Security lighting is a critical factor often overlooked when planning a CCTV system with many installers and specifiers relying on the presence of ambient or pre-installed lighting to bolster the performance of a surveillance system during the hours of darkness. This reliance can often spell disaster for the end user with the result being a CCTV system that either performs poorly at night or in some cases not at all.

Derwent are a leading manufacturer for security illumination with over 16 years of experience in the design and developments of high performance illumination for CCTV systems. This guide will demonstrate how to correctly specify security lighting for CCTV applications to ensure that when installed the system operates to its maximum potential and delivers great performance 24/7.
The illumination present on a scene determines the amount of light reaching the CCTV camera. It is therefore an important factor to take into consideration when designing a CCTV system to ensure the video image is of optimum quality.

Infrared illumination (IR), or near infrared (NIR) as it is known, is energy invisible to the human eye but which can be detected by a good quality monochrome or dual mode camera. This NIR energy is contained just outside the visible red section of the electromagnetic spectrum i.e. greater than 700 nanometres (nm) and is limited by the response of silicon to approximately 1000nm.

**WHAT IS SECURITY ILLUMINATION?**

The most common forms of security illumination have wavelengths\(^2\) of:

- **> 730nm** OVERT
  - Giving a strong red glow. This form of security infrared (IR) is most suitable for the less sensitive cameras.

- **> 830-850nm** SEMI-COVERT
  - A faint dull red glow when viewed on axis, this is the most commonly used security IR.

- **> 940-950nm** FULLY-COVERT
  - Also known as black light. This form of IR does not produce any glow when viewed with the human eye. It should only be used with a very light sensitive camera.

Alternatively, thermal or long wave infrared (LWIR) does not require the output of energy onto a scene. The specialist sensors used by the LWIR cameras have a response between 7000nm and 14000nm and as such can image the heat signatures of objects within the camera’s field of view, this technology is perfect for detection.

**THERMAL V’S ACTIVE INFRARED**

NIR is an active technology and as such puts energy onto the scene to enable the camera to obtain an image when the scene appears dark to the human eye. For this reason NIR illumination is ideal for combating the threat posed by light pollution and is essential when designing a covert or non-intrusive surveillance system.

\(^2\) Measure of the type of illumination or energy
There are two types of security infrared, the first being a tungsten halogen bulb based product. This is an IR lamp which is optically filtered to allow for the transmission of NIR only onto the scene whilst reflecting the visible light back into the unit where it is dissipated as heat by the housing.

These illuminators have a reduced outlay cost when compared to other forms of security illumination and require the tungsten halogen bulb to be replaced on a bi annual basis. This replacement can be factored into any maintenance contract. Bulb based illumination is ideal for larger projects or schemes with built in servicing contracts. This is because one of the advantages of the bulb based illumination like Derwent’s UF500 lamp is that its lifetime is extended indefinitely with the correct servicing. Derwent’s UF500 is a particularly efficient variant of this lamp available with differing front lenses to produce beam patterns for a wide range of applications.

The second source of security NIR is the LED based illuminator. In its most basic form this product uses an array of solid state Gallium Arsenide (GaAs) or Indium Gallium Arsenide (InGaAs) Light Emitting Diodes (LEDs). This array is fitted to a heat sink to dissipate the excess heat produced which if allowed to build would quickly damage the unit. Thermal management of LEDs is of primary note as this dictates the expected lifetime and efficiency of the illuminator.

With conversion efficiencies in excess of 50%, the LED illuminator is ideal for applications that are remotely located which would otherwise result in regular expensive maintenance costs. Alternatively, this style of illuminator should be specified when a site is either subject to power constraints or where the operating costs need to be kept to a minimum.
**CASE STUDY: UF500 BRINGS PTZ DOMES OUT OF THE DARKNESS**

A Californian based Energy Supply company uses Derwent’s UF500 infrared illuminators to enable Pan-Tilt-Zoom domes for 24/7 surveillance at its critical infrastructure sites. The company’s Security Manager understands the importance of IR enabled night-time surveillance. He states “We have obtained many successful prosecutions with the use of videos that we have taken of crimes that have occurred in the middle of the night”.

