Rev. 1 - 17 February 2020

# SP5605

UV Led Driver


CAEN Educational

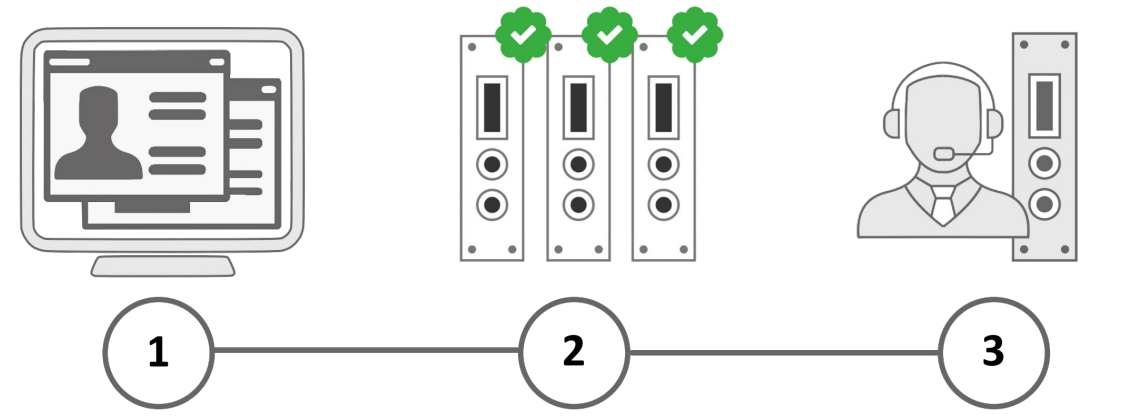
Data Sheet

DS6055

# Register your device

Register your device to your **MyCAEN+** account and get access to our customer services, such as notification for new firmware or software upgrade, tracking service procedures or open a ticket for assistance. **MyCAEN+** accounts have a dedicated support service for their registered products. A set of basic information can be shared with the operator, speeding up the troubleshooting process and improving the efficiency of the support interactions.

**MyCAEN+** dashboard is designed to offer you a direct access to all our after sales services. Registration is totally free, to create an account go to https://www.caen.it/become-mycaenplus-user and fill the registration form with your data.

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# Purpose of this Manual

This User's Manual contains the full description of the SP5605 LED driver.

# Change Document Record

| Date | Revision | Changes |
|---|---|---|
| 23 October 2013 | 00 | Initial release |
| 17 February 2020 | 01 | Modified "5mm Ultra Violet LED specifications" paragraph |

# Symbols, abbreviated terms and notation

Not available

# Reference Documents

Not available

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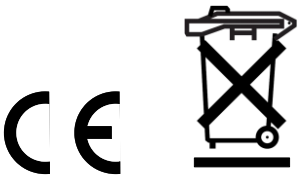

# Introduction

The SP5605is a fast UV (ultra-violet) LED driver and this is the first available UV LED tool for SiPM tests and characterization. The SP5605 provides a triggered light burst of intensity from few photons to about 27000 photons, where the sensor saturates. The SP5605 features tuneable intensity and repetition rate. Indeed the UV LED driver can be triggered either via the internal pulse generator, or via an external source. The sensor guarantees constant wavelength signal from 0 to 1kHz. The optical signal is routed to the sensor through a fibre, FC interfaced.

# Available items

| Ordering Code | Item | Description |
|---|---|---|
| WSP5605XAAAA | SP5605 | Led Driver for SIPM development kit |
| Thorlabs | M00279695 | Optical Fiber, 600 µm thick, 1m long |

# Back panel components


POWER: power switch for device turning On / Off; red led, lights up as device is ON
12V: PCB DC 2.1mm Power Socket (RAPC722X Switchcraft, +12V DC Input)
TRIGGER:

- IN: 00-type LEMO connector; External trigger input (TTL, High input impedance)
- OUT: 00-type LEMO connector; Local trigger output (TTL, drives 50 Ohm)
- INT/EXT (switch):
  - INT enables the internal trigger
  - EXT allows to use External trigger input (IN).

