Intelligent Camera Sensor ICS: Teach-in, Detecting, Switching

The ICS intelligent camera sensor integrates many functions and components into a single device and thus saves expenditure and space. Its compact housing contains all the components of a complete image processing system such as optics, object lighting, evaluation hardware and software.

Four pre-programmed evaluation tools make the ICS especially flexible. With pixel sum comparison, minimum pixel sum, area comparison and shape comparison, it has the basic features for virtually any application. Its Advanced Series even detects rotated contours and thus lends itself to difficult tasks. The cycle times are short throughout, making it suitable for machines with high cycle rates, assisted by simultaneous detection of up to four objects and the corresponding switching of four outputs.

Despite the variety of functions, parametrisation and set-up remains simple and secure. Teach-in is performed by the separate VSC operating device. During commissioning this displays all the parameters and also a grey scale image which makes alignment and adjustment very comfortable and secure. Parameter sets are easily read out via a serial interface and can be transferred to another or the same ICS – a convincing argument for flexibility during product format changes.

The internal memory of the ICS stores not only one, but twelve fully parameterised tasks and allows them to be called by a simple PLC signal. Ideal for systems with regular and fast product changes without extensive PC links.

▶ The ICS monitors whether the serial number has been fully printed on the packaging.

◀ Specialist for position and shape: the ICS checks the orientation of bottle tops in an automatic bottling plant.

▶ Is a gear tooth missing or was the surface incorrectly treated? The ICS already meets the requirements of different testing processes.

Fields of view
20 x 20, 40 x 40 and 80 x 80 mm²

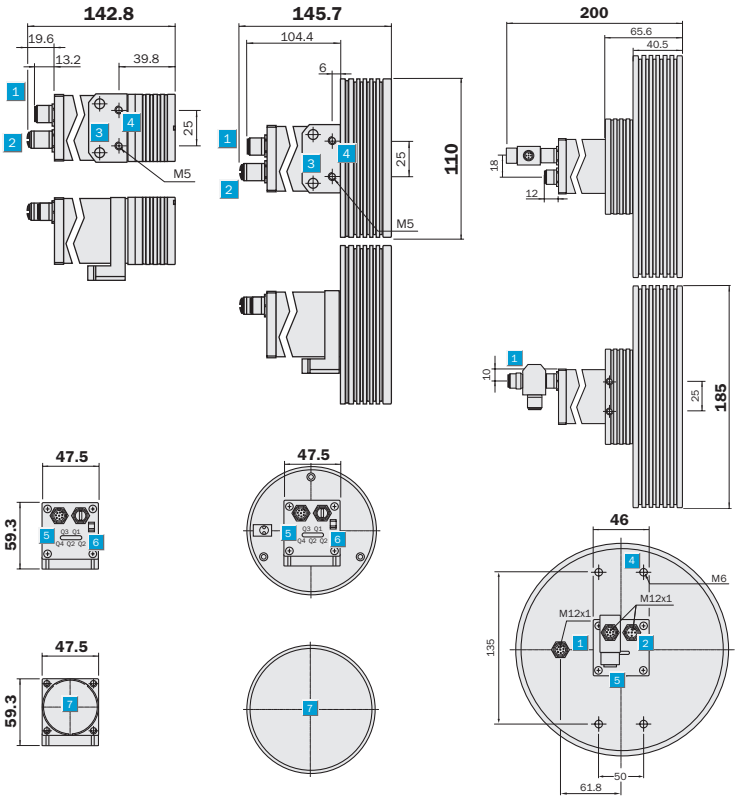
Intelligent Camera Sensor

- Suitable for very fast operations
- Parameter transmission from/to PC or PLC
- Teach data selectable via PLC
- Flexible use through:
  - different evaluation methods
  - robust, durable industrial design
- Secure settings due to LC image display

