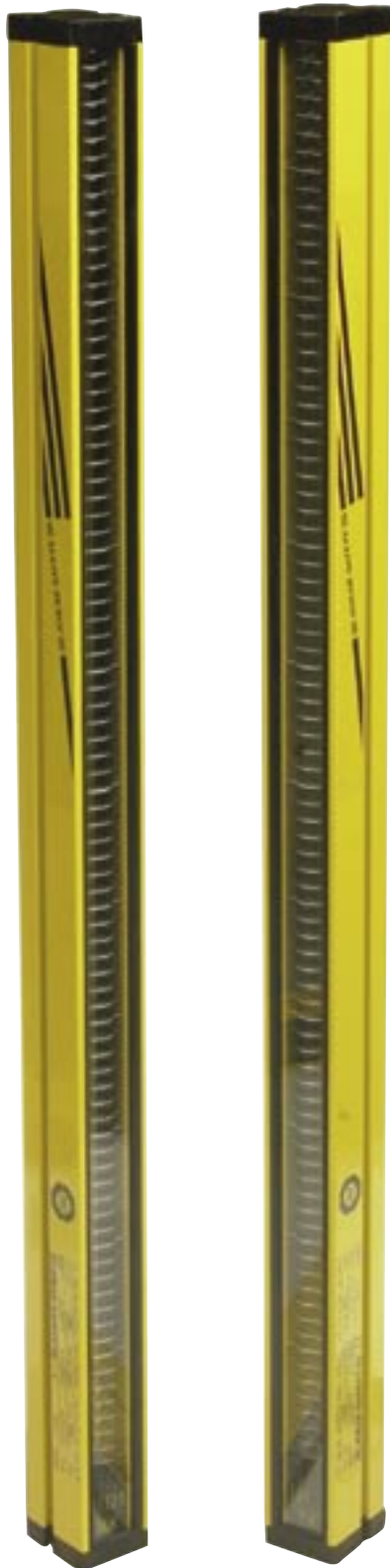


Why use light beams and light curtains?



Light beams and light curtains are a production friendly safety component that does not physically impact on the actions of the machine operator. An operator can have both his hands free when he puts in his hand or he passes in and out of a risk area. At the same time the operator knows that he can trust the safety component to stop all dangerous movements. Light barrier protection is also a good safety component for use when goods are to be passed in and out of a risk area.

How does a light beam/light curtain work?

Both light beams and light curtains utilise optical transmitter and receiver units. From the transmitters beams of infrared light are sent to the receiver. When a light beam is interrupted a dual stop signal is given to the dangerous machines inside the light beam/curtain protected area.

What is the difference between a light curtain and a light beam?

A light curtain has several beams that are placed closely together whereas a light beam consists of only one, two, three or four light beams. The beams are closest on a light curtain that is used for finger detection. Then the resolution is 14 mm. Light curtain beams are at their widest spacing when used for thigh detection (90mm resolution). For light beams the beams are normally placed at a relative distance of 300 to 500 mm. The choice between light beam or light curtain is often a question of available safety distance, reach and price. Light curtains are often chosen for short safety distances. Light beams are chosen for long reach, up to 50 m, and for a low price.



Light beams for long distances



Light beams with monitored bypassing during material transport



Light curtain for short safety distances



Light curtain to protect during cycle initiation



Light curtain as area protection



Light curtain for inner area limiting



What safety requirements are there for a light protection device?

High safety demands are stated in the standard EN 61496-1 which deals with light protection. 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 to choose between. Type 2 and 4 relates in principle to category 2 and 4 according to EN 954-1.

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 falling immediately or that they do not re-connect after being disconnected. Maximum allowed scattering 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 break the output when a fault occurs. Between the testing times there can though be faults which result in the safety component malfunctioning. The test function can either be built in the safety device or an external unit (e.g. the machine's control system) can initiate a test. Maximum allowed scattering angle for the light is $\pm 4^\circ$.

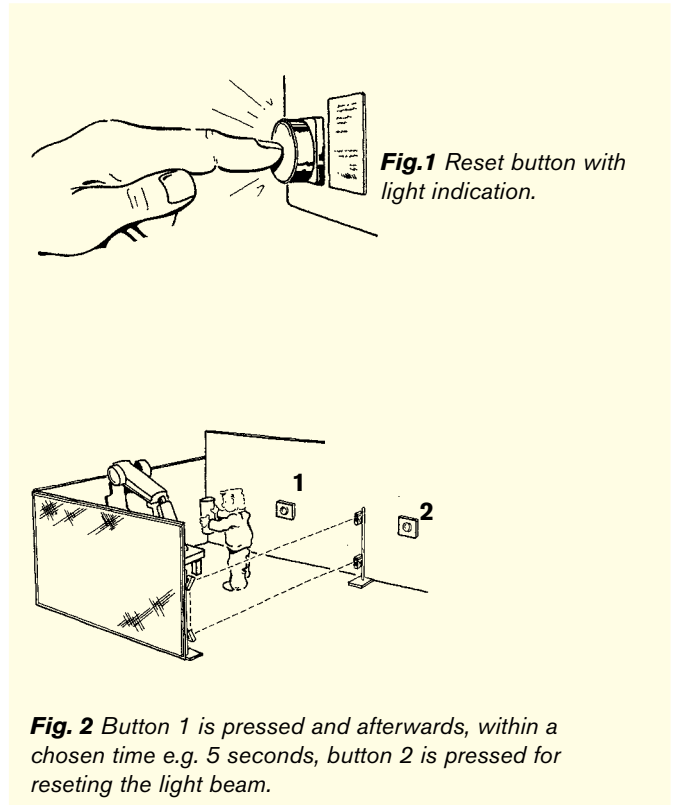
Light beams and light curtains are included among the products in the machine directive's appendix 4, which means that an external certifying procedure with an officially recognised institution is called for.

Reset

Different reset alternatives

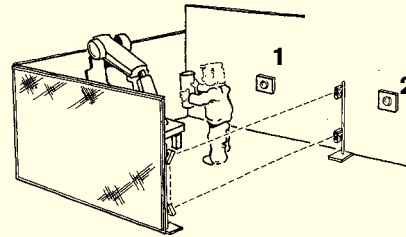
Supervised manual reset, Fig. 1

When a light beam/light curtain is interrupted it will give a stop signal to dangerous machines within the risk area it protects and a reset-lamp will be lit. For a new start of the machine the light beam/light curtain has to be reset. This is done with the reset button 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 reset-lamp is turned off.



Supervised time-reset, Fig. 2

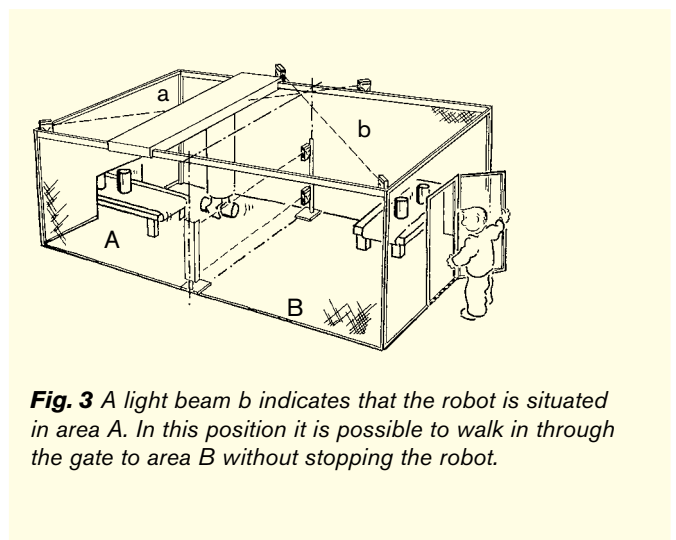
During time-reset unintentional reset is prevented when someone is inside the risk area. To reset the light beam (see Fig. 2) button 1 must first be pressed and afterwards button 2 within e.g. 5 seconds. This is especially important when one cannot see the entire area that is protected by the light beam.



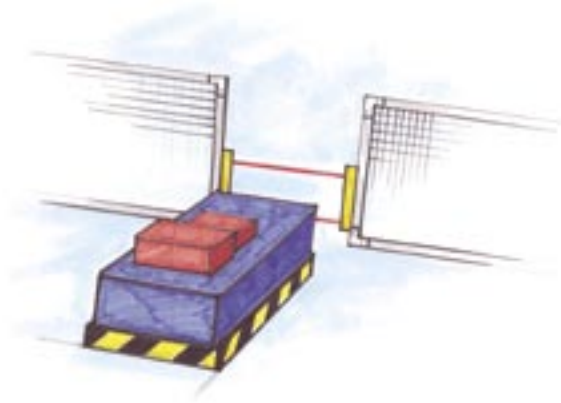
Automatic reset

Automatic reset, Fig. 3

Automatic reset is used when the light beam is used for area monitoring. When the light beam is actuated this indicates that e.g. a robot is in the area. The robot is stopped if a person enters the same area e.g. through a gate. When the light beam is free again the control unit will be reset automatically.



Muting (bypassing)



Automatic bypassing of light beam when an auto industrial truck passes.

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 of the probability of them both malfunctioning for the same reason e.g. common mode failure. An example of a solution is to use a mechanical limit switch and a photo-cell sensor.

To avoid deliberate defeating/ manipulation of the bypassing sensors/signals a safety relay or a safety-PLC is connected thereby monitoring that the sensors both are activated and disactivated in every bypassing cycle.

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

Light curtain for short safety distance

A light curtain can be used in a machine or a production plant in the same way as a hatch. There is a great difference though when it comes to the risk situation. When one has a light curtain installed with a short safety distance in front of a dangerous machine, there is a high risk for spontaneous engagement into the machine, often called after-grasp. If the dangerous machine movement does not stop during such an engagement, one has a small chance of avoiding injury because one can reach the risk place within maybe 50 ms.

Therefore it is of great importance that the whole chain in the stopping circuit is fully dualled and supervised. Even valves and contactors which ultimately control dangerous movements normally have to be doubled up and supervised.



Resolution for hand!

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 drive.

Operator protection during manually serviced machines

With manually operated machines where one or more operators pick in and out parts 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.

Light curtains on presses

Light curtains have traditionally been a common protection method among press applications and there has since long existed detailed information on the usage of light curtains on presses.

Safety level

Only light curtains of type 4 are accepted on presses.

Reset

On the servicing side i.e. the side or sides where there is an operator that picks in and out parts, there shall be a separate reset function for the light curtain, usually a button. 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



Resolution for finger!

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.

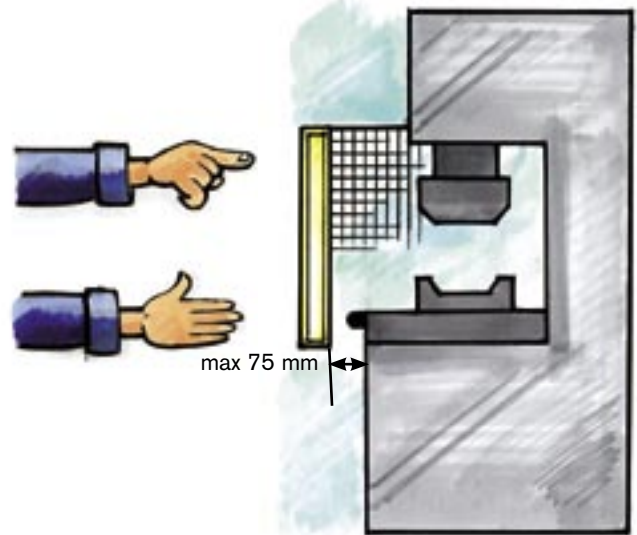
Cycle initiation with light curtain

Cycle initiation

Cycle initiation is a concept when the machine is designed so that a new cycle starts when you take your hand out from the light curtain. A cycle is defined as the hand being placed in and taken out once. Usually it is possible to choose between one-cycle and two-cycle operation. During one-cycle a new press stroke is started when the light curtain has been actuated once and during two-cycle when the light curtain has been actuated twice. The operator thereby operates the press by the action of putting parts in and out.

Because the press starts without any particular command there are some risks involved and therefore many conditions have to be met before the machine operates.

To restrict the usage to smaller presses which cannot be entered there are the following limitations: The table height may not be lower than 750 mm, the stroking length may not be larger than 600 mm and the table depth may not be larger than 1000 mm. The light curtain shall have 30 mm or higher resolution. If the press is not started within approx. 30 seconds after the the end of the cycle, a new cycle should not be accepted without the light beam being again manually reset. **Note.** For machines with cycle initiation, the installation of the light curtain must be in accordance with machine parameters and all relevant standards and regulations.



Installation of light curtain

The light curtain must be installed so no-one can reach a trapping/crushing risk without actuating the light curtain. The most important is that there are no gaps under, on the sides and over the top during cycle operation. The lower edge of the light curtain must therefore be slightly below the press table edge. Also if it is open above the light curtain the height must be adapted so that it is not possible to reach over the protection area (see EN 294). Possible physical adjustment possibilities must be limited so that no gaps can occur.

Between the light curtains protection area and mechanical parts there shall only be max 75 mm gap to prevent a human from standing there. In practise to achieve this demand and the required safety distance one usually has to complement with e.g. additional mechanical protection or additional horizontally positioned light curtains i.e. step-in light curtain. Another solution could be a lying or an angled light curtain.

Installation – correct and incorrect during cycle initiation



Correctly installed.

The operator cannot reach into the machine without actuating the light curtain.



Incorrect intallation.

