English

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1. GENERAL INFORMATION

1.1. General description of the AREAscan™ light grid

The **AREA*scan*™** light grids are optoelectronic multibeam devices that can be used to detect transparent and small objects and for dimensional measurement. The variety of possibile uses make BLG-DS3 a particularly flexible device that can be applied to many different applications.

The **AREA*scan*™** light grids of the DS3 series are manufactured in accordance with the international standards in force and in particular:

CEI EN 60947-5-2: low voltage proximity switch

CEI EN 50319: analog output on proximity switch

The device, consisting of emitter and receiver unit housed inside strong aluminium profiles, generates infrared beams that detect any object positioned within the light grids detection field.
The command and control functions are inside the two units; the connections are made an M12 connector located in the lower side of the profile.
The synchronisation between the emitter and the receiver takes place through direct connection (via cable) between the two units.
The control and management of the emitted and received beams are guaranteed by a microprocessor that, using LEDs, supplies to the operator information relative to the light grid status and error conditions.

Some parts or paragraphs of this manual containing important information for the operator are preceded by a note:

☞ Notes and detailed descriptions about particular characteristics of the **AREA*scan*™** devices in order to better explain their functioning.

DATASENSOR technical assistance is available for questions related to the functioning and installation of the DS3 series light grids (see section *9 "Checks and periodical maintenance"*).

English

1.2. Selecting the device

Choosing the correct version of the device may be based on the following:

- detection area needed. This is the height of the device's sensitive zone
- maximum operating distance. This is the distance between the emitter unit (TX) and receiver unit (RX)

Four versions are available:

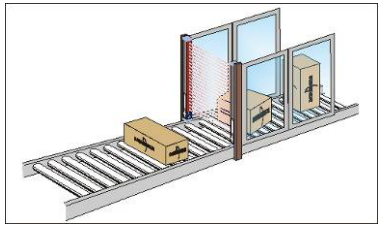
	Operating distance	Detection field
DS3-SD-015	0.2 … 0.6 m	24 beams; h=150 mm
DS3-SD-030	0.2 … 0.6 m	48 beams; h=300 mm
DS3-LD-015	0.6 … 1.5 m	24 beams; h=150 mm
DS3-LD-030	0.6 … 1.5 m	48 beams; h=300 mm
DS3-SD-045	0.2 … 0.6m	72 beams; h=450mm
DS3-SD-060	0.2 … 0.6m	96 beams; h=600mm
DS3-LD-045	0.6 … 1.5m	72 beams; h=450mm
DS3-LD-060	0.6 … 1.5m	96 beams; h=600mm

☞ The functions that characterise the DS3 **AREA*scan*™** light grids are available on all 4 versions that consequently have the same operating modes.
The specific technical characteristics (e.g. resolution, sensitivity etc) remain the same for all the versions, until differently indicated.

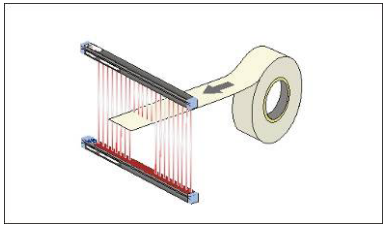
☞ For food industry applications, please verify with DATASENSOR Technical Service the compatibility of the materials of the light grid shell with the eventual chemical agents that are used in the production process.

1.3. Typical applications

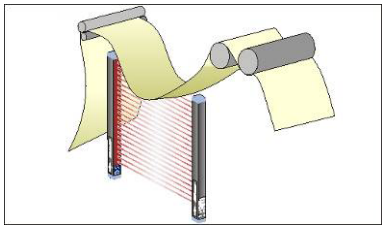
The following images supply an overview on some of the main applications.



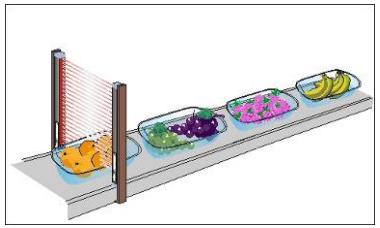
Object detection and measurement on conveyor belt



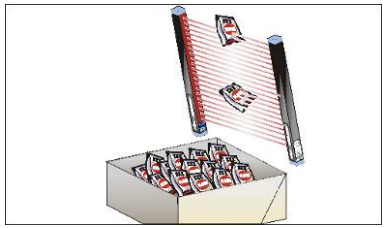
Control of the correct material positioning (opaque and transparent) during functioning (plastic, metal, paper etc)



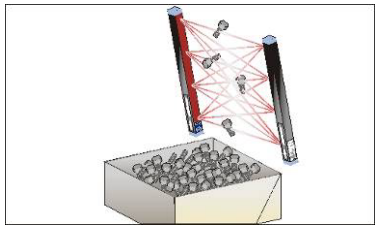
Loop control and positioning (also transparent material)



Detection of objects with different shapes in the food industry



Detection of objects in different positions (parallel beams)



Detection of small objects in different positions (crossed beams)

2 INSTALLATION MODE

2.1. Precautions to be observed for the choice and installation of the device

- The dimension of the smallest object to be detected should not to be lower than the resolution level of the device.
- The DS3 should be installed in a place compatible with the technical characteristics (see section *10 "Technical Data"*) of the **AREA*scan*™** light grids.

Other considerations:

- avoid installation near very intense and/or flashing light sources, in particular near the receiver unit.

- strong electromagnetic interferences can compromise the correct functioning of the device. Please contact DATASENSOR Technical Service when this problem occurs.

- the operating distance of the device can be reduced in the presence of smog, fog or airborne dust.

- a sudden change in environment temperature, with very low minimum peaks, can generate a small condensation layer on the lenses and jeopardise functioning.

