ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Find the *Thorlabs / Profile PRO8000* at our website: ***Click HERE***

Operation Manual

Thorlabs Blueline™ Series
PRO8000 (-4) / PRO800

Photo current module PDA8xxx



2003

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Version: 2.10
Date: 13.10.2003

Copyright© 2003, Thorlabs GmbH

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Contents **Page**

1 General description of the PDA8xxx 1
1.1 Safety 1
1.2 Warranty 3
1.3 Features 4
1.4 Technical data 6
1.5 Operating elements at the front of the module 7
1.6 Presettings 8
1.6.1 Offset adjustment 8
1.7 Connecting the photodiode 9
2 Operating the PDA8xxx 10
2.1 Functions in the main menu 10
2.1.1 Display 10
2.1.2 Selecting a module 10
2.2 Functions in the channel menu 11
2.2.1 Display 11
2.2.2 Changing parameters 12
2.2.3 Selecting the polarity of the photo diode 13
2.2.4 Calibrating the photo diode 13
2.2.5 Setting the bias voltage 14
2.2.6 Switching on the bias voltage of the photo diode 14
2.2.7 Setting the measurement range 15
2.2.8 Measuring the forward voltage (option PDA8xxx-FWD) 15
2.3 Display error messages 16
3 Communication with a control computer 17
3.1 General information 17
3.1.1 Nomenclature 18
3.1.2 Data format 18
3.2 Commands 20
3.2.1 Selecting the module slot 20
3.2.2 Selecting a port (PORT) 20
3.2.3 Calibrating a photo diode (CALPD) 21
3.2.4 Programming the forward current (IFWD) 22
3.2.5 Reading the photo diode current (IPD) 23
3.2.6 Switch the bias voltage on and off (PDBIA) 24
3.2.7 Select the photo diode polarity (PDPOL) 25
3.2.8 Reading the optical power (POPT) 25

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3.2.9 Selecting the measurement range (RANGE) 26
3.2.10 Question the module type 26
3.2.11 Programming the bias voltage (VBIAS) 27
3.2.12 Reading the forward voltage (VFWD) 28
3.3 1400 ... 1499 error messages of an PDA8xxx 29
3.4 Status reporting 30
3.4.1 Standard event status register (ESR) 31
3.4.2 Standard event status enable register (ESE) 31
3.4.3 Status byte register (STB) 32
3.4.4 Service request enable register (SRE) 32
3.4.5 Reading the STB by detecting SRQ 33
3.4.6 Reading the STB by "*STB?" command 33
3.4.7 Reading the STB by serial poll 33
4 Service and Maintenance 34
4.1 General remarks 34
4.2 Troubleshooting 35
5 Listings 37
5.1 List of abbreviations 37
5.2 List of figures 39
5.3 Certifications and compliances 39
5.4 Addresses 40

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 GmbH.

Thorlabs GmbH

This part of the instruction manual contains every specific information on how to operate the photo current module PDA8xxx. 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 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1 General description of the PDA8xxx

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 all 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 complete original packaging including the plastic form parts. If necessary, ask for a replacement package.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

☝ 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!

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, 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 EN 50 082-1.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1.2 Warranty

Thorlabs GmbH warrants material and production of the PDA8xxx modules for a period of 24 months starting with the date of shipment. During this warranty period *Thorlabs GmbH* 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 GmbH (Germany)* or to a place determined by *Thorlabs*. The customer will carry the shipping costs to *Thorlabs GmbH,* in case of warranty repairs *Thorlabs GmbH* 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 GmbH warrants the hard- and software determined by *Thorlabs GmbH* for this unit to operate fault-free provided that they are handled according to our requirements. However, *Thorlabs GmbH* does not warrant a faulty free and uninterrupted operation of the unit, of the soft- or firmware for special applications nor this instruction manual to be error free. *Thorlabs GmbH* 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 conditions (refer to the PRO8000 (-4) / PRO800 mainframe operation manual) stated by us or unauthorized maintenance.

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

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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1.3 Features

- **Utmost precision**
  The single or dual channel photocurrent amplifier modules PDA8xxx offer a maximum of precision and sensitivity. The polarity of the photodiode is nevertheless free selectable.

- **Different operating modes**
  The photodiode may either be operated photovoltaic or photoconductive by setting a bias voltage of 0 ... 10V.

- **7 measurement ranges**
  For a low noise measurement with 15 bit resolution plus sign there are seven measurement ranges from 10 nA to 10 mA. The lowest, still detectable current is about 0,1 pA (!)

- **Optical power measurement**
  Since the photocurrent amplifier modules can be calibrated by selecting the photodiode sensitivity η they can be used for precise optical power measurements after calibration.

