



## PI-MAX3: 1024 x 256

The PI-MAX3: 1024 x 256 from Princeton Instruments is the next generation, fully-integrated scientific intensified CCD camera (ICCD) system featuring a 1024 x 255 spectroscopy CCD fiber-coupled to a variety of Gen II, Gen III filmless and proprietary Unigen™ II intensifiers. The intensifiers offer the highest possible sensitivity from UV to NIR and offer resolution that is ideally matched to the CCD. Nanosecond gating capability and an integrated programmable timing generator (SuperSYNCHRO™) built into the camera make these ICCD cameras ideal for time-resolved imaging and spectroscopy applications. Kinetics mode is available for time-resolved spectral acquisition. **PI-MAX3: 1024 x 256 is the only ICCD camera in the market today to offer both high frame rate at 2 MHz/16-bit digitization, 1 MHz sustained gating repetition rate and exceptional sensitivity.**

FEATURES	BENEFITS
1024 x 255 imaging array	High resolution imaging and spectroscopy
2 MHz / 16-bit digitization	Video frame rates and higher to efficiently synchronize with high repetition rate lasers
Thermoelectric cooling	Reduces CCD dark current to negligible levels
Photocathode cooling	Reduces EBI of the photocathode by as much as 20x
A selection of intensifiers Gen II Gen III filmless	Best sensitivity and gate speed in the desired wavelength range Best combination of UV-Blue sensitivity and fast gating (SB); RB provides wide spectral coverage Offers highest sensitivity and fastest gate speed
Fiber optic coupling	Highest optical throughput; No vignetting
Nanosecond gating	Temporal resolution for effective background discrimination, kinetics imaging and spectroscopy
Super HV™ - Built-in high voltage pulser	Rugged design for high rep rate gating and minimal insertion delay
SuperSYNCHRO™ - Built-in programmable timing generator	Built-in, fully software controlled gate timing; Controls gate widths and delays in linear, or exponential increments; Low insertion delay (25 nsec). See page 3 for more info.
MCP gating	Provides < 8 nsec gate width for slow gate intensifiers while preserving high QE
Bracket pulsing™	Preserves high ON/OFF ratio of the Gen II intensifier in the UV - No sync pulse required
GigE interface	Industry standard for fast data transfer over long distances
WinSpec/WinView and PVCAM®	Offers powerful, easy-to-use set of Windows GUI controls; Automatic data acquisition, analysis and display; PVCAM provides unified programming interface for custom programming
LabVIEW™ Scientific Imaging Tool Kit (SITK™)	Pre-defined LabView VIs provide easy integration of the camera into complex experiment setup

### Applications:

Fluorescence Lifetime Imaging Microscopy (FLIM),  
Time Resolved Imaging & Spectroscopy, Combustion, Planar Laser  
Induced Fluorescence (PLIF)

## SPECIFICATIONS

CCD						
Image sensor	e2v CCD 30-11; scientific grade; front illuminated, MPP CCD					
CCD format	1024 x 255 pixels; 26 $\mu\text{m}$ x 26 $\mu\text{m}$ pixels 18 mm x 6.7 mm (using 18 mm intensifier); 25 mm x 6.7 mm (center region using 25 mm intensifier)					
System read noise (typical)						
@ 500 kHz digitization	15 e- rms					
@ 1 MHz digitization	20 e- rms					
@ 2 MHz digitization	35 e- rms					
Pixel Full Well	450 ke-					
Dark current @ -25°C (typical)	4 e-/p/sec					
Deepest cooling temperature	-25°C (Air)					
@ 20°C ambient	-30°C (Water assist)					
Vertical Shift Rate	10 $\mu\text{sec}/\text{row}$ (variable via software)					
INTENSIFIER						
Intensifiers available	18 mm - Gen II, Gen III filmless (Contact Princeton Instruments for 25 mm intensifiers)					
Method of coupling to the CCD	1:1 fiber optic					
Intensifier type	Gen II			Gen III <i>Filmless</i>		
	UV	SB	RB	HBf	HQf	HRf
Wavelength Range	See QE curves					
Min. Gate Width (Optical FWHM) *						
Fast Gate	~ 2 nsec (Typ), 3 nsec (Guar)			~ 2 nsec (Typ), 3 nsec (Guar)		
Slow Gate	< 200 nsec for SB; < 8 nsec (with MCP gating)			-NA-		
Repetition Rate: Sustained	1 MHz; 6 kHz with MCP gating					
Resolution limit	40 to 64 lp/mm			57 to 64 lp/mm		
EBI						
Photo e-/pixel/sec @ room temp (with photocathode cooling)	0.05 - 0.2 (0.005 - 0.02)			0.02 (0.002)		
Phosphor	P43 (P46 optional)					
Operating Environment	+5°C to +30°C non-condensing					
Storage Environment	-25°C to +55°C					
Certification	CE					

