High-Tech Digital

Delivering Imaging and Machine Vision products since 1983. Experts in System Integration.

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High-Tech Digital designs and manufactures application-specific vision systems and components for automated inspection, including motion controllers, lens and illumination controllers, and part-tracking controllers.

High-Tech Digital is also a source for a complete range of state-of-the-art imaging components including cameras, lenses, optics, illumination, imaging boards and imaging software.

High-Tech Digital, Inc.
655 Deep Valley Drive, Suite 305
Rolling Hills Estates, CA 90274
(310) 265-8203

Requires a Java Enabled Browser.

High-Tech Digital offers a complete range of state-of-the-art imaging and machine vision components, and a broad range of consulting services.

High-Tech Digital designs and manufactures application-specific systems and a number of machine vision components – needed for a complete turn-key system, but often overlooked by traditional component manufacturers.

The professional and executive staff members of High-Tech Digital, Inc. have been carrying on key responsibilities in all facets of the imaging and machine vision business for many years. Some of the specific research, design, development and system integration activities include:

- 20+ innovative, technologically advanced machine vision systems for the glass, beverage, packaging, pharmaceutical, cosmetics, electronics and semiconductor industry. More than 7000 of these systems have been sold worldwide.
- Complete solutions for a wide range of applications – surface and material flaw detection, foreign material detection, high precision metrology, glass and plastics stress detection, pattern and shape recognition, color recognition and processing, high speed inspection, parts handling and tracking, image acquisition with monochrome, color, and infrared cameras, inspections in industrial, hot (600°C), and “clean room” environments, GMP and FDA compliance validation, etc...
- Special sensors and detectors – RF, Gamma, X-Ray, light intensity; lighting – Strobe, LED, fiber-optics; lighting techniques – front, back, bright-field, dark-field, directional and diffused lighting; special custom optics.
- Frame grabbers and image processors; controllers for parts tracking and parts handling (including driving DC, AC, Step and Servo motors); motorized lens controllers; communication and networking controllers.
- Patents for innovations in sensing and inspection technologies. Published numerous technical papers and a textbook; university lectures on computer science.
- Technical sales to OEMs and end users of various machine vision products.

With the experience, knowledge, and skills highlighted above - combined with the proven track record, credibility and integrity of a 19 year-old company, we are positioned to continue to provide our customers with the excellent products and services they have learned to expect from High-Tech Digital.

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May 28, 2002
New issue of Imaging Insight newsletter

Fills you in on the latest from Matrox Imaging.

High-Tech Digital adds two new camera manufacturers to their camera product line

Uniq Vision

Sentech

News & Events

July 17, 2002
Matrox announces a leading-edge vision processor board family which combines evolutionary architecture with revolutionary performance.
A premier Motorola G4 PowerPC embedded microprocessor, state-of-the-art custom processor and router ASIC, DDR memory, and PCI-X interconnectivity come together on the **Matrox Odyssey Xpro** and **Odyssey XCL** to provide unrivalled power for vision processor boards.

June 29, 2002
High-Tech Digital introduces **Controllers** for automated machine vision and imaging.
A modular Motorized Lens Controller capable of controlling zoom, focus, iris, and other motors from a host computer. Standalone and OEM version available .

June 10, 2002
DALSTAR introduces new 'Stop-Action' CMOS Area Camera - **1M28-SA.**
Compact 1-megapixel design features non-rolling shutter, LINLOG(tm) response, windowing, and Camera Link interface.

June 3, 2002
Matrox introduces a high-quality industrial graphics with the Matrox **Meteor-II/Display**. Based on the Matrox G550 graphics controller, the new Meteor-II/Display is an adapter card for CompactPCI® that delivers exceptional graphics performance and product stability for industrial applications.

April 19, 2002
Slash development costs with Matrox new, ultra-low cost video capture board. **Matrox Cronos** is an entry-level frame grabber that delivers exceptional value and performance in capturing standard analog monochrome or color video.

High-Tech Digital has been delivering Imaging and Machine Vision products since 1983. To find more about our imaging systems and components call 310-265-8203 or send an e-mail to:
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Systems

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Imaging Hardware
Imaging Software
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Products

Systems

High-Tech Digital designs and manufactures application-specific turnkey systems. We offer Digital Video Recording Systems and High-Precision Metrology Systems.

Imaging Hardware

Matrox Imaging is a leading designer and manufacturer of PC-based hardware and for machine vision, image analysis and medical imaging. Products include frame grabbers, vision processors and stand-alone systems.

Imaging Software

Matrox Imaging is a leading developer of PC-based software for image acquisition, processing, analysis and display. Products include development software toolkits, prototyping software, and camera configuration utility software.

Cameras

Basler, Dalsa/Dalstar, Hitachi, Pulnix, and Uniq Vision are leading manufacturers of monochrome and color area-scan cameras for imaging and machine vision applications. Dalsa and Basler are leading providers of line-scan cameras.

Lenses/Optics

We offer a large selection of lenses from Cosmicar, Fujinon, Melles Griot, Navitar, Rainbow, and Schneider. We also offer other optical components from Melles Griot.

Controllers

High-Tech Digital designs and manufactures controllers for automated imaging and machine vision applications. We offer Motorized Lens/Optics Controllers and Parts Tracking/Reject Controllers.

High-Tech Digital has been delivering Imaging and Machine Vision products since 1983. To find more about our imaging systems and components call 310-265-8203 or send an e-mail to:

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Consulting Services

Imaging and Machine Vision Systems require the integration of diverse technologies – imaging sensors, optics, lighting, computers, operating system software, application specific software, and intranet/internet connectivity. The automated manufacturing requires additional features – application-specific material handling, parts tracking, and controls.

Technological advances in all areas have made it possible to have an imaging or machine vision system that is easy to set up and use – it “speaks” your language, yet still has a robust and reliable performance and can operate in practically any environment.

High-Tech Digital is helping existing and future customers by offering a broad range of consulting services: technology assessments, application-specific feasibility studies, conceptual system design, system development and integration, application-specific software development, intranet/internet connectivity, project management, acceptance testing, and validation for GMP and FDA compliance.

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Tutorials

- Optics Tutorial
- Lighting Tutorial
- Camera Tutorial
- Applications

Related Information

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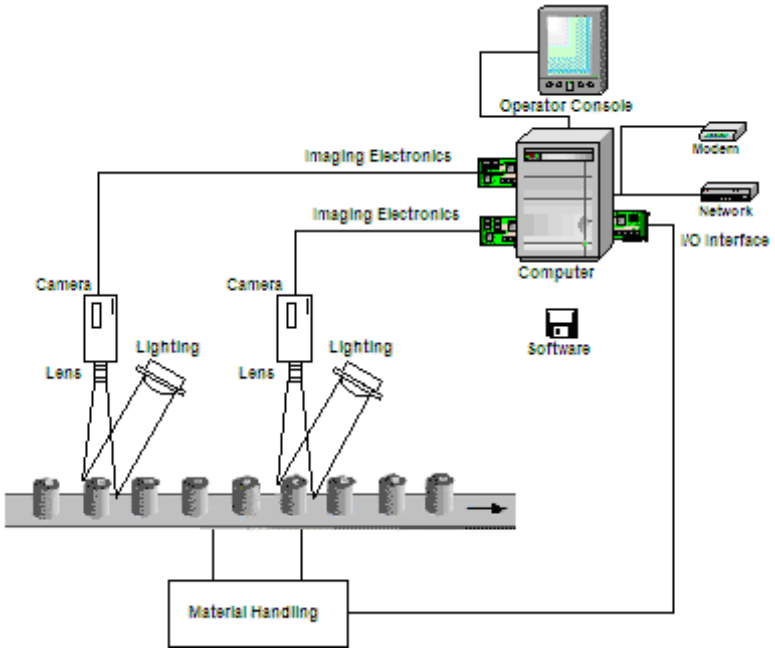
Imaging and Machine Vision Systems



Imaging and Machine Vision Systems can be described as the integration of image acquisition devices, computers, and imaging software. The automated manufacturing also requires application-specific material handling, **Motion Controllers**, **Part-tracking Controllers** and sensors, and control software. Today's high-speed, complex manufacturing systems require a machine vision system that can efficiently collect data, use historical information to provide context, and generate process knowledge for automatic characterization and control of product quality and the manufacturing process. The System consist of:

Image Acquisition Devices - **Lighting** to illuminate the object, **Optics/Lens** to couple the image to a camera sensor**,** a **Camera** to convert optical image to an analog signal, and for automated manufacturing a Trigger Sensor to initiate the image acquisition.

Computer – Typically a PC with a CPU (decision-making and control), an Operator Console (the operator interface), and **Imaging Hardware** (typically an analog to digital converter and image processing). The automated manufacturing also requires an addition of I/O Interface, Material Handling and communications to customer process information and control system.

Software – Operating System Software (e.g. Windows NT/2000/XP) and **Imaging Software** (the user interface, image acquisition and processing, image analysis and decision-making, historical data collection and analysis).

Image Acquisition Devices

Acquiring an image in machine vision is similar to photography – it requires proper lighting and a lens to capture a picture of the object and focus it onto a light sensitive camera sensor.
The quality and placement of the lighting and the quality of the optics (lens) affects the quality of the image and are key factors in creating the contrast required for the inspection system to distinguish features in the object under inspection.

The solid-state (semiconductor) image sensor consists of a finite number of equi-spaced discrete light-sensing elements arranged in a line (line-scan camera) or in a rectangular array (matrix camera). Each discrete element produces a portion of the total picture or a pixel. The camera image sensor dictates the smallest detail that the system can discriminate. A typical machine vision camera has a sensor with approximately 500 x 500 pixels. The smallest detail that the system can discriminate also depends, like in photography, on the lens field of view. If the field of view is 1", one pixel represents 0.002" and if the field of view is 10", one pixel represents 0.02".

When an object is illuminated, all of its points are simultaneously imaged on the imaging plane of the sensor by light-sensing elements - which are then read out, point by point, in a programmed sequence. The image sensor outputs a sequential electrical signal corresponding to the intensity of the light at the individual image points. The intensity of the light is a function of the intensity of a light source, the reflectivity of the object, the light and object position, and the sensitivity of the camera sensor. For a computer to operate on the image, the electrical signal (analog image) is digitized in dedicated hardware (analog to digital converter) and stored into dedicated memory (frame store). Typically, the brightness is represented by a value between 0 and 255 and is referred to as a level (shade) of gray.

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Contact Information

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Application Evaluations:	General and Sales Inquiries:	Technical Support:
Make a Request	**info@high-techdigital.com**	**support@high-techdigital.com**

(Click the map for more detailed map)

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Optics/Lens Tutorial

- Imaging Optics
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- Find Lens/Optics

Related Information

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Imaging Optics

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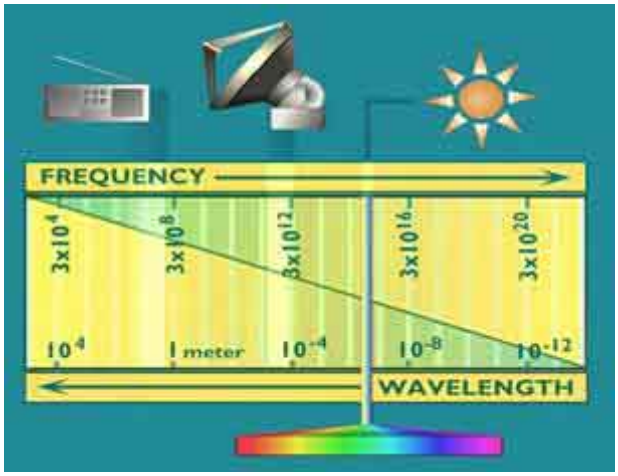
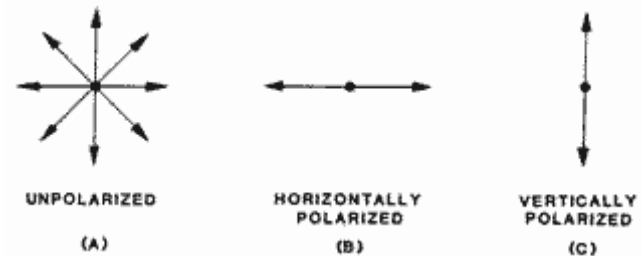


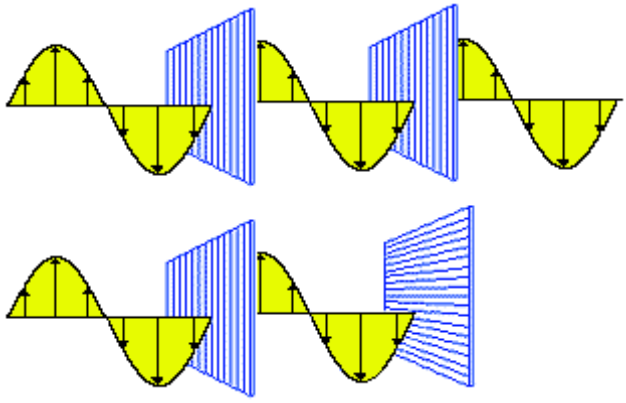
Light

Light is an electromagnetic energy propagating in space as a transverse electromagnetic wave. The wavelength range extends from gamma rays (very short) to radio-waves (very long). Wavelength determines how much light interacts with matter and how much of this interaction is seen by human eyes or by an image sensor.



Polarization

Ordinary white light is made up of many waves vibrating in all possible directions along the axis in which they are traveling. When all vibrations are blocked in all directions except those in the horizontal direction, the wave is said to be horizontally polarized. Similarly, the light can be vertically polarized. A polarizer is a material that allows only light with a specific angle of vibration to pass through.



If two polarizers are set up in series so that their optical axes are parallel, light passes through both. However, if the axes are set up 90 degrees apart (crossed), the polarized light from the first is extinguished by the second. As the angle rotates from 0 to 90 degrees, the amount of light that is transmitted decreases. This effect is demonstrated in the diagram on the left. The polarizers are parallel at the top and crossed at the bottom.

Although light is known to be a wave motion, it is often more convenient to consider only the paths along which light travels. These paths are known as *rays*, and in a homogenous medium (air) they are straight lines. By using the ray method (geometrical optics), it is possible to determine the location and brightness of an image. However, to determine the structure and distribution of light, which can be affected by phenomena such as polarization, diffraction, interference, and scattering, the light has to be treated as a wave (physical optics).

The main task of the optics is to generate an image of an object at the camera sensor with as little distortion as possible. Optics can also be used to remove some undesirable information from the image (filtering, polarizers) or it can be used to modify, direct, enhance or filter the lighting. The optics may include different devices – lenses, mirrors, beam splitters, prisms, polarizers, filters, etc.
The image is the only source of information for the machine vision. Therefore, the quality of the analysis is

dependent on the quality of the image. And the quality of the image is determined by the appropriate choice of optics. The software cannot correct for poor image quality.

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Lens Parameters

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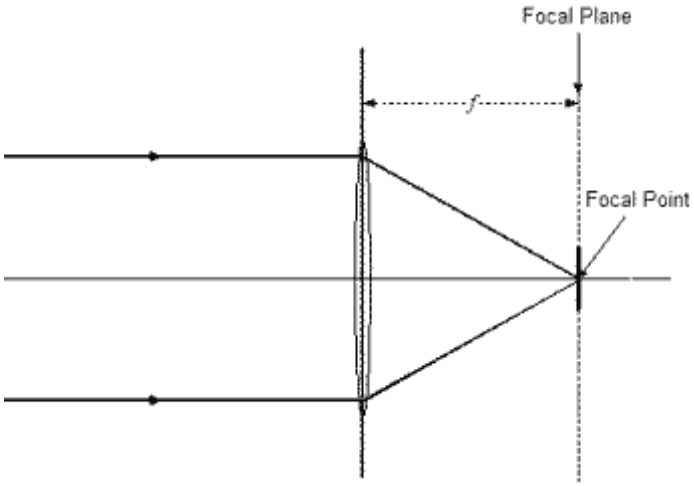
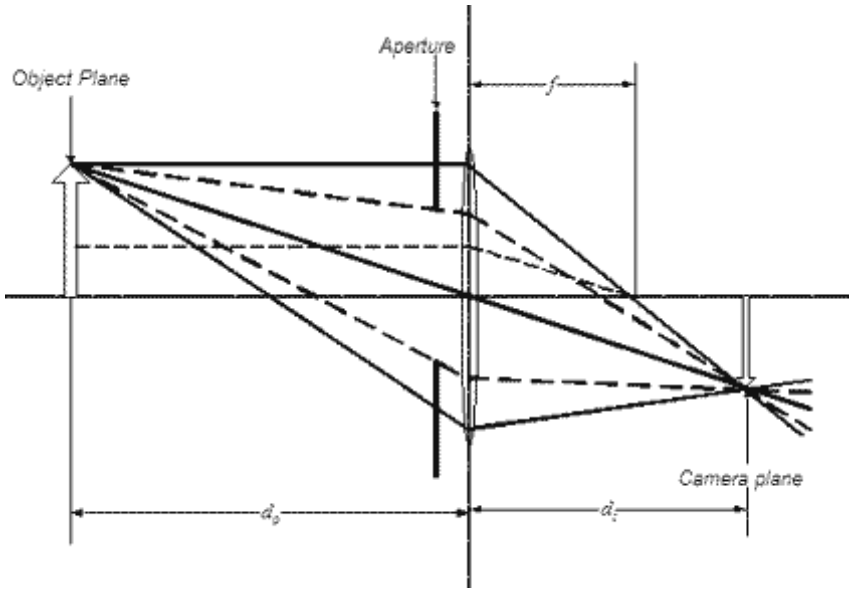
Focal Length – The focal point of a lens is the point where the collimated beam, which has all rays parallel, gets focused to a point. Consequently, the focal point is the image of an infinitely remote light source. The focal length *f* is a distance from the lens to the focal point given in millimeters (mm).



A thin lens model shows the basic lens principal. When an object is moved closer to the lens, the image will be in focus at a distance which is greater than the focal length.



The following simple lens formula applies:

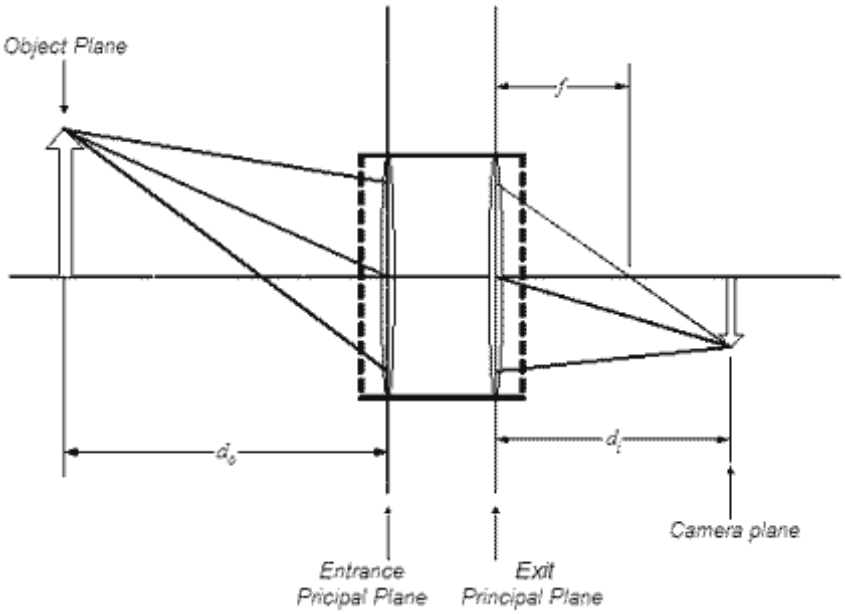
$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i} \quad and \quad m = \frac{d_i}{d_o}$$

where d_o is the distance from the object to the lens (working distance), d_i is the distance from the lens to the

camera sensor and *m* is magnification. If we know a magnification and a working distance we can calculate the required focal length using the following equation:

$$f = d_o \frac{m}{m+1}$$

Typically lenses are far more complex and consist of a number of lens elements with different thicknesses and curvatures, designed so that the combination corrects the imaging defects (aberrations). The focal length of a thick lens is measured from two planes called the principal planes.



The thick lens acts as though it were a thin lens placed at the entrance of the lens when considered from the object side, and at the exit of the lens when considered from the image side. The principal planes serve as the reference for the location of the front focal point, back focal point, object and image positions. The lens equation, for the above simple example, operates as though the space between the planes does not exist. In reality, the planes can be crossed inside of the lens or lay entirely outside the physical boundaries of the lens. Alternatively, often a back focal length *(BF)* of a lens is specified, which is the distance from the rear element of the lens to the back focal point, and a front focal length *(FF)* as a distance between the front lens element and the front focal point.

Lenses are available with a fixed focal length or variable focal length – e.g. *varifocal* lenses or *zoom* lenses.

Lenses with a focal length of more then 25 mm are telephoto lenses. They make the object appear larger – resulting in smaller fields of view. Lenses with a focal length shorter then 15 mm are wide-angle lenses. They make the object appear smaller – resulting in larger field of view.

Lens Power (*Diopter***)** – The power of a lens (*f* given in *meters)* is basically the reciprocal of its focal length:

$$D = \frac{1}{f}$$

Lens Aperture (f/Number) – In addition to the ability to focus light, lenses have the ability to control the amount of light that reaches the camera sensor. The f/number printed on the lens (fn_{∞}) is the ratio of the focal length (*f*) of the lens to the diameter of the aperture (*A*) and it is only valid if an object is infinitely far.

$$fn_{\infty} = \frac{f}{A}$$

For machine vision applications, the object is relatively close, hence there are two f/numbers – one for the object side, and one for the image side.

$$fn_{image} = \frac{d_i}{A} \quad and \quad fn_{object} = \frac{d_o}{A}$$

For close objects f_{image} is greater then f_{object} so the f/number will be higher than one shown on the lens. For example, a lens set at f/4 will act like an f/8 lens at a magnification of 1.

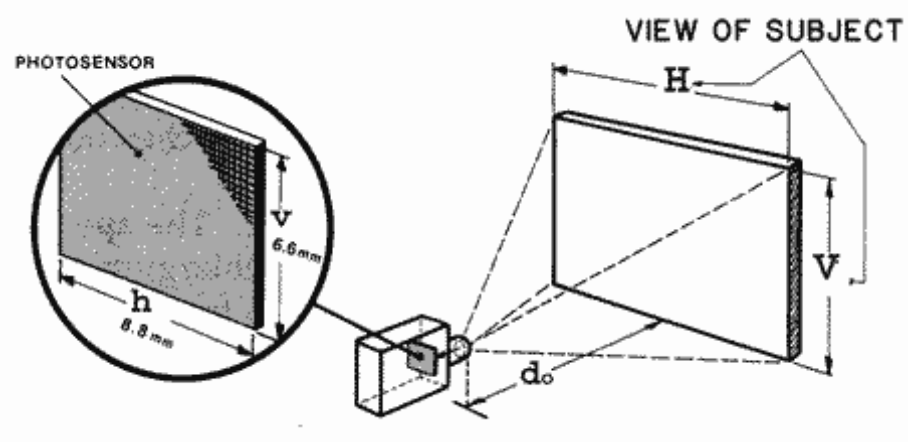
The f/number of a lens determines the brightness of the image, depth of field, and resolution of the lens. Standard f-stops are for f/numbers of 1.2, 1.4, 2, 2.8, 4, 5.6, 8, 11, 16, etc. Each f-stop changes the amount of light available to the camera by a factor of 2. The automatic aperture control available for some lenses should not be used in machine vision applications. The automatic aperture control may compensate for light changes that need to be detected.

Angle of View – Is the angle subtended by object producing the maximum image size. The maximum field angle *(Q_{max})* is obtained when camera is focused to infinity. For machine vision applications, the object is close and the field angle *(Q)* is calculated using the working f/number.

$$\Theta_{max} = 2\,a\tan\frac{1}{2f_{\infty}} = 2a\tan\frac{A}{2f} \qquad \Theta_{object} = 2\,a\tan\frac{1}{2f_{object}} \qquad \Theta_{image} = 2a\tan\frac{1}{2f_{image}}$$

Field of View (FOV) – Is the object area that is focused by the lens onto the image sensor. Typically, the FOV should be slightly larger than an area containing all desired features.

The FOV can be adjusted by adjusting the camera's distance from the object (**working distance**) – thehe greater the distance, the larger the FOV. It can also be adjusted by changing the focal length of the lens – the longer the lens focal length, the smaller the FOV. The FOV can be calculated using following equations:



$$H = d_o\frac{h}{f} - h \quad and \quad V = d_o\frac{v}{f} - v \quad or \quad f = d_o\frac{h}{H+h} \quad and \quad f = d_o\frac{v}{V+v}$$

The FOV size depends on the size of the smallest detail needed to be detected. This is also connected with camera resolution. Good sampling practice suggest a minimum of two samples (pixels) for reliable detection. Hence, 512 x 512 pixels camera needed to detect 0.25 x 0.25 mm detail could have maximum FOV of 64 x 64 mm.

Magnification – The magnification is:

$$m = \frac{h}{H} = \frac{v}{V} = \frac{d_i}{d_o}$$

where V x H is the size of the FOV, and v x h is the size of the camera sensor. As magnification is inversely proportional to working distance (d_o), care must be taken in gauging applications not to allow any lens vibrations – unless one uses a special telecentric lens.

Depth-of-Field – Depth-of-field is the range of lens-to-object distances over which the image will be in acceptable focus. The depth-of-field increases with higher object-side f/number. The object-side f/number (f_{object}) is given by:

$$f_{object} = f_{image}\frac{1}{m} = \frac{d_i}{A}\frac{1}{m}$$

Also, lenses with shorter focal length provide greater depth-of-field. Closing the aperture will require more illumination and using shorter focal length lenses will require positioning an object closer to the camera. However, moving an object closer reduces the depth-of-field – hence, requiring a compromise.

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Type of Lenses

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Video Camera Lens – Are primarily designed for the CCTV applications providing maximum light level and a recognizable image. Hence, they are suitable only for lower-resolution inspection tasks. Lenses are available in a focal length from 8.5 mm to 135 mm.

