GS 754 Forked Photo Electric CCD Sensors

Technical Description

Parameterization *Version 4*

Table of contents

1 General Information

1.1 Explanation of Symbols

The symbols used in this operating manual are explained below.

Attention
This symbol appears in front of text which must be carefully observed. Failure to heed this information can lead to injuries to personnel or damage to the equipment.

Notice
This symbol indicates text which contains important information.

1.2 Declaration of Conformity

The GS 754 forked photo electric sensors with CCD have been developed and produced in accordance with the applicable European standards and directives.

Notice
The corresponding declaration of conformity can be requested from the manufacturer.

The manufacturer of the GS 754 forked photo electric sensors with CCD, Leuze electronic GmbH & Co. in D-73277 Owen/Teck, possesses a certified quality assurance system in accordance with ISO 9001.

CE

2 Safety Notices

2.1 Safety Standard

The GS 754 forked photo electric sensors with CCD have been developed and tested by the manufacturer in accordance with the applicable safety standards.

2.2 Intended Use

The GS 754 forked photo electric sensors are used with a control system or an evaluation unit for the purpose of detecting and gauging of small objects in industrial production processes.

Attention
The protection of personnel and the device cannot be guaranteed if the device is operated in a manner not corresponding to its intended use.

Attention
Access to or changes on the device, except where expressly described in this operating manual, is not authorized.

2.3 Organizing Measures

All entries in this operating manual must be heeded, in particular those in the section "Safety Notices".

Carefully store this operating manual where it is accessible at all times.

Observe the locally applicable legal regulations and the rules of the employer's liability insurance association.

Mounting, commissioning and maintenance of the device must only be carried out by qualified personnel. Electrical work must be carried out by a certified electrician.

Repairs, in particular the opening of the housing, may only be carried out by the manufacturer or a person authorized by the manufacturer.

