

Original instructions

Spot

Safety light beam



Read and understand this document

Please read and understand this document before using the products. Please consult your ABB/JOKAB SAFETY representative if you have any questions or comments.

WARRANTY

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The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this document.

Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, and installations subject to separate industry or government regulations.

Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE ABB/JOKAB SAFETY PRODUCT IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

PERFORMANCE DATA

While every effort has been taken to ensure the accuracy of the information contained in this manual ABB/JOKAB SAFETY cannot accept responsibility for errors or omissions and reserves the right to make changes and improvements without notice. Performance data given in this document is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of ABB/JOKAB SAFETY'S test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the ABB/JOKAB SAFETY Warranty and Limitations of Liability.

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1 Introduction

Scope

The purpose of these instructions is to describe the safety light beam Spot and to provide the necessary information required for assembly, installation, checks and adjustments after installation, and maintenance.

Audience

This document is intended for authorized installation personnel.


Prerequisites

It is assumed that the reader of this document has knowledge of the following:

- Basic knowledge of ABB/Jokab Safety products.
- Knowledge of safety devices and safety light beams.
- Knowledge of machine safety.

Special notes

Pay attention to the following special notes in the document:

 **Warning!** Danger of severe personal injury!
An instruction or procedure which, if not carried out correctly, may result in injury to the technician or other personnel.

Caution! Danger of damage to the equipment!
An instruction or procedure which, if not carried out correctly, may damage the equipment.

NB: Notes are used to provide important or explanatory information.

2 Overview

General description

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 ABB/Jokab Safety mirrors and brackets.


The combination of Spot and Vital 1 fulfils the requirements for Category 4/PL e according to EN 954-1/EN ISO 13849 and type 4 according to EN 61496. Several light beams, Eden sensors and emergency stops can be connected in series and still achieve PL e 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, as well as the safety status. The 'contact' information is available via the light beam receiver connection cables.

Shielded cable is recommended between this unit and the rest of the safety circuits.

Intended use

The safety light beam Spot 10/35 is intended for use as part of a safety system to detect persons entering a hazardous area. Safe signals are supplied to the control unit (Vital 1) that is controlling the safety outputs.

 **Warning!** Spot 10/35 is not to be compiled as a light curtain to detect fingers or hands.

Safety regulations

 **Warning!**

Carefully read through this entire manual before using the device.

The devices shall be installed by a trained electrician following the Safety regulations, standards and the Machine directive.

Failure to comply with instructions, operation that is not in accordance with the use prescribed in these instructions, improper installation or handling of the device can affect the safety of people and the plant.

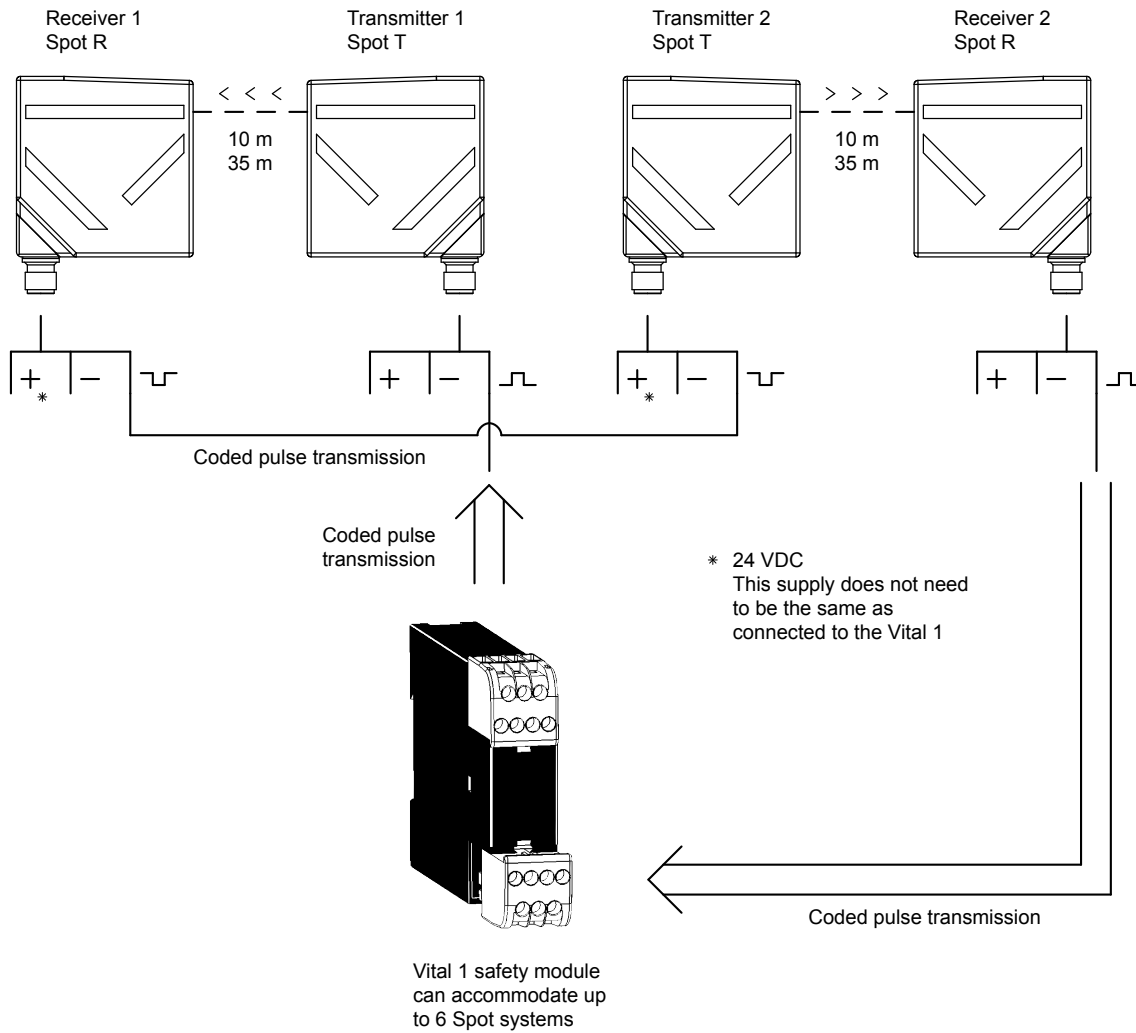
For installation and prescribed use of the product, the special notes in the instructions must be carefully observed and the technical standards relevant to the application must be considered.

