Baumer

SCATEC-J

Laser Copy Counter

FLDK 110G1010/S14
FLDK 110G10/xxxxxx

User manual

Sensor Solutions
Motion Control
Vision Technologies
Process Instrumentation

General notes

Rules for proper usage	This product represents a precision measuring device which has been designed for the detection of objects and parts. It generates and provides measured values issued as electrical signals for following systems. Unless this product has not been specifically marked it may not be used in hazardous areas.
Set-up	Installation, mounting and adjustment of this product may only be executed by skilled employees.
Installation	Only mounting devices and accessories specifically provided for this product may be used for installation. Unused outputs may not be connected. Unused strands of hard-wired sensors must be isolated. Do not exceed the maximum permissible bending radius of the cable. Before connecting the product electrically the system must be powered down. Where screened cables are mandatory, they have to be used in order to assure EMI protection. When assembling connectors and screened cables at customer site the screen of the cable must be linked to the connector housing via a large contact area.

0 Table of Contents

FLDK 110x10/xxxxxx

Check section 14 for data and information varying from the standard manual !

1 Safety information and Certifications

The laser diode installed in the ***SCATEC-J*** emits visible red light. This laser belongs to laser class 2 as specified by the standard IEC 60825-1 / 2001.

Avoid looking directly into the beam for longer periods. Brief irradiation of the eye (0.25 sec) as can occur during an accidental glance is not regarded to be dangerous.

However, the laser should not be aimed deliberately at people. The laser beam should also be blocked at the end of its intended path.

SCATEC-J complies with the following safety standards:

c UL us LISTED
IND. CONT. EQ.
1D02

CE

Complies with 21CFR 1040.10 and 1040.11

2 Introduction

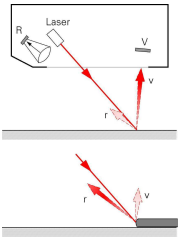
SCATEC-2 has the same key feature as all the other sensors from the ***SCATEC*** family: The capability of non-contact detection of object edges. ***SCATEC*** is the sensor of choice when it comes to detect flat objects conveyed in an overlapping stream or individually. The sensors in the ***SCATEC*** family were developed and highly optimized particularly with regard to the specific demands of non-contact counting of overlapping paper sheets and newspapers. Therefore the printing industry will be the ideal area of application for the ***SCATEC***.
Generally speaking a ***SCATEC*** sensor reacts to an edge facing the sensor's laser beam. If the laser beam strikes such an edge, ***SCATEC*** responds with an electrical output pulse of fixed duration.The

Within the ***SCATEC*** family, the ***SCATEC-J*** is characterized by the following properties:

- counts edges from a thickness of 1.5 mm
- optimum working distance: 40 mm
- "plug and play"; the user is not required to make adjustments
- counting rate up to 280,000 copies per hour

3 Principle of operation

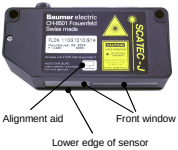
Described simply, the ***SCATEC-J*** consists of a laser light source and two photodetectors. The beam is aimed diagonally at the objects to be detected. Photodetector R is located close to the laser light source and photodetector V in a forward sensing position. The sensor measures the ratio between signal *v* (light propagated forwards) and signal *r* (light propagated backwards).
The ratio *v/r* differs widely depending whether the beam strikes on a flat surface or on an edge. When an edge moves into the laser beam, the direct line of sight from detector V to the point of contact of the laser is obstructed, which reduces signal *v*, and the edge also increases the backwards propagation, causing signal *r* to increase. Both effects cause ratio *v/r* to become substantially smaller than with a flat surface. If ration *v/r* falls below a specific level, the sensor interprets this as an edge.

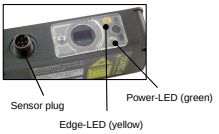


This principle of operation clearly demonstrates that:

- The orientation of the object to the beam is significant. An edge facing towards the beam creates a small ration *v/r*, in contrast to an edge facing away from the beam. Therefore only edges facing towards the laser beam will be detected!
- Edge detection is independent of the color, as only the ratio of the light intensities and not the absolute value is used for detection.

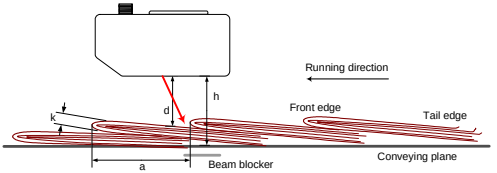
4 Part identification





5 Definition of technical terms

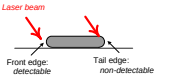
For reference, the terms defined in this section are used throughout the manual.