3 Control and Display Elements

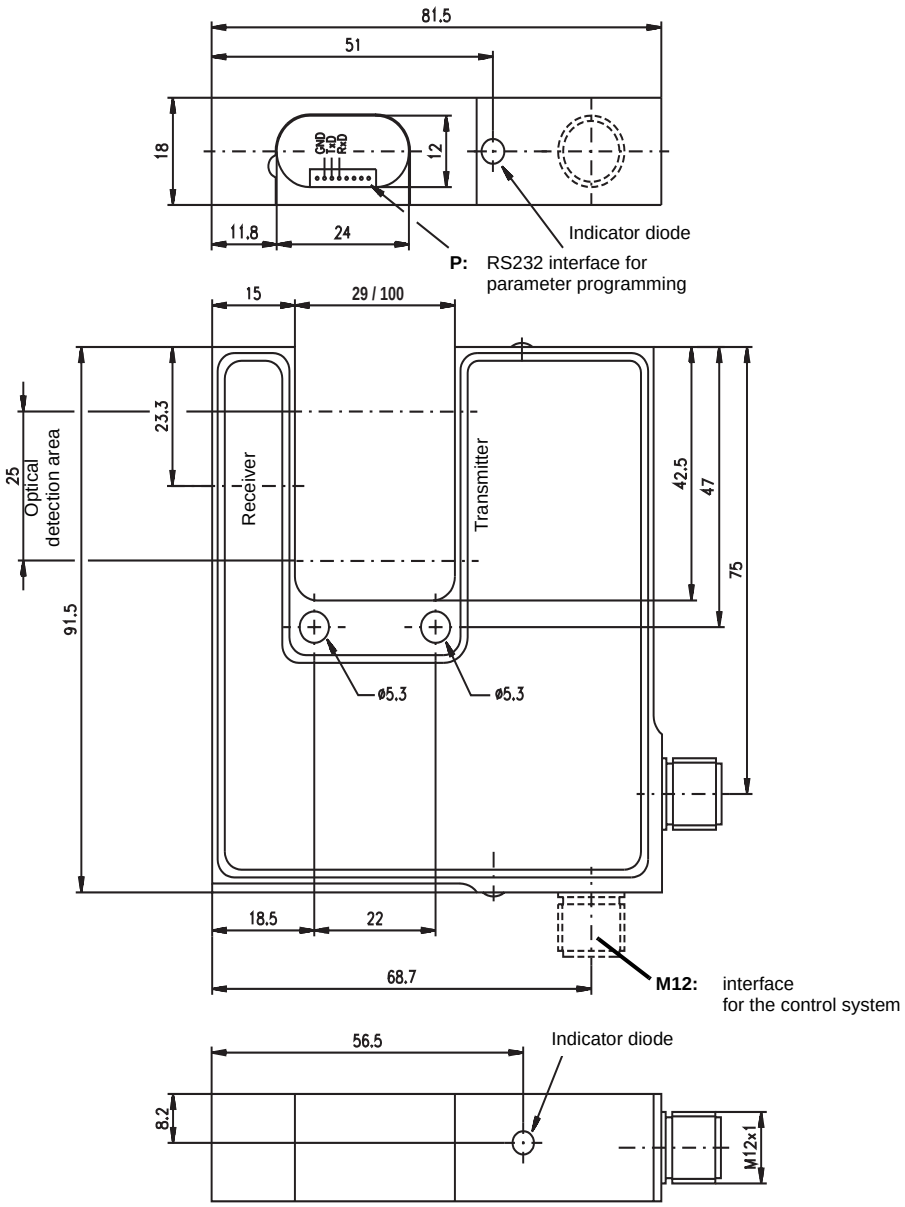


Figure 3.1: Positioning of operating and indicator elements

4 Description

4.1 General Description

The central part of the unit is an optical sensor that generates a horizontal band of light (Figure 3.1). The band of light illuminates a CCD camera. This CCD array produces an output signal that depends on the number of illuminated pixels.

The system has a permanent calibration and guarantees maximum precision and stability at any time.

Each sensor has two interfaces (see Figure 3.1).

1. Interface P (standard RS 232 interface):
   Programming interface for configuring the measurement modes and for visualising the measurement values.
2. M12 interface (process interface):
   Data for the control system are transmitted via this interface. Depending on the sensor type used, the measurement values are output either in analog or digital form.

Depending on the sensor type used, not all measurement values are available at the P and M12 interfaces.

Example: The analog interface can only output one measurement value at a time. The digital interface can output any number of measurement values.

5 Optical Data

	GS 754...-29/42... / GS 754...-100/42...	
	Output modes 1 ... 5	**Output mode 7**
Measurement range	25 mm	25 mm
Gap width	29 mm	29 mm
Gap depth	42 mm	42 mm
Width of band of light	1 mm	1 mm
Resolution	≤ 0.1 mm over the entire range	≥ 0.014 mm per measurement level
Smallest object	≥ 0.5 mm	≥ 0.5 mm
Light source	Infrared LED	Infrared LED
Wavelength	880 nm	880 nm

Table 1: Optical data

6 LED Indicators

LED	**Meaning**
green, continuously lit	ready
green, flashing	problem

Table 2: LED Indicators

7 Device Configuration

7.1 General Information

The parametrization cannot be carried out via the M12 interface. For this purpose, you should use the appropriate cable KB-ODS96-... .

To perform the parametrization, you require a PC with an RS232 interface and a terminal program with the following setting.

7.1.1 Terminal program

To do this, you can use any terminal or modem program that can access the serial interface of your PC directly.

Under Microsoft® Windows® 95/98/NT/2000 you can use the "Hyperterminal" program.

7.2 Basic configuration of the terminal program (interface P)

Transmission rate	9600 bit/s
Data bits	8
Parity	no
Stop bits	1
Protocol	no

Table 3: Basic configuration of the terminal program (interface P)

7.3 Configuration of the measurement, analysis and output procedures over interface P

The appropriate configuration is activated by entering ASCII characters. Letters may be entered in either capital or lowercase form.
By entering the ASCII character "R", the state on delivery is restored.
Configuration examples can be found at the end of the document.

7.3.1 GS 754…-29/42… configuration table

ASCII commands		Available for interface
Output mode		
1	Output cycle approx. 3 sec.	serial and analog
2	Output cycle approx. 1 sec.	serial and analog
3	Output cycle approx. 500 msec.	serial and analog
4	Output cycle approx. 250 msec.	serial and analog
5	Output cycle approx. 100 msec.	serial and analog
7	Max. measurement frequency approx. 20 msec. (default)	serial and analog
Averaging		
M,m	Averaging across the specified output cycle period	serial and analog
A,a	Output of instantaneous value (default)	serial and analog
Number of objects		
Q,q	Single object measurement (default)	serial
W,w	Measurement of 2 objects	serial
E,e	Measurement of 3 objects	serial
Evaluation process		
=	Diameter detection	serial and analog
-	Edge detection (default)	serial and analog
!	Non-continuous objects	serial and analog
?	Homogenous objects (default)	serial and analog
Reset		
R,r	Reset with config. switching output (7,a,-,o,?) Reset with config. teach-input (7,a,-,t,?)	serial and analog
Edge assignment for analog output (single object measurement)		
D,d	Object diameter	analog
$	Edge Center	analog
(	Edge Inside (default)	analog
)	Edge Outside	analog
Changing over teach-input / switching output (PIN 2)		
T,t	Function teach-input	analog
O,o	Function switching output	serial and analog
Level changeover for switching output (PIN 2)		
<	Function standard (default)	serial and analog
>	Function standard inverted	serial and analog
*	Function dark-switching photo electric sensor	serial and analog
#	Function light-switching photo electric sensor	serial and analog