In case of failure to comply with the instructions or standards, especially when tampering with and/or modifying the product, any liability is excluded.

Function description

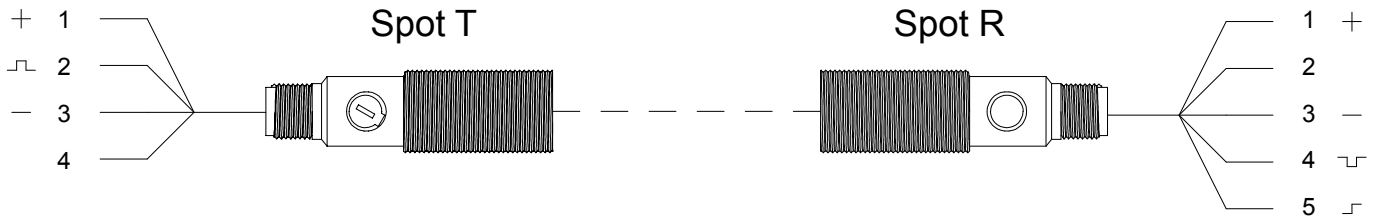
The Spot light beam is supervised by the Vital 1 safety module. A unique coded signal is sent out from the control unit to the transmitter (Spot T). The signal which comes back from the receiver (Spot R) is then compared in the Vital 1 safety module. If the correct coded signal is received the Vital 1 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 means of coding, the dynamic signal can pass between up to 6 pairs of transmitters and receivers, with only one pair needing to be electrically connected to a Vital 1.



3 Connections

Electrical connections – Spot



Transmitter:

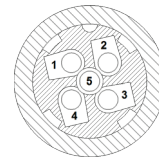
4-pole male M12-connector

- 1) +24 VDC
- 2) Dynamic signal input
- 3) 0 VDC
- 4) Not used

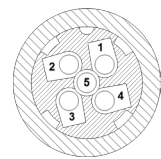
Receiver:

5-pole male M12-connector

- 1) +24 VDC
- 2) Not used
- 3) 0 VDC
- 4) Dynamic signal output
- 5) Information output