English

2.2. General information on the device positioning

- Place the device near the detection area.
- Align the receiver (RX) and emitter (TX) units parallel to one another.
- Fix the receiver and emitter units on rigid supports not affected by strong vibrations using the specific brackets (see section *3 "Mechanical mounting"*).
- Check that the distance between the receiver and emitter units is within the device operating distance (see section *10 "Technical data"*).

2.2.1. Minimum installation distance

The minimum installation distance corresponds to the minimum operating distance (= 20 cm for short distance versions; = 60 cm for long distance versions).
It is recommended that the distance be slightly increased to avoid problems caused from an imperfect alignment of the two units.

English

2.2.2. *Minimum distance from reflecting surfaces*

Reflecting surfaces placed near the light beams of the **AREA*scan*™** device (over, under or laterally) may cause passive reflections; these reflections could compromise the recognition of an object inside the controlled area (see Fig.1).

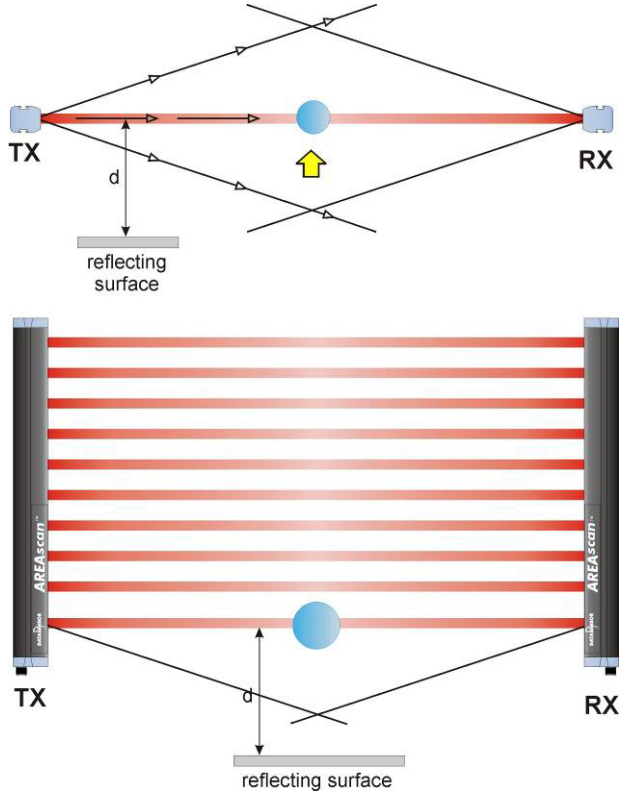


Fig. 1

However, if the receiver detects a secondary beam (reflected by the side-reflecting surface) the object cannot be detected, even if the main beam is interrupted by the entering object.

It is thus important to position the light grid according to the minimum distance from any reflecting surface.

The minimum distance depends on:
- Device operating distance
- Reflecting surface nature
- Position of the object inside the sensitive area

The minimum distance of the reflecting object has to be:
DS3-SD d > 7 cm

DS3-LD d > 12 cm
If the distance between the receiver and emitter is between 60 and 90 cm
DS3-LD d > 25 cm
If the distance between the receiver and emitter is between 90 and 150 cm

Note: These values are basèed on a mirrored surface sample with an 80% reflecting index.

English

2.2.3. *Installation of several adjacent light grids*

When several devices must be installed in adjacent areas, care must be taken to prevent interference between the emitter of one device and the receiver of another.

Fig.2 gives an example of possible interferences between different devices and two pertinent solutions.

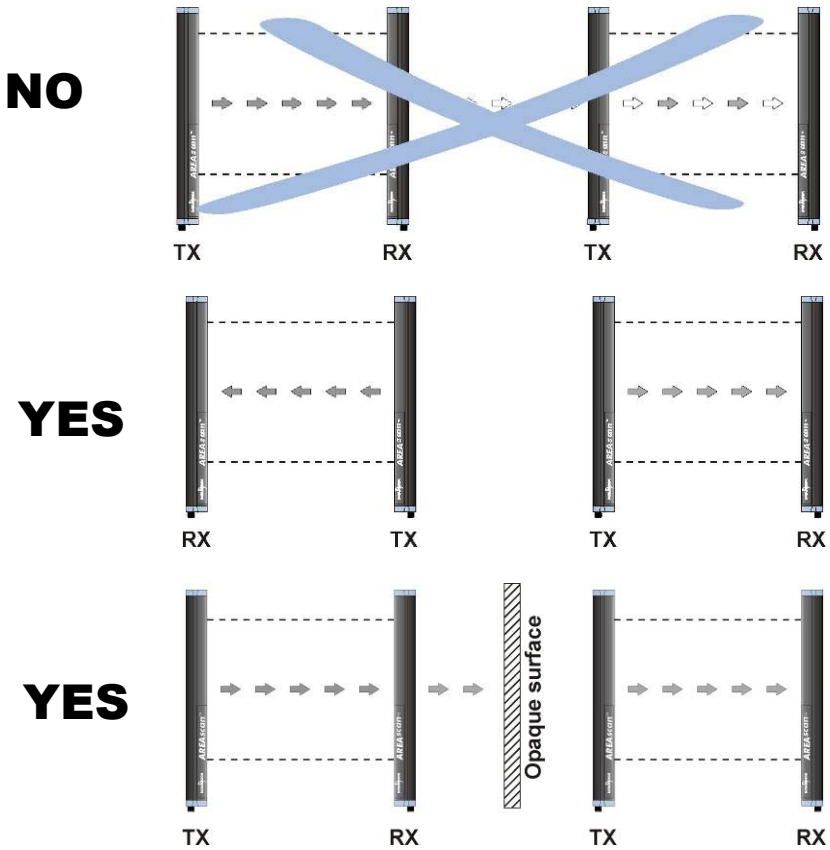


Fig. 2

3. MECHANICAL MOUNTING

The emitting and receiving bars must be installed with the relevant sensitive surfaces turned towards each other; the connectors must be positioned on the same side and the distance must be included within the operating range of the model used (*see section 10 "Technical data"*).
Once they have been positioned, the two bars should be aligned and completely parallel.

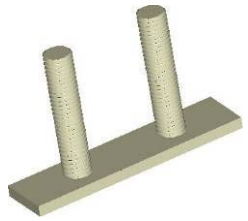


Fig. 3

To mount the device, use the threaded pins supplied (Fig.3); insert them into the slots on the two bars.

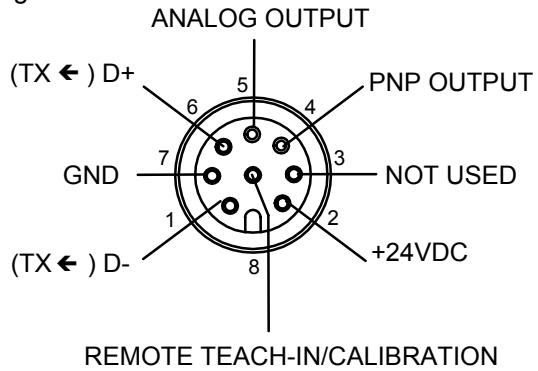
The operator can use the pins and/or the rigid mounting brackets – supplied with the device – depending on the particular application and/or the type of support on which the two bars must be placed (see Fig.4).

Fig. 4

Rigid brackets can be used where no large mechanical corrections are required, during the alignment operation.
The rotating supports for the correction of the bars' inclination of ±1° on the median transversal axis and of ±5° on the longitudinal axis, are available on request.
For applications with particularly strong vibrations, it is advisable to use anti-vibration shock absorbers that will reduce the impact of the vibraions. These should be installed with threaded pins, rigid brackets and/or rotating supports.

4. ELECTRICAL CONNECTIONS

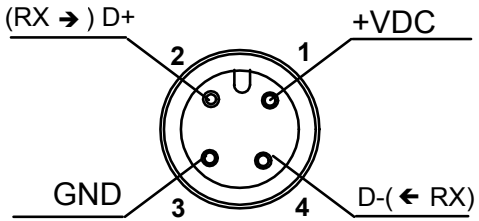
The electrical connection between the emitter and receiver units is made through male M12 connectors, located in the lower part of the light grids.



English

RECEIVER (RX):

1	=	white	=	SYNC D-
2	=	brown	=	+Vdc
3	=	green	=	NOT USED
4	=	yellow	=	PNP output
5	=	grey	=	Analog output
6	=	pink	=	SYNC D+
7	=	blue	=	0V
8	=	red	=	REMOTE TEACH-IN/ CALIBRATION



EMITTER (TX):

1	=	brown	=	+Vdc
2	=	white	=	SYNC D+
3	=	blue	=	0V
4	=	black	=	SYNC D-

4.1. Notes on the connections

For the correct functioning of the AREAscanTM. light grid, the following precautions regarding the electrical connections should be taken:

- Sheilded cables are not foreseen in the standard connection. However, if necessary, these cables can be used; in this case ground connection is necessary of both the unit and cable, as shown in Fig.5.

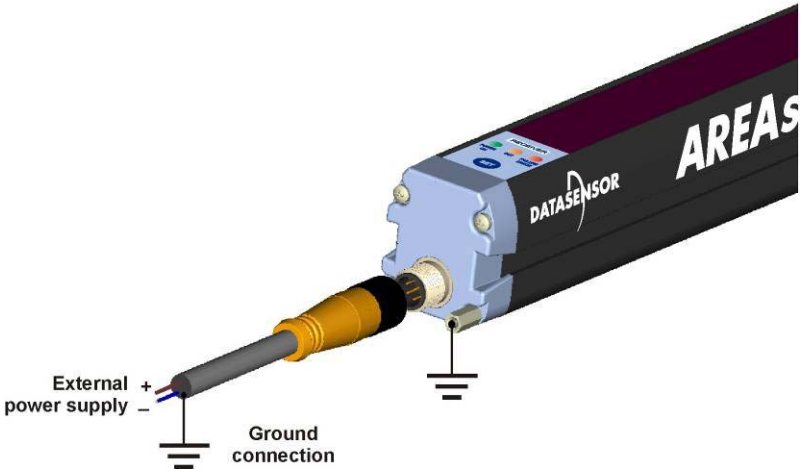


Fig. 5

The cables must not be placed in contact with or near any high voltage cable (e.g. motor power supply, inverters, etc.).
The correct functioning of the device can be compromised.

<u>Note</u>: Connecting pin n. 8 to 0V is activated the remote teach-in and calibration function; that is equivalent to pressing the teach-in pushbutton.

- The **AREA*scan*™** are NOT safety devices and so MUST NOT be used to control the safety of the machines where installed.

- The ground connection of the two units is not necessary. However, if required, the connection is possible; tighten the special screw – supplied with the device – instead of one of the 8 screws that lock the heads of each bar (see Fig.6).
- Follow the connection illustrated in Fig.5 when ground connection of the entire system is used.

English

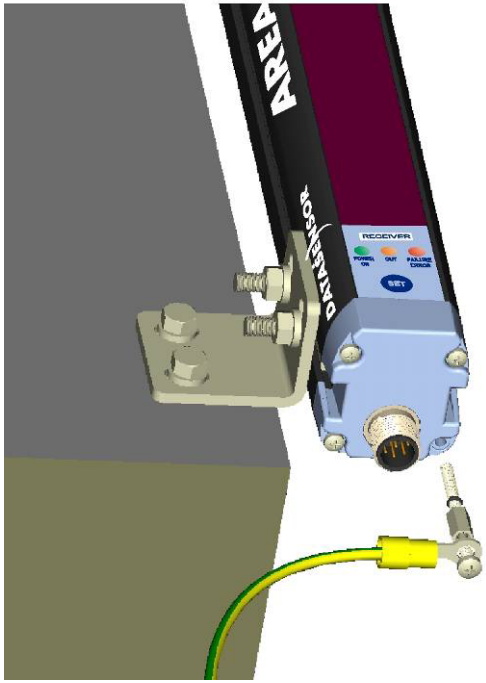


Fig. 6

5. FUNCTION SELECTION

The functions implemented in the **AREA*scan*™** devices can be selected using the dip-switches inside the receiver unit as shown in Fig.7.
The SET pushbutton, necessary for the calibration procedure (*see section 6 "Calibration Procedure"*) and teach-in function (see *section 7.3 "Teach-in detection of objects"*), is present on the same unit.

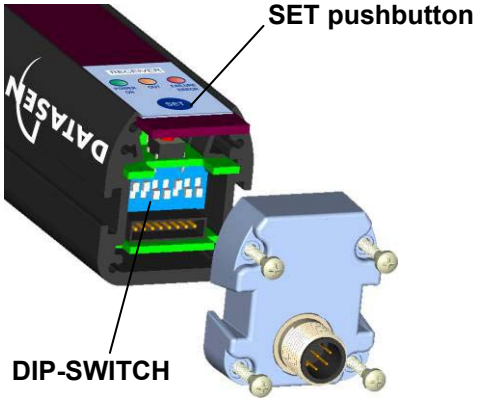


Fig. 7

5.1. Standard configuration

The device is supplied with the following standard configuration:

- *Parallel beams*
- *Calibration at powering on*
- *Aboslute measurement mode with V_{OUT} min at channel 1*
- *Sensitivity at level 9*

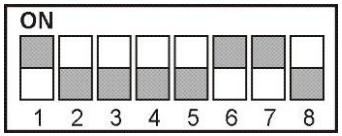


Table 1 indicates the type of function and the relative position of the dip-switches.

Tab. 1

1	Scanning with PARALLEL beams	SCANNING	Scanning with CROSSED beams	2
3	Manual calibration	CALIBRATION	Calibration at powering	4
5	Absolute detection VOUT min. to channel 1	MEASUREMENT	Absolute detection Vout max. to channel 1	6
7	Relative detection = n° of obscured channels			
9	TEACH-IN and absolute detection	DETECTION	TEACH-IN and relative detection	10
11	TEACH-IN and detection with a tolerance channel		TEACH-IN and exact detection	12
13	LIGHT mode output	OUTPUT	DARK mode output	14
15	Sensitivity level 15 = less sensitive	SENSITIVITY	Sensitivity level 12	16
17	Sensitivity level 9		Sensitivity level 5 = more sensitive	18

<u>Note</u>: The dip-switches not used are shown in grey. Black indicates the position of the dip-switch lever engaged.

English

6. CALIBRATION PROCEDURE

The calibration procedure sets the signal level that arrives from the receiver in the rest condition (no object detection).
In every other condition, the acquired signal will be compared to the one acquired during the calibration.

☞ The calibration depends on the alignment and distance of the two units; the procedure must be repeated every time these parameters change.

6.1. Correct calibration procedure guide

The calibration can be done according to the following procedure, once the mechanical mounting, electrical connections and alignment are completed:

- Switch ON the DS3.
- In the **CALIBRATION AT POWERING** mode (see function 4 in Tab.1 at page 14), the system will automatically calibrate itself at the powering on. Successive calibrations during functioning have to be made according to the following mode.
- In the **MANUAL CALIBRATION** mode (see function 3 in Tab.1 at page 14), press and release the SET pushbutton.

The calibration phase can have a variable duration and ends when the green LED lights up in a steady manner; the system functions only at this moment.

☞ • No undesired object should be present in the detection area during the calibration process. The calibration procedure can be made even if an object will remain fixed inside the detection area (e.g. support, paper etc). In this case, area affecting the fixed object will be excluded from the total sensitive area (**BLANKING** mode).

The powering on of the red LED (ERROR FAILURE) indicates this particular situation.

☞ • The position of both the receiver and emitter must remain the same both during and after calibration (the use of specific anti-vibration brackets are suggested in case of particularly critical applications characterised by strong vibrations).

English

7. FUNCTIONING MODE

The DS3 light grid is a detection and measurement device and thus the beam interruption due to an object causes the switching of the digital output (PNP type) and/or the change of the analog output signal. Small objects (up to 0.5 mm), transparent films and measurement of geometrical dimensions with a 6 mm resolution, can be obtained by setting the device at the right sensitivity.
The different functioning modes available are listed below:

7.1. Scanning mode

(see functions 1 and 2 of Tab.1 at page 14)

Two different scanning types can be accomplished with the **AREA*scan*™** of the DS3 series:

- **Scanning with PARALLEL beams:** where each single photoreceiver is illuminated only by the beam of the corresponding photoemitter with a precise scanning sequence (this mode activates only one photoreceiver/photoemitter couple each time, during the scanning cycle).

- This mode can be used both for the detection of objects as well as the dimensional measurement (this measurement is supplied to the operator by the analog output 0-10V). The minimum object that can be detected has to be ≥ 6 mm (that represents the minimum resolution (R), Fig.8, of the device in this mode).

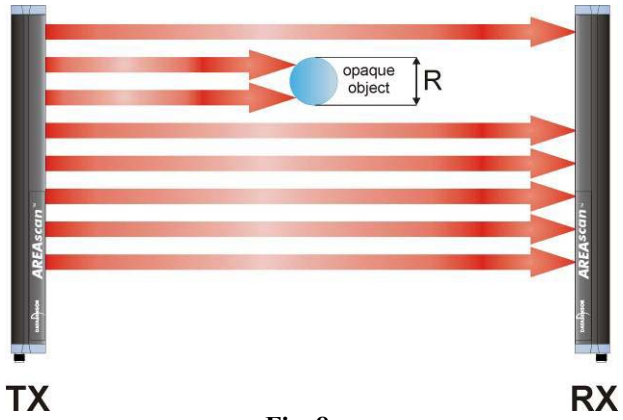


Fig. 8

- **<u>Scanning with CROSSED beams</u>:** where several photoreceivers are illuminated by the beam of a single photoemitter (this mode activates a series of photoreceivers and one photoemitter contemporarily, during the scanning cycle). The scanning with crossed beams can be used for the detection of objects with small dimensions and, in particular, for the detection of transparent objects.

The minimum object that can be detected is ≥ 0.5 mm (that represents the minimum resolution of the device in this mode). The real resolution of the device also depends on the object's position in the detection field, as shown below (Fig.9).

The analog output is not activated in this mode.

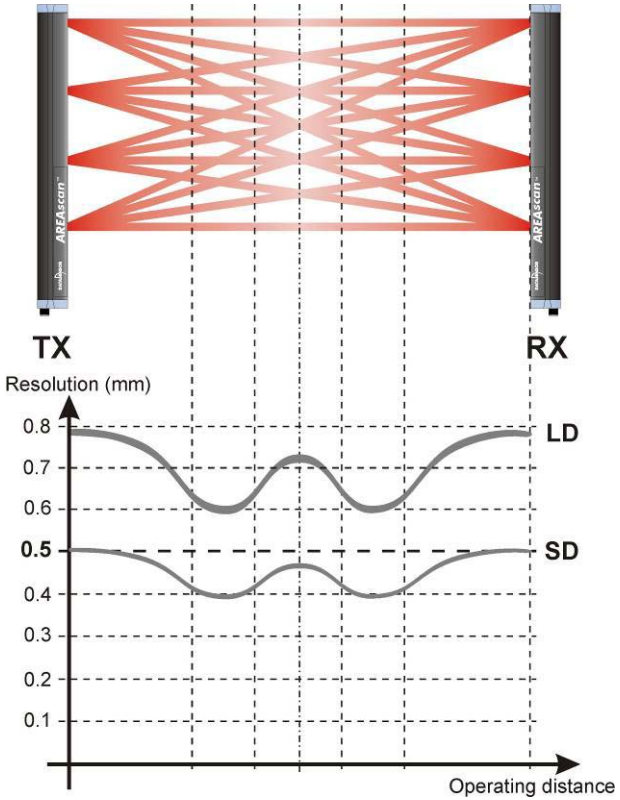


Fig. 9

English

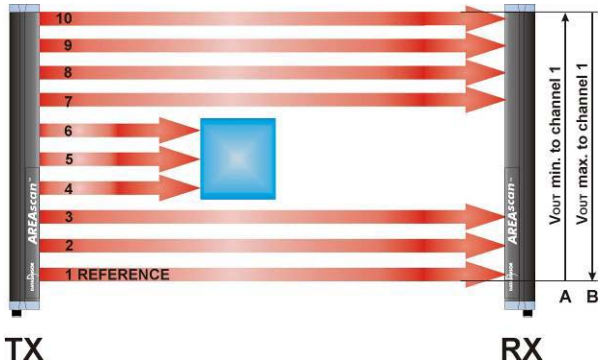
7.2. Measurement mode

7.2.1. Absolute mode

(see functions 5 and 6 of Tab.1 at page 14)

Provides the measurement of the dimension of the object beginning from an absolute reference. The first photoelement is taken as a reference (1) beginning from the connector side. The analog output voltage is proportional to the number of beams (obscured and not) included between the reference and last beam effectively obscured.
The level of the analog output voltage can be selected using the dip-switches (functions 5 and 6 of Tab.1 at page 14 – respectively V_{OUT} max. at channel 1 and V_{OUT} min. at channel 1); the voltage can thus be maximum or minimum in correspondence to the obscuring of the beam taken as a reference.
Fig. 10 can be taken as an example: the obscuring of the beams is considered as corresponding to the VOUT of 1V variation. At the obscuring of the last beam, the VOUT reaches the 10V full scale. If the VOUT min. option is set to the channel 1 (A), the VOUT in question will be = 6V; on the contrary will be = 7V (B).
The PNP output is active when at least one photoelement is obscured.

☞ **The function of the absolute measurement is active only with the parallel beam mode.**



	Analog output	Output level	PNP output
A	V_{OUT} min. to channel 1	6V	ON
B	V_{OUT} max. to channel 1	7V	

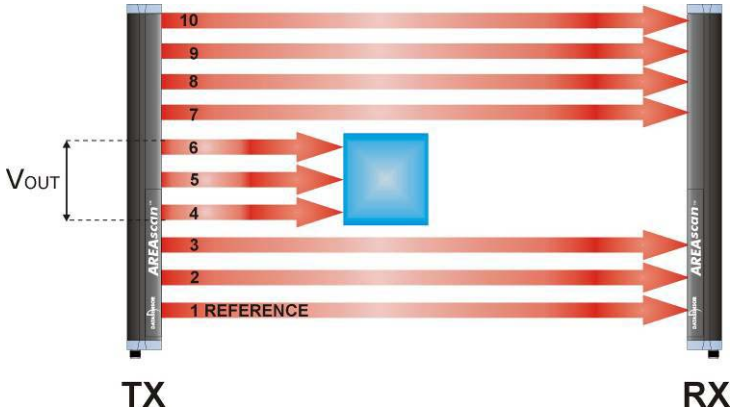
Fig. 10

7.2.2. *Relative measurement*

(see function 7 of Tab.1 at page 14)

Provides the measurement of the dimension of the object that affects the detection area independently from an absolute reference.
The voltage of the analog output is proportional to the number of beams effectively obscured.
Fig. 11 can be used as an example, considering the previous hypothesis (one obscured beam corresponds to V_{OUT} = 1V).
The PNP output is active when at least one photoelement is obscured.

The function of the relative measurement is active only with the parallel beam mode.



Analog output	PNP output
3V (4, 5, 6 channels)	ON

Fig. 11

English

7.3. Detection mode (teach-in)

The teach-in mode can be selected using the dip-switches (see functions 9 and 10 of Tab.1 at page 14) and is active only with one of these selections.
This mode allows the memorisation of the dimension of one or more objects (not adjacent) by pressing the SET pushbutton. The PNP output is then switched on when the objects pass in the sensitive area.

The teach-in mode is activated effecting the following phases:
- place the object inside the sensitive area in the desired position.
- press for at least 2 seconds the SET pushbutton.
- release the pushbutton after the powering on of the red LED.

The object detection is indicated by the successive powering on of the green LED.
The presence of the memorised object will allow the switching ON of the digital output (PNP) and powering on of the relative yellow LED.

The characteristics of the memorised object remain valid until another successive teach-in detection is made.

In the teach-in mode, the system forces the parallel beam mode independently from the dip-switch setting (dip-switch N°1) that, only in this configuration, is used to select the detection mode.

The function of the detection mode (teach-in) is active only with the parallel beam mode.

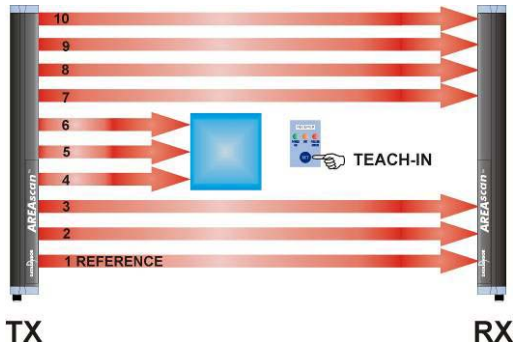


Fig. 12

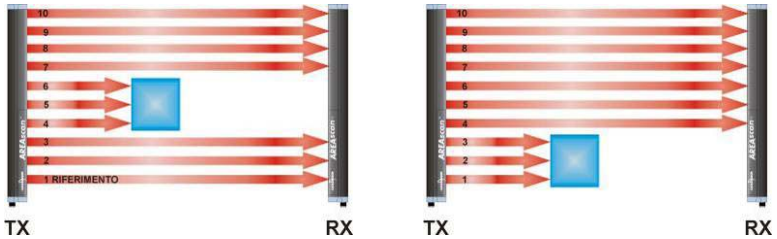
The characteristics of the memorised object remain valid until no other successive teach-in detection is made, *even if the device is switched off and then switched on again.*

The following operating modes can be selected using the dip-switches:

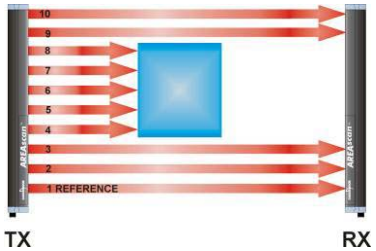
7.3.1. Absolute detection

(see function 9 of Tab.1 at page 14)

The digital output (PNP) switches only if a certain object (dimensions previously memorised) passes exactly in the desired position (Fig.13).
The analog output in this configuration is always active and the voltage is proportional to the number of obscured optics (also non adjacent) independently from the real switching of the digital output (PNP) caused by the object detection.



Analog output	PNP output	Analog output	PNP output
= 3V (4,5,6 channels)	ON	= 3V (1,2,3 channels)	OFF



Analog output	PNP output
= 5V (4,5,6,7,8 channels)	OFF

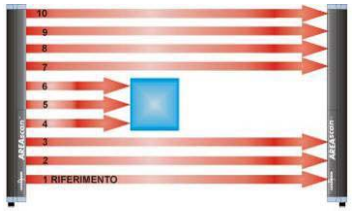
Fig. 13

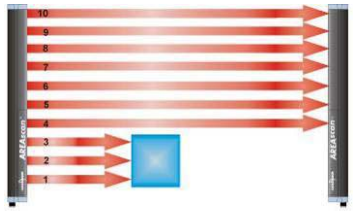
English

7.3.2. *Relative detection*

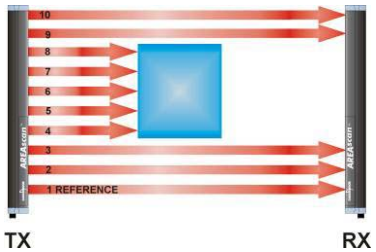
(see function 10 of Tab.1 at page 14)

The digital output (PNP) switches each time a certain object passes inside the sensitive area, independently from its position in the area (Fig.14). The analog output in this configuration is always active and the voltage is proportional to the number of obscured optics (also non adjacent) independently from the real switching of the digital output (PNP) caused by the object detection.





Analog output	PNP output	Analog output	PNP output
= 3V (4,5,6 channels)	ON	= 3V (1,2,3 channels)	ON



Analog output	PNP output
= 5V (4,5,6,7,8 channels)	OFF

Fig. 14

7.3.3. *Detection tolerance*

(see functions 11 and 12 of Tab.1 at page 14)

The tolerance of the detected object's measurement can be changed by means of the the dip-switches; in detail it is possible to select between an exact detection and detection with a tolerance channel.

7.4. DARK/LIGHT mode of the output

(see functions 13 and 14 of Tab.1 at page 14)

Defines the status of the digital output (PNP) and of the relative yellow signalling LED.

DARK MODE

Object detection	Output status	LED status
YES	OFF	Turned off
NO	ON	Turned on

LIGHT MODE

Object detection	Output status	LED status
YES	ON	Turned on
NO	OFF	Turned off

7.5. Sensitivity mode

(see functions 15÷18 of Tab.1 at page 14)

This function allows the sensitivity adjustment according to the characteristics of the object to be detected.
The standard value is fixed on level 9; in presence of small objects (comparable to the detection limit = 0.5 mm) or very transparent objects, with the units at the maximum operating distance, we recommend increasing the sensitivity to level 5.
In all other cases, such as when the detection or the calibration procedure is very difficult, we recommend decreasing the sensitivity to level 15.
The sensitivity increase is recommended only if strictly necessary, as the increase can deteriorate the immunity characteristics and require more frequent calibration operations.

☞ Operating on the 5 and 9 sensitivity levels (high sensitivity) can be accomplished only in the manual calibration mode.

8. DIAGNOSTIC FUNCTIONS

8.1. Visualisation of the device status

The operator can verify the operating status of the DS3 device through three LEDs present on the receiver unit and one LED present on the emitter unit.

English

The meaning of the LEDs present on the receiver unit (RX) depends on the functioning mode of the light grid.

RECEIVER UNIT

Signal	Status
POWER ON LED: Green ON OUT LED: OFF FAILURE ERROR LED: OFF	-Normal device functioning. -Absence of the device after calibration.
POWER ON LED: Green ON OUT LED: Orange ON FAILURE ERROR LED: OFF	-Switching signalling fo the PNP output.

EMITTER UNIT

Signal	Status
POWER ON LED: Green ON	-Normal device functioning.

☞ The diagnostic described makes reference to LIGHT mode output (object detection signalled by OUT LED ON).

8.2. Fault and diagnostic messages

The operator can verify the device functioning status and the stop or failure causes of the system, using the same LEDs used for the visualisation of the functions.

8.2.1. Diagnostic mode

RECEIVER UNIT

Signal	Cause	Check
POWER ON LED: OFF OUT LED: OFF FAILURE ERROR LED: OFF	-No power supply.	-Verify the power supply.
POWER ON LED: OFF OUT LED: OFF FAILURE ERROR LED: Red ON	-Device ready for teach-in detection; release the TEACH-IN button to memorise the object.	-Control the presence of an external object inside the detection area and remove it.

EMITTER UNIT:

Signal	Cause	Check
POWER ON LED: OFF	-No power supply.	-Verify the power supply.

8.2.2. Error mode

RECEIVER UNIT

Signal	Cause	Check and Repair
POWER ON LED: Green ON **OUT LED**: OFF/Orange ON **FAILURE ERROR LED**: Red ON	-PNP output does not switch. -Device failure. -Device not aligned or outside the maximum operating distance.	-Align the device again and inside the maximum operating distance. -Repeat the calibration procedure. -Turn off and on the device; if the anomaly persists replace the unit.
POWER ON LED: Green ON **OUT LED**: OFF/Orange ON **FAILURE ERROR LED**: Red ON	-PNP output switches. -Device not aligned or outside the maximum operating distance. -Wrong calibration.	-Align the device again and inside the maximum operating distance. -Control the presence of an external object inside the caliobration area and remove it and repeating the calibration. The **AREA*scan*™** will operate according to the modes of section 6 “Calibration *Procedure*”.

English

9. CHECKS AND PERIODICAL MAINTENANCE

The following is a list of recommended check and maintenance operations that should be periodically carried out by qualified personnel.
Check that:
The device has been calibrated, regularly repeating the calibration procedure (section 6 “Calibration procedure”).
The operating distance and alignment of the units conforms to the indications given in section 2 “Installation mode” and section 10 “Technical data”.
The device and external electrical connections are not damaged.
The frequency of checks depends on the particular application and on the operating conditions of the light grid.

The **AREA*scan*™** devices do not need any particular maintenance, with the exception of the cleaning of the protection frontal surfaces of the optics.
When cleaning, use a cotton cloth dampened with water.

Do not under any circumstances use:
- **alcohol or solvents**
- **wool or synthetic cloths**

Disturbances that cause power failure can cause the temporary opening of the outputs, do not compromise the functioning of the grid.
All appliances are under a 36 month guarantee from the manufacturing date. Datasensor will not be liable for any damages to persons and things caused by the non-observance of the correct installation modes and device use.
The warranty will not cover damages caused by incorrect installation, incorrect use and accidental causes such as bumps or falls.

In the event of breakdown send the appliance to DATASENSOR S.p.A.