**PROBLEM 1**

**SPEED DOMES INSTALLED AT THE ENERGY COMPANY’S CRITICAL INFRASTRUCTURE SITE COULD NOT CAPTURE USEABLE NIGHT-TIME IMAGES.**

- Day/Night speed domes produced poor unusable pictures under low light conditions
- Specific locations at this critical infrastructure site needed to stay dark at night so as not to draw unwanted attention
- Impractical and expensive to illuminate large perimeter areas with conventional visible light

**PROBLEM 2**

**A MATTER OF SPEED DOME SENSITIVITY**

- Most speed domes have a very limited IR spectral response
- Only illuminators with shorter near-IR wavelengths are compatible
- Wavelengths of 750nm and above cannot be seen by these speed domes

**THE SOLUTION**

**DERWENT’S UF500 IR ILLUMINATORS ENABLE OUTSTANDING 24/7 PERFORMANCE**

- 730nm output matches the spectral response of speed domes
- Wide beam patterns mean UF500 can illuminate broad areas to support speed domes
- Greatly enhanced video with high-resolution, high SN ratio images
- Illuminated areas remain dark to the human eye and do not cause light pollution to surrounding areas

**THE RESULT**

**DERWENT IR IMPROVES SECURITY AT CRITICAL INFRASTRUCTURE SITE**

- Night-time capability for pre-existing daytime only speed domes
- High resolution surveillance on 24/7 basis
- Valuable night-time video evidence used to help prosecute criminals
- Upgraded security at critical infrastructure sites addresses concerns over Homeland Security

Pointed towards dark areas of sensitive locations UF500 IR illuminators used with PTZ domes enable effective surveillance even under low light conditions.

UF500 Illuminator
Following a burglary in an upmarket Copenhagen residential suburb, a high specification CCTV system which uses Derwent’s Black Diamond™ SuperLED was installed at one high-end family home.

The projects Danish installer said: “We needed a high quality solution that could deliver high definition night-time surveillance which is why we chose Derwent’s Black Diamond SuperLED. The installation is working extremely well. We are particularly impressed by the quality of the night-time picture we are getting which are the best we have produced.”

THE PROBLEM

THE CLIENT REQUIRES MAXIMUM SURVEILLANCE PROTECTION WITH MINIMUM VISUAL IMPACT TO THE FAMILY HOME

- Criminals are targeting ‘softer’ high-end residential target following a high profile, substantial investment to upgrade Denmark’s banks and post office security
- Home in question is situated in extensive grounds which obscure the approach to the house
- Client required high resolution megapixel surveillance of a large site but wanted a discrete, unobtrusive installation
- False alarms from PIR activated floodlights traditionally used to secure homes would cause unnecessary stress to the already nervous family
- High power visible floodlights are expensive to run and can cause Light Pollution

THE SOLUTION

HIGH SPECIFICATION MEGAPIXEL CAMERAS SUPPORTED BY BLACK DIAMOND SUPERLEDS DELIVER PIECE OF MIND

- Derwent’s Black Diamond™ SuperLED delivers High-Fidelity™ Even Illumination, a perfect match for megapixel digital imaging
- 850nm wavelength means light emitted is practically invisible to the human eye for an unobtrusive installation which does not cause Light Pollution
- Long range surveillance to 270m (885ft) and widened beam patterns (to 135°) enable maximum area coverage
- Even-illumination produces night-time images free from overexposure, hotspots
- Low power consumption equals low cost of ownership for the end user
- Average operating life of in excess 5 years, no regular maintenance required

BLACK DIAMOND™ SUPERLED

IR ILLUMINATION OFF

BLACK DIAMOND ILLUMINATION ON
Derwent have developed new technologies which dramatically improve upon standard LED illuminator performance. The first Black Diamond™ is a micro-refractive technique which enables the beam pattern of an LED array to be altered to suit exactly the application that it is intended for, angular field of view are possible ranging from 10° to 135°.

