Alpao Deformable Mirror

Quick Start Guide

Issues with USB connection? See Section 3.3.

1 Important Notice

***Safety*: Deformable mirrors have the properties to deflect light or to focus it at different propagation distances. Therefore, caution must be taken to avoid any direct or indirect illumination of users and/or materials, especially when using lasers.**

***Warranty*: Never open the deformable mirror or the drive electronics. Warranty will be lost in such conditions. The mirror membrane is thin and fragile: avoid any contact by hand, tools, liquids or pressurized gas.**

2 Installation

2.1 Unpacking the deformable mirror

Keep the deformable mirror protected with its cover during unpacking and handling. The mirror membrane is fragile and difficult to clean. Try to use the cover as often as possible to prevent dust contamination. Please transport the deformable mirror in its dedicated case.

Before proceeding further, please check that all items listed hereafter have been supplied. In case of trouble, please contact Alpao at **support@alpao.com**.

Description	Quantity
Optical Head (mirror)	1
Drive Electronics	1
PCIe I/O board	1[a]
DM cables	1 to 16[b]
Power Supply	1
ALPAO USB-KEY (driver, report, documentation)	1
Quick Start Guide (this document)	1
Test report	1

[a] Only if purchased with high-speed data link option.
[b] Depend on the mirror model.

2.2 Overview

Your Alpao deformable mirror (DM) is based on electro-magnetic actuators. It is composed of a thin reflecting membrane, which is connected to small magnets and stabilized by individual springs. Ultra-miniature coils are located in front of each magnet. A current flowing through one coil will therefore locally deform the mirror surface.

The DM is delivered with its drive electronics (DE) and software, controlling the current sent to each coil. This drive electronics can be connected to your computer using a USB or Ethernet interfaces. For demanding applications requiring high speed communication, the drive electronics can be provided with High-Speed Data Link requiring PIC-E interface in computer.

High-Speed Data Link, if provided, can be plugged together with USB or Ethernet to enable health checking of the drive electronics.

- Drive electronics USB or Ethernet (do not plug both):

Figure 1: Overview of the deformable mirror control (using USB/Ethernet)

- Drive electronics using High-Speed PCI-E I/O Board:

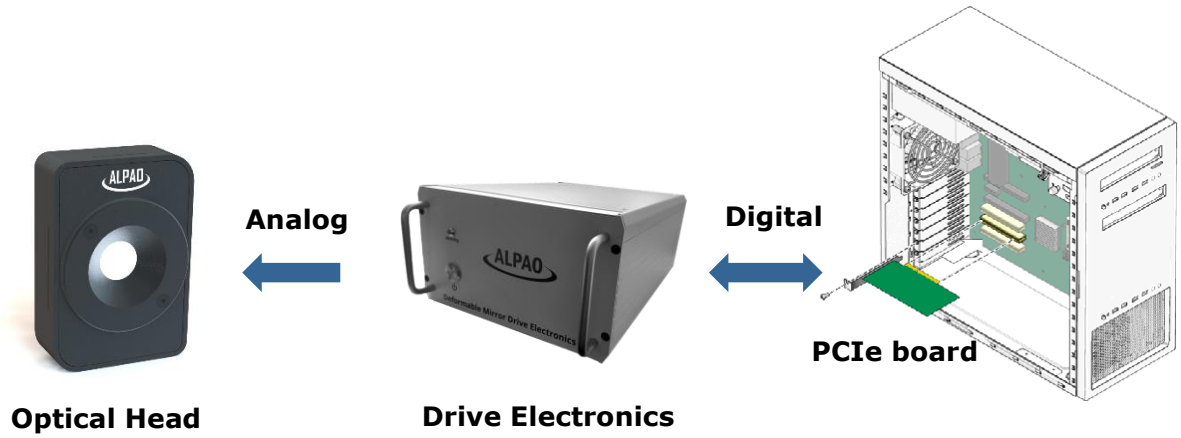


Figure 2: Overview of the deformable mirror control (using PCI-E I/O)

3 Drive electronics & software drivers

This section describes the installation for Windows® operating systems (Windows 7 to Windows 10, Windows XP support for 32-bit only). Please contact Alpao for other operating systems details.

