Operation manual

Thorlabs Blueline™ Series

Mainframe

PRO8000
PRO8000-4
PRO800

2003

Version: 2.10
Date: 13.10.2003

Contents Page

1 General remarks

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 specific information on how to operate the modular PRO800 / PRO8000 / PRO8000-4 mainframe.
The description of the different modules is given in the individual module manuals.

☝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.

1.1 Packing List

1. 1 Mainframe PRO8000 or PRO8000-4 or PRO800
2. 1 power cord, connector according to ordering country
3. 1 operation manual
4. 1 CD with drivers and software
5. inserted modules if ordered together with the PRO8, blindplates else

1.2 Safety

☝ Attention ☝

All statements regarding safety of operation and technical data in this operation 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 damage to your health or even death!

Also make sure that your line voltage agrees with the voltage given on the letterplate of the unit and that the right fuse has been inserted!

To avoid damage to the modules used or to the mainframe, modules may only be installed or removed with the mainframe switched off.

All modules must be fixed with all screws provided for this purpose.

All connections to the load have to be made with shielded cables (unless otherwise noted).

If a remote control interface is provided a control computer can be connected to the PRO8000 (-4) / PRO800 prior to operation of both units!

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.

The PRO8000 (-4) / PRO800 laser modules can deliver up to several 100mW of (maybe) invisible laser radiation!

When operated incorrectly, this can cause severe eye and health damage!

Make sure you 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!

☝ 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.

Mounting several PRO8000 (-4) in a rack, make sure to have 1 height-unit space between the different housings to ensure proper ventilation (ventilation slots are beneath the front panel!!)

To connect the unit to the mains, use only the supplied mains cord with safety mains plug. The unit is grounded via the protective conductor of this cable. To avoid electric shocks the plug of the mains cable must be inserted in a correctly grounded socket.
Interruption of the protective grounding could lead to health damage or even death due to electric shock.
Please check prior to operation, if the line voltage, indicated on the rear panel agrees with your local supply. If not please have a service technician change the line voltage and the appropriate fuse.

☝ Attention ☝

Changing the line voltage is a service operation and must be done only by qualified service personnel! (see section 5, Service).

To guarantee safe operation of the PRO8000 (-4) / PRO800 do not obstruct the ventilation slots beneath the front panel and the fan air outlets at the rear panel.

☝ Attention ☝

The unit must not be operated in explosion endangered environments.

Do not open the unit during operation. Internal adjustments as well as replacement of parts is only to be done by especially trained service personnel. Parts must not be exchanged with the unit switched on. Dangerous voltages may also be present in the unit when switched off and with power cord removed.
Proper discharge of power components is advised.

1.3 Warranty

Thorlabs GmbH warrants material and production of the PRO8000 (-4) / PRO800 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 still entitled to warranty. For warranty repairs or service the unit must be sent back to *Thorlabs Germany* or to a place determined by *Thorlabs GmbH*. The customer will carry the shipping costs back 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 will also carry the costs for back shipment. If the unit is sent back to *Thorlabs GmbH* from abroad the customer will carry all shipping costs, duties etc. which should arise for sending the goods back to *Thorlabs GmbH*.

Thorlabs warrants the hardware and software determined by *Thorlabs GmbH* for this unit to operate without fault provided that they are handled according to our statements. However, *Thorlabs GmbH* does not warrant a fault free or uninterrupted operation of the unit, of the software or firmware for special applications nor this operation manual to be fault free. We will not carry responsibility for ensuing damages.

Restriction of warranty

The aforementioned warranty does not cover errors and defects being the result of improper treatment, software and interface not supplied by us, modification, misuse or operation outside the defined ambient conditions 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 operation manual or the technical data of the described unit at any time.

1.4 Technical data

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

Number of slots:	
PRO8000	8
PRO8000-4	8
PRO800	2
Mains switch	Key-operated
Remote control	via IEEE488 and RS232C
Mains supply	100 V, 115 V, 230 V (± 10%) fixed
Mains frequency	50 ... 60 Hz
Maximum power consumption:	
PRO800	220 VA
PRO8000	500 VA
PRO8000-4	800 VA
Supply mains overvoltage	Category II (Cat II)
Operating temperature[1)]	0 ... +40°C
Storage temperature	-40°C ... +70°C
Relative Humidity	Max. 80% up to 31°C, decreasing to 50% at 40 °C
Pollution Degree (indoor use only)	2
Operation altitude	< 3000 m

Maximum output current for all modules:	
PRO800	8 A
PRO8000	16 A
PRO8000-4	32 A

Warm up time for maximum accuracy	15 min
Dimensions PRO800 (WxHxD)	232 x 147 x 396 mm (3 U, ½ 19")
Dimensions PRO8000 (WxHxD)	449 x 147 x 396 mm (3 U, 19")
Dimensions PRO8000-4 (WxHxD)	449 x 177 x 456 mm (4 U, 19”)

Maximum weight PRO800	< 9 kg
Maximum weight PRO8000	< 17 kg
Maximum weight PRO8000-4	< 21 kg

[1)] non condensing

Display and operating elements

Display	4 x 20 characters alphanumeric vacuum-fluorescence-display.
User guiding	interactive
Keypad	7 micro-switch keys
Main tuning knob	rotation encoder
Acoustic messages	internal beeper: short tone as confirmation long tone as warning

Protections

- Key operated power control switch (ON / STANDBY)
- Interlock connector
- Over temperature protection of the mainframe PRO8000 (-4) / PRO800
- Over temperature protection of the modules series 8000
- Protection against transients
- Protection against interrupted wiring (OPEN)
- Protection against too high laser or TEC current (limit)
- Protection against too high optical power (current limit of the monitor diode)

Connectors on the rear panel

Ground	4 mm banana jack
Line	3 pin IEC 320 with fuse
Remote control	IEEE488 (24 pin.) jack or RS232C (9 pin) D-SUB jack
Auxiliary jack	9-pin D-Sub. For extensions
TRIG IN (max. 5V, TTL)	BNC
TRIG OUT (max. 5V, TTL)	BNC

Connectors on the front panel Depending on type of modules used

2 Operating the PRO8000 (-4) / PRO800 mainframe

2.1 Operating elements on front panel

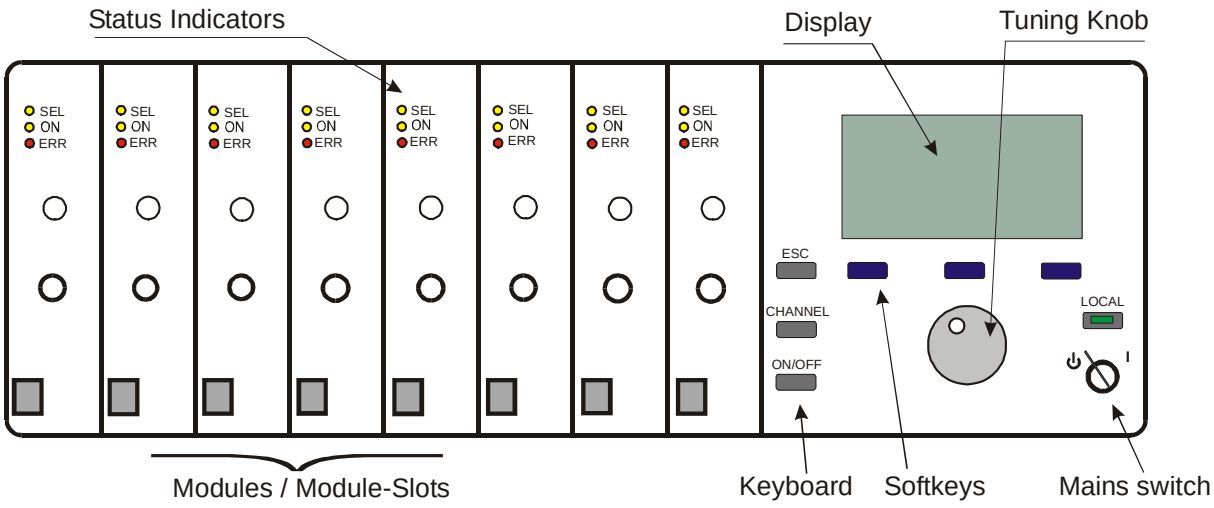


Figure 1 Front panel view of the PRO8000

Display

The alphanumeric vacuum-fluorescence display enables interactive communication with the PRO800 / PRO8000 / PRO8000-4. Different menus allow a clearly structured representation of the relevant values.

Mains switch

The mains switch is a key-operated power control switch (ON / STANDBY) to prevent accidental or non-authorized use.

Modules

The PRO8000 and PRO8000-4 can house up to 8 plug-in modules, the PRO800 two modules.
All in- or outputs are accessible directly at the front of the modules.

Keypad

With the keypad (gray) and the soft keys (blue) modules can be selected, switched on and off or settings changed. Numerical values are changed with the tuning knob.

 Escape key	interrupts the actual procedure
 Channel key	selects a module / a channel
 ON/OFF key	switches a module / a channel on or off
Three blue soft keys	have different functions in the different menus. The respective function is shown in the last line of the display in form of a LOGO, for example: ↑ or ↓, if a cursor may be moved.

Remote control

 LOCAL key	switches to manual operation from remote control. The LED lights if in local mode. If a remote controller has given a “local lock-out” command **[LLO]**, this key is disabled for further operation until you switch off the unit or give the command **[GTL]**.

Status display on module front panel

SEL	This LED is on when the module is selected for input.
ON	This LED will light when the module is switched on.
ERR	This LED will indicate if an error has occurred in the module.

Tuning knob

With the tuning knob numerical values can be changed. The respective value is selected with the cursor (▶) moved by the blue soft keys. The cursor must point to the left of the value to be changed.

A clockwise turn on the tuning knob increases the value and an anti-clockwise turn decreases it.