Table 4: Parameterizing commands GS 754…-29/42…

7.3.2 GS 754…-100/42… configuration table

ASCII commands		Available for interface
Output mode		
1	Output cycle approx. 3 sec.	serial, A1, A2
2	Output cycle approx. 1 sec.	serial, A1, A2
3	Output cycle approx. 500 msec.	serial, A1, A2
4	Output cycle approx. 250 msec.	serial, A1, A2
5	Output cycle approx. 100 msec.	serial, A1, A2
7	Max. measurement frequency approx. 20 msec. (default)	serial, A1, A2
Averaging		
M,m	Averaging across the specified output cycle period	serial, A1, A2
A,a	Output of instantaneous value (default)	serial, A1, A2
Number of objects		
Q,q	Single object measurement (default)	serial, A1, A2
W,w	Measurement of 2 objects	serial
E,e	Measurement of 3 objects	serial
Evaluation process		
=	Diameter detection	serial, A1, A2
-	Edge detection (default)	serial, A1, A2
!	Non-continuous objects	serial, A1, A2
?	Homogenous objects (default)	serial, A1, A2
Reset		
R,r	Reset with config. switching output (7,a,-,o,?) Reset with config. teach-input (7,a,-,t,?)	serial, A1, A2
Edge assignment for analog output A1 (single object measurement)		
$	Edge Center	A1
(	Edge Inside (default)	A1
)	Edge Outside	A1
Edge assignment for analog output A2		
	Object diameter (only if diameter detection activ [=])	A2
Activation teach-input		
T,t	activate teach-function (default)	A1, A2
O,o	deactivate teach-function	A1, A2
Level changeover for switching output		
<	Function standard (default)	serial, A1, A2
>	Function standard inverted	serial, A1, A2
*	Function dark-switching photo electric sensor	serial, A1, A2
#	Function light-switching photo electric sensor	serial, A1, A2
Level changeover for analog output A1 and A2		
I,i	current 0 … 20 mA	A1, A2
U,u	voltage 0 … 10 V	A1, A2

Table 5: Parameterizing commands GS 754…-100/42…

8 Precision and Linearity

The maximum theoretical measuring range is 28.6mm (2048 * 14 µm).
The maximum measuring range is dependent on the output mode.

The measurement values of the serial and analog interfaces are linearised.

The sensor makes the measurement values available in the following resolutions, depending on the output mode chosen:

Resolution:

	Output modes 1 ... 5	Output mode 7
Serial interface	0.1 mm (ASCII)	0.014 mm (binary)
Analog interface	0.1 mm (Current/Voltage)	0.014 mm (Current/Voltage)

Table 6: Resolution

Linearity in output modes 1 ... 5:

In output modes 1...5 the measurement values are scaled. These measurement values are scaled to the standard 4...20mA interface via the internal microcontroller. The resulting measurement field for output modes 1...5 is 25.3 mm (1807 * 14 µm).

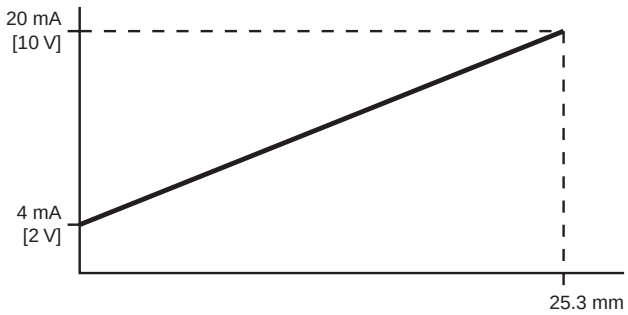


Figure 8.1: linearity in output modes 1 ... 5

Linearity in output mode 7:

In output mode 7 the measurement values are not scaled. Each measurement value is directly output by the internal microcontroller. The resulting measurement field for output mode 7 is 25.3 mm (1807 * 14 µm) and the output current 0...19.1 mA.

