

Velocity Infrared



Corporate Profile

Velocity Technology Industries is a young, potent & dynamic growing company. Despite its humble beginnings, the company has been dedicated to establishing a professional relationship with its clients and setting an example in this field by providing the cutting-edge technological solutions while assuring high quality products and maintaining a remarkable record of market reputation. Backed up with its state-of-the-art design and manufacturing technologies, we are able to stay in line with the changing market trend by being innovative through our continuous effort in research and development, to meet the ever increasing market demand.

Velocity has been working intensively to achieve its goal of maximizing the localization of products and intends to provide a one stop shopping experience for its local and regional customers.

Through the clear vision and entrepreneur spirit of our Managing Director, we have focused on developing long term relationships with our customers, suppliers and especially our employees. By being honest, reliable and trustworthy, we have succeeded in helping our customers to achieve product satisfaction towards our goods and services provided. We have implemented stringent quality control system to monitor the production line and finished products so as to assure our customers with only top quality and uniformity of our products.

We are a company that will overcome all difficulties and as such has committed ourselves to being flexible. With your support, we will be able to realize our vision. The best is yet to be.

All information presented in this catalogue is solely intended as a guide to product selection and are believed to be reliable. All printing errors are subject to correction prior to release of this catalogue. Velocity has taken precautions to ensure accuracy of product specifications for all Velocity products. Specifications for all Velocity products are subject to change without prior notice.

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Velocity Infrared Illuminators

VELOCITY infrared illuminators are manufactured basing on high – performance lighting – emitting arrays and light – emitting diodes of the best foreign and domestic producers.

Before being applied LEDs pass tight incoming inspection and testing. Unique designs and processing technology developed by the company’s specialists allow increasing each element’s emission intensity significantly. A wide range of products makes it possible to choose an optimal solution for any project in CCTV systems where infrared lighting is efficient to apply.

VELOCITY product range can be divided into three groups according to the application purpose and technical characteristics:

- **Short range illuminators** (illumination distance up to 20 meters) are used for lighting entrances and porches, elevators, offices, garages, storage facilities, passenger compartments etc.
- **Medium range illuminators** (illumination distance from 20 to 90 meters) are applied for lighting cinemas, night clubs, and casinos, parking places, private residences and surrounding areas.
- **Long range illuminators** (illumination distance from 90 to 350 meters) are used for military lighting airports, tunnels, boundary protection, sports grounds, large storage facilities, industrial enterprise territories etc.

IR illuminators are applied:

- When covert video surveillance is needed;
- In conditions of insufficient lighting in night video surveillance systems, security and access control systems;
- In case energy efficiency is one of the main decision – making criteria when choosing illumination type (perimeter protection, protection of big industrial enterprises imply high running costs).

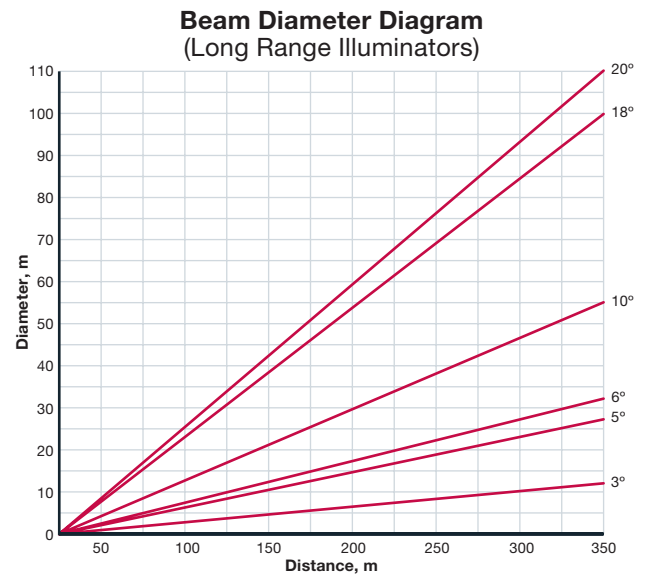
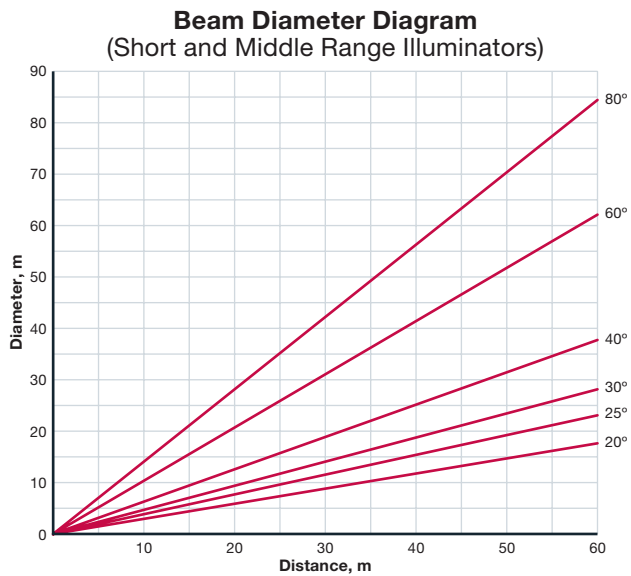
Basic Characteristics of Infrared Illuminators

RANGE	VIR - ILLUMINATORS	ILLUMINATION'S DISTANCE, m	EMISSION ANGLE, x°	CONTINUOUS CURRENT, A (MAX)	WEIGHT, kg
SHORT	VIR - PLATE - 940	3.5	160	0.5	0.1
	VIR - 21 / 60 x 40 - 940	10	60 x 40	0.35	0.245
	VIR - 21 / 60 x 40 - 880	12	60 x 40	0.35	0.245
	VIR - 56 / 60 x 40 - 940	13	60 x 40	0.81	0.51
	VIR - 16 / 20 - 940	17.5	20	0.45	0.9
	VIR - 56 / 60 x 40 - 880	18	60 x 40	0.81	0.51
VIR - 21 / 25 - 940	20	25	0.35	0.245	
MEDIUM	VIR - 16 / 20 - 880	25	20	0.45	0.9
	VIR - 21 / 25 - 880	25	25	0.35	0.245
	VIR - 294 - S / 90 - 880	30	90	1.2	0.99
	VIR - 56 / 20 - 940	30	20	0.81	0.51
	VIR - 84 / 30 - 940	30	30	1.3	1.03
	VIR - 16 / 10 - 940	35	10	0.45	0.9
	VIR - 56 / 20 - 880	40	20	0.81	0.51
	VIR - 294 - S / 60 - 880	45	60	1.2	0.99
	VIR - 294 - M / 90 - 880	45	90	2.4	1.2
	VIR - 16 / 10 - 880	50	10	0.45	0.9
	VIR - 84 / 30 - 880	50	30	1.3	1.03
	VIR - 294 - M / 60 - 880	60	60	2.4	1.2
	VIR - 294 - S / 45 - 880	60	45	1.2	0.99
	VIR - 294 - L / 90 - 880	60	90	3.0	1.88
	VIR - 16 / 6 - 940	63	6	0.45	0.9
	VIR - 294 - L / 60 - 880	75	60	3.0	1.88
	VIR - 294 - M / 45 - 880	80	45	2.4	1.2
	VIR - 294 - XL / 90 - 880	80	90	5.5	3.8
VIR - 16 / 5 - 940	84	5	0.45	0.9	
VIR - 16 / 6 - 880	90	6	0.45	0.9	
VIR - 294 - XXL / 90 - 880	90	90	7.0	4.5	
LONG	VIR - 294 - L / 45 - 880	100	45	3.0	1.88
	VIR - 294 - S / 30 - 880	100	30	1.2	0.99
	VIR - 294 - XL / 60 - 880	110	60	5.5	3.8
	VIR - 16 / 5 - 880	120	5	0.45	0.9
	VIR - 16 / 3 - 940	126	3	0.45	0.9
	VIR - 294 - XXL / 60 - 880	130	60	7.0	4.5
	VIR - 294 - M / 30 - 880	140	30	2.4	1.2
	VIR - 294 - XL / 45 - 880	140	45	5.5	3.8
	VIR - 294 - L / 30 - 880	170	30	3.0	1.88
	VIR - 294 - XXL / 45 - 880	170	45	7.0	4.5
	VIR - 16 / 3 - 880	180	3	0.45	0.9
	VIR - 294 - XL / 30 - 880	240	30	5.5	3.8
	VIR - 294 - XXL / 30 - 880	280	30	7.0	4.5
VIR - 16 / 4 - 850	350	4	0.45	0.9	

