

Choosing a lens for Megapixel Imaging

Why lens selection matters for megapixel applications

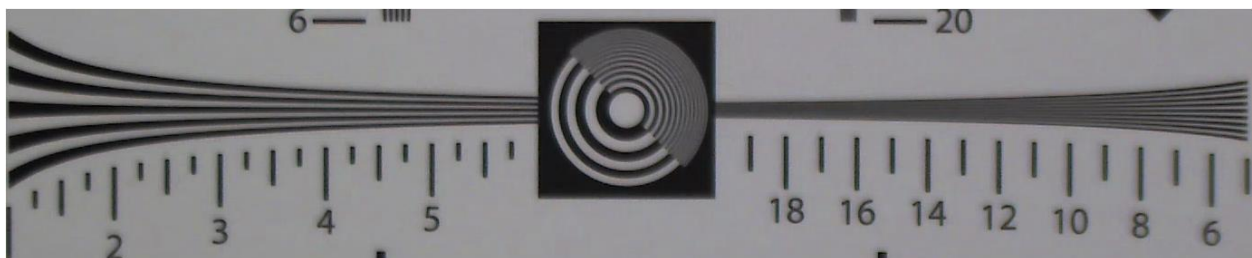
When designing or considering the purchase of a Megapixel video system, picking the correct lens is paramount. The lens is the very first step an image takes as it is captured by that system. With Analog and VGA resolution systems, this component of the video system was often overlooked. Using any lens off the distributor's shelf would usually provide an acceptable image by VGA standards because the resolution of the camera was not high enough to require a higher quality lens. This is not the case with Megapixel quality video!

The higher the pixel count of the sensor, the more important a high quality lens becomes for optimal image quality. As the resolution and pixel density increase, use of a substandard lens introduces issues such as aliasing and other issues related to modular transfer function.

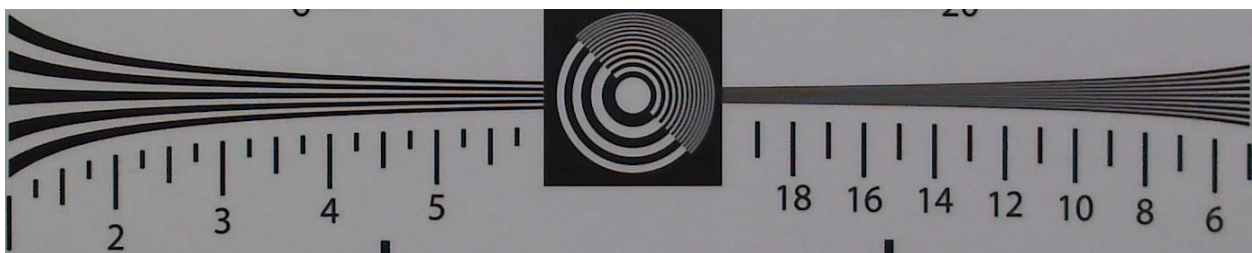
Why all megapixel lenses are not created equal

Not all lenses marked megapixel are of equal quality because there are no standards for specifying "megapixel", meaning "megapixel" quality lenses from two manufacturers could vary greatly. Specifications like line pairs per millimeter (lp/mm) which might provide some measure to compare are often not disclosed in the manufacturer's specifications. The physical pixel size can vary for different imagers as well so a lens rated with a high lp/mm for a 1/2" imager may perform differently on a 1/3" imager.

Image quality delivered by "megapixel" lenses of the same format, focal length, and F-stop from differing manufacturers can vary when applied to the same camera.



Lens A vs. Lens B, quality and image clarity can vary greatly with lenses of equal specifications:

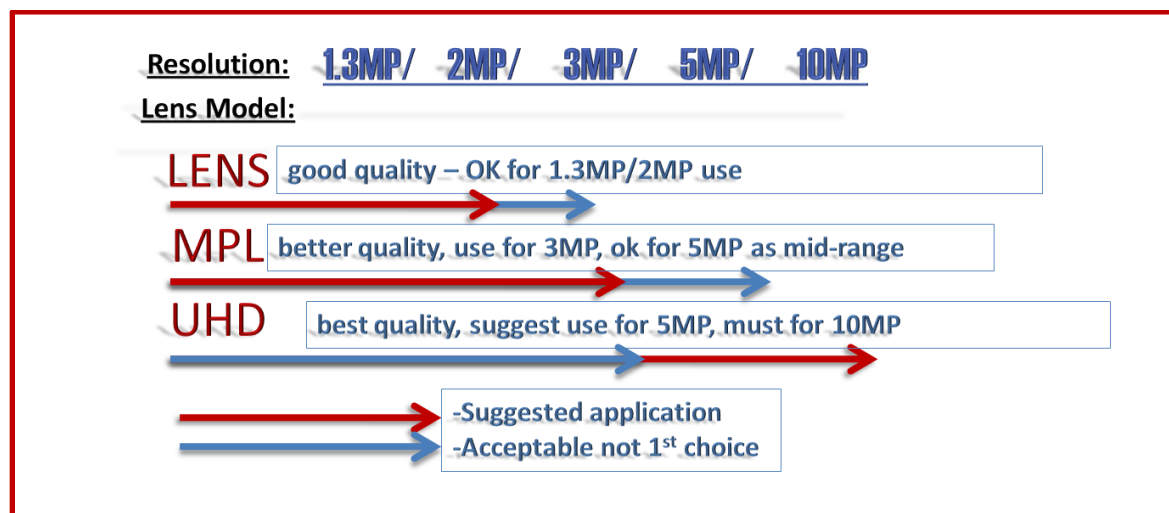


How to go about selecting the right lens?

Get a quality lens

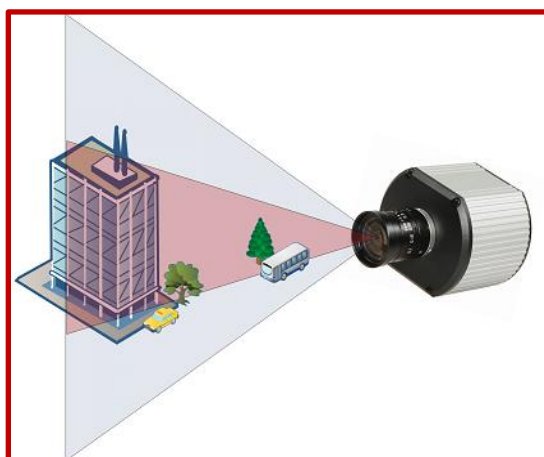
One way to be certain of getting a lens that meets the quality megapixel cameras require is to get it from Arecont Vision. All lenses that Arecont Vision sells are tested against a number of parameters and only the best are offered.

Arecont Vision offers three lens lines that represent different quality and pricing: LENS, MPL, UHD. The LENS line is low cost and good for 1.3 and 2MP. Depending on the application this line could meet the needs of a 3MP or 1080p camera. The MPL line is very cost competitive and has better quality than the LENS line. MPL lenses can be used on 1.3, 2, 1080p and 3MP cameras as well as could be a good mid-range 5MP lens. The UltraHD or UHD line is the flagship line specifically for the 10MP resolution. For critical 5MP applications, this line is recommended.

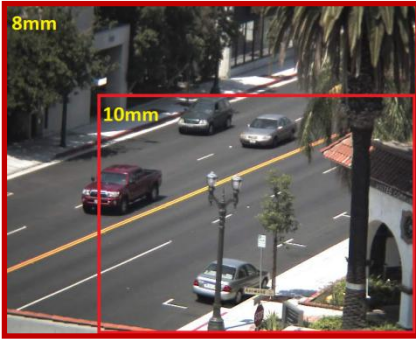


Arecont Vision also conducts the same testing against top tier lens manufacturers' "megapixel" lenses. The list of lenses that have successfully passed these tests is supplied at the end of this document.

Choose the lens to match the application (*Lens specifications & terminology*)



The angle of view determines the width and height of the image captured by the lens. This is often referred to as the field of view or FOV. The angle of view on a given lens is directly related to the focal length, what size sensor the lens is rated for, i.e. 1/3", 1/2", 2/3" and what size sensor is actually used Focal length is the distance between the focus point and the camera sensor and is specified in millimeters, i.e. 10mm. In the camera the image sensor is placed at the focal point of the lens. Some lenses have fixed focal points; others are called vari-focal. Vari-focal



lenses can be adjusted through a range of focal points and are usually specified and marked with the lowest and highest focal lengths they can be moved between, i.e. 8-16mm. The higher the focal length in millimeters (16mm in this example) the tighter the angle of view and conversely the smaller the focal length (8mm) in millimeters the wider the angle of view.”