Gap below the light curtain. The operator can reach into the machine without actuating the light curtain.



Incorrect installation. Gap above the 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.

Safety distance - light curtain according to EN999

The safety distance 'S' is a minimum distance between a light curtain and a dangerous area. The safety distance 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 from EN 999 Machine Safety - Placement of safety devices with concern to the speed in which the body approaches the risk area.

$$S = (K \times T) + C$$

S = safety distance in mm

K = body/part of body (e.g. hand) speed in mm/s

T = T1 + T2

where

T1 = the safety device's reaction time in seconds

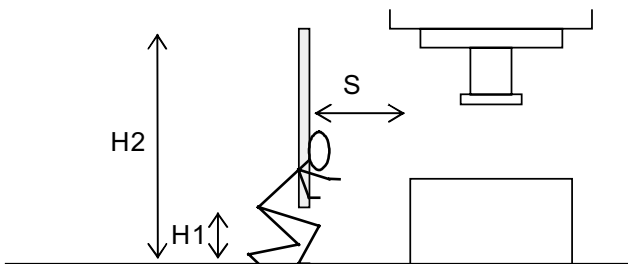
T2 = the machine's reaction time in seconds

C = further distance in mm based upon the body's intrusion towards the risk area before the safety device has been actuated.



Resolution for finger
(14 mm) gives C = 0

Calculation of safety distances for vertical and horizontal installation according to EN999



S = safety distance in mm

H1 = the lower beam may not be situated higher than 300 mm above the ground

H2 = the upper beam may not be situated lower than 900 mm above the ground

The safety distance for vertical installation
For $S \leq 500$ mm the safety distance is calculated with the following formula:

$$S = (2000 \times T) + 8 \times (d - 14)$$

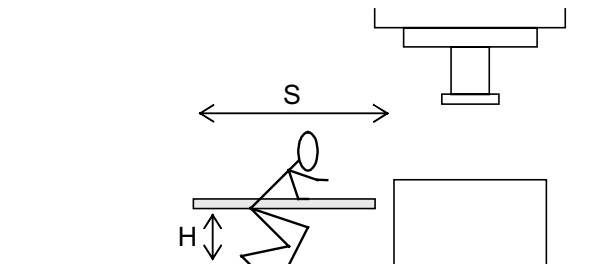
where d is the light curtain's resolution in mm.

K here is 2000 mm/s which represents the speed of the hand. The expression $(8 \times (d - 14))$ may never be less than 0. Minimum safety distance S is 100 mm.

If the safety distance according to the formula above gets larger than 500 mm one can instead use:

$$S = (1600 \times T) + 8 \times (d - 14)$$

K is 1600 mm/s which represents the speed of the body. Minimum safety distance according to this formula is 500 mm.



S = safety distance in mm

H = the light curtain field must be positioned between 0 and 1000 mm above the floor

The safety distance for horizontal installation is calculated with the following formula:

$$S = (1600 \times T) + (1200 - 0,4 \times H)$$

where H is the safety field's height above the reference plane, e.g. the ground

$(1200 - 0,4 \times H)$ may not be less than 850 mm. Depending on the resolution, d, that the light curtain has, there is a minimum height that the safety field may be placed. This is calculated with:

$$H = 15 \times (d - 50).$$

H cannot be less than 0. With a resolution $d = 14$ or 35 mm one can therefore install the light curtain from $H = 0$ and up. The higher it is situated, the shorter the safety distance gets. The highest permissible height H of the safety field is 1000 mm.

Safety distances for new and old presses

New presses

For new CE-marked presses there are specific requirements from the standards **EN 692** Mechanical presses - Safety and **EN 693** Machine tools - Safety - Hydraulic presses

The same requirements apply for vertical installation on presses as with vertical installation on other machines with the difference that C is given according to the following:

Resolution d mm	Safety distance addition C mm	Cycle initiation
≤14	0	Permitted
>14 - 20	80	
>20 - 30	130	
>30 - 40	240	Not Permitted
>40	850	

Old presses

N.B. For old presses there are different rules for each country.

Other manually serviced machines

The rules for presses may well be applied to other machines which function in a similar way and that have the same risk situation. There is no other standard which is as detailed on the usage of light curtains.

For cycle initiation the light curtains resolution, d, must be ≤ 30 mm. This applies to both old and new (CE-marked) presses.

Safety distance for light beams according to EN999

For light beams the safety distance is calculated from the following:

$$S = (1600 \times T) + 850 \text{ mm}$$

The formula applies whether one installs 2,3 or 4 beams. It is the risk assessment that decides the number of beams that are to be chosen. The following possibilities must be considered.

- to crawl under the lowest beam;
- to reach over the top beam;
- to reach in between two beams;
- that the body passes in between two beams.

To fulfill the requirements the beams should be installed at the following heights:

Number of beams	Height over the reference plane, e.g. ground
4	300, 600, 900, 1200
3	300, 700, 1100
2	400, 900

Safety Light Grids and Safety Light Curtains

Focus



A light grid/light curtain with many possibilities

The Focus units are light grids/curtains with safety functions intended for applications where it is of great importance to protect persons from a dangerous machine, robot or other automated systems where it is possible to access to a dangerous area.

Focus creates a protection field with infrared beams. If any beam is interrupted the safety mechanism is triggered and the dangerous machine is stopped. Focus fulfills the requirements for non-contact safety equipment type 2 (Focus 2 series) and type 4 (Focus 4 series) according to the international regulation IEC 61496 1-2.

Units are available with safety heights between 150 and 1650 mm. All electronic control and monitoring functions are included in the light curtain profiles. External connection is made via a M12 connection at the end of the profile. Synchronization between transmitter and receiver is achieved optically. No electrical connection between the units is required. Control and monitoring of the beam transmission is carried out by two micro-processors which also give information on the status and alignment of the light curtain via several LEDs.

Muting and Override included in all Focus

The "Muting" and "Override" functions are available on all

Approvals:



Application:

Optical protection in an opening or around a risk area

Features:

Type 2 or 4 according to EN 61496

Flexible assembly

LED indication

High protection class (IP65)

Range 6-50 m

Time reset

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

Focus light grids/curtains and is enabled directly when an indication lamp LMS 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 grid/curtain 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 for example 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 light grids/curtains 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.

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.

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.

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 a M12-connection.

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



FMC-Focus Muting Connector with M12 connection

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



Summary - Focus light curtain/grid, Type 2 (F2-) and 4 (F4-)

Type (x) X=2 or 4	Fx-14-zzz	Fx-35-zzz	Fx-K(L)4-zzz	Fx-K(L)3-800	Fx-K(L)2-500	Fx-K1C-500
Resolution (mm)	14	35	300/400	400	500	500
Safety field height (mm=zzz)	150	150	900	800	500	500
	300	300	1200			
	450	450				
	600	600				
	750	750				
	900	900				
	1200	1200				
	1500	1500				
	1650	1650				
Range (m)	6	15	type 2 K 0,5-50 type 4 K 4-50 type 4 KL 0,2-25	type 2 K 0,5-50 type 4 K 4-50 type 4 KL 0,2-25	type 2 K 0,5-50 type 4 K 4-50 type 4 KL 0,2-25	6
Reaction time (ms)	15 - 45	14 - 26	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				
Dyn. 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 or FMC-Tina

Function description

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 opening. The reaction time for the Focus varies from 14 ms to 45 ms depending on the number of beams in the light curtain. The five LED's in the receiver and the two in the transmitter show the status of the light curtain/grid.

Safety outputs OSSD 1 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.

Technical data - Focus

Manufacturer	JOKAB SAFETY AB, Sweden	Outputs:	2 supervised PNP outputs with cross circuit monitoring
Supply voltage	24 VDC +/- 20%	Max. load:	500 mA (overload c.c. protection)
Power consumption	10W max (transmitter and receiver connected)	Connection transmitter:	M12 5-pin
Wavelength on transmitter LED	950 nm	Connection receiver:	M12 8-pin
Protection class	IP65	Indication:	LED's on Receiver and Transmitter showing alignment, status and power supply
Profile dimensions	35 x 45 mm	Enclosure:	Aluminium painted yellow
Operating temperature	-10 to +55° C	Certified to standard:	Type 2 and 4 according to EN/IEC 61496-1/2
Storage temperature	-25 to +70° C		

LED information - Focus

The LED's in the receiver indicate the following:

1. Upper (Yellow) – Alignment
2. Break (Red) – Is lit if the light curtains beam is interrupted
3. Guard (Green) – Is lit when the entire light field is free.
4. Lower (Yellow) – Is lit during normal operation when there is dirt on the light curtain's front glass.
Is flashing during normal operation when the OSSD outputs are short-circuited.
5. Power (Green) – Is lit when the receiver has supply voltage.

The LEDs in the transmitter indicate the following:

1. Power (Green) – Is lit when the transmitter has supply voltage.
2. Status (Yellow) – Is lit when the transmitter is functioning correctly.
Is flashing or is turned off during an error in the transmitter.

Reset - Focus

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. (Setting when delivered).
- **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. On delivery the Focus is set for automatic reset.

Muting (bypassing) - Focus

Built-in muting for Focus is available in three ways:

- Pre-made muting units MFT and MFL, which have integral photo-cells. Units are manufactured with the same profile as Focus.
- Connection of muting sensors via a FMC.
- Separate connection of muting sensors (A and B) directly to the Focus receiver unit.

Muting-lamp

In the Focus receiver unit it is also possible to directly connect a muting-lamp. It is also possible to connect the muting-lamp via a FMC. During bypassing the muting-lamp is lit. Bypassing is only possible if the muting-lamp is functioning.

Conditions for muting

- a) Muting input A must be actuated at least 30ms before muting input B for muting to be possible.
- b) Muting is activated as long as the conditions are fulfilled.

Muting with MF-T and MF-L units

MF-T and MF-L are muting units with integrated photo cells in the same profile type as the Focus light grid/curtain. 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 (Diagram 1)

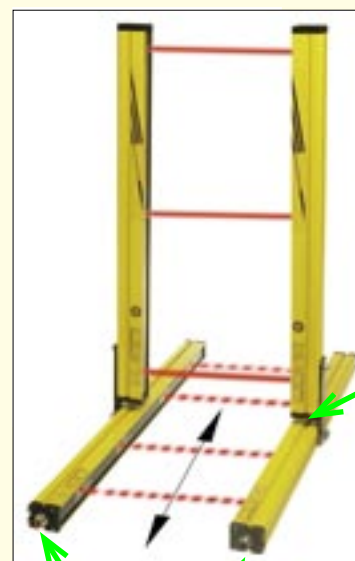
MF-T contains four photo cells A1, B1, B2 and A2 arranged as shown. They are configured for installations where material is transported "in" or "out" or in both directions "in and out".

NOTE. All standard Focus light grids/curtains are delivered connected to function together with the MF-T.

MF-L (Diagram 2)

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

NOTE. Unit MF-L is primarily intended for material transport "out" of a working area. The standard Focus light grid/curtain delivered does not function together with the MF-L version. They need to be ordered separately together with the MF-L unit.



M12 to control cabinet

Diagram1

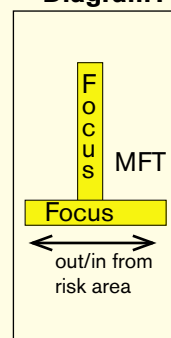
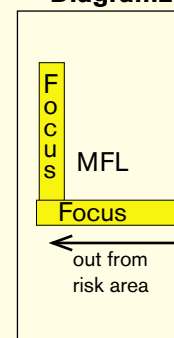


Diagram2



Examples on how the muting sensors can be placed

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

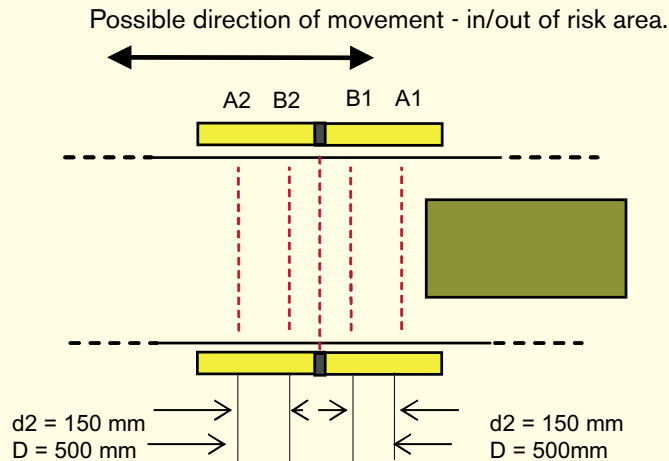


Diagram 1

A solution with Focus Muting unit MF-L with integrated muting sensors

This solution is recommended only for movement OUT from a risk area.

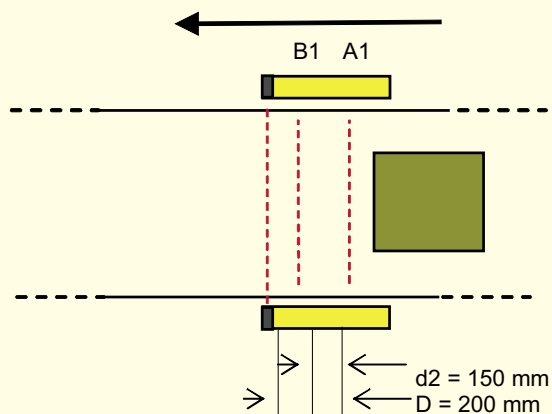


Diagram 2

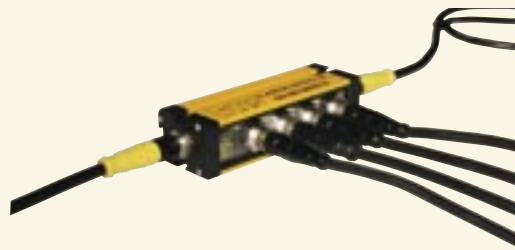
NOTE. the muting sensors A and B must be placed so that the sensor A is always activated at least 30 ms before sensor B.

assembled muting sensors within the MF-T and MF-L (= 150mm).