Selection of Camera & Objective 1/3"

RANGE	VIR - ILLUMINATORS 880 and 940mm	VIEWING ANGLE, x°	DISTANCE, m, (for cameras 0.01 lx)	BEAM DIAMETER, m	FOCAL DISTANCE of objective (f), mm
SHORT	VIR - PLATE - 940	100	3.5	10	2
	VIR - 21 / 60 x 40 - 940	65	10	12 x 7.3	3.7
	VIR - 21 / 60 x 40 - 880	67	12	14 x 9	3.6
	VIR - 56 / 60 x 40 - 940	62	13	15 x 9.5	4
	VIR - 16 / 20 - 940	17	17.5	5	16
	VIR - 56 / 60 x 40 - 880	62	18	21 x 13	4
	VIR - 21 / 25 - 940	22	20	7	12
MEDIUM	VIR - 16 / 20 - 880	17	25	7	16
	VIR - 21 / 25 - 880	22	25	11	12
	VIR - 294 - S / 90 - 880	90	30	53	2.5
	VIR - 56 / 20 - 940	22	30	10.6	12
	VIR - 84 / 30 - 940	33	35	19	8
	VIR - 16 / 10 - 940	8	35	4.5	36
	VIR - 56 / 20 - 880	22	40	14	12
	VIR - 294 - S / 60 - 880	60	45	57	3.5
	VIR - 294 - M / 90 - 880	90	45	79	2.5
	VIR - 16 / 10 - 880	11	50	9	25
	VIR - 84 / 30 - 880	33	50	27	8
	VIR - 294 - M / 60 - 880	60	60	75	3.5
	VIR - 294 - S / 45 - 880	45	60	55	6
	VIR - 294 - L / 90 - 880	90	60	105	2.5
	VIR - 16 / 6 - 940	5.5	63	5.5	50
	VIR - 294 - L / 60 - 880	60	75	67	4.8
	VIR - 294 - M / 45 - 880	45	80	56	6
	VIR - 294 - XL / 90 - 880	90	80	135	2.5
VIR - 16 / 5 - 940	5.5	84	6.5	50	
VIR - 16 / 6 - 880	5.5	90	8	50	
VIR - 294 - XXL / 90 - 880	90	90	155	2.5	
LONG	VIR - 294 - L / 45 - 880	45	100	73	6
	VIR - 294 - S / 30 - 880	30	100	54	8
	VIR - 294 - XL / 60 - 880	60	110	98	4.8
	VIR - 16 / 5 - 880	5.5	120	9.2	50
	VIR - 16 / 3 - 940	4	180	11	72
	VIR - 294 - XXL / 60 - 880	60	130	143	3.5
	VIR - 294 - M / 30 - 880	30	140	75	8
	VIR - 294 - XL / 45 - 880	45	140	98	6
	VIR - 294 - L / 30 - 880	30	170	98	8
	VIR - 294 - XXL / 45 - 880	45	170	130	6
	VIR - 16 / 3 - 880	4	180	11	72
	VIR - 294 - XL / 30 - 880	30	240	125	8
	VIR - 294 - XXL / 30 - 880	30	280	150	8
VIR - 16 / 4 - 850	4	350	22	72	

Short, Middle & Long Range Diameter Diagram



Notes:

Illumination distance is indicated for black and white video cameras without IR correction featured with the 1/3 CCD matrix the sensitivity of which is no less than $1.5 \cdot 10^{-5} \text{ W / m}$ in the IR range of $0.8...1\mu\text{m}$ (the equivalent of a video camera with the sensitivity of 0.01 lx), the lens is F1.4.

An illuminator is to be connected to a power supply unit of the input voltage $12\pm 0.6\text{V}$. Cable should not be more than 10 metres.

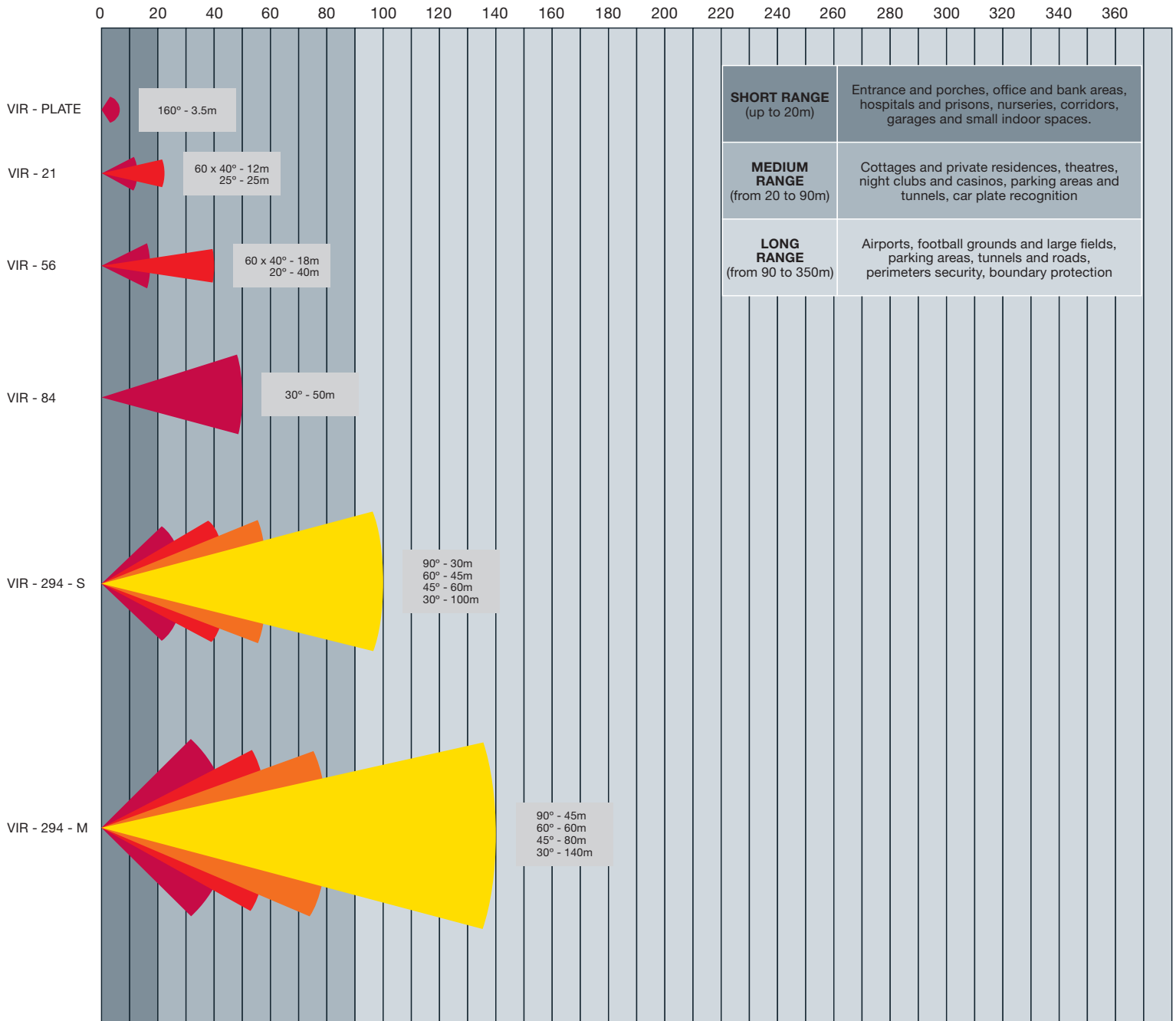
The illuminators do not impede due functioning of nearby electronic equipment.