FREQ trimmer: frequency setting within the selected range

# Front panel components


AMPLITUDE: Vishay Spectrol 10 Turn Dial with Lock lever for pulse light intensity setting
LIGHT: FC Connector (output)

# +12V DC External Power Supply

The module is powered via the external AC/DC stabilized power supply (Mod. Meanwell GS40A12-P1J 40W, 12V DC Output, 3.34A).

# 5mm Ultra Violet LED specifications

The SP5605 LED driver is provided with a UVTOP250 TO39 UV-LED from Roithner LaserTechnik.

| **Absolute Maximum Rating (Ta=25 °C)** | | | |
|---|---|---|---|
| **Item** | **Symbol** | **Value** | **Unit** |
| Power Dissipation, DC | $P_D$ | 180 | mW |
| Forward Current, DC | $I_F$ | 30 | mA |
| Operating Temperature | $T_{opr}$ | -30 ~ +55 | °C |
| Storage Temperature | $T_{stg}$ | -30 ~ +100 | °C |
| Lead Soldering Temperature | $T_{sol}$ | 190°C /5sec | - |

| **Electrical - Optical Characteristics (Ta=25 °C)** | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Symbol** | **Condition** | **Min.** | **Typ.** | **Max.** | **Unit** |
| DC Forward Voltage[1] | $V_F$ | $I_F$=20mA | - | 6.0 | 7.5 | V |
| Peak. Wavelength[2] | $\lambda_p$ | $I_F$=20mA | 250 | | 260 | nm |
| Half Width (FWHM) | $\Delta\lambda$ | $I_F$=20mA | - | 11 | 15 | nm |
| 50% Power Angle[3] | 2θ½ | $I_F$=20mA | - | 7 | - | deg |

[1] Forward voltage tolerance ± 3%
[2] Wavelength tolerance ± 3nm
[3] Output power tolerance ± 10%

# SP5605 UV-LED Driver Technical specifications

| | |
|---|---|
| **Dimensions** | Width 80mm, height 42mm, depth 80mm |
| **Power requirements** | 140mA@+12V (12V DC External Power Supply) |
| **Width of pulse** | 4ns typical @ full amplitude (FWHM) |
| **Trigger Input** | TTL ,High input impedence,1Hz-300kHz frequency (intensity has to be calibrated for frequencies greater than 1 kHz) |
| **Trigger Output** | TTL, drives 50 Ohm ; width: ~20ns; rise/fall time: <2ns |
| **Output frequency (intrinsic mode)** | 100Hz – 1500Hz |
| **Output light wavelength** | 248 ± 8 nm (measured) |
| **Output light intensity** | 0 - ~27000 photons |

# Characterization Measurements

Complete test and characterization of the SP5605 UV-LED Driver pulses has been performed at the University of Insubria (Como, Italy).
Precise measurements of the light wavelength has been performed by the use of a spectrophotometer. The measured wavelength is 248 ± 8 nm, as shown in the following histogram. The measurement is compatible with the LED specifications of 255 ± 3 nm.