This lens is typically a C-mount lens. This mount can be used with sensors that are 0.512" (13 mm) or less in size. However, due to distortions at the lower focal lengths, it is recommended that the sensor size does not exceed 0.128" (3.25 mm) for an 8.5-mm focal length lens, and 0.256" (6.5 mm) for a 12.5-mm lens.

35-mm Camera Lens – Are primarily designed for 35-mm photographic film. Their larger format provides a better image but their design is optimized for larger distances. They mount to the standard CCTV camera trough a C-mount adapter.

This lens is typically a U-mount lens. This mount is suitable for sensor not exceeding 1.25" (31.75 mm). The short focal lengths should not be used with sensors exceeding 1" (25 mm).

Microscope Lens – Are designed for small FOV (2 – 4 mm) and for viewing objects at short distances. They also mount to standard CCTV camera through a C-mount adapter.

Zoom Lens – Is a lens that has adjustable focal lengths over some range. Although zoom lenses may be more convenient, they have smaller apertures and usually more distortion than similar fixed-focal-length lenses.

Macro Lens – Allows focusing on very close objects without loss of definition and without the need for front or rear attachments. As it is optimized to work at a magnification near 1, it is usually used for magnification between 0.1 and 10.

Telecentric Lens – This lens provides constant magnification for any object distance. They are usually used for precision gauging. The disadvantage is that the first element must be as large as the FOV.

Close-Focusing Attachments – Adding a thin meniscus lens of 1-, 2-, or 3-diopters power in front of the camera lens shortens the object distance of a standard lens. The new object distance (*d* is given in *meters)* can be calculated by using the following equation:

$$\frac{1}{d_{object-new}} = D + \frac{1}{d_{object-old}}$$

While 1-D and 2-D attachments are generally satisfactory, the 3-D attachment causes distortion, even when the main lens is stopped down considerably.

Extension Tubes – The focusing distance can also be shortened by inserting extension tubes of different thickness between a camera and its lens. The new object distance can be calculated by using the following equation:

$$d_{object-new} = f + \frac{f^2}{E}$$

where *f* is a focal length, and *E* is the thickness of the extension tube. It is also possible to combine an extension tube with a diopter attachment.

Tele-Extenders – Instead of using an empty extension tube, a much greater change in image size can be obtained by using a telenegative attachment (tele-extender). These attachments serve to double or triple the image size without altering in any way the previously determined object distance. They are typically available at 2x and 3x power As the extender rings usually cause a reduction in depth of field and resolution and increase distortion, it is recommended not to exceed the 4x power.

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Other Optics

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Mirrors – May be used to provide projection of not directly visible object surfaces or to provide projection of up to 360º around an object into a single camera.

Cylindrical Lens – The right arrangement can unfold cylindrical areas and effectively produce field-flattened image.

Aspherical Image Formation – In order to make more efficient use of the imaging electronics or to increase the resolution in one image axis it is sometimes desirable to use a different magnification for two image axis. A cylindrical beam expander is then added to change the magnification in one image axis.

Beam Splitter – A beam splitter can be used to image different areas of an object using a single light or to project light into areas that are difficult to reach.

Split Imaging – Is required when one wants to inspect two or more features not accessible to a single camera. Two or more cameras can be used in multiplexed arrangements, or two or more lower resolution camera fields can be combined into a single video frame. An alternate method is to use mirrors or coherent fiber optics to combine two images into one.

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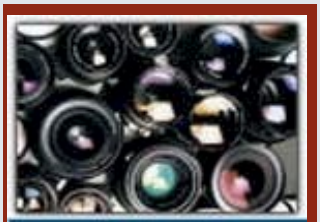

- Cosmicar
- Fujinon
- Melles Griot - Lenses
- Melles Griot - Optical Components
- Navitar
- Rainbow
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Lenses/Optics

COSMICAR/PENTAX CCTV LENSES

The Cosmicar/Pentax product line includes a wide selection of standard lenses as well as specialty lenses such as IR (Infrared) compatible lenses in which the aberrations have been corrected for use in a wide range of IR rays, manual override lenses which allow for automatic or manual control of the iris, and many different types of zoom lenses.

FUJINON

Fujinon offers a wide selection of CCTV lenses. Product line includes fixed focal length, vari-focal length, zoom, and 3CCD lenses. They also offer specialized machine vision lenses with fixed focal length and ultra small lenses with fixed focal length.

MELLES GRIOT

LENSES

Melles Griot specializes in the design and manufacture of multi-element optical systems for demanding OEM applications in machine vision and imaging. They offer high-quality, low distortion telecentric gauging lenses, and comprehensive selection of high-quality C-Mount CCTV lenses and F-Mount 35 mm SLR lenses .

MELLES GRIOT

OPTICAL COMPONENTS

Melles Griot is a major OEM supplier involved in the high-volume fabrication of both standard and custom optical components as well as optical tables, opto-mechanical hardware and enclosures.

NAVITAR

Navitar offers a wide range of video lenses for every industrial application in machine vision. The product line also includes Macro Zoom lenses for close-up inspection, Dyotar high depth-of-field lenses, Telecentric lenses, and Motorized lenses.

Rainbow

Rainbow's product line includes a wide selection of standard CCTV lenses. Rainbow offers the largest selection of vari-focal and manual/motorized zoom lenses in the industry.

Schneider

Schneider Optics offers a wide variety of optics for use in scientific applications, robotics, machine vision, industrial inspection, document scanning, and postal sorting. They offer high-quality C-Mount lenses, Compact lenses with high vibration stability, lenses with ultra-high image quality for machine vision applications, and a line of high-quality telecentric lenses for non-contact optical metrology.

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High-Tech Digital has been delivering Imaging and Machine Vision products since 1983. To find more about our imaging systems and components call 310-265-8203 or send an e-mail to:

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Lenses

1/4" Format Lenses
1/3" Format Lenses
1/2" Format Lenses
2/3" Format Lenses
Zoom Lenses
Machine Vision Lenses
Line-scan Camera Lenses
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Cosmicar Lenses

Monofocal Lenses – 1/4" Format

Since the same number of pixels that currently exist on 1/3" and 1/2" CCD chips is condensed within 1/4" CCD chip, each pixel on the 1/4" chip is smaller in size and therefore requires even higher resolution lenses to optimize its performance.

Manual Iris - Monofocal Lenses

Model	QS210 (C40206)
Focal length	2.2mm
Iris range	F1.0 to Close
Horizontal angle of view	92.6
Mount	CS
Dimensions	36.8 x 36.3mm

Model	QS310 (C40301)
Focal length	3mm
Iris range	F1.0 to Close
Horizontal angle of view	64.2
Mount	CS
Dimensions	36.8 x 33.8mm

Model	QS610 (C40601)
Focal length	6mm
Iris range	F1.0 to Close
Horizontal angle of view	34.8
Mount	CS
Dimensions	36.8 x 33.8mm

Monofocal Lenses – 1/3" Format

Model	Focal Length (mm)	F-Stop (mm)/ Iris Range	Horizontal Angle of View			Mount
			1/4" Format	1/3" Format	1/2" Format	
TS212A (C70214)	2.8	1.2 – C	71.54	94.31	-	CS
TS412A (C70409)	4	1.2 – C	49.18	63.89	-	CS

TS812A (C708o7)	8	1.2 – C	25.05	33.33	-	CS

Monofocal Lenses – 1/2" Format

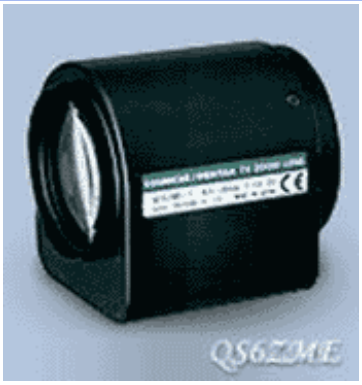
Model	Focal Length (mm)	F-Stop (mm)/ Iris Range	Horizontal Angle of View			Mount
			1/4" Format	1/3" Format	1/2" Format	
HS316A (C60305)	3.7	1.6 – C	53.54	71.02	93.65	CS
HS614B (C60622)	6	1.4 – C	33.86	44.55	57.82	CS
HS1214D (C61217)	12	1.4 – C	16.55	22.06	29.42	CS
H416 (C60402)	4.2	1.6 – C	47.87	64.27	86.77	C
H612A (C60607)	6	1.2 – C	32.97	43.55	58.93	C
H1212B (C61215)	12	1.2 – 22	16.93	22.60	30.18	C

Monofocal Lenses – 2/3" and 1" Format

Model	Focal Length (mm)	F-Stop (mm)/ Iris Range	Horizontal Angle of View			Mount
			1/4" Format	1/3" Format	1/2" Format	
C418DX (C30405)	4.8	1.8 – C	41.68	55.11	72.37	C
B618CX-2(C20612)	6.5	1.8 – C	29.94	39.73	52.52	C
C814 (C30808)	8	1.4 – C	25.15	33.31	43.88	C
B1214D-2(C21211)	12.5	1.4 – C	16.21	21.53	28.51	C
C1614A (C31630)	16	1.4 – 22	12.70	16.91	22.48	C
B2514D (C22525)	25	1.4 - 22	8.23	10.97	14.62	C
B5014A (C25011)	50	1.4 – C	4.13	5.50	7.32	C
B7514C (C27509)	75	1.4 – C	2.75	3.67	4.90	C

Zoom Lenses

Motorized Zoom Lens	
Model	**QS6ZME (C40400)**
Focal length	4.6-28mm
Iris range	F1.0 to 250
Horizontal angle of view	41.6 to 7.5
Mount	CS
Dimensions	65 x 72.8 x 77mm



Model	Zoom Focus Iris	Focal Length (mm)	F-Stop (mm) Iris Range	Horizontal Angle of View			Mount
				1/4" Format	1/3" Format	1/2" Format	
H6Z810 (C60812)	Manual	8 – 48	1.0 – 22	14.92-4.42	32.99-5.86	43.26-7.73	C
C6Z1218 (C31204)	Manual	12.5 – 22	1.8 – 22	16.08-2.75	21.40-3.66	28.44-4.87	C

C6Z1218M3(C31211) Motorized	12.5 – 75	1.8 – C	16.06-2.75	21.38-3.66	28.41-4.87	C

Machine Vision Lenses

The lenses are specially designed for machine vision and other industrial applications. The lenses are designed to best perform for shorter objective distance of 200mm to 500mm. The lenses feature ultra-high resolution and are compatible to mega-pixel cameras too.

Model	H1214-M (C61232)
Format	1/2
Focal length	12mm
Iris range	F1.4 to 16
Horizontal angle of view	28.9
Mount	C
Dimensions	29.5 x 28.5mm

Model	C1614-M (C31634)
Format	2/3
Focal length	16mm
Iris range	F1.4 to 16
Horizontal angle of view	31.0
Mount	C
Dimensions	29.5 x 33.2mm

Model	C2514-M (C32500)
Format	2/3
Focal length	25mm
Iris range	F1.4 to 16
Horizontal angle of view	20.0
Mount	C
Dimensions	29.5 x 32mm

Model	C5028-M (C35001)
Format	2/3
Focal length	50mm
Iris range	F2.8 to 22
Horizontal angle of view	10.1
Mount	C
Dimensions	29.5 x 34mm

Line-Scan Camera Lenses

COSMICAR/PENTAX have developed YF3528 / YK3528 and YF5028 / YK5028 lenses, exclusively for line-scan cameras. They are designed to best perform on close-up applications.

FEATURES:

- Ultra-high resolution corresponding with 7•m pixel.
- Less distortion.
- Best optical performance for short-distant objects.

- Focus & iris lock screws against vibration and shock

YF3528 / YK3528

Focal lengths: 35mm

Iris range: F2.8 TO F22

Mount: F or K mount

Dimensions: 72mm (D) x 56.8mm (L) - F mount lens YF3528
72mm (D) x 57.8mm (L) - F mount lens YF3528

Weight: 440 grams

YF5028 / YK5028

Focal lengths: 50mm

Iris range: F2.8 TO F22

Mount: F or K mount

Dimensions: 72mm (D) x 56.8mm (L) - F mount lens YF3528
72mm (D) x 57.8mm (L) - F mount lens YF3528

Lens Accessories

ITEM	MODEL NUMBER	REMARKS
2X EXTENDER	**2-EX (C80001)** **S2-EX (C80034)**	Rear Conversion lens to double the focal length. 2-EX: for C-mount, S2-EX: for CS-mount
MACRO-FOCUS RING	**EX-C6 (C90100)**	6 different length of rings to adjust the focal point for the close-up appl.
	RR-27 (C80036)	Reverse ring to mount lenses in reverse on cameras for the close-up appl.
	RR-40.5 (C80037)	Especially recommended where magnification of 1x or more is required.

For more information, please contact High-Tech Digital
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Monofocal Lenses

MODEL	FOCAL LENGTH	IRIS RANGE	MOUNT	REMARK	APPLICABLE CAMERA				
					1"	2/3"	1/2"	1/3"	1/4"
QF2.1A	2.1	F1.0~C	CS						*
YF2.8A-2	2.8	F1.3~C	CS					*	*
YF4A-2	4	F1.2~C	CS					*	*
YF8A-2	8	F1.2~C	CS					*	*
YF16A-2	16	F1.4~C	CS					*	
DF6HA-1	6	F1.2~C	C	*1,*2			*	*	*
HF9HA-1	9	F1.4~C	C	*1,*2		*	*	*	*
HF12.5HA-1	12.5	F1.4~C	C	*1,*2		*	*	*	*
HF16HA-1	16	F1.4~C	C	*1,*2		*	*	*	*
HF25HA-1	25	F1.4~C	C	*1,*2		*	*	*	*
HF35HA-1	35	F1.6~C	C	*1,*2		*	*	*	*
HF50HA-1	50	F2.3~C	C	*1,*2		*	*	*	*
HF75HA-1	75	F2.8~C	C	*1,*2		*	*	*	*
CF12.5A	12.5	F1.4~F22	C	*1	*	*	*	*	*
CF25B	25	F1.4~F16	C	*1	*	*	*	*	*
CF50B	50	F1.4~F22	C	*1	*	*	*	*	*
CF75A	75	F1.8~F22	C	*1	*	*	*	*	*

*1: With Metal Mount
*2: With Locking Knob for Iris and Focus

Ultra Mini Fixed Focal Length Lenses

MODEL	FOCAL LENGTH	IRIS RANGE	MOUNT	REMARK	APPLICABLE CAMERA				
					1"	2/3"	1/2"	1/3"	1/4"
YF2.8B-7	2.8	F2.8~F11	M10.5x0.5mm	*1				*	*
YF4B-7	4	F2~F11	M10.5x0.5mm	*1				*	*
YF12B-7	12	F2~F22	M10.5x0.5mm	*1				*	*
YF30B-7	30	F3.5~F22	M10.5x0.5mm	*1				*	*

*1: With Metal Mount

Motorized Zoom Lenses

MODEL	FOCAL LENGTH	ZOOM RATIO	IRIS RANGE	MOUNT	APPLICABLE CAMERA				
					1"	2/3"	1/2"	1/3"	1/4"
Y14X5.5A-M42	5.5~77	14	F1.4~F16·C	CS				*	*
D14x7.5A-M41/42	7.5~105	14	F1.4~F16·C	C/CS			*	*	*
H14x10.5A-M41	10.5~147	14	F1.9~F16·C	C		*	*	*	*
C10 x16A-MDM21	16~160	10	F1.8~F22	C	*	*	*		
C14x25B-MDM21	25~350	14	F3.5~F22	C	*	*	*		
C10x16A-SND21	16~160	10	F1.8~T1500	C	*	*	*		

3CCD Camera Lenses

GROUP TYPE	MODEL	FOCAL LENGTH	ZOOM RATIO	IRIS RANGE	MOUNT	APPLICABLE CAMERA			
						1"	2/3"	1/2"	1/3"
Manual	**TF2.8DA-8**	2.8	-	F2.2~F16·C	C				*
	TF4DA-8	4	-	F2.2~F16·C	C				*
	TF15DA-8	15	-	F2.2~F16·C	C				*
Motor Drive	**T14x5.5DA-M41**	5.5~77	14	F1.4~F16·C	C				*
	S14x7.3DA-M41	7.3~102	14	F1.9~F16·C	C			*	*

Lens Accessories

PRODUCT	MODEL	SPECIFICATION	MASS (g)	REMARK
Extender	HE15-1	1.5 x Extender	60	C Mount type
	HE20-1	2 x Extender	85	
Close-up Lens	ECL8072	M72 x 0.75mm Focal Length 800mm	50	Applicable Lens: D14x7.5,H14x10.5
	CL12072B	M72 x 0.75mm Focal Length 1200mm	50	Applicable Lens: D14x7.5,H14x10.5
	CL100101	M101 x 1mm Focal Length 1000mm	120	Applicable Lens: C10x16
	CL190101	M101 x 1mm Focal Length 1900mm	100	Applicable Lens: C10x16

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C-Mount Lenses (PDF)

Model No.	Focal Length	f/number Range	Focus Range	Angle of View (HxV)	Format	Mount
59 LFJ 109	9 mm	1.4 - 22	Inf. - 0.3 m	52º - 16º	2/3"	C
59 LFJ 112	12.5 mm	1.4 - 22	Inf. - 0.3 m	54º - 42º	1"	C
59 LFJ 116	16 mm	1.4 - 16	Inf. - 0.4 m	22.4º - 17º	2/3"	C
59 LFJ 125	25 mm	1.4 - 16	Inf. - 0.3 m	28.4º - 21.4º	1"	C
59 LFJ 135	35 mm	1.4 - 22	Inf. - 0.3 m	14.2º - 10.4º	2/3"	C
59 LFJ 150	50 mm	1.4 - 22	Inf. - 1 m	14.35º - 10.6º	1"	C

(PDF)

F-Mount Lenses (PDF)

Model No.	Focal Length	f/number Range	Focus Range	Angle of View (HxV)	Format	Mount
59 LAF 228	28 mm	2.8 - 22	0.3 m	74º	42 mm	F
59 LAF 235	35 mm	2.0 - 22	0.25 m	62º	42 mm	F
59 LAF 250	50 mm	1.8 - 22	0.45 m	46º	42 mm	F
59 LAF 299	105 mm	2.8 - 32	0.3 m	23.33º	42 mm	F
59 LAF M60	60 mm	2.8 - 32	0.22 m	39.33º	42 mm	F
59 LAF M99	105 mm	2.8 - 32	0.3 m	23.33º	42 mm	F
59 LAF Z00 (Zoom)	35 -105 mm	3.5 - 22	0.85 m	62º - 23.33º	42 mm	F
59 LAF Z01 (Zoom)	70 - 210 mm	4.0 - 32	1.5 m	34.3º - 11.8º	42 mm	F

Teleconverters and Adaptors (PDF)

Teleconverters are mounted between the lens and the camera when a closer view of objects is required in conjunction with the C-Mount or F-Mount lenses. They increase magnification by 1.4x, 1.5x, or 2.0x.

Close-up Lenses (PDF)

Close-up Lenses are used with F-Mount lenses to decrease minimum focus distance and to increase magnification.

Invaritar™ Telecentric Gauging Lenses (PDF)

Compared to conventional camera-type lenses, Invaritar™ telecentric lenses offer greatly improved gauging precision for three-dimensional parts and features. They have the following features:

- A constant perspective or viewing angle across the entire image
- A constant magnification over a large depth of field

A functional unit consist of an Invaritar™ base lens and an attachment lens. Any of the base lenses can be used with any of the attachment lenses. Choose from C5 series, F-Mount, or Custamag base lenses and a wide range of attachment lenses.

Choose a Custamag Invaritar™ base lens when your exact field of view requirements cannot be met with the standard Invaritar™ telecentric C5 or F-Mount lens. The Custamag Invaritar™ lens system is factory adjusted to your exact field of view/magnification requirements.

The Macro Invaritar™ gauging lenses offer exceptional telecentric characteristics for small object inspection.

Specifications can be obtained by downloading the corresponding PDF file.

Invaritar™ Telecentric Lenses
Invaritar™ C5 Series Base Lenses (PDF)
F-Mount Invaritar™ Base Lenses (PDF)
Custamag Invaritar™ Base Lenses (PDF)
Macro Invaritar™ Telecentric Gauging Lenses (PDF)
Macro Invaritar™ Extra Long Working Distance (ELWD) Lenses (PDF)
Large Depth of Field Adaptors for Invaritar™ Lenses (PDF)

Right Angle Attachments (PDF)

These attachments allow Invaritar™ lenses to view objects at right angles to the lens axis. The attachments can be rotated 360 degrees around the lens optical axis to provide viewing in any direction.

Filter Adaptor and Windows (PDF)
The filter adopters adopt the front lens element to accept 39 mm filters. The protective windows add extra protection for Invaritar™ series lenses.

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Melles Griot Optical Components

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Mirrors, Beamsplitters and Prisms

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Plate and Pellicle Beamsplitters (PDF)
Right Angle Prisms (PDF)
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Filters and Polarizing Components

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Opto-Mechanical Components

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Solid Aluminum Optical Baseplates (PDF)

Enclosures

Large Environmental Enclosure (PDF)
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Navitar Lenses

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1"-Format Lenses

Model	Focal Length (mm)	F-Stop (mm) Iris Range	Iris Control	Focus Control	Zoom Control	Focusing Range (meters)	Mount
DO-1213	12.5	1.3 - Close	Manual	Manual	-	0.3 - inf.	C
DO-2514	25	1.4 - Close	Manual	Manual	-	0.5 - inf.	C
DO-5013	50	1.3 - Close	Manual	Manual	-	1.0 - inf.	C
DO-5018	50	1.8 - Close	Manual	Manual	-	1.0 - inf.	C
DO-7513	75	1.3 - Close	Manual	Manual	-	1.0 - inf.	C
DO-1795	17	0.95 - Close	Manual	Manual	-	0.5 - inf.	C
DO-2595	25.0	0.95 - Close	Manual	Manual	-	0.5 - inf.	C
DO-5095	50	0.95 - 16	Manual	Manual	-	0.6 - inf.	C
DOZ-10X16	16-160	2.0 - Close	Manual	Manual	Manual	1.5 - inf.	C

2/3"-Format Lenses

Model	Focal Length (mm)	F-Stop (mm) Iris Range	Iris Control	Focus Control	Zoom Control	Focusing Range (meters)	Mount
DO-4818	4.8	1.8 - Close	Manual	-	-	0.3 Fixed	C
DO-813	8.0	1.3 - Close	Manual	Manual	-	0.2 - inf.	C
DO-1614	16.0	1.4 - Close	Manual	Manual	-	0.3 - inf.	C
DO-1616CWO	16.0	1.6	Fixed	Manual	-	0.3 - inf.	C
TC-5028	50	2.8 - Close	Manual	Manual	-	0.5 - inf.	C
DOZ-6X12/5	12.5 - 75 (6x)	1.6 - Close	Manual	Manual	Manual	1.0 - inf.	C
DOZ-11110	11 - 110 (10x)	1.8 - Close	Manual	Manual	Manual	1.3 - inf.	C
Zoom 7000E	12.5 - 75 (6x) (Macro Zoom)	1.8 - Close	Manual	Manual	Manual	1.0 - inf. (25 at Macro)	C
Zoom 7000 (MACRO)	18 - 108 (6x) (Close-up Focusing)	2.5 - Close	Manual	Manual	Manual	0.13 - inf.	C

1/2"-Format Lenses

Model	Focal Length (mm)	F-Stop (mm)/ Iris Range	Iris Control	Focus Control	Zoom Control	Focusing Range (meters)	Mount
DO-3514	3.5	1.4 - Close	Manual	N/A	-	0.3 - inf.	C
DO-4814	4.8	1.4 - Close	Manual	N/A	-	0.3 - inf.	C
DO-612	6.0	1.2 - Close	Manual	Manual	-	0.2 - inf.	C
DO-1212	12.0	1.2 - Close	Manual	Manual	-	0.3 - inf.	C
DOZ-6X8.5	8.5 - 51	1.2 - Close	Manual	Manual	Manual	1.0 - inf.	C

1/3"-Format Lenses

Model	Focal Length (mm)	F-Stop (mm)/ Iris Range	Iris Control	Focus Control	Zoom Control	Focusing Range (meters)	Mount
DO-2814	2.8	1.4 - Close	Manual	Manual	-	0.3 - inf.	CS
DO-412	4	1.2 - Close	Manual	Manual	-	0.3 - inf.	CS
DO-812	8	1.4 - Close	Manual	Manual	-	0.3 - inf.	CS
DOZ-2X4	4 - 8	1.4 - Close	Manual	Manual	Manual	Near - Far	CS
Zoom 7010	8.5 - 90	2.5 - Close	Manual	Manual	Manual	0.15 - inf.	C

Lens Accessories

Range Extenders - (for use with all lenses)

The use of a range extender, installed between a lens and a camera, will extend the focal length and increase the effective aperture (F/number) of a video lens. For example, using the 2XE range extender will extend the focal length by two times (2X) and double the effective aperture of the following lens:

(2X) 50 mm, F/1.3 lens = 100 mm F/2.6

We also offer an extension tube kit, which allows you to turn standard fixed focal length lenses into macro lenses. This kit includes six extender tubes
(0.5 mm, 1 mm, 5 mm, 10 mm, 20 mm and 40 mm) for extension from 0.5 mm to 76.5 mm. The tube(s) mount between the camera and the lens, making it possible for you to focus a C-mount lens at a much closer distance than normal.

Available Range Extenders

Range Extender Model No.	Lens to Use with Range Extender
HE-15-1	1.5X Extender, 13.08 mm long Ø45
HE-20-1	2.0X Extender, 13.74 mm long Ø45
2XE	2.0X Extender, 11.12 mm long Ø31.92
540E	Extension Tube Kit, 6 pieces, 76.5mm total (0.5mm, 1mm, 5mm, 1mm, 10mm, 20mm, and 40mm)
3-6073	5mm Extension Tube

Close-up Lenses - (for use with Fujinon lenses only)

Fujinon close-up lenses may be screwed to the front ring of your lens when you need to move closer to a subject than allowed by the minimum object distance (M.O.D.) of the lens.
The Fujinon model number of the close-up lens designates the maximum image-to-lens distance at the telephoto end (in cm), as well as the filter diameter of the lens.