The illuminators meet Protection Standards IP54...IP66 (depending on a model).

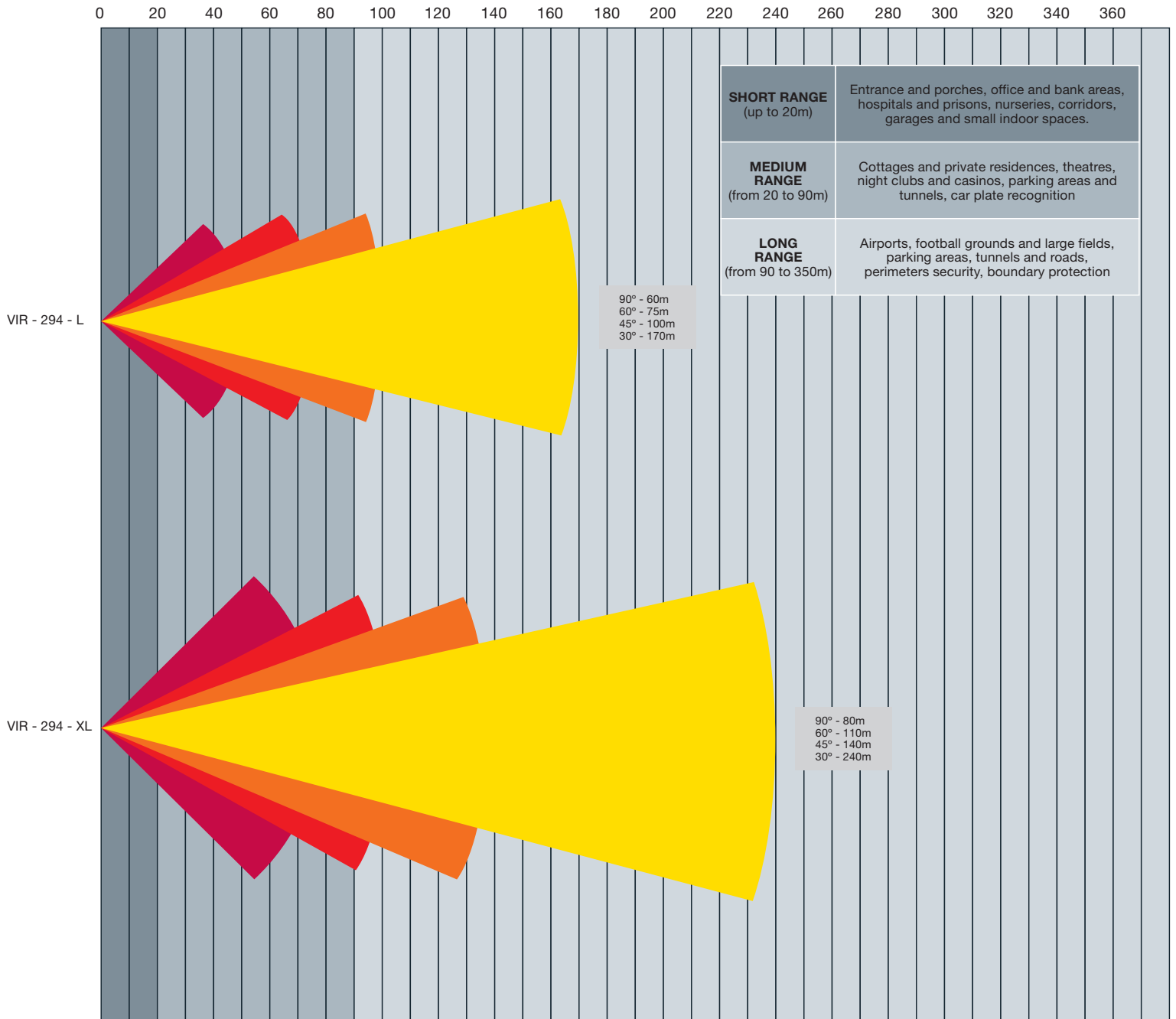
The illuminators comply with IEC/TS60825 -7:2000 ("Safety of products emitting infrared optical radiation, exclusively used for surveillance").

