

Real-time Laser Beam Position Detector

„XYPSD“



User Manual

1. Introduction

The XYPSD is a position sensing detector with readout electronics and outputs for x and y position. It is working on the lateral effect photodiode principle. The position of the laser beam on the diode can be displayed without relevant time delay on a scope. Thus, even fastest fluctuations can be resolved. This is the main difference between this detector and beam profilers that can not measure a position in real-time and integrate over several pulses or fast photodiodes that can not measure any position. In addition to the x- and y-position there is also an output for the measured intensity level on the detector.

The XYPSD displays the information about the intensity level and the position directly on the housing. For this purpose an LED line and an LED cross are used, respectively.

The following figure shows the backside with the displays:



Figure 1: XYPSD with displays for intensity level and position

2. System components

A typical delivery includes the following components:

- Detector with integrated lateral effect diode, readout electronics, and optical filter
- 3 measurement cables MCX↔BNC (19 cm)
- Wall power supply 12 V
- User manual

3. Specification

3.1 Technical data

Opto-electronic properties

| | |
|------------------------------------|---|
| Bandwidth | up to 100 kHz (The bandwidth can be optimized to a customized value in our lab. For the resolution of single pulses one should choose: bandwidth \geq laser repetition rate) |
| Sensor area | 9.0 x 9.0 mm ² |
| Typical spatial resolution | < 1.5 μ m (depending on the beam diameter and profile) |
| Spectral sensitivity | VIS version: 320 – 1100 nm |
| Sensitivity / position vs. voltage | approx. 1.2 mV / μ m |

Mechanical dimensions

| | |
|---------|--------------------------------|
| Housing | 49 x 40 x 23.9 mm ³ |
| Thread | M4 |

Optical filter

| | |
|------------------|--|
| | (can be adapted on laser power and wavelength) |
| Dimensions | 11.9 x 11.9 mm ² |
| Fastening screws | M2 |

Connectors

| | |
|--------------------------|--|
| x, y, I / Connectors | analog x, y: ± 5 V / I: 0 – 7 V / MCX Coax connectors, standard oscilloscope input (high impedance, ≥ 4.7 kOhm) |
| Power supply / Connector | 12 V, < 200 mA / DC pin-and-socket connector 1.1 mm |
| Measurement cables | MCX \leftrightarrow BNC, standard length 1.8 m (other lengths on request) |

3.2 Housing

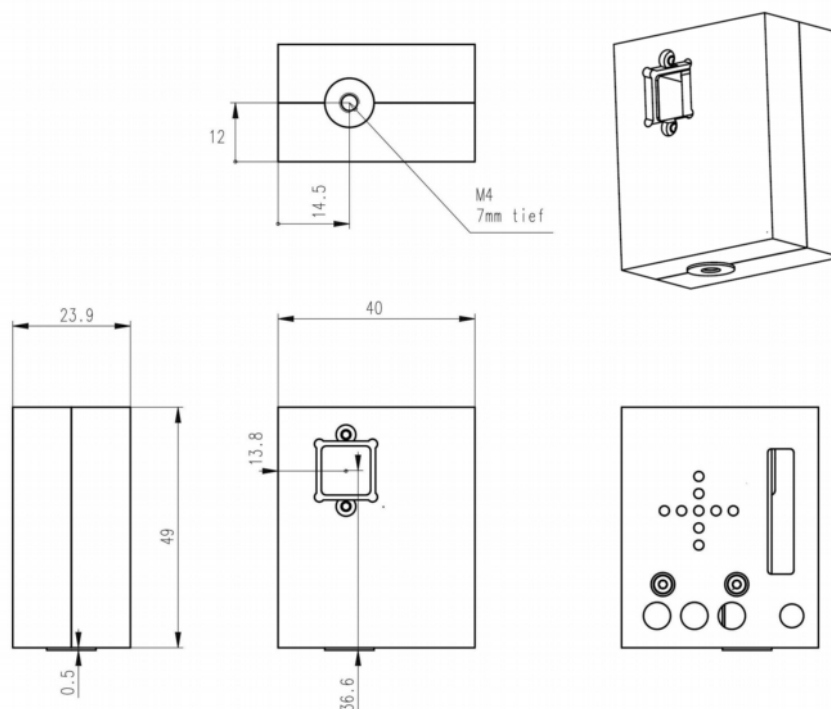


Figure 2: Housing

3.3 Displays

The XYPSD is equipped with a LED line for the intensity level and a LED cross for position display.

3.4 Intensity scaling

The raw signals of the x- and y- position are nearly proportional to the laser intensity and increase with higher intensities. To eliminate the dependency of the position signals with the laser intensity the read-out electronics in the XYPSD is equipped with an intensity scaling for a compensation by dividing the x- and y-signal by the I-signal. In that way the measurement is independent of the actual laser power.

4. Installation and operation

The intensity on the XYPSD should be chosen with values that lead to illumination of at least 3 and not more than 9 LEDs. This corresponds to voltages of 0.5 to 6 V. You can achieve the correct values by means of appropriate filters in front of the sensor or by the electronic adjustment as described in section 4.4.. The XYPSD should be aligned to the laser beam in that position where it hits the center of the PSD. In this case you can detect the widest range of position changes.

4.1 LED cross for position display

If the laser beam hits the center of the PSD only the green LED of the position display will shine. In other cases also yellow and red LEDs will shine according to the examples in figure 4.

