Operation Manual

Thorlabs Instrumentation

PRO8000 (-4) / PRO800

Optical Switches OSW8xxx

2010

THORLABS

Version: 3.1
Date: 16.09.2010

Contents   **Page**

We aim to develop and produce the best solution for your application in the field of optical measurement technique. To help us to come up to your expectations and develop our products permanently we need your ideas and suggestions. Therefore, please let us know about possible criticism or ideas. We and our international partners are looking forward to hearing from you.

In the displays shown by the PRO8 you may find the name PROFILE.

PROFILE was the name of the manufacturer before it was acquired by Thorlabs and renamed to Thorlabs.

Thorlabs

This part of the instruction manual contains every specific information on how to operate an optical switch OSW8xxx. A general description is followed by explanations of how to operate the unit manually. You will also find every information about remote control via the IEEE 488 / RS232C computer interface.

☞**Attention**☞

This manual contains "WARNINGS" and "ATTENTION" label in this form, to indicate dangers for persons or possible damage of equipment.

Please read these advises carefully!

NOTE

This manual also contains "NOTES" and "HINTS" written in this form.

1 General description

1.1 Safety

☞ **Attention** ☞

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

Before applying power to your PRO8000 (-4) / PRO800 system, make sure that the protective conductor of the 3 conductor mains power cord is correctly connected to the protective earth contact of the socket outlet!
Improper grounding can cause electric shock with damages to your health or even death!

Modules may only be installed or removed with the mainframe switched off.

All modules must be fixed with <u>all</u> screws provided for this purpose.

Modules of the 8000 series must only be operated in the mainframe PRO8000, PRO8000-4 or PRO800.

All modules must only be operated with duly shielded connection cables.

Only with written consent from Thorlabs may changes to single components be carried out or components not supplied by Thorlabs be used.

This precision device is only dispatchable if duly packed into the <u>complete</u> original packaging including the plastic form parts. If necessary, ask for a replacement package.

☝ **Attention** ☝

Semiconductor laser modules can deliver up to several 100mW of (maybe) invisible laser radiation!

When operated incorrectly, this can cause severe damage to your eyes and health!

Never switch on connected laser modules with the output connectors of the optical switch open!

Be sure to pay strict attention to the safety recommendations of the appropriate laser safety class!

This laser safety class is marked on your PRO8000 (-4) / PRO800 plug-in module or on your external laser source used.

☝ **Attention** ☝

Mobile telephones, handy 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 EN 50 082-1.

1.2 Features

General functions

The Thorlabs optical switches of the OSW8xxx series are ultra-fast MEMS (**M**icro **E**lectro-**M**echanical **S**ystem) based fiber optic switches with low insertion loss, designed for the Thorlabs PRO8000(-4) / PRO800 mainframe.

1.3 Technical data

(All technical data are valid at 23 ± 5°C and 35±15% humidity)

1.3.1 General data

Operating temperature	0 … +35°C
Storage temperature	-10 … +60°C

1.3.2 OSW8102

Switching configuration	1 x 2
Wavelength range	1240 … 1610 nm
Insertion loss [1]	typ. 0.7 dB, max. < 1.5 dB
Crosstalk, min.	- 50 dB
Back reflection, max.	- 50 dB
PDL [2]	< 0.1 dB
Switching time	typ. 0.5 ms. max. < 1ms
Input power, max.	+17 dBm (50 mW)
Fiber type	9/125/900, Corning SMF28e
Connectors [3]	FC/APC
Lifetime	10^9 switching cycles without degradation of performance

---

[1] measured at output port
[2] measured at 1550 nm
[3] other connectors on request

1.3.3 OSW8104

Switching configuration	1 x 4
Wavelength range	1240 … 1610 nm
Insertion loss [1]	typ. 1.2 dB, max. < 2.1 dB
Crosstalk min.	- 60 dB
Back reflection, max.	- 50 dB
PDL [2]	< 0.15 dB
Switching time	typ. 0.5 ms, max. < 1ms
Input power max.	+ 17 dBm (50 mW)
Fiber type	9/125/900, Corning SMF28e
Connectors [3]	FC/APC
Lifetime	10^9 switching cycles without degradation of performance

1.3.4 OSW8108

Switching configuration	1 x 8
Wavelength range	1240 … 1610 nm
Insertion loss [1]	typ. 1.6 dB, max. <2.6 dB
Crosstalk min.	- 60 dB
Back reflection, max.	- 45 dB
PDL [2]	< 0.2 dB
Switching time	typ. 0.5 ms, max. < 1ms
Input power, max.	+ 17 dBm (50 mW)
Fiber type	9/125/900, Corning SMF28e
Connectors [3]	FC/APC
Lifetime	10^9 switching cycles without degradation of performance

