

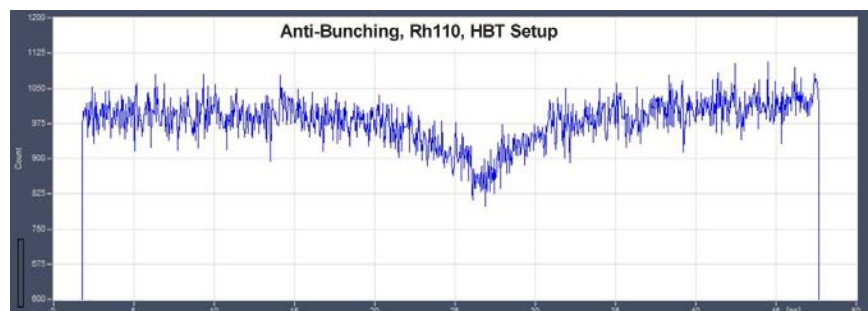
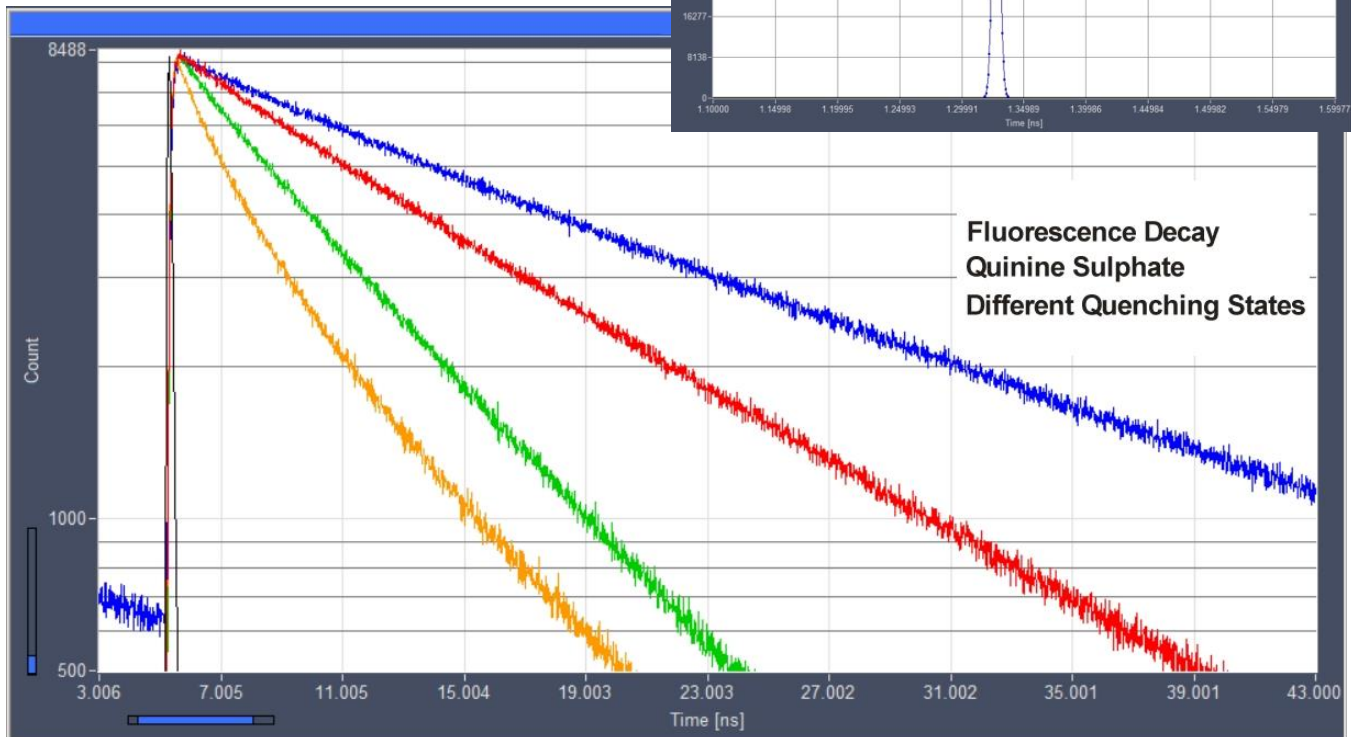
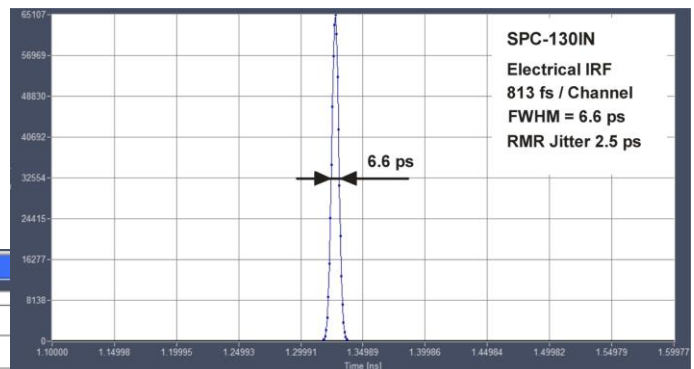


