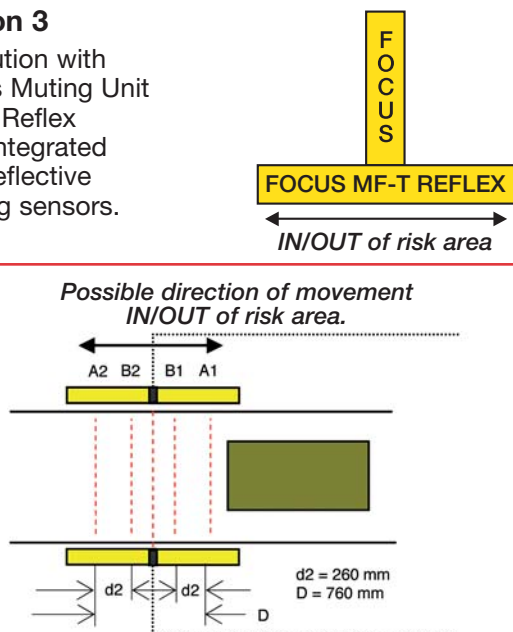
MF-L Reflex contains two transmitters/receivers and a separate reflector unit. Range 6m. Used in the muting mode for transport of material into and/or out of hazardous areas. For other functions refer to Option 2. This unit, together with light beam F4-K1C-500 provides electrical connections on only one side.

Note: MF-L Reflex unit is primarily intended for material transport "out" of a working area. The standard Focus Light Curtain/Grid delivered does not function together with the MF-L Reflex version. The Focus Light Curtain/Grid L version needs to be ordered separately, as well as the MF-L unit.



Option 3

A solution with Focus Muting Unit MF-T Reflex with integrated retroreflective muting sensors.

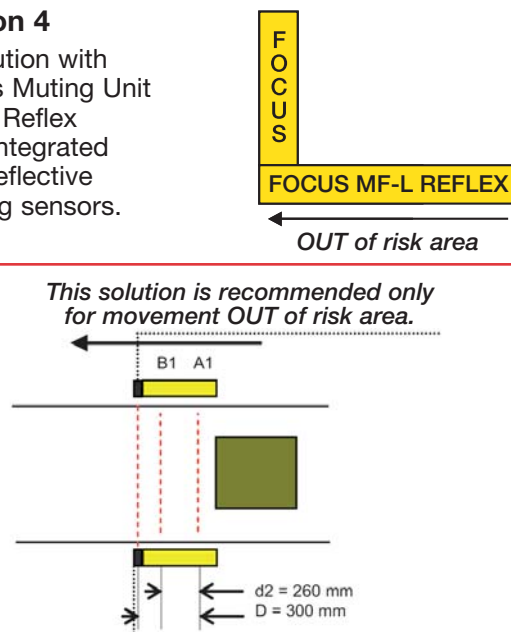


Note: The muting sensors A and B must be placed so that the sensor A is always activated at least 30 ms before sensor B.

D: indicates the minimum length of the material that is to actuate the muting sensors that must be maintained during the passage through the light curtain/grid.

Option 4

A solution with Focus Muting Unit MF-L Reflex with integrated retroreflective muting sensors.



This solution is recommended only for movement OUT of risk area.

d2: indicates the measurement between the two preassembled muting sensors within the MF-T Reflex and MF-L Reflex (= 150mm).

Focus Summary

Focus Light Curtain

Standard Muting (bypassing) partly or completely. Supervised output for muting lamp. Override. Manually supervised or automatic reset. Time-reset.

Option Fixed or floating blanking.

Muting Unit for Focus

Standard Muting (bypassing) of light curtain or light grid in one or two directions (L-form, T-form). The unit is connected directly to the light curtain/grid via an M12 connection.



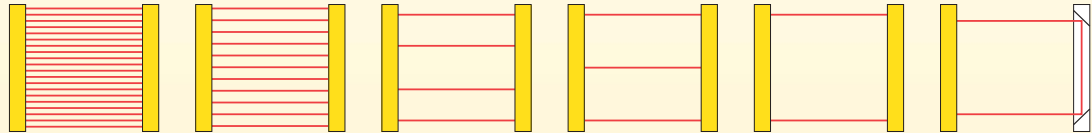
Muting unit MF-T with four beams connected directly to the bottom of a light grid with an M12 connection. The entire T-unit is then connected with an M12 connection on the muting unit.

Focus Light Grid

Standard Muting (bypassing) of one, two, three or four beams. Supervised output for muting lamp. Override. Manually supervised or automatic reset. Time-reset.

FMC Focus Muting Connector with M12 Connection

Standard FMC is a small, optimized connection block with M12 inputs. FMC is used for M12 connection of muting sensors, muting lamp, re-reset (for time reset), reset button with indication, override and safety outputs.



Type	F4-14-XXX	F4-35-XXX	F4-KX4-XXX	F4-KX3-800	F4-KX2-500	F4-K1C-500
Resolution (mm)	14	35	300/400	400/450	500/600	500
Protection Field Height (mm)	150 - 2400	150 - 2400	900/1200	800/900	500/600	500
Range (m)	6	15	25 or 50	25 or 50	25 or 50	6
Response Time (ms)	15 - 60	14 - 36	14	14	14	14
Manual Reset	•	•	•	•	•	•
Automatic Reset	•	•	•	•	•	•
Time Reset	•	•	•	•	•	•
Muting Inputs (Bypassing)	•	•	•	•	•	•
Supervision of Muting Lamp	•	•	•	•	•	•
Override	•	•	•	•	•	•
MF-T	•	•	•	•	•	•
MF-L	✖ ¹	✖ ¹	✖ ¹	✖ ¹	✖ ¹	✖ ¹
Floating Blanking	✖ ²	✖ ²				
Fixed Blanking	✖ ²	✖ ²				
Dynamic Adaption to Vital	✖ ³	✖ ³	✖ ³	✖ ³	✖ ³	✖ ³

• Standard

✖¹ When ordering add (-L).

✖² When ordering add (-FB).

✖³ With Tina 10A/10B/10C or FMC_Tina.

Focus Ordering Data

Safety Light Curtains

To create a complete Focus Safety Light Curtain Part Number, simply fill in the fields below.

F4 - - -
A B C

A This letter represents the effective resolution of the Focus Safety Light Curtain.

14	14mm (0.55") resolution for Finger Detection
35	35mm (1.38") resolution for Hand Detection

B This letter represents the protective height of the Focus Safety Light Curtain.

150	150mm (5.91")	1350	1350mm (53.15")
300	300mm (11.81")	1500	1500mm (59.06")
450	450mm (17.72")	1650	1650mm (64.96")
600	600mm (23.62")	1800	1800mm (70.87")
750	750mm (29.53")	1950	1950mm (76.77")
900	900mm (35.43")	2100	2100mm (82.68")
1050	1050mm (41.34")	2250	2250mm (88.58")
1200	1200mm (47.24")	2400	2400mm (94.49")

C This letter represents the functionality package of the Focus Safety Light Curtain.

(blank)	Modular Muting - No Blanking Pre-reset Standard Package
FB	Complete Muting and Blanking
L	Program for Single Direction MF-L Muting Capabilities

Example

F4 - 35 - 1200 - FB
A B C

Focus category 4 Light Curtain with 35 mm resolution and 1200 mm protected height. Fixed and floating blanking function package.

Safety Light Grids

To create a complete Focus Safety Light Grid Part Number, simply fill in the fields below.

F4 - K - - -
A B C

A This letter represents the effective range of the Focus Safety Light Grid.

(blank)	4m to 50m (13' to 164')
L	0.5m to 25m (1.5' to 82')

B This letter represents the number of beams and the protective height of the Focus Safety Light Grid.

4-900	4 beams spaced 300mm (11.81") apart with 900mm (35.43") protective height
4-1200	4 beams spaced 400mm (15.75") apart with 1200mm (47.24") protective height
3-900*	3 beams spaced 450mm (17.72") apart with 900mm (35.43") protective height
3-800**	3 beams spaced 400mm (15.75") apart with 800mm (31.50") protective height
2-600*	2 beams spaced 600mm (23.62") apart with 600mm (23.62") protective height
2-500**	2 beams spaced 500mm (19.69") apart with 500mm (19.69") protective height

* North American Standard ** European Standard

C This letter represents the functionality package of the Focus Safety Light Grid.

(blank)	Modular Muting Standard Pkg
L	Program for Single Direction MF-L Muting Capabilities

Example

F4 - K - L - 4-1200 - L
A B C

Focus category 4 Light Grid with 4 beams spaced 400 mm apart and 1200 mm protected height. Built-in complete modular muting.

Note: Kits include mounting hardware, brackets and manual. Cables and optional interface units are sold separately. See pages 5:36-5:38.

Bjorn Stand System for Light Grids and Mirrors

Bjorn is a very stable and flexible stand system in which Focus Safety Light Beams and Mirrors are mounted in the stand. The hardware for the mirrors in the stand can be turned to provide either vertical or horizontal angles. The robust material of the Bjorn protects Focus units from direct collisions, thus preventing unnecessary material damage and halts in production.