Another common term in optics is “depth of field”. Depth of field refers to how well objects in the foreground and background are in focus at the same time. The depth of field is affected by the “F-stop” and the focal length. The F-stop, also referred to as the aperture, is the measurement of the light gathering ability of the lens. The larger the F-stop, the greater the depth of field. The F-stop or aperture is controlled by the lens Iris. The iris can be opened and closed to allow more or less light in depending on the application and light level.

This table depicts expected angle of view for Arecont Vision’s lens line up.

Arecont Vision Lens Series												
Series	lenses	Focal Length	Format	F-Stop	Mount	FOV-H				IR Coated	Fixed/Varifocal	DC AI
						AV cameras	Sensor optical format	Wide	Tele			
Lens	LENS2.3	2.3	1/2	2.0	CS		1/2"	185		no	Fixed	N O N O
	LENS4.0	4	1/2	2.0	CS		1/2"	90		no	Fixed	N O N O
	LENS6.0	6	1/2	2.0	CS		1/2"	64.5		no	Fixed	N O N O
	LENS8.0	8	1/2	2.0	CS		1/2"	45		no	Fixed	N O N O
	LENS12.0	12	1/2	2.0	CS		1/2"	30		no	Fixed	N O N O
	LENS4-10	4-10	1/2	1.8	CS		1/2"	94.8	37.3	no	Varifocal	Y E S
	LENS4-10AI	4-10	1/2	1.8	CS		1/2"	94.8	37.3	no	Varifocal	N O N O
	LENS4-13	4-13	1/2	1.8	CS		1/2"	90.3	31.2	yes	Varifocal	N O N O
MPL	MPL4.0	4	1/1.8	1.8	CS	AV13XX	1/2"	76.8		yes	Fixed	N O
						AV21XX	1/2"	96				
						AV31XX	1/2"	94				
						AV51XX	1/2.5"	82				
						AV100XX*	1/2.3"	92				
						AV28XX	1/2.7"	86				

	MPL6.0	6	1/2	1.4	C	AV13XX	1/2"	48	no	Fixed	N O	
						AV21XX	1/2"	60				
						AV31XX	1/2"	58				
						AV51XX	1/2.5"	51				
						AV100XX*	1/2.3"	57				
						AV28XX	1/2.7"	52				
	MPL8.0	8	1/1.8	1.8	CS	AV13XX	1/2"	37.6	Yes	Fixed	N O	
						AV21XX	1/2"	47				
						AV31XX	1/2"	45				
						AV51XX	1/2.5"	40				
AV100XX*						1/2.3"	45.5					
MPL	MPL4-12	4-12	1/2	1.4	CS	AV13XX	1/2"	72	28	Yes	Varifocal	N O
						AV21XX	1/2"	90	36			
						AV31XX	1/2"	88	36			
						AV51XX	1/2.5"	75	42			
						AV100XX*	1/2.3"	86	35			
	MPL4-10	4.5-10	1/2	1.6	CS	AV13XX	1/2"	68	31.3	Yes	Varifocal	N O
						AV21XX	1/2"	85	39.1			
						AV31XX	1/2"	83	38.5			
						AV51XX	1/2.5"	71.5	33.4			
						AV100XX*	1/2.3"	81	37.5			
						AV28XX	1/2.7"	73.5	34			
	MPL8-16	8-16	1/2	1.6	CS	AV13XX	1/2"	37.7	19.2	yes	Varifocal	N O
						AV21XX	1/2"	47.1	24			
						AV31XX	1/2"	45.5	23.7			
						AV51XX	1/2.5"	40	21			
						AV100XX*	1/2.3"	45	23			
						AV28XX	1/2.7"	41	21.2			
	UHD	M118FM08	8	1/1.8"	1.4	C	AV51XX	1/2.5"	40.3	no	Fixed	N O
AV100XX							1/2.3"	45.1				
M118FM16		16	1/1.8"	1.4	C	AV51XX	1/2.5"	20.3	no	Fixed	N O	
						AV100XX	1/2.3"	22.8				
JHF25M		25	2/3"	1.4	C	AV51XX	1/2.5"	13	no	Fixed	N O	
						AV100XX	1/2.3"	14.6				
JHF35M		35	2/3"	1.4	C	AV51XX	1/2.5"	9.3	no	Fixed	N O	
						AV100XX	1/2.3"	10.5				