M12 5-pole male seen from cable side

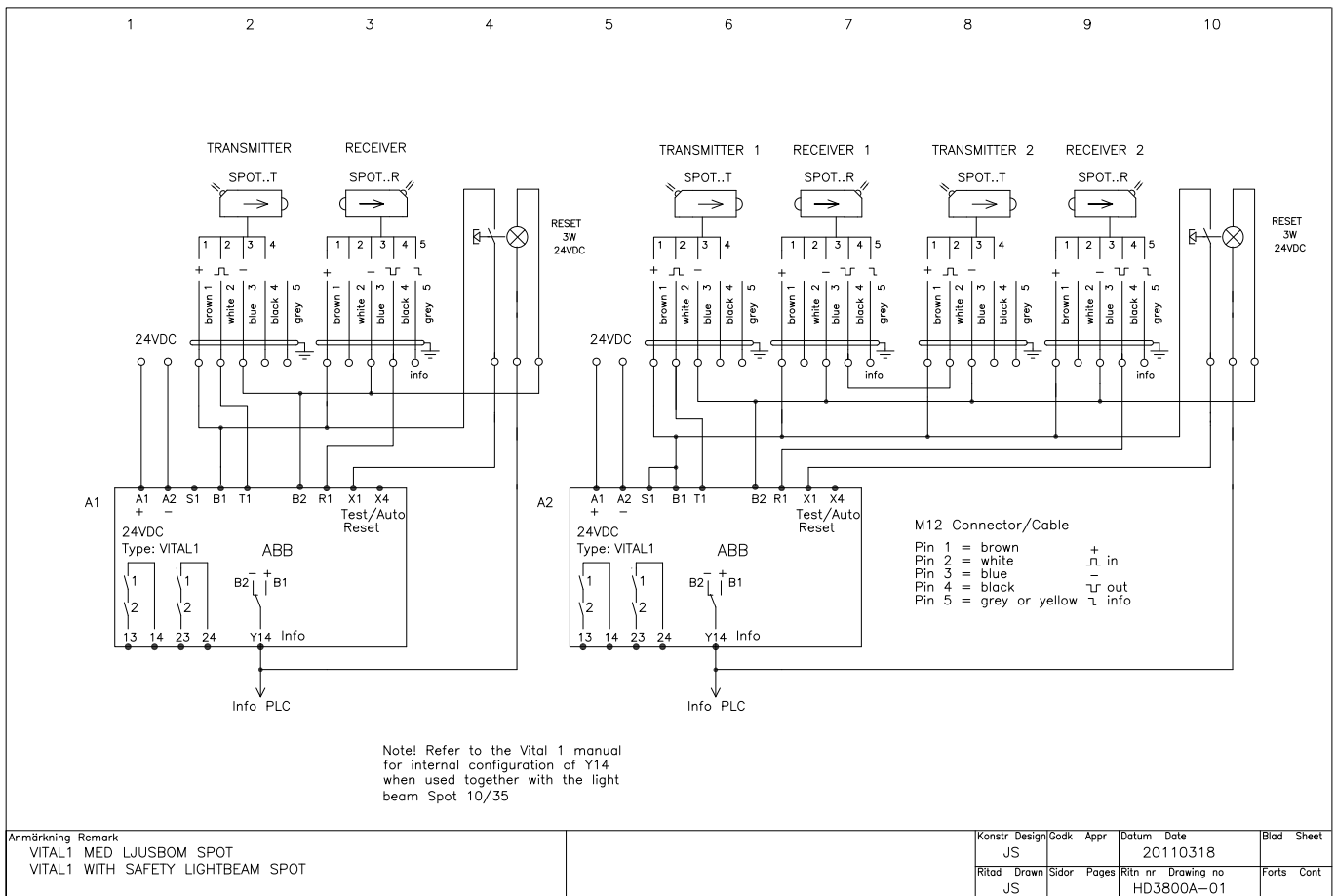


M12 5-pole female seen from cable side

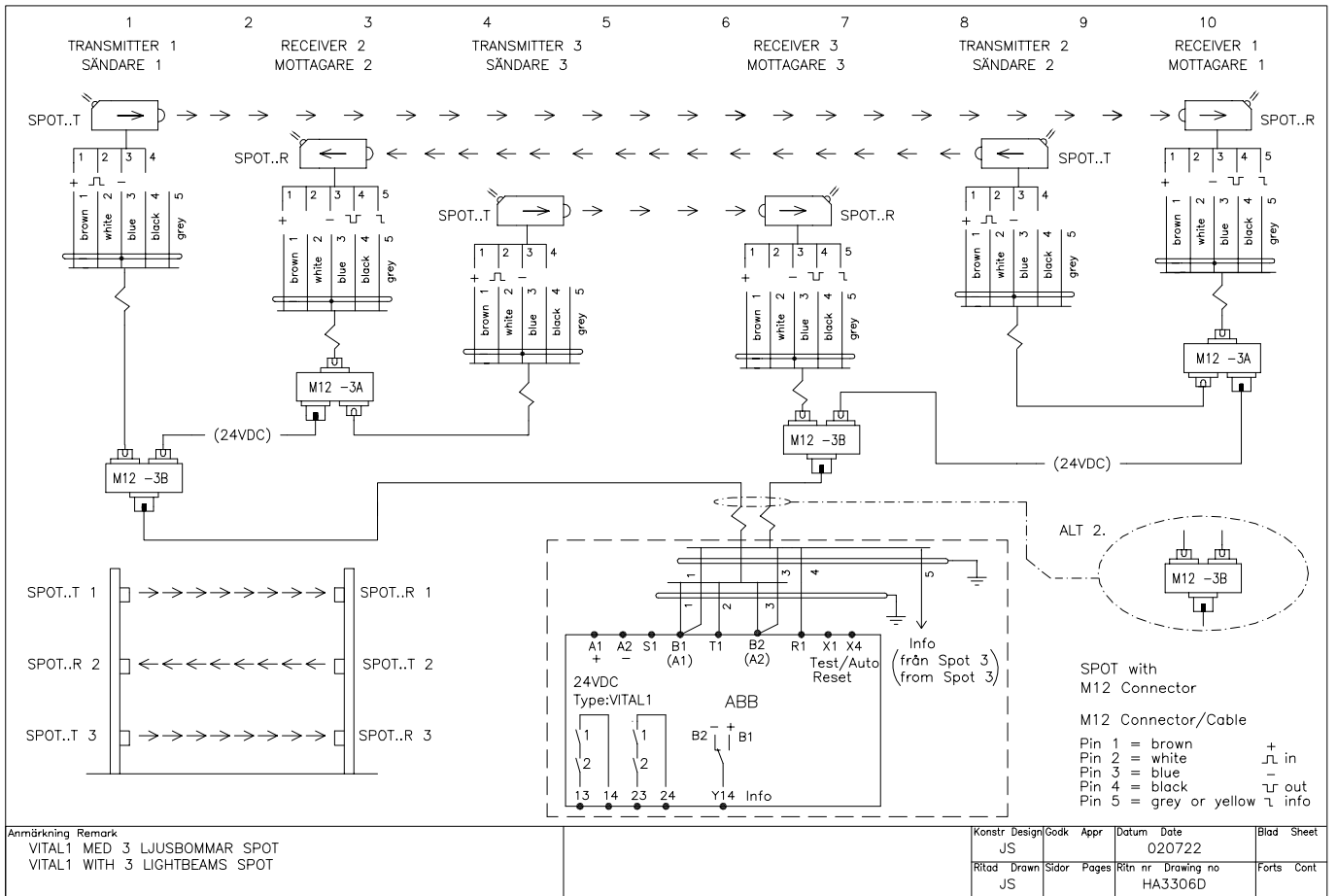
Warning! The information output signal is non-failsafe and must therefore **never** be used to control a safety application.

Connection examples

Connection example – Connection of Spot T/R to Vital 1



Connection example – Vital 1 with three light beams Spot



4 Installation and maintenance

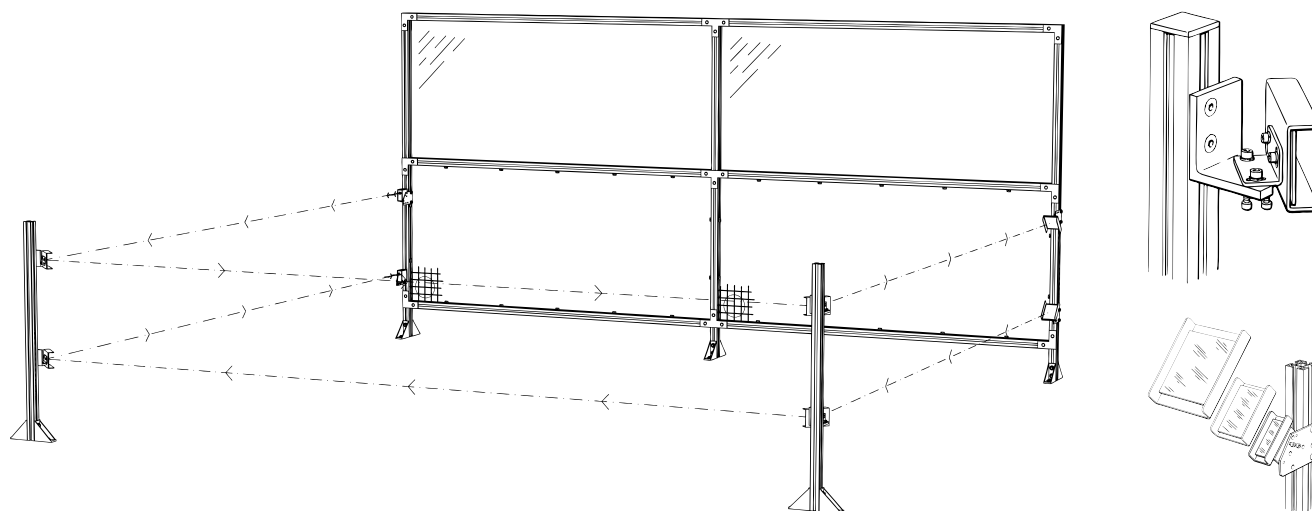
Mounting and alignment

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 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 13855). Contact ABB/Jokab Safety for further information.

Accessories and mounting

The Spot light beam can be mounted using a variety of brackets, posts and mirrors. Refer to the product list at www.abb.com/jokabsafety for further information.