---

[1] measured at output port
[2] measured at 1550 nm
[3] other connectors on request

1.3.5 OSW8202

Switching configuration	2 x 2
Wavelength range	1240 … 1610 nm
Insertion loss [1]	typ. 0.7 dB, max. < 1.5 dB
Crosstalk min.	- 50 dB
Back reflection, max.	- 50 dB
PDL [2]	< 0.15 dB
Switching time	typ. 0.5 ms, max. < 1ms
Input power (max.)	+ 17 dBm (50mW)
Fiber type	9/125/900, Corning SMF28e
Connectors [3]	FC/APC
Lifetime	10^9 switching cycles without degradation of performance

[1] measured at output port
[2] measured at 1550 nm
[3] other connectors on request

2 Operating the OSW8xxx

2.1 Display

The main menu shows the channel numbers of the inserted modules and their main parameters. In the case of the OSW8xxx this is t he fiber output connected to the common port.

Channel no.   Cursor   Switch settings

```
 CH1◀            COM -> 2
 CH2
 CH3
   1↑        ↓↓        CHANGE
```
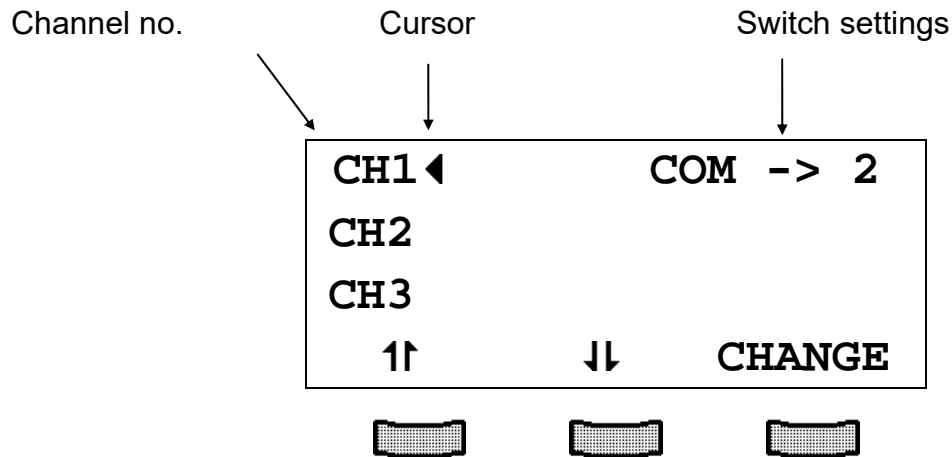
2.2 Selecting a module

Select a module for further input by setting   the cursor to the c hannel number of the desired module.

Use the soft keys **1↑** and **↓↓** .

CH1◀

Pressing [CHANNEL] will lead to the channel menu

Pressing again [CHANNEL] or [ESC] will lead back to the main menu.

```
 CH1◀            COM -> 2
 CH2
 CH3
   1↑        ↓↓        CHANGE
```
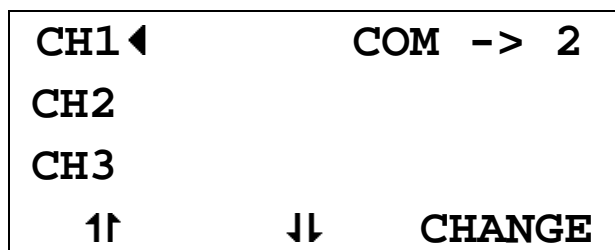
In the channel menu (just as also in the main menu) you can toggle between the different switch settings by pressing "CHANGE" and further selecting up or down by the corresponding soft-keys. In the case of the 2 -> 2 switch OSW8202 the word "TOGGLE" is displayed, to indicate the back and forward switching of the two configurations.

```
CH1◀            COM -> 3
CH2
CH3
CHANGE:   down    up
```

---

3 Communicating with a control computer

3.1 General information

The description of the mainframe of   the PRO8000 (-4) / PRO800 includes all instructions of how to prepare and exec   ute the programming of the system via IEEE 488 computer interface.

Special operation features of an OSW8xxx optical switch module are described here.

➔ (Refer to chapter 2, "Operating the OSW8xxx" starting on page 8)

3.1.1 Nomenclature

Program messages (PC $\Rightarrow$ PRO8000 (-4)) are written in inverted commas:
"*IDN?"