NOTE: \* Gating speeds for 18 mm intensifiers only.

All specifications subject to change. Contact your local sales representative for more information.

## SPECTRAL RATES

Binning	1024 x 256	1024 x 10*	1024 x 1*
1 x 1	6.67		
1 x 256	270		
1 x 10		1567	
1 x 1			1831

NOTE: Frames/second @ 2 MHz. \* CCD format using custom chip mode.

## SuperSYNCHRO™ Timing Generator

The PI-MAX3's integrated SuperSYNCHRO™ Timing Generator lets researchers set gate pulse widths and delays under GUI software control. The closed coupled SuperSYNCHRO significantly reduces the system delay inherent in the timing generator of ICCD cameras. The integrated timing generator means there is no need for an additional external timing generator, and a built-in Super HV high voltage pulser eliminates the requirement for an external high-voltage supply, making the PI-MAX3 camera one of the most advanced ICCD cameras on the market.

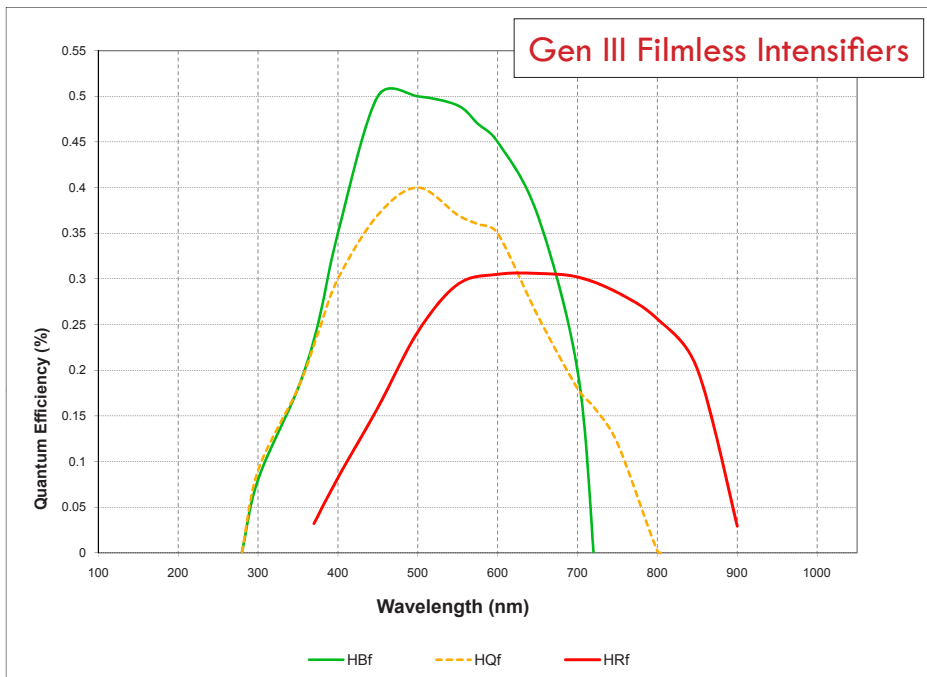
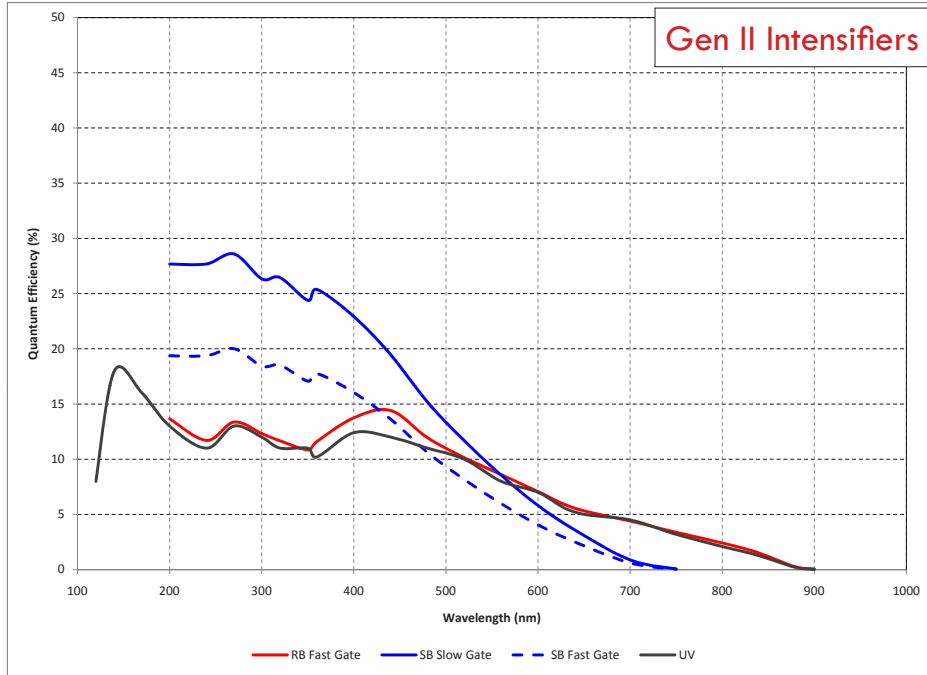
FEATURE	BENEFITS
Closed Coupled Design	Short signal paths for minimum insertion delays
On-board memory	Store and execute complex gate width/delay sequences with no software overhead
Internal oscillator*	Drive an external event and initiate repetitive experiments.
SyncMASTER Pulses	Independent continuous TTL outputs to trigger pulsed external devices, e.g. laser and Q-switch; Minimum experiment jitter
Configurable Trigger inputs	Synchronizes camera to a wide variety of standard and non-standard trigger sources.
Full Software Control	Easy setup and execution of complex gate width/delay sequences

