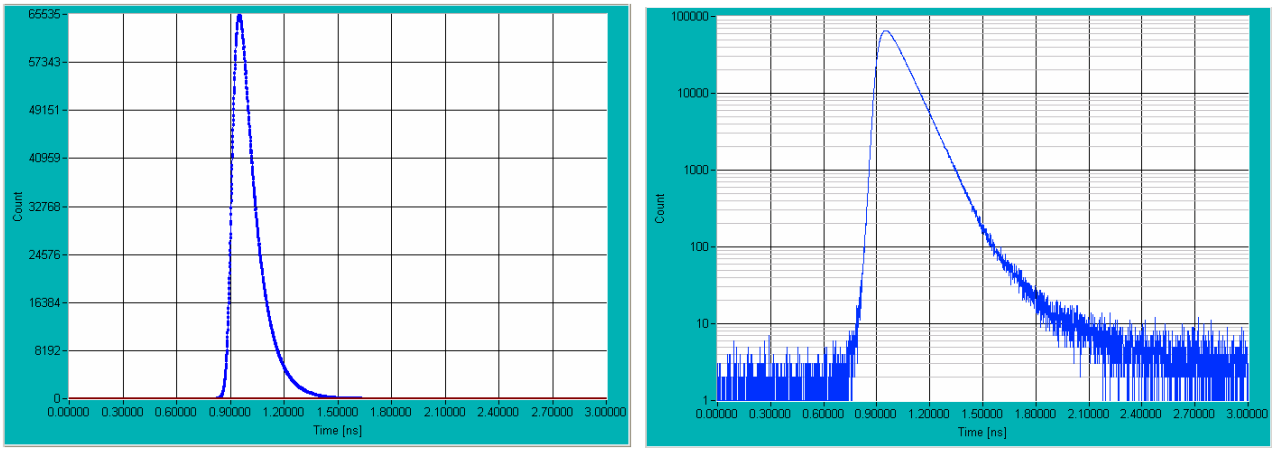
HPM-100-40

High Speed Hybrid Detector for TCSPC

GaAsP cathode: Excellent detection efficiency
Instrument response function 120 ps FWHM
Clean response, no tails or secondary peaks
No afterpulsing
Excellent dynamic range of fluorescence decay measurement
No afterpulsing peak in FCS measurements
Internal generators for PMT operating voltages
Power supply and control via bh DCC-100 card
Overload shutdown
Direct interfacing to all bh TCSPC systems
Adapters to bh DCS-120 FLIM system and Zeiss LSM 710 NLO NDD port

The HPM-100 module combines a Hamamatsu R10467-40 GaAsP hybrid PMT tube with the preamplifier and the generators for the PMT operating voltages in one compact housing. The principle of the hybrid PMT in combination with the GaAsP cathode yields excellent timing resolution, a clean TCSPC instrument response function, high detection quantum efficiency, and extremely low afterpulsing probability. The virtual absence of afterpulsing results in a substantially increased dynamic range for fluorescence decay recordings. Moreover, FCS curves obtained with the HPM-100 are free of the typical afterpulsing peak. FCS is thus obtained from a single detector, without the need of cross-correlation. The HPM-100 module is operated via the bh DCC-100 detector controller of the bh TCSPC systems. The DCC-100 provides for power supply, gain control, and overload shutdown. The HPM-100 interfaces directly to all bh SPC or Simple Tau TCSPC systems. It is available with standard C-mount adapters, adapters for the bh DCS-120 confocal scanning FLIM system, and adapters for the NDD ports of the Zeiss LSM 710 NLO multiphoton laser scanning microscopes.



Instrument response function. Left linear scale, right logarithmic scale. FWHM is 120 ps.