2.2 Operating elements on rear panel

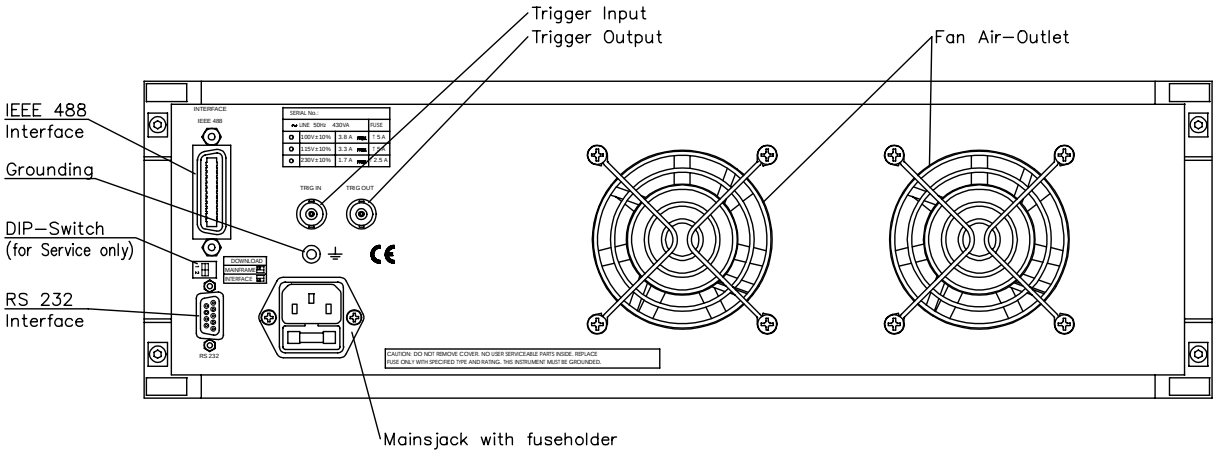
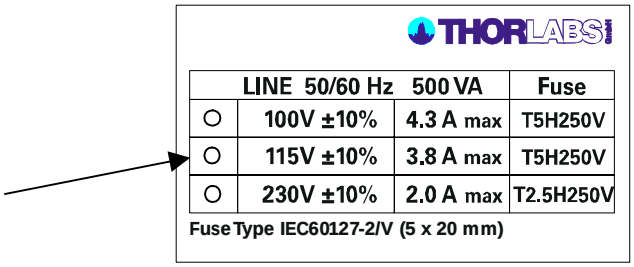


Figure 2 Operating elements on rear panel

At the rear panel of the PRO8000 / PRO8000-4 / PRO800 you will find:

- socket for mains cord with fuse
- trigger input and output
- connector for IEEE488.2 interface
- connector for RS232C interface
- 2pin DIP switch (for service und firmware update only! Both switches must be in the “right” position for operation.)
- fan air outlet(s)
- grounding connector
- label denoting the set voltage range and the appropriate fuses. The voltage range is indicated by a screw in the corresponding position e.g. for the PRO8000, 230V setting:



This screw only depicts the voltage setting. For changing the voltage range see section 5.1 “Line voltage setting”

NOTE

The DIP-Switch is for service purpose only!
Do not change their setting except for firmware update (->4.8)!
For operation both switches must be in the right position!

2.3 Menus of the PRO8000 (-4) / PRO800

2.3.1 After power on

After turning on your PRO8000 (-4) / PRO800 the main processor executes a self test program for a few seconds.

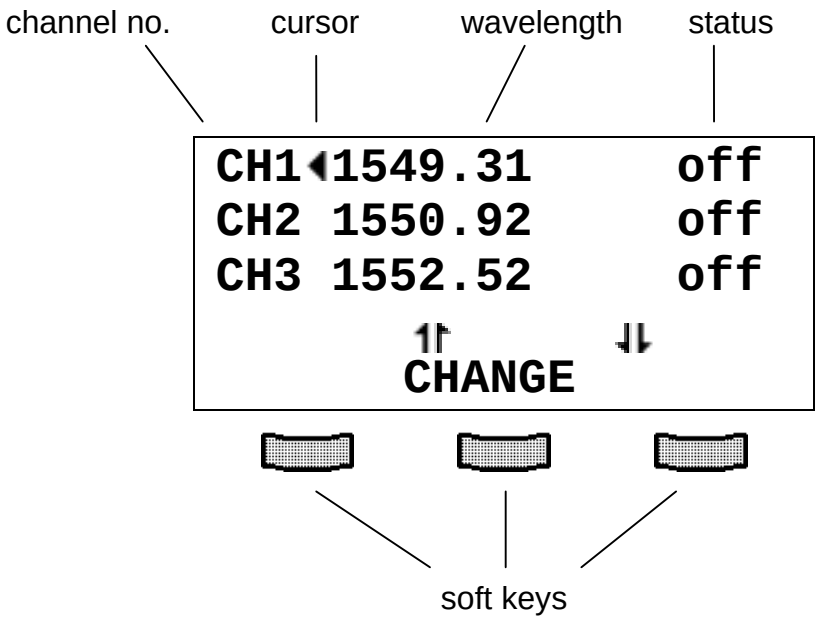
You see the following screen:

```
PROFILE    PRO8
Power on Self test
SW Revision  4.38
Interface    1.04
```

It shows the actual software revision number and the actual interface revision number.
After a few seconds the program enters the main menu screen.

2.3.2 Main menu

(examples with WDM modules)



The first three lines show the contents of the respective menu. In this example "main menu" the wavelengths of the inserted WDM modules of the channels CH1 to CH3 are displayed.

The fourth line describes the functions of the three soft keys (here up (↑), down (↓) and CHANGE).

2.3.3 The cursor

The cursor of the PRO8000 (-4) / PRO800 can be placed at different positions in the display. It can point to values to the left (◀) or to the right (▶)

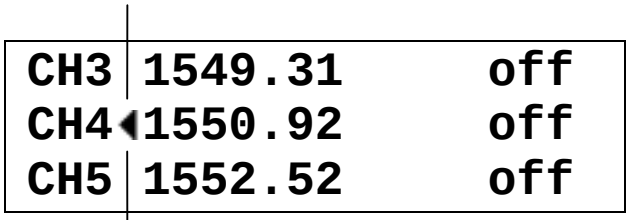
The cursor can be moved up with the soft key (↑) or down with the soft key (↓).

With the cursor leaving the upper or lower edge of the display you can scroll through the whole content of the corresponding screen.

With the cursor in the third line, the next line will appear from below when pressing (🡻).Vice versa by pressing the key (🡹).

Example in the main menu with 8 lines for the channels:

channels 1 and 2



channels 6 to 8

2.3.4 Selecting a module

A module is selected for further input by placing the cursor beside the respective channel number.

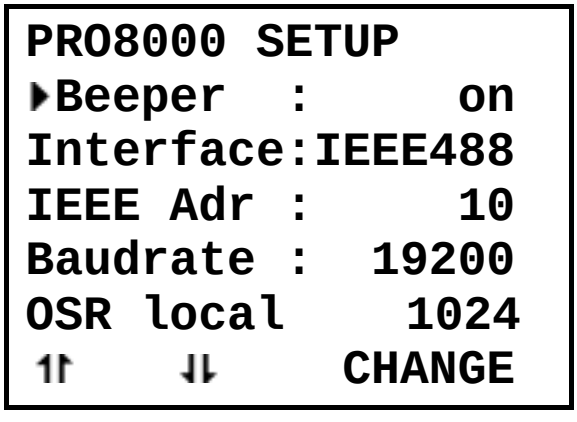
CH4◀

Pressing CHANNEL will lead to the channel menu of the selected module.

➔ Please refer to the operation manual of the individual module.

2.3.5 Setup menu

From main screen you can enter the set-up screen by pressing ESC.



The first line marked and hitting “CHANGE” toggles the beeper for occurring errors and input confirmation on and off.
In the second line you can select between IEEE488 Interface or terminal mode via RS232 Interface.
In the third line the IEEE-address is set, default value is 10.
The appropriate baud rate for the RS 232-interface is chosen in line 4 (default 19200 Baud).
OSR local allows to select the averaging rate for displayed values, i.e. how many measured values are averaged to reduce noise. The higher the value, the longer it takes to actualize the measured values on the screen. This item does not affect the remotely transferred measurement values. (‘Normal’ value =16).


. Brings you back to main menu.

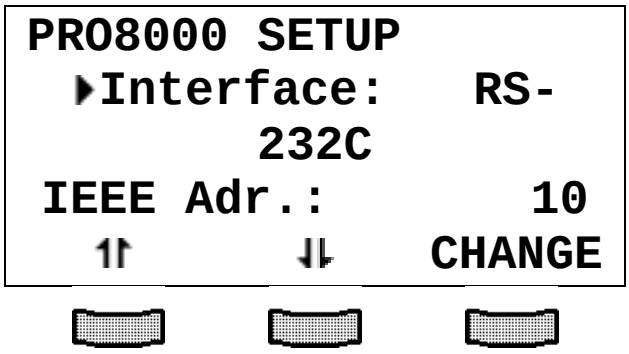
3 Communication with a PC

NOTE

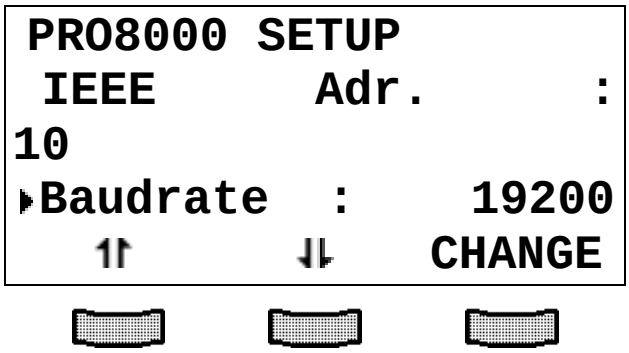
The following operating elements are still working with the remote control active: The key LOCAL, the LEDs SEL, ERR and ON and all potentiometers at the modules themselves

3.1 Hardware standard RS 232-C

The RS232C interface complies to the IEEE1174 standard for programmable instruments.
To use the implemented RS232C interface, first select this option in the setup menu.



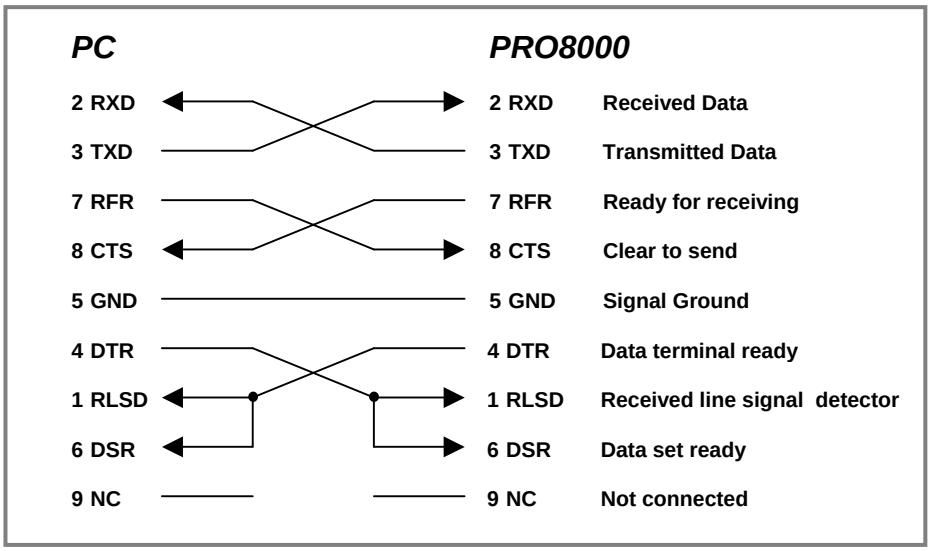
Then select the desired baud rate (default is 19200 Bd).



If you use an older PRO8 system it will have a female 9-pin D-SUB connector at the rear panel. You must use then an 1:1 connection cable between PRO8 and PC.

If you have a newer version with a 9-pin male connector you need a null modem cable shown in the diagram:

The control computer and the PRO8 are connected via 9pin D-SUB null modem cable with the following pinning.



If your control PC does not support DSR/DTR signaling you have to use a null modem cable which is connected like shown below.

