More cells, fewer costs

Customised automation solutions
for the solar industry

Our innovations for your efficiency

Improve your competitiveness with automation solutions from SensoPart

We develop and produce high-quality sensor products for the solar industry and other industrial sectors at our sites in Germany.

Innovative, flexible and practical – that's SensoPart. As a producer of high-quality sensors and systems for factory automation we know exactly what demands industry faces and have close personal collaborations with our customers. We are thus able to offer customised solutions that have successfully proven themselves on the market and in practice.

For the solar industry, SensoPart combines its competence in automation with system-level expertise in photovoltaic applications. Offering innovative and dedicated products and services to the industry, we aim to remain and become the partner of choice for sensing during handling in cell and module production. Dedicated solutions have been developed for both kinds of solar cells: for crystalline silicon-based as well as for thin-film photovoltaics.

For these applications, SensoPart offers a wide portfolio of products, ranging from proximity switches to powerful vision solutions. All our products share the same design objectives of providing efficient and user-friendly operation as well as maximum reliability and precision. We provide you with the innovations you need to be competitive in the highly dynamic photovoltaics market.

SensoPart in overview

SensoPart Industriesensorik is a medium-sized German producer of optoelectronic sensors. We are represented worldwide with subsidiaries in Europe, the USA and Asia as well as with sales partners in 40 countries on 5 continents.

We take environmental protection very seriously: solar collectors on the roof of our building in Gottenheim generate more electricity than is required by the works.

CONTENTS

Quality, step-by-step

100 % inspection, from blank wafers to solar modules

The production of silicon cells and modules involves various handling and inspection steps. SensoPart provides a portfolio of tailored solutions, ranging from dedicated vision sensors for easy integration of flexible smart cameras to high-performance PC-based cell inspection. Depending on the machine concept customers may choose the most suitable product – always exploiting the reliability of the largely field-proven algorithms.

Overview: solar applications and corresponding SensoPart solutions

| Application	Product/Solution
Presence detection Front-edge detection Checking for protrusions Stack height monitoring	FT 10 proximity switch, FT 50-RLA analogue distance sensor
Position detection	VISOR® vision sensors, PC-based Solar Cell Inspection
Chip & hole detection	VISOR® vision sensors
Double-layer detection	FMS 30 fibre-optic amplifiers, VISOR® vision sensors
Fragment detection	VISOR® vision sensors
Busbar detection	VISOR® vision sensors, PC-based Solar Cell Inspection
Cell analysis & measuring Print alignment Crack detection	PC-based Solar Cell Inspection,
Colour deviations	VISOR® vision sensors, Eyesight vision system
Electrical tests Stringing	PC-based Solar String Inspection, VISOR® vision sensors

Presence detection

Checking presence, front-edge detection and stack height monitoring

The presence of wafers and wafer boxes must be registered at numerous points during the process. Laser proximity switches from SensoPart are ideal here because of their precise light spot geometry and their high cycle frequency. The sub-miniature sensors of the FT 10 series offer trouble-free integration even when very little installation space is available. All sensors have an enclosure rating of IP 67 and can therefore be used in wet areas.
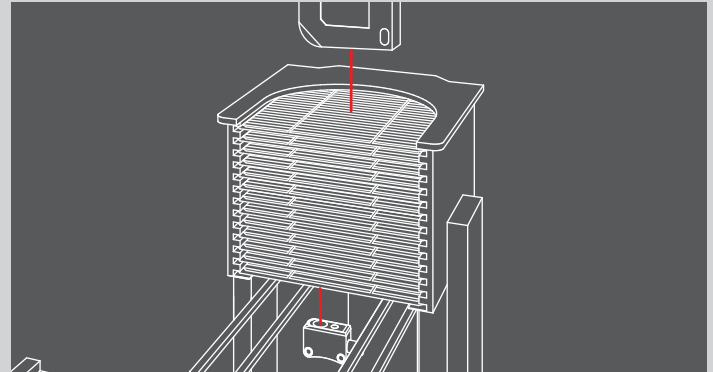

Checking presence:
An FT 10-RLH sub-miniature scanner with background suppression detects the lowest wafer in the cassette. At the same time, an FT 50-RLA analogue laser distance sensor checks slot occupation from above.
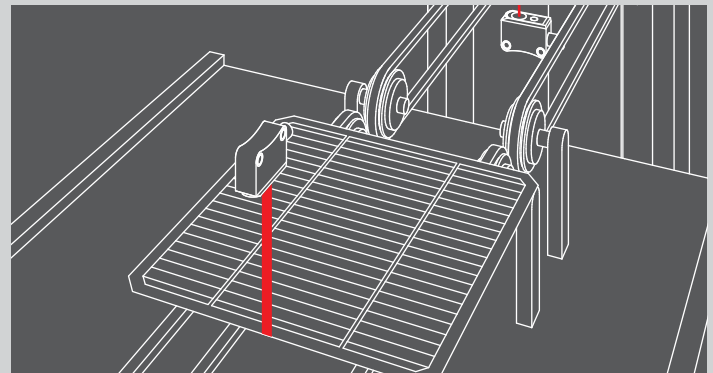
Front-edge detection:
An FT 10-RLHR sub-miniature scanner with background suppression and a broad laser beam (light spot is approx. 1 x 5 mm²) detects the wafer edge precisely and reliably even if there are chips.
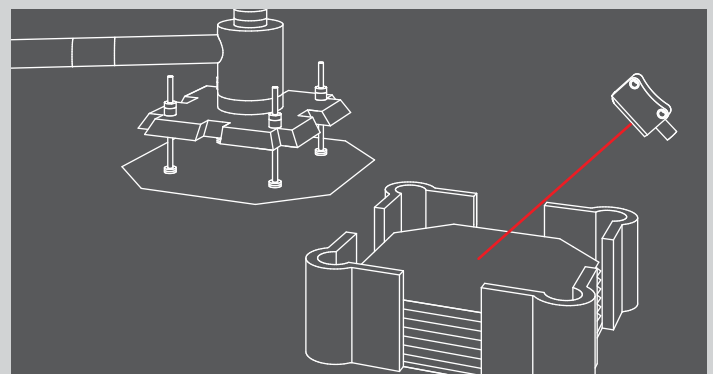
Stack height monitoring:
The FT 10 analogue laser distance sensor measures the filling height of the wafer box so that the gripper can accurately pick up the uppermost wafer.

Position detection

Precise positioning and breakage detection during running operation

VISOR® HIGHLIGHTS

- The only dedicated vision sensor for handling in the solar sector

- All-in-one solution: camera, signal processor, interfaces and illumination in a single compact housing

- Low space requirement: operating distance from 360 mm

- Cost efficient integrated illumination operating in daylight

- No backlight required

- Short cycle time from 60 ms

- Reliable detection even against structured backgrounds, conveyor belts can be blanked out

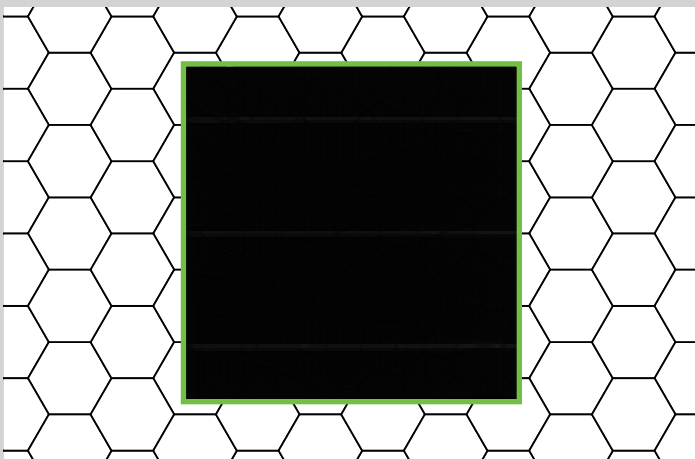- Very easy configuration without image processing knowledge

