

Системы внешнего освещения для датчиков

Технические характеристики

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Spot lighting

VOS-IL-F238W-49



- Uniform illumination of flat, matte and reflective surfaces
- Direct mounting of the spotlighting on the sensor
- Intelligent lighting control with integrated flash controller
- Opening angle of the light cone 49°

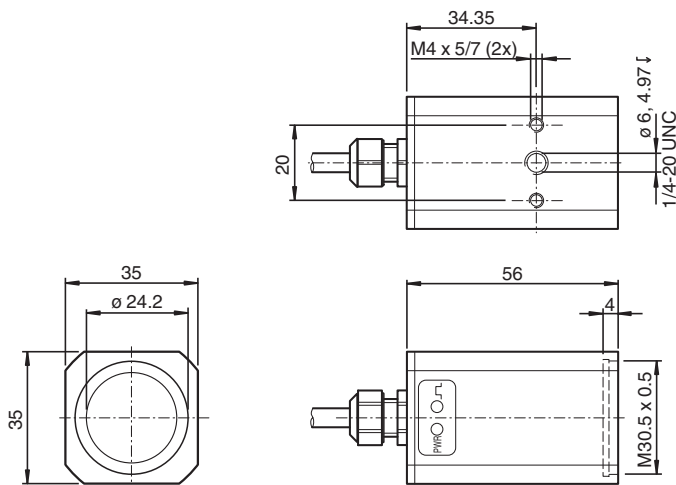
Opening angle of the light beam: 49°, white light, 1 high-power LED, light field size: dia. 24.2 mm, integrated flash controller



Function

Spot lighting is used to illuminate characteristic properties of test objects with a high level of brightness, evenness, and precision. Spot lighting can be used in flash operation or continuous light operation. The opening angle of the light cone can be focused or widened depending on the mounting distance by using the integrated lenses.

Dimensions



Technical Data

General specifications

Light area dimensions	$\varnothing 24.2$ mm
Light source	1 high-power LED
LED color	White light
Color temperature	5300 K
Light direction	Directed with 49° ancillary lenses
Irradiance	13 W/m ² at 0.2 m operating distance
Operating mode	Flash operation / permanent operation

Indicators/operating means

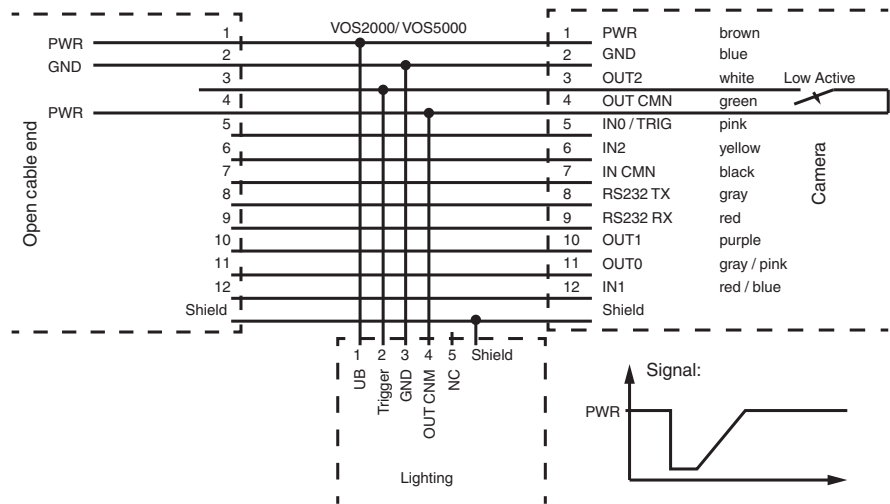
Operation indicator	LED green: supply
Function indicator	LED green: Trigger

Electrical specifications

Technical Data

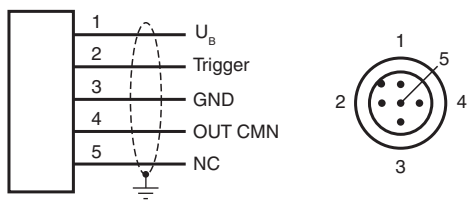
Operating voltage	U _B	21 ... 30 V DC
Current consumption		0.1 A at 24 V DC (average) / 0.2 A (max. pulsed)
Flash duration		0.01 ... 10 ms VOS2000 0.08 ... 10 ms VOS5000 0.18 ... 10 ms
Input/Output		
Input/output type		Flank-triggered / falling edge
0 Level		0 ... 8 V
1 Level		10 V ... U _B
Conformity		
Photobiological safety		risk group 2 according IEC 62471
Approvals and certificates		
CE conformity		CE
Ambient conditions		
Ambient temperature		5 ... 45 °C (41 ... 113 °F) , no moisture condensation
Storage temperature		-20 ... 85 °C (-4 ... 185 °F)
Relative humidity		90 % non-condensing
Mechanical specifications		
Housing length		35 mm
Housing width		35 mm
Housing height		56 mm
Degree of protection		IP65
Connection		cable PUR , M12 connector, 5 pin , A-coded , 230 mm
Material		
Housing		anodized aluminum I PMMA
Installation		Mounting bracket
Mass		approx. 200 g

Connection



NOTE: With trigger parameterization by means of software, the electrical status of the trigger is output to the outside at GPO2 (OUT2). Isolation recommended.

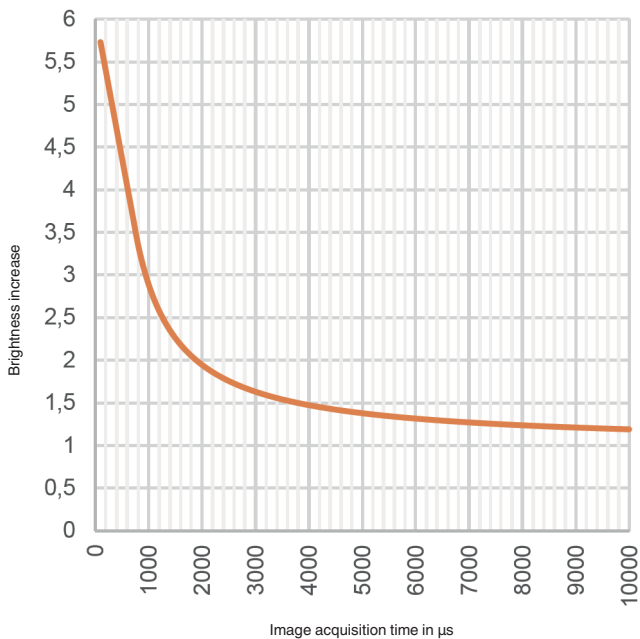
Connection Assignment



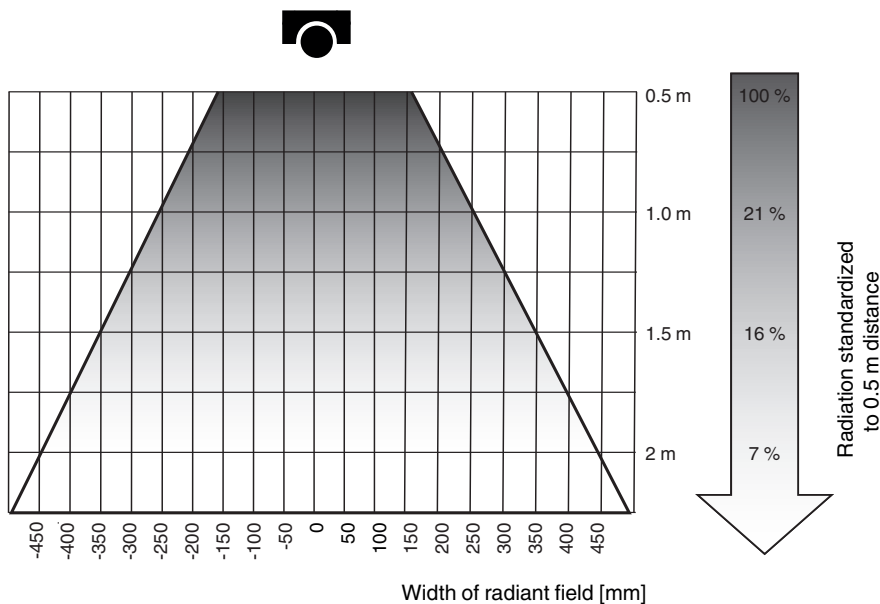
Operation

Increase in brightness from continuous operation to flash operation
The integrated controller with power electronics enables both flash operation and continuous operation. During flash operation, the brightness can be increased for a defined image capture time.

Brightness increase as a function of image acquisition time



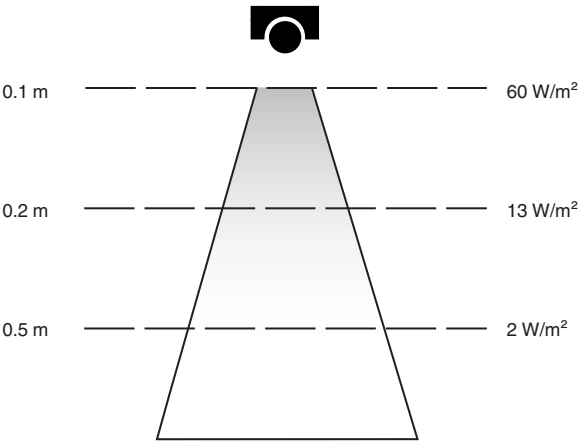
Characteristic Curve



Radiant field
Radiation < 50 % standardized to center axis

Characteristic Curve

Irradiance



Accessories

	VOS-IL-MH03	Mounting bracket for attaching VOS spot lighting to VOS2000 and VOS5000 sensors
	V19S-0,15M-PUR/V15-T-V19-VOS	Y connection cable M12 socket straight A-coded 12-pin to M12 plug 12-pin / M12 socket 5-pin straight A-coded, PUR cable black, shielded
	V1-G-BK2M-PUR-U/ABG-V1-G	Cordset M12 socket straight to M12 plug straight A-coded, 4-pin, PUR cable black, shielded, UL-approved, drag chain suitable

Additional Information

Information on:

- Intended use
- Notes on operation
- Fault repair
- Care and servicing
- Disposal

CAUTION: Photobiological safety—visible light

The lighting emits optical radiation in the wavelength range between 400 nm and 750 nm, which is visible to the human eye. This can cause irritation, damage, or glare to the eye and skin. Using additional optical accessories (e.g. lenses, interchangeable frames/discs) may change the risk group.

CAUTION: Hot housing surfaces

High ambient temperatures and insufficient convection make housing surfaces hot. These can cause burns if touched. Do not touch the lighting during operation. Keep at least 20 mm between the lighting and thermally insulating surfaces, or mount the lighting on a thermally conductive surface.

Intended Use

VOS system lighting are exclusively intended as components for Machine Vision systems, that are used for quality control as well as process control and optimisation in industrial installations.

Use the lighting in enclosed rooms only.

Notes on Operation

Commissioning

- Lightings should be put into operation by trained and qualified personnel only; installation must be in compliance with the specified protective measures. Ensure that the ambient conditions comply with regulations.
- For optimal heat dissipation, mount the lightings over as wide an area as possible on thermally conductive machine elements.
- Keep cooling fins clear to ensure adequate convection.

Software settings of the lighting control sensor:

1. Open the "Setup connections" menu of the sensor. (NOTE: The menu cannot be selected until you have configured a job in the sensor.)
2. In the "Digital I/O setup" operating menu, set output 2 (Out2) of the VOS camera to the "Strobe" output function to generate the trigger signal.
Setzen Sie im Bedienmenü "Setup der digitalen I/O" Ausgang 2 (Out2) der VOS-Kamera auf die Ausgangsfunktion "Strobe" zur Generierung des Triggersignals.
3. Then configure the duration of the pulse length in the "Sensor setup" operating menu.

Status LEDs

The lightings have two status LEDs on the side. The lightings only lights up when both status LEDs are lit or flashing.

- The green status LED indicates that the operating voltage is correct.
- The second green status LED flashes when there is a trigger signal on the ring light.

Decrease in LED brightness due to age

The brightness of LEDs decreases over time due to age. The lightings are designed and manufactured so that, during full load operation under the permissible ambient conditions, the following operating hours are achieved or exceeded without the decreasing intensity of the lighting by more than 30 % compared to the intensity on delivery:

21,000+ h for high-power LED spot lighting in the ultraviolet wavelength range.

Ageing is significantly affected by the installation conditions in the machine, the ambient temperature, and the operating mode of the lighting. Switching or flashing can significantly reduce the decrease in brightness of the LEDs and consequently the brightness of the lighting.

Fault Repair

Fault	Cause/LED status	Remedy
The lighting does not light up.	Insufficient power supply / PWR status LED (left) does not light up	Check that the lighting is connected as detailed on the datasheet and the corresponding operating voltage is set. If you are using a power supply with current limitation, increase the allowable current.
	Trigger signal status LED (right) does not light up	Please check the electrical connections and the software settings.
	Trigger signal status LED (right) lights up	Please check the software settings.

