

## Vision sensors – Simple and intelligent

### *SIMATIC MV220 color area sensor*

The SIMATIC MV220 compact color area sensor is a complete image processing system for automatic inspection of colored objects. It is ideally suited for use under harsh industrial conditions due to its degree of protection IP65.

It is used for applications in manufacturing, the packaging industry and food and beverages industry. It is so easy to operate that no courses are necessary and the system is "trained" instead of programmed, so even non-experts can use it instantly. It is integrated in the plant automation using digital inputs and outputs.

## Highlights

- Eminently suitable for use in harsh industrial environments thanks to degree of protection IP65
- Control of extremely high-speed processes possible thanks to the short inspection time of the sensor (approximately 30 inspections per second)
- Short changeover times thanks to simple model change
  - 16 inspection models can be taught
  - inspection models are selected using digital inputs
- Flexible adaptation to the individual applications possible
  - flexible adjustment of image window and operating distance
  - flexible adjustment of parameters
- Fast commissioning
  - no image processing knowledge necessary
  - no programming necessary



### *SIMATIC MV230 height profile sensor*

The SIMATIC MV230 compact height profile sensor is a complete image processing system for the automatic inspection of objects based on their surface contour or profile. It is ideally suited for use under harsh industrial conditions due to its degree of protection IP65.

The application areas lie in production engineering, machine construction and the packaging industry. It is so easy to operate that no courses are necessary and the system is "trained" instead of programmed, so even non-experts can use it instantly. It is integrated in the plant automation using digital inputs and outputs.

## Highlights

- Eminently suitable for use in harsh industrial environments thanks to degree of protection IP65
- Shielding against ambient light is not usually necessary due to its high degree of immunity to ambient light
- Short changeover times thanks to simple model change
  - 16 inspection models can be taught
  - inspection models are selected using digital inputs
- Flexible adaptation to the individual applications possible
  - flexible adjustment of the laser line range that can be evaluated
  - flexible adjustment of parameters
- Fast commissioning
  - no image processing knowledge necessary
  - no programming necessary
- Effective start-up and maintenance functions using diagnostics, checksums and statistical information
  - Prevention of unauthorized operation through button disabling



# Machine Vision Systems

## Vision Sensors

### Introduction

#### *SIMATIC VS100 Vision Sensors*

For inspection of small components for shape, type or position, our intelligent VS100 vision sensors are the perfect choice. The complete package comprises lighting, processing unit, sensor and cables. They are installed and commissioned with a flick of the wrist. It is so easy to operate that no courses are necessary and the system is "trained" instead of programmed, so even non-experts can use it instantly.

The compact design allows it to be used in a wide range of different infeed systems such as vibrating conveyors, conveyor belts or grippers. Thanks to standardized interfaces, the vision sensors can be flexibly integrated into the plant automation. For simple conveyor units, a stand-alone solution is available without an additional PLC.

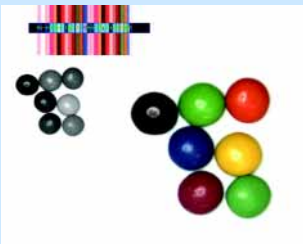
## Highlights

- Extremely easy operation
- Special image processing expertise is not required
- The system is commissioned by teaching it, not programming it
- Stand-alone operation possible
- Simple connection to PROFIBUS DP / PROFINET or serial interface
- WinCC integration
- Remote diagnostics




#### Application


##### Object inspection with SIMATIC MV220

Inspection task	Color inspection tasks in manufacturing and assembly systems	
Applications	Manufacturing, packaging industry and food and beverages industry	
Type of parts to be inspected	e.g. completeness of colored parts, blister packs, cups, bottles, labels and covers	


##### Object inspection with SIMATIC MV230

Inspection task	Inspection of surface contours and profiles in production engineering and assembly	
Applications	Production engineering, the packaging industry and machine construction	
Type of parts to be inspected	Inspection, parts recognition and position checking of parts based on their geometric surface contour or profile	

##### Form inspection with SIMATIC VS110

Inspection task	Correct or defective part and checking of infeed direction	
Applications	Vibrating conveyors, conveyor belts, workholder carousels, gripper units	
Type of parts to be inspected	e.g. screws, bolts, molded parts, pharmaceutical products, confectionery ...	