As an application-specific pre-configured all-in-one solution, the VISOR® Solar is very easily integrated in existing production lines.
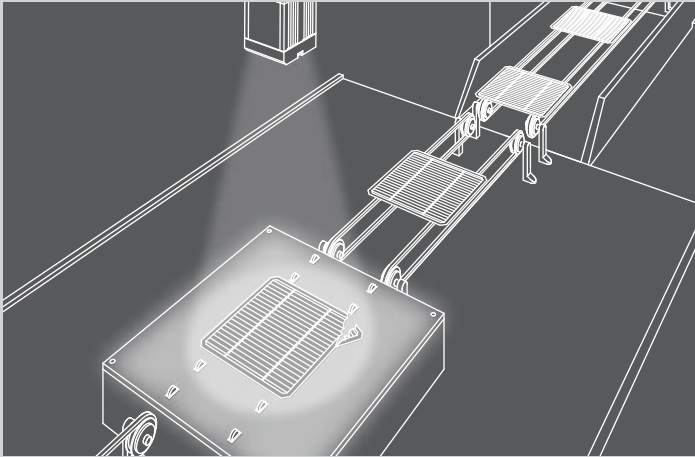
Highly precise position detection:
The VISOR® V10 Solar determines the position of every solar cell with an accuracy of
±50 µm and a reproducibility of ±1 µm.

The wafer position is reliably detected even under the most difficult conditions, such
as on the metal conveyor belt in a furnace.

The precise handling of wafers or cells is necessary at many points during the production process of solar cells. This requires accurate knowledge of their particular positions. The VISOR® Solar vision sensor has been specially designed for this task: it detects the wafer position to an accuracy of ± 50 µm and, in the same step, registers any damage (see P. 8). The precise position of the busbars, required for cell alignment in stringers and for electrical measurements, can also be detected with the VISOR®.

The VISOR® is an application-specific all-in-one solution – the camera, signal processor, interfaces and illumination are all integrated in a single compact housing. The vision sensor can thus be integrated in existing lines as easily as a photoelectric switch, and users can also set it up with a few mouse clicks without any previous knowledge of image processing. The very powerful PC-based Solar Cell Inspection is also available for special functions (see P. 12).

Accuracy	SensoPart Solution	Cycle time
+/-50 µm	VISOR®	≥ 60 ms
+/-20 µm*	Solar Cell Inspection (PC-based Software)	≥ 30 ms*

* In combination with commercial GigE cameras

Chip & hole detection

Preventing breakages by means of the early detection of defects
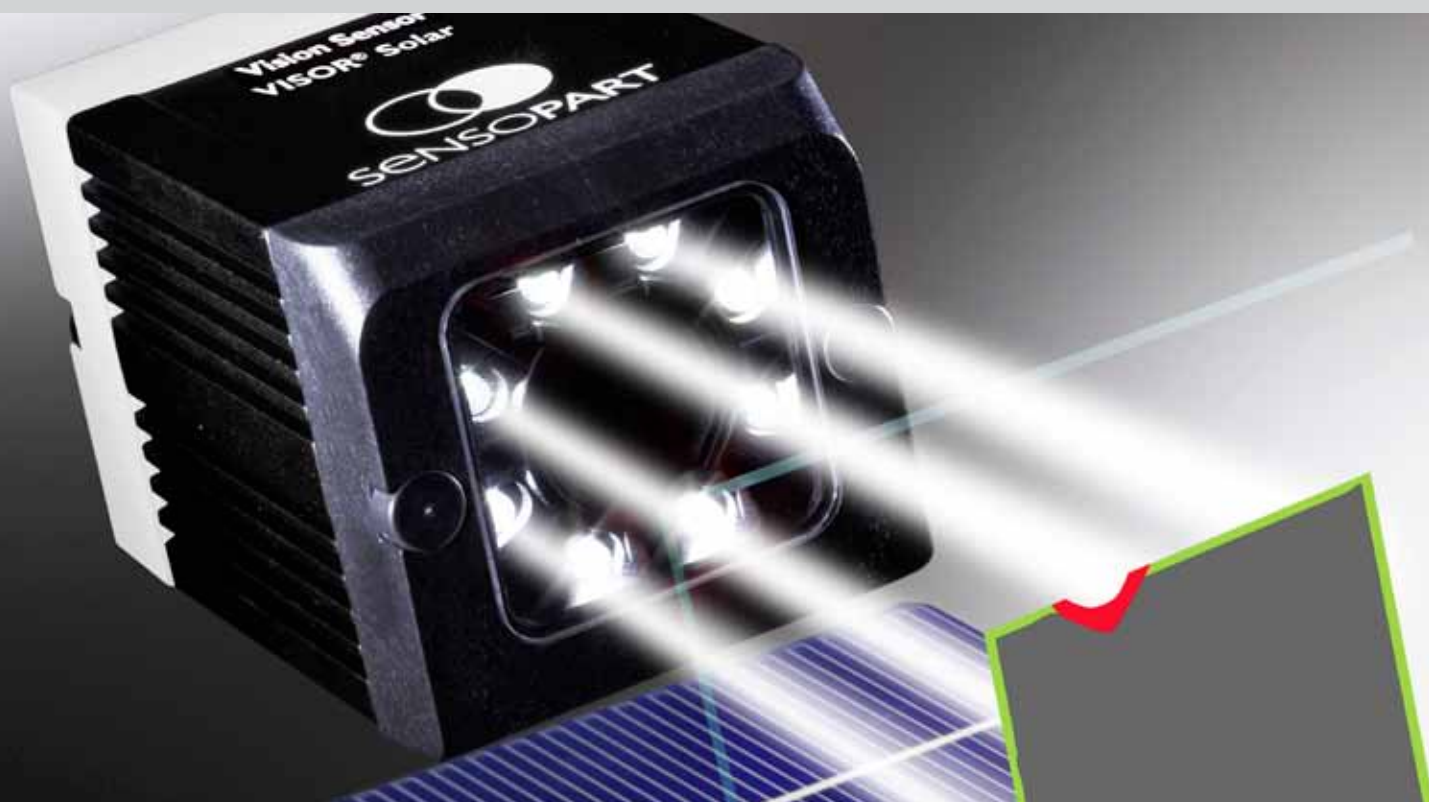
Silicon wafers are brittle and thus extremely liable to break – it is impossible to entirely prevent damage such as chips even with very careful transport and handling. It is important to detect such damage immediately, before the wafer breaks completely and damages even more material. This prevents the contamination of plants and the resultant costly machine downtimes.

The VISOR® very reliably detects even slight edge and surface defects whilst determining the position – so the affected wafer or cell can be removed immediately. Thanks to integrated LED illumination chips can be detected using a cost-efficient integrated illumination.
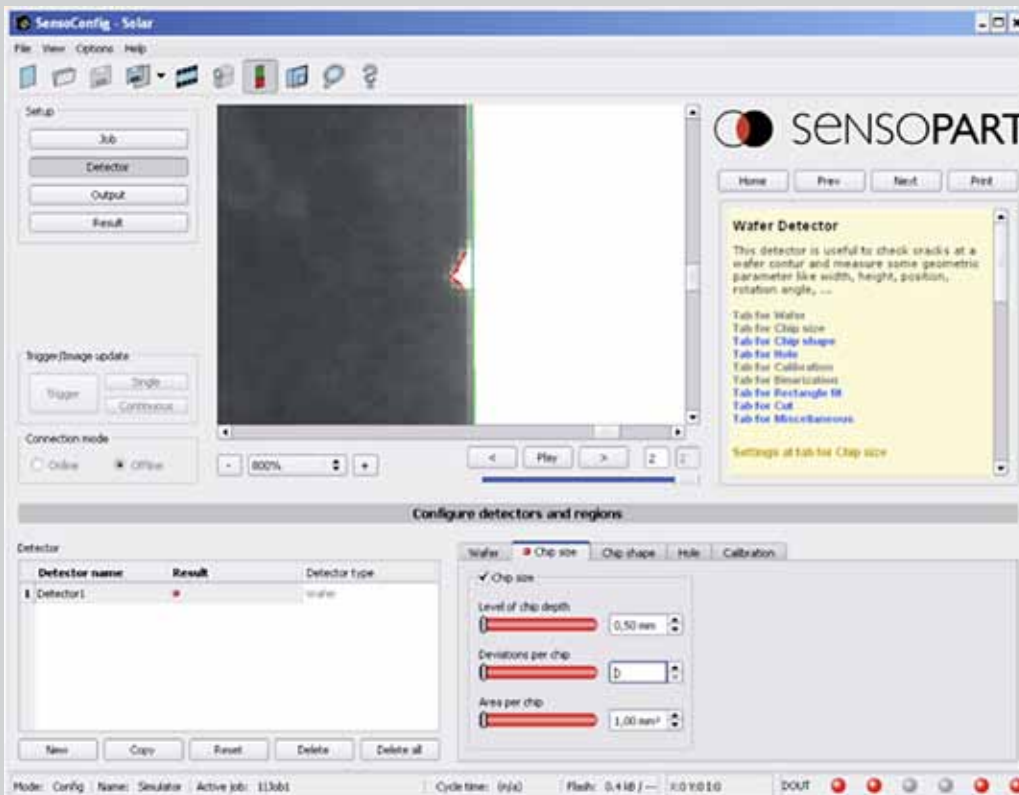
The detection accuracy for chips can be defined in the configuration software via the chips depth setting. Similarly, it is possible to distinguish between V- and C-chips.

A backlight is only required for hole detection. It is directly controlled by the VISOR® and is available as an accessory. Holes with a diameter from 0.02 mm can thus be detected.

Resolution	Solution
0.1 mm	Solar Cell Inspection (PC-based software)
0.5 mm	VISOR® V10 SO-Advanced
0.6 mm	VISOR® V10 SO-Standard
30 mm	Photoelectric sensors such as 5 × F 10 or fibre optics such as FMS 30

Double wafer & fragment detection

Special functions to prevent plant contamination
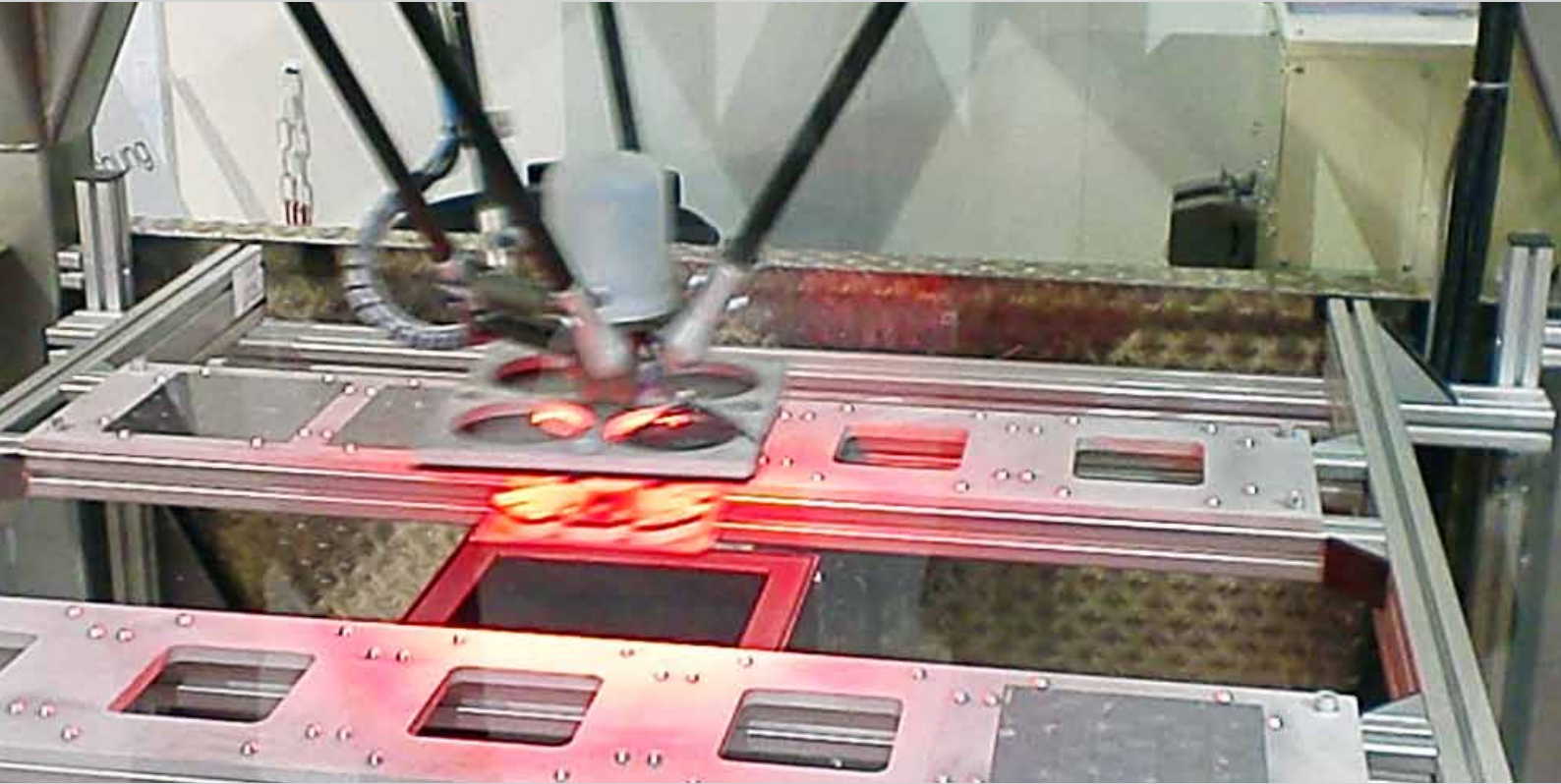
Stacked wafers may stick to one another on separation, inevitably leading to defective processing and breakages and even machine contamination. This problem can be prevented with the help of double-layer detection. Whereby two different processes may be used: measurement of wafer size with the VISOR® or through-light detection with a fibre-optic sensor (see illustrations).

Incorrect dimensions, caused by a double wafer, are detected with the VISOR® by measuring wafer size.

In addition, fragments from a broken wafer sticking to a good wafer can be detected down to a minimum size of 10 mm (monocrystalline) or 25 mm (polycrystalline) using the "Fragment Detection" function of the VISOR® Solar Advanced.
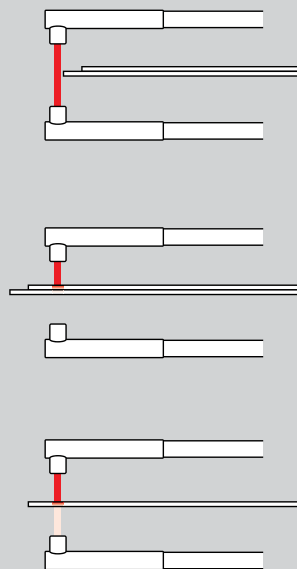
Alternatively, double wafers can be detected using FMS 30 fibre-optic through-beam photoelectric switches in a back-lighting process, whereby the strong IR transmission beam can pass through one wafer but not two.
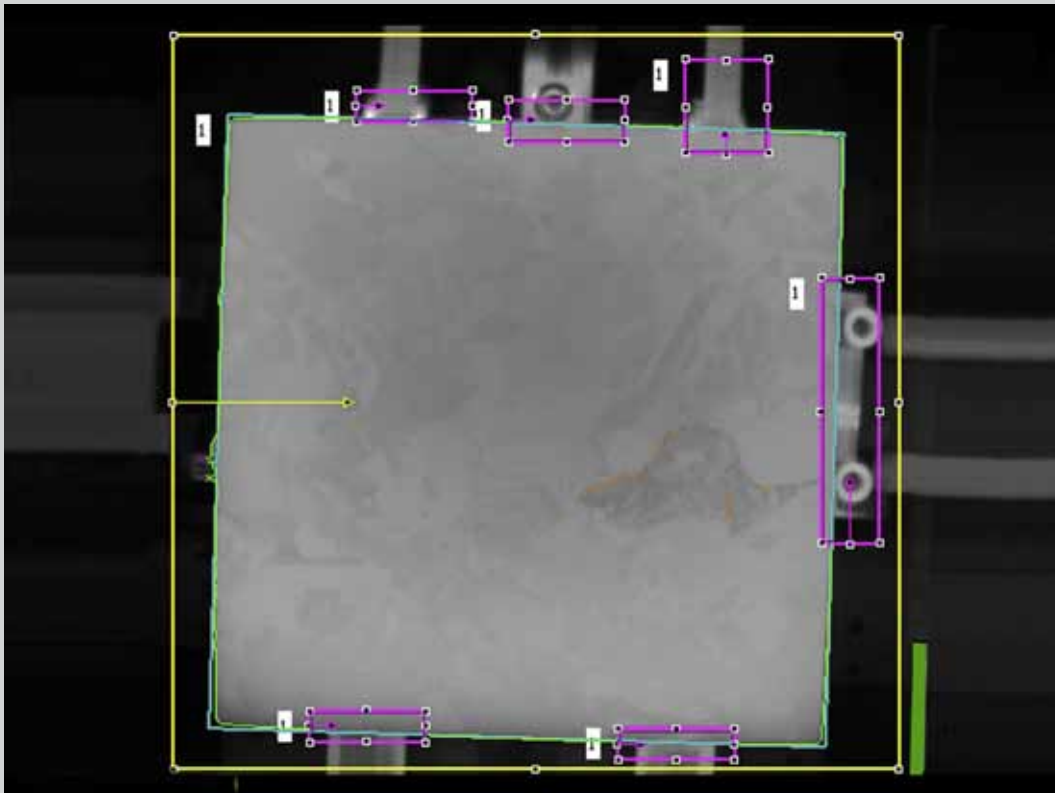
Practical special functions:
The VISOR® Solar Advanced detects wafer fragments (orange-coloured contour) that are sticking to another wafer. This function can even be used for poly-crystalline cells, which have a similar fragmentary surface structure. Moreover, interfering elements such as conveyor belts and other machine parts can be suppressed so that they cannot be incorrectly interpreted as wafer defects (area bordered in violet).

Resolution	Solution
10 mm (monocrystalline) 25 mm (polycrystalline)	V10 SO-Advanced
30 mm	Photoelectric sensors such as 5 × F 10 or fibre optics such as FMS 30

Solar cell & string inspection

Detailed analysis of cells and strings
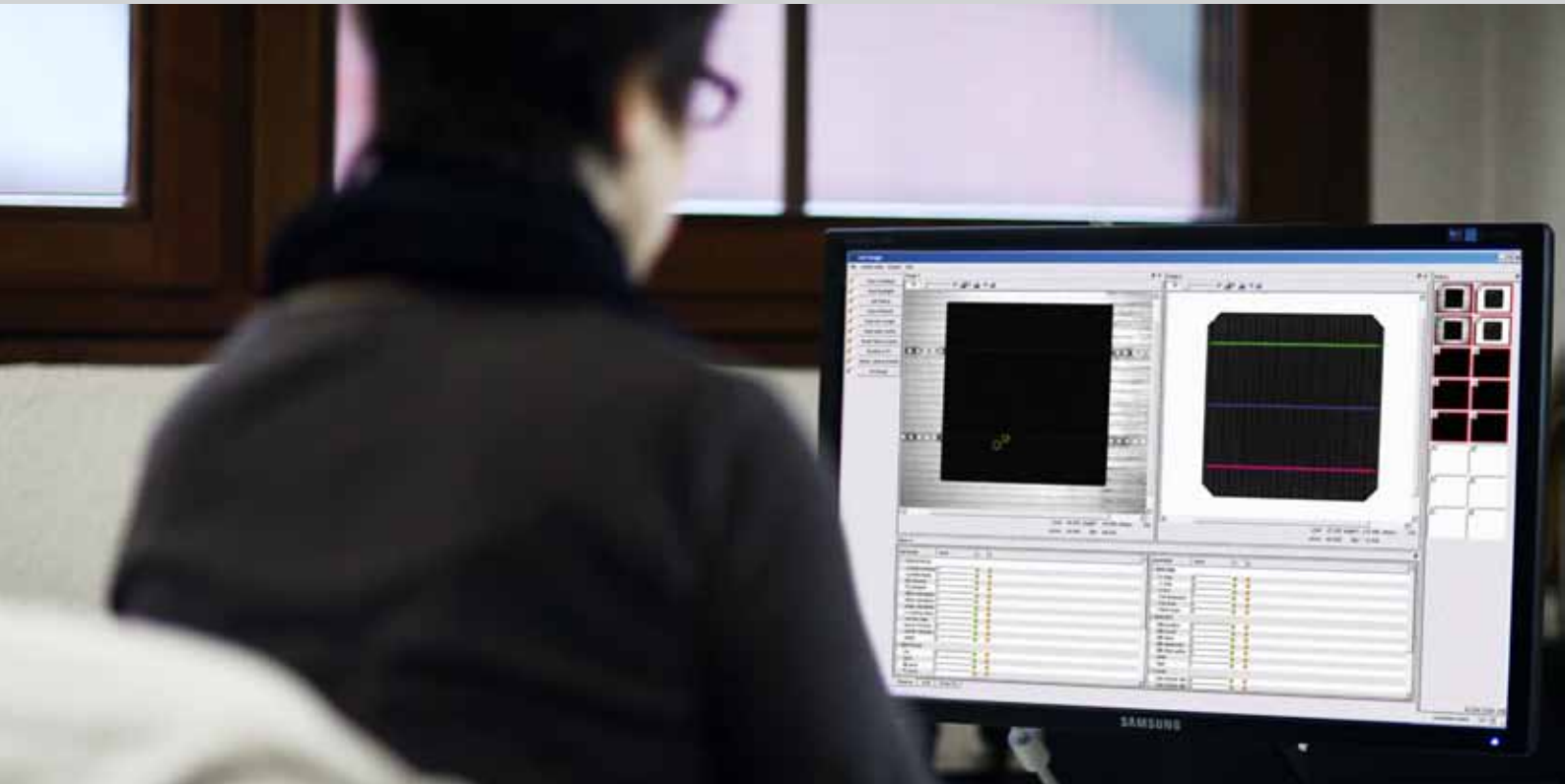
The PC-based Solar Inspection software is the ideal solution for demanding inspection tasks of all sorts: the product series offers high-quality and proven solutions for the cell, string and layup areas. Comprehensive and detailed inspections can also be carried out at very high cycle speeds (from 40 ms) in combination with conventional GigE cameras (e. g. Basler, IDS, SVS Vistek or Baumer). The very stable and reliable system has expert and observer interfaces and can, if necessary, easily be adapted and expanded by the user. Great emphasis was placed on the use of open interfaces (e. g. MES) to ensure flexible integration and long-term use in a machine platform.

All functions are accessible in Expert Mode, while critical settings are protected from unauthorised access on the Observer interface (in picture).

MAIN FEATURES OF USER INTERFACE

- MES connectivity
- Easy setup for new image-processing functions
- Open to new image-processing libraries
- Flexible to customer-tailored solutions
- Easy setup of PLC communication
- Seperate task and parameter setup
- The structure of all windows is based on XML files
- Many debug possibilities for easy parameterisation
- Many logging possibilities to verify results
- Password protection to prevent unauthorised operations
- Open to the integration of other cameras

Measure-
ment

Stain

Position

Crack

Chip

Finger
Interruption
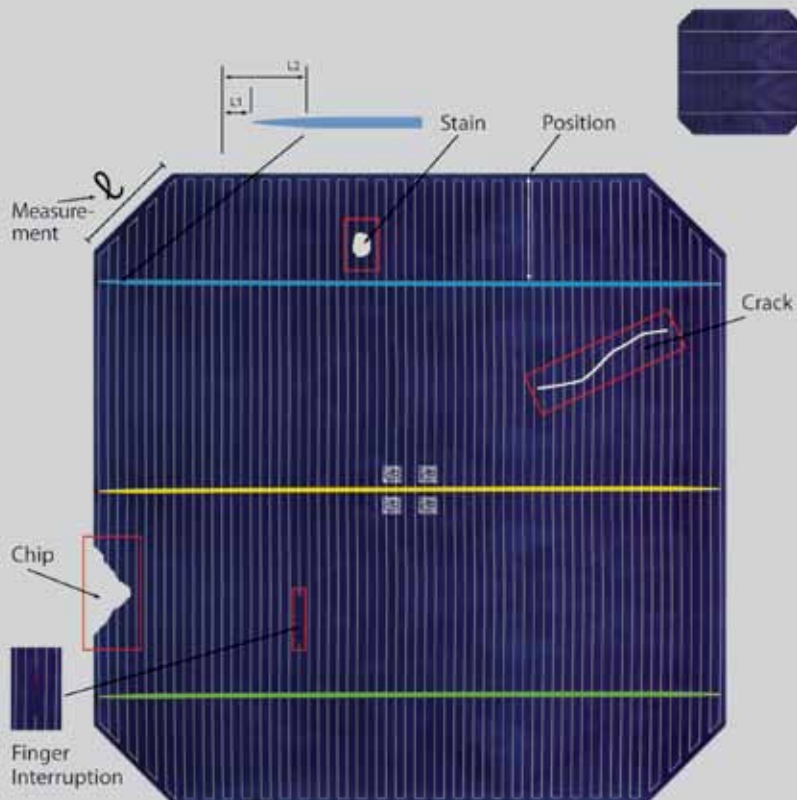
*Comprehensive inline inspections and
analyses can be carried out with Solar
Inspection software.*

MAIN FEATURES OF IMAGE PROCESSING

- Print alignment

- Finger interruptions

- Stains due to paste

- Chips >0.150 mm depth

- Exact chamfer measuring

- Exact busbar shape measuring

- Chip shape distinguished – "mouse bites" and "shark teeth"

- Hole / crack detection inside the solar cell

- Optional masking e. g. of conveyor belts

- Cycle time down to 30 ms

- Supports cameras from Basler, IDS, SVS Vistek and Baumer

Tracking

Identification of wafers and cells during the process

Immediately after cutting, blank wafers are labelled with four data matrix codes in compliance with the SEMI Standard PV29-0212 in order to ensure complete traceability of every single solar cell. The four-fold redundancy ensures that at least one of the codes remains readable even when the wafer is partially covered by a contact finger. A similar system is used for thin-film solar cells.

The VISOR® Code Reader Solar evaluates the codes – some of them invisible to the human eye – during every process step. Evaluation is reliable and reproducible even with strongly light-absorbing cells. During the same step, the VISOR® Code Reader can check the presence of producer symbols.

In its VISOR® series of products, SensoPart also offers code readers for evaluating bar codes and data matrix codes on wafer boxes as well as OCR readers. The integration and setup of VISOR® sensors is very easy thanks to the intuitive user software.

The VISOR® Code Reader Solar detects the data matrix codes on wafers and solar cells throughout the entire process chain. This is also the case for codes on strongly light-absorbing cells that are invisible to the human eye.

The easily comprehensible user interface of the VISOR® Code Reader Solar. In this live image it can be seen that all four ECC200 data matrix codes have been successfully read in one throughput.

MAIN FEATURES OF VISOR® CODE READER SOLAR

- Detection of data matrix codes such as ECC200 on silicon and thin-film solar cells according to SEMI Standard PV29-0212

- Dedicated illumination

- Easy setup of sensor and interface

- Resolution: 736 x 480 pixels and higher

Colour detection & metric measurements

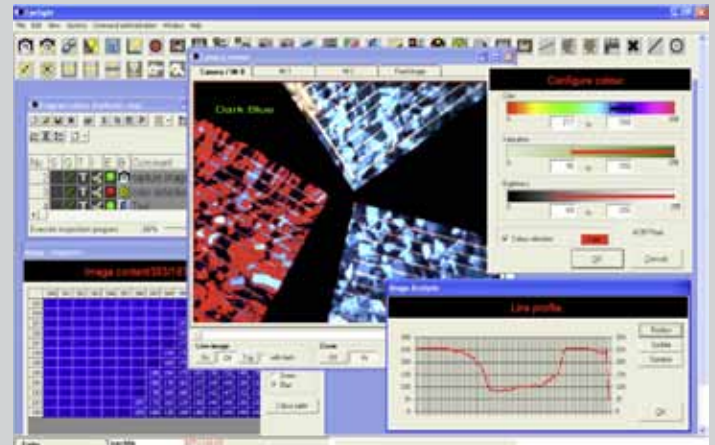## Flexible image-processing tools for special inspections

In order to check the quality of the anti-reflective coating the VISOR® detects the mean reflectivity as well as holes within the coating.

The products presented previously, particularly the vision sensors of the VISOR® series, cover all the image-processing applications frequently used in solar cell production. In addition, with its flexible "Eyesight" image-processing package, SensoPart offers a platform of powerful smart cameras with the same mechanical and electrical interfaces, with which special inspections can be carried out – for example, the detection of colour deviations in the coating process or special measurement tasks.

The system offers users a large choice of tools for image processing that can easily be configured in the programme editor using Drag & Drop. Even demanding image-processing solutions can be implemented with the help of these graphic "programming modules".

The Eyesight package offers various image-processing tools for measuring colour deviations during all texturizing and anti-reflection coating processes.

Some of the more than 100 functions in the Eyesight functions library:

Colour		Measurement	
	Select colour channel		Measure gap width
	Colour monitoring		Calliper (hor./vert.)
	Colour filter		Calliper (any orientation)
Programme control			Angle determination
	Process control and loop options		Curvature point
	Execute subprogramme		
	Access to variables		
	Evaluation		
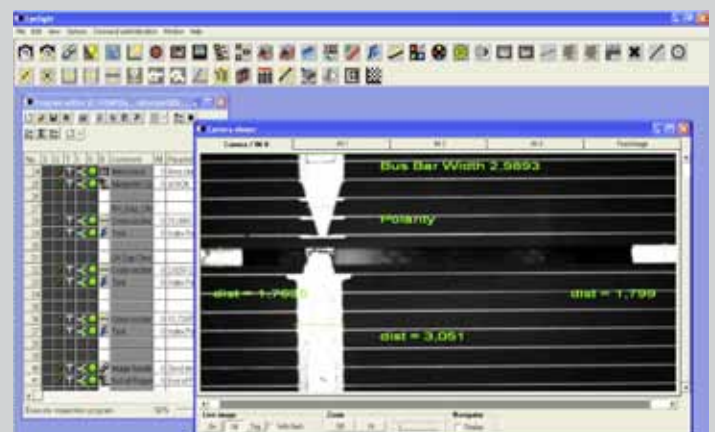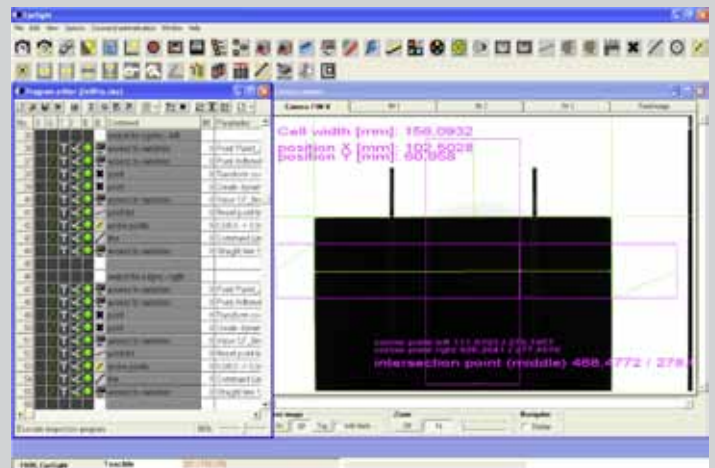
Eyesight functions for the measurement of solar cells (Top) and precise arrangement in strings (Bottom).

SensoPart products for solar applications – Overview

Proximity and distance sensors

F 10, FT 50-RLA, FMS 30 – Technical Data		
Subminiature photoelectric sensor	Laser distance sensor	Fibre optic amplifier

Features/Sensors	F 10	FT 50-RLA	FMS 30
Optical data			
Type of light	Laser, red, 655 nm	Laser, red, 670 nm	Infrared, 880 nm
Laser class	1	2	–
Electrical data			
Operating voltage, $+U_B$	10 … 30 V DC	18 … 28 V DC	10 … 30 V DC
No-load current, I_0	≤ 12 mA	≤ 35 mA	≤ 25 mA
Output current, I_e	≤ 50 mA	–	≤ 200 mA
Protective circuits	Reverse polarity protection U_B / short-circuit protection (Q)	Reverse polarity protection U_B / short-circuit protection (Q)	Reverse polarity protection U_B / short-circuit protection (Q)
Protection class	2	2	2
Switching output, Q	PNP/NPN	PNP	PNP/NPN
Output functions	N.O./N.C.	RS 485/ 4...20 mA	N.O./N.C.
Mechanical data			
Dimensions	21.1 x 14.6 x 8 mm³	50 x 50 x 17 mm³	(See connection diagram)
Enclosure rating	IP 67	IP 67	IP 65
Material: housing	PUR	ABS, shockproof	Brass, nickel-plated
Material: front screen	PMMA	PMMA	–
Ambient temperature: operation	-20 … +50 °C	-10 … +45 °C	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C	-20 … +60 °C	-40 … +80 °C

F 10 with plug connector

153-00894

4-pin connector, F 10

154-00508

FT 50-RLA with plug connector

153-00716

8-pin connector, FT 50-RLA

154-00127

FMS 30 with plug connector

153-00005

4-pin connector, FMS 30

154-00136   and   154-00282

F 10, FT 50-RLA, FMS 30 – Product Overview

Type	Retroreflective sensor	Through-beam sensor	Through-beam sensor	Laser distance sensor	Fibre optic amplifier*
Part number	FR10-RL-PS-KM4	FS/FE10-RL-PS-KM4	FT10-RLH-PS-KM4	FT50RLA-220-S1L8	FMS30-34 UL4
Article number	603-31004	611-51005	600-11134	574-41015	540-51319
Connection type	200 mm cable with M8 plug, 4-pin	200 mm cable with M8 plug, 4-pin	200 mm cable with M8 plug, 4-pin	M12x1 plug, 8-pin	M12x1 plug, 4-pin
Detection range/Scanning range	0.1…2.5 m	0…3 m	2…60 mm	80…300 mm	depends on optical fibre
Resolution	–	–	–	22 µm	–
Switching output	PNP**	PNP**	PNP**	PNP	PNP**
Switching frequency f (ti/tp 1:1)	≤ 1000 Hz	≤ 4000 Hz	≤ 1000 Hz	–	1000 Hz
Weight	approx. 3 g	2 x approx. 3 g	approx. 3 g	40 g	210 g

* Required fibre optic: part number: 30 LZ 12 250 Si L=16; article number: 978-06529   ** Also available as NPN variant

SensoPart products for solar applications – Overview

VISOR® Solar vision sensors

VISOR® V10 Solar – Technical Data
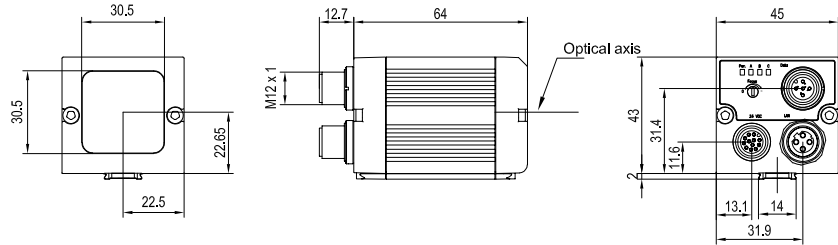
153-00911

Features/sensors	Standard V10-SO-S1-W6	Advanced V10-SO-A1-XX
Functions		
Position accuracy*	± 50 µm	± 50 µm
Repeatability*	± 1 µm	± 1 µm
Alignment to fiducials	–	✓
Chip detection limit depth*	0.5 mm	0.5 mm
Double-layer detection	✓	✓
Fragment detection	–	✓
Busbar position	–	✓
Hole detection	✓	✓
Sunny-side up / down detection	✓	✓
Typical cycle time (VGA)**	< 100 ms	< 100 ms
Number of jobs	2	255
Number of detectors	32	255
Detectors		
Wafer	✓	✓
Wafer detector analyses, fragments	–	✓
Busbar	–	✓
Pattern matching	–	✓
Grey level, brightness, contrast	✓	✓
Optics		
Max. resolution	WVGA = 736 × 480	WVGA = 736 × 480
Illumination	White	White or Infrared (depending on model)
Focal length	6 mm	6 mm or 12 mm (depending on model)
Min. working distance for 6-inch** wafer	350 mm	350 mm or 700 mm (depending on model)
C-mount	–	Optional
Interfaces		
Digital inputs | outputs	4 | 2	4 | 2
Number of configurable I/O ports	2	4
Encoder input	–	✓
Ethernet	✓	✓
EtherNet/IP	✓	✓
RS422	–	✓
Enclosure rating	IP 67	IP 67***

V10 Solar – Product Overview

Part number	V10-SO-A1-W6	V10-SO-A1-I6	V10-SO-A1-W12	V10-SO-A1-I12	V10-SO-S1-W6	V10-SO-A1-C
Article number	535-91051	535-91053	535-91052	535-91054	535-91049	535-91050
Integrated lens, focal length	6 mm, adjustable focal length	6 mm, adjustable focal length	12 mm, adjustable focal length	12 mm, adjustable focal length	6 mm, adjustable focal length	Depending on C-mount
Illumination	White	Infrared	White	Infrared	White	External
Min. working distance for 6-inch wafer**	350 mm	350 mm	700 mm	700 mm	350 mm	> 250 mm
Shutter speed*	0.17 ms	0.16 ms	0.09 ms	0.06 ms	0.17 ms	–
Chip detection	≥ 0.6 mm	≥ 0.6 mm	≥ 0.5 mm	≥ 0.5 mm	≥ 0.6 mm	≥ 0.5 mm

Solar Inspection – Product Overview

Order designation	Article number	Description
Solar String Inspection Professional for Dongle	533-11020	Inspection of up to 2 cells and 2 strings by one PC, requiring dongle
Solar Cell Inspection Advanced for Dongle	533-11021	Inspection of either 2 cells or 2 strings by one PC, requiring dongle
Solar Cell Inspection Standard for Dongle	533-11022	Position and chip detection of various cells by 1 camera, requiring dongle
Solar Cell Inspection Standard for MAC address	533-11024	Position and chip detection of various cells by 1 camera, requiring PC MAC address
Solar Layup Inspection Standard for MAC address	533-11025	Position detection of 2 cells by one PC, requiring PC MAC address
Solar Inspection MES interface for Dongle	533-11026	Extension of Solar Inspection by MES connection, requiring dongle
USB Dongle	067-12894	USB dongle for dongle based Solar Inspection products