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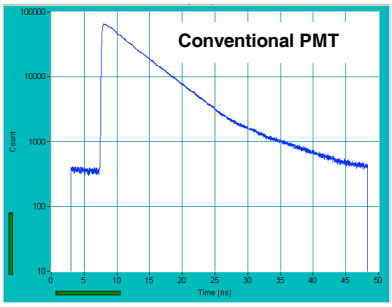
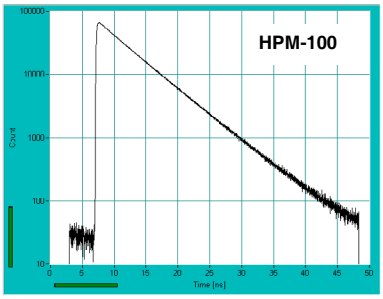
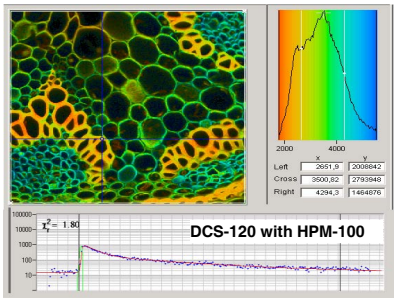
HPM-100-40

Absence of afterpulsing improves dynamic range of fluorescence decay measurements

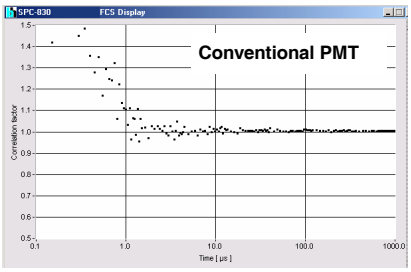


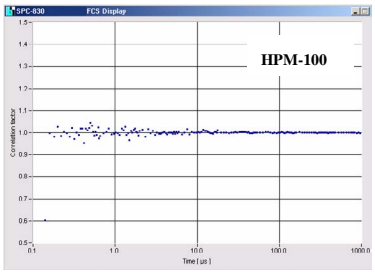


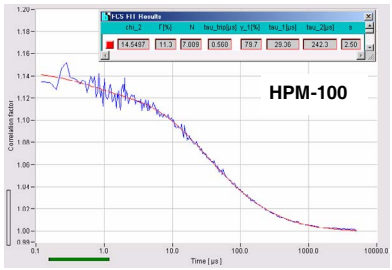


Left: Fluorescence decay recorded with conventional PMT. The background is dominated by afterpulsing. Middle: The only source of background in the HPM is thermal emission of the photocathode. The dynamic range is substantially increased. Right: The lower background yields improved lifetime accuracy and lifetime contrast in FLIM measurements.

Fluorescence correlation measurements are free of afterpulsing peak

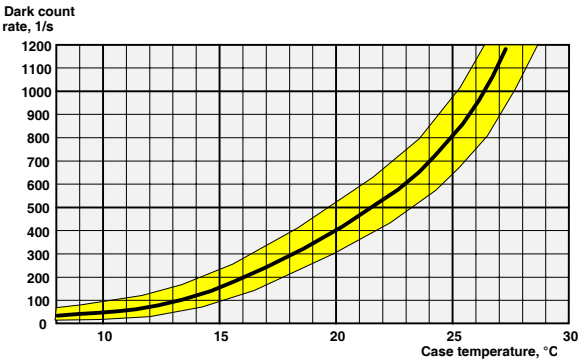




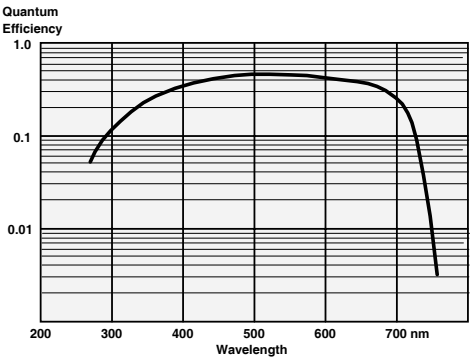


Left: Autocorrelation of continuous light signal of 10 kHz count rate, conventional GaAsP PMT. Middle: Autocorrelation of continuous light signal of 10 kHz count rate, HPM-100 module. The curve is flat down to the dead time of the TCSPC module. Right: FCS curve of fluorescein solution, HPM-100 module. The red curve is a fit with one triplet time and one diffusion time. bh DCS-120 confocal FLIM system, laser 473 nm.