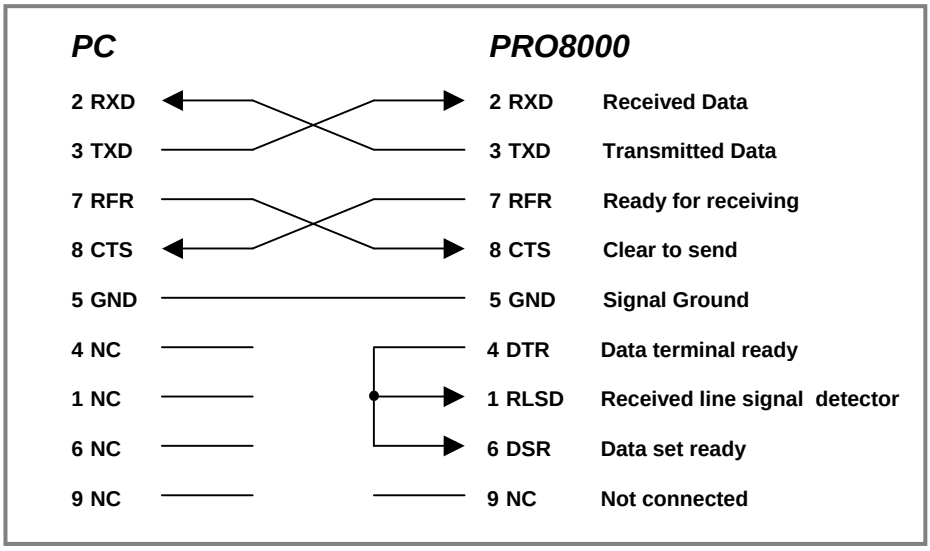


Figure 3 RS232C connection cable

3.1.1 Interface specification

Electrical characteristics	EIA RS232C
Connector	9pin D-SUB (male)
Communication	Full duplex
Baud rate	1200, 2400, 4800, 9600, 19200, 38400
Start bit	1 bit
Stop bit	1 bit
Data length	8 bit
Parity	No parity
Handshaking	RTS/CTS
Receive buffer length	256 bytes
Termination character	CR LF (ASCII 0DH0AH)

3.1.2 Emulating the IEEE488 bus commands

As the RS232 interface does not offer hardware control lines like the IEEE488 bus, the according IEEE488 bus command are emulated by specials commands.

➔ (Please refer to chapter 3.2, "Hardware standard IEEE 488.1" starting on page 21)

Device clear

Syntax: **"&DCL"**

Description: Clears the input buffer and output queue. Resets the parser unit and the execution unit

Go to local

Syntax: **"&GTL"**

Description: Switches the PRO8000 into LOCAL mode (manual operation). Previously set values for laser current, laser power, temperature etc. remain valid.

Local lockout

Syntax: **"&LLO"**

Description: Disables the 

button. Return to LOCAL mode (manual operation) is only possible with the command **"&GTL"**.

Poll Status-byte

Syntax: **"&POL"**

Description: Reads the status byte and clears bit 6 (MSS). This command is used to emulate a service request.

3.1.3 Service request emulation

To get the instrument status byte asynchronously the service request sequence is used:

- In case the device needs a service request it sends **[&SRQ]** to the PC.
- Now the PC should query the status byte with **"&POL"**.
- The device will then answer with **[&nnn]** where nnn represents the status byte in decimal notation.

➔ (See chapter 3.5.4, Service request enable register (SRE) on page 42)

3.1.4 Operating commands

All operating commands described in the following IEEE 488 section and in the individual module-manuals are valid also for the RS-232C communication!

3.2 Hardware standard IEEE 488.1

The IEEE 488 interface of the PRO8000 (-4) / PRO800 is based on the IEEE 488.2 standard. This includes the IEEE 488.1 standard for the hardware settings. There is a standard 24-pin IEEE488 jack on the rear panel. The address of the PRO8000 (-4) / PRO800 must differ from that of other devices using this IEEE488 bus.
You can select it in the setup menu .
➔ (Refer to chapter 2.3.5, "Setup menu" on page 15)

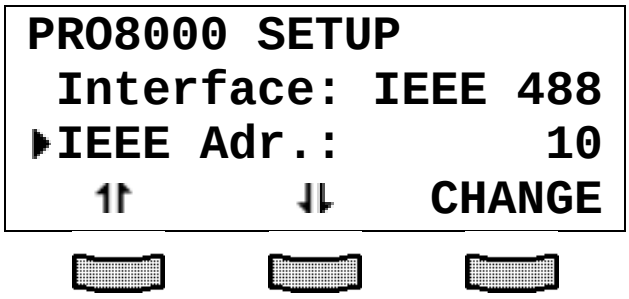
3.2.1 IEEE 488.1 subsets of the PRO8000 (-4) / PRO800

Function	Part set
Source Handshake	SH1
Acceptor Handshake	AH1
Talker	T6
Listener	L4
Service Request	SR1
Remote/Local	RL1
Parallel Poll	PP0
Device Clear	DC1
Device Trigger	DT0
Electrical Interface	E1

3.2.2 Device address and string terminator

3.2.2.1 Address

The device address of the PRO8000 (-4) / PRO800 can be changed by pressing ESC in the main menu. The display shows:



Pressing the key (**CHANGE),** soft keys ← ..... → appear, enabling the address to be changed. The device address can be selected between 0 and 30.

Pressing ESC will make the new settings valid and return to main screen.

NOTE

The default device address is 10.

3.2.2.2 String terminator

The string terminator of the PRO8000 (-4) / PRO800 is preset to <LF><EOI>. This is fixed and cannot be changed.

The PRO800 / PRO8000 (-4) itself accepts any combination of <LF> and <EOI> as string terminator.

3.2.3 Starting the IEEE488 interface

- Connect the PRO8000 (-4) / PRO800 and the PC with shielded IEEE488 cables
- Connect the units to the mains
- Switch on both units

To guarantee safe transmission of data the IEEE488 cable between two units should not be longer than 2 meters and the total cable length should not exceed 20 meters.

The PRO8000 (-4) / PRO800 will automatically enter REMOTE mode after the first command is transferred by the PC.

NOTE

Programming the control software will vary with the type of computer, the user interface, the programming language, the interface card used as well as with the driver software and the correspondingly supplied software interfaces. Please refer to the documentation of these components.

➔ (Also refer to chapter 3.5.15, "Hints for setting up control programs" on page 45)

3.2.4 IEEE488 bus commands

To communicate via the IEEE488 bus the standard control signals [MLA], [MTA], [UNL], [UNT], [ATN], [REN], [SPE], [SPD] are used.

If the control program for the PRO8000 (-4) / PRO800 system is written in a language as e.g. BASIC, then these IEEE488 control signals are automatically transmitted to the PRO8000 (-4) / PRO800 according to the used driver software and do not have to be explicitly produced in the control program.

These functions have also already been implemented in the LabView®- or LabWindows®-drivers from *Thorlabs GmbH*.

When receiving the IEEE488 bus commands [GET], [LLO], [GTL], [DCL] and [SDC] the PRO8000 (-4) / PRO800 will execute the following functions:

[LLO] Local Lockout

The command [LLO] once sent will disable the key 

throughout further operation.
Return to LOCAL mode (manual operation) is only possible with the command [GTL] (see below.).

[GTL] Go To Local

The command [GTL] will return the PRO8000 (-4) / PRO800 to LOCAL mode (manual operation). Previously set values for laser current, laser power, temperature etc. remain valid.

[DCL] Device Clear

The command [DCL] clears the output queue, the error queue and resets the registers. It affects only the IEEE 488-bus electronic (see 3.6).
Normal operation of the modules is not interrupted.

NOTE

The command [DCL] will set back all IEEE 488 units connected to the bus.

[SDC] Selected Device Clear

The command [SDC] resembles the command [DCL] but refers only to the IEEE 488 part of the selected unit (see 3.6).
Normal operation of the unit is not interrupted.

NOTE

In contrast to the command [DCL] the command [SDC] will only set back the IEEE 488 of the device addressed.

[GET] Group Execution Trigger

Due to interface specification “DT0” (refer to section 3.2.1, “IEEE 488.1 subsets of the PRO8000 (-4) / PRO800” on page 21) the command **[GET]** is not implemented.

3.3 Software standard IEEE 488.2

3.3.1 Nomenclature

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

3.3.2 Program and response messages

Messages are transferred in two directions between the PRO8000 (-4) / PRO800 and the PC. Before the PRO8000 (-4) / PRO800 can send a message to the PC the PC must send a status read query (a command ending with a quotation mark) to specify, what information shall be transferred.
With the next read command, this information is transferred from the PRO8000 (-4) / PRO800 to the controller.

Program messages

Messages from the PC to the PRO8000 (-4) / PRO800 are called program messages.
With program messages, settings are effected (command) at the PRO8000 (-4) / PRO800 and response messages are selected (status read query).

Examples:
":SLOT 2" selecting a slot (command)
"*IDN?" request the identification (status read query)

Response messages

Messages from the PRO8000 (-4) / PRO800 to the PC are called response messages.
With response messages, measurement values and status information is transferred to the PC.

Example:

[:ILD:ACT 7.12345678E-005] measure the actual laser current of a current controller module

3.3.3 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 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))

3.3.4 Common commands and queries

The IEEE 488.2 standard requires a set of commands, that every device must support. These commands are called mandatory commands.
All commands can be single or "compound" having a tree structure. Those with compounds are called compound- or group-commands.

IEEE 488.2 mandatory commands

Command	**Possible response**
Explanation	
***IDN?**	
Identification query	**[PROFILE PRO8000 Ver.4.38-1.04<LF>]**
***RST**	
Resets the PRO8000 (-4) / PRO800: All outputs of all modules are switched off, all macros are deactivated (not deleted), the unit stays in 'ready' status i.e. bit 0 (FIN) of the status byte register is set. All set parameters (current, power values etc. remain valid!)	
***TST?**	
Executes a self test and queries the result	**[0<LF>]**
***OPC**	
Operation completed active mode started	
***OPC?**	
Operation completed query	**[1<LF>]**
***WAI**	
Waiting until the last operation is completed	

***CLS**

Clears all event registers (ESR, DEE1...DEE8) and the error queue. Due to the cleared event registers, also DESR is 0, bit 0 (FIN) of the STB is set.

***ESE <NR1>**

Sets the value for the standard event status enable register (ESE)

***ESE?**

Queries the current value of the standard event status enable register (ESE). The content of the register is not changed. **[<NR1><LF>]**

***ESR?**

Queries the current value of the standard event status register (ESR) and clears it the same time. **[<NR1><LF>]**

***SRE <NR1>**

Sets the value of the service request enable register (SRE)

***SRE?**

Queries the current value of the service request enable register (SRE) **[<NR1><LF>]**

***STB?**

Queries the value of the status byte register (STB). Bit 6 is reset to 0, the other bits kept unchanged. **[<NR1><LF>]**

***SAV 0**

Immediately saves all set values as default values to be loaded on the next power up

Mainframe commands

➔ Special Macro-Commands « ELCH », see chapter 3.7

":CONFIG:PLUG?"

Shows the configuration of the plug-in modules, always 16 values, module type and subtype for every slot, e.g.:.

[:CONFIG:PLUG 223,0,191,0,247,0,159,0,107,1,243,2,47,0,0,0]

":SLOT <NR1>"

Selects a slot for further programming

":SLOT?"

