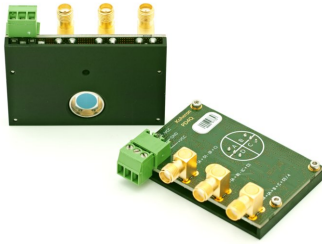


## 4-quadrant photodetector

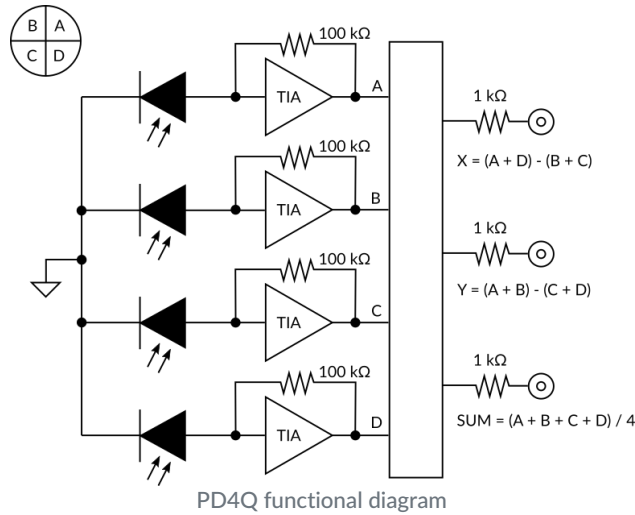


Koheron PD4Q is a 4-quadrant photodetector with 100 kV/A transimpedance gain and 250 kHz bandwidth. The PD4Q outputs three voltages:  $X = (A+D)-(B+C)$ ,  $Y = (A+B)-(C+D)$  and  $SUM = (A+B+C+D)/4$ . Thanks to its low noise and high dynamic range, the PD4Q can measure laser beam position with a resolution below 20 nm in a 10 kHz bandwidth.

## Specifications

	PD4Q-10k	PD4Q-100k
<b>Detector</b>		
Wavelength range	400 nm to 1050 nm	400 nm to 1050 nm
Active area per quadrant	12.3 mm <sup>2</sup>	12.3 mm <sup>2</sup>
Photodiode peak responsivity (900 nm)	0.64 A/W	0.64 A/W
Maximum photocurrent per quadrant	1 mA	100 $\mu$ A
<b>Electronics</b>		
3 dB bandwidth	500 kHz	250 kHz
Transimpedance gain	10 kV/A	100 kV/A
Noise Equivalent Power (at 10 kHz)	8.3 pW/ $\sqrt$ Hz	1.6 pW/ $\sqrt$ Hz
Output impedance	1 k $\Omega$	1 k $\Omega$
Output voltage range	-10 V to 10 V	-10 V to 10 V
Output	SMA female connector	SMA female connector
<b>Power supplies</b>		
Positive supply voltage	11.5 V to 13 V, nom. 12 V	11.5 V to 13 V, nom. 12 V
Negative supply voltage	-13 V to -11.5 V, nom. -12 V	-13 V to -11.5 V, nom. -12 V
Quiescent current per rail	20 mA	20 mA
Maximum current per rail	75 mA	75 mA
<b>Other</b>		
Outside dimensions	60 mm x 49 mm x 18 mm	60 mm x 49 mm x 18 mm
Operating temperature	0 $^{\circ}$ C to 50 $^{\circ}$ C	0 $^{\circ}$ C to 50 $^{\circ}$ C
Weight	43 g	43 g