Response messages (PRO8000 (-4) $\Rightarrow$ PC) are written in brackets:
[:SLOT 1]

There is a decimal point: **1.234**

Parameters are separated with comma: **"PLOT 2,0"**

Commands are separated with semicolon: **"*IDN?;*STB?"**

3.1.2 Data format

According to the IEEE 488.2 specifications   all data variables are divided into 4 different data formats:

Character response data (<CRD>)

Is a single character or a string. Examples:

A or **ABGRS** or **A125TG** or **A1.23456A**

➔ (Refer to IEE488.2 (8.7.1))

Numeric response data Type 1 (<NR1>)

Is a numerical value with sign in integer notation. Examples:

1 or   **+1** or **–22** or **14356789432**

➔ (Refer to IEE488.2 (8.7.2))

Numeric response data Type 2 (<NR2>)

Is a numerical value with or   without sign in floating poi nt notation without exponent. Examples:

1.1 or   **+1.1** or **–22.1** or **14356.789432**

➔ (Refer to IEE488.2 (8.7.3))

Numeric response data Type 3 (<NR3>)

Is a numerical value with or without sign in floating poi nt notation with exponent with sign . Examples:

`1.1E+1` or **`+1.1E-1`** or **`-22.1E+1`** or **`143.56789432E+306`**

➔ (Refer to IEE488.2 (8.7.4))

3.1.3 Selecting the module slot

`":SLOT <NR1>"`   Selects a slot for further programming

<Nr1>=1…8 (PRO8000), 1…2 (PRO800)

`":SLOT?"`   Queries the selected slot

`[:SLOT <NR1><LF>]`

3.1.4 Querying the module type

Reading:

`":TYPE:ID?"`   Reads the module ID (here 227)

`[:TYPE:ID 227<LF>]`

`":TYPE:SUB?"`   Reads module subtype:

0: 1 x 8 switch

1: 2 x 2 switch

2: 1 x 2 switch

3: 1 x 4 switch

`[:TYPE:SUB <NR1><LF>]`

`":TYPE:TXT?"`   Reads the module identification in text form, e.g.:

`[:TYPE:TXT "OSW8202 2x2"<LF>]`

`":TYPE:SN?"`   Reads the module serial number, e.g:

`[:TYPE:SN 1234-567<LF>]`

3.1.5 Changing the optical switch setting

Programming:

":OSW <NR1>"   Set the desired switch configuration:

                                     OSW8102:
                                     <NR1>=1: connect COM with output 1
                                     <NR1>=2: connect COM with output 2

                                     OSW8104:
                                     <NR1>=1: connect COM with output 1
                                     <NR1>=2: connect COM with output 2
                                     <NR1>=3: connect COM with output 3
                                     <NR1>=4: connect COM with output 4

                                     OSW8108:
                                     <NR1>=1: connect COM with output 1
                                     <NR1>=2: connect COM with output 2
                                     <NR1>=3: connect COM with output 3
                                     <NR1>=4: connect COM with output 4
                                     <NR1>=5: connect COM with output 5
                                     <NR1>=6: connect COM with output 6
                                     <NR1>=7: connect COM with output 7
                                     <NR1>=8: connect COM with output 8

                                     OSW8202:
                                     <NR1>=1: connect port 1 with 3 and 2 with 4
                                     <NR1>=2: connect port 1 with 4 and 2 with 3

Reading:

":OSW?"   Reads the OSW switch configuration
                                               [:OSW <NR1><LF>]

