PAX1000VIS(/M), PAX1000IR1(/M), PAX1000IR2(/M)

Compact Polarimeter

Quick Reference



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Chapter 1 Introduction

1.1 Intended Use

The PAX1000 Series of Polarimeters are intended for use in laboratory environments and complies with the requirements of EN 61326-1:2021.

The PAX1000 Series of Polarimeters may only be used in accordance with the instructions described in this quick reference. Any other use will invalidate the warranty.

1.2 Explanation of Safety Warnings

NOTICE Indicates information considered important, but not hazard-related, such as possible damage to the product.



Hazard indicates a medium level of risk that, if not avoided, could result in serious injury or even death due to electrical shock.



Caution indicates a hazard with a low level of risk that, if not avoided, could result in minor or moderate injury.





The CE/UKCA markings on the product are the manufacturer's declaration that the product complies with the essential requirements of the relevant European health, safety, and environmental protection legislation.



The wheelie bin symbol on the product, the accessories or packaging indicates that this device must not be treated as unsorted municipal waste but must be collected separately.

1.3 Description

Thorlabs polarimeters are terminating, wave-plate-based modules for free-space and - with installed fiber collimator - fiber-based measurements of the state of polarization (SOP). Their high dynamic range of 70 dB, three models covering the visible to near-infrared range, and accuracy of ±0.25° on the Poincaré sphere opens a wide spectrum of application possibilities.

Each measurement sensor is calibrated at different wavelength points. These base points are interpolated.

The PAX1000 Series of Polarimeters is basically powered via the USB port. For a measurement speed higher that 50 samples per second, an additional power supply is required - please connect the DS15 power supply to your mains outlet and to the PAX1000 Series of Polarimeters.

NOTICE Polarization measurements with the PAX1000 Series of Polarimeters are possible only for monochromatic coherent light (e.g., laser emission)!

For warnings and safety information concerning this product, please see Chapter 2 Safety.

1.4 Technical Data

1.4.1 Specifications

All technical data are valid at 23 ± 5 °C and 45 ± 15% relative humidity (non-condensing).

Optical Parameters[a]	
Wavelength Range **PAX1000 Series of PolarimetersVIS(/M)** **PAX1000 Series of PolarimetersIR1(/M)** **PAX1000 Series of PolarimetersIR2(/M)**	 400 to 700 nm 600 to 1080 nm 900 to 1700 nm
Dynamic Range	-60 to +10 dBm
Sampling Rate **Maximum[b]** **Default**	 400 Samples/s 30 Samples/s
Measurable SOP States	Full Poincaré Sphere
Azimuth Accuracy[c]	±0.25°
Ellipticity Accuracy	±0.25°
DOP Accuracy	±1.0%
Input Fiber Connector	FC/PC
Free Space Aperture	Ø3 mm
Maximum Input Beam Divergence	2°
General Specifications	
Power Supply	Via USB 2.0 Interface External Power Supply 15.0 V | 1.2 ADC[d]
Maximum Power Consumption	69 W
Operating Temperature Range[e]	5 to 40 °C
Storage Temperature Range[f]	-40 to 70 °C
Warm-Up Time for Rated Accuracy	15 min
Dimensions (W x H x D)	51.0 mm x 55.0 mm x 56.3 mm (2.01" x 2.17" x 2.22")
Weight	280 g (0.62 lbs)

a. All polarization specifications are valid for optical powers from -40 dBm to +3 dBm.
b. One sample per half turn and 200 Hz motor drive speed; with connected external power supply.
c. For any SOP with -30° < Ellipticity < 30°
d. Required for high-speed measurements; included with the PAX1000 Series of Polarimeters
e. Non-Condensing
f. The storage temperature range of the DS15 power supply is -10 to 70 °C.

Table 1 Specifications for the PAX1000 Series of Polarimeters

1.5 Components

Front Panel



Figure 3 Front Panel of the PAX1000 Series of Polarimeters

Front Panel	
Callout	**Description**
1	Mounting Hole for 30 mm Cage System (4-40, Depth 5.5 mm), 4 Places
2	Input Aperture with SM05 (0.535"-40) External Thread
3	Input Aperture with SM1 (1.035"-40) Internal Thread

Table 2 Front Panel of the PAX1000 Series of Polarimeters

Back Panel



Figure 4 Back Panel of the PAX1000 Series of Polarimeters

Back Panel	
Callout	**Description**
1	Connector for External Power Supply
2	Connector for USB Mini B
3	LED "Ready"

Table 3 Back Panel of the PAX1000 Series of Polarimeters

1.6 Simplified Declaration of Conformity

The full text of the EU declaration of conformity is available at the following internet adress:
https://www.thorlabs.com/polarimeter-systems-with-high-dynamic-range?tabName=Overview

1.7 FCC Designation

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules and meets all requirements of the Canadian Interference-Causing Equipment Standard ICES-003 for digital apparatus. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Thorlabs is not responsible for any radio television interference caused by modifications of this equipment or the substitution or attachment of connecting cables and equipment other than those specified by Thorlabs. The correction of interference caused by such unauthorized modification, substitution or attachment will be the responsibility of the user.