Most LED illuminators output a circular beam pattern which means that a lot of the infrared illumination is wasted up into the sky. Black Diamond™ takes this wasted energy and redirects it toward the back of the scene increasing the viewing distance. Secondly, because of the circular profile of the beam the illumination that is placed directly in front of the illuminator is of such a high intensity that the camera automatic gain cannot hold down the video signal, for cameras with a fixed aperture lens this leads to foreground over-exposure and a lost of information at close range. If the camera has an auto iris lens fitted the aperture closes to compensate reducing the effective night time range of CCTV system; again Black Diamond™ reduces the intensity of this problematic IR and redirects it to the back of the scene dramatically improving the range of the system and the quality of the images.

The Black Diamond™ micro-refractive technique also eliminates hotspots and produces an evenly illuminated image with reduced vignetting giving rise to higher quality images and making Black Diamond™ the ideal lighting system for DVR and NVR based CCTV as well as digital and mega-pixel security cameras. Select products from Derwent, Extreme CCTV and Forward Vision ranges are powered by Black Diamond™ to provide absolute night vision surveillance.

**The Future of Infrared Illumination**

The second breakthrough technology which has been incorporated into the new AEGIS range of Intelligent-IR™ illuminators is Constant Light™. The optical output of LED illuminators, by their very nature, degrades both with time and with increase in temperature. For instance, if you specify your illuminator at the limit of its initial performance after a period of time the illumination range of the product will decrease. The end result of this is that an inadequately illuminated scene and consequently poor quality and noisy images.

The same will occur if the unit is initially specified to operate in a 20°C environment, because when the temperature increases to 30°C the optical output of the unit will degrade, again producing poor quality and noisy images; in the past the only solution was over specification. Now, Derwent’s (patent pending) Constant Light rectifies this problem by constantly monitoring the output of the illuminator and adjusting the power to the array to compensate for lifetime degradation and temperature fluctuations. The result of this technology is that the image produced when the unit is installed is the same image being produced five years later throughout both winter and summer months.

**Demonstrating Black Diamond™ Technology**

![Conventional IR Illuminator](Image)

**Conventional IR Illuminator**

Hotspot in foreground, poorly illuminated background.

![Black Diamond IR Illuminator](Image)

**Black Diamond IR Illuminator**

High-Fidelity™ Even illumination light the foreground and the background of the entire scene.

![AEGIS](Image)

**AEGIS**

Demonstrating LED Degradation

![Start](Image)

**Start**

Illumination at point of installation.

![Six Months](Image)

**Six Months**

Output after 6 months.
The first issue to address is which form of illumination is required by the end users’ systems and are most suited to the end users’ needs:

> **PROACTIVE** This form of system is designed to act as a deterrent to intruders and is usually visible light or infrared with a wavelength of 730nm.

> **REACTIVE** This system is used after an event has taken place, the onus here is to produce high quality images while keeping the system as covert as possible, hence in this case 850nm or 940/950nm is the most suitable

The three most important factors when specifying illumination for CCTV are:

1. Divergence;
2. Range;
3. Required Image Quality (related to range)

**DIVERGENCE PATTERN**

Divergence is a property inherent in the illuminator itself. Accordingly, the divergence of the product should be matched to the horizontal angular field of view of the camera and lens combination required.

To calculate the horizontal angular field of view for the camera and lens combination, the two parameters required are the horizontal dimension of the camera sensor and the focal length of the lens – as follows:

\[ \text{Horizontal Angular Field of View (HFOV)} = 2 \times \tan^{-1} \left( \frac{\text{horizontal dimension of camera sensor}}{2 \times \text{focal length}} \right) \]

**Table:**

<table>
<thead>
<tr>
<th>Camera Sensor Size</th>
<th>Horizontal Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2” CCD</td>
<td>6.4mm</td>
</tr>
<tr>
<td>1/3” CCD</td>
<td>4.8mm</td>
</tr>
<tr>
<td>1/4” CCD</td>
<td>3.2mm</td>
</tr>
</tbody>
</table>

**Example:**

- **Focal Length = 12mm**
- **CCD Size = 1/2”**

\[ 2 \times \tan^{-1} \left( \frac{6.4}{2 \times 12} \right) = 30° \]
The underlying principle for calculation with respect to the range of infrared illumination is known as the ‘inverse square law of power’. This law basically states that as energy (in this case infrared illumination) travels outward from a source it diverges or spreads out, the greater the range or the divergence the more quickly the irradiance (energy per unit area) decreases.