3.2 Status reporting

The OSW8xxx has no own device er ror registers. You can only use t he PRO8000 (-
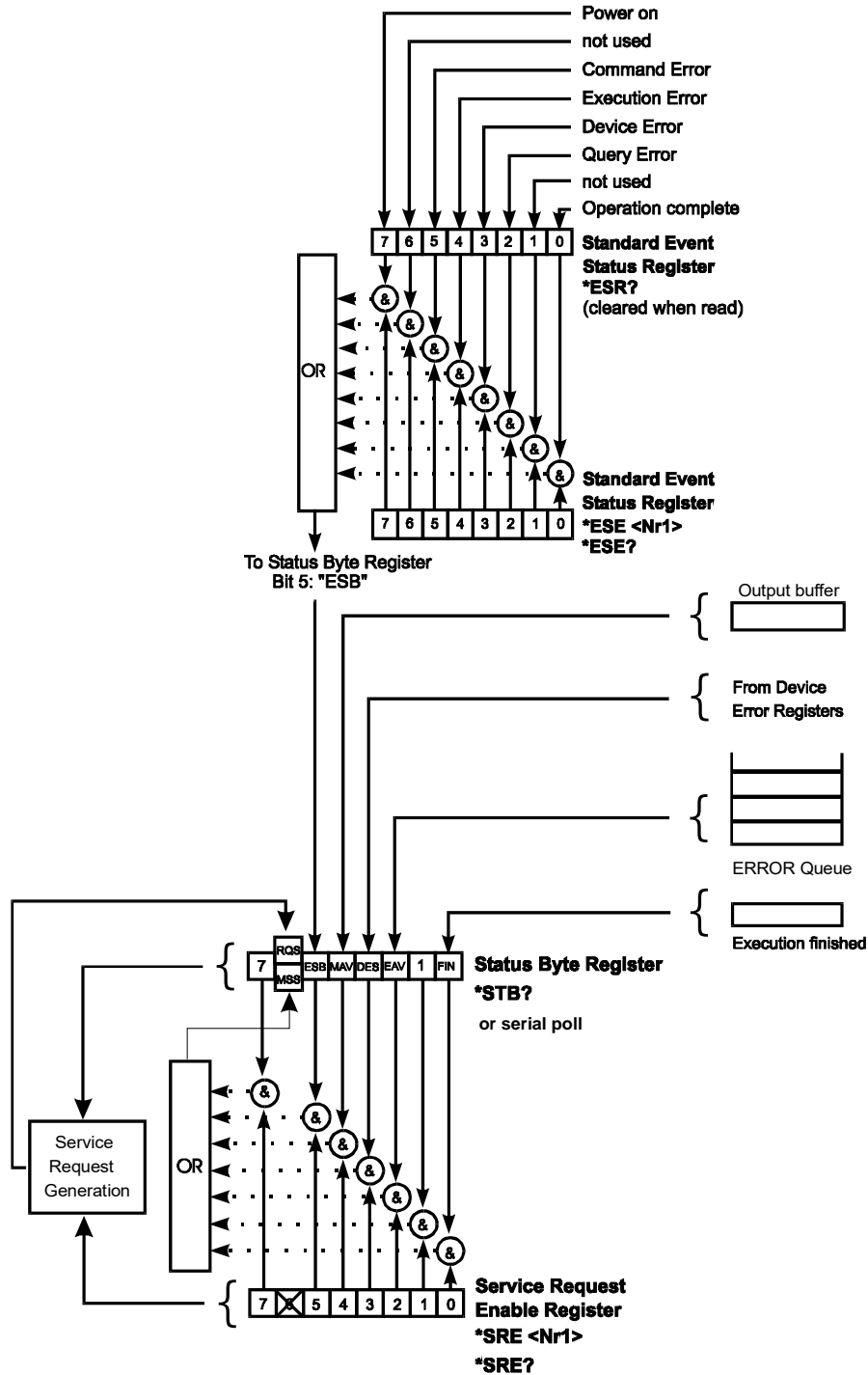4) / PRO800 mainframe status registers shown here.

Figure 1   The PRO8000 (-4)/ PRO800 register ESR, ESE, STB and SRE

3.2.1 Standard event status register (ESR)

The bits of this register represent the following standard events:

Power on   This event bit indicates, t hat an off to on transition has
                              occurred in the power supply. So it is high after turning on
                              the device for the first time.

User request   (Not used)

Command error   A command error occurred.

Execution error   An execution error occurred.

Device dependent error A device dependent error occurred.

Query error   A query error occurred.

Request control   (Not used)

Operation complete   Can be set with `"*OPC"`.

The ESR can be read dire ctly with the command `"*ESR?"`. This read command
clears the ESR. The content of the ESR can not be set.

The bits are active high.

3.2.2 Standard event status enable register (ESE)

The bits of the ESE are used to select, wh   ich bits of the ESR shall influence bit 5
(ESB) of the STB. The 8 bits of the ESE   are combined with the according 8 bits of
the ESR via a wired "AND"-function. These   8 results are combined with a logical
"OR"-function, so that any "hit" leads to a l ogical 1 in bit 5 (ESB) of the STB. As any
bit of the STB can assert an SRQ, every event (bit of the ESR) can be used to assert
an SRQ.

3.2.3 Status byte register (STB)

The bits of this register are showing the status of the PRO8000 (-4) / PRO800.