3.1 Driver installation

Please do not connect the Deformable Mirror optical head before chapter 4.1.

All drivers and libraries are installed from the "ALPAO Driver & SDK" USB-Key provided with your deformable mirror.

STEP 1. Insert the Alpao USB-Key and run: "**setup.exe**"
Then follow onscreen instructions to install all drivers, libraries, examples and documentations.

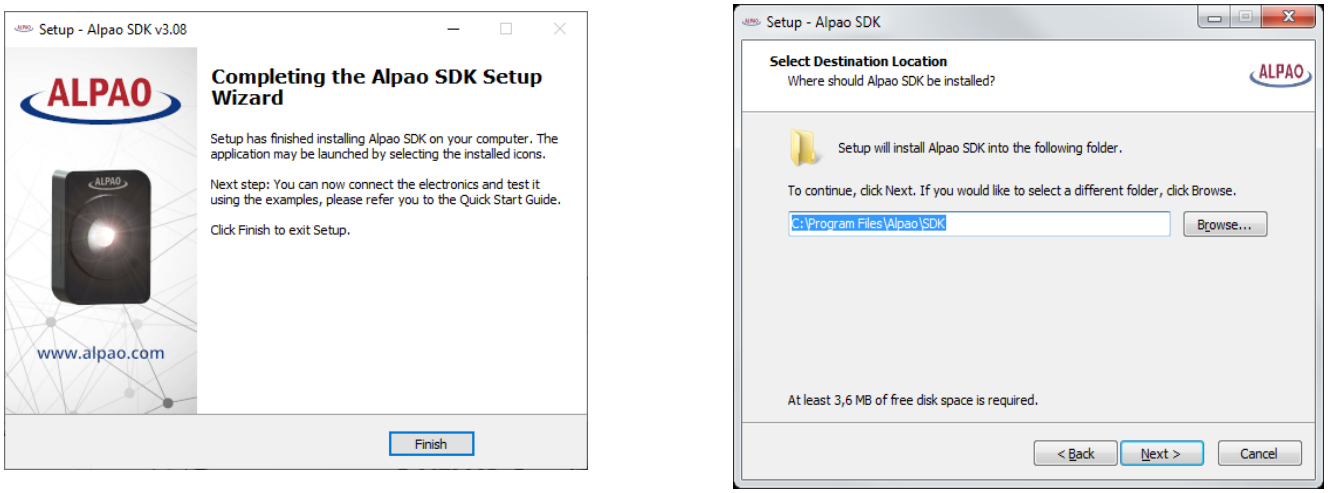


Figure 3: Alpao software – Setup

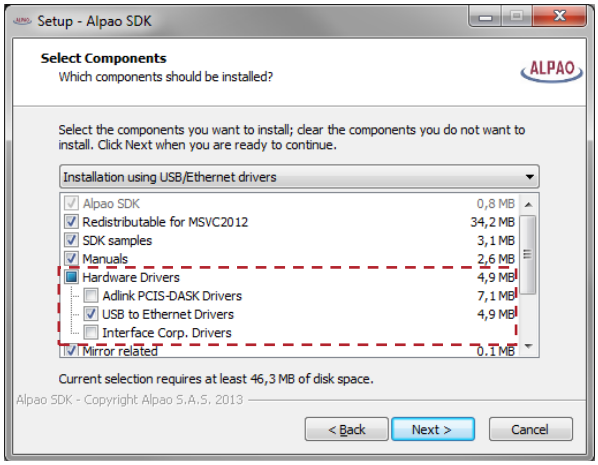


Figure 4: Select components

On the components page, select the interface you use.

