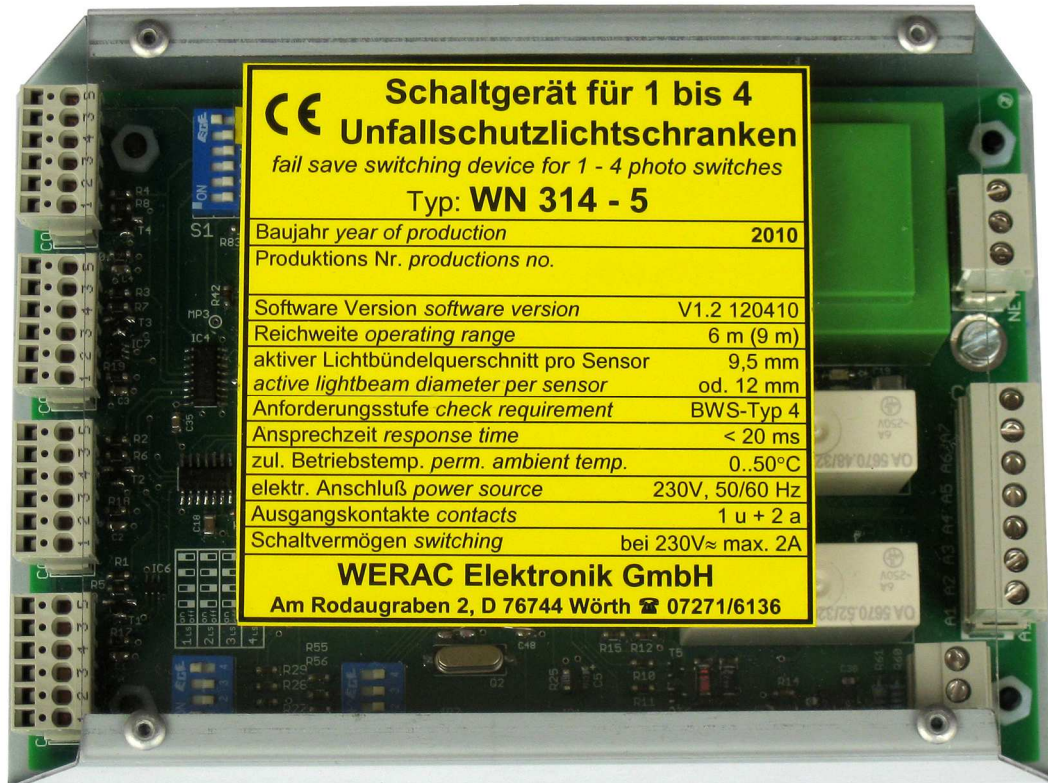


# Technical description



## Multiple safety light barrier

Switching device to wire alternatively:

### 1 - 4 safety light barriers

Type WN 304-5	Plastic housing	IP65
Type WN 314-5	Sheet-metal housing	IP20
Type WN 304-5M with start and restart lock	Plastic housing	IP65
Type WN 314-5M with start and restart lock	Sheet-metal housing	IP20

- Tested according to EN 61496-1:2009 ESPE type 4 (self monitoring) by testing and certification body "Prüf- und Zertifizierungsstelle im BG-PRÜFZERT. Fachausschuss Maschinenbau, Hebezeuge, Hütten- und Walzwerksanlagen Kenn-Nummer 0393, Graf-Recke-Straße 69, D-40239 Düsseldorf". European notified body, identification number 0393
- Performance Level PL e, Kategorie 4 acc. EN ISO 13849-1, 2008
- Fully compatible to our older models WN3xx -1 to -4
- Adaptable for one to four light barrier devices via DIP switch
- The light barrier that causes a interruption is displayed by a LED in the emitter
- Emitter and receiver available as straight and angular model
- Slender design of our emitters and receivers

## 1 General

This instruction manual is a constituent part of the safety light barrier WN 304, WN 314 and its dedicated transmitters and receivers. It must be available to all personnel concerned with assembly, commissioning, and maintenance during its entire life cycle.

If the instructions in this manual are not followed or only partly followed, accidents could occur.

Any warranty claims against WERAC Elektronik GmbH become null and void in this case.

### 1.1 Designated use:

The safety light barrier systems consist of the certificated components control unit, transmitter and receiver (see type name) and may be used only coherently.

The system is a electro-sensitive protective equipment (ESPE) of the type 4 according to IEC 61496-1 which can be used depending on the implementation for the access security of danger zones and safeguarding dangerous points on power-driven machinery in compliance with the safety engineering requirements as stated in the standard EN 999 and the standards of the corresponding machinery up to category 4 according to EN 954-1.

### 1.2 Approval

EC type-test certificate: MHHW 10033

Fachausschuss Maschinenbau, Hebezeuge, Hütten- und Walzwerksanlagen

Prüf und Zertifizierungsstelle im BG-PRÜFZERT, Kenn-Nummer 0393

[Expert Committee on Mechanical Engineering, Lifting Equipment, Iron-Making and Steel-Making.