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

Mounting height

When using two or three light beams, the mounting heights specified in **Table 1** should be used.

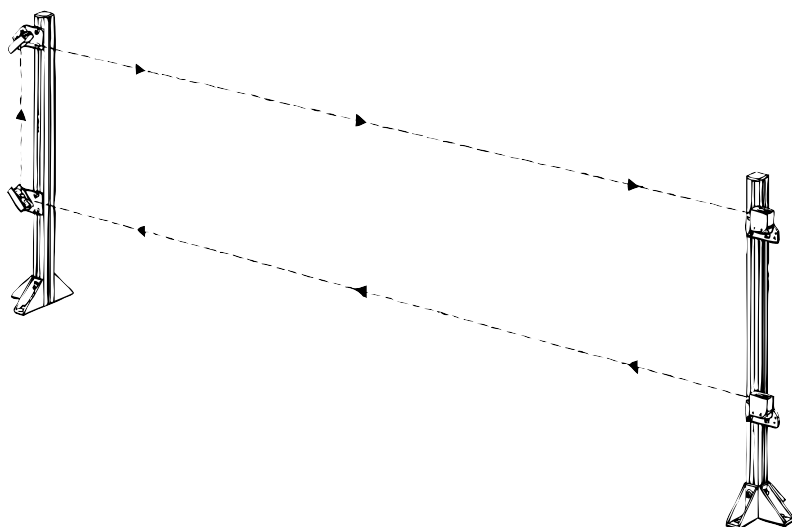


Table 1

#	2 beams	3 beams
1	400 mm	300 mm
2	900 mm	700 mm
3	-	1100 mm

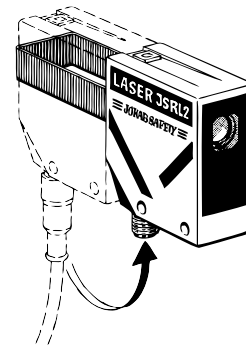
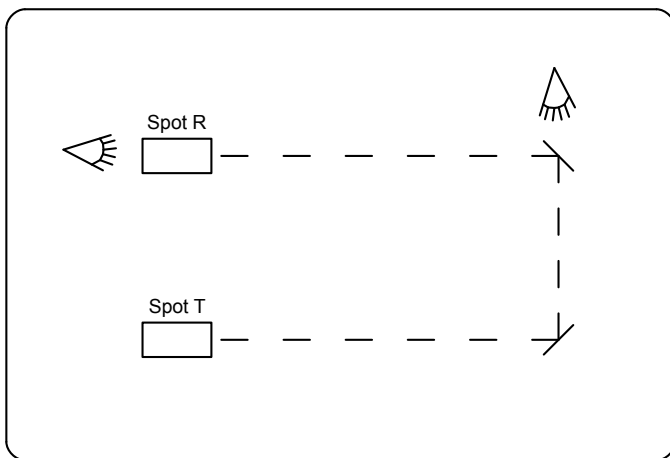
Alignment

When aligning the light beam, look towards the transmitter. A strong red light will be seen in the lens. 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.

In case of vertical mounting, (as shown in the illustration) 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 responsivity can be adjusted with a trim potentiometer on the Spot 35 receiver. On Spot 10 the radiant power can be adjusted on the transmitter in order to reduce disturbance of other sensors.

To simplify the alignment, the Laser Aligner (JSRL2) can be used for Spot 35. The laser has visible light (class IIa) and is easy to temporarily mount for the alignment procedure. Supply to the Laser Aligner is taken from the Spot 35 T/R connector.

NB: When using the 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.



Light disturbance

Light from the beam may spread by up to $\pm 2.5^\circ$ originating from the transmitter. Caution must therefore be taken when several pairs of Spot T/R units are used. Each receiver must be affected only by the beam from the corresponding transmitter. See section *Positioning precautions* for further information.

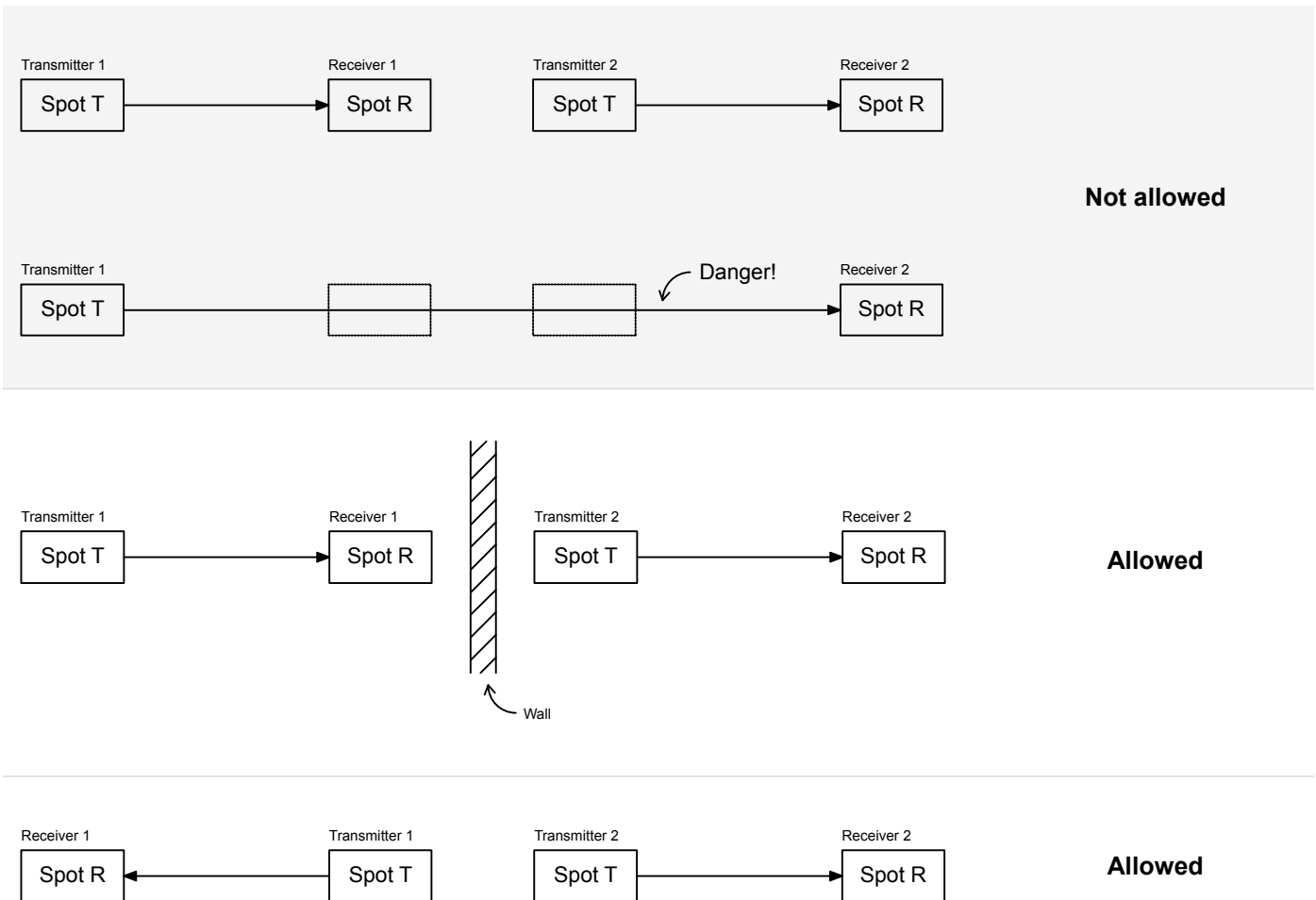
Additional measures may be necessary to ensure that the Spot T/R unit does not fail to danger when other forms of light radiation are present in a particular application (for example, use of cable-less control devices on cranes, radiation from weld spatter or effects from stroboscopic lights).