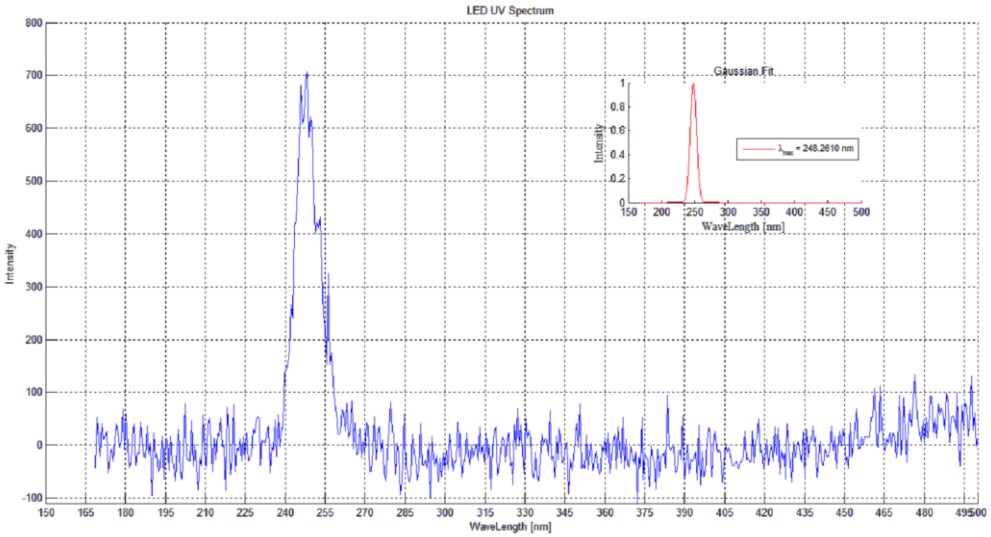


**Figure 1: Emitted light spectrum wavelength. The peak is at 248 nm**

The characterization of the UV-LED Driver has been performed by means of the R821 PMT from Hamamatsu Solar Blind, with known spectral and gain response.
A custom optical fiber from Thorlabs (Multimode, 600 µm thick) has been used to drive the input light from the UV-LED to the PMT. The PMT can work in single photo-electron mode, making possible to calibrate the spectra in number of photons. The PMT quantum efficiency at 250 nm wavelength is equal to 10%.

Picture below shows the typical pulse response of UV-LED from PMT (yellow), with its synchronization pulse (green). The amplitude is proportional to the UV-LED intensity, and ranges from few tens of mV to hundreds of mV. The pulse width is defined by the PMT specifications.

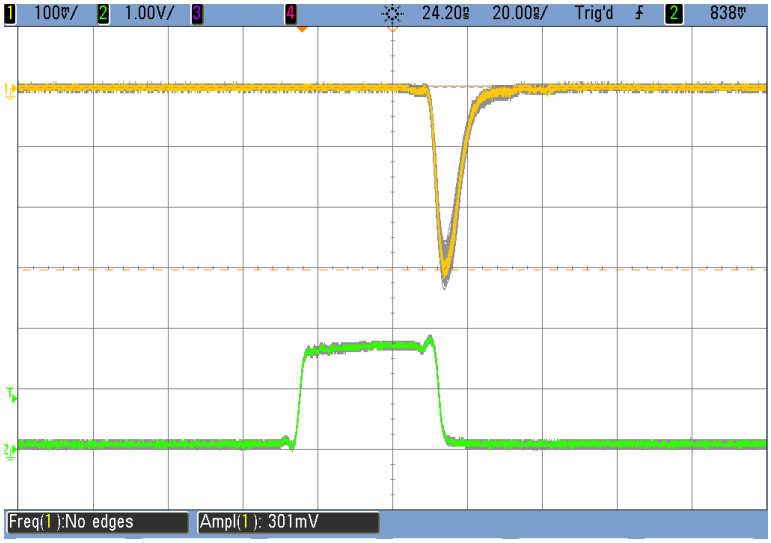


**Figure 2: Oscilloscope view of the UV-LED signal from PMT (yellow), and its synchronization signal (green).**

The CAEN V792N QDC has been used to evaluate the number of emitted photons by the UV-LED. An external TTL trigger has been used to drive the UV-LED light emission.

In the following figure it is shown the result of the measurement of emitted light variations versus the input trigger frequency. The input trigger frequency varied from 50Hz to 1kHz. In the range of 1Hz to 1kHz the emitted wavelength is guaranteed to be stable. The resulting light intensity variations are within 15%, as can be seen from the plot. The measurements are normalized to the highest intensity value.