## SuperSYNCHRO™ Specifications

Internal Timing Generator	0.05 Hz - 1 MHz
Gate Delay + Width Range*	~0.01 ns to 21 sec (from T0)
Timing resolution/ Timing jitter	10 ps/ 35ps rms
Insertion delay	< 27 ns (trigger in to intensifier opening); < 225 ns (with MCP gating)
<b>TRIGGER INPUTS</b>	
External Sync (Trigger In)	-5 v to +5 v (including TTL); AC/DC coupling: 50 ohm / High Z Variable Threshold; +ve or -ve edge
Pre Trigger In	TTL input. A rising edge will stop CCD Cleans and set camera to wait for the external trigger for fastest response.
<b>TRIGGER OUTPUTS</b>	
SyncMASTER <sub>1</sub>	Programmable continuous frequency output to synchronize external devices with PI-MAX3, e.g. Laser
SyncMASTER <sub>2</sub>	Programmable continuous frequency output (delay from SyncMASTER <sub>1</sub> - 100 ns - 6.55 msec) synchronize external devices with PI-MAX3, e.g. Q-switch
T0	TTL Signal: T0 indicates start of timing sequence
Monitor	TTL signal to monitor actual gate timing
Ready	TTL signal. Represents camera status. It changes state when ready just before the exposure.
Aux	DC coupled programmable delay (Delay from T0 - 0.01ns - 1 sec) trigger output to synchronize external devices with PI-MAX3
Logic	Software programmable: Select one of the following signals: Acquiring, Image Shift, Logic 1, Readout, Shutter or Wait for trigger. See users' manual for detailed signal descriptions.

