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Description B

Infra-red edge sensor
FR 5001 / FR 5021

en

Software: **ZC 3202-0001F_ZB**
ZC 3202-8001F_ZD

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1. General instructions

1.1 Explanation of symbols

➜ jobs to be performed

❙❙ important information and instructions

1.2 Operating manual

Please keep the above in a safe place and make accessible to personnel at all times.

The manual is part of the package supplied and should be read carefully prior to assembly, operation and maintenance.

All jobs listed in this description should be performed by qualified or suitably instructed personnel only.

1.3 Safety instructions



Never touch the edges of running webs.

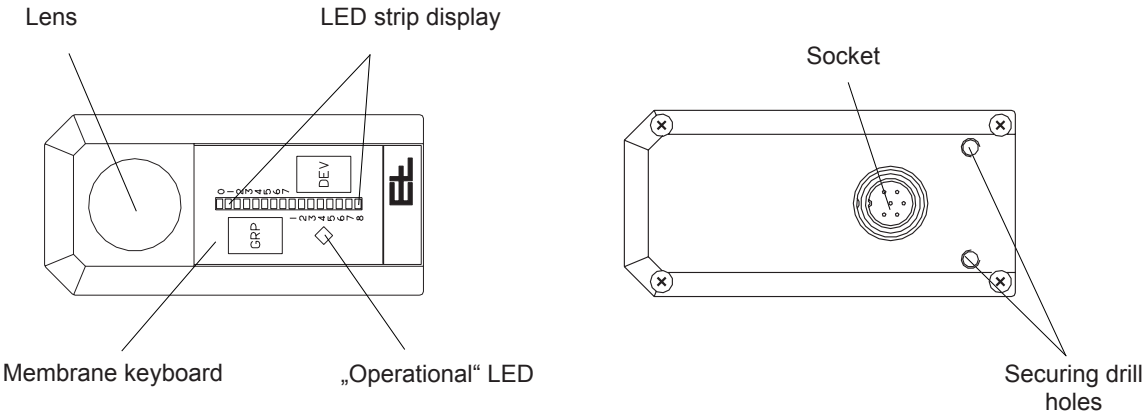
2. Function

2.1 Intended usage

The E+L infra-red edge sensor FR 5001/FR 5021 scans the edges of opaque materials (threads/stripes/mesh) such as paper, carpets or tightly knit textiles without touching.

The Infra-red edge sensor should only be used
- in perfect technical condition,
- for use as intended,
- in accordance with the operating instructions.

2.2 Design



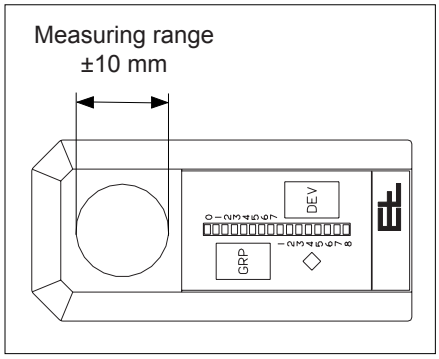
2.3 Operating principle

The edge sensor operates on a light-sensitive barrier principle and uses an infra-red LED as light source.

This infra-red LED projects light onto the micro-prism reflector located behind the web via a mirror. The reflector reflects back the light according to a retroreflecting principle, depending on how far the web covers the measuring range. The reflected light is reflected onto the CCD array via the telecentric optical unit. The CCD elements can cope with a higher signal level when thus illuminated.

The signal is converted in the microprocessor into an output value proportional to the position of the web edge and conveyed to the CAN bus. This output value can be used to e.g. trigger a digital web controller. At the same time, the current web position in the measuring range is indicated on the LED strip display.

If the LED beside the strip of LEDs lights up green, the edge sensor is signalling that it is operational.