VIR Series

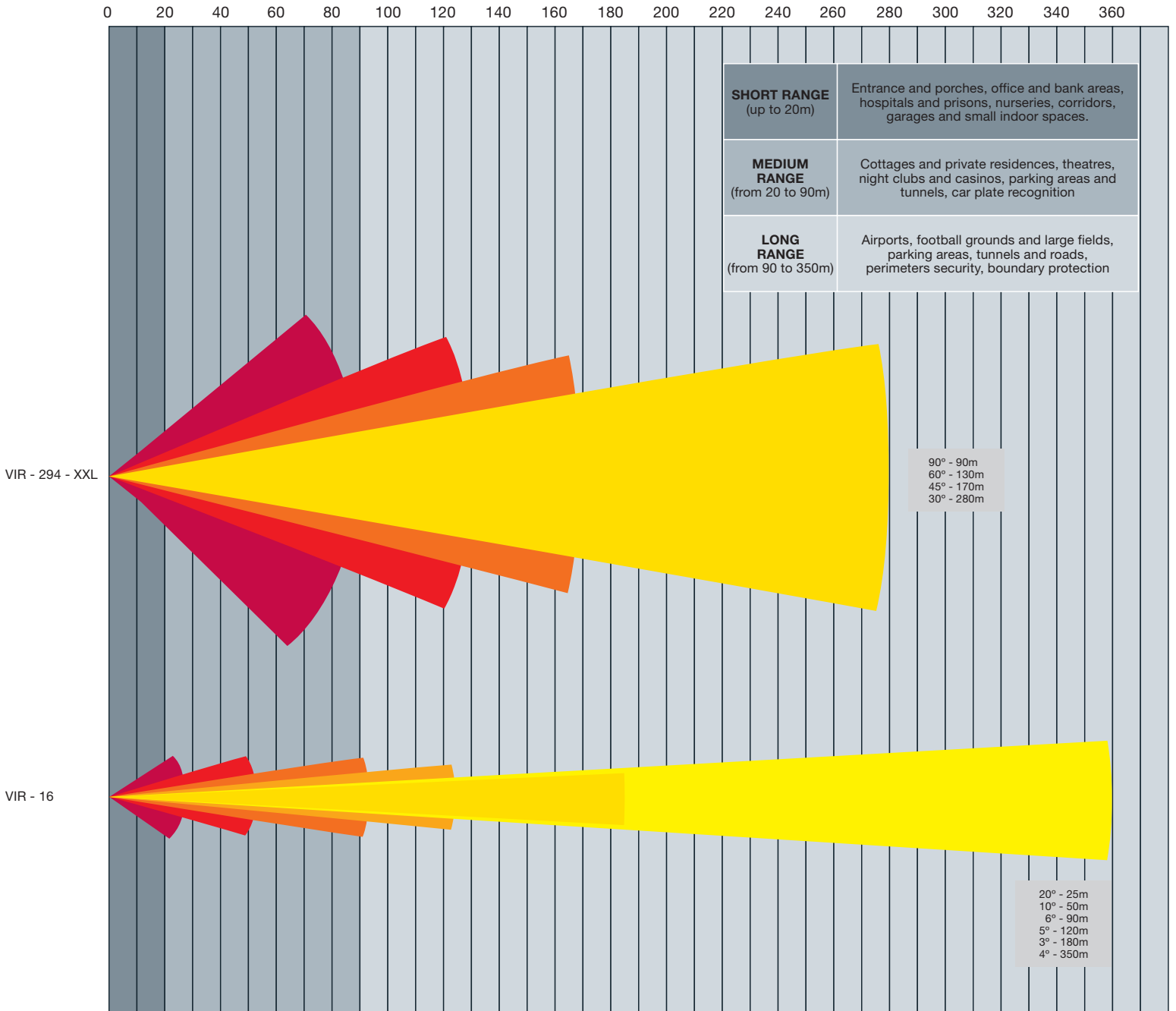
Illumination Distance / Angle Diagram



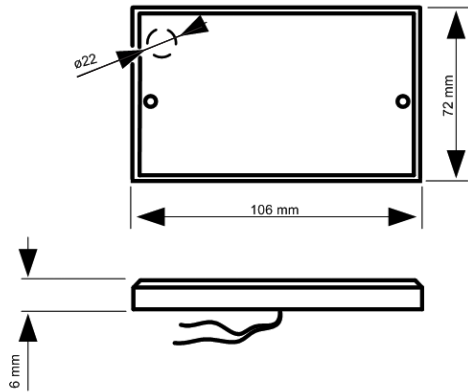
Illumination Distance / Angle Diagram



Illumination Distance / Angle Diagram

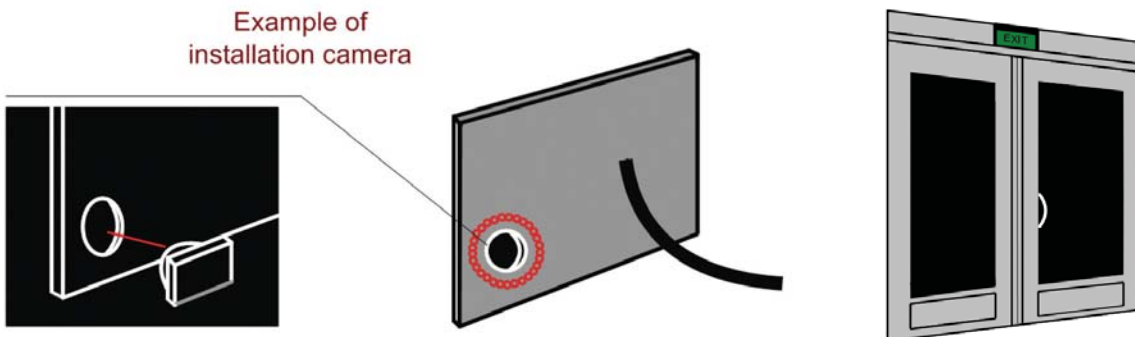


VIR - PLATE



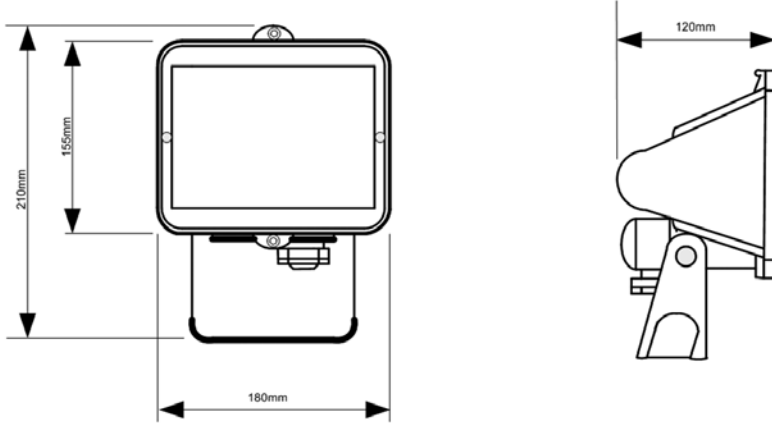
Order Code	VIR - PLATE
Wavelength, nm	940±20
Illumination Range, m	3.5
Emission Angle, °	160±10
Continuous Current, A	0.4 nominal / 0.5 max
Input Voltage, V	12±0.6
Dimensions, mm	106 x 72 x 6
Weight, kg	0.1
Protection Standard	IP65

Example of installation camera

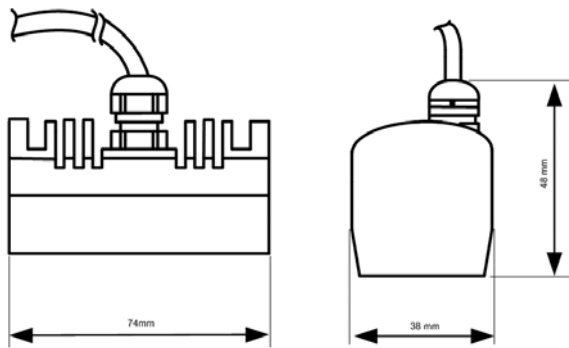


VIR Series

VIR - 16 / VIR - 21

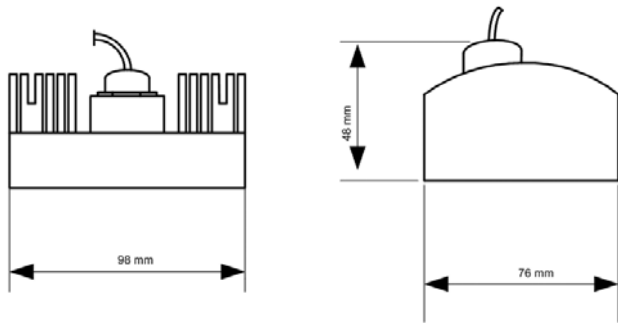


Order Code	VIR-16/4-850	VIR-16/3-880	VIR-16/5-880	VIR-16/6-880	VIR-16/10-880	VIR-16/20-880	VIR-16/3-940	VIR-16/5-940	VIR-16/6-940	VIR-16/10-940	VIR-16/20-940
Wavelength, nm	850±20	880±20					940±20				
Illumination Range, m	350	180	120	90	50	25	126	63	84	35	17.5
Emission Angle, °	4±0.4	3±0.3	5±0.5	6±0.6	10±1	20±2	3±0.3	5±0.5	6±0.6	10±1	20±2
Continuous Current, A	0.35 nominal / 0.45 max										
Input Voltage, V	12±0.6										
Dimensions, mm	210 x 180 x 120										
Weight, kg	0.9										
Protection Standard	IP55										

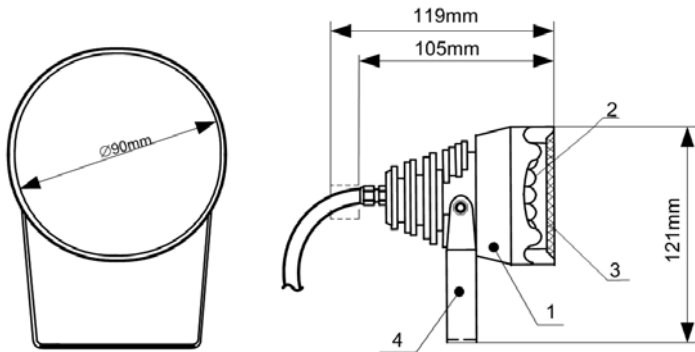


Order Code	VIR-21/25-880	VIR-21/(60x40)-880	VIR-21/25-940	VIR-21/(60x40)-940
Wavelength, nm	880±20		940±20	
Illumination Range, m	25	12	20	10
Emission Angle, °	25±2	60±6 x 40±4	25±2	60±6 x 40±4
Continuous Current, A	0.2 nominal / 0.35 max			
Input Voltage, V	12±0.6			
Dimensions, mm	74 x 38 x 48			
Weight, kg	0.245			
Protection Standard	IP66			