- **Forward voltage measurement (optional)**
  Optionally it will be possible to measure the forward voltage of the photodiode with a selectable measurement current between 0.01 and 10 mA. (option PDA8xxx-FWD).

- **Extensive filtering**
  The mains filter installed in the mainframe and the careful shielding of the transformer, the microprocessor and the module itself will provide an excellent suppression of noise and ripple.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

- **Selecting the reference ground**
  Additionally the reference ground for the measurements can be adapted to the measurement setup.

- **LabVIEW®- and LabWindows/CVI®-driver**
  For the PDA8xxx *Thorlabs GmbH* supplies LabVIEW®- and LabWindows/CVI®-drivers for MS Windows 32.

  Please refer to our homepage for latest driver updates.
  http://www.thorlabs.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1.4 Technical data

(All technical data are valid at 23 ± 5°C and 45 ±15% humidity)

Photocurrent amplifier module PDA8xxx-1(2)

General data

Photodiode current range	10 nA ... 10 mA[1)]
Resolution	16 bit
Polarity of photodiode	selectable
Setting range of bias voltage (can be switched off)	0 V ... 10 V
Setting range of the photodiode coefficient η	0.001 ... 5.000 A / W
Temperature coefficient	≤ 50 ppm/K
Input impedance	0Ω (virtual ground)
Operating temperature	0 … + 40°C
Storage temperature	- 40 … + 70°C

Forward voltage measurement for channel 1 (opt. PDA8xxx-FWD)

Measurement technique	2-wire technique
Measurement current	0.01 ... 10 mA (± 5%)
Measurement range U_{FWD}	0 ... 2 V[2)]
Resolution	0.3 mV
Accuracy	± 5 mV

Connectors

Photodiode	BNC

Measurement ranges

Current range	Resolution	Accuracy
10 mA	0.1 µA	± 0.025 % f.s.
1 mA	10 nA	± 0.025 % f.s.
100 µA	1 nA	± 0.025 % f.s.
10 µA	0.1 nA	± 0.025 % f.s.
1 µA	10 pA	± 0.025 % f.s.
100 nA	1 pA	± 0.250 % f.s.[3)]
10 nA	0.1 pA	± 0.800 % f.s.[3)]

[1] other ranges on request

[2] reduces to 0 ... 1 V for I_{FWD} > 8 mA

[3] higher accuracy can be reached by repeated measurements

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1.5 Operating elements at the front of the module

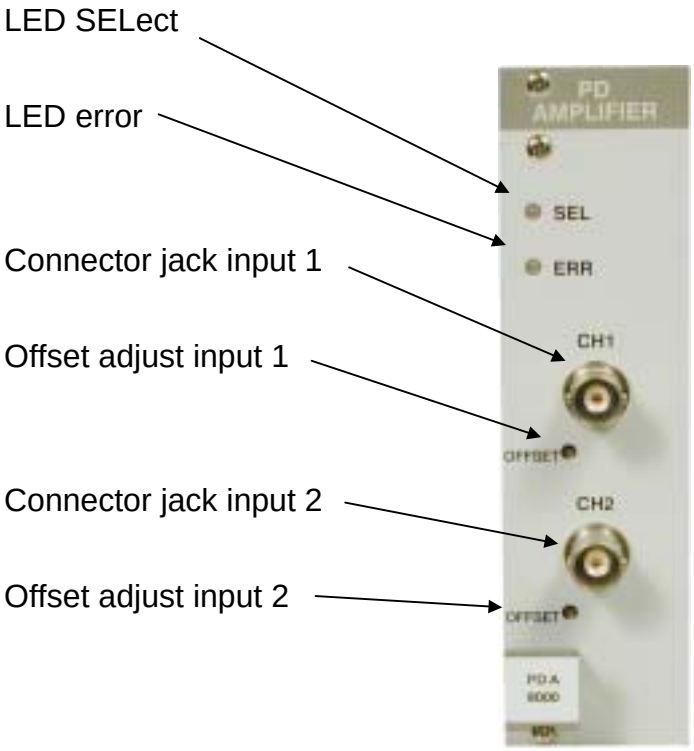


Figure 1 Operating elements on the PDA8xxx-2 front panel

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1.6 Presettings

1.6.1 Offset adjustment

- Connect the photodiode and all other components of the complete system (the photodiode must be in total darkness).
- Switch on the PRO8000 (-4) / PRO800.
- Select 10 µA-range.

➔ (Refer to chapter 2.2.7, "Setting the measurement range" on page 15)

- Enter the channel menu to observe the photodiode current.
- Adjust the offset with the offset potentiometer of the corresponding channel to "zero".