Edge sensor measuring range

Edge sensor measuring range

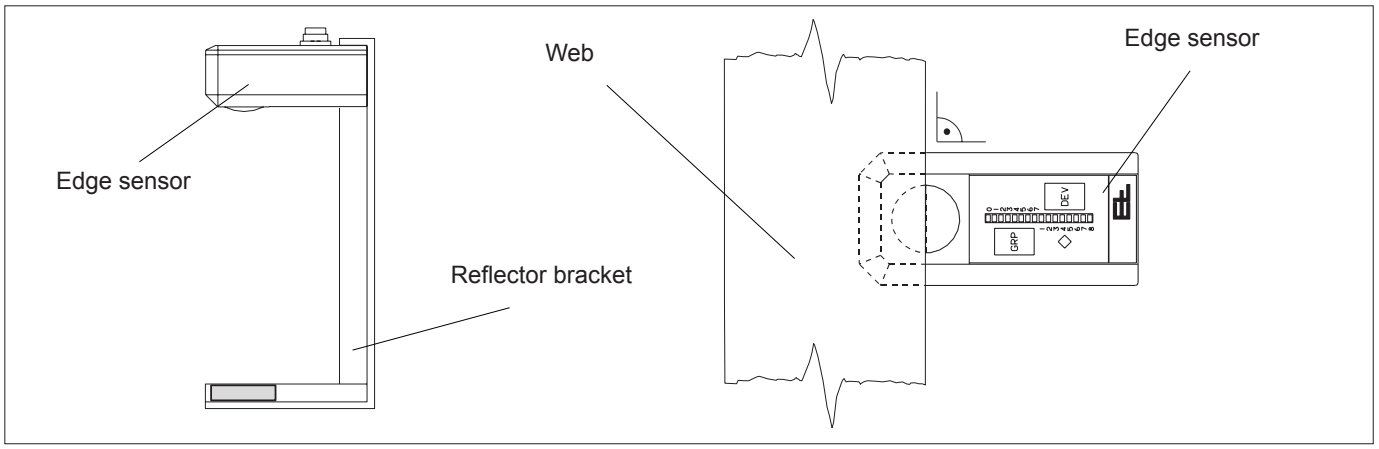
The edge sensor measuring range is ±10 mm and has a resolution of 512. The edge sensor outputs the web edge position value for this range.

3. Assembly

3.1 Edge sensor with reflector bracket

➜ Mount the edge sensor on the first third of the web guider exit path (see actuator description).

The web must run at a 90° angle to the edge sensor (see fig. below).

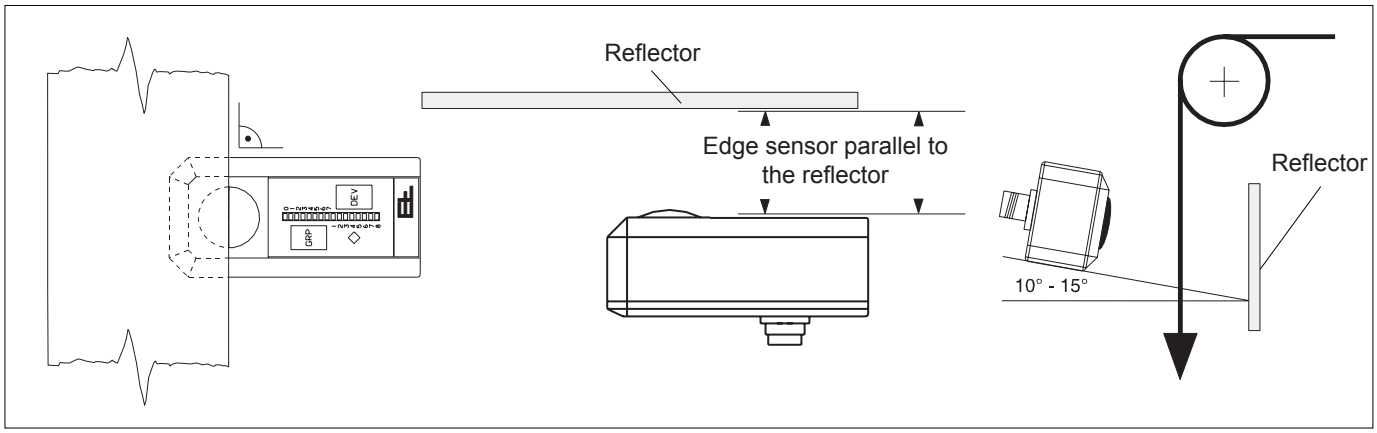


The web height during travel may change to any degree with edge sensor FR 5001 but must not however touch the edge sensor or reflector.
With edge sensor FR 5021 the web should be 140 -160 mm (as measured from the lens) away from it. At a distance of 0 - 140 mm, reliable web edge (narrow thread) detection is limited.

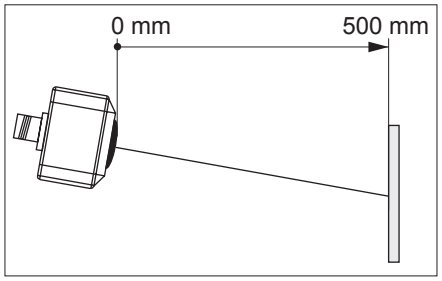
3.2 Separate edge sensor and reflector

➜ Mount the edge sensor and reflector on the first third of the web guider exit path (see actuator description).

Mount the edge sensor so that the web runs at a 90° angle to the edge sensor. Mount the reflector parallel to the edge sensor. To avoid any self reflection caused by the web, the edge sensor must be tilted towards the reflector by 10° to 15°. The web must run parallel to the reflector .



3.2.1 FR 5001 mounting clearances

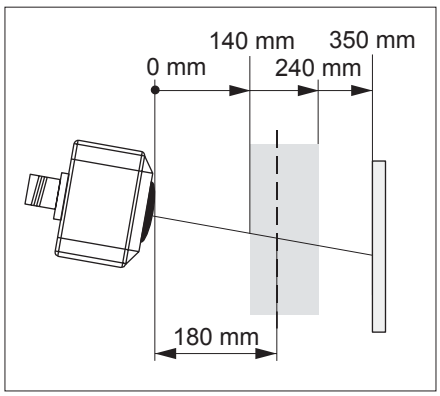


Flat, homogenous web edge

The distance between the edge sensor lens and the reflector may be 20 to 500 mm.

The height at which the web travels between the edge sensor and reflector may vary to any extent but must not touch the edge sensor or reflector.

3.2.2 FR 5021 mounting clearances

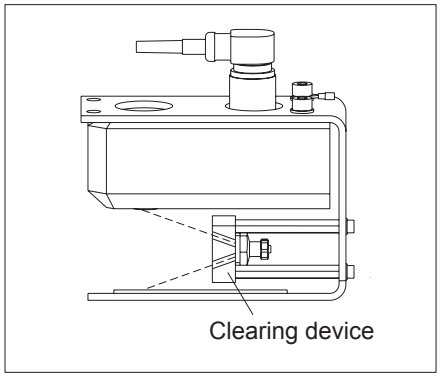


Thread(stripe) or mesh-type web edge

The distance between the edge sensor lens and the reflector must be 300 to 350 mm. The reflector must **not** be mounted in the 0 - 300 mm area. This dimensional restriction does not apply to permanently mounted E+L reflector brackets (section 3.1).

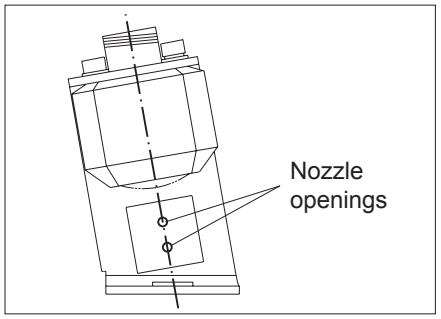
The optimum web position is a clearance of 180 mm. The web height during travel may change to any degree in the shaded grey area (140 - 240 mm). The web should not be located outwith this range as otherwise reliable web edge (narrow thread) detection is limited.

3.3 Clearing device (optional)



The optional clearing device must be connected to the customer's compressed air supply using a service unit with a submicron filter. The service unit must meet the following conditions:

- Oil-free
- Operating pressure 2 bar
- Pore size < 5µm



If the clearing device is mounted at the customer, the nozzle openings must be aligned with the sensor and reflector.

4. Installation

➜ Protect signal leads and run apart from heavy current-carrying leads.

➜ Pull off the union nut on the sensor cable. These ensure that the edge sensor housing and the signal lead insulation are conductively connected.

➜ Secure the signal lead with a cable clamp.

If the web is subject to a high degree of static charging we recommend you link the edge sensor housing to the machine frame.

5. Commissioning

On compact units, **no** adjustment to the edge sensor is needed on first-time commissioning.

If you have ordered these control components separately and wish to construct your own operable control loop or if edge sensors are supplied but not pre-mounted you must perform the steps described in section 5.1 and 5.2.