Applications

Protects mirrors and light beams

Features

- Robust
- Adjustable

Bjorn Technical Data

Manufacturer.....JOKAB SAFETY

Ordering Data/Article Numbers..... see page 5:31

Color.....yellow powder-coated (RAL 1018)

Material..... 3mm steel

Dimensions

Cross-Section146mm x 130mm

Raised Stand - H2 Two-Beam1000mm

H3 Three-Beam 1230mm

H4 Four-Beam1330mm

Foot 230mm x 190mm

Weight

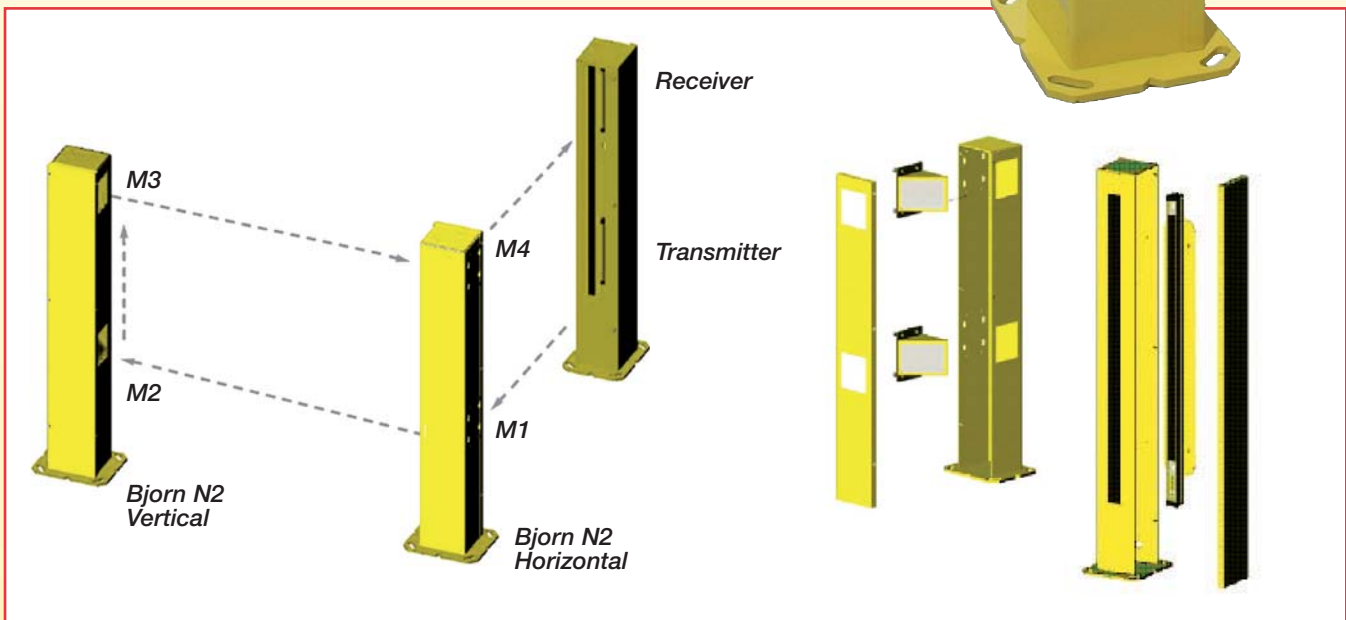
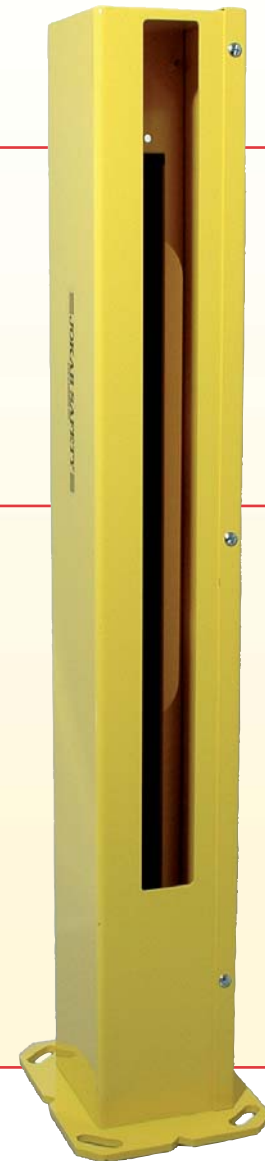
H2, N215 kg/st

H317 kg/st

H419 kg/st

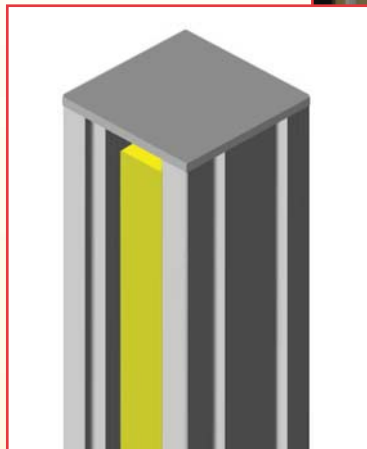
Protection

Against water and dust..... 20%



Kepguard Protective Machine Mounted Enclosures

Kepguard is an extruded aluminum protective housing for Focus Light Curtains/Grids for machine mounted applications. Kepguard has been designed to absorb impact hits while still offering secure protection for the enclosed safety device. Protective front 5mm thick polycarbonate lens and stamped aluminum end caps are included for additional, optional protection.



Kepguard Technical Data

Manufacturer.....JOKAB SAFETY

Ordering Data/Article Number..... see page 5:31-5:33

Color/Material

End Caps..... yellow polyamide

Lens..... 5mm polycarbonate

Housing..... natural anodized aluminum

Dimensions

Cross-Section.....88mm x 88mm

Overall Length - Kepguard 300..... 431mm

Kepguard 450..... 578mm

Kepguard 600..... 725mm

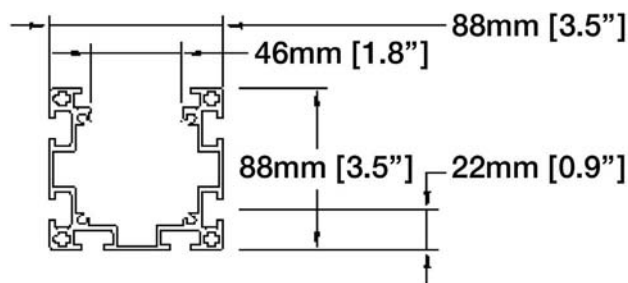
Kepguard 750..... 872mm

Kepguard 900..... 1019mm

Kepguard 1050..... 1166mm

Kepguard 1200..... 1312mm

Kepguard 1350..... 1460mm



Applications

Protects light curtains/grids or muting sensor bars from impact hits.

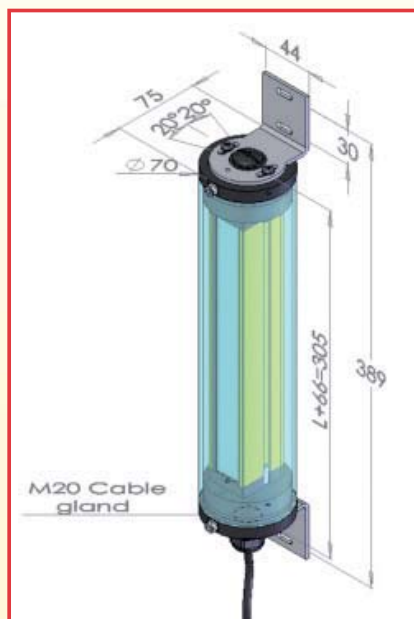
Features

- Robust for rugged environments
- Adjustable with 3 sides for T-slot mounting
- Easily mounts to QuickGuard® fencing, QuickGuard® Express Fencing or machine frames
- Natural Anodized Aluminum

Wet Wash Down Tubes for Protection against Water and Dust

Wet Wash Down Tubes are used for protection against water (or dust) where extreme washing conditions are encountered. The protective encapsulation rating (IP68) now enables Focus Light Curtains and Light Beams to be used for such applications as the food industry, where the use of high pressure washing for cleaning machinery often occurs. The draining and through ventilation capabilities mean that condensation can be avoided.

Wet, with Focus Light Curtains/Beams, is pre-assembled complete with cabling on request. During installation on a machine, a Wet unit can be adjusted by $\pm 20^\circ$ with the accompanying angle bracket. The plastic tube is rotatable and the outside is easy to clean.



Applications

Protection in severe environments

Features

- Adjustable $\pm 20^\circ$
- Rotatable and replaceable
- Capable of draining and through ventilation

Wet Technical Data

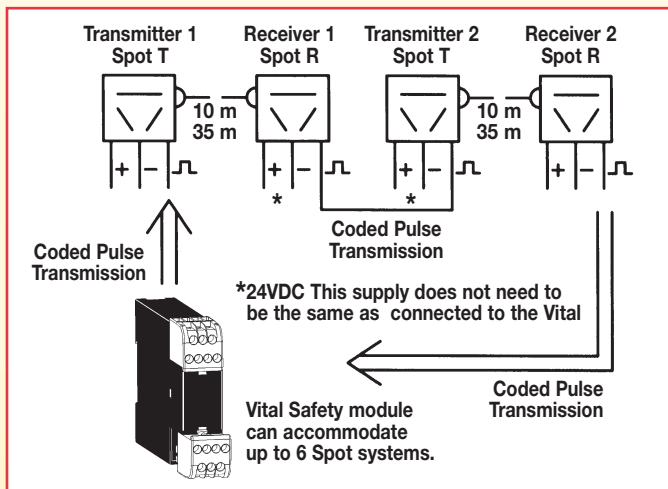
Manufacturer.....	JOKAB SAFETY
Ordering Data/Article Numbers.....	see page 5:33
Color.....	transparent plastic
Length including Lid.....	66mm + light curtain/beam
Material	
Tube.....	PC
Lid.....	PEHD-300
Maximum Ambient Temperature.....	+55°C
Installation Adjustment.....	$\pm 20^\circ$
Protection Class.....	IP68

Spot Safety Light Beam for the Highest Level of Safety

The light beam is available in two versions — Spot 10 for distances up to 10 m and Spot 35 for up to 35 m. The light beams can be mounted at different heights and be angled around a machine using our mirrors and brackets.

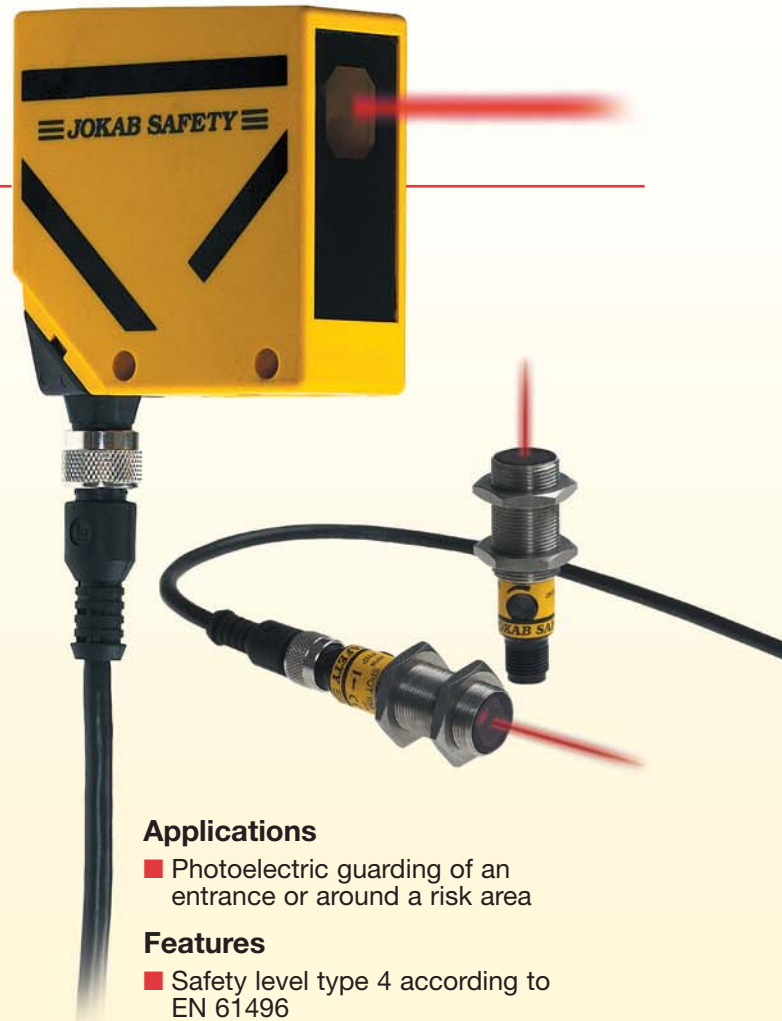
Spot and Vital in combination fulfills the requirements for Category 4 according to EN-954-1/EN ISO 13849-1 and type 4 according to EN 61496. Several light beams, Eden sensors and emergency stops can be connected in series achieving the high safety level for the safety circuit. A number of solutions for bypassing of light beams for material transport are available.