Application note for **Megapixel Imaging**



The following table lists some of the highest optical quality lenses available and suitable for use with Arecont Vision megapixel cameras. Please note that the horizontal field of view “Wide” column is the FOV for the listed optical format and will vary slightly for differing resolution cameras due to image sensor size variation between models.

Manufacturer	lenses	Focal Length	Format	F-Stop	Mount	1/2" Sensor FOV-H		IR Coated	Fixed/Varifocal	DC AI
						Wide	Tele			
Computar	H0514-MP	5	1/2	1.4	c	65.5		no	Fixed	no
Computar	M0814-MP	8	2/3	1.4	c	42.5		no	Fixed	no
Computar	M1214-MP	12	2/3	1.4	c	30		no	Fixed	no
Computar	M1614-MP	16	2/3	1.4	c	22.7		no	Fixed	no
Computar	M2514-MP	25	2/3	1.4	c	14.6		no	Fixed	no
Computar	M3514-MP	35	2/3	1.4	c	13.9		no	Fixed	no
Computar	M5018-MP	50	2/3	1.8	c	7.6		no	Fixed	no
Computar	M7528-MP	75	2/3	2.8	c	5		no	Fixed	no
Computar	H2Z0414C-MP	4-8	1/2	1.4	c	90.4	47	no	Varifocal	no
Computar	HG2Z0414FC-MP	4-8	1/2	1.4	C	90.4	47	no	Varifocal	yes
Computar	M3Z1228C-MP	12-36	2/3	2.8	C	30.2	10	no	Varifocal	no
Computar	H3Z4518CS-MPIR	4.5-13.2	1/2	1.8	cs	80	28.6	yes	Varifocal	no

Manufacturer	lenses	Focal Length	Format	F-Stop	Mount	1/2" Sensor FOV-H		IR Coated	Fixed/Varifocal	DC AI
						Wide	Tele			
Fujinon	DV3.4X3.8SA-1	3.8-13	1/2	1.4	c	97	28	no	Varifocal	no
Fujinon	DV3.4X3.8SA-SA1	3.8-13	1/2	1.4	c	97	28	no	Varifocal	yes
Fujinon	HF9HA-1B	9	2/3	1.4	c	39		no	Fixed	no
Fujinon	HF12.5HA-1B	12.5	2/3	1.4	c	28		no	Fixed	no
Fujinon	HF16HA-1B	16	2/3	1.4	c	22		no	Fixed	no
Fujinon	HF25HA-1B	25	2/3	1.4	c	14		no	Fixed	no
Fujinon	HF35HA-1B	35	2/3	1.4	c	10		no	Fixed	no
Fujinon	HF50HA-1B	50	2/3	1.4	c	7		no	Fixed	no
Fujinon	HF75HA-1B	75	2/3	1.4	c	5		no	Fixed	no
Fujinon	DV10x8SA-SA1	8-80	1/2	1.4	c	44.2	4.3	no	Varifocal	yes
Fujinon	DV10x8SA-1	8-80	1/2	1.4	c	44.2	4.3	no	Varifocal	no
Manufacturer	lenses	Focal Length	Format	F-Stop	Mount	1/2" Sensor FOV-H		IR Coated	Fixed/Varifocal	DC AI
SpaceCom	HD880DCIR	8-80	1/2	1.6	c	46.6	34.3	YES	varifocal	no
Manufacturer	lenses	Focal Length	Format	F-Stop	Mount	1/2" Sensor FOV-H		IR Coated	Fixed/Varifocal	DC AI