Available Close-up Lenses

Model	Focusing Range (mm)	Filter Diameter (mm)
CL3355	333-250	Ø55
CL10055	1000-500	Ø55
ECL8072	800-463	Ø55
CL12072B	1200-574	Ø55

For more information, please contact High-Tech Digital
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Lenses

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Fixed Focal Length Lenses with Manual Iris

Model No.	Focal Length	Max. Aperture	Format	Data
L28CSWI	2.8mm	F1.3	1/3"	PDF
L4CSWI	4mm	F1.2	1/3"	PDF
L8CSWI	8mm	F1.3	1/3"	PDF
H3.5 1.6CS	3.5mm	F1.6	1/2"	PDF
H6 1.2CS	6mm	F1.4	1/2"	PDF
H12 1.2CS	12mm	F1.2	1/2"	PDF
S4.8 1.8	4.8mm	F1.8	2/3"	PDF
S7.5 1.4	7.5mm	F1.4	2/3"	PDF
S16 1.4	16mm	F1.4	2/3"	PDF
S50WI	50mm	F1.8	2/3"	PDF
G25 1.4	25mm	F1.4	1"	PDF
G25 1.4M	25mm	F1.4	1"	PDF
G50 1.8	50mm	F1.8	1"	PDF
G75 1.8	75mm	F1.8	1"	PDF

Vari-Focal Lenses with Manual Iris

Model No.	Focal Length	Max. Aperture	Format	Data
L163VCS	1.6~3.4mm	F1.4	1/3"	PDF
L2864VCS	2.8~6.4mm	F1.4	1/3"	PDF
L212AVCS	2.8~12mm	F1.4	1/3"	PDF
L338VCS	3.3~8mm	F1.4	1/3"	PDF
L540VCS	5~40mm	F1.6	1/3"	PDF

L550AVCS	5~50mm	F1.4	1/3"	PDF
L582VCS	5.5~82.5mm	F1.8	1/3"	PDF
L639VCS	6.5~39mm	F1.4	1/3"	PDF
H612VCS	6~12mm	F1.4	1/2"	PDF
L851VCS	8.5~51mm	F1.6	1/2"	PDF

Manual Zoom Lenses

Model No.	Focal Length	Max. Aperture	Zoom Ratio	Format	Data
L639VCS	6.5~39mm	F1.4	6X	1/3"	PDF
L851VCS	8.5~51mm	F1.6	6X	1/2"	PDF
H6X8	8~48mm	F1.0	6X	1/2"	PDF
S6X11	11.5~69mm	F1.4	6X	2/3"	PDF

Motorized (3-Motors) Zoom Lenses

Model No.	Focal Length	Max. Aperture	Zoom Ratio	Format	Data
L10X6M/CS	6~60mm	F1.0	10X	1/3"	PDF
L6X6.5M/CS	6.5~39mm	F1.0	6X	1/3"	PDF
L10X65MCS	6.5~65mm	F1.4	10X	1/3"	PDF
H16X6.5M	6.5~104mm	F1.4	16X	1/2"	PDF
H6X8M-II	8~48mm	F1.0	6X	1/2"	PDF
H10X8M-II	8~80mm	F1.2	10X	1/2"	PDF
H10X85M	8.5~85mm	F1.8	10X	1/2"	PDF
S16X9.5M-II	9.5~152mm	F1.8	16X	2/3"	PDF
S10X10M-II	10~100mm	F1.4	10X	2/3"	PDF
S6X11M-II	11.5~69mm	F1.4	6X	2/3"	PDF
H20X15M	15~300mm	F3.6	15X	1/2"	PDF
G10X16M	16~160mm	F2.2	10X	1"	PDF

Lens Accessories

Model No.	Description	Data
0.7XWC	Wide Converter for our 6X zooms	PDF
2XHE	2X Extender	PDF
2.5XE	2.5X Extender for our S16X zooms	PDF
EX TUBE	Tube Extension Kit	PDF

LCA4	Lens Controller for single zoom lens	**PDF**

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Lenses

Standard and 3-CCD C-Mount Lenses

Visible and Near IR C-Mount Lenses

Compact Lenses

Telecentric Lenses

Machine Vision Lenses (Macro System)

Home

Schneider Lenses

Click on the lens group or the PDF of corresponding Lens Model to download lens datasheet in PDF format. Downloading PDF files require the free **Adobe® Acrobat® Reader™**

C-Mount Standard and 3-CCD Lenses (PDF)

Lens Model	Focal Length	f/number Range	Min. Object Distance	Format	Part No.	Data
Cinegon 1.8/10	10 mm	1.8 - 16	0.20 m	1"	12849	PDF
Cinegon 1.4/16	16 mm	1.4 - 16	0.30 m	1"	37146	PDF
Xenon 0.95/25	25 mm	0.95 - 11	0.30 m	1"	12101	PDF
Xenon 0.95/17	17 mm	0.95 - 11	0.15 m	2/3"	10456	PDF
Xenonplan 1.7/17	17 mm	1.7 - 16	0.30 m	2/3"	10892	PDF
Variogen 1.8/12.5-75	12.5-75 mm	1.8 - 16	0.50 m	2/3"	13462	PDF
Variogen 1.8/10-100	10-100 mm	1.8 - 16	1.00 m	2/3"	13714	PDF
Cinegon 2.0/5.3	5.3 mm	2.0 - 22	0.07 m	1/3" 3-CCD	36939	PDF
Cinegon 1.7/10	10 mm	1.7 - 32	0.10 m	1/3" 3-CCD	36942	PDF
CS-Mount Adapter					25081	-
C-Mount Extension Tube - 5 mm					39316	-
C-Mount Extension Tube - 8 mm					39315	-
C-Mount Extension Tube - 10 mm					39312	-
Clamping device for focus, for series 3-CCD					10277	-
Clamping device for zoom for Variogen lenses					20057	-

All lenses are available with motorized iris and spot filter.

C-Mount Visible and Near IR Lenses (PDF)

Lens Model	Focal Length	f/number Range	Minimum Object Distance	Angle of View			Part No.	Data
				2/3"	1/2"	1/3"		
Cinegon 1.8/4.8	4.8 mm	1.8 - 22	0.001 m	91	69	53	10432	PDF
Cinegon 1.4/8	8 mm	1.4 - 22	0.005 m	55	42	33	12543	PDF

Cinegon 1.4/12	12 mm	1.4 - 22	0.020 m	38	29	22	10423	PDF
Xenonplan 1.4/17	17 mm	1.4 - 22	0.070 m	28	21	16	10623	PDF
Xenonplan 1.4/23	23 mm	1.4 - 22	0.115 m	22	16	12	10425	PDF
Xenonplan 1.9/35	35 mm	1.9 - 22	0.310	14	10	7.9	39959	PDF
Tele-Xener 2.2/70	70 mm	2.2 - 22	1.250 m	7.2	5.2	3.9	39963	PDF

All lenses are available with motorized iris and spot filter.

Compact Lenses (PDF)

Lens Model	Focal Length	f/number Range	Min. Object Distance	Format	Part No.	Data
Cinegon 1.4/8	8 mm	1.4 - 22	0 mm	2/3"	41823	PDF
Cinegon 1.4/12	12 mm	1.4 - 22	12.3 mm	2/3"	41827	PDF
Xenonplan 1.4/17	17 mm	1.4 -22	42.0 mm	2/3"	41831	PDF
Xenonplan 1.4/23	23 mm	1.4 -22	81.7 mm	2/3"	41835	PDF
Xenonplan 1.9//35	35 mm	1.9 - 22	246 mm	2/3"	41877	PDF

Telecentric/Gauging Lenses (PDF)

Lens Model	Num. Aperture	Working Distance	Object Size (mm)		Telecentric Depth (mm)	Part No.	Data
			2/3"	1/2"			
Xenonplan 1:1	0.14	47 ± 3	8.8 x 6.6	6.4 x 4.8	± 2	35850	PDF
Xenonplan 1:2	0.14	195 ± 12	17.6 x 13.2	12.8 x 9.6	± 4	35851	PDF
Xenonplan 1:3	0.14	161 ± 27	26.4 x 19.8	19.2 x 14.4	± 6	35852	PDF
Xenonplan 1:4	0.13	176 ± 48	35.2 x 26.4	25.6 x 19.2	± 8	35853	PDF
Xenonplan 1:5	0.13	269 ± 75	44.0 x 33.0	32.0 x 24.0	± 10	35854	PDF
Telecentric Lens Mounting Collar						-	PDF

Machine Vision Lenses / Macro System (PDF)

Normal lenses used for photography typically produce good imagery in the range of 1:oo to about 1:10. With larger magnifications, the optical performance of these lenses falls off considerably. Even so-called macro lenses, which are corrected for magnifications from 1: to 1:2 or 1:1, are an optical compromise. The Macro System enables the use of Schneider enlarging lenses to capture the highest quality close-up and macro images. These lenses are designed exclusively for close-up scales of about 1:20 to 1:1.

The Macro System provides an uniform interface with 3 lock-screws that engage into a groove. This guarantees a stable and durable connection and makes it possible to use multiple combinations of the individual components. It also permits the reversal of the lenses for magnified images.
Due to the good mechanical stability, the Macro System is also very suitable for industrial use.

Lenses

Example:
Apo-Componon
HM 4.,0/60

The optical components of the enlarging lenses are screwed into a compact and robust diaphragm body, which makes it possible to adjust and to lock the aperture and to use accessories such as filters. Because the interface is identical on both sides, the lenses can be reversed for magnifying images. Eight lenses are available:

Lens Name	Iris /Focal Length	Parts No.	Data
Componon	2,8 / 28	14794	PDF
Componon	2,8 / 35	14792	PDF
Apo-Componon	2,8 / 40	14798	PDF
Apo-Componon	4,0 / 45	14783	PDF
Componon-S	2,8 / 50	14796	PDF
Apo-Componon	4,0 / 60	14802	PDF
Componon-S	4,0 / 80	14780	PDF
Apo-Componon	5,6 / 80 *	35145	PDF
Apo-Componon	4,5 / 90	14767	PDF
Componon-S	5,6 / 100	35142	PDF

* for close-up scales 1:4 - 4:1

Helical Mounts

Example:
Macro-UNIFOC 12

Enlarging lenses have no built-in helicoid, because they are usually focused using a bellows on the enlarger. Therefore, in order to focus an enlarging lens when it is used on a camera, a helical mount is needed. The **Unifoc 12** respectively **Unifoc 6** Helical Mount makes this possible. It is extremely compact with 12 mm respectively 6 mm of displacement. In the shortest setting, the length is 17.4 mm, and fully extended it is 29.4 mm. It comes complete with a focus locking screw.

Extension Tubes

Example:
Extension Tube 25 mm

Unlike small and medium format photographic lenses, enlarging lenses have no fixed flange-to-image distances. The distance from the lens to the camera is different for each lens with the same imaging dimensions. Cameras differ also in their back focal lengths, which means that the extension length of the lenses on the image side must be adapted to the current image task. This is done with extension tubes, which can be combined in different lengths. They are installed between the lens and the camera.

Available Extension Tubes:					
6 mm	**8 mm**	**10 mm**	**25 mm**	**50 mm**	**75 mm**
Spare: Screws and Allen Key					

Camera Adapters

Example:
Camera Adapter Olympus

Special camera adapters are available that connect the Macro System interface to a variety of camera mounts. Types and extensions are shown in the table:

Bayonet-Adapter		Thread-Adapter	
Type	Extension	Type	Extension
Canon	13,8 mm	C-Mount	6,5 mm
Contax/Yashica	10,3 mm	T2 (M42x0,75)	6,5 mm
Pentax K	10,3 mm	M42x1	6,5 mm
Leica	8,8 mm	Leica	6,5 mm
Minolta AF	11,3 mm	1 (M36x0,75)	6,5 mm
Minolta MD	12,3 mm	0 (M29,5x0,5)	6,5 mm
Nikon	9,3 mm	-	-
Olympus	9,8 mm	-	-
Rollei	11,3 mm	-	-

Machine Vision Lenses / UNIFOC 58/76 Focusing Mounts (PDF)

Lens Model	Image Circle (mm)	Extension Tube	Working Distance (mm)	Magnification	Part No.	Data
Componon 4.0/28	30.0	-	52 -21	1.76 - 0.69	37275	-
		1 x 25 mm	21 - 13	0.76 - 0.44		
		2 x 25 mm	13 - 10	0.44 - 0.32		
Componon 4.0/35	32.5	-	112 - 38	3.07 - 0.94	37277	-
		1 x 25 mm	39 - 25	0.96 - 0.56		
		2 x 25 mm	25 - 19	0.57 - 0.40		
APO-Componon HM 4.0/40	43.2	-	476 - 71	11.16 - 1.41	19746	-
		1 x 25 mm	73 - 44	1.44 - 0.76		
		2 x 25 mm	45 - 34	0.77 - 0.52		
APO-Componon HM 4.0/45	43.2	-	Inf. - 104	Inf. - 1.84	39256	-
		1 x 25 mm	106 - 61	1.90 - 0.92		
		2 x 25 mm	62 - 47	0.94 - 0.62		
Componon-S 2.8/50	43.2	-	Inf. - 138	Inf. - 2.12	16828	-
		1 x 25 mm	141 - 82	2.18 - 1.06		
		2 x 25 mm	83 - 63	1.07 - 0.70		
APO-Componon HM 4.0/60	60.0	-	Inf. - 287	Inf. - 4.21	18928	-
		1 x 25 mm	300 - 126	4.43 - 1.53		
		2 x 25 mm	128 - 91	1.56 - 0.93		
Componon-S 4.0/80	80.6	1 x 25 mm	Inf. - 482	Inf. - 5.35	14850	-
		2 x 25 mm	503 - 213	5.61 - 2.01		
		3 x 25 mm	216 - 151	2.04 - 1.24		
APO-Componon HM 4.5/90	87.8	1 x 25 mm	Inf. - 1308	Inf. - 13.83	37834	-
		2 x 25 mm	1459 - 319	15.50 - 2.86		
		3 x 25 mm	325 - 205	2.93 - 1.60		
Componon-S 5.6/100	96.8	2 x 25 mm	Inf. - 558	Inf. - 4.71	14022	-
		3 x 25 mm	574 - 300	4.87 - 2.19		
Componon-S 5.6/135	150.9	2 x 25 mm	Inf. - 1055	Inf. - 6.98	39569	-
		3 x 25 mm	1091 - 522	7.25 - 3.05		

Unifoc 58 - Leica/T2(M42 x 0.75) Mount	39549	-
Extension Tube 25 mm - T2/T2 Mount	41643	-
T2/C-Mount Adapter	41629	-
T2/Nikon Adapter	21591	-
T2/M42 x 1.0 Adapter	21592	-
Unifoc 76 - Leica/M58 x 0.75 Mount	13048	-
Extension Tube 10 mm - M58 x 0.75 / M58 x 0.75	13051	-
Extension Tube 25 mm - M58 x 0.75 / M58 x 0.75	13050	-
M58 x 0.75 / M72 x 0.75 Adapter	13052	-

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Lighting Requirements

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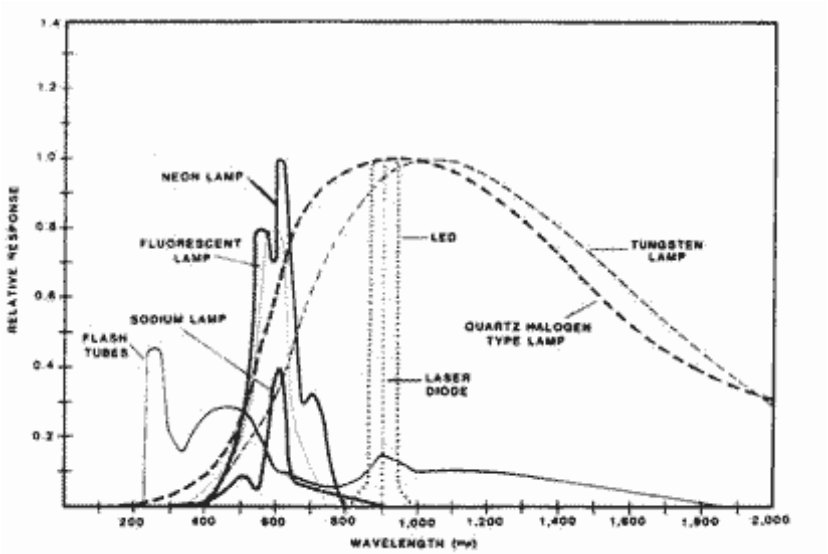
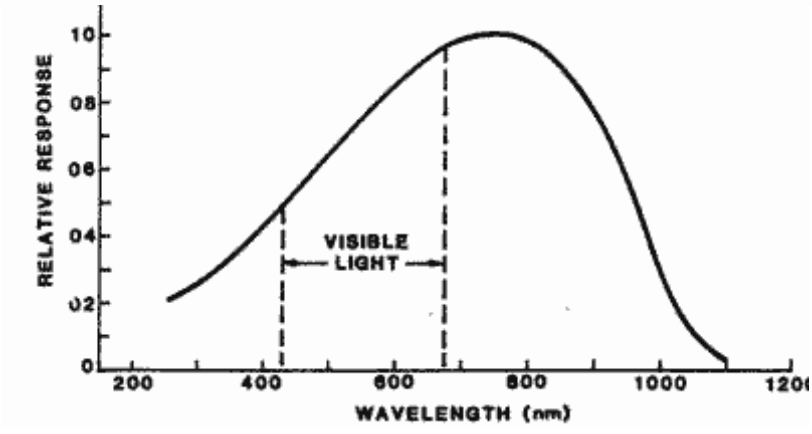
The proper lighting is very important for generating images that are detectable by an image sensor. Optimum lighting provides a clear image, which is not too bright or too dark, and enables a vision system to distinguish the features and characteristics it needs to in order to accomplish the required task. The lighting must be adequate enough to obtain a good response out of the sensor, but not too excessive to cause blooming or saturation of the sensor.

The lighting needs to be uniform and consistent - therefore controlled in such way that enhances features (contrast) that are looked for and minimizes features that should be ignored. The lighting also needs to eliminate or minimize effects of ambient lighting and to simplify image processing.

Light Sources

Spectral distribution is one of several ways in which light sources differ. The spectral distribution of a light source must be within the spectral response of the image sensor. The following graphs show the spectral response of several different light sources and a typical spectral sensitivity of the CCD sensor.

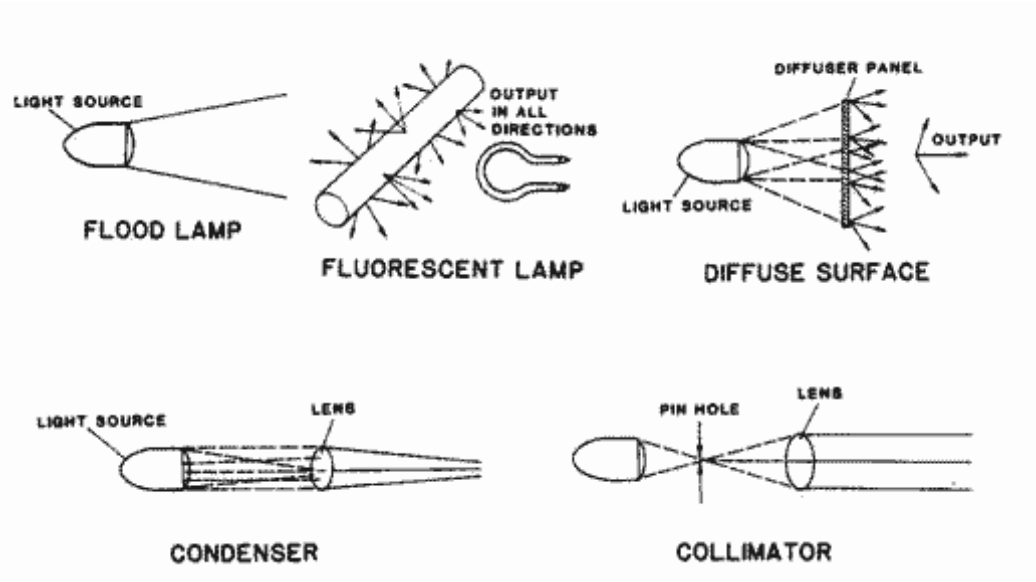




The light sources may also be classified according to their radiation pattern (point, linear, hemispherical), distribution of light (spot, diffused, collimated), geometrical shape, physical size, and efficiency. For an object or a feature to appear in an image, light coming from a light source must reflect off the object into the lens. Therefore, the object is seen differently when illuminated by different types of light.

A point source illuminates an object from a single direction (point) and hence causes reflections and shadows – which are sometimes desirable and other times unacceptable. Good point source illumination can be generated by incandescent spotlights or by using fiber-optic point sources.
Diffused light illuminates an object from all directions thus creating little or no reflections, and no shadows. Good sources of diffused lighting include fluorescent lights, fiber-optic diffuse sources, and array of LEDs.

Collimated light is unidirectional and originates from a single source optically located at an infinite distance. It creates reflection and very sharp shadows.



Incandescent Light Bulbs – The light bulb can be used as a point source. With proper optics it can also be used as a collimated or diffused source. Their disadvantage is that most of their energy is converted to heat, light intensity declines with time, and light has a high infrared content.

Quartz Halogen Bulbs – They are a much more efficient light source with more white-light emission. Dichronic reflector eliminates the infrared spectrum.

Discharge Tubes – Light is generated by the electrical discharge in neon, xenon, krypton, mercury, or sodium gas vapor. The light spectrum of emitted light depends on the gas and its pressure – e.g. mercury discharge tube generates light in the UV band.

Fluorescent Tubes – They are mercury discharge tubes where the UV light excites the visible fluorescence of a special phosphor coating on the inside of the tube. Typically the light is white but different light colors can be obtained with different phosphors. Tubes are manufactured with different geometries – e.g. long and straight, circled, U-shaped, etc. The fluorescent lighting is very efficient, easy to diffuse, and matches spectral response of camera sensors very closely. These lights typically pulse at rate that is twice the power line frequency (120 Hz in US). However, they can operate at much higher frequencies and thus produce a light without any visible flicker.

Strobe Tubes – The strobe tube is a discharge tube driven by the very short current pulse of a storage charge capacitor. As it generates a short (10 – 20 **m**sec) pulse it is possible to capture an image of a moving part as if it were stationary. Their disadvantage is a need for very precise timing control of the light source and camera. The alternative to using strobes is using a camera with a built-in shutter. However, shutter is not a direct replacement for strobe. Compared to a high intensity light of the strobe, the shuttered light source integrates much less light during the exposure time allowed to image moving part, without getting a blurred image.

Arc Lamps – They provide a very intense light in a narrow spectral band. Their disadvantage is high cost, need for a high voltage power supply, and a short life.

LEDs – The light-emitting diodes emit light in narrow spectral bands - infrared, red, yellow, green, and white. As their output energy is relatively low, they are combined into arrays of different configurations in order to increase the light output and direct light where is needed. They can be pulsed at very high frequencies making them an alternative for strobe lights. LEDs have a very long life, are highly efficient, and maintenance free.

Laser – Lasers are monochromatic and coherent sources – meaning they have the same frequency and phase and the wavefront is perpendicular to the direction of propagation. Hence, the laser beam can be focused to a very small spot with extremely high energy and be perfectly collimated.

There are different types of lasers that have been developed – gas, solid-state, injection, and liquid. The following are some of the lasers used in the machine vision applications: He-Ne laser, Argon gas laser, diode laser, He-Cd vapor laser, and gas injection laser.

Lasers are used when a selective high-intensity illumination is required and when changing reflection of a part makes conventional light sources difficult to use.

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Light Interaction with Objects

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An image sensor does not see an object but rather sees light as reflected by the object. The incident light can be reflected, front-scattered, absorbed, transmitted, and/or back-scattered.

Reflection – If the surface of an object is shiny, incident light will reflect at an angle with the normal equal to the angle of incidence. Some materials may cause a change in the polarization of the light. In a shiny (specular) reflection, light from each incoming ray reflects in a single direction. Specular reflections are bright and unreliable; in many cases they saturate the image sensor.

In diffuse reflection, generated by dull (diffuse) surfaces, light from each incoming ray is scattered over a range of outgoing angles. The intensity is reduced but very stable.

Scattering – If the surface of an object is rough, the light may reflect, but over a wide angular range.

Absorption – The light can be absorbed by an object in the form of heat, chemical reaction, etc. These processes are wavelength dependent.

Transmission – It is the light that passes through after undergoing refraction at the entrance to an object. The light may back-scatter when exiting.

Change of Spectral Distribution – This change is wavelength dependent and causes a change in the remaining light beam. Consequently, the image sensor may see an object in a different color and sometimes differently shaped.

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Illumination Optics

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Fiber Optics – Provides a means of transferring light to hard-to-get places and small restricted areas, or of illuminating a large area with uniform illumination. The source of light is typically a quartz halogen bulb that is coupled to a bundle of optical fibers. The efficiency is quite low. The fibers can be ended in different geometries to produce different shapes and/or multiple light beams.

Condenser Lenses – They are used in combination with field lenses to transfer light with maximum efficiency to a desired area.

Diffusers – A diffuser – e.g. ground or opal glass is illuminated by light source and then the diffuser is imaged out to the area of the object. Incoherent fiber-optic bundle, where fibers at the exit are distributed differently then at the entrance, can produce more uniform diffused light. Diffuse illumination of specular surfaces allows imaging without bright reflections.

Collimators – They move the light source optically far from an object by collimating the light.