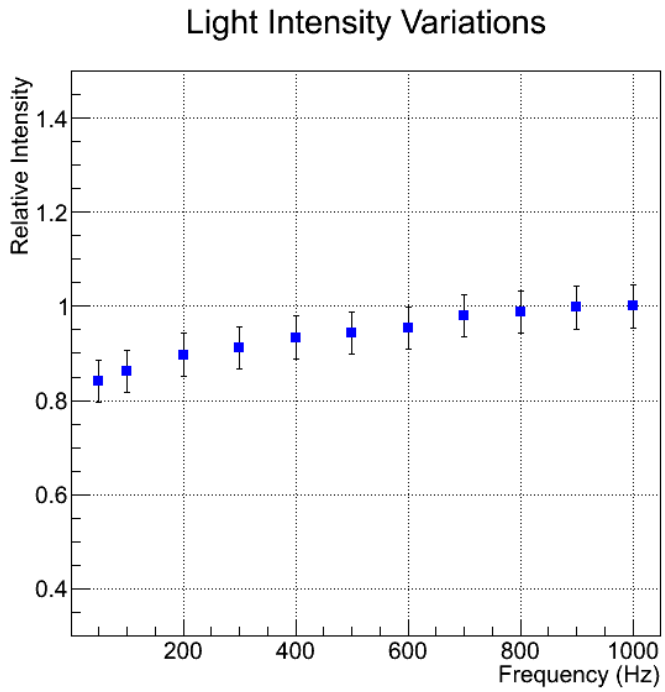


**Figure 3: UV-LED light intensity variations in the 1Hz-1kHz range, where the wavelength is guaranteed to be stable.**

Calibration of the light intensity has been performed as well, by varying the potentiometer knob. To evaluate the number of photons, the V792N QDC has been previously calibrated. Moreover, the PMT gain and quantum efficiency are known, and those values are used to convert the QDC integral value into the number of detected photo-electrons first, and finally into the number of emitted photons.
In the figure below it is shown for each value of the potentiometer knob the corresponding value of emitted photons. The measurement has been performed with the input trigger frequency of 500Hz. For frequencies in the range of 1Hz to 1kHz, the number of photons remains compatible within the differences already observed in the previous measurement.

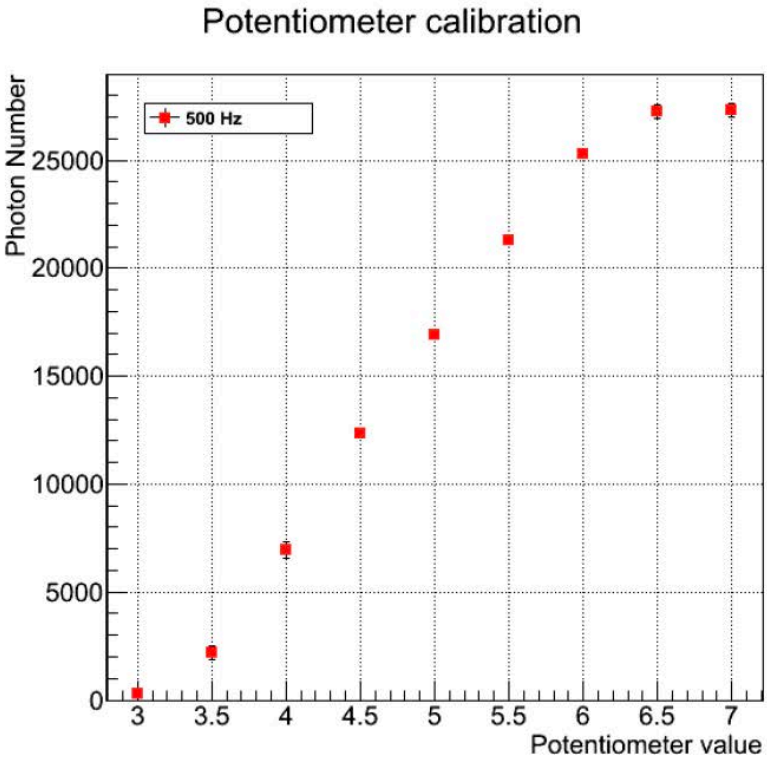


**Figure 4: Potentiometer calibration. For each value of the know the corresponding photon number is shown in the y axis.**

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