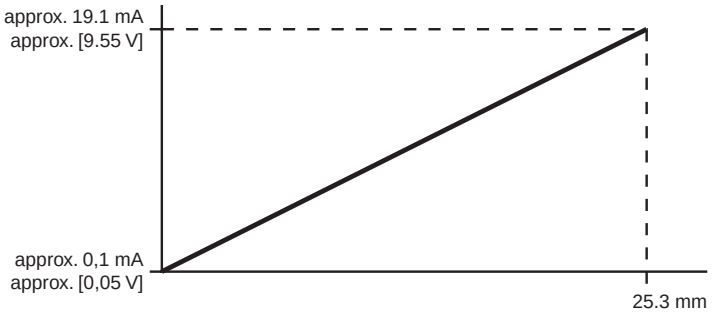


Figure 8.2: linearity in output mode 7

9 Error Messages (interfaces P and M12)

Errors vary depending on the configured measurement, analysis and output variants.

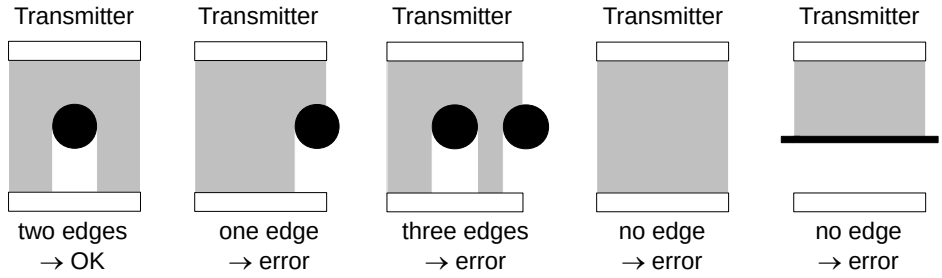
The errors are output at both the P and M12 interfaces.

		Fewer edges than specified		More edges than specified		Light path fully blocked	
		Middle pos.	Dia.	Middle pos.	Dia.	Middle pos.	Dia.
Serial output	**Modes 1 ... 5**	000	000	555	555	999	999
	Mode 7						
Analog current	**Modes 1 ... 5**	3.5 mA		>20 mA		>20 mA	
	Mode 7	0 mA					
Analog voltage	**Modes 1 ... 5**	1.75 V		>10 V		>10 V	
	Mode 7	0 V					
Warning output		High Level (+24 V)		High Level (+24 V)		High Level (+24 V)	

Table 7: Error messages (standard function)

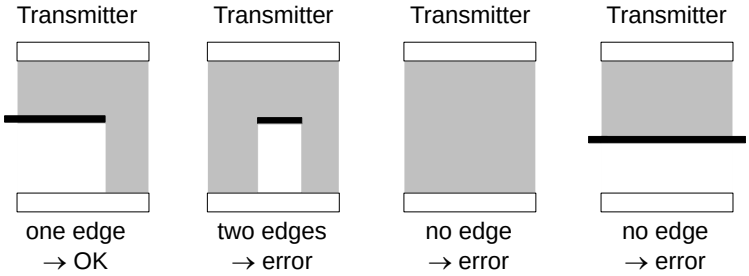
Example of diameter detection:

In this setting the sensor expects two object edges. If more or fewer object edges are detected, an error message is output.



Example of edge detection:

In this setting the sensor expects only one object edge. If more or fewer object edges are detected, an error message is output.



10 Digital Measurement Value Output (P and M12 interfaces)

The measurement value output is dependent on the type of sensor used and the configuration which is set.

There are a number of different output modes available.

These are divided into two primary output variants:

1. Output modes 1, 2, 3, 4, 5:
   The measurement value output is performed at 0.3 Hz, 1 Hz, 2 Hz, 4 Hz or 10 Hz. The measurement values are linearized by the sensor and converted to mm values. Conversion of the pixel data is no longer necessary. The sensor transmits the measurement values to both the P and M12 interfaces. The digital information is, in this case, transmitted in ASCII format and can be read using the terminal program. The resolution is 0.1 mm.
2. Output mode 7:
   The measurement value output is performed at 50 Hz. The sensor transmits the measurement values to both the P and M12 interfaces. The digital information is, in this case, transmitted in binary format and can no longer be read using the terminal program. The resolution is 0.014 mm.

The various output formats are explained on the following pages using examples.

10.1 ASCII format for the P and M12 interfaces

Readable ASCII data are only output via the digital interfaces in output modes 1, 2, 3, 4, 5. The resolution is 0.1 mm.

ASCII commands		Measurement value output in ASCII format
=, q, 5	Diameter detection	Middle-Pos.:125 Diameter:020
-, q, 5	Edge detection	Edge-Pos.:185

Example of diameter detection:

Middle-Pos.: 125 (equivalent to 12.5 mm)
Diameter: 020 (equivalent to 2.0 mm)

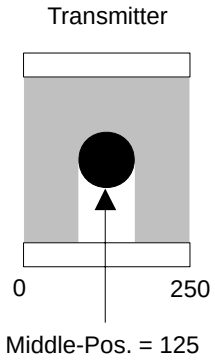


Figure 10.1: Example Diameter detection (ASCII format)

The middle of the object is located at CCD position 12.5 mm.
The diameter of the object is 2.0 mm.