## Time-Correlated Single Photon Counting Module

- High-throughput PCI-Express interface
- SPC-180N technology
- Ultra-fast, ultra-stable timing electronics
- Electrical IRF width 6.6 ps FWHM
- Internal timing jitter 2.5 ps RMS
- Time-channel width down to 813 fs
- Discriminator input bandwidth 4 GHz
- Photon distribution and parameter-tag modes
- Multi-detector / multi-wavelength capability
- Excitation-wavelength multiplexing
- Parallel operation of 2, 3 or 4 modules
- Laser repetition rates up to 150 MHz
- Dead time 80 ns
- Saturated count rate 12.5 MHz



- Fluorescence-decay experiments
- Anti-bunching experiments
- NIRS and fNIRS experiments
- Simultaneous multi-wavelength detection
- Simultaneous fluorescence / phosphorescence
- Single-molecule spectroscopy
- Fluorescence correlation



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# SPC-130IN

# TCSPC Module

## Photon Channel

Principle	Constant Fraction Discriminator (CFD)
Discriminator Input Bandwidth	4 GHz
IRF Width, FWHM	< 6.6 ps, FWHM
RMS Timing Jitter	< 2.5 ps, RMS
Variance in Time of IRF Centroid	< 0.8 ps RMS over 100 seconds
Optimum Input Voltage Range	- 30 mV to - 500 mV
Min. Input Pulse Width	200 ps
Threshold	0 to - 250 mV
Zero Cross Adjust	- 100 mV to + 100 mV

## Synchronisation Channel

Principle	Constant Fraction Discriminator (CFD)
Discriminator Input Bandwidth	4 GHz
Optimal Input Voltage Range	- 30 mV to - 500 mV
Min. Input Pulse Width	200 ps
Threshold	0 to -250 mV
Frequency Range	0 to 150 MHz
SYNC Frequency Divider	1 - 2 - 4
Zero Cross Adjust	-100 mV to + 100 mV

## Time-to-Amplitude Converters / ADCs

Principle	Ramp Generator / Biased Amplifier
TAC Range	50 ns to 5 us
Biased Amplifier Gain	1 to 15
Biased Amplifier Offset	0 to 50 % of TAC Range
Time Range incl. Biased Amplifier	3.3 ns to 5 us
Min. Time / Channel	813 fs
ADC Principle	50 ns Flash ADC with Error Correction
Diff. Nonlinearity, Electrical	< 0.5% RMS, typ. <1% peak-peak

## Data Acquisition (Histogram Modes)

Method	on-board multi-dimensional hardware histogramming process
Dead Time	80 ns, independent of computer speed
Saturated Count Rate	12 MHz
Useful Count Rate	6 MHz
Max. Counts / Time Channel (Counting Depth)	2 <sup>16</sup> -1
Overflow Control	none / stop / repeat and correct
Collection Time	0.1 us to 100,000 s
Display Interval Time	10 ms to 100,000 s
Repeat Time	0.1 us to 100,000 s
Sequential Recording	Unlimited recording by memory swapping
Routing	7 bit TTL
Count Enable	1 bit TTL
Experiment Trigger	TTL

## Data Acquisition (FIFO / Parameter-Tag Mode)

Method	Parameter-tagging of individual photons, continuous writing to disk
Online Display	Decay functions, FCS, Cross-FCS, PCH, MCS traces
FCS Calculation	Multi-tau algorithm, online calculation and online fit
Number of Counts of Decay / Waveform Recording	unlimited
Dead Time	80 ns
Saturated Count Rate, Peak	12 MHz
Sustained Count Rate (Bus-transfer Limited)	5 MHz
Max. Counts / Time Channel (Counting Depth)	unlimited
Output Data Format (ADC / Macrotimer / Routing)	12 / 12 / 4 bit
On-board FIFO Buffer Capacity (Photons)	2 · 10 <sup>5</sup>
Macro Timer Resolution, Internal Clock	25 ns, 12 bit, overflows marked in data stream
Macro Timer Resolution, Clock from SYNC Input	10 ns to 100 ns, 12 bit, overflows marked in data stream
Routing	4 bit TTL
External Event Markers	4 bit, TTL
Experiment Trigger	TTL