RQS	RQS: Request service message: Shows, that this device has asserted SRQ (read via serial poll).
MSS	Master summary status: Shows that this device requests a service (read via `"*STB?"`).
MAV	(Message AVailable) This bit is high after a query request, as a result "waits" in the output queue to be fetched. It is low, if the output queue is empty.
DES	(Device Error Status) This bit is high after a device error occurred. Which device errors will set this bit is defined with the EDE.
EAV	(Error AVailable) This bit is high as long as there are errors in the error queue.
FIN	(command FINished) This bit is high, after a command has finished and all bits of the STB have been set.

The STB can be read directly with the command `"*STB?"`. The content of the STB can not be set. The bits are active high.

All bits except bit 6 of the STB can be used to assert a service request (SRQ)
➔ (Please refer to 3.2.5). Alternatively the SRQ can be recognized using the command `"*STB?"` (Please refer to 3.2.6) or by serial poll (Please refer to 3.2.7).

3.2.4 Service request enable register (SRE)

The bits of the SRE are used to select, which bits of the STB shall assert an SRQ. Bit 0, 1, 2, 3, 4, 5 and 7 of the STB are re lated to the according 7 bits of the SRE by logical "AND". These 7 results are combined by a logical "OR", so that any "hit" leads to a logical 1 in bit 6 of the STB and asserts an SRQ.

3.2.5 Reading the STB by detecting SRQ

If an SRQ is asserted (see 3.2.4) bit 6 of t he STB is set to logical 1, so that the controller can detect which device asserted the SRQ by auto serial polling.

3.2.6 Reading the STB by `"*STB?"` command

If the controller does not "listen" to SRQ's at all, the service request can be detected by reading the status byte with the command `"*STB?"`.
If bit 6 is logical 1, a service request was asserted.

3.2.7 Reading the STB by serial poll

If the controller does not suppor t auto serial poll, the service request can also be detected via manual serial poll.
If bit 6 is logical 1, a service request was asserted.

4 Service and Maintenance

4.1 General remarks

The OSW8xxx modules don't need any regularly maintenance by the user.

If the fiber optic connectors are changed very frequently and if an increased insertion loss is registered, standard cleaning procedure for fiber connectors should be applied.

5 Appendix

5.1 Warranty

Thorlabs warrants material and production of the OSW8xxx for a period of 24 months starting with the date of shipm ent. During this warranty period *Thorlabs* will see to defaults by repair or by exchange if these are entitled to warranty.

For warranty repairs or service the unit must be sent back to *Thorlabs (Germany)* or to a place determined by *Thorlabs*. The customer will carry the shipping costs to *Thorlabs,* in case of warranty repairs *Thorlabs* will carry the shipping costs back to the customer.

If no warranty repair is applicable the customer also has to carry the costs for back shipment.

In case of shipment from outside EU duties, taxes etc. which should arise have to be carried by the customer.

Thorlabs warrants the hard- and software determined by *Thorlabs* for this unit to operate fault-free provided t hat they are handled accordi ng to our requirements. However, *Thorlabs* does not warrant a faulty free and uninterrupted operation of the unit, of the soft- or firmware for special app lications nor this instruction manual to be error free. *Thorlabs* is not liable for consequential damages.

Restriction of warranty

The warranty mentioned before does not cover errors and defects being the result of improper treatment, software or interface not supplied by us, modification, misuse or operation outside the defined ambient c onditions (refer to the PRO8000(-4) / PRO800 mainframe operation manual) stated by us or unauthorized maintenance.

Further claims will not be consent ed to and will not be acknowledged. *Thorlabs* does explicitly not warrant the usability or the economical use for certain cases of application.

Thorlabs reserves the right to change this instru ction manual or the technical data of the described unit at any time.

5.2 Thorlabs "End of Life" policy (WEEE)

As required by the WEEE (Was te Electrical and Electronic Equipment Directive) of the European Community and the corresponding national laws, Thorlabs offers all end users in the EC the possibility to retu rn "end of life" units without incurring disposal charges.

This offer is valid for Thorlabs electrical and electronic equipment
- sold after August 13th 2005
- marked correspondingly with the crossed out "wheelie bin" logo (see Figure 2)
- sold to a company or institute within the EC
- currently owned by a company or institute within the EC
- still complete, not disassembled and not contaminated

As the WEEE directive applies to self cont ained operational electrical and electronic products, this "end of life" take back se rvice does not refer to other Thorlabs products, such as
- pure OEM products, that means assemblies to be built into a unit by the user (e. g. OEM laser driver cards)
- components
- mechanics and optics
- left over parts of units disassembled by the user (PCB's, housings etc.).