Care and Servicing

The lightings do not generally require any maintenance. However, if the outer plastic surfaces or housing parts need cleaning, please observe the following:

- Never use acetone, alcohol, or other solvents to clean glass surfaces.
- Use a soft, lint-free cloth moistened with soapy water or a standard spectacles cleaning cloth to clean the plastic surfaces and housing parts.

Disposal

Dispose of the lightings at a designated electrical and electronic equipment collection facility.



Ring lighting

VOS-IL-F236W-10

- Uniform illumination of flat, matte and reflective surfaces
- Direct mounting of the ring lighting on the sensor
- Intelligent lighting control with integrated flash controller
- Opening angle of the light cone 10°

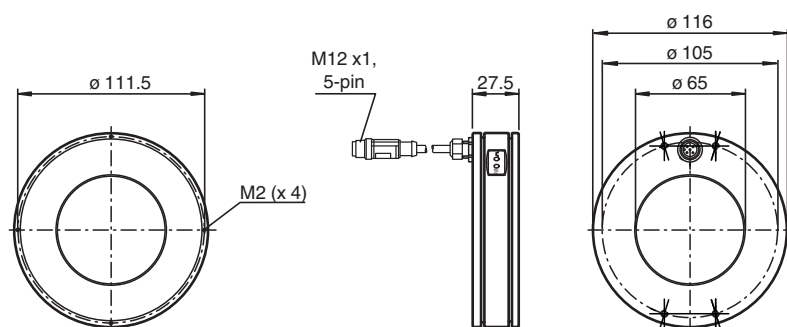
Opening angle of the light beam: 10°, white light, 16 high-power LEDs, light field size: dia. 71 mm x 104 mm, integrated flash controller



Function

Ring lighting is a ring-shaped lighting design in which the light is concentrated in the center of the lighting system. The lighting around the lens minimizes object shadows. The LEDs provide bright and intense lighting with excellent image contrast. The opening angle of the light cone can be focused or widened by using the integrated lenses. A polarization filter can be mounted as an option.

Dimensions



Technical Data

General specifications

Light area dimensions	Ø 71 mm x 104 mm
Light source	16 high-power LEDs
LED color	White light
Color temperature	5300 K
Light direction	Directed with 10° ancillary lenses
Irradiance	278 W/m ² at 0.2 m operating distance
Operating mode	Pulse / flash mode

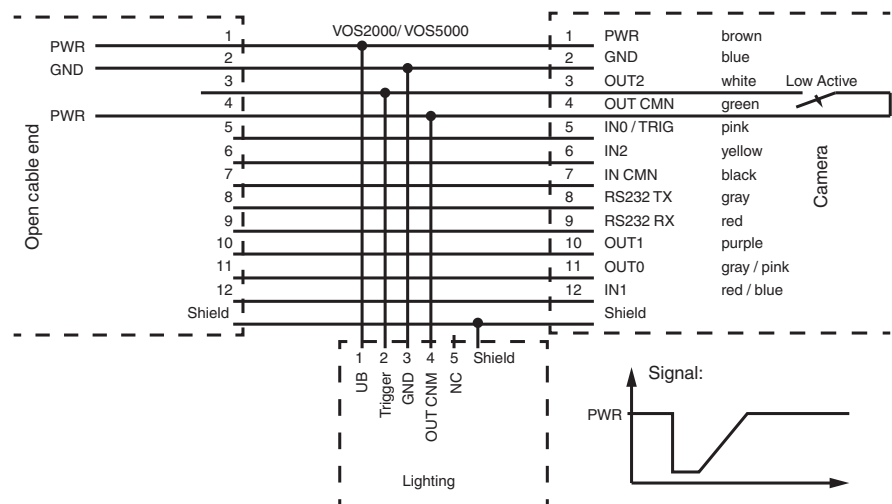
Indicators/operating means

Operation indicator	LED green: supply
Function indicator	LED green: Trigger

Technical Data

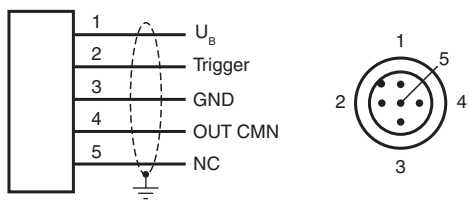
Electrical specifications		
Operating voltage	U _B	21 ... 30 V DC
Current consumption		0.3 A at 24 V DC (average) / 0.8 A (max. pulsed)
Power consumption	P ₀	14 W
Flash duration		VOS2000 0.05 ... 10 ms VOS5000 0.18 ... 10 ms
Input/Output		
Input/output type		Flank-triggered / falling edge
0 Level		0 ... 8 V
1 Level		10 V ... U _B
Conformity		
Photobiological safety		risk group 1 according IEC 62471
Approvals and certificates		
CE conformity		CE
Ambient conditions		
Ambient temperature		5 ... 45 °C (41 ... 113 °F) , no moisture condensation
Storage temperature		-20 ... 85 °C (-4 ... 185 °F)
Relative humidity		90 % non-condensing
Mechanical specifications		
Housing height		27.5 mm
Housing diameter		116 mm
Degree of protection		IP65
Connection		cable PUR , M12 connector, 5 pin , A-coded , 230 mm
Material		
Housing		anodized aluminum I PMMA
Installation		Mounting bracket
Mass		approx. 450 g

Connection

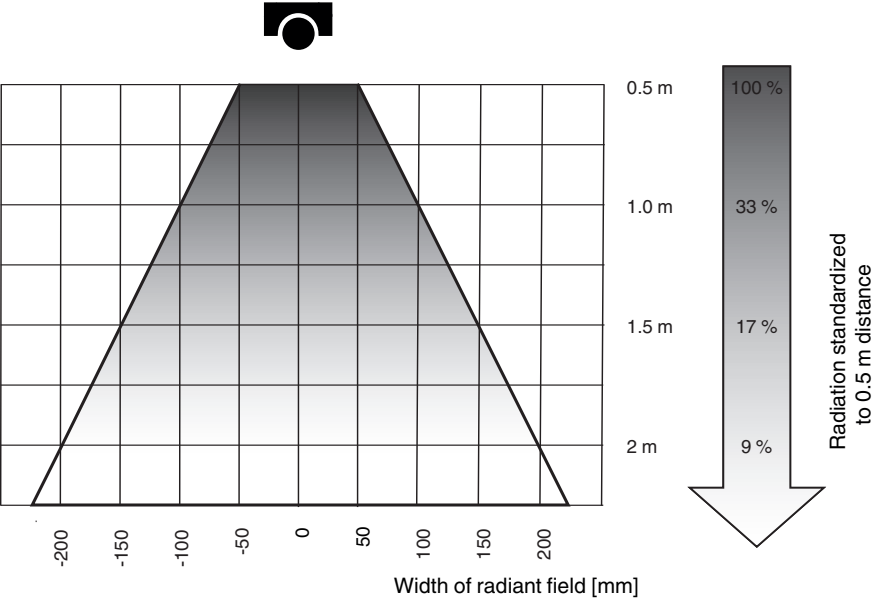


NOTE: With trigger parameterization by means of software, the electrical status of the trigger is output to the outside at GPO2 (OUT2). Isolation recommended.

Connection Assignment

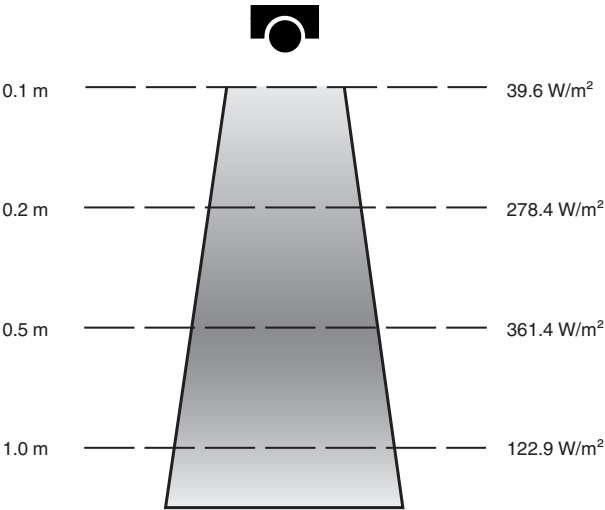


Characteristic Curve



 Radiant field
Radiation < 50 % standardized to center axis

Irradiance



Accessories

	VOS-IL-MH01	Mounting bracket for attaching VOS ring lights to VOS2000 sensors
	VOS-IL-MH02	Mounting bracket for attaching VOS ring lights to VOS5000 sensors
	VOS-IL-POL01	Polarization filters are components for lenses in VOS sensors that are used to suppress interfering reflections in the camera image.
	VOS-IL-MH05	Mounting ring for fastening optical accessories to VOS ring lighting
	V19S-0,15M-PUR/V15-T-V19-VOS	Y connection cable M12 socket straight A-coded 12-pin to M12 plug 12-pin / M12 socket 5-pin straight A-coded, PUR cable black, shielded

Additional Information

Information on:

- Intended use
- Notes on operation
- Fault repair
- Care and servicing
- Disposal

CAUTION: Photobiological safety—visible light

The lighting emits optical radiation in the wavelength range between 400 nm and 750 nm, which is visible to the human eye. This can cause irritation, damage, or glare to the eye and skin. Using additional optical accessories (e.g. lenses, interchangeable frames/discs) may change the risk group.

CAUTION: Hot housing surfaces

High ambient temperatures and insufficient convection make housing surfaces hot. These can cause burns if touched. Do not touch the lighting during operation. Keep at least 20 mm between the lighting and thermally insulating surfaces, or mount the lighting on a thermally conductive surface.

Intended Use

VOS system lighting are exclusively intended as components for Machine Vision systems, that are used for quality control as well as process control and optimisation in industrial installations.

Use the lighting in enclosed rooms only.

Notes on Operation

Commissioning

- Lightings should be put into operation by trained and qualified personnel only; installation must be in compliance with the specified protective measures. Ensure that the ambient conditions comply with regulations.
- For optimal heat dissipation, mount the lightings over as wide an area as possible on thermally conductive machine elements.
- Keep cooling fins clear to ensure adequate convection.

Software settings of the lighting control sensor:

1. Open the "Setup connections" menu of the sensor. (NOTE: The menu cannot be selected until you have configured a job in the sensor.)
2. In the "Digital I/O setup" operating menu, set output 2 (Out2) of the VOS camera to the "Strobe" output function to generate the trigger signal.
Setzen Sie im Bedienmenü "Setup der digitalen I/O" Ausgang 2 (Out2) der VOS-Kamera auf die Ausgangsfunktion "Strobe" zur Generierung des Triggersignals.
3. Then configure the duration of the pulse length in the "Sensor setup" operating menu.

Status LEDs

The lightings have two status LEDs on the side. The lightings only lights up when both status LEDs are lit or flashing.

- The green status LED indicates that the operating voltage is correct.
- The second green status LED flashes when there is a trigger signal on the ring light.

Decrease in LED brightness due to age

The brightness of LEDs decreases over time due to age. The lightings are designed and manufactured so that, during full load operation under the permissible ambient conditions, the following operating hours are achieved or exceeded without the decreasing intensity of the lighting by more than 30 % compared to the intensity on delivery:

80,000+ h for high-power LED lightings in the visible and infrared wavelength range

Ageing is significantly affected by the installation conditions in the machine, the ambient temperature, and the operating mode of the lighting. Switching or flashing can significantly reduce the decrease in brightness of the LEDs and consequently the brightness of the lighting.

Fault Repair

Fault	Cause/LED status	Remedy
The lighting does not light up.	Insufficient power supply / PWR status LED (left) does not light up	Check that the lighting is connected as detailed on the datasheet and the corresponding operating voltage is set. If you are using a power supply with current limitation, increase the allowable current.
	Trigger signal status LED (right) does not light up	Please check the electrical connections and the software settings.
	Trigger signal status LED (right) lights up	Please check the software settings.

Care and Servicing

The lightings do not generally require any maintenance. However, if the outer plastic surfaces or housing parts need cleaning, please observe the following:

- Never use acetone, alcohol, or other solvents to clean glass surfaces.
- Use a soft, lint-free cloth moistened with soapy water or a standard spectacles cleaning cloth to clean the plastic surfaces and housing parts.

Disposal

Dispose of the lightings at a designated electrical and electronic equipment collection facility.