Positioning precautions

The following precautions must be considered when using more than one pair of Spot units.

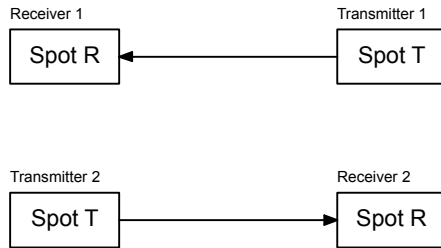
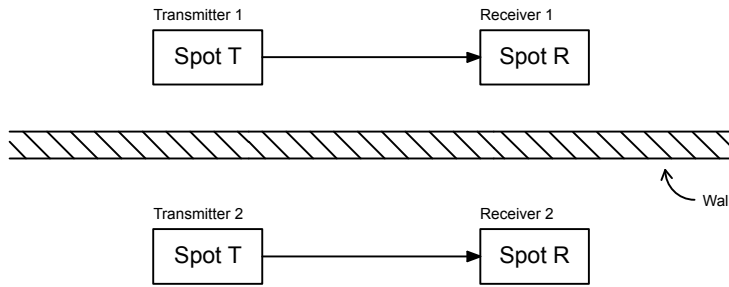
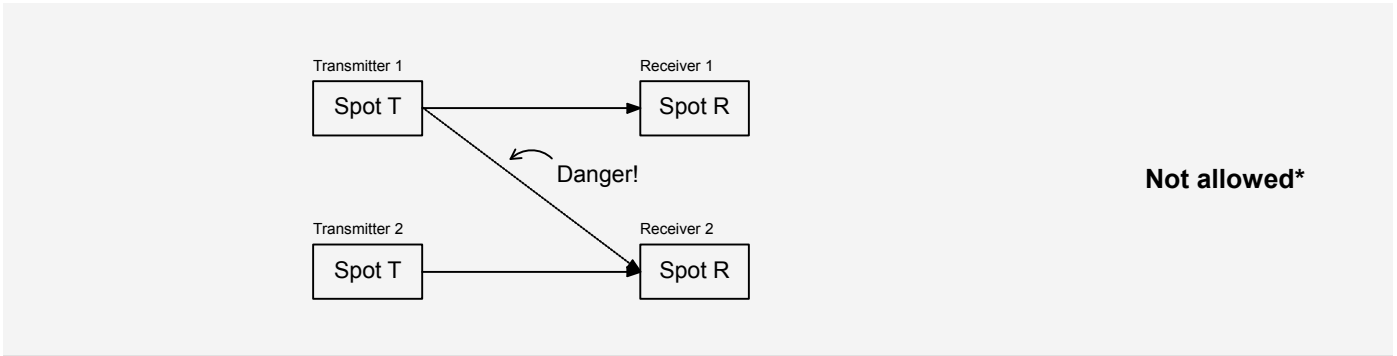
In line

Examples of more than one pair of Spot units set up in a straight line.



Parallel

Examples of more than one pair of Spot set up beside (or on top of) each other.



* This setup may be non-safe depending on the distance between the Spot pairs. The minimum distance between the Spot pairs are calculated assuming the worst case scenario.

Worst case

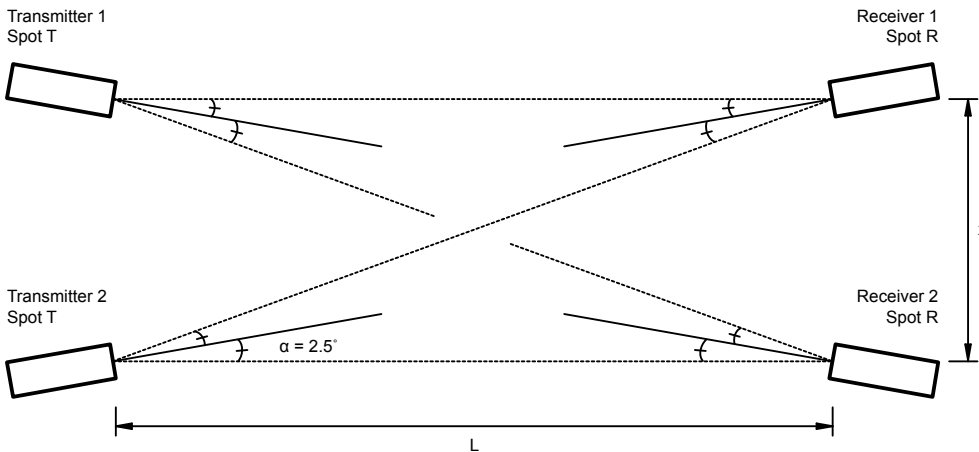


Table 2

L	x
5 m	0.44 m
10 m	0.87 m
20 m	1.75 m
35 m	3.06 m

Calculation of minimum distance (worst case):

$$x = L \times \tan (2\alpha)$$

where

x = minimum distance between two pairs

L = distance between transmitter and receiver

α = maximum spreading angle of light disturbance

NB: Example values are given in Table 2.