3.2 Drive Electronics

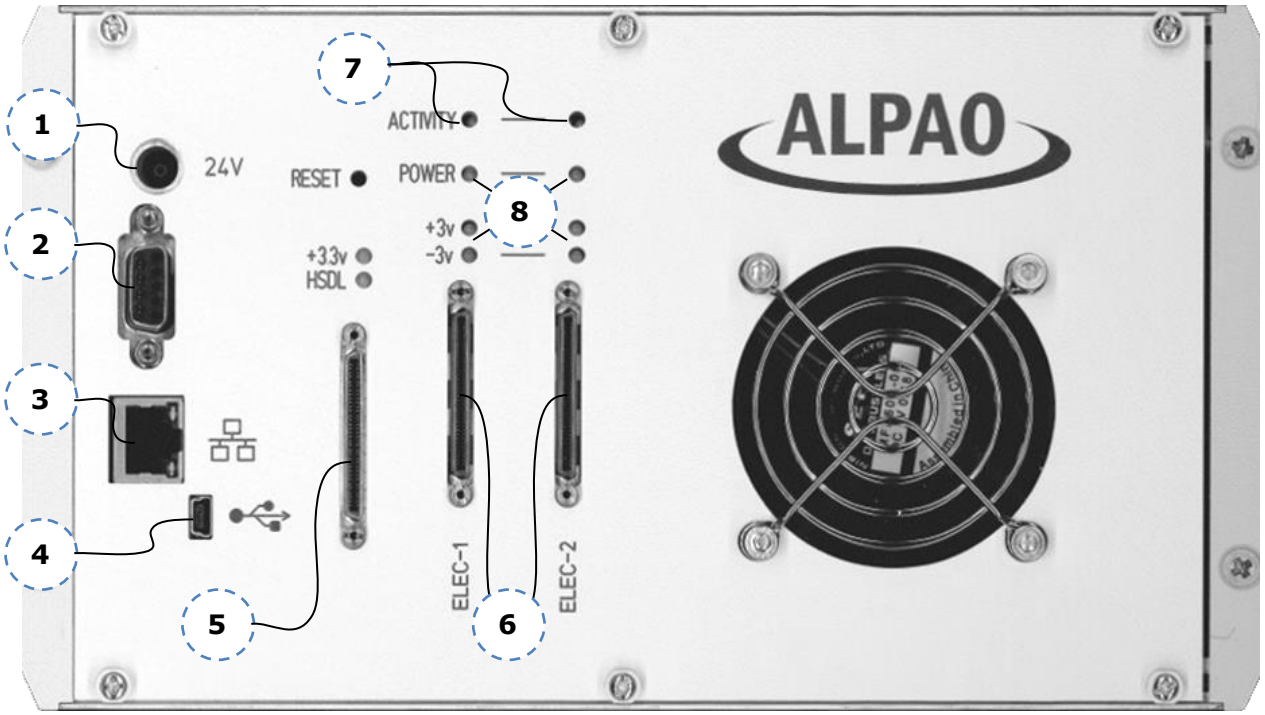


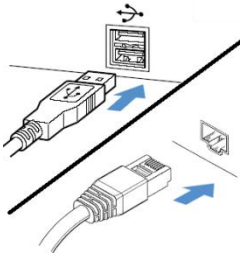
Figure 5: Alpao Drive Electronics rear panel

1	24V input	5	High-Speed link (optional)
2	AUX port (DB9)	6	DM actuators
3	Ethernet 100 Mbps	7	Activity LED (Orange)
4	Mini-USB 2.0	8	Power LED (Green)

3.2.1 Power Connection

Connect the 24V power supply to the Alpao drive electronics. The power supply is compatible with any voltage from 100 to 240 V-AC and any frequency from 50 to 60 Hz.

3.3 Ethernet / USB



Connect the USB or Ethernet cable between the drive electronics and the computer.