Ring lighting

VOS-IL-F236W-49

- Uniform illumination of flat, matte and reflective surfaces
- Direct mounting of the ring lighting on the sensor
- Intelligent lighting control with integrated flash controller
- Opening angle of the light cone 49°

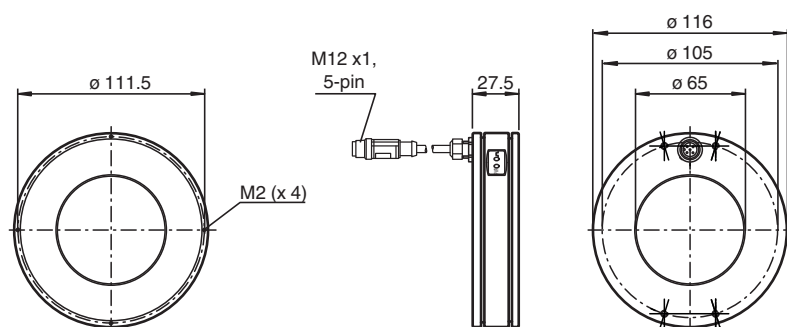
Opening angle of the light beam: 49°, white light, 16 high-power LEDs, light field size: dia. 71 mm x 104 mm, integrated flash controller



Function

Ring lighting is a ring-shaped lighting design in which the light is concentrated in the center of the lighting system. The lighting around the lens minimizes object shadows. The LEDs provide bright and intense lighting with excellent image contrast. The opening angle of the light cone can be focused or widened by using the integrated lenses. A polarization filter can be mounted as an option.

Dimensions



Technical Data

General specifications

Light area dimensions	Ø 71 mm x 104 mm
Light source	16 high-power LEDs
LED color	White light
Color temperature	5300 K
Light direction	Directed with 49° ancillary lenses
Irradiance	149 W/m ² at 0.2 m operating distance
Operating mode	Pulse / flash mode

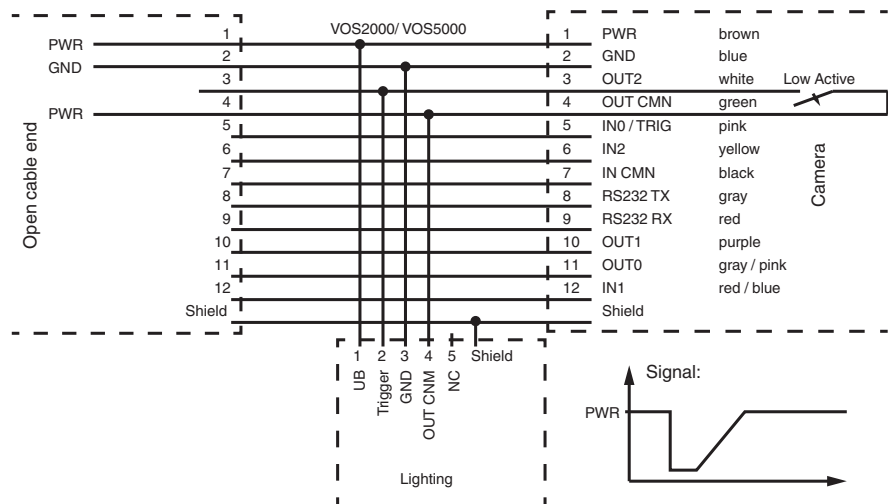
Indicators/operating means

Operation indicator	LED green: supply
Function indicator	LED green: Trigger

Technical Data

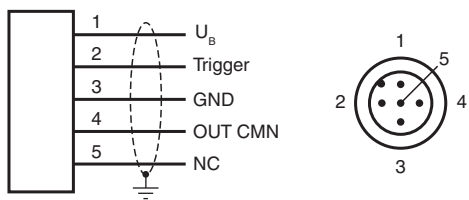
Electrical specifications		
Operating voltage	U _B	21 ... 30 V DC
Current consumption		0.3 A at 24 V DC (average) / 0.8 A (max. pulsed)
Power consumption	P ₀	14 W
Flash duration		VOS2000 0.05 ... 10 ms VOS5000 0.18 ... 10 ms
Input/Output		
Input/output type		Flank-triggered / falling edge
0 Level		0 ... 8 V
1 Level		10 V ... U _B
Conformity		
Photobiological safety		risk group 1 according IEC 62471
Approvals and certificates		
CE conformity		CE
Ambient conditions		
Ambient temperature		5 ... 45 °C (41 ... 113 °F) , no moisture condensation
Storage temperature		-20 ... 85 °C (-4 ... 185 °F)
Relative humidity		90 % non-condensing
Mechanical specifications		
Housing height		27.5 mm
Housing diameter		116 mm
Degree of protection		IP65
Connection		cable PUR , M12 connector, 5 pin , A-coded , 230 mm
Material		
Housing		anodized aluminum I PMMA
Installation		Mounting bracket
Mass		approx. 450 g

Connection

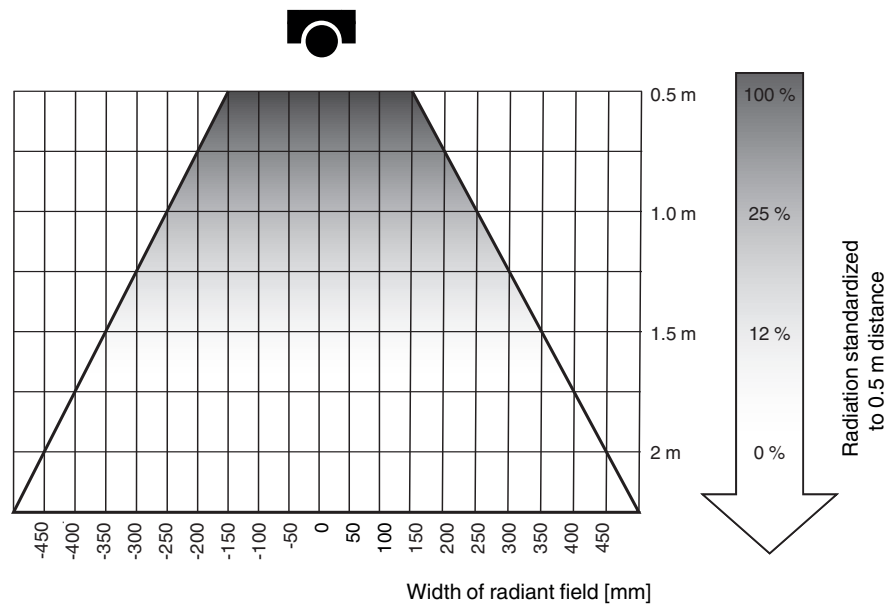


NOTE: With trigger parameterization by means of software, the electrical status of the trigger is output to the outside at GPO2 (OUT2). Isolation recommended.

Connection Assignment



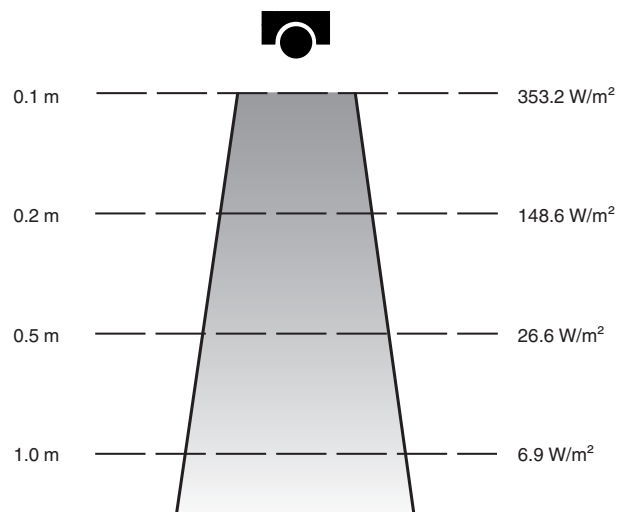
Characteristic Curve



 Radiant field

Radiation < 50 % standardized to center axis

Irradiance



Accessories

	VOS-IL-MH01	Mounting bracket for attaching VOS ring lights to VOS2000 sensors
	VOS-IL-MH02	Mounting bracket for attaching VOS ring lights to VOS5000 sensors
	VOS-IL-POL01	Polarization filters are components for lenses in VOS sensors that are used to suppress interfering reflections in the camera image.
	VOS-IL-MH05	Mounting ring for fastening optical accessories to VOS ring lighting
	V19S-0,15M-PUR/V15-T-V19-VOS	Y connection cable M12 socket straight A-coded 12-pin to M12 plug 12-pin / M12 socket 5-pin straight A-coded, PUR cable black, shielded

Additional Information

Information on:

- Intended use
- Notes on operation
- Fault repair
- Care and servicing
- Disposal

CAUTION: Photobiological safety—visible light

The lighting emits optical radiation in the wavelength range between 400 nm and 750 nm, which is visible to the human eye. This can cause irritation, damage, or glare to the eye and skin. Using additional optical accessories (e.g. lenses, interchangeable frames/discs) may change the risk group.

CAUTION: Hot housing surfaces

High ambient temperatures and insufficient convection make housing surfaces hot. These can cause burns if touched. Do not touch the lighting during operation. Keep at least 20 mm between the lighting and thermally insulating surfaces, or mount the lighting on a thermally conductive surface.

Intended Use

VOS system lighting are exclusively intended as components for Machine Vision systems, that are used for quality control as well as process control and optimisation in industrial installations.

Use the lighting in enclosed rooms only.

Notes on Operation

Commissioning

- Lightings should be put into operation by trained and qualified personnel only; installation must be in compliance with the specified protective measures. Ensure that the ambient conditions comply with regulations.
- For optimal heat dissipation, mount the lightings over as wide an area as possible on thermally conductive machine elements.
- Keep cooling fins clear to ensure adequate convection.

Software settings of the lighting control sensor:

1. Open the "Setup connections" menu of the sensor. (NOTE: The menu cannot be selected until you have configured a job in the sensor.)
2. In the "Digital I/O setup" operating menu, set output 2 (Out2) of the VOS camera to the "Strobe" output function to generate the trigger signal.
Setzen Sie im Bedienmenü "Setup der digitalen I/O" Ausgang 2 (Out2) der VOS-Kamera auf die Ausgangsfunktion "Strobe" zur Generierung des Triggersignals.
3. Then configure the duration of the pulse length in the "Sensor setup" operating menu.

Status LEDs

The lightings have two status LEDs on the side. The lightings only lights up when both status LEDs are lit or flashing.

- The green status LED indicates that the operating voltage is correct.
- The second green status LED flashes when there is a trigger signal on the ring light.

Decrease in LED brightness due to age

The brightness of LEDs decreases over time due to age. The lightings are designed and manufactured so that, during full load operation under the permissible ambient conditions, the following operating hours are achieved or exceeded without the decreasing intensity of the lighting by more than 30 % compared to the intensity on delivery:

80,000+ h for high-power LED lightings in the visible and infrared wavelength range

Ageing is significantly affected by the installation conditions in the machine, the ambient temperature, and the operating mode of the lighting. Switching or flashing can significantly reduce the decrease in brightness of the LEDs and consequently the brightness of the lighting.

Fault Repair

Fault	Cause/LED status	Remedy
The lighting does not light up.	Insufficient power supply / PWR status LED (left) does not light up	Check that the lighting is connected as detailed on the datasheet and the corresponding operating voltage is set. If you are using a power supply with current limitation, increase the allowable current.
	Trigger signal status LED (right) does not light up	Please check the electrical connections and the software settings.
	Trigger signal status LED (right) lights up	Please check the software settings.

Care and Servicing

The lightings do not generally require any maintenance. However, if the outer plastic surfaces or housing parts need cleaning, please observe the following:

- Never use acetone, alcohol, or other solvents to clean glass surfaces.
- Use a soft, lint-free cloth moistened with soapy water or a standard spectacles cleaning cloth to clean the plastic surfaces and housing parts.

Disposal

Dispose of the lightings at a designated electrical and electronic equipment collection facility.

Spot lighting

VOS-IL-F238W-10



- Uniform illumination of flat, matte and reflective surfaces
- Direct mounting of the spotlighting on the sensor
- Intelligent lighting control with integrated flash controller
- Opening angle of the light cone 10°

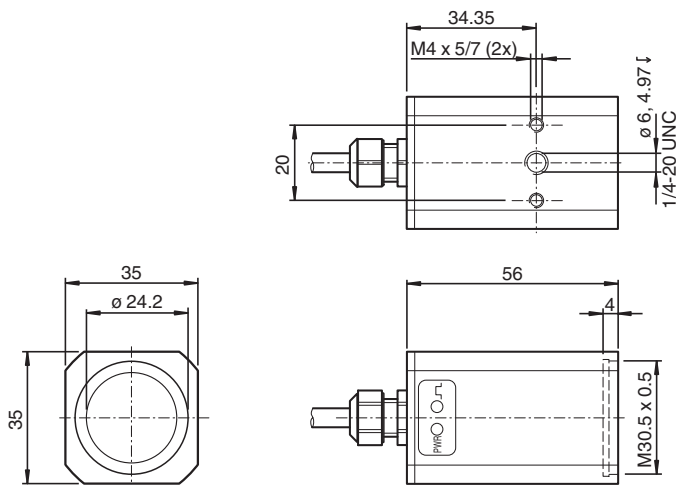
Opening angle of the light beam: 10°, white light, 1 high-power LED, light field size: dia. 24.2 mm, integrated flash controller



Function

Spot lighting is used to illuminate characteristic properties of test objects with a high level of brightness, evenness, and precision. Spot lighting can be used in flash operation or continuous light operation. The opening angle of the light cone can be focused or widened depending on the mounting distance by using the integrated lenses.