For indication there are LEDs on the transmitter and on the receiver which indicate 'contact' between transmitter and receiver and safety status. The 'contact' information is available via the light beam receiver connection cables.



Function

The Spot light beam is supervised by the Vital safety module. A unique coded signal is sent out from the control unit (Vital) to the transmitter (Spot T). The signal which comes back from the receiver (Spot R) is then compared in the Vital. If the correct coded signal is received the Vital switches the necessary safety output contacts to permit dangerous machine movements. Coding guarantees that no output signals can be produced by light from other sources, interference or faults in components in the transmitter or receiver. The light beam is dynamically supervised which means that if the signal stops pulsating at the correct frequency it is immediately detected. By using this special code function in the sensors, the signal can travel via up to 6 transmitter/receiver pairs which are not electrically connected to the Vital unit.



Applications

- Photoelectric guarding of an entrance or around a risk area

Features

- Safety level type 4 according to EN 61496
- Versatile mounting
- LED indication
- Protection class IP67
- 10 m or 35 m range
- Bypassing possibility
- Can be connected with several other different safety devices in the same safety circuit at category 4 together with Vital according to EN-954-1/EN ISO 13849-1.

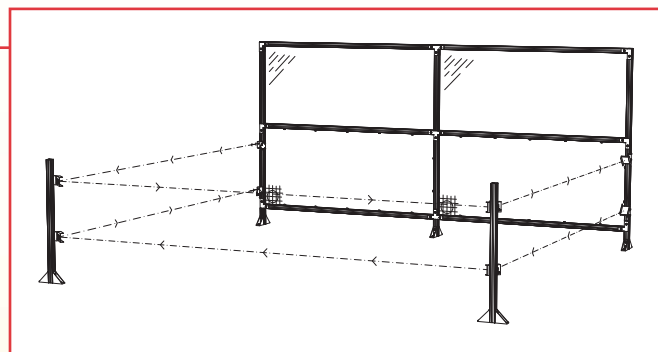
Approvals



Spot Mounting and Alignment

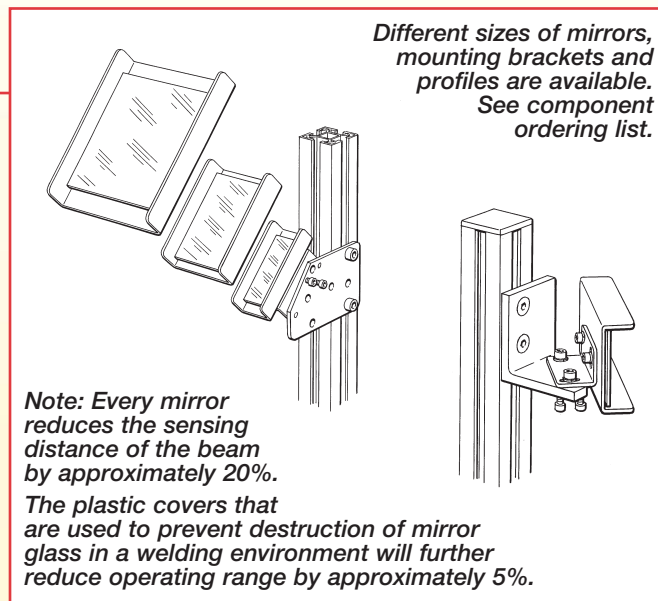
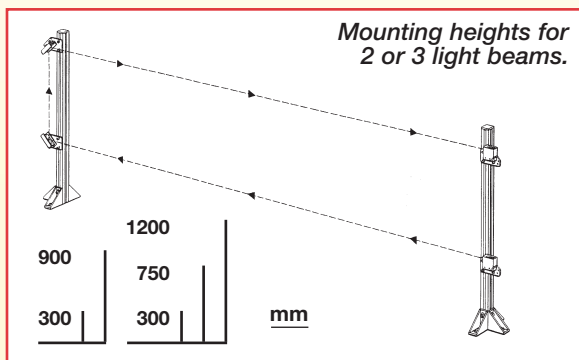
Safety Distance

The basic principle is that dangerous machine movements should be stopped before a person reaches the dangerous area, which should be at least 1200 mm from the light beams. When determining the correct safety distance the stopping time of the machine and the risk level must be taken into account (see also EN 999). Contact us for further information.



Accessories and Mounting

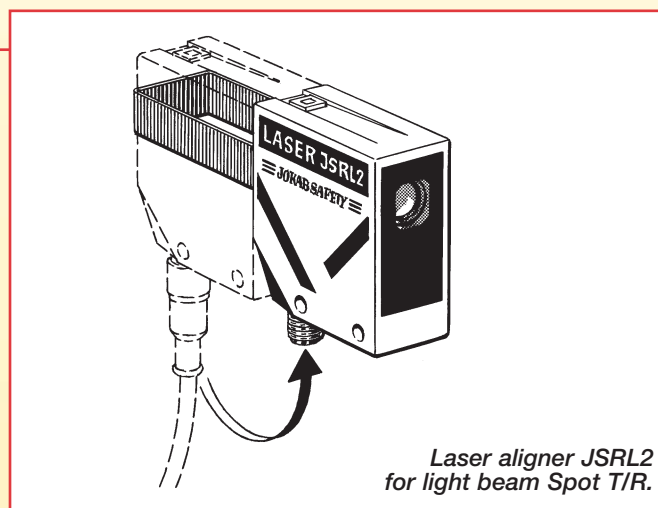
The Spot light beam can be mounted using a variety of brackets, posts and mirrors. See component list for further information.



Alignment

When aligning the light beam, look towards the transmitter. In the lens will be seen a strong red light. When this light is seen from the receiver (via mirrors if fitted) the light beam is basically aligned. The LED on the receiver is on when the receiver is aligned with the transmitter. By moving the transmitter up/down and left/right the best alignment can be found.

When vertically mounting, (as shown in the diagram) the receiver should be mounted above the transmitter as this will simplify the alignment and minimize the risk of extraneous light disturbance. In exceptional light disturbance environments the received light can be adjusted by a screw on the rear of the Spot 35 receiver. On Spot 10 this adjustment can be made on the transmitter. To make the alignment even easier the Laser Aligner (JSRL2) can be used for Spot 35. The laser has



visible light (class IIa) and is easy to mount for aligning. Supply to the Laser Aligner is taken from the Spot 35 T/R connector.

Spot Technical Data

Manufacturer.....JOKAB SAFETY

Ordering Data/Article Numbers.....see page 5:33-5:34

Safety Level with Vital
(according to EN 61496).....Type 4

Safety Category together with Vital
(according to EN 954-1).....4

Color.....Spot 10: steel grey
Spot 35: yellow

Weight.....Spot 10: 2 x 21 g
Spot 35: 2 x 100 g

Power Supply.....17 - 27 VDC,
ripple +/- 10% of operation voltage

Current Consumption

Transmitter.....< 25 mA

Receiver.....< 15 mA

Info. Output.....+10 mA max.

Light Source.....Red visible light,
660 nm, <+/- 2°

Function Indication

Transmitter LED on.....Power supply ok

Receiver LED status

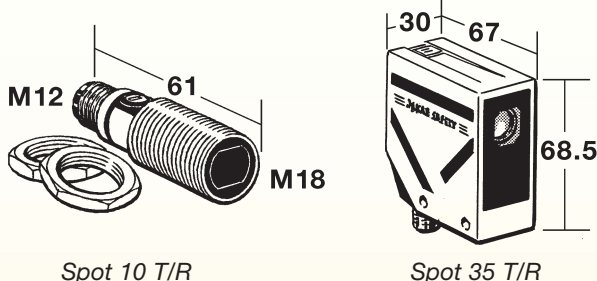
On.....Alignment ok, safety circuit closed

Flashing.....Alignment ok, earlier safety circuit open

Off.....Beam interrupted, safety circuit open

Range.....Spot 10: 0 - 10 m
Spot 35: 0 - 35 m

Operating Temperature Range.....-25°C to +65°C



Installation

Spot 10.....(2) M18 nuts (provided)

Spot 35.....Either via mounting holes in the casing
or with angle bracket JSM63 (provided)

Cable Connection.....M12 fixed connector

Casing Material

Spot 10.....Steel

Spot 35.....Polyamide housing with polyacryl lens protection

Connections

Transmitter - Brown (1).....+24 VDC

White (2).....dynamic signal in

Blue (3).....0 VDC

Receiver - Brown (1).....+24 VDC

White (2).....dynamic signal in

Blue (3).....0 VDC

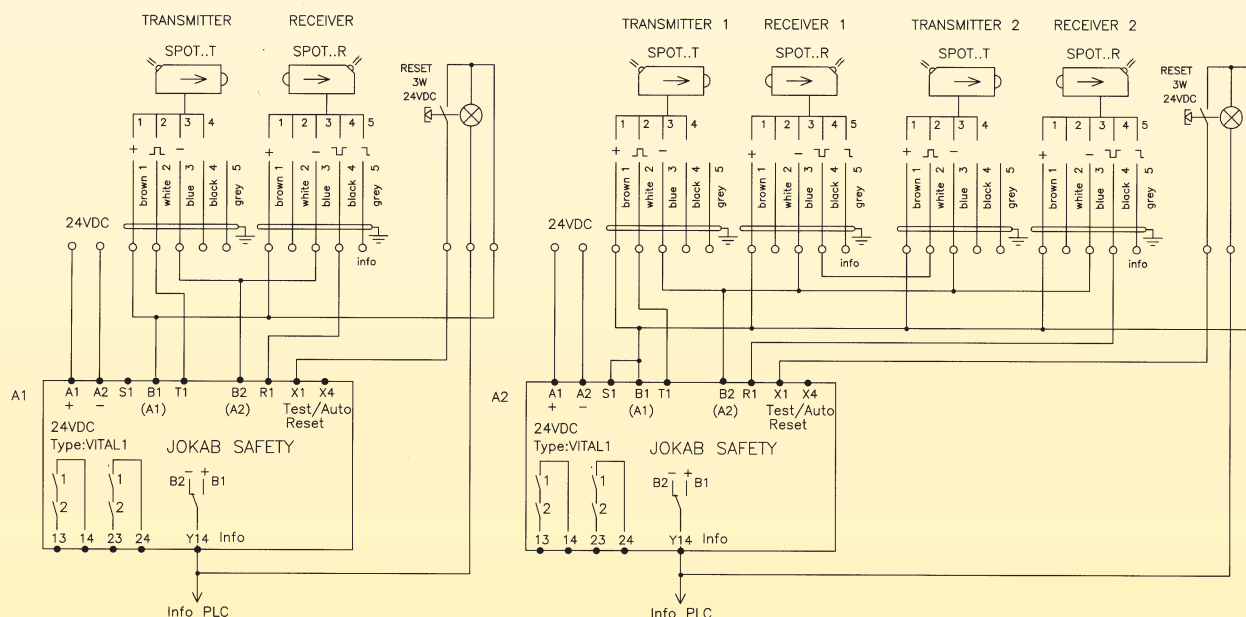
Black (4).....dynamic signal out

Grey (5).....Info. output (see below)