Queries the selected slot **[:SLOT <NR1><LF>]**

":STAT:xxx?"

XXX stands for one of the additional IEEE 488 registers implemented (BFC, BFR, BFE, DESR or DESE)

It returns the binary content of the register **[:STAT:xxx <NR1><LF>]**

":STAT:xxx <NR1>"

Sets the content of the enable register (BFE, EDE and DESE).

➔ (refer to section 3.5, “Status reporting ” on page 37.

":PORT?"

Queries the chosen port of a multidevice controller as MLC8xxx or PDA8xxxx. **[:PORT <NR1><LF>]**

":PORT <NR1>"

Selects a port of a multidevice controller as MLC8xxx or PDA8xxx.

":SYST:ERR?"

Queries the error queue **[0,"No error"<LF>]**

":SYST:ANSW?"

Query the answering format of the PRO8. **[:SYST:ANSW FULL]**

":SYST:ANSW VALUE"

PRO8000 (-4) / PRO800 will send only the requested parameter without designator.
Example:
When requesting the slot number with **":SLOT?"** the PRO8000 (-4) / PRO800 will only send **[2<LF>]** instead of **[:SLOT 2<LF>]**.
This is ☝ **not** ☝ according to the IEEE 488.2 standard but useful, if you want to increase speed.

":SYST:ANSW FULL"

PRO8000 (-4) / PRO800 will stop the function started with ":SYST:ANSW VALUE" and answer again according to the IEEE488.2 standard.

":TYPE:ID?"

Queries information about the selected module
Possible answers:
ITC8xxx: 159, LDC8xxx: 191, PDA8xxx: 107, TED8xxx: 223, MLC8xxx: 47, WDM-B: 249.
➔ (See also operation manuals of the specific modules)

":TYPE:SUB?"

Queries a possible sub type of a module. E.g.: CW, EA, DIR, LS, SLED for the optical source modules, depending on the modulation type.

":TYPE:TXT?"

Module ID in text form.

":TYPE:OPT?"

Returns 10 figures (0...255) depending on the installed options (mainly for service purposes)

":TYPE:SN?"

Query Pro8 serial number

3.3.5 module specific commands and queries

➔ See operating manual of the corresponding module

3.4 Error messages

Devices following the IEEE 488.2 standard provide an error queue storing errors one by one. Every query **":SYST:ERR?"** will fetch one error from the error queue. Repeated use of **":SYST:ERR?"** is necessary until the error queue is empty.

If the queue is empty, the error message **[0, "No error"]** is sent to the PC.

Error messages are organized in groups:

Error number	Error type
0	no errors
100 ... 199	command errors
200 ... 299	execution errors
300 ... 399	system errors
400 ... 499	query errors
1000 ... 9999	module dependent errors

3.4.1 Error queue empty

[0,"No errors"]

Error queue is empty.

3.4.2 100 ... 199 command error messages

[100,"Unknown command"]

Possible reason: ":HELLO WORLD". This string sent to the PRO8000 (-4) / 800 was not recognized as valid command.
":ILD:SET? 1.1". This command requires no numerical parameter.

[101,"Invalid character"]

Possible reason: Hex 09. This character sent to the PRO8000 (-4) / PRO800 does not belong to the allowed set of characters.

[102,"Invalid numeric parameter"]

Possible reasons: ":ILD:SET 1.1." The second decimal point is not allowed.
":ILD:SET 12E+12E". The second "E" is not allowed.

[103,"Invalid text parameter"]

Possible reasons: ":SENSOR CG". This parameter is not valid for a temperature sensor.
":MODE THH". This parameter is not valid for this command.

[104,"Missing parameter"]

Possible reason: ":ILD:SET". This command requires a numerical parameter.

[105,"Invalid separator"]

Possible reason: ":ILD:SE". This command was not complete.

[107,"Empty slot"]

Possible reason: ":SLOT 3" selected an empty slot.

[108,"Parameter can not be set"]

Possible reason: ":ILD:ACT 2.3E-3". This is only a read query but no set command.

[109,"Wrong compound"]

Possible reason: ":ILD:ERR?". This combination is not allowed.

[110,"Unknown compound"]

Possible reason: ":ILD:ERM?". This is a wrong compound (ERM).

[111,"Wrong parameter"]

Possible reason: ":ILD:ERM!". This is a wrong parameter (!).

[112," Wrong command for the selected port "]

Possible reason: e.g. PDA, setting forward current on channel 2.

[190, "Parser buffer overflow"]

Possible reason: Transmitted string was longer than the parser input buffer.

3.4.3 200 ... 299 execution error messages

[200,"Data out of range"]

Possible reason: ":ILD:SET 10E+30" sent to the PRO8000 (-4) / PRO800 but this current is much too high.

3.4.4 300 ... 399 system error messages

[300,"Hardware error"]

Possible reason: Service is requested.

[301,"Software error"]

Possible reason: Unfixed bug. Please report to *Thorlabs GmbH*.

[304,"Update required"]

Possible reason: You are using a very new module together with older firmware. Please update your firmware (refer to 4.8 on page 69).

[310,"ELCH set value initialization not complete"]

Possible reason: You tried to start a macro function while not all necessary parameters have been set.

[311,"ELCH read value(s) initialization not complete"]

Possible reason: You tried to start a macro function while no read parameters have been set.

3.4.5 400 ... 499 query error messages

[400,"Too many errors"]

Possible reason: More than 30 errors in the error queue.

[410,"Query interrupted"]

Possible reason: More than one query sent to the PRO8000 (-4) / PRO800 before the read command.

[420,"Query unterminated"]

Possible reason: No query sent to the PRO8000 (-4) / PRO800 before the read command.

The module dependent error messages are described in the specific module operation manuals.

3.5 Status reporting

The PRO8000 (-4) / PRO800 provides nine 8 bit registers to program various service request functions: ESR, ESE, STB, SRE, BFC, BFE, BFR and DESR, DESE

ESR	Standard event status register
ESE	Standard event Status Enable Register
STB	Status Byte Register
SRE	Service Request Enable Register
BFC	Block Function Condition Register
BFR	Block Function Event Register
BFE	Block Function Enable Register
DESR	Device Error Summary Register
DESE	Device Error Summary Enable Register

The structure of the registers ESR, ESE STB, SRE, BFC, BFR and BFE are shown in Figure 4, the remaining two registers DESR and DESE are shown in Figure 5 together with the device error registers of the plug-in modules.

➔ (Please refer to the IEEE 488.2 standard 4.4)

3.5.1 Standard event status register (ESR)

The ESR can be read directly with the command "*ESR?". Reading the ESR clears it at the same time. The content of the ESR can not be set.

The bits are active high and have the following meaning:

Power on
This bit indicates an off to on transition in the power supply. So it is high after switching on the device for the first time.

User request (not used here)
A local control has been activated.

Command error
A command error occurred.

Execution error
An execution error occurred.

Device dependent error
A device dependent error (module error) occurred.

Query error
A error occurred trying to query a value.

Request control
The PRO8000 (-4) / PRO800 is requesting to become the system controller.

Operation complete
All started operations have been completed. System is in idle mode.