The use of shielded I/O cables is required when connecting this equipment to any and all optional peripheral or host devices. Failure to do so may violate FCC and ICES rules.

Mobile telephones, cellular phones or other radio transmitters are not to be used within the range of three meters of this unit since the electromagnetic field intensity may then exceed the maximum allowed disturbance values according to IEC 61326-1.

This product has been tested and found to comply with the limits according to IEC 61326-1 for using connection cables shorter than 3 m (9.8 ft).

Chapter 2 Safety

The safety of any system incorporating the equipment is the responsibility of the assembler of the system.

All statements regarding safety of operation and technical data in this instruction manual will only apply when the unit is operated correctly as it was designed for.



WARNING: Risk of Serious Injury and Even Death Due to Electrical Shock

Improper grounding and connecting the power supply to the mains can cause electric shock.

Electric shock results in damage to your health or even death.

Observe the following instructions when applying power to the PAX1000 Series of Polarimeters:

- Make sure that the protective conductor for the 3 conductor mains power cord is correctly connected to the protective earth ground contact of the socket outlet.
- Before connecting the power supply to the mains make sure that the line voltage range marked on the power supply agrees with your local supply.



WARNING: Risk of Serious Injury and Even Death Due to Explosion

The PAX1000 Series of Polarimeters must not be operated in explosion endangered environments.



CAUTION: Risk of Serious Injuries of Incorrect Use

Pay attention to the following aspects during use:

- Do not obstruct the air ventilation slots in the housing.
- Do not remove covers or open the device. There are no user-serviceable parts inside.
- Refer servicing to qualified personnel.
- Changes to this PAX1000 Series of Polarimeters cannot be made nor may components not supplied by Thorlabs be used without written consent from Thorlabs.

NOTICE: Electrically Sensitive Product

Mobile telephones, cellular phones or other radio transmitters are not to be used within the range of three meters of this unit since the electromagnetic field intensity may then exceed the maximum allowed disturbance values according to IEC 61326-1.

NOTICE

The PAX1000 Series of Polarimeters has been tested and found to comply with the limits according to IEC 61326-1 for using connection cables shorter than 3 m (9.8 ft).

- The instrument must only be operated with a duly shielded and low resistance USB cable delivered by Thorlabs.
- Only connect duly shielded SMA cables to the SMA connector.

Chapter 3 Installation

3.1 Warranty

The precision devices are only serviceable if returned and properly packed into the complete original packaging including the complete shipment plus the cardboard insert that holds the enclosed devices. If necessary, ask for replacement packaging. Refer servicing to qualified personnel.

General Terms and Conditions of Sale can be found at https://www.thorlabs.com/legal.

3.2 Packing List

Verify that you have received the following items within the package, depending on the ordered item:

1. PAX1000VIS (PAX1000VIS/M) Polarimeter, Wavelength Range 400 to 700 nm
2. F240FC-A Fiber Collimator
3. KAD12F SM1 Threaded Adapter for the Fiber Collimator
4. SM1M10 SM1 Lens Tube
5. SM1CP1 End Cap (Modified: Laser-Engraved Cross-Hair)
6. Cable USB 2.0, A to Mini-B, 1.5 m Length
7. Power Supply DS15
8. Quick Reference

or

1. PAX1000IR1 (PAX1000IR1/M) Polarimeter, Wavelength Range 600 to 1080 nm
2. F240FC-B Fiber Collimator
3. KAD12F SM1 Threaded Adapter for the Fiber Collimator
4. SM1M10 SM1 Lens Tube
5. VRC2SM1 with Mounting Adapter
6. Cable USB 2.0, A to Mini-B, 1.5 m Length
7. Power Supply DS15
8. Quick Reference

or

1. PAX1000IR2 (PAX1000IR2/M) Polarimeter, Wavelength Range 900 to 1700 nm
2. F240FC-C Fiber Collimator
3. KAD12F SM1 Threaded Adapter for the Fiber Collimator
4. SM1M10 SM1 Lens Tube
5. VRC2SM1 with Mounting Adapter
6. Cable USB 2.0, A to Mini-B, 1.5 m Length
7. Power Supply DS15
8. Quick Reference

3.3 Unpacking Instructions

Please inspect the shipping container for damage. Please do not cut through the cardboard, as the box might be needed for storage or returns.