VIR - 56 / VIR - 84



Order Code	VIR-56/20-880	VIR-56/(60x40)-880	VIR-56/20-940	VIR-56/(60x40)-940
Wavelength, nm	880±20		940±20	
Illumination Range, m	40	18	30	13
Emission Angle, °	20±2	60±6 x 40±4	20±2	60±6 x 40±4
Continuous Current, A	0.6 nominal / 0.81 max			
Input Voltage, V	12±0.6			
Dimensions, mm	98 x 76 x 48			
Weight, kg	0.51			
Protection Standard	IP66			



1 - case, 2 - luminodiodes, 3 - light filter, 4 - bracket

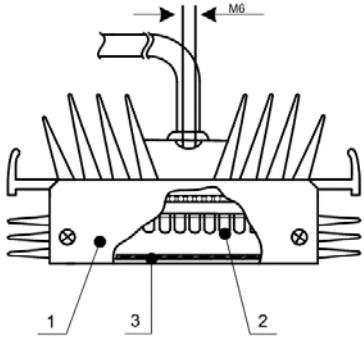


Order Code	VIR-84/30-880	VIR-84/30-940
Wavelength, nm	880±20	940±20
Illumination Range, m	50	30
Emission Angle, °	30±3	
Continuous Current, A	1.0 nominal / 1.3 max	
Input Voltage, V	12±0.6	
Dimensions, mm	Ø90 x 105 x 121	
Weight, kg	1.03	
Protection Standard	IP66	



VIR Series

VIR - 294



Illuminator, 1 - case, 2 - LEDs, 3 - light filter



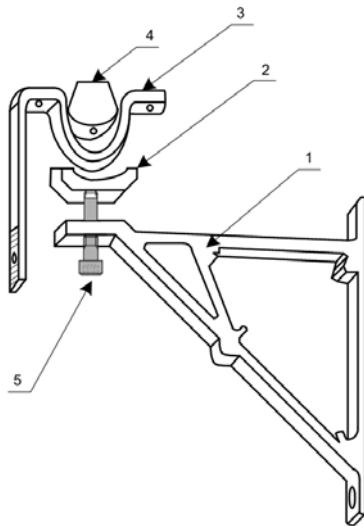
General view of an illuminator with a bracket for model Nos. VIR-294-S, VIR-294-M, VIR-294-L



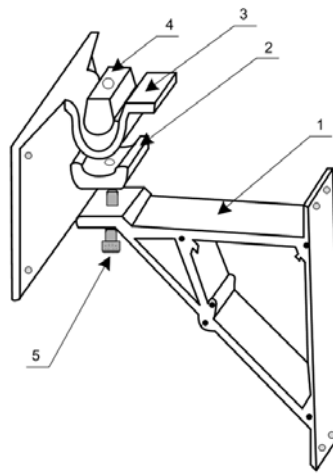
General view of an illuminator with a bracket for model Nos. VIR-294-XL and VIR-294-XXL



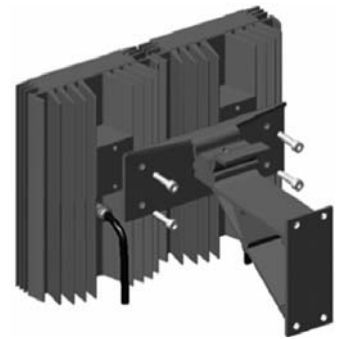
Model	VIR-294-S	VIR-294-M	VIR-294-L	VIR-294-XL	VIR-294-XXL
Wavelength, nm	880±20				
Emission Angle, °	30±3	100	140	170	240
	45±5	60	80	100	140
	60±6	45	60	75	110
	90±9	30	45	60	80
Direct Current, A	1.2 max	2.4 max	3.0 max	5.5 max	7.0 max
Operating Supply Voltage, V	12±0.6				
Temperature Range, °C	-30... +40				
Dimensions, mm	219 x 134 x 134	219 x 141 x 134	219 x 200 x 134	236 x 200 x 272	236 x 270 x 272
Weight, kg	0.99	1.2	1.88	3.8	4.5
IP Protection Standard	IP66				



1 - bracket, 2 - pivot bearing, 3 - ball stud, 4 - die, 5 - allen screw



1 - bracket, 2 - pivot bearing, 3 - ball stud, 4 - die, 5 - allen screw



Useful Information

Certain Aspects of IR Illumination Application during Video Surveillance

Covert video surveillance in low – light – level conditions can not be imagined without IR illumination nowadays. IR illuminators with light – emitting diodes are finding ever – growing use. For the last few years the efficiency and unit capacity of these illuminators have grown significantly. This enables their successful competition with illuminators on the basis of halogen lamps.

In modern IR illuminators they use LEDs with generation lines of 870 – 880 and 940 – 950 nm. Taking into account spectral sensitivity of standard CCD array, presented on figure 1, illuminators with minimal wavelength are the most efficient ones. In this case decrease of equivalent sensitivity of TV camera is minimal and this enables to increase illumination range. Besides image misfocusing effect as a result of refraction coefficient change together with focal plane of the lens shift is minimal as well. However light – red distinct glow of diodes' chips can reduce to nothing all the measures for the secrecy of surveillance. Generation line shift to 940 – 950 nm leads to decrease of glow intensity of chips together with simultaneous shift of emission color to dark – cherry. In all probability, less visibility of glow is connected first of all with approaching of visible component to sensitivity border of an eye (750 nm). It is also confirmed by the color of the glow thanks to which we can access the visible component as close to 600 nm and 700 nm respectively for emitters with the wavelength of 870 – 880 nm and 940 – 950 nm. Specialists have long explained the IR LED luminous efficiency as the high – frequency edge of the emission spectrum being sensed by the human eye. LED based on its operation principle is a relatively monochrome source, its spectrum width not exceeding 30 – 40 nm at 0.5 levels. Plus one can not expect any long “tail” areas in the spectrum that could be caught by the human's eye. Besides color sensation of any qualified observer contradicted these suppositions. At the same time spectrograms, attached by manufactures, did not extraneous emission lines.

Special spectrum measurements of emitters on the basis of array LED IR – 6 with the generation wavelength of 880 nm which were carried out on a modernized spectrometer definitely registered the second maximum in the region of 600 nm comprising 0,0074 from the maximum value of primary emission power at the wavelength of 870 – 880 nm. Emission with such wavelength has bright red color. In all probability the appearance mechanism of the second maximum for the emitters for 940 and 950 nm is the same. This is indirectly confirmed by the shift of glow visible component to cherry color. On figure 1 one can see the relative position of spectral characteristic of CCD array (I) of main spectrums of IR – illuminators with the wavelength of 880nm (II) and 950 nm (III) and spectrums of spurious visible component (II') and (III') for every emitter.

