Princeton Instruments

PI-MAX®4: 1024f

The PI-MAX4:1024f from Princeton Instruments is the next generation, fully-integrated scientific intensified CCD camera (ICCD) system featuring a 1k x 1k full-frame CCD fiberoptically coupled to a variety of Gen II and Gen III filmless intensifiers. The intensifiers provide the highest possible sensitivity from UV to NIR and offer resolution that is ideally matched to the CCD. Picosecond gating capability of < 500 ps and an integrated programmable timing generator (SuperSynchro) built into the camera make these ICCD cameras ideal for time-resolved imaging and spectroscopy applications.

PI-MAX4:1024f is the only ICCD camera on the market today to offer high frame rate at 10MHz/16-bit digitization, 1 MHz sustained gating repetition rate and exceptional sensitivity.

FEATURES	BENEFITS
1024 x 1024 Imaging Array	High resolution imaging and spectroscopy
10 MHz* / 16-bit digitization	Video frame rates and higher to efficiently synchronize with high repetition rate lasers
Kinetics mode	Allows high speed images / spectra capture
Wide selection of intensifiers *Gen II* *Gen III filmless*	Best sensitivity and gate speed in the desired wavelength range Provides wide spectral coverage with UV, SB, RB and SR intensifiers from UV - NIR, with options for MCP gating and Picosecond gating Offers highest sensitivity and option for Picosecond gating
Fiberoptic coupling	Highest optical throughput; No vignetting
Optional: Picosecond gating	< 500 ps gating delivers high temporal resolution for effective background discrimination
Super HV - Built-in high voltage pulser	Rugged design without a bulky external controller, for high repetition 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 (~ 27 ns). *See page 3 for more info.*
SyncMaster I and II	Provides continuous TTL signals to control external instruments such as a laser; Eliminates need for external timing generater in most experiments
MCP gating	Provides < 8 ns 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, up to 50 M
Optional: LightField® (for Windows 8/7, 64-bit) Or WinView/Spec (for Windows 8/7/XP, 32-bit)	Flexible software packages for data acquisition, display and analysis; LightField offers intuitive, cutting edge user interface, IntelliCal® and more.
PICAM (64-bit) / PVCAM (32-bit) software development kits (SDKs)	Compatible with Windows 8/7/XP, and Linux; Universal programming interfaces for easy custom programming.
LabVIEW Scientific Imaging Tool Kit (SITK®)	Pre-defined LabView vis provide easy integration of the camera into complex experiment setup

* With dual port readout at 5 MHz/port

Detector shown with a C-mount nose and lens, sold separately

Applications:

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

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CCD							
Image sensor	e2v CCD 47-10 scientific grade full-frame CCD						
CCD format	1024 x 1024 imaging pixels; 13.0 x 13.0 µm pixels; 13.3 x 13.3 (18.8 mm diagonal)						
System read noise (e- rms) @ 1 MHz digitization @ 2 MHz digitization @ 10 MHz digitization	Typical 7.0 9.0 20.0	Maximum 10 17 30.0					
Pixel full well	100 ke-						
Dark current @ -25° C (max)	2 e-/p/sec						
CCD temperature @ + 23° C room temperature @ + 20° C ambient	 -20° C (Air), -30° C (Liquid assist), Guaranteed -25° C (Air), -35° C (Liquid assist)						
Vertical shift rate	6.0 µs/row						
INTENSIFIER							
Intensifiers available	18 mm - Gen II, Gen III filmless						
Method of coupling to the CCD	1:1 fiber optic						
Intensifier type	Gen II				Gen III *Filmless*		
	UV	SB	RB	SR	HBf	HRf	InGaAs
Wavelength range	See QE curves, pages 4 & 5						
Min. Gate Width (Optical FWHM)* Optional Picosecond Gate Fast Gate Slow Gate	 < 500 ps (for Fast Gate tubes only) ~ 2 ns (typical), 3 ns (guaranteed) For SB only: < 200 ns, < 8 ns (w/MCP gating)				 < 500 ps (for Fast Gate tubes only) ~ 2 nsec (typical), 3 nsec (guaranteed) -NA-		
Repetition rate: Sustained	1 MHz; 100 kHz with Picosecond gating; 8 kHz with MCP gating; 6.25 kHz with MCP bracket pulsing						
Resolution limit	40 to 64 lp/mm				57 to 64 lp/mm		
Equivalent Background Illumination (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, P47 optional)						
Operating environment	+5° C to +30° C non-condensing						
Storage environment	-25° C to +55° C						
Certification	CE						

* Measured with 18 mm intensifier. Contact your local sales representative for more information.
All specifications subject to change.

FRAME RATES

Binning	1024 x 1024	512 x 512	256 x 256
1 x 1	7.69	14.8	17.2
2 x 2	19.6	35.2	58.8
4 x 4	33.9	56.5	85.5

NOTE: Frames per second at 10MHz

The PI-MAX4'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 *em*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-MAX4 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 / 35 ps rms
Insertion delay	< 27 ns (trigger in to intensifier opening)
TRIGGER INPUTS	
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. User selectable option.
TRIGGER OUTPUTS	
$SyncMASTER_1$	Programmable continuous frequency output to synchronize external devices with PI-MAX4, e.g. Laser
$SyncMASTER_2$	Programmable continuous frequency output (delay from $SyncMASTER_1$ - 100 ns - 6.55 msec) synchronize external devices with PI-MAX4, 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-MAX4
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

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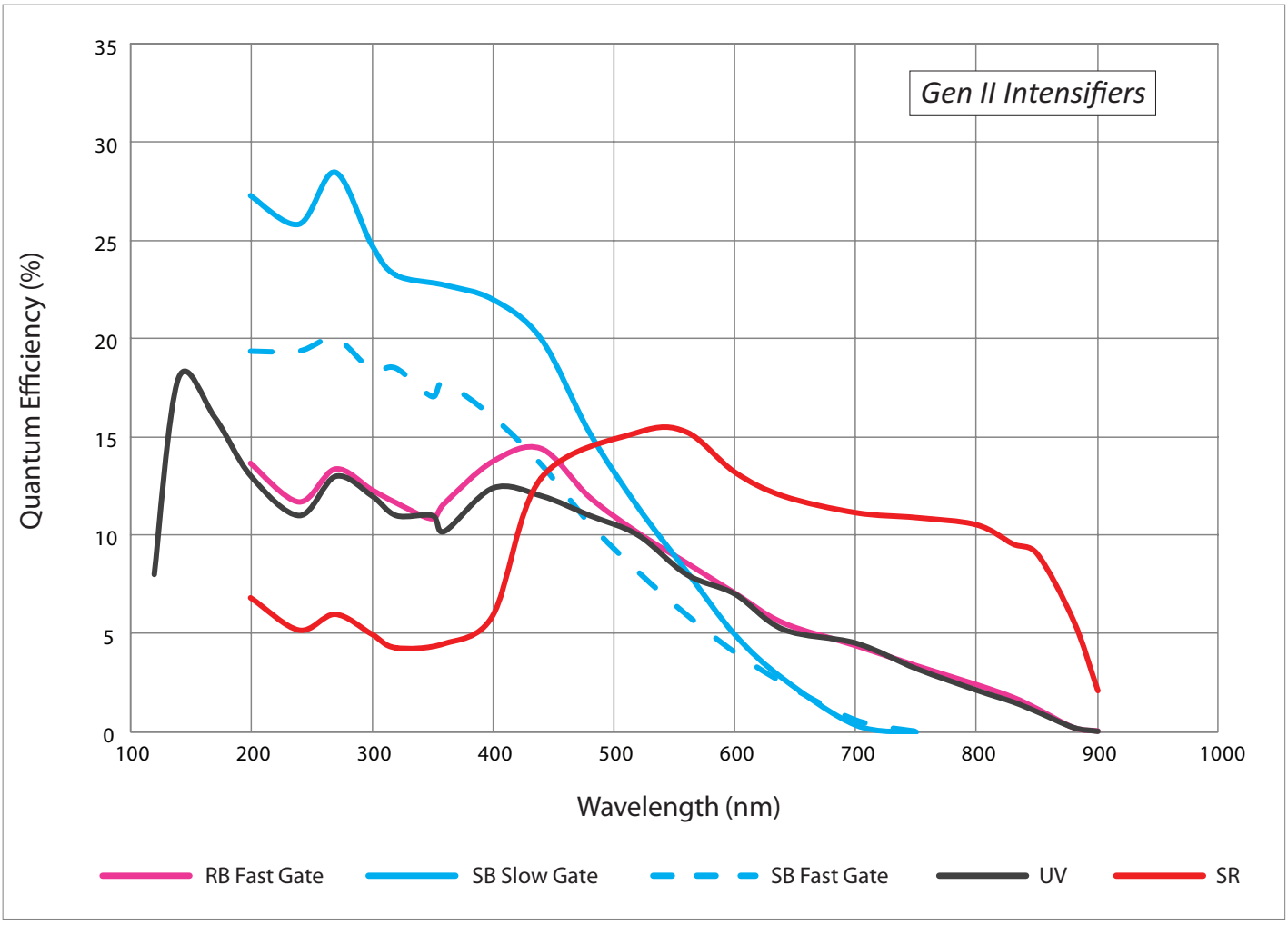
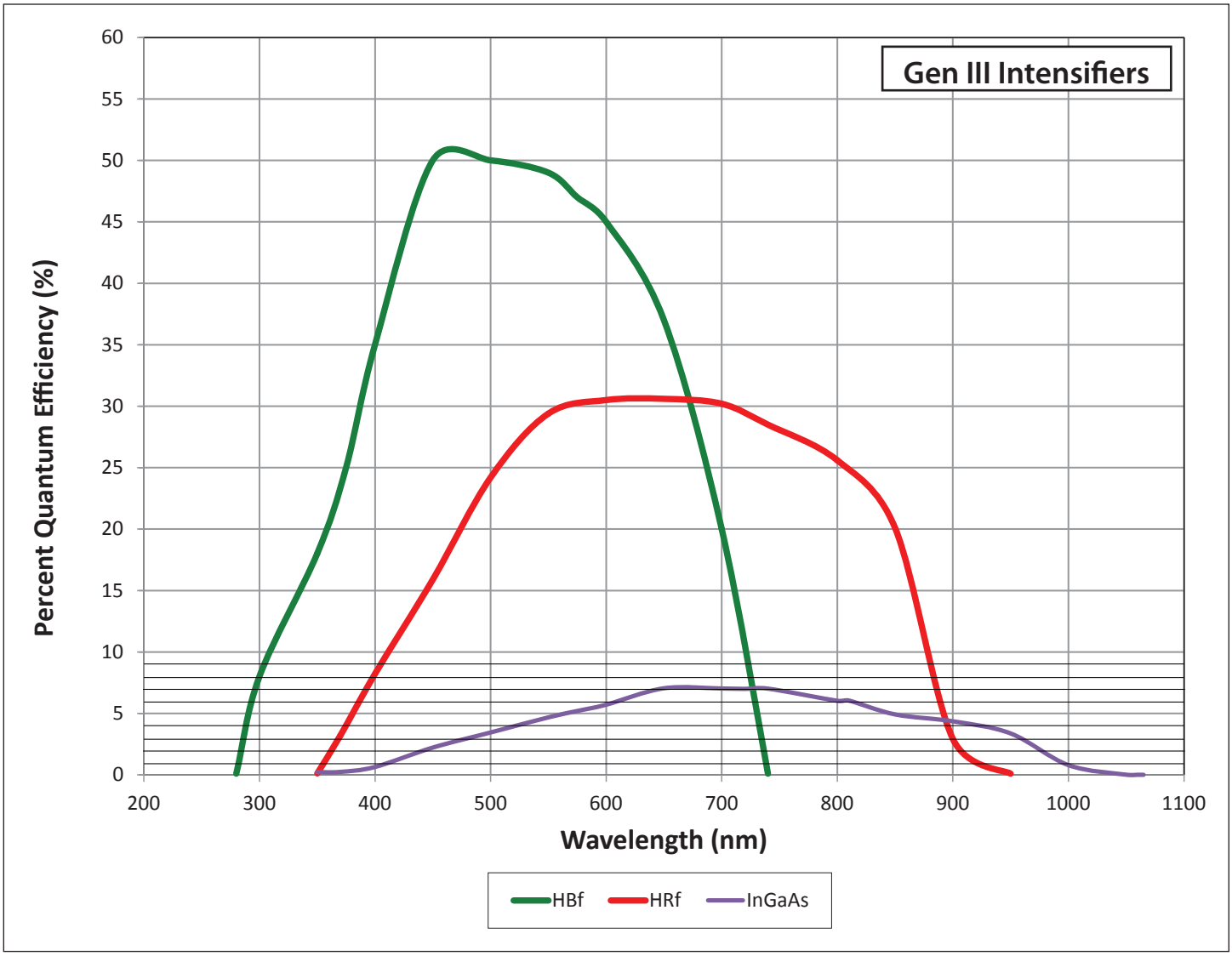
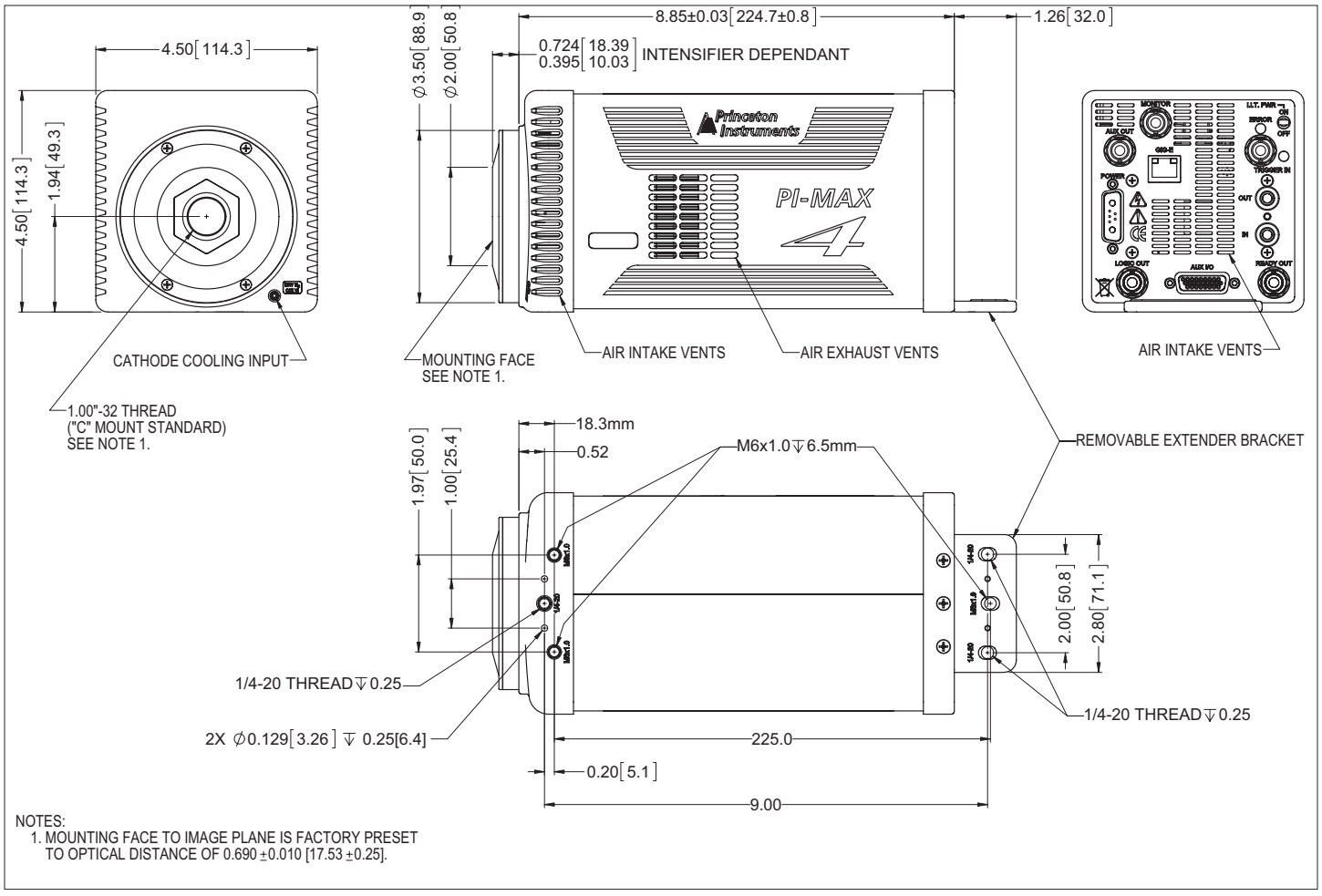

Gen II Intensifiers
Quantum Efficiency (%)
35
30
25
20
15
10
5
0
100
200
300
400
500
600
700
800
900
1000
Wavelength (nm)
RB Fast Gate
SB Slow Gate
SB Fast Gate
UV
SR


Gen III Intensifiers
Percent Quantum Efficiency (%)
60
55
50
45
40
35
30
25
20
15
10
5
0
200
300
400
500
600
700
800
900
1000
1100
Wavelength (nm)
HBf
HRf
InGaAs

OUTLINE DRAWING
"C" MOUNT



NOTES:
1. MOUNTING FACE TO IMAGE PLANE IS FACTORY PRESET TO OPTICAL DISTANCE OF 0.690 ±0.010 [17.53 ±0.25].

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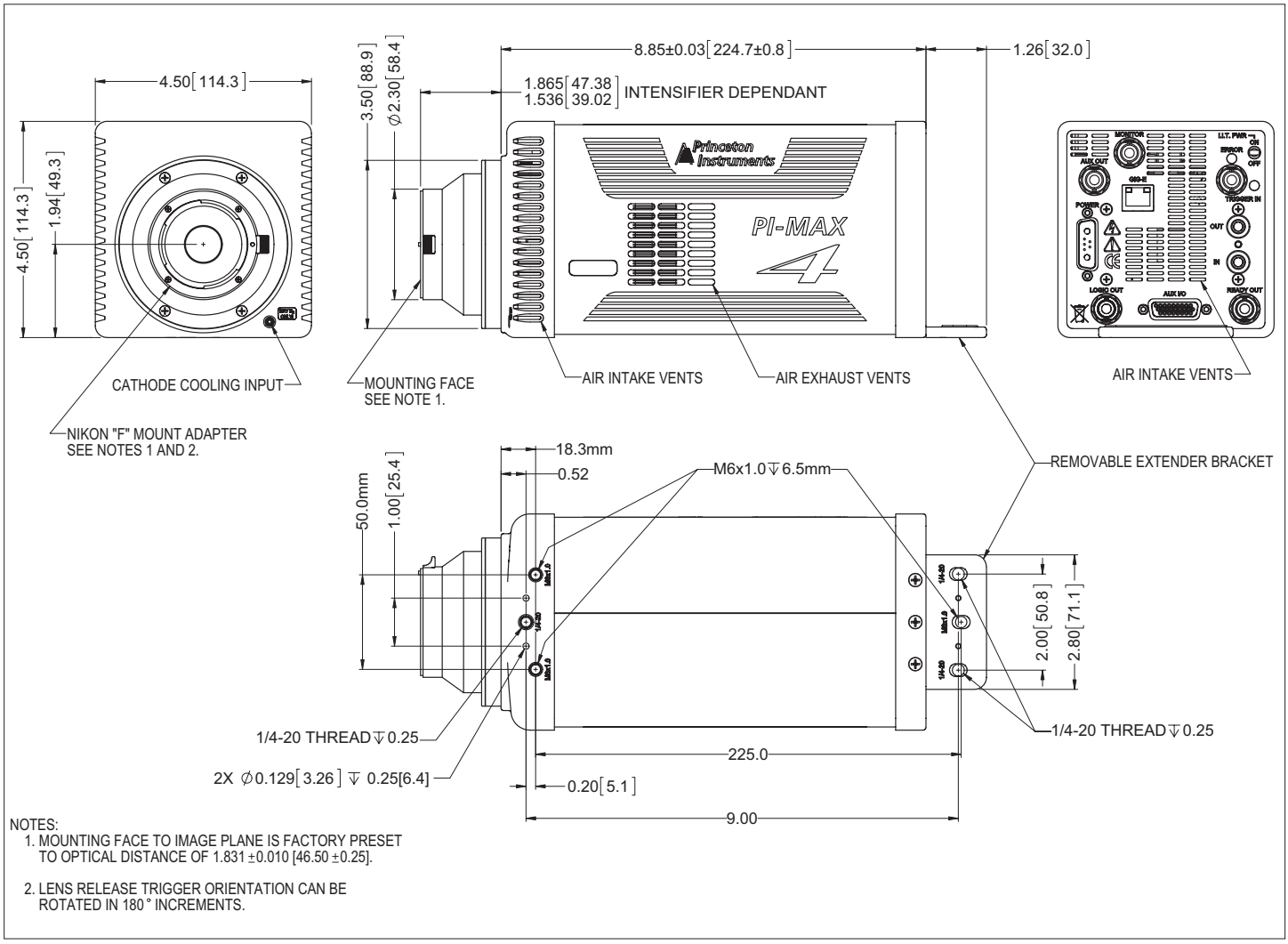
OUTLINE DRAWING
"F" MOUNT



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.