**RANGE**

The energy twice as far from the source is spread over four times the area, hence one-fourth the intensity i.e. double the centrepower = $1.4 \times$ distance

The operational range of Derwent’s IR illuminators has been specified to produce an image quality (SNR) of a minimum of 20dB during complete darkness when used with a 1/2" IR sensitive camera\(^3\) with an F1.4 lens.

\[ \text{SNR} > 20\text{dB} = \text{High quality image} \]

\[ \text{SNR} > 15\text{dB} = \text{General image quality} \]

\[ \text{SNR} > 10\text{dB} = \text{Minimum recommended image quality} \]

The parameters involved in calculating the range of a camera - lens - illuminator combination in complete darkness in order to produce a 20dB Signal to Noise Ratio (SNR) image are:

\[ > \text{Firstly} \]

The sensitivity of the sensor to the wavelength of illumination being specified. This is found from the spectral response chart\(^4\) for the sensor used in the camera; and

\[ > \text{Secondly} \]

The size of the sensor and the F stop of the lens. If the spectral response chart is unavailable for the end user camera but the camera has a known performance in the NIR range a close estimate of the range is possible

\(^3\) Camera used for test Extreme FSX800

\(^4\) Not required if using a Sony Ex-view CCD
Note: If the camera has a low sensitivity to 850nm illumination it is advisable to use a 730nm security illuminator such as the UF500.

The second parameter for calculating range is the area of the sensor. The larger the sensor area the more photons it can collect to produce an image.

- 1/2" CCD Area = 30.72 mm²
- 1/3" CCD Area = 17.28 mm²
- 1/4" CCD Area = 07.68 mm²

The camera for which Derwent base their products achievable illumination ranges on uses a 1/2" Sony ExView CCD which has a 36% conversion efficiency for photons of a wavelength of 850nm. Should the end user camera sensor have a different value of quantum conversion then the range will be a factor of:

\[ \text{Square root (Sqrt) } \left( \frac{\text{New value}}{0.36} \right) = \text{multiplier} \times \text{[specified range]} \]

The 940nm and 950nm illuminator ranges are based upon the same CCD, the conversion efficiency at 950nm is 14%.

\[ \text{Sqrt (New value / 0.14) = multiplier } \times \text{[specified range]} \]

5 Sqrt of the value is taken to incorporate the inverse square law
6 Sqrt of the value is taken to incorporate the inverse square law

5 Camera used for test Extreme FSX800
6 Not required if using a Sony Ex-view CCD
As can be seen the range of a CCTV system with illumination can be drastically affected by the F-stop number of the lens specified, for night time application a low F number should, where possible, be specified.

Finally, the three multiplication factors above should be applied to the range of the IR illuminator specification to produce the range for the end user equipment to produce a minimum SNR of 20dB. It should be noted that most CCTV systems do not require a 20dB image at night and as such if a lower image quality is required a longer range can be specified.

The above conversion factors should be applied to recalculate the range of a given Derwent illuminator for a smaller CCD (charge coupled device i.e. camera sensor) size.

Due to the demand for 1/3” and 1/4” CCD sensors the low light performance of these sensors is increasing rapidly with the new 1/3” sensors moving toward the sensitivity of the 1/2” and the 1/4” moving toward the 1/3”.

The third parameter used to calculate range is the aperture size i.e. the F-stop number of the lens, Derwent specify at F1.4 which means that if a F1.0 lens is used instead of the F1.4 the amount of light reaching the lens will double and the range will increase by a factor of 1.4. Therefore if an F2 lens is used the amount of light hitting the lens will half and the range will need to be multiplied by 0.7.