Testing and certification body of BG-PRÜFZERT, identification number 0393]

Graf-Recke-Straße 69

D-40239 Düsseldorf

### 1.3 Manufacturer

WERAC Elektronik GmbH

Am Rodaугraben 2

D-76744 Wörth am Rhein

Telephone: 07271/6136

Telefax: 07271/8932

email: info@werac.de

### 1.4 Version no.

This manual applies for the safety light barriers of version 1.2 of 12.04.2010

### 1.5 Approval marks



QM-System  
ISO 9001



## 2 Description of function

Our safety light barriers consist of one up to four emitters, one to four receivers and the control unit WN 304 or WN 314. No external test signal is required, the system tests itself internally. The WN 304, WN 314 control unit must first of all be enabled via start enable T1, T2. The self monitoring logic starts and checks the photo switches in serial, each with emitter on and off. Provided that the light barriers are not interrupted and without internal or external errors, the output relays A and B are activated. Each of these relays delivers one normally opened contact for external use. If one relay fails, the second one remains dropped, i.e. in a safe condition. The switching status of the relays is indicated in the control unit's LED's. If a light beam is interrupted the LED in the according emitter lights up until the next start. Thereby it is easier to find the reason why the machine has stopped, especially if the failure is not static. After power-ON or a switch off by a light barrier, which also influences the following circuit, all emitter LED's stay de-energized. A differentiation of the cause of switch off between a light barrier and the safety microswitches is thereby easier to take. The current is supplied from the mains via a transformer with a PTC fuse.

A start and restart lock is in the already integrated in the control units WN 304-5M, WN 314-5M and always active. However, when the control unit types WN 304-5 and WN 314-5 are used the restart lock must be realized by a following circuit with relays or contactors as shown under point 6.

### 3 Start

When you want to start the safety light barrier you have to distinguish between the devices with integrated start and restart lock without start and restart lock.

#### Without start and restart lock (devices - types WN 304-5, WN 314-5)

To start the safety light barriers and to keep the system active, a current through the optocoupler must be provided (terminal T1 and T2).

#### With start and restart lock (devices - type WN 304-5M, WN 314-5M)

For follow-circuits without start and / or restart lock, that do not go to the OFF position after power ON, the M version WN 304-5M, WN 314-5M (start lock) can be used, which takes over the start and restart lock.

A low high signal at the start enable input is necessary to start the light barrier device, for example after a light barrier was interrupted (restart lock), the current must flow through T1, T2 constantly as long as the light barrier should be active.

### 4 Optical adjustment and setting the number of sensor pairs

The number of light barrier devices (1 to 4) is set with the DIP-switches S2 in accordance with the following table 1.

This is a safety setting (parameters) that depends on the requirements described in Chapter 8, that means the requirements of section 8 must be complied with.

	DIP switch 2			
	1	2	3	4
1 LB	off	off	on	on
2 LB	on	off	off	on
3 LB	off	on	on	off
4 LB	on	on	off	off

Table 1

Before putting the system into operation, all light barrier devices must be adjusted. To adjust the light barriers set DIP-switch S1/A and S1/1-4 (corresponding to the number of the light barrier) in ON position. The LED in the selected emitter lights up. As soon as emitter and receiver are adjusted correctly, the yellow LED in the receiver lights up. When the optimal position of emitter and receiver in both axis is found, the adjustment procedure can be finished by setting all DIP switches S1 (except of S1/B) to position OFF. Error flashing on the control unit does not influence the adjustment during the adjustment mode. After the successful adjustment of the sensors, the control unit must be switched off and on again, then the device is ready.

To check the adjustment reserve it is possible to reduce the emitting power by a factor of 30 %. For that set DIP switch S1/B in OFF position. If a light barrier does not work it is necessary to readjust the concerned line.

This test should be done during the yearly maintenance routine. It is possible to do the test with running machine.

Attention: In normal operation the DIP switches S1/A an S1/1 to 4 are in OFF position, S1/B in ON position.

Since our emitters work with infrared light, the light beams are invisible for the human eye. For a more comfortable adjustment procedure we recommend our measure-receiver and our optic gray filters.

Note: If the number of light barrier devices and the position of the DIP switch (S2) do not correspond, the output relays will stay de-energized.

#### 4.1 Technical data for control unit WN 304-5

Standard to IEC EN 61496-1	Type 4
Performance Level	PL e, Categorie 4 (EN ISO 13849-1, 2008)
Probability of a dangerous failure per hour	$PFH_D = 4.93 \text{ E-}08 \text{ 1/h}$
Mission time TM	20 years
Response time	<20 ms
Permissible operating temperature	0 ... +50°C
Stock temperature	-25°C ... +70°C
Supply voltage	230V $\pm$ 10% 48 – 62 Hz
Deviating line voltage	24 V $\pm$ 10% 48 – 62 Hz
Power consumption	ca. 8 VA
Output contacts:	
max. switching voltage	250 V~
max. switching current at 230 V~ (ind. load)	2 A
max. switching frequency	2 /s
min. operating cycles	10 <sup>7</sup> with contactor for 5.5 kW 3-phase motor
Switch-on delay after power supply ON	~ 4 s
Switch-on delay after test ON	$\leq$ 70 ms
Housing	ABS, gray
Enclosure rating	IP 65
Electrical connection	Terminal plug, up to 2.5 mm <sup>2</sup> spring-type terminal (emitter and receiver)
Status display	red, yellow, green
Start enable T1, T2	external voltage 10-50 V $\cong$

Table 2

#### External connections control unit WN 304, WN314 (see fig. 1)

connection A1 – A2 (normally open contact/ NOC)	safety output relay A - OSSD 1
connection A5 – A6 (NOC )	safety output relay B - OSSD 2
connection A3-A4 (normally closed contact/ NCC)	e.g., message to PLC, rest NCC query, display red
connection A4-A7 (NOC)	e.g., message to PLC, display green
connection T1, T2	start enable of the sequential switching
connection PE, 0V, 24V or PE, N, L1	electricity supply with 24 V AC or 230 V AC

Table 3

The relay outputs are line voltage isolated from the light barriers; to IEC60664 -1 overvoltage category III

The control unit starts automatically, when a current flows through T1, T2.