If the shipping container appears to be damaged, keep it until you have inspected the contents for completeness and tested the PAX1000 Series of Polarimeters mechanically and electrically.

Verify that you have received the items listed in the section Packing List within the package.

3.4 Installing Hardware

For accurate alignment and mounting of the PAX1000 Series of Polarimeters, various accessories are provided to ensure the incident beam is properly centered and oriented with respect to the input aperture (see Figure 5).



Figure 5 The PAX1000 Series of PolarimetersVIS (left) is delivered with a cross-hair engraved protection cap, while the PAX1000 Series of PolarimetersIR1 and PAX1000 Series of PolarimetersIR2 (right) are equipped with a mounted viewing target.

The PAX1000 Series of Polarimeters can be integrated into a free-space (open beam) setup using mounting options on either the bottom or the front of the housing.

Bottom Mounting

The underside of the housing provides three threaded holes for post mounting:

- One central hole: M6 × 1 (metric) or 1/4"-40 (imperial)
- Two additional holes: M4 × 0.7 (metric) or 8-32 (imperial)
  These holes allow secure attachment to standard metric or imperial posts and mounting plates, providing mechanical stability for free-space measurements.

Front Mounting

Four threaded holes are located on the front face of the housing:

- Thread size: 4-40 (imperial)
  These are fully compatible with the Thorlabs 30 mm Cage System, enabling integration into modular cage assemblies for precise optical alignment.

For exact dimensions and hole positions, please refer to section 1.4.2 Mechanical Drawings.

NOTICE

NOTICE: Alignment for Accurate Polarization Measurements

For accurate polarization measurements with the PAX1000 Series of Polarimeters, center the input beam on the aperture and align it perpendicular (normal) to the front surface.

- **Centering**
  Use the supplied protection cap for alignment. The PAX1000 Series of PolarimetersVIS includes a crosshair-engraved end cap; the PAX1000 Series of PolarimetersIR1 and PAX1000 Series of PolarimetersIR2 include a mounted viewing target.
- **Angular Alignment**
  Ensure normal incidence to the front surface. Use the PAX1000 Series of Polarimeters software Alignment Assistance tool to optimize angular positioning.

Proper centering and normal incidence preserve measurement accuracy and avoid polarization bias. Decentering or tilt can reduce accuracy and introduce systematic errors.

3.5 Requirements

The following PC specifications are required for remote operation of the PAX1000 Series of Polarimeters.

Minimum Hardware Requirements

- CPU : 2.4 GHz
- RAM : 2 GB Available RAM
- Graphics Card Resolution : 1024 x 768
- Hard Drive : 1.0 GB of Available Disk Space (32-bit)
  2.3 GB of Available Disk Space (64-bit)
- Interface : Free USB 2.0 Port

Software Requirements

The GUI Software which operates the PAX1000 Series of Polarimeters is compatible with the following operating systems:

- Windows® 8.1 (32-bit and 64-bit)
- Windows® 10 (32-bit and 64-bit)
- Windows® 11

For operation of the PAX1000 Series of Polarimeters by the GUI Software the following software is required als well:

- Microsoft .NET (V 4.6.1 or Later)
- NI-VISA™ Runtime (V 5.4 or Later)
- DirectX9 or Higher

Above mentioned software is included with the Thorlabs PAX1000 Series of Polarimeters installation package, and will be installed automatically, if the required minimum versions are not recognized.

3.6 Installing Software

The GUI Software supports the PAX1000 Series of Polarimeters and is available for download from the website.

As a part of our green initiative, Thorlabs no longer ships physical data carriers for installation of software. The GUI Software can be accessed and installed from the website instead. The most recent version of the GUI Software will always be available online.

NOTICE

NOTICE: Clean Installation

- Do not connect the PAX1000 Series of Polarimeters to the PC prior to software installation.
- Uninstall all previous versions of the software relating to the same device before installing the latest version.
- Exit all running applications on your PC as the installer may require a reboot of your PC during installation.
- Please make sure that the installation is carried out completely, including the reboot requests.

NOTICE

NOTICE: System Configuration Windows 8.1 and 10 Users

To ensure proper installation, disable the Windows Fast Startup feature if prompted by the NI-VISA™ installer.

Failure to do so may prevent correct hardware recognition by NI-VISA™ on Windows 8.1 and 10 systems.

1. Download the the GUI Software from the website.
2. Save the ZIP-file to your PC.
3. Unpack the ZIP-file.
4. Select the *ThorlabsPAX1000Setup.exe* file and double click to install the GUI Software.
5. Follow the installation guide.
6. Read and accept the End-User License Agreement and the GNU Lesser General Public License.
7. After installing the GUI Software, connect the PAX1000 Series of Polarimeters to the PC.
8. Start the GUI Software from the desktop icon.