➔ (Refer to chapter 1.5, "Operating elements at the front of the module" on page 7)

NOTE:

When using photodiodes with a dark current higher than 1 nA only the ground conductor of the photodiode is to be connected.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1.7 Connecting the photodiode

Photodiodes can be connected to the BNC jacks of an input with both polarities.
The outer conductor of the BNC jack is always grounded.

Both polarity settings of the PDA8xxx (AG = "**a**node **g**round" and CG = "**c**athode **g**round") can be used depending on how the photodiode is connected to the BNC jack.

If one of the connectors of the photodiode itself is connected to ground (e.g. as with many housed laser diodes) this ground connector has to be connected to the outer conductor of the BNC jack.

Only one of the polarity settings of the PDA8xxx (AG or CG) will then be correct.

If in doubt, the correctly selected polarity yields a positive photo current on the display.

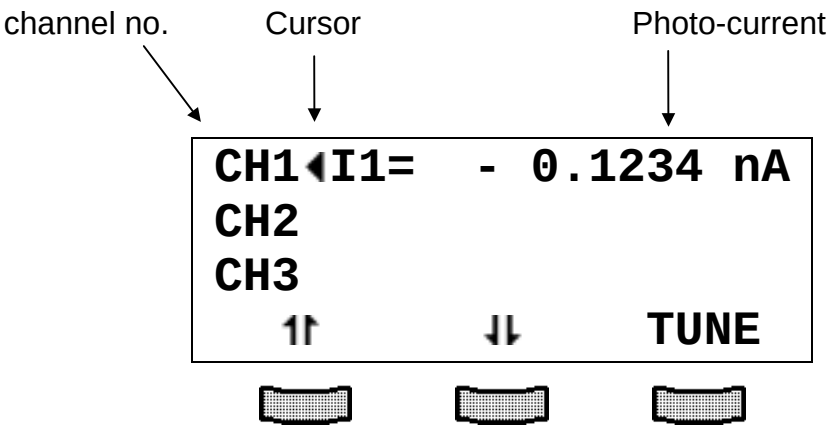
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

2 Operating the PDA8xxx

2.1 Functions in the main menu

2.1.1 Display

The main menu shows the channel number and the photo diode current measured at input 1



2.1.2 Selecting a module

Select a module for further input by setting the cursor to the channel number of the desired module.
Use the softkeys ↑ and ↓ .

CH4

Pressing CHANNEL will lead to the channel menu

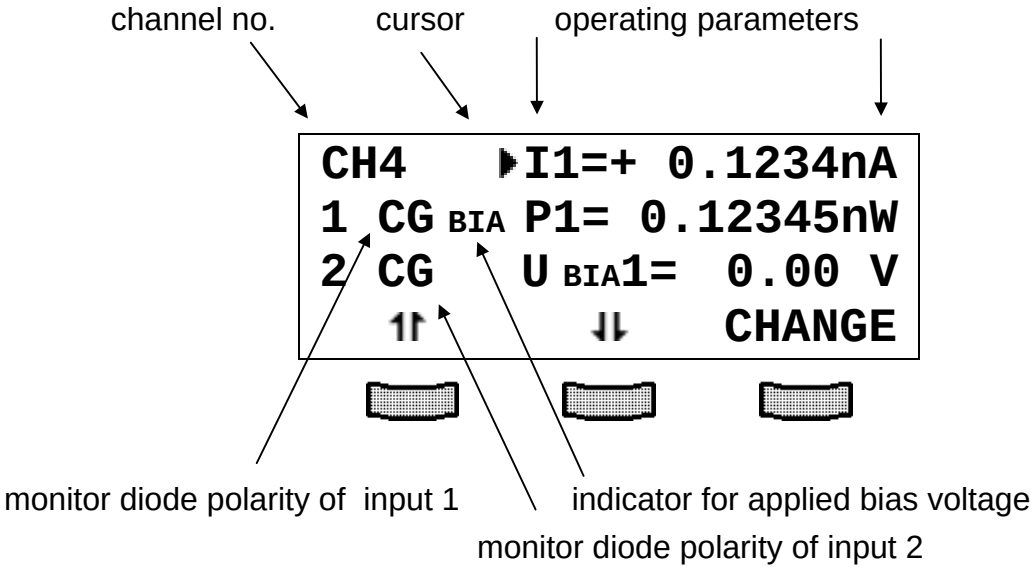
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

2.2 Functions in the channel menu

By pressing the key CHANNEL you enter the channel menu.
Pressing again CHANNEL or ESC will lead back to the main menu.