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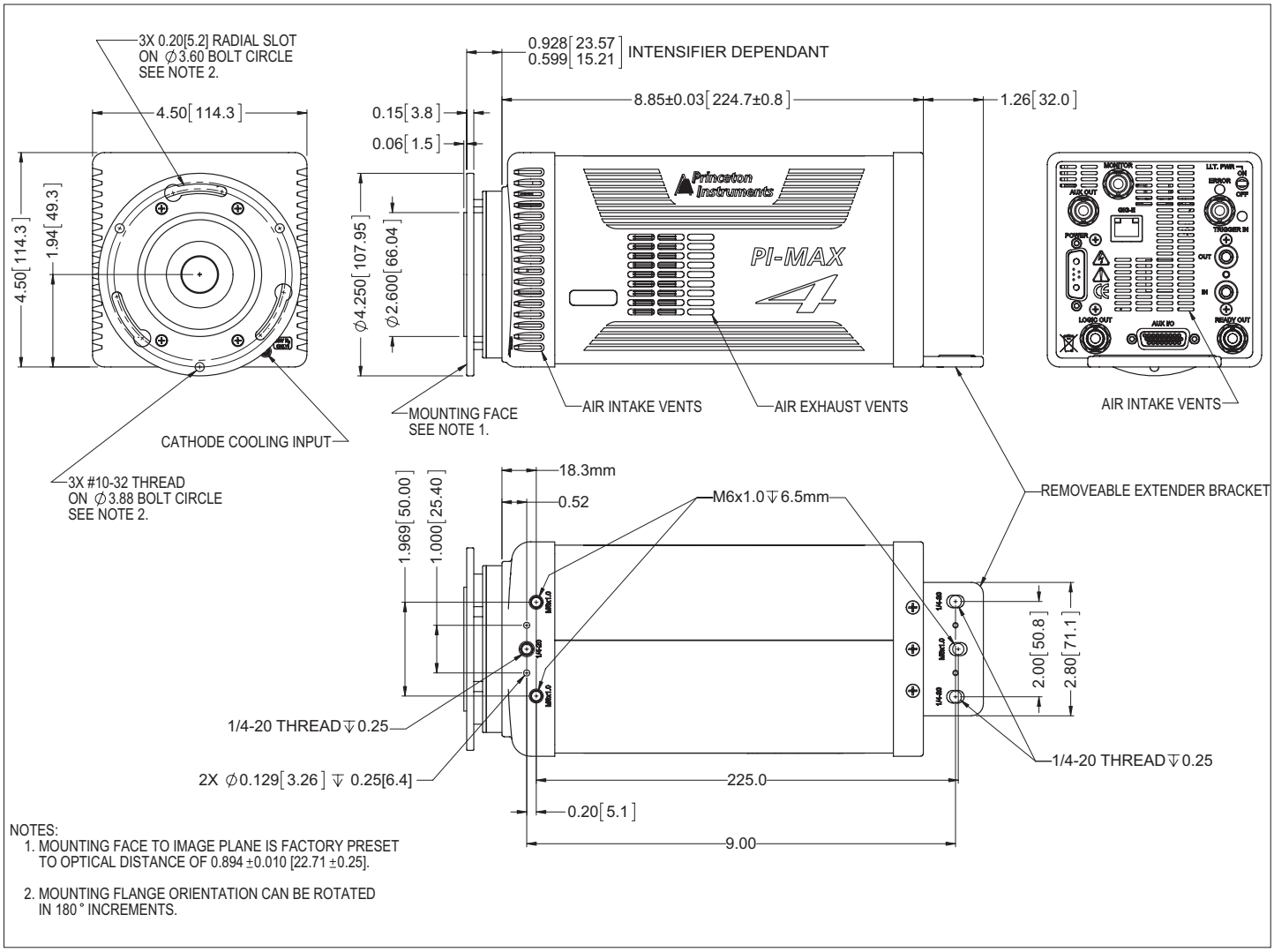

NOTES:
1. MOUNTING FACE TO IMAGE PLANE IS FACTORY PRESET TO OPTICAL DISTANCE OF 0.894 ±0.010 [22.71 ±0.25].
2. MOUNTING FLANGE ORIENTATION CAN BE ROTATED IN 180 ° INCREMENTS.