Reflecting surfaces

The Spot units must be set up in such a way that a reflecting surface may **never** be allowed to redirect the light from the transmitter into the receiver. The minimum distance to a reflective surface (horizontal or vertical) from which the Spot pair may be mounted is calculated depending on the distance between the transmitter and receiver.

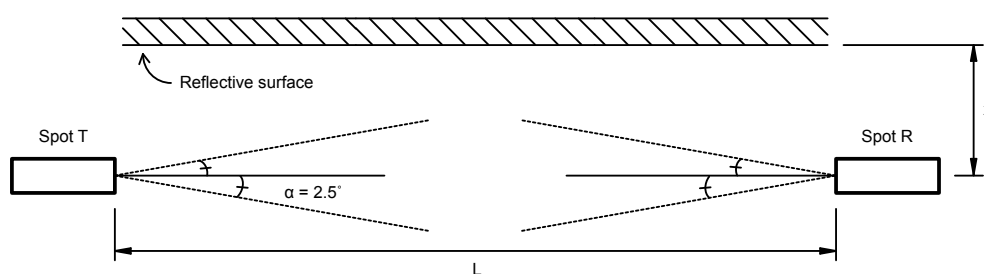


Table 3

L	x
≤ 3 m	131 mm
5 m	0.22 m
10 m	0.44 m
20 m	0.87 m
35 m	1.53 m

Calculation of minimum distance:

If the distance (L) between the transmitter and receiver is less than or equal to 3 meters ($L \leq 3$ m) the minimum distance (x) is 131 mm.

If the distance (L) between transmitter and receiver is greater than 3 meters ($L > 3$ m) then the following formula applies:

$$x = L \times \tan (\alpha)$$

where

x = minimum distance between Spot and reflective surface

L = distance between transmitter and receiver

α = maximum spreading angle of light disturbance

NB: Example values are given in Table 3.

Installation precautions

The safety light beam shall be installed by a trained electrician following the Safety regulations, standards and the Machinery directive.

All the safety functions shall be tested before the starting up of the system:

- Interrupt the dynamic safety circuit before this unit. The LED on the receiver should flash green.
- Interrupt the protection by obstructing the beam. The LED on the receiver should turn off.
- The LED on the receiver should light green if protection is OK and the safety circuit before this unit is not interrupted.

Caution! The main voltage for the system shall be switched off before installation, modifications or other adjustments are made that can risk the safety of the system.

Precautions when using safety light beam Spot with Vital 1:

- The information output switch on Vital 1 must be in position 2. A yellow indication lamp must be connected to the information output on Vital 1 and mounted where it is visible from the protected area. Refer to the Vital 1 manual for further details.
- Vital 1 must be installed within an electrical cabinet (or similar housing) with a minimum protection class rating of IP54.
- The information output signal from Spot must be connected to an indication lamp in such a way that it:
 - Lights green when Spot is OK (uninterrupted)
 - Lights red when Spot is interrupted

Caution! When changing the internal switch position, the power supply to Vital 1 must be disconnected before the connection blocks may be removed.

Maintenance

Warning!

The safety functions and the mechanics shall be tested regularly, at least once every year to confirm that all the safety functions are working properly (EN 62061:2005).

In case of breakdown or damage to the product, contact the nearest ABB/Jokab Safety Service Office or reseller. Do not try to repair the product yourself since it may accidentally cause permanent damage to the product, impairing the safety of the device which in turn could lead to serious injury to personnel.

Caution! This product shall be handled with caution: The product should be replaced with the same product type in a situation where it has been dropped on the floor, knocked strongly, exposed to extreme voltages, temperatures or humidity outside the specified limits.

In case of functional problems

Test the sensors. The entire system shall be tested without disconnecting the power supply. Check that the LED indicators work as it is described in the section *LED indication*. Check that all safety units in the system are working properly by following the instructions in the respective manuals. If the problem cannot be resolved, please contact the nearest ABB/Jokab Safety Service Office or reseller.

5 Operation

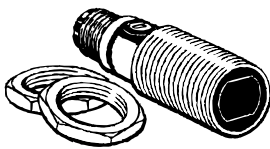
LED indication

LED	Indication	Description
LED on transmitter	Green	Power supply OK
	Green	Alignment OK, safety circuit closed
LED on receiver	Green (flash)	Alignment OK, safety circuit opened before this unit
	OFF	Beam interrupted, safety circuit open

6 Model overview

Available models

Type	Article number	Description
Spot 35 T/R	2TLA020009R0500	Transmitter and receiver. Maximum distance 35 m.
Spot 10 T/R	2TLA020009R0600	Transmitter and receiver. Maximum distance 10 m.
Spot 10 T	2TLA020009R1500	Transmitter only. Part of Spot 10 T/R. Maximum distance 10 m.
Spot 35 T	2TLA020009R1600	Transmitter only. Part of Spot 35 T/R. Maximum distance 35 m.
Spot 10 R	2TLA020009R2500	Receiver only. Part of Spot 10 T/R. Maximum distance 10 m.
Spot 35 R	2TLA020009R2600	Receiver only. Part of Spot 35 T/R. Maximum distance 35 m.



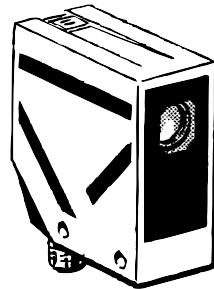
Spot 10
Maximum distance 10 m

Article number:

Spot 10 T/R: 2TLA020009R0600

Spot 10 T: 2TLA020009R1500

Spot 10 R: 2TLA020009R2500



Spot 35
Maximum distance 35 m

Article number:

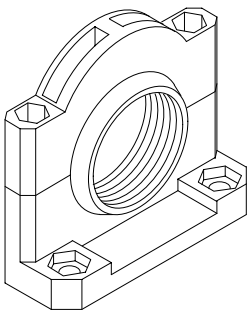
Spot 35 T/R: 2TLA020009R0500

Spot 35 T: 2TLA020009R1600

Spot 35 R: 2TLA020009R2600

Accessories

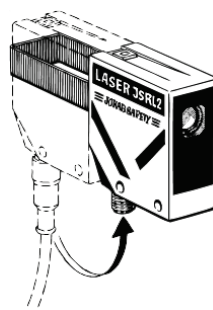
Type	Article number	Description
JSM64	2TLA040007R0200	Pivot M18 bracket for Spot 10
JSRL2	2TLA020008R0100	Laser aligner for Spot 35



JSM64
Pivot M18 bracket for Spot 10

Article number:

2TLA040007R0200



JSRL2
Laser aligner for Spot 35

Article number:

2TLA020008R0100

The Jokab Safety branded product with articlenumber beginning with 2TLJ is fully compatible with the ABB branded product with articlenumber beginning with 2TLA.