Application note for Megapixel Imaging



Manufacturer	lenses	Focal Length	Format	F-Stop	Mount	1/2" Sensor FOV-H		IR Coated	Fixed/Varifocal	DC AI
						Wide	Tele			
Tamron	M12VG412	4-12	1/2	1.4	c	100.5	33.4	no	Varifocal	yes
Tamron	M12VM412	4-12	1/2	1.4	c	100.5	33.4	no	Varifocal	no
Tamron	23FM16SP	16	2/3	1.4	c	22.7		no	Fixed	no
Tamron	23FM25SP	25	2/3	1.4	c	14.6		no	Fixed	no
Tamron	23FM50SP	50	2/3	2.8	c	7.3		no	Fixed	no
Manufacturer	lenses	Focal Length	Format	F-Stop	Mount	1/2" Sensor FOV-H		IR Coated	Fixed/Varifocal	DC AI
						Wide	Tele			
Theia	SY110M	1.7	1/3	1.8	CS	120		no	Fixed	no
Theia	SY110A	1.7	1/3	1.8	CS	120		no	Fixed	yes
Theia	SY125M	1.3	1/3	1.8	CS	135		no	Fixed	no
Theia	SY125A	1.3	1/3	1.8	CS	135		no	Fixed	yes
Theia	MY125M	1.3	1/3	1.8	C	135		no	Fixed	no
Manufacturer	lenses	Focal Length	Format	F-Stop	Mount	1/2" sensor FOV-H		IR Coated	Fixed/Varifocal	DC AI
						Wide	Tele			
Kowa	LM8JC10M	8.5	2/3"	1.8	c	40.8		no	Fixed	no
Kowa	LM12JC10M	12	2/3"	1.8	c	28.9		no	Fixed	no
Kowa	LM16JC10M	16	2/3"	1.8	c	22		no	Fixed	no
Kowa	LM25JC10M	25	2/3"	1.8	c	14.6		no	Fixed	no
Kowa	LM35JC10M	35	2/3"	2	c	10.4		no	Fixed	no
Kowa	LM50JC10M	50	2/3"	2.8	c	7.3		no	Fixed	no
Manufacturer	lenses	Focal Length	Format	F-Stop	Mount	1/2" sensor FOV-H		IR Coated	Fixed/Varifocal	DC AI
						Wide	Tele			
Fujion	HF12.5SA-1	12	2/3"	1.4	c	28.43		no	Fixed	no
Fujion	HF16SA-1	16	2/3"	1.4	c	22.37		no	Fixed	no
Fujion	HF25SA-1	25	2/3"	1.4	c	14.35		no	Fixed	no
Fujion	HF35SA-1	35	2/3"	1.4	c	10.27		no	Fixed	no
Fujion	HF50SA-1	50	2/3"	1.8	c	7.19		no	Fixed	no
Fujion	HF75SA-1	75	2/3"	1.8	c	4.53		no	Fixed	no
Manufacturer	lenses	Focal Length	Format	F-Stop	Mount	1/2" sensor FOV-H		IR Coated	Fixed/Varifocal	DC AI
						Wide	Tele			
Tokina	KCM-0914MP5	9	2/3"	1.4	c	38.2		no	Fixed	no
Tokina	KCM-12514MP5	12.5	2/3"	1.4	c	28		no	Fixed	no
Tokina	KCM-1814MP5	18	2/3"	1.4	c	20.4		no	Fixed	no
Manufacturer	lenses	Focal Length	Format	F-Stop	Mount	1/2.3" sensor FOV-H		IR Coated	Fixed/Varifocal	DC AI
						Wide	Tele			
Tamron	M118FM25	25	1/1.8"	2.8	c	15		no	Fixed	no
Tamron	M118FM50	50	1/1.8"	2.8	c	7.7		no	Fixed	no

Application note for **Megapixel Imaging**



Manufacturer	lenses	Focal Length	Format	F-Stop	Mount	1/2" Sensor FOV-H	IR Coated	Fixed/Varifocal	DC AI	
Manufacturer	lenses	Focal Length	Format	F-Stop	Mount	1/2.3" sensor FOV-H		IR Coated	Fixed/Varifocal	DC AI
						Wide	Tele			
Space Com	Pyxis8 / JHF8M	8	2/3"	2.8	c	40.4		no	Fixed	no
Space Com	Pyxis12 / JHF12M	12.5	2/3"	1.4	c	27.58		no	Fixed	no
Space Com	Pyxis16 / JHF16M	16	2/3"	1.4	c	20.82		no	Fixed	no

Note: Lenses on these pages shaded Orange are acceptable quality for use with 10 Megapixel model cameras.