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Lighting Techniques

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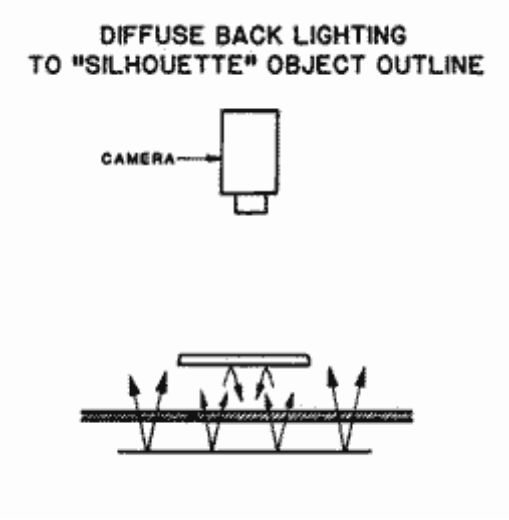
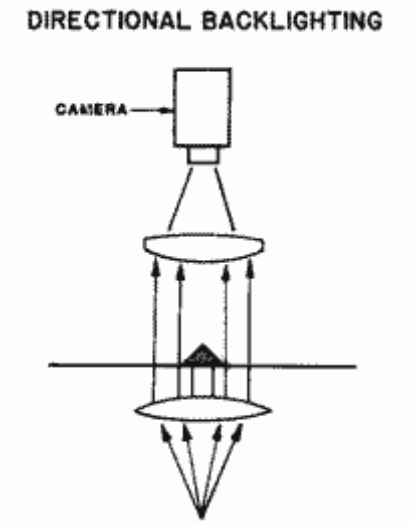
Lighting is dictated by the application and depends on the object's surface properties, color, background, and the data needed to extract. It may also be optimized for the image processing and analysis techniques used.

Diffuse Backlighting – A diffuser and a source are placed behind an object – with the diffuser positioned between the source and the object. It creates a silhouette of the object, generating an image with sharp contrast. If the object is thick, collimated light or telecentric lighting may be required. It can also be used for imaging translucent objects – e.g. glass containers.

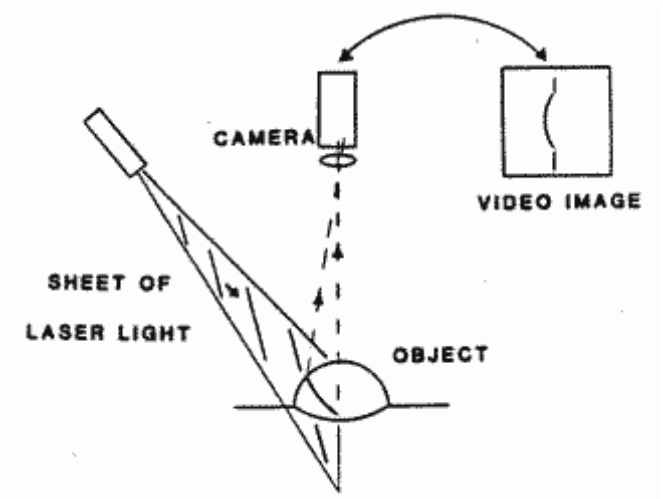
Collimated Backlighting – A collimating lens is used instead of a diffuser.



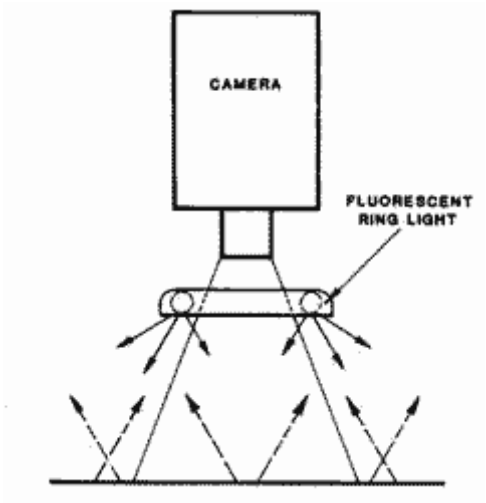


Polarized Backlighting – Diffused backlight with a polarizer in the front of it and a cross polarizer in front of the imaging lens. Highlights birefringent defects but edges may be fuzzy.

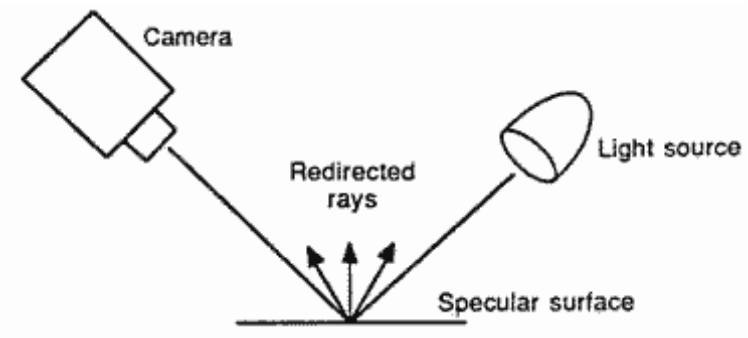
Structured Lighting – Projects a pattern of light in order to gather three dimensional information about an object.



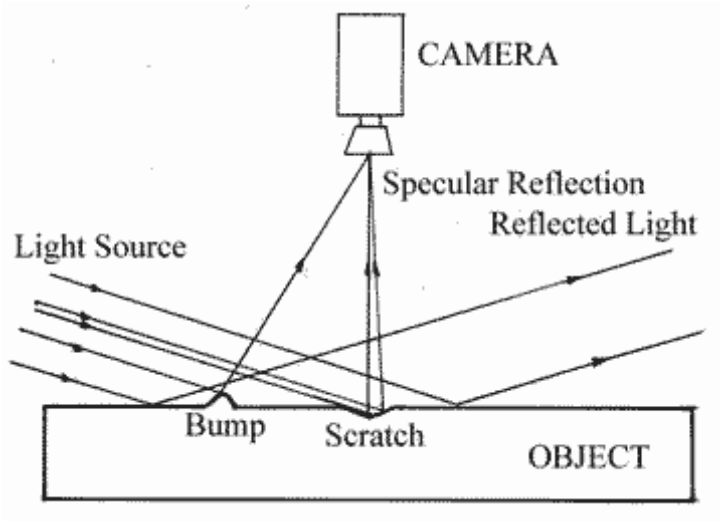
Diffuse Front Illumination – A fluorescent lamp, a fiber-optic light with diffuser, or an incandescent light with diffuser. It generates very even illumination and reduces glare on specular surfaces, but edges may be fuzzy.



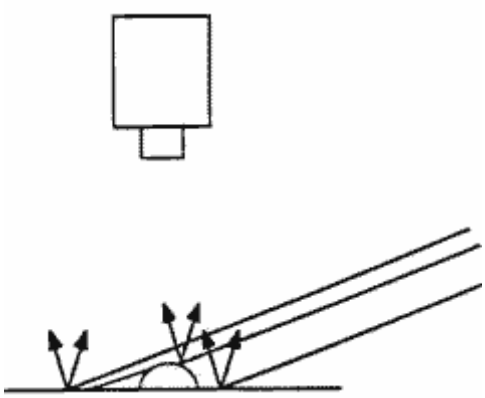
Bright Field Illumination - An incandescent lamp or fiber-optic light illuminates an object from the top. Good for detecting surface defects such as scratches, racks, pits, and rust spots – which create shadows. It can create glare on specular surfaces or unwanted shadows on uneven surfaces.



Dark Field Illumination – The surface is illuminated with partly collimated light at a low angle. As the camera looks from the top, the reflection from the regular surface is eliminated making a field of view completely dark. Any deviation from flat surface (e.g. bump or depression) will cause a reflection visible by the sensor.



Directional Front Lighting – Is similar to bright field illumination except that the light is collimated with help of collimating optics. It creates a greater shadowing for use in finding small burrs on a flat surface or locating the edge of a hole.



Polarized Front Illumination – Is used for reducing a specular glare from shiny or specular areas. It uses a point or diffused illumination with a polarizer in the front of it and a cross polarizer in the front of the lens. This method removes the specular glare because the light reflected from a shiny surface remains polarized and, therefore, cannot pass through the cross polarizer. The diffuse surface, however, depolarizes the light so that the light reflected from a diffused surface passes through the cross polarizer and reaches the sensor.

Color Discrimination by Filters – Sometimes, it is possible to achieve better image contrast by using a light source that does not have some colors or wavelengths, or by filtering out unwanted colors before they reach the camera. It is also possible to perform multiple inspections at the same time using an illumination of a different color or wavelength for each one of them. Commercial filters are available that can filter or pass specific color bands and can be used either at the light source or at the camera (lens).

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Lighting

Advanced Illumination (Ai) has created a modular product line consisting of a series of LED "Light Heads" as well as a series of strobe controllers and DC sources. These devices offer custom illumination support aimed at enhancing the image quality demanded by the more sophisticated software-driven vision systems of today.

Specializing in LED illuminators for machine vision.

Dolan-Jenner is the leading manufacturers of fiber optic components and fiber optic illumination systems serving the microscopy, imaging, and machine vision industries.

NER products are manufactured under the brand name of NERLITE™. There are many lighting techniques to choose from including: ring lights, dark-field illuminators, back lights, co-axial, diffused on-axis, continuous diffuse illumination, domes, area arrays and spot illuminators. NER products use a variety of sources. In addition to LED (light emitting diode) technology, the sources use halogen, fiber optic, xenon strobe, CCFL (cold cathode fluorescent lamp), fluorescent, ultra-violet, electro-luminescent panels and metal halide.

SCHOTT-FOSTEC offers a full range of FOSTEC® brand and Schott standard fiber-optic illumination products and accessories for microscopy, machine vision, and industrial applications.

Stocker & Yale offers four broad categories of illumination products: Fiber Optics for illumination, Fluorescent illumination systems, LED illumination systems, and Lasiris™ structured-light lasers.

Volpi is a manufacturer of light sources, fiber optic illuminators and special lenses for fiber optic lighting, and LED illumination.

High-Tech Digital has been delivering Imaging and Machine Vision products since 1983. To find more about our imaging systems and components call 310-265-8203 or send an e-mail to:

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Image Sensors

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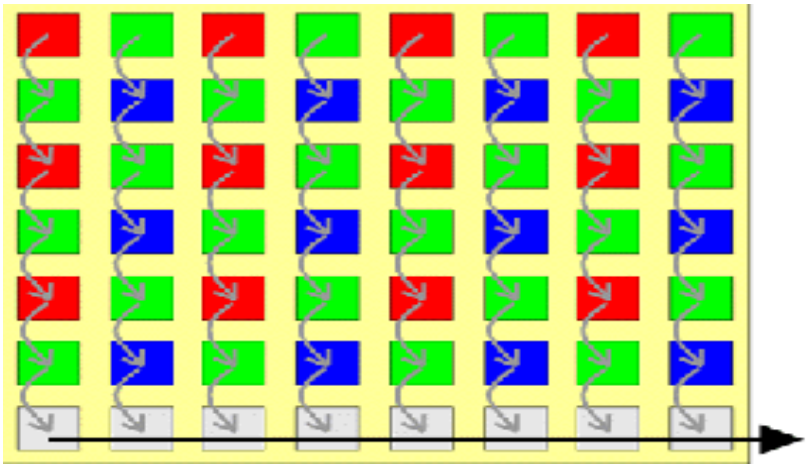
Charge-Coupled Device (CCD) Image Sensors

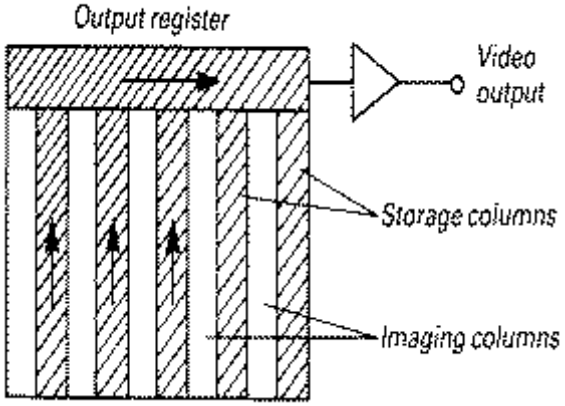


The CCD shifts one whole row at a time into the readout register. The readout register then shifts one pixel at a time to the output amplifier.

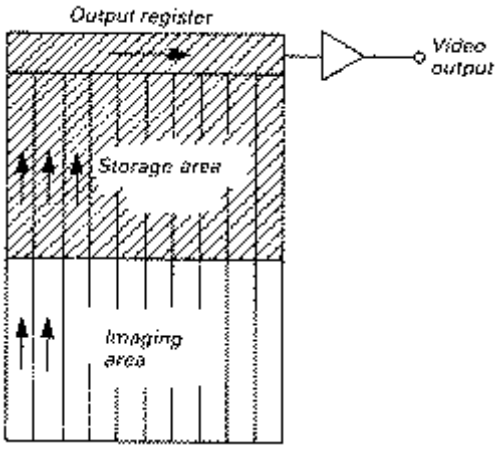
Until recently, CCD sensors were the only choice. They capture light in the small-photo sensing elements on their surface and get their name from the way that charge is read after an exposure. To begin, the charges on the first row are transferred to a readout register. From there, the signals are then fed to output circuitry that generates the video signal according to the RS-170 (EIA) standard. Once a row has been read, its charges on the readout register row are deleted. The next row then enters the readout register, and all of the rows above march down one row. The charges on each row are "coupled" to those on the row above, so when one moves down, the next moves down to fill its old space. In this way, each row can be read—one row at a time.

In addition to the parallel/serial transfer CCD, there are two more recent types of CCDs.

Interline transfer CCD



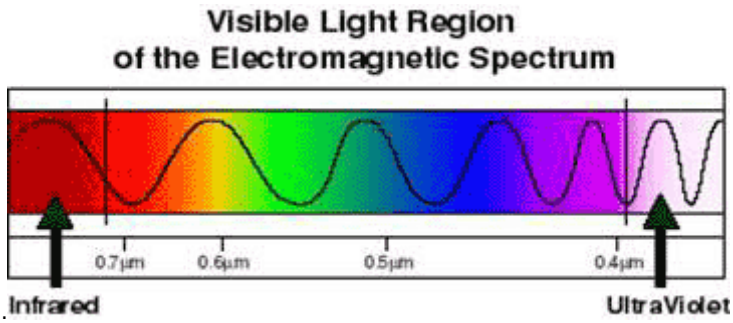
Frame transfer CCD



CMOS Image Sensors - CCD sensors are created by using specialized and expensive processes while CMOS sensors are created using the same process used to make chips for computer processors and memory – thus making the CMOS sensors less expensive.

There are two basic kinds of CMOS image sensors: passive and active. The active-pixel sensors reduce the noise associated with passive-pixel sensors but still have a higher noise level and are not as sensitive to light (lower dynamic range) as CCD sensors. However, the CMOS image sensors have been constantly improving and in the future may outperform CCD sensors. The advantage of CMOS sensors over CCD sensors is their ability to address each photo-element independently and have other circuits added to the same chip, eliminating the many separate chips required for a CCD. This also allows additional on-chip features to be added at little extra cost.

Color Image Sensors – Visible light waves are the only electromagnetic waves we can see. We see these waves as the colors of the rainbow. Each color has a different wavelength. Red has the longest wavelength and violet has the shortest. When all the waves are seen together, they make white light.



To achieve a color image, the light must be sensed at the three different wavelength ranges known as color – red, green, and blue. The information from these three measurements can be combined to simulate the color we see with our eyes.

One method uses a single CCD or CMOS sensor; the other requires three sensors, one for each color. The single-sensor cameras are typically smaller, less expensive, and have better low-light sensitivity then the three-sensor design. Disadvantages are a lower resolution (three times lower then three-sensor design) and a less accurate color reproduction. Color cameras produce a color signal in one of the following ways: generating an 1-wire composite video by adding color information to the monochrome video signal (NTSC), generating a 2-wire S-Video signal (Luminance + Chroma), or generating a 3-wire RGB signal.

Line-Scan Sensors – They can be manufactured from CCD or CMOS technologies; the only difference is that line-scan sensors are one photo-element wide. Typical use is in acquiring information from moving objects – e.g. continuous sheets or web. Acquiring successive lines of video at the fixed intervals and storing them into a memory can generate a two-dimensional image of a moving object. The advantage of a line-scan sensor is the availability of much higher resolutions - up to 12,000 pixels.

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Image Acquisition

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"Standard" 2:1 Interlaced Scanning - This scanning is based on the television standard (RS-170 or EIA). Each field is repeated at a rate of 60 Hz and the frame at a rate of 30 Hz. The scanning starts from the top of the frame. The camera reads all the odd-numbered lines during the first half of the frame time (odd field). It then starts at the top again and reads all the even lines during the second half of the frame (even field). By changing only half the picture lines at a time, the picture has less flicker.

As adjacent lines are read at different times, moving objects cause a double image (blur). Some cameras have an option that allows light to be collected for an entire frame period for both odd and even lines (frame integration) instead of separately collecting light for each half-frame period (field integration).

Progressive Scanning - In progressive-scan cameras, the image sensor is exposed at the same time rather then in two steps – thus eliminating differences between fields. The frame is transferred at once – without the interlacing. As the frame is produced and transferred in less time, each frame can be repeated at a higher rate – typically 60 Hz.

Shuttering – Many cameras have electronic shuttering. Instead of collecting light during the whole frame time, the camera discards light except for a brief period just before the frame is read. The shortest shutter time available is typically 100 msec. Shuttering reduces image blur when imaging moving objects. Increasing the shutter speed reduces the effective light level without changing the lens resolution or depth of field.

Asynchronous Image Acquisition - Acquiring images of objects in motion requires a strobe light or shutter in order to minimize the effect of motion (smearing). Hence, the camera and image acquisition hardware (typically referred to as a frame grabber) has to be capable of asynchronous reset - which is initiated by a trigger sensor detecting a presence of the inspected object. The trigger sensor also activates the strobe light and/or the shutter and initiates the transfer of the image from camera to frame grabber.

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Type of Cameras

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"Analog" RS-170 Cameras – Video information is transferred from the camera to the imaging electronics (frame grabber) according RS-170 television standard. The timing (synchronization) of a video system is controlled by either the camera or the frame grabber. In standard RS-170 mode, the camera outputs timing signals and the frame grabber follows these signals. In the "external sync" mode, the frame grabber provides the signals.

Each line in the transmitted image is conveyed as an analog signal. There are no pixels. The position of a feature along the line is determined by the time difference between it and the horizontal sync pulse. The frame grabber must resample each line into pixels. The resampling rate may be such as to generate a different number of pixels (usually less) from the number of pixels generated by the image sensor. The vision system uses "frame grabber" pixels for image processing and analysis. As the vertical relation between lines is fixed, each line of pixels in the image sensor corresponds to a unique line in the transmitted image.

In a synchronous analog system resampling is entirely controlled by the camera with line ready, frame ready, and pixel clock signals. For these cameras, the camera and frame grabber pixels are the same.

The position of the features along each horizontal line depends on the time between the horizontal sync pulse and that feature. As the sync pulse is carried on the same wire as the video data, level change in the video signal may cause a shift in the sync pulse. Hence, the sync pulse change may move the image over by several pixels. The pixel jitter has to be kept to a minimum, especially if the system is used for measurements.

The typical analog camera resolution is 640 x 480 pixels. Higher resolution cameras (up to 4096 x 4096) are available.

Digital Camera – Digital cameras are analog cameras with an analog-to-digital converter incorporated into the camera itself. This improves the signal and reduces noise, which results in higher accuracy. As they operate in a progressive-scan mode (non-TV standard), they can support larger image sizes, faster frame rates, and higher resolution.

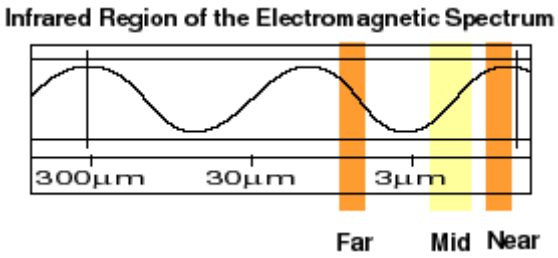
Improved video signal allows for higher than 8-bit resolution. While 8-bit cameras allow for 256 gray levels, 10-bit allow for 1024 gray levels, and 12-bit allows for 4096 gray levels. Higher resolution cameras (14-16 bits) are typically used for scientific imaging and require special cooling techniques. Digital color cameras have typically a 24-bit output – 8-bit for each R, G, and B channel.
Digital cameras transfer pixels directly to the imaging electronics; hence, the camera and frame grabber pixels are the same.

Parallel Digital Cameras - Most digital cameras have been using a parallel interface standard for connection to imaging electronics. The parallel interface can have different types of data transfer signal - TTL, RS-422, and LVDS (RS-644). The TTL can only be used for extremely short cable runs. The RS-422 and LVDS are differential signals which are much more robust, with LVDS allowing longer cable runs and lower signal voltages.

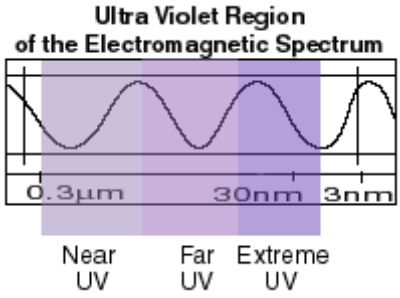
Camera Link Cameras – Digital cameras, using the camera link interface standard and LVDS hardware standard, are becoming the standard - especially for high-resolution and high-speed cameras. The benefit of the camera link interface is having a standard simplified (less cabling) connection between cameras and imaging boards.

IEEE-1394 (Firewire) Cameras – These are digital cameras with a serial bus standard for use with a PC. The IEEE-1394 interface supports data rates of 400 Mbits/second. A single cable combines power, control and data. Because IEEE-1934 is a shared bus, there is bandwidth limitation and it also requires processor control to acquire image data, which limits processor availability for image processing.

Infrared Cameras – Infrared, or thermal, cameras measure the infrared, or thermal, energy emitted from objects. They are used in applications that require detecting the difference in a temperature of across inspected object – e.g. inspecting glass while it is being molded, or finding hot spots on electronic boards.

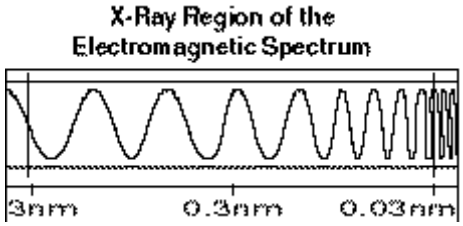


UV Cameras – Ultraviolet light is part of the light spectrum with a shorter wavelength than the visible light spectrum.



It is invisible to the human eye. The UV camera, which is sensitive to the UV light, can typically capture greater detailed data – e.g. surface scratches and blemishes, than the standard (visible spectrum) camera.

X-Ray Cameras – X-Rays are electromagnetic waves with an even shorter wavelength than UV light and therefore have higher energy.



X-rays tend to act more like particle than a wave. When passing through a material, x-rays are partly absorbed in the transmission direction. The relation between absorption and penetration depends on the kind of material (its atomic number) and on the energy of the X-rays. X-ray detectors collect actual photons of x-ray light.

An X-ray system has three main components: an X-Ray Generator, an X-Ray Camera, and the imaging electronics used to acquire and process data. X-Ray Generator emits a stream of x-rays into a fan beam that passes through the object before entering an X-Ray sensor – typically an x-ray sensitive image intensifier (scintillator) - producing a visible image on its output phosphor. The image is relayed into a CCD camera whose output is passed to the imaging electronics. The scintillator material can be coated on a tapered fiber optic bundle - which is directly coupled to a CCD camera.

In recent years, flat sensor panel imagers have been introduced which offer many advantages over image intensifiers. The 16-bit panel offers superior resolution with 65,536 possible gray levels. It also incorporates a windowing technique that enables it to display image data at multiple gray level settings for each imaging position. This allows details to be gathered from thick as well as thin sections of an object without blooming effects. The sensor panel imager incorporates an amorphous silicon photodiode array that is coupled to a scintillation material that fluoresces when hit by x-rays. When the x-rays strike the scintillator material, they are converted to visible light that is detected by a photodiode array and transformed into electrical signals. The electrical signals are extracted from the sensor and a digital image is produced.

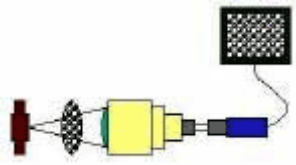
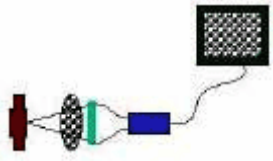
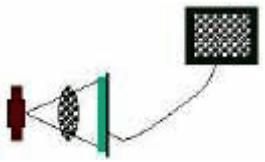


Image Intensifier



Fiberoptic Bundle



Sensor Panel

The LDAs (Linear Diode Arrays) use some type of scintillator to transform the incoming radiation into visible light and photodiode arrays to measure the amount of light generated by the scintillator. The scintillator is mounted on the photodiode surface. Diode arrays can be arranged in various different shapes (e.g. L-shape, U-shape, Arc). When the x-ray energies are low (bellow 30 – 35 keV), a plain photodiode can be used to detect radiation. In high-resolution LDAs, photodiodes are connected to a CCD or CMOS sensor for additional signal amplification.

Different applications may use x-ray sources operating in different ways. Typically the X-ray generator provides a continuous flux of a broad spectrum of x-rays whereas a Pulsed X-Ray Generator provides a few microsecond broadband pulses several tens or hundreds of times a second. Isotopic sources are based on natural radioactive decay and produce monochromatic x-rays. In an application where different materials, typically organic and metal, have to be distinguished, dual-energy detection is used. Instead of using two separate x-ray sources and detectors, the dual-energy information is gathered by one detector comprised of two diode arrays.