*   Typical values under recommended conditions
**   Typical values for wafer or busbar detection
***   C-mount version reaches IP 65 with overhousing

SensoPart products for solar applications – Overview

VISOR® Code Reader Solar and Eyesight vision system

VISOR® Code Reader / Code Reader Solar – Technical Data
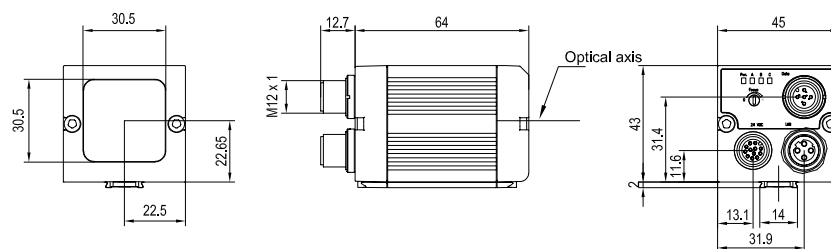
153-00911

| Features/sensors	VISOR® V10 Code Reader	VISOR® V10 Code Reader Solar
Part number	V10-CR-A1-W12	V10-CRS-A1-U12-01
Article number	535-91022	535-91055
Version	Advanced	Advanced
Illumination	White	Tailored
Optical data		
Resolution	736 x 480 Pixels	736 x 480 Pixels
CMOS	1/3'', monochrome	1/3'', monochrome
Integrated lens, focal length	12 mm, adjustable focal length	12 mm, adjustable focal length
Adjustment range	30 mm to infinity	30 mm to infinity
Min. field of view (X x Y)	8 x 6 mm	8 x 6 mm
Electrical data		
Operating voltage, $+U_B$	18 … 26,4 V DC	18 … 26,4 V DC
Power consumption (without illumination or I/O)	≤ 120 mA	≤ 120 mA
Power consumption (without I/O)	≤ 200 mA	< 5 A
Protective circuits	Reverse polarity protection U_B / short-circuit protection, all outputs	Reverse polarity protection U_B / short-circuit protection, all outputs
Readiness delay	approx. 13 s after Power On	approx. 13 s after Power On
Outputs	PNP/NPN (switchable)	PNP/NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (Pin 12)	50 mA, 100 mA (Pin 12)
Inputs	PNP/NPN High > U_B-1V, Low <3 V	PNP/NPN High > U_B-1V, Low <3 V
Input resistance	> 20 kOhm	> 20 kOhm
Encoder input	High > 4 V	High > 4 V
Interfaces, VISOR® V10-CR-Advanced	Ethernet (LAN), RS422, EtherNet/IP	Ethernet (LAN), RS422, EtherNet/IP
Digital inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs
Mechanical data		
Dimensions	65 x 45 x 45 mm³ (without plug)	65 x 45 x 45 mm³ (without plug)
Enclosure rating	IP 67	IP 67
Material: housing	Aluminium, plastic	Aluminium, plastic
Material: front screen	Plastic	Plastic
Ambient temperature: operation	0 … +50 °C	0 … +50 °C
Ambient temperature: storage	-20 … +60 °C	-20 … +60 °C
Weight	approx. 160 g	approx. 160 g
Plug connector	Power supply and I/O M12, 12-pin, Ethernet M12, 4-pin, Data M12, 5-pin	Power supply and I/O M12, 12-pin, Ethernet M12, 4-pin, Data M12, 5-pin
Vibration and shock resistance	EN 60947-5-2	EN 60947-5-2

Eyesight vision system – Technical Data
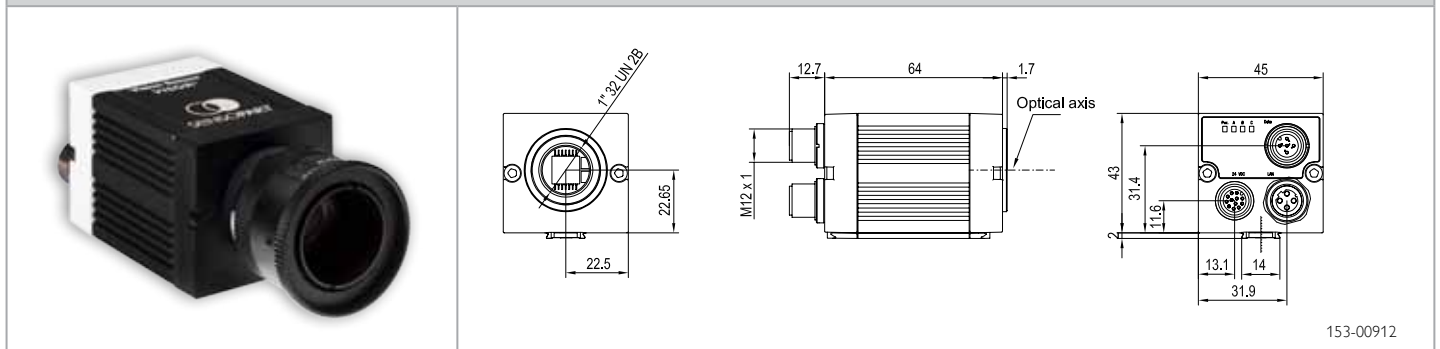
153-00912

Features/sensors	V10 Eyesight Advanced	FA 45 Eyesight Advanced
Optical data		
Resolution	WVGA = 736 x 480 Pixels monochrome	VGA = 640 x 480 Pixels colour
Functions		
Number of inspection programmes	No restriction (max. approx. 40 MByte)	No restriction (max. approx. 3 MByte)
Electrical data		
Operating voltage $+U_B$	18 … 26,4 V DC	18 … 30 V DC
Current consumption (without I/O)	≤ 200 mA	≤ 200 mA
Protective circuits	Reverse polarity protection U_B/short-circuit protection, all outputs	Reverse polarity protection U_B/short-circuit protection, all outputs
Readiness delay	approx. 13 s after Power On	approx. 6 s after Power On
Outputs	PNP (N.O. contact)	PNP (N.O. contact)
Max. output current (per output)	50 mA, 100 mA (Pin 12)	50 mA, 100 mA (Pin 12)
Inputs	PNP High > U_B - 1 V, Low < 3 V	High 10 … 24 V (+10 %), Low 0 … 3 V
Input resistance	> 20 kOhm	> 20 kOhm
Interfaces	Ethernet (LAN), RS422	Ethernet (LAN), RS422, EtherNet/IP
Digital inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs	2 inputs, 4 outputs
Mechanical data		
Dimensions	65 x 45 x 45 mm³ (without plug)	65 x 45 x 45 mm³ (without plug)
Material: housing	Aluminium, plastic	Aluminium, plastic
Material: front screen	Plastic	Plastic
Ambient temperature: operation	0 … +50 °C	0 … +50 °C
Ambient temperature: storage	-20 … +60 °C	-20 … +60 °C
Weight	approx. 160 g	approx. 170 g
Plug connection	Power supply and I/O M12, 12-pin, Ethernet M12, 4-pin, Data M12, 5-pin	Power supply and I/O M12, 8-pin, Ethernet M12, 4-pin, Data M12, 5-pin
Vibration and shock resistance	EN 60947-5-2	EN 60947-5-2

Eyesight vision system – Product Overview

Part number	V10-EYE-A1-W6	V10-EYE-A1-W12	V10-EYE-A1-C	FA45-300-WCCC-EAO6HS6	FA45-300-WCCC-EAO12HS6	FA45-300-WCCC-EAOCSHS6
Article number	537-91000	537-91001	537-91004	522-91143	522-91144	522-91145
Integrated lens, focal length	6 mm	12 mm	C-mount	6 mm	12 mm	C-mount
Illumination	White	White	–	White	White	–
Colour	Monochrome	Monochrome	Monochrome	Colour	Colour	Colour
Adjustment range	6 mm … ∞	30 mm … ∞	Lens-dependent	20 mm … ∞	20 mm … ∞	Lens-dependent
Min. field of view (X × Y)	6 x 4 mm²	8 x 6 mm²	Lens-dependent	8 x 6 mm²	18 x 14 mm²	Lens-dependent
Enclosure rating	IP 67	IP 67	IP 65 (option)	IP 67	IP 67	IP 65 (option)

Errors excepted. Subject to change without notice.