Example of edge detection:

Edge pos.:185 (equivalent to 18.5 mm)

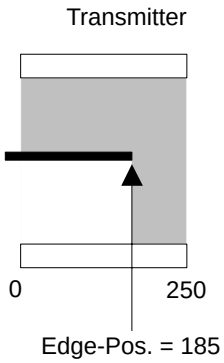


Figure 10.2: Example Edge detection (ASCII format)

The edge of the object is located at CCD position 18.5 mm.

10.2 Binary format for the P and M12 interfaces

Binary data are only output via the digital interfaces in output mode 7. These binary data cannot be displayed by the terminal program.

The resolution is 0.014 mm.

ASCII commands	
=, q, 7	Diameter detection
-, q, 7	Edge detection

Example of diameter detection:

Measurement value output in binary format								
Data						Byte designator		
D_5	D_4	D_3	D_2	D_1	D_0	P_1	P_0	
Middle-Pos. (low byte)						0	0	Byte 0
Middle-Pos. (high byte)						0	1	Byte 1
Diameter (low byte)						1	0	Byte 2
Diameter (high byte)						1	1	Byte 3

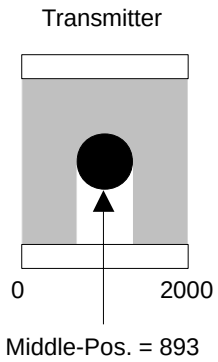


Figure 10.3: Example Diameter detection (binary format)

The middle of the object is located at CCD pixel 893.

The diameter of the object is 143 pixels.

Measurement value output in binary format									
Data						Byte designator			
D_5	D_4	D_3	D_2	D_1	D_0	P_1	P_0		
1	1	1	1	0	1	0	0	Byte 0	001101111101 Value: 893 (893 x 0.014 mm = 12.5 mm)
0	0	1	1	0	1	0	1	Byte 1	
0	0	1	1	1	1	1	0	Byte 2	000010001111 Value: 143 (143 x 0.014 mm = 2.0 mm)
0	0	0	0	1	0	1	1	Byte 3	

Example of edge detection:

Measurement value output in binary format								
Data						Byte designator		
D_5	D_4	D_3	D_2	D_1	D_0	P_1	P_0	
Edge-Pos. (low byte)						0	0	Byte 0
Edge-Pos. (high byte)						0	1	Byte 1

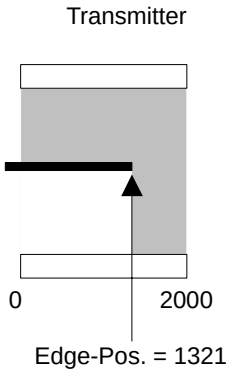


Figure 10.4: Example Edge detection (binary format)

The edge of the object is located at CCD pixel 1321.

Measurement value output in binary format									
Data						Byte designator			
D_5	D_4	D_3	D_2	D_1	D_0	P_1	P_0		
1	0	1	0	0	1	0	0	Byte 0	010100101001 Value: 1321 (1321 x 0.014 mm = 18.5 mm)
0	1	0	1	0	0	0	1	Byte 1	

11 Analog measurement value output (interface M12)

The analog current and voltage values are available only at the M12 interface. These values vary depending on the type used and on the configuration. The measuring range is changed in output modes 1...5 and in output mode 7 (see Chapter 8).

	Output modes 1 ... 5	Output mode 7
Analog current	0.063 mA / 0.1 mm	0.01057 mA / 0.014 mm
Analog voltage	0.0316 V / 0.1 mm	0.005285 V / 0.014 mm

Table 8: Data Formats for the Analog Interface M12

12 Typical Areas of Application

12.1 Diameter Detection

Depending on which interface is used, data for up to three objects can be output. Data for more than one object can only be transmitted via the serial interface. The analog value is always based on the edge or diameter information.