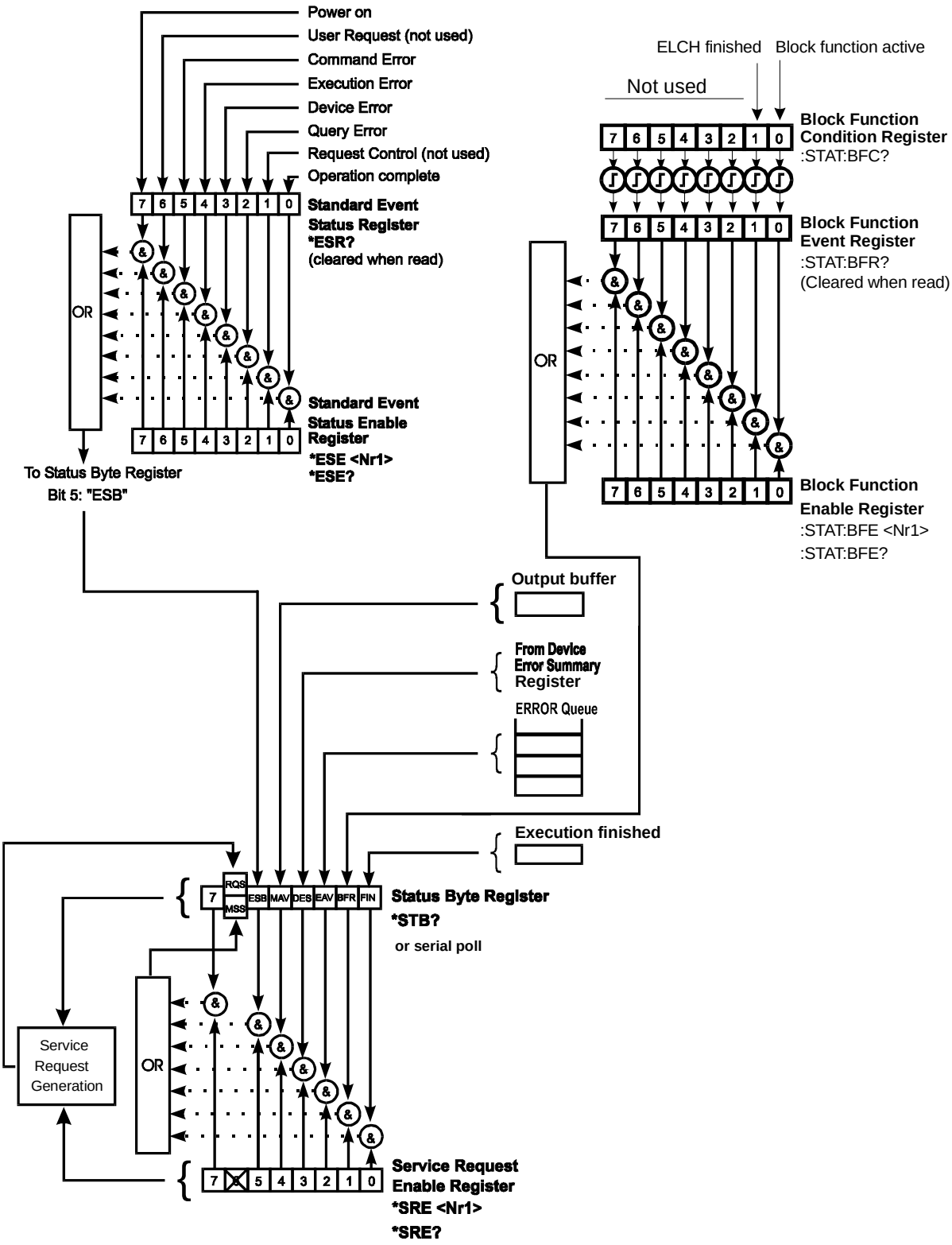


Figure 4 The 7 registers ESR, ESE, STB, SRE, BFC, BFR and BFE

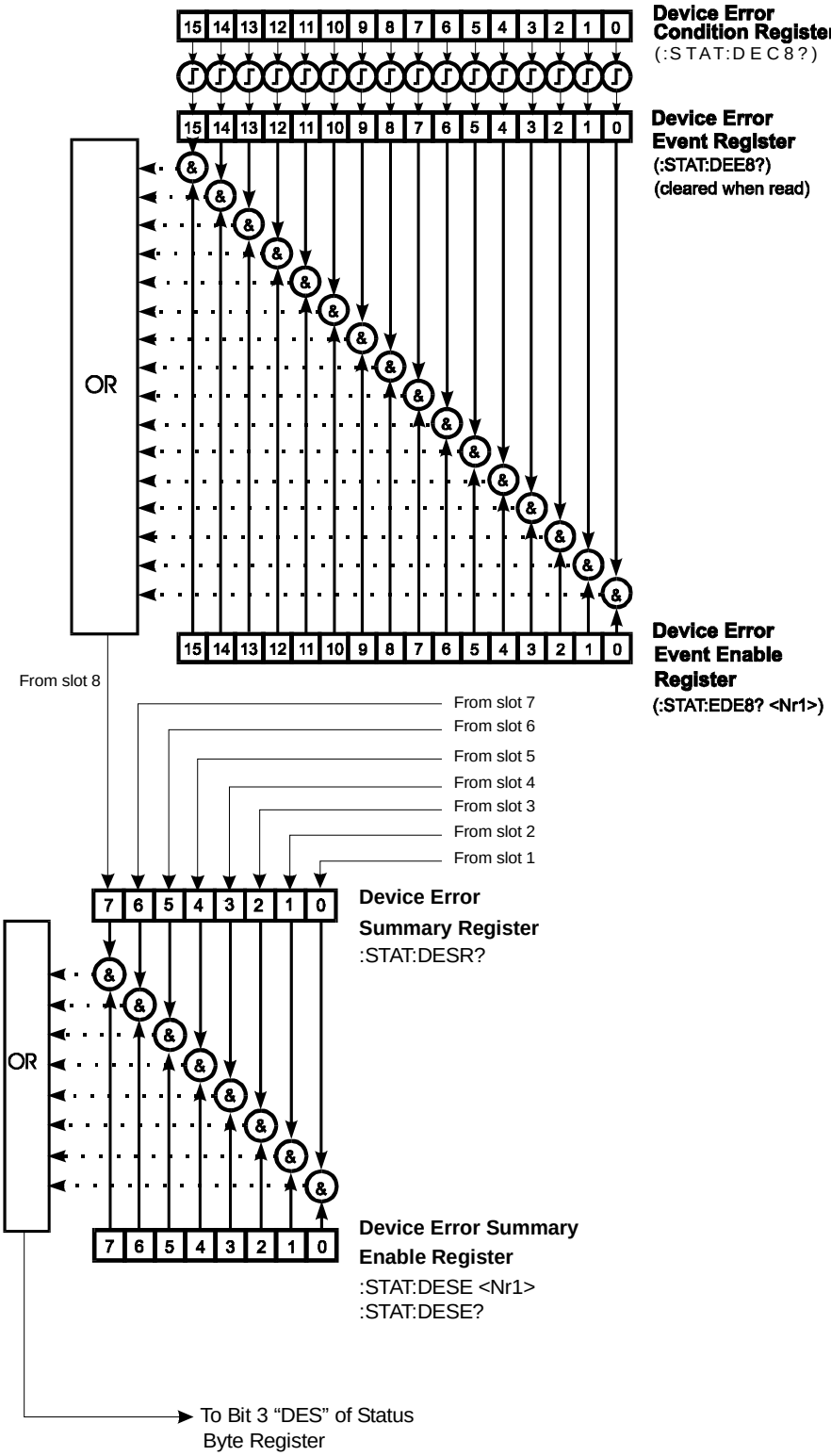


Figure 5 The registers DESR, DESE, DEC,DEE and EDE

3.5.2 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 Status Byte Register (STB). The 8 bits of the ESE are connected by logical "AND" with the according 8 bits of the ESR. These 8 results are connected by logical "OR", so that any "hit" leads to a logical 1 of 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.

3.5.3 Status byte register (STB)

The bits of this register show the status of the PRO8000 (-4) / PRO800. The register can be read with *STB?.
The content of the STB can not be set. The bits are active high.

RQS/MSS
RQS: Request service message: Shows that this device has asserted SRQ.
MSS: Master summary status: Shows that this device requests a service.

ESB (Event Status Byte)
Shows if any event has occurred in the Standard Event Status Register, enabled by the Standard Event Status Enable Register. (see section 3.5.1)

MAV (message available)
This bit is high after a query, as a result "waits" in the output queue to be fetched.
It is low, if the output queue is empty.

DES (Device Error Summary Register Bit)
Indicates whether any of the plug-in modules has send an error message through its Device Error Event Register.

EAV (Error Available)
Shows the error queue not to be empty yet.

BFR (Block Function Register-Bit)
Indicates whether the block functions are active or the “ELCH”-function (ELectrical CHaracterization) has finished its work.

FIN (command finished)
This bit is high, after a command has finished and all bits of the STB have been set.

All bits except bit 6 of the STB can be used to assert a service request (SRQ)
➔ Please refer to section 3.5.13 on page 44).
Alternatively the SRQ can be recognized using the command "*STB?"
➔ (Please refer to section 3.5.14 on page 44).

3.5.4 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 combined by logical "AND" with the according 7 bits of the SRE. These 7 results are combined by logical "OR", so that any "hit" leads to a logical 1 in bit 6 of the STB and asserts an SRQ.

3.5.5 Device Error Summary Register (DESR)

Bit 0.....7 indicate if any plug-in module in the slots 1...8 (1..2) has asserted an error message via it’s Device Error Event Register (see Figure 5).

3.5.6 Device Error Summary Enable Register (DESE)

The DESE enables via “AND” functions which module in which slot is allowed to create an error message, i.e. set bit “DES” in the Status Byte Register.

3.5.7 Device error condition register (DEC)

The bits of this register show the errors, that occur during operation (operation errors). The bits are active high.

The function of the Device-Error_Condition register depends on the module in the corresponding slot.
Please refer to the individual operation manual of the plug in module.

3.5.8 Device error event register (DEE)

The bits of this register hold the errors, that occurred during operation (operation errors). So each bits of the DEC sets the according bit of the DEE.

The DEE can be read but not set. Reading clears the DEE.

3.5.9 Device error event enable register (EDE)

The bits of the EDE are used to select, which bits of the DEE shall influence bit 3 (DES) of the STB. The 8 bits of the EDE are related by logical "AND" to the according 8 bits of the DEE. These 8 results are combined by logical "OR" so that any "hit" leads to a logical 1 in bit 3 (DES) of the STB. As any bit of the STB can assert an SRQ, every error (bit of the DEE) can be used to assert an SRQ.

3.5.10 Block Function Condition Register (BFC)

At present state only bit 0 and 1 of the BFC have any function:
Bit 0 indicates if the block function mode is active.

Bit 1 shows if the programmed “ELCH”-function has finished its work (=high).

3.5.11 Block Function Event Register (BFR)

The bits of this register hold the status changes that occurred during operation. So each bit of the BFC sets the according bit of the BFR.

The BFR can be read but not set. Reading clears the BFR.

3.5.12 Block Function Enable Register (BFE)

The BFE enables via “AND” functions which block message is allowed to set the bit “BFR” in the Status Byte Register.

3.5.13 Service request by detecting SRQ

If an SRQ is asserted (see section 3.5.4) bit 6 of the STB is set to logical 1, so that the controller can detect by serial polling, which device asserted the SRQ.

3.5.14 Service request by *STB? command

If the controller does not "listen" to SRQs 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.

3.5.15 Hints for setting up control programs

NOTE

During the test phase of control programs all program messages should be transmitted separately. Each command should be followed by a status request (response message) so that possible errors are read out directly after the command causing them.

NOTE

The producer of the interface card being used in the control computer will provide communication functions for both directions between PC and PRO8000 (-4) / PRO800 for all common software packages. These will be embedded in the programming text and accomplish the data transfer between control computer and PRO8000 (-4) / PRO800. We recommend building these write and read back commands into separate functions and then using these functions for the data transfer.

These functions should use an additional global flag that determines whether the write or read back communication is to be stored on a data file together with the talker and listener address of the IEEE488 system or printed out additionally.

Occurring problems on the bus, or error messages that cannot be explained immediately can be investigated later by analyzing the data transfer file between the PRO800 / PRO8000 (-4) and the control computer.

The same procedure is useful for the RS 232 communication.

3.6 System reset

There are mainly 5 different ways to reset the PRO8000 (-4) / PRO800 or parts of it. All of them behave different.

- Power on reset
- Reset by device clear
- Reset by clear status
- Reset by software
- Reset by interface clear

3.6.1 Power on reset

The following happens inside a PRO8000 (-4) / PRO800 after turning on the power:

- The power on bit in the Event Status Register (ESR) is set.
- The output queue is deleted, bit 4 (MAV)of the status byte is set to 0.
- The error queue is cleared, bit 2 (EAV) of the status byte is set to 0.
- The execution unit and the command queue is cleared.
- The command decoder (parser) is reset.
- All event registers are cleared.
- The device error summary register is 0.
- All event registers are cleared.
- System goes into 'ready' state, bit 0 (FIN) of the status byte is set.
- All 'ELCH' macro functions are discarded.
- All module outputs are switched off.
- Set values are reset to the manually entered ones. Very new modules reset these values to default values.

3.6.2 Reset by device clear

This reset is done by the IEEE bus commands device clear **[DCL]** or selected device clear **[SDC]**.

- The output queue is deleted, bit 4 (MAV)of the status byte is set to 0.
- The error queue is cleared, bit 2 (EAV) of the status byte is set to 0.
- The execution unit and the command queue is cleared.
- The command decoder (parser) is reset.
- System goes into 'ready' state, bit 0 (FIN) of the status byte is set.
- All module outputs and set values stay unchanged.

3.6.3 Reset by the clear status command

The clear status command ***CLS** resets the following parts of the PRO8:

- The error queue is cleared, bit 2 (EAV) of the status byte is set to 0.
- All event registers are cleared.
- The device error summary register is 0.
- System goes into 'ready' state, bit 0 (FIN) of the status byte is set.

3.6.4 Reset by the reset command

The reset command ***RST** resets all device functions:

- Possibly activated macro functions are deactivated (not deleted!)
- All module outputs are switched off.
- System goes into 'ready' state, bit 0 (FIN) of the status byte is set.
- All set values and module assignments stay unchanged!

3.6.5 Reset by interface clear

The IFC is a IEEE bus connection. The PRO8 system does not react on the activation of this line by the control computer.

3.7 The PRO8000 (-4) / PRO800 “ELCH” – macro functions

3.7.1 What is ELCH?

ELCH, the ELectrical CHaracterization of laser components, is a group of embedded macro functions (block commands), allowing easy acceleration of standard measurements, e.g. determination of P-I dependency of laser diodes etc.

Benefits of ELCH are mainly:

- Low IEEE 488 traffic
- High measurement speed

3.7.2 Basic settings

Before using the ELCH macro functions, the following basic settings have to be carried out:

1. The desired module must be selected
2. The polarities of the laser diode and the monitor diode must be set appropriately.
3. The desired operating mode has to be set (constant current or constant power).
4. The thermoelectric coolers must be switched on.