2.2.1 Display

In the channel menu all parameters of the selected module are shown:



Only three parameters can be shown at a time, so there is a scroll function. All parameters are sorted in a virtual list, which can be run through with the cursor:

```
I1=+ 0.1234nA
P1=  0.1234nW
UBIA1=  0.00 V
C1=1.12345A/W
BIA1 = OFF
RNG1 =10.00nA
POL1 = CG
Ifwd=1.1234mA
Ufwd=1.234 V
MEASURE Ifwd
I2=+ 0.1234nA
P2=  0.1234nW
...
```

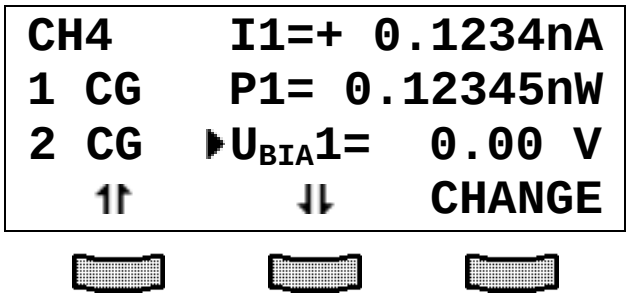
```
...
UBIA2=  0.00 V
C2=1.12345A/W
BIA2 = OFF
RNG2 =10.00nA
POL2 = CG
If you use the PDA8xxx-FWD:
Ifwd= 3.000mA
Ufwd= 1.551 V
MEASURE  Ifwd
```


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

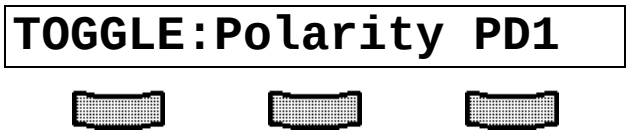
2.2.2 Changing parameters

To set or change a numerical parameter in the channel menu the respective line is selected with the cursor:

Example: $U_{BIA}1$ is to be changed:



Pressing the key (**CHANGE),** activates the tuning knob enabling the selected parameter to be changed. If the selected parameter is a switch parameter (i.e. the polarity of the photo diode) the function of the softkeys will change:



Pressing the right softkey will toggle the polarity.

Pressing ESC terminates the input.

NOTE

Some parameters can not be changed, as they are measurement values (i.e. the photo diode current) or may not be changed during bias voltage switched on. In these cases access is denied indicated by a long beep.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

2.2.3 Selecting the polarity of the photo diode

To change the polarity of the photo diode select

POL1 = for input 1
POL2 = for input 2

in the channel menu of the module. It then can be changed to the desired polarity.

➔ (Refer to chapter 2.2.2, "Changing parameters" on page 12)

NOTE

If the selected polarity of the photodiode is wrong the measured photodiode current will be displayed negative. Trying to set a bias voltage or to measure the forward voltage (opt. PDA8xxx-FWD) will yield an error message.

2.2.4 Calibrating the photo diode

If the displayed optical power shall be calibrated, the correct sensitivity η of the photo diode must be entered.

If for example η is 0.5 A/W this can be done in the channel menu entering the value

C1=0.5000A/W for input 1
C2=0.5000A/W for input 2

The default value of η is 0.1000 A/W. It is valid without specific confirmation.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

2.2.5 Setting the bias voltage

Each input can operate with a bias voltage in the range of 0 ... 10 V.

If for example the photo diode shall work with 3.000 V bias voltage this can be entered in the channel menu :

$U_{BIA}1=$ 3.00 V for input 1
$U_{BIA}2=$ 3.00 V for input 2

➔ (Refer to chapter 2.2.2, "Changing parameters" on page 12)

2.2.6 Switching on the bias voltage of the photo diode

☝ Attention ☝

Before switching the bias voltage on make sure that the photodiode is poled correctly (inverse direction).

If the photodiode is forward biased with a voltage, a current will flow through it that could damage or even destroy it.

The bias voltage is switched on by setting the parameter:

BIA1 = ON for input 1
BIA2 = ON for input 2

in the channel menu of the module.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

2.2.7 Setting the measurement range

Each input offers 7 measurement ranges.

Measurement range	Resolution	Accuracy
10 mA	0.1 µA	± 0.025 % f.s.
1 mA	10 nA	± 0.025 % f.s.
100 µA	1 nA	± 0.025 % f.s.
10 µA	0.1 nA	± 0.025 % f.s.
1 µA	10 pA	± 0.025 % f.s.
100 nA	1 pA	± 0.250 % f.s.
10 nA	0.1 pA	± 0.800 % f.s.

To set for example the measurement range to 1 mA full scale, enter

RNG1 =1.000mA for input 1
RNG2 =1.000mA for input 2

In the channel menu.