## Operation Environment

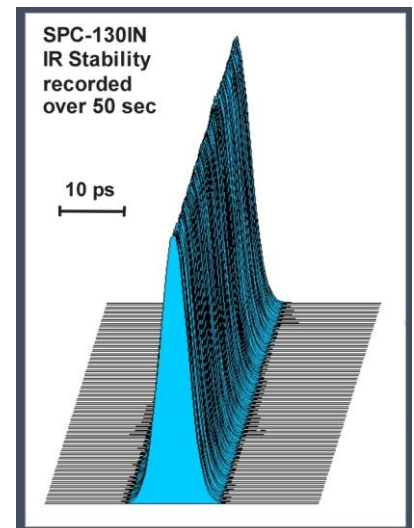
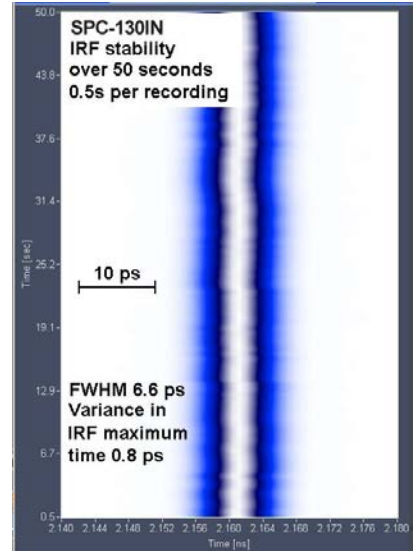
Computer / Operating System	PC Pentium, multi-core, >8GB RAM, Windows 10, Windows 11
Bus Connector	PCI-ex
Used PCI-ex Slots	1
Total Power Consumption	approx. 12 W from +12V
Dimensions	230 mm x 130 mm x 18 mm

## Related Products

SPC-130INX, -INXX TCSPC Modules, SPC-180N, -NX, -NXX TCSPC Modules, SPC-150N, SPC-150NX, SPC-150NXX TCSPC modules  
 HPM-100-40, -42, -50 GaAsP and GaAs hybrid detectors, HPM-06, -07 ultra-fast hybrid detectors  
 PMC-150 PMT and PMCS-150 PMT modules, PML-16 and PML16 GaAsP multi-wavelength detectors, DCC-100 detector / laser controllers  
 BDL-SMN ps diode lasers, BDS-SM, BDS-MM picosecond diode lasers

## Related Literature

W. Becker, The bh TCSPC Handbook, 9th edition (2021). 950 pages, available on <https://www.becker-hickl.com>. Please contact bh for printed copies.  
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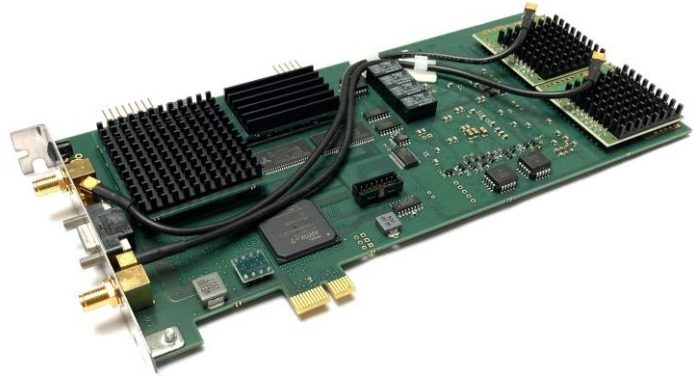