3.7.3 Individual settings for a measurement

The following parameters must be set for an individual measurement:

1. Which parameter shall be changed during measurement? (e.g. laser current)
2. Give the start and stop value for this parameter.
3. In how many steps shall this span be subdivided?
4. How many dependent values are to be measured at every single step?
5. In which mode do you want the system to run: continuous or triggered mode?
6. Which parameter from which module do you want to read out?
7. On which position in the answer-string shall this value stand?

3.7.3.1 Start and stop values for the chosen parameter

Depending on the module selected, different parameters can be chosen for the automated measurement:
The laser diode current ILD, Monitor diode current IMD (every value that also uses the compound **":ACT"**).
Enter the start and stop values by appending the compound **"START"** or**" STOP"** to the desired parameter.

Programming:

e.g. **:ILD:START 1e-3** (start value 1 mA)
:ILD:STOP 100e-3 (stop value 100 mA)

Reading:

:ILD:START? or
:ILD:STOP?

3.7.3.2 Number of steps for the chosen interval

Set the desired number of steps for the appropriate start-stop interval:

Programming:

:ELCH:STEPS n with $2 \leq n \leq 1000$

Reading:

:ELCH:STEPS?

3.7.3.3 Number of measured values for every step

This defines how many different values depending on the chosen variable are to be registered. If e.g. one wants to measure the dependency of laser power from laser current (P-I) on has one dependent value (P) and thus n is set to1.
(The default setting for n is 1).
In maximum 8 dependent values can be registered.

Programming:

:ELCH:MEAS n with $1 \leq n \leq 8$

Reading:

:ELCH:MEAS?

3.7.4 Cascading several ELCH runs

It's not necessary to read out the measured data immediately after an ELCH run. In certain cases it might be useful to cascade several runs, e.g. to allow for a 'nonius-like' scale spreading of certain regions in the measured characteristic.

Just start the next ELCH run (with changed parameters) when the preceding one has stopped.

But care must be taken, not to exceed a maximum of 1001 measurement steps (each with a maximum of 9 data, 1 independent and 8 dependent values).

n=1001 is the maximum number of measurement steps, which can be stored in the PRO8.
If the total number of measurement steps exceeds 1001, the overhead will overwrite the values measured at the beginning (ring memory architecture)!.

Such an example is shown in the next figure. Here the number of steps exceeds the maximum by two steps.

In the subsequent read procedure, the first two values of measurement #1 would be wrong and the last two values of run #3 missing.

Of course you can start with data read out before starting the next measurement. Then the first two measurements would be correct, however the last two of measurement #3 would still be missing.

If you want to discard run#1 you should give the command "**`:ELCH:RESET 0`**" before starting run #2. This resets the read pointer to position 1.

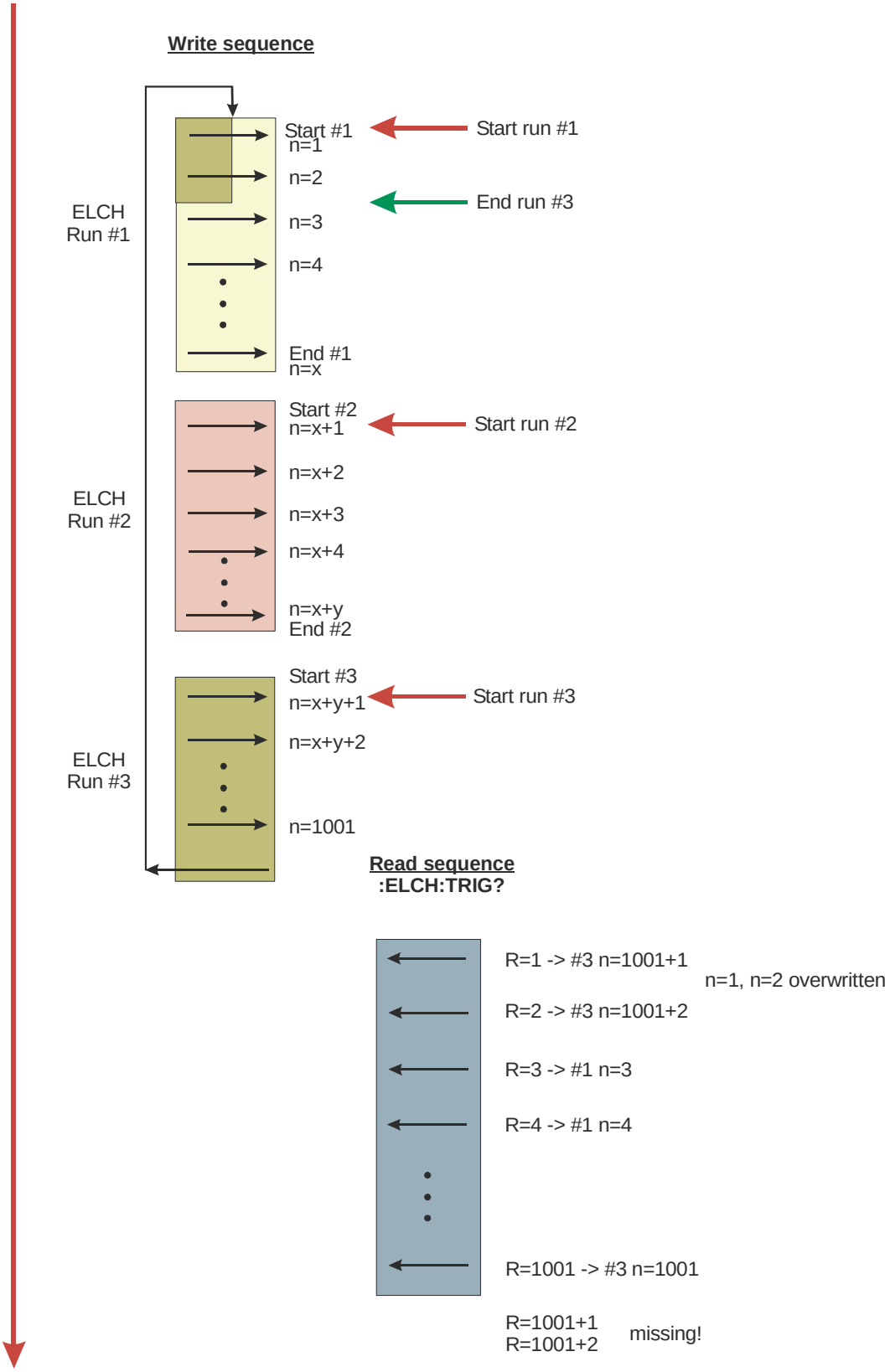


Figure 6 ELCH memory overflow

3.7.5 Which values do you want to measure?

First select the desired module by means of the **":SLOT n"** command.
Then enter the value to be measured (e.g. ILD, VLD etc.) with the compound **":MEAS."**

e.g. **:ILD:MEAS n**

n stands for the position of the measured value in the output string and can have values from 1 to 8.

You can not choose fixed parameters (e.g. a hardware limit ILIM etc. or values that must be calculated from others). If you try to do, you will get an error message (310: ELCH set value initialization not complete) when starting the ELCH measurement.

If you define less values to be measured than defined with **:ELCH:MEAS n**, the error message " 311: ELCH read value(s) initialization not complete" is given when starting ELCH.
The variable parameter always shows up in the first position of the output string and must not be programmed explicitly.

In the answer string the values are separated by commas.

3.7.6 Setting the desired measurement mode

There are (up to now) two possible modes of operation within ELCH:
Continuous mode and triggered mode.

In continuous mode PRO8000 (-4) / PRO800 will measure all values as fast as possible. Data are not transferred automatically to the PC, but the PC can query all results measured until then.

Programming:

The ELCH measurement in continuous mode is started by:

:ELCH:RUN 1

Reading:

:ELCH:RUN?

The measurement can also be started in triggered mode, that means you only start a new measurement on the next step by the next query of a measured value:
Thus the user can affect measurement speed by the read frequency of measured values, and also can stop the measurement interactively if limits of measured values are reached.

Programming:

:ELCH:RUN 2

Reading:

:ELCH:RUN?

If the ELCH function is running in continuous mode at that moment, this command of course triggers a short interruption in the measurement sequence.

The command:

:ELCH:TRIG?

Starts the measurement for the next step and reads the measured value

The order:

:ELCH:RUN 0

Will stop the measurement and discard the block function ELCH.

3.7.7 Reading the 'ELCH' status

There are several possibilities to see whether the 'ELCH' measurement sequence is still running or not:

- Query the ELCH status directly: **":ELCH:RUN?"** (time consuming, especially if the ELCH sequence is still running)
- Read the Block Function Event Register of the PRO8000. If ELCH has finished, bit 1 is set to 1 (**":STAT:BFR?"**)
- If enabled via the Block Function Enable Register, read bit 2 of the Status byte (faster) **"*STB?"**
- If enabled via the Service Request Register, trigger a service request (takes no additional time)
- Poll the status byte with the low level IEEE 488 messages serial poll sequence SPE and SPD (refer to IEEE 488, section 2.5.1)

3.7.8 Reading the measured values

With the command:

:ELCH:TRIG?

You can step through the list of measured values.
If you use this command more often than measurement-steps have been defined, you will get the last answer string again and again.

Example of an answer string:

7.12345678E-003,6.94673825E-002,1.00453298E+000<LF>

With the command:

:ELCH:GETALL?

You can retrieve all data measured by "ELCH" with a single command. Depending on the number of measurement values, this can take a considerable time.
E.g.: 1001 measurement values with 8 readout values results in a 1001 *(1set + 8read) * 17Byte/value + 2 ...3 Byte string terminator = max. **153156 Byte!**
So you must ensure that your input buffer is large enough and that the IEEE timeout is set high enough to not generate a timeout error (e.g. read-out of 1001 measurements with 9. values takes some 40 seconds!)

Example of answer string (meas. values separated by comma, meas. points by semicolon):

1.00000005E-003,9.79492208E-004;3.25000030E-003,3.23242205E-003;5.50000044E-003,5.47656277E-003;7.75000080E-003,7.73339858E-003;1.00000007E-002,9.98535194E-003;

NOTE

Please keep in mind: IEEE488 bus traffic of all connected hosts is ceased as long as the data transfer from the PRO8 to the controller is active, or your program must stop data transfer for other traffic in-between.
You must also make sure, that your input buffer is large enough!

If you use the **:ELCH:GETALL?** command while the 'ELCH' routine is still running, you will get all measured date up to this point as output. You can then use the **:ELCH:GETALL?** command again or proceed with the **:ELCH:TRIG?** command to read the subsequent data.

The command:

:ELCH:RESET?

gives you the remaining number of measurement values.

:ELCH:RESET 0

resets the internal "ELCH" counters to zero, so that data recorded previously but not read yet are overwritten by the next ELCH run.

3.7.9 Example of an ELCH measurement procedure

Here we show an ELCH measurement sequence (after system configuration) which measures the photocurrent of a laser internal and an external photo diode in dependence from the laser current.