2.2.8 Measuring the forward voltage (option PDA8xxx-FWD)

If the PDA8xxx is used with the -FWD option the forward voltage (U_{FWD}) of the photodiode can be measured at input 1. The measurement current (I_{FWD}) used for measurement can be selected in the range of 0.01 mA to 10 mA and is set by the parameter:

Ifwd= 5.000mA

To measure the forward voltage (U_{FWD}) select:

MEASURE Ufwd!

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Then press the softkey **CHANGE** twice to do a measurement. The measured voltage is displayed in the line **Ufwd=**

2.3 Display error messages

NOT IF BIAS	It is not possible to change the polarity of the photo diode, the measurement range or to start a forward voltage measurement, if a bias voltage is applied.
POLARITY !	It is not possible to switch on the bias voltage. The polarity of the photodiode is most likely reversed.

Possible reasons for error messages when forward voltage measurement failed

ACCURACY !	The measurement was not accurate enough. (non-linearities or noise)
OVERFLOW !	No photo diode connected or bad connection. The entered forward current could not be reached, even with the highest possible voltage.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3 Communication 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 execute the programming of the system via IEEE 488 or RS232C computer interface.

Special operation features of a PDA8xxx photo current module are described here.

➔ (Refer to chapter 2, "Operating the PDA8xxx" starting on page 10)

NOTE

All analog values are read and written in SI units, i.e. A (not mA), W (not mW) etc. Letters may be written in small or capital letters.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3.1.1 Nomenclature

Program messages (PC ⇒ PRO8000 (-4)) are written in inverted commas:
"*IDN?"
Response messages (PRO8000 (-4) ⇒ 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))

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Numeric response data Type 2 (<NR2>)

Is a numerical value with or without sign in floating point 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 point 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))

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3.2 Commands

3.2.1 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>]

3.2.2 Selecting a port (PORT)

Programming:

":PORT 1" Select port 1 for further commands
":PORT 2" Select port 2 for further commands

Reading:

":PORT?" Read the selected port
[:PORT <NR1><LF>]

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3.2.3 Calibrating a photo diode (CALPD)

Programming:

":CALPD:SET <NR3>"	Program the sensitivity (η) of the monitor diode in A/W

Reading:

":CALPD:SET?"	Read the sensitivity (η) of the monitor diode in A/W **[:CALPD:SET <NR3><LF>]**
":CALPD:MIN?"	Read the minimum sensitivity (η) of the monitor diode in A/W allowed **[:CALPD:MIN <NR3><LF>]**
":CALPD:MAX?"	Read the maximum sensitivity (η) of the monitor diode in A/W allowed **[:CALPD:MAX <NR3><LF>]**

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3.2.4 Programming the forward current (IFWD)

NOTE

This command always affects port 1, so you do not need to select the port 1 first. This command is **only** available for a PDA8xxx **with the option PDA8xxx-FWD**

Programming:

":IFWD:SET <NR3>"	Program the forward current of port 1

Reading:

":IFWD:SET?"	Read the forward current of port 1 **[:IFWD:SET <NR3><LF>]**
":IFWD:MIN?"	Read the minimum forward current of port 1 allowed **[:IFWD:MAX <NR3><LF>]**
":IFWD:MAX?"	Read the maximum forward current of port 1 allowed **[:IFWD:MIN <NR3><LF>]**

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3.2.5 Reading the photo diode current (IPD)

NOTE

Please first select the desired port with the command ":PORT"

Programming:

":IPD:MEAS <NR1>"	Program the photo current to be a measurement value for "ELCH" on output string position <NR1> (1...8)

Reading:

":IPD:ACT?"	Read the actual photo diode current **[:IPD:ACT <NR3><LF>]**
":IPD:MIN_R?"	Read Ipd – ADC = 0000 **[:IPD:MIN_R <NR3>]**
":IPD:MAX_R?"	Read Ipd – ADC = FFFF **[:IPD:MAX_R <NR3>]**

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3.2.6 Switch the bias voltage on and off (PDBIA)

NOTE

Please first select the desired port with the command ":PORT"

☝ Attention ☝

Before switching the bias voltage on make sure that the photodiode is poled correctly (inverse direction).

If the photodiode is forward biased with a voltage, a current will flow through it that could damage or even destroy it.