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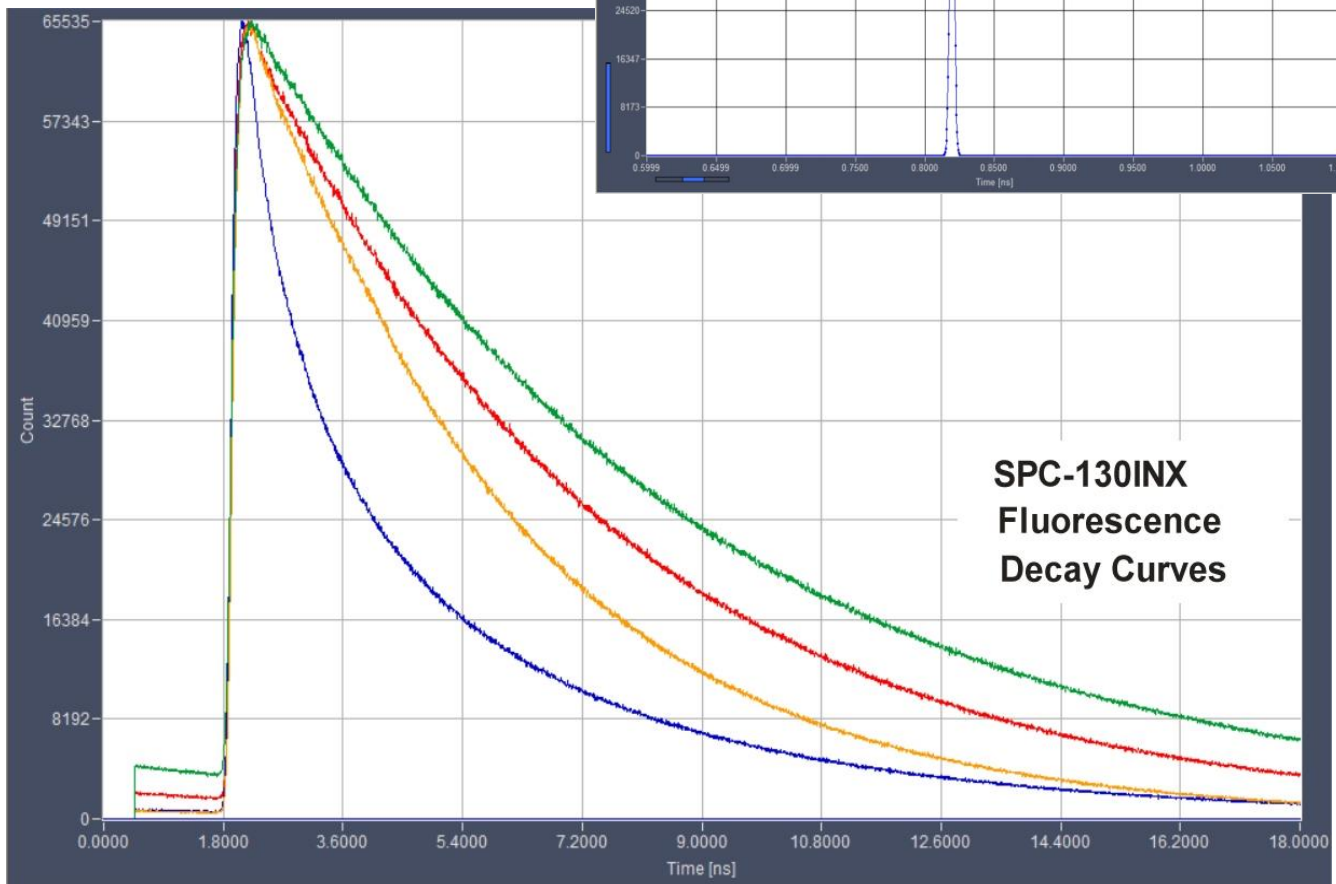
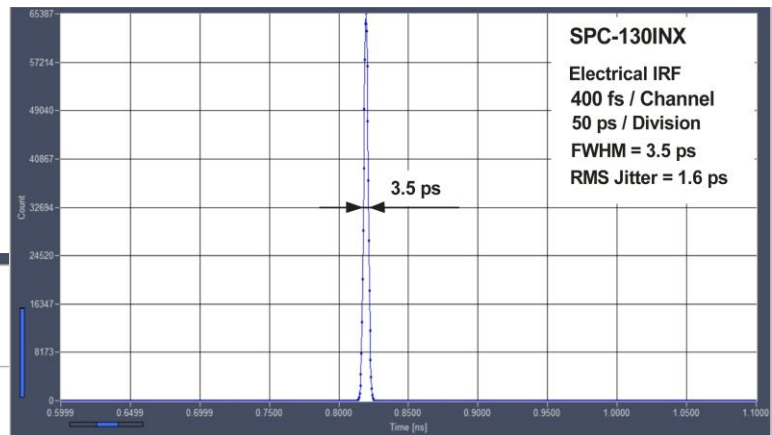