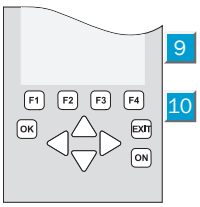
CE

Dimensional drawing

ICS100/110 | ICS101/111 | ICSL02



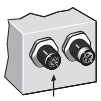
VSC100 8

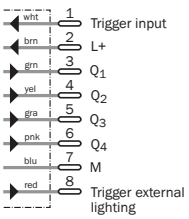


1 Supply connection (external thread), 8-way, M12
2 Operating device connection (internal thread), 8-way, M12/5-way, M12 for ICS L02
3 Positioning hole
4 Mounting hole M5/M6 at ICS L02, 4-times
5 Switching output display (Q1-Q4)
6 Operational status indicator
7 Front lens
8 VSC 100: W x H x D = 150 x 82 x 31 mm³
9 LC Display
10 Keyboard

Connection type ICS100-B1111

8-pin, M12 (Output)

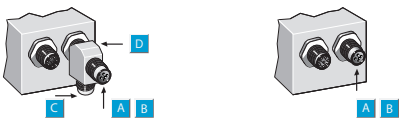


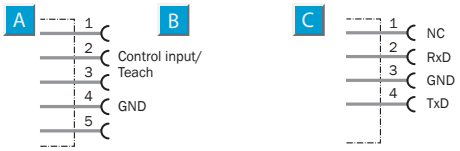


Cable, 2 m with receptacles M12, 8-pin	
Order no.	6020633

8-/5-pin, M12 setup unit/control input

ICS100/110/101/111 | ICS L02





A	Cable ICS–VSC, 2 m with plug M12, 5-pin	
	Order no.	6025931

B	Cable–control input, 2 m, M12, 4-pin	
	Order no.	6028077

C	Cable ICS-PC	
	Order no.	6028622

D	T-switch 8-/5-/4-way	
	Order no.	6028485

Technical data		ICS100 -B1211	ICS110 -B1211	ICS101 -B1211	ICS111 -B1211	ICS L02 -B1111	VSC 100
Nominal scanning distance/	70 mm/20 x 20 mm²	■	■				
Field of view	140 mm/40 x 40 mm²			■	■		
	330 mm/80 x 80 mm²					■	
Flash time for LED lighting [1]	Adjustable, 50 µs to 1300 µs	■	■	■	■	■	
Exposure time for ext. lighting [2]	8 ms ... 23 ms	■	■	■	■	■	
Colour of light/Filters	Green (Filter: 450 ... 550 nm)	■	■	■	■	■	
Image sensor	CMOS; 512 x 512 pixels	■	■	■	■	■	
Test modes	1 ... 4 (Explanation see below)	■		■		■	
	1 ... 5 (Explanation see below)		■		■		
Copying/Changing [3]	Mechanical, optical, parameters	■	■	■	■		
Supply voltage V_S [4]	24 V DC	■	■	■	■	■	
Residual ripple [5]	< 5 V_{PP}	■	■	■	■	■	
Current consumption [6]	< 450 mA	■	■				
	< 600 mA			■	■		
	< 1.2 A					■	
Switching outputs	4 x B (NPN/PNP)	■	■	■	■	■	
Output currents I_A max. [7]	< 100 mA	■	■	■	■	■	
Response time/cycle time [8]	≥ 2.5 ms	■	■	■	■	■	
Max. image frequency	400/s	■	■	■	■	■	
Trigger input [9]	HIGH corresp. ≥ 10 V ... 28.8 V	■	■	■	■	■	
Trigger output for ext. light.	TTL; LOW = active	■	■	■	■	■	
Serial interface [10]	RS 232	■	■	■	■		
I/O + V_S connection	M12, 8-pin	■	■	■	■	■	
VSC – ICS connection	M12, 8-pin [11]	■	■	■	■		
	M12, 5-pin					■	■
Teach field, Search field	Adjustable size and position	■	■	■	■	■	■
Ambient temperature T_A	Operation: 0 °C ... +50 °C	■	■	■	■	■	■
	Storage: –25 °C ... +75 °C	■	■	■	■	■	
	Storage: –20 °C ... +60 °C						■
Shock load	15 g, 6 directions	■	■	■	■	■	■
Enclosure rating	IP 64	■	■	■	■	■	
Weight	240 g						■
	350 g	■	■				
	780 g			■	■		
	2,200 g					■	