If you use the USB interface, Windows® will detected the drive electronics and install the corresponding drivers:

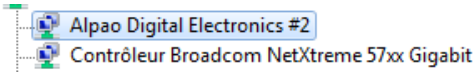


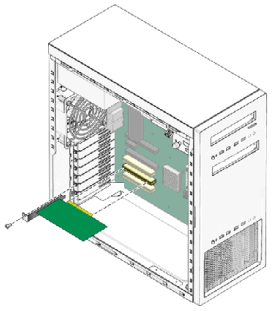
Figure 6: Device Manager USB

Windows 10 sometimes prevents the installation of the USB driver. An alternative driver can be found here:

Here: C:\Program Files\Alpao\SDK\Drivers\USB\USB Drivers installation issue\

or here: https://www.alpao.com/Download/TNO-031_UsbConnection_QuickFix.zip

3.4 High speed PCI-E interface (optional)



Even if bought with High-Speed interface, USB or Ethernet can be plugged for health checking.

STEP 1. Turn off the computer and unplug the power cord.

STEP 2. Install the PCIe board in an empty PCIe slot.

Each cable provided by Alpao is marked with a unique label. The label on the cable corresponds to the name of the connector where it has to be connected to (either on the mirror, the drive electronics or the PCIe board).

STEP 3. Connect the "DATA" cables between the PCIe board and the Alpao drive electronics.

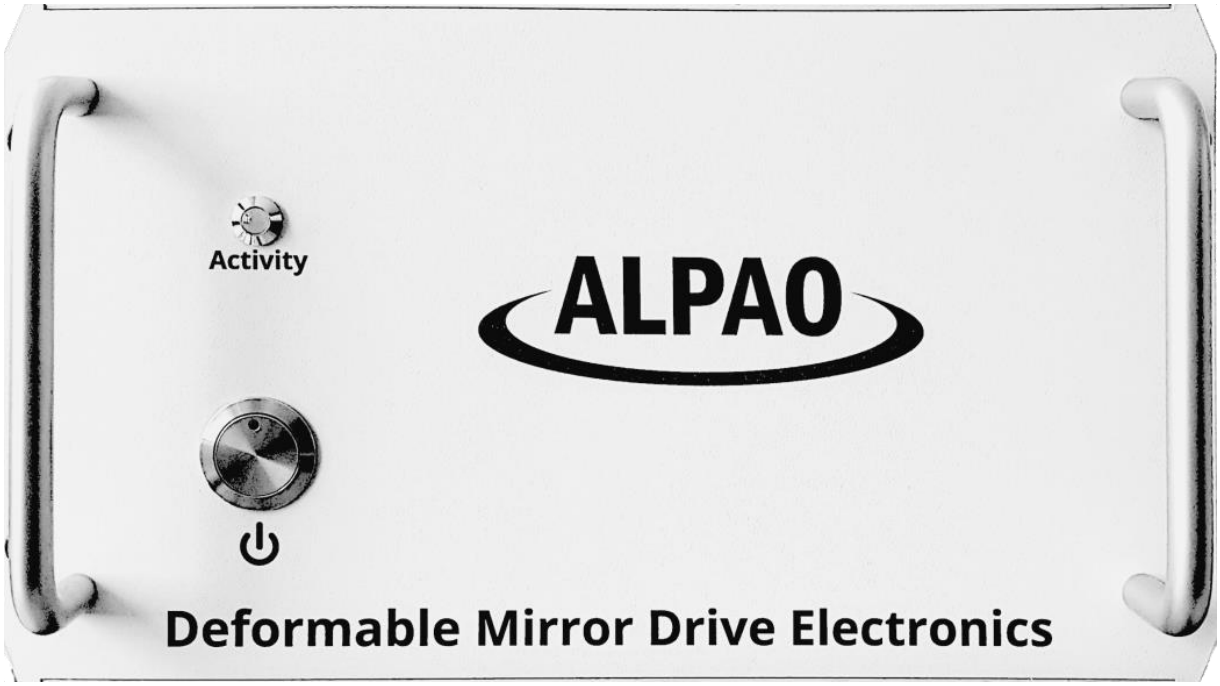
STEP 4. Boot the PC; the PCI board is detected by Windows®, and appears in the device manager.