Dark count rate vs. temperature
Typical values and range of variation



Detection quantum efficiency vs. wavelength
APD voltage 95% of maximum



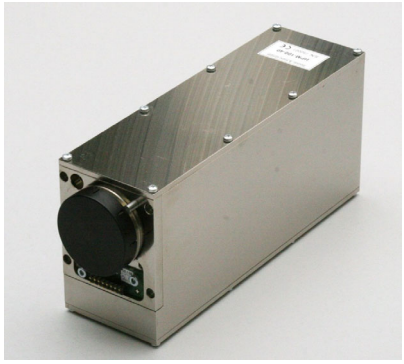
Specifications, typical values

Wavelength Range	300 nm to 730 nm
Detector Quantum efficiency, at 500 nm	45%
Dark Count rate, Tcase = 22°C	560 s^{-1}
Cathode Diameter	3 mm
TCSPC IRF width (Transit Time Spread)	120 ps, FWHM
Single Electron Response Width	850 ps, FWHM
Single Electron Response Amplitude	50 mV, V_{apd} 95% of V_{max}
Output Polarity	negative
Output Impedance	50 Ω
Max. Count Rate (Continuous)	> 10 MHz
Overload shutdown at	>15 MHz
Detector Signal Output Connector	SMA
Power Supply (from DCC-100 Card)	+ 12 V, +5 V, -12V
Dimensions (width x height x depth)	60 mm x 90 mm x 170 mm
Optical Adapters	C-Mount, DCS-120, LSM 710 NDD port

HPM-100-50

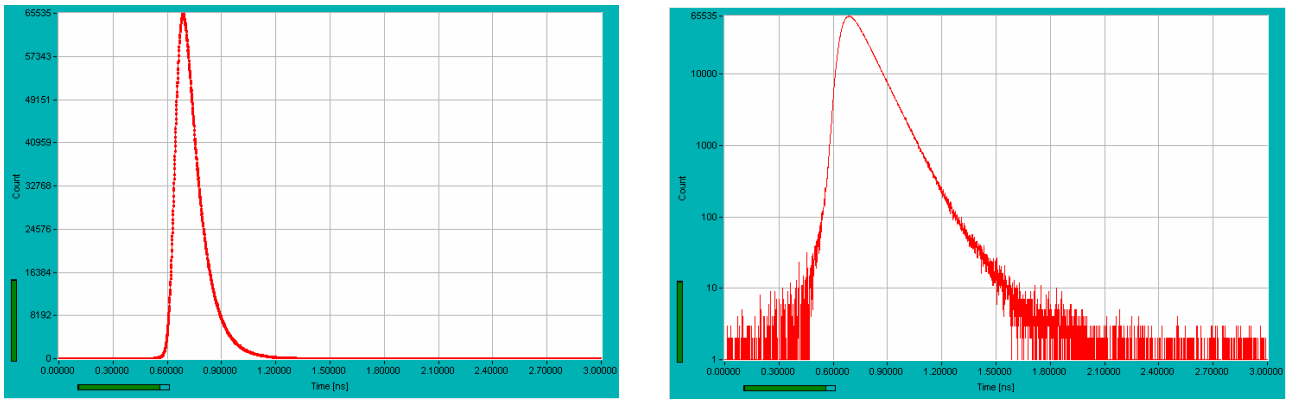
High Speed Hybrid Detector for TCSPC

GaAs cathode: Excellent detection efficiency
Sensitive up to 900 nm
Instrument response function 130 ps FWHM
Clean response, no tails or secondary peaks
No afterpulsing background
Excellent dynamic range of TCSPC measurements
Internal generators for PMT operating voltages
Power supply and control via bh DCC-100 card
Overload shutdown
Direct interfacing to all bh TCSPC systems



The HPM-100-50 module combines a Hamamatsu R10467-50 GaAs hybrid detector tube with the preamplifier and the generators for the tube operating voltages in one compact housing. The principle of the hybrid detector in combination with the GaAs cathode yields excellent timing resolution, a clean TCSPC instrument response function, high detection quantum efficiency up to NIR wavelengths, and extremely low afterpulsing probability. The absence of afterpulsing results in a substantially increased dynamic range of TCSPC measurements. The HPM-100-50 is therefore an excellent detector for NIR fluorescence decay measurements and time-domain diffuse optical tompgraphy.

The HPM-100-50 module is operated via the bh DCC-100 detector controller of the bh TCSPC systems. The DCC-100 provides for power supply, gain control, and overload shutdown. The HPM-100 interfaces directly to all bh SPC or Simple Tau TCSPC systems. It is available with standard C-mount adapters, adapters for the bh DCS-120 confocal scanning FLIM system, and adapters for the NDD ports of the Zeiss LSM 710 NLO multiphoton laser scanning microscopes.



Instrument response function. Left linear scale, right logarithmic scale. FWHM is 130 ps.

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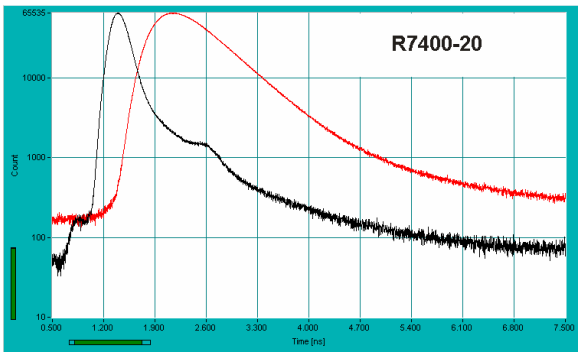
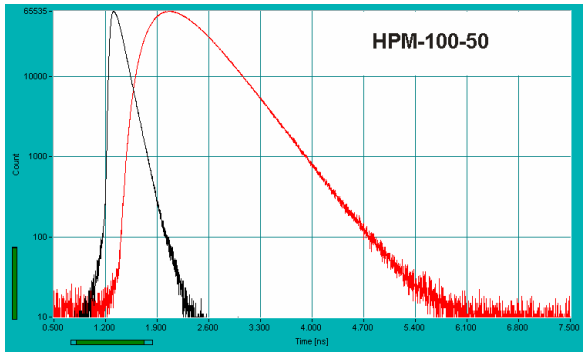
HPM-100-50

Absence of afterpulsing improves dynamic range of TCSPC measurement

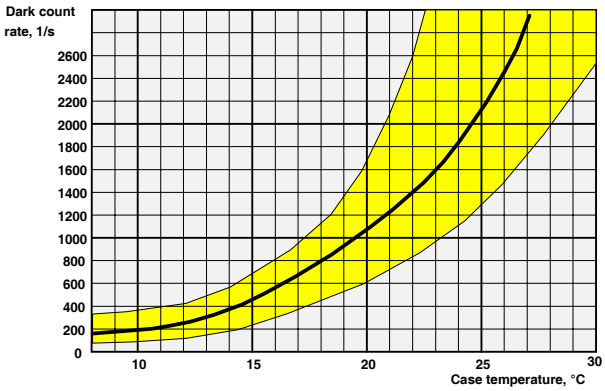




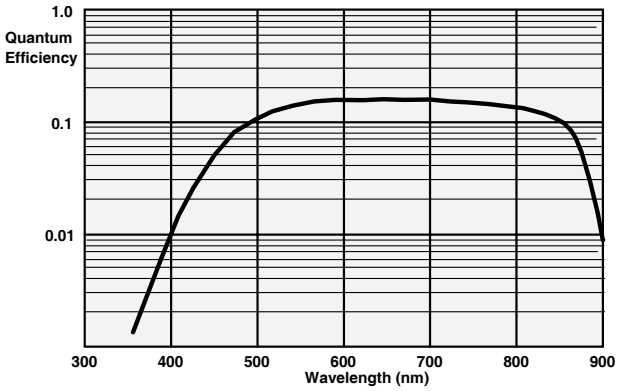
Photon migration curves (red) and IRF (black) recorded with conventional PMT (left) and HPM-100-50 (right). The background signal of the conventional NIR PMT is dominated by afterpulsing. Late photons are lost in the background. Right: The HPM-100-50 is free of afterpulsing. The only background is the thermal emission of the photocathode. The dynamic range is substantially higher than for the conventional PMT.

Dark count rate vs. temperature

Typical values and range of variation



Detection quantum efficiency vs. wavelength



Specifications, typical values

Wavelength Range	400 nm to 900 nm
Detector Quantum efficiency, at 600 nm	15 %
Dark Count rate, Tcase = 22°C	500 to 3000 s^{-1}
Cathode Diameter	3 mm
TCSPC IRF width (Transit Time Spread)	130 ps, FWHM
Single Electron Response Width	850 ps, FWHM
Single Electron Response Amplitude	50 mV, V_{apd} 95% of V_{max}
Output Polarity	negative
Output Impedance	50 Ω
Max. Count Rate (Continuous)	> 10 MHz
Overload shutdown at	>15 MHz
Detector Signal Output Connector	SMA
Power Supply (from DCC-100 Card)	+ 12 V, +5 V, -12V
Dimensions (width x height x depth)	60 mm x 90 mm x 170 mm
Optical Adapters	C-Mount, DCS-120, LSM 710 NDD port

Related products: HPM-100-40 hybrid detector module, 300 to 700 nm, 45% quantum efficiency

Literature: [1] The HPM-100-50 hybrid detector module: Increased dynamic range for DOT. Application note, www.becker-hickl.com
[2] The HPM-100-40 hybrid detector. Application note, www.becker-hickl.com

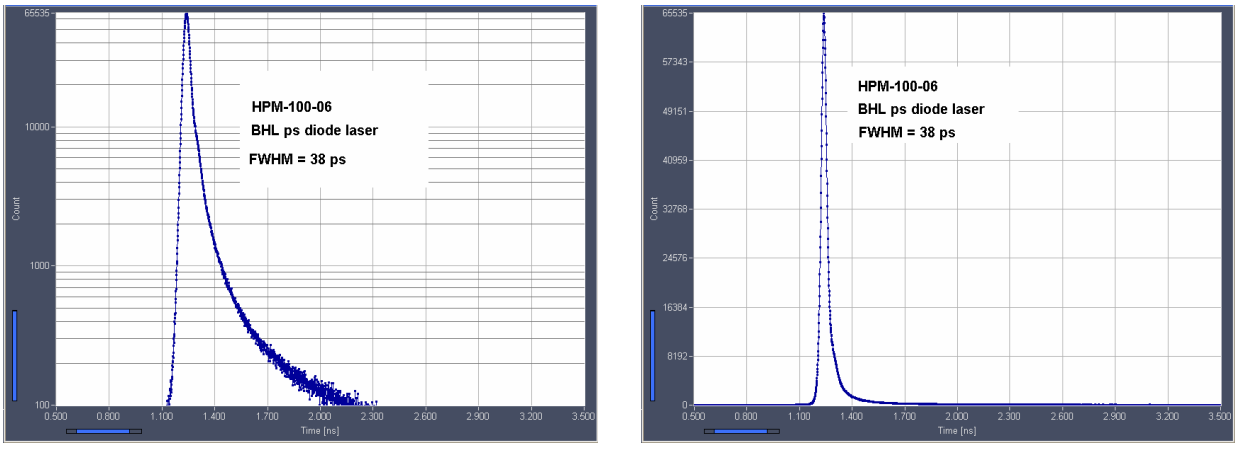
HPM-100-06

Ultra-High Speed Hybrid Detector for TCSPC

Instrument response function <35 ps FWHM
Clean response, no tails or secondary peaks
No afterpulsing background
Excellent dynamic range of TCSPC measurements
Internal generators for PMT operating voltages
Power supply and control via bh DCC-100 card
Overload shutdown
Direct interfacing to all bh TCSPC systems