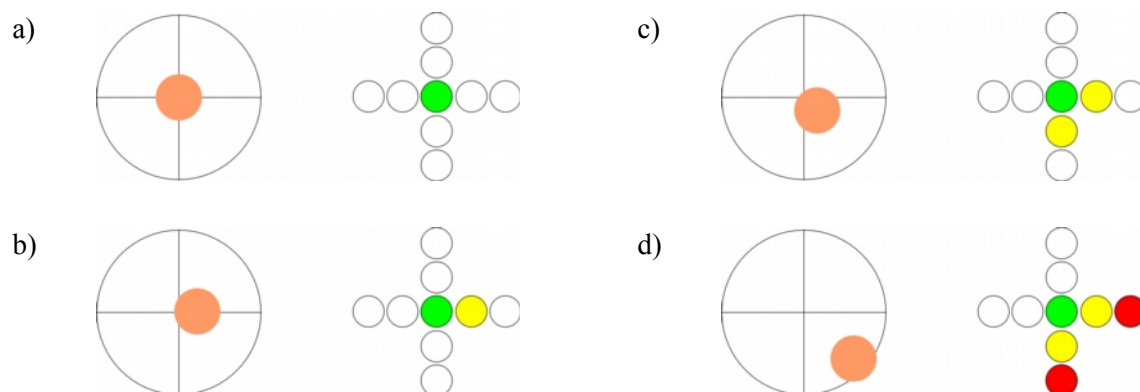


Figure 3: Examples for laser beams hitting the PSD (orange spots) and the corresponding position display. The left pictures are shown from the direction of the position display, i.e. from the rear side of the housing.

If only green and yellow LEDs shine the beam is in a range where a direct correlation between measured signal and position exists (see section 4.2 “Calibration”). If the red LED shines too, the laser beam is close to the border of the sensor.

You can get a comparable information regarding the position by using a scope. In order to get this you can connect the x and y signals to two channels of the scope and choose the scope's x-y-display mode.

4.2 Calibration

The absolute beam position in x and y depends on intrinsic non-linearities of the PSD. Furthermore there is a slight influence of the laser beam diameter and the intensity. For high accuracy applications we recommend to perform a calibration of the detector for a linearization of the position signal by moving the PSD relative to the laser beam by means of a micro-positioner and measuring the voltages for different positions.

4.3 Sham fluctuations at low intensities

Depending on the laser beam diameter and the chosen bandwidth sham fluctuations of the beam position can occur at low intensities although the beam position might be stable. These fluctuations are due to small intensity deviations of the laser and the noise of the diodes. Please take care for an appropriate intensity on the PSD.

If the intensity on the PSD is too small, the central green LED will not shine.

4.4 Intensity adjustment

To make sure that the detector operates in an appropriate intensity range, the power level can be adjusted by tuning the digital potentiometer for intensity variation (see figure 4). For that purpose adjust the laser beam onto the detector and set the intensity amplification with the digital potentiometer. Please choose the amplification in that way that at least 3 but not more than 9 elements of the power level display are shining. The setting can be done by slightly pressing the push-buttons with the metal pin which is included in the delivery. For each setting direction there is a separate push button.

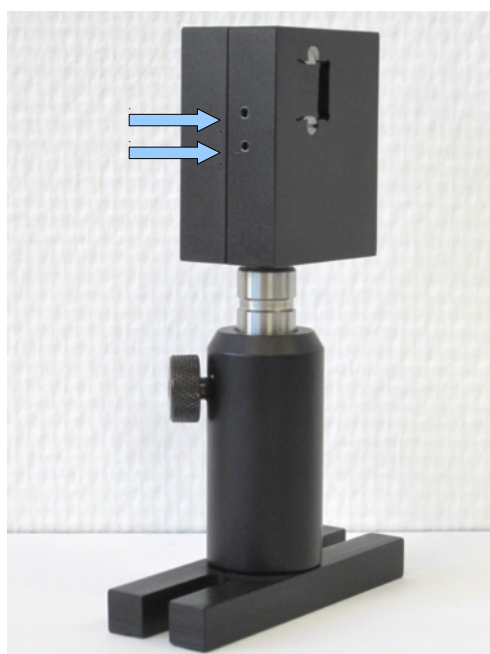


Figure 4: PSD-detector. The arrows show the push buttons of the digital potentiometers for the intensity settings (under use of the included metal pin).

With the upper push button the intensity level can be increased stepwise, while the lower push button decreases the level accordingly. There are 64 steps between the highest and the lowest level. This corresponds to a factor of 20 of the intensity-scaling.

If you do not find an appropriate adjustment you have to exchange the optical filters in front of the PSD. If the required filters are not available please contact the manufacturer or distributor.

Notes:

- In a standard delivery we integrate two optical filters in front of the sensor area. These are filters with a high and a low density for coarse and fine adjustment, respectively. Usually the filter which is the first to be reached is the low density one.
- Please be aware that the sensor area is quite sensitive. If you want to clean it you should do this carefully with a wet lint-free cotton swab.

If you want to exchange the filters you can detach the plastic screws which fix the filters in the housing. With a tilt of the detector housing it should be possible to release the filters. Once you put in new filters please be careful so that you do not damage the detector. Finally you can fix them with the plastic screws.

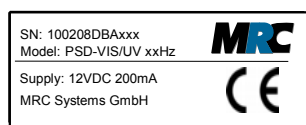
5. Safety

The detector has left our factory in a faultless state. Please only store and operate it in dry environments in order to maintain this state.



The device was designed and manufactured according to the requirements of the European EMC Directive 2014/30/EU.

Label



6. Contact

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