SensoPart products for solar applications – Overview

VISOR® accessories

VISOR® cables and lenses

Part number	Article number	Description
Power supply and I/O cables for VISOR®		
C L12FG-S-2m-PUR	902-51801	Power / I/O cable, 2 m, M12 / 12-pin, straight connector, shielded
C L12FG-S-5m-PUR	902-51796	Power / I/O cable, 5 m, M12 / 12-pin, straight connector, shielded
C L12FG-S-10m-PUR	902-51797	Power / I/O cable, 10 m, M12 / 12-pin, straight connector, shielded
C L12FW-S-2m-PUR	902-51798	Power / I/O cable, 2 m, M12 / 12-pin, angled connector, shielded
C L12FW-S-5m-PUR	902-51799	Power / I/O cable, 5 m, M12 / 12-pin, angled connector, shielded
C L12FW-S-10m-PUR	902-51800	Power / I/O cable, 10 m, M12 / 12-pin, angled connector, shielded
Network / Ethernet cables for VISOR®		
CI L4MG / RJ45G-GS-3m-PUR	902-51754	Ethernet cable, 3 m, M12, straight connector, 4-pin / RJ45 shielded
CI L4MG / RJ45G-GS-5m-PUR	902-51782	Ethernet cable, 5 m, M12, straight connector, 4-pin / RJ45 shielded
CI L4MG / RJ45G-GS-10m-PUR	902-51784	Ethernet cable, 10 m, M12, straight connector, 4-pin / RJ45 shielded
CI L4MW / RJ45G-SG-3m-PUR	902-51786	Ethernet cable, 3 m, M12, angled connector, 4-pin / RJ45 shielded
CI L4MW / RJ45G-SG-5m-PUR	902-51788	Ethernet cable, 5 m, M12, angled connector, 4-pin / RJ45 shielded
CI L4MW / RJ45G-SG-10m-PUR	902-51790	Ethernet cable, 10 m, M12, angled connector, 4-pin / RJ45 shielded
Data cables for VISOR®		
CI L5FG-S-2m-PUR	902-51813	Data cable, 2 m, M12 / 5-pin, straight, shielded
CI L5FG-S-5m-PUR	902-51814	Data cable, 5 m M12 / 5-pin, straight, shielded
CI L5FG-S-10m-PUR	902-51815	Data cable, 10 m, M12 / 5-pin, straight, shielded
CI L5FW-S-2m-PUR	902-51816	Data cable, 2 m, M12 / 5-pin, angled, shielded
CI L5FW-S-5m-PUR	902-51817	Data cable, 5 m M12 / 5-pin, angled, shielded
CI L5FW-S-10m-PUR	902-51818	Data cable, 10 m M12 / 5-pin, angled, shielded
Lens accessories		
LO C 8	526-51513	Lens, C-mount, 8 mm
LO C 12	526-51514	Lens, C-mount, 12 mm
LO C 16	526-51515	Lens, C-mount, 16 mm
ETS	527-51129	Lens, C-mount , spacer ring set
LPT 45 CML 5	527-51132	Lens, C-mount housing, over-housing, IP 65, flange 5 mm
VFT M1	533-01010	Infrared filter for C-mount lens

VISOR® Lighting

Part number	Article number	Description
Ring light		
LFR115 WD-24-2L12	525-51150	Illumination, VISOR®, ring, LFR115, white, diffuse, 2 × M12/12-pin
LFR115 RD-24-2L12	525-51151	Illumination, VISOR®, ring, LFR115, red, diffuse, 2 × M12/12-pin
LFR115 ID-24-2L12	525-51152	Illumination, VISOR®, ring, LFR115, infrared, diffuse, 2 × M12/12-pin
MA LR-100/112	543-11015	Fixing bracket ring light, 100 mm diameter, for LFR115
LF 200 WD-24-KFL5	532-51024	Surface light, diffuse, 200 mm, white
LF 200 RD-24-KFL5	532-51025	Surface light, diffuse, 200 mm, red
LA45V-24-2L12	525-01001	Illumination, VISOR®, amplifier adapter, 2 × M12/12-pin
CB L12FS / L12FS- 0,5m-GG-PUR	902-51806	Illumination, VISOR®, cable, 2 × M12/12-pin, 0.5 m, straight connector, shielded

Illumination accessory

Part number	Article number	Description
Reflective foil		
RF 775x…mm	904-51643	Reflective foil, 775 mm width, length: multiples of 100 mm

VISOR® mountings

Part number	Article number	Description
MA 45	543-11001	Mounting, camera bracket
MB 45	543-11002	Mounting, block rod camera
MP 45	543-11003	Mounting, plate for camera
MZ 45	543-11004	Mounting, adapter for rods
MST 45-20	543-11005	Mounting, rod 20 cm camera
MST 45-40	543-11007	Mounting, rod 40 cm camera
MG 45	543-11008	Mounting, hinge camera
MA 45 L	543-11013	Mounting, camera bracket, long
MK 45 L	543-11021	Mounting, long dovetail mounting bracket
MG 2A	543-11023	Mounting, dovetail mounting bracket, 2-axis rotation

Test equipment and tools

Part number	Article number	Description
ST V10	543-11022	Testbox VISOR®
ST M12-12	994-51135	VISOR® power supply with plug M12, 12-pin, Euro-plug
ST M12-12-M	994-51138	VISOR® power supply with plug M12, 12-pin, Multi-plug

Panel PC (NOT outside EU/EFTA)

Part number	Article number	Description
PPC-AW710,4TX	533-01014	Panel PC, 10.4", Atom, Win7, Touch, XGA
MS-PPC10,4	533-01013	Mounting kit for panel PC, 10.4", PPC-AW710, 4TX

Data interface converters

Part number	Article number	Description
K2-ADE-TB	533-11017	Converter, RS232 - RS 485 / 422
CUSB-RS232-2m	901-05097	Interface cable, incl. CD Rom, 2 m - USB to RS 232
AS S7/B1 D9F-D9F	902-51735	Anybus Communicator - PROFIBUS

We look ahead.

Yesterday, today and in the future.

"We gauge ourselves not by what is possible today, but by our vision of what can be achieved" – this has been our motto since the foundation of SensoPart in 1994. Our goal is to always be a step ahead and to be able to offer our customers the most innovative sensor for industrial automation.

With our easy to integrate VISOR® Vision sensors and our compact laser sensors with an amazing background suppression made in Germany, we stick up to this motto.

Get ready – we still have a lot of ideas for the future.

SENSOR TECHNOLOGY	VISION
Light barriers	Vision sensors
Proximity switches	Smart cameras
Laser sensors	Vision systems
Miniature sensors	Object detection
Distance sensors	Object measurement
Colour sensors	Colour detection
Contrast sensors	Code reading
Anti-collision sensors	Lighting
Slot sensors	Lenses
Fibre-optic amplifiers	
Inductive sensors	
Capacitive sensors	
Ultrasonic sensors	

Click here to find your regional contact: www.sensopart.com/international

www.sensopart.com