(24 VDC when LED is green or flashing/tolerance -2 VDC)
(0 VDC when LED is off/tolerance +2 VDC)

Protection Class.....IP 67

Connection of Spot T/R to Vital 1



Spot Resetting - 3 Possibilities

Supervised Manual Reset (Figure 1)

When the Spot light beam is broken Vital gives stop signals to dangerous machines inside the guarded area and the reset indication lamp is on. A new start of the machine requires a reset of the light beam. The reset button must be placed so that it cannot be reached from inside the guarded area and so that it has to be activated from outside the machine. When the reset button has been activated, i.e. the reset inputs have been both closed and opened, the outputs from the Vital are activated, the reset indication lamp is off and the machine can be started. High demands are placed on the reset function, a fault must not lead to the ready signal being given when someone has interrupted the light beam. (See connection example HD3800A on page 3:42.)

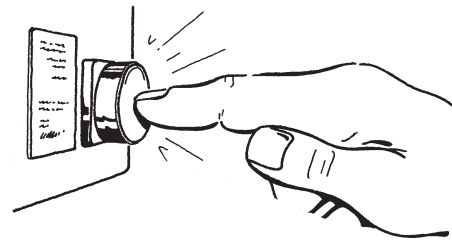


Figure 1 - Reset push button with lamp indication.

Supervised Time Resetting (Figure 2)

To reset the light beam, push button 1 must first be pressed and then push button 2 (within the predetermined preset time). This prevents unintentional resetting when someone is within the hazardous area. This is especially important when the area which is being protected by the light beam is not clearly visible from outside.

When time resetting is performed the safety timer relay JSHT1 A/B is used together with the Vital. This allows pre-reset times (in steps from 5 to 40 seconds) to be set. (See connection example HE3811B on page 3:43.)

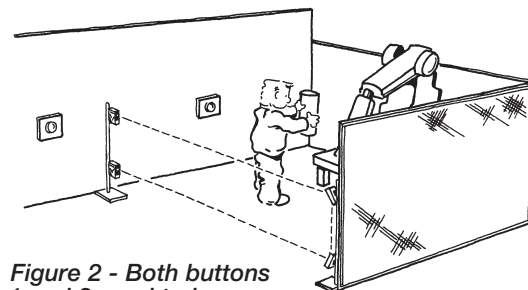


Figure 2 - Both buttons 1 and 2 need to be pressed (in sequence) within the pre-reset time to reset the Spot light beam

Automatic Reset (Figure 3)

Automatic reset is utilized for example when a light beam is used to monitor an area. In this case when the light beam is interrupted this indicates that the robot is operating in the area allowing it to be stopped if a person enters into the same area. When the light beam is clear, the Vital is reset automatically.

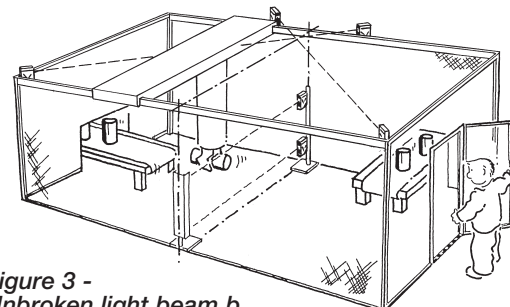


Figure 3 - Unbroken light beam b indicates that the industrial robot is outside area B. Area B can now be entered without stopping the robot.

Bypassing

Automatic Bypassing (Figure 4)

For the transport of materials, the light beams, grids or curtains can be bypassed just before they are interrupted. The bypassing is achieved by sensors which detect the auto carrier and give signals direct or via a safety relay to the Vital.

In the connection examples you can find a number of different solutions. (See connection examples HE3824C-E on pages 3:43 and 3:44.)

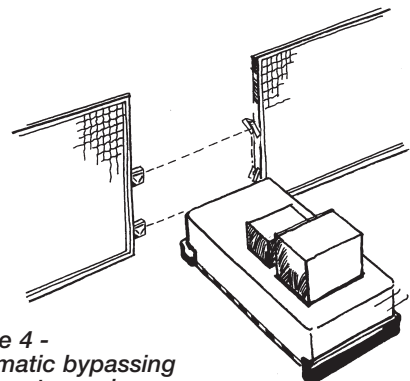


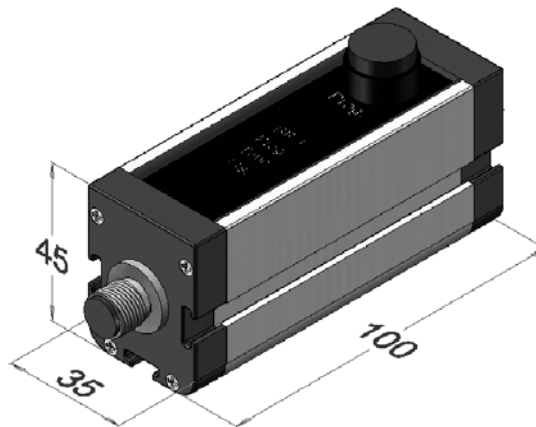
Figure 4 - Automatic bypassing when auto carrier passes.

BP1 Blanking Programmer A Quick Way to Program Blanking

A dipswitch at the cable connection of the light curtain receiver enables a choice of whether a blanking function is to be used. Once this choice has been made, programming of the unit in the light field is made easy by using the Blanking Programmer BP1.

If the extent of the object in the protected field then changes, the light curtain can be reprogrammed — only 11 seconds after the push button on the front of the BP1 has been pressed.

The BP1 is easily connected, in series with the cable to the light curtain receiver unit, using the M12 connector and the free length of the unit's cable.



The BP1 must be removed before power is applied to the machine controls.



JSRL-3 Laser Aligner

The JSRL-3 Laser Aligner facilitates alignment of light beams or light curtains, particularly when the solution involves one or more mirrors.

The JSRL-3 is simply secured by the accompanying elasticated tape around the transmitter and receiver unit, which must be located so that the flat rear of the unit is up against the front glass of the light curtain. When the Laser Aligner is switched on, the red laser spot must be visible — if appropriate via a mirror — at the corresponding unit.

The JSRL-3 contains two type AAA batteries that are changed by unscrewing the bottom end lid.



FSTR1 Muting Sensors

Retro/Reflective with Polarizing Filters

Features

- Adjustable Range
- Light reserve warning indicator
- Transistor output, PNP
- 1000 Hz switching frequency
- Short-circuit protection, reverse polarity protection and power-up output suppression
- M12 connector
- EMC tested according to IEC 801 and EN 50081-1/En 50082-2

Approvals

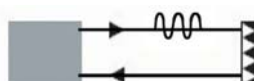
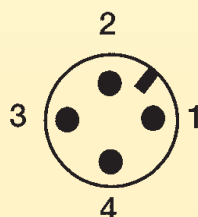


FSTR1 Technical Data

Manufacturer.....	JOKAB SAFETY
Ordering Data/Article Numbers.....	see page 5:35
Weight.....	approx. 15 g
Output.....	PNP, dark on
Connection.....	M12 connector
Range Adjustment.....	Yes
Range.....	0.15 - 2.5 m (with reflector FZR 1) 0.15 - 5 m (with reflector FZR 2)
Light Source.....	Visible-red, 660 nm, pulsed with polarizing filter
Supply Voltage.....	10 - 30 VDC
Allowable Ripple.....	+/- 10% of U_s
Current Consumption without Load.....	<15 mA
Maximum Load Current.....	100 mA
Residual Voltage.....	<1.6V
Maximum Switching Frequency.....	1000 Hz
Temperature (Operating and Storage).....	-25°C to +65°C
Protection Class.....	IP67

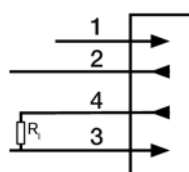
Note: All technical data at 25°C and 24V

M12 Connector



10 - 30 VDC
PNP, Dark-on output

PNP Output

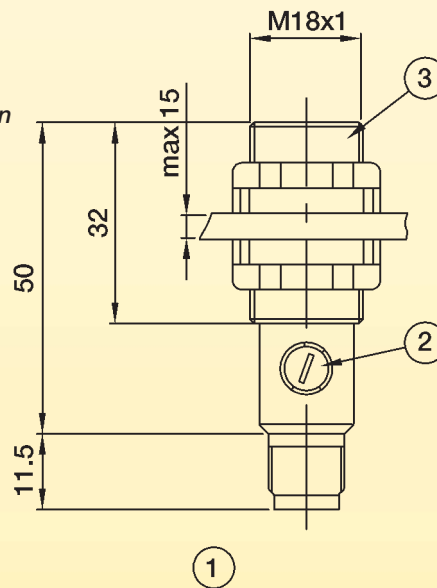


1 (+) Supply voltage 10 - 30 V
4 Dark-on output
3 (-) Supply voltage

Dark-on Output

The output is activated when an object interrupts the light.