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 grid/curtain.
d2: indicates the measurement between the two pre-

Muting with FMC and FMI units

The FMC Focus Muting Connector, is a small, optimal unit which is used when the Focus light grid/curtain 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 a M12 connector.



Focus Muting Connector, FMC

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.

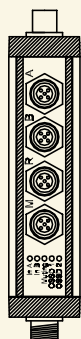


Focus Muting Indicator, FMI

Various FMC and FMI versions

The Tina-versions have dynamic safety outputs for Vital/Pluto.

FMC-1
22-042-00



FMC-2
22-042-10



FMI-1A
22-043-00



FMI-1B
22-043-01



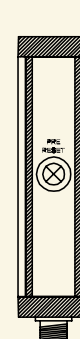
FMI-1C
22-043-02



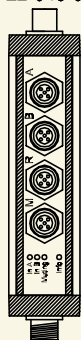
FMI-1D
22-043-03
With muting
resistor incl.



FMI-1E
22-043-04



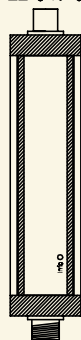
FMC-1 TINA
22-045-00



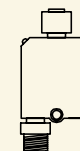
FMC-2 TINA
22-046-00



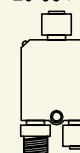
FMC-1A TINA
22-047-00



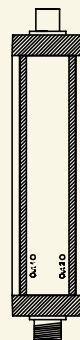
Tina 10 A
20-054-12



Tina 10 B
20-054-13



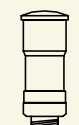
FRM-1
22-048-00



JS SP-1
22-070-00

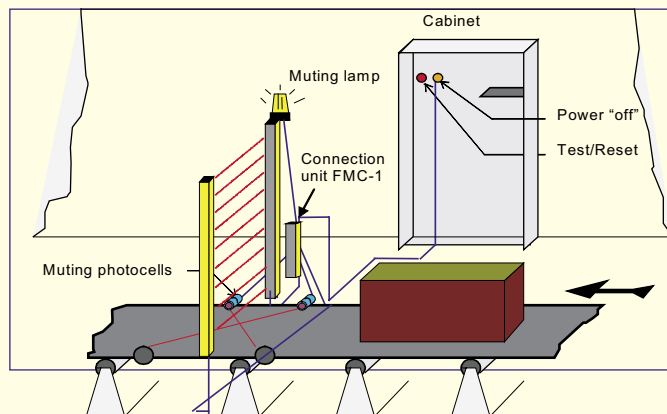


JS AP-1
22-070-10

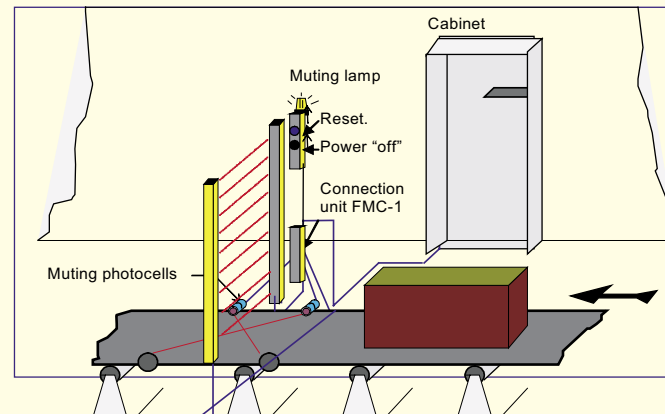


Connection of Focus and muting components with FMC 1 and FMI 1

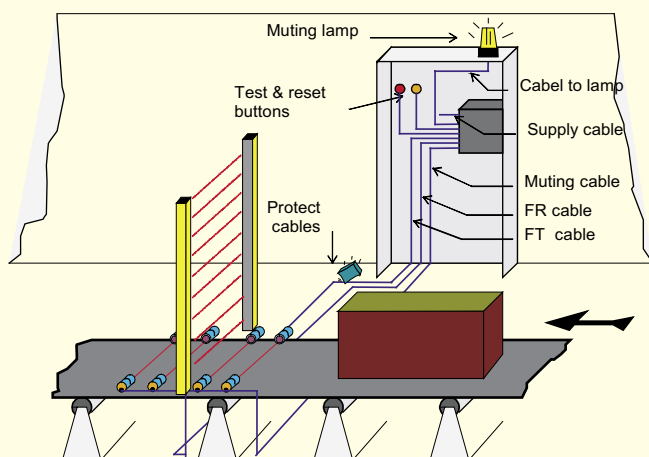
Ex 1. Connection of light curtain with connection block FMC 1, test/reset button 1 and switch for supply voltage placed in (by) the control cabinet.



Ex 2. Connection of light curtain with connection block FMC 1. The Reset unit FMI must be placed out of reach from the risk area.



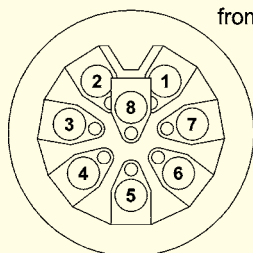
Connection of Focus and muting components directly to the control cabinet



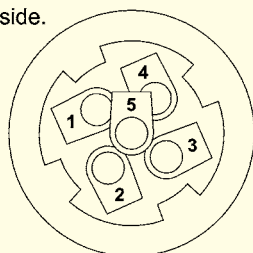
- The TEST /RESET button shall be placed so the operator can see the protected area during reset, testing, and bypassing. It should not be possible to reach the button from within the risk area.
- The LMS lamp for indication of muting and bypassing shall be placed so that it can be seen from all directions from where it is possible to access the dangerous area
- If photo cells are used as muting sensors then the sensor receivers should be assembled on the light curtain's transmitter side to minimise 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 minimised.

M12-connection device with screw connectors

Female
connector view
from cable side.

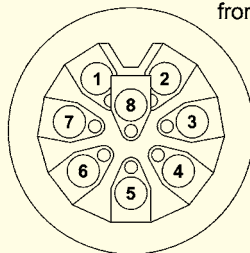


M12-C03

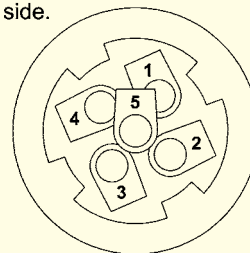


M12-C01

Male
connector view
from cable side.



M12-C04

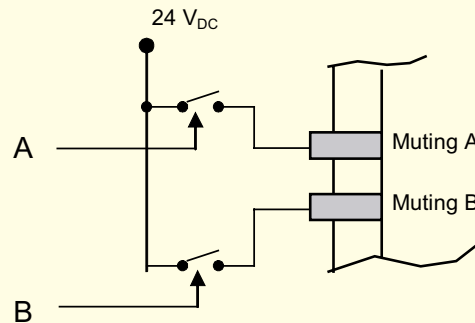
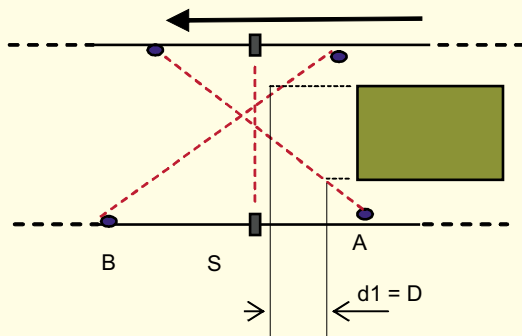


M12-C02

Muting with FSTR-1 and JSOGP 800 units

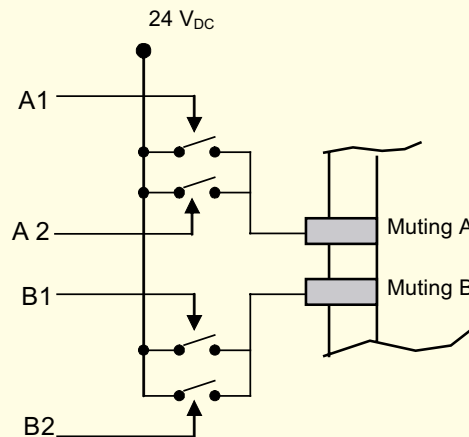
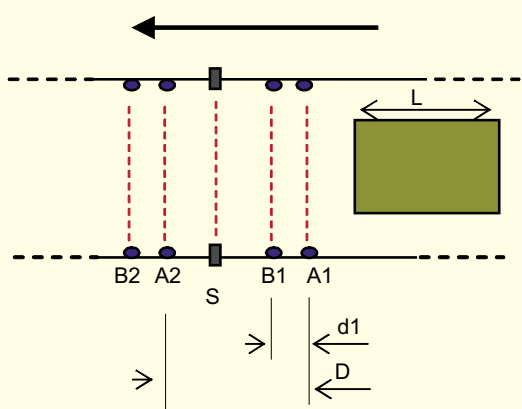
A solution with two sensors (here photocells) and ONE (or TWO) movement directions for material transport:

Possible direction of movement - IN (Even IN/OUT is possible)



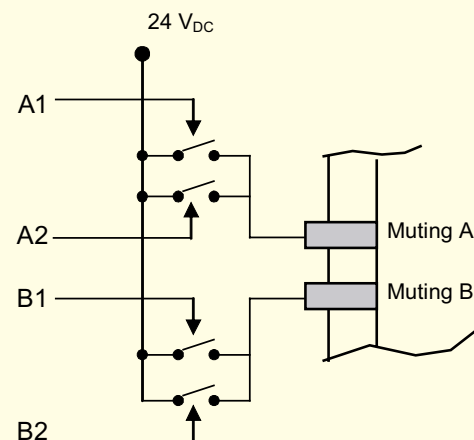
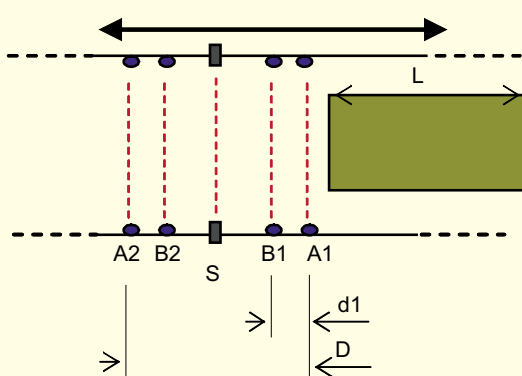
A solution with four sensors and ONE movement direction for material transport:

Possible direction of movement - IN.



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

Possible direction of movement - IN/OUT.



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

d1: indicates the distance between A1 and B1

Muting sensors – FSTR-1

Retro-reflective with polarizing filters

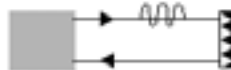


Features:

- Range adjustable
- Light reserve warning indicator
- Transistor output, PNP
- 1000 Hz switching frequency
- Short-circuit protection, reverse polarity protection and power-up output suppression
- Connector M12
- EMC tested according to IEC 801 and EN50081-1/ EN 50082-2



10...30 VDC
PNP
Dark-on output

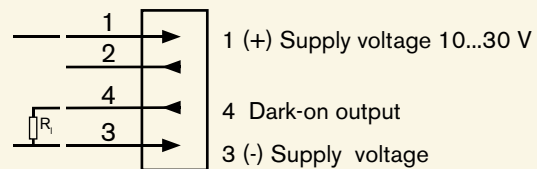


Technical data - FSTR-1

Manufacturer	JOKAB SAFETY AB, Sweden	Allowable ripple	+/- 10% of U_s
Ordering data	FSTR-1	Current consumption (without load)	<15 mA
Output	PNP, dark on	Max. load current	100 mA
Connection	Connector M12	Residual voltage	<1,6 V
Range adjustment	Yes	Max. switching frequency	1000 Hz
Range	0.15... 2.5 m (with reflector FZR 1) 0.15...5m (with reflector FZR 2)	Protection class	IP67
Light source	Visible-red, 660 nm, pulsed with polarizing filter	Temperature (operating and storage)	-25 to +65° C
Supply voltage	10...30 VDC	Weight	approx. 15 g

All technical data at 25° C and 24V.

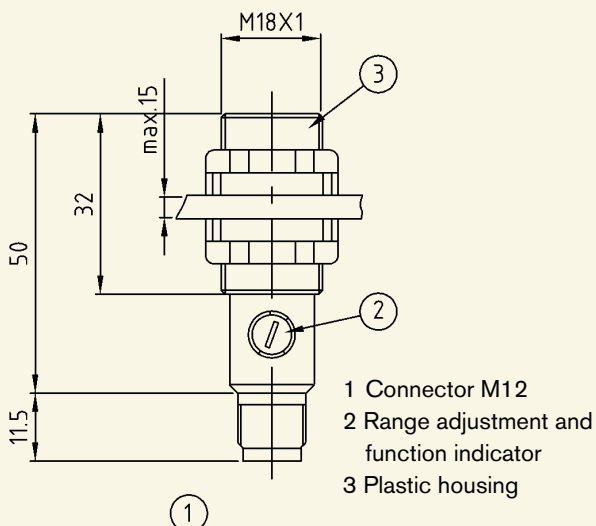
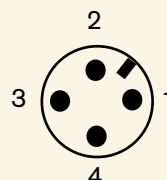
PNP output



Dark-on output

The output is activated when an object interrupts the light.