\* Software programmable

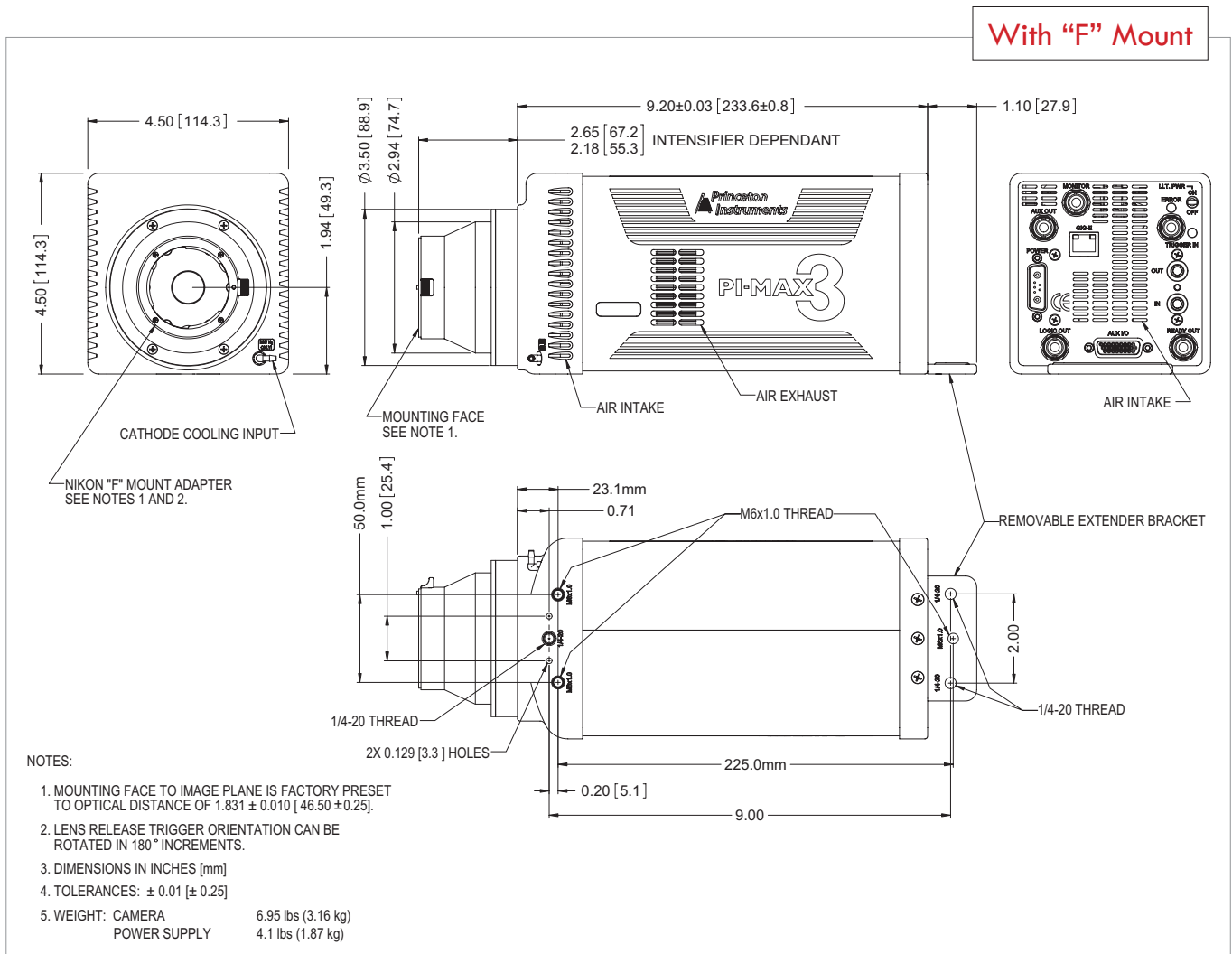
Quantum Efficiency Curves





## PI-MAX3:1024 x 256 Drawing

With "F" Mount



NOTES:

1. MOUNTING FACE TO IMAGE PLANE IS FACTORY PRESET TO OPTICAL DISTANCE OF 1.831 ± 0.010 [46.50 ± 0.25].
2. LENS RELEASE TRIGGER ORIENTATION CAN BE ROTATED IN 180° INCREMENTS.
3. DIMENSIONS IN INCHES [mm]
4. TOLERANCES: ± 0.01 [± 0.25]
5. WEIGHT: CAMERA 6.95 lbs (3.16 kg)  
POWER SUPPLY 4.1 lbs (1.87 kg)

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