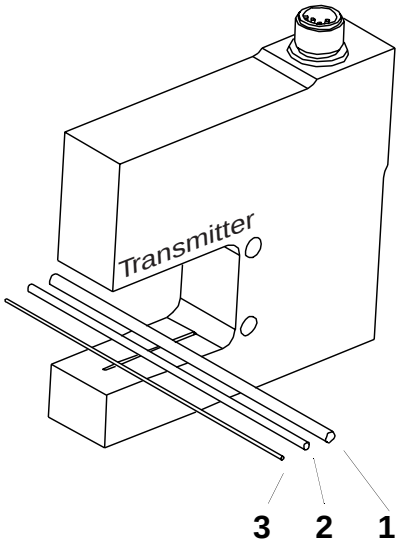


Figure 12.1: Sample Application Diameter Detection

12.1.1 ASCII display via RS232 (P and M12 interfaces)

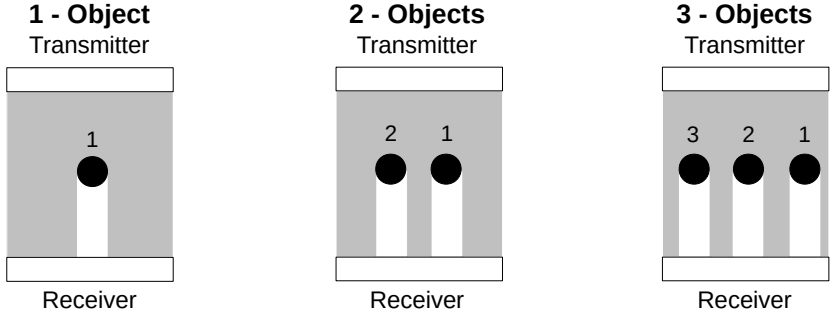
Parameter		ASCII output data via S1 and S2
Q,q	Single object detection	Middlepos. : xxx Diameter: xxx
W,w	Detection of two objects	Middlepos. : xxx Diameter: xxx Middlepos. : xxx Diameter: xxx
E,e	Detection of three objects	Middlepos. : xxx Diameter: xxx Middlepos. : xxx Diameter: xxx Middlepos. : xxx Diameter: xxx

Table 9: ASCII representation, output modes 1 ... 5

Example for xxx:123 (12.3 mm)

12.1.2 Binary display via RS232 (P and M12 interfaces)

Due to the fast output of measurement values, only data for single-object detection can be output in this output mode. The measurement values cannot be displayed on the screen (see Chapter 10.2).



13 Edge Detection and Height Verification

With this measurement, the sensor expects only one edge within the measurement field. An error message results if more or fewer edges are detected by the system.

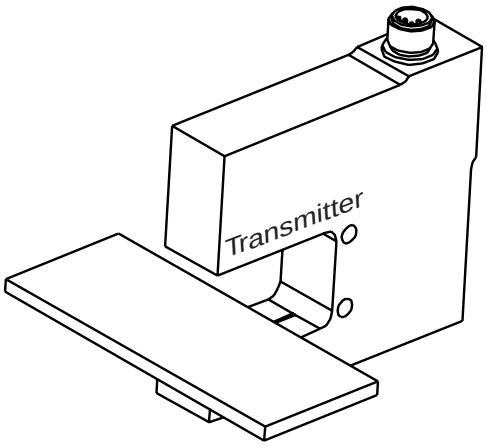
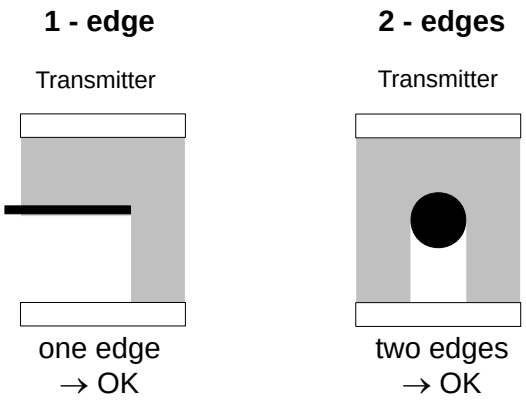


Figure 13.1: Edge Detection and Height Verification



Various configurations are possible with this measurement.
The following only applies to devices with an analog interface:

1. Linear edge measurement over the entire measuring range (see chapter 8)
2. Teach-in edge measurement with 5V-output at teaching point

These functions are described in the following.

14 Special Configurations

14.1 Teachable single-object- and edge-measurement for devices with analog output

Connection pin 2 of devices with analog output can be configured as a warning output or as a teaching input. If pin 2 is has been configured as a teaching input, edge-adjustment is possible here at 5 V. In this way, any given point of the measurement field can be assigned the output value 5 V. It is no longer necessary to adjust the process software.

14.1.1 Teach-in in the middle of the measurement field

The measurement value is output linearized. As a result, the entire measurement field is available for the measurement.