Connector M12



Muting sensors – JSOGP800

Diffuse-reflective with background rejection



Features:

Electronically adjustable background rejection

Light reserve warning indicator

Dual transistor outputs, PNP

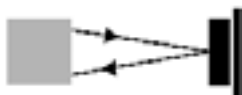
Short-circuit protection, reverse polarity protection and power-up output suppression

Connector M12 rotatable

EMC tested according to IEC 801 and EN50081-1/ EN 50082-2



10...30 VDC
PNP
light-on output
dark-on output

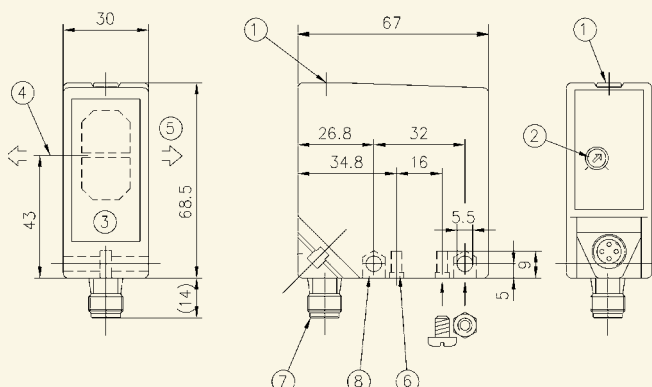


Technical data - JSOGP800

Manufacturer	JOKAB SAFETY AB, Sweden	Current consumption (without load)	<35 mA
Ordering data	JSOGP800	Max. load current	200 mA
Output	2 PNP (light- and dark-on)	Residual voltage	<1,6 V
Connection	Connector M12	Max. switching frequency	200 Hz
Range adjustment	Yes	Protection class	IP67
Range	0.2... 0.8 m	Operating temperature	25 to +65° C
Light source	Infrared-LED, 880 nm, pulsed	Weight	approx. 130 g

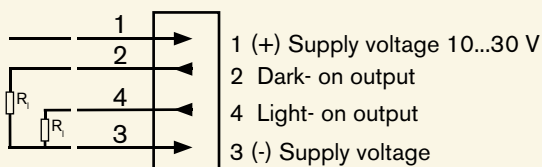
Supply voltage 10...30 VDC
Allowable ripple +/- 10% of U_s

All technical data at 25° C and 24V.



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

PNP output



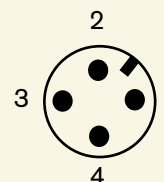
Light-on output:

Output energized when object is present.

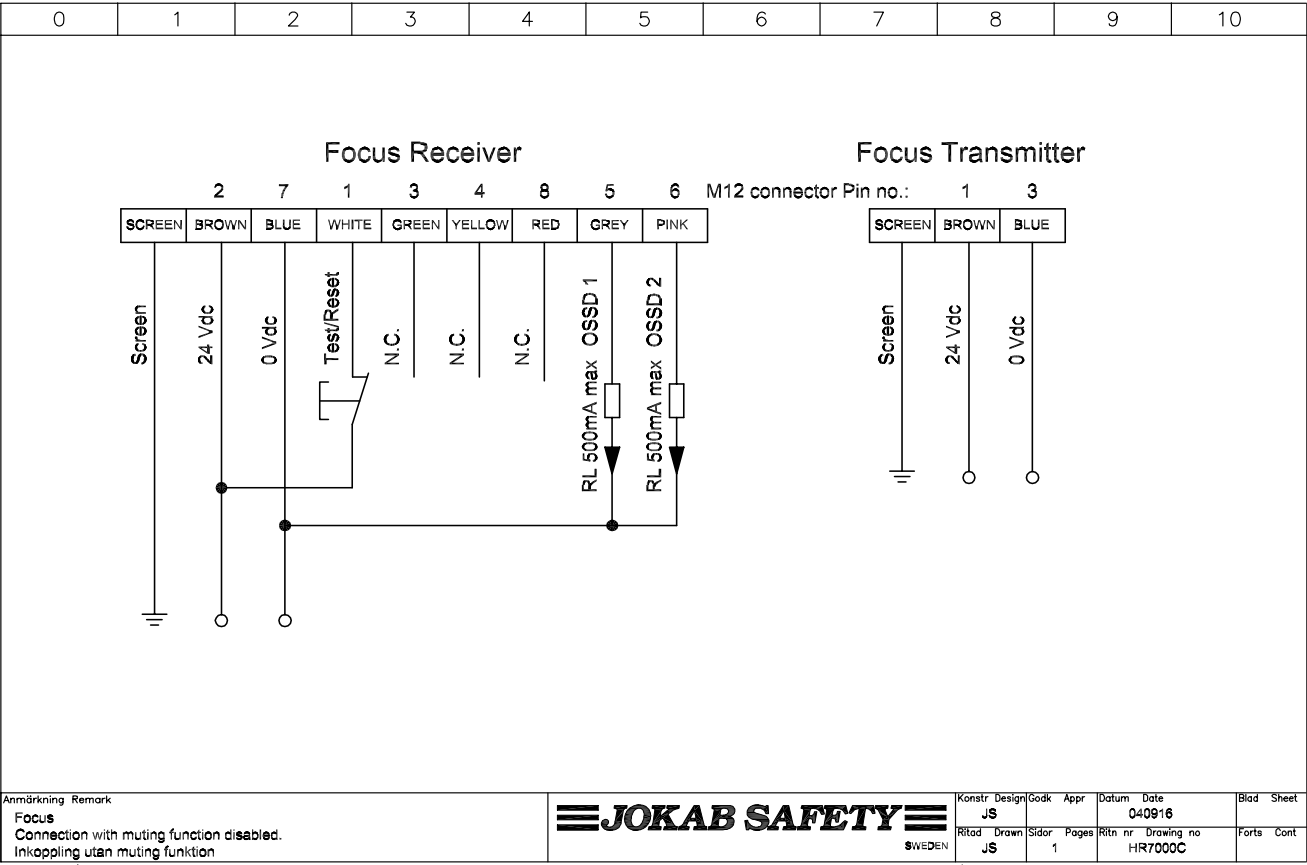
Dark-on output:

Output energized when no object is present.

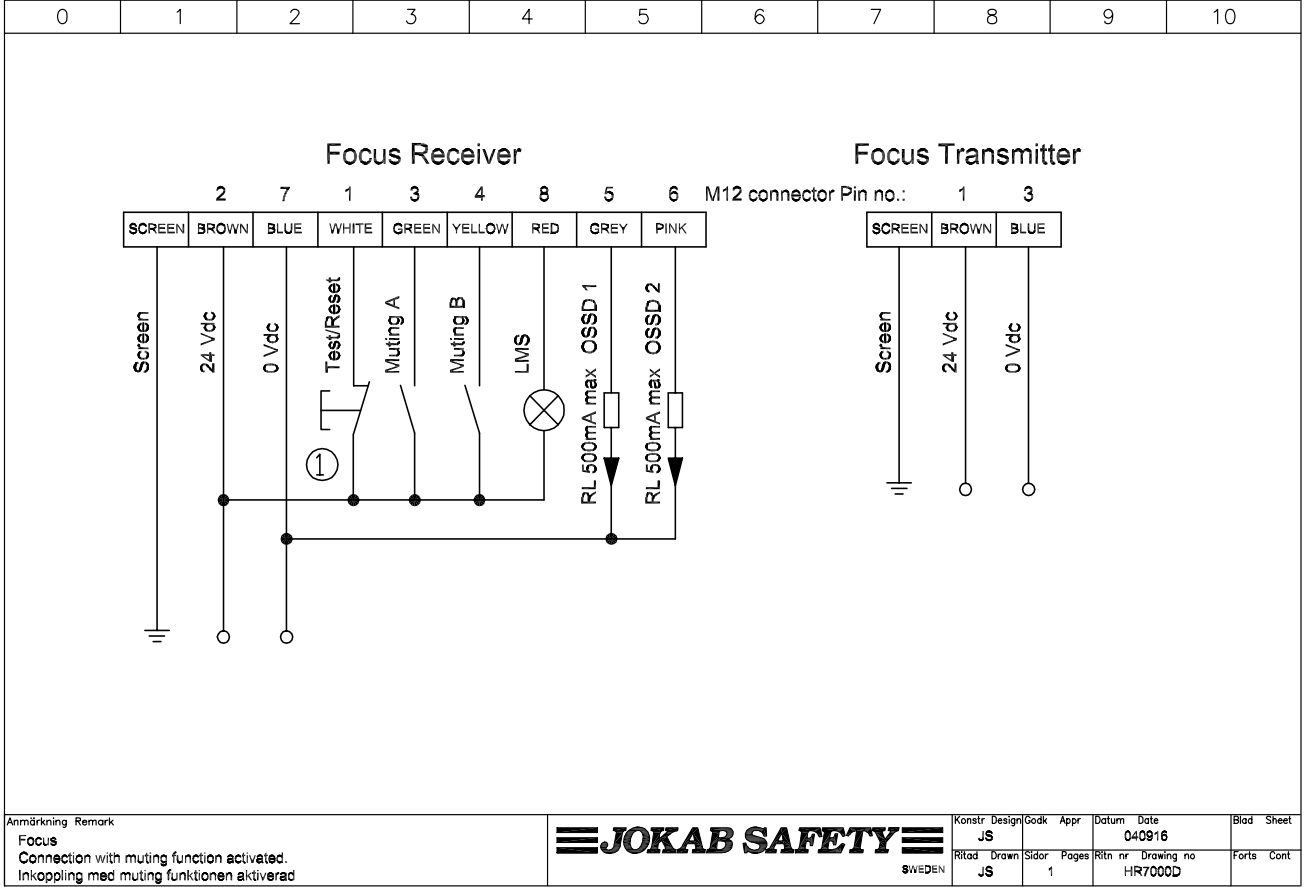
Connector M12



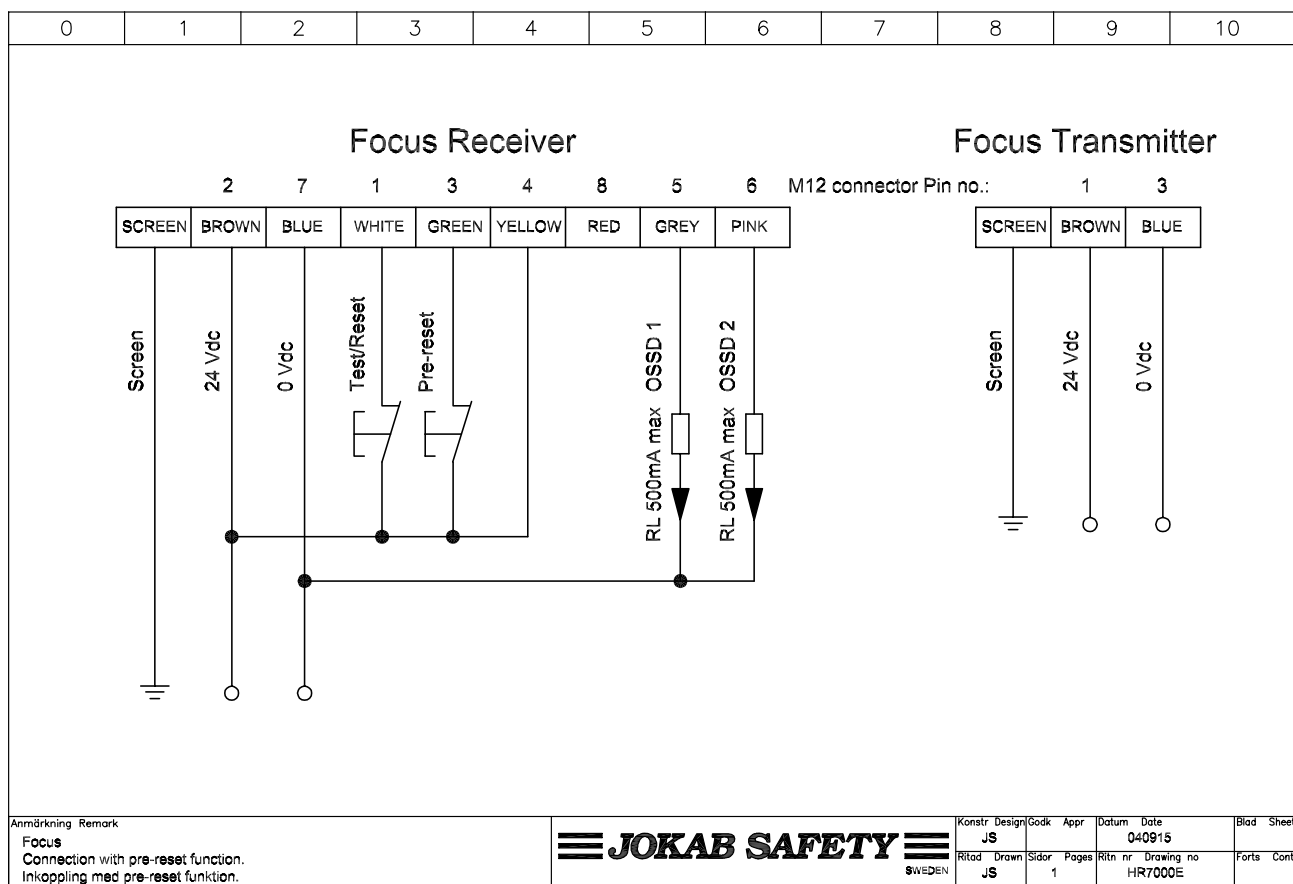
Focus - Connection with muting function disabled



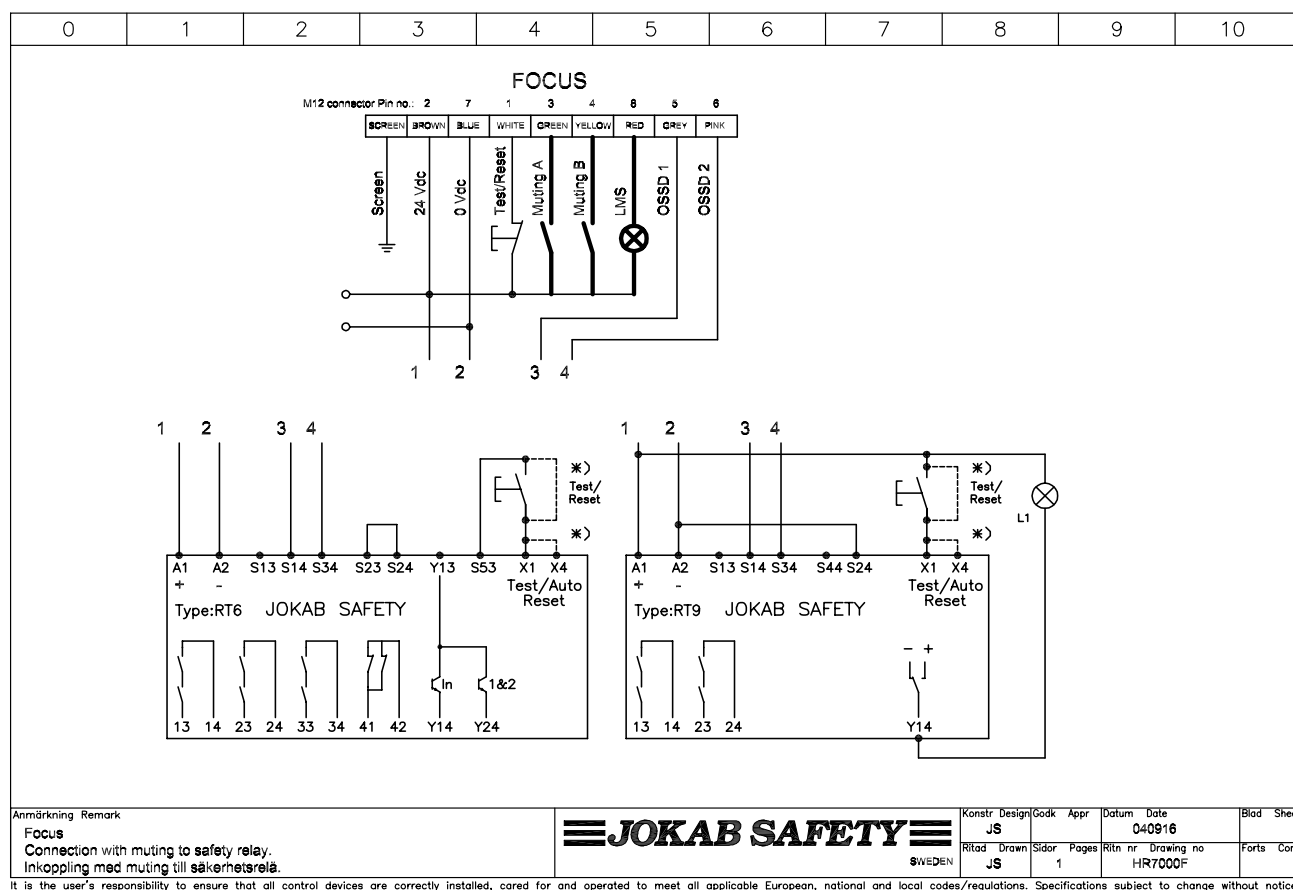
Focus - Connection with muting function activated



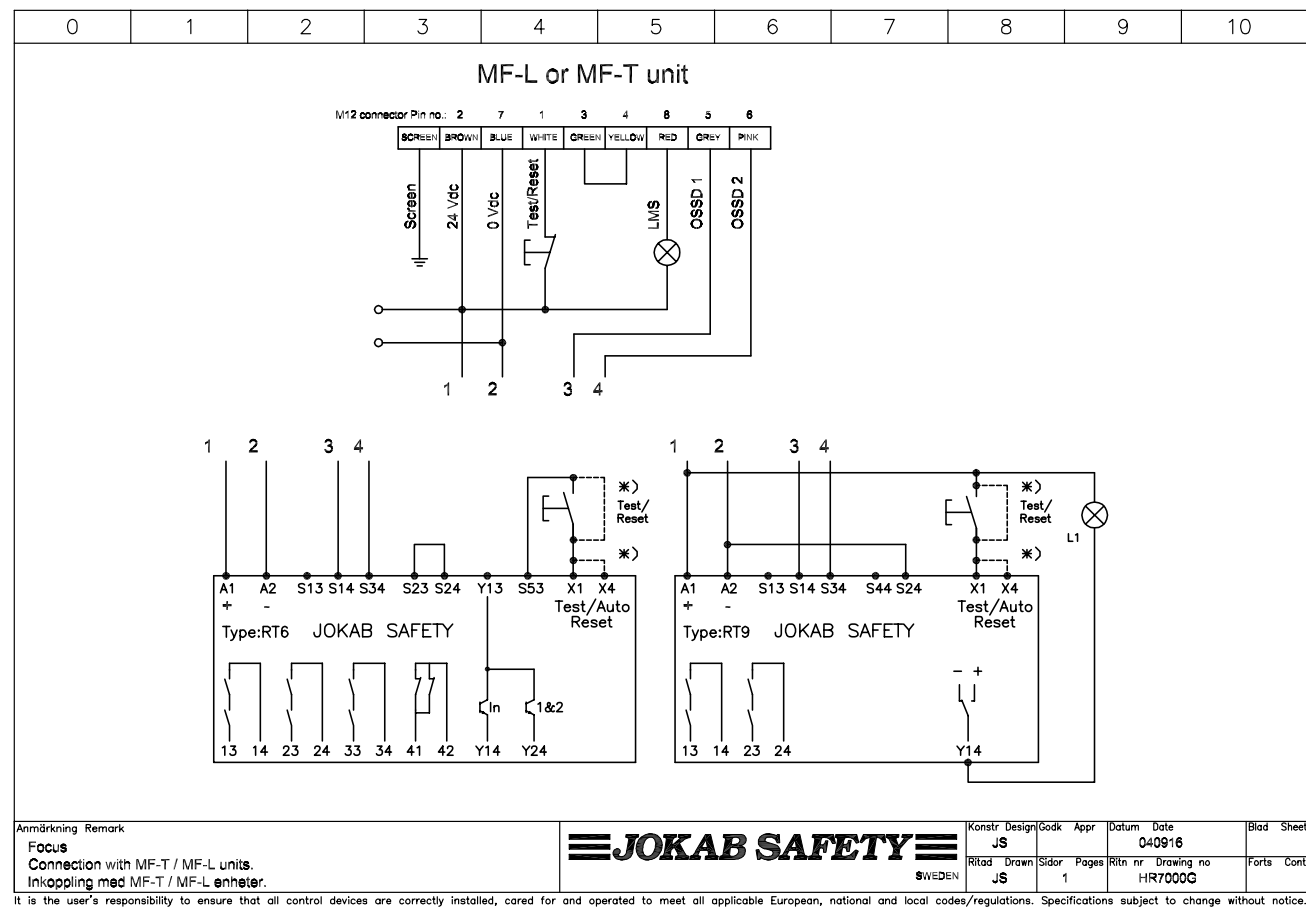
Focus - Connection with pre-reset function



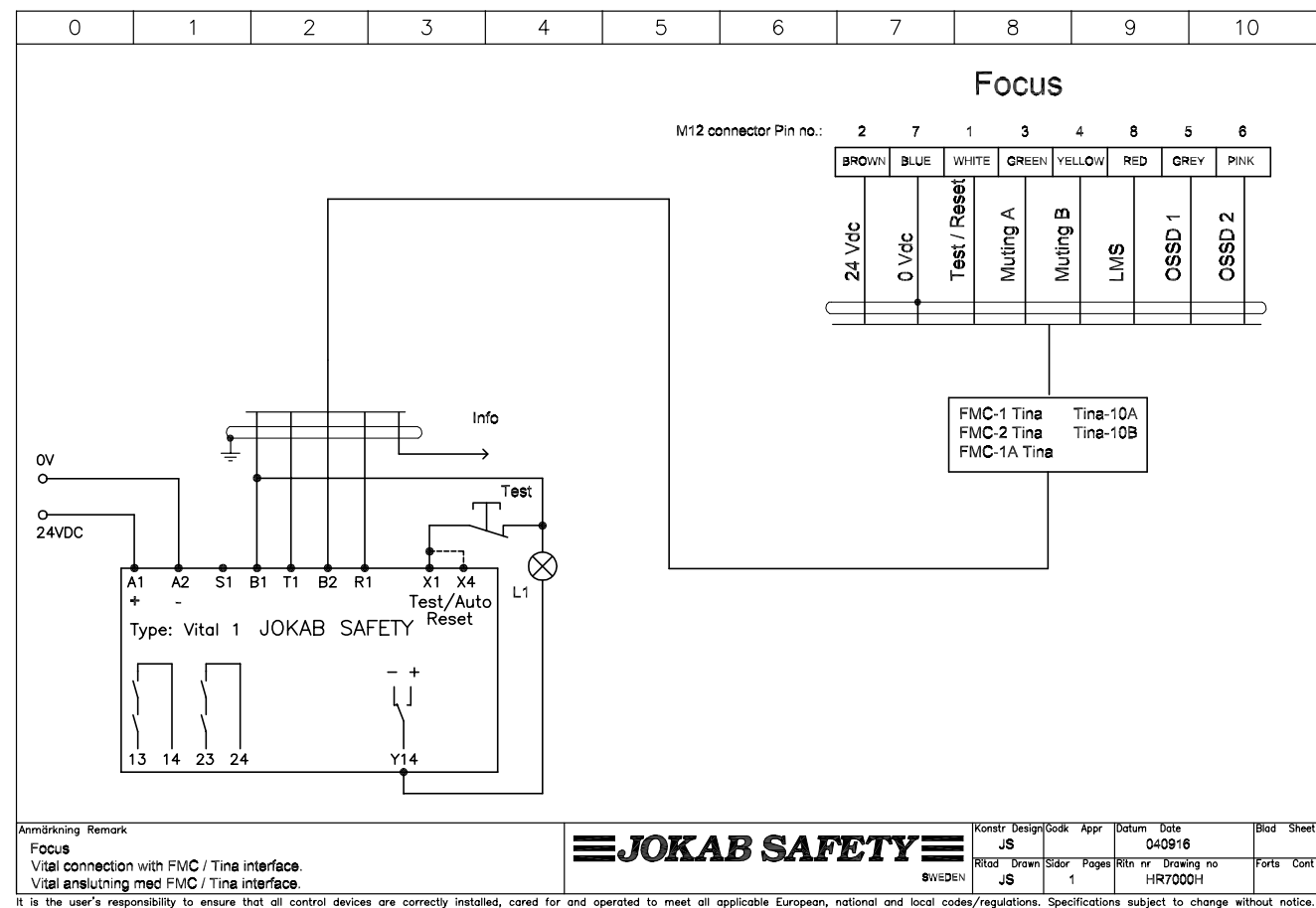
Focus - Connection with muting to safety relay