Figure 7: Device Manager "Interface Corp. PEX-292144"

3.5 Power on

Power-on the drive electronics by pressing the power button on the front panel; activity LED should blink until electronics is ready.

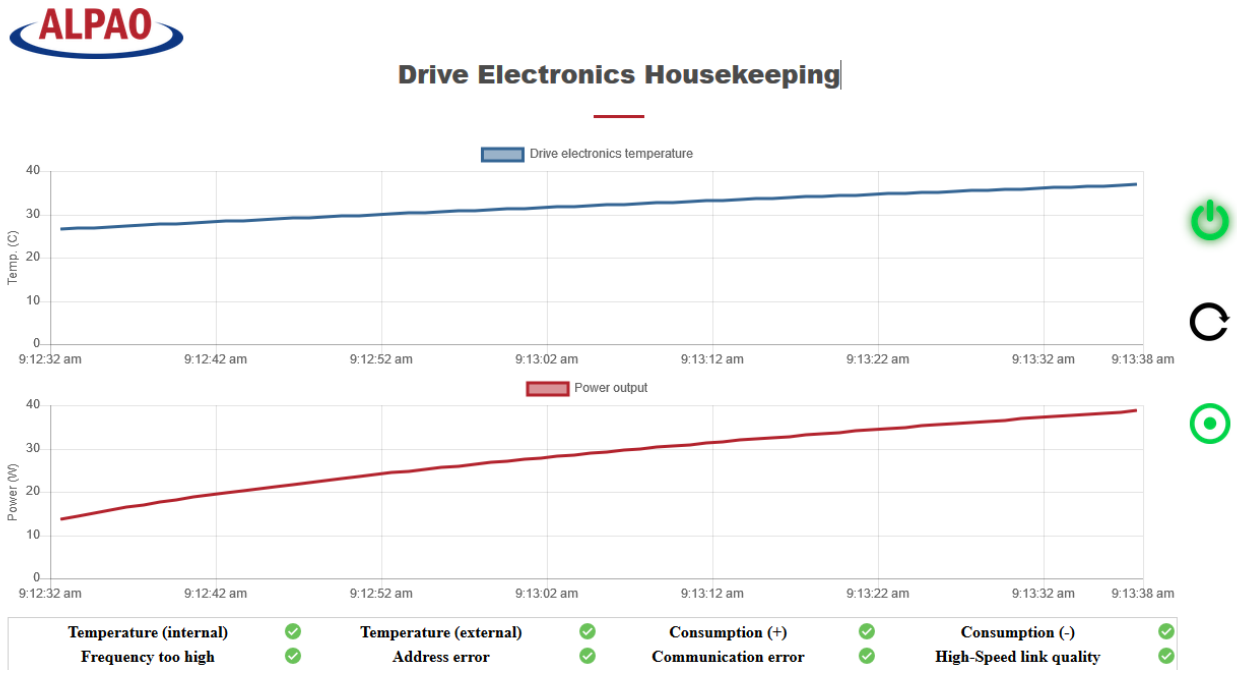
When activity led turn off, you can start communication with it.



3.6 Housekeeping Data

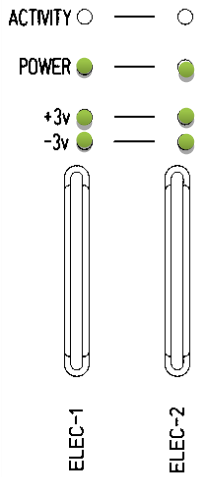
When USB or Ethernet interface is plugged, you can access multiple telemetry from you drive electronics. You can display housekeeping information through your web browser or using Housekeeping API.

Navigate to the IP address of your drive electronics or http://192.168.7.2/ if plugged using USB.