For a sequential switching without restart lock the control unit version M is available. These control units start only after detecting a low-high slope of the current through T1, T2.

The system is compatible to all emitters WS 50 – WS 531 (standard and small versions) and all receivers WE 50 – WE 531 (standard and small versions).

#### 4.2 Technical data for control unit WN 314-5

Similar to control unit WN 304, but with sheet-metal housing that can be snapped on to the TS 35 rail for mounting inside control cabinets. Enclosure rating IP 20. The control cabinet has to come up to soiling category 2 according to DIN VDE 0110.

#### 4.3 Technical data for emitters with front or angular optics



WS52 standard angular optics



WS 51C small front optics with plug

	<b>WS 5xx</b>
Standard to IEC EN 61496-1	type 4
Infrared impulse light (950 nm) focused to	± 2°
Permissible operating temperature	0...+50 °C
Stock temperature	-25...+70 °C
Display	yellow LED in all emitters
Housing	ABS, yellow, enclosure rating IP 65
Width of guarded area	see table 5
Electrical connection	3 m cable (max. 25 m) 2 x 0.25 mm <sup>2</sup> with wire terminal lug
Optional	plug M12 x 1 instead of cable output. Type no. With additional C (e.g. WS 53C)
Standard	ESPE type 4 EN 61496-1: 2009
Permissible operating temperature	0...50°C

Table 4

type	optics	housing	range	active light beam Ø d	extended range
WS 50	front	standard	6 m	12 mm	-
WS 501	front	standard	9 m	12 mm	X
WS 52	angular	standard	6 m	12 mm	-
WS 521	angular	standard	9 m	12 mm	X
WS 51	front	small	6 m	9.5 mm	-
WS 511	front	small	8 m	9.5 mm	X
WS 53	angular	small	6 m	9.5 mm	-
WS 531	angular	small	8 m	9.5 mm	X

Table 5

Emitters with extended range must be operated exclusively with the according extended range receivers.

Our small housing emitters (light beam diameter 9.5 mm) must be used exclusively with our small housing receivers. Emitters with standard housing (light beam diameter 12 mm) must be operated with standard housing receivers.

#### 4.4 Technical data for receivers with front or angular optics

type	housing	optics	extended range	active light beam Ø d
WE 50	standard	front	-	12 mm
WE 501	standard	front	X	12 mm
WE 52	standard	angular	-	12 mm
WE 521	standard	angular	X	12 mm
WE 51	small	front	-	9.5 mm
WE 511	small	front	X	9.5 mm
WE 53	small	angular	-	9.5 mm
WE 531	small	angular	X	9.5 mm

Note:

The receivers with an additional index "1" (e.g. WE 501) have a improved match of optical and mechanical axis.  
Receivers with extended range must be operated exclusively with the according extended range emitters.

Table 6

Receivers with standard housing (light beam diameter 12 mm) must be operated exclusively with the according standard housing emitters. Our small housing receivers (light beam diameter 9.5 mm) must be used exclusively with our small housing emitters.

The receivers of the types WE 5x are fully compatible to our older types WE 4x.



WE 53 small angular optics



WE 50 standard front optics



	<b>WE 5xx</b>
Standard to IEC EN 61496-1	Type 4
Sensor	phototransistor, ± 2°, preamplifier, switching amplifier
Permissible operating temperature	0...+50 °C
Stock temperature	-25...+70 °C
Display	yellow LED in all receivers
Housing	ABS, yellow, enclosure rating IP 65
Width of guarded area	see table 5
Electrical connection	3 m cable (max. 25 m) 2 x 0.25 mm <sup>2</sup> with wire terminal lug
optional	plug M12 x 1 instead of cable output. Type no. With additional C (e.g. WE 51C)
Emitter impulse keying	To increase immunity to interference against incidence of extraneous light pulses
Standard	ESPE type 4 EN 61496-1: 2009
Permissible operating temperature	0...50°C