### Ratio of Range with Respect to F-Stop

<table>
<thead>
<tr>
<th>F-stop</th>
<th>Ratio to Specified Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1.0</td>
<td>1.4</td>
</tr>
<tr>
<td>F1.4</td>
<td>1.0</td>
</tr>
<tr>
<td>F2.0</td>
<td>0.7</td>
</tr>
<tr>
<td>F2.8</td>
<td>0.5</td>
</tr>
<tr>
<td>F4.0</td>
<td>0.35</td>
</tr>
<tr>
<td>F5.6</td>
<td>0.25</td>
</tr>
<tr>
<td>F8.0</td>
<td>0.18</td>
</tr>
<tr>
<td>F11.0</td>
<td>0.13</td>
</tr>
</tbody>
</table>

### Ratio of Range with Respect to Image Quality (SNR)

- 20dB to 15dB = 1.3 x [Specified Range]
- 20dB to 10dB = 2.0 x [Specified Range]
BEST PRACTICES FOR CCTV ILLUMINATION LAYOUT

CCTV illumination schematics can be laid out in two ways, the first being a full coverage solution where the whole area under CCTV surveillance is to be illuminated. This is the best option as it enables the system to protect the entire premises 24/7, this is especially applicable to PTZ systems. The second and more cost-effective solution is to illuminate only the critical areas, such as entry gates, access points and other areas of weakness.

CCTV cameras are available in a variety of formats: fully functional domes, box camera PTZ’s, power domes and static cameras. Each has its own specific method of installing to support night-time surveillance illumination should be added.

FULLY FUNCTIONAL DOMES WITH SUPPORT ILLUMINATION

A full coverage solution using fully functional domes will require the installation of either 180°, 270° or 360° illumination depending upon whether the fully functional dome is mounted to a wall, corner or a pole.

Wide angle illuminators should be specified for this type of application in order to reduce the amount of product which is required to be installed, for example 3 x Black Diamond SuperLED 135° will give 360° coverage to a range of approximately 50m whereas 36 x 10° illuminators, whilst giving the maximum 350m+ range would be completely impractical and prohibitively expensive.

For the reason stated overleaf if a significant increase in range is required, the most appropriate solution is to illuminate only those areas for which CCTV coverage is deemed critical. The infrared illuminators can then be remotely activated using the telemetry input on the illuminator Power Supply Unit (PSU) when the fully functional dome moves to the specified pre-set and outputs an alarm signal (see installation tips for method). This directional illumination can either be local to the area under surveillance or it can be installed at the camera position and directed toward the areas required.

Diagrams which demonstrate both these methods of illumination can be found on the next page.
This is the simplest illumination solution to implement. A specialist plate is used to attach the box camera to the PT motor. This plate has mounting positions to take both LED and bulb based IR illuminators. The best configuration of illuminator for this form of installation is to mount two illuminator units, one with a wide beam pattern $30^\circ + (12\text{mm on a } 1/2''\text{ CCD})$ and the other with a narrow beam pattern such as a $10^\circ$ [$36\text{mm on a } 1/2''\text{ CCD}$]. Whatever scene the camera PTZ views, the illumination pattern will be matched.

**BOX CAMERA PTZ WITH IR**

Solution 2
Specific Target Illumination

Solution 3
Local Area Illumination

Full area with specific target IR coverage

Target Area

100 metres

Fully functional Dome

Infra-Red located close or near to target
The IR illumination should be matched to the angular field of view of the camera and lens combination. When setting up perimeter security illumination it is often advisable to set the cameras and illuminators in a heel-toe configuration. The advantage of this layout is that the cameras do not have any of the illuminators in the field of view.

Another method of setting perimeter security is to have all of the static cameras facing outwards from the area under protection. This system will require the illuminators to be spaced at a distance equal to the horizontal field of view of the camera and the divergence of the illuminators ensuring that a uniform spread of optical power is obtained. The advantage of this design is that the detection can be obtained at a greater distance outwards from the installation.
The MIC1 has additional IR lamps which can be fitted to the MIC sphere. These lamps will give approximately 70m of illumination and stay aligned with the camera field of view over the full movement range of the unit.