1) Average service life 50,000 h at T_A = +25 °C
2) In flash mode = pulse duration
3) Mechanical: with adapter plate; optical: calibration tube Parameters: via PLC/PC download
4) Limit values ±20 %
5) May not exceed or fall short of V_S tolerances
6) Without load
7) Amount total for all four outputs
8) With resistive load
9) Falling edge; pulse length ≥ 0.5 ms; response time ≥ 1.3 ms
10) Parameter transmission and data output
11) Connection using T-switch M12, 8-/5-/4-way and 5-way connecting lead

Check Mode	Procedure[12]
1. Pixel sum	Checking the number of pixels for exceeding or falling below the limit values
2. Minimum pixel sum	Checking pixel number exceeding a limit
3. Multi-area evaluation	Connected surfaces are compared in respect of number and area
4. Shape check	All pixels in the teach-in field should appear identically arranged (no tilt) in any position in the search field
5. Rotational contour check	Taught-in contours (=limit pixels between black and white) are searched for in the image to be checked – even if these are tilted or displaced

12) All procedures are used in the binary image. A comparison is made each time between the taught-in reference image and the image to be checked.

Order information

Intelligent Camera Sensor		Mounting technology	
Type	Order no.	Type	Order no.
ICS100-B1211	1026253	Bracket mounting (set) ICS100/110	2027839
ICS110-B1211	1026255	Universal rod mount clamp ICS100/110	2022464
ICS101-B1211	1026254	Fixing plate [13] ICS100/110/101/111	2029533
ICS111-B1211	1026256	Rod mounting, ICS101/111	2029925
ICS L02-B1111	1025547	Calibration tube for field of view 20 mm x 20 mm	2030744
VSC 100	2025857	Calibration tube for field of view 40 mm x 40 mm	2030808

13) Enables dismantling without loss of alignment.

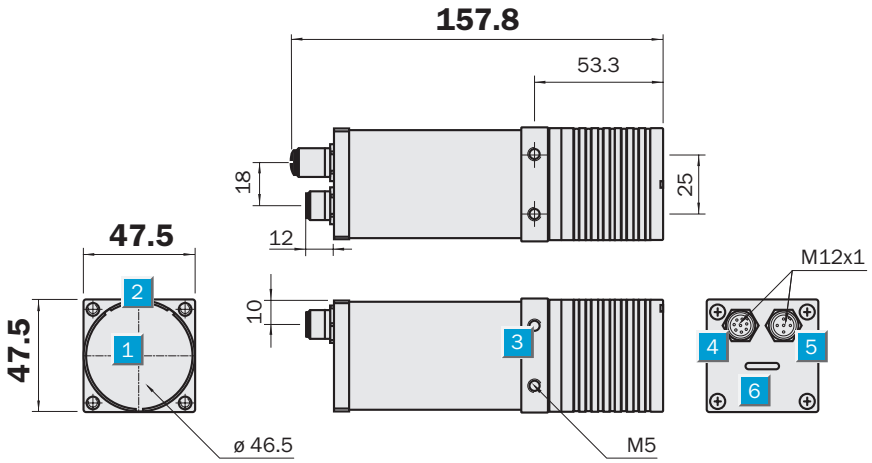
Fields of view 20 x 20, 40 x 40, 80 x 80 and 160 x 160 mm²

Intelligent Camera Sensor

- Suitable for fast operations
- Flexibly used with external lighting
- Easy product format change through memory selection via PLC
- Secure settings due to LC image display
- Robust design

Dimensional drawing

ICS00X

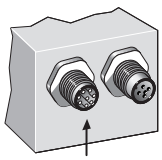


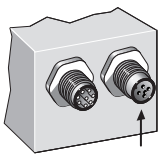
VSC100 9

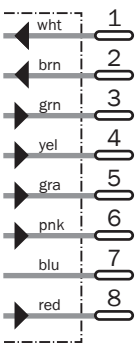
1 Lens/"C" mounting thread
2 Hood
3 Fixing hole M5, 4-times
4 Output, 8-pin, M12
5 Setup unit connection, 5-pin, M12
6 Display of output switching state
7 LC Display
8 Keyboard
9 VSC100: W x H x D = 150 x 82 x 31 mm³