:SLOT 2	Select LDC module in slot 2
:ILD:START 10e-3	Start value for ILD 10 mA
:ILD:STOP 100e-3	Stop value for ILD 100 mA
:ELCH:STEPS 101	The current range is divided in 101 steps
:ELCH:MEAS 3	3 measurements for every step
:VLD:MEAS 1	Select VLD (measured) to be on position 1 in the output string
:IMD:MEAS 2	Select IMD to be on position 2
:SLOT 3	Select module in slot 3
:PORT 1	Select input port 1 of the photo-amplifier module
:IPD:MEAS 3	Select measured photocurrent of module 3 on position 3
:SLOT 2	Return to slot 2 (the module which gives the independent parameter, i.e. the value which is stepped through, must be selected when starting ELCH).
:LASER ON	Switch on the laser

Because *THORLABS* laser controllers use a soft start function to not endanger the laser diode, you should include a 1-2 second break here, to allow the laser current to stabilize!

:ELCH:RESET 0	Resets the ELCH data pointers
:ELCH:RUN 1	Starts ELCH measurement in continuous mode

The command:

:ELCH:TRIG?

Requests the first measurement string:

	ILD(set)	VLD (read)	IMD	IPD
Position	0	1	2	3

7.12500000E-003,7.12345678E-001,3.34673825E-004,1.00453298E-003<LF>

:ELCH:TRIG? Request the next measurement string

:ELCH:RESET? Shows the number of remaining values

Repeat until all values are read or use the single command:

:ELCH:GETALL?

To retrieve all data measured in a single step.

Attention: with this command the user must ensure, that the input buffer size is large enough (max. 160kB) and that your timeout is set to a corresponding high value (max 50 sec.)!!

If you use the **:ELCH:GETALL?** command when the measurement has not yet finished, you will get all data registered up to then. You can use the command again to retrieve the rest of the data.

:ELCH:RUN 0 Stops the ELCH function.

3.7.10 Possible ELCH Error sources

Working with ELCH, different sources of errors are possible:

- "**310, ELCH set value initialization not complete**"

  - The value you selected as independent variable is not allowed for this purpose, e.g. values which are calculated from others. Please refer to the operation manual of the individual module. You can use every command, which also offers the compound "**:MEAS n**"
  - The given START and STOP values either belong to different commands or/and to different modules.
  - The module involved is not or not completely initialized.
  - The module involved is not switched on.
  - You did not select the module which operates the independent variable (**:SLOT n**) when starting ELCH

- "**311, ELCH read value(s) initialization not complete**"

  - You tried to use a read value that is not a measurement value (e.g. p-share). You can use every command which offers the compound "**:ACT?**"
  - The selected module was not initialized correctly (e.g. read resistance with a TED but the module is switched to an AD590 temperature sensor).
  - You specified e.g. 3 dependent values "**:ELCH:MEAS 3**" but initialized only 2 : "**:ILD:MEAS 1**"; "**:TEMP:MEAS 2**"

- "**312, ELCH was stopped**"

  - You gave a stop order to ELCH
  - An error has occurred in a module (e.g. interlock open)

- Errors while using the data read-out commands "**:ELCH:GETALL?**" or "**:ELCH:TRIG?**"

  e.g.: "**Timeout expired before operation completed**"

or

  e.g.: "**The number of bytes transferred is equal to the input count**"

  - Timeout value to small .
  - Input buffer too small.

  - You don't get out all measured data : Perhaps your measurement is still in progress. Either test the ELCH status (see 3.7.7) or use the "**:ELCH:GETALL?**" command again to retrieve the rest of the data.

  - Your retrieved data do not start with the expected first set value:
    Maybe you had another ELCH run previous and did not read out the old data.
    Start your ELCH run with the **:ELCH:RESET 0** command, to discard previous measured values.

4 Maintenance and repair

4.1 General care

Protect the PRO8 from adverse weather conditions. The PRO8 is not water resistant.

☝ Attention ☝

To avoid damage to the PRO8, do not expose it to spray, liquids or solvents!

4.2 Cleaning

The unit and the display window can be cleaned with a cloth dampened with water. You can use a mild 75% Isopropyl Alcohol solution for more efficient cleaning.

4.3 Line voltage

The mainframes PRO800 / PRO8000 / PRO8000-4 operate at fixed line voltages of 90 V … 110 V, 104 V … 127 V or 207 V … 253 V. Prior to starting operation check that the line voltage specified on the letterplate agrees with your local supply. A qualified service person is required to change the operating line voltage. See section 5.1 (Line voltage setting) for instructions.

4.4 Exchanging the mains fuse

If the line fuse has opened due to line disturbance, incorrectly set voltage or other influences from the outside, it can be exchanged at the rear without opening the unit.

☝ Attention ☝

To avoid fire hazard only the appropriate fuse for the corresponding line voltage is to be used

Execution

- Switch off the PRO8000 (-4) / PRO800 and remove the mains cable from the mains jack. Look at the back of the unit.

- Remove the cover of the fuse holder by means of a screwdriver. A small drawer opens. First the replacement fuse will be visible, if provided. The active fuse is in the back of the drawer.

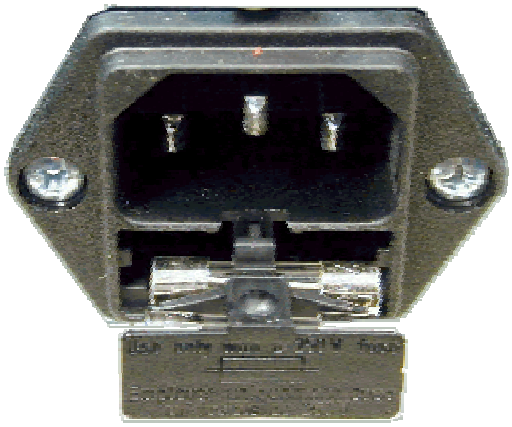


Figure 7 Changing the mains fuse

- Remove the fuse holder completely and exchange the blown fuse. We recommend examining the value and function of the replacement fuse at the same time. IEC 60127-2/V, 5 x 20 mm, 250 V fuses with slow response and high breaking capacity are used.

Line voltage	PRO8000	PRO8000-4	PRO800
100 V ±10%	T5H250V	T8H250V	T2.5H250V
115 V ±10%	T5H250V	T8H250V	T2.5H250V
230 V ±10%	T2.5H250V	T4H250V	T1.25H250V

- Push back the fuse holder until it is locked in position again.

- Switch on the PRO8000 (-4) / PRO800. If the unit cannot be switched on even with the correct fuse inserted, please contact your supplier or *Thorlabs GmbH*.

4.5 Repair

The PRO8000 (-4) / PRO8000-4 / PRO800 does not contain any components to be repaired by the user. If any disturbances in function should occur, please send the respective module or unit to *Thorlabs GmbH Germany* for repair.
Please refer to chapter 6.4, ”Addresses”, on page 79.

4.6 Installing and uninstalling modules

☝ Attention ☝

Modules are only to be installed or uninstalled with the mainframe switched off. If not, severe damage could occur to module and/or mainframe!!

The PRO8000 (-4) / PRO800 has a modular design and can be operated with a variety of different modules.

The change of modules or retro-fitting of modules can be done by the user himself.
It is not necessary to re-adjust the modules after reconfiguration of the PRO8000 (-4) / PRO800.

The number of modules that can be used simultaneously is limited by the number of slots. The modules can be freely configured in all slots.

After switching on the PRO8000 (-4) / PRO800 will recognize each new configuration automatically.

Uninstalling a module

- Switch the PRO8000 (-4) / PRO800 off and remove the mains cable from the mains jack. The modules are uninstalled from the front of the unit.
- Modules of normal width are fixed with two screws, modules with double or triple width with four screws.
- Pull out the modules by means of the handle.
- Close the free slot with a blind plate, or install another module (see below).
- Check the function of the PRO8000 (-4) / PRO800 by switching it on.

Installing a module

- Depending on the required width of the module one, two or three adjacent slots must be free ;uninstall modules (see above) or remove blind plates.
- Put the module into the guide rail of the slot and push until it locks in.
- Fix the modules with the appropriate number of screws.
- Check the function of the modules by switching the PRO8000 (-4) / PRO800 on.

The inserted modules must be recognized correctly in the set-up menu.

4.7 Troubleshooting

In case that your PRO8000/PRO800 system shows malfunction please first check the following items:

◆ PRO8000/800 does not work at all (no display on the mainframe):

- ➢ Mainframe PRO8000 (-4) / PRO800 connected properly to the mains?
  - ♦ Connect the PRO8000 / 800 to the power line, take care of the right voltage setting and grounding 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, replace the fuse by the correct type (one spare fuse is inserted in the fuse holder)

➔ Please refer to 4.4 “ Exchanging the mains fuse”, on page 62).

◆ The PRO8000/800 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.

  - ♦ See the individual manual of the module for further troubleshooting.

◆ The installed IEEE 488 interface does not respond to the connected computer

➢ Do you have selected the option “Interface: IEEE488” in the PRO8000 setup menu?
  ♦ Press “ESC” until you enter the setup menu. Use the ↑ ↓ keys to select the interface line, press the change button and select IEEE488 interface.

➢ Do you use the correct type of interconnecting cable?
  ♦ Install the appropriate cable.

➢ Did you install the cable after turning on the PRO8000/800 or the PC?
  ♦ Turn off both units and turn them on again.

➢ Is the correct device address of the PRO8000 (-4) / PRO800 given to your PC-program?
  ♦ Refer to section 2.3.5, “Setup menu ” on page 15 to see the present IEC-bus address of the PRO8000 (-4) / PRO800 and enter the correct address in your program (default address is 10) or change the actual IEC-bus address of your PRO8000 (-4) / PRO800 corresponding to your PC-program.

➢ Is the PRO8000 (-4) / PRO800 the exclusive owner of the present IEC-bus address or is there another device having the same address?
  ♦ Change the settings of the devices participating in that IEC-bus so that every device has its individual address.

◆ The installed RS232 interface does not respond to the connected computer

➢ Do you have selected the option “Interface: RS232” in the PRO8000 setup menu?
  ♦ Press “ESC” until you enter the setup menu. Use the ↑ ↓ keys to select the interface line, press the change button and select RS232 interface.

➢ Do you use the correct type of interconnecting cable?
  ♦ Install the appropriate cable. (refer to section 3.1).

- The PRO8 enters remote mode with the first RS232 command, but does not respond further

  - Do you have selected the corresponding baud rate?
    - Either change the baud rate in the PRO8 setup menu or in your application program.

- The key “LOCAL” on the PRO8000/800 keypad is not working

  - Your remote control computer may have send a “LLO” (local lockout) message. The “LOCAL” key is then deactivated. To enter local mode again, your PC must send a “GTL” (go to local) message. The deactivation of the “LOCAL” key remains until you turn off your PRO8000 (-4) / PRO800 system.

- Displayed measured values seem to react only very slowly

  - Adjust the over sampling rate (OSR) in the setup menu to a lower value.

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 GmbH-Hotline (blueline@thorlabs.com)* before sending the whole PRO8000 (-4) / PRO800 system for checkup and repair to *Thorlabs* -Germany.

➔ (refer to section 6.4, “Addresses“ on page 79.