##### Object inspection with SIMATIC VS120




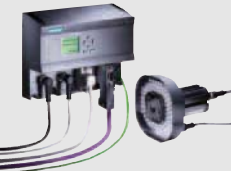
Inspection task	Correctness, lack of damage and position of a part or pattern; position of the part with x/y coordinate and angle of rotation in degrees	
Applications	Conveyor belts, workholder carousels, gripper units, production machines	
Type of parts to be inspected	e.g. screws, bolts, molded parts, pharmaceutical products, confectionery, logos, patterns ...	

# Machine Vision Systems

## Vision Sensors

### Introduction

### Technical specifications

	MV220	MV230	VS110	VS120
				
	<b>Object inspection (color)</b>	<b>Object inspection</b>	<b>Form inspection</b>	<b>Object inspection</b>
<b>Sensor type</b>	CMOS sensor (color), 640 x 480 pixels	CMOS sensor, 750 x 480 pixels	CCD chip, 640 x 480 quadratic pixels	
<b>Image capture</b>	Digital, max. 33 frames/second	Digital, 20 frames/second	Digital, max. 58 frames/second	Triggered frame transfer
<b>Sensor head type</b>	Variable display field size	Fixed display field size	2 x fixed focus (fixed display field size)	2 x fixed focus with fixed display field size, 1 x C/CS-Mount with variable display field size
• Available versions	Complete system			
• Enclosure	see below	see below	Extruded aluminum enclosure	
• Degree of protection	IP65			
<b>Parts size (W x H)</b>	Display field size (infinitely adjustable) <ul style="list-style-type: none"> <li>• For object distance of 50 mm: Display field size 40 x 30 mm</li> <li>• For object distance of 250 mm: Display field size 200 x 150 mm</li> </ul>	<ul style="list-style-type: none"> <li>• For object distance of 310 mm: Display field size 75 x 100 mm</li> </ul>	<ul style="list-style-type: none"> <li>• Objects up to 59 mm x 45 mm, inspection window: 70 mm x 50 mm</li> <li>• Objects up to 35 mm x 25 mm, inspection window: 40 mm x 30 mm</li> </ul>	<ul style="list-style-type: none"> <li>• Objects up to 60 mm x 40 mm, inspection window: 70 mm x 50 mm</li> <li>• Objects up to 34 mm x 24 mm, inspection window: 40 mm x 30 mm</li> <li>• Variable size of object with C/CS-Mount</li> </ul>
<b>Ambient temperature</b>	0 - 45 °C, no condensation		0 °C to 50 °C, without fans	
<b>Lighting</b>				
• Illuminant	Integrated white LEDs	Laser diode, red light	Infrared LEDs	Red LEDs
• Enclosure	see below	see below	Metal with plastic diffusing panel	Plastic ring light with plastic diffusing panel
• Degree of protection	IP65		IP40	IP65
<b>Processing unit</b>				
• Operator controls	4-character text display with 4 operator buttons	operator buttons	LCD display panel (4 lines with 10 characters each) and 6 operator buttons for menu operation	
• Number of types to be saved	up to 16		up to 15	up to 64
• Triggering inspection	External	External or internal freewheeling trigger	External or automatic	External
• Permissible parts rate	33 inspections/s	20 inspections/s	25 items/s	20 items/s (object-dependent)
• Infeed direction				
- For external triggering	Any			
- For automatic triggering	–	Any	From left to right or vice-versa	–
<b>Enclosure (degree of protection)</b>	Plastic, aluminium (IP65)		Plastic, suitable for cabinetless installation (IP40)	
<b>Interfaces on processing unit</b>				
• Digital inputs for 24 V DC	6 (including 1 trigger input)		8 (including 1 trigger input)	
• Digital outputs for 24 V DC	5	4	6 (3 of which 0.5 A)	
• Integrated interface	–		RS232	PROFIBUS DP/Ethernet
• Sensor head interface	–		Digital interface	
• Supply voltage	24 V DC			
<b>Current consumption, max.</b>	2 A		2.5 A	4 A

#### Overview



- Compact image processing sensor for automatic inspection of colored objects
- A synthesis of high-performance image processing technology with simple, compact sensors
- For applications in manufacturing, the packaging industry and food and beverages industry
- Process-oriented implementation thanks to degree of protection IP65
- Integration in plant automation using digital inputs and outputs
- Quick familiarization with task thanks to the teach-in function

#### Benefits

- Eminently suitable for use in harsh industrial environments thanks to IP65 degree of protection
- Control of extremely high-speed processes possible thanks to the short inspection time of the sensor (approximately 30 inspections per second)
- Short changeover times thanks to simple model change
  - 16 inspection models can be taught
  - Inspection models are selected using digital inputs
- Flexible adaptation to the individual applications possible
  - Flexible adjustment of image window and operating distance
  - Flexible adjustment of parameters
- Fast commissioning
  - No image processing knowledge necessary
  - No programming necessary

#### Application

The SIMATIC MV220 image processing sensor is a complete image processing system for automatic inspection of color objects. It completes the product portfolio in the low-end image processing segment and high-end segment of conventional sensors.

Due to its high performance and simplicity, simple color inspection tasks are accessible that are too complex for the other image processing systems and which exclude themselves on grounds of cost.

The module is used in:

- Manufacturing and assembly systems for automobile industry suppliers and electronics;
- Checking the presence of colored components

- Packaging machines for blister packs and combined packs
- Checking for presence, part recognition and checking the location of colored objects
- Cup and bottle filling in the food & beverages industry
- Print inspection and parts identification for labels and covers

#### Design

The SIMATIC MV220 image processing sensor combines all the components required for the test in a compact housing:

- Rugged plastic/metal housing with IP65 degree of protection
- Digital camera for evaluation of color pictures:
  - CMOS chip
  - Resolution of 640 x 480 pixels
- Continuously adjustable lens:
  - Variable image field from 40 x 30 mm to 200 x 150 mm
  - Variable object distance from 50 mm to 250 mm
- Integrated white lighting
- Laser-based alignment tool
- Operator controls and displays:
  - Input keys
  - Display
  - LEDs
- M12 plug and socket with connections for:
  - Power supply
  - Digital inputs and outputs
- M4 fastening holes for mechanical fixing system for industrial sensors

#### Function

The following functions are available:

- Teaching in the models using one or more good parts
- Inspecting an object using the features extracted during teach-in
- Inspection can be performed on stationary and moving objects
- Inspection of the object supplies a good/bad statement in accordance with the set threshold values
- The results are output on two digital outputs:
  - OK: Compliance of the object with the saved model is better or equal to the set threshold value
  - N\_OK: Compliance of the object with the saved model is worse than or equal to the set threshold value

#### Mode of operation

Manual alignment of the sensor is supported by a laser-based alignment tool. Two laser beams project two light spots into the image window of the sensor.

The sensor is calibrated to the ambient conditions, menu-driven, based on the templates supplied.

The inspection tasks are taught by presenting one or more good objects. The result of teach-in can be saved in one of 16 data records. The learned inspection task can then be tested immediately in test mode.

To start the evaluation mode you have to select a trained object data record and switch to "RUN" mode. The sensor starts the evaluation after triggering.

Depending on the trained threshold values and the actual evaluated values, the result is output to the OK or N\_OK digital outputs for a good or bad result respectively.

The inspection task can be changed by selecting a different data record (model) in "RUN" mode.

Any sensor faults or errors in operating the sensor are reported in the diagnostics. Evaluation mode continues or is terminated depending on the type of error.

# Machine Vision Systems

## Vision Sensors

### SIMATIC MV220

#### Technical specifications

MV220 Vision Sensor	
<b>Image sensor</b>	
Image acquisition	CMOS sensor (color); 640 x 480 pixels
Size of the image field	Continuously variable; depending on the object distance
<ul style="list-style-type: none"> <li>For object distance of 50 mm</li> <li>For object distance of 250 mm</li> </ul>	40 x 30 mm 200 x 150 mm
Number of distinguishable colors	Depending on inspection severity; 2048 colors / 64 colors / 16 colors
Inspection types	Matching, recognition
Inspection triggering	External; via digital input
Output of results	"OK" and "N_OK"; via LEDs and digital outputs
<b>Lighting</b>	
Light source	Integrated white LEDs
Light intensity	800 LUX for object distance of 150 mm
External lighting	Controllable via digital output
<b>Functions</b>	
Operator control	4-character text display and 4 operator buttons
Alignment tool	Using laser projection (laser class 2)
Number of models that can be stored	16; using digital inputs
Teach-in of models	Using "Teach-in"
Diagnostics messages	Using LED, text display and digital output
Operating status display	Using LED and digital output
Disabling operation of keys	Possible using digital input
<b>Interfaces</b>	
Digital inputs	6 inputs, 24 V DC of which one trigger input (100 µs delay time) and 5 inputs for model selection and key disabling
Digital outputs	5 outputs; 24 V DC Outputs for results, 500 mA Outputs for diagnostics and external lighting, 100 mA Outputs for operating status, 20 mA
Connection of digital inputs and outputs	M12 socket and M12 plug, 8-pole
Mounting the sensor	Using M4 fixing holes

#### MV220 Vision Sensor

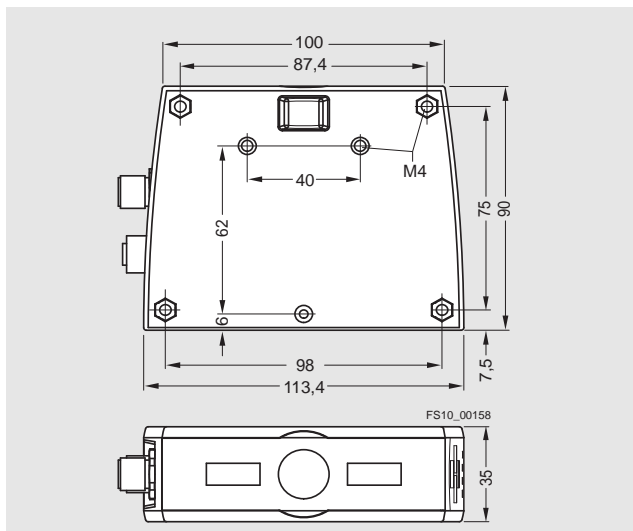
##### General Specifications

Supply voltage	
<ul style="list-style-type: none"> <li>Rated value</li> <li>Voltage range</li> </ul>	24 V DC 20.4 to 28.8 V DC; with reverse polarity protection
Current consumption, max.	2 A
Material	
<ul style="list-style-type: none"> <li>Housing</li> <li>Lens cover</li> </ul>	Plastic, aluminum Plastic
Weight	113 x 35 x 90
Degree of protection	430 g
Ambient temperature	IP65 acc. to DIN EN 60529
Mechanical strength	0 – 45°C
Mechanical strength	
<ul style="list-style-type: none"> <li>Oscillations</li> <li>Shock</li> </ul>	acc. to IEC61131-2 acc. to IEC61131-2

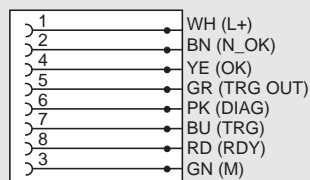
#### Selection and Ordering data

	Order No.
<b>SIMATIC MV220</b> Color mark sensor for inspecting colored objects; size of image field 40 mm x 30 mm to 200 mm x 150 mm; operating unit, display unit and LED lighting integrated; incl. operating instructions and templates	<b>6GF5 110-0AA0-0AA0</b>
<b>Accessories</b>	
<b>M12 cable plug</b> With 5 m PUR cable, black, shielded, 8-pole (8 x 0.25 mm <sup>2</sup> )	<b>3RX8 000-0CB81-1GF0</b>
<b>M12 cable plugs</b> With 5 m PUR cable, black, shielded, 8-pole (8 x 0.25 mm <sup>2</sup> )	<b>3RX8 000-0CD81-1GF0</b>
<b>Round-steel fixing bar</b> Diameter = 12 mm, length = 200 mm, for fixing system for sensors	<b>3RX7 315</b>
Diameter = 12 mm, length = 300 mm, for fixing system for sensors	<b>3RX7 316</b>
<b>Holding plate</b> For accommodating the SIMATIC MV 220, use in connection with fixing bar; for fixing system for sensors	<b>3RX7 326</b>
<b>Mounting base</b> With 12 mm receptacle for sensor fixing system	<b>3RX7 322</b>

#### Dimensions

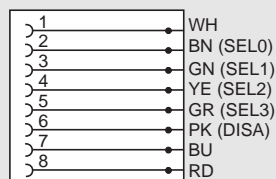


#### Schematics



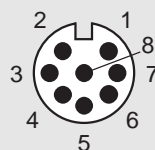
FS10\_00163

MV220 Vision Sensor, X1 interface

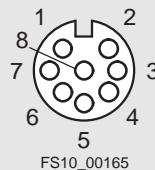


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MV220 Vision Sensor, X2 interface



MV220 Vision Sensor, socket pin assignment



MV220 Vision Sensor, plug pin assignment

# Machine Vision Systems

## Vision Sensors

### SIMATIC MV230

#### Overview



- Compact image processing sensor for the automatic testing of objects based on the specific surface contour or profile.
- A synthesis of high-performance image processing technology with simple, compact sensors
- High stability against ambient light
- For applications in manufacturing, the packaging industry and in the construction of special machines and serial machines
- Process-oriented implementation thanks to degree of protection IP65
- Integration in plant automation using digital inputs and outputs
- Quick familiarization with task thanks to the teach-in function

#### Benefits

- Degree of protection IP65 makes use in harsh industrial environments possible
- Costs for shielding against ambient light can normally be saved due to their high stability against ambient light
- Short changeover times thanks to simple model change
  - 16 inspection models can be taught
  - inspection models are selected using digital inputs
- Rapid startup thanks to Teach In
  - no image processing knowledge necessary
  - effective start-up and maintenance functions using diagnostics, checksums and statistical information
- Prevention of unauthorized operation through button disabling

#### Application

The SIMATIC MV230 height profile sensor is a complete image processing system for the automatic inspection of objects based on the specific height contour or profile. The split-beam method and laser projection on which it is based supports extremely rugged and reliable inspection.

It completes the product portfolio in the low-end image processing segment and high-end segment of conventional sensors.

Its performance capability, simplicity and in particular the ruggedness of the test procedures can be used for inspection tasks that are too complex for other image processing systems and that must be disregarded for cost reasons.

The module is used in:

- Production and assembly systems for automotive suppliers and electrical engineering; checking, parts recognition and position inspection during assembly
- Packaging machines
  - Checking for presence, parts recognition and checking the location of objects
- General machine construction
  - Checking for presence, parts recognition and checking the location of objects

#### Design

The SIMATIC MV230 height profile sensor combines all the components required for the test in a compact enclosure:

- Rugged plastic/metal enclosure with degree of protection IP65
- Digital camera:
  - CMOS chip
  - Resolution of 750 x 480 pixels
- Integrated laser line of up to 75 mm in length
- Operator controls and displays:
  - Input keys
  - Display
  - LED displays
- M12 plug and socket with connections for:
  - Power supply
  - Digital inputs and outputs
- M4 fastening holes for mechanical fixing system for industrial sensors

#### Function

The following functions are available:

- Training of models based on a Good object
- Inspecting an object using the features extracted during teach-in
- Inspection of the object supplies a good/bad statement in accordance with the set threshold values (Q-LIMIT)
- Inspection results are output on two digital outputs:
  - OK: Compatibility of the object with the saved model is greater than or equal to the set threshold value
  - N\_OK: Compatibility of the object with the saved model is less than the set threshold value

#### Operating principle

Manual alignment of the sensor is supported by the visible laser line.

The inspection task is trained by presenting a Good object. The object to be inspected or the object area to be inspected is positioned under the laser line.

For smaller objects, the length of the laser line range that can be evaluated can be reduced. The teach-in result is saved under one of 16 data records (model number).

The learned inspection task can then be tested immediately in test mode.

To start the evaluation mode you have to select a trained object data record and switch to "RUN" mode.

After triggering, the sensor starts evaluation.

On the basis of the learned threshold values and the actual values of the evaluation, a result is output on the OK digital outputs (Good) or N\_OK (Bad).

The inspection task can be changed by selecting a different data record (model) in "RUN" mode.

Any sensor faults or errors in operating the sensor are reported in the diagnostics. Evaluation mode continues or is terminated depending on the type of error.



### Technical specifications

<b>MV230 Vision Sensor</b>	
<b>Image sensor</b>	
Operating distance	CMOS sensor; 750 x 480 pixels 210 mm to 310 mm
Size of the image field	75 x 100 mm (for 310 mm operating distance)
Test type	Profile evaluation
Accuracy/physical resolution	Height accuracy: 0.5 mm; Width accuracy: 0.2 mm
Triggering for image capture	Internal, freewheeling trigger; external trigger through digital input TRG
Max. cycle time	50 ms
Response time	16 ms
Output of results	"OK" and "N_OK"; via LEDs and digital outputs
<b>Lighting</b>	
Light source	Laser diode, red light
Laser protection class	2M (IEC 825-1, EN 60825-1)
Length of laser line	50 mm to 75 mm
<b>Functions</b>	
Operation	4-character text display and 4 operator buttons
Number of models that can be taught	16
Teach-in of models	"Teach-in" on the sensor
Diagnostic messages	available; using LED, text display and digital output
Operating status display	available; using LED and digital output
Disabling operation of keys	possible; using digital input
Checking the set values	possible using global and model-specific checksums
Statistics function	available
<b>Interfaces</b>	
Digital inputs	6 inputs; for trigger (TRG), model selection (SEL0-3) and button disable (DISA)
Rated voltage	24 V DC
Input current	typ. 7 mA
Voltage range	Signal 1: 15 ... 30 V Signal 0: -3 ...5 V
Input delay	3 ms typical (input TRG 0.1 ms)
Input characteristics curve	IEC1131, Type 1
Digital outputs	4 outputs; for result output (OK, N_OK), diagnostics (DIAG) and ready status (RDY)
Output voltage for "1" signal	L+ (-0.8 V)
Output current for "1" signal	500 mA (outputs OK, N_OK) 100 mA (DIAG) 20 mA (RDY)
Short-circuit protection at the outputs	Yes, electronic
<b>General data</b>	
Supply voltage L+	
• Nominal value	24 V DC
• Voltage range	20.4 to 28.8 V DC, with reverse polarity protection
Power consumption max.	2 A

### MV230 Vision Sensor

Material	
• Enclosure	Plastic, aluminum
• Lens cover	plastic
Dimensions (H x W x D) in mm	161 x 35 x 112
Weight	450 g
Degree of protection	IP65 to DIN EN 60529
Ambient temperature	0 to 45 °C, no moisture condensation
Mechanical strength	
• Vibration	acc. to IEC61131-2
• Shock	acc. to IEC61131-2

### Selection and Ordering data

	Order No.
<b>SIMATIC MV230</b>	A <b>6GF2 110-0BA00-0AA0</b>
Image processing sensor for the automatic inspection of objects and their position based on the specific surface contour and profile	
<b>Accessories</b>	
<b>M12 cable plug</b>	<b>3RX8 000-0CB81-1GF0</b>
With 5 m PUR cable, black, shielded, 8-pole (8 x 0.25 mm <sup>2</sup> )	
<b>M12 cable plugs</b>	<b>3RX8 000-0CD81-1GF0</b>
With 5 m PUR cable, black, shielded, 8-pole (8 x 0.25 mm <sup>2</sup> )	
<b>Round-steel fixing bar</b>	
Diameter = 12 mm, length = 200 mm, for fixing system for sensors	<b>3RX7 315</b>
Diameter = 12 mm, length = 300 mm, for fixing system for sensors	<b>3RX7 316</b>
<b>Holding plate</b>	<b>3RX7 326</b>
For accommodating the SIMATIC MV 220, use in connection with fixing bar; for fixing system for sensors	
<b>Mounting base</b>	<b>3RX7 322</b>
With 12 mm receptacle for sensor fixing system	

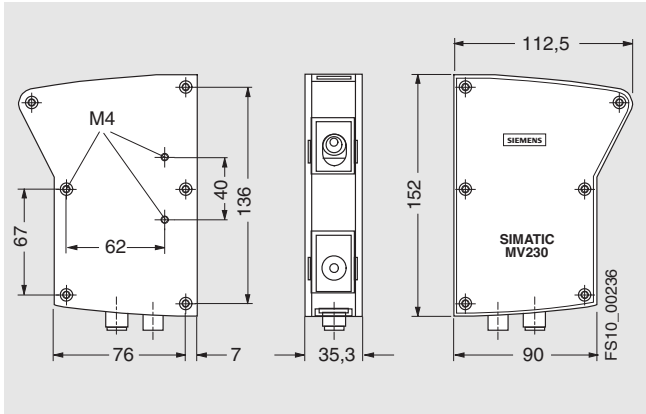
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# Machine Vision Systems

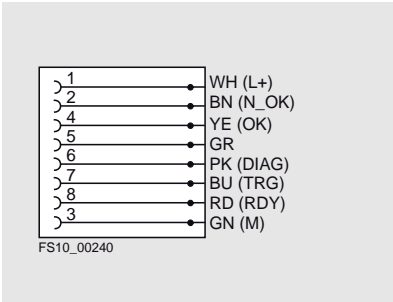
## Vision Sensors

### SIMATIC MV230

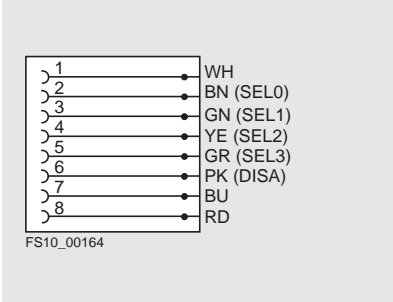
#### Dimensions



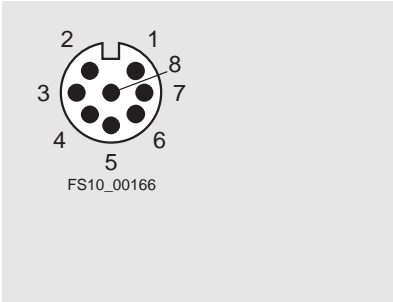
#### Schematics



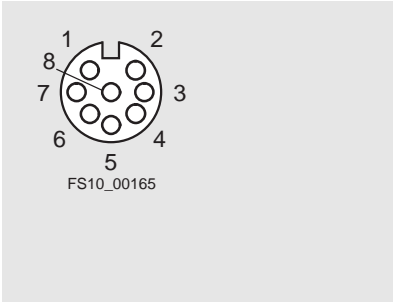
Plug connection for interface X1 and core color for M12 cable socket, 8-pin, length 5 m (Order No.: 3RX8 000-0CB81-1GF0)



Plug connection for interface X2 and core color for M12 cable plug, 8-pin, length 5 m (Order No.: 3RX8 000-0CD81-1GF0)



Pinout X1, M8 connection for cable sockets



Pinout X2, M8 connection for cable plug