

# High sensitivity light amplifier for fiber optic applications

Type PMD

High sensitivity amplifier dedicated to acquisition and analysis of the light intensity from combustion.

- Amplification of up to 16 light input channels
- 4 slots for PM4 measure modules or PD4 measure modules
- A mixed operation of measure modules (with photomultiplier or photo diode detectors) is possible
- Remote control via Combi software or PMD Control Box software
- The amplification factor of each channel can be adjusted singularly by software

### Description

The light intensities acquired with optical probes in the cylinder are transferred to the PMD system by means of optical fibers plugged to the BNC input connectors. The light intensity of each channel is converted into a proportional voltage signal by photomultipliers (PM4 measure module) or photo diode detectors (PD4 measure module). The output voltage signals are acquired and analyzed by the software tool Combi.

### Application

Reliable combustion data are readily available thanks to the easy adaptability of the fiber-optic spark plug and the high sensitivity amplifier PMD. In addition to the ignition process, abnormal combustion phenomena such as knocking, pre-ignition and soot formation can be made clearly apparent both over time and in space. The extreme sensitivity of the system allows for combustion analysis even during idle operation and cold start.



### Technical data

#### PMD – electronics chassis with 16 channels

Signal out	-	BNC and D-SUB 44-pol. neg.
Output voltage	V	0 – 10
Amplifier slots	-	4 (PM4 and/or PD4)
Remote control interface	-	Serial
Dimensions	-	½ 19" (4 HU)
Weight	g	3060
Power supply	V	90 – 230 V

#### PM4 – Measure module 4 channels with Photomultiplier detectors

Photomultipliers	-	4
Sensitivity	nm	190 – 850
Rise time	ns	0.65
Input connectors	-	ST
Weight	g	580

#### PD4 – Measure module 4 channels with Photo diode detectors

Photodiodes	-	4
Technical data on request	-	-

### Options

- Remote control with "PMD Control Box" if Combi is not available
- Wavelength filter on request



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**Photomultiplier vs. photo diode detectors**

Photomultiplier tubes are the most suitable sensors to detect flame radiation. They are very sensitive in a wide wavelength range; thanks to their high amplification range they are able to detect single photons. In comparison to photodiodes the signal amplification is not a digital amplification which also amplifies the noise of a signal. The analog amplification of photomultiplier tubes allows the detection of very low intensity signals without amplifying the electronic interfering signal. The signal to noise ratio of photomultiplier tubes is much higher than that of photodiodes.

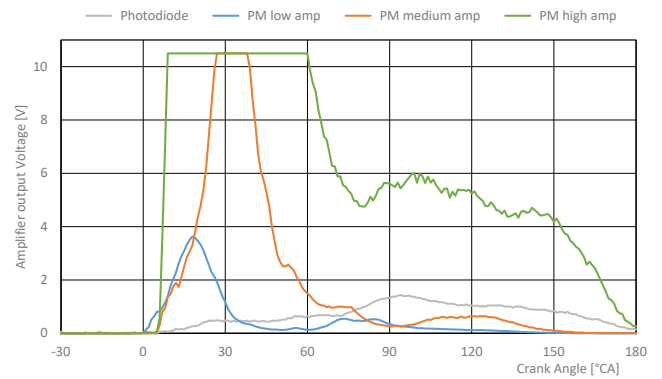


Fig. 3: Output sensitivities of Photodiode and Photomultiplier (PM) sensors

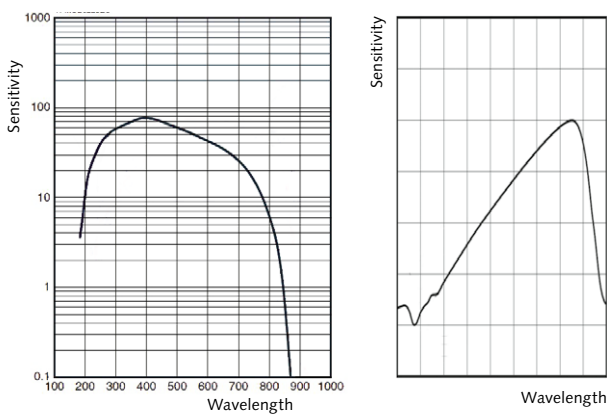


Fig. 1: Sensitivity of the photomultiplier from 190 nm to 850 nm (left); Sensitivity of the photodiode from 200 nm to 1100 nm (right)

The flame front in gasoline engines is characterized by the hydrocarbon radiation which occurs in the UV wavelength range at approx. 300 nm. The implemented photomultiplier tubes are optimized in this UV range. They also have an excellent sensitivity in the visible wave length range up to 650 nm as well. Photodiodes are optimized for the visible and near infrared wave length; the sensitivity in the UV range is low thus they are not suitable to detect flame propagation, especially at idle and cold start conditions.

**Measuring chain**

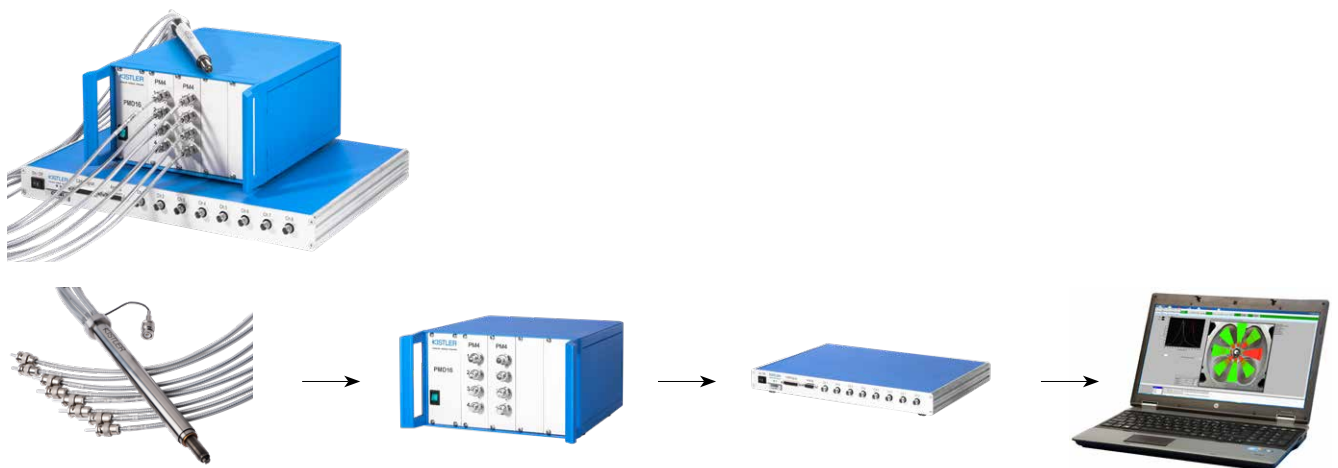


Fig. 2: Components used to capture local light intensity in the combustion chamber: fiber optic spark plug, PMD optical amplifier, Combi data acquisition system, PC with Combi software

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