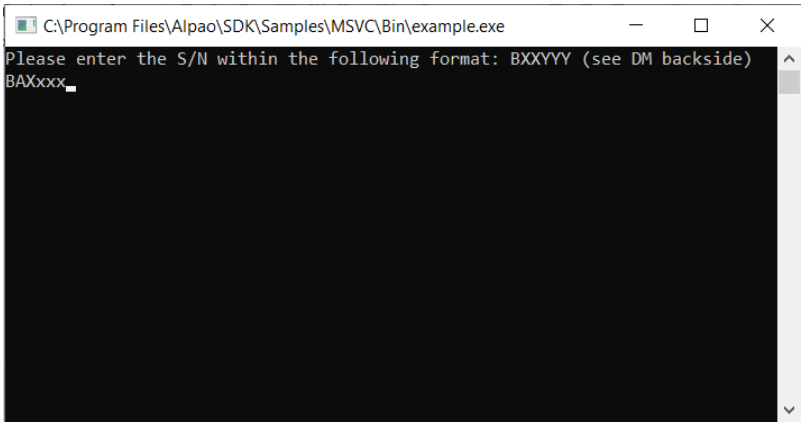
3.7 Test the drive electronics

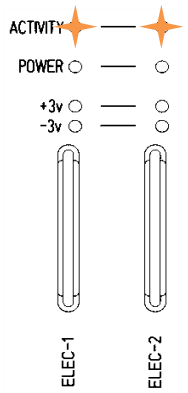
STEP 1. After power-on, all green LEDs should be ON:



STEP 2. Check the presence of the DM configuration file in C:\Program Files\Alpao\SDK\Config . The files are named according to the DM serial name.

STEP 3. Run the test executable in: C:\Program Files\Alpao\SDK\Samples\MSVC\Bin





This tool activates one after the other each actuator of the deformable mirror during **0.5s**.
The activity LED should blink.

STEP 4. ***Optional***: If you purchased the LED test tool, you can connect it to one of the "ELEC" outputs.
You should see the LEDs blinking one after the other. This tool is mainly useful for custom low-level software development.

4 Optical head

4.1 Mechanical installation

STEP 5. You can now mount the deformable mirror optical head. Please secure it onto your optical bench before connecting the cables. You can use the grooves on the package as a mechanical reference during alignment. On some devices, grooves are aligned with the plane of the deformable mirror surface.

Figure 8: On some devices, grooves are aligned with the membrane (indicated in red)

4.2 First end-to-end test

STEP 6. Connect the deformable mirror optical head to the drive electronics. Please double-check that the connectors are not inverted: The cable labels must match the socket labels.

STEP 7. Restart the test executable, as in 0. As a simple test, it is possible to see the effect of moving actuators with a flashlight and a paper screen. A pulling actuator will create a bright spot in the beam; a pushing actuator creates a dark spot.

Figure 9: Simple test to visualize the deformation of the mirror surface (cables are not represented)

If one of these tests fails, please send an email to support@alpao.com.

5 Next

You can now control your deformable mirror:

- From the Alpao Core Engine (ACE) Toolbox for Matlab® (available separately). This is the simplest and fastest way to integrate adaptive optics into new applications. If you purchased the ACE toolbox, please browse the ACE USB-Key for more information.
- From your favorite language (C/C++, Matlab®, Labview® and Python). Please see the ***Samples*** folder in your Alpao SDK folder. The Software Development Kit (SDK) reference is available in the PDF format:
  (C:\Program Files\Alpao\SDK\Manual).

6 Maintenance & Warranty

Users are not expected to perform any maintenance operation. Opening the deformable mirror or the drive electronics can only be done by Alpao staff. Only dust on the mirror surface can be removed respecting the following cleaning protocol.

WARNING

The mirror membrane is very fragile.
Extreme care must be taken during cleaning.

6.1 Cleaning

The deformable mirror should be operated in a clean environment. Its front cover should be in place as long as the mirror is not in use. If dust contamination is present, it can only be removed with a manual air blower developing low pressure and of course, with great care.