- 1 Connector M12
- 2 Range adjustment and function indicator
- 3 Plastic housing



JS OBP800 Muting Sensors Diffuse/Reflective with Background Rejection

Features

- Electronically adjustable background rejection
- Light reserve warning indicator
- Dual transistor outputs, PNP
- Short-circuit protection, reverse polarity protection and power-up output suppression
- Rotatable M12 connector
- EMC tested according to IEC 801 and EN 50081-1/EN 50082-2

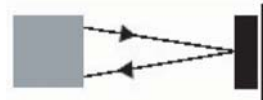
Approvals



JS OBP800 Technical Data

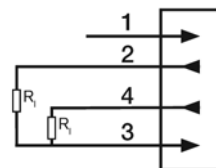
Manufacturer.....	JOKAB SAFETY
Ordering Data/Article Numbers.....	see page 5:35
Weight.....	approx. 130 g
Output.....	2 PNP (light-on and dark-on)
Connection.....	M12 connector
Range Adjustment.....	Yes
Range.....	0.2 - 0.8 m
Light Source.....	Infrared-LED, 880 nm, pulsed
Supply Voltage.....	10 - 30 VDC
Allowable Ripple.....	+/- 10% of U_s
Current Consumption without Load.....	<35 mA
Maximum Load Current.....	200 mA
Residual Voltage.....	<1.6V
Maximum Switching Frequency.....	200 Hz
Temperature (Operating and Storage).....	25°C to +65°C
Protection Class.....	IP67

Note: All technical data at 25°C and 24V



10 - 30 VDC
PNP, Light-on output
Dark-on output

PNP Output



- 1 (+) Supply voltage 10 - 30 V
- 2 Dark-on output
- 4 Light-on output
- 3 (-) Supply voltage

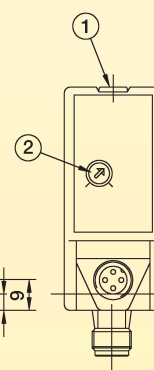
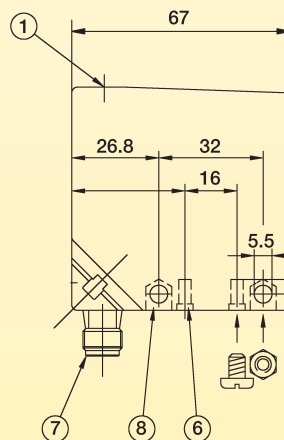
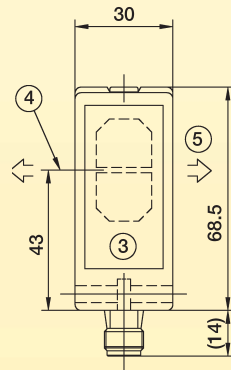
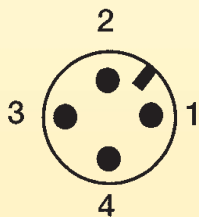
Light-on Output

Output energized when object is present.

Dark-on Output

Output energized when no object is present.

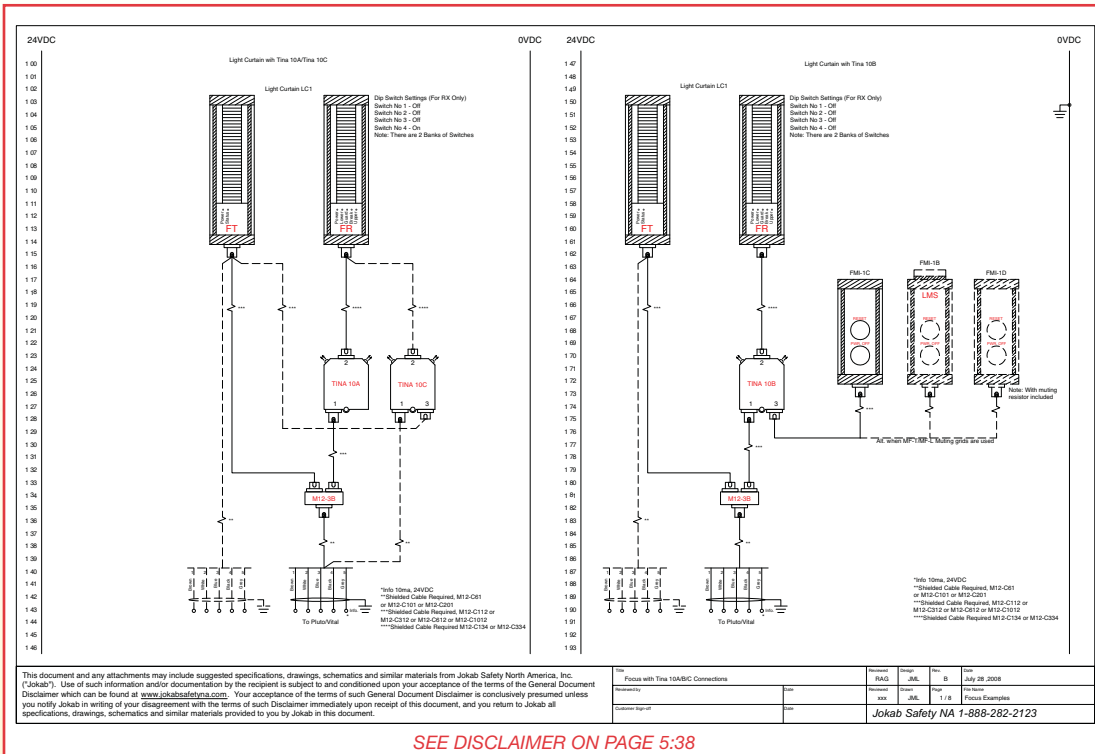
M12 Connector



- 1 Function indicator
- 2 Range adjustment
- 3 Glass-covered optics
- 4 Center of the optical axis
- 5 Preferred detection direction
- 6 Bore for 5mm self-tapping screw
- 7 M12 Connector
- 8 Opening for M5 nut