Table 7

### 5 Wiring diagram

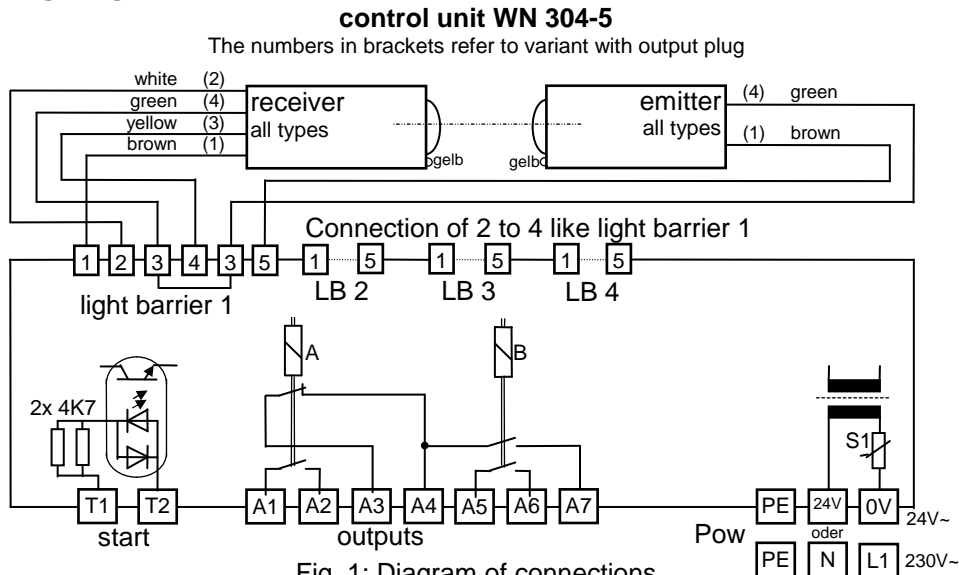


Fig. 1: Diagram of connections

If any light barrier connections are not in use the plugs with the highest numbers have to stay vacant. The sequential switching must provide the restart lock and the start enable (T1, T2). The sequential switching schematic should be specified in coordination with us. The plug connectors may only be manipulated when they are off-circuit.

### 6 Proposed wiring diagrams for the sequential switching

The contactors or relays actuated by the control unit must have positively driven contacts and be suitable for industrial use.



**IMPORTANT:** When using plug-in auxiliary contacts, the positively driven operation must also be available between the main contact set. It must also be checked whether disconnection of the auxiliary block is detected by the controller. No further work on the machine may be possible in such cases.

The spark suppression must always be connected via the contactor coil (by means of an RC element or varistor).

### 6.1 Proposed wiring diagram for control unit WN 304, WN 314 to EN 954-1 category 4 on power driven machinery (PDM) with start-up test and restart lock

The control line for contactor A (terminals A1, A2), contactor B (terminals A5, A6) and the start enable (T1, T2) must be laid in separate cables if the control unit and the contactors are spatially separated. If both are located in the control cabinet, standard wiring is adequate. The user has to provide a max. 2 A fuse for current-limiting measures to protect the output signal switching devices (OSSD).

We will be pleased to supply you with other proposed wiring diagrams on inquiry.

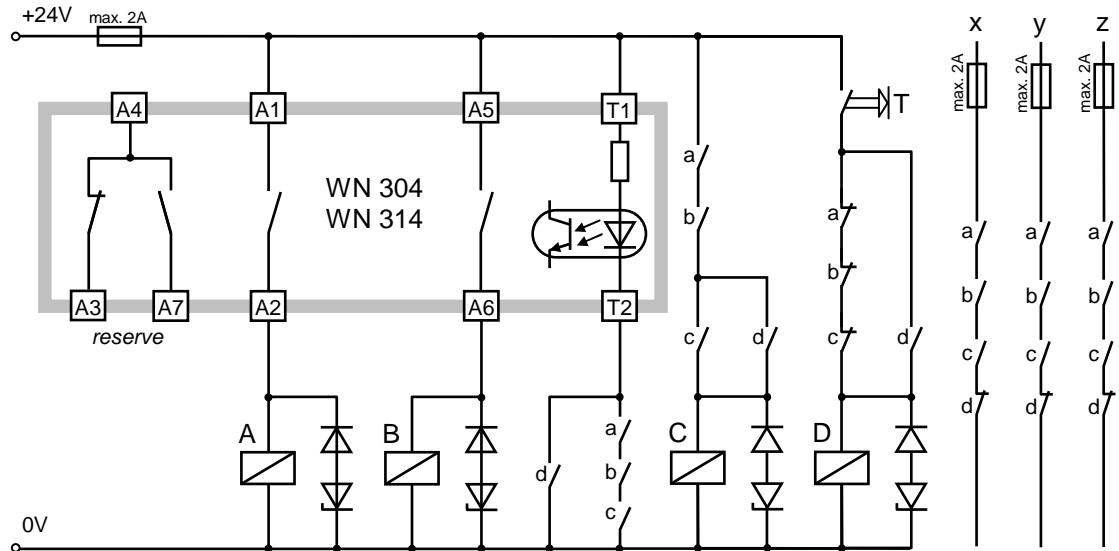


Fig. 2: Proposed wiring diagrams for the sequential switching

A, B, C and D = contactors or relays with positively driven contacts.

T = operating device (pushbutton) which has to be pressed for start-up (release of the starting and the restart lockout). The identifying marking of the pushbutton must be located near this component.

It must be impossible to press the pushbutton T from inside the danger area.

x, y = Two-channel implementation in the controller of the PDM for interruption of the movement. Note: category 4 to EN 954-1.

z = Variant with only single-channel control of the PDM. Important: At maximum safety category 2 of EN 954-1 is complied with in this case.

Note: The declaration of the safety category according to EN 954-1 is only valid for the entirety of the shown elements. If additional contacts are needed, they must be implemented according to the required safety category.

## 7 Applications and assembly instructions

The safety light barriers (ESPE = Electro-Sensitive Protective Equipment) are used for the **access protection of danger zones** and **safeguarding hazardous points** on power-driven machinery in compliance with the safety engineering requirements as stated in this description, the standard EN 999 and the type C standards of the corresponding machinery.

When the type C standards contain details for the use of safety light barriers, they should be followed in favor.

Operation e.g. in the following areas of operation is possible:

- Operating machines for the chemicals, rubber and plastics industries as defined by VBG 22
- Printing and paper converting machinery as defined by prEN 1010
- Conveying equipment
- Power driven windows, doors and gates as defined by ZH 1/494
- Storage facilities and equipment as defined by BGR 234 and EN 15095
- Food processing machines as defined by prEN 1672-1 and/or VBG 77
- Robots
- Textile machines as defined by VBG and DIN EN ISO 11 111
- Packaging machines as defined by as defined by DIN EN 415-1 to -7 and/or VBG 76

The above individual applications were not an object of the EC type-test.