## High-Resolution Time-Correlated Single Photon Counting Module

- SPC-180NX technology
- High-throughput PCI-Express interface
- Ultra-fast, ultra-stable timing electronics
- Electrical IRF width 3.5 ps FWHM
- Internal timing jitter 1.6 ps RMS
- Time-channel width down to 405 fs
- Discriminator input bandwidth 4 GHz
- Photon distribution and parameter-tag modes
- Multi-detector / multi-wavelength capability
- Excitation-wavelength multiplexing
- Parallel operation of 2, 3 or 4 modules
- Laser repetition rates up to 150 MHz
- Dead time 80 ns
- Saturated count rate 12.5 MHz



- Fluorescence-decay experiments
- Anti-bunching experiments
- NIRS and fNIRS experiments
- Simultaneous multi-wavelength detection
- Simultaneous fluorescence / phosphorescence
- Single-molecule spectroscopy
- Fluorescence correlation



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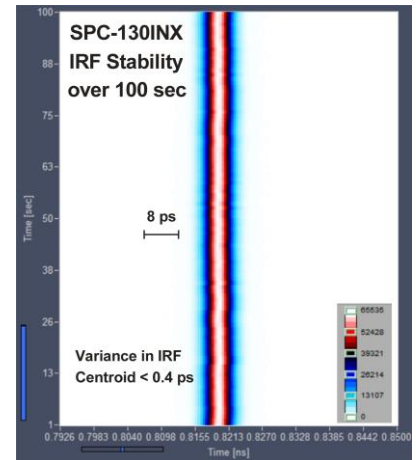
# SPC-130INX

# TCSPC Module

## Photon Channel

Principle  
 Discriminator Input Bandwidth  
 IRF Width, FWHM  
 RMS Timing Jitter  
 Variance in Time of IRF Centroid  
 Optimum Input Voltage Range  
 Min. Input Pulse Width  
 Threshold  
 Zero Cross Adjust

Constant Fraction Discriminator (CFD)  
 4 GHz  
 < 3.5 ps, FWHM  
 < 1.6 ps, RMS  
 < 0.4 ps RMS over 100 seconds  
 - 30 mV to - 500 mV  
 200 ps  
 0 to - 250 mV  
 - 100 mV to + 100 mV



## Synchronisation Channel

Principle  
 Discriminator Input Bandwidth  
 Optimal Input Voltage Range  
 Min. Input Pulse Width  
 Threshold  
 Frequency Range  
 SYNC Frequency Divider  
 Zero Cross Adjust

Constant Fraction Discriminator (CFD)  
 4 GHz  
 - 30 mV to - 500 mV  
 200 ps  
 0 to -250 mV  
 0 to 150 MHz  
 1 - 2 - 4  
 -100 mV to + 100 mV

## Time-to-Amplitude Converters / ADCs

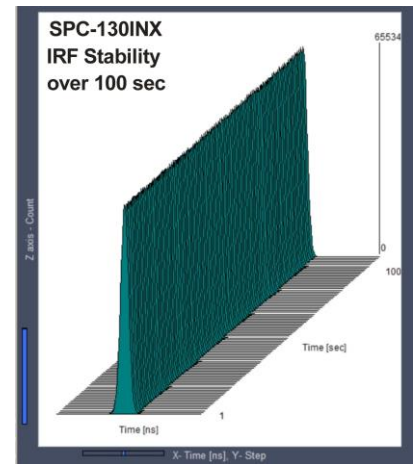
Principle  
 TAC Range  
 Biased Amplifier Gain  
 Biased Amplifier Offset  
 Time Range incl. Biased Amplifier  
 Min. Time / Channel  
 ADC Principle  
 Diff. Nonlinearity, Electrical

Ramp Generator / Biased Amplifier  
 25 ns to 2.5 us  
 1 to 15  
 0 to 50 % of TAC Range  
 1.67 ns to 2.5 us  
 405 fs  
 50 ns Flash ADC with Error Correction  
 < 0.5 % RMS, typ. < 1 % peak-peak

## Data Acquisition (Histogram Modes)

Method  
 Dead Time  
 Saturated Count Rate  
 Useful Count Rate  
 Max. Counts / Time Channel (Counting Depth)  
 Overflow Control  
 Collection Time  
 Display Interval Time  
 Repeat Time  
 Sequential Recording  
 Routing  
 Count Enable  
 Experiment Trigger

on-board multi-dimensional hardware histogramming process  
 80 ns, independent of computer speed  
 12 MHz  
 6 MHz  
 $2^{16}-1$   
 none / stop / repeat and correct  
 0.1 us to 100,000 s  
 10 ms to 100,000 s  
 0.1 us to 100,000 s  
 Unlimited recording by memory swapping  
 7 bit TTL  
 1 bit TTL  
 TTL