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Camera Format

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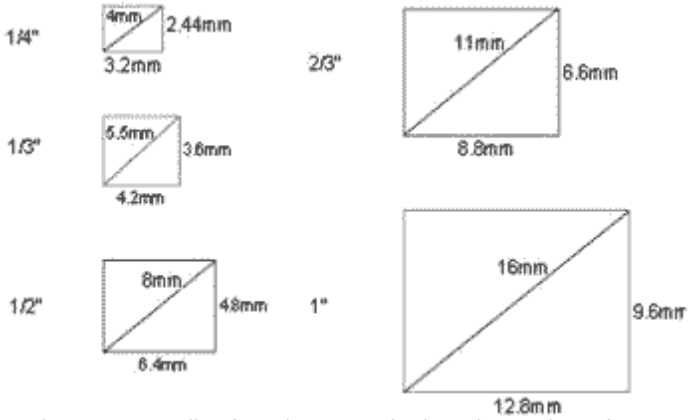
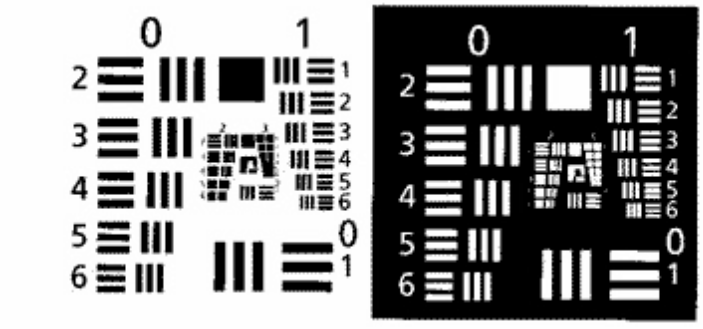
The size of the image sensor is called the image format. The name of the format does not correspond to the actual dimension. Historically, a one-half inch format was the size of the sensing area of a Vidicon Tube, which is one-half inch in diameter. Most CCD sensors come in sizes of 1', 2/3", 1/2", 1/3" and 1/4".



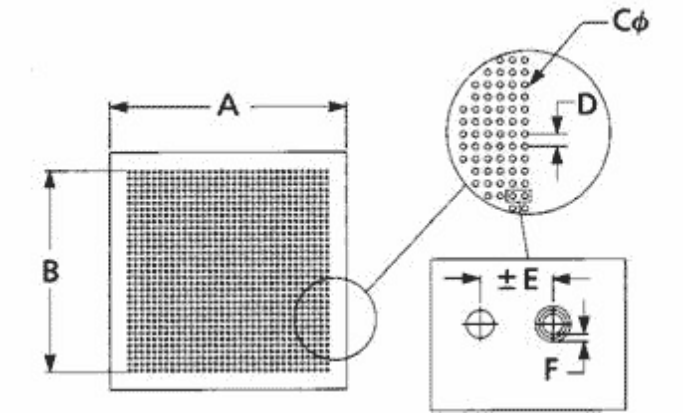
Different sensor formats require corresponding lens formats. The lens format has always to be equal or larger than the sensor format. C-Mount and CS-Mount CCTV lenses can be used for all area-scan sensor formats. Mega-pixel line-scan cameras, due to their size, need a larger image format than C-mount lenses can offer. In this case, an F-format 35 SLR lens can be used.

Camera Resolution

Resolution is a measure of the camera's ability to distinguish between objects that are close together. It is measured as either spatial frequency or TV lines. It is effected by different factors – light level, light spectrum, lens f/number, etc.
A practical test for determining the resolution for machine vision uses a target with multiple bars with various spacing between bars. The same target can be used to check for optical aliasing (elements with high spatial frequency appear to move), which occurs when the lens is imaging spatial frequencies that are beyond the camera's capability.



Camera Anamorphism – The same type of target can also be used to measure camera anamorphism, which is a difference in magnification in horizontal and vertical directions. This is due to a timing error designed in to achieve a more pleasing picture for TV viewing. The camera anamorphism can also be measured by using a precise dot target.



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Home

Cameras

Basler offers progressive scan VGA cameras, mega-pixel cameras and color cameras. It also offers high-speed monochrome and color line-scan cameras.

Dalsa offers line-scan cameras - from a single output camera running at 20 MHz to the multi-tap cameras which operate up to 100 MHz. They offer cameras with resolutions ranging from 512 to 8192 pixels.

Dalstar is Dalsa's new brand for area-scan cameras. Cameras range from 1k x 1k to 3k x 2k - and most are 12-bit. They offer both, B/W and color cameras.

Hitachi offers interlaced B/W cameras, progressive scan cameras, mega-pixel cameras, and color cameras.

Pulnix offers interlaced B/W cameras, progressive scan cameras, mega-pixel cameras, color cameras, and specialty (intensified, IR, UV) cameras.

Sentech specializes in high-quality industrial cameras. They offer B/W and color cameras, cameras optimized for machine vision, high-sensitivity cameras, and OEM/Custom cameras.

Uniq Vision offers high-resolution and high-speed B/W and color cameras for scientific and industrial applications.

High-Tech Digital has been delivering Imaging and Machine Vision products since 1983. To find more about our imaging systems and components call 310-265-8203 or send an e-mail to:
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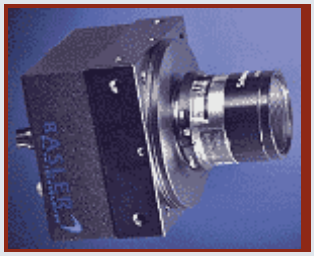
Cameras



Area-Array Cameras

Standard

Mega-pixel

Line-Scan Cameras

Monochrome

Color

Related Information

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Basler Cameras

Click on the Camera Model to download camera datasheet in PDF format.
Downloading PDF files require the free **Adobe® Acrobat® Reader™.**

Get the frame grabber information: **Corona-II, Meteor-II/Digital, Meteor-II/Multi Channel**, **Meteor-II/Camera Link**, **Meteor-II/1394**, **Genesis, Genesis-LC**.

Get the camera interface information by clicking on the Application Note for the respective camera and frame grabber.

Area-Array Cameras

Camera Model	Image Sensor	Pixels	Bits	Line/ Frame Rate	Video Output	Extra	Frame Grabber
A301b	1/2" CCD	640x480	Dual 8/10	80 fps	Channel Link*	RS232	Meteor-II/ Camera Link *
A301bc (Color)	1/2" CCD Bayer CFA	640x480	Dual 8/10	80 fps	Channel Link*	RS232	Meteor-II/ Camera Link *
A301f	1/2" CCD	640x480	8	75 fps	1394		Meteor-II/1394
A301fc (Color)	1/2" CCD Bayer CFA	640x480	8	30 fps	1394 YUV 4:2:2		Meteor-II/1394
A302b	1/2" CCD	780x580	Dual 8/10	60 fps	Channel Link*	RS232	Meteor-II/ Camera Link *
A302bc (Color)	1/2" CCD Bayer CFA	780x580	Dual 8/10	60 fps	Channel Link*	RS232	Meteor-II/ Camera Link *
A302fs	1/2"CCD	780x580	8	30 fps	1394		Meteor-II/1394
A302fc (Color)	1/2" CCD Bayer CFA	789x580	16	30 fps	1394 YUV 4:2:2		Meteor-II/1394
A101p	2/3" CCD	1300x1030	8	12 fps	RS-644	RS232 Binning Partial Scan	Meteor-II/Digital Genesis, Genesis-LC Corona-II
A101cp (Color)	2/3" CCD Bayer CFA	1300x1030	8	12 fps	RS-644	RS232 Binning Partial Scan	Meteor-II/Digital, **Appl. Note** Genesis, Genesis-LC, **Appl. Note** Corona-II
A101f	2/3" CCD	1300x1030	8	12 fps	1394		Meteor-II/1394
A101fc (Color)	2/3" CCD Bayer CFA	1300x1030	16	12 fps	1394 YUV 4:2:2		Meteor-II/1394
A202k	7.5x7.5 mm CCD	1004x1004	Dual 8/10	48 fps	Camera Link		Meteor-II/Camera Link, **Appl. Note**
A201b	9.1x9.2 mm CCD	1008x1018	Dual 8/10	30 fps	Channel Link*	RS232	Meteor-II/Camera Link*
A201bc (Color)	9.1x9.2 mm CCD	1008x1018	Dual 8/10	30 fps	Channel Link*	RS232	Meteor-II/ Camera Link*

Line-Scan Cameras

Camera Model	Image Sensor	Pixels	Bits	Line/ Frame Rate	Video Output	Extra	Frame Grabber
L101-1k/2k	Linear CCD 10.3/20.5 mm	1024/ 2048	1 x 8 2 x 8	18.35/9.42 kHz	RS-644	RS232	Meteor-II/Digital, **Appl. Note** Genesis, Genesis-LC, **Appl. Note**
L103-1k/2k	Linear CCD 10.3/20.5 mm	1024/ 2048	1 x 8 2 x 8	36.75/18.90 kHz	RS-644	RS232	Meteor-II/Digital Genesis, Genesis-LC
L104-1k/2k	Linear CCD 10.3/20.5 mm	1024/ 2048	1 x 8 2 x 8	57.45/29.56 kHz	RS-644	RS232	Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital
L101k-1k/2k	Linear CCD 10.3/20.5 mm	1024/ 2048	1 x 8 2 x 8	17.94/9.38 kHz	RS-644		Meteor-II/Camera Link
L103k-1k/2k	Linear CCD 10.3/20.5 mm	1024/ 2048	1 x 8 2 x 8	35.71/18.78 kHz	RS-644		Meteor-II/Camera Link
L104k-1k/2k	Linear CCD 10.3/20.5 mm	1024/ 2048	1 x 8 2 x 8	58.5/29.2 kHz	RS-644		Meteor-II/Camera link
L201	Linear CCD 28.7 mm	4096	1 x 8 2 x 8	4.73 kHz	RS-644	RS232	Meteor-II/Digital Genesis, Genesis-LC
L203	Linear CCD 28.7 mm	4096	1 x 8 2 x 8	9.50 kHz	RS-644	RS232	Meteor-II/Digital, **Appl. Note** Genesis, Genesis-LC, **Appl. Note**
L301bc (Color)	Tri-linear CCD	2098x3	1 x 8/10 2 x 8 Mono, or 3x8 RGB	9.20 kHz	Channel Link*	RS232	Meteor-II/Camera Link*, **Appl. Note**

*Requires a Basler Channel Link to Camera Link adapter cable.

Related Information

RS-644 (LVDS) Standard

The Official Camera Link Specifications (PDF - 287Kb)

Camera Interface Guide (This comprehensive tutorial serves as an introduction to video and interfacing a camera to Matrox frame grabbers).

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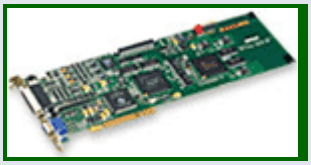
Imaging Hardware



Meteor-II

Meteor-II/Multi-Channel

Meteor-II/Digital

Meteor-II/Camera Link

Meteor-II/1394

Orion

Corona-II

Cronos

Genesis-LC

Home

Matrox Corona-II

High-quality PCI frame grabber for RGB or monochrome video acquisition with integrated DualHead display.

Key Features

- long PCI form factor
- captures from interlaced or progressive scan component RGB or single/dual channel monochrome video sources
- three 10-bit A/D converters[1]
- 24-bit RS-422/LVDS digital interface[2]
- acquisition rates of up to 30 MHz analog, 25 MHz RS-422 digital and 40 MHz LVDS digital
- connect two RGB or up to six analog monochrome video sources
- configurable LUTs (three 256 x 8-bit or two 1024 x 10-bit)
- trigger input and timer outputs
- 32-bit/33 MHz PCI bus-master
- extensive on-board buffering for reliable capture
- simultaneous analog VGA with independent digital VGA[3,4] or TV outputs
- VGA display at up to 1280 x 1024 @ 75 Hz
- non-destructive overlay of true-color graphics on live video
- TV output capable of composite, Y/C or RGB NTSC/PAL
- power output and RS-232 serial interface
- available software is sold separately and includes **Matrox Imaging Library (MIL)/ ActiveMIL**, **MIL-Lite/ ActiveMIL-Lite** and **Matrox Inspector**
- support for Microsoft® Windows® 98, Windows® Me, Windows NT® 4.0, Windows® 2000 and Windows® XP

1. For 2 x 10-bit monochrome or 3 x 8-bit (RGB) acquisition.
2. Requires separate ISA/PCI companion board.
3. Requires flat panel add-on module.
4. DualHead with DVI not available under Windows NT 4.0.

Read more about **Matrox Corona-II** (datasheet in PDF format - 256Kb)
Get **Adobe® Acrobat® Reader™**

Related Information

Matrox Corona-II Installation and Hardware Reference Manual (PDF - 1,119Kb)
Matrox Corona-II PC Compatibility List (PDF - 32Kb)

Available Cameras

Camera Interface Guide (PDF - 799Kb)
Optimizing Video Digitization (PDF - 130Kb)
LVDS Signaling Standard
Hardware/Software Cross-Reference Table (PDF - 23Kb)
Hardware Comparison Chart (PDF - 30Kb)

Connector Pinouts

Matrox Corona-II video I/O connector
Matrox Corona-II VGA output connector

Matrox Corona-II digital interface connector
Matrox Corona-II DVI-D connector

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Stand-alone Systems

Frame Grabbers

Vision processors

Hardware Comparison Chart (PDF – 30Kb)

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Imaging Hardware

Stand-alone Systems

A unique combination of embedded PC technology, compact size and ruggedness make Matrox Imaging's stand-alone platform the ideal solution for cost-sensitive machine vision, image analysis and video surveillance applications.

Frame Grabbers

Matrox Imaging provides developers with the industry's most comprehensive frame grabber family. Hardware ranges from basic boards designed for very cost-sensitive applications, to frame grabbers integrating flexible, high-rate acquisition and leading-edge display technology. All products combine maximum functionality and unbeatable value.

Vision Processors

Matrox Imaging’s award-winning vision processing technology integrates flexible acquisition, real-time processing and high-resolution display. A combination of leading-edge electronics, including custom ASICs, and a scalable architecture have made the Matrox Genesis the world's most successful family of vision processor engines.

High-Tech Digital has been delivering Imaging and Machine Vision products since 1983. To find more about our imaging systems and components call 310-265-8203 or send an e-mail to:

info@high-techdigital.com

Imaging Hardware

4Sight-II

Home

Standalone Systems

4Sight-II

Offering desktop PC performance in a compact, rugged enclosure, Matrox 4Sight-II is an industrial computer that integrates image capture, processing, display, networking and general purpose I/Os.

High-Tech Digital has been delivering Imaging and Machine Vision products since 1983. To find more about our imaging systems and components call 310-265-8203 or send an e-mail to:

info@high-techdigital.com

Imaging Hardware

Home

4-Sight-II

Compact, industrial computer with desktop PC performance for cost-sensitive machine vision, medical imaging and video surveillance applications.

Key Features

- integrated video capture, processing and display platform
- small footprint and rugged construction
- standard and non-standard analog and digital video acquisition including Camera Link™ and IEEE 1394[1]
- simultaneous primary analog/digital VGA and secondary TV/analog VGA display outputs
- true-color graphics overlay on live video output
- audio input and output
- Ethernet network interface
- USB, RS-232 and RS-422/ RS-485 communication
- discrete TTL[2] or opto-isolated I/Os
- optional mass storage for video archiving
- runs Microsoft® Windows NT®, Windows® 2000 or Windows NT® Embedded
- programmed using standard Windows®-based development tools and Matrox Imaging Library (MIL)

1. Supports IEEE 1394 video sources based on DCAM specification using MIL.
2. LVTTL.

Read more about **Matrox 4Sight-II** (datasheet in PDF format - 430Kb)
Get **Adobe® Acrobat® Reader™**

Related Information

Matrox 4Sight-II Installation and Hardware Reference Manual (PDF - 37,073Kb)
Matrox 4Sight-II Software Manual for Windows NT Workstation (PDF - 5,417Kb)

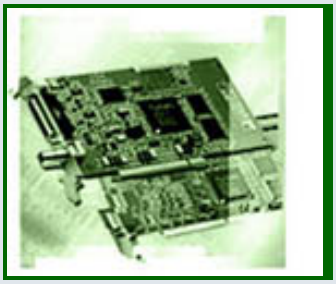
Connector Pinouts

Matrox 4Sight-II digital interface connector
Matrox 4Sight-II connector for opto-isolated auxiliary I/Os (requires optional module)
Matrox 4Sight-II connector for TTL auxiliary I/Os

For more information, please contact High-Tech Digital
310-265-8203
info@high-techdigital.com

Site Design: CLC Consulting

Imaging Hardware



Meteor-II
Meteor-II/Multi-Channel
Meteor-II/Digital
Meteor-II/Camera Link
Meteor-II/1394
Orion
Corona-II
Cronos
Genesis-LC
Home

Frame Grabbers

Meteor-II
Ideally suited for cost-sensitive applications, Matrox Meteor-II is a frame grabber that supports capture from standard analog video sources and provides real-time image transfer to system or VGA memory.

Meteor-II/Multi-Channel
Designed to capture from standard or variable analog monochrome or component RGB frame scan sources, Matrox Meteor-II/Multi-Channel is a frame grabber that offers acquisition flexibility and real-time image transfer to system or VGA memory.

Meteor-II/Digital
Matrox Meteor-II/Digital is a flexible frame grabber that supports capture from frame and line scan sources including multi-tap configurations, and offers real-time image transfer to system or VGA memory.

Meteor-II/Camera Link
Matrox Meteor-II/Camera Link is a flexible frame grabber for digital area or line scan video acquisition that provides a simple standard connection to digital imaging devices using the Camera Link™ interface specification.

Meteor-II/1394
Matrox Meteor-II/1394 is an IEEE 1394-to-PCI adapter board for simplified, high-performance digital video capture.

Orion
Matrox Orion frame grabber is the ideal choice for basic color or monochrome imaging applications. It supports standard color/monochrome video capture and integrates a display section based on the award-winning MGA G400 graphics controller, providing leading edge graphics features and performance.

Corona-II
Combining flexible video capture and display on a single PCI board, Matrox Corona-II captures from RGB or monochrome cameras and integrates the Matrox G400 graphics controller with Dual Head display.

Cronos
Matrox Cronos is an entry-level, ultra low-cost frame grabber for standard analog monochrome or color video acquisition.

Genesis-LC

Matrox Genesis-LC frame grabber offers exceptional flexibility for interfacing to a complete range of cameras and input devices. It also supports simultaneous acquisition into PC memory and features an integrated true-color display with pseudo-color non-destructive overlay.

High-Tech Digital has been delivering Imaging and Machine Vision products since 1983. To find more about our imaging systems and components call 310-265-8203 or send an e-mail to:

info@high-techdigital.com

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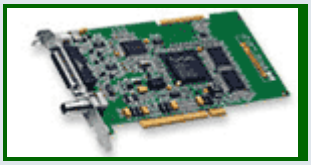
Imaging Hardware



Meteor-II

Meteor-II/Multi-Channel

Meteor-II/Digital

Meteor-II/Camera Link

Meteor-II/1394

Orion

Corona-II

Cronos

Genesis-LC

Home

Matrox Meteor-II

Low-cost frame grabber for standard analog color or monochrome acquisition.
New! Graphics adapter available for CompactPCI®!

Key Features

- PCI, CompactPCI® or PC/104-*Plus*™ form factor
- captures from NTSC, PAL, RS-170 and CCIR video sources
- up to 12 video inputs[1]
- trigger input
- PCI bus-master
- real-time transfer to system or VGA memory
- extensive on-board buffering for reliable capture
- supports packed or planar transfers of color or multiple monochrome streams
- power output[2] and RS-232 serial interface[3]
- available software is sold separately and includes **Matrox Imaging Library (MIL)/ ActiveMIL**, **MIL-Lite/ ActiveMIL-Lite** and **Matrox Inspector**
- support for Microsoft® Windows® 98, Windows® Me, Windows NT® 4.0 and Windows® 2000

1. Up to 7 video inputs on CompactPCI® version.
2. Power output not available on PC/104-*Plus*™ version.
3. RS-232 interface not present on PC/104-*Plus*™ version.

Read more about **Matrox Meteor-II** (datasheet in PDF format - 852Kb)
Get **Adobe® Acrobat® Reader™**

Related Information

Matrox Meteor-II Installation and Hardware Reference Manual (PDF - 797Kb)
Matrox Meteor-II PC Compatibility List (PDF - 51Kb)

Available Cameras

Camera Interface Guide (PDF - 799Kb)
Rapid Switching between Multiple Video Inputs (PDF - 353Kb)
Hardware/Software Cross-Reference Table (PDF - 23Kb)
Hardware Comparison Chart (PDF - 30Kb)

Graphics Adapter for CompactPCI®

Matrox Meteor-II/Display (PDF - 164Kb)
Matrox G550 Chip Specification

Connector pinouts

Matrox Meteor-II analog video input connector

For more information, please contact High-Tech Digital
310-265-8203
info@high-techdigital.com

Site Design: CLC Consulting

Imaging Hardware

Meteor-II

Meteor-II/Multi-Channel

Meteor-II/Digital

Meteor-II/Camera Link

Meteor-II/1394

Orion

Corona-II

Cronos

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Home

Matrox Meteor-II/Multi Channel

Low-cost frame grabber for analog variable frame or area scan acquisition.

Key Features

- PCI, CompactPCI® or PC/104-*Plus*™ form factor
- captures from interlaced and progressive scan component RGB and single or dual channel monochrome analog video sources
- sampling rates up to 30 MHz
- three 256 x 8-bit LUTs
- connect two RGB or up to six monochrome video sources
- trigger input and timer outputs
- PCI bus-master
- real-time transfer to system or VGA memory
- extensive on-board buffering for reliable capture
- support for packed or planar transfers of color or multiple monochrome streams
- power output[1] and RS-232 serial interface[2]
- available software is sold separately and includes **Matrox Imaging Library (MIL)/ ActiveMIL**, **MIL-Lite/ ActiveMIL-Lite** and **Matrox Inspector**
- support for Microsoft® Windows® 98, Windows® Me, Windows NT® 4.0 and Windows® 2000

1. Power output not available on PC/104-*Plus*™ version.
2. RS-232 interface not present on PC/104-*Plus*™ version.

Read more about **Matrox Meteor-II/Multi-Channel** (datasheet in PDF format - 988Kb)
Get free **Adobe® Acrobat® Reader™**

Related Information

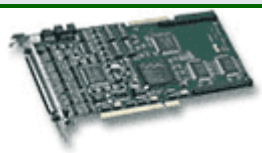
Matrox Meteor-II/Multi-Channel Installation and Hardware Reference Manual (PDF - 728Kb)
Matrox Meteor-II and Meteor-II/Multi-Channel PC Compatibility List (PDF - 63Kb)
Available Cameras
Camera Interface Guide (PDF - 799Kb)
Optimizing Video Digitization (PDF - 130Kb)
Hardware/Software Cross-Reference Table (PDF - 17Kb)
Hardware Comparison Chart (PDF - 30Kb)

Connector pinouts

Matrox Meteor-II/Multi-Channel analog video input connector

For more information, please contact High-Tech Digital
310-265-8203
info@high-techdigital.com

Imaging Hardware



Meteor-II

Meteor-II/Multi-Channel

Meteor-II/Digital

Meteor-II/Camera Link

Meteor-II/1394

Orion

Corona-II

Cronos

Genesis-LC

Home

Matrox Meteor-II/Digital

Low-cost frame grabber for RS-422/LVDS digital area or line scan video acquisition.

Key Features

- video capture board for PCI or PC/104-*Plus*™ form factors
- captures from digital frame and line scan sources including multi-tap configurations
- 32-bit wide RS-422 or LVDS interface
- sampling rates up to 25 MHz for RS-422 and 40 MHz for LVDS
- configurable LUT (four 256 x 8-bit or two 4K x 16-bit)
- trigger input and timer outputs
- 32-bit/33 MHz PCI bus-master
- real-time transfer to system or VGA memory
- extensive on-board buffering for reliable capture
- supports packed or planar transfers of color or multiple monochrome streams
- RS-232 serial interface[1]
- available software is sold separately and includes **Matrox Imaging Library (MIL)/ ActiveMIL**, **MIL-Lite/ ActiveMIL-Lite** and **Matrox Inspector**
- support for Microsoft® Windows NT® 4.0, Windows® 2000, Windows® XP and QNX®[2]

1. RS-232 interface not present on PC/104-*Plus*™ version.
2. QNX supported through Matrox Genesis Native Library (GNL).

Read more about **Matrox Meteor-II/Digital** (datasheet in PDF format - 401Kb)
Get free **Adobe® Acrobat® Reader™**

Related Information

Matrox Meteor-II/Digital Installation and Hardware Reference Manual (PDF - 789Kb)
Matrox Meteor-II/Digital PC Compatibility List (PDF - 32Kb)
LVDS Signaling Standard

Available Cameras

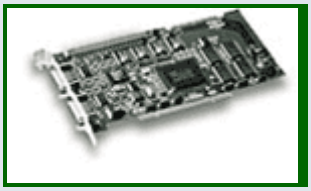
Camera Interface Guide (PDF - 799Kb)
Hardware/Software Cross-Reference Table (PDF - 23Kb)
Hardware Comparison Chart (PDF - 30Kb)

Connector pinouts

Matrox Meteor-II/Digital digital interface connector
Matrox Meteor-II/Digital for PC/104-*Plus* interface connector

For more information, please contact High-Tech Digital
310-265-8203
info@high-techdigital.com

Imaging Hardware



Meteor-II

Meteor-II/Multi-Channel

Meteor-II/Digital

Meteor-II/Camera Link

Meteor-II/1394

Orion

Corona-II

Cronos

Genesis-LC

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Matrox Meteor-II/Camera Link

Low-cost Camera Link frame grabber for digital area or line scan video acquisition.

Key Features

- PCI or PC/104-*Plus*™ form factor
- captures from Camera Link area or line scan video sources including multi-tap configurations
- simultaneously acquires from two monochrome or one monochrome and one RGB video source[1]
- connect and switch between two monochrome, two RGB or one monochrome and one RGB video source
- acquisition rates up to 40 MHz
- configurable LUT (four 256 x 8-bit or two 4K x 12-bit)
- trigger input and timer outputs
- PCI bus-master
- real-time transfer to system or VGA memory
- extensive on-board buffering for reliable capture
- supports packed or planar transfers of color or multiple monochrome streams
- available software is sold separately and includes **Matrox Imaging Library (MIL)/ ActiveMIL** and **MIL-Lite/ ActiveMIL-Lite**
- support for Microsoft® Windows NT® 4.0, Windows® 2000 and QNX® [2]

1. Video sources must have the same format and must be synchronized. Moreover, the combined data format cannot exceed 32-bits.
2. QNX supported through Matrox Genesis Native Library (GNL).

