

*Ultimate Solution for Ultra Micro Light  
Analyzer **NEW!!**  
With lock-in functions and external  
synchronization functions.*



**Work with Lab View**

**<Application>**

- ◇ Various forms of physical photometry
- ◇ Photodetection for chemical analysis instruments
- ◇ Near-field optical microscopes
- ◇ Photodetection elements for liquid chromatography

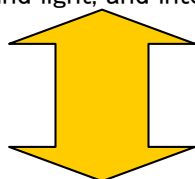
**<Features>**

- ◇ With lock-in functions  
Connectible with optical choppers
- ◇ Standard PC driver attachment
- ◇ Responds to PMT signals and TTL signals
- ◇ With high-speed D/A analog output
- ◇  $\pm 5V$  power external output

**<Outline>**

PHOTON COUNTER is a tester which measures light (photons) that generate at atomic level.

It is used widely in research in the physical photometry, chemical analysis, and medical fields, and is one of the tools which are indispensable to the latest in academic research. Lock-in functions and external synchronization functions have been added to reflect the demands of the users. Because of this, S/N is improved even in cases where there is background light, and interfaces with external devices such as spectrometers become easy.



With USB interface, PMT signal, TTL signal inputs.

**\* Photodetection Head \***

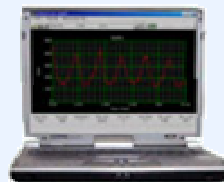


Built-in photomultiplier housing  
Model Number PHC-HA-1  
PMT signal direct output type  
PMT Connect to IN  
With C mount  
Connection cable attached



Counting Module  
Model Number H6240,  
H8259  
TTL signal output type  
TTL Connect to IN  
★Hamamatsu Photonics  
Co.,Ltd.

**Connections with Various PCs**

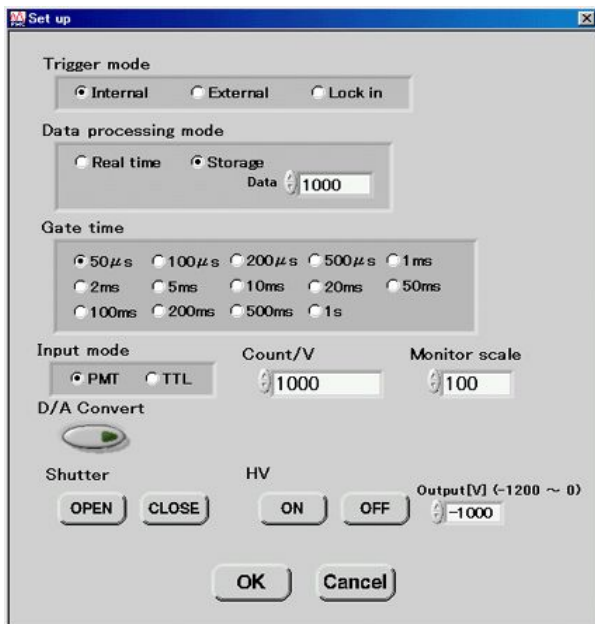
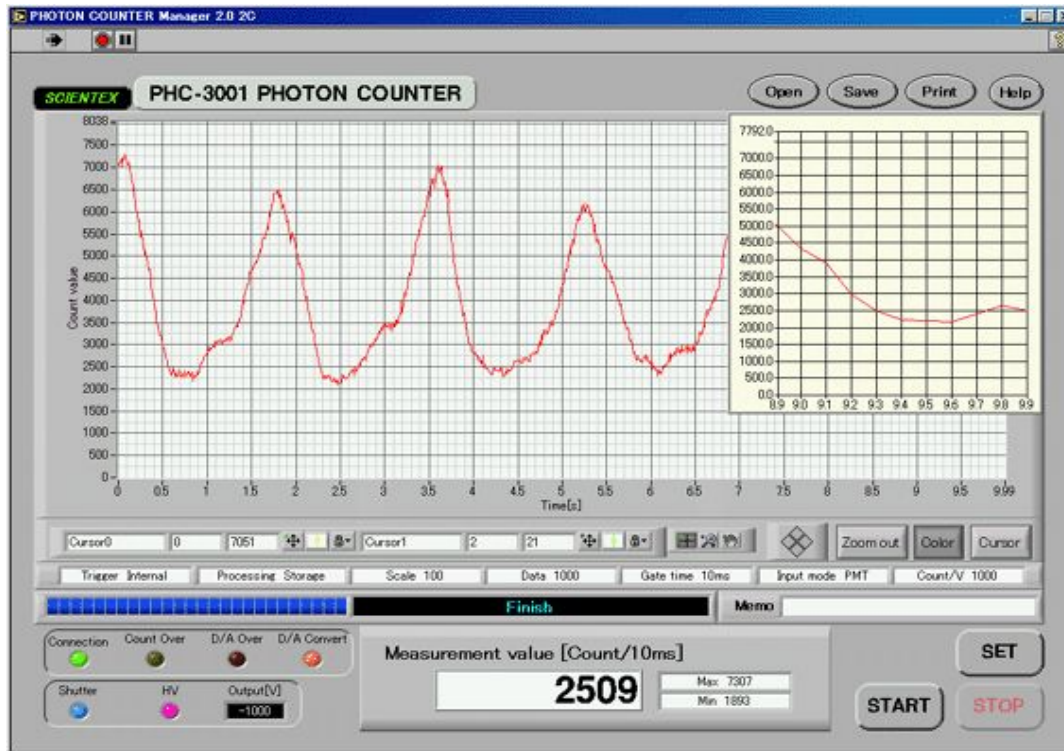