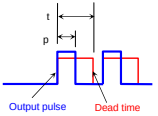


Mounting height *h* — Distance between the lower edge of the sensor and the conveying plane

Working plane — The edge lies on the working plane. With thick overlapping copies, the working plane is slightly higher than the top of the conveying plane on which the copies are transported. Distance d is measured vertically to the lower edge of the sensor.

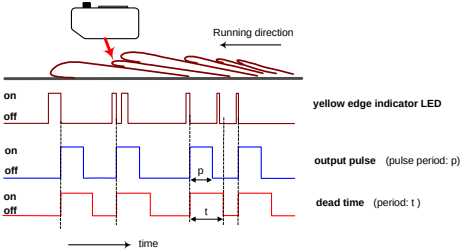
Working distance *d*	Distance between the lower edge of the sensor and the working plane.
Overlap *a*	Separation between two successive edges, measured along the conveying plane. (Also referred to as the object interval.)
Edge thickness *k*	Thickness of the copy at the point where the edge is to be detected.
Front edge	The edge of an object facing the laser beam. Front edges are detected by the sensor.
Tail edge	The edge of an object facing away from the laser beam. Tail edges are not detected by the sensor unless they are pointing upwards.
Running direction	The preferred running direction is indicated. The opposite direction is also permitted by the ***SCATEC-J***.
Dead time	The sensor responds to an edge with an output pulse with period *p*. The dead time begins when the pulse is issued. The sensor can only issue the next pulse after the dead time *t* has expired. This means: an edge detected by the beam during the dead time does not initiate an output pulse.





6 Sequence of the signals

The yellow edge indicator LED lights as long as the edge is located in the beam. The output pulse is issued at the end of the edge. The dead time begins when the output pulse is issued. During the dead time and when issuing the pulse, the ***SCATEC-J*** is inactive, i.e. no edges are counted. Therefore, the next output pulse can only be issued after the dead time has expired and the output pulse has been issued.



7 Installation

7.1 Electrical connection

Make the electrical connection as specified in Sections *10.2 Electrical data* and *10.3 Pin assignment*.

7.2 Mounting

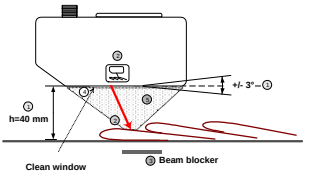
(1) Mount the sensor at a height h of 40 mm (+5/-10 mm) with the front window parallel to the working plane.

(2) Adjust the sensor so that the laser beam is aimed towards the edges to be counted. (When fitted correctly, the overlap of the copies is facing in the same direction as indicated in the alignment aid.)

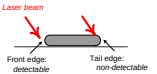
(3) Block the laser beam after the objects whenever possible.

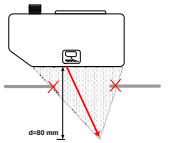
(4) Keep the window clean (no finger-prints).

(5) A direct line of sight from the laser impact point to the entire front window must be ensured.



Mounting height *h*	40 mm above the conveyor belt The resolution is dependent on the distance. The highest resolution of 1.5 mm edge thickness is achieved at a distance d of 30 – 45 mm. (See also Section *10.6 Application data*.)
Angular tolerance	max. +/- 3°
Overlap orientation	The copies are counted when the edge facing the laser beam moves through the beam. If an edge faces away from the beam, it is not detected. Tail edges are therefore not counted unless they face upwards.
Running direction	The ***SCATEC-J*** permits both running directions. The edges facing the laser beam are detected by the sensor regardless of the running direction.
Front window	The direct line of sight from the impact point of the laser to the entire front window must not be obstructed by the mountings in a distance range d of 0 – 80 mm. If mountings or other components are close to this zone for any reason, you should consult a technician from Baumer Electric AG in this respect.





7.3 Beam blocker

Uncontrolled reflections of the laser beam can cause malfunctioning of the sensor or dazzle people. Therefore, a beam blocker should be fitted whenever possible to block the beam when there is no target present. A flat surface (at least approx. 25x25 mm) made of a matt, non-reflecting material is recommended as the beam blocker. The beam blocker must be mounted parallel to the sensor. The yellow edge indicator LED must not light when the laser beam strikes the beam blocker.

7.4 Cleaning the front window

Fingerprints, dust and other forms of dirt on the front window can impair the function of the sensor. It is normally sufficient to wipe the glass pane dry with a clean (!), soft cloth. Alcohol may be used for heavier soiling.