Sales Technical Service
Tel.: +39 051 6765611
Fax.: +39 051 6759324
email: service@datasensor.com

English

10. TECHNICAL DATA

Power supply:	24 Vdc ± 15%
Consumption of emitter unit (TX):	100 mA max
Consumption of receiver unit (RX):	100 mA max without load
Outputs:	1 PNP output; load max 10 kΩ 1 analog output ; 0-10V ($\Delta V_{max.}$ 5%)
Output current on PNP output:	100mA; short circuit protection
Output voltage on PNP output:	-1 V of the power supply at T=25°C
Response time:	Refer to “Available models” table page30
Light emission:	Infrared (880 nm)
Resolution of crossed beams:	DS3-SD: 0.5 mm (see pag.17) DS3-LD: 0.8 mm (see pag.17)
Resolution of parallel beams and minimum object detected	6mm
Accuracy on relative measurement (parallel beams):	± 6mm
Accuracy on absolute measurement (parallel beams):	± 3mm
Dimensional difference of equally detected objects in absolute teach-in:	± 6mm
Dimensional difference of equally detected objects in relative teach-in:	Δ = 12mm
Operating distance:	0.2 - 0.6 m Short distance version (SD) 0.6 - 1.5 m Long distance version (LD)
Available functions:	see page 14
Operating temperature:	- 10…+ 55 °C
Storage temperature:	- 25…+ 70 °C
Humidity:	15…95 % (non condensating)
Electrical protection:	Class 1
Mechanical protection:	IP 65 (EN 60529)
Vibrations:	0.35 mm amplitude, 10 … 55 Hz frequency, 20 sweep for every axis, 1octave/min (EN 60068-2-6)
Shock resistance:	16 ms (10 G) 1.000 shock for every axis (EN 60068-2-29)
Housing material:	Painted aluminium (RAL9005 shiny black)
Optics material:	PMMA
Connections:	M12-4 pole connector for TX M12-8 pole connector forRX
Weight:	DS3-015: 310 g. for unit DS3-030: 530 g. for unit DS3-045: 750 g. for unit DS3-060: 970 g. for unit

11. LIST OF AVAILABLE MODELS

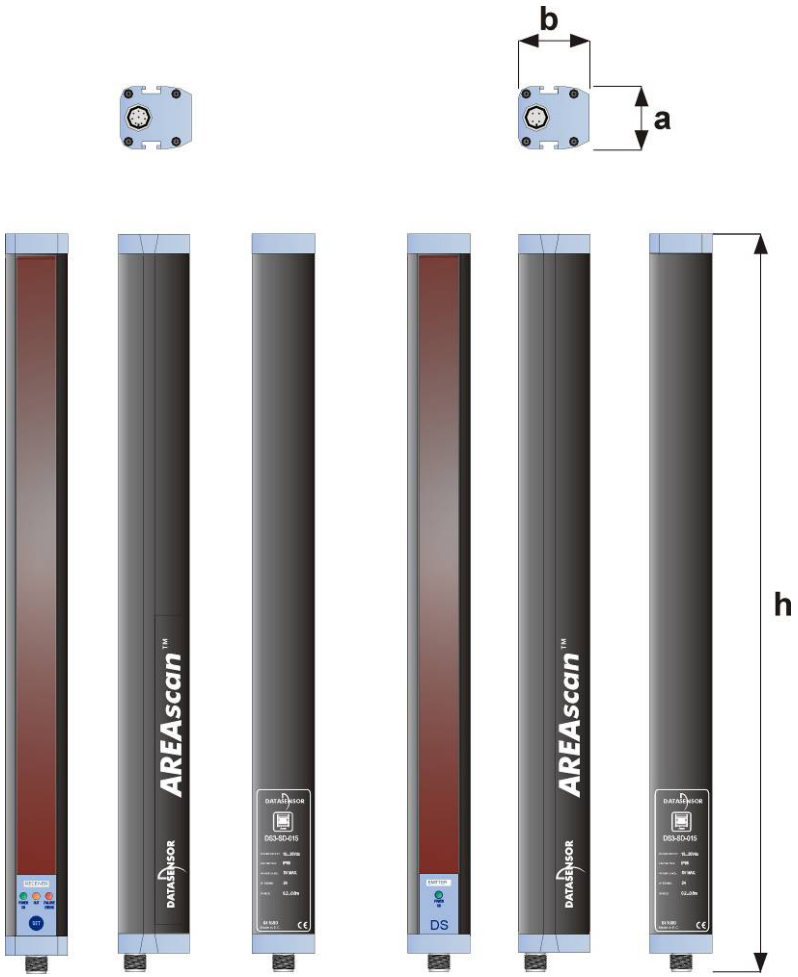
Model	Length of sensitive area	Length of controlled area	N°. beams	Response time of crossed beams	Response time of parallel beams	Operating distance (m)
DS3-LD-015	155	155	24	23 msec	3 msec	0.6…1.5
DS3-LD-030	305	305	48	46 msec	6 msec	0.6…1.5
DS3-SD-015	155	155	24	23 msec	3 msec	0.2…0.6
DS3-SD-030	305	305	48	46 msec	6 msec	0.2…0.6
DS3-LD-045	455	455	72	69 msec	9 msec	0.6…1.5
DS3-LD-060	605	605	96	92 msec	12 msec	0.6…1.5
DS3-SD-045	455	455	72	69 msec	9 msec	0.2…0.6
DS3-SD-060	605	605	96	72 msec	12 msec	0.2…0.6

MODEL	a x b (mm)	h (mm)
DS3-LD-015	35 x 40	226
DS3-LD-030	35 x 40	376
DS3-SD-015	35 x 40	226
DS3-SD-030	35 x 40	376
DS3-LD-045	35 x 40	526
DS3-LD-060	35 x 40	676
DS3-SD-045	35 x 40	526
DS3-SD-060	35 x 40	676

12. OVERALL DIMENSIONS

All the dimensions given are in mm.

RECEIVER **EMITTER**



English