4.8 Updating the PRO8000 (-4) / PRO800 firmware

Thorlabs GmbH offers the possibility for a regular update of the internal firmware. The latest version is always available in the on our homepage:

http://www.thorlabs.com

You can download:

- The PRO8 update wizard (ProUpdate.zip)
- The latest firmware image (V40_xxx.img)
- and a readme text file (update.txt).

ProUpdate.zip is the compressed update wizard which leads you through the whole process.
The complete update will take about 10 minutes.

You need:

- The decompressed .zip file and the firmware image which yield the following programs and files:

  - Readme.txt
  - ProUpdat.001
  - ProUpdat.002
  - Setup.exe
  - V40_xxx.img

- One connection cable for the 9-pin D-SUB serial interface connector.

➔ (Please refer to 3.1, "Hardware standard RS 232-C" on page 17)

If you have already the ProUpdat Software installed, you need only to download the image file V40_xxx.img.

4.8.1 Update procedure

1) Switch off your PRO8000 (-4) / PRO800
2) Set the PRO8000 (-4) / PRO800 rear panel DIP-switch to upload mode:
   (In normal operation all switches are set to OFF)
   The older PRO8 version has an DIP-switch with 8 individual switches. Set DIP-switch #5 to on for upload mode.
   The latest PRO8 has a DIP switch with only two single switches. Set DIP-switch 1 to ON for upload mode.
3) Connect the PRO8 with the described cable to a standard COM port of your PC.
4) Install the Update Wizard with setup.exe program and start the Wizard
   (The Wizard will guide you step by step through the procedure).
5) Select the upload COM port.
6) Specify the name of the image file (firmware) which shall be updated.
7) Switch on your PRO8000 (-4) / PRO800 the Wizard will continue the procedure automatically

☝Attention☝

Please wait until the update has finished. This takes about 7 minutes.

8) Do not interrupt the upload procedure. This could lead to malfunction.
9) Switch off your PRO8.
10) Reset the DIP-switch on back panel to "OFF"-mode.
11) Turn on the PRO8 for normal operation with the new firmware.

Watch for the initialization screen, which should show now the number of the just loaded firmware version.

5 Service

5.1 Line voltage setting

☝ Attention ☝

Dangerous or even lethal voltages inside the unit!
Any service procedure like changing of operating voltage must only be done by specially trained service personal!

The PRO8000 / PRO8000-4 / PRO800 operate with line voltages of:
100 V ±10%, 115 V ±10% or 230 V ±10%.

Before operating the unit make sure that the voltage stated on the letter plate is in accordance with the locally supplied line voltage.

The setting of the line voltage is done by the wiring of connector clamps fastened on the ring-shaped transformer at the left side panel inside the unit.

Wiring of the clamps for the respective line voltage:

100V: clamp 1 and 2
115V: clamp 1 and 3
230V: clamp 1 and 4
(see Figure 8Setting the mains voltage)

After changing the line voltage, make sure to change also the appropriate line fuse (see section 4.4, Exchanging the mains fuse).

☝ Attention ☝

Before opening the unit it is absolutely necessary to remove the power jack!
Even after disconnecting the mains cable, dangerous voltages may be present inside the unit!

- **Disconnect Power.** To avoid electrical shock, first switch off the PRO8 power, and then disconnect the power cord from the mains power.

- Remove the upper two plastic parts (Allen key screws) on the rear panel and remove the cover.

- Insert the gray cable in the corresponding clamp. For release of the wire press a screwdriver into the slot below the cable.

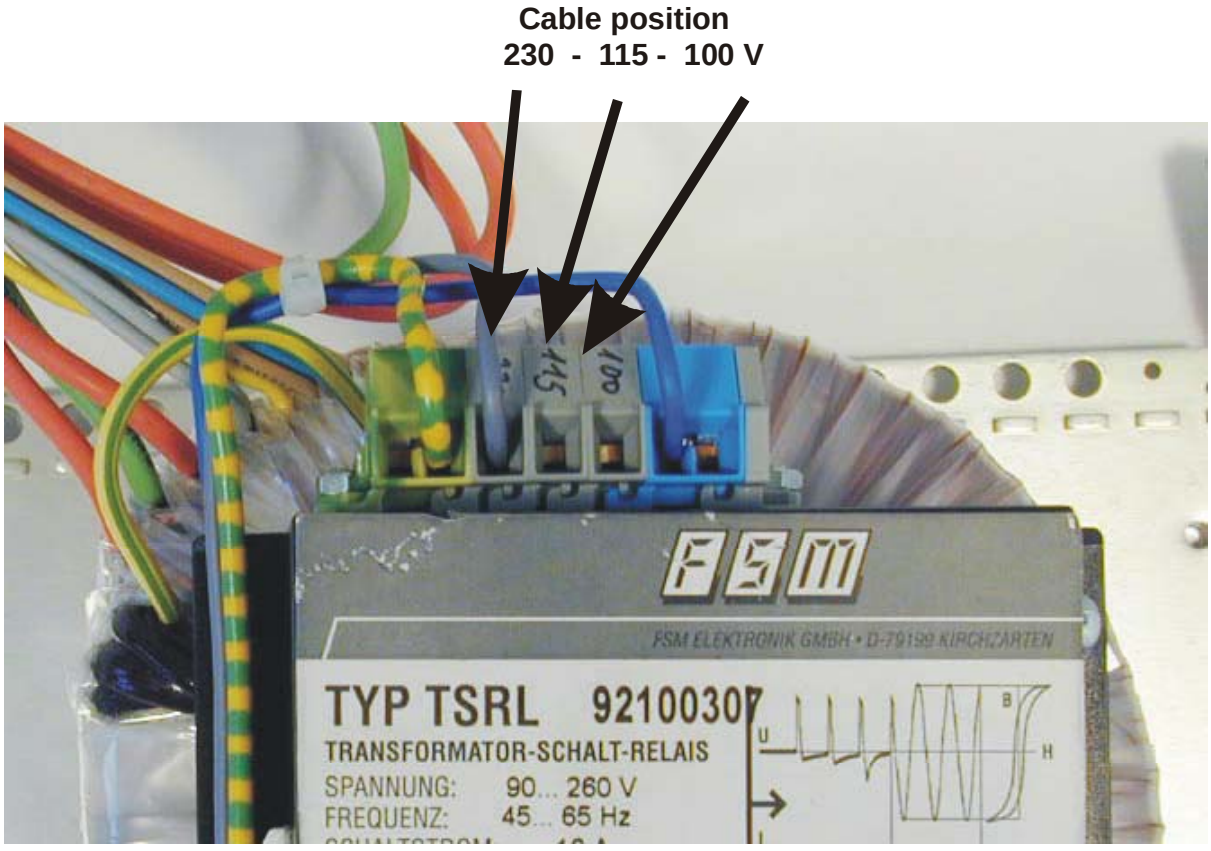
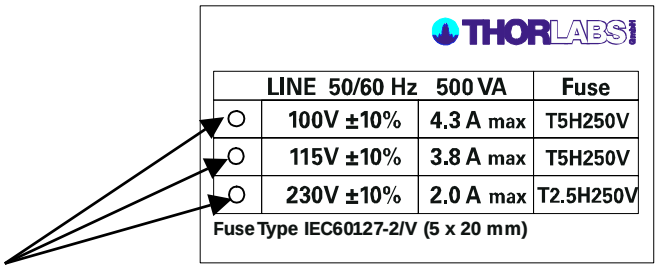


Figure 8 Setting the mains voltage

- Put the cover back on the unit and fasten the plastic parts again.

- Check whether fuse and replacement fuse are correct and exchange them if necessary.



e.g. settings for PRO8000

- Please also do not forget to put the marker screw into the right position, according to the set line voltage.

5.2 Internal Fuse Replacement

Internal fuses must be changed only by qualified service personnel.
Open the unit like described in section 5.1.

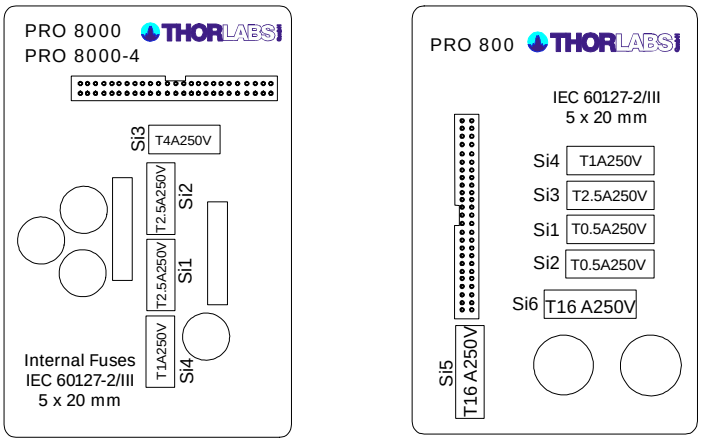


Figure 9 Internal fuses

Name, type and location of the internal fuses are given on adhesive labels

Replace the defective fuse, put on the cover and reattach it with the two Allan-key screws.

6 Listings

6.1 List of acronyms

AG	Anode Ground
BFC	Block Function Condition Register
BFE	Block Function Enable Register
BFR	Event Register
CG	Cathode Ground
CRD	Character Response Data
DBR	Distributed Bragg Reflector
DCL	Device Clear
DEC	Device Error Condition Register
DEE	Device Error Event Register
DES	Device Error Status
DESE	Device Error Summary Enable Register
DESR	Device Error Summary Register
EAV	Error AVailable
EDE	Enable Device Error Event Register
ELCH	ELectrical CHaracterization
EOI	End Of Information
ESB	Error Status Byte
ESE	Standard Event Status Enable register
ESR	Event Status Register
FIN	Command FINished
GET	Group Execute Trigger
GTL	Go To Local
GPIB	General Purpose Interface Bus
IEEE	Institute for Electrical and Electronic Engineering
ITU	International Telephone and Telegraph Union
LF	Line Feed
LLO	Local Lockout
LS	Laser Source Module
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
SRE	Service Request Enable Register
SRQ	Service ReQuest
STB	STatus Byte Register
SW	Soft Ware
TEC	ThermoElectric Cooler (Peltier Element)
TRG	TRiGger
TTL	Transistor-Transistor Logic
WDM	Wavelength Division Multiplex

6.2 List of figures

6.3 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 various PRO8x series Light Source modules and Electrical modules installed.

[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.

EC Declaration of Conformity - Low Voltage	Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities: Low Voltage Directive 73/23/EEC, amended by 93/68/EEC

Certifications and compliances

Category	Standards or description	
	EN 61010-1/A2:1995	Safety requirements for electrical equipment for measurement control and laboratory use.
U.S. Nationally Recognized Testing Laboratory Listing	UL3111-1	Standard for electrical measuring and test equipment.
	ANSI/ISA S82.01:1994	Safety standard for electrical and electronic test, measuring, controlling, and related equipment.
Canadian Certification	CAN/CSA C22.2 No. 1010.1	Safety requirements for electrical equipment for measurement, control, and laboratory use.
Additional Compliance	IEC61010-1/A2:1995	Safety requirements for electrical equipment for measurement, control, and laboratory use.
Equipment Type	Test and measuring	
Safety Class	Class 1 (as defined in IEC 61010-1, Annex H) - grounded product	

6.4 Addresses

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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**