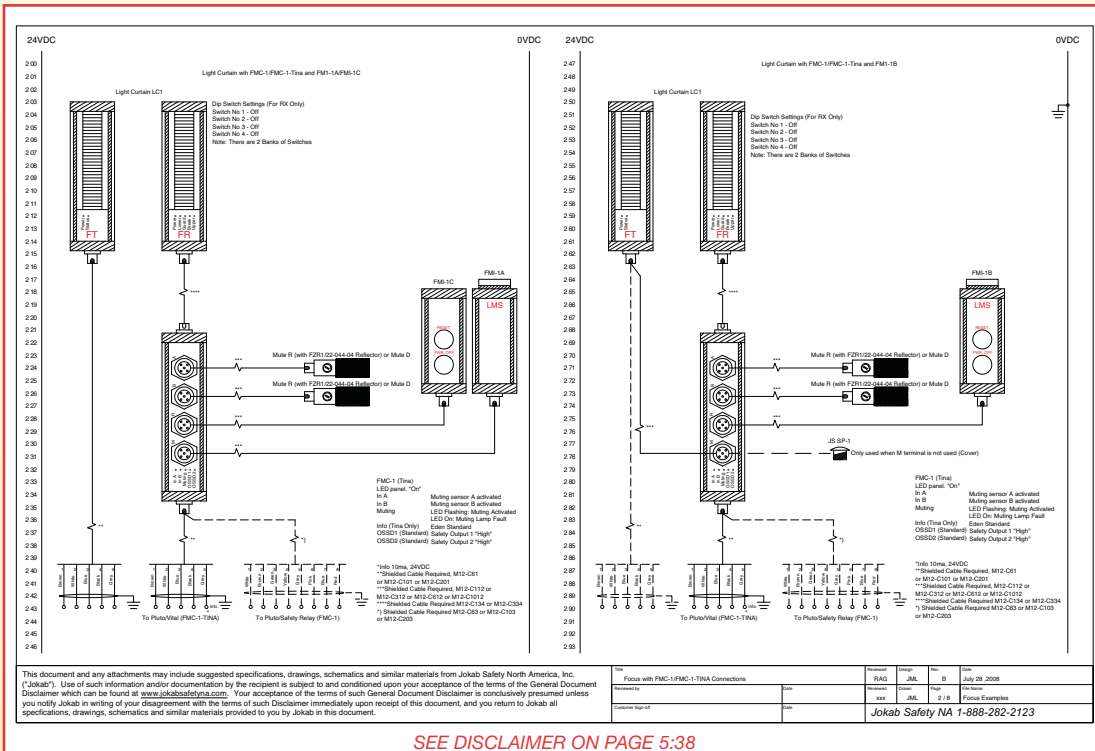
Connection Example

Focus with Tina 10A/B/C Connections



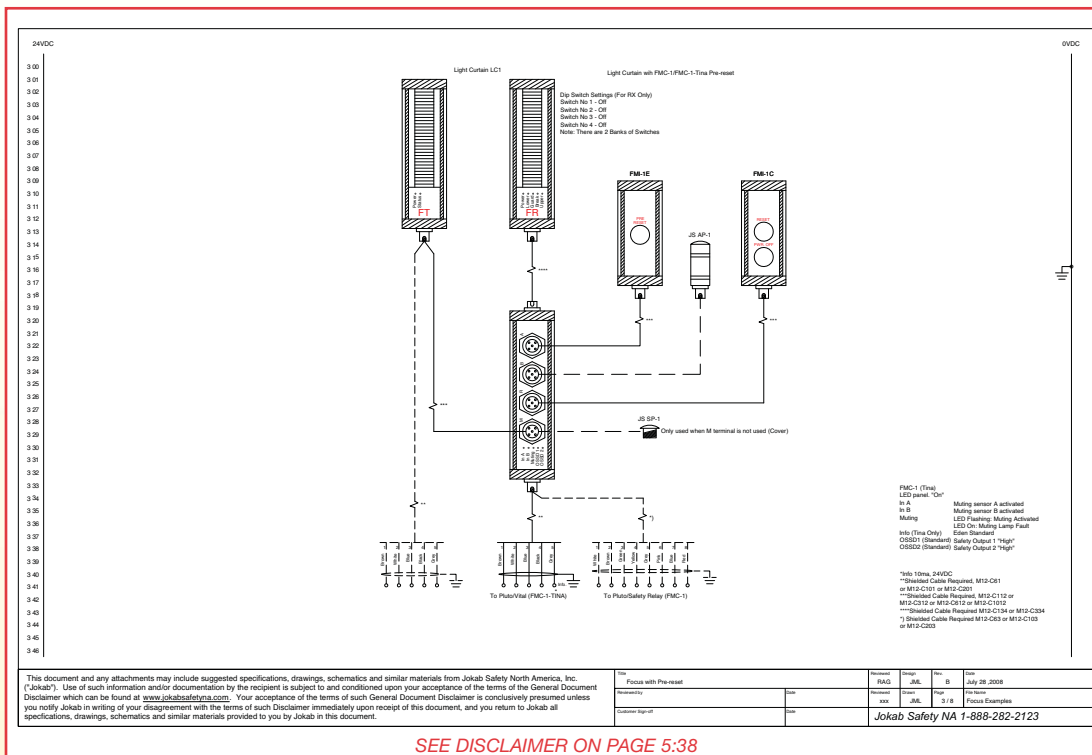
Connection Example

Focus with FMC-1/FMC-1-Tina Connections



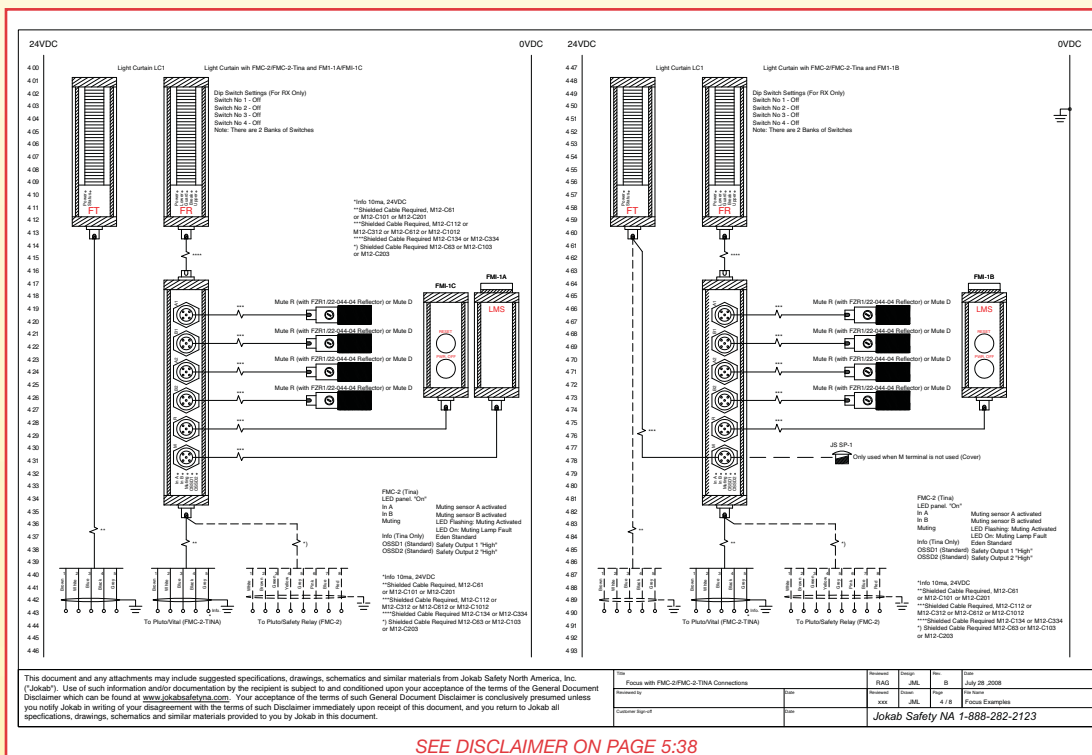
Connection Example

Focus with Pre-reset



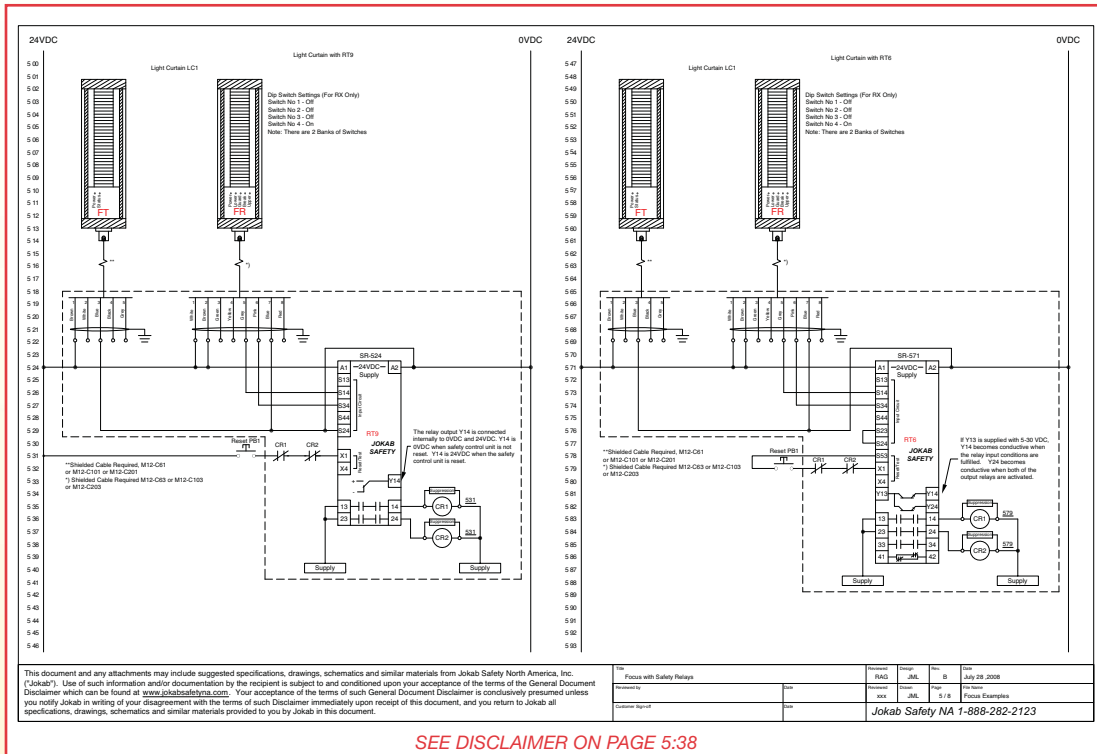
Connection Example

Focus with FMC-2/FMC-2-Tina Connections



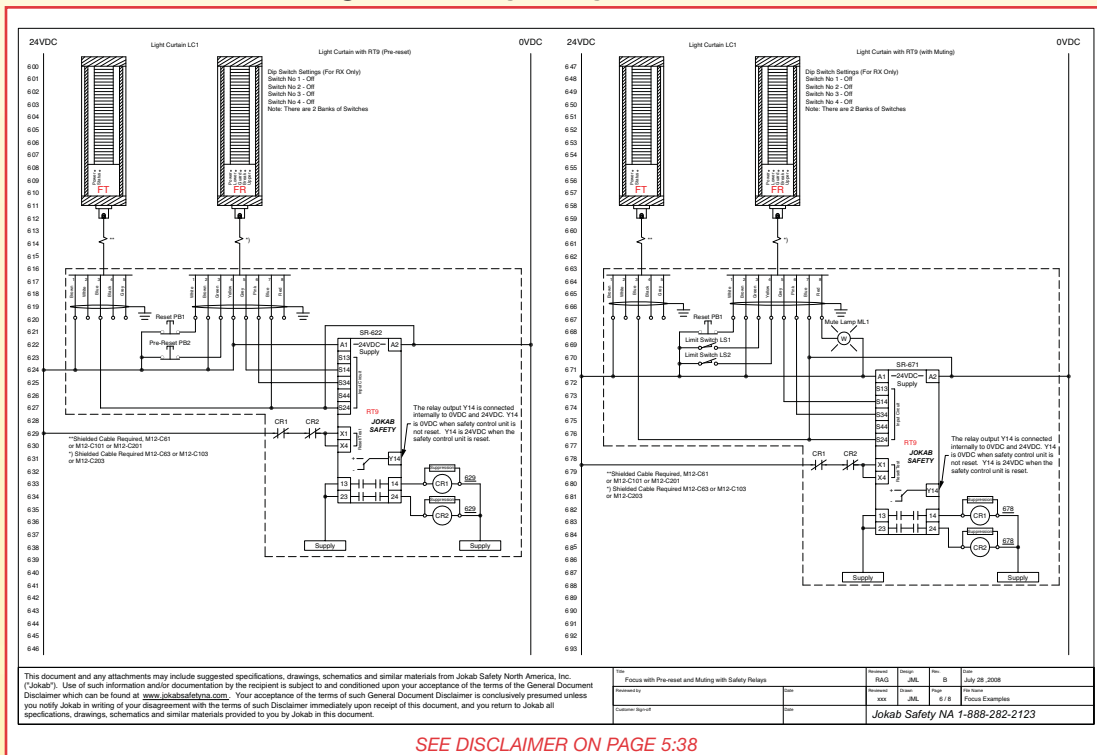
Connection Example

Focus with Safety Relays



Connection Example

Focus with Pre-Reset and Muting with Safety Relays



Focus with MF-T/MF-L



Focus with MF-T/MF-L



Component List - Mirrors

Designation	Article Number	Description
MF-150	22-041-01	Focus Light Curtain Mirror, For use with 150mm Focus Safety Light Curtains.
MF-300	22-041-02	Focus Light Curtain Mirror, For use with 300mm Focus Safety Light Curtains.
MF-450	22-041-03	Focus Light Curtain Mirror, For use with 450mm Focus Safety Light Curtains..
MF-600	22-041-04	Focus Light Curtain Mirror, For use with 600mm Focus Safety Light Curtains.
MF-750	22-041-05	Focus Light Curtain Mirror, For use with 750mm Focus Safety Light Curtains.
MF-800	22-041-06	Focus Light Curtain Mirror, For use with 800mm Focus Safety Light Curtains.
MF-900	22-041-07	Focus Light Curtain Mirror, For use with 900mm Focus Safety Light Curtains.
MF-1200	22-041-08	Focus Light Curtain Mirror, For use with 1200mm Focus Safety Light Curtains.
MF-1500	22-041-09	Focus Light Curtain Mirror, For use with 1500mm Focus Safety Light Curtains.
MF-1650	22-041-10	Focus Light Curtain Mirror, For use with 1650mm Focus Safety Light Curtains.
MF-1800	22-041-11	Focus Light Curtain Mirror, For use with 1800mm Focus Safety Light Curtains.
	22-041-20	Brackets for MF mirrors for mounting to Quick-Guard extruded aluminum. 2 required for each mirror.
JSNA-FOCUS-MC	50-010-09	2000mm Quick-Guard Stand 44mm x 88mm Light Curtain/Mirror mounting post with endcaps and 2 floor mounts.

Component List - Bjorn Support for Light Grids and Mirrors

Designation	Article Number	Description
Bjorn H2	22-041-40	Protective floor mounted housing for 2 horizontally mounted single beam mirrors. 3mm yellow powder-coated (RAL 1018) 1000mm tall steel enclosure.
Bjorn V2	22-041-41	Protective floor mounted housing for 2 vertically mounted single beam mirrors. 3mm yellow powder-coated (RAL 1018) 1000mm tall steel enclosure.
Bjorn H3	22-041-42	Protective floor mounted housing for 3 horizontally mounted single beam mirrors. 3mm yellow powder-coated (RAL 1018) 1230mm tall steel enclosure.
Bjorn H4-1	22-041-43	Protective floor mounted housing for 4 horizontally mounted single beam mirrors. 3mm yellow powder-coated (RAL 1018) 1330mm tall steel enclosure.
Bjorn H4-2	22-041-44	Protective floor mounted housing for 4 horizontally mounted single beam mirrors. 3mm yellow powder-coated (RAL 1018) 1600mm tall steel enclosure.
Bjorn N2	22-041-45	Protective floor mounted housing for 1 vertically mounted Focus Light Curtain or Grid. 3mm yellow powder-coated (RAL 1018) 1000mm tall steel enclosure.

Component List - Kepguard Protective Machine Mounted Enclosures

Designation	Article Number	Description
Kepguard-300	50-010-91	Protective housing for the Focus 300mm Light Curtain. 88x88mm extruded natural anodized aluminum with inside 16x44mm aluminum mounting plate. Protective stamped aluminum end cap and 5mm thick protective polycarbonate front lens.
Kepguard-450	50-010-92	Protective housing for the Focus 450mm Light Curtain. 88x88mm extruded natural anodized aluminum with inside 16x44mm aluminum mounting plate. Protective stamped aluminum end cap and 5mm thick protective polycarbonate front lens.

Component List - Kepguard Protective Machine Mounted Enclosures

Designation	Article Number	Description
Kepguard-600	50-010-93	Protective housing for the Focus 600mm Light Curtain. 88x88mm extruded natural anodized aluminum with inside 16x44mm aluminum mounting plate. Protective stamped aluminum end cap and 5mm thick protective polycarbonate front lens.
Kepguard-750	50-010-94	Protective housing for the Focus 750mm Light Curtain. 88x88mm extruded natural anodized aluminum with inside 16x44mm aluminum mounting plate. Protective stamped aluminum end cap and 5mm thick protective polycarbonate front lens.
Kepguard-900	50-010-95	Protective housing for the Focus 900mm Light Curtain. 88x88mm extruded natural anodized aluminum with inside 16x44mm aluminum mounting plate. Protective stamped aluminum end cap and 5mm thick protective polycarbonate front lens.
Kepguard-1050	50-010-96	Protective housing for the Focus 1050mm Light Curtain. 88x88mm extruded natural anodized aluminum with inside 16x44mm aluminum mounting plate. Protective stamped aluminum end cap and 5mm thick protective polycarbonate front lens.
Kepguard-1200	50-010-97	Protective housing for the Focus 1200mm Light Curtain. 88x88mm extruded natural anodized aluminum with inside 16x44mm aluminum mounting plate. Protective stamped aluminum end cap and 5mm thick protective polycarbonate front lens.
Kepguard-1350	50-010-98	Protective housing for the Focus 1350mm Light Curtain. 88x88mm extruded natural anodized aluminum with inside 16x44mm aluminum mounting plate. Protective stamped aluminum end cap and 5mm thick protective polycarbonate front lens.
Kepguard-1500	50-010-99	Protective housing for the Focus 1500mm Light Curtain. 88x88mm extruded natural anodized aluminum with inside 16x44mm aluminum mounting plate. Protective stamped aluminum end cap and 5mm thick protective polycarbonate front lens.
Kepguard-1650	50-110-00	Protective housing for the Focus 1650mm Light Curtain. 88x88mm extruded natural anodized aluminum with inside 16x44mm aluminum mounting plate. Protective stamped aluminum end cap and 5mm thick protective polycarbonate front lens.
Kepguard-1800	50-110-01	Protective housing for the Focus 1800mm Light Curtain. 88x88mm extruded natural anodized aluminum with inside 16x44mm aluminum mounting plate. Protective stamped aluminum end cap and 5mm thick protective polycarbonate front lens.
Kepguard-1950	50-110-02	Protective housing for the Focus 1950mm Light Curtain. 88x88mm extruded natural anodized aluminum with inside 16x44mm aluminum mounting plate. Protective stamped aluminum end cap and 5mm thick protective polycarbonate front lens.
Kepguard-2100	50-110-03	Protective housing for the Focus 2100mm Light Curtain. 88x88mm extruded natural anodized aluminum with inside 16x44mm aluminum mounting plate. Protective stamped aluminum end cap and 5mm thick protective polycarbonate front lens.
Kepguard-2250	50-110-04	Protective housing for the Focus 2250mm Light Curtain. 88x88mm extruded natural anodized aluminum with inside 16x44mm aluminum mounting plate. Protective stamped aluminum end cap and 5mm thick protective polycarbonate front lens.

Component List - Kepguard Protective Machine Mounted Enclosures

Designation	Article Number	Description
Kepguard-2400	50-110-00	Protective housing for the Focus 2400mm Light Curtain. 88x88mm extruded natural anodized aluminum with inside 16x44mm aluminum mounting plate. Protective stamped aluminum end cap and 5mm thick protective polycarbonate front lens.

Component List - Wet Wash Down Tubes

Designation	Article Number	Description
WET-150	22-038-00	Wash down tube kit for use with 150mm Focus Safety Light Curtains.
WET-300	22-038-01	Wash down tube kit for use with 300mm Focus Safety Light Curtains.
WET-450	22-038-02	Wash down tube kit for use with 450mm Focus Safety Light Curtains.
WET-600	22-038-03	Wash down tube kit for use with 600mm Focus Safety Light Curtains.
WET-750	22-038-04	Wash down tube kit for use with 750mm Focus Safety Light Curtains.
WET-900	22-038-05	Wash down tube kit for use with 900mm Focus Safety Light Curtains.
WET-1050	22-038-14	Wash down tube kit for use with 1050mm Focus Safety Light Curtains.
WET-1200	22-038-06	Wash down tube kit for use with 1200mm Focus Safety Light Curtains.
WET-1350	22-038-15	Wash down tube kit for use with 1350mm Focus Safety Light Curtains.
WET-1500	22-038-07	Wash down tube kit for use with 1500mm Focus Safety Light Curtains.
WET-1650	22-038-08	Wash down tube kit for use with 1650mm Focus Safety Light Curtains.
WET-K500	22-038-09	Wash down tube kit for use with 500mm Focus Safety Light Grids.
WET-K800	22-038-10	Wash down tube kit for use with 800mm Focus Safety Light Grids.
WET-K900	22-038-11	Wash down tube kit for use with 900mm Focus Safety Light Grids.
WET-K1200	22-038-12	Wash down tube kit for use with 1200mm Focus Safety Light Grids.
WET-K1C	22-038-13	Wash down tube kit for use with 500mm Focus Safety Light Transceivers.

Component List - Spot Light Beams

Designation	Article Number	Description
Spot 10T/R	20-009-06	Safety light beam with 10m range, 24VDC supply, multi-function status indicator LEDs, integrated information output 24VDC - 10mA on receiver, IP67 protection class, M18 barrel style steel housing, 5 pole M12 male quick disconnect. Requires Vital 1 controller/Pluto to function. Provides safety category level 4 according to EN954-1 with Vital 1 controller/Pluto. Maximum of 6 light beam pairs connected to one controller possible while maintaining category 4 level of safety.
Spot 35T/R	20-009-05	Safety light beam with 35m range, 24VDC supply, multi-function status indicator LEDs, integrated information output 24VDC - 10mA on receiver, IP67 protection class, plastic housing, 5 pole M12 male quick disconnect. Requires Vital 1 controller/Pluto to function. Provides safety category level 4 according to EN954-1 with Vital 1 controller/Pluto. Maximum of 6 light beam pairs connected to one controller possible while maintaining category 4 level of safety. 2 pieces of JSM 63 brackets are included.

Component List - Spot Light Beams

Designation	Article Number	Description
JSRL2	20-008-01	Laser alignment aid for SPOT 35 single beams. Secured by an adjustable elastic fabric band around the sensing unit. Housed in the SPOT housing with 4 pole M12 connector for power connection via existing SPOT cable.

Component List - Focus Quick Connections

Designation	Article Number	Description
TINA 10A	20-054-12	Tina dynamic adapter with 5 pole M12 male quick disconnect for connecting transistor output safety devices to the Vital 1 controller. 8 pole M12 female quick disconnect for direct connection to the safety device or safety device enclosure, 24VDC supply, multi-function status indicator LEDs, integrated information output 24VDC - 10mA.
TINA 10B	20-054-13	Tina dynamic adapter with 5 pole M12 male quick disconnect for connecting transistor output safety devices to the Vital 1 controller. 8 pole M12 female quick disconnect for direct connection to the safety device or safety device enclosure. Additional 5 pole M12 connector for local reset capabilities, 24VDC supply, multi-function status indicator LEDs, integrated information output 24VDC - 10mA.
TINA 10C	20-054-16	Tina dynamic adapter with 5 pole M12 male quick disconnect for connecting transistor output safety devices to the Vital 1 controller. 8 pole M12 female quick disconnect for direct connection to the safety device or safety device enclosure. Additional 5 pole M12 connector for connection of light curtain transmitter, 24VDC supply, multi-function status indicator LEDs, integrated information output 24VDC - 10mA.
FMC-1	22-042-00	Focus Muting Connector, connects from the Focus receiver. 4 M12, 5 pin female connections for 2 muting sensors, muting lamp and reset push button. M12, 8 pin male connector for machine interface.
FMC-1 Tina	22-045-00	Focus Muting Connector, connects from the Focus receiver. 4 M12, 5 pin female connections for 2 muting sensors, muting lamp and reset push button. Integrated Vital Tina M12, 5 pin male connector for machine interface.
FMC-2	22-042-10	Focus Muting Connector, connects from the Focus receiver. 6 M12, 5 pin female connections for 4 muting sensors, muting lamp and reset push button. M12, 8 pin male connector for machine interface.
FMC-2 Tina	22-046-00	Focus Muting Connector, connects from the Focus receiver. 6 M12, 5 pin female connections for 4 muting sensors, muting lamp and reset push button. Integrated Vital Tina M12, 5 pin male connector for machine interface.
FMI-1A	22-043-00	Focus Muting Lamp, 24VDC, 5W integrated muting lamp in a protective Focus housing.
FMI-1B	22-043-01	Focus Muting Connector, integrated 24VDC, 5W muting lamp, reset push button and power interrupt in a protective Focus housing.
FMI-1C	22-043-02	Focus Muting Connector, integrated reset push button and power interrupt in a protective Focus housing.
FMI-1D	22-043-03	Focus Muting Connector, integrated reset push button and power interrupt in a protective Focus housing. Muting resistor included.
FMI-1E	22-043-04	Focus Muting Connector, integrated reset push button for pre-reset or Tina Duo 2 in a protective Focus housing.
FMI-1G	22-043-05	Focus Muting Initiator, Integrated reset push button in a protective Focus housing. Internal resistor for muting lamp.

Component List - Focus Quick Connections

Designation	Article Number	Description
JSSP-1	22-070-00	FMC empty port cover.
JSAP-1	22-070-10	FMC "R" port terminator with terminal jumpers and integrated muting resistor.
FRM-1A	22-048-00	Focus convertor from 2 transistor outputs to relay outputs in a protective Focus housing. M12, 8 pole male/female connectors for integration between Focus and the control circuit.
M12-3A	20-055-00	M12 Y Connector for series connection. 2 M12 5 pole female connectors and 1 M12 5 pole male connector.
M12-3B	20-055-01	M12 Y Connector for parallel connection. 2 M12 5 pole female connectors and 1 M12 5 pole male connector.
M12-3D	20-055-03	M12 Y Connector, parallel Connection. 1 M12 8 pole female connector for connection of the Focus Receiver, 1 M12 5 Pole female connector for connection of the Focus Transmitter and 1 M12 8 pole male connector for panel connection.
F4-TEACHBOX-1	50-010-05	Focus FB version external teach box with power on - off selector switch, reset push button, 3 position momentary selector switch for teach process, 18" female 8 pole cable for Focus receiver connection and 18" male 8 pole cable for machine interface.
F4-TEACHBOX-4	50-010-07	Focus FB version external teach box with 3 position removable keyed selector switch. Integrated reset push button, and 2 M12 8 pole connectors for connection to the Focus Receiver and the main panel.
BP-1	22-090-23	Focus FB version external teach box for inline connection to the Focus receiver for single push button teaching of fixed/floating blanking.
JSRL3	20-008-02	Laser alignment aid for Focus Light Curtains, Grids and beams. Secured by a adjustable elastic fabric band around the sensing unit. Housed in the 45mm x 35mm Focus housing with two AAA batteries, included.

Component List - Muting Sensors and Indicators

Designation	Article Number	Description
FSTR1 - Mute R	22-044-00	Retro-reflective muting sensor with polarized filter. 24VDC 18mm barrel style with range adjustments from 0.15 to 5m, light reserve warning indicator, 1000Hz switching frequency and M12 4 pole male connector.
FZR 1	22-044-01	Polarized 80mm circular reflector for use with the FSTR1 muting sensors. Offers a range of 0.15 to 2.5m. 5mm center mount through hole for mounting capabilities.
FZR 2	22-044-04	Polarized 100mm x 100mm reflector for use with the FSTR1 muting sensors. Offers a range of 0.15 to 5m.
JS OBP800 - Mute D	22-044-10	Muting sensor, diffuse-reflective with back ground suppression. 24VDC, 2 pnp light, dark switching, M12 4 pin connector in a IP67 housing.
JSM63	40-007-01	Bracket for cubic style single beam. Fixed 90 degrees.
JSM64	40-007-02	Adjustable mounting bracket with rotational knuckle for 18mm barrel style sensors.
JSM66	22-090-13	Focus bracket, 90 degree bend, 2.5mm RF A2 painted black.
JSM67	22-090-15	Focus bracket, adjustable plastic hinge.

Component List - Muting Sensors and Indicators

Designation	Article Number	Description
MF-T	22-040-20	Focus Muting Actuator 669mm overall length with 4 preadjusted and integrated muting sensors. Applicable for entry and exit of material through the Focus Light Curtain or Grid.
MFT-T	22-040-21	Focus transmitter bar with 669mm overall length with 4 preadjusted and integrated muting transmitting sensors. Applicable for entry and exit of material through the Focus Light Curtain or Grid. Must be used with the MFR-T receiving bar.
MFR-T	22-040-22	Focus receiver bar with 669mm overall length with 4 preadjusted and integrated muting receiver sensors. Applicable for entry and exit of material through the Focus Light Curtain or Grid. Must be used with the MFT-T transmitting bar.
MF-L	22-040-30	362mm overall length with 2 preadjusted and integrated muting sensors. Applicable for exit of material through the Focus Light Curtain or Grid.
MF-T Reflex	22-040-40	Focus Muting Actuator with 4 preadjusted and integrated, retro-reflective muting sensors and retro-reflective passive target. Applicable for entry and exit of material through the Focus Light Curtain or Grid with wiring only to one side.
MFTR-T Reflex	22-040-41	Focus Muting Actuator with 4 preadjusted and integrated, retro-reflective muting sensors. Applicable for entry and exit of material through the Focus Light Curtain or Grid with wiring only to one side. Requires the M-T REFLEX passive target to operate.
M-T Reflex	22-040-42	Focus Muting Actuator, retro-reflective passive target. Applicable for entry and exit of material through the Focus Light Curtain or Grid with wiring only to one side. Requires the MFTR-T-REFLEX active sensor bar to operate.
LH1	40-007-10	Bypass indicator lamp with 24VDC, 5W BA15d style bulb.
ML1	40-007-15	Replacement light bulb for LH1, 24VDC, 5W BA15d style.
ML2	40-007-20	LED replacement bulb for LH1.

Component List - Transmitter Cables

Designation	Article Number	Description
M12-C61	20-056-00	Cable single ended 6 meters black PVC jacket with straight 5 pole M12 female molded connector, 22AWG conductors, overall braid shield.
M12-C101	20-056-10	Cable single ended 10 meters black PVC jacket with straight 5 pole M12 female molded connector, 22AWG conductors, overall braid shield.
M12-C201	20-056-14	Cable single ended 20 meters black PVC jacket with straight 5 pole M12 female molded connector, 22AWG conductors, overall braid shield.

Component List - Transmitter Extension Cables

Designation	Article Number	Description
M12-C112	20-056-20	Extension cable, 1 meter, black PVC jacket with straight 5 pole M12 male/female connectors, 22AWG conductors, overall braid shield.
M12-C312	20-056-21	Extension cable, 3 meters, black PVC jacket with straight 5 pole M12 male/female connectors, 22AWG conductors, overall braid shield.

Component List - Transmitter Extension Cables

Designation	Article Number	Description
M12-C612	20-056-22	Extension cable, 6 meters, black PVC jacket with straight 5 pole M12 male/female connectors, 22AWG conductors, overall braid shield.
M12-C1012	20-056-23	Extension cable, 10 meters, black PVC jacket with straight 5 pole M12 male/female connectors, 22AWG conductors, overall braid shield.
M12-C2012	20-056-24	Extension cable, 20 meters, black PVC jacket with straight 5 pole M12 male/female connectors, 22AWG conductors, overall braid shield.
M12-C01	20-055-10	5 pole M12 female field retrofittable connector with screw terminals for connecting wires. Cable diameter range 2.5 - 6.5 mm.
M12-C02	20-055-11	5 pole M12 male field retrofittable connector with screw terminals for connecting wires. Cable diameter range 2.5 - 6.5 mm.
C5	20-057-00	5 conductors, 22AWG, black PVC jacket cable with overall braid shield. Per meter.

Component List - Receiver Cables

Designation	Article Number	Description
M12-C63	20-056-30	Cable single ended 6 meters black PVC jacket with straight 8 pole M12 female molded connector, 22AWG conductors, overall braid shield.
M12-C103	20-056-40	Cable single ended 10 meters black PVC jacket with straight 8 pole M12 female molded connector, 22AWG conductors, overall braid shield.
M12-C203	20-056-41	Cable single ended 20 meters black PVC jacket with straight 8 pole M12 female molded connector, 22AWG conductors, overall braid shield.
M12-C2/53Y	50-110-06	Cable, 8 pole M12 female molded connector split into 2 separate cables. 5 meters black PVC cable with 8, 22AWG conductors, overall braid shield. 2 meters black PVC cable with 3, 22AWG conductors, overall braid shield. Used for local connection of Focus reset or dual reset.

Component List - Receiver Extension Cables

Designation	Article Number	Description
M12-C134	20-056-50	Extension Cable, 1 meter, black PVC jacket with straight 8 pole M12 male/female connectors, 22AWG conductors, overall braid shield.
M12-C334	20-056-51	Extension Cable, 3 meter, black PVC jacket with straight 8 pole M12 male/female connectors, 22AWG conductors, overall braid shield.
M12-C03	20-055-16	8 pole M12 female field retrofittable connector with screw terminals for connecting wires. Cable diameter range 2.5 - 6.5 mm.
M12-C04	20-055-17	8 pole M12 male field retrofittable connector with screw terminals for connecting wires. Cable diameter range 2.5 - 6.5 mm.
C8	20-057-10	8 conductors, 22AWG, black PVC jacket cable with overall braid shield. Per meter.

Component List - FMC/FMI Connector Cables

Designation	Article Number	Description
M12-C62	20-056-02	Cable single ended 6 meters black PVC jacket with straight 5 pole M12 male molded connector, 22AWG conductors, overall braid shield.
M12-C102	20-056-12	Cable single ended 10 meters black PVC jacket with straight 5 pole M12 male molded connector, 22AWG conductors, overall braid shield.

Component List - Optional Interface Units

Designation	Article Number	Description
RT9-24VDC	10-029-00	Safety Relay with 2 safety outputs, 5 selectable input options (single or dual channel), automatic or manual supervised reset, test input for monitoring of external positive guided relays/contactors, 5 LED indicators, 1 dual purpose information output, quick release terminal blocks, 22.5mm wide, 24VDC supply. Meets safety category 1 to 4.
RT6-24VDC	10-026-00	Safety Relay with 3 safety outputs, 5 selectable input options (single or dual channel), automatic or manual supervised reset, test input for monitoring of external positive guided relays/contactors, 5 LED indicators, 1 NC information output and 2 potential free transistor information outputs, quick release terminal blocks, 45mm wide, 24VDC supply. Meets safety category 1 to 4.
RT6-115VAC	10-026-04	Safety Relay with 3 safety outputs, 5 selectable input options (single or dual channel), automatic or manual supervised reset, test input for monitoring of external positive guided relays/contactors, 5 LED indicators, 1 NC information output and 2 potential free transistor information outputs, quick release terminal blocks, 45mm wide, 115VAC supply. Meets safety category 1 to 4.
VITAL 1	20-052-00	Safety Controller with 2 safety outputs, uses unique dynamic signal technology, automatic or manual supervised reset, test input for monitoring of external positive guided relays/contactors, 5 LED indicators, 1 dual purpose information output, quick release terminal blocks, 22.5mm wide, 24VDC supply. Meets safety category 4, dynamic self test.
PLUTO		See Pluto Safety PLC section for proper product selection.

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