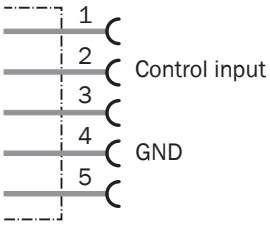
Connection type

ICS00X	8-pin, M12 (Output)	5-pin, M12 setup unit/control input









Cable, 2 m with plug M12, 5-pin	
Order no.	6025931

Cable, 2 m with receptacles M12, 8-pin	
Order no.	6020633

Cable-control input, 2 m, M12, 4-pin	
Order no.	6028077

Technical data		ICS000 -B2111	ICS001 -B1111	ICS001 -B2111	ICS002 -B1111	ICS002 -B2111	ICS003 -B2111	ICS009 -B0111	VSC 100
Nominal scanning distance/	70 mm/20 x 20 mm²	■							
Field of view	140 mm/40 x 40 mm²		■	■					
	330 mm/80 x 80 mm²				■	■			
	650 mm/160 x 160 mm²						■		
	Provided by customer							■	
Filters/lens	Lens with green filter (450 ... 550 nm)		■		■				
	Lens with red filter (610 ... 690 nm)	■		■		■	■		
	Without lens (“C” mounting thread)							■	
Image sensor	CMOS; 512 x 512 pixels	■	■	■	■	■	■	■	
Supply voltage V_S [1]	24 V DC	■	■	■	■	■	■	■	
Residual ripple [2]	< 5 V_{PP}	■	■	■	■	■	■	■	
Power consumption [3]	< 350 mA	■	■	■	■	■	■	■	
Switched outputs	4 x B (NPN/PNP)	■	■	■	■	■	■	■	
Output currents I_A max. [4]	< 100 mA	■	■	■	■	■	■	■	
Response time/cycle time [5]	≥ 2.5 ms	■	■	■	■	■	■	■	
Switching frequency max.	400/s	■	■	■	■	■	■	■	
Trigger output for ext. light. [6]	TTL; low = active	■	■	■	■	■	■	■	
Trigger input [7]	Falling edge;	■	■	■	■	■	■	■	
	High corresp. ≥ 10 V ... 28.8 V	■	■	■	■	■	■	■	
I/O + V_S connection	M12, 8-pin, plug on ICS side	■	■	■	■	■	■	■	
Programming unit connection [8]	M12, 5-pin, receptacle	■	■	■	■	■	■	■	■
Software features	4 evaluation methods (see below)	■	■	■	■	■	■	■	
Teach field, search field	Adjustable size and position	■	■	■	■	■	■	■	
Autoform teach field [9]	Object selectable by arrow	■	■	■	■	■	■	■	
Number of teach fields (test programs)	4 simultan. + max. 12 in memory	■	■	■	■	■	■	■	
Ambient temperature	Operation: 0 °C ... +50 °C	■	■	■	■	■	■	■	
	Storage: –20 °C ... +60 °C								■
	Storage: –25 °C ... +70 °C	■	■	■	■	■	■	■	
Shock load	15 g, 6 directions	■	■	■	■	■	■	■	■
Enclosure rating	IP 64	■	■	■	■	■	■	■	
	IP 40								■
Weight	Approx. 350 g	■	■	■	■	■	■	■	
	Approx. 240 g								■
Housing material	Aluminium and brass	■	■	■	■	■	■	■	

1) Limit values ± 20 %
2) May not exceed or fall short of V_S tolerances
3) Without load
4) Total amount for all four outputs
5) Signal run-time with resistive load
6) Flash length adjustable between 50 µs and 1.3 ms
7) Trigger pulse ≥ 2.5 ms
8) Cable length 2 m, PVC, Ø 5 mm, do not distort cable below 0 °C
9) Contour of teach field = contour of object selected

Test mode	Process [10]	Typical applications
Shape check (pattern matching)	The patterns taught are sought in the image being checked, even when shifted	Shape, position and dimension check, object detection, presence monitoring, completeness
Multi-area evaluation	Pixels are compared with respect to number and area	Presence monitoring, completeness check
Minimum pixel sum	Checking pixel number exceeding a limit	Presence monitoring, e.g. for transparent objects with reflective surfaces, completeness monitoring, object detection with shiny surfaces [11]
Pixel sum	Comparison of the absolute number of white and black pixels	Presence monitoring, completeness check

10) All procedures are used in the binary image. A comparison is made each time between the taught-in reference image and the image to be checked
11) Made possible by the special resistance of the sensor against blooming using a CMOS receiver

Order information

Intelligent Camera Sensor		Intelligent Camera Sensor		Mounting technology		Adapter rings M30x1 on “C” mount	
Type	Order no.	Type	Order no.	Type	Order no.	Type	Order no.
ICS000-B2111	1026154	ICS002-B2111	1025314	Bracket mounting (set)	2027839	With red filter	2030743
ICS001-B1111	1025310	ICS003-B2111	1025315	Uni. rod mount clamp	2022464	With green filter	2030746
ICS001-B2111	1025313	ICS009-B0111	1025312	“C” mount lens 1 : 1.3/25 mm	5312900	Without filter	4039708
ICS002-B1111	1025308						

Fields of view 20 x 20, 40 x 40, 80 x 80 and 160 x 160 mm²

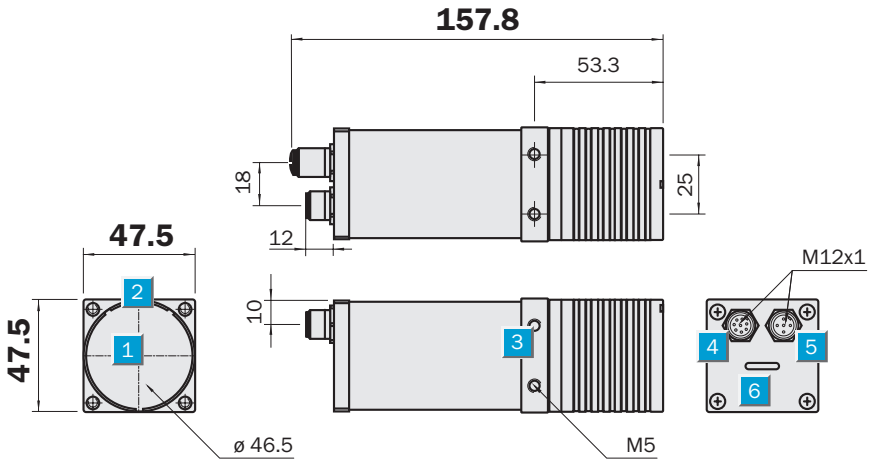
Intelligent Camera Sensor

- Suitable for fast operations
- Flexibly used with external lighting
- Easy product format change through memory selection via PLC
- Secure settings due to LC image display
- Robust design

CE

Dimensional drawing

ICS0XX

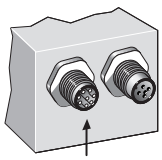


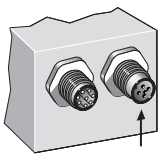
VSC100 9

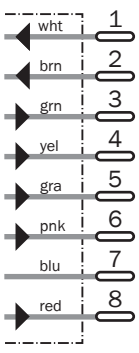
1 Lens/"C" mount thread
2 Hood
3 Fixing hole M5, 4-times
4 Output, 8-pin, M12
5 Setup unit connection, 5-pin, M12
6 Display of output switching state
7 LC Display
8 Keyboard
9 VSC 100: WxHxD = 150 x 82 x 31 mm³