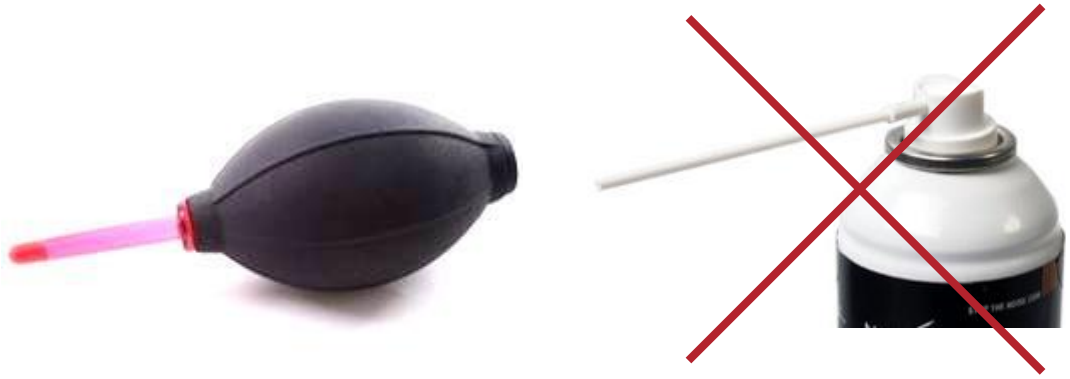


Figure 10: Example of a manual air blower (available from any serious camera shop).
Do *not* use pressurized cans: excessive pressure can damage the mirror.

For any other maintenance operation, please mail us at support@alpao.com.

Do not send back the mirror for cleaning or repair without a preliminary agreement from Alpao.

7 Appendix

A.1 Safety instructions

- *The exclamation point within an equilateral triangle is intended to alert the user about the presence of important operating and maintenance instructions.*

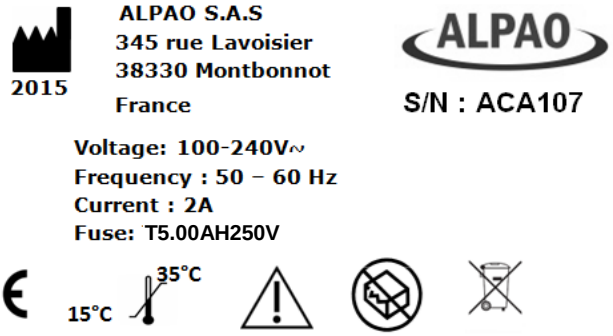
- *Do not use those devices near water.*
- *Do not disassemble, attempt to repair or modify the devices without explicit approval by Alpao.*
- *Do not insert objects into the ventilation holes of the drive electronics.*
- *Clamp the deformable mirror to a thermal drain such as a mechanical mount or an optical bench.*
- *Choose the place of installation such that under no circumstances liquids or objects can get into the equipment (e.g. condensation, water coming from leaky roofs, etc.).*
- *Choose the place of installation so that you can always access easily and quickly the switch (*on/off *button located at the back of the drive electronics).*
- *Vent slots are required for cooling. It is absolutely necessary to make sure that they are under no circumstances covered or blocked. Also provide generous air circulation around the equipment.*
- *Plug the device only into properly grounded electrical outlets*.
- *Only use attachments / accessories specified by the manufacturer.*
- *Avoid placing loose papers underneath your equipment*.
- *Developing a new software driver is at the user's own risk: Alpao does not warrant any defect or damage caused by software developed by the user or by a third-party.*

A.2 Symbols description

Symbols located at the back side of the:

Deformable mirror

Drive electronics



⎓	Continuous current
~	Alternative Current
CE	CE Certified
15°C 35°C	Temperature limitations
	Caution, consult accompanying documents
	Do not use if package is damaged
	Do not put in trashcan but recycle

A.3 Drive electronics general Specifications

	Desktop	Rackable 19”
Power supply	24 V-DC	100-240V-AC
Current consumption	2 A	10 A
Operating temperature[a]	15-35°C	
Fuse	T5.00AH250V	16A-500V
Operating humidity	30-75 % HR	
Storage humidity	20-90 % HR	

[a] Please contact Alpao if a different range is required.

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