Read more about **Matrox Meteor-II/Camera Link** (datasheet in PDF format - 182Kb)
Get free **Adobe® Acrobat® Reader™**

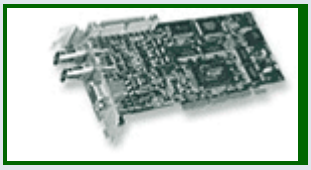
Related Information

Matrox Meteor-II/Camera Link Installation and Hardware Reference Manual (PDF - 599Kb)
Matrox Meteor-II/Camera Link PC Compatibility List (please contact High-Tech Digital Technical Support)
Available Cameras
The Official Camera Link Specifications (PDF - 287Kb)
Hardware/Software Cross-Reference Table (PDF - 17Kb)
Hardware Comparison Chart (PDF - 30Kb)

For more information, please contact High-Tech Digital
310-265-8203

info@high-techdigital.com

Imaging Hardware



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Matrox Orion

Low-cost color/monochrome frame grabber with integrated display for AGP or PCI.

Key Features

- AGP or PCI form factor
- composite, S-video, or RGB NTSC/PAL video capture
- composite RS-170/CCIR video capture
- up to 8 video inputs
- arbitrary video scaling
- trigger input
- VGA display up to 1280 x 1024
- non-destructive overlay of true-color graphics on live video
- separate and independent composite, Y/C or RGB NTSC/PAL video output
- NTSC/PAL video output is synchronized to video input
- 32 MB graphics and video buffer
- available software is sold separately and includes **Matrox Imaging Library (MIL)/ ActiveMIL**, **MIL-Lite/ ActiveMIL-Lite** and **Matrox Inspector**
- support for Microsoft® Windows® 98, Windows® Me, Windows NT® 4.0 and Windows® 2000

Read more about **Matrox Orion** (datasheet in PDF format - 1,128Kb)
Get **Adobe® Acrobat® Reader™**

Related Information

Matrox Orion Installation and Hardware Reference Manual (PDF - 168Kb)
Matrox Orion PC Compatibility List (PDF - 155Kb)
Available Cameras
Rapid Switching between Multiple Video Inputs (PDF - 353Kb)
Hardware/Software Cross-Reference Table (PDF - 17Kb)
Hardware Comparison Chart (PDF - 30Kb)

Connector pinouts

Expanded video I/O connector
VGA output connector
Video input and TV output connectors

For more information, please contact High-Tech Digital
310-265-8203
info@high-techdigital.com

Site Design: CLC Consulting

Imaging Hardware

Meteor-II

Meteor-II/Multi-Channel

Meteor-II/Digital

Meteor-II/Camera Link

Meteor-II/1394

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Home

Matrox Cronos

Matrox ultra low-cost frame grabber for standard analog monochrome or color video acquisition.

Key Features

- video capture board for PCI form factor
- captures from NTSC, PAL, RS-170 and CCIR video sources
- connect and switch between 4 to 16[1] CVBS, 4 Y/C[2] or combination of inputs
- trigger input[3]
- 11 TTL auxiliary I/Os[4] and RS-232/RS-485 serial interface[5]
- 32-bit/33MHz PCI-bus master
- support for scatter-gather DMA
- available software is sold separately and includes **Matrox Imaging Library (MIL)/ActiveMIL**,**MIL-Lite/ActiveMIL-Lite** and **Matrox Inspector**
- support for Microsoft® Windows® Me, Windows® 2000 and Windows® XP

1. 8, 12 and 16 video inputs require separate expansion modules (1 module for 4 inputs).
2. Available on separate Y/C input module.
3. Trigger input not available when in fast-channel-switching mode.
4. Only 4 TTL I/Os available when in fast-channel-switching mode.
5. Available on separate I/O module.

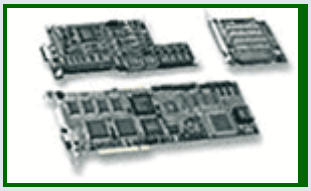
Read more about **Matrox Cronos** (datasheet in PDF format - 328Kb)
Get free **Adobe® Acrobat® Reader™**

Related Information

Available Cameras

For more information, please contact High-Tech Digital
310-265-8203
info@high-techdigital.com

Imaging Hardware



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Matrox Genesis-LC

High-throughput PCI frame grabber for flexible color/monochrome acquisition, with simultaneous capture to integrated display and transfer to host.

Key Features

- full size PCI board
- captures from standard/non-standard, color/monochrome, analog/digital, frame/line scan sources
- digitizes at up to 140 MHz
- 32-bit wide RS-422 or RS-644 (LVDS) digital interface
- PCI bus master
- simultaneous capture to system and on-board VGA memory
- extensive on-board buffering for reliable capture
- true-color display with pseudo-color non-destructive overlay
- display at up to 1600 x 1200
- VMChannel™ secondary bus interface
- available software is sold separately and includes **Matrox Imaging Library (MIL)/ ActiveMIL**, **MIL-Lite/ ActiveMIL-Lite** and **Matrox Inspector**
- support for Microsoft® Windows NT® 4.0, Windows® 2000 and QNX® [1]

1. QNX supported through Matrox Genesis Native Library (GNL).

Read more about **Matrox Genesis-LC** (datasheet in PDF format - 408Kb)
Get free **Adobe® Acrobat® Reader™**

Related Information

Matrox Genesis-LC PC Compatibility List (PDF - 37Kb)
Grabbing to a Host Buffer with Matrox Genesis-LC (PDF - 148Kb)
RS-644 (LVDS) Signaling Standard
Camera Interface Guide (PDF - 799Kb)
Available Cameras
Hardware/Software Cross-Reference Table (PDF - 17Kb)
Hardware Comparison Chart (PDF - 30Kb)

Connector Pinouts

Analog video input connector (STD module)
Display output connector
Digital interface connectors

For more information, please contact High-Tech Digital
310-265-8203
info@high-techdigital.com

Imaging Software

Free!!

MIL 7.0 Showroom CD

Home

Matrox Imaging Library (MIL) version 7.0

Field-proven software development toolkit for machine vision, medical imaging, and image analysis. Now with geometric pattern recognition technology and support for JPEG2000!

Key Features

- complete and easy-to-use programming library for image capture, processing, analysis, display, and archiving
- fully exploits Intel MMX™/SSE™ technology and Matrox vision processors
- applications easily ported to new hardware platforms
- processing performed to sub-pixel accuracy
- multi-processing and multi-threading support
- available as DLL and OCX for Microsoft® Windows® 98[1], Windows® Me[1], Windows NT® 4.0[1] and Windows® 2000[1]
- includes **Matrox Intellicam** camera configuration utility
- flexible run-time licensing

1.Contact High-Tech Digital Sales for information regarding which environments are supported by specific Matrox hardware and the revision number of development tools.

Read more about **Matrox Imaging Library (MIL)** (datasheet in PDF format - 456Kb)
Get free **Adobe® Acrobat® Reader™**

Related Information

Ask us about **MIL/MIL-Lite customer training!**
Matrox Imaging Library Maintenance Program (PDF - 122Kb)
Matrox Software Licensing (PDF - 154Kb)
Understanding the MIL Licensing Mechanism (PDF - 167Kb)
MIL Guide (PDF - 384Kb)
Overview (PDF - 55Kb
MIL/ActiveMIL benchmarks (PDF - 65Kb)
MIL command listing and description (PDF - 101Kb)
Programming examples (PDF - 165Kb)
ActiveMIL control listing and description (PDF - 100Kb)
Hardware/Software Cross-Reference Table (PDF - 17Kb)

For more information, please contact High-Tech Digital
310-265-8203
info@high-techdigital.com

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MIL

MIL-Lite

Inspector

Matrox Intellicam

Home

Imaging Software

Matrox Imaging Library (MIL)

An award-winning, field-proven software development toolkit for machine vision, medical imaging and image analysis. ActiveMIL, a collection of ActiveX controls for managing image capture, transfer, processing, analysis and display is bundled with MIL

MIL-Lite

Complete software development toolkit for image acquisition, transfer and display control. ActiveMIL-Lite, a collection of ActiveX controls for managing image capture, transfer and display is bundled with MIL-Lite.

Inspector

Build your proof-of-concept demonstration in no time, using Matrox Inspector Windows®-based prototyping software that provides interactive access to an extensive set of imaging operations.

Matrox Intellicam

To interface to additional cameras or use cameras in a different mode, Matrox Intellicam, a camera configuration software utility, provides the necessary support to build or modify digitizer configuration files (DCFs)

High-Tech Digital has been delivering Imaging and Machine Vision products since 1983. To find more about our imaging systems and components call 310-265-8203 or send an e-mail to:

info@high-techdigital.com

Site Design: CLC Consulting

Imaging Software

Home

MIL-Lite (version 7.0)

Complete software development toolkit for image acquisition, transfer and display control. Ask us about **MIL/MIL-Lite customer training!**

Key Features

- complete and easy-to-use programming library for image capture, display, and archiving
- royalty-free redistribution
- applications easily ported to new hardware platforms
- multi-processing and multi-threading support
- supports TIF, BMP, AVI, and raw file formats
- available as DLL and OCX for Microsoft® Windows® 98, Windows® Me, Windows NT® 4.0, and Windows® 2000[1]
- includes **Matrox Intellicam** camera configuration utility

1.Contact High-Tech Digital Sales for information regarding which environments are supported by specific Matrox hardware and the revision number of development tools.

Read more about **MIL-Lite** (datasheet in .pdf format - 198Kb)

Get free **Adobe® Acrobat® Reader™**

Related Information

MIL-Lite Maintenance Program (PDF - 122Kb)
Matrox Imaging Library (MIL)
Matrox Software Licensing (PDF - 154Kb)
Hardware/Software Cross-Reference Table (PDF - 17Kb)

For more information, please contact High-Tech Digital
310-265-8203
info@high-techdigital.com

Introduction to the MIL/MIL-Lite Environment Training Course

Are you about to develop using MIL/MIL-Lite for the first time?

Matrox Imaging offers an ideal introduction to our library with a training course entitled Introduction to the MIL/MIL-Lite Environment. Created especially for first-time users, the course is designed to increase your productivity, enabling you to reduce development and engineering costs and bring your project to market sooner.

Learn how to navigate the MIL/MIL-Lite environment like a seasoned pro!
This intensive training includes a general introduction to MIL/MIL-Lite, explains how to set up your development environment, and covers the basics of managing image buffers, image capture and display. "Hands-on" workshops and question & answer periods with MIL development and applications engineers ensure that you leave the training with the knowledge needed to solve real-world applications!

What you can expect...

Small class size with a maximum of 12 students guarantees personalized attention.
All course materials are provided, including an individual workstation equipped with a state-of-the-art PC, frame grabber and video camera.
Instructors possess an in-depth knowledge of MIL and have extensive experience solving real-world applications.

Autumn 2002 Schedule:

	Date	Location	Tuition
Session 1	September 10-12 (September 13 is an optional half-day)	Matrox Corporate Headquarters Dorval, Quebec, Canada	$1,995

Please note: All sessions are offered in English.

Prerequisites:
Participants should have a good knowledge of C or C++ and be familiar with Microsoft Visual C++. No prior knowledge of MIL/MIL-Lite is required.

Agenda:

Day One (9:00 am - 4:30 pm)
- Introduction
- MIL software architecture
- Setting up a proper development environment
- Buffers and memory management
- Displaying images
- Introduction to video and Matrox Intellicam
- Introduction to digitizers

Day Two (9:00 am - 4:30 pm)
- Digitizers (cont.)
- Buffers and memory management (cont.)

- Displaying images (cont.)

Day Three (9:00 am - 4:30 pm)
- Advanced digitizer control
- Development and debugging techniques
- Redistribution

Day Four (Optional 9:00 am - 12:00 pm)
- Application-specific question and answer period

For more information, please contact High-Tech Digital
310-265-8203
info@high-techdigital.com

Matrox Intellicam

Quickly interface your camera to Matrox hardware, using Matrox Intellicam, a Windows™-based interactive utility.

Key Features

- interactive utility for interfacing to a complete range of video devices
- grab images at the click of a button
- access digitizer control functions
- fine-tune image capture
- device-independent application for Matrox PCI frame grabbers and vision processors

Read more about **Matrox Intellicam** (datasheet in PDF format - 790Kb)
Get free **Adobe® Acrobat® Reader™**

Related Information

Camera Interface Guide (PDF - 799Kb)

For more information, please contact High-Tech Digital
310-265-8203
info@high-techdigital.com

Matrox Inspector version 4.0

Interactive Windows® imaging software for scientific and industrial applications. Now with geometric pattern recognition technology and ActiveMIL Builder code generator tool!

Key Features

- easy-to-use interactive work environment
- directly acquire images from a variety of video sources using Matrox Imaging hardware
- load and save images in many file formats (AVI, DICOM[1], BMP, JPEG, JPEG2000[2] TIFF, etc.)
- calibrate images to correct visual distortions and perform measurements in real-world units
- extensive set of optimized functions for image processing and analysis
- measurements performed to sub-pixel accuracy
- annotate images with text and graphics
- exchange data with, and control from, other Microsoft® Windows® applications
- automate routines with Microsoft® VBA or 'C' compatible scripting
- generate Microsoft® Visual Basic® code for stand-alone applications
- create and manage image databases
- includes Matrox Intellicam camera configuration utility

1. Only save as a single frame DICOM format file.
2. Only JPEG2000 bit stream.

Read more about **Matrox Inspector** (datasheet in PDF format - 185Kb)
Get free **Adobe® Acrobat® Reader™**

Related Information

Matrox Software Licensing (PDF - 154Kb)
Hardware/Software Cross-Reference Table (PDF - 23Kb)

For more information, please contact High-Tech Digital
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Imaging Software

Free!!

Matrox Inspector CD

Home

Free Imaging Software CD

Matrox Inspector is an interactive Windows® imaging software for scientific and industrial applications that provides point 'n' click access to an extensive set of optimized functions for image processing, blob analysis, gauging and measurement, pattern matching, bar and matrix code recognition, and OCR. Take a second to complete the following form and you'll receive an Inspector 4.0 30-day evaluation CD free of charge!

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MIL 7.0 Showroom CD

Matrox Imaging Library (MIL) is a complete programming library for image capture, transfer, processing, analysis and display that offers a common API across our entire hardware line. MIL 7.0 introduces Geometric Model Finder, an innovative pattern recognition tool that uses geometric features to quickly find objects with unparalled levels of accuracy and robustness - under the harshest conditions. Order your free presentation CD today by taking a few moments to complete the following form.

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LVDS Signaling Standard

What is LVDS?

Interfacing today's high-speed, high resolution digital cameras to frame grabbers and vision processor boards requires an electrical interface that can quickly handle a large amount of data over long cable lengths. Until now, the most commonly used digital signaling standard for such applications has been RS-422, however this standard is starting to show its limitations.

To overcome these limitations, camera and board manufacturers have adopted a new digital signaling standard - Low Voltage Differential Signaling (LVDS). LVDS, as the name indicates, is a low-voltage differential-signaling technology. There are currently several industry standards that define LVDS including ANSI/TIA/EIA-644 (EIA-644) and IEEE 1596.3.

IEEE 1596.3 is used primarily for communication between processors or grouping workstations into clusters. EIA-644 is more general-purpose and application independent, and it provides a high bandwidth from higher transmission speeds with low noise and power consumption. EIA-644 is particularly well suited for interfacing high performance video cameras to imaging systems such as Matrox frame grabbers and image processors.

What are the differences between RS-422 and LVDS?

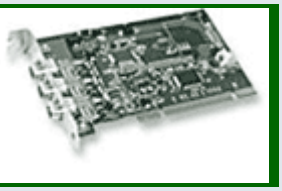
RS-422 is an electrical specification for the transmission of digital data. RS-422 requires the use of a twisted pair of wires to transmit one signal in a differential mode. The balanced signal[2] is transmitted in differential mode; one signal must be high (» 3 volts) while the other signal must be low (» 0 volts). RS-422 devices can operate at full duplex (i.e., transmit and receive data simultaneously) or half duplex (i.e., cannot transmit and receive data simultaneously). Typical data rates for RS-422 are 40 Mbps for distances between 1 and 3 meters. The rate drops to 10 Mbps at 10 meters.

Similar in design, LVDS provides higher transmission speed due to several factors. Firstly by using a constant-current driver, whereby the constant-current allows power consumption to be relatively independent of frequency. Another is by way of the standard's ability to operate independently from the power-supply voltage (since the interface voltage is low enough to operate from a 2V power supply). LVDS drivers and receivers have a very low voltage swing (typically 350 mV with an offset of 1.25V) and achieve high speeds using little power. Typical data rates for LVDS[3] are 110 Mbps for a 1meter distance, dropping to 90 Mbps over a 10-meter distance.

Where can I find information about LVDS?

Visit **National Semiconductor(R) LVDS home page** for a comprehensive selection of product briefs, FAQs, design guides and tools (LVDS owner manuals and white papers), and late-breaking LVDS news.

Imaging Hardware



Meteor-II

Meteor-II/Multi-Channel

Meteor-II/Digital

Meteor-II/Camera Link

Meteor-II/1394

Orion

Corona-II

Cronos

Genesis-LC

Home

Matrox Meteor-II/1394

IEEE 1394-to-PCI adapter board for digital video acquisition.

Key Features

- three 400 Mbps IEEE 1394 ports
- extensive FIFO for reliable capture to PC
- power for IEEE 1394 drawn directly from PC power supply
- supports IEEE 1394 video cameras based on the Digital Camera (DCAM) Specification using Matrox Imaging Library (MIL)
- available software is sold separately and includes **Matrox Imaging Library (MIL)/ ActiveMIL**, **MIL-Lite/ ActiveMIL-Lite** and **Matrox Inspector**
- support for Microsoft® Windows® Me, Windows NT® 4.0 and Windows® 2000

Read more about **Matrox Meteor-II/1394** (datasheet in PDF format - 121Kb)
Get free **Adobe® Acrobat® Reader™**

Related Information

Matrox Meteor-II/1394 Installation and Hardware Reference Manual (PDF - 267Kb)
Available Cameras
Matrox Meteor-II/1394 PC Compatibility List (please contact High-Tech Digital Technical Support)
Hardware/Software Cross-Reference Table (PDF - 17Kb)
Hardware Comparison Chart (PDF - 30Kb)

For more information, please contact High-Tech Digital
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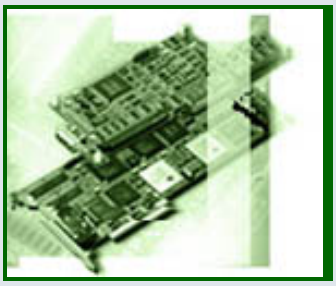
Imaging Hardware



GenesisPlus

Genesis

Home

Vision Processor

Genesis*Plus*

Vision processor board based on Motorola® G4 PowerPC processor with AltiVec technology.

Genesis

Single-slot PCI board integrates acquisition, processing and display, and includes state-of-the-art ASICs and multi-processor DSPs.

High-Tech Digital has been delivering Imaging and Machine Vision products since 1983. To find more about our imaging systems and components call 310-265-8203 or send an e-mail to:

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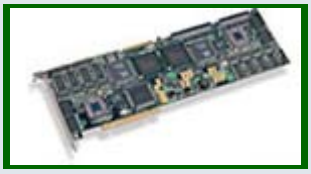

Matrox GenesisPlus

Vision processor board based on Motorola® G4 PowerPC processor with AltiVec technology.

Key Feature

- full-size PCI board
- one or two processing nodes
- processing node consisting of:
- G4 processor (MPC7410) includes:
    - 32-bit superscalor RISC
    - 500 MHz core speed
    - 2 MB external L2 cache
    - 64-bit, 125 MHz MPX bus interface to main memory
- Matrox Neighborhood Operations Accelerator (NOA) coprocessor
- Matrox's Video Interface ASIC (VIA) processor bridge
- 128 or 256 MB SDRAM memory
- VMChannel™ and Grab Port secondary bus interface
- software is sold separately and includes **Matrox Imaging Library (MIL)/ ActiveMIL**, **Matrox Genesis Native Library** and **Matrox Genesis Developer's Toolkit** (PDF - 137Kb)
- support for Microsoft® Windows NT® 4.0, Windows® 2000 and QNX®

Read more about **Matrox Genesis*Plus*** (datasheet in PDF format - 203Kb)
Get free **Adobe® Acrobat® Reader™**

Related Information

Matrox Genesis*Plus* PC Compatibility List (please contact High-Tech Digital Technical Support)
Genesis Native Library (GNL) Benchmarks (PDF - 47Kb)
Hardware/Software Cross-Reference Table (PDF - 17Kb)
Hardware Comparison Chart (PDF - 30Kb)

For more information, please contact High-Tech Digital
310-265-8203
info@high-techdigital.com

Matrox Genesis

Redefining high-performance imaging with speeds of up to 100 billion operations per second (BOPs).

Key Features

- flexible acquisition, real-time processing and high-resolution display all on one Main Board
- grab module acquires from virtually any video device: color/monochrome, analog/digital, frame scan/line scan at up to 140 MHz sampling rate
- scalable processing - add more power by cascading Processor Boards as required for up to 100 BOPs performance
- user configurable multi-processing (parallel or pipeline or a combination)
- high throughput I/O between acquisition, processing and display sections; between multiple boards and to external resources; handled by custom video interface ASIC (VIA)
- VIA offloads data management tasks from the vision processors, allowing them to be completely dedicated to processing
- display resolutions up to 1600 x 1200 @ 85Hz
- true-color image display with non-destructive pseudo-color overlay
- available software is sold separately and includes **Matrox Imaging Library (MIL)/ ActiveMIL**, Matrox Genesis Native Library and **Matrox Genesis Developer's Toolkit** (PDF - 137Kb)
- support for Microsoft® Windows NT® 4.0, Windows® 2000 and QNX® [1]

1. QNX supported through Matrox Genesis Native Library (GNL).

Read more about **Matrox Genesis** (datasheet in PDF format - 805Kb)
Get free **Adobe® Acrobat® Reader™**

Related Information

Genesis Native Library (GNL) Benchmarks (PDF - 47Kb)
Matrox Genesis Installation and Hardware Reference Manual (PDF - 2,668Kb)
Matrox Genesis PC Compatibility List (PDF - 56Kb)
RS-644 (LVDS) Signaling Standard
Cross-Reference Guide (MIL vs. Genesis Native Library commands)
Matrox Genesis Native Library Maintenance Program (PDF - 117Kb)
Camera Interface Guide (PDF - 799Kb)
Available Cameras
Matrox Genesis Developer's Toolkit (PDF - 137Kb)
Hardware/Software Cross-Reference Table (PDF - 81Kb)
Hardware Comparison Chart (PDF - 30Kb)

Connector Pinouts

Analog video input connector (STD module)
Display output connector
Digital interface connectors

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Dalsa Cameras

Click on the Camera Model to download camera datasheet in PDF format.
Downloading PDF files require the free **Adobe® Acrobat® Reader™.**

Get the frame grabber information: **Corona-II**, **Meteor-II/Digital**, **Meteor-II/Camera Link**, **Genesis**, **Genesis-LC** .

Get the camera interface information by clicking on the Application Note for the respective camera and frame grabber.

Line-scan Cameras

Camera Model	Image Sensor	Pixels	Bits	Line/ Frame Rate	Video Output	Extra	Frame Grabber
CL-P1-0512W Piranha	5.1 mm CCD	512	2 x 8	79 kHz	RS-644		Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note** Corona-II
CL-P1-1024W Piranha	10.2 mm CCD	1024	2 x 8	43 kHz	RS-644		Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note** Corona-II
CL-P1-2048W Piranha	20.5 mm CCD	2096	2 x 8	23 kHz	RS-644		Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note** Corona-II
CL-P1-4096W Piranha	41 mm CCD	4096	2 x 8	11 kHz	RS-644		Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note** Corona-II
CL-P4-6144W Piranha	43 mm CCD	6144	2 x8	7.9 kHz	RS-644		Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note** Corona-II
CL-P4-8192W Piranha	57.3 mm CCD	8192	2 x 8	6 kHz	RS-644		Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note** Corona-II
CT-P1-1024W Piranha	10.2 mm CCD	1024	4 x 8	79 kHz	RS-644		Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note**
CT-P1-2048W Piranha	28.7 mm CCD	2048	4 x 8	43 kHz	RS-644		Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note**
CT-P1-4096W Piranha	41 mm CCD	4096	4 x 8	23 kHz	RS-644		Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note**
CT-P4-6144W Piranha	43 mm CCD	6144	4 x 8	15.6 kHz	RS-644		Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note**
CT-P4-8192W Piranha	57.3 mm CCD	8192	4 x 8	11.8 kHz	RS-644		Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note**
P2-2x-01k40 Piranha2	10.2 mm CCD	1024	2x8/10	67 kHz	Camera Link		Meteor-II/Camera Link

P2-2x-02k40 Piranha2	20.5 mm CCD	2048	2x8/10	36 kHz	Camera Link		Meteor-II/Camera Link
P2-2x-04k40 Piranha2	41 mm CCD	4096	2x8/10	18 kHz	Camera Link		Meteor-II/Camera Link
P2-2x-06k40 Piranha2	43 mm CCD	6144	2x8/10	12 kHz	Camera Link		Meteor-II/Camera Link
P2-2x-08k40 Piranha2	57.4 mm CCD	8192	2x8/10	9 kHz	Camera Link		Meteor-II/Camera Link
P2-4x-04k40 Piranha2	28.7 mm CCD	4096	4x8/10	36 kHz	Camera Link		4 x 8 Bits Meteor-II/C. Link
P2-4x-06k40 Piranha2	43 mm CCD	6144	4x8/10	24 kHz	Camera Link		4 x 8 Bits Meteor-II/C. Link
P2-4x-08k40 Piranha2	57.4 mm CCD	8192	4x8/10	18 kHz	Camera Link		4 x 8 Bits Meteor-II/C. Link
SP13/14-05h30 Spark	7.2 mm CCD	512	8	50 kHz	RS-644		Genesis, Genesis-LC Meteor-II/Digital Corona-II
SP-13/14-01k30 Spark	14.4 mm CCD	1024	8	27 kHz	RS-644		Genesis, Genesis-LC Meteor-II/Digital Corona-II
SP-13/14-02k30 Spark	28.8 mm CCD	2048	8	14 kHz	RS-644		Genesis, Genesis-LC Meteor-II/Digital Corona-II
SP-13/14-05h40 Spyder	7.2 mm CCD	512	8	67.1 kHz	RS-644		Genesis, Genesis-LC Meteor-II/Digital Corona-II
SP-13/14-01k40 Spyder	14.4 mm CCD	1024	8	36.1 kHz	RS-644		Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note** Corona-II
SP-13/14-02k40 Spyder	28.8 mm CCD	2048	8	18.7 kHz	RS-644		Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note** Corona-II
TR-33/34/35-01k25 Trillium/Color	14.4 mm 3 x CCD	1024	3 x 8	21 kHz	RS-644 (RGB)	RS232	Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital Corona-II
TR-33/34/35-02k25 Trillium/Color	28.7 mm 3 x CCD	2048	3 x 8	11 kHz	RS-644 (RGB)	RS232	Genesis, Genesis-LC Meteor-II/Digital Corona-II
CT-E4-2048W	26.6x1.3 mm TDI CCD	2048 x 96	4 x 8	44 kHz	RS-644		Genesis, Genesis-LC Meteor-II/Digital
CT-E4-4096W Unidirectional	53.3x1.3 mm TDI CCD	4096 x 96	4 x 8	23 kHz	RS-644		Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital
EC-11-05h40 Eclipse/High Sensitivity	6.7x1.3 mm, TDI CCD	512 x 96	8	64.1 kHz	RS-644	RS232	Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note** Corona-II
EC-11-01k40 Eclipse/High Sensitivity	13.3x1.3 mm TDI CCD	1024 x 96	8	34.8 kHz	RS-644	RS232	Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note** Corona-II
EC-11-2k40 Eclipse/High Sensitivity	26.6x1.3 mm TDI CCD	2048 x 96	8	17.4 kHz	RS-644	RS232	Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note** Corona-II

Related Information

RS-644 (LVDS) Standard
TDI CCD Sensors
Line Scan / TDI Line Scan Calculation Worksheet

The Official Camera Link Specifications (PDF - 287Kb)

Camera Interface Guide (This comprehensive tutorial serves as an introduction to video and interfacing a camera to Matrox frame grabbers).