**7.1 General**

The operating device for start-up (pushbutton T) must be installed in such a way that a good overview of the danger area is provided from its operating position. Actuation of the operating device from inside the danger area must be excluded.

The ESPE must be installed in such a way that the dangerous points can only be reached through the guarded area.

**7.2 Access security of danger zones**

Two to four single beams are required for the access security of danger zones depending on the risk evaluation. The beams are only considered to this extent that they are arranged parallel to the floor, and that the beam is interrupted by the body of a person standing upright (not the intrusion of hands).

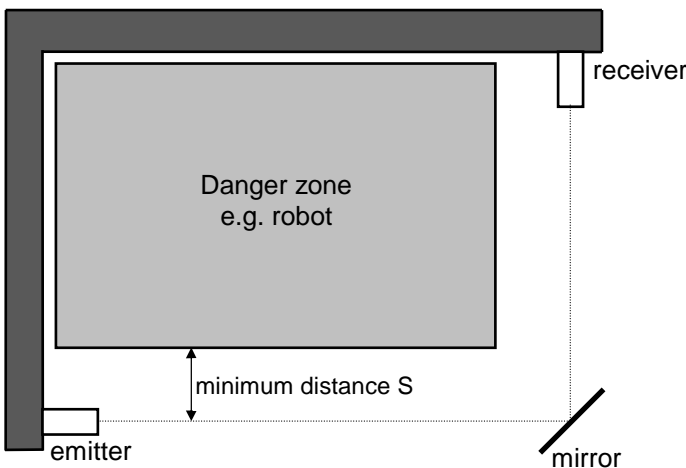


Fig. 3

To secure the access of hazardous areas with 2 to 4 single light beams can not surely catch the intrusion of a body or a part of a body.

**Note:** All possibilities of access into the danger zone should be considered in the risk evaluation.

The risk assessment consideration must also include methods that may be used to bypass the light barriers e.g.:

- Crawling under the lowest beam (300 mm ground clearance is regarded as secure)
- Reaching over the topmost beam
- Reaching between two beams
- Climbing between two beams

Note: All foreseeable methods of access should be considered in the risk assessment into account.

The height of the single beams from a fitting with 2, 3 and four beams can be calculated with the accompanying table:

no. of beams	2	3	4
height form the bottom (mm)	400	300	300
	900	700	600
		1100	900
			1200

Table 8 accords to EN 999 section 6.1.4

The minimum distance between the safety area and hazardous area can not be reached until the hazardous process has finished.



The application is permissible when the risk evaluation displays that a detection of an introducing hand has not, but the body of a person standing upright has to be detected.

If the result of the risk evaluation is such that protective devices have to be used with several single beams, they must be positioned at a distance obtained using the formula below:

$$S = K \cdot T + C$$

$S$  = Safety distance [mm]  
 $K$  = 1.6 m/s hand-arm speed  
 $T$  = Stop time [ms]  
 $C$  = 850 mm

**Example:** Access to a robot is protected by 3 light beams at 300, 700 and 1100mm. The braking time of the robot is 100ms, the response time of the ESPE is 20ms

$$S = K \cdot T + C = 1.6 \text{ m/s} \cdot (100 \text{ ms} + 20 \text{ ms}) + 850 \text{ mm}$$

$$S = 192 \text{ mm} + 850 \text{ mm} = 1042 \text{ mm}$$

The ESPE must be fixed in that way, that the hazardous area can only be reached through the safety area.

Only one safety area can be established with the one to four single sensors. A safeguarding of several entrances to hazardous areas at power-driven machinery e.g. by splitting the sensors in several groups is not allowed.

The standard EN 999 has complex specifications for the safety distance. As far as there are type C standards for the machine, these specifications must be implemented.

### 7.3 Safeguarding hazardous points by means of a light grid made of single light beams

#### Resolution

For a light grid assembly the distance between the light beams  $P$  and the active light beam diameter  $d$  (9.5 mm for light barriers in our small housing, 12 mm for our standard type) must be added, to guarantee a safe function. The resolution  $R$  for the lightgrid arises from the formula:  $R = P + d$ .

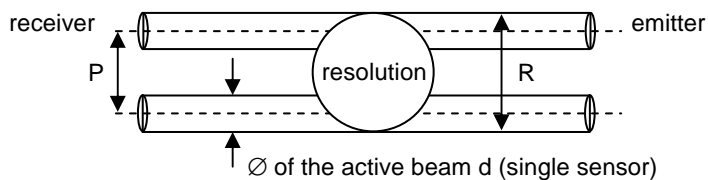


Fig. 4

Example: 30 mm between the light beams lead to a EPSE resolution:  $R = 30 \text{ mm} + 9,5 \text{ mm} = 39,5 \text{ mm}$

#### Height of guarded area:

The height of guarded area (HGA) is calculated as illustrated here.