7 Technical data

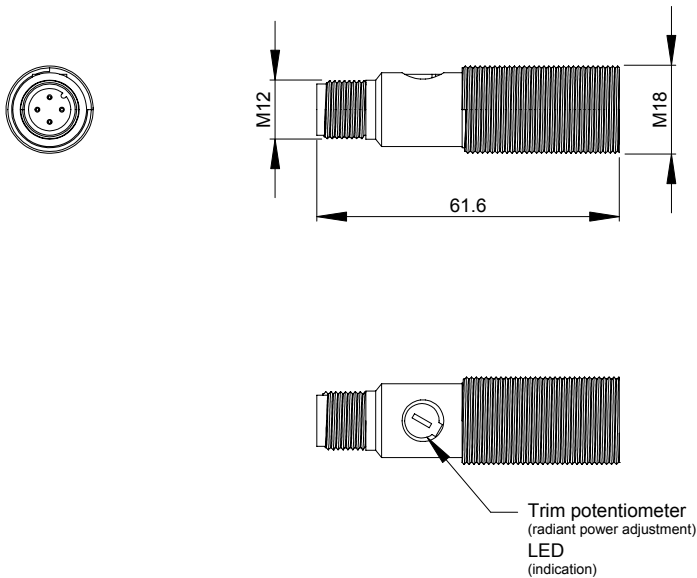
Manufacturer	
Address	ABB AB / JOKAB SAFETY Varlabergsvägen 11 SE-434 39 Kungsbacka Sweden
Power supply	
Operating voltage	17-27 VDC, ripple $\pm 10\%$ (SELV/PELV)
Current consumption	Transmitter: < 25 mA Receiver: < 15 mA
Output currents	Information output: Max. 10 mA Dynamic signal output: Max. 30 mA
Time delay t (in/out)	t < 250 μ s
General	
Protection class	IP67
Response time	Spot 10: 5 ms (+48 ms in Vital 1) Spot 35: 5 ms (+48 ms in Vital 1)
Light source	Red visible light, 660 nm. Spreading angle $< \pm 2.5^\circ$
Minimum interruption time	90 ms
Min. detectable object	50 mm
Optical power	Spot 10: < 0.1 mW Spot 35: < 0.2 mW
Range	Spot 10: 0 – 10 m Spot 35: 0 – 35 m
Radiant power adjustment	Spot 10: Trim pot. on transmitter
Responsivity adjustment	Spot 35: Trim pot. on receiver
Mounting	Spot 10: 2 x M18 nuts (provided) Spot 35: Either via mounting holes in the casing or with angle bracket JSM63 (provided)
Ambient temperature	-25...+65°C
Size	See drawing
Weight	Spot 10: 2 x 21 g Spot 35: 2x 100 g
Material	Spot 10: Steel housing with polyacryl lens protection Spot 35: Polyamide housing with polyacryl lens protection
Colour	Spot 10: Steel grey Spot 35: Yellow and black
Connector	M12 fixed connector

Safety performance / Standards

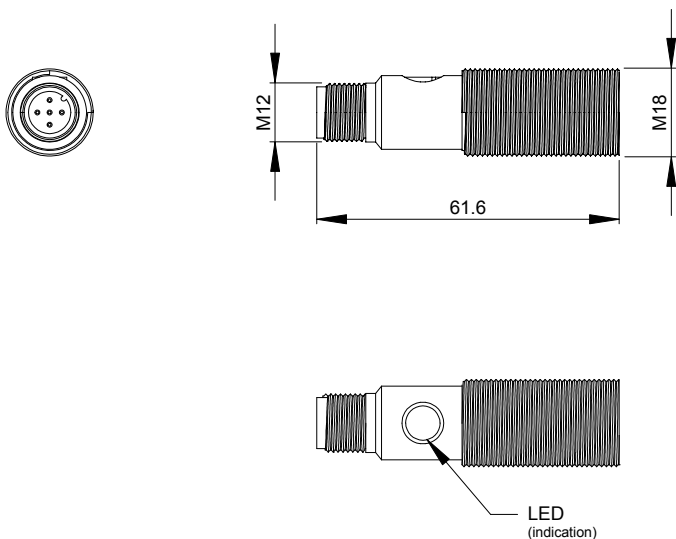
Conformity	European Machinery Directive 2006/42/EC CE EN ISO 12100:2012, EN 954-1:1996, EN ISO 13849-1:2008, EN 62061:2005, EN 61508:2010, EN 60204-1:2006+A1:2009, EN 61496-1:2004+A1:2008, EN 60664-1:2007, EN 61000-6-2:2005, EN 61000-6-4:2007 CLC/TS 61496-2:2006
EN ISO 13849-1	Performance level: PL e, Category 4 $PFH_d: 1.14 \cdot 10^{-8}$
EN 954-1	Category 4
EN 61496	Type 4 (in combination with Vital 1)
Certifications	TÜV Nord