For more information, please contact High-Tech Digital
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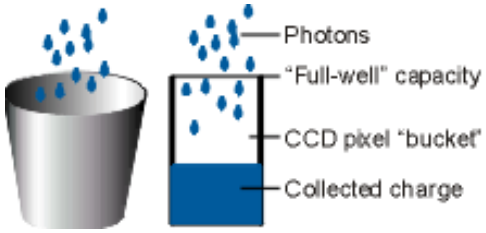
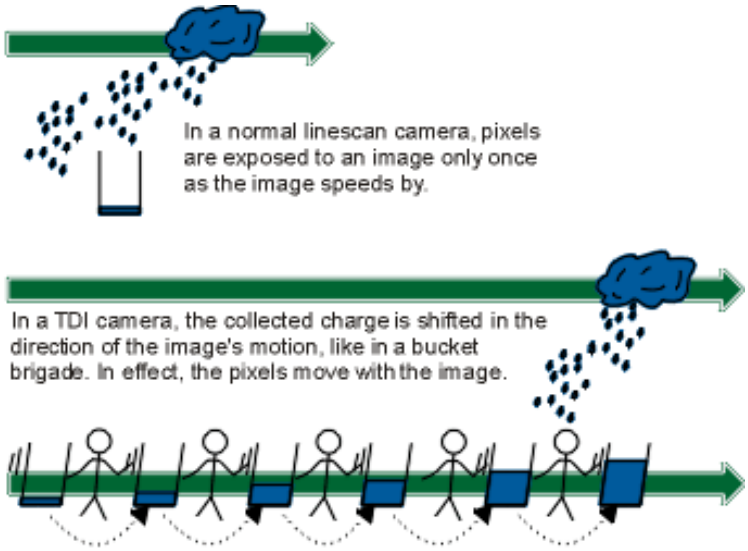
HIGH SENSITIVITY AND ADVANCED LINE SCAN CCD CAMERA PRIMER

How High Sensitivity and Advanced Line Scan CCD Image Sensors Work

In high sensitivity and advanced line scan cameras, a CCD image sensor converts photons (light) into electrons (charge). When photons hit an image sensor, the sensor accumulates electrons. This is called charge integration. The brighter your light source, the more photons available for the sensor to integrate, and the smaller the amount of time required to collect a given amount of light energy.



The way photosensitive elements (pixels) on CCD image sensors collect charge has often been compared to wells or buckets filling with water. From this analogy comes the term "full-well capacity," meaning the maximum charge (number of electrons) a pixel can hold without "spilling" charge onto adjacent pixels.



As an image sweeps over a line (one TDI stage) of pixels, the pixels collect charge. At certain intervals, a high sensitivity sensor shifts its collected charge from one stage to the next, in the same direction as the image travels. The sensor exposes the line of pixels again, and shifts again. Multiple stages of exposure are progressively combined to yield an image much stronger and sharper than a single line could have collected. Finally, the sensor transfers its aggregate charge to readout registers, which feed each pixel's charge from the image sensor into an output node that converts the charges into voltages.

After this transfer and conversion, the voltages are amplified to become the camera's analog output. In digital output cameras, the camera's analog-to-digital (A/D) board converts voltages to digital numbers (0-255 for 8-bit cameras). These digital numbers are what the camera outputs as data to a frame grabber.

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Dalstar Cameras

Click on the Camera Model to download camera datasheet in PDF format.
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Get the frame grabber information: **Corona-II**, **Meteor-II/Digital**, **Genesis**, **Genesis-LC** .

Get the camera interface information by clicking on the Application Note for the respective camera and frame grabber.

Area-Array Cameras

Camera Model	Image Sensor	Pixels	Bits	Line/ Frame Rate	Video Output	Extra	Frame Grabber
CA-D6-0256	2.6x2.6 mm CCD	260x260	4 x 8	955 fps	RS-644		Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note**
CA-D6-0512	5.3x5.2 mm CCD	532x516	4 x 8	262 fps	RS-644		Genesis, genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note**
CA-D8-0512	5.2x5.2 mm CCD	512x512	8	77 fps	RS-644		Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note** Corona-II
BT25 Low Light UV	9.2x6.9 mm CCD	658x490	12	25 fps	RS-644	RS232	Genesis, Genesis-LC Meteor-II/Digital Corona-II
1M15	14.3x14.3 mm CCD	1024x1024	12	15/30 fps	RS-422	RS232	Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note** Corona-II
1M30	12.3x12.3 mm CCD	1024x1024	12	30 fps	RS-644	RS232	Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note** Corona-II
1M60	14.3x14.3 mm CCD	1024x1024	4 x 12	60 fps	RS-422 or RS-644	RS232	4 x 8 bits Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note**
4M15	28.7x28.7 mm CCD	2048x2048	4 x 12	15 fps	RS-422 or RS-644	RS232	4 x 8 bits Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital
4M30	24.5x24.5 mm CCD	2048x2048	4 x 12	30 fps	RS-644	RS232	4 x 8 bits Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital
6M3P	36.9x24.6 mm CCD	3072x2048	12	2.75 fps	RS-422 or RS-644	RS232	Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note** Corona-II

6M18	36.9x24.6 mm CCD	3072x 2048	4 x 12	18 fps	RS-644	RS232	4 x 8 bits Genesis, Genesis-LC Meteor-II/Digital
CA-D4-1024A/T **CA-D7-1024A/T**	12.3x12.3 mm CCD	1024x1024	1,2 x 8/ 1x12	40/8 fps	RS-422	-	Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, Corona-II
6M3PC (Color)	9.2x6.9 mm CCD Bayer CFA	3072x2048	12	2.75 fps	RS-422 or RS-644	RS232	Genesis, Genesis-LC Meteor-II/Digital Corona-II

Related Information

RS-644 (LVDS) Standard
Advantages/Disadvantages of Various CCD Area-Array Sensors
The Official Camera Link Specifications (PDF - 287Kb)
Camera Interface Guide (This comprehensive tutorial serves as an introduction to video and interfacing a camera to Matrox frame grabbers).

For more information, please contact High-Tech Digital
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Cameras

Standard Cameras

Mega-pixel Cameras

Color Cameras

Related Information

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Hitachi Cameras

Click on the Camera Model to download camera datasheet in PDF format.
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Get the frame grabber information: **Cronos, Orion**, **Corona-II, Meteor-II/Digital, Meteor-II/Multi Channel**, **Genesis, Genesis-LC.**

Get the camera interface information by clicking on the Application Note for the respective camera and frame grabber.

Camera Model	Image Sensor	Pixels	Bits	Line/ Frame Rate	Video Output	Extra	Frame Grabber
KP-M2/3	1/2"/1/3" CCD	768x494		30/60 fps	Analog Interlaced		Genesis, Genesis-LC Meteor-II/Multi Ch. Meteor-II Corona-II Orion, Cronos
KP-M22/32	1/2"/1/3" CCD	768x494		30/60f fps	Analog Interlaced		Genesis, Genesis-LC Meteor-II/Multi Ch. Meteor-II Corona-II Orion, Cronos
KP-F1	1/2"CCD	659x494		30/60 fps interlaced or progressive	Dual Analog		Genesis, Genesis-LC, **Appl. Note** Meteor-II/Multi Ch., **Appl. Note** Corona-II
KP-F2A/B	1/3"CCD	658x496		30/60 fps progressive	Single/ Dual Analog	Near IR	Genesis, Genesis-LC, **Appl. Note** Meteor-II/Multi Ch. Corona-II
KP-F3W	1/3"CCD	647x485		30/60 fps interlaced or progressive	Single Analog		Genesis. Genesis-LC Meteor-II/Multi Ch. Corona-II Meteor-II Orion, Cronos
KP-F100A	2/3"CCD	1300x1030	0	12/24 fps	RS-644	RS232	Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital Corona-II
KP-F102	2.3"CCD	1300x1030	10	12-768 fps	RS-644	RS232	Genesis, Genesis-LC Meteor-II/Digital Corona-II
KP-F110	2/3"CCD	1024x1024	10	30 fps	RS-644 Analog		Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital Corona-II
KP-F120	2/3"CCD	1392x1040	10	30-190 fps	RS-644 Analog	RS232 Near IR	Genesis, Genesis-LC, **Appl. Note** Meteor-II/Digital, **Appl. Note** Corona-II

HV-C20 (Color)	1/2" 3 x CCD	768x494		30 fps	RGB Y/C	RS232	Genesis, Genesis-LC Meteor-II/Multi Ch., **Appl. Note** Corona-II
KP-F100C (Color)	2/3"CCD Bayer CFA	1300x1030	10	12/24 fps	RS-644		Genesis, Genesis-LC Meteor-II/Digital Corona-II

Related Information

RS-644 (LVDS) Standard
Camera Interface Guide (This comprehensive tutorial serves as an introduction to video and interfacing a camera to Matrox frame grabbers).

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Cameras

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Mega-pixel Cameras

Color Cameras

Related Information

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Get the frame grabber information: **Cronos, Orion, Corona-II**, **Meteor-II, Meteor-II/Digital, Meteor-II/Multi Channel**, **Meteor-II/Camera Link**, **Genesis, Genesis-LC.**

Get the camera interface information by clicking on the Application Note for the respective camera and frame grabber.

Image Sensor	Image Sensors	Pixels	Bits	Line/ Frame Rate	Video Output	Extra	Frame Grabber
TM-200	1/2" CCD	768x494		30/60 fps	Analog		Genesis, Genesis-LC Meteor-II/Multi Ch. Meteor-II, Cronos, Orion Corona-II
TM-200NIR	1/2"CCD	768x494		30/60 fps	Analog	Near IR	Same as above
TM-250	1/2" CCD	768x494		30/60 fps	Analog		Same as above
TM-7	1/2" CCD	768x494		30/60 fps	Analog		Same as above
TM-75	1/2" CCD	768x494		30/60 fps	Analog	Custom Timing	Same as above
TM-6300	1/3" CCD	640x494		30/60 fps Progressive	VGA		Meteor-II/Multi Ch. Genesis, Genesis-LC Corona-II
TM-6702	1/2" CCD	640x484		30/60 fps Progressive	VGA		Meteor-II/Multi Ch., **Appl. Note** Genesis, Genesis-LC, **Appl. Note** Corona-II
TM-6703	1/2" CCD	640x484		60 fps Progressive	VGA	Partial Scan	Meteor-II/Multi Ch., **Appl. Note** Genesis, Genesis-LC, **Appl. Note** Corona-II
TM-6705AN	1/2" CCD	640x484		60 fps Progressive	VGA	Multi Shutter	Meteor-II/Multi Ch. Genesis, Genesis-LC Corona-II
TM-6710	1/2" CCD	640x484	8	60/120 fps Progressive	RS-644 & Analog	RS232 Partial Scan	Meteor-II/Digital, **Appl. Note** Genesis, Genesis-LC, **Appl. Note** Meteor-II/Multi Ch* Corona-II

TM-6760	1/2" CCD	640x484	8	60 fps Progressive	RS-422	RS232	Meteor-II/Digital Genesis, Genesis-LC Corona-II
TM-6760CL	1/2" CCD	640x484	8	60 fps Progressive	Camera Link	RS232	Meteor-II/Camera Link
TM-9701	2/3" CCD	760x484	8	30 fps Progressive 30 fps Interlaced	RS-422 & Analog		Meteor-II/Digital, **Appl. Note** Meteor-II/Multi Ch*, **Appl. Note** Genesis, Genesis-LC, **Appl. Note** Meteor-II*, Orion*, Cronos* Corona-II,
TM-1001	1" CCD	1008x1018	8	15 fps	RS-422 & Analog		Meteor-II/Digital, **Appl. Note** Genesis, Genesis-LC Meteor-II/Multi Ch* Corona-II
TM-1020-15	1" CCD	10008x1018	8	15 fps	RS-422 & Analog	RS232 LUT Binning	Meteor-II/Digital, **Appl. Note** Genesis, Genesis-LC, **Appl. Note** Meteor-II/Multi Ch* Corona-II
TM-1020-15CL	1" CCD	1008x1018	8	15 fps	Camera Link & Analog	LUT Binning	Meteor-II/C. Link, **Appl. Note** Genesis, Genesis-LC* Meteor-II/Multi Ch* Corona-II*
TM-1010	1" CCD	1008x1018	10	15 fps	RS-644 & Analog	RS232	Meteor-II/Digital, **Appl. Note** Genesis, Genesis-LC, **Appl. Note** Meteor-II/Multi Ch* Corona-II
TM-1040	1" CCD	1008x1018	10	30 fps	RS-644 & Analog	RS232	Meteor-II/Digital, **Appl. Note** Genesis, Genesis-LC Meteor-II/Multi Ch* Corona-II
TM-1320-15	2/3" CCD	1300x1030	8	15 fps	RS-644 & Analog	RS232 LUT Binning	Meteor-II/Digital Genesis, Genesis-LC Meteor-II/Multi Ch* Corona-II
TM-1320-24	2/3" CCD	1300x1030	8	24 fps	RS-644 & Analog	RS232 LUT Binning	Meteor-II/Digital Genesis, Genesis-LC Meteor-II/Multi Ch Corona-II
TM-1320-15CL	2/3" CCD	1300x1030	8	15 fps	Camera Link & Analog	LUT Binning	Meteor-II/C. Link, **Appl. Note** Genesis, Genesis-LC* Meteor-II/Multi Ch* Corona-II*
TM-1320-24CL	2/3" CCD	1300x1030	8	24 fps	Camera Link & Analog	LUT Binning	Meteor-II/C. Link Genesis, Genesis-LC* Meteor-II/Multi Ch. Corona-II*

TM-1300	2/3" CCD	1300-1030	8/10	12 fps	RS-422 & Analog	RS232 SVGA	Meteor-II/Digital, **Appl. Note** Genesis, Genesis-LC, **Appl. Note** Meteor-II/Multi Ch* Corona-II*
TMC-7DSP (Color)	1/2" CCD Cy/Ye/Mg/G CFA	768x494	-	30/60 fps Interlaced	NTSC, YC, S, RGB	RS232 DSP	Genesis, Genesis-LC Meteor-II/Multi Ch. Meteor-II, Orion, Cronos Corona-II
TMC-73M (Color)	1/3" CCD Cy/Ye/Mg/G CFA	768x494		30/60 fps Interlaced	NTSC Y/C		Same as Above
TMC-6700CL (Color)	1/2" CCD Bayer CFA	640x484	24	60 fps Progressive	Camera Link & SVGA	RS232 DSP	Meteor-II/C. Link, **Appl. Note** Genesis, Genesis-LC* Meteor-II/Multi Ch* Corona-II*
TMC-9700 (Color)	2/3" CCD 3G/R/B CFA	760x484	24	30 fps Progressive 60 fps Interlaced	TTL RGB NTSC Y/C	RS232 DSP	Meteor-II/Digital, **Appl. Note** Genesis, Genesis-LC, **Appl. Note** Meteor-II/Multi Ch. Meteor-II, Orion, Cronos Corona-II
TMC-1000CL (Color)	1" CCD Bayer CFA	1008x1018	24	15 fps	Camera Link & SVGA	RS232 DSP	Meteor-II/ C. Link, **Appl. Note** Genesis, Genesis-LC* Meteor-II/Multi Ch* Corona-II*

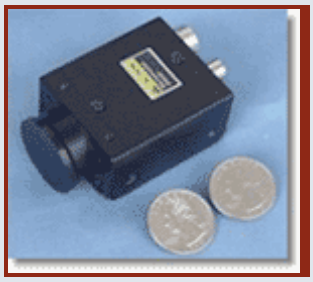
* For connection to the Analog camera output.

Related Information

RS-644 (LVDS) Standard
LUT (Look-Up Table)
The Official Camera Link Specifications (PDF - 287Kb)
Camera Interface Guide (This comprehensive tutorial serves as an introduction to video and interfacing a camera to Matrox frame grabbers).

For more information, please contact High-Tech Digital
310-265-8203
support@high-techdigital.com.

Cameras



Monochrome Cameras

Color Cameras

High-Sensitivity Cameras

Line-Scan Cameras

Related Information

Home

Sentech Cameras

Click on the Camera Model to download camera datasheet in PDF format.
Downloading PDF files require the free **Adobe® Acrobat® Reader™.**

Get the frame grabber information: **Corona-II, Meteor-II/Digital, Meteor-II/Multi Channel**, **Genesis, Genesis-LC** .

Get the camera interface information by clicking on the Application Note for the respective camera and frame grabber.

Area-Array Cameras

Camera Model	Image Sensor	Pixels	Bits	Line/ Frame Rate	Video Output	Extra	Frame Grabber
STC-160BC	1/3" CCD	760 x 480		30fps	Analog	CS-Mount Low Cost	Genesis, Genesis-LC Meteor-II/Multi Ch. Meteor-II Corona-II Orion, Cronos
STC-300/310	1/2" / 1/3" CCD	760 x 480		30/60 fps	Analog		Same as Above
STC-400/410	1/2" / 1/3" CCD	760 x 480		30/60 fps	Analog	Higher Sensitivity	Same as Above
STC-400L/410L	1/2" / 1/3" CCD	760 x 480		30/60 fps	Analog	Right Angle View	Same as Above
STC-SS400/410	1/2" / 1/3" CCD	760 x 480		30/60 fps	Analog	Remote Head	Same as Above
STC-700/720/730	2/3" / 1/2" / 1/3" CCD	760 x 480		30/60 fps	Analog	Compact, Extended Integration, Trigger Options	Genesis, Genesis-LC Meteor-II/Multi Ch. Meteor-II Corona-II Orion, Cronos
STC-1000 **STC-1001** **STC-1100A/B** **STC-1000C/D** **STC-1000 Models**	1/3" CCD	640 x 480		60 fps Progressive 30 fps Interlaced	Analog	Double Speed	Genesis, Genesis-LC Meteor-II/Multi Ch., **Appl. Note** Meteor-II Corona-II, **Appl. Note** Orion, Cronos
STC-530/540 Configurations* (Color)	1/3" / 1/4" 1-CCD	510 x 480		30 fps	NTSC Y/C	10-bit DSP RS-232	Genesis, Genesis-LC Meteor-II/Multi Ch. Corona-II
STC-620/630/640 Configurations** (Color)	1/2" / 1/3" / 1/4" 1-CCD	760 x 480		30 fps	NTSC Y/C	10-bit DSP RS-232	Genesis, Genesis-LC Meteor-II/Multi Ch. Corona-II

**** Datasheets** (PDF format) **for six different configurations of STC-620/630/640 color cameras:**

STC-620BT	**STC-620BJ**	**STC-620AII**	**STC-620AS**	**STC-620CC**	**STC-620CT**
STC-630BT	**STC-630BJ**	**STC-630AII**	**STC-630AS**	**STC-630CC**	**STC-630CT**
STC-640BT	**STC-640BJ**	**STC-640AII**	**STC-640AS**	**STC-640CC**	**STC-640CT**

* **Datasheets** (PDF format) **for three different configurations of STC-520/530 color cameras:**

STC-530AII	**STC-530BJ**	**STC-530BT**
STC-540AII	**STC-540BJ**	**STC-540BT**

Sentech High Sensitivity Cameras

Sentech has introduced a new series of High Sensitivity cameras. These cameras provide an excellent image quality with significantly less light.

The new Sentech low light color cameras have a 0.1 Lux minimum illumination, approximately 10X greater performance than most cameras. The Sentech color cameras which have this feature are:

- STC-H620 Series
  1/2" CCD, 0.1 Lux
- STC-H630 Series
  1/3" CCD, 0.1 Lux
- STC-H530 Series
  1/3" CCD, 0.05 Lux

This same high sensitivity capability is also available on Sentech's B/W cameras. The minimum illumination available on the STC-H400 is 0.002 Lux. It provides a near Infra-red spectral response, with about a 30% relative response at 850 nano-meters. Sentech B/W cameras which have this feature are:

- STC-H160 Series
  1/3" CCD, 0.04 Lux
- STC-H400 Series
  1/2" CCD, 0.002 Lux
- STC-H720 Camera
  1/2" CCD, 0.02 Lux
- STC-H730 Camera
  1/3" CCD, 0.05 Lux

Line-Scan Cameras

Camera Model	Image Sensor	Pixels	Bits	Line/ Frame Rate	Video Output	Extra	Frame Grabber
STC-2048FD	28.67 mm	2048	10	9.3 kHz	RS-422/644 Analog	Nikon Mount	Genesis, Genesis-LC Meteor-II/Digital Corona-II
STC-5150FD	36.05 mm	5150	10	7.5 kHz	RS-644 Analog	Nikon Mount	Genesis, Genesis-LC Meteor-II/Digital Corona-II
STC-7450FD	35 mm	7450	10	5 kHz	RS-644, Analog	Nikon Mount	Genesis, Genesis-LC Meteor-II/Digital Corona-II

Related Information

RS-644 (LVDS) Standard
Camera Interface Guide (This comprehensive tutorial serves as an introduction to video and interfacing a camera to Matrox frame grabbers).

For more information, please contact High-Tech Digital
310-265-8203
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Cameras

Monochrome RS-170 Cameras

Monochrome Digital Cameras

Color Digital Cameras

Related Information

Home

Uniq Vision Cameras

Click on the Camera Model to download camera datasheet in PDF format.
Downloading PDF files require the free **Adobe® Acrobat® Reader™.**

Get the frame grabber information: **Cronos, Orion, Corona-II, Meteor-II/Digital, Meteor-II/Multi Channel, Genesis, Genesis-LC.**

Get the camera interface information by clicking on the Application Note for the respective camera and frame grabber.

Monochrome RS-170 CCD Cameras

UM-100/UM-101 1/2", 760 x 480 at 30 fps, 2:1 interlaced camera.	Meteor-II, Meteor-II/Multi Channel Orion, Cronos, Cronos-II Genesis, Genesis-LC
UM-200/UM-201 1/2", 760 x 480 at 30 fps, interlaced, asynch capture camera.	Meteor-II, Meteor-II/Multi Channel Orion, Cronos, Cronos-II Genesis, Genesis-LC
UM-300/UM-301 1/2", 760 x 480 at 30 fps, interlaced, near infrared (NIR) camera.	Meteor-II, Meteor-II/Multi Channel Orion, Cronos, Cronos-II Genesis, Genesis-LC
UM-400/UM-401 1/2", 760 x 480 at 30 fps, interlaced, auto electronic shutter camera.	Meteor-II, Meteor-II/Multi Channel Orion, Cronos, Cronos-II Genesis, Genesis-LC

Monochrome Progressive-Scan Digital CCD Cameras

UP-600 1/3", 640 x 480 at 60 FPS, digital camera.	Meteor-II/Digital, Corona-II Genesis, Genesis-LC
UP-610 1/3", 640 x 480 at 110 FPS, digital camera.	Meteor-II/Digital, Corona-II Genesis, Genesis-LC
UP-800 1/3", 1024 x 779 at 45 FPS, digital camera.	Meteor-II/Digital, Corona-II Genesis, Genesis-LC
UP-900 1/2", 1392 x 1040 at 15 FPS, digital camera.	Meteor-II/Digital, Corona-II Genesis, Genesis-LC
UP-930 1/2", 1024 x 1024 at 29 FPS, digital camera.	Meteor-II/Digital, Corona-II Genesis, Genesis-LC

UP-1800 2/3", 1300 x 1030 at 15 FPS, digital camera.	Meteor-II/Digital, Corona-II Genesis, Genesis-LC
UP-1830 2/3", 1024 x 1024 at 29 FPS, digital camera.	Meteor-II/Digital, Corona-II Genesis, Genesis-LC
UP-2000 (Preliminary datasheet) 1/2", 1328 x 1236 at 15 FPS, digital camera.	Meteor-II/Digital, Corona-II Genesis, Genesis-LC
UF-1000 1/3", 400, 500, 600, 1000 FPS, digital camera.	Meteor-II/Digital, Corona-II Genesis, Genesis-LC

Color Progressive Scan Digital CCD Cameras

UC-600 1/3", 640 x 480 at 60 FPS, color digital camera.	Meteor-II/Digital, Corona-II Genesis, Genesis-LC
UC-610 1/3", 640 x 480 at 110 FPS, color digital camera.	Meteor-II/Digital, Corona-II Genesis, Genesis-LC
UC-800 1/3", 1024 x 779 at 45 FPS, color digital camera.	Meteor-II/Digital, Corona-II Genesis, Genesis-LC
UC-900 1/2", 1392 x 1024 at 15 FPS, color digital camera.	Meteor-II/Digital, Corona-II Genesis, Genesis-LC
UC-930 1/2", 1024 x 1024 at 29 FPS, color digital camera.	Meteor-II/Digital, Corona-II Genesis, Genesis-LC
UC-1800 2/3", 1300 x 1030 at 15 FPS, color digital camera.	Meteor-II/Digital, Corona-II Genesis, Genesis-LC
UC-1830 2/3", 1024 x 1024 at 29 FPS, color digital camera.	Meteor-II/Digital, Corona-II Genesis, Genesis-LC

Custom Options

Options like RS-170 output, RS-343 output, 2 x 2 and 4 x 4 binning, and multi-exposure within a frame output can be added into standard progressive scan cameras such as UP-1000 and UP-1030 models. Contact UNIQ applications engineer for further details.