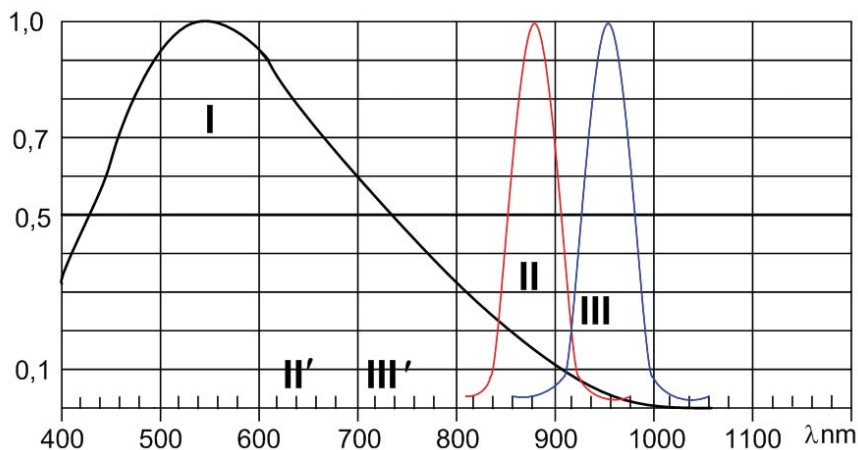


Fig. 1

Useful Information

When using IR - illuminators it is quite hard to determine the necessary illumination power to create the necessary illumination on the surveillance object. As a rule, manufactures normalize power consumption, illumination range and directional characteristic of IR - illuminator. At that the directional characteristic opening angle is normalized most often on the S level from the power maximum value. The given illumination range supposes that at the same time they also indicate camera sensitivity, resolution and signal/noise relation of an image received. The criterion of image minimal quality is the distinct recognition of immovable border of black and white fields on the noise level. The difficulties of IR - illumination normalization is the sufficiency of the given characteristics as well as it is also quite common when the real characteristics do not correspond to those that are indicated. That led to the expansion of experimental method when they tried IR - illuminators in real conditions straight during the installation process.

Lack of data on radiation power does not allow to determine power density on the object. Direct measurement of IR - illumination power is difficult in view of rare availability of optical power meters. But even if they are available the direct measurements are problematic because of the mismatch between the large apertures of the light beam and the size of the photo detector windows. Radiation power can be assessed with accuracy enough for practice on the basis of illuminator power consumption with regard to modern LEDs coefficient of efficiency which does not exceed 20 - 25%.

LED IR - illuminator directional characteristic is nearly always formed by built-in LED focons and has a cone form. The directional characteristic opening angle value is normalized as a rule on the S level relative to the maximum located on the light beam axis. The examples of standard directional characteristics with 40 and 80 angle degrees are given on fig. 2 and fig. 3. Within the borders of S level from 65 to 80% of nearly all the power is radiated, depending on focon construction, additional reflector availability and directional characteristic opening angle.

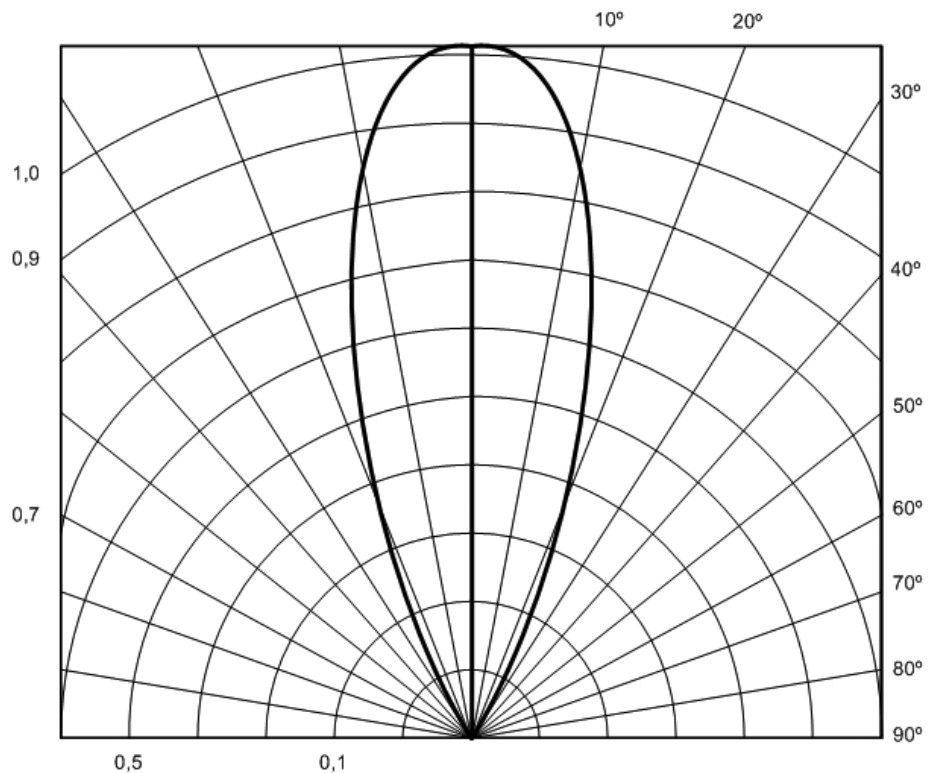


Fig. 2

Useful Information

Camera sensitivity, as well as the sensitivity of other optical - electrical devices operating in the visible spectrum, is normalized by illumination (lux) or luminous flux (lumen) - photometric quantities which characterize the influence of visible light on the human's eye. Luminous flux is the luminous radiation power assessed on the basis of its influence on the human's eye. In general case luminous flux of a light source with uniform spectral concentration is equal to:

$$\Phi_{\text{JM}} = K_{\lambda} \int \frac{P_{\lambda}}{\lambda^2} Y_{\lambda} d\lambda$$

Luminous flux for monochromatic radiation in the eye sensitivity maximum (555nm) for radiation power of 1 Wt. is equal to 683 lumens.

$$E = \frac{\Phi}{S} \cos \varphi$$

The illuminance of a surface (E) is the ratio of the incident flux (Φ) to its area (S). A light wave for quite a remote source can be considered as flat. In this case at light incidence on the surface angularly the expression for the illumination mean value is of the form:

$$E = \frac{683 \cdot P}{S} \cos \varphi$$

Taking into account the above - mentioned correlation for monochromatic radiation in the sensitivity maximum, we will write down the illumination expression through luminous radiation power:

When using IR - illumination for video surveillance one may consider an infrared source as quite narrow - band and monochrome. That is with accuracy enough for practice one may calculate all the emitter power concentrated in the maximum of its spectral characteristic. As in the case with interpretation of monochrome and white light interaction with the human eye we can assess the creation of equivalent IR illumination for CCD array with regard to its sensitivity in the illumination spectral region. Averaged standard spectral characteristic of CCD array sensitivity (I) is given on fig. 1. The diagram shows that the camera sensitivity for generation lines of widespread LED IR - illuminators with the wavelength of 880nm (I) is about 14 and 5% from the maximal value respectively.

The area of the light spot on the object is approximately calculated by the know formula for the area of a base of cone, in our case a light one, with regard to illumination range L and flat opening angle of directional characteristic.

$$S = \pi \left(L \cdot \operatorname{tg} \frac{\alpha}{2} \right)^2$$

For simplicity, we assume that location of light beam axis and illumination object plane is orthogonal. Average equivalent illumination in a light spot of IR - radiation in the range of power density of 0.5 from the maximum value for different wavelengths can be assesses from the following expression:

$$E_{\text{ЭKB}} = \frac{683 \cdot P \cdot \Pi \circ \Gamma \rho \cdot \eta \cdot K_{\lambda} K_{\alpha}}{\pi \left(L \cdot \operatorname{tg} \frac{\alpha}{2} \right)^2}$$

Where:

P cons - power consumption of IR - illuminator, Wt;

η - illumination coefficient of efficiency (≈0.2);

K λ - for 880 nm. ≈ 0.14; for 950 nm. ≈ 0.05;

K α - from 0.65 up to 0.8

L - range, m;

α - directional characteristic opening, angle degrees

Undoubtedly the received estimation is going to be highly approximate, however even this estimation enables to find out evident discrepancy of the stated parameters which is quite often can be found on IR - illuminators' market.

In conclusion we may state that devices for IR - illumination are the efficient means for covert video surveillance in low - light conditions using standard cameras. Domestic manufactures of these devices already now can seriously compete with major foreign companies if not in production volume, than in construction solutions, achieved technical parameters and, of course, prices.