The HGA is bigger than the scanned area A. It is calculated with:

$$HGA = (N+1) \times (R-d) + d$$

Example:

A light grid with  $N = 4$  lines in standard housing light barriers ( $d = 12 \text{ mm}$ ) and a resolution of  $R = 40 \text{ mm}$ :

$$HGA = (4+1) \times (40 \text{ mm} - 12 \text{ mm}) + 12 \text{ mm}$$

$$HGA = 5 \times 28 \text{ mm} + 12 \text{ mm} = 152 \text{ mm}$$

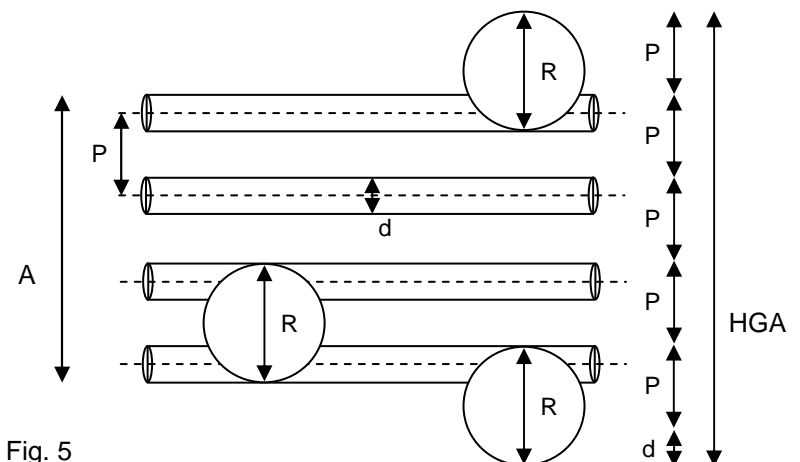


Fig. 5

Further example:

A light grid with 3 small light barriers and a resolution  $R = 30$  mm has a height of guarded area of 91,5 mm. A light grid with 3 standard light barriers and a resolution  $R = 40$  mm has a height of guarded area of 124 mm. Wider heights of guarded area with single sensors are only possible with bigger resolution. Correspondingly the addition  $C$  to the safety distance increases and the use is limited to arm and body protection.

For arm protection the max. height of guarded area at the use of 8 light beams is 554 mm or 534 mm for a resolution of  $\leq 70$  mm. On this occasion the addition  $C$  to the safety distance is always 850 mm.

**A possible introduction into the hazardous area from outside the safety area must be prevented in every individual case by additional measures (e.g. with covers).**

The mounting of the emitters and receivers, according to the calculated resolution and the calculated safety distance must be unchangeable.

Required resolution for hand protection:  $\leq 30$  mm.

Required resolution for arm protection:  $\leq 70$  mm.

A test rod with the diameter of the grid resolution should be introduced in the guarded area of the running machine, to test the mode of operation of the shutdown of the machine or installation. Accordant test rods can be ordered from us.

### Safety distance

An adequate safety distance between the guarded area and the hazardous points must be provided, so that if the guarded area is entered, the dangerous movement is interrupted before the dangerous points can be reached

Extensive information concerning the safety distance is provided in the standard EN 999. If type C standards are already in existence for the machinery, the specifications of these standards must be used.

The subsequent shown formulas and demands are part of the standard EN 999, chapter 6.1.1

In general, the following applies for a normal approach to the guarded area:

$$S = K \cdot T + C$$

$S$  = Safety distance [mm]

$K$  = 2 m/s hand-arm speed

$T$  = Stop time of machine and ESPE [ms]

$C$  = Allowance depending on the resolution

The following applies for a resolution up to  $\leq 40$  mm:

$$C = 8 \cdot (R - 14 \text{ mm})$$

$R$  = Resolution of the ESPE in mm (as a grid system)

$C$  may be not less than 0

The calculation applies for all safety distances up to 500 mm. **If  $S$  is  $< 100$  mm, the minimum value  $S = 100$  mm must still be complied with.** If  $S$  is  $> 500$  mm,  $K = 1.6$  m/s may be used. In this case,  $S$  may not be less than 500 mm.

In general, the following applies from a resolution of  $> 40$  mm:

$$C = 850 \text{ mm and } K = 1.6 \text{ m/s}$$

If children are present (non industrial area), the safety distance  $S$  must be increased by **at least 75 mm**.

Example: A machine with a braking time of 100 ms is equipped with a light grid (ESPE) built with four light barriers in vertical order. The resolution of the light grid is 30 mm and the response time of 20 ms (WN 304 or WN314). The maximum guarded area is 112 mm.

$$C = 8 \cdot (30 - 14 \text{ mm}) = 128 \text{ mm}$$

$$S = 2 \text{ m/s} \cdot (100 \text{ ms} + 20 \text{ ms}) + 128 \text{ mm} = 240 \text{ mm} + 128 \text{ mm} = 368 \text{ mm}$$

If a resolution of 40 mm is used in an otherwise identical machine, a safety distance  $S = 2$  m/s (100 ms + 20 ms) + 208 mm = 448 mm results.

The operating device (pushbutton T) which has to be pressed for start-up must be placed at a position with a good view over the hazardous area. Actuation of the operating device from inside the danger area must be excluded. It must be impossible to press the pushbutton T from inside the danger area. If the ESPE is used as finger, hand or arm protection, it must be mounted in such a way that the guarded area cannot be reached over, reached under, reached around or stepped behind. If this requirement cannot be met solely by the ESPE, additional protective devices such as fixed covers must be provided.

#### Information in the operating manual of the machine

- Maximum after-running time of the machine
- Safety distance S
- Guarded area dimensions (height x max. width of guarded area of the light barriers)
- Test rod diameter
- Reaction time T (stop time of machine and ESPE)

#### Information on the machine:

A good readable and durable label with the following minimum information should be placed at the location of the emitters/ receivers.