Related Information

Uniq Vision Cameras Comparison Chart
Matrox (Meteor-II/Digital) to Uniq digital cameras Cable Connection
RS-644 (LVDS) Standard
Camera Interface Guide (This comprehensive tutorial serves as an introduction to video and interfacing a camera to Matrox frame grabbers).

For more information, please contact High-Tech Digital
310-265-8203
support@high-techdigital.com.

Tutorials

- Optics Tutorial
- Lighting Tutorial
- Camera Tutorial

Related Information

- Systems
- Find Camera
- Find Lens/Optics
- Find Lighting
- Find Controllers
- Find Imaging Hardware
- Find Imaging Software
- Industry Links
- Home

Applications

Industrial vision system checks for missing teeth
> **Motion Metrics uses Matrox 4Sight in Missing Tooth Detection System (MTDS) for hydraulic mining shovel buckets**

Matrox 4Sight helps automated wing assembly take flight
> **Integrated industrial computer provides key vision component in Airbus UK's Automated Wing Box Assembly research project**

> **Matrox Imaging helps keep trains on the right track (PDF - 103Kb)**

The quest for speed, precision and high yield in BGA placement technology
> **CAMALOT Matrixx™ Sphere Placement System uses Matrox Imaging for vision components and software**

Camera-to-PC interfaces:
> **New interface options promise bandwidth for high-resolution, high-speed imagers without taking up more space.**

What's on your plate?
> **MIL and Meteor-II used to develop new imaging system for rapid reading and diagnosis of specimen plates**

> **You've got the cutest little Baby*Face*™**
Matrox 4Sight used in 3D ultrasound diagnostic imaging

> **Upon close inspection:**
Here's what it takes to create a robust, reliable manufacturing inspection solution

High-Tech Digital has been delivering Imaging and Machine Vision products since 1983. To find more about our imaging systems and components call 310-265-8203 or send an e-mail to:

info@high-techdigital.com

Site Design: CLC Consulting

Metrology Systems

Digital Video Recording Systems

Home

Systems

Under Construction!

Coming Soon!

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Site Design: CLC Consulting

Motorized Lens Controller

Part Tracking Controller

Home

Controllers

Motorized Lens Controller

The Motorized Lens Controller (MLC) provides extensive support for controlling motorized optics. The ability to control zoom, focus, iris, and additional motors from a host computer allows for fully automated machine vision or imaging applications. The MLC/S - a standalone version, controls standard motorized lenses, while the MLC/OEM is the motorized optics controller kit for OEM customers, wishing to integrate automated optics controls into their turn-key systems.

Part Tracking Controller

Automated manufacturing requires automated inspection and real time feedback. To act upon inspection results (e.g. to remove a bad part), the machine vision system has to know very precisely where each part is.

The Part Tracking Controller (PTC) is a modular tracking system that can track parts transported by a conveyer. It tracks parts independently of the changes in the conveyer speed and the spacing between parts. Multiple tracking modules can be daisy-chained to track unlimited number of inspections per part for unlimited length of the conveyer. The PTC can be easily incorporated into any machine vision system and interfaced to the part handling devices - e.g. a robot or a rejecter.

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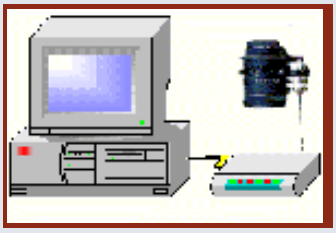

Motorized Lens Controller (MLC)

Key Features

- accurate control of zoom, focus, and iris
- control of an additional motors
- modular design – a separate control and motor driving modules
- RS-232 and RS-485 connectivity to the Host Computer
- includes the control software
- source code (C++) available
- standalone unit runs off 110 or 220V and 50/60Hz.
- OEM version runs off standard DC voltages
- small size
- CE certified

Read more about **Motorized Lens Controller** (datasheet in PDF format)
Get free **Adobe® Acrobat® Reader™**

Related Information

MLC Installation and Hardware Reference Manual (PDF)
Connector Pinouts
Computer Interface Connector (PDF)
Intelligent Motor Interface Connector (PDF)
Standard Lens Interface Connector (PDF)

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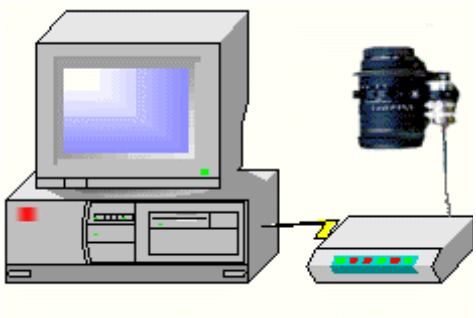
MLC

Motorized Lens Controller



Versatile and Modular

Allows Computer Control of Motorized Optical Systems

Makes Fully Automated Machine Vision and Imaging Possible

The MLC provides extensive support for controlling motorized optics. The ability to control zoom, focus, iris, and additional motors from a host computer allows for fully automated machine vision or imaging applications. The MLC/S - a standalone version, controls standard motorized lenses, while the MLC/OEM is the motorized optics controller kit for OEM customers, wishing to integrate automated optics controls into their turn-key systems.

FEATURES

- Accurate control of zoom, focus, and iris.
- Control of an additional motor.
- Modular design – a separate control and motor driving modules.
- RS-232 and RS-485 connectivity to the Host Computer.
- Includes the control software. Source code (C++) available.
- Standalone unit runs off 110 or 220V and 50/60Hz.
- OEM version runs off standard DC voltages.
- CE certified.

BENEFITS

- No need for the operator intervention. Higher accuracy and repeatability.
- Could control a camera position.
- Cost effective options. Future upgradeability.
- The Host Computer can control multiple camera/lenses easily.
- Ready to use “as is” or integrate easily into the existing control software.
- No need for additional power supplies.
- Industry standard control voltages.
- Can be easily integrated into the CE certified systems.

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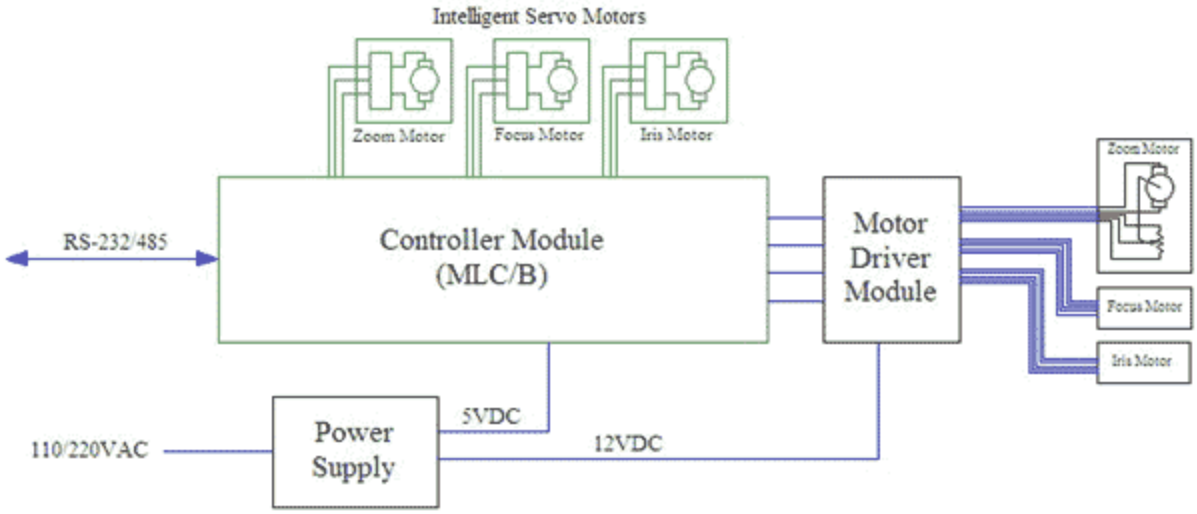
BLOCK DIAGRAM



PHYSICAL SPECIFICATIONS

Electrical Power - MLC/S: 12 VDC
- MLC/OEM: 5 VDC, 12 VDC

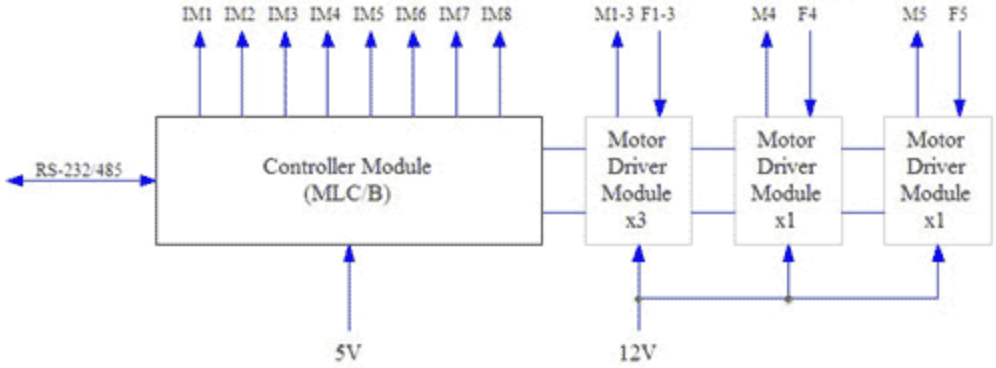
Ambient Temperature: 32-122 F (0-50°C)
Relative Humidity: 95% (non-condensing)

CONTROL SPECIFICATIONS

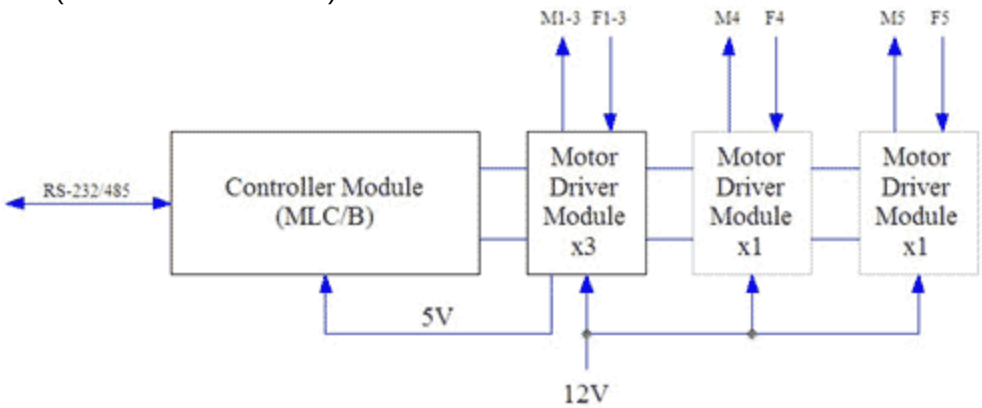
Motor Control Voltage: 6 to 12VDC
Motor Current: 100 mA maximum, each motor
Feedback Input: 5k or 10k potentiometer
Positional Resolution: 0 -255
Computer Connectivity: RS-232/RS-485

CONFIGURATIONS

MLC/OEM: Controller Module (**MLC/B**), Intelligent Servo Motor (**ISM1**), Software (C++ Source Code).
Options: **ISM1** (additional servo motors), **MDM3** (3-Motor Driver Module), **MDM1** (1-Motor Driver Module)
Total Number of Motors: 8



MLC/S: Standalone MLC unit (for use with standard motorized lenses), Software
Options: MDM1 (1-Motor Driver Module)



Links to Imaging / Machine Vision Organizations and Magazines

Machine Vision Online is supported by Automated Imaging Association (AIA). Founded in 1984, AIA is the only trade association in North America organized specifically to serve machine vision suppliers and machine vision users.

Vision Systems Design is a magazine for engineers, engineering managers and corporate managers who are in the business of researching, designing, developing, manufacturing and integrating components and subsystems for machine-vision systems and image-processing. This monthly publication covers all the details of the cutting-edge work being done in the development and applications of vision and imaging systems.

Advanced Imaging is a magazine dedicated to providing the latest information on imaging hardware, software and peripherals to qualified professionals working with all forms of electronic imaging. Whether an image is captured, displayed, manipulated, output, stored or transmitted.

SPIE - The International Society For Optical Engineering
Since its formation in 1955 as the Society for Photo-optical Instrumentation Engineers, SPIE has been dedicated to providing the best possible service to the optical engineering community.

Machine Vision Association of SME (Society of Manufacturing Engineers)

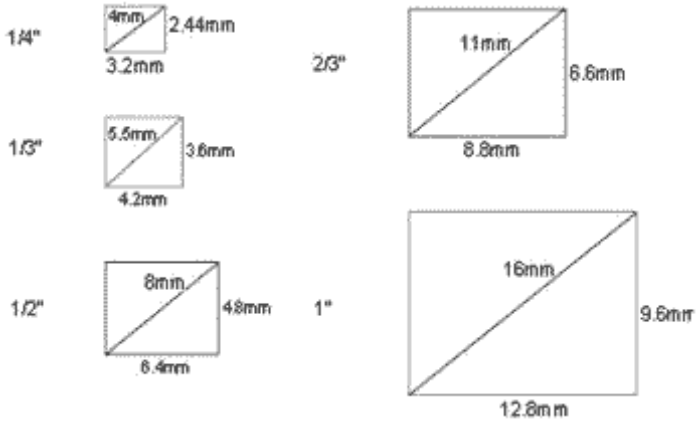
Robotic Industries Association

Lens Parameters

(Part 2 0f 2)

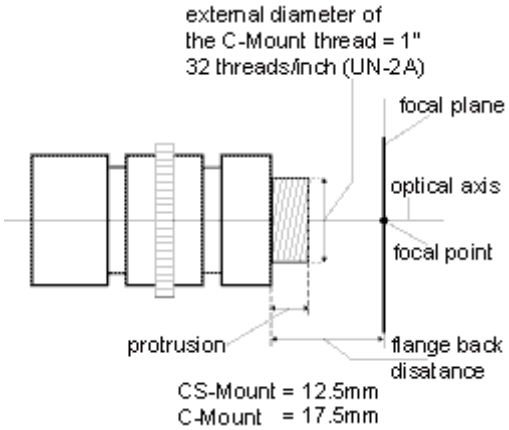
Back Next

Lens Format – The lens needs to cover an area as large or larger than the sensor size. Hence, the lens format should be, at least, equivalent to the camera format. Most CCD sensors come in sizes of 1", 2/3", 1/2", 1/3" and 1/4".



Different sensor formats require corresponding lens formats. The lens format has always to be equal or larger than the sensor format. Larger lens formats reduce distortion at the outside edges. C-Mount and CS-Mount CCTV lenses can be used for all area-scan sensor formats. However, these lenses are not recommended for precision measurements or three-dimensional part inspection.

Mega-pixel line-scan cameras, due to their size, need a larger image format than C-mount lenses can offer. In this case, an F-mount 35 SLR lens can be used. These lenses can also be used with a C-mount camera when a higher image quality is required. This requires a C-mount to F-mount adapter.



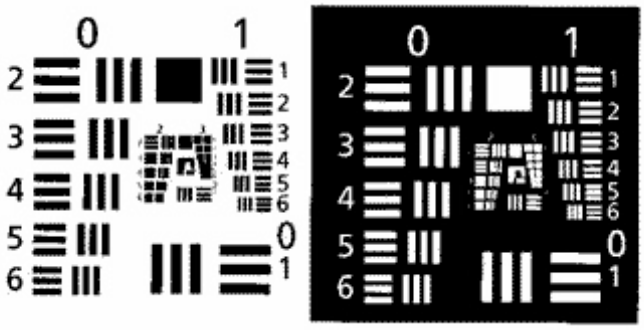
C-MOUNT - An industry standard for mounting a lens to a camera where a 1" x 32 thread is employed and the distance from the image plane is 17.52mm from the shoulder of the lens. A C-mount lens may be used with a CS-mount camera with the use of a 5mm-adapter ring.

CS-MOUNT - A relatively new industry standard for mounting a lens to a camera where a 1" X 32 thread is employed and the distance from the image plane to the shoulder of the lens is 12.52mm. A CS-mount lens may NOT be used on a C-mount camera.

Resolution – Resolution is the ability of a lens to distinguish two features that are close together. Also, a lens with high resolution will show an edge transition in fewer pixels than a lens with low resolution. The resolving power of the optics for viewing distant objects is:

$$D = 2.44N\lambda$$

where *N* is the f/number and λ is the light's wavelength. The resolving power is limited by diffraction that spreads each object point to an image spot (Airy disk) - the *D* being the diameter of the inner bright spot. A practical test for determining the resolution for machine vision uses a target with multiple bars and various spacing between bars.



This type of target can also be used to measure contrast and magnification. Resolution of the lens does not determine detection resolution, which can be effected by lens distortions and aberrations, lighting deficiencies, or limited camera resolution.

Contrast - Contrast is the amount of difference between light and dark features in an image.

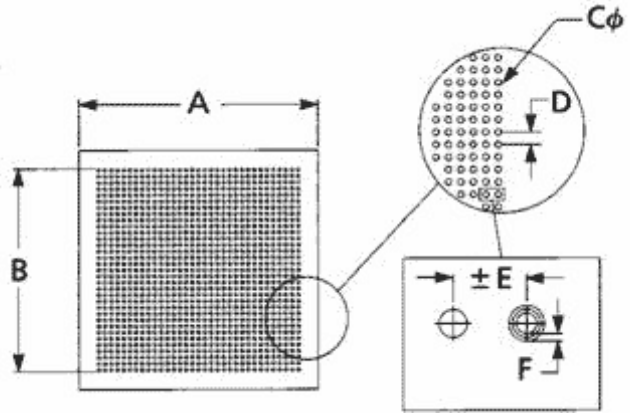
$$contrast = \frac{light - dark}{light + dark}$$

The *light* is the gray level of the brightest pixel and the *dark* is the gray level of the darkest pixel.

A contrast of 1 means transition from full light to full dark. A higher resolution lens not only resolves finer features but also images larger features at a higher contrast. A high-contrast image appears sharper than a lower contrast image even at the same resolution. The quality of optics and lighting can affect the contrast.

Distortion and Aberrations – The simple lens formulas are valid only with ideally thin lenses, no spherical distortion, no field curvature, and using monochromatic light.

Geometric Distortions – Pincushion and barrel geometric distortions must be compensated especially in gauging applications. Distortion can be measured by using a precise dot target, which can also measure the magnification.



Aberrations – chromaticity, sphericity, coma, astigmatism, field curvature, and vignetting are corrected by incorporating multiple lenses that compensate for each other. However, it is impossible to design a lens that is well corrected for all distances, FOVs, and wavelengths. The smaller the range, the simpler the design. Hence, the lens may not perform correctly if used under different conditions.

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Travel to a new dimension in vision processing with Matrox Odyssey

Launched at Semicon West 2002, Matrox Imaging's Odyssey Xpro and Odyssey XCL vision processor boards integrate the latest off-the-shelf and custom technologies with an established, fourth-generation architecture to deliver unprecedented performance and value.

The scalable Matrox Odyssey Xpro features the premier Motorola G4 PowerPC™ embedded microprocessor, running at 1 GHz. The PowerPC, combined with Matrox Imaging's state-of-the-art Oasis processing and router ASICs, delivers over 130 billion operations per second (BOPS). The single-slot Odyssey Xpro also offers over 5 GB per second of memory bandwidth, up to 1 GB of DDR SDRAM memory and up to 2 GB per second of external I/O bandwidth. These features, combined with the latest PCI-X bus technology and its linearly scalable architecture, provide the Odyssey Xpro with the power and flexibility needed for vision applications today and tomorrow.

Matrox Oasis ASIC
The high-density Matrox Oasis ASIC is the pivotal component on the Odyssey Xpro and integrates a CPU bridge, main memory controller, Pixel Accelerator and Links Controller. The Pixel Accelerator (PA) is a parallel processor core that accelerates neighborhood, point-to-point and LUT mapping operations. It consists of an array of 64 processing elements all working in parallel. Operating at a core frequency of 167 MHz enables the PA to process up to two billion pixels per second.

The Links Controller (LINX) is the router that manages all data movement inside and outside the processing node, which consists of the Pixel Accelerator, CPU and main memory. It can handle several concurrent video and message streams, thereby offloading data management tasks from the CPU and PA and allowing them to focus on image processing tasks.

With 22.4 million transistors, the Oasis also incorporates the 64-bit, 133 MHz CPU bus interface to the G4 PowerPC and a 128-bit wide, 166 MHz double data rate DRAM interface capable of transferring image data at rates of up to 5.3 GB per second.

PCI-X interconnectivity
The Odyssey Xpro is the first vision processor on the market to take full advantage of the latest bus technology. PCI-X is a high-performance, backwards-compatible enhancement to the conventional PCI bus specification. Version 1.0 of PCI-X specifies a 64-bit physical connection running at speeds of up to 133 MHz, resulting in a peak bandwidth of up to 1 GB per second. The custom-designed Matrox System Interface Bridge (SIB), a four-port PCI-X router, handles the PCI-X connections on the Odyssey Xpro, including those between processing nodes, to optional frame grabber modules and to the host PC, including display. The Odyssey Xpro offers superb scalability by way of a pair of link ports dedicated to interconnecting multiple boards. These ports provide point-to-point PCI-X connections, delivering up to 1 GB per second of bandwidth.

Plug-in modules
The Odyssey Xpro can capture from the majority of area or line scan video sources, thanks to a standard PCI mezzanine card (PMC) site located on the board that allows for the addition of Camera Link™ and analog frame grabber modules. The Camera Link module, which acquires up to 680 MB per second, is available in two versions. The dual-base version enables simultaneous acquisition from two completely independent Camera Link video sources using the Base configuration, while the single-full configuration acquires from a single Camera Link video source using the Base, Medium or Full configuration. The analog module, which acquires up to 800 MB per second, provides four 10-bit/100MHz channels that can be used independently or synchronized together.

Matrox Odyssey XCL
The Odyssey XCL is an entry-level, non-scalable version of the Odyssey Xpro, geared towards cost-sensitive yet computationally intensive applications. Also featuring the Motorola G4 PowerPC™ embedded microprocessor,

running at 600 MHz, the Odyssey XCL offers 256 MB of DDR SRAM memory, up to 1 GB per second of external I/O bandwidth, over 5 GB per second of memory bandwidth and delivers up to 120 BOPS. The Odyssey XCL also takes full advantage of PCI-X bus technology and integrates a Camera Link frame grabber that acquires up to 680 MB per second and offers the same configuration options as the Odyssey Xpro Camera Link module.

All-encompassing software environment
The Odyssey software development tools for both the Odyssey Xpro and Odyssey XCL offer developers a choice of application programming interfaces (APIs) and programming models. The board can be programmed using either the award-winning, hardware-independent Matrox Imaging Library (MIL) or the Matrox Odyssey Native Library (ONL), which is compatible with the Matrox Genesis family of vision processors. Both options come with royalty-free run-time environments.

Developers are provided with high-level algorithms and workload distribution across multiple boards. Highly optimized for the Odyssey family's onboard processors, these software libraries are carefully tuned to exhibit low function call overhead, thereby maximizing application efficiency and performance. In terms of application control, developers can either run their application remotely from the host PC, run it entirely on the board itself, or write their own custom functions for the Odyssey's onboard processors.

The Matrox Odyssey family offers support for Microsoft® Windows® 2000, Windows® XP, QNX® Neutrino® and Linux.

For more information, please call High-Tech Digital at 310-265-8203, or e-mail your questions to **info@high-techdigital.com**.

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AREA SCAN PRODUCTS: DALSTAR 1M28-SA

1M28-SA Stop-Action CMOS Camera

Features

- "Stop Action" (SA) imaging
- 1-Megapixel (1024 x 1024) resolution, 27fps
- CMOS image sensor
- LINLOG™ output response
- Windowing capability
- Camera Link™
- Selectable 8 or 10-bit digitization
- Robust and compact

The DALSTAR 1M28-SA is our newest area scan camera for electronics manufacturing, industrial metrology, medical imaging, and traffic management. The camera uses a one-megapixel (1024 x 1024), CMOS image sensor capable of running at up to 27 frames per second (fps) at full resolution. Frame rates over 100,000 fps can be achieved through windowing. Unlike regular CMOS imagers, our camera features an electronic global non-rolling shutter for “Stop Action” (SA) imaging, allowing for smear-free capture of fast moving objects. LINLOG(TM) technology provides high intrascene dynamic range (up to 120dB) for applications like traffic management and welding. Programmable features and diagnostics are accessible through the Camera Link™ MDR26 connector. The camera's small body and robustness make it perfect for the wear and tear of industrial environments.

A small, robust CMOS camera combining 1-megapixel resolution, high speed and "Stop Action" imaging.

Applications

- Electronics manufacturing
- Industrial metrology
- Medical imaging
- Traffic management

Specifications:

- 1M28-SA Datasheet

For more information, please call High-Tech Digital at 310-265-8203, or e-mail your questions to **info@high-techdigital.com**.

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