Dimensions



Technical Data

General specifications

Light area dimensions	$\varnothing 24.2$ mm
Light source	1 high-power LED
LED color	White light
Color temperature	5300 K
Light direction	Directed with 10° ancillary lenses
Irradiance	206 W/m ² at 0.2 m operating distance
Operating mode	Pulse / flash mode

Indicators/operating means

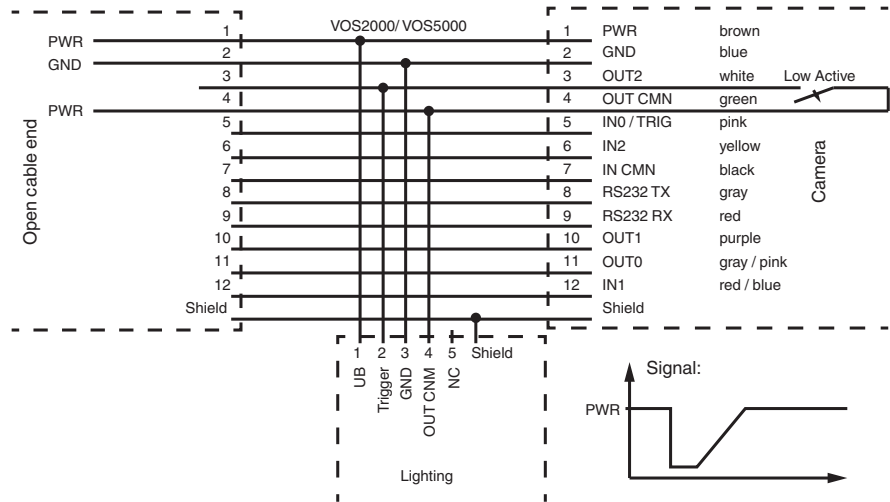
Operation indicator	LED green: supply
Function indicator	LED green: Trigger

Electrical specifications

Technical Data

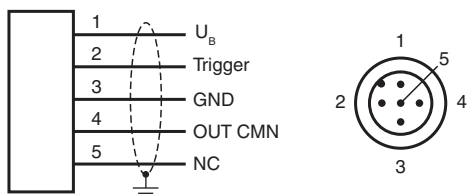
Operating voltage	U _B	21 ... 30 V DC
Current consumption		0.1 A at 24 V DC (average) / 0.2 A (max. pulsed)
Flash duration		0.01 ... 10 ms VOS2000 0.08 ... 10 ms VOS5000 0.18 ... 10 ms
Input/Output		
Input/output type		Flank-triggered / falling edge
0 Level		0 ... 8 V
1 Level		10 V ... U _B
Conformity		
Photobiological safety		risk group 2 according IEC 62471
Approvals and certificates		
CE conformity		CE
Ambient conditions		
Ambient temperature		5 ... 45 °C (41 ... 113 °F) , no moisture condensation
Storage temperature		-20 ... 85 °C (-4 ... 185 °F)
Relative humidity		90 % non-condensing
Mechanical specifications		
Housing length		35 mm
Housing width		35 mm
Housing height		56 mm
Degree of protection		IP65
Connection		cable PUR , M12 connector, 5 pin , A-coded , 230 mm
Material		
Housing		anodized aluminum I PMMA
Installation		Mounting bracket
Mass		approx. 200 g

Connection



NOTE: With trigger parameterization by means of software, the electrical status of the trigger is output to the outside at GPO2 (OUT2).
Isolation recommended.

Connection Assignment

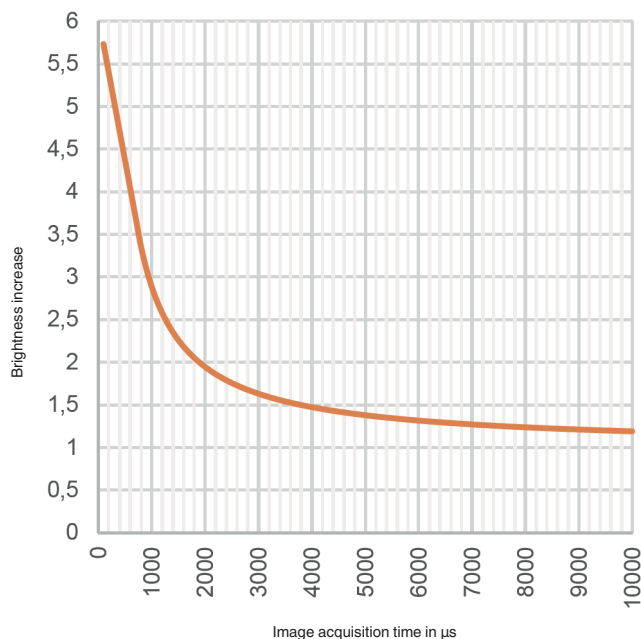


Operation

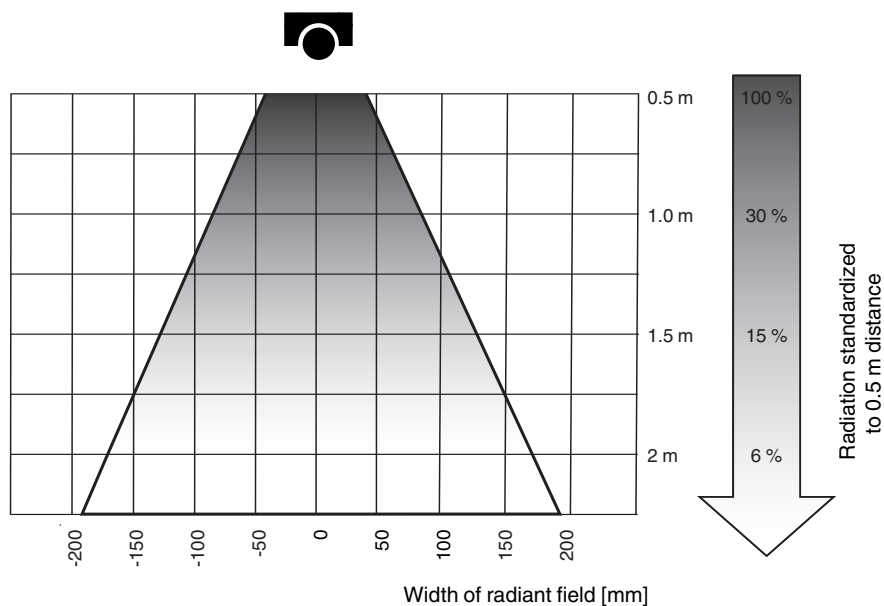
Increase in brightness from continuous operation to flash operation

The integrated controller with power electronics enables both flash operation and continuous operation. During flash operation, the brightness can be increased for a defined image capture time.

Brightness increase as a function of image acquisition time



Characteristic Curve

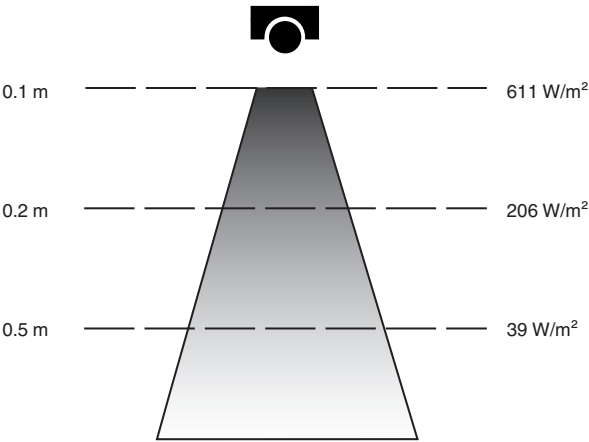


Radiant field

Radiation < 50 % standardized to center axis

Characteristic Curve

Irradiance



Accessories

	VOS-IL-MH03	Mounting bracket for attaching VOS spot lighting to VOS2000 and VOS5000 sensors
	V19S-0,15M-PUR/V15-T-V19-VOS	Y connection cable M12 socket straight A-coded 12-pin to M12 plug 12-pin / M12 socket 5-pin straight A-coded, PUR cable black, shielded
	V1-G-BK2M-PUR-U/ABG-V1-G	Cordset M12 socket straight to M12 plug straight A-coded, 4-pin, PUR cable black, shielded, UL-approved, drag chain suitable

Additional Information

Information on:

- Intended use
- Notes on operation
- Fault repair
- Care and servicing
- Disposal

CAUTION: Photobiological safety—visible light

The lighting emits optical radiation in the wavelength range between 400 nm and 750 nm, which is visible to the human eye. This can cause irritation, damage, or glare to the eye and skin. Using additional optical accessories (e.g. lenses, interchangeable frames/discs) may change the risk group.

CAUTION: Hot housing surfaces

High ambient temperatures and insufficient convection make housing surfaces hot. These can cause burns if touched. Do not touch the lighting during operation. Keep at least 20 mm between the lighting and thermally insulating surfaces, or mount the lighting on a thermally conductive surface.

Intended Use

VOS system lighting are exclusively intended as components for Machine Vision systems, that are used for quality control as well as process control and optimisation in industrial installations.

Use the lighting in enclosed rooms only.

Notes on Operation

Commissioning

- Lightings should be put into operation by trained and qualified personnel only; installation must be in compliance with the specified protective measures. Ensure that the ambient conditions comply with regulations.
- For optimal heat dissipation, mount the lightings over as wide an area as possible on thermally conductive machine elements.
- Keep cooling fins clear to ensure adequate convection.

Software settings of the lighting control sensor:

1. Open the "Setup connections" menu of the sensor. (NOTE: The menu cannot be selected until you have configured a job in the sensor.)
2. In the "Digital I/O setup" operating menu, set output 2 (Out2) of the VOS camera to the "Strobe" output function to generate the trigger signal.
Setzen Sie im Bedienmenü "Setup der digitalen I/O" Ausgang 2 (Out2) der VOS-Kamera auf die Ausgangsfunktion "Strobe" zur Generierung des Triggersignals.
3. Then configure the duration of the pulse length in the "Sensor setup" operating menu.

Status LEDs

The lightings have two status LEDs on the side. The lightings only lights up when both status LEDs are lit or flashing.

- The green status LED indicates that the operating voltage is correct.
- The second green status LED flashes when there is a trigger signal on the ring light.

Decrease in LED brightness due to age

The brightness of LEDs decreases over time due to age. The lightings are designed and manufactured so that, during full load operation under the permissible ambient conditions, the following operating hours are achieved or exceeded without the decreasing intensity of the lighting by more than 30 % compared to the intensity on delivery:

21,000+ h for high-power LED spot lighting in the ultraviolet wavelength range.

Ageing is significantly affected by the installation conditions in the machine, the ambient temperature, and the operating mode of the lighting. Switching or flashing can significantly reduce the decrease in brightness of the LEDs and consequently the brightness of the lighting.

Fault Repair

Fault	Cause/LED status	Remedy
The lighting does not light up.	Insufficient power supply / PWR status LED (left) does not light up	Check that the lighting is connected as detailed on the datasheet and the corresponding operating voltage is set. If you are using a power supply with current limitation, increase the allowable current.
	Trigger signal status LED (right) does not light up	Please check the electrical connections and the software settings.
	Trigger signal status LED (right) lights up	Please check the software settings.

Care and Servicing

The lightings do not generally require any maintenance. However, if the outer plastic surfaces or housing parts need cleaning, please observe the following:

- Never use acetone, alcohol, or other solvents to clean glass surfaces.
- Use a soft, lint-free cloth moistened with soapy water or a standard spectacles cleaning cloth to clean the plastic surfaces and housing parts.

Disposal

Dispose of the lightings at a designated electrical and electronic equipment collection facility.

Spot lighting

VOS-IL-F238W-26



- Uniform illumination of flat, matte and reflective surfaces
- Direct mounting of the spotlighting on the sensor
- Intelligent lighting control with integrated flash controller
- Opening angle of the light cone 26°

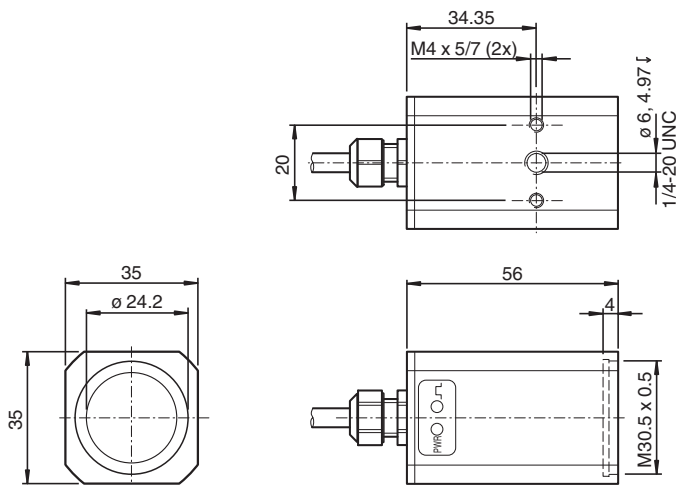
Opening angle of the light beam: 26°, white light, 1 high-power LED, light field size: dia. 24.2 mm, integrated flash controller



Function

Spot lighting is used to illuminate characteristic properties of test objects with a high level of brightness, evenness, and precision. Spot lighting can be used in flash operation or continuous light operation. The opening angle of the light cone can be focused or widened depending on the mounting distance by using the integrated lenses.