- Manufacturer and type of the ESPE, serial number and year of construction
- Resolution in mm
- Response time of the ESPE in ms
- Height of guarded area in mm (or visualization of the guarded area)

#### 7.4 Further applications

In some product-specific standards (type C standards) safety light barriers are recommended to secure hazardous areas. The mounting recommendations given there should be followed.

#### 7.5 Deflector mirror

Special problems can be considered with a reduced width of guarded area by means of 1 or max. 2 deflector mirrors.

#### 7.6 Optical bypassing:

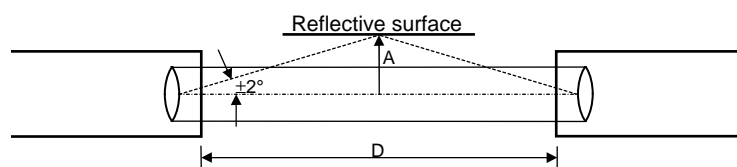
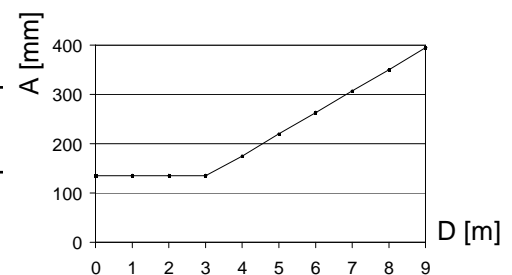


Fig. 6



To prevent optical bypassing, a minimum distance A of the optical axis to reflective surfaces must be complied with. Read off the value in the diagram (Fig. 6) for your distance D between the emitter and receiver to determine the minimum distance A.

#### 7.7 Mounting instruction

The light barriers can be installed in any possible mounting position. For an easy installation of the emitters and receivers, use our mounting bracket W 115. The distance between each single line can be chosen arbitrarily, because the sensors do not influence each other.

The device has to be installed in a cabinet / control box and protected that only authorized persons have access to the safety relevant mode switch (DIP switch).

## 7.8 LED statuses

LED statuses			Meaning	OSSD
red	yell	grn		
⊗	⊗	○	Power ON, Initializing	OFF
⊗	○	○	Normal mode, light barriers interrupted	OFF
⊗	⊗	○	Light barriers ready for activation (external restart lock enabled)	OFF
○	○	⊗	Normal mode, light barriers active and free	ON
⏏	○	○	Error in system – Power OFF required	OFF

Table 9 ⊗ on, ○ off, ⊗ blinking, ⏏ error blinking

## 8 Commissioning and regular inspections

The commissioning engineer must have all the requisite information on the machine and the mounted ESPE (here the safety light barriers including the control unit WN 304 or WN 314) available. The inspection must extend to the perfect interaction of the ESPE with the controller of the powerdriven machinery and the setup in compliance with these safety regulations. An inspection must be carried out by a qualified person before the initial start-up of ESPE (The manufacturer of the press is also to be included for presses).

### Differences between commissioning and regular inspections:

#### a) Inspection before the commissioning or after retooling or repair

Before the initial start-up of the ESPE and after modifications of the ESPE or safety relevant components, an inspection must be carried out by a authorized, qualified person.

These modifications are all changes to the switching, the control unit, the configuration, the parameterization and the programming of the ESPE and all components that are involved to the safety function of the ESPE.

These inspections should secure that the requirements of a power-driven machinery using a ESPE are conformed. A faultless work with the components that participate the safety functions in coaction with the ESPE must be met.

Furthermore the type of operation and the mounting of the ESPE must be inspected.

The manufacturer of the press is also to be included for presses.

#### b) Regular inspections

Regular inspections conduce to a systematic revealing and retraction of defects regarding technical safety (e.g. technical changes or manipulations) of the safety devices of the machines after the start-up.

According to §3 section 3 of the “Ordinance on industrial safety and health” type, scope and time intervals of the necessary inspections shall be determined by the user with respect to work equipment. Besides, the employer shall determine and define the requirements to be satisfied by persons he shall designate to carry out the inspections and inspections for work equipment.

According to the technical rules for industrial safety and health (TRBS 1201) for presses a time interval as appropriate but of minimum one inspection per year has proved. Part of this inspection is, a security check of the faultless function of the ESPE, the condition of the devices, the adequate mounting of the ESPE and the coaction of ESPE with the press control unit

Furthermore this also includes a check as to whether the after-running of the machine is in the permissible range.

For all inspections the official process specifications, type C standards or rules and information of the responsible inspection authority for the respective machine/ equipment shall be considered.

The inspection results must be documented in a report, which must be signed by the inspector. The report must be kept at the site of installation of the power-driven machinery.