## Data Acquisition (FIFO / Parameter-Tag Mode)

Method  
 Online Display  
 FCS Calculation  
 Number of Counts of Decay / Waveform Recording  
 Dead Time  
 Saturated Count Rate, Peak  
 Sustained Count Rate (Bus-transfer Limited)  
 Max. Counts / Time Channel (Counting Depth)  
 Output Data Format (ADC / Macrotime / Routing)  
 On-board FIFO Buffer Capacity (Photons)  
 Macro Timer Resolution, Internal Clock  
 Macro Timer Resolution, Clock from SYNC Input  
 Routing  
 External Event Markers  
 Experiment Trigger

Parameter-tagging of individual photons and continuous writing to disk  
 Decay function, FCS, Cross-FCS, PCH, MCS traces  
 Multi-tau algorithm, online calculation and online fit  
 unlimited  
 80 ns  
 12 MHz  
 5 MHz  
 unlimited  
 12 / 12 / 4 bit  
 $2 \cdot 10^5$   
 25 ns, 12 bit, overflows marked by MTOF entry in data stream  
 10 ns to 100 ns, 12 bit, overflows marked by MTOF entry in data stream  
 4 bit TTL  
 4 bit, TTL  
 TTL

## Operation Environment

Computer / Operating System  
 Bus Connector  
 Used PCI-ex Slots  
 Total Power Consumption  
 Dimensions

PC Pentium, multi-core, >8GB RAM, Windows 10  
 PCI-ex  
 1  
 approx. 12 W from +12V  
 230 mm x 130 mm x 18 mm

## Related Products

SPC-180NX, SPC-150N, SPC-150NX, SPC-150NXX TCSPC modules, HPM-100 GaAsP and GaAs hybrid detectors, DCC-100PCIe detector controller  
 BDL-SMN ps diode lasers, BDS-SM, -SMY, -MM picosecond diode lasers, SPCImage NG data analysis software

## Related Literature

W. Becker, The bh TCSPC Handbook, 9th edition (2021), 950 pages, available on <https://www.becker-hickl.com>. Please contact bh for printed copies.  
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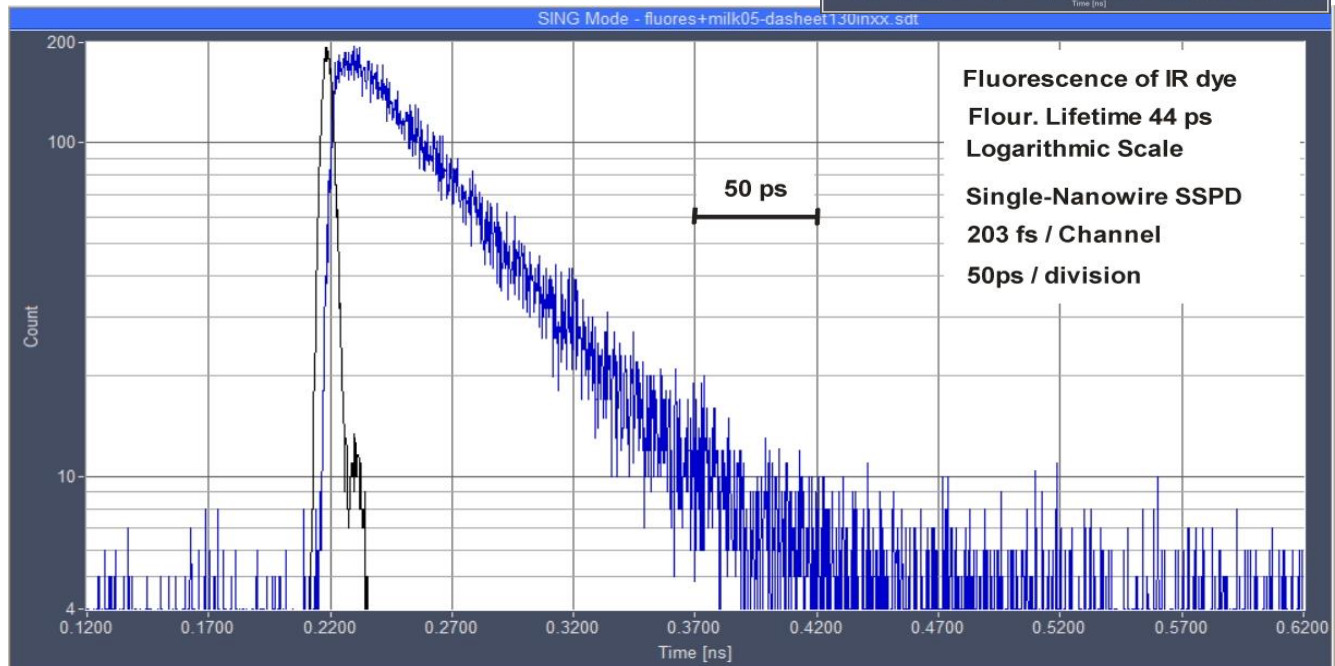
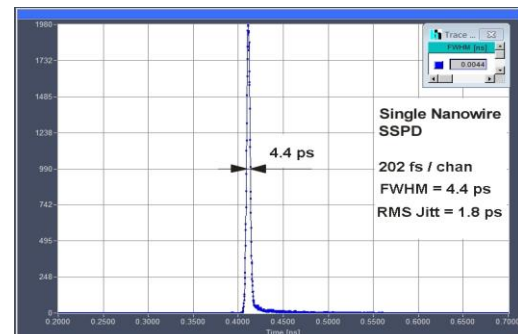
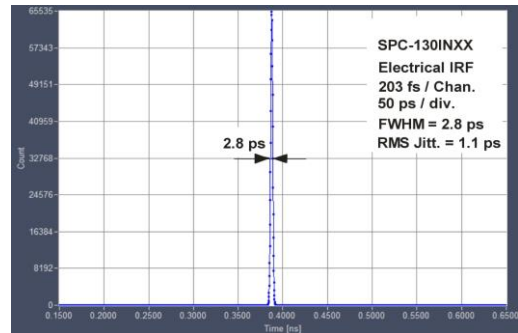
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 www.dyna-sense.com