Dimensions



Technical Data

General specifications

Light area dimensions	$\varnothing 24.2$ mm
Light source	1 high-power LED
LED color	White light
Color temperature	5300 K
Light direction	Directed with 26° ancillary lenses
Irradiance	80 W/m ² at 0.2 m operating distance
Operating mode	Pulse / flash mode

Indicators/operating means

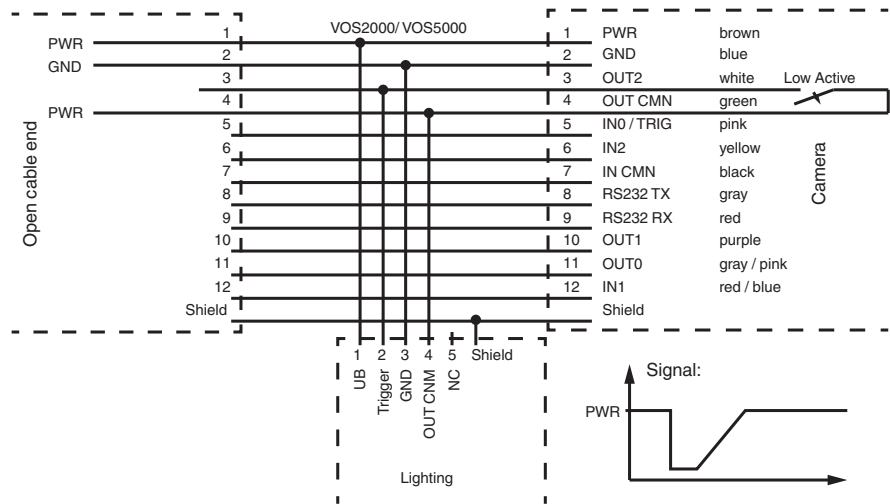
Operation indicator	LED green: supply
Function indicator	LED green: Trigger

Electrical specifications

Technical Data

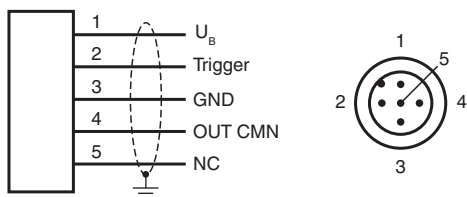
Operating voltage	U _B	21 ... 30 V DC
Current consumption		0.1 A at 24 V DC (average) / 0.2 A (max. pulsed)
Flash duration		0.01 ... 10 ms VOS2000 0.08 ... 10 ms VOS5000 0.18 ... 10 ms
Input/Output		
Input/output type		Flank-triggered / falling edge
0 Level		0 ... 8 V
1 Level		10 V ... U _B
Conformity		
Photobiological safety		risk group 2 according IEC 62471
Approvals and certificates		
CE conformity		CE
Ambient conditions		
Ambient temperature		5 ... 45 °C (41 ... 113 °F) , no moisture condensation
Storage temperature		-20 ... 85 °C (-4 ... 185 °F)
Relative humidity		90 % non-condensing
Mechanical specifications		
Housing length		35 mm
Housing width		35 mm
Housing height		56 mm
Degree of protection		IP65
Connection		cable PUR , M12 connector, 5 pin , A-coded , 230 mm
Material		
Housing		anodized aluminum I PMMA
Installation		Mounting bracket
Mass		approx. 200 g

Connection



NOTE: With trigger parameterization by means of software, the electrical status of the trigger is output to the outside at GPO2 (OUT2). Isolation recommended.

Connection Assignment

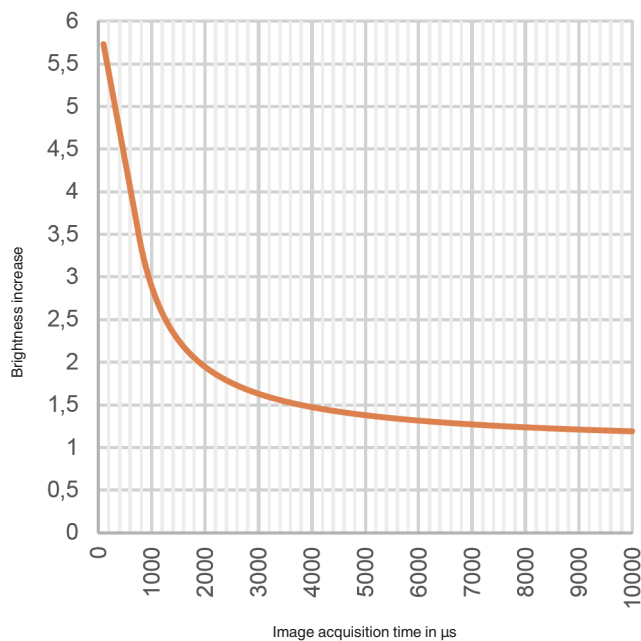


Operation

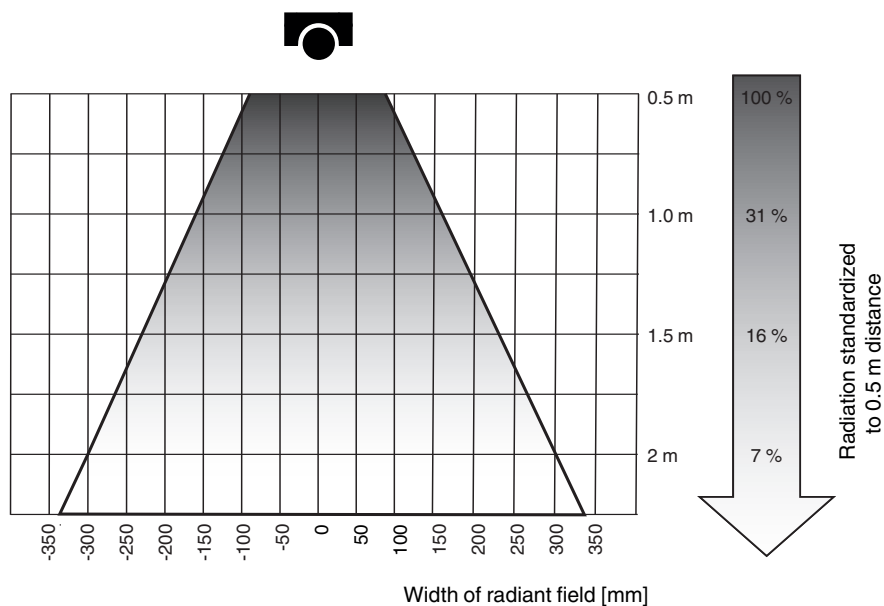
Increase in brightness from continuous operation to flash operation

The integrated controller with power electronics enables both flash operation and continuous operation. During flash operation, the brightness can be increased for a defined image capture time.

Brightness increase as a function of image acquisition time



Characteristic Curve

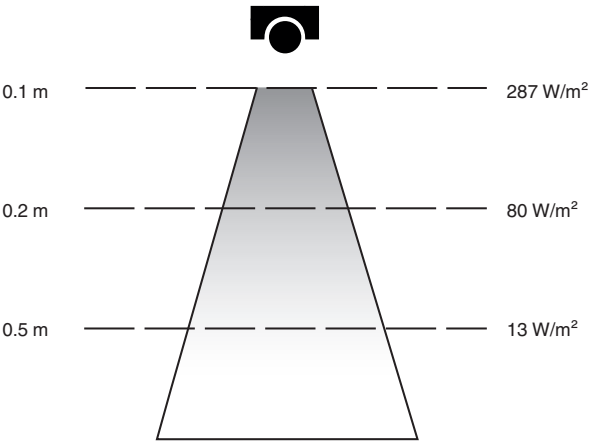


Radiant field

Radiation < 50 % standardized to center axis

Characteristic Curve

Irradiance



Accessories

	VOS-IL-MH03	Mounting bracket for attaching VOS spot lighting to VOS2000 and VOS5000 sensors
	V19S-0,15M-PUR/V15-T-V19-VOS	Y connection cable M12 socket straight A-coded 12-pin to M12 plug 12-pin / M12 socket 5-pin straight A-coded, PUR cable black, shielded
	V1-G-BK2M-PUR-U/ABG-V1-G	Cordset M12 socket straight to M12 plug straight A-coded, 4-pin, PUR cable black, shielded, UL-approved, drag chain suitable

Additional Information

Information on:

- Intended use
- Notes on operation
- Fault repair
- Care and servicing
- Disposal

CAUTION: Photobiological safety—visible light

The lighting emits optical radiation in the wavelength range between 400 nm and 750 nm, which is visible to the human eye. This can cause irritation, damage, or glare to the eye and skin. Using additional optical accessories (e.g. lenses, interchangeable frames/discs) may change the risk group.

CAUTION: Hot housing surfaces

High ambient temperatures and insufficient convection make housing surfaces hot. These can cause burns if touched. Do not touch the lighting during operation. Keep at least 20 mm between the lighting and thermally insulating surfaces, or mount the lighting on a thermally conductive surface.

Intended Use

VOS system lighting are exclusively intended as components for Machine Vision systems, that are used for quality control as well as process control and optimisation in industrial installations.

Use the lighting in enclosed rooms only.

Notes on Operation

Commissioning

- Lightings should be put into operation by trained and qualified personnel only; installation must be in compliance with the specified protective measures. Ensure that the ambient conditions comply with regulations.
- For optimal heat dissipation, mount the lightings over as wide an area as possible on thermally conductive machine elements.
- Keep cooling fins clear to ensure adequate convection.

Software settings of the lighting control sensor:

1. Open the "Setup connections" menu of the sensor. (NOTE: The menu cannot be selected until you have configured a job in the sensor.)
2. In the "Digital I/O setup" operating menu, set output 2 (Out2) of the VOS camera to the "Strobe" output function to generate the trigger signal.
Setzen Sie im Bedienmenü "Setup der digitalen I/O" Ausgang 2 (Out2) der VOS-Kamera auf die Ausgangsfunktion "Strobe" zur Generierung des Triggersignals.
3. Then configure the duration of the pulse length in the "Sensor setup" operating menu.

Status LEDs

The lightings have two status LEDs on the side. The lightings only lights up when both status LEDs are lit or flashing.

- The green status LED indicates that the operating voltage is correct.
- The second green status LED flashes when there is a trigger signal on the ring light.

Decrease in LED brightness due to age

The brightness of LEDs decreases over time due to age. The lightings are designed and manufactured so that, during full load operation under the permissible ambient conditions, the following operating hours are achieved or exceeded without the decreasing intensity of the lighting by more than 30 % compared to the intensity on delivery:

21,000+ h for high-power LED spot lighting in the ultraviolet wavelength range.

Ageing is significantly affected by the installation conditions in the machine, the ambient temperature, and the operating mode of the lighting. Switching or flashing can significantly reduce the decrease in brightness of the LEDs and consequently the brightness of the lighting.

Fault Repair

Fault	Cause/LED status	Remedy
The lighting does not light up.	Insufficient power supply / PWR status LED (left) does not light up	Check that the lighting is connected as detailed on the datasheet and the corresponding operating voltage is set. If you are using a power supply with current limitation, increase the allowable current.
	Trigger signal status LED (right) does not light up	Please check the electrical connections and the software settings.
	Trigger signal status LED (right) lights up	Please check the software settings.

Care and Servicing

The lightings do not generally require any maintenance. However, if the outer plastic surfaces or housing parts need cleaning, please observe the following:

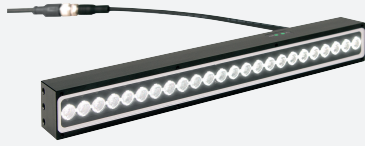
- Never use acetone, alcohol, or other solvents to clean glass surfaces.
- Use a soft, lint-free cloth moistened with soapy water or a standard spectacles cleaning cloth to clean the plastic surfaces and housing parts.

Disposal

Dispose of the lightings at a designated electrical and electronic equipment collection facility.