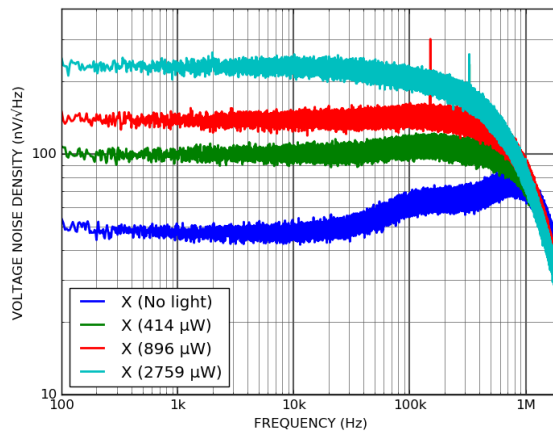
## Functional diagram



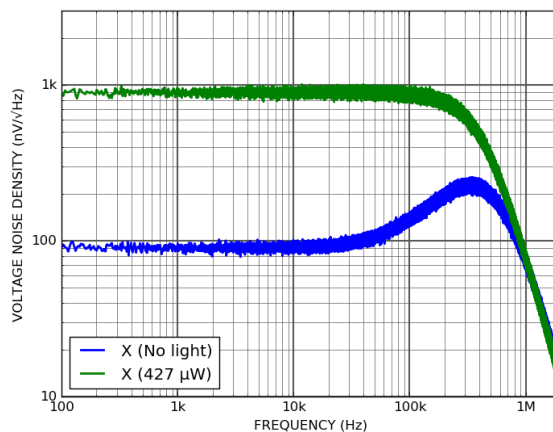
## Characterization

### Output noise

The figure below shows the X output ( $X = (A+D)-(B+C)$ ) power spectral density, with and without light. The optical source is a 810 nm LED driven by a [Koheron DRV110-A-375 laser driver](#).



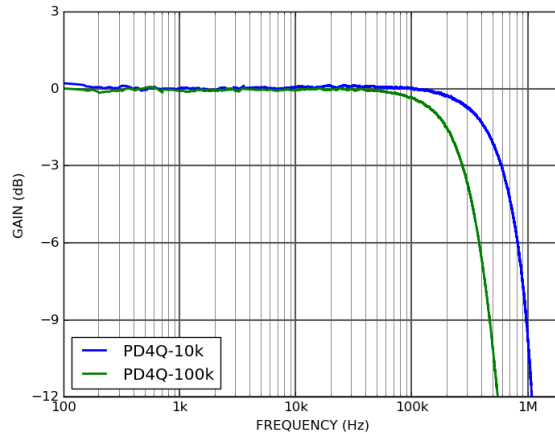
PD4Q-10k (10 kV/A) output power spectral density



PD4Q-100k (100 kV/A) output power spectral density

## Frequency response

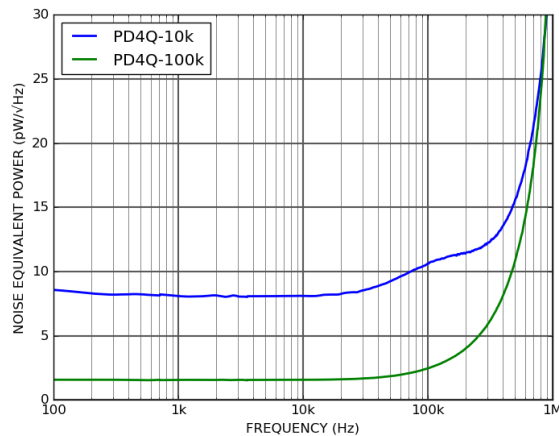
The figure below shows the frequency response of the PD4Q photodetector.



PD4Q frequency response

## Noise Equivalent Power

The figure below shows the Noise Equivalent Power of the PD4Q photodetector measured at 810 nm.



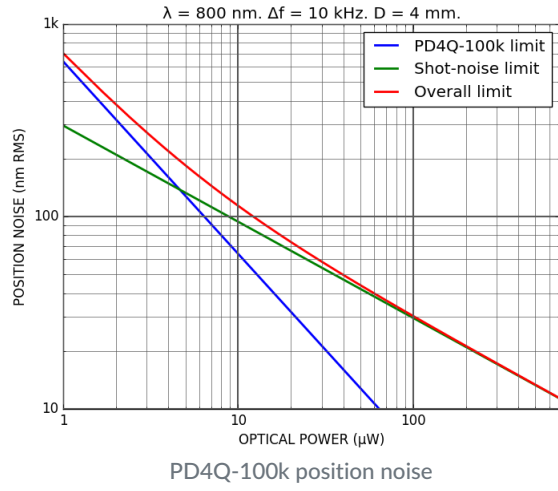
PD4Q noise equivalent power

## Position noise

The Noise Equivalent Power (NEP) of the detector can be converted into a position noise spectral density:

$$L_n = \sqrt{\text{NEP}^2 + \frac{2 e P_{\text{opt}}}{S}} \cdot \frac{D}{P_{\text{opt}}}$$

where  $D$  is the beam diameter,  $P_{\text{opt}}$  is the total input optical power and  $S$  is the photodiode responsivity. Below is the position noise over a  $\Delta f = 10$  kHz bandwidth for a 800 nm laser with 4 mm beam diameter:



## Ordering codes

REFERENCE	ATTRIBUTE
PD4Q-10k	Transimpedance gain 10 kV/A
PD4Q-100k	Transimpedance gain 100 kV/A