5.1 Setting group and device numbers

Edge sensor on right in web direction of travel, unit number **„1“**

Edge sensor on left in web direction of travel, unit number **„2“**

Direction of web travel = Processing direction for the entire system

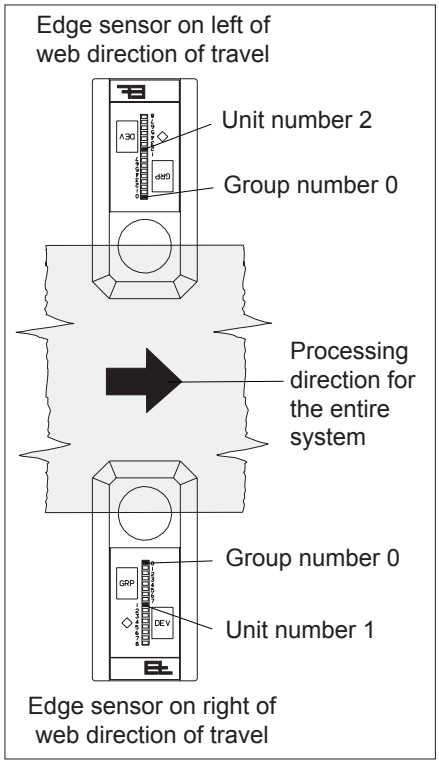
The group number depends on the digital controller
(identical to the group number of the web guider to which it belongs, see block diagram).



➜ Set the controller to "center position" mode.

➜ Press the "GRP" and "DEV" buttons on the edge sensor at the same time. After about 6 seconds the group and unit numbers on the LED display will start to flash. After approx. a further 20 seconds the edge sensor switches into setup mode. The LEDs stop flashing and stay on permanently and the group number (GRP button) and unit number (DEV) can be changed.

If the „GRP“ and „DEV“ keys are not pressed for longer than approx. 20 seconds. the group and device numbers are stored and setup mode quit again.



Example: setting the group and unit numbers

5.2 Calibrating the edge sensor

Please observe the following when calibrating the edge sensor:

- the sensor must be mounted mechanically correctly,
- clean the lens and reflector with a soft dry cloth,
- no web or reflector joints should be located in the sensor visual range .

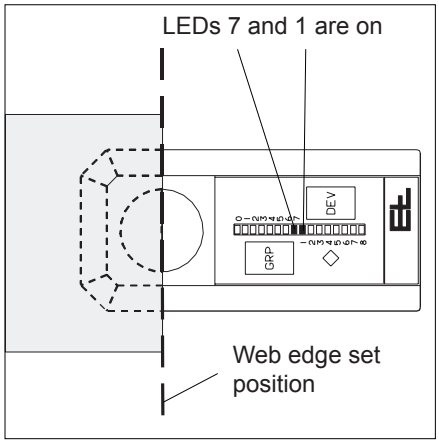
➜ Enter the edge sensor group and device numbers on the command station.

➜ Select parameter 3 and enter value 10.

➜ Select parameter 4. The edge sensor calibrating process is initiated by changing parameters.

During calibration, the yellow strip LEDs 0-7 and 1-8 will flash in alternation and the "Operational" LED will light up red. When calibration is finished the "Operational" LED will light up green and the yellow strip LEDs 0-7 will go on. If the "Operational" LED lights up red there must have been a error during calibration, repeat calibration and check the error message in parameter ..9. .

6. Operation



Positioning the edge sensor

With the help of the row of LEDs on the receiver, the edge sensor can be manually positioned at the web edge.

➜ Set the web offset on the digital controller to „0“.

➜ Position the edge sensor manually:

If the web is in its set position, locate the edge sensor on the web so that only the LEDs in the middle, 1 and 7, only light up.

If the web is not in its set position or no web is available, locate the edge sensor so that middle of the scanning range is on the web edge set position.

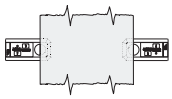
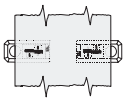
7. Parameters

In setup mode setup parameters can be displayed and to a certain extent, changed. To enter setup mode from the edge sensor, you will need a command device DO .... or RT ....

7.1 Parameter list

The parameter numbers are listed in the **No.** field of the table, in the **Name** field the abbreviation. The **Default** field indicates the standard settings, **Min.** and **Max.** are the permissible limit values respectively. The unit is indicated in the **Unit** field. The **Description** explains the parameter function. If a dot (•) comes after the parameter number this indicates that it is a display parameter, the value of which cannot be changed.

The parameter list applies for the CAN data protocols **PR 1** and **PR 2**. The fields indicate whether each parameter is used in the related CAN data protocols. You can see which CAN data protocol is used from the number in parameter "..4. FR 5001".

No.	Name	Default	Min	Max	Unit	PR 1	PR 2	Description
..0.	edit device	X.X	X.1	X.F	hex	X	X	Device number (see block diagram)
..1.	edit group	X.X	0.X	7.X	hex	X	X	Group number (see block diagram)
..2.	reset settings	0	0	2	-	X	X	Works setting 0 = no function 1 = E+L basic settings 2 = internal value specification (default)
..3.	start service	0	0	199	-	X	X	Starting a function 0 = no function 1 = reset 2 = save parameters 10 = perform sensor calibration
..4. •	FR 5001	1.1	1.0	1.1	-	X	-	Software version
..4. •	FR 5001	4.3	4.0	4.3	-	-	X	Software version
..5.	mounting norm/rev	0	0	1	-	X	X	Edge sensor mounting "0" = standard  "1" = scanning direction turned (edge sensor turned by 180°) 
..6. •	resolution abs.	1024	1024	1024	-	X	X	Available sensor measuring range in pixels
..7. •	range +/-	10.00	10.00	10.00	mm	X	X	Available sensor measuring range in mm
..8. •	position	0	-10.00	10.00	mm	X	X	Actual edge position in mm

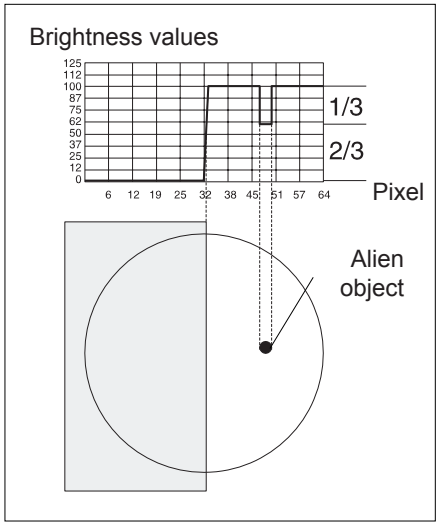
No.	Name	De-fault	Min	Max	Unit	PR 1	PR 2	Description
..9. •	error code	0	0	299	-	X	X	Error messages "..0" = no error "..1" = lens or reflector damaged or soiled "..2" = edge sensor under-exposed (lens or reflector soiled) "..3" = edge sensor over-exposed (direct sunlight on lens) "..4" = CCD chip error "..5" = operating temperature exceeded or not attained (temperature < 0 °C or > 60 °C) Calibration errors: ".4." = dark threshold too high (send in sensor) ".5." = white threshold too low (repeat calibration) ".6." = error during saving (send in sensor) “1..” = sensor not calibrated
.1.0.	display brightness	8	0	15	-	X	X	Display brightness 0 = minimum brightness 15 = maximum brightness
.1.1.	display mode	0	0	1	-	X	X	Display mode 0 = normal display (web edge is displayed as deviation from the sensor center) 1 = web edge is displayed as illuminated band
.1.2. •	temperature	0	-60	150	-	X	X	Edge sensor interior temperature in °C
.1.3. •	transm. brightness	0	0	255	-	X	X	Transmitter brightness 0 = maximum brightness 255 = minimum brightness
.1.4. •	IR LED on/off	0	0	1	-	X	X	Infra-red diode 0 = ON 1 = OFF
.1.5.	position norm/rev	0	0	1	-	X	X	Reverse sensor signal 0 = normal 1 = reversed
.1.6. •	maximum pixel	0	0	255	-	X	X	Maximum brightness value
.1.7.	thread detec-tion	0	0	1	-	X	X	Infra-red edge sensor FR 5001/FR 5021 0 = Flat, homogenous web edge 1 = Thread(stripe) or mesh-type web edge
.1.8.	diff. - limit	30	10	100	-	X	X	Sensitivity of thread detection 10 = sensitive 100 = insensitive **Note!** High sensitivity level also means a high level of sensitivity to soiling. Dirt deposits are detected as a web edge.
.1.9.	invalid state flag	0	0	1	-	X	X	Web guider blocking 0 = blocking OFF 1 = blocking ON. The web guider is blocked if there is no web edge in the scanning range. (invalid state signal is emitted by the CAN)
.2.0.	mount position	0	-3276.8	3276.7	mm	-	X	Distance between sensor and reference point
.2.1.	use supportadr	0.0	0.0	F.F	hex	-	X	Entry for the support address The position of the support is added to the sensor signal and the value sent over the CAN bus.
.2.2.	invert support pos	0	0	1	-	-	X	Entry for the support address The position of the support is inverted and added to the sensor signal, and the value sent over the CAN bus.

