

SPECIFICATION	VHS-2146A7	31/07/2012
HiCATT25 (D, P, S, GF, SH options) – Intensifying high-speed camera attachment, with Gen2/Gen3 Hybrid Intensifier, fast gating and relay optics for use in combination with high speed cameras.		

Specification **HiCATT 25**

Intensifying high-speed camera attachment, with Gen2/Gen3 Hybrid Intensifier



Description

The **HiCATT 25** is an intensifying camera attachment specially designed for use in combination with high-speed cameras. The HiCATT 25 amplifies low-light-signals to a level that is up to 10.000 times higher. This way the sensitivity of the attached high-speed camera is increased and high-speed, low-light-level imaging is possible. The hybrid Image Intensifier of the **HiCATT 25** consists of 2 stages. The first stage, a 25mm Gen2/Gen3 proximity focused MCP intensifier, offers a very high, adjustable gain. The second stage, a 25mm proximity focussed Gen1 booster, produces the extra high output brightness that is required for high speed imaging. In gating mode the first stage functions as a fast electro optical shutter with shutter times down to nanoseconds.

The intensifier stages and their high voltage power supplies, including gate unit, are mounted in a metal housing. At the output of the intensifier a relay objective is mounted having a magnification that matches the output size of the intensifier to the sensor format. The gate unit provides gate pulses to the photocathode of the image intensifier. The pulse width is variable and follows a TTL input pulse over the range from 40ns to DC at a repetition rate up to 300kHz.

With the **S option** for the HiCATT 25 a additional digital intensifier interface unit is supplied. Using a Windows control program it allows for controlling the gating and gain setting of the image intensifier by PC.

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The **D option** incorporates a digital delay generator unit. This unit delivers very precise timed pulses and offers multiple programmable sync output signals. The delay generator has a burst mode which sends a pulse on m out of n triggers. A trigger divider can be set additionally. To protect the intensifier from excessive light an overexposure control closes the gate if the total light flux exceeds a preset level. A Windows Control program is supplied for controlling the gating and gain setting of the image intensifier.

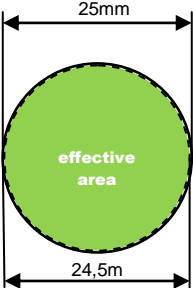
The **P option** offers a programmable version of the digital delay generator unit. Pulse trains with individual gate, delay and repetition settings per trigger can be programmed.

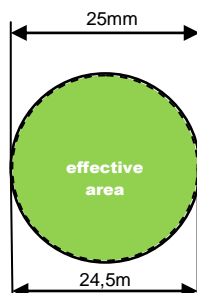
The **GF option** offers fast gating down to 3 ns (5 ns Gen 3 intensifier). The maximum repetition rate is 200 kHz.(300kHz GF300 option).

With the **SH option** the HiCATT 25 is delivered with a mechanical shutter that can be used to protect the image intensifier between measurements and increase the lifespan of the unit.

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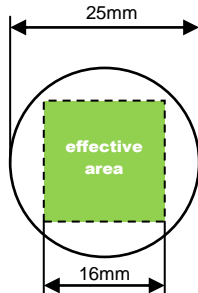
Gen2 hybrid image intensifier.

Specifications at 20 ^{±2} °C:	Min.	Typ.	Max.	Min.	Typ.	Max.
Photocathode Gen2 Intensifier	S20(UV)			Super S25		
Input window	Quartz			Borosilicate Glass		
Input window thickness (mm)	6.0					
Input / output diameter (mm)	25 / 25					
maximal response at (nm)	270 to 450			500 to 850		
Typical spectral response	See curve on the last page					
@270nm	38	55		-		
@400nm	58	65		-		
@800nm	-			43	65	
@850nm	-			33	55	
Luminous sensitivity (µA/lm)		120		500	700	
Peak Quantum efficiency (%)		27			17	
Luminous Gain Gen2 intensifier	1100 (ph/ph)	1500 (ph/ph)		4500 (cd/m ² /lx)	5000 (cd/m ² /lx)	
Photon gain Gen1 booster (ph/ph)	6	11		6	11	
EBI gen2 (µlx)		0.1	0.25		0.1	0.25
MCP pitch		12µm			12µm	
Resolution on output (lp/mm)						
25:11 relay lens	50	61		50	61	
25:25 relay lens	25	28		23	28	
Phosphor	P46 (P20, P43 on request)					
P46 decay time to 10% (µs)	0.2-0.4					
Gating time (FWHM) (ns)	40ns – ∞ (3ns for HiCATT 25 F)					
Gate repetition freq. (kHz)	D.C to 100kHz (300kHz, 2.5Mhz burst for HiCATT 25 F)					
Gate pulse synchronisation	Follow External TTL-signal					
Effective area	Ø24,5mm					
Uniformity, Spots	The number of spots exceeding a contrast with their surrounding area of 30% is less or equal to the number indicated in the table below. The size of non-circular spots is determined on the basis of equal area to circular spots. When the distance between two spots is less than the maximum dimension of either spot, the two spots are considered to be one spot.					
	Size of Spots		Max. number of spots within useful area			
			-Ø8	Ø8 – Ø20	Ø20 – Ø25	
	> 300 µm		0	0	0	
	225 – 300 µm		0	0	1	
	150 – 225 µm		0	1	2	
	75 – 150 µm		1	2	3	
	< 75 µm		Minimal	Minimal	minimal	



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Gen3 hybrid image intensifier.

Specifications at 20 ^{±2} °C:	Min.	Typ.	Max.	Min.	Typ.	Max.
Photocathode Gen3 intensifier	GaAsP			GaAs		
Input window	Borosilicate Glass					
Input window thickness (mm)	5.5					
Input / output diameter (mm)	25 / 25					
maximal response at (nm)	450 to 550			550 to 750		
Typical spectral response	See curve on the last page					
Luminous sensitivity (µA/lm)	400	650		900	1100	
Peak Quantum efficiency (%)	35	50			25	
Luminous Gain Gen3 intensifier ((lm/m²)/lx)	3.0x10³	6.0x10⁴		3.0x10³	1.0x10⁴	
Photon gain Gen1 booster (ph/ph)	6	11		6	10	
EBI gen3 (µlx)		0,2	0,5		0,2	0,5
MCP pitch		12µm			12µm	
Resolution on output (lp/mm)						
25:11 relay lens	50	61		50	61	
25:25 relay lens	20	25		23	28	
Phosphor	P46 (P20, P43 on request)					
P46 decay time to 10% (µs)	0.2-0.4					
Gating time (FWHM) (ns)	40ns – ∞ (5ns for HiCATT 25 F)					
Gate repetition freq. (kHz)	D.C to 100kHz (300kHz for HiCATT 25 F)					
Gate pulse synchronisation	Follow External TTL-signal					
Effective area	16 x 16 mm in the center					
Uniformity, Spots	The dark and white spots which exceed a contrast of 30% of their surrounding area should not exceed the following values over the guarantee area:					
	Size of Spots		Max. number of spots within effective area			
			Dark Spots		White Spots	
	> 150 µm		0		0	
	100 – 150 µm		3		0	
	75 – 100 µm		15		7	
	50 – 75 µm		n/a		11	
	< 50 µm		n/a		n/a	

Note 1: The Gen2/Gen3 image intensifier of the **HiCATT 25** is standard equipped with a single MCP. Dual MCP image intensifiers are available on request. Please contact Lambert Instruments for details.

Note 2: The HiCATT 25 is standard equipped with a hybrid image intensifier (gen2/gen3 + gen1 booster). The Gen1 booster can be omitted to increase the resolution of the HiCATT 25 (at the cost of a lower value for the maximal output brightness). Please contact Lambert Instruments for details.

Note 3: The HiCATT 25 is standard equipped with a 25mm hybrid image intensifier. It is also possible to supply the unit with a 18mm hybrid image intensifier. Please contact Lambert Instruments for details.

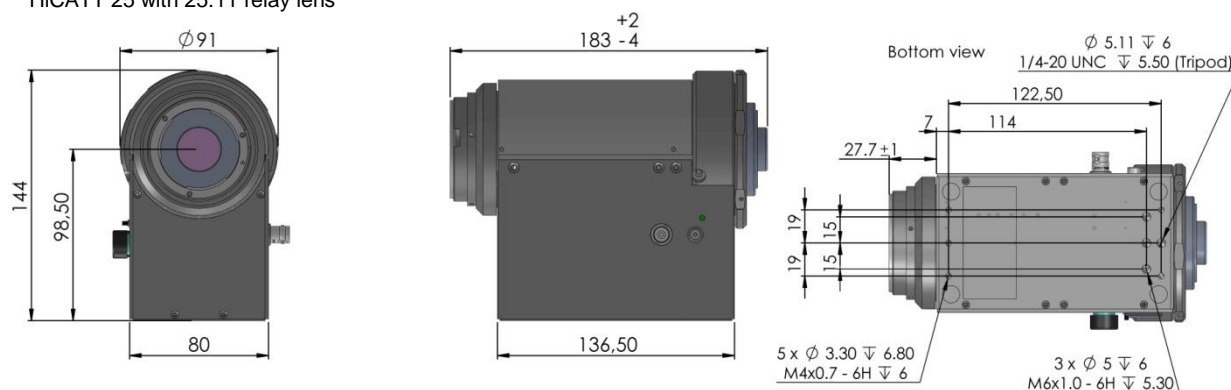
Housing and relay lens

A metal housing contains the image intensifier, high voltage power supply with gating and relay lens. The relay lens images the output of the image intensifier onto the image sensor of the attached camera. The HiCATT 25 can be equipped with a 25:11 relay lens and a 25:25 relay lens.

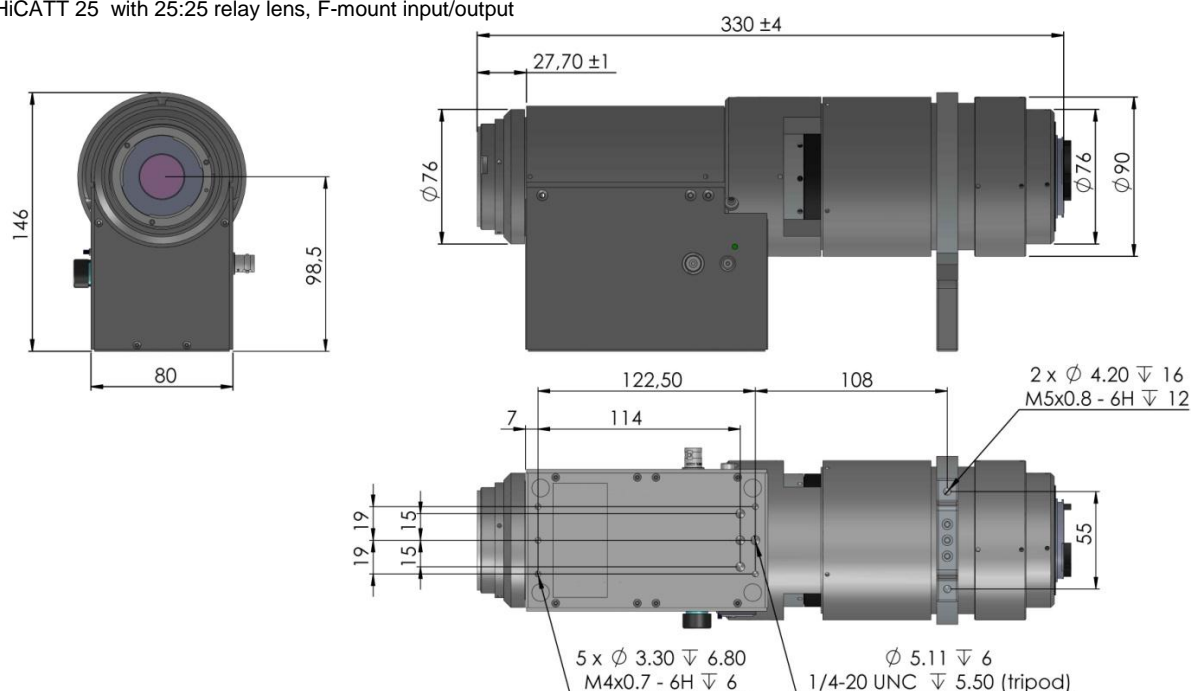
Optical parameters:	25:11 relay lens	25:25 relay lens
Input image diameter	25mm	25mm
Output image diameter	11mm	25mm
Input lens mount	F-mount / C-mount	F-mount / C-mount
Output lens mount to camera	C-mount	F-mount /C-mount

Dimensions:

HiCATT 25 with 25:11 relay lens



HiCATT 25 with 25:25 relay lens, F-mount input/output



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High voltage power supply and gate unit.

The high voltage power supply for the image intensifiers is mounted inside the intensifier housing and provides a fixed high voltage to the anode and a variable MCP voltage. The built-in gate unit supplies a fixed voltage for continuous operation or a pulsed voltage for gated operation to the cathode of the intensifier. The HiCATT 25 intensifier has a manual gain control by means of a variable MCP voltage that is controlled by a potentiometer. (Digital gain control via USB is provided in the **HiCATT 25S**, **HiCATT 25D** and **HiCATT 25P**, See below for details). The gating is controlled by following an external TTL signal and can be varied from 40ns to DC. The unit is powered by 12VDC.

Gating Parameters	Minimum	Typical	Maximum
Gate pulse frequency Continuous (kHz)			100
Gate pulse synchronisation		Follow External TTL-signal	
Gate pulse width (ns)	40 (standard)		DC
Rise and fall time, 10-90% (ns)		15	20
Propagation delay (ns)		80	
Power supply (VDC)		12	

Gating

The dynamic range of the intensifier can be further expanded by the use of gating. The effective integration time of the camera can be lowered by decreasing the gate pulse width of the intensifier. A shorter gate pulse shortens the duty cycle of the intensifier and allows it to be used at higher light levels. Also a shorter gate pulse results in reduction of the motion blur caused by moving objects or dynamic events. Applying shorter gating will require higher gain to prevent loss of intrascene dynamic as the same number of photons have to be delivered within a shorter time. An external TTL signal defines the pulse width and pulse frequency when gating the intensifier. Any pulse width from DC down to a few nanoseconds can be applied.

Fast gating 3ns (GF-option)

The fast gating option allows gating down to 3ns with a 200kHz repetition rate

Parameters	Minimum	Maximum
Gate Time T _g	3 ns FWHM	Unlimited (D.C.)
Repetition Rate	0 Hz "Single Shot"	200 KHz global,
Jitter		30 ps r.m.s.

Fast gating 300kHz (GF300-option)

In addition to fast gating this option offers high repetition rates up to 300kHz and 2.5 Mhz in burst.

Parameters	Minimum	Maximum
Gate Time T _g	3 ns FWHM	Unlimited (D.C.)
Repetition Rate	0 Hz "Single Shot"	300 KHz global, 2.5 MHz burst mode
Jitter		30 ps r.m.s.

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Standard digital interface (S option):

With this interface the gain and gating properties of the Lambert Intensifier HiCATT 25 can be controlled by software. The unit provides the gate pulses for the image intensifier. The pulse width and delay can be set by software. An external TTL signal determines the gate frequency (can be up to 100kHz). By connecting a synchronisation signal from the camera for example EXP, SHUTTER OUT or WEN) the gating of the intensifier can be synchronised with the exposure time of the camera by selecting the external trigger or follow external mode.

The unit also supplies the DC voltages for the intensifier and the gating electronics. The interface is connected to the computer via USB (optional via RS-232). A Windows interface program is supplied to change all the settings like gain, gating mode, gate pulse width and delay. The unit can also be controlled by a set of ASCII commands from customer software.

Gain control	100% - 1% in 4096 steps (logarithmic)
Gating modes	closed continuous open ext. trigger follow external manual one-shot
programmable gate delay in the ext. trigger mode (delay from rising edge trigger input)	up to 5s in 20ns steps (jitter +/- 10ns)
programmable gate pulse width in the ext. trigger mode	up to 5s in 20ns steps (jitter < 250ps)
Propagation delay	80ns (typical)
Output power for intensifier	+12V
Input power	110-230VAC (50-60Hz) , 30W
Interface to PC	USB (optional RS232, contact Lambert Instruments)
Control	Via supplied Windows interface software or ASCII command set
Options	Customer specified re-programming of timing. Extra in- and outputs.

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Digital delay generator interface with overexposure detection (D-option):

This pulse generator has 4 independent programmable pulse outputs (including the one that is used for gating) that can provide precise timed TTL pulses with pulse widths down to 3ns (FWHM). An USB interface (optional RS232) allows for easy control of the pulse width, delay, polarity and synchronisation mode by using the supplied Windows interface program, or by sending simple ASCII commands to the virtual COM port.

The unit has a programmable DDS rate synthesizer for setting output pulse repetition frequency. The output pulses can also be synchronised with an external trigger signal.

The digital delay generator interface is, among other things, ideally suited for controlling the gating of image intensifiers, like the Lambert HiCATT. The digital control of the image intensifier gain is also possible with this unit. The unit supplies the DC voltages for the intensifier and the gating electronics.

Synchronizing the gating of the image intensifier with the exposure time and frame rate of an attached camera can be done by connecting a trigger signal from the camera (e.g. EXP, Strobe or Shutter out) to the trigger input of the low jitter digital interface.

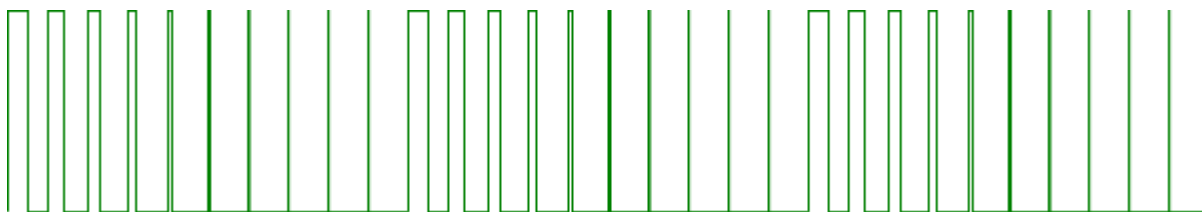
In the case of excessive light fluxes which might damage the intensifier the gate can be closed automatically by the overexposure control. If not desired the overexposure control can be deactivated.

Programmable digital delay generator interface (P-option):

Trigger to trigger variations in gate with and delay are offered with the programmable digital delay generator interface. Pulse trains can be triggered by a single input pulse. In combination with the frame storage facility which allows storing thousands of different delay/width-settings endless scenarios of freely definable gate sequences can be created.

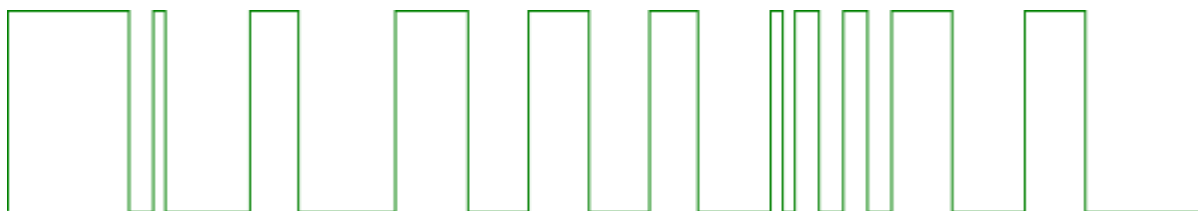


Example 1: alternating gate width



Example 2: repeated linear reducing gate width

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Example 3: complex gate pattern

Specification (D and P option)

Gain control	100% - 1% in 4096 steps (logarithmic)
Intensifier Gate time control	3ns – 10s, 10ps resolution (FWHM) Note: The minimal possible gate time depends on the type of intensifier and gate unit.
Intensifier Gate delay control	0 - 10s, 10ps resolution
Output A/B/C pulse width control	5ns – 10s, 10ps resolution (FWHM)
Output A/B/C delay control	0 - 10s, 10ps resolution
Maximal trigger rate	16Mhz
internal trigger source	DDS rate synthesizer, programmable between 0-16 MHz, 0.02 Hz resolution
Timing accuracy	$\pm 400\text{ps} \pm 10\text{ps}/^\circ\text{C}$
Jitter delay	Below 50ps RMS (typ. < 40ps RMS) between ext. trigger to any output or between any outputs. For delays > 1ms add 10ps per millisecond of delay
Insertion delay	20ns \pm 400ps
Trigger input	TTL, Programmable trigger level between +0.25 to +3.3 volts Programmable trigger slope, Programmable termination, hi-Z or 50 ohm Programmable trigger divider Programmable bursts (m out of n triggers)
Output A/B/C/D	TTL (max. output level is 5V), Programmable delay, width and polarity, 50-ohm source impedance (at 50-ohm max. level = 2,5V) Train generation and frame storage (P-option)
Communication	USB
Dimensions	223 x 199 x 72 (lxwxh)
Supply voltage	100-240Vac, 50-60Hz
Deliverables	Low Jitter digital interface, cables, manual and CD with Windows control software

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Mechanical shutter (SH option):

The HiCATT can be supplied with an optional mechanical shutter. With the shutter attached damage to the image intensifier caused by e.g. stray light or laser bundles that may occur during the alignment of the light source can be prevented. The shutter can also be closed between measurements to increase the lifespan of the image intensifier.

The shutter is encased in an aluminum housing with a standard F-mount input that replaces the original F-mount adapter of the HiCATT. The back focal distance of the F-mount input is unchanged so any F-mount objective can be used.

The shutter comes with a power supply and a remote shutter controller with a timer. The timer can be used to automatically close shutter after a predetermined time. The remote has a stylish and ergonomic design and a large LCD screen.

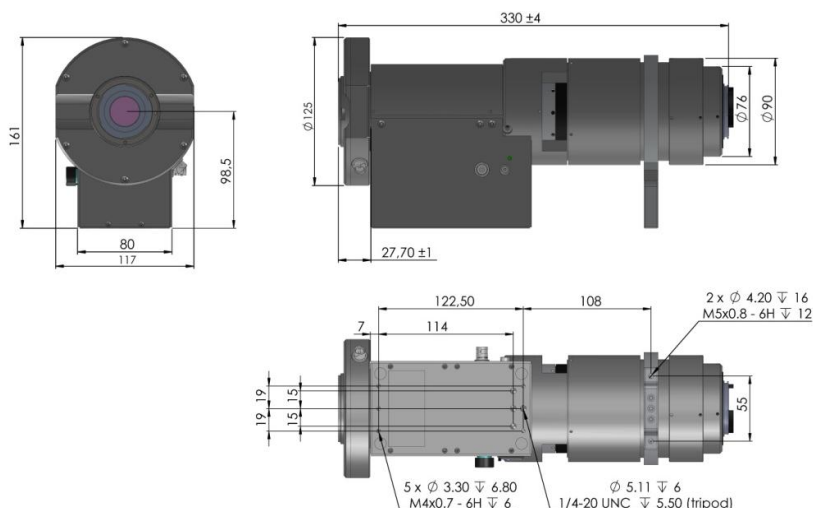


The shutter can also be controlled by an external TTL signal.

When purchased together with one of our digital interfaces (**s**, **d** or **p** option) control of the shutter can be done via the software of the digital interface.

Parameters shutter	Maximum
shutter	UNIBLITZ VS35
Repetition Rate	DC to 5Hz (20Hz burst of maximal 4s, with 1min between bursts)
Transfer time on opening /closing	13ms
Minimal open time	20ms
Lens mount	F-mount
Shutter control via	<ul style="list-style-type: none"> - Hand held shutter remote controller with push button and timer. - External TTL signal
Delay / timer specification	1s to 99 hrs in 1 sec increments
TTL input	0-5V, minimal pulse width of 20ms

Dimensions of the HiCATT 25 with mechanical shutter (SH option):



SPECIFICATION VHS-2146A7

31/07/2012

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Spectral response available Photocathodes:

