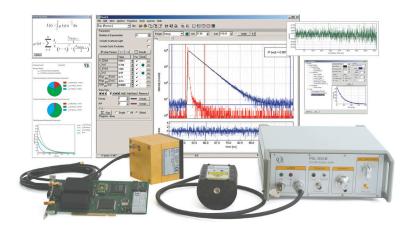# QM Upgrade Kit

Lifetime Upgrade Kit for PTI QuantaMaster™

- Picosecond fluorescence lifetime measurements
- Turn-key picosecond diode lasers or sub-nanosecond LEDs
- Time-Correlated Single Photon Counting (TCSPC)
- Advanced data analysis software

Applications

- Time-resolved fluorescence spectroscopy
- Fluorescence anisotropy decay analysis
- Ultra sensitive analytics
- Photochemistry
- Material research

The spectrofluorometer QuantaMaster™ from PTI can be used for many basic spectroscopic applications like the determination of the excitation and emission characteristics of a sample. The capabilities of this system can be further enhanced by using time-resolved techniques, because they will grant the following advantages:

- Decay time as further dimension enhances the accuracy of analytical measurements
- Independence from fluorophore concentration
- Discrimination of fluorescence light against elastic and Raman scattering by temporal resolution

The upgrade of a QuantaMaster™ is based on the method of Time-Correlated Single Photon Counting (TCSPC), which is considered to be the most sensitive and accurate measurement method to determine fluorescence lifetimes with picosecond accuracy. The kit further includes picosecond pulsed diode lasers or LEDs, a detector suited for photon counting, all necessary cables as well as a powerful analysis software.

The upgrade kit can in principle be directly attached to the QuantaMaster™. However, as there are some requirements that have to be fulfilled by the QuantaMaster™, e.g. a second exit port at the monochromator or a second entrance port at the sample chamber, a close cooperation is needed to propose the optimum solution. Upon request an installation as well as an extensive training on the system is also possible.

Excitation

The excitation subsystem consists of a common pulsed diode laser driver and different laser heads or LEDs with pulses in the picosecond time range. The available wavelengths range from 245 nm to 900 nm. Wavelength changes are very easy as only the corresponding head needs to be changed.

TCSPC Data Acquisition

The photon counting modules (TimeHarp 200, PicoHarp 300) contain the complete timing electronics for Time-Correlated Single Photon Counting (TCSPC) with picosecond resolution. Depending on the type of excitation source and detector, fluorescence lifetimes down to 10 picoseconds can be resolved. The data acquistion is controlled by an easy to use Windows™ software.

Detector

The PMA-M series detector unit is recommended for the majority of applications. The unit has a built-in high voltage power supply, signal pre-amplifier and a gold plated iron housing for maximum shielding. The standard detector covers the spectral range from 185 nm to 820 nm. Other spectral ranges as well as other detector types are also possible.

Software

The FluoFit program is a multiexponential fluorescence decay fitting software for PCs. It implements an iterative reconvolution of the instrument response and the observed fluorescence decay with nonlinear error minimization. Up to four exponential decay models or different lifetime distribution models can be fitted to the observed data. IRF and decay background as well as time shift are included as fit parameters. Anisotropy analysis and advanced error analysis with different methods is also possible. Global analysis is possible for all included models.

Specifications

Excitation Sources[1]		
Light source	Picosecond Laser Diode Heads (LDH Series)	Pulsed LEDs (PLS Series)
Wavelengths	375 - 510 nm, 530 nm, 635 - 900 nm	245 - 600 nm
Repetition rate	up to 40 MHz (optional 80 MHz)	up to 40 MHz
Pulse width	60 - 500 ps	400 ps - 1 ns

Detectors[1]		
Type	PMT (PMA Series)	
Spectral range	185 - 700 nm	185 - 820 nm
Dark counts (20 °C, typ. value)	< 50 cps	< 900 cps

Data Acquisition		
Type	TimeHarp 200	PicoHarp 300	NanoHarp 250
Time resolution (bin width)	< 40 ps	4 ps	4 ns or 32 ns (selectable)
Time channels per curve	up to 4096	up to 65536	up to 262144
Time range	150 ns - 4.5 µs	260 ns - 33 µs	up to 1.04 ms resp. 2.15 s (depending on selected time resolution)

Software Features (FluoFit)	
Fitting algorithm	nonlinear least squares fitting, iterative reconvolution, global fitting for all models
Fitting models	exponential decay up to 4th order, lifetime distributions (Gaussian, Lorentzian, Stretched exponential), anisotropy (up to 4th order exponential decay model)
Error analysis	χ^2, distribution and autocorrelation of weighted residuals, Asymptotic Standard Errors (ASE), support Plane Analysis and Bootstrap

Operational and Electrical	
Operating environment	PC Pentium class, 2 GHz, 512 MB memory with Windows™ XP/Vista/7
Power requirements	110/230 V, 50/60 Hz

1) lasers, other detectors and cooling available upon request