The HPM-100-06 module combines a Hamamatsu R10467-06 hybrid detector tube with a preamplifier and the generators for the tube operating voltages in one compact housing. The principle of the hybrid detector yields excellent timing resolution, a clean TCSPC instrument response function, high detection quantum efficiency, and extremely low afterpulsing probability. The absence of afterpulsing results in a substantially increased dynamic range of TCSPC measurements.

The HPM-100-06 module is operated via the bh DCC-100 detector controller of the bh TCSPC systems. The DCC-100 provides for power supply, gain control, and overload shutdown. The HPM-100 interfaces directly to all bh SPC or Simple Tau TCSPC systems. It is available with standard C-mount adapters, adapters for the bh DCS-120 confocal scanning FLIM system, and adapters for the NDD ports of the Zeiss LSM 710 NLO multiphoton laser scanning microscopes.

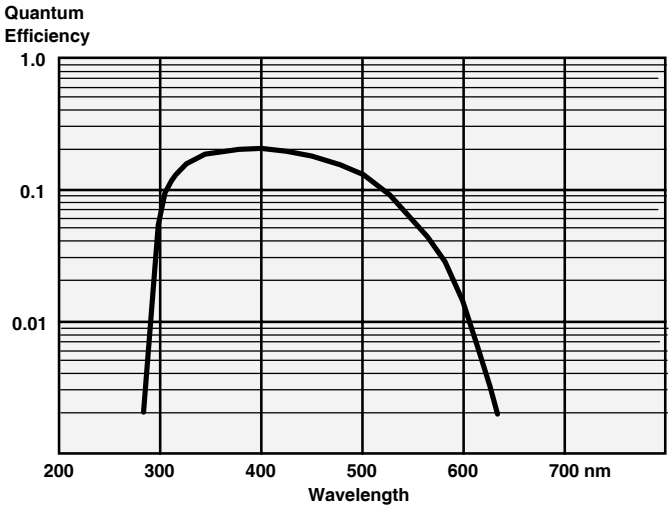


Instrument response function. Left linear scale, right logarithmic scale. Light pulse from BHL-150 picosecond diode laser recorded with SPC-150 TCSPC module. FWHM of recorded pulse shape is 38 ps. With a pulse width of the laser of 25 ps the estimated IRF width is 29 ps.

Technology Leader in TCSPC

HPM-100-06

Detection quantum efficiency vs. wavelength



Specifications, typical values

Wavelength Range	300 nm to 600 nm
Detection Quantum efficiency, at 400 nm	20 %
Dark Count rate, Tcase = 22°C, 3mm version	100 to 400 s^{-1}
Cathode Diameter	3 mm or 5 mm
TCSPC IRF width (Transit Time Spread)	<40 ps, FWHM
Single Electron Response Width	850 ps, FWHM
Single Electron Response Amplitude	50 to 80 mV, V_{apd} 95% of V_{max}
Output Polarity	negative
Output Impedance	50 Ω
Max. Count Rate (Continuous)	> 10 MHz
Overload shutdown at	>15 MHz
Detector Signal Output Connector	SMA
Power Supply (from DCC-100 Card)	+ 12 V, +5 V, -12V
Dimensions (width x height x depth)	60 mm x 90 mm x 170 mm
Optical Adapters	C-Mount, DCS-120, LSM 710 NDD port

Related products: HPM-100-40 GaAsP and HPM-100-50 GaAs hybrid detector modules
Literature: The bh TCSPC Handbook, 5th edition, Becker & Hickl GmbH, 2013

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