For  
Windows  
98SE  
Me/2000/XP

USB interface  
Measurement Condition  
Settings  
Can read data

# PHOTON COUNTER PHC-3001 Driver Software

★It can read data by being connected to the PC, switch between parameter settings, measurement mode, etc. (include the driver software)



Measurement condition settings can be made when the SET button is pressed.

Selecting of <Trigger Mode>

Internal: Operated with the internal clock

External: The gate is operated with the synchronized signal from outside

Lock-In: Operated with the synchronized signal from the optical chopper

Selecting of <Data Processing>

Real Time: Displayed at the same time as the measurement

Storage: Displayed when the data is recorded in PHOTON COUNTER once.

Setting of <Gate Time>

Setting of 50 μs to 1s

Selecting of <Input Mode>

PMT: Signals of photomultipliers are inputted directly.

TTL: Signals that have been turned to TTL are inputted.

<Count/V>

The count value is outputted as an analog signal.

The ratio of the analog (voltage) and count value are set.

<Shutter> OPEN/CLOSE

The opening and shutting of the shutter is done.

<HV> ON/ OFF: The ON/OFF states of the high-voltage power supply are set.

The output [V] output voltage is set.

★The background color of the screen can be changed to either black or white. Changeable with the color button.

★A trial version software is available. The operations can be manipulated even without the actual equipment.

★The recommended operating environment of the PC

<Platform> Windows 2000/NT 4.0 ServicePack6 or above/XP/Me/98

<CPU> Pentium III or Celeron 600MHz or above

**Short Column**

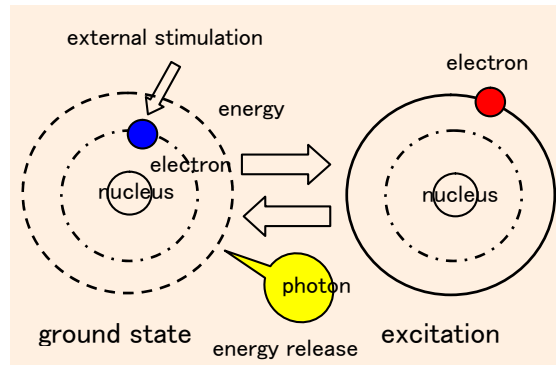
■ How Photons are Generated

The electrons that surround atomic nuclei are usually at a fixed energy level (normal state). When there is stimulation from outside, the electrons become excited and move to an outer orbit (be in an excited state).

This condition is unstable and is to return to the original state right away.

When returning to the original state, light (photons) is emitted.

Stimulation from outside may be physical factors



■ Fundamentals of PHOTON COUNTER

Light has wave-particle duality.

There is a photomultiplier (PMT) that is used as a sensor which indicates the particle-like properties of light and applies the photoelectric effects.

When there is a lot of light, the signals of the PMT are observed as analog amounts, and under ultra micro optical signal conditions, they are in discrete pulse conditions.

The amount of the microscopic optical light can be accurately determined through the counting of this pulse.



When there is a lot of light:  
Output like an analog-like signal.



When there is ultra micro light:  
Output like a discrete pulse.

■ Signal Amount of PMT and Photons

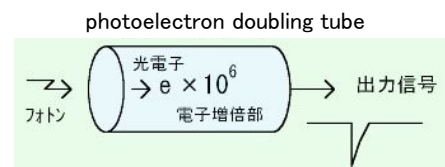
When there is a photon incidence in the PMT, electrons (photoelectrons) fly out of the photoelectric surface due to the photoelectric effects.

One photoelectron is multiplied with the electron-multiplier section (dynode) of the PMT, and multiplied by about a million.

The charge amount that is outputted from the PMT is  $Q=0.16\text{pC}$  (picocoulomb), and becomes an extremely weak current of  $0.16\text{pA}$  with the mean current.

The dark current (the current that is generated even in the dark) has several nAs, so measurements can't be made because it is hidden behind the noise when analog measurements are made with this signal amount.