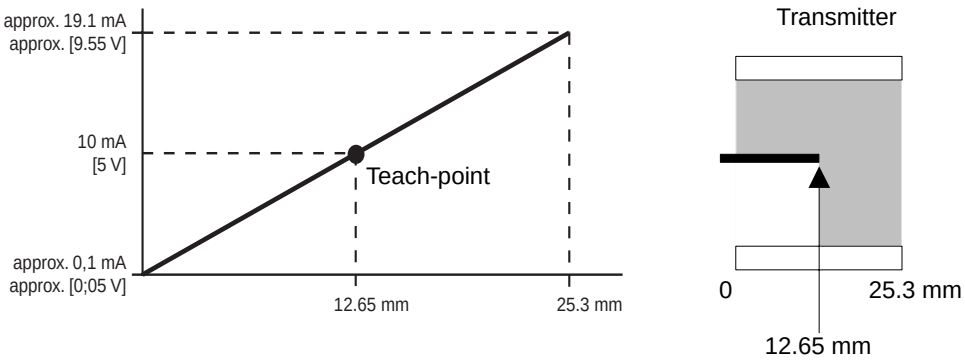


Figure 14.1: Teach-in (edge in the middle of the measurement field)

14.1.2 Teach-in at the end of the measurement field

The measurement value is output linearized. The measurement field range is restricted. A change in measurement value no longer occurs at the beginning of the measurement field.

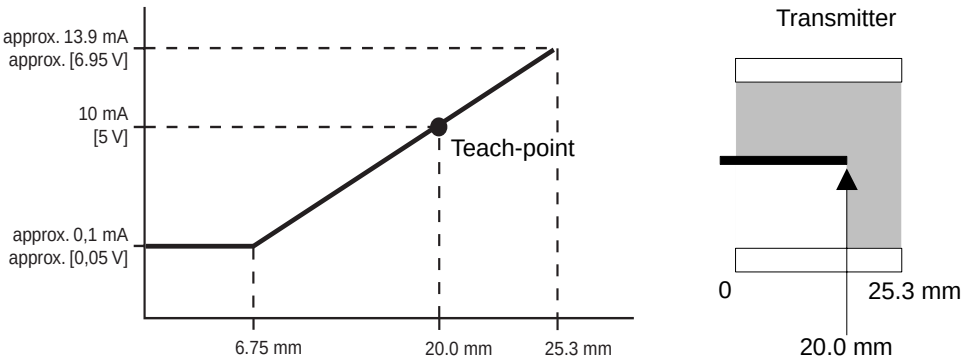


Figure 14.2: Teach-in (edge at the end of the measurement field)

14.1.3 Teach-in at the start of the measurement field

The measurement value is output linearized. The measurement field range is restricted. A change in measurement value no longer occurs at the end of the measurement field.

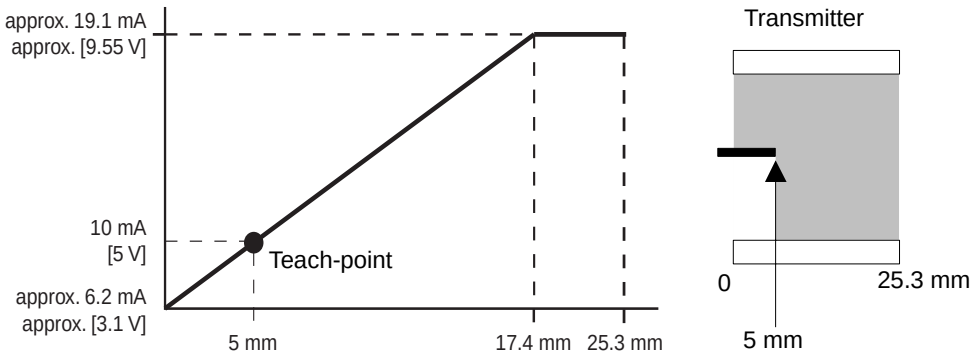
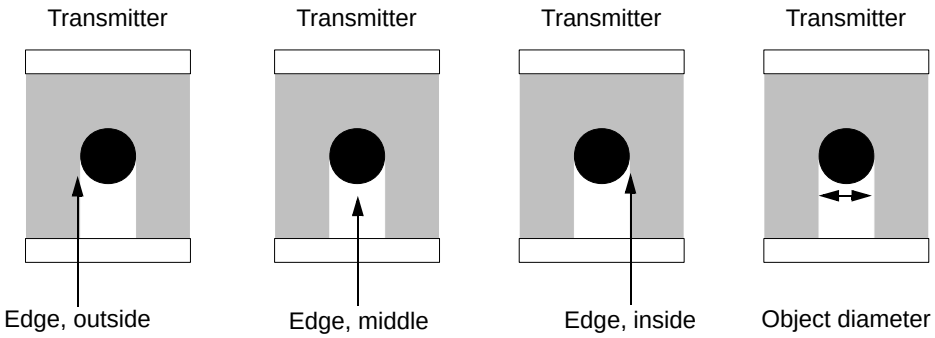


Figure 14.3: Teach-in (edge at the start of the measurement field)

14.2 Changeover of the edge assignment with single-object measurement

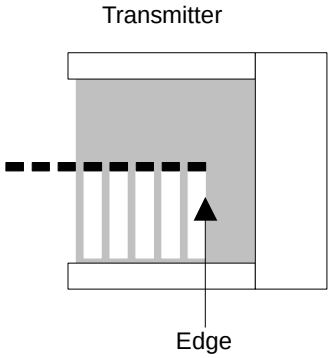
Only one piece of edge information can be output via the analog interface. With single-object measurement, the sensor sees two edges. Using these edges, information such as object diameter and object middle can be calculated. These edge assignments can be configured.