If additional security illumination is required the approach taken for the fully functional dome can be applied.

**MIC1-400**

**IDN – INTEGRATED IR WITH DAY AND NIGHT CAPABILITY**

These products are the most simple and therefore the quickest to install, as all of the configuration will have been being completed at the point of manufacture. Essentially, the divergence of the illuminator and the angular field of view of the camera have been matched and aligned with a single photocell switching the cameras mode of operation (colour – monochrome) and turning the illuminator on.

**MIC1-400 EX30 IR IMAGER™**
INSTALLATION TIPS

EXTERNAL PHOTOCCELL SWITCHING OF DUAL MODE CAMERAS (ALARM OUTPUT)

A common problem when installing IR illumination is camera “ringing”. This means that the camera switches back and forth between operational modes due to the additional illumination causing the video level of the camera to increase whilst it is in monochrome mode. The camera then makes the decision that this high video level means that the ambient lighting is sufficient for the camera to operate in colour mode and hence switches back, placing an IR cut filter across the sensor and effectively blocking the IR illumination from reaching the camera sensor. The camera now produces a very low video signal and hence its assumes rightly that it is night time and switches back to monochrome mode removing the IR cut filter causing the video level to increase as the IR illumination is now hitting the sensor, again the camera inter-operates this as an increase in ambient light and switches to a colour mode of operation, and so on.

REMOTE TELEMETRY INPUT (ALARM INPUT)

Derwent IR illuminator power supplies have an alarm input to switch the IR illuminator remotely either manually or as part of a present program on a PTZ system. The preferred method for this alarm input is a volt free contact switch or an isolated relay to close the connection. This method is especially useful for surveillance of access gates, doors, barriers and other critical surveillance points.

WIRE DIAGRAM OF SETUP
INSTALLATION TIPS

ADJUSTABLE INFRARED OUTPUT POWER

This function allows the intensity of the IR illumination to be reduced. It is used more commonly used for indoor application where the IR is reflected from walls and objects in the field of illumination and as such less IR is required to light the scene.

Another use for this adjustment is where a fixed iris is used the IR can at times override the automatic exposure function of the camera leading to overexposure, should this be the case then the IR should be reduced.

Reducing the infrared intensity will increase the lifetime of the illuminator.

FOCUS OF CAMERAS WITH INFRARED ILLUMINATION

The lens used on the camera focuses different wavelengths of light through a range of distances back toward the camera sensor. As IR illumination is further from the central part of the visible spectrum, most standard lenses have not been designed to cope with this wider range. To eliminate this problem it is advisable to use a zero focus shift or IR corrected lens, which has a coating applied to the optic to allow both the colour and infrared wavelengths to be focused correctly on the sensor.

However, as visible sunlight has a large component in the IR part of the electromagnetic spectrum, if an infrared filter is held in front of the lens aperture when it is focused during the day, the image will stay chromatically focused at night. In addition, even with the addition of infrared security illumination lighting levels drop significantly during darkness. This causes the aperture of auto-iris lenses to open to their widest diameter reducing the depth of field (DOF). DOF is distance in front of and behind the optimum focus point for which the image of the scene will stay focused. To achieve optimum focus there are two choices, the first is to focus the system at night. This is not ideal due to additional costs incurred for night time installation. The second option is to use the infrared filter mentioned previously in conjunction with a neutral density filter, these two components will cause the amount of infrared energy from the sun to be severely attenuated with the end result being the aperture opens wide while only passing the infrared illumination through to the sensor simulating night time operation. This should eliminate loss of focus at night due to focus shift and depth of field reduction.

WIRE DIAGRAM OF SETUP
Will my camera see infrared illumination?
If your camera is B&W or has a B&W mode it will see infrared illumination to some degree. The quality of the images will depend on the camera’s capability of reading the specific IR wavelength on the scene. Do not be misled by lumen specifications. Not all low lux cameras are efficient at reading the IR part of the ‘electromagnetic spectrum’. Ensure that you determine the spectral response of the camera to confirm its capabilities for viewing infrared. If your camera has an adequate spectral response at 950nm then you can be assured it will see IR up to this wavelength, most IR illuminators emit IR light in the 730nm - 950nm range.