## Ultra-High Resolution Time-Correlated Single Photon Counting Module

- SPC-180NXX technology
- High-throughput PCI-Express interface
- Ultra-fast, ultra-stable timing electronics
- Electrical IRF width typ. 2.8 ps, FWHM
- Internal timing jitter 1.1 ps, RMS
- Time-channel width down to 203 fs
- Discriminator input bandwidth 4 GHz
- Recording-time interval 0.83 ns to 50 ns
- Photon distribution and parameter-tag modes
- Multi-detector / multi-wavelength capability
- Excitation-wavelength multiplexing
- Parallel operation of 2, 3 or 4 modules
- Laser repetition rates up to 150 MHz
- Dead time 80 ns
- Saturated count rate 12.5 MHz

- Ideal for superconducting NbN detectors (SSPDs)
- Ideal for ultra-fast hybrid detectors
- Ultra-high resolution fluorescence-lifetime experiments
- Photon correlation
- Anti-bunching experiments
- NIRS and fNIRS experiments at short distance
- Simultaneous multi-wavelength detection
- Simultaneous fluorescence / phosphorescence



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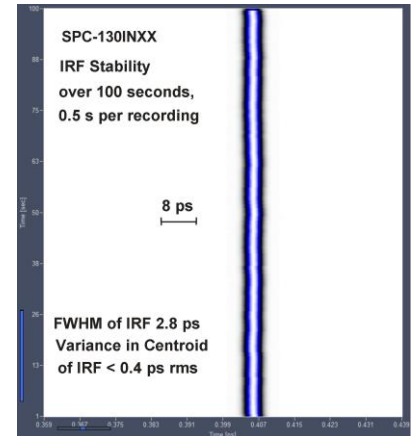
# SPC-130INXX

# TCSPC Module

## Photon Channel

Principle  
 Discriminator Input Bandwidth  
 IRF Width, FWHM  
 RMS Timing Jitter  
 Variance in Time of IRF Centroid  
 Optimum Input Voltage Range  
 Min. Input Pulse Width  
 Threshold  
 Zero Cross Adjust