14.3 Edge measurement with non-continuous objects

With this function, net-like objects, e.g. fabric, can be detected.

Here, the first edge of the object is output as the measurement value. All other edges are suppressed. In this configuration the number of edges is not checked. Error messages are not output.



14.4 Level changeover for the switching output PIN 2

When PIN 2 is configured as a switching output, various logical functions can be assigned to this switching output. A distinction is made between standard and photo-electric-sensor functions.

		Switching output Pin 2		
Configuration	Function	Object partially in the measurement field	Object completely in the measurement field	Object not in the measurement field
<	Standard	high	low	high
>	Standard inverted	low	high	low
*	Dark switching	high	high	low
#	Light switching	low	low	high

Table 10: Level changeover for the switching output PIN 2

14.4.1 Function standard

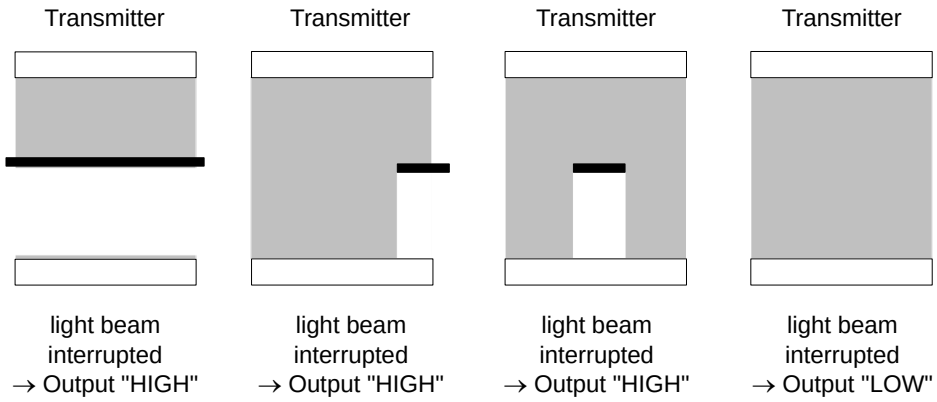
The number of object edges is monitored and output as described in chapter 9.

14.4.2 Function standard inverted

The number of object edges is monitored and output inverted as described in chapter 9.

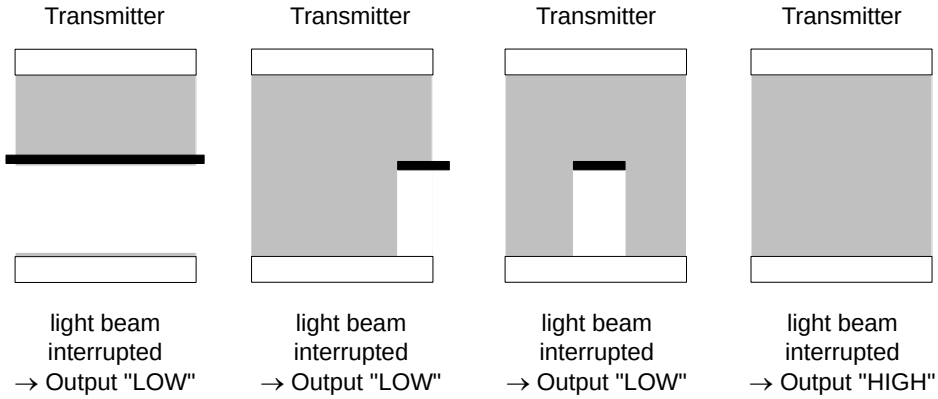
14.4.3 Function photo-electric-sensor dark switching

When configured for the photo-electric-sensor function, the number of edges is not monitored. The entire measuring range is analysed as a throughbeam photo electric sensor. The switching output functions on a dark-switching basis.



14.4.4 Function photo-electric-sensor light switching

With photo electric sensor level, the entire measurement range is analysed as a throughbeam photo electric sensor. The switching output functions on a light-switching basis.



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D 133/02 – 05/00 Artikel-Nr. 500 32 298