If you wish to return a Thorlabs unit for wa ste recovery, please contact Thorlabs or your nearest dealer for further information.

5.2.1 Waste treatment on your own responsibility

If you do not return an "end of life" unit to Thorlabs, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

5.2.2 Ecological background

It is well known that WEEE pollutes the   environment by releasing toxic products during decomposition. The aim of the Eu   ropean RoHS directive is to reduce the content of toxic substances in electronic products in the future.

The intent of the WEEE dire ctive is to enforce the re cycling of WEEE. A controlled recycling of end of live products will t   hereby avoid negative impacts on the environment.

Figure 2   Crossed out "wheelie bin" symbol

5.3 Certifications and compliances

Certifications and compliances

Category	Standards or description	
EC Declaration of Conformity - EMC	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:	
	EN 61326	EMC requirements for Class A electrical equipment for measurement, control and laboratory use, including Class A Radiated and Conducted Emissions[1,2,3] and Immunity.[1,2,4]
	IEC 61000-4-2	Electrostatic Discharge Immunity (Performance criterion C)
	IEC 61000-4-3	Radiated RF Electromagnetic Field Immunity (Performance criterion A)
	IEC 61000-4-4	Electrical Fast Transient / Burst Immunity (Performance criterion C)
	IEC 61000-4-5	Power Line Surge Immunity (Performance criterion C)
	IEC 61000-4-6	Conducted RF Immunity (Performance criterion A)
	IEC 61000-4-11	Voltage Dips and Interruptions Immunity (Performance criterion C)
	EN 61000-3-2	AC Power Line Harmonic Emissions
Australia / New Zealand Declaration of Conformity - EMC	Complies with the Radiocommunications Act and demonstrated per EMC Emission standard[1,2,3]:	
	AS/NZS 2064	Industrial, Scientific, and Medical Equipment: 1992
FCC EMC Compliance	Emissions comply with the Class A Limits of FCC Code of Federal Regulations 47, Part 15, Subpart B[1,2,3].	

[1] Compliance demonstrated using high-quality shielded interface cables.

[2] Compliance demonstrated with the OSW8x series modules installed in the Thorlabs PRO8x series of mainframes. Test configuration included a Thorlabs POL8000 Polarization Controller.

[3] Emissions, which exceed the levels required by these standards, may occur when this equipment is connected to a test object.

[4] Minimum Immunity Test requirement.

5.4 Copyright

Thorlabs GmbH has taken every possible care in preparing this Operation Manual. We however assume no liability for the content, completeness or quality of the information contained therein. The content of this manual is regularly updated and adapted to reflect the current status of the software. We furthermore do not guarantee that this product will function without errors, even if the stated specifications are adhered to.

Under no circumstances can we guarantee that a particular objective can be achieved with the purchase of this product.

Insofar as permitted under statutory regulations, we assume no liability for direct damage, indirect damage or damages suffered by third parties resulting from the purchase of this product. In no event shall any liability exceed the purchase price of the product.

Please note that the content of this User Manual is neither part of any previous or existing agreement, promise, representation or legal relationship, nor an alteration or amendment thereof. All obligations of *Thorlabs GmbH* result from the respective contract of sale, which also includes the complete and exclusively applicable warranty regulations. These contractual warranty regulations are neither extended nor limited by the information contained in this User Manual. Should you require further information on this product, or encounter specific problems that are not discussed in sufficient detail in the User Manual, please contact your local *Thorlabs* dealer or system installer.

All rights reserved. This manual may not be reproduced, transmitted or translated to another language, either as a whole or in parts, without the prior written permission of *Thorlabs GmbH*.

Status: 2010

5.5 Addresses

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

USA, Canada, and South America
Thorlabs, Inc.
sales@thorlabs.com
techsupport@thorlabs.com

Europe
Thorlabs GmbH
europe@thorlabs.com

France
Thorlabs SAS
sales.fr@thorlabs.com

Japan
Thorlabs Japan, Inc.
sales@thorlabs.jp

UK and Ireland
Thorlabs Ltd.
sales.uk@thorlabs.com
techsupport.uk@thorlabs.com

Scandinavia
Thorlabs Sweden AB
scandinavia@thorlabs.com

Brazil
Thorlabs Vendas de Fotônicos Ltda.
brasil@thorlabs.com

China
Thorlabs China
chinasales@thorlabs.com