7.5 Checklist for correct fitting

When the ***SCATEC-J*** is fitted correctly:

- the green power LED lights as long as the electrical supply is connected
- the product overlap faces in the same direction as indicated on the sensor label
- the laser beam has a diameter of about 2 mm at 40 mm beneath the window
- the yellow edge indicator LED does *not* light when the laser beam strikes the beam blocker
- the yellow edge indicator LED lights as long as an edge is located in the beam
- the front windows are clean

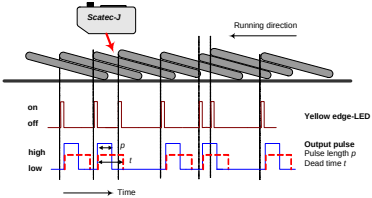
8 Adjustments

The ***SCATEC-J*** is ready for operation after fitting. No further adjustments are necessary.

9 Instructions for use

9.1 Maximum counting rate

Since the output pulses and the dead time cannot overlap, edges must be separated by at least a dead time. (With the ***SCATEC-J***, the dead time *t* is always greater than the output pulse period *p)*. If the following edge arrives within a time shorter than the dead time, then this edge will be suppressed meaning that the edge will not initiate an output pulse as illustrated in the figure below.



The dead time *t* therefore determines the maximum counting rate because within time *t*, the ***SCATEC-J*** cannot issue more than one output pulse.

The maximum counting rate is therefore 1/*t*.

Example: Dead time $t = 12$ ms
Therefore: maximum counting rate = 1/12 ms = 300,000 per hour

Please note that this is the maximum counting rate. The closer the actual production rate gets to this value the higher the risk becomes that copies are suppressed due to too short intervals between copies. If suddenly the ***Scatec-J*** starts to miss copies while the production rate is run up, the reason very often are occasionally way too short intervals between copies. Such irregularities of the lap stream are very often unexpected and difficult to see directly.

9.2 Variation of the working distance

The thickness that an edge must have to be detected by the ***SCATEC-J*** depends on the working distance. The ***SCATEC-J*** is most sensitive at a working distance of about 40 mm. The relationship between the sensitivity and the working distance is contained in the specifications in Section 10.6.

☞ *the sensitivity of the sensor varies with the working distance*

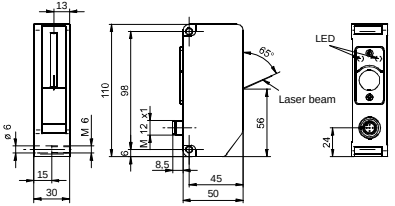
9.3 Applications outside the paper processing industry

Due to the fundamental principle of edge detection employed by the ***SCATEC-J***, the field of application for the sensor is not restricted to the paper processing industry. For applications concerning high-gloss surfaces (e.g. sheet metals), it is advisable to consult a technician from Baumer Electric AG on the application.

10 Specifications

10.1 Mechanical and thermal data

Sensor size	110 x 50 x 30 mm
Housing material	plastic (PA6.6)
Front window	glass
Weight	approx. 130 g
Protection class	IP 54
Working temperature range	0℃ to +50℃ (non-condens ing)
Storage temperature	-20℃ to +60℃



10.2 Electrical data

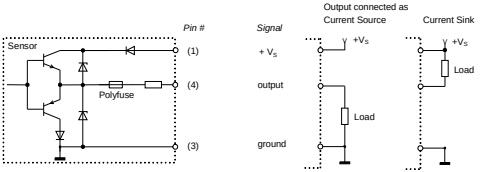
Operating voltage V_S	
Limits:	+10 VDC to +30VDC (UL-Class 2)
reverse-protected	yes
Ripple V_S	10% within the limits of V_S
Power consumption	< 2 W
Current consumption	
Average:	< 170 mA
Peak (after switching on)	< 180 mA
Output connector	M12 connector, 5-pole
Output circuit	Push-pull
Current load:	max. 100 mA
short-circuit protected	yes
Normal state:	low
Output pulse period	
FLDK 110G1010/S14:	10 ms
FLDK 110G10/xxxxxx:	*see section 14*

10.3 Pin assignment

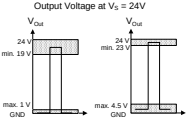
Pin	assignment (on Scatec)
1	Operating voltage $+V_S$
2	Seriell TxD (sensor)
3	GND (0V)
4	Signal output $+V_{out}$
5	Seriell RxD (sensor)