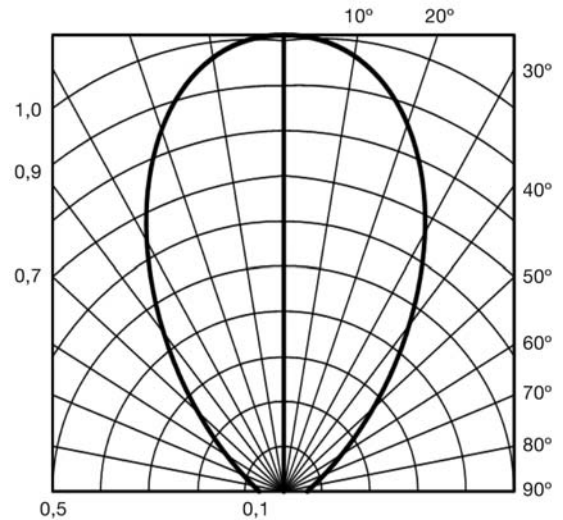


Fig. 3

Useful Information

IR Illumination Efficiency and Surveillance Object

When analyzing IR illumination efficiency in CCTV usually we take into account influence of equipment characteristics (video cameras, lenses, IR illuminators etc.) In this article we take into consideration the influence of an object under observation itself on IR illumination system efficiency.

Reflection Power

Image sharpness and object recognition ability depend to a large extent on subject - to - background contrast and intra - subject contrast. Reflection power of different surfaces is different in visible spectrum and close IR band where IR illumination for CCTV works. The difference is not very significant for the most of surfaces; otherwise an image in IR band would not be the same as an analogous image in the visible spectrum. This should be taken into account when projecting systems with IR illumination.

Foliage and grass have higher reflection power in IR band than in the visible spectrum. That is why the greenery in IR band looks brighter and forms more contrast image details. Water, on the contrary, has lower reflection power in IR band than in the visible spectrum. Water surface looks in IR band darker. But many objects on the water surface look more contrasting. Extraordinary high reflection power in IR band is found with certain synthetics.

Positional Relationship of Camera and Illumination

When protecting CCTV with illumination one can use different schemes of camera and illumination positional relationship. It is necessary to avoid pointing searchlight beams directly into the camera lens. Such situation can appear if one uses several cameras and illuminators at the same territory. At the direct pointing of spurious emission may not be reflected on the picture straightforwardly but may lead to the response of auto - diaphragm or camera's AGC which will significantly desensitize the camera.

Location of Objects in the Surveillance Area

If there are closely located objects in the surveillance area it can lead to camera desensitization owing to auto - diaphragm and AGC and picture - quality degradation in the background. For example, a tree situated in the foreground may lead to significant desensitization for the background objects whose lighting conditions are far inferior. Sometimes in this case it is rational to place IR illuminators at some distance from the camera to create the optimal illumination or to use several illuminators: one - near the camera and the other one - at some distance. Use of several illuminators for the surveillance area may help to avoid unilluminated zones created by shadows from objects in the foreground.

Summary

- An image with IR illumination may be different from an image with white light owing to different reflection power of objects in the visible and IR spectrum.
- Avoid pointing of spurious emission into the camera lens; this may lead to significant desensitization for the foreground image.
- When projecting positional relationship of cameras and IR illuminators it is necessary to ensure the best illumination of the area which makes up the video image as opposed to simply ensure the alignment of an illuminating beam with the camera's angle of visibility (this is only a particular case).

Useful Information

Visibility and Invisibility of IR Radiation

Matters of different cameras' sensitivity in visible spectrum band and IR band, impact of CCTV different elements on image quality, application conditions, IR illuminators characteristics and many other issues will not be mentioned in this article. Here we will deal with the issues connected with visibility and invisibility of IR to the naked eye, that is to an independent observer whose sector of vision comprises an IR illuminator and objects illuminated by it.

Curiously enough but IR illumination application for image acquisition in CCTV during nighttime has become so usual that we even don't always think about why it is IR that we use. The first thing that comes to mind is the fact that the black – and – white camera has high sensitivity in IR band.

This is really so but it is enough to look at the spectral characteristic of CCD array sensitivity to make sure that the camera sensitivity in the visible light is significantly higher than in IR band.

The answer is simple – the main advantage of IR illumination is its invisibility to the naked eye.

And the thing here is not only about the fact that it is necessary to make the illumination invisible thus misleading the intruder. Today environmentalists speak more and more often about light pollution and its negative impact on human beings. In some countries they adopt legislative acts on "light ecology". There also exist quite obvious cases when IR illumination can not be substituted by illumination in the visible spectrum when the source of such light can blind humans. These are the cases with motorways, airfields railways ets.

Sensitivity of a human eye falls as the wavelength grows. The illustration presents a standardized visibility function of a human eye at the so called "night vision" when illumination is 10-4 cd/m².

A human eye has maximal sensitivity at about 510nm. At the wavelength of 720 nm. The sensitivity is equal to 0.000004780, at the wavelength of 780 nm – 0.000000139 from maximal one.

However at sufficient power of IR illuminator with the wavelength less than 900 – 920 nm. Its illumination can be seen by a human eye. At the same time the illumination which falls on the surrounding objects at the wavelength more than 800nm. Can not be seen but if to look at the illuminator itself one can see faint red glow.

One should remember that the infrared diode spectrum may have a complex structure: aside from a main lobe there might be phantom lobes as well. This means that the diode can emit not only within the specified wavelength but also produce a less intensive radiation, at wavelengths substantially different from the main range. In particular the diode can create spurious emission in the red.

The device must be tested before using IR illuminators in particularly critical cases when it is necessary to ensure complete invisibility of its illumination. For this purpose it is enough to switch one of the illuminator in complete darkness and make sure that its illumination can not be seen by the human eye from the appropriate distance.

It is necessary to take into account that the longer the Illuminator wavelength the lower its efficiency because camera's sensitivity decreases with the wavelength growth. That is why choosing the wavelength of IR illuminator it is necessary to take into account the application of CCTV with IR illumination.

Practical Guidelines

- If the reason you use IR illuminators is the carrying – out light ecology requirements, it is reasonable to use IR illuminators with the minimal wavelength. At the same indices of radiation power the device will be more efficient within the band of 720 – 750 nm (due to the greater camera sensitivity). Modern illuminators on the basis of LED rarely have such band because of the low efficiency of IR diodes with such wavelength that is why they usually use devices with the wavelength of 850 – 880 nm.
- If it is necessary to ensure relative security if illumination, it is reasonable to use IR illuminators with wavelength of 850 – 880 nm. Illumination which falls on objects that are suitable near the illuminator will not be nearly seen and when looking at the illuminator itself one can see faint red glow.
- If it is necessary to eliminate the possibility of seeing the red glow of an illuminator by human eye (the cases with motorways, railways, subways) and ensure complete security of illumination one must use IR illuminators with the wavelength of 940 nm.