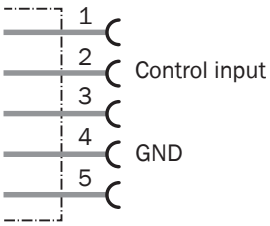
Connection type

ICS0XX	8-pin, M12 (Output)	5-pin, M12 setup unit/control input









Cable, 2 m with plug M12, 5-pin	
Order no.	6025931

Cable, 2 m with receptacles M12, 8-pin	
Order no.	6020633

Cable-control input, 2 m, M12, 4-pin	
Order no.	6028077

Technical data		ICS010 -B2111	ICS011 -B1111	ICS011 -B2111	ICS012 -B1111	ICS012 -B2111	ICS013 -B2111	ICS019 -B0111	VSC 100
Nominal scanning distance/	70 mm/20 x 20 mm²	■							
Field of view	140 mm/40 x 40 mm²		■	■					
	330 mm/80 x 80 mm²				■	■			
	650 mm/160 x 160 mm²						■		
	Provided by customer							■	
Filters/lens	Lens with green filter (450 ... 550 nm)		■		■				
	Lens with red filter (610 ... 690 nm)	■		■		■	■		
	Without lens (“C” mounting thread)							■	
Image sensor	CMOS; 512 x 512 pixels	■	■	■	■	■	■	■	
Supply voltage U_V [1]	24 V DC	■	■	■	■	■	■	■	
Residual ripple [2]	< 5 V_{PP}	■	■	■	■	■	■	■	
Current consumption [3]	< 350 mA	■	■	■	■	■	■	■	
Switched outputs	4 x B (NPN/PNP)	■	■	■	■	■	■	■	
Output currents I_A max. [4]	< 100 mA	■	■	■	■	■	■	■	
Response time/cycle time [5]	≥ 2.5 ms	■	■	■	■	■	■	■	
Switching sequence [6]	400/s	■	■	■	■	■	■	■	
Trigger output for ext. light. [7]	TTL; low = active	■	■	■	■	■	■	■	
Trigger input [8]	Falling edge;	■	■	■	■	■	■	■	
	High corresp. ≥ 10 V ... 28.8 V	■	■	■	■	■	■	■	
I/O + V_S connection	M12, 8-pin, plug on ICS side	■	■	■	■	■	■	■	
Programming unit connection [9]	M12, 5-pin, receptacle	■	■	■	■	■	■	■	■
Software features	5 evaluation methods (see below)	■	■	■	■	■	■	■	
Teach field, search field	Adjustable size and position	■	■	■	■	■	■	■	
Autoform teach field [10]	Object selectable by arrow	■	■	■	■	■	■	■	
Number of teach fields (test programs)	4 simultan. + max. 12 in memory	■	■	■	■	■	■	■	
Ambient temperature	Operation: 0 °C ... +50 °C	■	■	■	■	■	■	■	
	Storage: –20 °C ... +60 °C								■
	Storage: –25 °C ... +70 °C	■	■	■	■	■	■	■	
Shock load	15 g, 6 directions	■	■	■	■	■	■	■	■
Enclosure rating	IP 64	■	■	■	■	■	■	■	
	IP 40								■
Weight	Approx. 350 g	■	■	■	■	■	■	■	
	Approx. 240 g								■
Housing material	Aluminium and brass	■	■	■	■	■	■	■	

1) Limit values ± 20 %
2) May not exceed or fall short of V_S tolerances
3) Without load
4) Total amount for all four outputs
5) Signal run-time with resistive load
6) With light/dark ratio 1:1
7) Flash length adjustable between 50 µs and 1.3 ms
8) Trigger pulse ≥ 2.5 ms
9) Cable length 2 m, PVC, Ø 5 mm, do not distort cable below 0 °C
10) Contour of teach field = contour of object selected

Test mode	Process [11]	Typical applications
Rotational contour check	The contours taught are sought in the image being checked, even when rotated and/or shifted	Shape, position and dimension check, object detection, presence monitoring, completeness
Comparison of shapes (pattern matching)	The patterns taught are sought in the image being checked, even when shifted	Shape, position and dimension check, object detection, presence monitoring, completeness
Multi-area evaluation	Pixels are compared with respect to number and area	Presence monitoring, completeness check
Minimum pixel sum	Checking pixel number exceeding a limit	Presence monitoring, e.g. for transparent objects with reflective surfaces, completeness monitoring, object detection with shiny surfaces[12]
Pixel sum	Comparison of the absolute number of white and black dots	Presence monitoring, completeness check

11) All procedures are used in the binary image. A comparison is made each time between the taught-in reference image and the image to be checked
12) Made possible by the special resistance of the sensor against blooming using a CMOS receiver

Order information

Intelligent Camera Sensor		Intelligent Camera Sensor		Mounting technology		Adapter rings M30x1 on “C” mount	
Type	Order no.	Type	Order no.	Type	Order no.	Type	Order no.
ICS010-B2111	On request	ICS012-B2111	On request	Bracket mounting (set)	2027839	With red filter	2030743
ICS011-B1111	On request	ICS013-B2111	On request	Uni. rod mount clamp	2022464	With green filter	2030746
ICS011-B2111	On request	ICS019-B0111	On request	“C” mount lens 1 : 1.3/25 mm	5312900	Without filter	4039708
ICS012-B1111	On request						