Programming:

":PDBIA ON"	Switch the bias voltage on
":PDBIA OFF"	Switch the bias voltage off

Reading:

":PDBIA?"	Read the bias voltage switch **[:PDBIA ON<LF>]** **[:PDBIA OFF<LF>]**

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3.2.7 Select the photo diode polarity (PDPOL)

NOTE

Please first select the desired port with the command ":PORT"

Programming:

":PDPOL AG"	Select anode on ground
":PDPOL CG"	Select cathode on ground

Reading:

":PDPOL?"	Read the monitor diode polarity **[:PDPOL AG<LF>]** **[:PDPOL CG<LF>]**

3.2.8 Reading the optical power (POPT)

NOTE

Please first select the desired port with the command ":PORT"

Reading:

":POPT:ACT?"	Read the actual optical power **[:POPT:ACT <NR3><LF>]**
":POPT:MIN_R?"	Read P_{LD} – ADC = 0000 **[:POPT:MIN_R <NR3><LF>]**
":POPT:MAX_R?"	Read P_{LD} – ADC = FFFF **[:POPT:MAX_R <NR3><LF>]**

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3.2.9 Selecting the measurement range (RANGE)

NOTE

Please first select the desired port with the command ":PORT"

Programming:

":RANGE 1"	Select the 10 nA range
":RANGE 2"	Select the 100 nA range
":RANGE 3"	Select the 1 µA range
":RANGE 4"	Select the 10 µA range
":RANGE 5"	Select the 100 µA range
":RANGE 6"	Select the 1 mA range
":RANGE 7"	Select the 10 mA range

Reading:

":RANGE?"	Read the selected range **[:RANGE <NR1><LF>]**

3.2.10 Question the module type

Reading:

":TYPE:ID? "	Read the module ID (here 107) **[:TYPE:ID 107<LF>]**
":TYPE:SUB? "	Read module subtype: 0: 1-channel PDA, no U_{FWD} measurement 1: 2-channel PDA, no U_{FWD} measurement 2: 1-channel PDA, with U_{FWD} measurement 3: 2-channel PDA, with U_{FWD} measurement **[:TYPE:SUB <NR1><LF>]**

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3.2.11 Programming the bias voltage (VBIAS)

Programming:

":VBIAS:SET <NR3>"	Program the bias voltage
":VBIAS:START <NR3>"	Program the bias voltage start for “ELCH”
":VBIAS:STOP <NR3>"	Program the bias voltage stop for “ELCH”

Reading:

":VBIAS:SET?"	Read the set bias voltage **[:VBIAS:SET <NR3><LF>]**
":VBIAS:MIN?"	Read the minimum set bias voltage allowed **[:VBIAS:MIN <NR3><LF>]**
":VBIAS:MAX?"	Read the maximum set bias voltage allowed **[:VBIAS:MAX <NR3><LF>]**
":VBIAS:MIN_W?"	Read U_{BIAS} – DAC = 0000 **[:VBIAS:MIN_W <NR3><LF>]**
":VBIAS:MAX_W?"	Read U_{BIAS} – DAC = FFFF **[:VBIAS:MAX_W <NR3><LF>]**
":VBIAS:START?"	Read the start bias voltage for “ELCH” **[:VBIAS:START <NR3><LF>]**
":VBIAS:STOP?"	Read the stop bias voltage for “ELCH” **[:VBIAS:STOP <NR3><LF>]**

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3.2.12 Reading the forward voltage (VFWD)

NOTE

This command always affects port 1, so you do not need to select the port 1 first. This command is **only** available for a PDA8xxx **with the option PDA8xxx-FWD**

Reading:

":VFWD:ACT?"	Read the actual laser voltage **[:VFWD:ACT <NR3><LF>]**
":VFWD:MIN_R?"	Read U_{FWD} – ADC = 0000 **[:VFWD:MIN_R <NR3><LF>]**
":VFWD:MAX_R?"	Read U_{FWD} – ADC = FFFF **[:VFWD:MAX_R <NR3><LF>]**

NOTE

Before measuring the forward voltage, you should select a suited forward current with the command ":IFWD".

If the photo diode is poled wrong, you will measure a voltage of abt. 10V.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3.3 1400 ... 1499 error messages of an PDA8xxx

[1401,"Attempt to switch on BIAS while photo current is negative"]
Possible reason: Wrong photo diode polarity

➔ (Refer to chapter 3.2.7, "Select the photo diode polarity (PDPOL)" on page 25)

[1402,"Attempt to change polarity while BIAS is on"]
Possible reason: The polarity of the photo diode can not be changed with bias on.

[1403,"Attempt to change measurement range while BIAS is on"]
Possible reason: The measurement range can not be changed with bias on.

[1404,"Attempt to measure Ufwd while BIAS is on"]
Possible reason: The forward voltage can not be measured with bias on.

[1405,"Ufwd measurement failed – accuracy error"]
Possible reason: Non-linearity or noise affected the measurement.

[1406," Ufwd measurement failed – voltage overflow"]
Possible reason: No diode installed or bad contact. No forward current flow.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3.4 Status reporting

The PDA8xxx has no own device error registers. You can only use the PRO8000 (-4) / PRO800 mainframe status registers shown here.