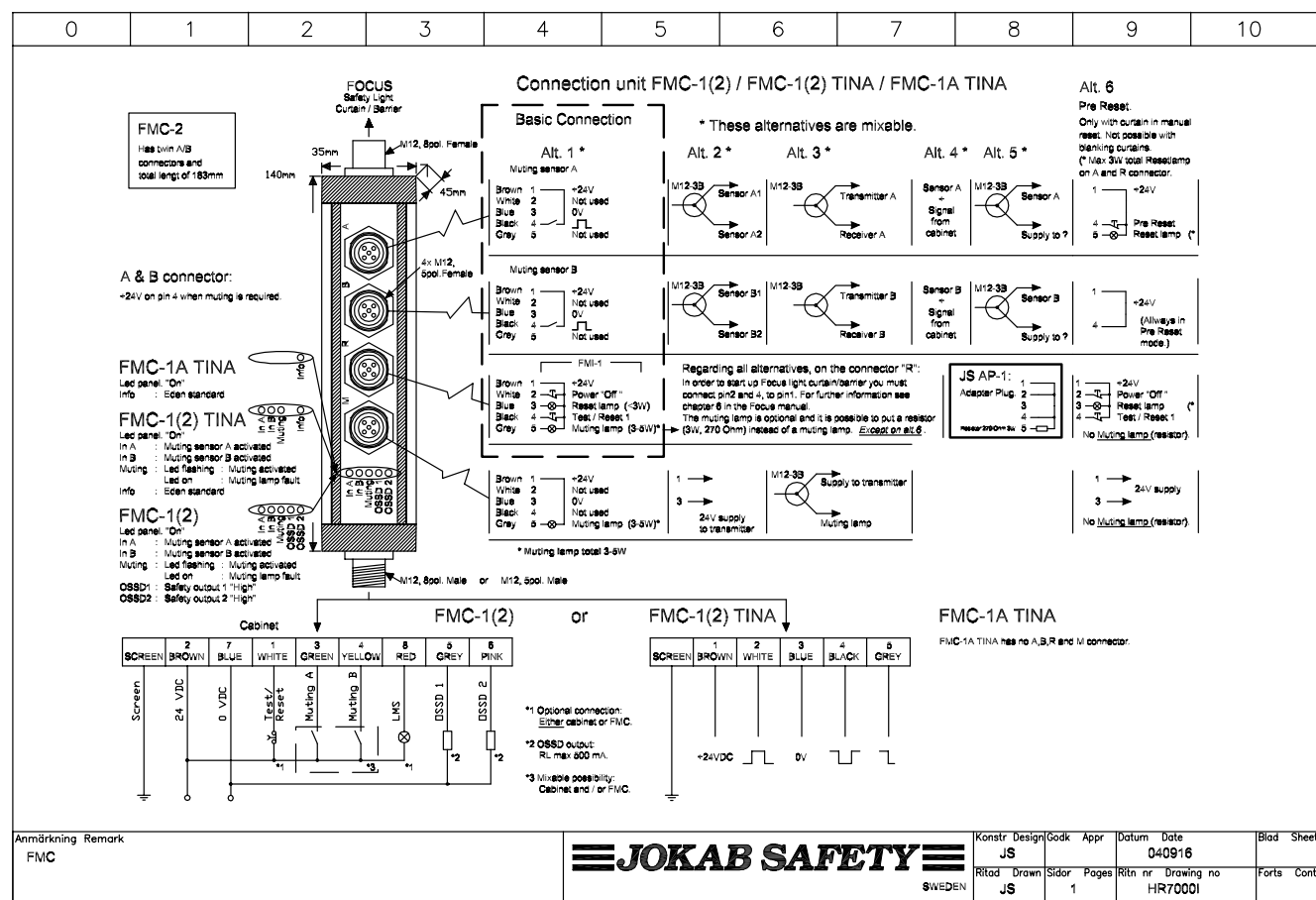


Focus - Connection with MF-T/MF-L units

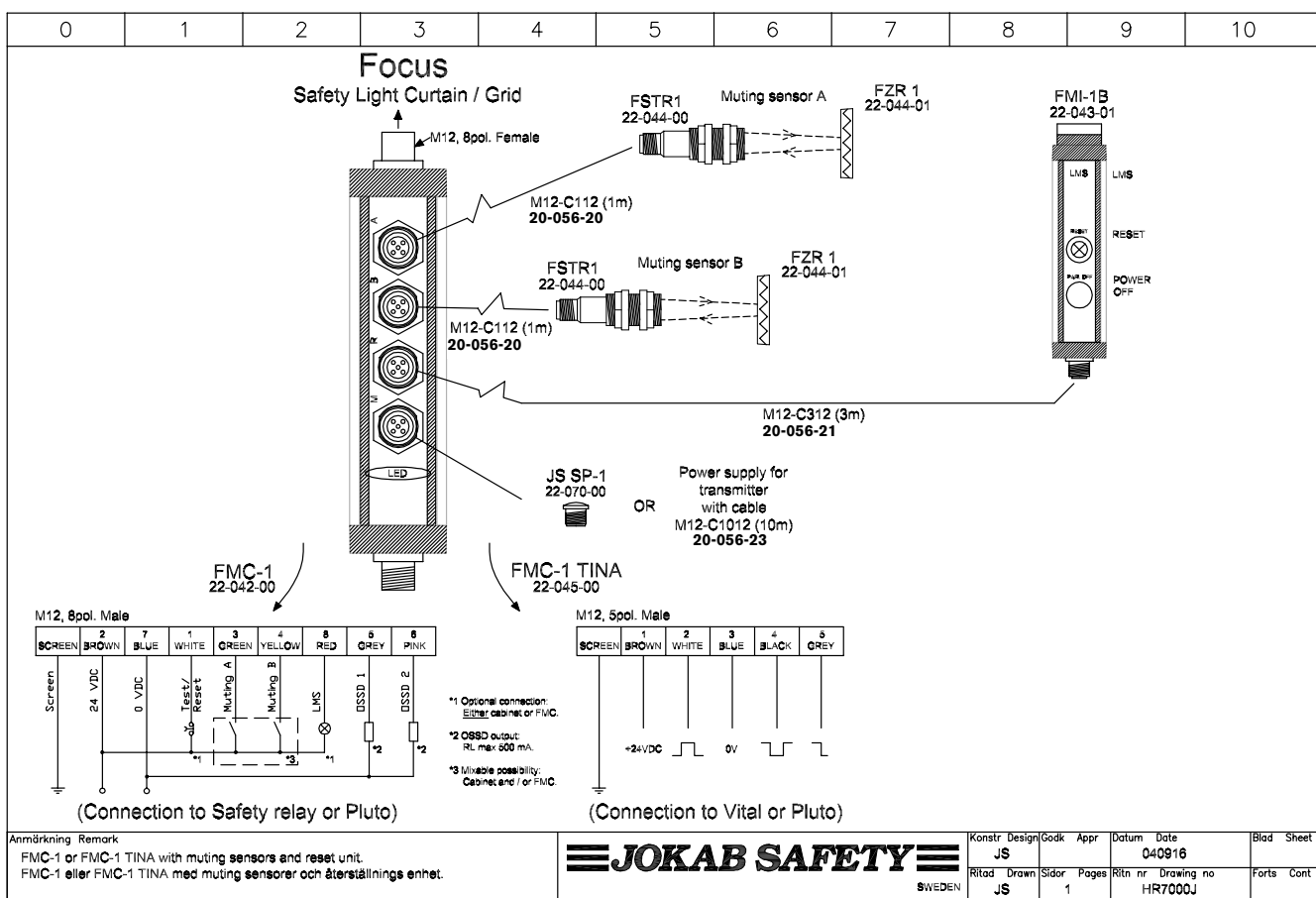


Focus - Connection with FMC/Tina Interface

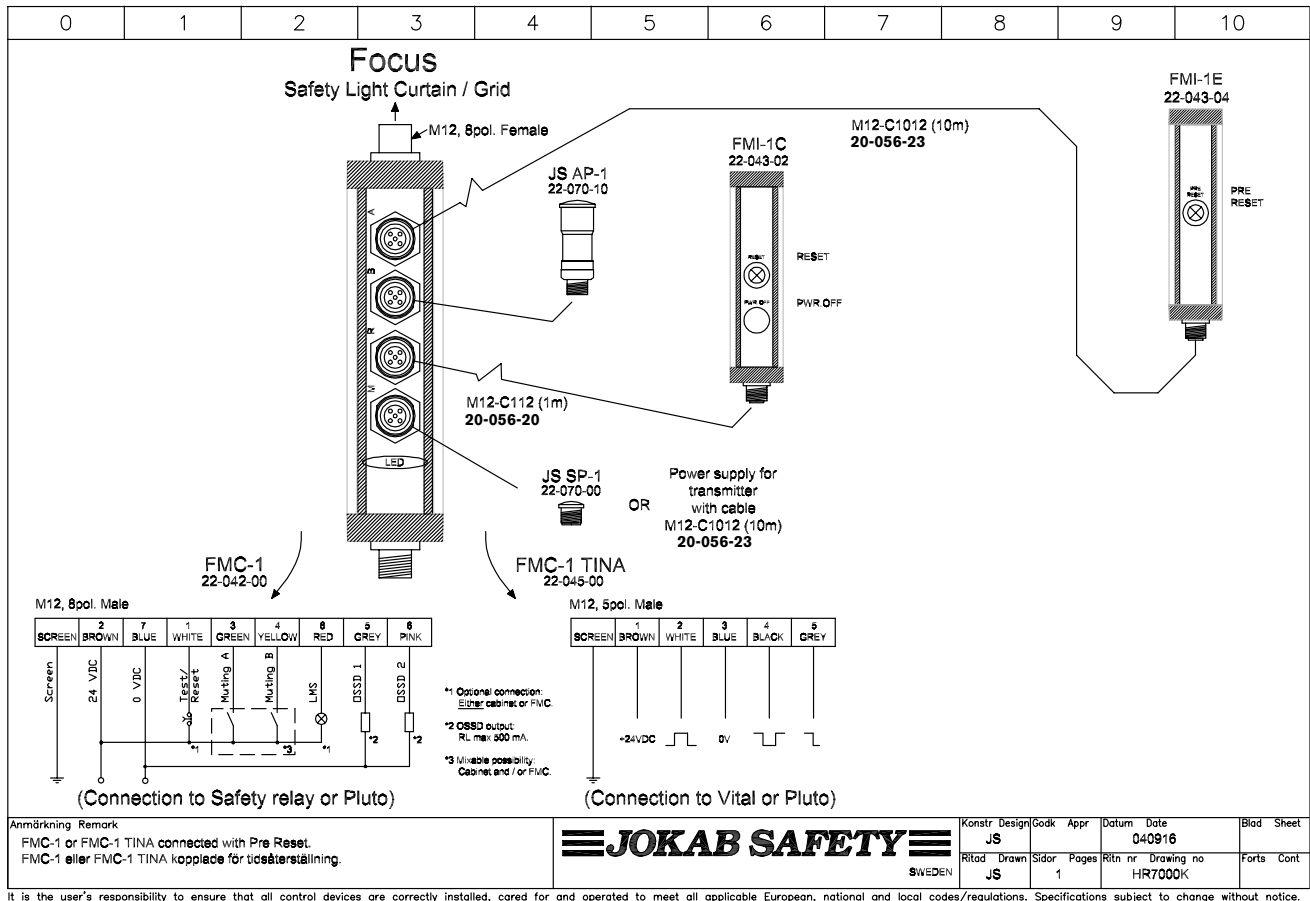




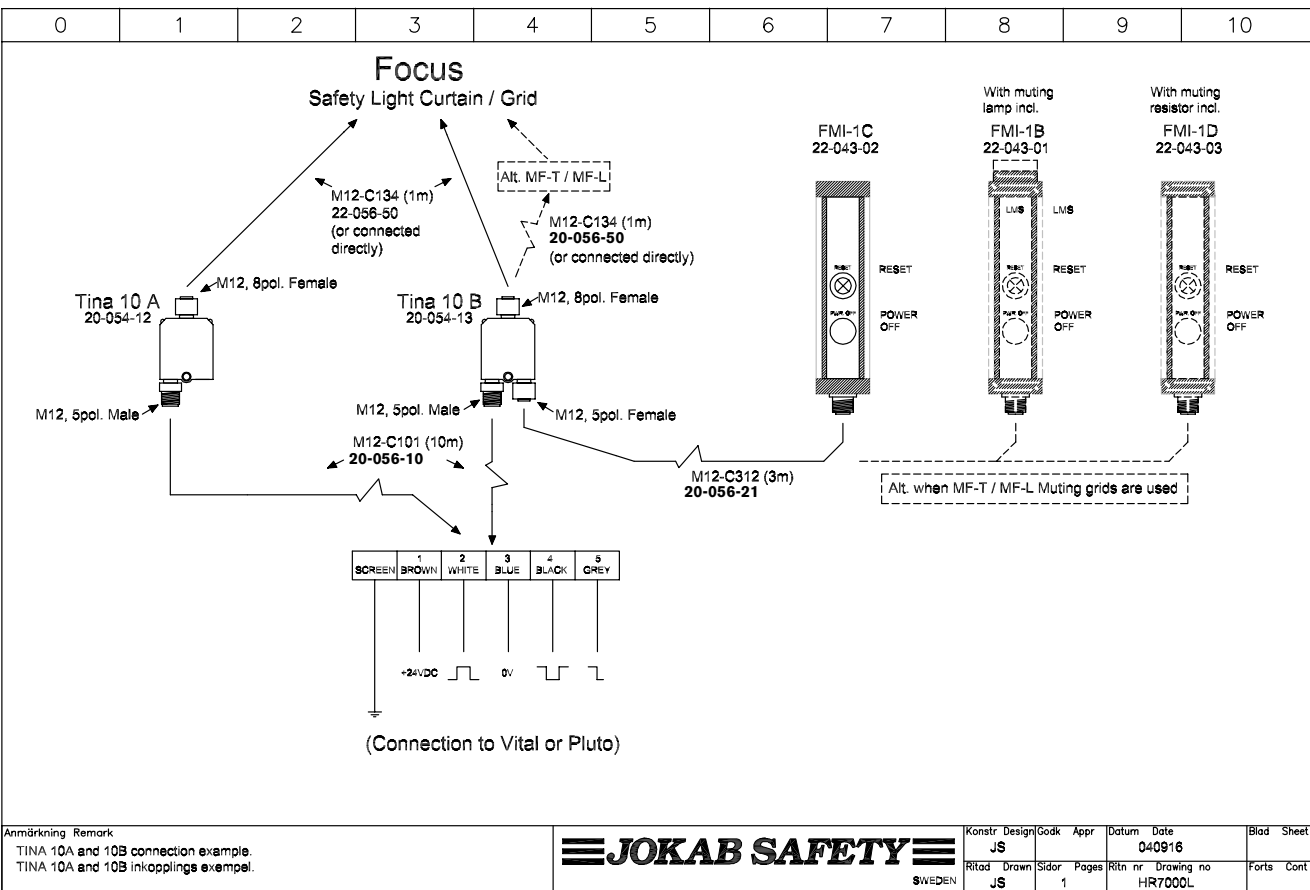
FMC-1 or FMC-1 TINA with muting sensors and reset unit



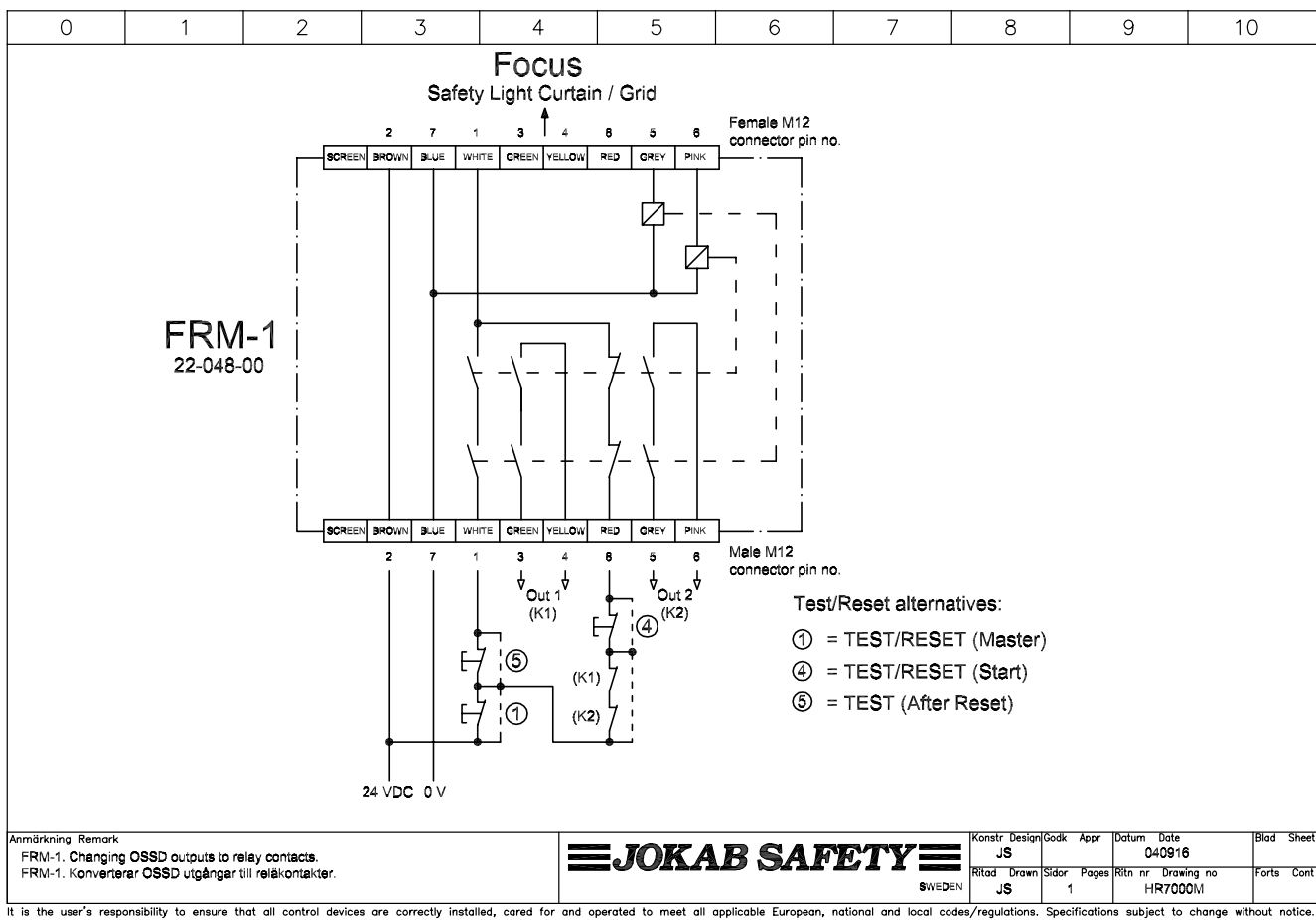
FMC-1 or FMC-1 TINA connected with Pre Reset



TINA 10A and 10B connection example



FRM-1 - Changing OSSD outputs to relay contacts



Focus - Certificates



Safety Light Beam Spot



A light beam for the highest safety level

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/Pluto in combination fulfils the requirements for Category 4 according to EN-954-1 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 LED's 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 or by the Pluto safety-PLC. A unique coded signal is sent out from the control unit to the transmitter (Spot T). The signal which comes back from the receiver (Spot R) is then compared in the Vital/Pluto. If the correct coded signal is received the Vital/Pluto 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 5 transmitter/receiver pairs which are not electrically connected to the Vital unit.

Approvals:



Application:

Photoelectric guarding of an entrance or around a risk area

Features:

Safety level Type 4 according to , EN 61496

Versatile mounting

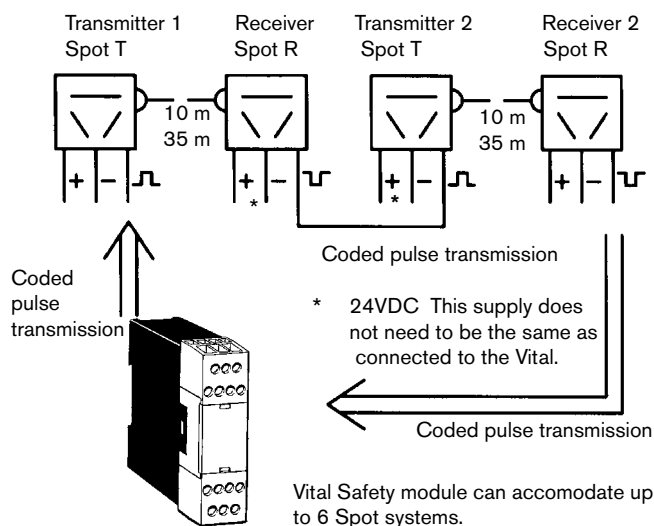
LED indication

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/Pluto according to EN-954-1.



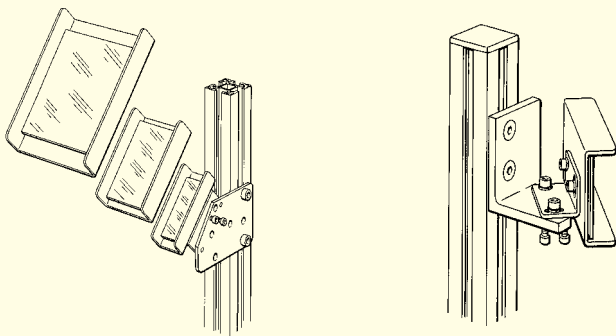
Mounting and alignment – Spot

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 850 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 ordering list for further information.



Different sizes of mirrors, mounting brackets and profiles are available. See component ordering list.

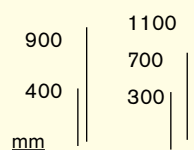
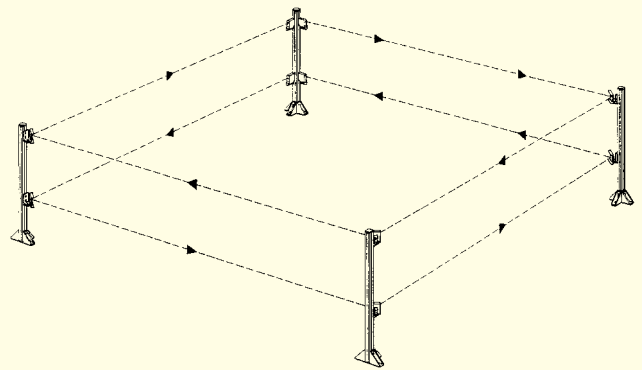
Note. Every mirror reduces the sensing distance of the beam by approx. 20%.

Alignment

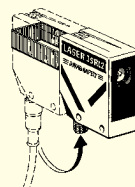
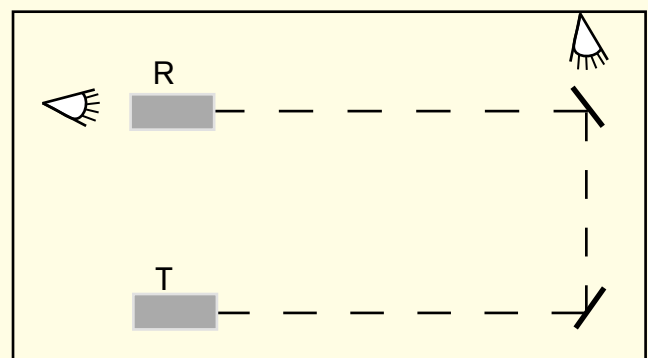
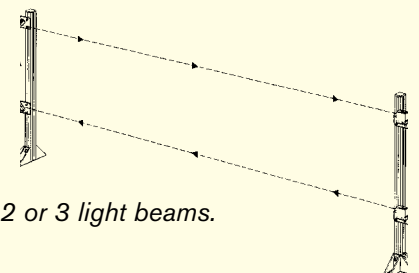
When aligning the light beam, look towards the transmitter. In the lens will be seen a strong red light. When this light is seen from the receiver (via mirrors if fitted) the light beam is basically aligned. The LED on the receiver is on when the receiver is aligned with the transmitter. By moving the 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 minimise 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.

NOTE! When using Laser aligner **do not** look directly into the laser. Observe all necessary precautions when using laser devices, failing to do so can result in eye damage.

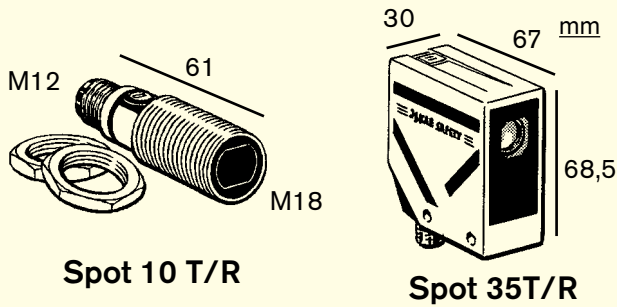


Mounting heights for 2 or 3 light beams.



Laser aligner JSRL2 for light beam Spot T/R.

Technical data - Spot



Protection class	IP 67
Range	Spot 10: 0 - 10 m Spot 35: 0 - 35 m

Installation	Spot 10: 2 M18 nuts (provided) Spot 35: Either via mounting holes in the casing or with angle bracket JSM63 (provided)
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Operating temperature range	-25°C - +65°C
Cable connection	M12 fixed connector
Casing Material	Spot 10: Steel housing with polyacryl lens protection. Spot 35: Polyamide housing with polyacryl lens protection.

Manufacturer	JOKAB SAFETY AB, Sweden
Ordering data	Spot 10 T/R and Spot 35T/R

Safety level with Vital/Pluto (according to EN 61496) type 4

Safety category together with Vital/Pluto (according to EN 954-1) 4

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°
Optical power Spot 10: < 0.1 mW
 Spot 35: < 0.2 mW

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

Colour	Spot 10: Steel grey Spot 35: yellow/black
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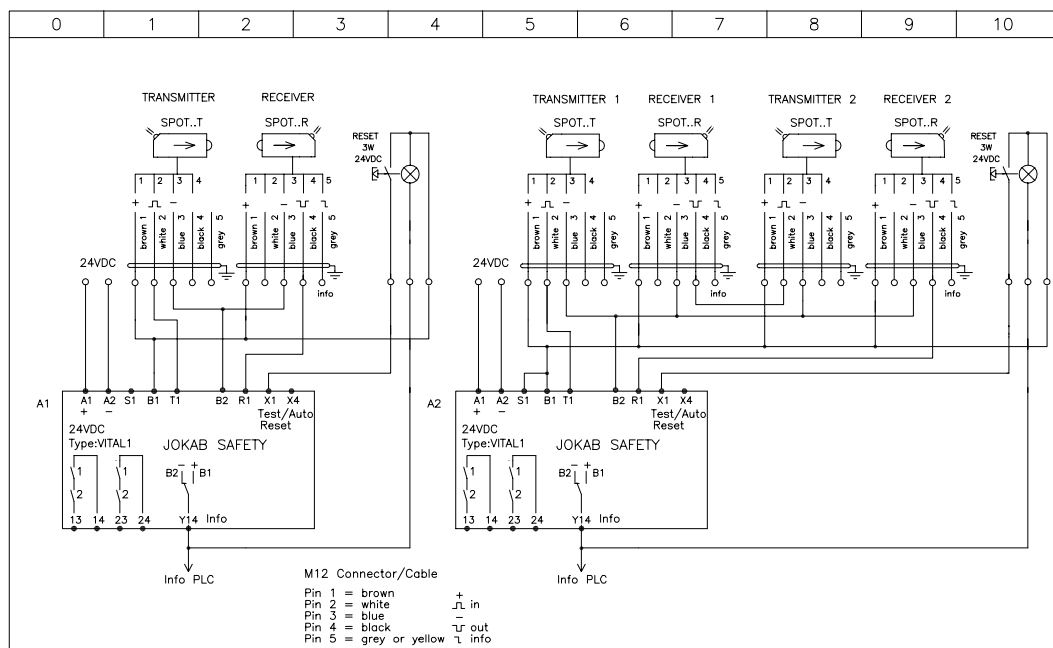
Weight	Spot 10: 2 x 21g Spot 35: 2 x 100 g
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Connections	
Transmitter	Brown (1) +24 VDC White (2) Dynamic signal in Blue (3) 0 VDC

Receiver	Brown (1) +24 VDC White (2) 0 VDC Blue (3) 0 VDC Black (4) Dynamic signal out Grey (5) Info output
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24 VDC when LED is green or flashing (tolerance -2 VDC)
 0 VDC when LED is off (tolerance +2 VDC)

Connection of Spot T/R to Vital1

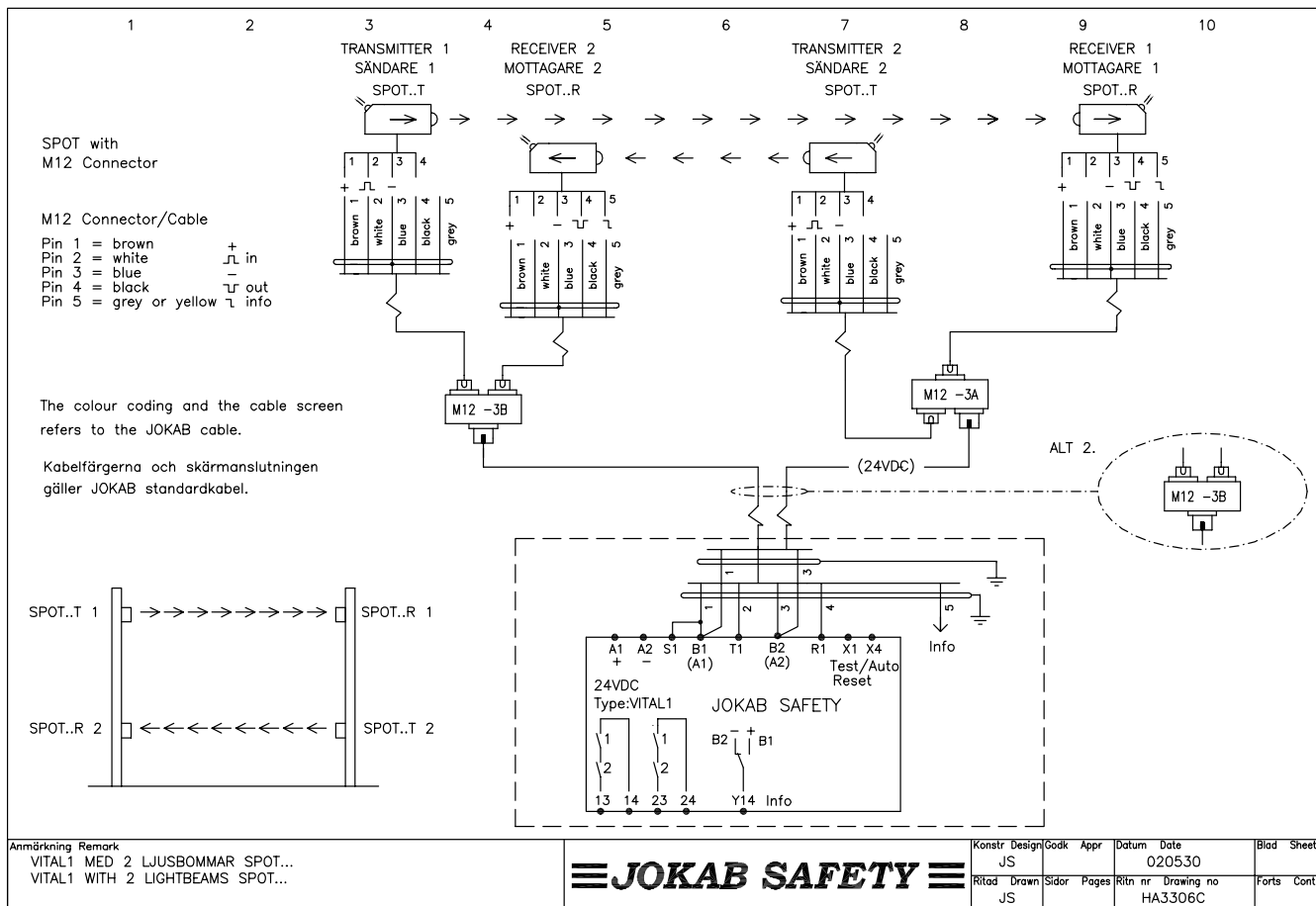


Anmärkning Remark
 VITAL1 MED LJUSBOM SPOT..
 VITAL1 WITH SAFETY LIGHT BEAM SPOT..

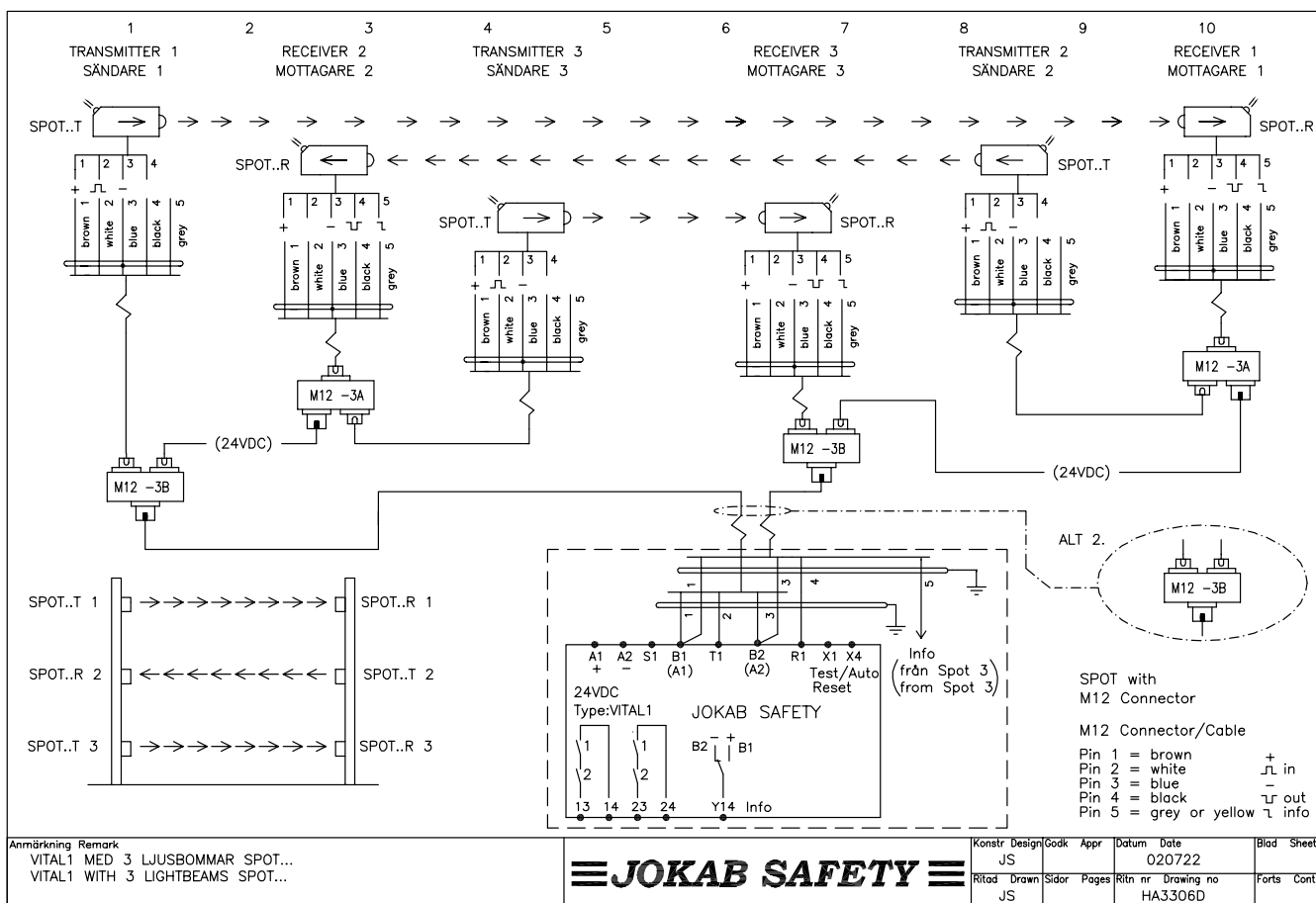
JOKAB SAFETY		Konstr. Design/Code	Appr.	Datum Date	Blad Sheet
		JS		020530	1
Ritad Drawn	Sidor Pages	Ritad Drawn	Sidor Pages	Ritad Drawn	Sidor Pages
JS	1	JS	1	JS	1
		HD3800A		Forts. Cont.	

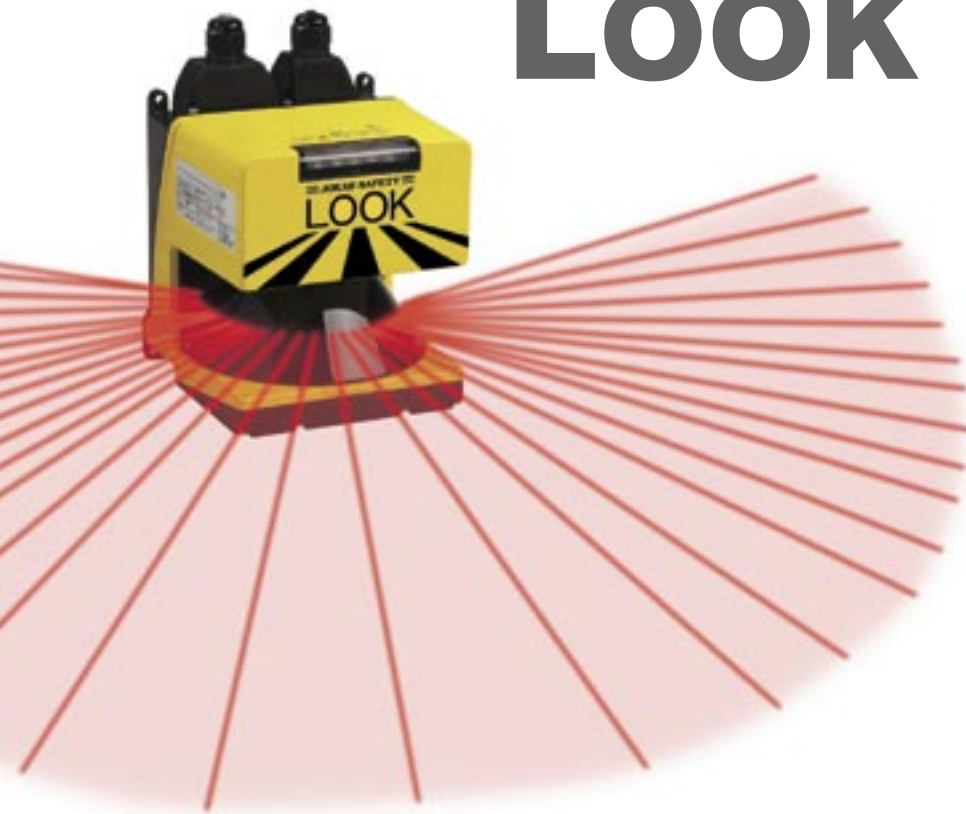
It is the user's responsibility to ensure that all control devices are correctly installed, cared for and operated to meet all applicable European, national and local codes/regulations. Specifications subject to change without notice.

Vital 1 with 2 light beams Spot



Vital 1 with 3 lightbeams Spot





Approvals:



Application:

Photoelectric guarding of several risk areas

Features:

Type 3, IEC61496-3

Easy to install

Protected from welding sparks/arcs

Easy to program

4 individual programmable protection areas simultaneously with Pluto

A laser scanner that has the ability to scan four individual areas

The Laser Scanner 'Look' has the ability to scan four individual areas. Each area can be programmed individually for the specific application, making it ideal for auto-carriers that need to operate along different paths. The safety level is according to Type 3, IEC 61496-3. It is approved for use as personnel protection in robot working areas, conveyor equipment etc. The small design makes it easy to install. Look is not affected by ambient light levels (sun etc) or welding arcs/sparks. The protection fields are quick and

easy to create on a PC in a Windows environment. It has four individual programmable protection areas. Each area consists of one personnel protection field with maximum 4 m radius, and one warning field of maximum 15 m radius. Changing between the areas is easily achieved using additional sensors.

Technical Data - Look

General data

Scanning rate:	25 Scans/sec
Scanning angle:	190°
Operating voltage:	24 VDC +20%/-30%
Transmitter:	Laserdiode; Protection class 1
Current consumption:	approx. 300 mA
Angle resolution:	0,36°
Weight:	2 kg
Housing:	H=155 mm, W=140 mm, D=135

Personnel protection field

Scanning distance:	Radius 0.2 - 4 m
Area:	4 areas, switchable by 24 VDC input
Output:	2 x OSSD; 250 mA; failsafe transistor PNP outputs 24 VDC
Resolution:	70 mm at 4 m
Response time:	80 ms
Reflectance factor:	min 1,8 %

Warning field

Scanning distance:	Radius 0 - 15 m
Area:	4 areas, switchable by 24 VDC input
Output:	PNP-transistor, 24 VDC/100 mA
Resolution:	150 mm at 15 m, +/- 20%
Response time:	80 ms
Reflectance factor:	min 20%

Contour measurement

Measurement range:	Radius 0- 50 m
Output:	RS 232/422
Response time:	80 ms
Reflectance factor:	min 20%

Reset: manual or automatic

Suitable interface safety relay: RT6, RT7, RT9, JSBRT11 or Pluto

Function buttons

Dialog box for selecting which area pair to display

Inactive safeguarded area pair 3

Measured area limits

Warning indication, an object is inside the safeguarded area

An object is detected inside the detection area, the machine stops

Active safeguarded area pair 1
Red: Detection area
Green: Safeguarded area

[illegible]