Bar lighting

VOS-IL-F237W-4819



- Uniform illumination of flat, matte and reflective surfaces
- Intelligent lighting control with integrated flash controller
- Opening angle of the light cone 48°x19°

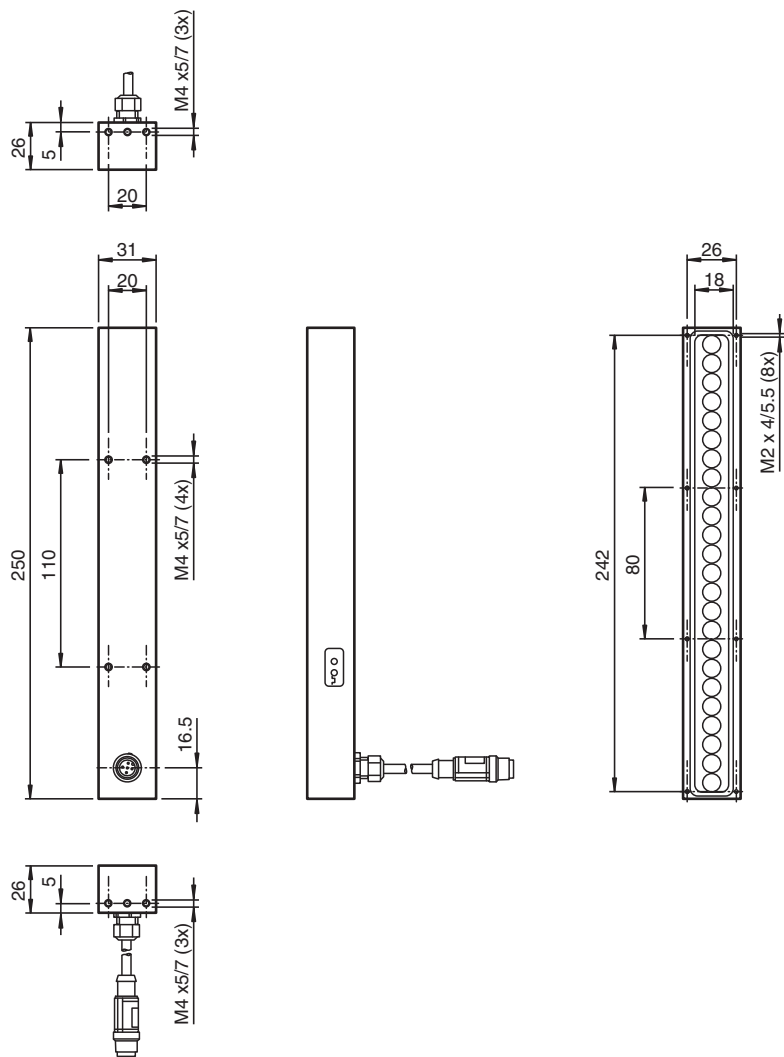
Opening angle of the light beam: 48°x19°, white light, 24 high-power LEDs, light field size: 242 x 18 mm, integrated flash controller



Function

Bar lighting is designed to generate a strip of light on the measurement object or along the edge of the measurement object, which allows the features of the measurement object to be illuminated evenly. Depending on the incident angle of the light and camera, bar lighting can be used to amplify or attenuate the surface reflection of a target. The opening angle of the light cone can be focused or widened depending on the mounting distance by using the integrated lenses.

Dimensions



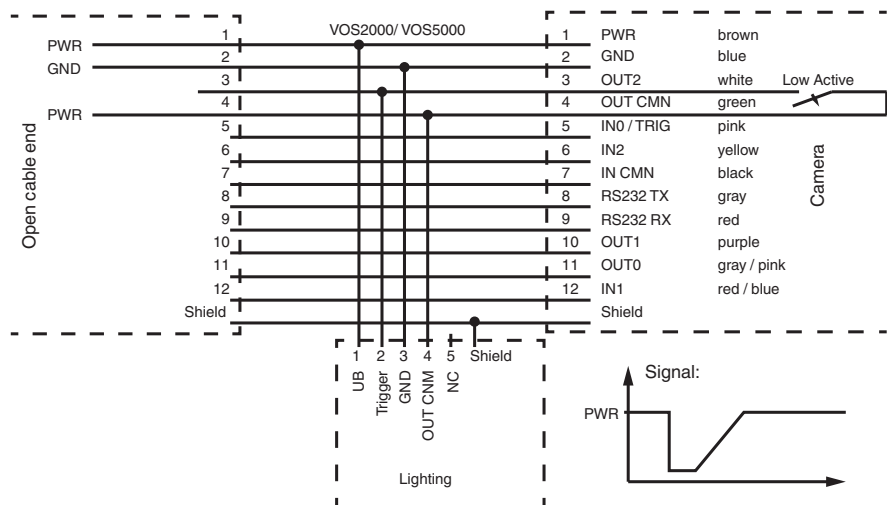
Technical Data

General specifications		
Light area dimensions		242 x 18 mm
Light source		16 high-power LEDs
LED color		White light
Color temperature		5300 K
Light direction		Directed with 48x19° ancillary lenses
Irradiance		81 W/m² at 0.2 m operating distance
Operating mode		Pulse / flash mode
Indicators/operating means		
Operation indicator		LED green: supply
Function indicator		LED green: Trigger
Electrical specifications		
Operating voltage	U _B	21 ... 30 V DC
Current consumption		0.3 A at 24 V DC (average) / 0.5 A (max. pulsed)
Power consumption	P ₀	16 W
Flash duration		0.01 ... 10 ms VOS2000 0.08 ... 10 ms VOS5000 0.18 ... 10 ms
Input/Output		
Input/output type		Flank-triggered / falling edge
0 Level		0 ... 8 V

Technical Data

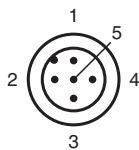
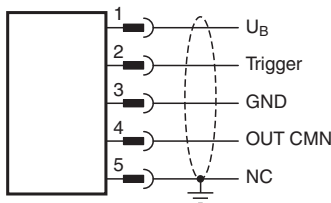
1 Level	10 V ... U _B
Conformity	
Photobiological safety	Risk group 1 according to IEC 62471
Approvals and certificates	
CE conformity	CE
Ambient conditions	
Ambient temperature	5 ... 45 °C (41 ... 113 °F) , no moisture condensation
Storage temperature	-20 ... 85 °C (-4 ... 185 °F)
Relative humidity	90 % non-condensing
Mechanical specifications	
Degree of protection	IP65
Connection	cable PUR , M12 connector, 5 pin , A-coded , 230 mm
Material	
Housing	anodized aluminum I PMMA
Installation	Mounting bracket
Mass	approx. 400 g
Dimensions	
Height	25 mm
Width	31 mm
Length	250 mm

Connection

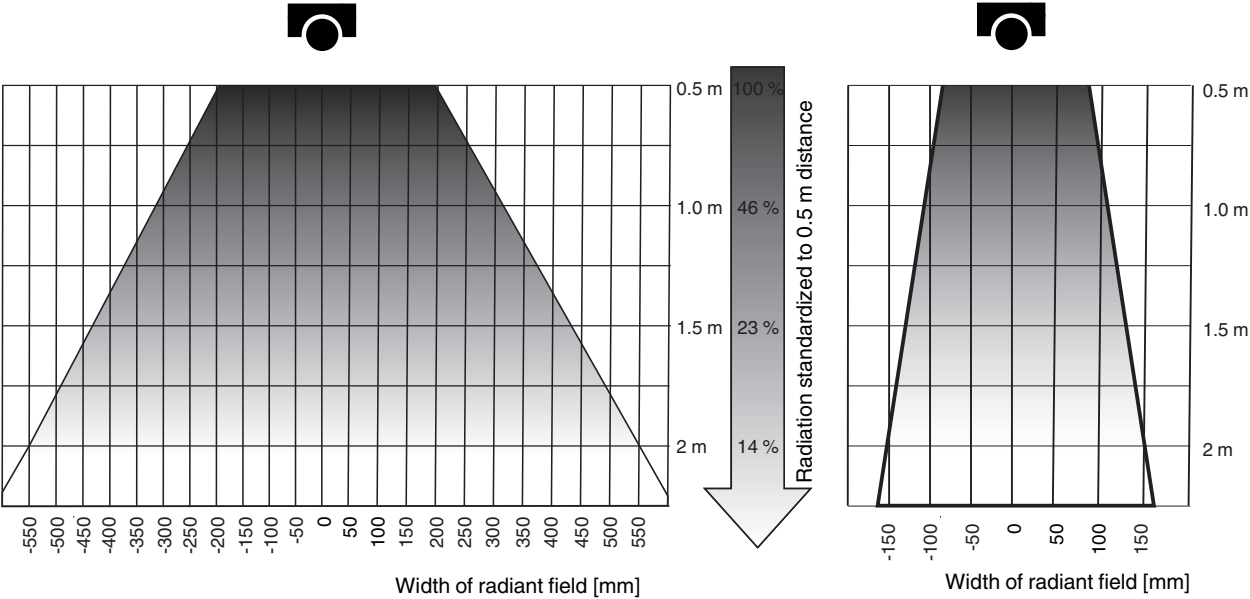


NOTE: With trigger parameterization by means of software, the electrical status of the trigger is output to the outside at GPO2 (OUT2). Isolation recommended.

Connection Assignment

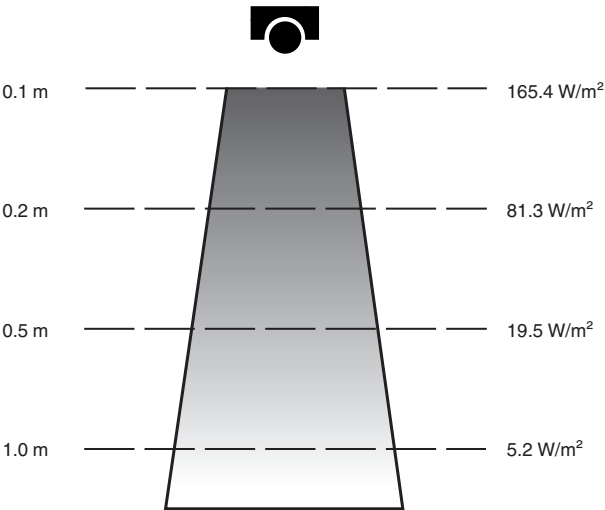


Characteristic Curve



■ Radiant field
Radiation < 50 % standardized to center axis

Irradiance



Additional Information

Information on:

- Intended use
- Notes on operation
- Fault repair
- Care and servicing
- Disposal

CAUTION: Photobiological safety—visible light

The lighting emits optical radiation in the wavelength range between 400 nm and 750 nm, which is visible to the human eye. This can cause irritation, damage, or glare to the eye and skin. Using additional optical accessories (e.g. lenses, interchangeable frames/discs) may change the risk group.

CAUTION: Hot housing surfaces

High ambient temperatures and insufficient convection make housing surfaces hot. These can cause burns if touched. Do not touch the lighting during operation. Keep at least 20 mm between the lighting and thermally insulating surfaces, or mount the lighting on a thermally conductive surface.

Intended Use

VOS system lighting are exclusively intended as components for Machine Vision systems, that are used for quality control as well as process control and optimisation in industrial installations.

Use the lighting in enclosed rooms only.

Notes on Operation

Commissioning

- Lightings should be put into operation by trained and qualified personnel only; installation must be in compliance with the specified protective measures. Ensure that the ambient conditions comply with regulations.
- For optimal heat dissipation, mount the lightings over as wide an area as possible on thermally conductive machine elements.
- Keep cooling fins clear to ensure adequate convection.

Software settings of the lighting control sensor:

1. Open the "Setup connections" menu of the sensor. (NOTE: The menu cannot be selected until you have configured a job in the sensor.)
2. In the "Digital I/O setup" operating menu, set output 2 (Out2) of the VOS camera to the "Strobe" output function to generate the trigger signal.
Setzen Sie im Bedienmenü "Setup der digitalen I/O" Ausgang 2 (Out2) der VOS-Kamera auf die Ausgangsfunktion "Strobe" zur Generierung des Triggersignals.
3. Then configure the duration of the pulse length in the "Sensor setup" operating menu.

Status LEDs

The lightings have two status LEDs on the side. The lightings only lights up when both status LEDs are lit or flashing.

- The green status LED indicates that the operating voltage is correct.
- The second green status LED flashes when there is a trigger signal on the ring light.

Decrease in LED brightness due to age

The brightness of LEDs decreases over time due to age. The lightings are designed and manufactured so that, during full load operation under the permissible ambient conditions, the following operating hours are achieved or exceeded without the decreasing intensity of the lighting by more than 30 % compared to the intensity on delivery:

80,000+ h for high-power LED lightings in the visible and infrared wavelength range

Ageing is significantly affected by the installation conditions in the machine, the ambient temperature, and the operating mode of the lighting. Switching or flashing can significantly reduce the decrease in brightness of the LEDs and consequently the brightness of the lighting.

Fault Repair

Fault	Cause/LED status	Remedy
The lighting does not light up.	Insufficient power supply / PWR status LED (left) does not light up	Check that the lighting is connected as detailed on the datasheet and the corresponding operating voltage is set. If you are using a power supply with current limitation, increase the allowable current.
	Trigger signal status LED (right) does not light up	Please check the electrical connections and the software settings.
	Trigger signal status LED (right) lights up	Please check the software settings.

Care and Servicing

The lightings do not generally require any maintenance. However, if the outer plastic surfaces or housing parts need cleaning, please observe the following:

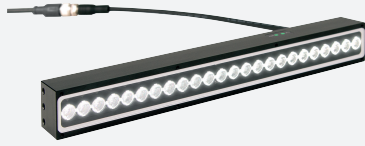
- Never use acetone, alcohol, or other solvents to clean glass surfaces.
- Use a soft, lint-free cloth moistened with soapy water or a standard spectacles cleaning cloth to clean the plastic surfaces and housing parts.

Disposal

Dispose of the lightings at a designated electrical and electronic equipment collection facility.

Bar lighting

VOS-IL-F237W-44



- Uniform illumination of flat, matte and reflective surfaces
- Intelligent lighting control with integrated flash controller
- Opening angle of the light cone 44°

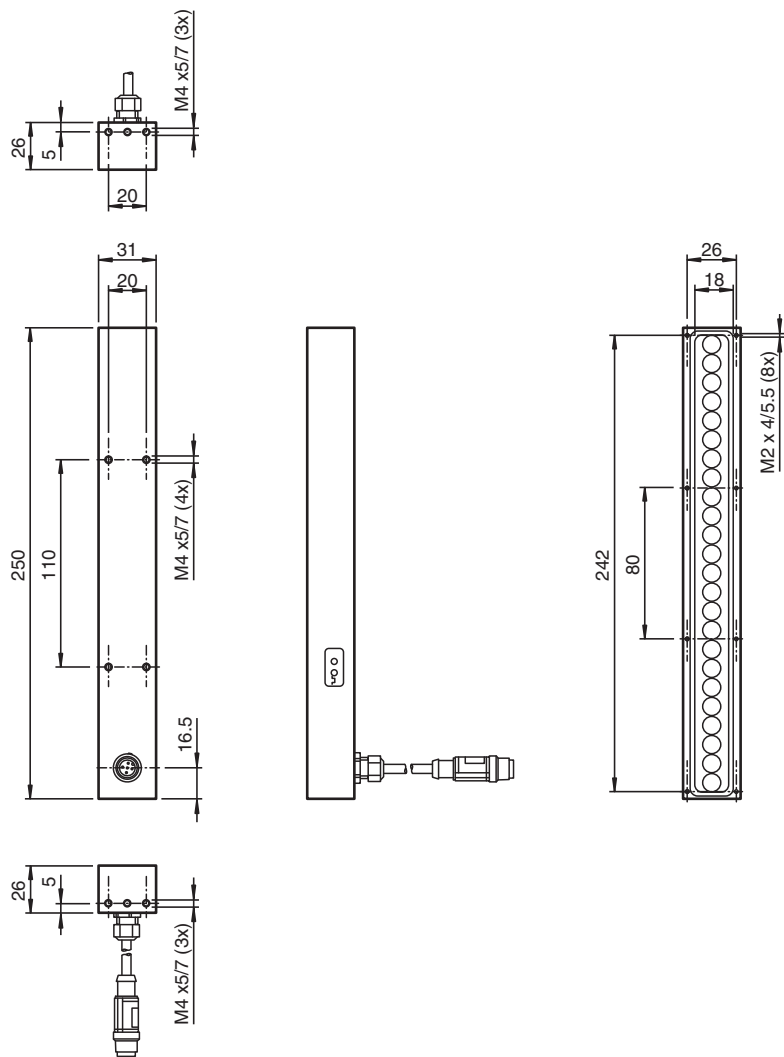
Opening angle of the light beam: 44°, white light, 24 high-power LEDs, light field size: 242 x 18 mm, integrated flash controller



Function

Bar lighting is designed to generate a strip of light on the measurement object or along the edge of the measurement object, which allows the features of the measurement object to be illuminated evenly. Depending on the incident angle of the light and camera, bar lighting can be used to amplify or attenuate the surface reflection of a target. The opening angle of the light cone can be focused or widened depending on the mounting distance by using the integrated lenses.

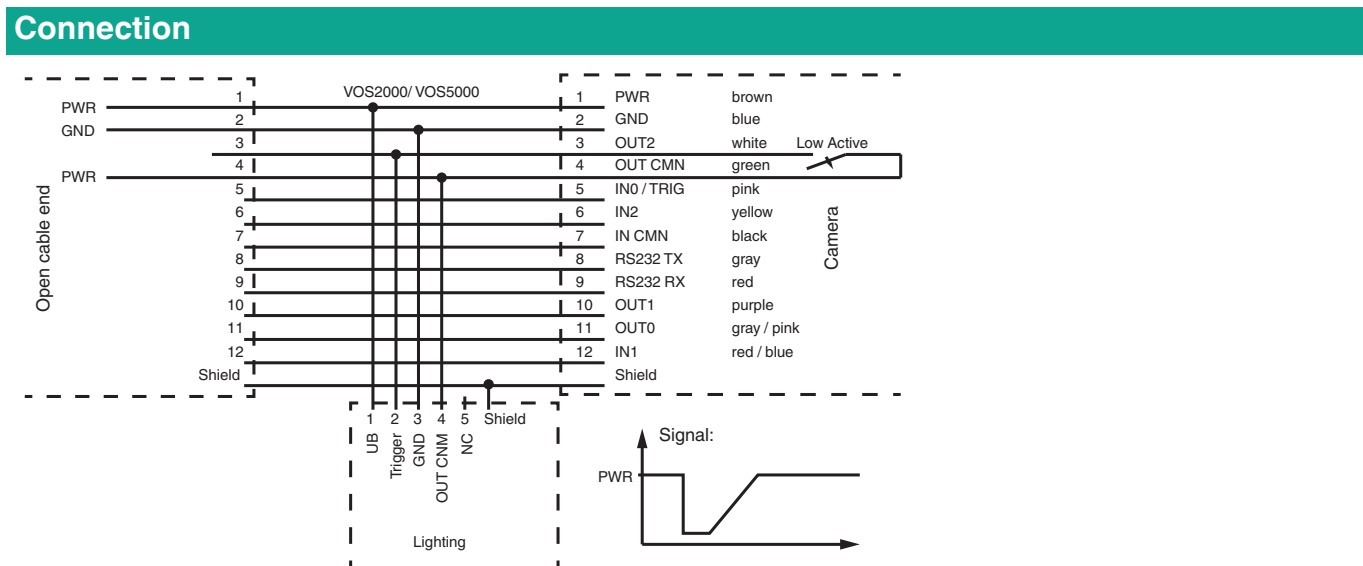
Dimensions



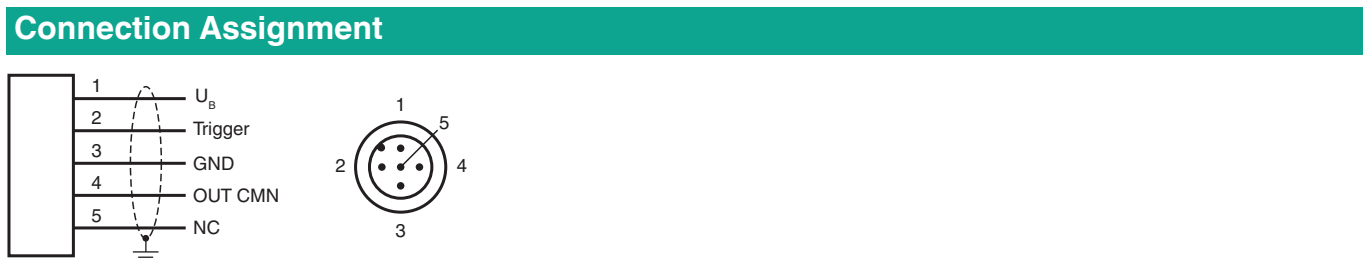
Technical Data

General specifications		
Light area dimensions		242 x 18 mm
Light source		24 high-power LEDs
LED color		White light
Color temperature		5300 K
Light direction		Directed with 44° ancillary lenses
Irradiance		50 W/m² at 0.2 m operating distance
Operating mode		Pulse / flash mode
Indicators/operating means		
Operation indicator		LED green: supply
Function indicator		LED green: Trigger
Electrical specifications		
Operating voltage	U _B	21 ... 30 V DC
Current consumption		0.3 A at 24 V DC (average) / 0.5 A (max. pulsed)
Power consumption	P ₀	16 W
Flash duration		0.01 ... 10 ms VOS2000 0.08 ... 10 ms VOS5000 0.18 ... 10 ms
Input/Output		
Input/output type		Flank-triggered / falling edge
0 Level		0 ... 8 V

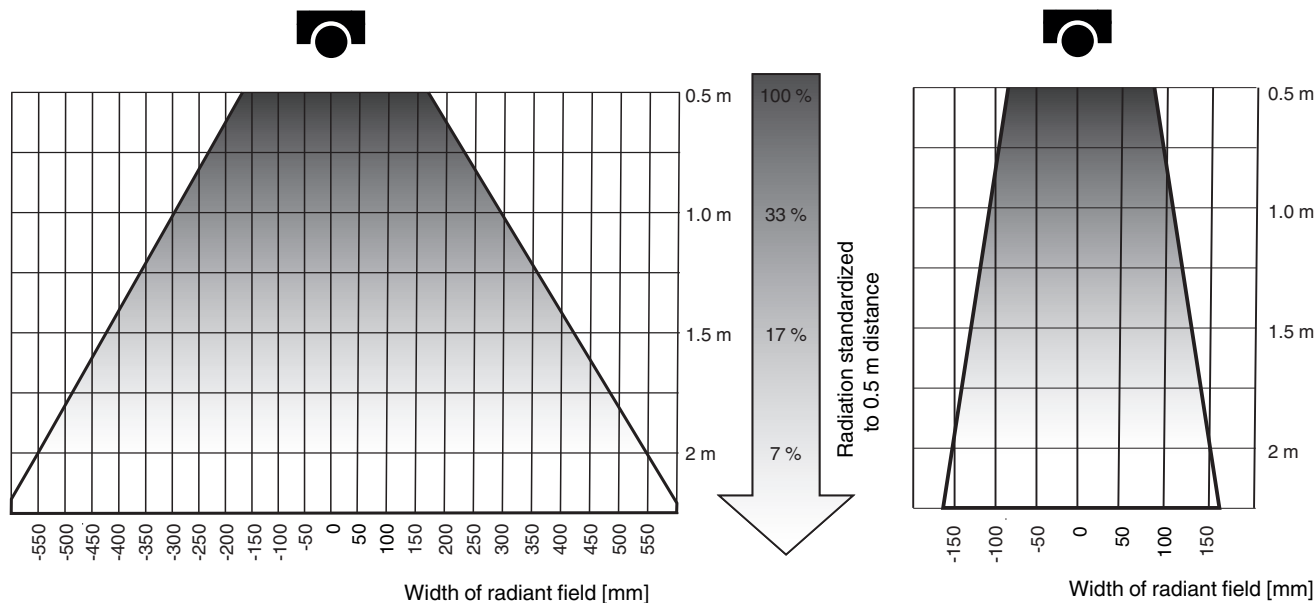
Technical Data		
1 Level		10 V ... U _B
Conformity		
Photobiological safety		risk group 1 according IEC 62471
Approvals and certificates		
CE conformity		CE
Ambient conditions		
Ambient temperature		5 ... 45 °C (41 ... 113 °F) , no moisture condensation
Storage temperature		-20 ... 85 °C (-4 ... 185 °F)
Relative humidity		90 % non-condensing
Mechanical specifications		
Housing length		250 mm
Housing width		31 mm
Housing height		25 mm
Degree of protection		IP65
Connection		cable PUR , M12 connector, 5 pin , A-coded , 230 mm
Material		
Housing		anodized aluminum I PMMA
Installation		Mounting bracket
Mass		approx. 400 g



NOTE: With trigger parameterization by means of software, the electrical status of the trigger is output to the outside at GPO2 (OUT2). Isolation recommended.

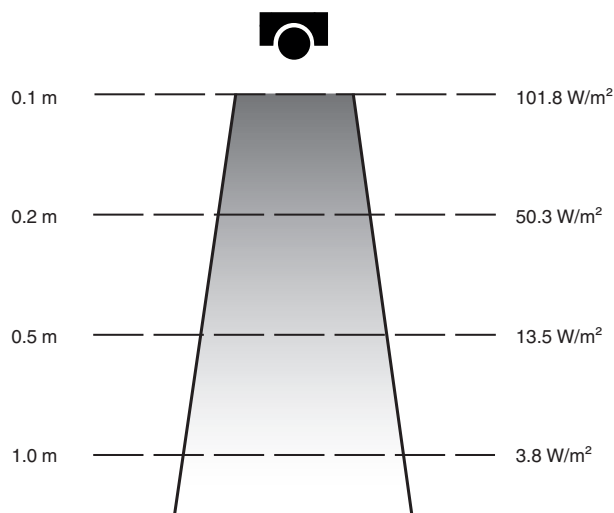


Characteristic Curve



Radiant field
Radiation < 50 % standardized to center axis

Irradiance



Accessories

	VOS-IL-MH04	Mounting bracket for fastening VOS bar lighting to system profiles
	V19S-0.15M-PUR/V15-T-V19-VOS	Y connection cable M12 socket straight A-coded 12-pin to M12 plug 12-pin / M12 socket 5-pin straight A-coded, PUR cable black, shielded
	V1-G-BK2M-PUR-U/ABG-V1-G	Cordset M12 socket straight to M12 plug straight A-coded, 4-pin, PUR cable black, shielded, UL-approved, drag chain suitable

Additional Information

Information on:

- Intended use
- Notes on operation
- Fault repair
- Care and servicing
- Disposal

CAUTION: Photobiological safety—visible light

The lighting emits optical radiation in the wavelength range between 400 nm and 750 nm, which is visible to the human eye. This can cause irritation, damage, or glare to the eye and skin. Using additional optical accessories (e.g. lenses, interchangeable frames/discs) may change the risk group.

CAUTION: Hot housing surfaces

High ambient temperatures and insufficient convection make housing surfaces hot. These can cause burns if touched. Do not touch the lighting during operation. Keep at least 20 mm between the lighting and thermally insulating surfaces, or mount the lighting on a thermally conductive surface.

Intended Use

VOS system lighting are exclusively intended as components for Machine Vision systems, that are used for quality control as well as process control and optimisation in industrial installations.

Use the lighting in enclosed rooms only.

Notes on Operation

Commissioning

- Lightings should be put into operation by trained and qualified personnel only; installation must be in compliance with the specified protective measures. Ensure that the ambient conditions comply with regulations.
- For optimal heat dissipation, mount the lightings over as wide an area as possible on thermally conductive machine elements.
- Keep cooling fins clear to ensure adequate convection.

Software settings of the lighting control sensor:

1. Open the "Setup connections" menu of the sensor. (NOTE: The menu cannot be selected until you have configured a job in the sensor.)
2. In the "Digital I/O setup" operating menu, set output 2 (Out2) of the VOS camera to the "Strobe" output function to generate the trigger signal.
Setzen Sie im Bedienmenü "Setup der digitalen I/O" Ausgang 2 (Out2) der VOS-Kamera auf die Ausgangsfunktion "Strobe" zur Generierung des Triggersignals.
3. Then configure the duration of the pulse length in the "Sensor setup" operating menu.

Status LEDs

The lightings have two status LEDs on the side. The lightings only lights up when both status LEDs are lit or flashing.

- The green status LED indicates that the operating voltage is correct.
- The second green status LED flashes when there is a trigger signal on the ring light.

Decrease in LED brightness due to age

The brightness of LEDs decreases over time due to age. The lightings are designed and manufactured so that, during full load operation under the permissible ambient conditions, the following operating hours are achieved or exceeded without the decreasing intensity of the lighting by more than 30 % compared to the intensity on delivery:

80,000+ h for high-power LED lightings in the visible and infrared wavelength range

Ageing is significantly affected by the installation conditions in the machine, the ambient temperature, and the operating mode of the lighting. Switching or flashing can significantly reduce the decrease in brightness of the LEDs and consequently the brightness of the lighting.

Fault Repair

Fault	Cause/LED status	Remedy
The lighting does not light up.	Insufficient power supply / PWR status LED (left) does not light up	Check that the lighting is connected as detailed on the datasheet and the corresponding operating voltage is set. If you are using a power supply with current limitation, increase the allowable current.
	Trigger signal status LED (right) does not light up	Please check the electrical connections and the software settings.
	Trigger signal status LED (right) lights up	Please check the software settings.

Care and Servicing

The lightings do not generally require any maintenance. However, if the outer plastic surfaces or housing parts need cleaning, please observe the following:

- Never use acetone, alcohol, or other solvents to clean glass surfaces.
- Use a soft, lint-free cloth moistened with soapy water or a standard spectacles cleaning cloth to clean the plastic surfaces and housing parts.

Disposal

Dispose of the lightings at a designated electrical and electronic equipment collection facility.



Area lighting VOS-IL-F239W

- Uniform illumination of flat, matte and reflective surfaces
- Intelligent lighting control with integrated flash controller

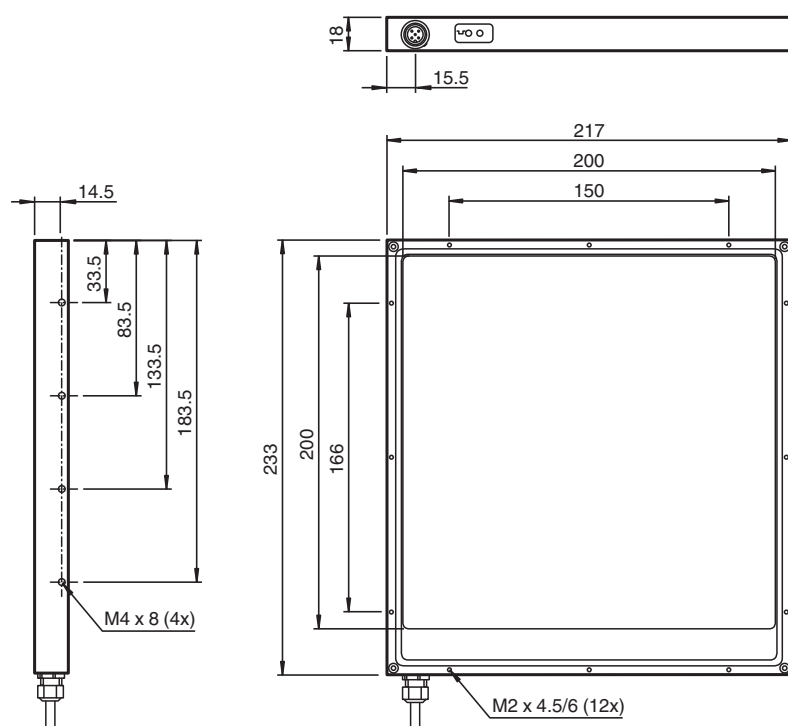
White light, 576 high-power LEDs, diffused light, can be used as back lighting, light field size: 200 x 200 mm, integrated flash controller



Function

The diffuse area lighting is used to evenly illuminate a measurement object. It is placed below or behind the object. The object itself appears dark and generates a shadow or outline image. The outline and free inner contours of the target can be clearly identified in the generated image. In the case of (partially) transparent objects, this lighting can be used to assess encapsulations or fill levels. The high contrast achieved in this way allows the outer contours or recesses of the object to be measured accurately.

Dimensions



Technical Data

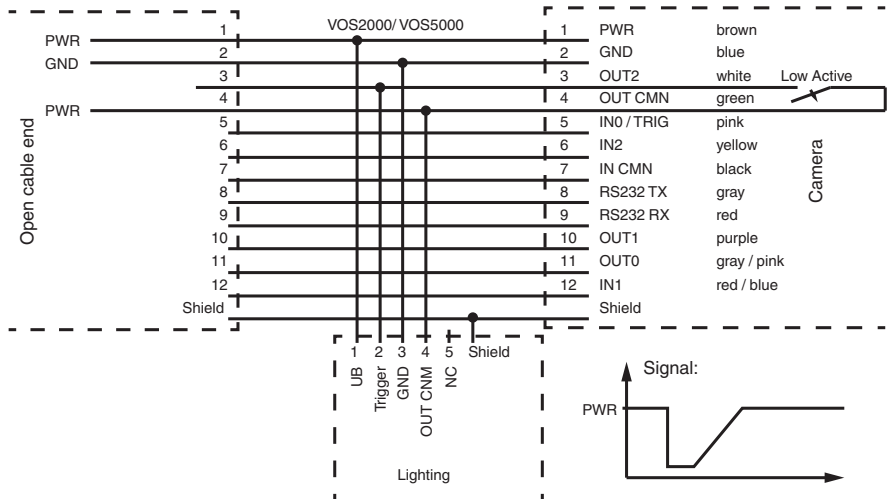
General specifications

Light area dimensions	200 x 200 mm
Light source	576 high-power LEDs
LED color	White light

Technical Data

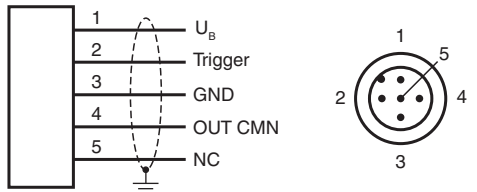
Color temperature		5300 K
Light direction		Diffuse, suitable for backlight applications
Irradiance		8 W/m ² at 0.2 m operating distance
Operating mode		Pulse / flash mode
Indicators/operating means		
Operation indicator		LED green: supply
Function indicator		LED green: Trigger
Electrical specifications		
Operating voltage	U _B	21 ... 30 V DC
Current consumption		0.3 A at 24 V DC (average) / 0.5 A (max. pulsed)
Power consumption	P ₀	17 W
Flash duration		0.01 ... 10 ms VOS2000 0.08 ... 10 ms VOS5000 0.18 ... 10 ms
Input/Output		
Input/output type		Flank-triggered / falling edge
0 Level		0 ... 8 V
1 Level		10 V ... U _B
Conformity		
Photobiological safety		risk group 1 according IEC 62471
Approvals and certificates		
CE conformity		CE
Ambient conditions		
Ambient temperature		5 ... 45 °C (41 ... 113 °F) , no moisture condensation
Storage temperature		-20 ... 85 °C (-4 ... 185 °F)
Relative humidity		90 % non-condensing
Mechanical specifications		
Housing length		233 mm
Housing width		217 mm
Housing height		18 mm
Degree of protection		IP65
Connection		cable PUR , M12 connector, 5 pin , A-coded , 230 mm
Material		
Housing		anodized aluminum I PMMA
Installation		Mounting bracket
Mass		approx. 1400 g

Connection



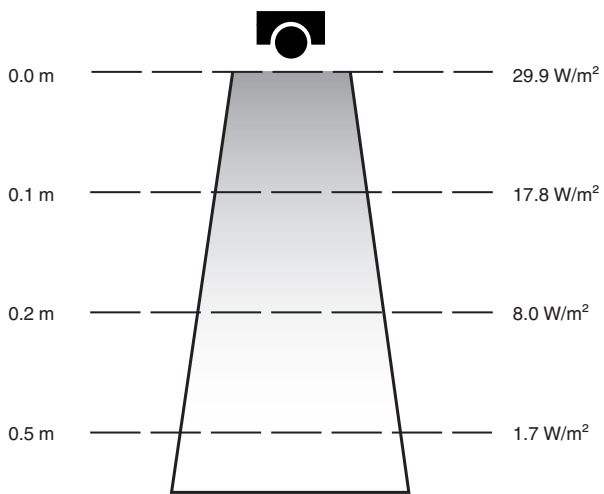
NOTE: With trigger parameterization by means of software, the electrical status of the trigger is output to the outside at GPO2 (OUT2). Isolation recommended.

Connection Assignment



Characteristic Curve

Irradiance



Accessories

	V19S-0,15M-PUR/V15-T-V19-VOS	Y connection cable M12 socket straight A-coded 12-pin to M12 plug 12-pin / M12 socket 5-pin straight A-coded, PUR cable black, shielded
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Intended Use

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Notes on Operation

Commissioning

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Disposal

Dispose of the lightings at a designated electrical and electronic equipment collection facility.

По вопросам продаж и поддержки обращайтесь:

Алматы (727)345-47-04
Ангарск (3955)60-70-56
Архангельск (8182)63-90-72
Астрахань (8512)99-46-04
Барнаул (3852)73-04-60
Белгород (4722)40-23-64
Благовещенск (4162)22-76-07
Брянск (4832)59-03-52
Владивосток (423)249-28-31
Владикавказ (8672)28-90-48
Владимир (4922)49-43-18
Волгоград (844)278-03-48
Вологда (8172)26-41-59
Воронеж (473)204-51-73
Екатеринбург (343)384-55-89

Иваново (4932)77-34-06
Ижевск (3412)26-03-58
Иркутск (395)279-98-46
Казань (843)206-01-48
Калининград (4012)72-03-81
Калуга (4842)92-23-67
Кемерово (3842)65-04-62
Киров (8332)68-02-04
Коломна (4966)23-41-49
Кострома (4942)77-07-48
Краснодар (861)203-40-90
Красноярск (391)204-63-61
Курск (4712)77-13-04
Курган (3522)50-90-47
Липецк (4742)52-20-81

Магнитогорск (3519)55-03-13
Москва (495)268-04-70
Мурманск (8152)59-64-93
Набережные Челны (8552)20-53-41
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Орел (4862)44-53-42
Оренбург (3532)37-68-04
Пенза (8412)22-31-16
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Псков (8112)59-10-37
Пермь (342)205-81-47

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