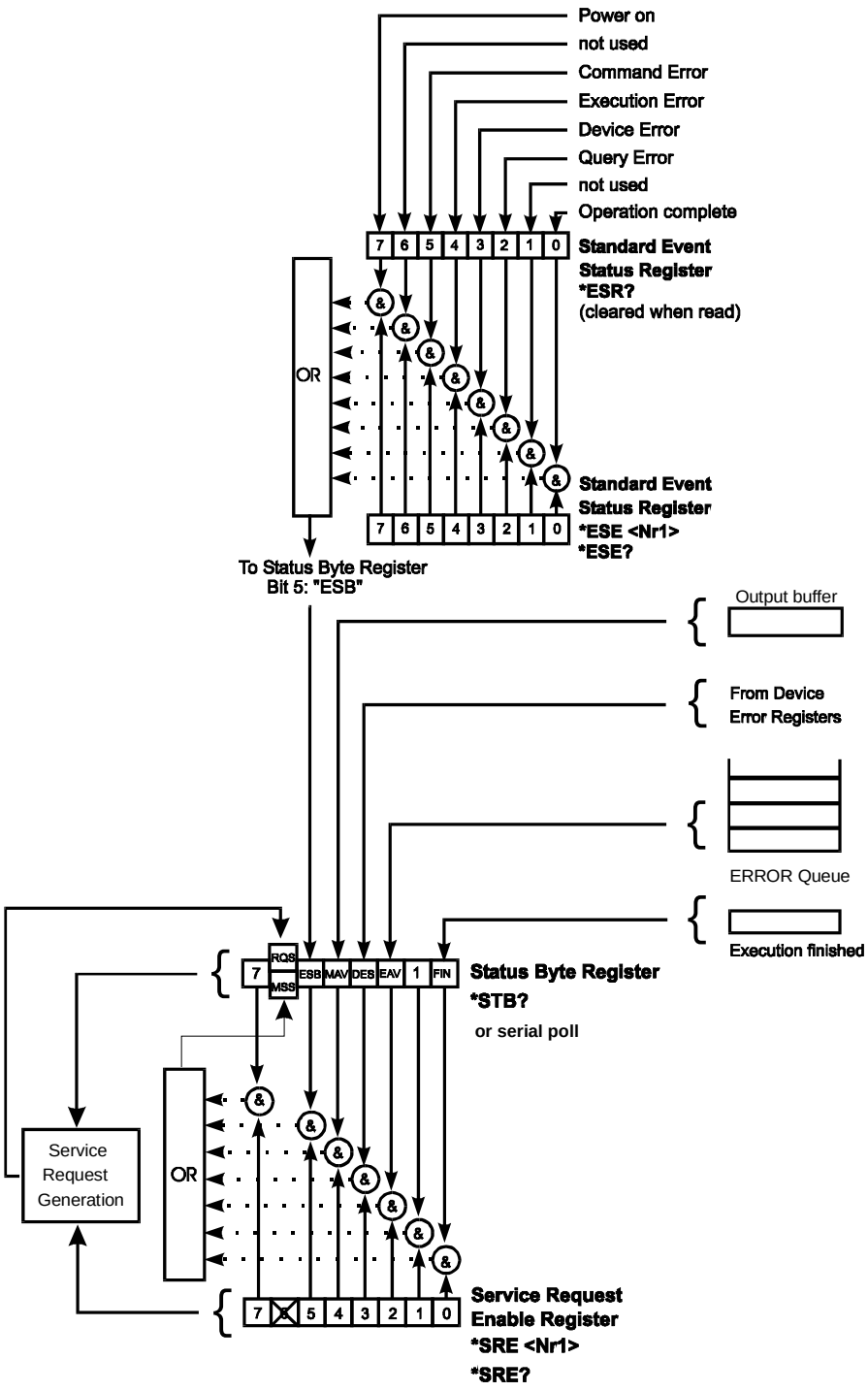


Figure 2 The PRO8000 (-4)/ PRO800 register ESR, ESE, STB and SRE

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3.4.1 Standard event status register (ESR)

The bits of this register represent the following standard events:

Power on	This event bit indicates, that 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 directly with the command **"*ESR?".** This read command clears the ESR. The content of the ESR can not be set.

The bits are active high.

3.4.2 Standard event status enable register (ESE)

The bits of the ESE are used to select, which 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 logical 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3.4.3 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 3.4.5). Alternatively the SRQ can be recognized using the command **"*STB?"** (Please refer to 3.4.6) or by serial poll (Please refer to 3.4.7).

3.4.4 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 related 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3.4.5 Reading the STB by detecting SRQ

If an SRQ is asserted (see 3.4.4) bit 6 of the STB is set to logical 1, so that the controller can detect which device asserted the SRQ by auto serial polling.