Applications

Advices on how to Install IR – Illumination

System Creation Stages

- What light do you need – infrared or white?
- Have you made sure that illumination horizontal angle covers all field of view?
- What is the maximal range which needs to be illuminated? Determine the illuminator model on the assumption of required entrance angle and range.
- If white light is required be sure you use white light with appropriate spectral correction, make sure that red, green and blue colours can be distinctly seen in the night time.
- If IR light is required than decide on the wavelength. Shorter wavelengths (such as 850 nm) provide visibility of longer range while longer wavelengths (950 nm) provide covert illumination but reachable range is shorter.
- Calculate maintenance and running costs of illumination system. Make sure you have chosen long – life illuminators with low power consumption.
- Consider the question of illumination placement. It should be installed thus none of the cameras would be directed on the source of light. The best solution is to stall illumination at the same place where cameras are installed. You also need to pay attention if there any obstacles in the direction of surveillance and illumination. As for as light movement occurs in straight lines any obstacle (for example, spread tree) can create shadows.
- Pay attention to camera and lens characteristics. High – efficient camera and lens ensure high – quality image. To get the same result with a less efficient camera and lens one needs additional lighting.
- If illuminating equipment is used together with full – function dome camera then you need to choose between wide spanning angle illumination, limited area illumination or target region illumination. The best option here is to use wide spanning angle illumination because one can ensure 360 degree illumination for dome camera.
- Is light pollution an important factor? Excessive lighting is when light is used in excessive amount. If light pollution is not admissible at all then one needs to use IR illumination.

Camera Sensitivity defines illumination minimal level required for sharp images. Despite the fact that manufactures often overstate the indicated rates; anyway these rates are the only available measurement methods. Sensitivity is usually measured in luxes. Black – and – white cameras are more sensitive than colour ones. The higher is the resolution the lower is camera sensitivity. There exist no cameras with sensitivity zero exponent because any camera needs light to operate.

Lens Diaphragm (Aperture) defines the amount of light which transmit through it on the camera chip. Simply speaking the smaller is the aperture the more transmits inside the lens. In the following table one can observe how the application of different aperture influences light transmission:

Focal Number	Transmitted Light (%)	Amount of Light Required to Deliver 1 Lux of Light to the Sensor
f / 1*	20	5
f / 1.2	15	7.5
f / 1.4	10	10
f / 1.6	7.5	13.3
f / 1.8	6.25	16
f / 2*	5	20
f / 2.4	3.75	30
f / 2.8	2.5	40
f / 4*	1.25	80

* = total lens diaphragm

IR – Correction Lens – such lens is projected in a way that there would be no problem of focal switch between day and night modes, it is made of special glass using coating technology which minimizes light diffusion. Defocusing is caused by different light wavelengths. Each separate wavelength is focused at different point after transmitting through the lens.

Colour Correction Lens transmits only visible light and provides focusing of each separates colour of visible light in the same point rendering thereby reference colours and sharp images. Colour correction lenses are not for application with IR – illumination.

Illumination – as a rule the floodlight beam from the illuminator goes at a certain fixed angle. If requirements to illumination change or if camera coverage changes then illumination may become rejectable. It is quite often that the final decision on lens and surveillance area is taken straight at installment process. Changeable focal length lenses are used in many projects and illumination angle should also be changeable. The beam should be directed downwards in order to minimize its dispersion. To define the necessary illumination type one need to define the goal of all the system. White light provides possibility to illuminate the territory for pedestrians, staff and transport; it can be used as visible disincentive.

Applications

	Advantages	Drawbacks	Suitable camera type
White light	Visible disincentive Full colour transfer	Light pollution Shorter rangers	Colour
IR illumination	Advantages Hidden Longer rangers No light pollution	Drawbacks Ineffective crime deterrence More problem when installing	Suitable camera type Day / Night Black-and-White

Application Area

Installment Advice

Prisons	Long – range IR light directed along the perimeter or white light sources located along the perimeter, at the illumination is directed inside the territory – for the territory guard and for inner area surveillance
Military Bases	Long – range IR illuminators located along the perimeter
Railway Lines	Required by railway administration to ensure safety on the railway lines, illuminators with wavelength of 950 nm are used. It is necessary because safety illumination must not be taken for signal lights.
Ports	Long – range IR light directed at the sea or white light used for coastline surveillance. If to look at water then an image will be dark until an object (reflection point) appears within the surveillance area.
Number Plate Identification	In order not to distract driver’s attention, IR illumination which is used should not be bright – one may use light with wavelength of 850 or 950 nm. Pulse IR light will be more efficient in certain cases (when camera lens shutter speed is higher).
Underground	IR light with wavelength of 950 nm can be used for railways illumination – the same as in case with ground railway lines.
Dome Cameras Systems	Such systems are used with IR light and white light. The main thing here is to apply illumination equipment which provides a wide angle – for example, an illuminator with illumination angle of 120° – 180°, which enables to cover the full field of view of the dome camera with the help of a few illuminators.
Industrial Zones	IR light application enables to provide twenty – four – hour perimeter building guarding, at the light pollution does not take place.
Dumps	Illegal waste disposal and household rubbish disposal usually take place under the screen of night. White light sources application in obscure places or white light sources activated by passive IR transducer can scare away violators who will know that they are under surveillance. An alternative solution – IR illumination can provide covert violators surveillance.
Waiting Spaces	Apply white light in multipurpose projects and fields of application, for example, at waiting spaces. White light ensures illumination for personal belongings’ guarding in cloak – rooms, as well as it provides general illumination for personnel and transport.
Parking Lots	Depending on the goal one may use white or IR light. White light can be used for illumination of parking lots for personnel and transport security. With the help of IR light one may watch the parking lot and building perimeter in night time.
Elite Residences	White light can provide illumination for residents and CCTV. As an alternative IR light can be used maintenance of surrounding conditions in night time and as means not to allow light pollution.

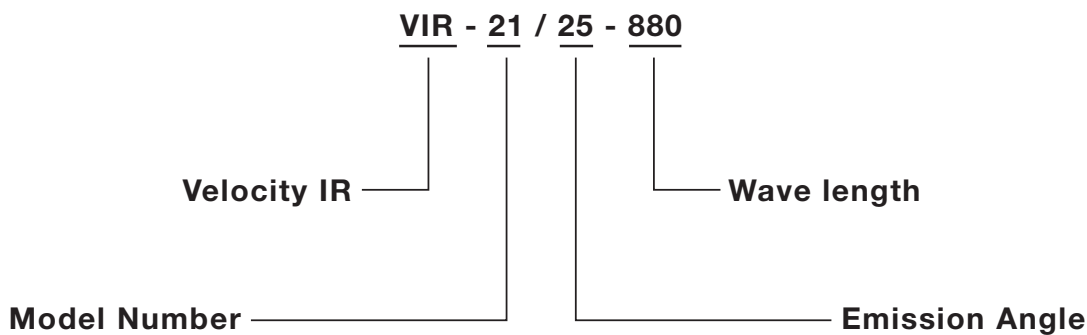
Applications

Illumination System Running Costs – 20% of all the expenditure in the world are connected with illumination. At that the bulk of them are spent on inefficient or unnecessary illumination. Illumination maintenance – and – running costs remains high. In the case of ordinary lamps' application running costs are significantly higher than purchase and installation costs. As an example we may consider 500 Watts illumination from a lamp with an average life time of 3 months. Electricity costs are simply astronomical and at that every 3 months one needs to pay again for changing the lamps. LED technologies offer considerable economy of maintenance – and – running costs. LED electricity consumption level is 5 – 10 times lower. LED efficient life time is 30 – 40 times longer with considerably low costs on maintenance.

Required Entrance Angle Determination: To obtain the best picture the angle at which the light hits the object should perfectly match the angle to which the camera and lenses are adjusted. Otherwise if the angle is too narrow the camera will see only a bright spot within it's the field of view. Illumination at a very wide angle can lead to useless loss of energy and decrease of illumination range.

Required Illumination Range Determination. Light follows the inverse square law: radiation intensity is inversely to square of range from light source. In practice it means that if an object moves away from a given point at a distance 2 times longer than the distance to the source of light, the object gets only the quarter of the light. So, an object located 10 meters away from the light source gets 100 luxes of light. If this object is 40 meters away, it gets only the 16th part of light, and as a result the object gets only 6, 25 luxes.

Ordering Information:



Notes:

Refer to the list of Basic Characteristics of Infrared Illuminators For different Illumination's Distance

Notes

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