10.4 Output connection

Push-pull Output



$+V_s$	Operating voltage (+10VDC ... +30VDC)
V_{out}	Signal output
GND	0 V
I_{Load}	maximum 100 mA



10.5 Optical data

Laser	
Wavelength	650 nm - 680 nm (visible red)
Pulse frequency	50 kHz
Duty cycle	50%
Average power	< 0.5 mW
Laser class	2 (to IEC 60825-1 / 2001)
Beam diameter	
at emission point	about 2.5 mm
40 mm beneath sensor	about 2 mm
Focus position	about 120 mm beneath sensor
Optical receiver	equipped with NIR suppression filter and daylight suppression filter

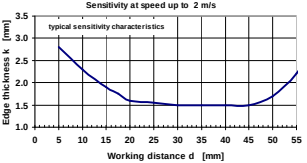
10.6 Application data

Measuring range	0 to 55 mm beneath sensor
Mounting height	40 mm
Object speed	2 m/s maximum (5 m/s maximum for thicker edges)
Minimum object spacing	
FLDK 110G1010/S14	13 mm @ v = 1 m/s, or proportional to speed
FLDK 110G10/xxxxxx:	*see section 14*
Counting rate	
FLDK 110G1010/S14	280,000 maximum copies/h
FLDK 110G10/xxxxxx:	*see section 14*
Product orientation	Fold facing laser beam
Output pulse period	
FLDK 110G1010/S14	10 ms
FLDK 110G10/xxxxxx:	*see section 14*
Dead time	
FLDK 110G1010/S14	12 ms
FLDK 110G10/xxxxxx:	*see section 14*
Pulse issue time	at the end of the edge

Sensitivity	Edges from 1.5 mm thickness and greater are detected Sensitivity is dependent on distance and speed Typical sensitivity: see diagram

SCATEC-J FLDK 110G1010/S14

Sensitivity at speed up to 2 m/s

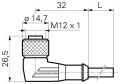


An edge with thickness k (*) at distance d can be detected when in the graphics k is above the curve at the corresponding distance d.
(*) Test object: cleanly cut white cardboard

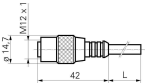
11 Accessories

Cable with plug

Article number		Cable length
ESW 33AH0200	4-pin	2m PUR/halogen-free
ESW 33AH0500	4-pin	5m PUR/halogen-free
ESW 33AH1000	4-pin	10m PUR/halogen-free



Article number		Cable length
ESG 34AH0200	4-pin	2m PUR/halogen-free
ESG 34AH0500	4-pin	5m PUR/halogen-free
ESG 34AH1000	4-pin	10m PUR/halogen-free



12 Maintenance

The ***SCATEC-J*** requires no maintenance apart from keeping the front windows clean. Dust or fingerprints can impair the sensor function. It is normally sufficient to wipe the windows dry with a clean (!), soft cloth. Alcohol may be used for heavy soiling.

13 Troubleshooting

First try to resolve the problem using the following table. If this is unsuccessful, consult Baumer Electric AG (www.baumer.com) for technical support.
The search for fault causes can be substantially shortened if the following issues are clarified before you make contact with a technician from Baumer Electric AG:

1. What is the type designation and P-code of the sensor?
2. Exact description of the problem. (Does the ***SCATEC*** count more or less copies than actually pass the sensor?)
3. Retain several samples of the products causing the counting error. (Mark the running direction on one sample and the approximate line along which it passes the laser beam.)
4. If possible, digital images of the installed sensor in operation and the immediate surroundings.

	Fault	Possible causes	Corrective actions
1	Scatec counts less copies than actually pass the sensor	a) Overlap spacing sporadically too small	Increase the overlap spacing or reduce the conveying speed
		b) Copies to close to or too far away from the Scatec, so that the copies are in a distance range at which the sensitivity of the sensor is inadequate	Set the distance of the copies in a range where the sensor is sufficiently sensitive to detect the copies. See chart 10.6
		c) Some copies are covered by another copy	Prevent complete coverage of the copies
2	Scatec counts more copies than actually pass the sensor	Apart from the edges, there are other points on the copies which cause spurious pulses	Prevent faulty points on the copies
		b) Laser beam on beam blocker causes spurious pulses	Adjust beam blocker correctly (yellow edge LED must never light when the laser beam strikes the beam blocker)
		c) Unblocked laser beam is reflected and causes spurious pulses	Install beam blocker at proper distance

14 Corrections for customized FLDK 110x10/xxxxxx

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