3.4.6 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.

3.4.7 Reading the STB by serial poll

If the controller does not support 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

4 Service and Maintenance

4.1 General remarks

The PDA8xxx modules don’t need any maintenance by the user.

If highest precision of measurements is vital to you, you should have recalibrated the PDA8xxx module by Thorlabs about every two years.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

4.2 Troubleshooting

In case that one module of your PRO8000 (-4) / PRO800 system shows malfunction please check the following items:

◆ Module does not work at all (no display on the mainframe):

- ➢ Mainframe PRO8000 (-4) / PRO800 connected properly to the mains?
  - ▪ Connect the PRO8000 (-4) / PRO800 to the power line, take care of the right voltage setting of your mainframe.

- ➢ Mainframe PRO8000 (-4) / PRO800 turned on?
  - ▪ Turn on your PRO8000 (-4) / PRO800 with the key mains-switch.

- ➢ Control the fuse at the rear panel of the PRO8000 (-4) / PRO800 mainframe.
  - ▪ If blown up, replace the fuse by the correct type

➔ (refer to your PRO8000 (-4) / PRO800 mainframe operating manual to select the appropriate fuse)

◆ The PRO8000 (-4) / PRO800 display works, but not the module:

- ➢ Is the module inserted correctly and are all mounting screws tightened?
  - ▪ Insert the module in the desired slot and tighten all mounting screws properly.

◆ You don't measure the right photo current

- ➢ Is the photo diode connected properly?
  - ▪ Check the connecting cable.

- ➢ Is the photo diode poled correctly?
  - ▪ If not, change the polarity with the **":PDPOL "** command or in the channel menu.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

- Do you use a bias voltage with the photo diode in photocurrent mode?
  - Turn off bias voltage in the channel menu, with the **":PDBIA OFF"** command or change the polarity of the diode for photo element mode.

- Is the bias voltage set to 0 in photo-element mode?
  - Enter an appropriate bias voltage with the command **":VBIAS:SET <NR3>",** or in the channel menu**.**

- Is the correct photo diode efficiency η set (A/W)?
  - Enter the coefficient in the channel menu or with the command: **":CALPD:SET <NR3>"**

- Do you have chosen an appropriate measurement range for your application?
  - Use the command **":RANGE <NR1>"** or use the channel menu to select a higher or lower sensitivity

If you don't find the error source by means of the trouble shooting list or if more modules work erratic please first connect the *Thorlabs -Hotline (blueline@thorlabs.com)* before sending the whole PRO8000 (-4) / PRO800 system for checkup and repair to *Thorlabs*-Germany.

(refer to section 5.4, "Addresses " on page 40

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5 Listings

5.1 List of abbreviations

The following abbreviations are used in this manual:

ADC	Analog to Digital Converter
AG	Anode Ground
CG	Cathode Ground
CLR	CLeaR
CR	Carriage Return
CRD	Character Response Data
DAC	Digital to Analog Converter
DC	Direct Current
DCL	Device Clear
EAV	Error AVailable
ELCH	ELectrical Characterization
EOI	End Of Information
ESE	Standard Event Status Enable register
ESR	Event Status Register
FIN	Command FINished
GET	Group Execute Trigger
GTL	Go To Local
IEEE	Institute for Electrical and Electronic Engineering
LD	Laser Diode
LF	Line Feed
LLO	Local Lockout
NR1	Numeric Response data of type 1
NR2	Numeric Response data of type 2
NR3	Numeric Response data of type 3
MAV	Message AVailable)
MSS	Master Summary Status
PC	Personal Computer
PD	Photo Diode
RQS	ReQuest Service Message
SDC	Selected Device Clear
SEL	SELect

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SRE	Service Request Enable Register
SRQ	Service ReQuest
STB	STatus Byte Register
TRG	TRiGger

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5.2 List of figures

Figure 1 Operating elements on the PDA8xxx-2 front panel 7
Figure 2 The PRO8000 (-4)/ PRO800 register ESR, ESE, STB and SRE 30

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 B)
	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 B)
	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 PDA8000 series modules installed in the Thorlabs PRO8x series of mainframes.
[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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5.4 Addresses

Thorlabs GmbH

Gauss-Strasse 11
D-85757 Karlsfeld
Fed. Rep. of Germany

Tel.: +49 (0)81 31 / 5956-0
Fax: +49 (0)81 31 / 5956 99

Email: **profile@thorlabs.com**
Internet: **http://www.thorlabs.com**
Technical Hotline: **blueline@thorlabs.com**

Our company is also represented by several distributors and sales offices throughout the world.
Please call our hotline, send an E-mail to ask for your nearest distributor or just visit our homepage **http://www.thorlabs.com**

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP