Polarization Analyzer Series SK010PA-...
Multiple Wavelength Ranges 350 – 1600 nm
Interface: USB 2.0

The polarization analyzer series SK010PA-VIS/NIR is a comprehensive universal measurement and test system, for free beam applications and laser beam sources with polarization-maintaining fiber optics, that was developed for ease of use by experts in the field.

The polarization analyzer is a plug & play device and connects to the USB port of a standard computer. Alignments and measurements are performed rapidly, especially in comparison with tedious and highly time-consuming standard methods. A real-time interactive display shows the state of polarization and the oscillating axis of the linearly polarized fraction, as well as the orientation of the connector key index for when a fiber cable is attached.

The radiation coupled to the polarization analyzer is collimated, passed through a rotary quarter-wave plate and a polarizer and recorded by a photo detector. The photo detector signal and the rotary angle are evaluated by an onboard chip and transferred via the USB port to the computer. The software SkPolarimeter evaluates the components of the Stokes Vector and displays them as points on the Poincaré Sphere and as a Polarization Ellipse.

The measurements are saved with a simple command in the software menu, can be followed using a timer-based logging function or can be fed into external software using the DLL or LabView files that are delivered with the device for user customization.

- 'Plug & play' device, no interface card necessary
- Large spectral ranges: 350 - 450 nm SK010PA-UV
  450 - 800 nm SK010PA-VIS
  700 - 1100 nm SK010PA-NIR
  1100 - 1600 nm SK010PA-IR
- Connection for fiber connectors of types FC-APC included in delivery
- Compatible with microbench for beam optics applications
- Diaphragm as power attenuator and automatic electrical gain control
- 'Real-time' display with 30 measurements per sec
- USB interface, PC operating system: Windows

Free beam and fiber-optic configurations

Dimensions

Order Code SK010PA - VIS Wavelength range:

UV 350 - 450 nm
VIS 450 - 800 nm
NIR 700 - 1100 nm
IR 1100 - 1600 nm

Analysis Software SKPolarimeter

- Extinction ratio (ER) measurement
- Display of polarization state on a Poincaré sphere
- Display of polarization ellipse (linear or logarithmic scale)
- Adjustment support for PM fiber coupling of high and low coherent sources
- Measurement results can be logged and saved
- Log file of measurements over a designated time
- Calibration of polarization zero phase and resetting to the original factory settings
- Integration of the polarimeter in customizable software with LabVIEW VI-library and DLL
- Remote control and client/server application via TCP/IP
Software applications: PM fiber alignment

PM fiber adjustment with coherent sources

The extinction ratio, ER, of fiber-coupled radiation is the ratio of the optical power coupled to the two main axes of a polarization-maintaining fiber. The polarization analyzer can be used to optimize the coupling alignment of polarization-maintaining fibers.

Figure 3: Enhanced measurement adjustments for PM fiber axes

A

When linearly polarized radiation is not coupled exactly to one of the fiber polarization axes, the actual state of polarization fluctuates with temperature or with fiber position. The measured states of polarization are mapped as a circle on the Poincaré sphere. The center of this circle represents the mean extinction ratio for the given alignment. For an ideal linear birefringent fiber, the center is on the equator of the sphere. The circle data point furthest away from the equator represents the lowest extinction ratio that can occur with the current alignment. The radius of the circle is a measure of the misalignment angle of the fiber, with a smaller radius indicating an improvement in the coupling alignment of the PM fiber. For perfect coupling of linear polarized radiation to one of the main axes of a polarization-maintaining linear birefringent fiber, the circle degrades to a single point located on the equator of the Poincaré sphere.

In the software modus ER, a series of measurements are performed and the data logged. For the modulation of the polarization state, the fiber is stressed or heated and a circular cloud of data points is generated on the Poincaré sphere. After data acquisition, a circle is automatically fitted to the data.

The aim of the subsequent adjustments is to cause the convergence of these data points to the center of this circle, by rotating the linear input state of polarization with respect to the fiber main axes. As an additional aid, the reciprocal distance from the center is displayed continuously by means of a bar plot with a linear or logarithmic scale.

B

A second measurement of the extinction ratio has been performed. This reduced radius indicates that the fluctuation of the current state of polarization is reduced. For the final ER measurement, the mean and minimum ER values are displayed on the linear or logarithmic bar plot.

PM fiber adjustment with low coherent sources

The ER measurement procedure described applies only to a coherent laser source with the degree of polarization close to 100%.

For low coherent sources, the light not coupled to the main axis of the fiber contributes to the unpolarized light, described by an extinction ellipse, see figure 4.

For each measured degree of polarization lower than 80%, an additional dotted polarization ellipse depicts the ratio between linearly polarized light and the sum of circular and unpolarized light. The dotted ellipse becomes smaller for improved alignments between the fiber axes and the linear polarization fraction of the light.

Figure 4: Polarization ellipse of PM fiber alignment with a low coherent laser source

Technical Data

| Power range:                  | 0.01 - 50 mW |
| Accuracy:                    | ± 0.2°, ± 0.2° |
| Extinction ratio ER:         | 0.5 dB, Degree of polarization: 2% |
| Sensor Aperture:             | 2.85 by 2.85 mm² |
| PC interface:                | USB (providing power supply) |
| Housing:                     | 40x70x82 (w x l x h) |

Accessories (included):
- USB cable
- Adapter for fiber connectors type FC-APC
- Analysis software: SKPolarimeter for WINDOWS 7/Vista/XP (32/64 Bit)
- LabView DLL included

External programming

To integrate the Polarization Analyzer into a customized software application, only three functions from the SKPolarimeter DLL are needed.

Attachments

Adapter for fiber connectors of other wavelenghts

<table>
<thead>
<tr>
<th>Connector Type</th>
<th>Spectral Range</th>
<th>Order Code</th>
</tr>
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<tbody>
<tr>
<td>FC-APC</td>
<td>400 - 600 nm</td>
<td>9780-60SMS-4-A6.2-01</td>
</tr>
<tr>
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<td>600 - 1050 nm</td>
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<td>FC-PC</td>
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<tr>
<td></td>
<td>1300 - 1750 nm</td>
<td>9780-60SMS-0-A6.2-45</td>
</tr>
</tbody>
</table>

Adapters for fiber connectors type F-SMA, ST and DIN-AVIO are available on request.

Adapter plate

For attaching beam optical components with Ø 19.5 mm system mount or with Ø 25 mm compatible with microbench systems

Order Code
48MC-MP-19.5 Ø 19.5 mm
48MC-MP-25 Ø 25 mm

Rod for mounting to microbench system

Order Code: 48MC-6-75

Notes:
- In the software mode ER, a series of measurements is performed and the data logged. For the modulation of the polarization state, the fiber is stressed or heated and a circular cloud of data points is generated on the Poincaré sphere. After data acquisition, a circle is automatically fitted to the data.
- The aim of the subsequent adjustments is to cause the convergence of these data points to the center of this circle, by rotating the linear input state of polarization with respect to the fiber main axes.
- As an additional aid, the reciprocal distance from the center is displayed continuously by means of a bar plot with a linear or logarithmic scale.
- Birefringent fibers degrade the circle on the Poincaré sphere to a single point located on the equator of the sphere. Linear birefringent fibers have a center on the equator.
- The radius of the circle is a measure of the misalignment angle of the fiber, with a smaller radius indicating an improvement in the coupling alignment of the PM fiber.
- For each measured degree of polarization lower than 80%, an additional dotted polarization ellipse is depicted, showing the ratio between linearly polarized light and the sum of circular and unpolarized light. The dotted ellipse becomes smaller for improved alignments between the fiber axes and the linear polarization fraction of the light.

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