Dimensions

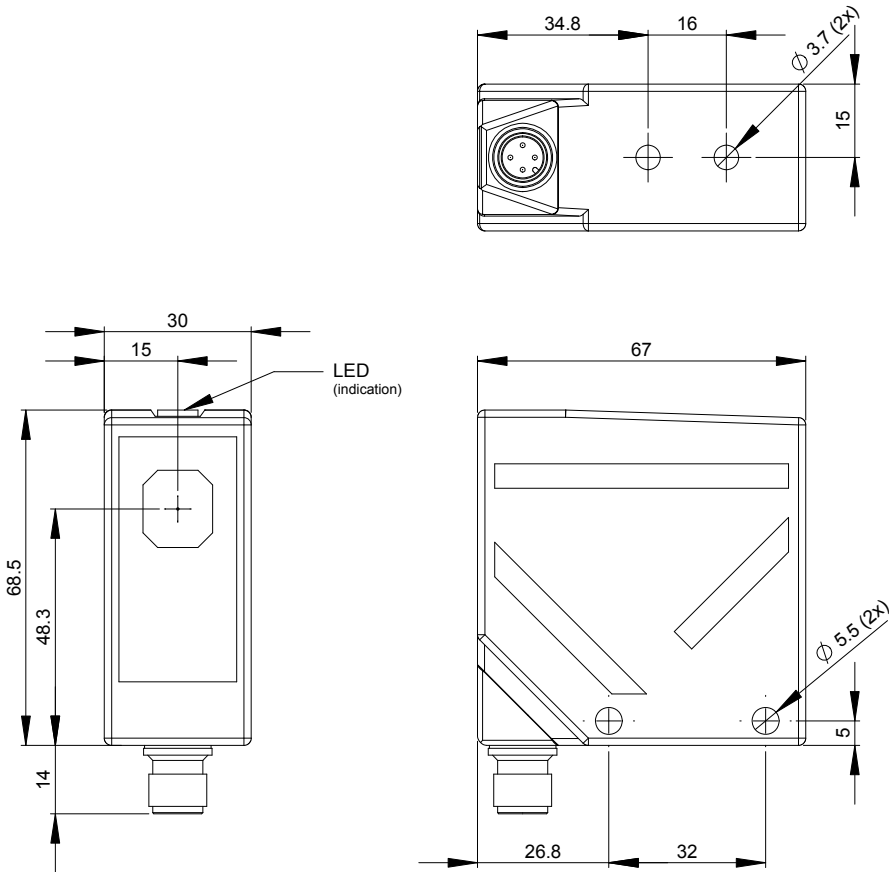
Spot 10T



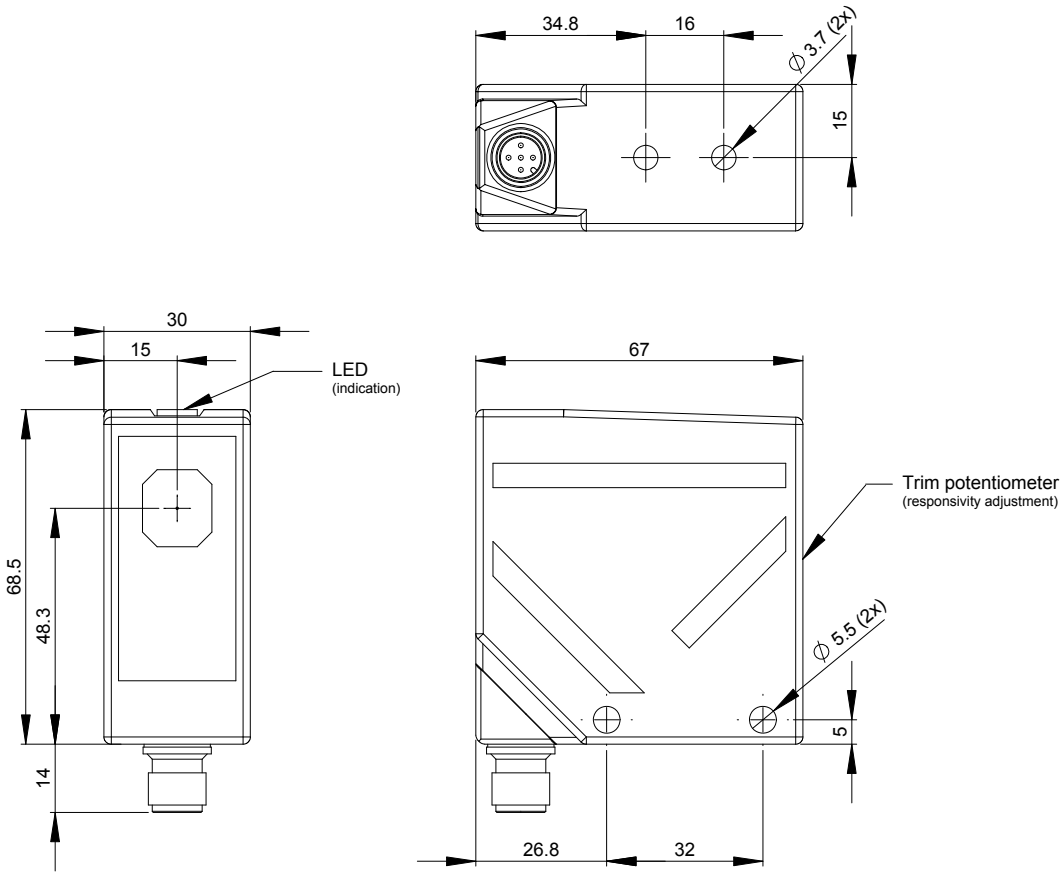
Spot 10 R



Spot 35T



Spot 35R



8 EC Declaration of conformity

EC Declaration of conformity (according to 2006/42/EC, Annex2A)		
We	ABB AB JOKAB Safety Varlabergsvägen 11 SE-434 39 Kungsbacka Sweden	declare that the safety components of ABB make with type designations and safety functions as listed below, is in conformity with the Directives 2006/42/EC 2006/95/EC 2004/108/EC
Authorised to compile the technical file	ABB AB JOKAB Safety Varlabergsvägen 11 SE-434 39 Kungsbacka Sweden	
Product	EC type-examination certificate	Serialnumber
Safety device for the detection of persons Light beam Spot 10/35 connected to Vital1	44 205 11 372092 002	[000 – 000 ... 999-999]
EC type-examination	TÜV NORD CERT GmbH Langemarckstrasse 20 45141 Essen Germany Notified body No. 0044	
Used harmonized standards	EN ISO 12100:2010, EN 954-1:1996, EN ISO 13849-1:2008, EN 62061:2005, EN 61508:2010, EN 60204-1:2006+A1:2009, EN 61496-1:2004+A1:2008, EN 60664-1:2007, EN 61000-6-2:2005, EN 61000-6-4:2007	
Other used standards	CLC/TS 61496-2:2006	
	Jesper Kristenssen PRU Manager Kungsbacka 2011-10-18	
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