How do I stop my camera from switching back to colour when the IR activates?
By using a connection in the illuminator power supply called the photocell relay output. This sends a signal to the camera to override its automatic switching level, the camera will then switch on and off at the same time as the illuminator.

My image is blurred when I use IR at night but is sharply focused during the day. How can I remedy this problem?
The lens used on the camera focuses different wavelengths of light through a range of distances back toward the camera sensor. As infrared is further from the central part of the visible spectrum, most standard lenses have not been designed to cope with this wider range. To eliminate this problem use a zero focus shift or IR corrected lens, which has a coating applied to the optic to allow both the colour and IR wavelengths to be focused correctly on the sensor.

Is it possible to remotely trigger infrared illumination?
If continuous night-time surveillance of an area is not required most IR illuminators can be triggered via alarm outputs from contact and PIR sensors to give light only when required, this can considerably reduce the lamps power consumption and extend its operational life.

If my camera has frame integration, do I need additional IR illumination?
Frame integration involves the addition of frames of video one on top of another, essentially allowing more photons to land on the camera sensor. However as the camera’s exposure time is increased, it becomes more difficult for the camera to image moving objects. A good example of this is when a compact digital camera is used without a flash at night, the image is usually very blurred due to the photographer’s hand shaking. If infrared illumination is used with a security camera, this is essentially the same as using the compact digital camera with a flash. The camera will no longer need to integrate, hence objects moving in the scene can be resolved without motion blur.

Why use IR as oppose to conventional visible lighting?
IR provides unobtrusive, even illumination which dramatically improves the performance of CCTV systems during the vulnerable hours of darkness, without drawing attention to the location or disturbing the surrounding area with unwanted light pollution. Visible lighting systems are not usually designed to provide even illumination and therefore make it very difficult to get a clear picture or to use motion detection. IR has much lower operating cost than most conventional visible lighting and can illuminate further. A single 220W UF500 IR lamp will effectively illuminate distances up to 170m. Conventional street lamps throw 80% of their light to within 12m of the base of the pole. It would be cost prohibitive to attempt to achieve even illumination with conventional street lamps or metal halide security lamps.

The exception to this rule is Derwent’s visible (white) security lighting which has been specifically designed to operate with today’s CCTV cameras; these white light products use optical lenses to give a high uniformity of illumination across the scene. However the operational range of a white light LED illuminator is reduced by a factor of 2 when compared with an IR LED illuminator of the same divergence (angular field of view).

When should I use an integrated Day–Night camera (IDN)?
Integrated Day–Night (IDN) cameras are particularly effective for shorter range projects (up to 70m), applications with short separation installation points or where the installer does not want to have to integrate camera, lens and illumination themselves. It is also advisable to use IDN when the visual impact of the surveillance equipment is required to be minimal, or where installation space is at a premium. The components of IDN products have been specifically designed to work together, bringing together an IR sensitive camera and LED illumination array, a zero focus shift lens and integrating the full package together in an IP rated and cable managed housing. Use of IDN products can significantly reduce the installation and set-up time of a CCTV system.

Which wavelength of infrared should I use?
Infrared illumination is available in three variations of wavelength, 730, 850 and 950nm. The 730nm wavelength produces a red glow similar to that given off by a traffic light and should be used when maximum range is required. Most day/night and monochrome cameras are sensitive to this wavelength. 850nm illumination is described as ‘semi-covert’ infrared and produces a very dull red glow. Some day/night and monochrome cameras are sensitive to this wavelength although the more cost-effective sensors will struggle. Finally, 950nm is completely covert and invisible to the human eye. This form of IR requires a very sensitive camera with a high spectral response in the IR region of the sensors quantum efficiency curve. Derwent have quantum efficiency curves for most security cameras on the market.