No.	Name	De-fault	Min	Max	Unit	PR 1	PR 2	Description
.2.3.	disable expos ctrl	0	0	1	-	X	X	Deactivate the exposure controller If this value is set there is no automatic exposure control. This parameter will not be saved and must be set if required.

7.2 Error messages

. .9.

Error code (parameter 9)
Any edge sensor errors that may occur are displayed in parameter 9. The main error messages are listed below.

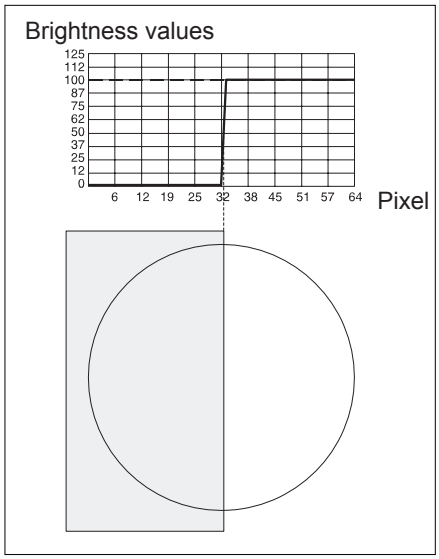


Error message 1

Error message: ..1 "Lens/reflector soiled"
An alien object (e.g. grain of sand, thread, plastic splinter etc.) located in the edge sensor scanning range in addition to the web edge is represented as a dark spot on the scan. If the degree of brightness is less than 2/3 of the total brightness (<67 brightness value) and brightness contrast exceeds a width of more than 3 pixels, a "..1" error shall be emitted.

What to do: clean the edge sensor lens and reflector.

Error message ..1 has no function for edge sensor FR 5021.



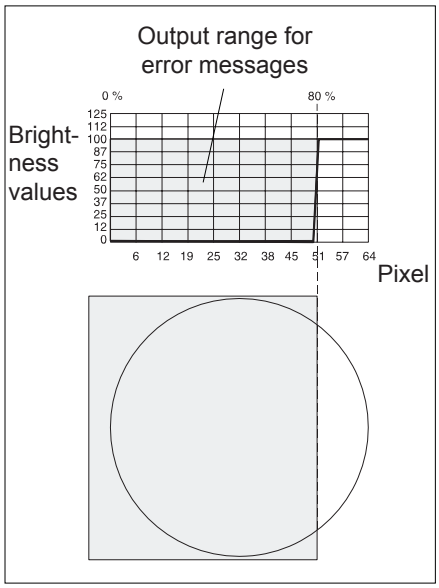
Error message 2 and 3

Error message: ..2 "Edge sensor under-exposed"
The transmitter brightness is regulated so that the receiver elements that are not covered by the web reach an approx. brightness value of 100. If a brightness value of 100 (parameter 16) given maximum transmitter brightness (parameter 13 = 0) is not achieved, error "..2" is output. Every second LED on the illuminated LED band flashes.

What to do: clean the edge sensor lens and reflector.

Error message: ..3 "Edge sensor over-exposed"
If a brightness value of 100 (parameter 16) is exceeded given minimum transmitter brightness (parameter 13 = 255), error "..3" is output. Every second LED on the illuminated LED band flashes.

What to do: shield the edge sensor from external light (e.g. sunlight, artificial lights).



Output range for error messages

The following applies to all error messages:

For error messages to be output, error 5 s must be available and the web edge positioned within a range of 0 % to 80 % of the sensor measuring area.

8. Maintenance

Maintenance work should only be performed when the processing machine is switched off.

➜ Depending on the ambient conditions, clean the lens and reflector regularly with a dry or damp cloth.

➜ Damaged reflectors must be replaced.

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9. Technical data

Operating voltage Nominal value Nominal range (incl. residual ripple)	 24 VDC 20 - 30 V DC
Current input	approx. 80 mA
Scanning frequency	200 Hz
Measuring range	±10 mm
Measuring range resolution	0,02 mm (64 pixels x 16 subpixels)
Fabric and stripe thickness FR 5001 FR 5021	 - min. 0,2 mm
Ambient temperature	+10 °C to +50 °C
Storage temperature	-20 °C to +80 °C
Cable length	max. 8 m
Reflector to edge sensor distance FR 5001 FR 5021	 20 - 500 mm 300 - 350 mm
Protection class	max. IP 65 with suitable connector inserted
Weight	ca. 300 g
Dimensions	see attached dimensioned drawing
Operating pressure clearing device	2 bar
Pore size	<5 µm

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