3.7 First Steps

Installation and Startup

NOTICE

NOTICE: System Configuration Windows 8.1 and 10 Users

To ensure proper installation, disable the Windows Fast Startup feature if prompted by the NI-VISA™ installer.
Failure to do so may prevent correct hardware recognition by NI-VISA™ on Windows 8.1 and 10 systems.

NOTICE

NOTICE: Clean Installation

- Do not connect the PAX1000 Series of Polarimeters to the PC prior to software installation.
- Uninstall all previous versions of the software relating to the same device before installing the latest version.
- Exit all running applications on your PC as the installer may require a reboot of your PC during installation.
- Please make sure that the installation is carried out completely, including the reboot requests.

1. Mount the PAX1000 Series of Polarimeters securely to your optical setup.
2. Connect the PAX1000 Series of Polarimeters to your computer using the supplied USB 2.0 cable.

NOTICE

NOTICE: USB Cable Requirements

Use only the supplied, certified USB cable with the PAX1000 Series of Polarimeters. Using other and/or longer cables may degrade performance, cause data loss, or result in malfunction of the PAX1000 Series of Polarimeters.

3. Provide power.

NOTICE

NOTICE: Power and Speed

SB 2.0 bus power (max. 500 mA) is sufficient for waveplate rotation speeds up to 100 Hz. For faster measurements, also connect the supplied DS15 wall-plug adapter.

4. Observe device indicators: after connecting the PAX1000 Series of Polarimeters, the green LED on the back turns on and blinks during the boot phase.
5. Allow the PAX1000 Series of Polarimeters to warm up before making critical measurements
6. Complete driver installation. A pop-up confirms that Windows has recognized the PAX1000 Series of Polarimeters and shows the driver installation status.

NOTICE

NOTICE: Driver Source

Skip searching Windows Update for drivers; none will be found and this will only lengthen the installation time.

7. Launch the software: after the driver installs successfully, double-click the *PAX1000 Series of Polarimeters Desktop* icon. The GUI starts, scans USB for installed devices, and automatically connects to the recognized PAX1000 Series of Polarimeters.

NOTICE

NOTICE: Multiple Device Connections

Up to five PAX1000 Series of Polarimeters instruments can be connected and displayed in a single software instance. When more than one PAX1000 Series of Polarimeters is connected and recognized, the software will automatically connect to the first recognized device at startup. Verify the intended device is selected before performing measurements or changes.

Please see the user guide for further instructions. After software installation, it can be found on the computer (*Windows* button > All Programs > Thorlabs > PAX1000). Alternatively, it can be downloaded from the PAX1000 Series of Polarimeters product website at https://www.thorlabs.com/manuals.cfm.

3.8 Return of Devices

This precision device is only serviceable if returned and properly packed into the complete original packaging including the complete shipment plus the cardboard insert that holds the enclosed devices. If necessary, ask for replacement packaging. Refer servicing to qualified personnel.

Chapter 4 Maintenance and Cleaning

NOTICE

NOTICE: Risk of Damaging the PAX1000 Series of Polarimeters

The PAX1000 Series of Polarimeters is not water resistant. If the PAX1000 Series of Polarimeters comes into contact with fluids, the PAX1000 Series of Polarimeters can be damaged.

To avoid damaging, do not expose the PAX1000 Series of Polarimeters to:

- Spray
- Liquids
- Solvents
- Adverse Weather Conditions

The unit does not need regular maintenance by the user. It does not contain any modules and/or components that could be repaired by the user himself. If a malfunction occurs, please see the Return of Devices section and contact Thorlabs for return instructions.

Do not remove covers!

Chapter 5 Disposal



Thorlabs verifies our compliance with the WEEE (Waste Electrical and Electronic Equipment) directive of the European Community and the corresponding national laws. Accordingly, all end users in the EC may return “end of life” Annex I category electrical and electronic equipment sold after August 13, 2005 to Thorlabs, without incurring disposal charges. Eligible units are marked with the crossed out “wheelie bin” logo (see right), were sold to and are currently owned by a company or institute within the EC, and are not dissembled or contaminated. Contact Thorlabs for more information. Waste treatment is your own responsibility. “End of life” units must be returned to Thorlabs or handed to a company specializing in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site. It is the user's responsibility to delete all private data stored on the device prior to disposal.

Chapter 6 Thorlabs Worldwide Contacts

For technical support or sales inquiries, please visit us at www.thorlabs.com/contact for our most up-to-date contact information.



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