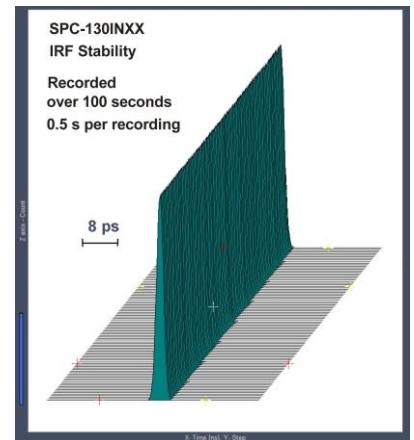
Constant Fraction Discriminator (CFD)  
 4 GHz  
 < 3 ps, FWHM  
 < 1.1 ps, RMS  
 <0.4 ps RMS over 100 seconds  
 - 30 mV to - 500 mV  
 200 ps  
 0 to - 250 mV  
 - 100 mV to + 100 mV



## Synchronisation Channel

Principle  
 Discriminator Input Bandwidth  
 Optimal Input Voltage Range  
 Min. Input Pulse Width  
 Threshold  
 Frequency Range  
 SYNC Frequency Divider  
 Zero Cross Adjust

Constant Fraction Discriminator (CFD)  
 4 GHz  
 - 30 mV to - 500 mV  
 200 ps  
 0 to -250 mV  
 0 to 150 MHz  
 1 - 2 - 4  
 -100 mV to + 100 mV



## Time-to-Amplitude Converters / ADCs

Principle  
 TAC Range  
 Biased Amplifier Gain  
 Biased Amplifier Offset  
 Time Range incl. Biased Amplifier  
 Min. Time / Channel  
 ADC Principle  
 Diff. Nonlinearity, Electrical

Ramp Generator / Biased Amplifier  
 12.5 ns to 50 ns  
 1 to 15  
 0 to 50 % of TAC Range  
 0.83 ns to 99 ns  
 203 fs  
 50 ns Flash ADC with Error Correction  
 < 0.5 % RMS, typ. < 1 % peak-peak

## Data Acquisition (Histogram Modes)

Method  
 Dead Time  
 Saturated Count Rate  
 Useful Count Rate  
 Max. Counts / Time Channel (Counting Depth)  
 Overflow Control  
 Collection Time  
 Display Interval Time  
 Repeat Time  
 Sequential Recording  
 Routing  
 Count Enable  
 Experiment Trigger

on-board multi-dimensional hardware histogramming process  
 80 ns, independent of computer speed  
 12 MHz  
 6 MHz  
 $2^{16}-1$   
 none / stop / repeat and correct  
 0.1 us to 100,000 s  
 10 ms to 100,000 s  
 0.1 us to 100,000 s  
 Unlimited recording by memory swapping  
 7 bit TTL / CMOS  
 1 bit TTL / CMOS  
 TTL / CMOS

## Data Acquisition (FIFO / Parameter-Tag Mode)

Method  
 Online Display  
 FCS Calculation  
 Number of Counts of Decay / Waveform Recording  
 Dead Time  
 Saturated Count Rate, Peak  
 Sustained Count Rate (Bus-transfer Limited)  
 Max. Counts / Time Channel (Counting Depth)  
 Output Data Format (ADC / Macrotime / Routing)  
 On-board FIFO Buffer Capacity (Photons)  
 Macro Timer Resolution, Internal Clock  
 Macro Timer Resolution, Clock from SYNC Input  
 Routing  
 External Event Markers  
 Experiment Trigger

Parameter-tagging of individual photons, continuous writing to disk  
 Decay function, FCS, Cross-FCS, PCH, MCS traces  
 Multi-tau algorithm, online calculation and online fit  
 unlimited  
 80 ns  
 12 MHz  
 5 MHz  
 unlimited  
 12 / 12 / 4 bit  
 $2 \cdot 10^5$   
 25 ns, 12 bit, overflows marked by MTOF entry in data stream  
 10 ns to 100 ns, 12 bit, overflows marked by MTOF entry in data stream  
 4 bit TTL / CMOS  
 4 bit, TTL / CMOS  
 TTL / CMOS

## Operation Environment

Computer / Operating System  
 Bus Connector  
 Used PCI-ex Slots  
 Total Power Consumption  
 Dimensions

PC Pentium, multi-core, >8GB RAM, Windows 10, Windows 11  
 PCI-ex  
 1  
 approx. 12 W from +12V  
 230 mm x 130 mm x 18 mm

## Related Products

SPC-130IN, SPC-130INX, SPC-180N, SPC-180NX, SPC-180INXX, SPC-150N, SPC-150NX, SPC-150NXX TCSPC modules, HPM-100-06 and -07 hybrid detectors  
 BDL-SMN ps diode lasers, BDS-SM, picosecond diode laser, DCS-120 multiphoton FLIM systems

## Related Literature

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