Even when there is an incidence of light that generates photoelectrons of 10MCps, the signal amount that can



■ PHOTON COUNTER Dramatically Improves Detection Limits.

Diagram 1 shows a comparison between an analog-like measurement and photon counting.

Although the limit for the practical level for measuring with an analog measurement is empirically 10nA (about a hundred thousand cps), the practical level for photon counting is from about 1000cps. The reason why it is not from 0cps is because there is some dark count (a count that is generated in the dark).

In this way, the detection limit for photon counting is improved by three digits compared with analog-like measurements.

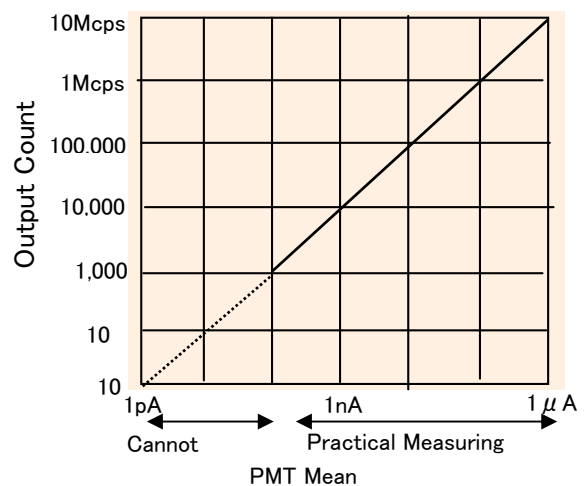


Figure 1

■ The Limit of the Optical Power that can be Detected with Photon Counting

How many watts is the measurement limit when measurements are made with photon counting?

When a measurement is made with a normal optical power meter, measuring power of nW or below is difficult.

However, close to **10-15 W (1/1000 of pW)** is possible with photon counting.

# PHOTON COUNTER PHC-3001

Specifications	
Trigger Mode	◇Internal Synchronous Mode, ◇External Synchronous Mode, Lock-In Mode (option)
Gate Time	◇50 μs, 100 μs, 200 μs, 500 μs, 1ms, 2ms, 5ms, 10ms, 20ms, 50ms, 100ms 200ms, 500ms, 1s
Input	◇PMT INPUT MAX 10Mcps ◇TTL INPUT (2.4~5V) MAX 10Mcps ◇TRIG INPUT (2.4~5V) 1)External synchronous mode: Pulse Width ≥ 100ns (negative polarity) Recommended Operating Repetition •Real time mode 【Gate Time < 200ms】 Repetition ≥ Gate Time + 100ms 【Gate Time ≥ 200ms】 Repetition ≥ Gate Time + 500 μs •Storage mode Repetition ≥ Gate Time + 500 μs 2)Lock-in mode This operation is storage mode only. DUTY Cycle: Square wave of 50%, Repetition ≤ 1KHz
Output	◇D/A OUTPUT: Output voltage with the ratio of the set voltage and the COUNT value ◇TRIG.OUTPUT: ≥4V, Outputted after completion of D/A output Pulse Width: negative polarity about 10 μs
Option	◇High-Voltage Power Supply: 0 to - 1200V ◇Shutter (COPAL electromagnetic shutter NO.0) and dedicated drive circuit
Power	AC100V(50/60Hz)
Power Consumption	35VA
Operating Temperature	0 to +40°C
Size	250(W) X 99(H) X 330(D) mm
Weight	about 5Kg (standard product)

◇Option: Shutter and dedicated drive circuit



★Built-in in the user's equipment and used.  
dedicated cable attached.

◇Product Series The products have many options showing below.

Model Number	Specifications
PHC-3001-1A	Standard Model
PHC-3001-1B	Standard model + high-voltage power supply
PHC-3001-1C	Standard model + high-voltage power supply + shutter functions
PHC-3001-2A	Standard model + lock-in functions
PHC-3001-2B	Standard model + lock-in functions + high-voltage power supply
PHC-3001-2C	Standard model + lock-in functions + high-voltage power supply + shutter functions

This product consists of the main body and the following accessories. ⚠ Avoid the following environments.

Standard Accessories

- ◇ AC Power Cord (3P) 2m
- ◇ Signal Cable BNC-BNC 2m 2

※An exclusive DC cable is attached for set products with a counting module (TTL Output by Hamamatsu Photonics).

- ◇ Driver Software CD (for reading data)
- ◇ Instruction Manual
- ◇ USB Cable

- ◇ Hot, humid, or wet environments
- ◇ Dusty environments
- ◇ Environments with corrosive gas
- ◇ Environments with many vibrations
- ◇ Environments that receive direct sunlight

- ⚠ Follow the safety measures
- ◇ Beware of electric shock as high voltages are used.

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