### 9 Dimensional drawings

Fig. 7: emitter WS 50, WS 52, WS 501, WS 521 and receiver WE 50 und WE 52

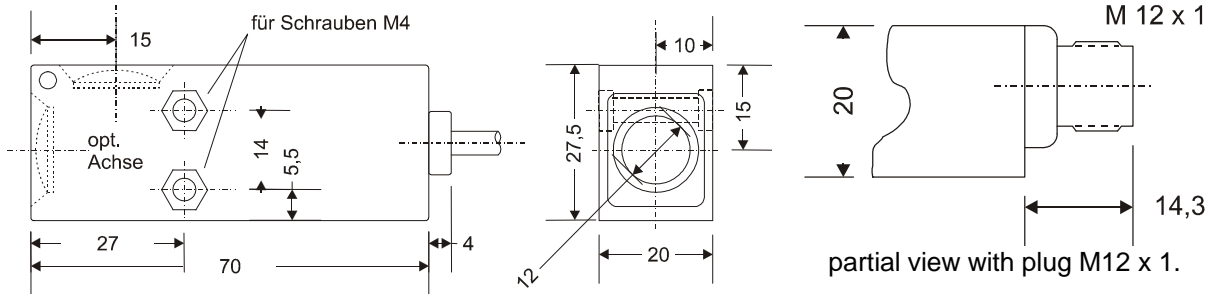


Fig. 8: emitter WS 51, WS 53, WS 511, WS 531 and receiver WE 51 and WE 53

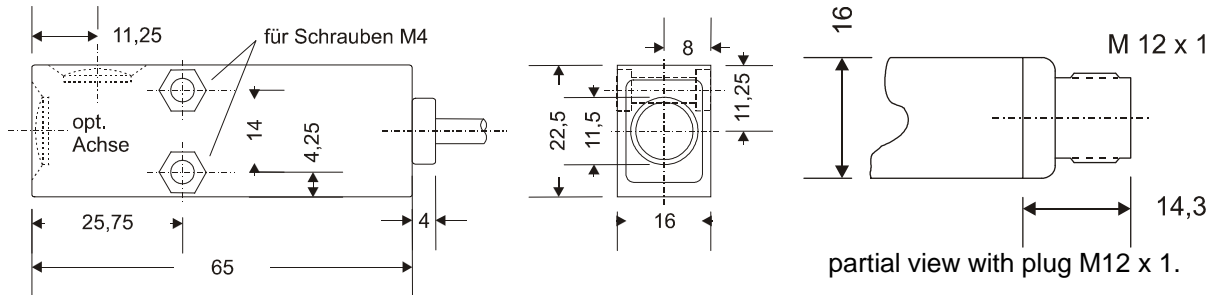


Fig. 9: control unit WN 314-5

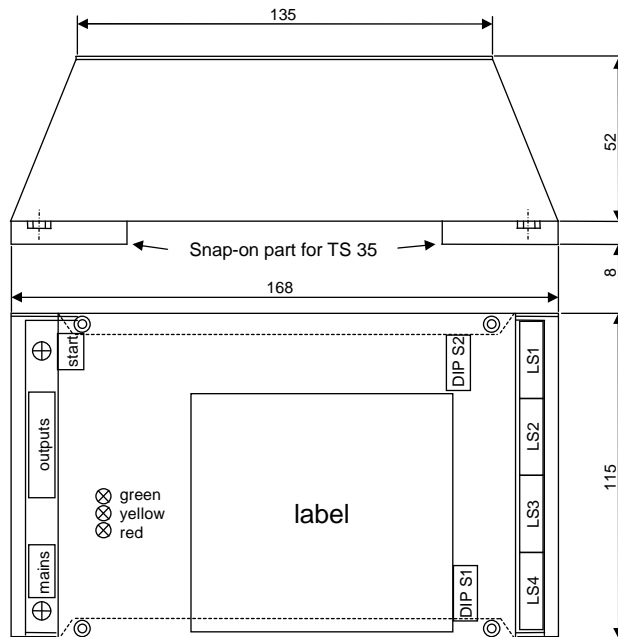
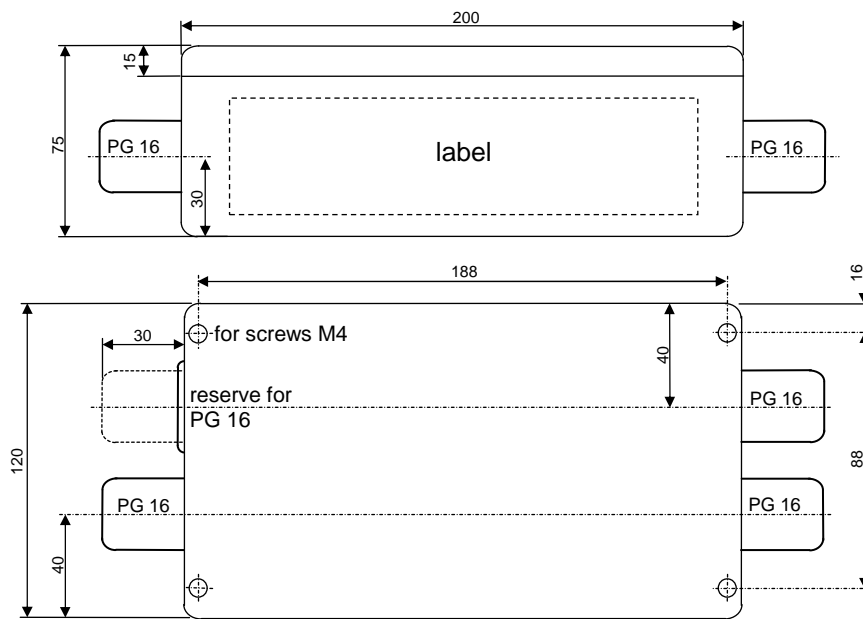


Fig. 10: control unit WN 304-5



The right PG 16 screw joints (at the light barrier side) have a inside sealing with four traverses with 4.5 mm  $\varnothing$ . The left PG 16 screw joint has three traverses for power supply, output and test input with 6 mm  $\varnothing$ .